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Evaluation Summary

Evaluation	**Ethiopian Church Forest Initiative (ECFI).**
Publication year:	2022 (evaluation carried out in 2021)
Donor:	NORAD
Name of Organisation(s):	Norwegian Church Aid
Internal, External or Mixed team?	External
Local Partner(s):	EOC-DICAC
Country/Region:	Ethiopia, Gocha Siso Enesie woreda of Amhara region and Wolmera Woreda of Oromia region
Author:	One and Zero Consultancy
Commissioned by:	NCA
Type of evaluation (midline endline, formative):	Endline
DAC-sector:	
DAC-criteria used:	
Intervention period:	October 2018 to October 2021
Key words:	End evaluation, forest conservation,
Evaluation summary and recommendations (max 2 pages):	**Objective:** The overall objective of this endline evaluation was to determine the relevance, efficiency, effectiveness, and effect/result of the Ethiopian Church Forest Initiative (ECFI). **Method:** • Reviewing relevant literatures • Data collection: • Data analysis and report writing • Presenting of findings: **Key Findings:** • ECFIP Project was in a good track to deliver its outcome and objectives and is highly relevant to the protection and sustainable management of church/monastery forests. • Project outputs has been delivered efficiently and the impact is considerable. • Stakeholder engagement has been excellent • The negative impacts of the surrounding community on the church forest, has substantially minimized due to the intervention • Conflict resolution mechanisms that have been introduced have been well received and effective. Specific Recommendations: • Expand interventions to increase/safeguard forest cover including energy saving technologies, guarding the forest, protecting the forest, seedling planting, tree planting, labor sharing between the church and community, awareness creation, solar lighting, seedling planting and energy saving technologies, seedling planting and preserving, protection, guarding and seedling planting, seedling planting organized by the community, different types of seedling planting. • Policy support for scaling of the interventions to other areas is required. Church/monastery land certification is very important and it was one of the encouraging output from this project, • Next phase project intervention should also target the cleric community and the monks living inside the monasteries as wood cutting including whole tree harvest or heavy branch and shrub cutting is a common practice in the churches and monasteries.

	• Further studies are recommended if the theological underpinning of the church forest is still understood by the inhabitants of the monasteries/churches and the surrounding community.
Cross-cutting issue(s):	
Link to full report:	https://kirkensnodhjelp.sharepoint.com/sites/pims/fundings/G1168/Documents/05%20Evaluations/NICFI%20Phase%201%20-%20Final_endline_draft_report_40.docx
Link to preregistration form:	

Norwegian Church Aid Ethiopia (NCA)

Endline impact evaluation on six church forests under the "Ethiopian Church Forest Initiatives"

Project Name: **Ethiopia Church Forests Initiative Project**
Project Location: **Gocha Siso Enesie woreda of Amhara region and Wolmera Woreda of Oromia region**

Submitted to:
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Disclaimer

The depiction and use of geographic boundaries (Woreda/Kebelle boundaries), geographic names and related data shown on maps and included in this document and accompanying databases are not warranted to be error free; nor do they necessarily imply official endorsement by the Government and/or NCA. They are meant to support analysis of an endline impact evaluation on six church forests under the "Ethiopian Church Forest Initiatives".

Colophon

Document title	Endline impact evaluation on six church forests under the "Ethiopian Church Forest Initiatives"
Client	Norwegian Church Aid (NCA)
Status	1st draft report
Datum	6/03/2022
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Reviewed by	NCA staffs, Addis Ababa

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Acronym and abbreviations

ACT	Action of Churches Together
CHS	Core Humanitarian Standard
CRGE	Climate-Resilient Green Economy
DICAC	Inter-Church Aid Commission (DICAC)
ECFI	Ethiopian Church Forest Initiative
ECFI	Ethiopian Church Forest Initiative
ELE	Endline Evaluation
EOC	Ethiopian Orthodox Church
FBOs	Faith Based Organizations (FBOs)
FDE	Forest Development Extension
FMNR	Farmer managed natural regeneration
GSE	Goncha Sisso Enessie woreda
IRCE	Inter-Religious Council of Ethiopia (IRCE)
NCA	Norwegian Church AID
NFG	Norwegian Forestry Group (NFG)
NICFI	Norway International Climate and Forest Initiative

Executive summary

The Ethiopian Church Forest Initiative Project (ECFIP) is a three-year project (Oct 2018 to Oct 2021) financed by the Norwegian Ministry of Foreign Affairs through the Norwegian Church Aid (NCA) and to the Ethiopian Orthodox Church-Development and Inter Church Aid Commission (EOC DICAC). EOC-DICAC is responsible for the implementation of the project, in full coordination with the Gonhca Siso Enese (GSE) Woreda office of Agriculture in the Amhara national Regional State (ANRS) and Wolmera Woreda of Oromia National Regional State (ONRS) across six monasteries and/churches. The ECFIP is designed to assist, the orthodox church of Ethiopia in becoming a climate ambassador by promoting forest protection, protecting the church forest degradation and increase the resilience of the communities dwelling around monastery/church forests. Therefore, the overall project outcome was to promote the Orthodox church and other faith communities to contribute towards Ethiopian Climate-Resilient Green Economy (CRGE) strategy.

The overall objective of the Endline Evaluation (ELE) is to determine the relevance, efficiency, effectiveness, and effect/result of the ECFIP. Specifically, to provide an independent assessment of results achieved, draw lessons learned and best practices and identify challenges faced during implementation, review the accomplishments in reference to the baseline, produce digital map and analysis on the forest cover change and biodiversity, assess impact on the community awareness and participation, and evaluate if there are untended side effects from the project.

The ELE methodology comprises a combination of desk review, collection of primary data through meetings and semi- structured interviews with project stakeholders, and field visits to each of the six monasteries and/or churches for vegetation survey.

Overall, the findings indicate that the ECFIP Project was in a good track to deliver its outcome and objectives. It is highly relevant to the protection and sustainable management of church/monastery forests. It has been effective in the delivery of almost all of its outputs. Project outputs has been delivered efficiently and the impact is considerable. Stakeholder engagement has been excellent, and all of the stakeholders interviewed, were enthusiastic and supportive of the project. The cleric community living inside the church and the community living outside church had both positive and negative impacts. Notably speaking, the negative impacts of the surrounding community, on the church forest, has substantially minimized due to the intervention of the project. However, major disturbance indicators such as whole tree cutting, major crown and branch cutting, and livestock browsing were evident in many plots. The major source of disturbances came mainly from the cleric community. They harvest the wood for fuel to feed their visitors as well as members.

Firewood is the major source of energy followed by animal dung and crop residue, while charcoal being the major and preferred source of energy for cooking. Fuel is obtained by collecting form the nearby woodland or purchased. Both men and women participate in fuelwood collection. Among children, only girls participate, where they rarely get social discrimination or animal attack. Homemade mud stoves are widely used, which needs much improvement. Energy efficient stoves are available but not widely used.

Not very few people across different churches believe that the forest cover was very good during the imperial time, declined in between and improving currently. In the last 10 years the forest cover is believed to be improving.

Tree planting on private land is practiced by majority of the people. The most important tree/shrub functional groups planted by the farmers are firewood, fodder, timber, and fruit. Government nurseries are the major source of seedling supply, and the seedlings are obtained on highly subsidized price. A greater proportion of the of church inhabitant, across all churches, support the establishment of nursery near to the church, and the preferred seedlings are for fruit trees, firewood, fodder, timber trees and trees that have shade function.

Farmers also grow trees for market supply, and for home consumption. Farmers believe that there is no problem in survival and growth of seedlings. The major challenges for increasing tree planting are labor shortage, limited knowledge and skill, limited access to land, free grazing problem destroying the seedlings, and limited seedling supply.

There are differences in terms of management practices frequently used by community inside the monastery and the surrounding community. The most important tending operations are weeding and cultivation, fencing, protecting from livestock, and limited watering. Exclosure is common practice, except that there are no well-developed bylaws.

Training on forest management were rare, which are organized by the government with the content focusing on physical soil and water conservation and seedling preparation. There was an interest to take part in training dealing with nursery management and irrigation. And, with this project several trainings were delivered.

Conflict between church forest and the surrounding community rarely happen. The major conflict resolution mechanisms are involvement of elders and church fathers, arbitration, mediation, and the formal justice procedure taking cases to the court.

Best possible interventions to increase/safeguard forest cover were distributing energy saving technologies, guarding the forest, protecting the forest, seedling planting, tree planting, labor sharing between the church and community, awareness creation, solar lighting, seedling planting and energy saving technologies, seedling planting and preserving,

protection, guarding and seedling planting, seedling planting organized by the community, different types of seedling planting.

The key development challenges were high firewood demand, high demand of wood for firewood and house construction, high demand for grazing land, lack of awareness, lack of labor, lack of electricity, free grazing, low level of tree planting, lack of water for irrigation, seedling plantation, high demand of firewood and lack of energy saving power sources, and deforestation.

key potential intervention to enhance livelihood were nursery establishment using irrigation, irrigation and horticulture, supplying different purpose wood, building irrigation dam, beehive, and honeybee production, sheep and goat production training, planting market-oriented plants, Eucalyptus plantation with irrigation, awareness creation by religious fathers, honeybee production, irrigation and horticulture plantation for market, guarding the forest by guard.

The overall forest/vegetation cover change (net difference) within the individual church/monastery is balanced. Meaning there was destruction as well as plantation activities resulting in an overall almost zero net gain. Since some of the plantations are at seedling stage they had little/no signal contribution using NDVI as well as image segmentation. At some locations/churches there was noticeable change due to removal of trees, for example, in the Menagesha-Mariam & Medhane'alem church. The area of the intervention including gulley rehabilitation, and tree plantation activities was 3580 ha's which is an increase by 289 % from the target/planned 1240 ha's.

In general, the endline evaluation of ECFIP is positive. We recommend a follow up project activity to substantiate and/or continue the achievements of the first or previous phase project outputs considering sustainability. To our knowledge, there was no project that attempted intervention in the Church/Monastery forests in the past, thus, this project is symbolic. However, there were several research conducted in the church/monastery forests. The lessons learned from this small project can be scaled to other areas for greater impacts and to contribute to the Ethiopian CRGE outcomes.

Next phase project intervention should also target the cleric community and the monks living inside the monasteries. Because, wood cutting including whole tree harvest or heavy branch and shrub cutting is a common practice in the churches and monasteries. The main reason or the main driver is cutting for fuel for cooking food for the inhabitants and the temporary visitors of pilgrimage visits. Therefore, we recommend addressing energy source for fuel. This intervention may reduce the pressure on the remnant church forests.

Many of the monasteries have quite big livestock population. The herders practice free forest grazing and browsing. The livestock population is a threat for the natural regeneration of native trees and for the enrichment planting. Therefore, the livestock

population should be managed by focusing on productive livestock breeds. Besides, by using animal dung, production of biogas energy source for fuel can be good intervention for next phases.

Buffer zone plantation by using exotic tree species has encouraging results. Proportional focus for indigenous trees should be considered by the project team for woodlot and enrichment planting. Farmers Managed Natural Regeneration (FMNR) activities are nowadays encouraging and intervention in this regard could be a potential intervention.

Participatory Forest Management (PFM) is the dominant forest management and governance feature in Ethiopia. PFM in general deals with power devolution and delegation for the local community in the process of forest management and benefit sharing. The local community will decide how their forests will be managed to improve livelihoods while the wellbeing of the forests are protected. In church forests, there is a possibility to implement PFM together with the clergy and faith community.

The church forests' persistence in Ethiopia is in large part due to the church compound being seen as a sacred space and hence respected and protected by the community. This strong social norm has allowed for multiple uses of the church forest to continue over time. Hence, the difference in the land cover between an open field forest and church forests is due to the differences in the knowledge, attitude and perception of the church and surrounding community. Meaning, to fill the gaps, it would require more environmental education and other forms of public engagement or ownership.

The theological rationale of church forests has preserved the forests up to now. We believe that a tipping point has been reached in the efficiency of the theological rationale to preserve the church forests in the next years and decades. Further studies are recommended if the theological underpinning of the church forest is still understood by the inhabitants of the monasteries/churches and the surrounding community.

Policy support for scaling of the interventions to other areas is required. Church/monastery land certification is very important and it was one of the encouraging output from this project, however, land certification issues for Menagesha-Mariam & Medhane'alem church has not been resolved due to several reasons. There are also some theological issues in the GSE woreda which needs to be resolved. For better communication and smooth implementation, the issue need to be resolved.

1. Brief background and rationale

The tropical dry forests in Africa cover 17.4 million km², and more than half a billion people directly and indirectly depend on them (Chidumayo & Gumbo, 2010; FORESTS, Chidumayo, & Marunda, 2010) and contain a wealth of biodiversity and trees of high cultural, economic and ecological importance. These forests also provide a variety of ecosystem services which helps maintain productivity of agriculture including feed for livestock, pollination and carbon storage services (Mulugeta Mokria, Gebrekirstos, Aynekulu, & Bräuning, 2015). Despite of their role in the global carbon cycle and importance for food, energy, water and livelihood, dry forests of the Sudano-Sahelian forests are under-investigated and prone to further degradation (Blackie et al., 2014; Karlson & Ostwald, 2016; Karlson et al., 2015). The degradations usually lead to loss of biodiversity, change in species composition, increase greenhouse gas emission, increase soil erosion, loss of springs and water points, decreasing agricultural productivity and many other livelihoods and environment related challenges and problems. Thus, understanding the degradation and/or disturbance of the forest ecosystem, either by biotic or abiotic agents gives an insight on the changes in species composition and structure over space and time (S. T. A. Pickett & McDonnell, 1989) including in the church forests and national parks of Ethiopia as one of the known country in terms of richness in biodiversity of forest trees and species.

Historical sources indicate that 35% of the Ethiopian land mass was once covered with high forest (Gill et al. 2010). The heterogeneous forests of Ethiopia are composed of 6,500–7000 vascular plants, about 12% of which are endemic (EFAP 1994). Forests and their products have played a great role in economic development. Tens of millions of people in Ethiopia still rely on forests for a whole range of products and services (EFAP 1994), while the forest area has been gradually dwindling, for example, from 13.7 % to 12.5% of the total land area from 2000 to 2015 (World Bank World Development Indicators 2018), FAO 2010).

The restoration of degraded forests including the church forests are important interventions for Ethiopia in order to meet future demands for forest products and services, as well as to combat climate change. The Ethiopian Government has been implementing the Climate Resilient Green Economy (CRGE) strategy, which presented a plan to create 50% abatement potential in the forestry sector by 2030 in order to sequester carbon emissions while significantly reducing deforestation (Yigremachew et al. 2015, FDRE 2011). The CRGE targets sequestration of more than 40 million tons of CO_2 through the afforestation and reforestation of 3 million ha's of land and the sustainable management of 4 million ha's of forests and woodlands by 2030.

Ethiopia's diverse forest resources, including high forests, woodlands, and trees on farms, have among the highest biodiversity in the world and provide a wealth of goods and

services to ensure a green economic growth pathway. The natural forests in most other areas have been destroyed and converted into farms and grazing lands over centuries. Despite, these all challenges and constraining factors, in the dry highlands of Ethiopia, church and monastery forests play a meaningful role in conserving plant diversity and providing essential ecosystem services including shade and fresh water (Abiyu, Teketay, Glatzel, Aerts, & Gratzer, 2017; Aerts et al., 2016) and have been investigated as steppingstones for forest restoration in Ethiopia.

Evaluation of the key constraining factors and drivers of forest degradation in general and the church forests in particular in Ethiopia is important to design proper measures, appropriate and context specific intervention activities, implementation modalities as well as mentoring and evaluation systems which will help for project/program implementing organizations and institutions. It will also increase the understanding and knowledge of project/program implementers, forest extension officers, local communities and faith-based institutions taking church and monastery forests as case on the long-term effects of biotic and abiotic factors in order to design/plan and implement proper measures and modalities in a way to increase benefits from the forest areas as well as adapting the changing climate and providing the full ecosystem services to the church and local communities and beyond.

The Ethiopian orthodox church has a long history of conserving forest resources, which usually envelop the churches. Although the main purpose of churches is as places for worship, burials and meditating religious festivals, they also provide valuable, often unique, and secured habitats for plants and animals, shade and green spaces for people. Church and monastery compounds are serving as conservation sites and hotspots of biodiversity, mainly indigenous trees and shrubs of Ethiopia, which, in turn, give prestige to the religious sites (Wassie et al 2005). These church and monastery forests, however, are threatened because of disturbances and encroachments such as cutting woods for various purposes, free grazing and browsing, recurrent droughts, and fires which occurred at increasing intensity and frequency.

Norwegian Church Aid (NCA) with Funding from the Norwegian Ministry of foreign affairs through the embassy and the implementation partner Ethiopian Orthodox Church Development and Inter-Church Aid Commission (EOC-DICAC), initiated a project in November 2018 entitled "Ethiopian Church Forest Initiative" to be implemented in six monasteries and churches located in Amhara regional state in the Goncha Sisso Enessie district and the Wolmera district from the Oromia regional state. Tach Mariam, Koga Kidane Mehret, Baza Asteryo, Yemrat Abo and Jiret Medhane Alem from Amhara Region and Menagesha Mariam and Medhane'alem from Oromia region were the targeted. The project aims that the Orthodox Church and other faith communities contribute towards government effort in Climate Resilience Green Economy strategy mainly through restoration of 15 million hectares of degraded environments and also contribute to the

African Restoration Initiative (AFR 100). To achieve this, NCA with its local partners proposed three core objectives (i) Orthodox church of Ethiopia as a climate ambassador can promote forest protection; (ii) church forests are protected from degradation and; (iii) communities around church forests have increased climate resilience.

NCA is an international development and humanitarian organization working in more than 20 countries in Africa, Asia and Central America. Globally, NCA is a member of the ACT (Action of Churches Together) Alliance, a coalition of churches and affiliated organizations. NCA's assistance and collaboration are offered without any intention to influence people or organizations' political opinions or faiths. Its vision: "Together for a Just World," reflects the organization's commitment to eradicate poverty and injustice. In many countries NCA has been instrumental in establishing and strengthening inter-faith cooperation and has been certified for Core Humanitarian Standard (CHS).

NCA started its operation in Ethiopia since 1974. It is a registered Foreign Charity with the Charities and Societies Agency. Its long years of experience, partnership and presence in the country has allowed NCA develop competency to cooperate with Faith Based Organizations (FBOs) and received acceptance by FBOs as trustworthy partner. NCA has currently partnership with FBOs both with individual and their umbrella organization–the Inter-Religious Council of Ethiopia (IRCE), having first contributed to its establishment as inter-faith forums.

In 2018 baseline information on these church/monastery forests and the surrounding was gathered. This report is thus, an endline evaluation or survey (ELE) to evaluate the project initial intended goals. The endline evaluation intends to determine the relevance, efficiency, effectiveness, sustainability and/or effect/result program implemented by NCA and the local partner (EOC DICAC).

With this understanding, an in-depth context specific desk review and comprehensive field survey with special emphasis on socioeconomic, biophysical and policy related matters of church and monastery forests was conducted. Relevant questionnaires and checklists were formulated. In addition, GIS and remote sensing technologies to collect preliminary field data and information were used and analyzed.

1.1. Objectives of the evaluation

The overall objective of this endline evaluation was to determine the relevance, efficiency, effectiveness, and effect/result of the Ethiopian Church Forest Initiative (ECFI). The specific objectives of the endline evaluation were to:

1. Provide an independent assessment of results achieved in the church forest initiative project.

2. Draw lessons learned and best practices and identify challenges faced during implementation of the program and recommendations for the future interventions.
3. Review the accomplishments of the project in the two operational Woredas using the project results framework and baseline/benchmarks as the basis.
4. Produce digital map and analysis on the forest cover change and biodiversity species (tree density, frequency and distribution) on the six churches and monasteries targeted by the project against the baseline.
5. Stratify the forest resources (natural and plantation) and species distribution mapping.
6. Develop land use /land cover map of the two target woredas (Goncha Siso Enese Woreda in Amhara region and Wolmera Woreda in Oromia region)
7. Assesses whether the knowledge-sharing and communication activities of the project had any impact on the targeted groups or not (communities, authorities, organizations)? Have they adopted approaches, methodologies, arguments, etc.? Are there lessons to be learned from these activities?
8. What degree has the project established contact or built alliances with other likeminded actors in the domain of forest protection and community forestry (other NICFI-funded organizations like the Development Fund, Norwegian Forestry Group, Farm Africa, as well as other actors) in order to change policies and legislation in desired direction?
9. Assesses whether the project had unintended negative consequences or not.

1.2. Scope of the evaluation

All the six churches and monasteries targeted by the project in Goncha Siso Enese Woreda in Amhara region and Wolmera Woreda in Oromia region were covered by the evaluation. The evaluation team considered cross-cutting aspects such as anti-corruption, the environment and vulnerability to climate change, inclusion of people with disabilities, participation of women and gender equality. The evaluation focused on the period spanning from November 2018 until end of October 2021 (3 Years).

2. Description of approach and methods

The ELE study used a mixed research approach to collect both qualitative and quantitative data and information. Understanding the context of church and monastery forests by conducting quick review and preliminary scoping helped the team to come up with well-designed and context specific questions and checklists as well methods of data and information collection. Our prior experience and our participation during the baseline survey has been an additional asset during the survey. The study team followed the following sequences of core activities.

- **Reviewing relevant literatures:**

A desk review was carried out throughout the review process, and comprise thorough reading and analysis of project documents, consultant's reports, meetings minutes and proceedings of stakeholder meetings.

- **Data collection:**

This includes preparation of well thought plan, tools, sampling design, staffing and provision of training, pre-testing and fieldwork.

- **Data analysis and report writing:**

Analysis of the collected data based on a well-defined analytical model was conducted.

- **Presenting of findings:**

In addition to the hard copy reports and maps, full database will be provided and the report was presented to NCA & the Kingdom of the Norwegian Embassy and other stakeholders).

2.1. Study location

The six study locations (churches and monasteries) are found in two regions, namely Amhara and Oromia national regional starts as indicated on table 1, Figure 1, and Figure 2 below. Detailed study area description is given in the baseline study document.

Table 1: The list of target study areas and their geographical locations.

