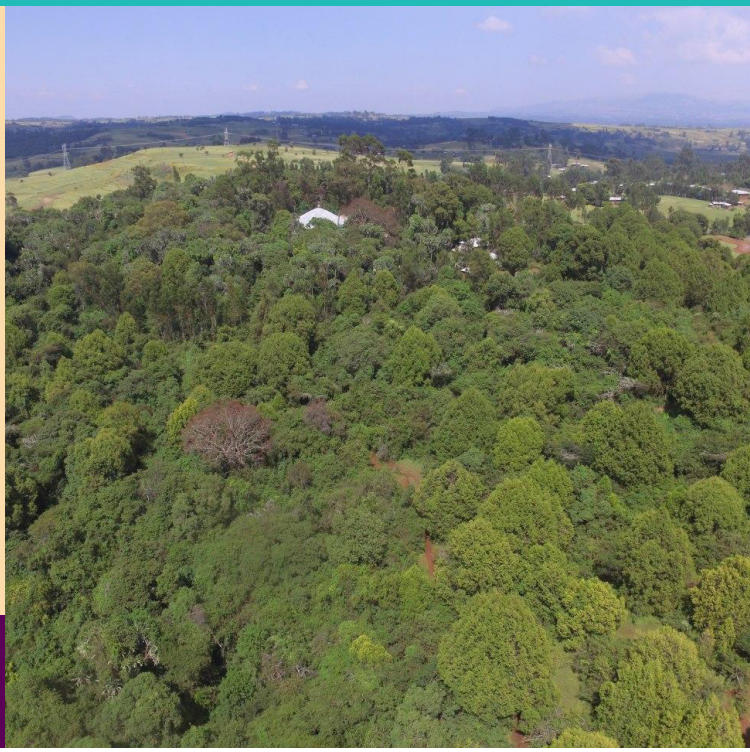
Church Forest and Green Corridor Methodology

Food-for-thoughts for present and future church forest activities



NICFI
Norway's International Climate and Forest Initiative

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actalliance

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Food-for-thoughts for present and future church forest activities

Documentation of a Church Forests Methodology

Norwegian Church Aid – Ethiopia and Ethiopian Orthodox Church Development and Inter-Church Aid Commission,2020

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Acronyms

CRGE	Climate Resilience Green Economy
ECFI	Ethiopia Church Forest Initiative
EEFRI	Ethiopian Environment and Forest Research Institute
EFCCC	Environment Forest and Climate Change Commission
EOC	Ethiopian Orthodox Church
EOC DICAC	Ethiopian Orthodox Church Development and Inter-church Aid Commission
FBO	Faith-Based Organizations
FMNR	Farmer Managed Natural Regeneration
GPS	Global Position System
HQ	Head Quarter
IBA	Important Birds Area
M and E	Monitoring and Evaluation
MASL	Mean Above Sea level
MM	Millimetre
NCA	Norwegian Church Aid
NTFP	Non-Timber Forest Product
PADD	Protestant Agency for Diakonia And Development
REDD	Reducing Emission from Deforestation and Forest Degradation
SDG	Sustainable Development Goals
SWC	Soil and Water Conservation
UNESCO	United Nations Educational, Scientific and Cultural Organization
WASH	Water Access Sanitation and Hygiene

Introduction

1. Introduction

The Ethiopia Church Forests Initiative (ECFI) is a project that aims at supporting the Ethiopian Orthodox Church and other faith communities to contribute towards Ethiopia's Climate Resilient Green Economy Strategy (CRGE). Specific goals of the project include:

1. The Ethiopian Orthodox Church is a climate ambassador promoting forest protection;
2. Church forests are protected from degradation;
3. Communities around church forests are resilient to climate change.

The project is launched in November 2018 and is currently being implemented in six Church/ Monastery forests in Amhara and Oromia regions. The churches/ monasteries are surrounded by forest that covers approximately 315 ha of land. The first five church forests (in the below list) are located around 165 km from Debre Markos, the capital of the East Gojam Zone in Amhara Region, and 306 km North West of Addis Ababa. The 6th church forest (Menagesha Mariam and Medhane'alem Church) is found in Oromia region, around 25 km to the west of Addis Ababa.

The churches and monasteries are:

1. Tach Mariam Monastery, having approximately 70 ha of forest;
2. Koga Kidane Mehret Monastery, having approximately 96 ha of forest;
3. Baza Asteryo Monastery, having approximately 29 ha of forest;
4. Yemrat Abo Church, having approximately 48 ha of forest;
5. Jiret Medhane Alem Monastery, having approximately 10 ha of forest;
6. Menagesha Mariam and Medhane'alem Church, having approximately 329 ha of forest.

Although the NCA funded initiative started in the above-mentioned 6 Church/Monastery forests, there is a high demand for scaling up both geographically and with other faith institutions. The present 'Church Forest Methodology' therefore seeks to gather the learnings and

experiences from the past implementations so that NCA and partners can scale them up as models for present and upcoming projects.

This document sets out to build a comprehensive Church forests development methodology that serves as a model for scaling up the project in other areas and faith institutions. The Church forest methodology will provide NCA, the EOC, other faith institutions, NGOs, Government sectors, and development partners a strategy for scaling up successful conservation of sacred and communal forests and restoration of degraded environments.

2. Recommendation for a methodology to improve and to scale up current and future church forest projects and initiatives

The baseline of the recommendation relies on a review of available, recent studies on Church forests with special emphasis on the NCA supported sites. The following documents, provided by NCA, were examined:

I. Ethiopia Church Forest Initiative - Project proposal by Norwegian Church Aid to the Norwegian International Climate and Forest Initiative's Funding Scheme, Revised September 2018.

II. Ethiopia Church Forest Initiative: ETH-18/0013 – Annual Progress and Financial Report (Nov. 1, 2018 – Oct. 30, 2019).

III. Offer by the consultancy based on the Inception report to undertake baseline study on "Ethiopian Church Forest Initiatives".

The following measures are recommended for the stakeholder groups (governmental entities, faith communities, local community, etc.) to improve their required collaboration to achieve forest conservation and restoration in a holistic and sustainable project:

- Communication: An intensive multi-stakeholder dialogue and feedback loops of best practice, critics, and lessons learned;
- Structure: New components of activities and capacity development;

- Interaction: Connecting measures and activities by finding synergies and solutions to reach the Sustainable Development Goals (SDGs).

2.1. Creating a holistic and sustainable approach for church forest projects

The Church Forest Initiative is unique in its approach to promoting a multi-stakeholder dialogue. To be most effective, NCA needs to discuss and share results with all stakeholders involved to get and to give feedback to all. This work is intensive, but the final results will be promising. Different stakeholders are well addressed and included in the NCA funded Church Forest Initiative:

- Multi-stakeholder projects have continued to improve the feedback and communication between the partners. The Patriarch of the Ethiopian Orthodox Church and several other important stakeholders are included from the beginning of the project. This is important to create a higher level of awareness among all stakeholders towards upcoming church forest activities.

- It has been vital to motivate partners to share and to communicate their knowledge, results, and findings e.g. through internal communication and feedback - from scientists to implementers (DICAC) to Donors to EOC to government

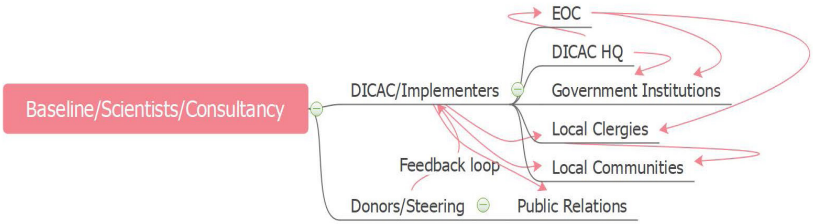

Figure 1 Chain of communication and feedback loops.

institutions (on national, regional, and zonal level) and to local clergies and village communities (woreda and kebele level). It is important to include feedback loops to ensure a common understanding:

Adopting the feedback loops shown in Figure 1 is highly supportive to achieve the expected project impact to enable the Orthodox Church and other faith-based organizations (FBOs) to contribute towards Ethiopia's CRGE-strategy and to improve the governance of forest and land management. For this, it is essential to build the role of the Ethiopian Orthodox Church as a climate ambassador - is nationally and internationally known for its forest protection.

With communication and advocacy, a comprehensive church forest project is in a better position to secure and to improve the status of the church forests and the surrounding communities.