No	Name of Church/Monastery	Woreda/Zone, Region	Kebelle	Approximate area (ha's)	Distance
1.	*Tach Mariam Monastery*	Goncha Sisso Enessie woreda, East Gojam; Amhara regional state	Kosoye Qaleqal	239	165 Km from Debre Markos
2	*Koga Kidane Mehret Monastery*		Eneget Weyin Wiha	123	
3.	*Baza Asteryo Monastery*		Ginde weyin Beza	48	
4.	*Yemrat Abo Church*		Buza Yemerat	53	
5	*Jiret Medhane Alem Monastery*		Merhagifan	19	
6	*Menagesha-Mariam & Medhane'alem church*	Wolmera woreda, West Shewa, Oromia regional state	Wetabecha Minjaro	344	25 km to west of Addis Ababa

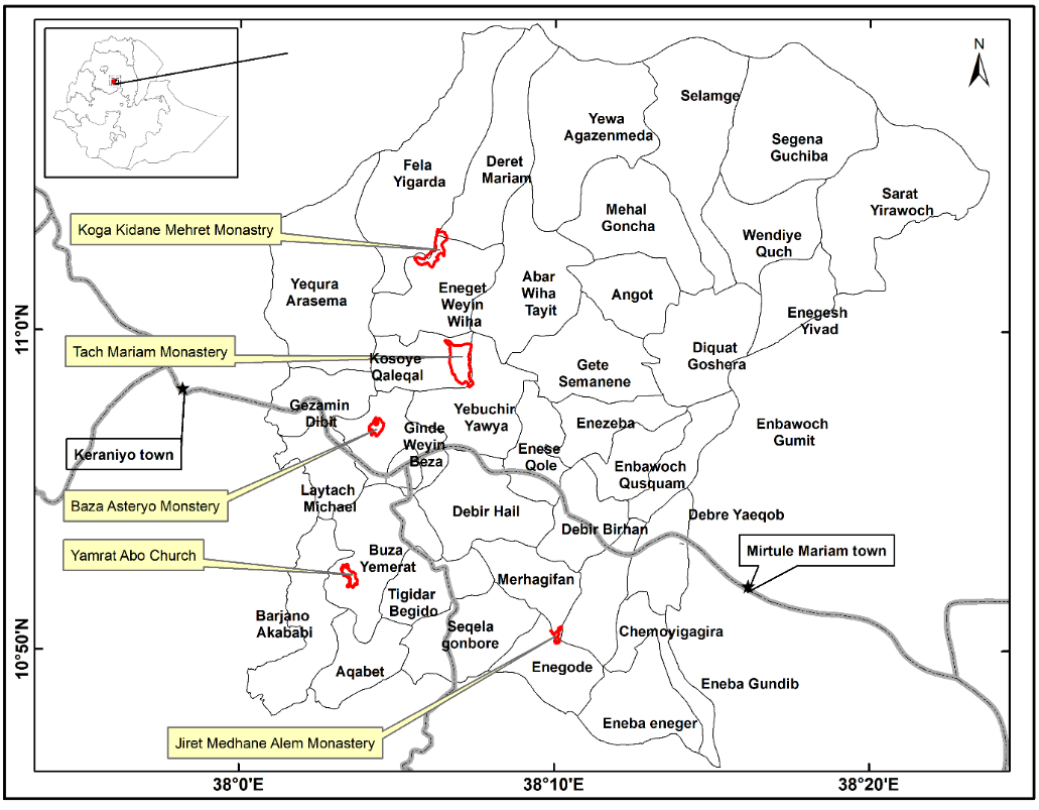


Figure 1 The Goncha Sisso Enessie (GSE) woreda with the 5 study site locations namely (from below): Jiret Medhane Alem Monastery, Yemrat Abo Church, Baza Asteryo Monastery, Tach Mariam Monastery, and Koga Kidane Mehret Monastery (Source: our NCA baseline report)

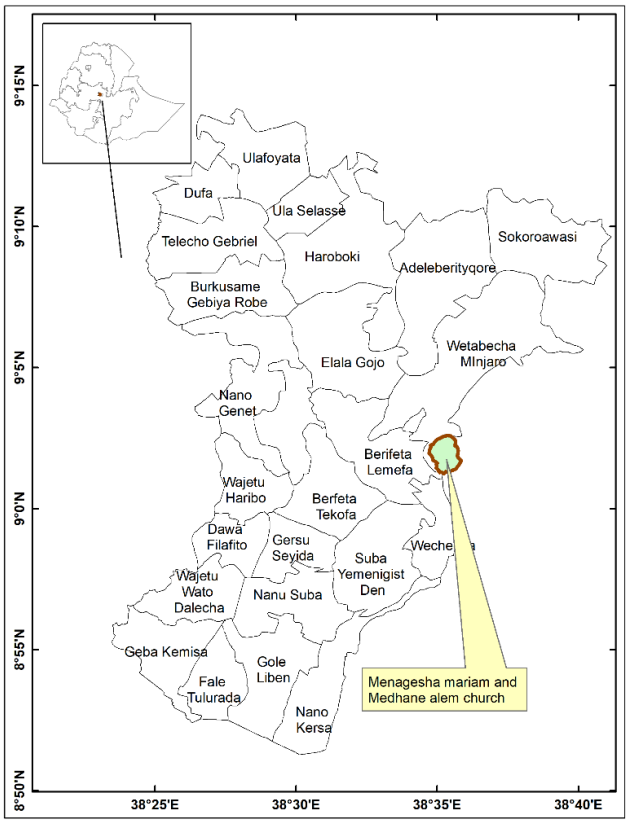


Figure 2 The Wolmera woreda, Oromia (Menagesha-Mariam & Medhane'alem church study site)

2.2. Data collection and analysis

The NCA baseline indicator fact sheet (Result section) is the main guiding for all the detailed analysis. To arrive at answering the indicators and additional information the fact sheet was strictly used. The fact sheet is summarized with relevant questions (Table 2).

In broad terms, the interviews with project stakeholders was restructured in a way that enables stakeholders to identify perceived strengths, weaknesses, opportunities and challenges associated with the NCA project. In addition, stakeholders will be encouraged to share their views on the strategic (impact and outcome) potential of Ethiopian Church Forest Initiative. Later, specific questions for specific stakeholders (Table 2, below, for a preliminary list of questions) was presented. In addition to seeking answers to specific questions, all meetings and interviews were conducted in a way that encourages participants to discuss and explore issues.

Table 2: Questions for Ethiopian Church Forest Initiative project stakeholders

Topic	**Key stakeholders**	**Questions**
General	All project stakeholders	In your opinion, what are the project main strengths, weaknesses, opportunities and challenges?
Relevance	ECFI team, EOC, NCA team, local stakeholders and churches	● Which elements of Ethiopian CRGE and national forest restoration target is the Ethiopian Church Forest Initiative (ECFI) is focusing, i.e. forest protection and improvement; production systems; energy etc.? ● Which elements of NICFI/NCA objectives is the project *primarily* focusing on? ● Which planting interventions is the project *primarily* focusing on, i.e. enrichment planting, participatory forest management, assisted natural regeneration, plantations and woodlots, agroforestry? ● Given the above, are the ECFI and NCA/NICFI projects compatible or complementary
Effectiveness	ECFI team, NCA team, EOC at the Woredas in Goncha-Siso-Enese and Wolmera districts	**General** ● What were the main challenges to project delivery? ● Have the project outputs and activities been effectively delivered? ● Which adaptive management measures have been put in place, and are these proving effective? ● Has the project design been significantly altered in response to new findings or realities? ● How will any changes affect project delivery, outcome and impact? **Output 1** ● Is a National Climate Platform established? ● Is a church forest methodology developed? ● Are the Orthodox Church and the patriarch linked with IRI and other faith communities internationally? ● Do theological rational and foundation for forest protection developed by the orthodox church? ● Are other faith communities in Ethiopia linked to National Climate platform to promote forest protection? **Output 2** ● Do church-forest baseline and inventory documented? ● Does forest conservation enhanced? ● Do congregations increased their knowledge of climate change and the importance of forests? ● Do knowledge sharing and communication with national and international stakeholders have taken place? **Output 3** ● Do community mobilized in climate resilience task forces? ● Do communities increased adoption of sustainable land management practices? ● Do communities engaged in income generating activities related to sustainable harvesting and value addition of non-timber forest produce (NTFP)?
Possibility of impact	NCA team, implementing churhces	● Are the activities and outputs of the ECFI optimal to achieve the project's desired outcome and impact? ● Will ECFI of NCA interventions be of sufficient scale to significantly affect the project's desired outcome and impact? ● How might the project be adapted to increase the possibility of impact? ● Are there likely to be any positive or negative unintended effects caused by ECFI? ● How are potentially negative effects being mitigated?
Efficiency	All project partners including finance/admin	● What have been the main challenges regarding project delivery? ● Where has the project deviated from budget, to what extent and for what reasons?

		• Where has the project deviated from its initial timeline, to what extent and why? • Which adaptive management measures have been put in place, and are these proving effective? • Has the project design been significantly altered in response to new findings or realities? • How will any changes affect project delivery, outcome and impact?
Sustainability	All project stakeholders	• Has the project engaged adequately with all stakeholders? • How has the project taken into account stakeholder's views, and adapted accordingly? • Has the project communicated effectively with its stakeholders? If so, how? • Are the project outputs, outcome and impact supported by the EOC and GoE policies? • How will long term mentoring, monitoring and evaluation be carried out after the project ends? • Is there an exit strategy? • Has proper linkages been developed to continue the same after the project?

2.2.1. Checklists and semi-structured questionnaires

The data and information with regard to the socioeconomic views, attitudes and opinions was managed through quantitative and qualitative data collection which involved interviewing target groups such as the priests, elders, youths and any other relevant social group including the local leaders or decision makers and organizations and institutions working around the target study areas. Quantitative socioeconomic data was collected using semi-structured questionnaires, whereas, the qualitative data was collected using checklists. The socioeconomic survey focused on detailed target and individual based information pertaining to existing situations in a way to address and respond to the specific objectives of the assignment. In principle, the quantitative data collection method was focused on the "what" questions whereas, the qualitative data collection method was mainly to respond to questions related to "why" and "how".

Sampling: Random sampling technique (as mentioned in the TOR) was employed in identifying target groups for the survey. The sample size was proportional to the population, but it is set to the statistically minimum acceptable sample size. Therefore, list of church communities as well as nearby relevant institutions and individuals was obtained from the church or any relevant government institutions like the Kebelle administration. Residents which are 18 years old and above were eligible for the survey. Equal allocation for women and men respondents was given during the interview. In addition, we will also survey/look into cross-cutting aspects such as anti-corruption, the environment and vulnerability to climate change, inclusion of people with disabilities, participation of women and gender equality issues through systematic survey.

Checklists and questionnaire preparation: checklist and semi-structured questionnaire was designed by the consulting firm to collect data from the unit of analysis (church/monetary communities and communities surrounding the churches/monasteries)

as well as other relevant institutions serving to the church and the communities. Most items of the semi-structured questionnaire would be close ended with some partially open-ended items. The questionnaire was prepared and proofread then translated into the local language (Amharic) which the respondents use and dispatch for piloting to determine whether it is clear and understandable by the respondents as well as whether the questionnaire is able to collect the intended information. The questionnaire was reviewed and endorsed by NCA and its partner organizations prior to its field usage during the inception report. After checking and taking corrections, the final version was prepared and administered by well-trained enumerators.

In the qualitative data collection method, primary data will be collected using **Focus Group Discussion (FGD) and Key Informant Interview (KII) tools:** FGD was conducted with the church/monastery and surrounding community members of male and female groups in all target assessment areas. Each group comprised of 8 to 12 members. KII method was employed while dealing with local extension officers, experts, administrators/decision makers and representatives relevant institutions working in the survey areas. This was supported with transact walks along the church areas to understand the overall situation of the churches and have a general insight on the biophysical, socioeconomic and residence settings within the churches and surroundings.

2.2.2. Conducting document review and consultative meetings

Relevant secondary data was collected, reviewed and synthesized. This was helpful to review policies and legal framework from the government and other assessment reports of government and non-government organizations. In addition, the baseline NCA report was reviewed. Moreover, a validation workshop will be conducted in the presence of relevant stakeholders to share and validate the findings and also to collect more inputs and information that will capitalize the information obtained at local level. Moreover, the meeting will provide a room to NCA and its local partners to create strong partnership with government and non-government stakeholders who can support and leverage resources before the closure of the project. It will also help to discuss and share experiences more with regard to church and monastery forest management as well as existing opportunities and enabling environments.

2.2.3. Biophysical data collection method

Forest inventory and sampling: To investigate the species composition, richness, density and regeneration status, line transects and GPS locations used during the baseline survey on the same spot as the baseline survey used for this endline survey. In addition, additional sample plots were sampled (randomly in the intervention and outside the intervention areas) with plot spacing of 20 m * 20 m for trees, 10 * 10m for saplings and 5 * 5m for seedling will be established along new (intervention area) transect lines within the six

church/monasteries in both regions. Number of transects, distance between transects, number of plots within each transects and their spacing for the new plots will be determined following a quick visit and observation of each church forest. In each quadrant, identity, number, total height and diameter at breast height of individuals of plants will be recorded and measured. Height is to be measured using graduated sticks, while the diameter was measured using a caliper and diameter tape (Valencia and Henrik, 1993; Alelign*et al.,* 2007). Individual woody categorization will be as height < 0.75 m seedling,≥ 0.75m and Dbh<2.5 cm sapling, and Dbh≥2.5 cm tree. For species which will be difficult to identify in the field, their local names were recorded. Woody plant species outside the church/monastery areas were recorded so as to have complete checklist of plants in the area. Nomenclature of plants follows Edwards et al. (1997) and Hedberg et al. (2003).

Qualitative biophysical data within the churches/monasteries and surrounding plots was collected through transect walk. Forest degradation level, vegetation composition status, species regeneration status and resource mapping will be undertaken throughout the walking transect. Soil erosion status i.e., rill erosion and/or sheet erosion and/or gully, physical and biological soil and water conservation practices, non-wood products like wild edible fruits, beehive, honey etc. in each plot will be recorded and measured. This was done by observation and asking residents along the transect.

Forest mapping using GIS and remote sensing techniques: Using the recent GIS and Remote sensing techniques, a digital mapping of the six church and/or monastery forests was conducted. The mapping work was supported with ground truthing. To understand the degradation levels both within the church and surrounding areas, a canopy map of existing forest areas was developed and compared with the canopy map produced during the baseline study. The vegetation dynamics in the six churches/monasteries was assessed using Normalized Difference Vegetation Index (NDVI). To do this, recent satellite images of the six church/monastery forest from free satellite provider web site www.glovis.usgs.gov was downloaded using latitude and longitude of these target areas. After downloading satellite image radiometric and spatial enhancement will be performed, then layer stacking, extracting using ENVI 5.x followed by NDVI computation using ArcGIS 10.x and R environment. This is the same method used during the baseline survey. Hence, the change/difference between the baseline and the endline will have low error. The more leaves a plant has, the more these wavelengths of light are affected. Very low values of NDVI (0.1 and below) correspond to barren areas of rock, sand, or snow. Moderate values represent shrub and grassland (0.2 to 0.3), while high values (0.6 and above) indicate temperate and tropical rainforests. NDVI is therefore a mathematical combination of two or more satellite spectral bands in relation to the spectral characteristics of vegetation. Such NDVI values for the entire study sites was available during the baseline study. Thus, a positive change in NDVI between the endline and baseline indicate a positive impact due to intervention. The arithmetic equation for NDVI is given as:

$$NDVI = \frac{P_{NIR} - P_{RED}}{P_{NIR} + P_{RED}}$$

Where P_{RED} represent reflectance at red (0.6-0.7µm), and P_{NIR} represent reflectance at Near-Infrared (NIR) wavelengths (0.7-1.1µm).

In addition to the NDVI analysis land use land cover and canopy cover analysis was conducted. The schematic workflow is shown on Figure 3.

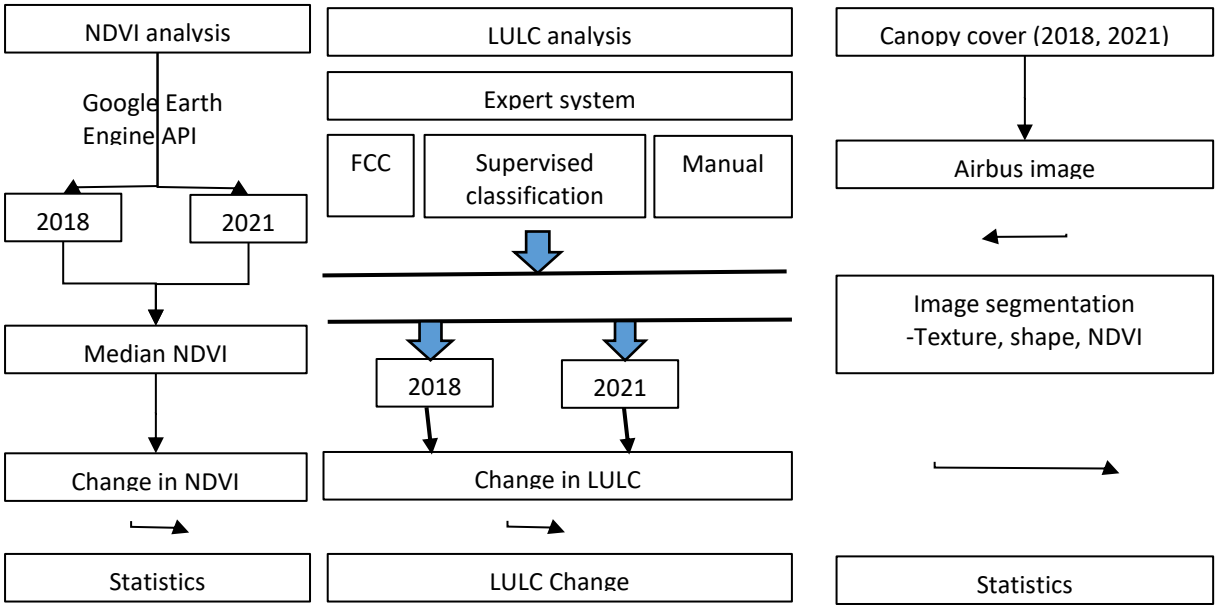


Figure 3 Schematic workflow for the image analysis. FCC stands for image false colour composite

In addition to the NDVI and land use land cover map making and change detection a digital and canopy maps of the six church and/or monastery forests was developed using image segmentation on a high resolution Airbus images (2018 and 2021). For canopy/cover density analysis almost equal classes/ spacing is used to describe it (Table 3, after Chandrashekhar et.al., 2005). The image segmentation considered texture, shape and NDVI to produce canopy cover map using the same legend as used during 2018.

Table 3 Legend used for canopy cover/density mapping

S.no.	Canopy description	% ground cover
1	Very dense	> 95%
2	Dense	80-95%
3	Moderately dense	60-80%
4	Moderately sparse	40-60%
5	Sparse	20-40%
6	Open	<20%

Climate data

Observed daily rainfall and CHIRPS data (rainfall) were used to evaluate the climate condition of the two study sites the Goncho Siso Enessie (GSE) woreda and Wolmera for 2018 and 2021. For GSE and Wolmera the meteorological stations used were Motta and Addis Ababa (observed/Airport) stations respectively. The rainfall and temperature datasets had data gaps, these data gaps were filled using long-term Chirps (for rainfall), AgMERRA and ENACTS data sets for temperature. The summary of the input datasets used is shown under (Table 4).

Finding of climate analogues (future climatic suitable) sites can be done using the online analogues tools developed by Climate Change Agriculture and Food Security (CCAFS; http://gismap.ciat.cgiar.org/analogues) or the R package CCAFS analogues tool. In this study, we implemented R package CCAFS analogues tool for midcentury (2050's), to find climate analogues sites of the study areas (both the GSE and Wolmera woredas) using the "backward" method, to answer a question "where can I find sites in Ethiopia whose current climate is analogues to the future expected climate for the study area?" relevant for the analysis of devising adaptation options. This is based on the assumption that present distribution of tree species are in equilibrium with current climate conditions.

We used grid based CCAFS (dis) similarity index with growth period of 12 months during the analysis. Moreover, the temperature and rainfall datasets was normalized to same scale and the threshold will be set to 5 % (to find the closest 95 % of the sites). This will result into numerous analogues sites. Finding of the analogues sites is not sufficient, hence we recommend additional biophysical and socioeconomic survey on the analogues sites to learn from the analogues to the reference woreds. The information (for instance, on the type of tree species, management practices and the effect of climate change) can be collected through.

Furthermore, using the baseline 30 years' climate (1980 to 2009) will be used to project to a 30 years' time segment (2040-2069 and 2070-2099) using two RCP's (representative concentration pathways, RCP 4.5 and RCP 8.5) and 20 GCM's (Global circulation models) following the international research group (AgMIP, https://agmip.org/) protocols for both stations. Meteorological data was obtained from the Ethiopian National metrological Agency (NMA) data gaps were filled and quality was checked.

Table 4 Summary of input datasets used

Data used	Resolution	Temporal	Source
Landsat 8 OLI	30 m	2008 & 2021	http://earthexplorer.usgs.gov/ and Google Earth Engine
SRTM-30	30 m	2000	
Airbus GE	0.65 m		Google Earth

Data used	Resolution	Temporal	Source
CHIRPS daily	~5km	1981-2022	ftp://ftp.chg.ucsb.edu/pub/org/chg/products/CHIRPS1.8/africa_daily/tifs/africa_p05_tif/
ENACTS daily	~4 km	1981 -2018	http://iri.Columbia.edu
GPS	< 6 m	2018 & 2021	Field (primary data)
Met data	Monthly	2018 & 2021	NMA data for Motta
Met data	Daily	1969-2018, 2021	NMA data for Addis Ababa (obs and AP)
Met data	Daily	1980-2016, 2018	NMA data for Motta

2.2.4. Data analysis

The primary and secondary data obtained from respondents and documents respectively were processed, classified and tabulated. It is presented in different ways using tables, line/bar graph, and pie chart to mention some. Consequently, a combination of different statistical techniques such as percentages, frequencies and mean were used to adequately address the objectives. To do this SPSS v. 20x and R were used. The frequency of codes and memos were used to identify the major themes from the transcripts. Qualitative data would also be used to analyze opinions and perceptions by using common expressions and similar opinions.

The data processing and analysis for the biophysical related data also followed the standard methods. The number of species were determined by summing up the number of species identified in the field and national herbarium. Abundance of each woody species was defined as the number of occurrence of stems of a given species in quadrats of each sites. Moreover, the density of each woody species in each site was determined by converting the total number of individuals of the species encountered in all quadrats to a unit area of one hectare. The frequency of each woody species was defined as the probability or chance of finding a species in a given quadrat of each sample site (Kent and Coker, 1992). Natural regeneration status was surveyed during the baseline survey thus it is not of much relevance this time. Data from the transect walk was described qualitatively. In addition to the population structure and regeneration status of the natural forest/vegetation within the church forests, the artificial plantations existing within the churches was analyzed and mapped. A digital and canopy maps of the six church and/or monastery forests was developed using appropriate GIS and remote sensing techniques and tools for analysis and reporting.

2.2.5. Evaluation of the project performance

In addition, to what is described above, the project performance was evaluated as follows:

2.2.5.1. Description of project baseline period (2018)

- Major problems to be summarized from situation analysis report of the project
- E.g. Land use/cover, forest inventory, socio-economic data of the baseline
- Livelihood status.

2.2.5.2. Description and evaluation of intervention plans and objectives

- Summarize the major proposed interventions of the project;
- Evaluate their suitability;
- Identify interventions that should have been but not proposed.

2.2.5.3. Evaluation of the impact of the project

Relevance

- Are we doing the right thing? How important is the relevance or significance of the intervention regarding local and national requirements and priorities?
- Multitude of problems across the entire church forest will be analyzed (described in the baseline study);
- A comprehensive and integrated approach for the proper and effective utilization of the resources was very vital to avert the problems and improve the living conditions of the community and conserve the resource (natural forest);
- Analyze if the initiative was timely in view of the objectives, goals and strategies of the National policy and the Regional Conservation Based Agricultural Development Program;
- Gaps.

Planning and implementation procedures

- Presentation of our evaluation about the process of planning and implementation including stakeholder participation, problem and intervention identification implementation.
- Gaps.

Effectiveness

- Are the objectives of the development interventions being achieved? How big is the effectiveness or impact of the project compared to the objectives planned (comparison: result – planning)?
- Evaluation of achievements against the interventions proposed by the project as presented above in the description and evaluation of intervention plans and objectives.
- Current land use land cover map;
- Number of intervention/development projects (eg. Solar power, nursery, plantations, etc);
- Current livelihood status;
- Description of achievements other than those proposed by the project;

- Gaps.

Efficiency

- Are the objectives being achieved economically by the development intervention? How big the efficiency or utilization ratio of the resources used (comparison: resource applied – results)?
- Assessing the degree of implementation of proposed interventions including evaluation of more efficient alternative approaches that can deliver same results.

Sustainability

- Are the positive effects or impacts sustainable? How is the sustainability or performance of the intervention and its effect to be assessed?
- Evaluating the institutional, financial, technical (human resource), environmental (natural vegetation), stakeholder participation, equity, etc.
- Gaps.

Monitoring and evaluation mechanisms

- Evaluating mechanisms of monitoring of proposed interventions including institutional monitoring, financial regulation, forest regulations, etc
- Gaps.

2.2.6. Potentials and constraints that affected project performance

3.1 Relevance to national and regional development policies
3.2 Preparation and readiness
3.3 Stakeholder participation and ownership
3.4 Financial planning
3.5 Implementation approach
3.6 backstopping activities

2.2.7. Lessons learned and recommendations

4.1 Lessons learned
4.2 Recommendations

The overall method for the project impact evaluation is summarized under Figure 4

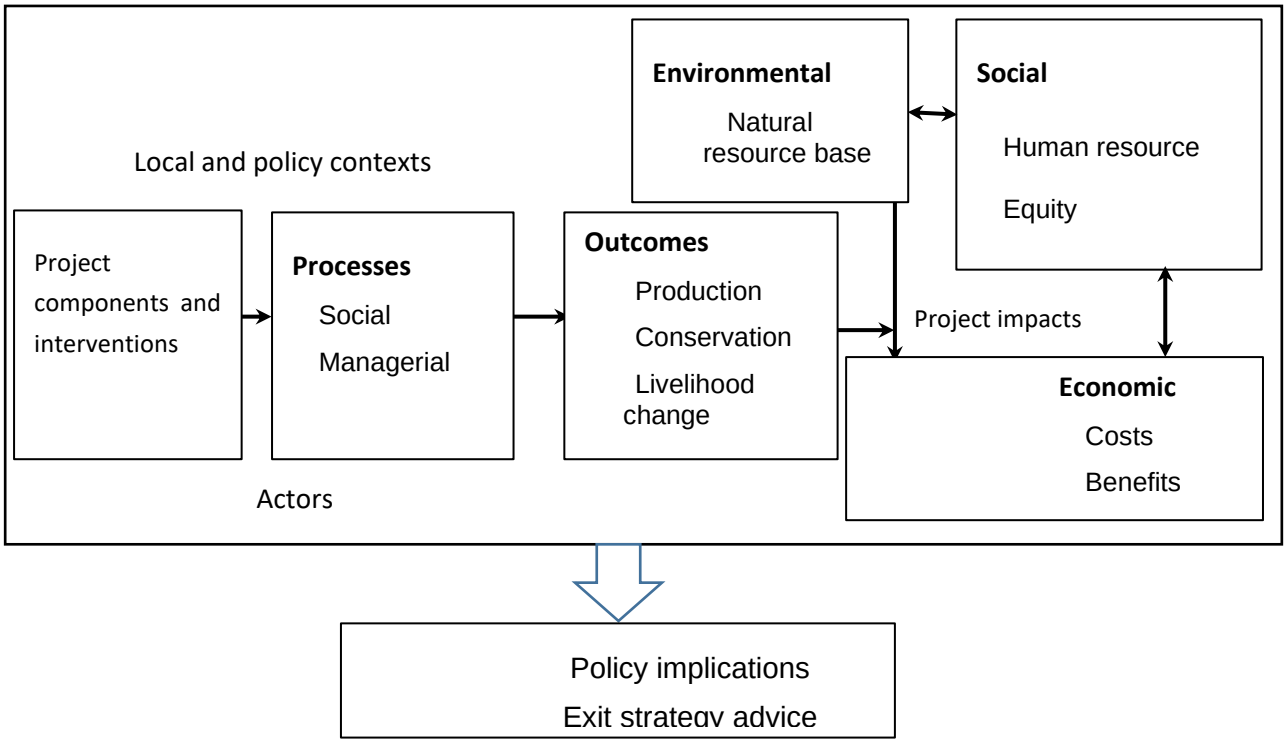


Figure 4 A generalized conceptual framework for the impact assessment

3. Results

3.1. Baseline-endline fact sheet

The detailed survey result of the 6 church/monastery forest areas is summarized in the "results framework" shown under Table 6. Site specific/extended results based on the cover types can be obtained from the spatial database.

Considering the results framework (Table 6) the survey result from the study sites indicates that almost all indicators (mainly for Outcome 1: The Orthodox Church of Ethiopia is a climate ambassador promoting forest protection and, Outcome 3: Communities around church forest have increased climate resilience) for the outcomes do not exist (had zero or "Nill" values) during the baseline survey. Except, for Outcome 2: Church forests are protected from degradation, the land cover (Table 5) types (There are large areas under church forests protection). For, example, both dense and very dense forest cover had an area of 514.29 ha's from the total area of 828.45 ha's. This was evaluated from the canopy cover/image segmentation analysis.

Table 5 Summary of land cover for the six church forests (based on canopy cover) in ha's.

S. no	Church or Monastery	Built-up	Cultivated	Open	Sparse	Moderately Sparse	Moderately dense	Dense	Very dense	Total (ha's)
1	Beza	0.09	7.02	11.45	0.35		1.39	3.79	23.66	47.74
2	Jiret	0.14	3.14	3.83	1.91		1.88	2.11	5.70	18.70
3	Koga	0.24	2.56	24.27	3.55	3.55	1.18	1.97	88.98	126.31
4	Menagesha	0.61	1.60	13.07			11.65	18.45	298.61	343.99
5	Tach mariam	0.88	1.78	160.26	6.99	19.29	23.02	26.50	0.23	238.95
6	Yemrat	0.24		1.78	3.31		3.13	9.83	34.46	52.75
	Grand Total	**2.20**	**16.10**	**214.66**	**13.15**	**22.85**	**42.25**	**62.65**	**451.64**	**828.45**

Table 6 : Indicator baseline-endline fact sheet

	EXPECTED RESULT	INDICATORS	BASELINE VALUE (Oct, 2018)	TARGET by the End of 2021	ENDLINE VALUE (Oct, 2021)	Data source verification
OUTCOME 1	The Orthodox Church of Ethiopia is a climate ambassador promoting forest protection.	• Strong and functional interreligious platform is established • The Orthodox Church has prepared and applied a climate action statement	0 (Nill) 0 (Nill)	• 1	• 1 •	• Annual reports "
Output 1.1	A National Climate platform is established	• No of functional climate action groups established at church level	0 (Nill)	• 1	• 1	• Annual reports "
Output 1.2	A church forest methodology is developed	• A Church forest methodology published in English and Amharic	0 (Nill)	• 1	• 1	• Evaluation report
Output 1.3	The Orthodox Church and the patriarch is linked with IRI and other faith communities internationally	• No of EOC's and other Ethiopian faith groups' representation and contributions to IRI	0 (Nill)	• 9	• 9	• Annual reports • Evaluation report
Output 1.4	Theological rational and foundation for forest protection developed by the orthodox church	• No of congregations within the Orthodox church applying the theological statements and the developed material • No of people reached through sermon Sunday schools etc	0 (Nill) 0 (Nill)	• 18	• 18	• Annual reports • Evaluation report • Periodic report
Output 1.5	Other faith communities in Ethiopia are linked to National Climate platform to promote forest protection	• No of faith communities who have committed to work towards a national interfaith climate platform • No of faith communities developing theological foundation for forest protection • The church forest methodology is disseminated amongst participating faith communities	0 (Nill) 0 (Nill) 0 (Nill)	• 4 • 4	• 4 • 4	• Letter of commitment • Joint statement
OUTCOME 2	Church forests are protected from degradation	• Ha of forest land protected (Dense and very dense forest increase from:)	514.29	1,240	1,240	

	EXPECTED RESULT	INDICATORS	BASELINE VALUE (Oct, 2018)	TARGET by the End of 2021	ENDLINE VALUE (Oct, 2021)	Data source verification
Output 2.1	Church-forest baseline and inventory documented	• Church-forest baseline and inventory are documented in the six churches	0 (Nill)	• 12	• 12	• Annual reports • Evaluation report • Drone photos • GPS data
Output 2.2	Forest conservation enhanced	• Area of church forest restored (in hectares) • No of forest governance systems in place • No of church forests obtained land right certifications • No of churches electrified by renewable energy	0 (Nill) 0 (Nill)	• 343 • 9 • 12 • 5	• 343 • 9 • 12 • 5	• Annual & evaluation reports
Output 2.3	Congregations have increased their knowledge of climate change and the importance of forests	• No of community members attending theological reflections, dialogue, ecological literacy events • No of community members attending theological reflections dialogue ecological-literacy events • No of participants in exposure visits • Community awareness on climate change and forest conservation has increased • No of climate and forest trainees	0 (Nill) 0 (Nill) 0 (Nill)	• Men = 527 • Women = 505 • Young men = 978 • Young women =940 •Men = 411 •Women = 394 •Young men = 762 •Young women =733	• Men = 527 • Women = 505 • Young men = 978 • Young women =940 •Men = 411 •Women = 394 •Young men = 762 •Young women =733	• Knowledge, Attitude and Practice (KAP) survey
Output 2.4	Knowledge sharing and communication with national and international stakeholders have taken place	• No of joint initiatives • No of annual exposure visits	0 (Nill) 0 (Nill)	• 14	• 14	• Periodic (Quarterly reports) • Annual reports

	EXPECTED RESULT	INDICATORS	BASELINE VALUE (Oct, 2018)	TARGET by the End of 2021	ENDLINE VALUE (Oct, 2021)	Data source verification
OUTCOME 3	Communities around church forest have increased climate resilience	• Communities have more access to knowledge and resources around climate resilience	0 (Nill)	•	•	• Focus group discussions • Semi structured interviews
Output 3.1	Community mobilized in climate resilience task forces	• No of climate resilience task forces • Number of congregations that have organized activities within their communities to promote Climate resilience • Amount of community contribution (cash and monetized labor and in kind)	0 (Nill) 0 (Nill) 0 (Nill)	• 15 • 42	• 15 • 42	• Evaluation report • Annual reports
Output 3.2	Increased adoption of sustainable land management practices	• Ha of land covered by trees • Ha of land rehabilitated as a result of gulley protection structures	0 (Nill) 0 (Nill)	• 343 • 435	• 343 • 435	• Quarterly reports • Annual reports
Output 3.3	Communities engaged in income generating activities related to sustainable harvesting and value addition of non-timber forest produce (NTFP)	• No of income generating activities suitable for the context, identified • No of HHs that has taken up new income generating activities related to sustainable harvesting/value addition of NTFP	0 (Nill) 0 (Nill)	• 29	• 29	• Federal socio-economic surveys and market assessments

3.2. Project management

The evaluation team first communicated the project team at GSE woreda. From the project team, the consultants learned that ECFIP is managed at the district level by two major committees, namely the major committee and the technical committee.

The major committee is composed of the heads of the district office of agriculture, office of Environment, office of health, office of education, office of women, youth and children, office of water, energy and mines, and the group leader of the natural resources case team from the district office of agriculture. The main committee is responsible for and actively engaged in planning, monitoring and evaluation as well as participate as beneficiary in capacity building packages.

The technical committee is composed of the group leader of the natural resources case team in the district office of Agriculture and the technicians (experts) of offices whose heads are represented in the main committee. The technical committee is responsible for and participate in the implementation of all development activities, such as in nursery management, beehives and honeybee rearing, irrigation activities and gender mainstreaming. The technical committee was active in capacity building as a trainer and as a trainee.

Similar committee formations can be found at the village level. In every village, there are forest committee and forest plantation task forces.

3.3. Climate analysis

The annual total rainfall for GSE during 2018 and 2021 were 1334 mm and 1123 mm respectively (Figure 5). 1st Dekad of June in 2018 had high rainfall when compared to 2018. On the other hand, for Wolmera (Addis Ababa observation/airport) the annual total rainfall during 2018 and 2021 were 1,036 and 1,188 mm respectively (Figure 7).

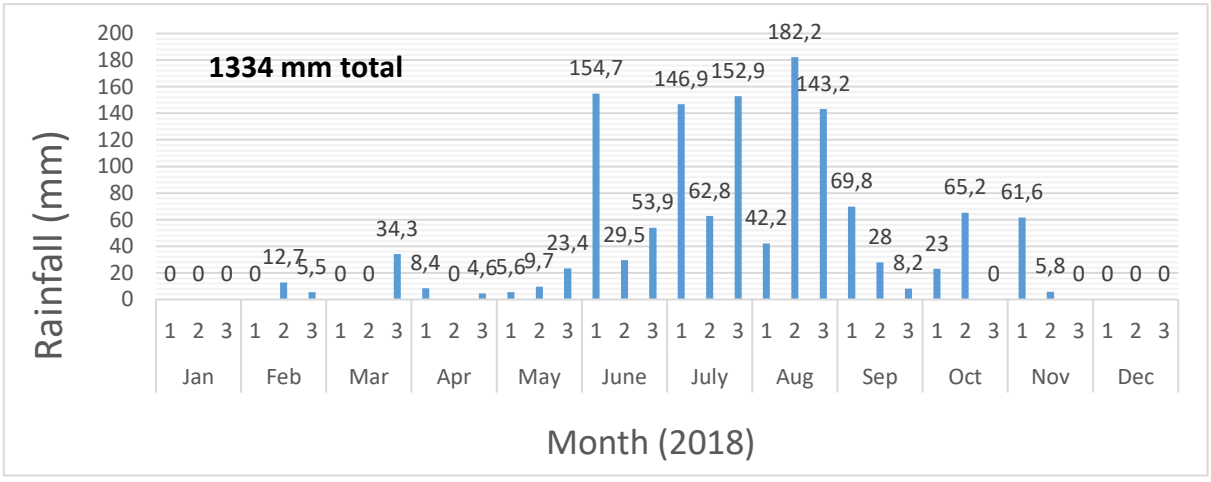


Figure 5 Dekadal (10 days) rainfall (mm) for Motta station (E=37.89, N=11.074) for 2018 (1345 mm total)representing the Goncha Sisso Enessie woreda.

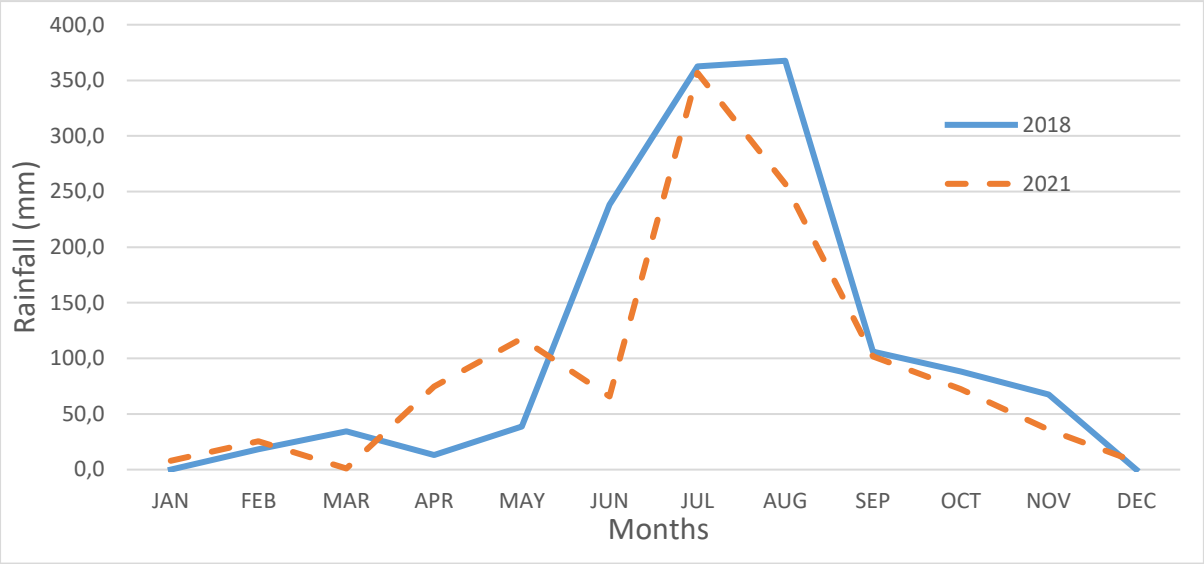


Figure 6 Monthly rainfall (mm) for Motta station for 2018 and 2021. Rainfall total for 2018 was 1334 mm and for 2021 it was 1123 mm. The main difference is in April, May and Auguest.

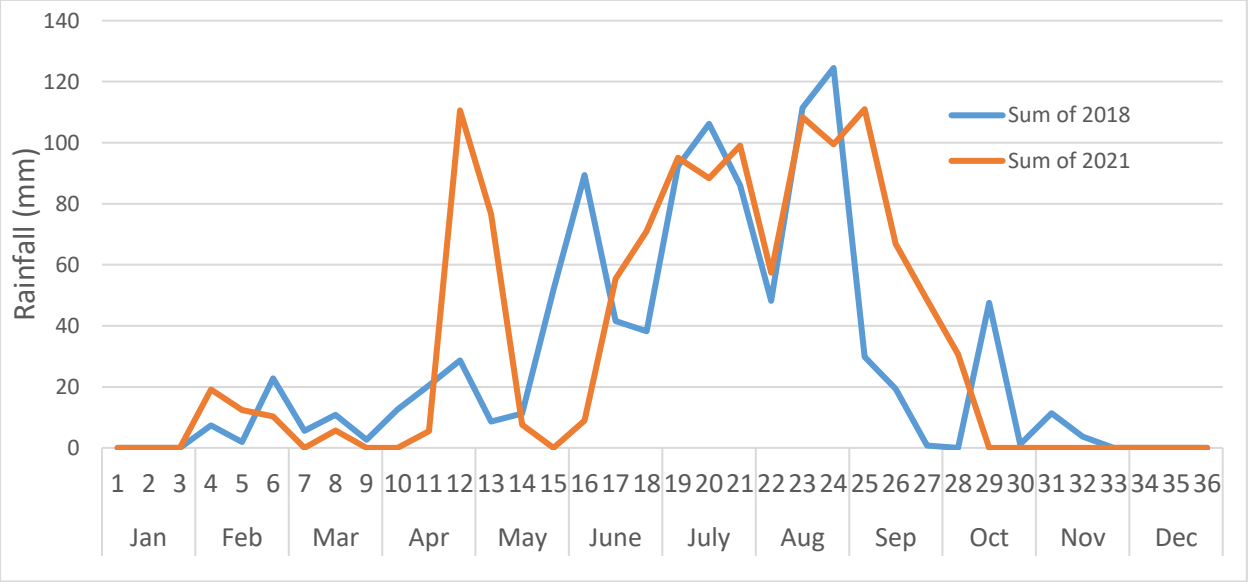


Figure 7 Dekadal Total Rainfall (mm) for Addis Ababa station (E=38.7475, N=9.01891) for 2018 (1036 mm total) and 2021 (1,188 mm total) representing the Menagesha-Mariam & Medhane'alem church.

In both locations the total amount of rainfall is higher than 1000 mm, which is sufficient for survival of most tree species. Hence, a good opportunity to have forest development intervention in both locations.

The future climate of the study sites was also analysed from projected climate as well as finding of the analogues sites. The analogues sites for both the GSE (purple) and the Wolmera woredas (black) are shown on Figure 8.

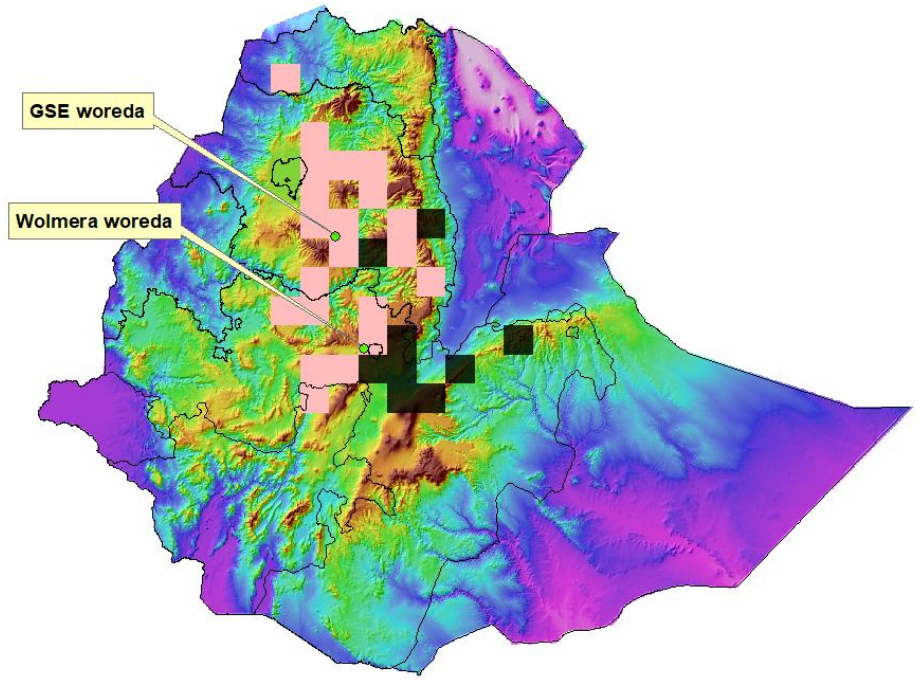


Figure 8 The climate analogues sites (midcentury) for the Goncho Sise Enese Woreda (purple colour) and Wolmera woredas (black colour).