- The Ethiopian Orthodox Church and the communities were consulted in the Church Forest Initiative approach. which serves as a foundation for upscaling the project initiatives.
- The government, both at the federal and the local level, is supportive in providing technical and administrative support.
- The interreligious approach of the initiative has shown to be successful, as there are positive feedbacks from the different religious leaders in influencing for positives changes of the community and for preparing an interfaith project for forest conservation and climate action.
- Regarding Outcome 1, the Ethiopian Orthodox Church has a historical and theological perspective and practical experiences on forest protection. The EOC accepted their role as a climate ambassador to promote its experience. To increase the impact of their ambassadorship, the church forest initiative plans to create awareness using different media like EOTC-TV. Further meetings and ongoing discussions with the Patriarch are on the agenda.
- For the ongoing activities, as well as for any other follow-ups such as upscaling an official statement/pledge regarding church forests and climate change by the EOC and other faith-based institutions (FBOs) is immensely helpful.

Using the Sustainable Development Goals as Guidance for implementing the project activities

Figure 2: The Sustainable Development Goals inform projects and initiatives to focus on global needs and solutions

- Conclusion:

The advantage of the NCA initiative is the advocacy for forest protection among FBOs by promoting the achievements of the Ethiopian Orthodox Church, as well as the outreach on a national and international scale through improved public relations.

Local church forest networks

The NCA initiative is currently working in five church forests located in Goncha Sisso Enessie woreda and a sixth church Forest in Menagesha.

The 'Green Corridor Methodology' in section three, for example, enables the initiative to integrate neighboring church forests. And the needed density of church forests is available in Goncha Sisso Enessie woreda. Green corridors can be used to create networks for forest landscape restoration and sustainable management of watersheds and can build the foundation for a project to use the concept of SDGs on the ground level. Church forests can be the cornerstone or anchor points for such an approach and the eco-theological message of the EOC can be used to change mindsets towards sustainable use of natural resources.

2.2. Developing components as a framework to reach higher goals:

To recommend which combination of activities, inputs (financial, technical, and equipment) are required to initiate and expand Church/Monastery forests programs, the suggested measures were classified into seven components to build a framework which is interconnected through the Sustainable Development Goals (see Figure 2):

(2.1) Agriculture and Food Security (SDG 2), (2.2) Natural Resource Management (SDG 13, 15), (2.3) Health and WASH (SDG 3, 6), (2.4) Economic Growth (SDG 1, 8), (2.5) Advocacy (SDG 16, 17), (2.6) Education and Research (SDG 4), and (2.7) Monitoring and Evaluation (M & E).

Build sustainable communities

Protecting and developing (growing) forest resources is time-taking. In regions where people are desperately dependent on natural resources, a project needs to improve livelihood conditions to successfully implement sustainable management and conservation of natural resources.

Gender equality

All recommended measures should promote gender equality to create gender-sensitive restoration and conservation options in and around the church/ monastery forests. EOC-DICAC should involve an advisor for gender equality.

Costs

Costs and prices for the recommended measures are highly dependent on the scale (e.g. size and the number of sites), time, and intensity of the implementation. To avoid confusion and to allow comparison, rough estimations of costs of the activities were classified into three categories:

- $ (low),
- $$ (medium),
- $$$ (high).

2.2.1. Agriculture and Food security

- Elimination of the food gap of the beneficiaries needs to be the goal, but most people living in areas - adjacent to the selected church forest sites - depend on rainfed subsistence agriculture and due to eroded soil with limited access to water and nutrition, lack of crop

diversification, and absence of techniques such as soil fertility management, agroecology, and agroforestry, as well as the shortage of farmland communities, are facing a food shortage for several months. Limited access to irrigation schemes further aggravates the vulnerability of the farmers to climate risks.

Land scarcity

- To decrease the risk of land-use conflicts, farmland expansion should be dealt with in line with improving farming methods and using improved varieties to increase the effectiveness of current farmland.
- There must be an agreed-upon plan for allocation and total land use. Improvement of farming methods needs to be connected to plantation management to create awareness that agriculture and silviculture are both improved to generate more income but work on different time scales, which is addressed in the next component The pre-development of a church forest management plan is needed to avoid conflicts in such multiple approaches.

The following measures are recommended to improve agriculture and food security:

- Activities:
  - Irrigation Scheme ($$$)
  - Soil and Water Conservation (SWC) in the plantation sites as best practice showcases ($-$$)
  - Crop Diversification and introducing agroforestry
    - Supply of vegetable seeds ($)
    - Supply of Fruit- and Fodder-tree species ($)
- Capacity Development:
  - Agro-Ecological Farming Field Schools to create a Network of Beneficiaries and to facilitate Training-of-Trainers approach ($)
  - Training in home-gardening and small-scale vegetable production ($)
  - Engagement of a consultancy service specialized in agroecology and agroforestry (specified in youth involvement) ($$)
  - Conduct climate risk analysis and training of adaption and reduction of vulnerability towards the climate crisis ($$)

- Training and access to climate and weather information/news for community members to create awareness and usage of such important data ($)

2.2.2. Natural resource management

Besides improving livelihood conditions, the church forest initiative needs to address in its main sectors of implementation of natural resource management and protection of the remaining natural church forests.

- The 'green corridor' methodology for example serves both: on the one hand management corridor plantation can be income-generating and improving ecosystem services, and on the other hand this method can increase the genetic exchange between (former isolated) tree species, which increases the resilience of the church forests towards climate change (see Annex). The green corridor methodology could also be taught in the planned pieces of training for FMNR.

- Additional to the partnership with the Norwegian Forestry Group (NFG) the initiative can partner with Plant-for-Ethiopia, a joint venture of the international tree-planting organization and global mobilizer Plant-for-the-Planet (www.trilliontreecampaign.org) and EOC-DICAC. Both partners are already active in planting forest corridors between church forests with youth groups in Libo-KemKem, South-Gondar.

- It seemed, that the newly established nurseries in East-Gojam were short on available planting material (choice of species and quantity). EOC-DICAC runs an established, professional nursery in Yefag, South Gondar which could support the project activities - if needed.

- Planting exotic tree species, e.g. inside Menagesha Mariam Church Forest should be avoided (see Annex). The answer to planting exotics might be that the clergies like them. But why do we protect church forests? Because of their natural and cultural heritage. The natural heritage depends on the last remaining natural forests in Ethiopia, which we should not replace with exotics. Regarding the planned plantations, follow these basic rules: (A) Do not plant exotics as enrichment inside Church Forests and (B)

Plant exotics for utilization only according to a management plan (agroforestry, short- or long-term rotation).

- Responsible Planting trees and develop management plans are necessary to reach the main objective 'plantation to improve the forest cover'. Improvement of forest cover without management and responsible stewardship can have a negative impact esp. when you deal with exotic (slightly invasive) species like Acacia decurrens and A. saligna.

- Implement lessons and best practices already in ongoing activities, e.g. there is a need to try and practice the 'Korean' tree nursery methods in the CF project nurseries.

The following measures are recommended to improve natural resource management:

- Activities:
  - Prepare church forest management plans ($)
  - Support youth groups in establishing private tree nurseries ($)
  - Implement SWC and tree plantations for soil protection and rehabilitation ($$)
  - Introduce renewable energy to decrease dependence on fuelwood (solar apparatus, fuel-saving stoves) ($$)
- Capacity Development:
  - Training of Forest Development ($)
  - Training of tree seed collection, forest fire protection, natural resource management, and soil and water conservation (SWC) ($)
  - Community exposure visits of best-practice e.g. of FMNR ($)
  - Train youth groups in business planning and evaluate the market potential for tree nurseries and plantations for income generation ($)
  - Train students and pupils in church and public schools in natural resource management ($)
  - Include conduct studies on sustainable forest management ($)

2.2.3. Health and WASH

The communities in and outside the church forests have limited

access to safe water for WASH and the spread of COVID-19 has been increasing at an alarming rate in Ethiopia. A COVID-19 component must be included, which is addressing the needs of the (mostly rural) communities in health education, protection promotion (social distancing, hand washing, etc.). Here religious and community leaders must be addressed as key change agents.