The GSE woreda may have analogues climate as that of Ginde beret, Goro, and Girar jarso climate currently have. Meaning the 2050's climate of GSE woreda will be similar to that of the aforementioned woredas current climate. Hence, some adaptation strategies can be devised from these locations to GSE woreda since the sites already have the future climate of GSE area. Similarly, for Wolmera woreda some of the analogues sites are Bugna, Anchar, and Gara Muleta.

In addition to the finding of the climate analogues sites, the two woredas future climate was analyzed. The results indicate that all the 20 Global Circulation Models (GCM's) used predict the future maximum (TMAX) and minimum temperature (TMIN) to increase in the range between 1 to 6°C from the baseline depending on the RCP (Representative Concentration Pathway) and time segment (mid or end of century) considered. The end of century had the highest increase when compared to the midcentury. In addition, the RCP 8.5 had the highest increase (see details in the Annex section (Annex 1 and Annex 2)). In the end century maximum temperature increased from a minimum of 4°C to 6°C using RCP 8.5. There will be no conclusive remark as to increase or decrease in rainfall amount. Some of the GCM's predict below and some above the baseline rainfall. Selected examples are shown for both GSE and Wolmera weredas below (Figure 9, Figure 10).

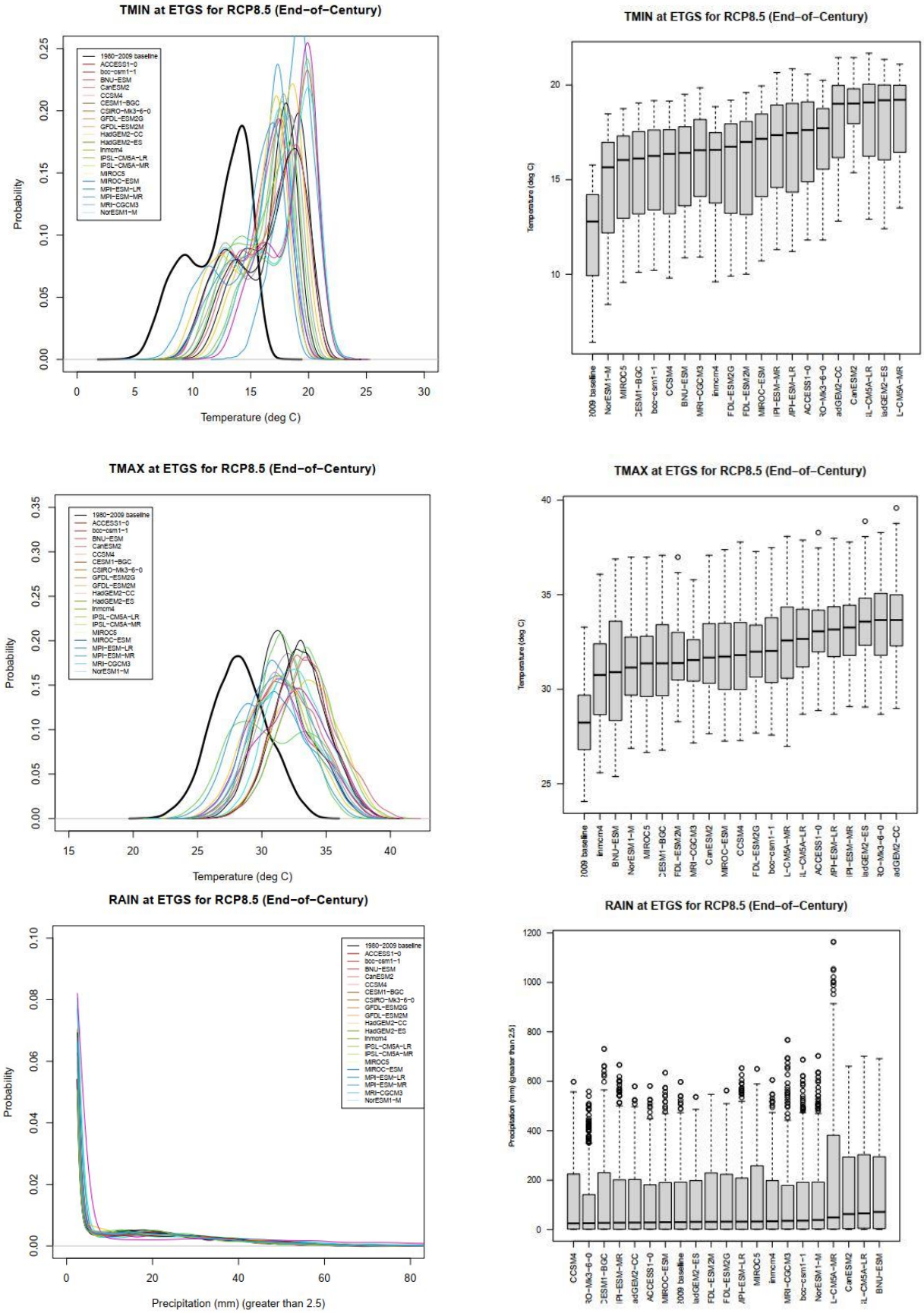


Figure 9 End of century RCP 8.5 climate projection for Goncho Sise Enese woreda for minimum (TMIN, top row), Maximum (TMAX, middle row) temperature and rainfall (bottom row).

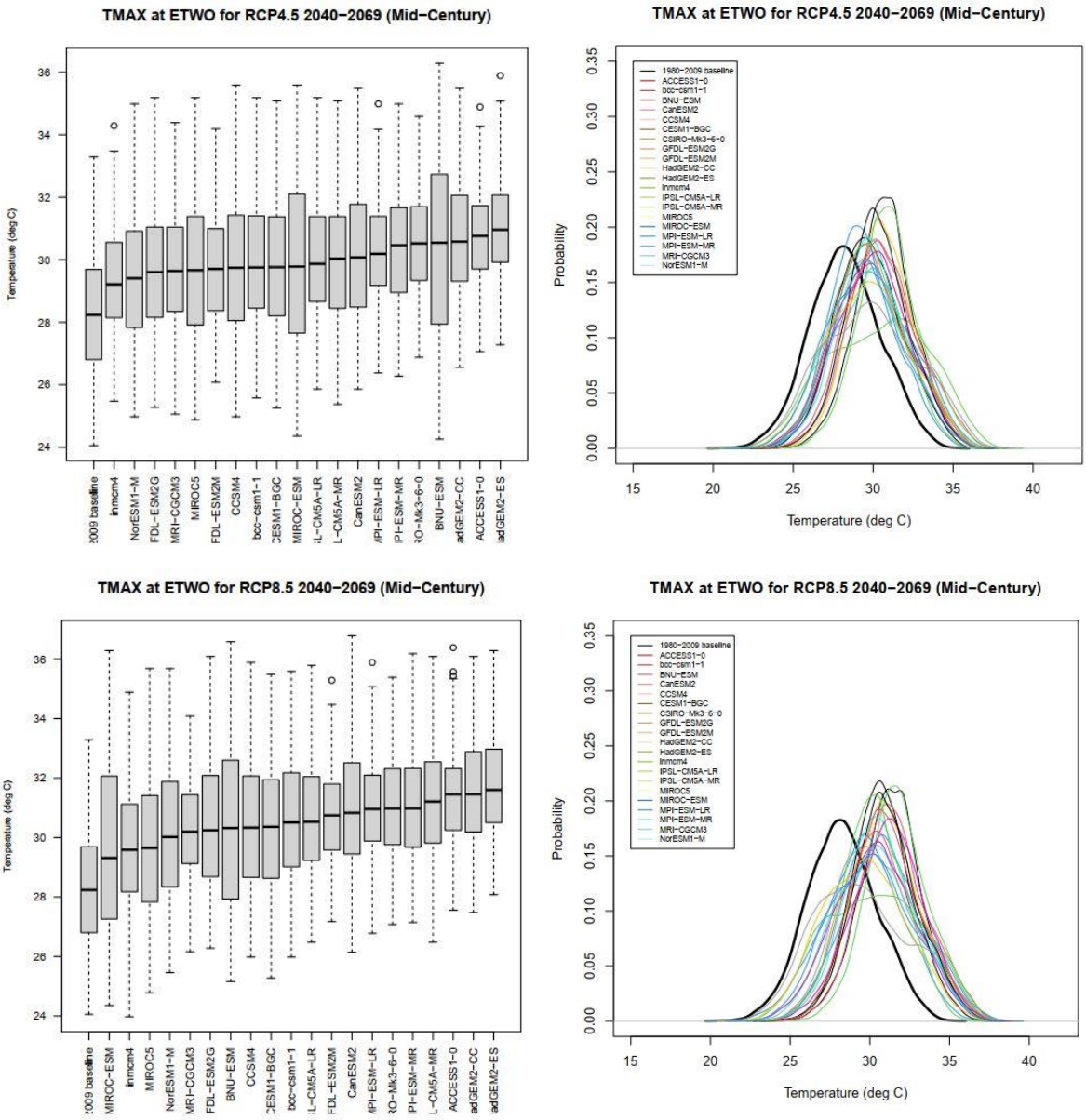


Figure 10 Mid of century RCP 4.5 (top row) and 8.5 (bottom row) Maximum Temperature (TMAX) projection for Wolmera woreda.

3.4. Vegetation inventory

All the churches were revisited for the change in vegetation composition in the church forest as well as the surrounding and in the Woreda. From each church the previous baseline GPS points of different plots were revisited. They were evaluated if there were any qualitative changes also, for example, the presence of whole tree cutting where there could be stumps, heavy branch cutting, natural regeneration of native trees, and intrusion of animals. Besides, the evaluation team measured new plantation areas in the buffer zone of the church forest.

3.4.1. NDVI change between 2018 and 2021

The Goncha Sisso Enessie woreda NDVI (2018) and change (2021-2018) is computed (Figure 11). A negative change (reduction) in NDVI is noticed towards the eastern part of the woreda (the bottom figure).

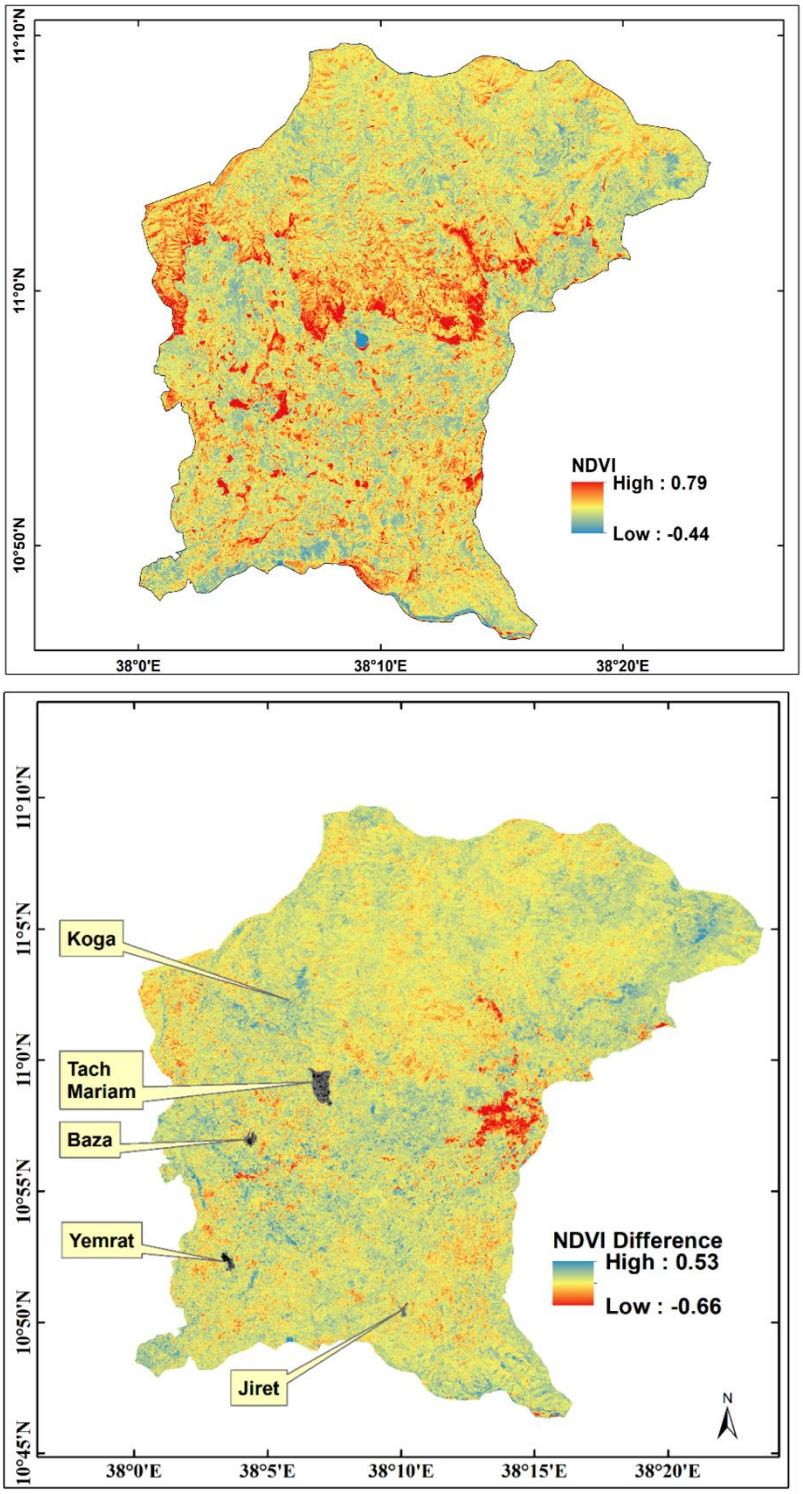


Figure 11 Landsat 8 OLI derived NDVI in 2018 (top) and change (2021 – 2018) (bottom) using annual median NDVI values.

Both the median and mean statistics for the annual median NDVI values change between 2021 and 2018 shows an overall slight reduction.

Table 7 Annual median NDVI value change between 2021 and 2018 for the GSE woreda

	NDVI		
Statistics	**2018**	**2021**	**Diff**
Min.	-0.44	-0.28	0.16
1st Qu.	0.26	0.24	-0.02
Mean	**0.33**	**0.31**	**-0.02**
Median	0.32	0.29	-0.02
3rd Qu.	0.38	0.36	-0.03
Max.	0.79	0.81	0.02

The weighted individual church/monastery NDVI (Table 8), however, didn't show significant change. This doesn't mean that there was no change at specific locations in the church/monastery rather it means that the overall net NDVI had no change. The details of the individual church/monastery forests are provided under each section below.

Table 8 Landsat 8 OLI derived NDVI change (2021 – 2018) weighted by area using annual median NDVI values for each church/monastery.

S.no.	Church/ Monastery	Average NDVI difference	Area (ha)	Weighted	NDVI change
1	Jiret Medhan	0.011	19	0.023	0.00
2	Baza Asterio	-0.035	48	0.058	0.00
3	Tach mariam	-0.050	239	0.289	-0.01
4	Yemrat	0.007	53	0.064	0.00
5	Koga	0.033	123	0.149	0.00
6	Menagesha	0.028	344	0.416	0.01
			826	1.000	0.001

3.4.2. Yemrat Abo Church

The total area of the church is 53 ha's. It has certificate of land ownership and book of land holding. From the forest inventory of the year 2018, the basal area is relatively low when compared to big forests. Very few species showed basal area (BA) of more than 2-meter square (Figure 13 a). There is plantation of *Cupressus lusitanica, Grevillea robusta, Acacia decurrens*, and *Olea europeae* trees in the buffer zone of the church. The trees were planted in 2020/2021. Inside the church forest, there are clear indications that there is no disturbance. Human and animal disturbance were effectively protected. The enrichment planting inside the church forest composed of *Cupressus lusitanica, Olea europeae, Cordia africana, Acacia decurrens and Juniperus procera.* There is a need for thinning for some tree species.

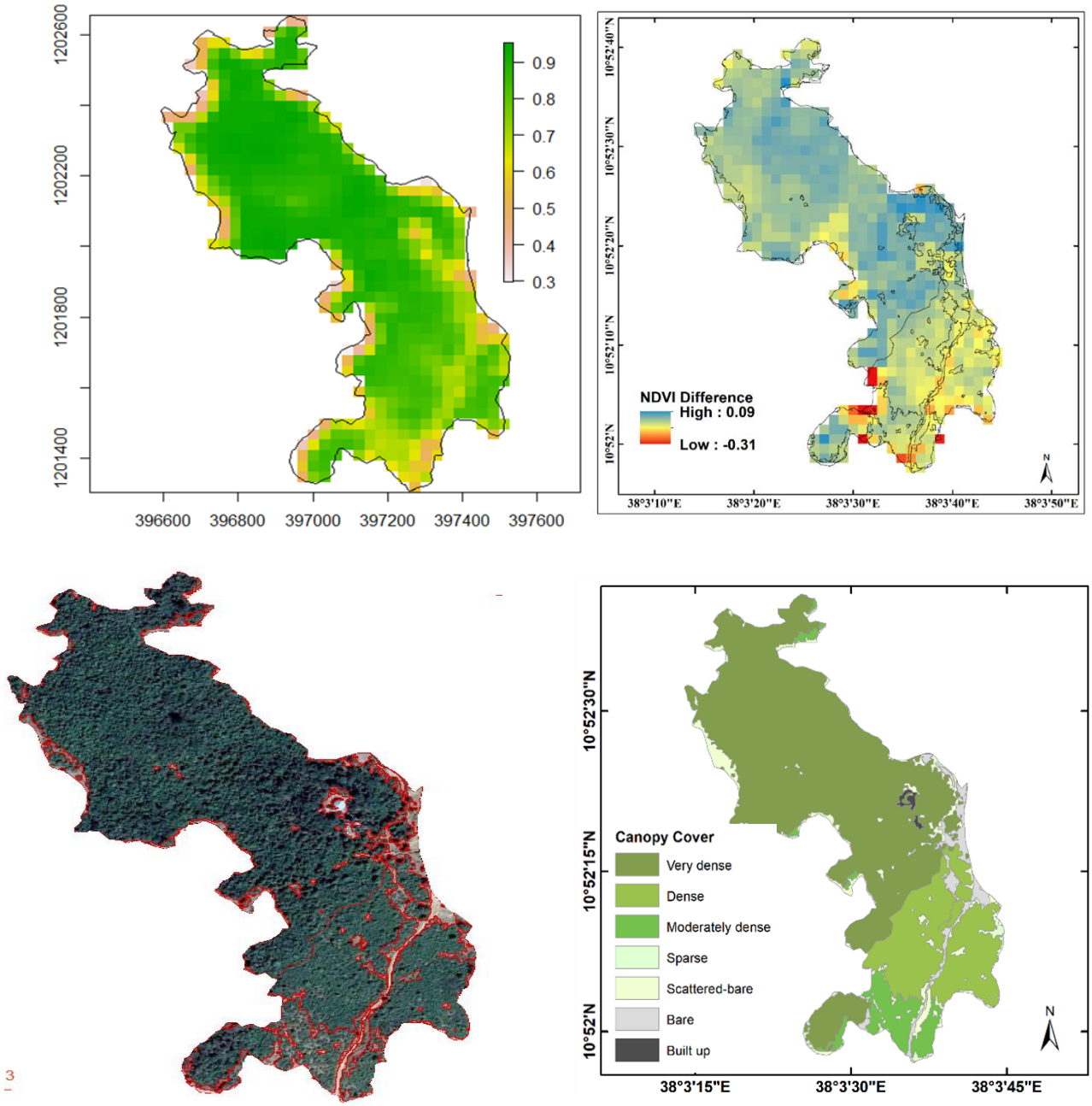


Figure 12 Top left: NDVI in 2018 & top right: Change in NDVI between November 2018 and October 2021 (-ve or red is reduction) overlaid with image segmentation layer for Yemrat Abo Church. And, bottom left canopy cover segmentation and bottom right canopy cover map. There is no difference in the canopy cover between 2021 and 2018.

The change in canopy cover (CC) between 2021 and 2018 didn't show significant difference (Figure 12) probably due to small size of the tree seedlings/intervention to be detected with the satellite data resolution available. However, the NDVI clearly shows areas with +ve and –ve changes.

We noticed low survival of *Juniperus procera* seedlings planted. Two options can be considered to improve the survival and growth performance of *J. procera* seedlings. The first

option is irrigating young seedlings during the long and extended dry spell, and the other option is extending the nursery life of the seedling while in the nursery. *Acacia decurrens* has promising performance for further expansion of plantation in the whole district. This information has been discussed with the group leader of the Natural Resources Management of the district office of agriculture, who is also a member of the main committee and technical committee formed to manage ECFIP.

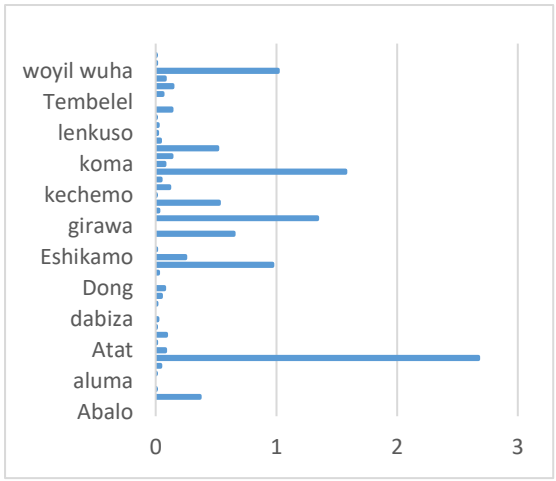
Outside the church, there is a catchment treatment activity. The total area of the catchment treated is 35 ha. The main physical activities are gully treatment, check dams, cut off drains and soil bunds. The physical activities are reinforced with plantation of *Acacia decurrens* and *Sesbania sesban*. The project contributed all the material requirements and the labor contribution was from the community.

There is a household level plantation of trees. For example, the farm of Alebachew Yigrem, who planted *A. decurrens* in an area of < 0.5 ha, which was planted in 2021 rainy season. The project staff has given satisfactory explanation on the relation between farm household level tree planting and ECFIP. It was noted that when individual farms obtain their wood demand from their own sources, the pressure on the natural vegetation inside the church will be highly minimized. Besides, when individual households are encouraged to plant trees, the connection between adjacent churches with green corridor will be highly enhanced.