The following measures are recommended to improve health and WASH:

- Activities:
  - Expansion of water supply (e.g. deep wells, shallow wells, hand-dug wells, and springs) ($-$$$)
  - Introduction of improved pit latrines (also for church schools, pilgrims, and holy water users) ($$)
  - Support health institutions with personal protective materials ($)
  - Support for COVID-19 victims ($)
- Capacity Development:
  - Awareness and Sensitization for WASH and the current pandemic ($)

2.2.4. Economic development

Especially for the economic component, new stakeholders should be included for innovative pilot programs, targeting youth. A concept needs to be developed with concrete steps. The assistance of consultants should be sought, especially for forage/fodder & organic fertilizer production, honey value chain. The focus should be on the following aspects:

a. Income Generation

b. Small business development, which will be targeting youth

c. Value chain development (private nurseries, renewable energy, honey, wax, spices, herbs, organic fertilizer, biogas, renewable energy, fodder, etc., and plantation management)

So far, the project conducted the potential markets for different activities such as tree nursery site development, manufacturing energy-efficient stoves, small scale irrigation, and Non-Timber-Forest Products (NTFP) like honey. But for further development of innovation as part of the church forests initiative, integrating youth groups into church forest activities seems often limited to beekeeping and nursery groups,

but young Ethiopian start-ups could give examples about what else is possible and feasible for young people to generate income. The Blue Moon incubator https://www.bluemoonethiopia.com/ or the Agroecology Network of www.agriprofocus.com/can recommend innovation to integrate youth and to discuss alternatives to create income and to start a business.

The following measures are recommended to improve Economic Development:

- Activities:
  - Providing modern beehives ($$)
  - Providing hardware e.g. bakery oven, weaving loom, solar panels, and grain mill to initiate economic activities and to create jobs ($$$)
- Capacity Development:
  - Developing value chains for honey and beekeeping side-products like bee wax ($)
  - Train young beneficiaries in forage production and supply chains for animal fodder ($)
  - Create a business concept for youth involvement in various sectors (incl. training for hardware maintenance) ($)
  - Consultancy service on agribusiness and value chain development ($$)

2.2.5. Advocacy

Advocacy is an important pillar of the church forest initiative and this component includes innovative activities, like:

a) **A Theological Reflection Booklet**

- The Theological Reflection Booklet on Forest and Environmental protection which all clergies will use for their eco-theological reflection and actively use in their service is a convenient result for the feedback loops described earlier Because the output of the booklet is linking the achievements of DICAC with the theological reflections of the Ethiopian Orthodox Church and their clergies. The clergies will be able to reach within their constituency of millions of Orthodox followers.
- Internal reflections on the Church Forest topic will help to catalyse the demand from EOC and DICAC to initiate and to expand church forest projects. EOC(-DICAC) should be able to

develop a holistic strategy to conserve 35,000 church forests in the future and to improve the livelihood conditions in the adjacent communities. Losing church forests would cause negative feedback on several crucial ecosystem services and contribute to climate change.

b) **An *open-source* Database and Website on Church Forest Activities**

- Think big! and include all ongoing church forest activities by various stakeholders (i.e. local communities, implementers, researchers, donors).
- The initiative needs to discuss the set-up of the database, and EOC / DICAC needs to communicate their wish and their capacity to host a database connecting all the knowledge, tradition, and church forest sites and implementation/lessons learned of church forest activities in the past, present, and future. They might need capacity development to host and to manage such a database.
- NCA should buy the copyrights of booklets, toolkits, and guidelines which were produced during the church forest initiative and publish them again in print and online as open source.
- 'Church forests' are a trending topic and to create awareness of the existing approaches and to contact EOC / DICAC and to discuss new project ideas, it could be supportive to create a simple **website** that connects stakeholders with the Ethiopian Orthodox Church.

c) ***A Climate Platform***

- The target(s) of the interreligious climate platform (e.g. climate justice) need(s) to be more detailed and defined. Such a platform could be its independent project and initiative. And the platform needs strong steering and well planned and scheduled events which should be planned along a red thread to enable the platform to grow and to gain more influence and impact – in an interreligious and regional network.
- Establishing a meta-network: Use the interreligious climate platform to create a network to share knowledge and to coordinate church forest activities. Directly address

other stakeholders and potential project donors to share their ideas and to learn from each other.

- Share the platform with other international FBOs/networks e.g. the ACT-Alliance.

d) ***Connecting with broader networks of religious actors working on forest protection and reforestation (Interfaith Rainforest Initiative).***

  - With an Ethiopian Orthodox Toolkit for Forest Protection (see Annex)

e) ***Interaction with parallel running projects (e.g. Sustainable Church Forest Management Projects by PADD and EOC-DICAC).***

  o To support EOC / DICAC to apply for a world heritage status for the church forests at UNESCO.

f) ***Peacebuilding to solve local conflicts during Church Forest activities, especially land-use conflicts can increase because of afforestation and for this reason, a deeper understanding of the needs of the local population as well as the important role of forests is necessary.***

The following measures are recommended to improve advocacy:

- Activities:
  - Communications and public relations

- Website to present EOC-DICAC as a partner for Church Forest Projects;

- Photo and documentary filming to promote the important role of church forests;

  - Organize meetings and facilitate a dialogue on conflict resolution between communities in and outside church forests.

- Capacity Development:

  - Training on peacebuilding for religious and community leaders, community, and government representatives;

  - Training for religious and community leaders, community, and government representatives about climate change, crisis, and justice to promote the climate platform.

2.2.6. Research and Education

- It is not needed to analyse 35,000 church forests to start helping the people in- and

outside these forests and to protect the environment. But the creation of common knowledge and understanding can be particularly useful to support and improve the work of the partnering institutions and the lives of the local people and clergies in the surroundings of the church forests.

- Do not focus so much on the study of the ecology and floristic composition of the forests. The choice of the six forests is already made and it is evident that the church forests have a high bio-quality and that they are the last remaining forests with the last individuals of the (northern) Ethiopian forest flora and fauna. Rather do your research in such a project on long-term protection, best practices in increasing forest cover, and how to strengthen the climate resilience of the surrounding communities. Also, it is convenient for DICAC to conduct a climate risk analysis. Here collaboration with partners could be fruitful to learn from their experience to cope with climate risks. Various institutions can be strategic partners to work together on research.

The following measures are recommended to improve research and education:

- Activities (including capacity development):
  - Research on long-term protection and sustainable management of natural (forest) resources,
- On best practices in increasing forest cover;
- And how to strengthen the climate resilience of the surrounding communities.
  - Conduct climate risk analysis;
  - Organize environmental clubs in local schools to involve the youth and create platforms for discussion on forests and climate and to train students and pupils in church and public schools in natural resource management;
  - Organize Agro-Ecological Farming Field Schools.

2.2.7. Monitoring and Evaluation (M&E)

- General project monitoring:
  - EOC-DICAC has an M & E department, which should be involved in the project

monitoring because EOC-DICAC should develop a professional monitoring and evaluation plan for the church forests and need to set standards by themselves;

- Establish peer review and exchange between church forest sites and groups.

- Specific monitoring:

Nurseries and Plantations

- Nurseries and plantations should be inventoried and continuously monitored to be effective. See designed evaluation forms to standardize the process in the Annex.

Carbon and Plantations (Tree maintenance)

- There might be other tools than WRI's MRV available for the calculation of carbon stock and sequestration of church forests (see Plant-for-the-Planet App and Inventory Program: https://www.youtube.com/watch?v=sXUakN5Iz_s.).

The following measures are recommended to improve monitoring and evaluation:

- Activities:

- Involve the M&E department of EOC-DICAC;

- Introduce the annexed monitoring and inventory sheets to the partners and establish precise monitoring and evaluation based on standards;

- As REDD+, EOC & DICAC, EFCCC, NCA, and various others are interested in the carbon stock and sequestration of the natural Ethiopian forests, it is interesting to conduct a nationwide estimation to define the relevance of the EOC church Forests as carbon stock.

- Technical recommendation:

- Instead of GPS, use free GPS-apps for smartphones. A basic smartphone would cost less than 100€. Compared to a GPS (e.g. Garmin, ...) the added value of a phone with GPS would have more benefits. The data export from a GPS can be tricky and further use of the data needs a PC or laptop. A smartphone can easily share and visualize the data via Google Maps or other apps.

3. Green corridors – linking Ethiopia's fragmented landscapes

Linking Biodiversity Conservation, Climate Adaptation, and Local Communities

3.1. Abstract

The 'green corridor' concept was developed to connect isolated forest or natural habitat patches with a territorial extension of various sizes and shapes, whose main function is to link protected or important areas to permit both migration and the dispersal of floral and faunal species. Green corridors can be planned in a different dimension - in size and length. A bigger and wider corridor is better than a smaller one. Green corridors can be established on a regional, sub-regional, and local level. For the recommended methodology, the components of green infrastructure are defined as Core habitats (forests) or anchor points, buffer zones or hubs, and links like corridors and steppingstones. The methodology provides a ranking system to plan the most feasible corridor structures regarding conservation and connectivity. The methodology toolbox is followed by recommendations to start planning in three different approaches: (1) Green corridors to connect habitats in fragmented landscapes; (2) Green corridors to connect isolated church forests; and (3) Green corridors to connect church forests with other churches, mosques, schools without forest(s). The concept of green corridors is not only protecting nature it also supporting the local communities, because parts of the green corridors can be utilized. For this reason, it is important to create ownership and responsibility. Plantation management and several other income-generating activities will turn landless youth into tree planting youth. Green corridors are connecting nature and are connecting people.