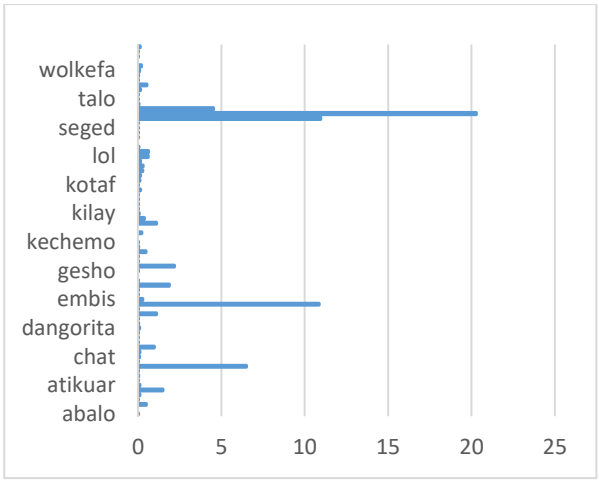
The seed store construction inside the compound of Yemrat church is a commendable activity. It will encourage churches as source of germplasm materials of native trees and also, it can be promoted as income generation activity to improve livelihood. Seed stores should have cold rooms with low relative humidity. Therefore, EOC-DICAC at GSE is advised to plant trees in the surrounding of the seed store for such purpose.

The honeybee and the beehives are also performing well. The solar lamps and solar cell are proved demand driven interventions. Almost all interviewed individuals need distribution of more solar lamps.

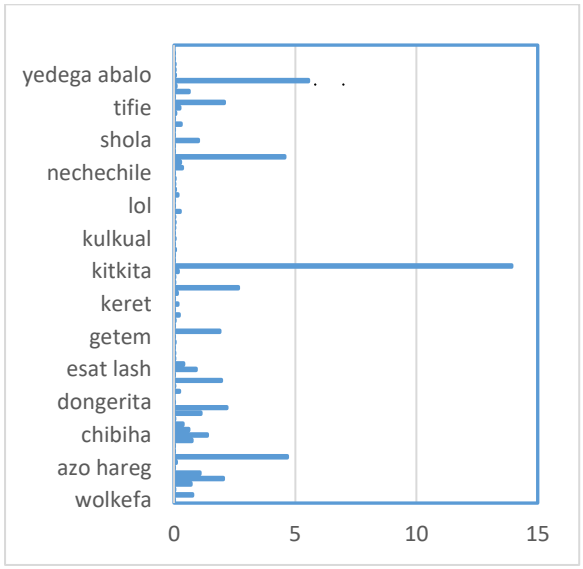
Furthermore, there are reports of increased conflict (human-wildlife) incidences of damage by wild animals, such as damage on the crop by small ruminant wild animals, and damage by large cats and hyena to small ruminant domestic animals.



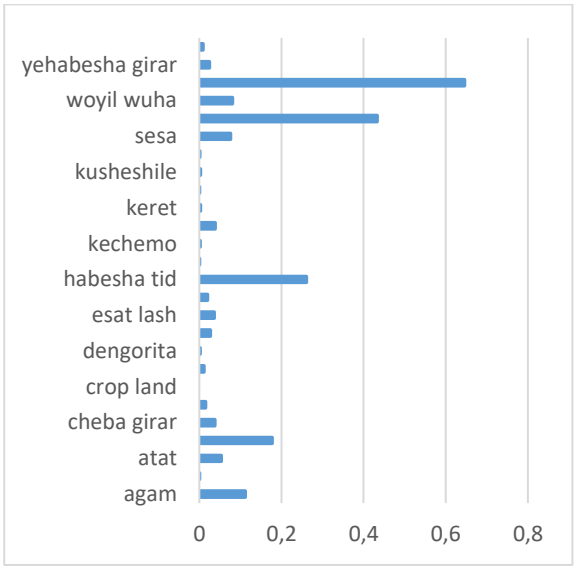
a. Yemrat Abo



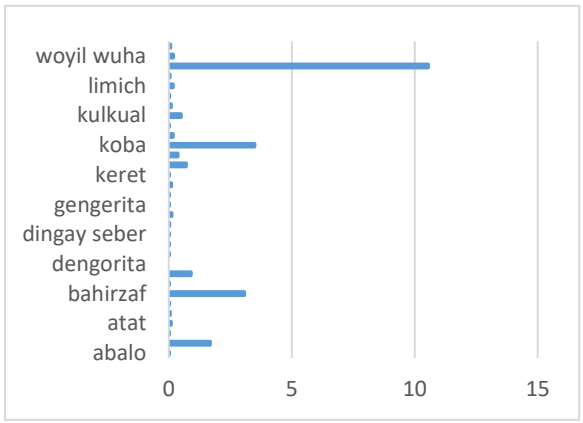
b Tach Mariam



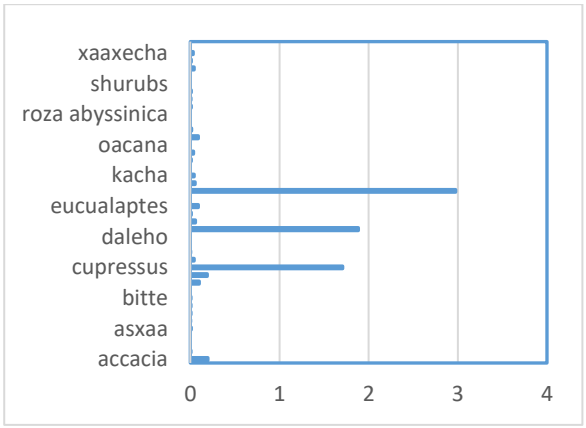
c. Koga Kidane meheret



d Jiret Medihni yalem



e. Baza Asterio



f. Menagesha Mariam

Figure 13 The basal area (BA m-2) of the six churches

3.4.3. Jiret Medihanialem Monastery

The total area of the church is 19 ha. The church has secured land ownership certificate, and the book of land holding is already in the church. It is the smallest forest compared to other churches. This forest is bounded and protected by two rivers. The forest inventory of 2019 showed, the growth stock in this forest is very low. Only a single species showed total basal area of 0.6-meter square (Figure 13 d). The revisited plots showed clear presence of tree cutting where stumps of trees clearly seen. Besides, other forms of forest disturbance like livestock browse and heavy branch cutting were observed. The inhabitants of the monastery indicated that the forest harvest is from the inside. There is no external threat from the surrounding community.

The head of the monastery, Aba Yohannes explained that the monastery harvest and burn a woodlot from the natural forest mainly for the purpose of cooking. The 300-watt solar cell has solved their problem of lighting. He said "we need to feed the community living in the monastery. We harvest wood in the natural forest for the purpose of cooking our food." The head of the monastery suggested either to connect the monastery with the national electric grid or provision/donation/ of generator enough to cook food. If these options are not feasible, biogas will be an option to be considered as source of fuel for cooking, since there are livestock owned by the monastery.

There is promising buffer zone plantation in the monastery. The main planted species are *Cupressus lusitanica, Olea europeae, Cordia africana, Acacia decurrens, Juniperus procera, Grevillea robusta.* As in other places, *Acacia decurrens* has promising performance. It is ready for harvest. Wood harvest from this plantation will reduce the pressure on the natural forest. Despite encouraging performance of *A. decurrens*, the performance of *Juniperus procera* seedlings was not satisfactory or rather poor. The same recommendations, provided for other places will apply for the plantation of *Juniperous* in this monastery also.

In terms of enrichment planting, the major tree species used were: *Juniperus procera* & *Grevillea robusta.* However, this enrichment plantation is far from satisfactory. There are available potential areas for this purpose.

The irrigation infrastructure at this monastery is a commendable activity. This is a clear example of adaptive project management. Successful project management activities are supposed to react adaptively to emerging demands of the key partners and project beneficiaries. The design and the materials used for the irrigation facilities are excellent. Availability of water will increase survival of planted seedlings and improve livelihood by increasing agricultural productivity and production.

The irrigation facilities can be considered for irrigation of trees which are planted in the buffer zone. Currently the facility is being used for crop production and for limited number of fruit trees. The density of fruit trees and the spacing between trees needs to be widen.

Compared to Yemrat Abo church and Baza Asteryo, the Jiret Medhanialem community live far from the forest.

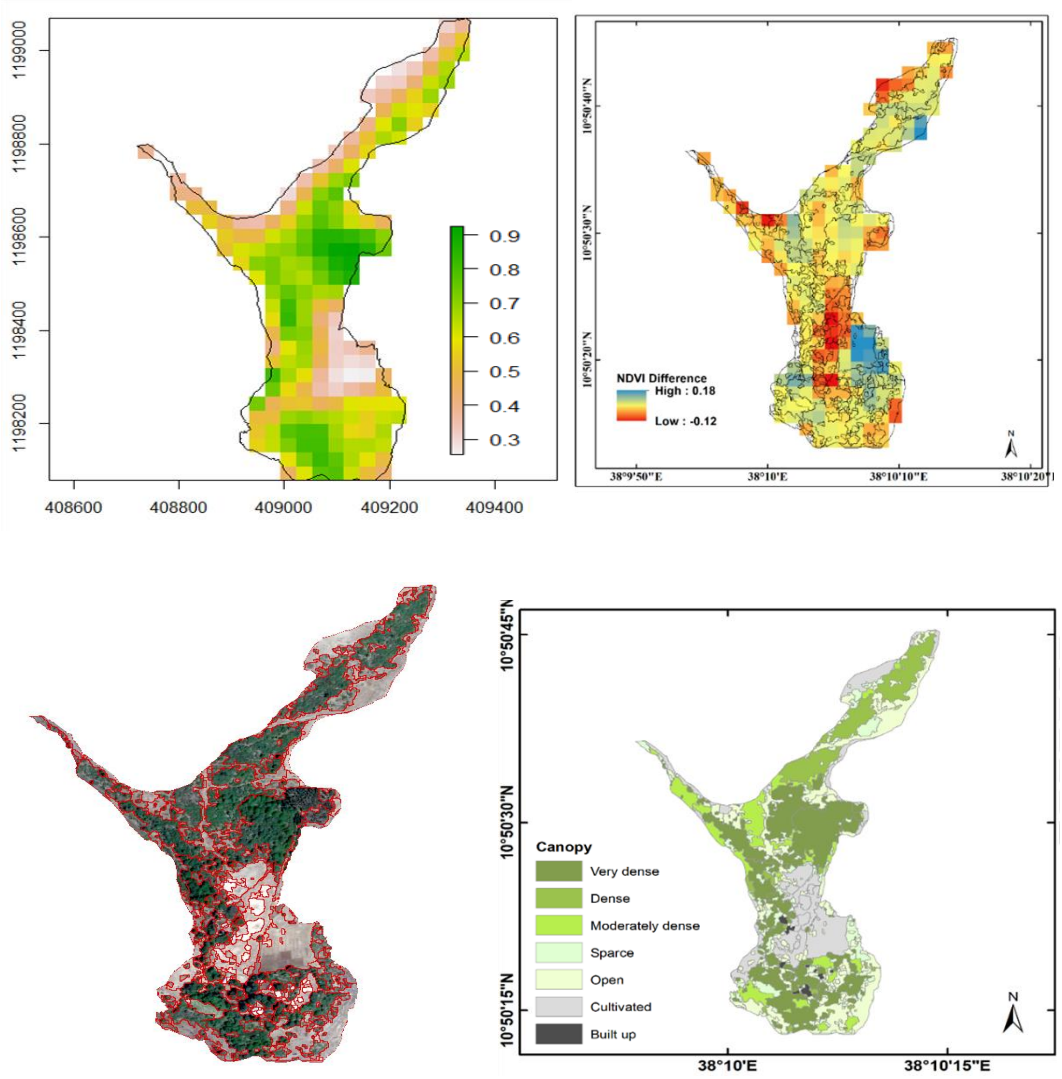


Figure 14 Top left: NDVI in 2018 & top right: Change in NDVI between November 2018 and October 2021 (-ve or red is reduction) overlaid with image segmentation layer for Jiret Medhanialem Monastery. And, bottom left canopy cover segmentation and bottom right canopy cover map. There is no difference in the canopy cover between 2021 and 2018.

The change in canopy cover (CC) between 2021 and 2018 didn't show significant difference (Figure 14) probably due to small size of the tree seedlings/intervention to be detected with the satellite data resolution we used. However, the NDVI clearly shows areas with +ve and –ve changes.

The community forest management setting is clear. Hired guards protect the forest. Compared to the beginning of the ECFIP, human intrusion has drastically reduced. The community has developed a sense of protection for the church forest. There is still high demand for solar lamps from the community side. Encouraging honey production and honeybee management are also available. All the interview participants explained the project has achieved its objectives and suggested to have another phase of similar project.

The major problem reported which is created or aggravated due to the project is increased human wildlife conflict in the area. There is increasing conflict incidence damage by wild animals, like damage on the crop by small ruminant wild animals and damage on small ruminant domestic animals by large cats and hyena.

3.4.4. Tach Mariam Monastery

From the forest inventory of 2019, Tach Mariam monastery is a forest with higher amount of biomass reserve. Many standing tree species total biomass, measured in terms of basal area (BA), has been more than 10-meter square, which is high by any standard for the region and the country (Figure 13 b). Conserving the existing forests and expanding new plantation on deforested land is a major climate change mitigation and adaptation strategy.

From the inventory result and the information obtained from the district project management office, the total area of the forest is 239 ha. Previous plots from the 2019 inventory have been revisited. There are clear indications for the presence of forest disturbance of various types and by different disturbance agents. There are live tree cutting, whole tree harvest, large branch cutting, and browse by domestic animals.

In Tach Mariam monastery area, there is encouraging and organized tree planting inside the church forest, on individual farm households and community holdings. Inside the church forest the trees are planted in the form of enrichment planting. The major tree species planted are: *Cupressus lusitanica, Olea europeae, Cordia africana, Acacia decurrens, Juniperus procera.*

The evaluation team visited the on-farm tree planting of Ato Temogn Afele. He has planted *Acacia decurrens* seedlings on a plot of land with a size of < 0.5 ha in the rainy season of 2021. Similarly, the review team visited hillside tree planting by the community on common lands. The planting area is 12 ha and planting specie are *Cupressus lusitanica, Olea europeaea, Cordia africana, Acacia decurrens, Juniperus procera*, which was established in 2020. Furthermore, there is catchment treatment with a combination of physical and biological soil and water conservation method. Thus, the evaluation team visited Eneget Woyin Wuha Kebele, Kokeb catchment where there is integrated physical activities like gully treatment with checkdams with plantation of *Cupressus lusitanica, Acacia saligna, Acacia decurrens.*

The change in canopy cover (CC) between 2021 and 2018 didn't show significant difference (Figure 15) probably due to small size of the tree seedlings/intervention to be detected with the satellite data resolution we used. However, the NDVI clearly shows areas with +ve and –ve changes. The majority of the intervention for this monastery was on the Eastern periphery (buffer zone plantation). This is clearly seen with the NDVI change (blue areas). In terms of overall NDVI reduction Tach Mariam had a negative (Table 8) performance (-0.05).

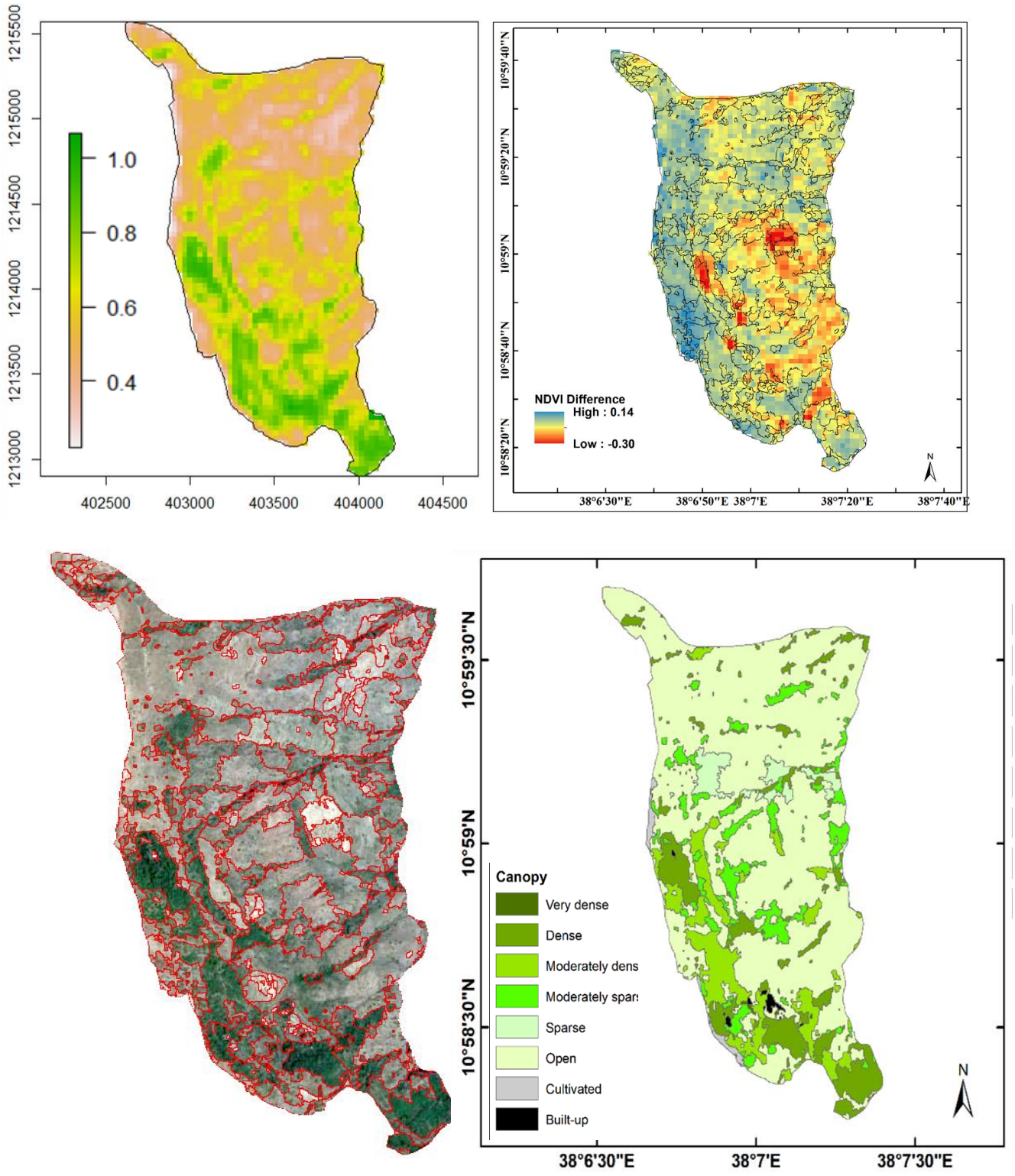


Figure 15 Top left: NDVI in 2018 & top right: Change in NDVI between November 2018 and October 2021 (-ve or red is reduction) overlaid with image segmentation layer for Tach Mariam Monastery. And, bottom left canopy cover segmentation and bottom right canopy cover map. There is no difference in the canopy cover between 2021 and 2018.

3.4.5. Koga Kidane Mehret Monastery

From the forest inventory of 2019, Koga Kidane Mehret monastery harbor one of the most diverse and high woody biomass reserve. Many standing tree species total biomass, measured in terms of basal area (BA), has been higher than many of the churches under consideration (Figure 13 c). It is considered by the evaluation team as a forest reserve which needs consideration in terms of conservation and source of germplasm.

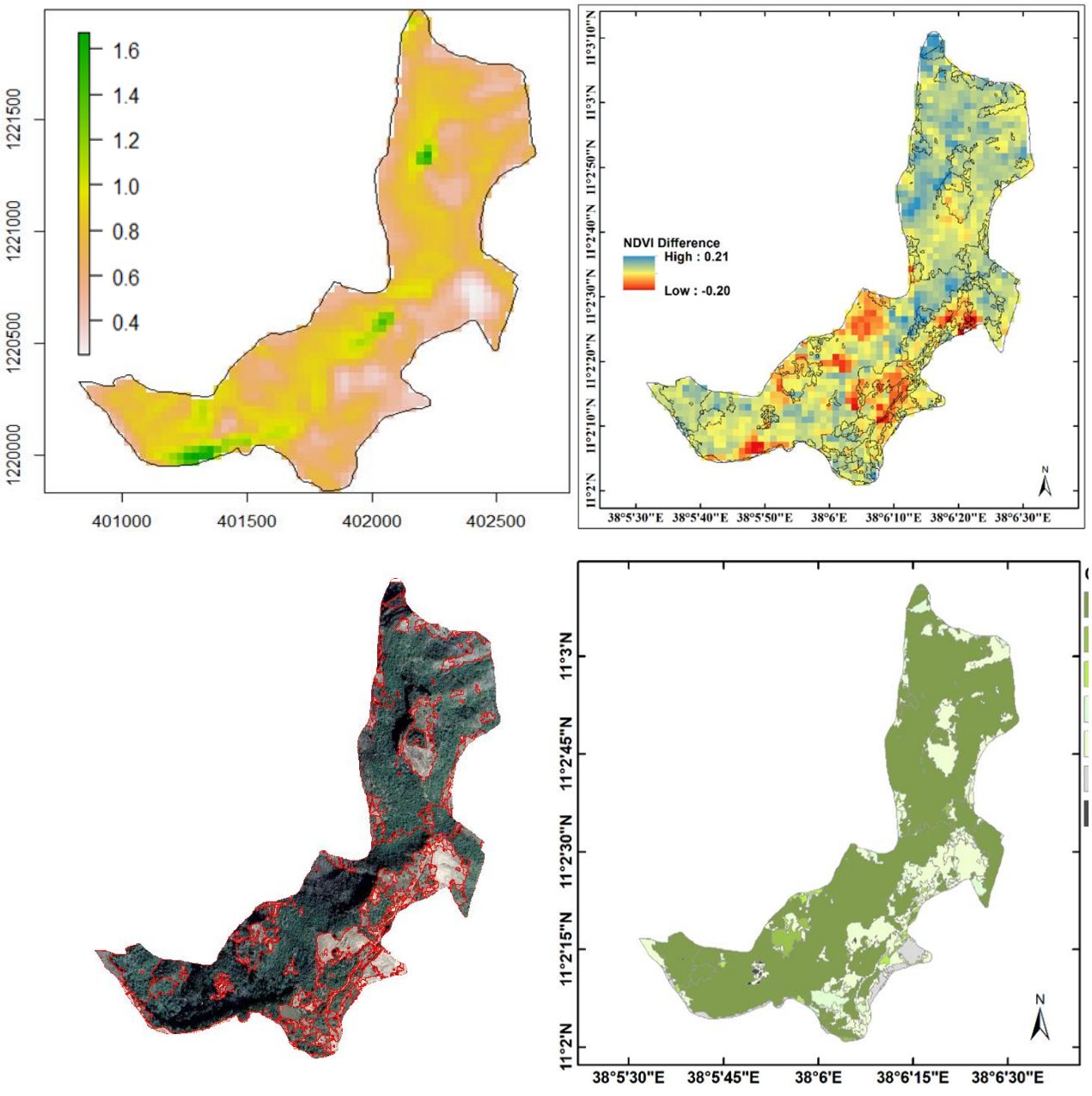


Figure 16 Top left: NDVI in 2018 & top right: Change in NDVI between November 2018 and October 2021 (-ve or red is reduction) overlaid with image segmentation layer for Koga Kidane Mihret Monastery. And, bottom left canopy cover segmentation and bottom right canopy cover map. There is no difference in the canopy cover between 2021 and 2018.

The change in canopy cover (CC) between 2021 and 2018 didn't also show significant difference (Figure 16) probably due to small size of the tree seedlings/intervention to be detected with the satellite data resolution we used. However, the NDVI clearly shows areas with +ve and –ve changes. Similar to the Tach Mariam Monastery this Monastery has also buffer zone plantation and outside of the Monastery.

Despite its rich flora, revisited plots the monastery showed stumps of big trees removed, heavy branch cutting, and livestock browsing. In the last two years, the project did enrichment planting inside the forests with *Cupressus lusitanica, Olea europeaea, Cordia africana, Acacia decurrens, Juniperus procera, and Grevillea robusta* seedlings.

In the buffer zone of the forest, seedlings such as *Cupressus, E. saligna, A.decurrens* have been planted. There is unhindered livestock intrusion in this buffer zone plantation as well as in the forest.

Hillside plantation outside the monastery forest can be mentioned as a very good achievement. For instance, the hillside plantation at Enegat weynwuha kebele is one testimony. It was planted in 2021, and the planting area is 6 ha. The tree species planted were *Cupressus, A.decurrens, and Juniperus procera.* Around Dibin Mesk area, at Kosoye Kebele there is a 25 ha of forest plantation. The main species planted are *Cupressus, Olea, Cordia, A.decurrens, Juniperus, and Grevillea.* Around 54 households participated in plantation and management of this catchment. Besides, the plantation there are physical water and soil conservation structures like check dams and soils bunds.

In the same Kebele (Kosoye Kebele), in 2021, there is also 10 ha plantation where 103 households participated to plant *Cupressus lusitanica, Olea europeaa, Cordia africana, Acacia decurrens, Juniperus procera,* and *Grevillea robusta.*

3.4.6. Baza Asteryo Monastery

This is a monastery where all weather road passes through the forest. The surrounding community lives in proximity with the forest. During the forest inventory of 2018, it has been reported that human encroachment was a serious problem. In the current evaluation, the study team observed that human encroach has been halted. Although, human pressure is highly reduced, the revisited plots showed different types of disturbances like whole tree cuts where stumps are evident, browse by animals and heavy branch cutting. There are enrichment planting inside the forests with *Cupressus lusitanica, Olea europeaea, Cordia africana, Acacia decurrens, Juniperus procera, and Grevillea robusta* seedlings.

Tree planting households in their own land holding is also common. For instance, the evaluation team visited the plantation of Mr. Wudud Yemengist, who planted *Acacia decurrens* in a plot of less than 0.5 ha, in 2021. In a similar fashion, Mr. Yibra Wendim has been involved tree planting.

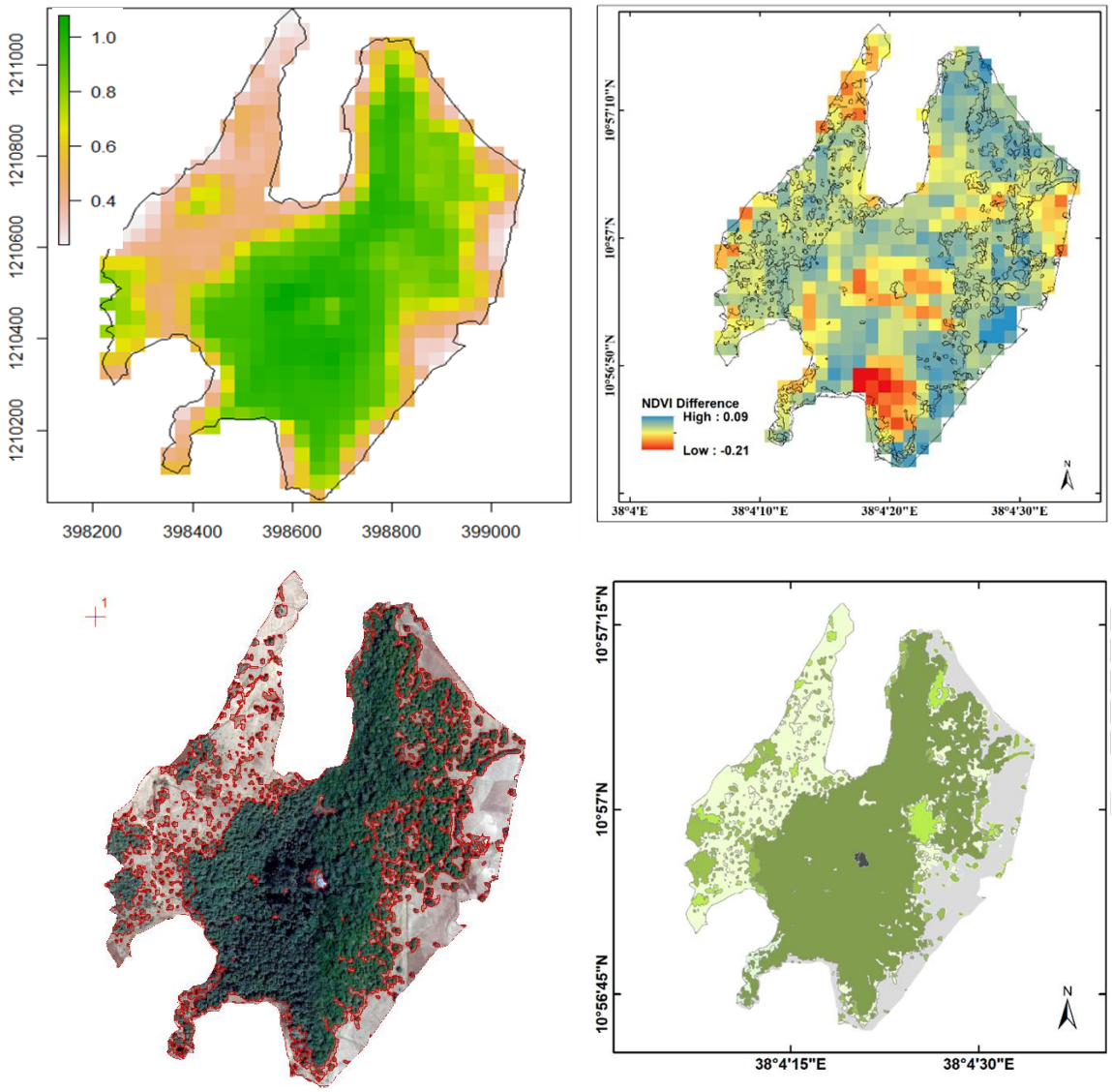


Figure 17 Top left: NDVI in 2018 & top right: Change in NDVI between November 2018 and October 2021 (-ve or red is reduction) overlaid with image segmentation layer for Baza Asteryo Monastery. And, bottom left canopy cover segmentation and bottom right canopy cover map. There is no difference in the canopy cover between 2021 and 2018.

The change in canopy cover (CC) between 2021 and 2018 didn't show significant difference (Figure 17) probably due to small size of the tree seedlings/intervention to be detected with the satellite data resolution we used. However, the NDVI clearly shows areas with +ve and –ve changes. In terms of overall NDVI change this church had negative performance (0.035) (Table 8).

3.4.7. Menagesha-Mariam & Medhane'alem church

Little has been changed in terms of ownership and use right of this forest. It was indicated that some 78,000 seedlings for households in four kebeles surrounding the church and additional 4,000 seedlings for the Wolmera district office of agriculture have been distributed. More than 2000 seedlings have been planted around Menagesha Mariam

church. However, the survival of seedlings has been low due to trampling by human during annual festive of the church. The establishment of the nursery and panting other holding of the church is creating microclimate suitable for human and animal shelter. The nursery has serious water shortage.

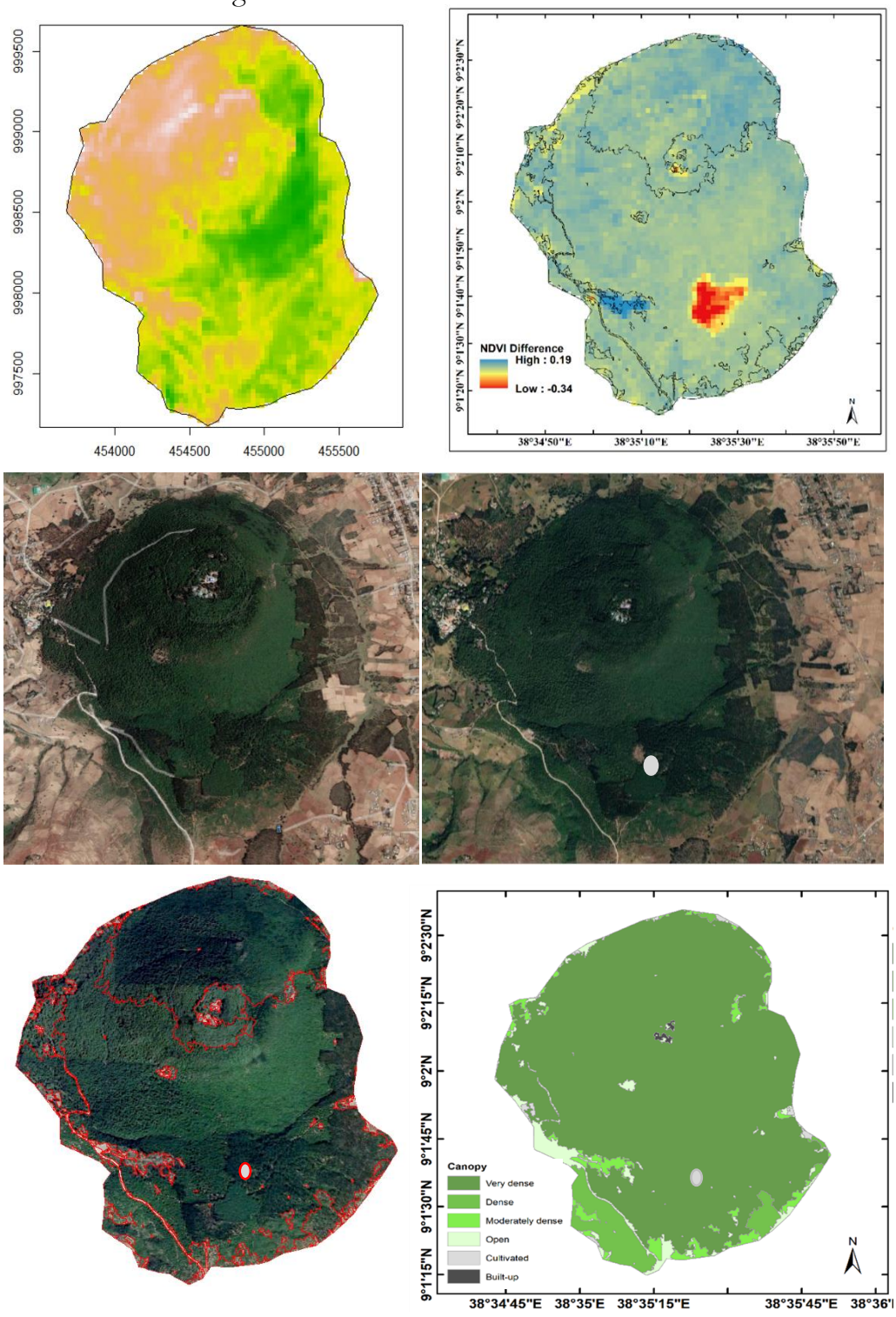


Figure 18 Top left: NDVI in 2018 & top right: Change in NDVI between November 2018 and October 2021 (-ve or red is reduction) for Menagesha-Mariam & Medhane'alem church. Middle left and right are Google images showing tree harvesting location. And, bottom left canopy cover segmentation and bottom right canopy cover map.

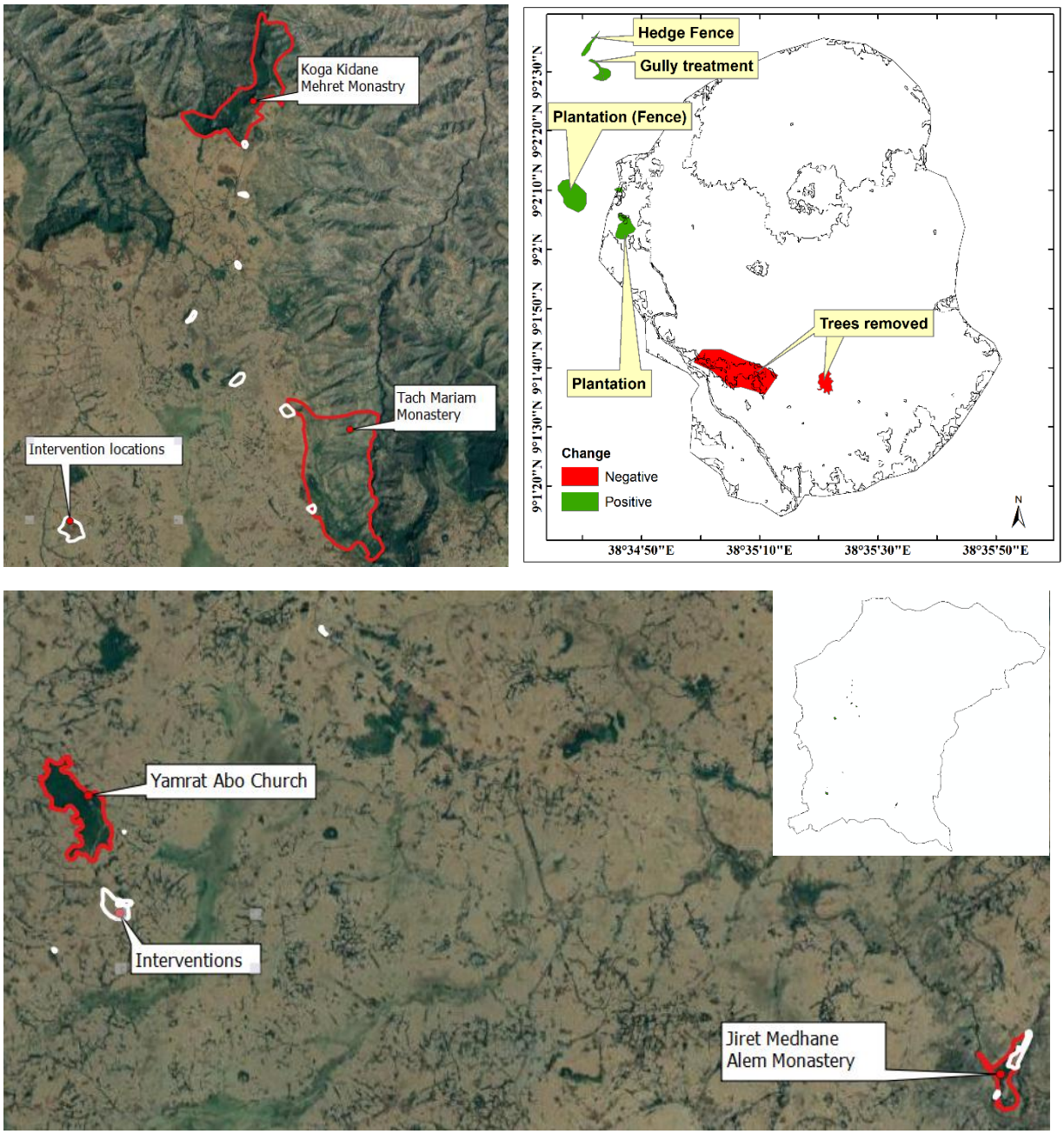


Figure 19 Different intervention locations top left: in The Goncha Siso Enese Woreda (Tach Mariam and Koga Kidanemihret) area, bottom in and around Jiret Medhane Alem and Yemrat Abo church. Top right: at the Menagesha Mariam & Medhane'alem area the white boundaries are the intervention areas.

3.5. Achievements by target

The list of activities implemented and their target and achievement (%) is shown on Table 6.

3.6. Strength, weakness, opportunities challenge

3.6.1. Strength

The major strength of the project is being symbolic to showcase the available opportunity and impact. The Ethiopian church forest can bring if there is proper intervention and investment. The project is pilot type, but it can reach massive faith community through the already available structure. The church fathers could be good avenues to reach the community. The other strength is its novel approach and intervention. There are several studies about church forests. The ECFIP by NCA and EOC-DICAC is the first in its type to intervene for the sustainable management of church forests and restoration of forest landscapes around churches.

3.6.2. Weakness

No major weakness is observed apart from being small in size and geographic focus. There have been delays in sending reports in time and report quality problem in terms using consistent templates. Moreover, the project didn't give much focus on the church members rather on the communities. However, significant reduction in forest was also noticed from within the church/monasteries. At the start of the project, there was also budget inefficiency.

3.6.3. Opportunities

little explored from development perspective; quite a lot of research information has been produced including a recent book (2022). The church forests need a policy support to support CRGE. Fund support could also be available from both Government and Non-government institutions. The faith community is also very supportive.

3.6.4. Challenges/risks

Improving livelihoods (alternative or forest-friendly) of adjoining communities should be improved to conserve the remnant church forests. A lot needs to be done in this regard for successful sustainable management of these forests. Market linkages for small businesses like honey production is needed. Differences in school of thought among some churches could also be a potential conflict/risk unless resolved. Wild fire, climate change and other natural disasters could be potential risks for the forest degradation.

3.7. Measuring the impact

3.7.1. Relevance of the ECFIP

Relevance is the extent to which the objectives of a programme are consistent with beneficiaries' requirements, country needs, global priorities and partners' and donors 'priorities. The tasks of the ELE were to evaluate:

- Which elements of Ethiopian CRGE and national forest restoration target is the Ethiopian Church Forest Initiative Project (ECFIP) is focusing, i.e. forest protection and improvement; production systems; energy etc.?
- Which elements of NICFI/NCA objectives is the project *primarily* focusing on?
- Which planting interventions is the project *primarily* focusing on, i.e. enrichment planting, participatory forest management, assisted natural regeneration, plantations and woodlots, agroforestry?
- Given the above, are the ECFI and NCA/NICFI projects compatible or complementary

Main findings– relevance

ECFIP focus was on supporting the six churches and monasteries in GSE woreda and Wolmera Woreda to conserve the existing forests and conduct new plantations. The church forests will be sources of germplasm. There are plantations of deforested areas inside and outside the church.

The ELE team findings suggest that the ECFIP project is currently supporting the churches and monasteries to protect their forests and restore deforested areas. In almost all cases, the threat from the surrounding community is currently drastically reduced. The problem of internal threat is not addressed by the project. The inhabitants of the monastery themselves and their animals are the main disturbance agents in cutting the whole tree or parts of the tree.

For these reasons, ECFIP is most relevant to, and will have the greatest impact on the protection of forests in churches and monasteries in the target woredas. To effectively, protect the forests:

1. Provision of energy saving stoves to the community.
2. Support with solar cells as source of light
3. Supply churches with renewable energy sources for cooking or provision with gasoline/diesel generators for cooking.

ECFIP is highly relevant to the following beneficiaries:

1) Direct beneficiaries are churches, monasteries and communities who depend on the forests for living and source of energy

2) Indirect beneficiaries are the surrounding community with social and economic relations with the church community.
3) The woreda, and other institutions (seed/timber sources and as carbon sink).

The ECFIP is currently most closely aligned with the EOC DICAC objective and demand of the community

1. The EOC DICAC, the churches and the surrounding community should organize themselves to support the protection and sustainable management of the forest.
2. The churches should avoid free grazing and browsing.

3.7.2. Effectiveness of the ECFIP Project

General questions

- What were the main challenges to project delivery?
- Have the project outputs and activities been effectively delivered?
- Which adaptive management measures have been put in place, and are these proving effective?
- Has the project design been significantly altered in response to new findings or realities?
- How will any changes affect project delivery, outcome and impact?

General findings by the study team

The main challenges for ECFIP at the beginning have been slow to hire project staff and the challenge among the community fear that the project will change the old religion (*Kibat Vs Tewahido*) and belief of the churches.

The project took some adaptive management measures, like irrigation infrastructure construction.

The project has not been much affected significantly due to COVID 19 and the civil war in the country.

Output 1: The Orthodox Church of Ethiopia is a climate ambassador promoting forest protection.

Output 1 questions

- Is a National Climate Platform established?
- Is a church forest methodology developed?
- Are the Orthodox Church and the patriarch linked with IRI and other faith communities internationally?
- Do theological rational and foundation for forest protection developed by the orthodox church?

- Are other faith communities in Ethiopia linked to National Climate platform to promote forest protection?

Output 1 main findings

- Start up and induction workshop was conducted at woreda level
- Experience sharing and exposure visits to community managed forestry projects with good methodology
- Conducted two interfaith consultation meetings and dialogues on climate per annum.
- Facilitate create and management of buffer zones, including enrichment plantations, in and around the church forest
- Facilitate establishment of church-based forest governance systems and local by laws

Output 2: Church forests are protected from degradation

Output 2 questions

- Do church-forest baseline and inventory documented?
- Does forest conservation enhanced?
- Do congregations increase their knowledge of climate change and the importance of forests?
- Do knowledge sharing and communication with national and international stakeholders have taken place?

Output 2 main findings

- Baseline inventory carried out and documented
- Demarcation of boundaries and secure land rights certification for the church forests conducted except for the Menagesha churches.
- Management of church forest and adjacent trees conducted
- Supported establishment of private and community nurseries
- Renewable energy installations for off-grid supply of electricity in the churches undertaken.
- Gully rehabilitation/ treatment and hedge plantations were conducted.

Output 3: Communities around church forest have increased climate resilience

Output 3 questions

- Do community mobilized in climate resilience task forces?
- Do communities increased adoption of sustainable land management practices?
- Do communities engaged in income generating activities related to sustainable harvesting and value addition of non-timber forest produce (NTFP)?

Output 3 main findings

- Theological reflections and dialogues on value of forest in the congregations, applying material developed under outcome 1

- Ecological literacy sessions/ campaigns (Community trainings)
- Experience sharing and exposure visits on Farmer Managed Natural Regeneration initiatives (FMNR) (inland) for EOC-DICAC, partner organizations and church communities.
- Training of religious leaders, youths and elders on Forest Development Extension (FDE) & FMNR (150 priests, Sunday youth schoolteachers and opinion leaders/community elders)
- Exposure visit on interfaith initiatives for EOC-DICAC and partner organizations
- Policy dialogues on climate and forest
- Prepare policy briefs on involvement of local community and religious leaders
- Establish & support six Youth Sunday School environmental clubs and three school environment clubs
- Train Sunday school environment club members, teachers and students on forest conservation and management
- Promote seedling pit preparation & planting campaign days by environment clubs (2 campaigns per annum)
- Community Training on agroforestry practices
- Construction of context specific soil and water conservation structures (terraces, soil/stone bunds, ditches, waterways half-moon basins etc.) and simple stone fencing
- Establish youth groups for tree and seedlings distribution and Tree planting (Youth Green Action Groups) - 6 groups of 15 members each
- Training and practical experience sharing with Norwegian Forestry Group (NFG) on Land use planning
- Construction of a simple tree seed storage house
- Establish producer groups and support value chain development
- Small scale irrigation (Accessing irrigation canal construction vegetable seed and fruit seedlings for vulnerable HH)
- Agroforestry materials and seedlings support
- Support establishment of private, multi-purpose tree nurseries, nursery materials support, & establish youth groups for tree and seedlings distribution
- Joint monitoring and internal evaluation with local stakeholders

Summary of ECFIP Project effectiveness findings and conclusions

After a slow start related with procurement and resistance due to inter-religious conflict (Kibat vs Tewahido), project outputs and activities have largely been effectively delivered.