3.2. Green corridors - definition and terminology

The so-called green - or *wildlife, forest, ecological, biological* - corridors are an internationally, common strategy to rehabilitate defragmented landscapes (Rosenberg et al., 1995).

In this methodology toolbox, the term 'green' is chosen, because

the colour green as well as the Amharic translation '*lemlem*' is associated with heaven (like the Garden of Eden), renewal, growth, luck, and hope. Green stands for the need for growth. Green also stands for new growth and rebirth, usually in the rainy season, when all the plants are coming back to life with fresh growth and life after the dryer months are over.

On the other hand, corridors are strips of habitats to increase the exchange of individuals of plant and animal species between formerly isolated habitat patches. This promotes genetic exchange and enables the species and ecosystems to adapt better to changes, e.g. caused by the climate crisis. Corridors do not only increase wildlife exchange between patches, but they also facilitate ecosystem services like pollination, seed dispersal, erosion control, and others. Corridors contribute to the landscape's ecology beyond the area they add because the increased movement will have a positive impact on community interactions and, formerly isolated, plant populations in fragmented landscapes.

According to Moreno (2012), the most accurate and frequent used definitions for the corridor approach in conservation biology are:

Territorial extension of various sizes and shapes, whose main function is to link protected areas to permit both migration and the dispersal of floral and faunal species (García, 2002).

A defined geographical area that provides connectivity between

landscapes, ecosystems, and atural or modified habitats, and ensures the maintenance of biological diversity and ecological and evolutionary processes (CCAD, UNDP/GEF, 2002).

3.3. Designing a corridor

The idea of 'Green Corridors' describes a network of green infrastructure. Its connections can be planned in a different dimension - in size and length. A bigger and wider corridor is better than a smaller one. Wider corridors provide space for higher biodiversity and give migrating animals more space to travel and to hide. The negative impact from outside the corridor, the so-called edge-effect, decreases as the corridor is wider and the habitat inside becomes more isolated e.g. from land use, fertilizer, weeds, predators. Generally, green corridors can be classified into three levels (EPRD-DEC, 2004):

Regional corridors

We describe corridor structures on a regional level as connecting landscapes. Those landscapes can be larger important areas of habitats. Those habitats can be part or can fill whole protected areas like biosphere reserves and national parks. A regional corridor would be able to connect two larger protected areas and regional corridors are generally substantial in width (> 500m) and provide not only for dispersal of individual species but they build habitats – on their own – for a range of species. Regional corridors typically connect along major ecologically gradients such as altitudinal and/or geographical migratory pathways (e.g. coast to the hinterland, connecting wet- and drylands, crossing large drylands).

Sub-regional corridors

Sub-regional corridors are smaller than regional ones, but they need to be wide enough to provide landscape connections for species movement and dispersal (generally > 300 m). Those structures might not provide enough space for habitats but are big enough to facilitate a wide range of species movement and exchange. Those corridors normally connect larger vegetated areas (e.g. forests) in connected landscapes with similar vegetation (along ridges, escarpments, floors like parts of the rift valley).

Local corridors

This is the lowest level of corridor structures. Local corridors are smaller linkages that provide local connections of remnant patches of vegetation (like church forests). Small corridors are less defined than the (sub-)regional structures and often they are compromising to bridge at least some kind of connection between local habitats. For this, they must follow landscape features like wetlands, creeks, and gullies. They may be in some cases less than 50 m in width. The impact of edge-effect cannot be avoided in such small pathways, but they are important components of a conservation framework in a fragmented landscape.

For the recommended methodology, we define the components of green infrastructure as:

- **Core habitats (forests) or anchor points,**

That we need to connect via corridors or similar structures. In the best case, those structures should be continuously connecting e.g. two or more core habitats/

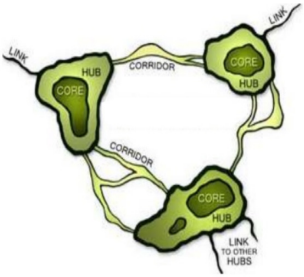

Figure 3: Concept of green infrastructure. ttps://www.slideshare.net/EmonfurProject/davies-european-experiences-of-upf

anchor points, but in the reality, the project should be aiming to connect anchor points with the shortest distance between them possible using existing forest or vegetation structures*.

- **Buffer zones or hubs**

Around the core habitats often a buffer zone is found which protects the core zone, this buffer can be extended with enrichment plantations. Buffer zones work as hubs where the green corridors are connecting.

- **Links**

Are the connections tying the system together and facilitating the flow of ecological processes like migration, dispersal, and pollination. Links include green corridors and stepping stones.

- **Corridors**

Area forest corridor, plantation, and or a hedge – best with indigenous, suitable tree and shrub species which serves as a vector for exchange and migration.

- **Stepping stones**

Are single, alone-standing, bigger trees like old *Ficus* trees which represent a habitat for several plant and animal species that can bypass distances between core habitats.

- **Other core habitats**
    - Are protected areas, forest priority areas, community, or government forests that can be integrated into the concept of green corridors.

**Not only forests, but hedges or bigger trees can be connecting structures - also wetlands, rivers, and rock formations allow animals and potential pollinators to migrate between habitats.*

3.4. Identification and selection of the available green infrastructure to build a green network

With the following scoring system (see Table 1a-c, Table 2a-c), the project can rank the most efficient corridor structures between

isolated habitats like forest patches. Applying the scoring system will enable projects to plan and to develop efficient green corridors between isolated forest patches. The scoring system was compared with an existing approach developed by the World Bank to connect larger, protected areas in Ethiopia (Mulugeta 2019, unpublished). Table 1a-c gives implementers options to classify potential core habitats regarding protection status, land cover class, size, and location.

Table 1: Ranking core habitats as potential anchor points.

Rank	Protection status and land cover class	Score
1	Protected Forest patches of high interest - specifically for this approach: EOC Church forests	40
2	Non-protected forest patches - but highlighted importance (e.g. IBA – important bird areas, RAMSAR wetlands)	30
3	All other natural ecosystems - not protected - like natural forests, wetlands, woodlands, grasslands	20

Table 2: Size matters – ranking forest patches by their size.

Rank	Habitat size	Score
1	Large	40
2	Medium	20
3	Small	10

Table 3: Location is important for biodiversity, connectivity, and ecosystem services.

Rank	Location	Score
1	Located on hilltops, hillsides, slopes, and/or along river banks or lake shores	20
2	Located elsewhere	10

The following tables (Table 2a-c) enable implementers to classify the degree of the connectivity between anchor sites and to connect sites most feasibly.

Table 4: Distance can be a crucial factor for the feasibility – economically and ecologically.

Rank	Distance	Score
1	< 5 km distance between the anchor habitats (church forests)	40
2	5-10 km distance between the anchor habitats (church forests)	25
3	>10 km distance between the anchor habitats (church forests)	5

Table 5: Barriers need to be avoided to build functional corridors.

Rank	Barriers	Score
1	No human structures	40
2	Minor structures, e.g. individual houses, small villages, minor roads	20
3	Major structures (towns, railway, major roads, industrial areas or intense commercial agriculture)**	0

Table 6: Smaller or bigger structures can support the connectivity of the planned corridor network.

Rank	Supporting structures in the landscape	Score
1	Stepping stones: Forest patches, big old trees, extensively used land, rangeland, soil, and water conservation features (e.g. terraces)	20
2	None of the above	0

*total maximum score is 100. **considering planned development.

Not only physical structures and distance influence the connectivity between the sites. Administration on a federal, zonal, or local level, discussion with the local communities, and land availability might also challenge the process of corridor planning. All stakeholders need to be involved to create the corridors with the most transparency and this will be reflected in the sustainability of the corridor network.

3.5. Recommendations:

The following recommendations are divided into three different approaches:

- Green corridors to connect habitats in fragmented landscapes;
- Green corridors to connect isolated church forests;
- Green corridors to connect church forests with other churches, mosques, schools without forest(s).
- Green corridors to connect habitats in fragmented landscapes

In general, the concept of green corridors can be applied to connect any sites of the natural vegetation on a regional, sub-regional, and local level. This matter can be already discussed during the process of project planning and the approach and methodology should be already included in the stage of proposal writing. Depending on the size of the project, respectively the size of the implementation area, the criteria of green infrastructure can be used as a toolbox to connect single project sites. This concept will increase the impact and value of the project measures by far more than just the added area. So, if it is part of the project to protect and/or plant trees, a feasibility study should be implemented as a baseline to locate potential corridor structures.