In our opinion, the ECFIP project certainly achieved the project **outcome**, which is: "Conservation of Ethiopian Church Forest."

The project design has not been significantly altered, and the project was on good track while delivering main **outputs**. The most important of these are:

- Baseline surveys of the target forests

- The establishment project management from Woreda, to Church level and to Kebele and watershed level.
- Areas were treated with physical and biological soil and water conservation methods
- Energy saving stoves distributed
- Solar powered lights have been distributed
- Agricultural inputs for construction of conservation structures distributed
- Nurseries established
- Household tree planting encouraged and supported
- Degraded communal lands and hill slopes have been restored with trees/seedlings
- Upgrade knowledge and capabilities of selected staff at relevant stakeholder institutions.

3.7.3. Efficiency of the ECFIP

Efficiency: Efficiency is a measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to outputs. The tasks of the ELE were to:

- Assess whether the operation of the ECFIP cost-efficiently converts funds to activities and outputs.

Main findings - efficiency

According to the interview with the group leader of Natural Resources Management case team in the Office of Agriculture of the GSE woreda, the ECFIP demonstrated higher efficiency than other projects active in the area. The project achieved a lot with limited budget.

At the beginning of the project, there have disparity between activity budget estimate and actual expenditure. During the planning phase, there have been over estimation of costs. If there is a second phase, budget estimate should be more realistic or closer to the reality.

3.7.4. Sustainability and stakeholder collaboration

Sustainability is the continuation of benefits from a programme after major development assistance has been completed, thus the probability of continued long-term benefits. As for impact, this is difficult to assess with the relatively short time of operation.

Major questions:

- Has the project engaged adequately with all stakeholders?
- How has the project taken into account stakeholder's views, and adapted accordingly?
- Has the project communicated effectively with its stakeholders? If so, how?

- Are the project outputs, outcome and impact supported by the EOC and GoE policies?

Main findings – sustainability and stakeholder collaboration

In general, NCA has no any problem in working with relevant stakeholder. Open to invite and involve stakeholders like the Ethiopian Environment, Forest and Climate Change Commission (EFCCC), the Forest Sector Transformation Unit in the EFCC, and other relevant parties in the forest sector.

The project has achieved impressive achievements, and the evaluation team believe that it has met its objectives in the allocated timeframe. A second phase is desirable to maximise project outputs and impacts. Ideally, further work would be supported by NCA. It is essential, that the NCA and EOC DICAC play an increasing role in supporting the objectives of ECFIP financially and through policy and practice.

The project management model which starts from Woreda centres where there are main committees and technical committee and then cascades to the Kebele, church and villages level with equivalent structures appears to be sustainable.

The documentary video film and airtime with the Ethiopian Orthodox Church television channel will have long lasting effects. These documentaries are available freely online on YouTube. These documents will have effects for future viewers.

Many of use groups have started obtaining revenue from honey production and selling of tree seedlings. Some of the honey production groups we interviewed said that they were financially self-sustaining without ECFIP. Government stakeholders should work with the user groups in planning honey production and supply targets for future years and should make funding available to significantly scale up honey production from youth and women honey producing groups.

Church forests are protected by paid guards. Long term technical backstopping is a potential risk to project sustainability. ECFIP is currently fulfilling an essential role in giving payments for forest protection and providing technical support either directly or indirectly through financing. For the project to be truly sustainable, long term technical support needs to be available to the churches and other groups organized for the creation of sustainable livelihood option. And, for this as a limitation, to our knowledge exit strategy was not designed and document was not available.

Stakeholder involvement has been very good. Stakeholder communication has been good, and all of the stakeholders we interviewed felt that there had been adequate consultation,

and their views had been taken into account. All of the church/monastery leaders said they could not identify any weaknesses with the project and, without exception, all of the stakeholders interviewed said the project contributed a lot and asked if it can continue. The main Committee, Technical Committee, and the Forest Committee and Forest Task forces were indicated as being useful.

4. Conclusion and recommendation

Despite their small size, church forests in Ethiopia – like other sacred natural sites regionally and globally are an essential component of natural landscapes that can contribute a variety of benefits to local communities and beyond. Church forests in Ethiopia are a powerful example of the myriad benefits sacred natural sites can provide to enhance the quality of life, particularly in the fragmented landscapes of the tropics. They are an essential hotspot for woody plant species, in addition to providing a regulating capacity vis à vis climate and pollination.

Understanding, supporting, and promoting the institutions that maintain forest patches and sacred forests via integrated strategies including traditional, scientific, and cultural approaches are crucial for the sustainability of sacred natural sites in the years to come.

In general, the endline evaluation of ECFIP is positive. We recommend a follow up project activity to substantiate the achievements of the first or previous phase project outputs. Next phase project activities should specifically target the cleric community and the monks living inside the monasteries.

Wood cutting including whole tree harvest or heavy branch and shrub cutting is a common practice in the churches and monasteries. The main reason or the main driver is cutting for fuel for cooking food for the inhabitants and the temporary visitors of pilgrimage visits. Therefore, we recommend addressing energy sources for fuel is important. This intervention may reduce the pressure on the remnant church forests.

Many of the monasteries have quite big livestock population. The herders practice free forest grazing and browsing. The livestock population is a threat for the natural regeneration of native trees and for the enrichment planting. Therefore, the livestock population should be managed by focusing on productive livestock breeds. Besides, by using animal dung, production of biogas energy source for fuel can be good intervention for next phases. Buffer zone plantation by using exotic tree species has encouraging results. Proportional focus for indigenous trees should be considered by the project team for woodlot and enrichment planting.

The minimum and maximum temperature for both the study woredas is projected to increase. However, rainfall is predicted in between the several climate models predicting higher and lower. Hence, there will be no change in the amount of rainfall. The increase in the minimum and maximum temperature means there will be a decrease in moisture availability to vegetation due increased evapotranspiration. The increase in temperature may also affect some physiological activities of vegetation hence affecting species distribution. The identified analogues sites could be a learning site for devising adaptation strategies e.g. on which type of vegetation to focus on plantation, strategy on saving the available germplasm and what type of management to use.

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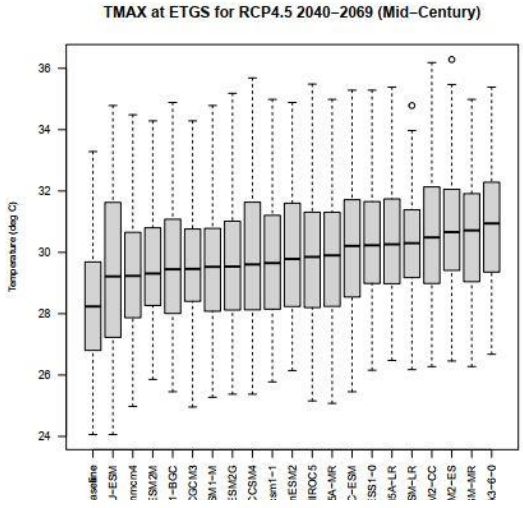
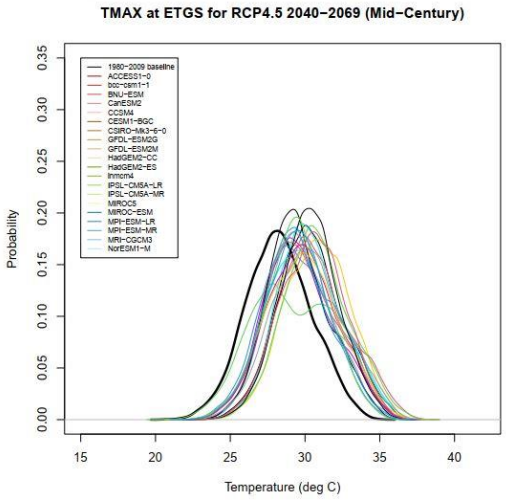
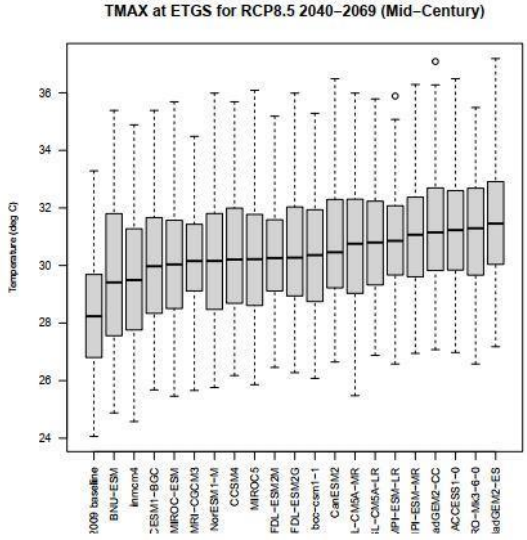
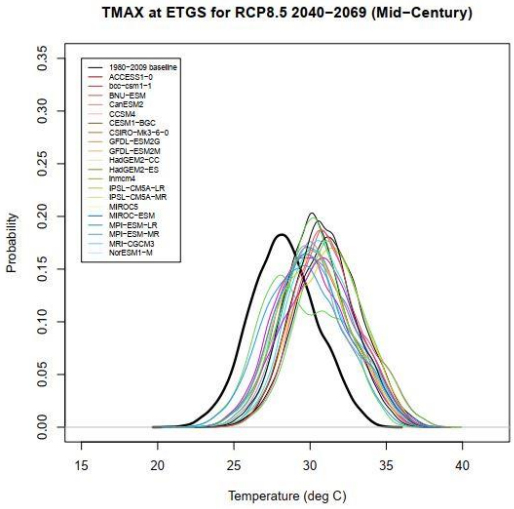
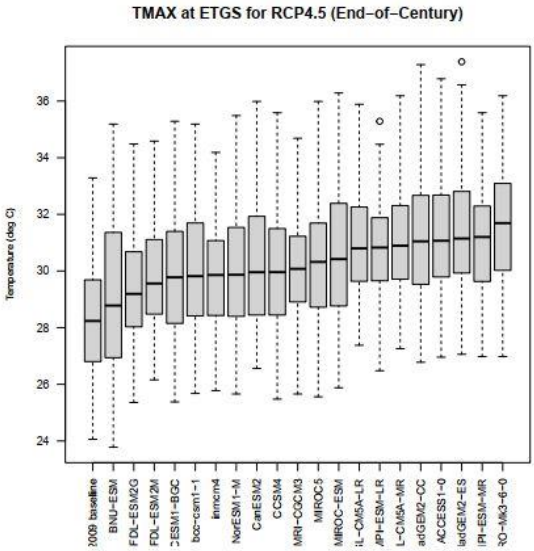
Annex 1: Goncho Siso Enese woreda climate projections output

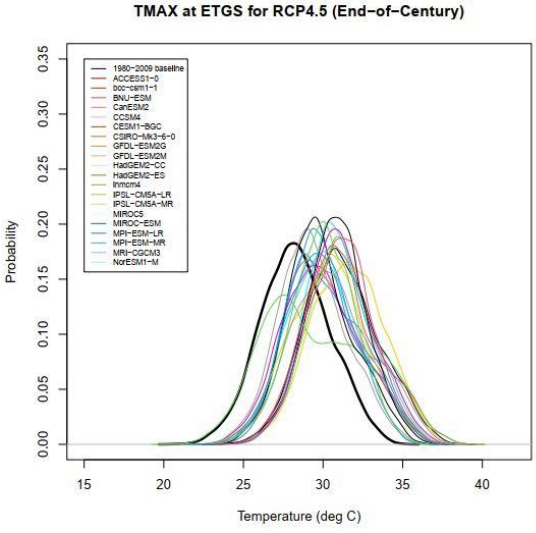


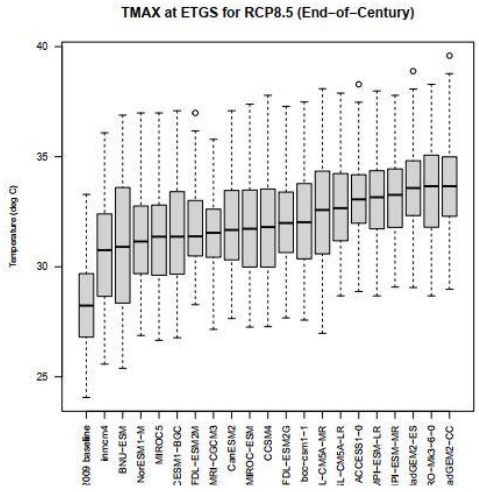


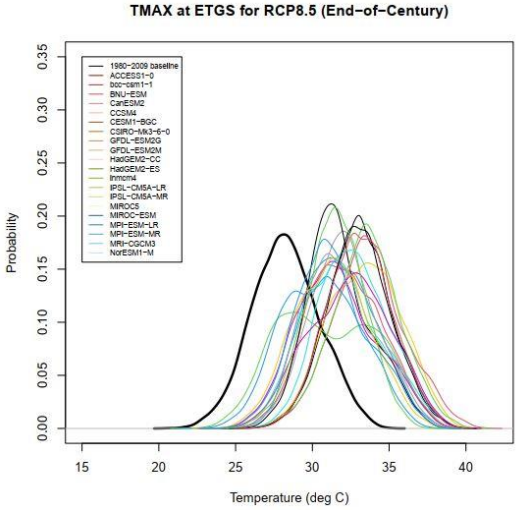









TMAX at ETGS for RCP8.5 (End−of−Century)
Temperature (deg C)


TMAX at ETGS for RCP8.5 (End−of−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
Inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
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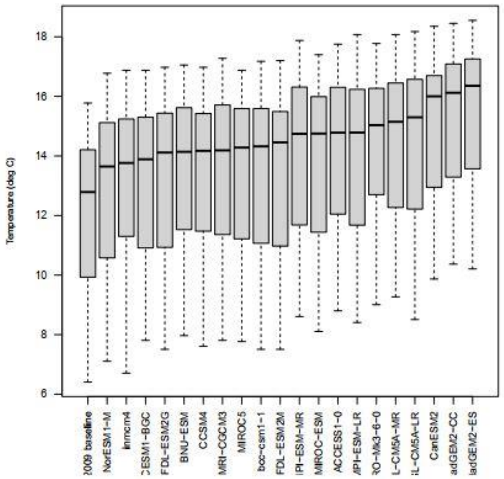
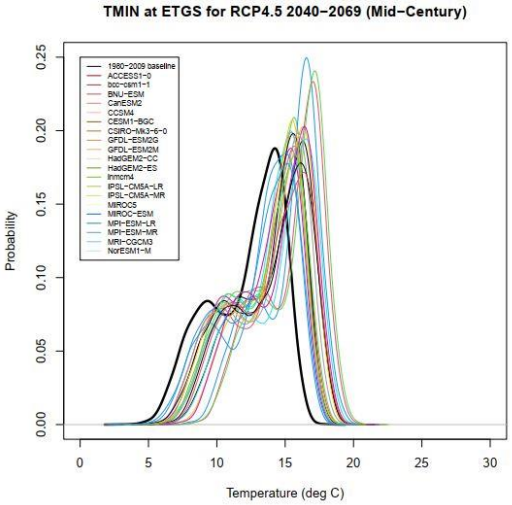
MPI−ESM−MR
MRI−CGCM3
NorESM1−M


TMIN at ETGS for RCP4.5 2040−2069 (Mid−Century)
Temperature (deg C)


TMIN at ETGS for RCP4.5 2040−2069 (Mid−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
Inmcm4
IPSL−CM5A−LR
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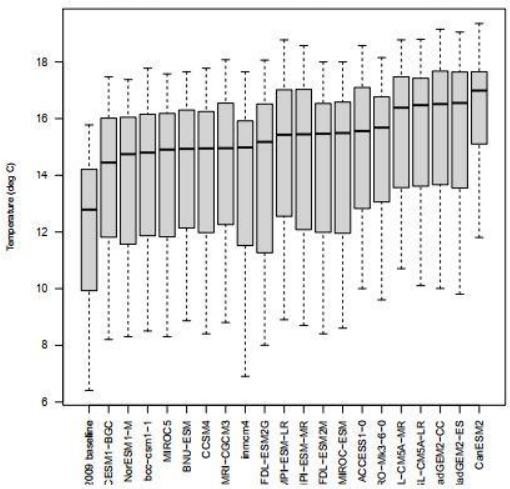
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M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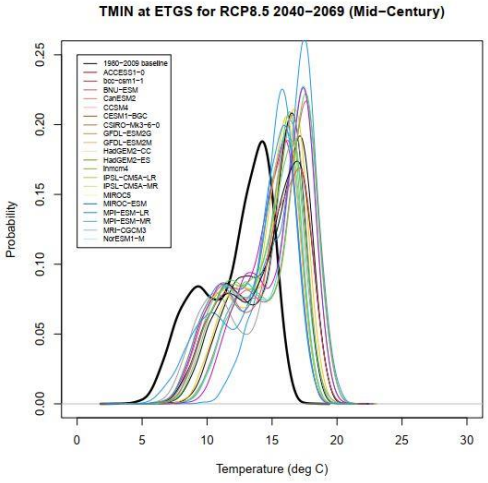
Temperature (deg C)


TMIN at ETGS for RCP8.5 2040−2069 (Mid−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
Inmcm4
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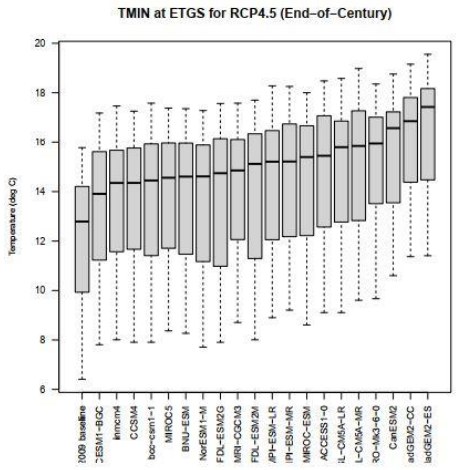
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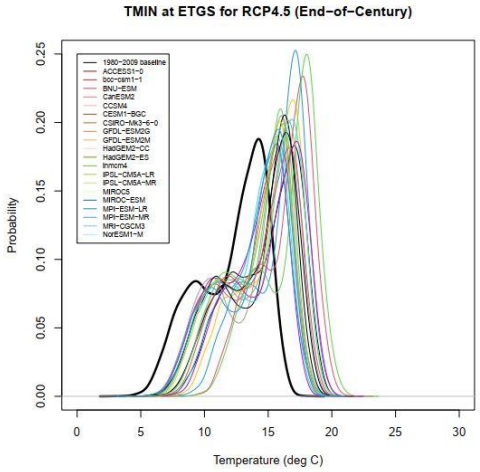
Temperature (deg C)


TMIN at ETGS for RCP4.5 (End−of−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
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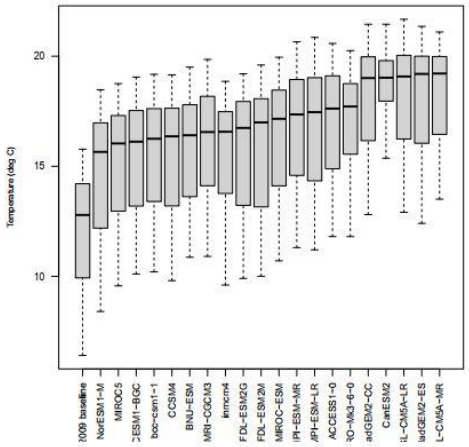
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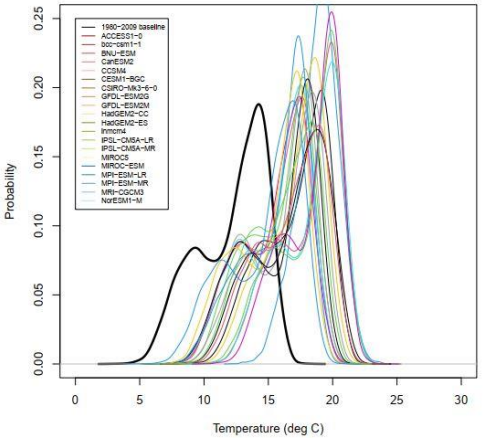
Temperature (deg C)


TMIN at ETGS for RCP8.5 (End−of−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
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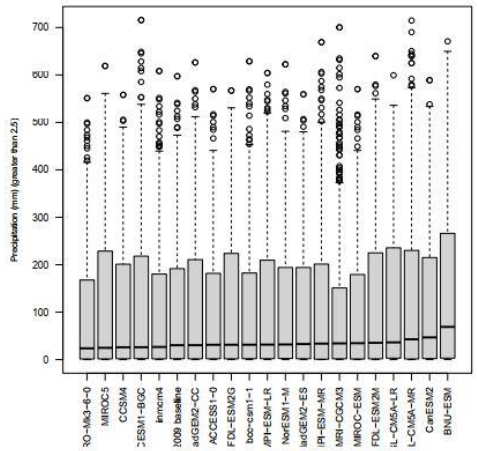
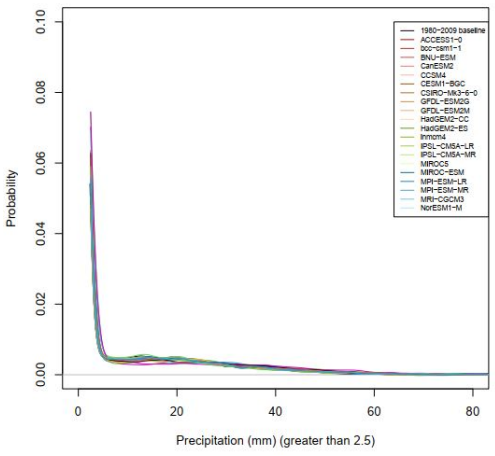
NorESM1−M


RAIN at ETGS for RCP4.5 2040−2069 (Mid−Century)
Precipitation (mm) (greater than 2.5)