- Green corridors to connect isolated church forests

Natural forests in northern and central Ethiopia are mainly limited to the extent of the 'church forests' of the Ethiopian Orthodox Tewahido Church. About 35,000 church forests exist in Ethiopia, most of them are found in central, northern Ethiopia. The composition of the church forest vegetation is similar to the expected potential natural vegetation. Problematic for the development and the resilience of the species populations inside the forests is the size and isolation of the church forest patches. Most of the church forests are of rather a small size and are isolated for a long-time. The smaller size of the forests increases the edge-effect, which is shown through the negative impact coming from the surrounding environment (Aerts, et al. 2016).

Church forest projects need to include the clergies living inside the forest as well as the local communities living outside the forest to create sustainability and to protect the forests in the future. For this reason, projects working on sustainability need to include local communities in the process of implementing and creating green corridors.

The terminology for the green infrastructure in an adapted concept to connect church forests needs to be slightly changed:

- **Church forests**
  - Are the **core** habitats which will function as anchor points.
- **Buffer plantation and enrichment planting**
  - Buffer plantation includes indigenous and exotic trees with a short- or long-term plantation management plan. It includes harvesting of trees, never clear-cutting, but always replanting of new trees,
  - and enrichment planting and forest restoration sites which only consist of indigenous trees, which represent the potential natural vegetation.
- are the **hubs** to connect the church forest with other forest patches, corridors, and/or stepping stones.
- **Corridors (local corridors)**
  - Existing green infrastructure will be analyzed and as much as possible included in the setup of the corridor structure.
  - Corridor gaps will be

discussed with the local communities and with the woreda and kebele administration. The aim is to identify degraded land which can be used for reforestation (compare p. 9).

- **Stepping stones**
  - Steppingstones can be e.g. wetland, hedges, or isolated, big, old trees which are often used as meeting points for the local villagers. The steppingstones should be extended with tree planting activities. Due to the high impact of humans and livestock the planted trees need to be well protected.
- Connecting church forests with other church compounds without forests, mosques, and schools
- Creating corridors on the ground and in the minds of the local people
  - Additionally, to the already mentioned corridor approaches it is also possible to create corridors between a forest site and a non-existing but planned plantation site. It would be an innovative approach to develop partnerships between different stakeholders, e.g. with other groups coming from other FBOs (faith-based organizations), government institutions, and other stakeholders. The project could facilitate joint tree planting activities.
  - and discussing the importance of trees using the example of the Ethiopian Orthodox Church as a climate change ambassador and the role of trees for adaptation during the climate crisis. This discussion can take place in interreligious networks as well as organized by the environmental clubs in the local schools to involve and include the youth and talk about climate justice.
- Utilizing Green corridors: Ownership and income generation for local communities

It is possible to involve local landless youth in the establishment of new green corridors. To connect the church forest islands a lot of women- and manpower is needed to work on tree plantation between the

forests and it is best to bring local people with ownership and a management plan into responsibility and income. On the one hand, this will decrease the pressure on the church forests, and on the other hand, the corridor plantations create an alternative source of biomass for energy and construction.

- Turning landless youth into tree planting youth

- In a case study in Angot Kebele, Libo Kemkem Woreda, a youth group already started tree planting to build up new corridor structures on degraded land to increase the connectivity of church forests. The project is funded by an international tree-planting organization called Plant-for-the-Planet.

The youth group is organized under the supervision of EOC-DICAC. And from the beginning on, EOC-DICAC took care of the project and they moderated the needed negotiations between the youth group and the woreda administration to lease the amount of degraded land (30 ha) needed for the planned tree planting activities.

Connecting nature – connecting people

In this process, a group of seven former landless youth got the ownership of 30 ha degraded land for plantation. The ownership is sealed with a land lease contract for up to 99 years. Further, a land-use binding agreement confirms that the 30 ha must be used as a tree plantation and to guarantee the plantation/forest cover on the 30 ha for the period of the land lease contract.

To increase the economic value of the plantation, a management strategy needs to be developed the groups and trees need to be planted accordingly. Plantation management for short- and long-term rotation of chosen tree species with high ecologic and economic value.

To establish a sustainable plantation, it is important that

- Harvested trees are re-planted,

- and the clear cut is forbidden.

Alternative livelihood strategies and income-generating options

1) Agroforestry, Inter-cropping,

2) Permaculture (with vegetables, herbs, and ornamentals) in and around the nursery site

3) Beekeeping

4) Establishment of a seed orchard and seed collection

5) Fuelwood generated through thinning and tending measures

This example can be upscaled as best practice and multiplied.

4. Church Forest Tree Planting Guide

Recommendations and food-for-thoughts for present and future tree-planting activities.

4.1. Introduction

This study aims to discuss with all stakeholder groups tree planting activities and selection of tree species in all kinds of Church Forest management activities and sites and to give recommendations for present and future tree-planting activities.

For a standardized inventory and monitoring of the nursery activities, tree planting, as well as seedling survival, using the Nursery Planting Survival Inventory is recommended (See annex).

4.2. General recommendations

Landscape restoration with trees

No exotic tree should be planted inside a church forest, and no exotic species should be used to restore a natural environment. Only indigenous trees – over time – can contribute fully to functioning ecological services and can create potential natural vegetation (PNV) as part of a natural environment.

Conservation

We want to save the church forests through sustainable forest management. **Planting exotic tree species inside church forests is demolishing the conservation status of the church forests.**

Exotic trees were introduced to Ethiopia in the past, because of their fast growth rate, but some of them have negative characteristics such as, not being resistant towards termites and/or causing allelopathic, negative side-

effects on other herbs, shrub, and tree species nearby. Fast growth results also in consuming a lot of water and nutrition, which might be also then not available for other trees and plants nearby. This can lead to scarcity of water, a decrease in vegetation cover, and land degradation.

Considering that the climate crisis will increase the number of hot and dry days per year, planting some exotic tree species which need more water than others (e.g. *Eucalyptus* spec.) is the opposite of adaptation.

The remnant, old Church forests have their value for conservation because they are protective reserves of the remaining Afromontane forests of the Abyssinian highlands, so the church forest management projects should not plant exotic trees inside church forests.

Most of the existing church forests are already degraded and need reforestation measures such as enrichment-planting inside the forest and restoration of degraded land – outside the church forest – to extend the size of the remaining forest:

Enrichment planting inside Church Forests

The species composition of each church forest does not need to be analyzed in detail – but at least it is crucial to know the dominating tree species and the agro-ecological zone, altitude, and climatic conditions of each site. Local species perform best in the locality from which they are coming from. Seed collection inside the church forests is highly recommended. The dominating species are recommended to be propagated in a tree nursery nearby the site. For enrichment planting inside the church forest all woody species from the church forest can be used – also smaller trees and shrubs. I recommend collecting seeds of all available species.

Protection and zero-encroachment will enable the natural regeneration and succession of the church forest. Without disturbance (e.g. by free grazing) the natural soil seed bank would generate new seedlings and saplings inside the church forest.

Enrichment planting is mainly needed where disturbance cannot be avoided, like e.g. the entrance, gathering/meeting points, pathways, ... or in any enclosure.

Some important species like *Podocarpus falcatus* and *Olea europaea* need special attention and protection because of their low germination rate.

Figure 4:EOC-DICAC in Mekelle manages to plant successfully Podocarpus (Zigba).

Reforestation on degraded land

Most of the project sites and in general most of the Ethiopian Orthodox Church Forests have lost already their round-shaped form and size. Degraded land, as well as agricultural land, is surrounding the Church Forests like islands in the ocean. But not only 'surrounding' - degraded patches are already entering the forests.

In analogy, islands in the ocean are highly affected by flooding and the rising sea level, caused by climate change.

Figure 5:Typical round-shaped Church Forest Island (Credit: Kieran Dodds).

To restore these patches, we need indigenous seedlings and physical structures to increase their survival rate and to slow down erosion as well as to collect water and to drain the soil.

Species need to be differentiated by their ecological benefits and traits. Pioneer species, like *Acacia albida*, which are soil-improving are a good choice.

Figure 6:Soil and water conservation and tree planting can go together – here implemented by EOC-DICAC Mekelle and the clergies from the Emba Kidist Aresema Mekane Kidusan Andenet Monastery

Figure 7:Weeding and mulching around the seedling is good for the nutrition supply for the seedling (here Cordia Africana at Montogera Estifanos).

Figure 8:Tree maintenance is as important as tree planting (here: Olea europaea var. cuspidata at Montogera Estifanos).

Soil and water conservation (SWC)

Minimize erosion and keep always trees on your plantation to avoid the soil to dry out.

Figure 9:The half-moon shaped micro-catchment supports the planted tree seedlings with water and nutrition. It can be covered with mulching compost to add nutrition and to avoid drying up

Establishing such half-moon shaped micro-catchments are important for soil and water conservation on degraded church forests. Additionally, the half-moon shaped structures should be covered with biomass like grass or mulching compost.

Half-moon success stories:

- https://mcc.org/stories/how-digging-half-moons-helps-farmers-burkina-faso#
- https://justdiggit.org/project/kenya-olgulului-ololarashi/
- Zougmore et al. (2003) Role of nutrient amendments in the success of half-moon soil and water conservation practice in semiarid Burkina Faso.

Develop a constant 'forest climate'

Keeping solitary trees will help you to manage a constant 'forest climate' on your plantation site (at least at a minimum). Such a local 'forest climate' is more humid and some degrees colder than outside the plantation.

Additional to the 'forest climate', trees will increase the groundwater table and decrease surface runoff/overland flow after heavy rains, this will decrease erosion and loss of valuable soil on the church forest plantation.

Economic use and management

There are several tree species with economic useful traits such as strong timber or tasty fruits. While most of the common fruit trees are anyway exotic origin, firewood and timber can be produced from indigenous and exotic trees.

Most important is a management plan to harvest the benefits of economically useful tree species. All stakeholders - who are part of tree planting activities - in the Church Forest management project should have a management plan in place before

planting trees for any economic use.

The management plan should at least answer the following questions:

- Who is using the planted trees (ownership)?
- When are the planted trees used (timeframe)?
- Why are the planted trees used (purpose)?

The focus should be on the sustainability of the plantation.

Short-term Rotation

Several exotic tree species (like *Grevillea robusta*, *Acacia Decurrens*, *Acacia Saligna*, *Eucalyptus* sp.) are used in Ethiopia for Short-term Rotation. Short means harvesting the plantation after 10 to 20 years after planting. The trees are already used with the first measures of tending and thinning after three to eight years for firewood or charcoal.

Acacia albida and *Sesbania sesbans* are useful indigenous species for short term rotation.

After eight years of growth, the trees can be already used as timber for poles and stems for construction sites. But it is important to keep in mind that the growth rate can vary from site to site.

Plantation for short time rotation can be monoculture and should be planted dense, but never harvested in clear-cuts. Rather divide the plantation into patches and harvest a patch each year and start restoring and replanting each patch accordingly. Choose the location of the 'forest' patches to decrease potential erosion to a minimum.

Long Term Rotation

After 20 to 30 years trees are harvested for long-term rotation use – mostly to produce timber of a certain quality. Trees should be planted widely each species in one patch, but tree species can be mixed. Several exotics like *Cupressus lusitanica* are used in such plantations and *Grevillea* and *Eucalyptus* can be used.

Some important indigenous tree species should be used in such a plantation. These species can be e.g. *Cordia Africana*, *Croton macrostachyus,* and *Juniperus procera*.

Trees should NOT be harvested at once in a clear cut! Rather include in the management plan a harvesting period of three years.

And never forget replanting.

Agroforestry

Various combinations of crops, vegetables can be grown together in the planned tree plantation, and examples are widely found in Ethiopia. Trees can bring several positive ecosystems services to an agricultural field:

- Increase the level of the groundwater table by decreasing overland flow, creating drainage by their roots, and pulling the groundwater level by their water consumption (their roots go much deeper);
- Fertilizing through nitrogen fixation and creating mulch by dropping their leaves;
- Decreasing soil erosion by rain and wind.

And additionally, the farmer can make use of:

Timber/Firewood: -with e.g. *Terminalia brownii*, *Cordia Africana,*

Juniperusprocera;

Fertilizer / Nitrogen fixation:- with *Acacia* spec., *Sesbania sesbans;*

Fruit:- with various fruit tree species like Mango, Orange, Apple, Guava;

Honey / Bee fodder:- with *Cordia Africana* and various *Acacia* spec.;

Medicine:- with *Hagenia abyssinica;*

Ornamental/Shade and Recreation - with *Ficus* spec.*

4.2.1. Site-specific purposes

There are of course different purposes of tree planting for each project site/church forest. Please find on the following pages a summary of the purposes of tree planting and a short comment to each of them:

Inside the monastery forest:

No exotic tree should be planted inside a church forest, and no exotic species should be used to restore a natural environment (see page 5).

In & around the church forest:

Here, we differentiate between church and monastery forests, because clergies, nuns, and monks, living inside monasteries can better care for their forests than priests serving at several churches.

The paradigm should still be '**not to plant exotic trees inside church forests**'. But outside the

church compound, of course, also exotic tree species can be planted as buffer plantations for the need of firewood and timber. But exotics cannot be used to extend the natural church forest.

Surrounding the monastery forest

If the monastery has land for agricultural purposes outside the church forest, we can discuss potential tree plantations, agroforestry, and soil and water conservation and turn agriculture monoculture into a more sustainable 'agroforestry food forest'.

For land restoration:

Before we discuss land restoration in general, we should focus on restoring church forests. Inside Church forests more and more empty spaces occur, due to degradation, and lack of regeneration, and encroachment. Strategic measures can restore intact church forest islands (see pages 7 and 8, and compare Figure 8 (Aerts et al., 2016)).

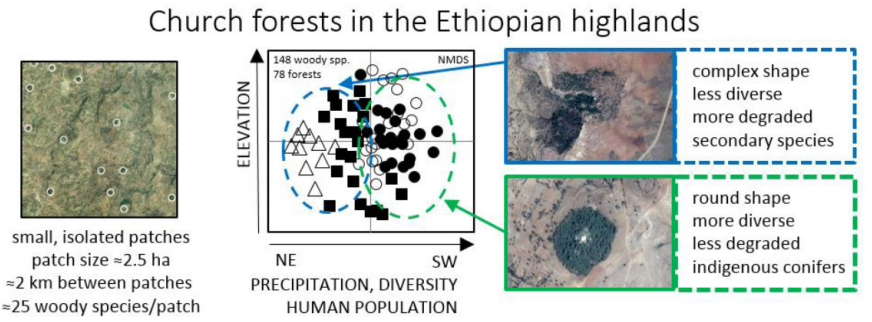

Figure 10: Degraded church forests have a more complex shape, less degraded forests have a typical round shape (Aerts et al., 2016).

- Aerts et al. (2016) Conservation of the Ethiopian Church Forests: threats, opportunities, and implications for their management. Science of the Total Environment.

Farmers can be inspired by the church forest to collect seeds, to start their nursery, and to plant trees on their land.

On the women (self-help group) for firewood, Especially women can get more independence by starting their tree plantation for firewood.

Various government institutions (schools, offices, district plantation sites), should be included in the church forest projects. The Orthodox Church partnering with EEFRI and/ or EFCCC might be the best in Ethiopia for sustainable capacity development of a new understanding of trees, forests, and sustainable management of natural resources. Schools are a good platform to discuss projects with youth. Youth involvement is particularly important to care for the slowly growing trees.

4.2.2. Tree species

i. Indigenous trees

Acacia albida (syn. Faidherbia albida, indigenous):

- **Biophysical limits:** Up to 2600 m asl.;
- **Groth rate:** Slow initial growth, later fairly fast-growing on good sites;
- **Soil type:** Widespread in a wide range of soil types and different climates;
- **Products:** Firewood, charcoal, timber (construction), posts, utensils, food (pods for flavoring, boiled seeds), medicine (bark), fodder (pods, leaves);
- **Use:** Shade, mulch, nitrogen fixation, soil conservation, soil improvement, windbreak, tannin, dye, soap, fence (cut branches).

Cordia Africana (indigenous):

- **Biophysical limits:** 550-2600 m asl. (900-2500 m asl.*); 700-2000 mm;
- **Growth rate:** Easy to raise and reasonably fast-growing;
- **Soil type:** Thrives in forest soil;
- **Products:** Firewood; timber (furniture, beehives, boxes, mortars); food (fruit); medicine (juice from bark, roots); fodder (leaves); excellent for apiculture

(traditional hives are also placed in the branches); green fertilizer (heavy leaf fall in the dry season);

- **Use:** Shade or shelter; ornamental; mulch; soil conservation.

Croton macrostachyus (indigenous):

- **Biophysical limits:** 200-2 000 m asl. (*1100-2500 m asl.);
- **Growth rate:** Fast-growing on good sites, slow on drier sites;
- **Products:** Fuelwood; timber; apiculture; poison; medicine;
- **Services:** Erosion control; shade/shelter; ornamental; apiculture.

Dodonaea cf. viscosa (indigenous):

- **Biophysical limits:** 1000-2700 m asl.;
- **Growth rate:** Not browsed and therefore easy to establish. It is especially useful in reclaiming poor land;
- **Products:** Firewood, charcoal, poles;
- **Use:** Medicine, bee forage, soil conservation, windbreak, live fence, toothbrushes.

Dovyalis cf. caffra / abyssinica (indigenous):

- **Biophysical limits:** 200-2450 m asl. (for *D. abyssinica* 1700-3000m asl.); 1500-3000 mm;
- **Products:** Food (fruits are high in Vitamin C); fodder; apiculture; timber; poison;
- **Soil type:** Thrives in deep, well-drained, loamy, or sandy soil to which compost has been added;
- **Use** Excellent live fence; ornamental.

Hagenia abyssinica (indigenous):

- **Biophysical limits:** 2300-3300 m asl.;
- **Growth rate:** Not competitive against crops if managed to prevent shading. It is recommended for homesteads because of its good timber. It constantly sheds leaves forming a carpet of dried leaves.
- **Products:** Firewood, timber (furniture, flooring), carvings, poles, medicine;
- **Use:** Ornamental, mulch, green manure, soil conservation, firebreak.

Juniperus procera (indigenous):

- **Biophysical limits:** 1100-3500 m asl. (*1500-3300 m asl.); 400-1200 mm;
- **Growth rate:** Fast-growing in

the open but otherwise slow;

- **Soil type:** Prefers well-drained soils no heavier than sandy clay. Can be found scattered on rocky sites; limestones; granite and basalt;
- **Products:** Fuelwood; apiculture; timber; medicine;
- **Use:** Shade/shelter; ornamental; windbreak.

Olea europaea spp. cuspidata (syn. Olea Africana, indigenous):

- **Biophysical limits:**1.400-3100 m asl.;
- **Growth rate:** Moderate but durable, with a low germination rate;
- **Soil type:** Grows best in forest soil, but hardy and drought resistant once established, even in poor soils. Also withstands acidic soils;
- **Products:** Fuelwood; charcoal; timber; posts; medicine; apiculture;
- **Use:** Land reclamation; ornamental.

Podocarpus falcatus (indigenous):

- **Biophysical limits:** 1550-3000 m asl. (*1500-2500 m asl.); 1200-1800 mm;
- **Growth rate:** Slow-growing. Hardy once established;
- **Soil types:** Rich, well-drained soils are needed for *P. falcatus*; mainly found in humus-rich sandy soils;
- **Products:** Firewood; excellent timber (furniture, boxes, plywood, panels, poles); medicine;
- **Use:** Shade or shelter; ornamental; reclamation; encourages biodiversity (favorite for indigenous nesting birds).

Sesbania sesban (indigenous):

- **Biophysical limits:** 300-2000 m asl.;
- **Growth rate:** Fast-growing. Pruning, short rotation. The genetic diversity of Sesbania types allows for selection (e.g. for different uses, management, soil types);
- **Soil types:** Various;
- **Products:** Firewood, poles, medicine (ground leaves), fodder (leaves), (leaves);
- **Use:** The leaf mulch and nitrogen-fixation features make this a tree of great potential for intercropping and thereby soil improvement on small

farms. Shade (young coffee), mulch, nitrogen fixation, soil improvement, soil conservation, fibres (young stems), soap.

ii. Exotic trees

Acacia decurrens (exotic):

- **Biophysical limits:** 1600-2500 m asl.;
- **Growth rate:** This plant may become a weed, spreading rapidly by seed in good conditions. In Ethiopian conditions, it has great potential for poles and firewood. Best grown in woodlots and can be used to stabilize soil;
- **Soil type:**
- **Products:** Firewood, charcoal, poles, posts, forage (pods), bee forage;
- **Use:** Shade, ornamental, nitrogen fixation, soil conservation, windbreak, tannin (bark), live fence.

Acacia saligna (exotic):

- **Biophysical limits:** 0-1000 m asl.; 350-600 mm;
- **Growth rate:** Fast-growing;
- **Soil type:** This occurs on many soil types, especially poor acid, or calcareous sands. It will grow under the most adverse and dry soil conditions;
- **use:** Firewood; timber (posts); fodder (young seeds, pods, and shots-can be grazed without harming the plant);
- **Services:** Erosion control (one of the best for binding sand); shade or shelter; windbreak; land reclamation/rehabilitation; nitrogen-fixing; ornamental.

Azadirachta indica (exotic):

- **Biophysical limits:** 0-1900 m asl.; 400-1200 mm;
- **Growth rate:** Fast-growing after the first year;
- **Soil type:** It grows on a wide variety of neutral to alkaline soils but performs better than most species on shallow, stony, sandy soils or places where there is a hard calcareous or clay pan not far below the surface. It grows best on soils with a pH of 6.2 – 7;
- **Products:** Firewood, charcoal, timber (furniture), poles, medicine (oil, leaves, bark, roots), fodder (leaves eaten by goats, oil-seed cake), bee forage, shade, ornamental, soil conservation, windbreak, insecticide (azadirachtin), oil (seed), soap;
- **Services:** Soil conservation;

windbreak; encourages biodiversity (feeding birds, bees, and bats); soil improvement.

Chamaecytisus proliferus (tree lucerne, exotic):

- **Biophysical limits:** 1700-3300 m asl., it grows best in high rainfall cool highlands.
- **Grows rate:** Harvest fodder frequently by pruning to encourage low, bushy, and readily accessible re-growth and to reduce the number of woody stems.;
- **Soil type:**
- **Products:** Firewood, fodder (leaves, pods);
- **Services:** Bee forage, mulch, nitrogen fixation, soil conservation, soil improvement, windbreak, live fence.

Cupressus lusitanica (exotic):

- **Biophysical limits:** It grows best in Dry, Moist, and Wet Weyna Dega and Dega agroclimatic zones. The tree is only moderately drought resistant and requires deep moist soils;
- **Growth rate:** Fast-growing on good sites, moderate on poorer sites;
- **Soil type:** Only moderately drought resistant and requires deep moist soils;
- **Products:** Firewood, timber (furniture, construction), poles, posts;
- **Use:** Shade, ornamental, windbreak, live fence.

Eucalyptus camaldulensis (exotic):

- **Biophysical limits:** 1200-2800 m asl.;
- **Growth rate:** Fast. Young trees require protection from termites. The species has been primarily introduced for quick-growing fuelwood. Useful for homestead plantation, woodlots, and along roads. The timber is red, heavy, and hard. Do not plant near crops because of root competition for water and nutrients.
- **Soil type:** Does well in deep silt or clay soil in Dry and Moist Kolla agroclimatic zones;
- **Products:** Firewood, charcoal, timber (construction), poles (power lines), posts;
- **Use:** Bee forage, ornamental, windbreak.

Eucalyptus globulus (exotic):

- **Biophysical limits:** 1700-2800 m asl.;

- **Growth rate:** Fast. The wood is hard, heavy, and strong and is often used for telephone poles. In some places, the tree is liable to attack by beetles. The tree tolerates frost;
- **Soil type:**
- **Products:** Firewood, charcoal, timber (heavy and light construction), poles (power lines), posts, veneer, plywood;
- **Use:** Medicine, bee forage, windbreak, essential oil (young leaves).

Grevillea robusta (exotic):

- **Biophysical limits:** 0-2300 m asl. (1500-2700 m asl.*); 600-1700 mm;
- **Growth rate:** Moderate to fast-growing;
- **Soil type:** Establishes well in riverine habits, on alluvial soils with mildly acid to neutral pH. Loam soil is preferred. It also occurs on clay loam and sand;
- **Products:** Apiculture; firewood; charcoal; excellent timber;

  Use: shade and shelter; reclamation (great pioneer species on degraded land); soil improver (high-quality mulch); intercropping (deep roots do not interface with shallow-roots crops); windbreak; live fence.

Literature:

Bekele-Tesemma, A. (2007) Useful Trees and Shrubs for Ethiopia – Identification, Propagation, and Management for 17 Agroclimatic Zones. World Agroforestry Centre, Kenya.

5. Recommendations for an Orthodox Toolkit on Forest Protection

The Catholic toolkit developed by the International Rainforest Initiative was used as a baseline to inspire the work for an Ethiopian Orthodox Toolkit. The content of the Catholic Toolkit is structured according to the following chapters:

- Introduction / Contributors
- The self-conception of the Interfaith Rainforest Initiative
- Partners
- List of Content

- Opening Reflections – based on Laudato si by Pope Francis (on the care of our common home)
  - On Rainforests and Biodiversity
  - Climate Change
  - On indigenous people
- Prayer with the forest
- Litany of the tropical forests
- Lessons: Writing your ECO-BIOGRAPHY

The article '*The Ethiopian Orthodox Tewahido Church Forests and Economic Development - The Case of Traditional Ecological Management'* by David K. Goodin et al. (2019)' is a good source to start working on the toolkit. The following outline is the first recommendation:

Introduction

- ❖ Ethiopia's traditional knowledge
- ❖ Religious Attitude towards nature

Talking point

- ❖ Role and function of the Ethiopian Church Forests
  - o Genetic Ark for any future restoration
- ❖ The Ethiopian Orthodox Church
  - o Three cornerstones of the Eco-theology of the Ethiopian Orthodox Church
    - ▪ Incarnational Theology
    - ▪ Covenant Typology
    - ▪ Eucharistic Communitarianism
- ❖ Role of EOC-DICAC
- ❖ Prayers and hymns from the church forest

6. Annex I

Guide for the Nursery Inventory and Planting / Survival Report

1.1) Nursery Inventory: Sheet

Nursery site: **Coordinates/Location:**		**Date:**	
Active Workers:		Seasonality of nursery activities:	
How old is the nursery?		**Contact:**	
Tree species sowed (date / no. of pots/seeds)		**Comment on germination (date)**	**Amount (n / %)**
Strength and Challenges of the nursery:		**Management plan / Improvement / Next steps:**	

		Ownership Status (land given by who? / status of contract /	
		Length of Leasing agreement):	
Date **Signature/Stamp**			

1.2) Nursery Inventory: Manual

a. Nursery Site: Name of the Site and the Location

b. Date

c. Coordinates/Location: If possible, note the coordinates of the nursery. Use for the positioning and indicating your location either a GPS or a GPS App on your Smart Phone.

d. Seasonality of nursery activities: According to the seasonality of dry and rainy season when do the nursery activities start (bed preparation, filling of polythene tubes/pots, sowing, transplanting, ...)

e. How old is the Nursery? Please note the Age and the year of the establishment of the nursery.

- Nurseries in Ethiopia are popping up and disappearing while projects come and go. We are looking for sustainability, skills, and experience and the age of the nursery can tell us a lot.

f. Contact: Please leave the contact data of a responsible person at the nursery site and another person from the supervising (partner) organization.

g. Nursery Inventory

- Tree species sowed, date of sowing, no. of pots/polythene tubes, and number of used seeds for each species

- Comment on germination success of each species (date of average germination) and note how many (amount and percentage) of the originally sown seeds have germinated and successfully

grown up to a seedling ready for transplanting.

h. Explain the Strength and Challenges of the nursery.

i. Next steps:

- Is there any kind of Management Plan for the nursery in place?
- Is there any Improvement planned, if needed?

j. What is the Ownership Status of the Nursery? Please indicate any contracts or agreements which secure the official status of the nursery.

k. Please sign the Inventory Report.

2.1) Planting / Survival Report: Sheet

Site:		**Date:**	
Coordinates/Location:			
Description of the Environment:		**Season and Weather conditions:**	
Age of the Plantation:		**Contact:**	
Tree species planted/survived	**Age**	**Comment (indicate planting or survival)**	**Amount**

Status of Land Degradation:		**Management plan:**	
		Ownership Status:	
Date Signature/Stamp			

2.2) Planting / Survival Report: Manual

a. Plantation Site: Name of the Site and the Location

b. Date

c. Coordinates/Location: If possible, note the coordinates of the nursery. Use for the positioning and indicating your location either a GPS or a GPS App on your Smart Phone.

d. Description of the Environment: Note anything of importance for the tree plantation and changes caused by the tree planting activities.

e. Season and Weather Conditions: Please indicate any irregularities in the dry or rainy season as well as any extreme weather

conditions with an impact on the tree plantation and the people's lives.

f. Age of the Plantation: What the average age of the monitored trees documented in the present report.

g. Contact: Please leave the contact data of a responsible person at the plantation site and another person from the supervising (partner) organization.

h. Plantation Inventory

- Tree species planted/survived

Name the planted tree species

- Age: When did you plant the trees / how old are the trees?
- Comment (indicate planting or survival)

  Indicate, if you are monitoring first year planting, or second- or third-year survival,

- Note the Amount of the Planted trees in the 1st year. The amount of the planted trees in the 1st year is our 100 % baseline. The amount of the surviving seedlings and young trees in the 2nd year and 3rd year is the survival rate (please note the amount and percentage related to the planting in the 1st year).

i. Status of Land Degradation: Describe any signs of erosion and degradation with a negative effect on the plantation, as well as any effect on the surrounding environment related to the tree planting activities.

j. Management Plan: What is the purpose of the present plantation now and in the future, take a look at the following examples:

- Short Term Plantation with *Grevillea robusta*, *Acacia saligna,* and *Acacia decurrens*
- Long Term Plantation with *Juniperus procera* and *Cupressus lusitanica*
- Conservation and Enrichment Planting with *Olea europaea / Africana*, *Croton macrostachyus* and other indigenous trees
- Strategic planting for a specific purpose: *Cordia Africana* for beekeeping, *Hagenia abyssinica* for medicinal use, *Ficus* sp. for shade and ornamental, *Dovialis* for fencing, and many other options

k. What is the Ownership Status of the visited Plantation? Please indicate any contracts or agreements which secure the official status of the nursery.

l. Please sign the Inventory Report.

Annex II

Compilation of available literature on the thematic of Ethiopia's church forests

For further reading and as a scientific baseline please find a compilation of 52 articles under the following link.

https://www.dropbox.com/sh/5h8w3yi6zefo28p/AABPD9cd2QWoj4j4PGIfoNBOa?dl=0

Baseline Literature from NCA:

I. Ethiopia Church Forest Initiative - Project proposal by Norwegian Church Aid to the Norwegian International Climate and Forest Initiative's Funding Scheme, Revised September 2018.

II. Ethiopia Church Forest Initiative: ETH-18/0013 – Annual Progress and Financial Report (Nov. 1, 2018 – Oct. 30, 2019).

References:

I. Aerts R., Van Overtveld, K., November, E., Wassie, A., Abiyu, A., Demissew, S., Desalegn D. Daye, D.D., Giday, K., Haile, M., Berhan, S., Teketay, D., Teklehaimanot, Z., Binggeli, P., Deckers, J., Friis, I., Gratzer, G., Hermy, M., Heyn, M., Honnay O., Paris, M., Sterck, F.J., Muys, B., Bongers, F. & J.R. Healey (2016) Conservation of the Ethiopian church forests: Threats, opportunities and implications for their management, Science of the Total Environment.

II. CCAD-PNUD/ GEF. (2002) Proyecto para la Consolidación del Corredor Biológico Mesoamericano. El Corredor Biológico Mesoamericano Costa Rica. Serie Técnica. No.03. 1ª. Edición. Managua.

III. García, R. (2002) Biología de la conservation: conceptos y prácticas. 1a. Edición. Santo Domingo de Heredia, Costa Rica. INBio.

IV. Environment Protection and Regulation Division - Department of Environment and Conservation (EPRD-DEC) (2004) What are Wildlife Corridors. Australia.

V. Moreno, R., Zamora, R. & M.A. Herrera (2012) Chapter: Wildlife corridors: Conceptualization, valuation as an environmental management tool and applicability on forest ecosystems in Book: Forest Management: Technology, Practices, and Impact. Spain.

VI. Mulugeta Lemineh (2019) Preliminary set of criteria for the selection of Green Corridors within RLLP watersheds. Workshop November 21, 2019, Ethiopian Federal Ministry of Agriculture, unpublished.

VII. Rosenberg et al. (1995) Towards a definition of the biological corridor. International Wildlife Management Congress, Wildlife Society, Maryland, US.

VIII. Tewksbury et al. (2002) Corridors affect plants, animals, and their interactions in fragmented landscapes, PNAS, US.

IX. **Internet Sources:**

X. https://www.slideshare.net/EmonfurProject/davies-european-experiences-of-upf