RAIN at ETGS for RCP4.5 2040−2069 (Mid−Century)
Probability
Precipitation (mm) (greater than 2.5)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
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MIROC5
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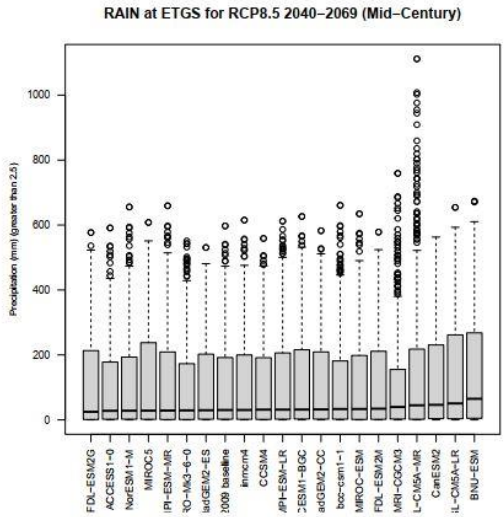
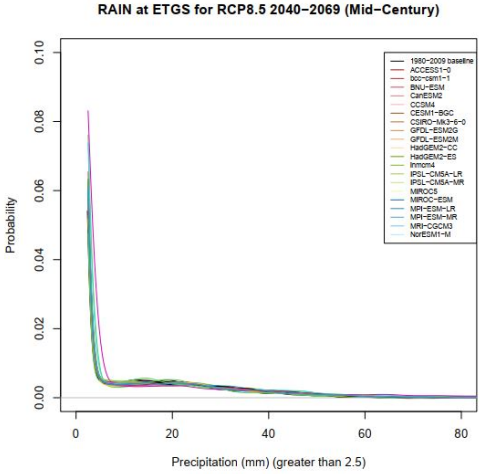
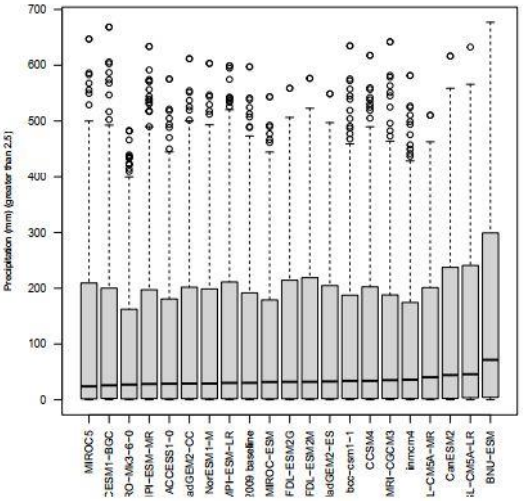
MRI−CGCM3
NorESM1−M


RAIN at ETGS for RCP8.5 2040–2069 (Mid–Century)
Precipitation (mm) (greater than 2.5)
0
200
400
600
800
1000
FDL–ESM2G
ACCESS1–0
NorESM1–M
MIROC5
IPI–ESM–MR
adGEM2–ES
CCSM4
API–ESM–LR
adGEM2–CC
bcc–csm1–1
MIROC–ESM
FDL–ESM2M
MRI–CGCM3
L–CM5A–MR
CanESM2
BNU–ESM


RAIN at ETGS for RCP8.5 2040–2069 (Mid–Century)
Probability
0.00
0.02
0.04
0.06
0.08
0.10
0
20
40
60
80
Precipitation (mm) (greater than 2.5)
1980–2009 baseline
ACCESS1–0
bcc–csm1–1
BNU–ESM
CanESM2
CCSM4
CESM1–BGC
CSIRO–Mk3–6–0
GFDL–ESM2G
GFDL–ESM2M
HadGEM2–CC
HadGEM2–ES
Inmcm4
IPSL–CM5A–LR
IPSL–CM5A–MR
MIROC5
MIROC–ESM
MPI–ESM–LR
MPI–ESM–MR
MRI–CGCM3
NorESM1–M


RAIN at ETGS for RCP4.5 (End–of–Century)
Precipitation (mm) (greater than 2.5)
0
100
200
300
400
500
600
700
MIROC5
CESM1–BGC
CSIRO–Mk3–6–0
IPI–ESM–MR
ACCESS1–0
adGEM2–CC
NorESM1–M
API–ESM–LR
1980–2009 baseline
MIROC–ESM
FDL–ESM2G
FDL–ESM2M
adGEM2–ES
bcc–csm1–1
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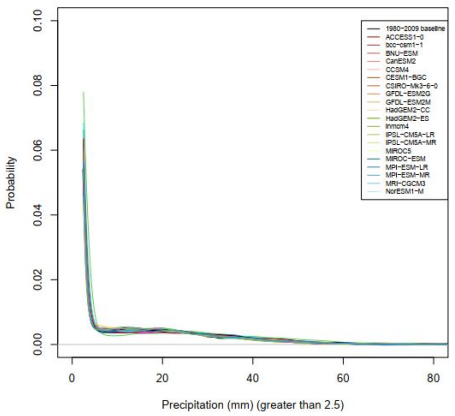
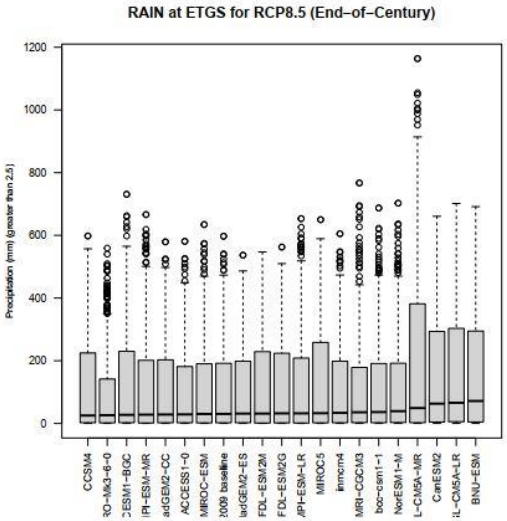
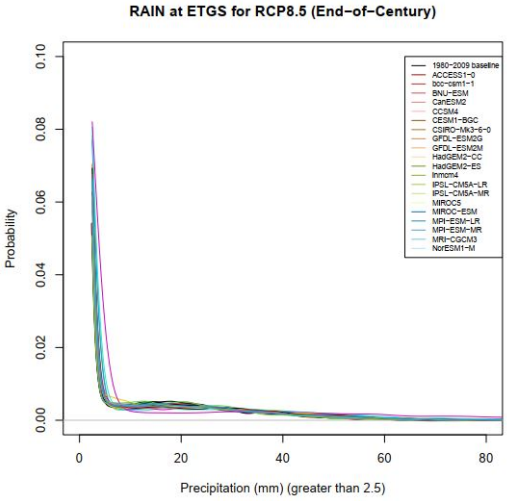
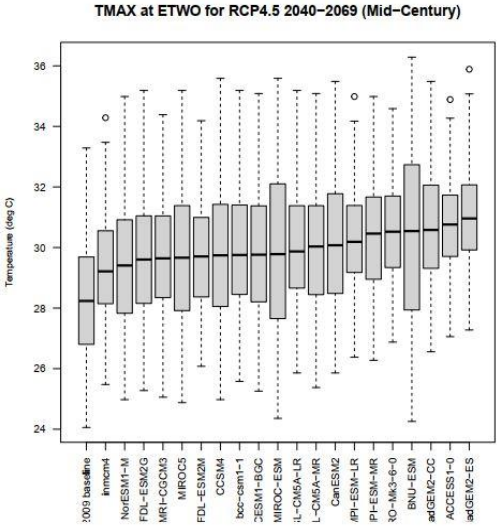
MRI–CGCM3
Inmcm4
L–CM5A–MR
CanESM2
iL–CM5A–LR
BNU–ESM

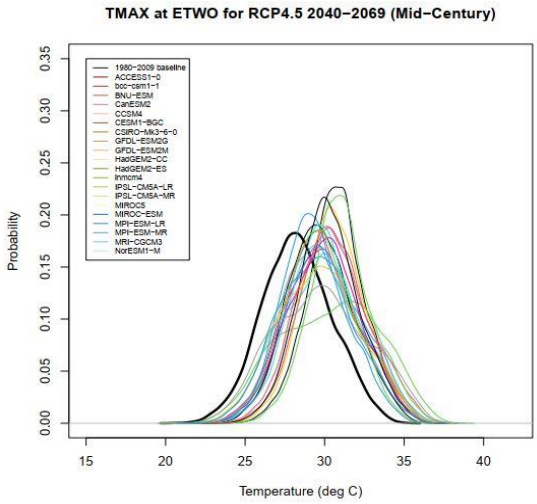

RAIN at ETGS for RCP4.5 (End–of–Century)
Probability
0.00
0.02
0.04
0.06
0.08
0.10
0
20
40
60
80
Precipitation (mm) (greater than 2.5)
1980–2009 baseline
ACCESS1–0
bcc–csm1–1
BNU–ESM
CanESM2
CCSM4
CESM1–BGC
CSIRO–Mk3–6–0
GFDL–ESM2G
GFDL–ESM2M
HadGEM2–CC
HadGEM2–ES
Inmcm4
IPSL–CM5A–LR
IPSL–CM5A–MR
MIROC5
MIROC–ESM
MPI–ESM–LR
MPI–ESM–MR
MRI–CGCM3
NorESM1–M

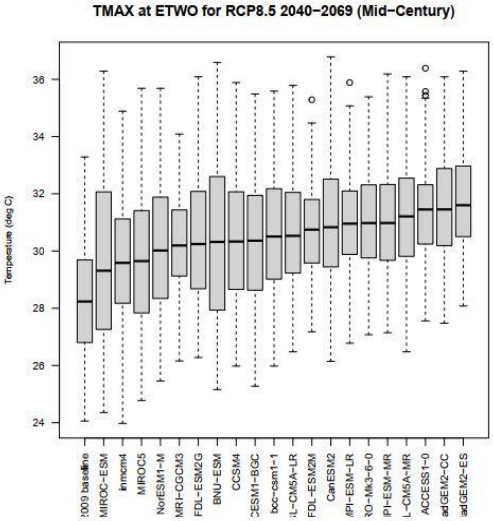

RAIN at ETGS for RCP8.5 (End–of–Century)
Precipitation (mm) (greater than 2.5)
0
200
400
600
800
1000
1200
CCSM4
CSIRO–Mk3–6–0
CESM1–BGC
IPI–ESM–MR
adGEM2–CC
ACCESS1–0
MIROC–ESM
1980–2009 baseline
adGEM2–ES
FDL–ESM2M
FDL–ESM2G
API–ESM–LR
MIROC5
Inmcm4
MRI–CGCM3
bcc–csm1–1
NorESM1–M
L–CM5A–MR
CanESM2
iL–CM5A–LR
BNU–ESM

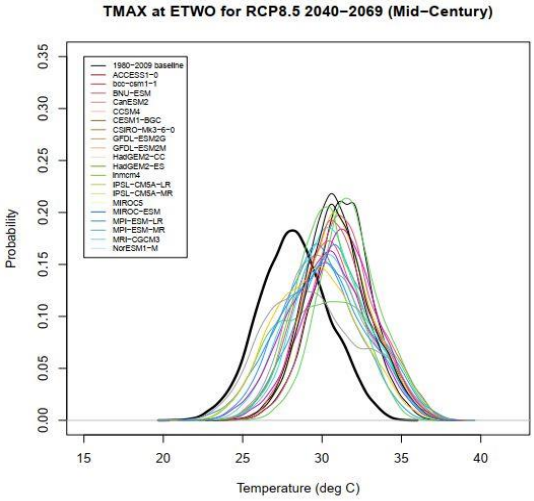

RAIN at ETGS for RCP8.5 (End–of–Century)
Probability
0.00
0.02
0.04
0.06
0.08
0.10
0
20
40
60
80
Precipitation (mm) (greater than 2.5)
1980–2009 baseline
ACCESS1–0
bcc–csm1–1
BNU–ESM
CanESM2
CCSM4
CESM1–BGC
CSIRO–Mk3–6–0
GFDL–ESM2G
GFDL–ESM2M
HadGEM2–CC
HadGEM2–ES
Inmcm4
IPSL–CM5A–LR
IPSL–CM5A–MR
MIROC5
MIROC–ESM
MPI–ESM–LR
MPI–ESM–MR
MRI–CGCM3
NorESM1–M

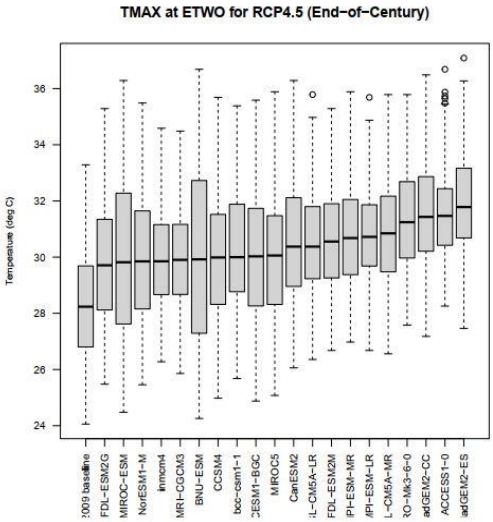
Annex 2: Wolmera woreda climate projections output

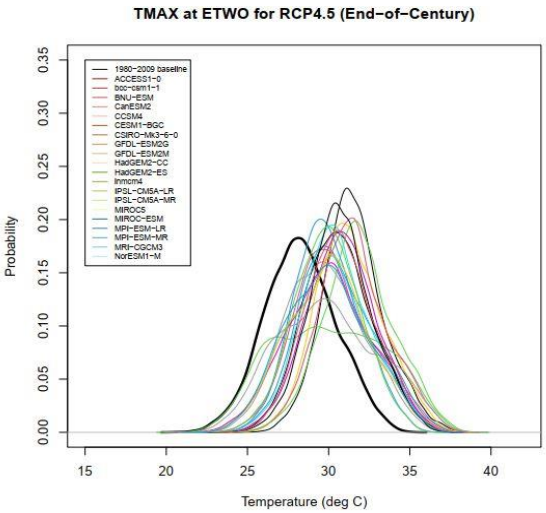


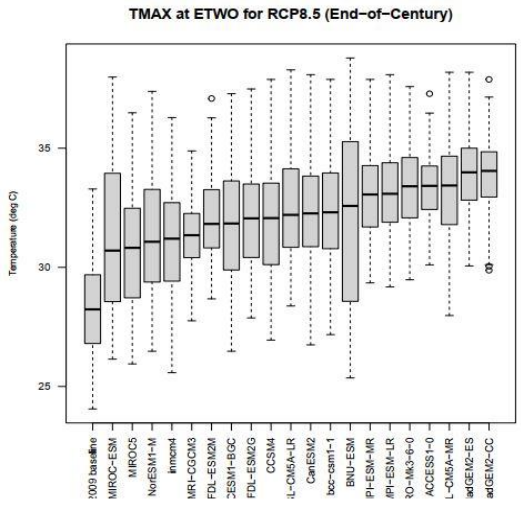


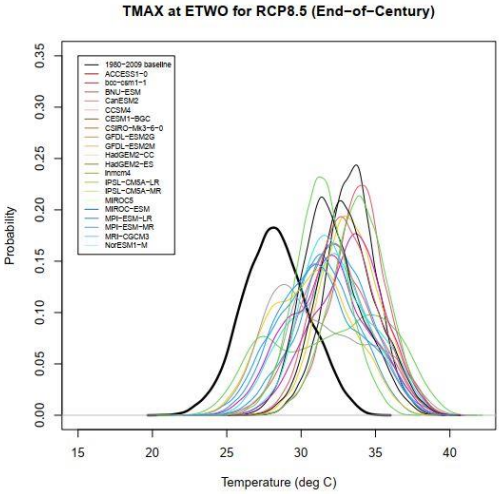


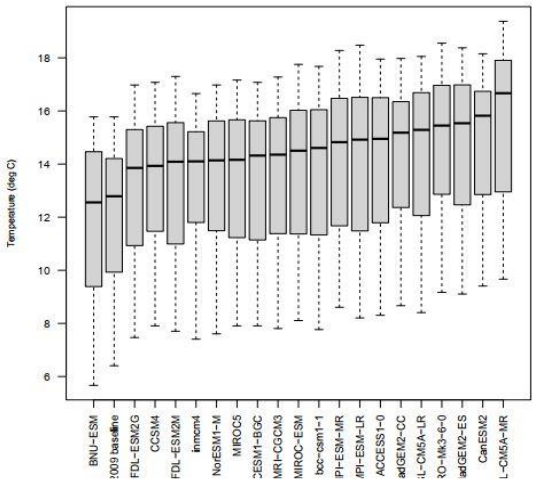


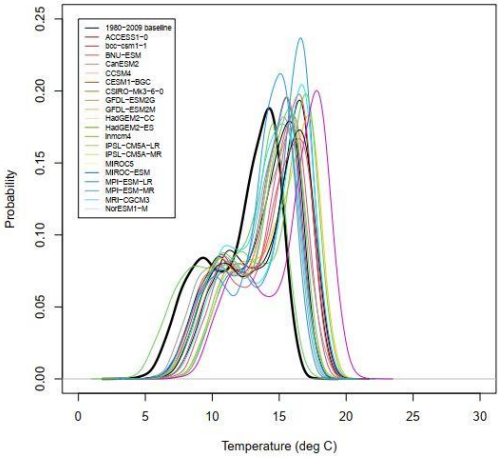


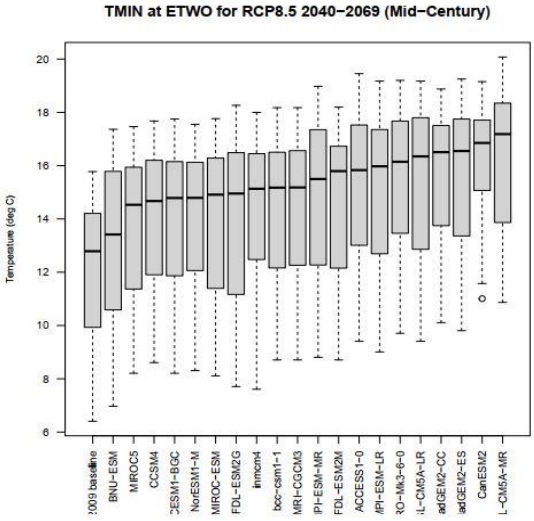


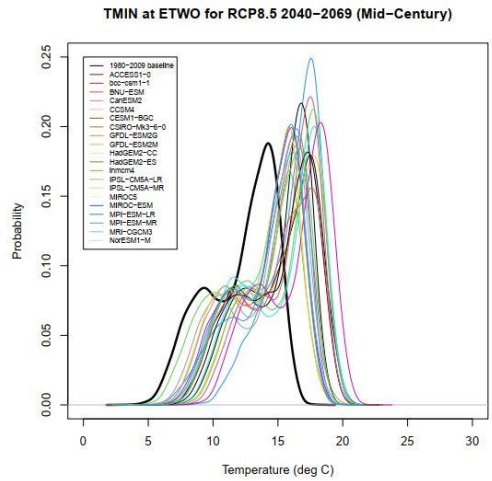

TMAX at ETWO for RCP8.5 (End−of−Century)
Temperature (deg C)
25
30
35
MIROC−ESM
MIROC5
NorESM1−M
inmcm4
MRI−CGCM3
FDL−ESM2M
CESM1−BGC
FDL−ESM2G
CCSM4
IPSL−CM5A−LR
CanESM2
bcc−csm1−1
BNU−ESM
MPI−ESM−MR
MPI−ESM−LR
ACCESS1−0
adGEM2−ES
adGEM2−CC

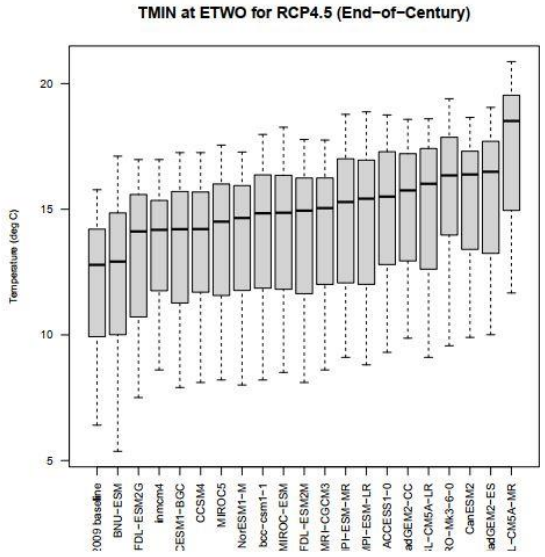

TMAX at ETWO for RCP8.5 (End−of−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M

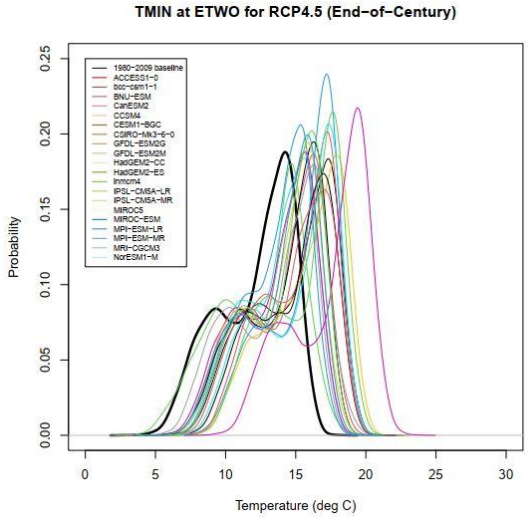

TMIN at ETWO for RCP4.5 2040−2069 (Mid−Century)
Temperature (deg C)
6
8
10
12
14
16
18
BNU−ESM
1980−2009 baseline
FDL−ESM2G
CCSM4
FDL−ESM2M
inmcm4
NorESM1−M
MIROC5
CESM1−BGC
MRI−CGCM3
MIROC−ESM
bcc−csm1−1
IPSL−CM5A−LR
MPI−ESM−MR
MPI−ESM−LR
ACCESS1−0
adGEM2−CC
CSIRO−Mk3−6−0
adGEM2−ES
CanESM2
IPSL−CM5A−MR

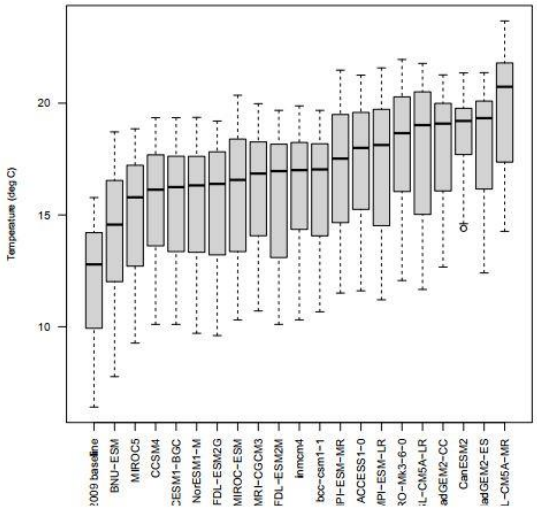

TMIN at ETWO for RCP4.5 2040−2069 (Mid−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M

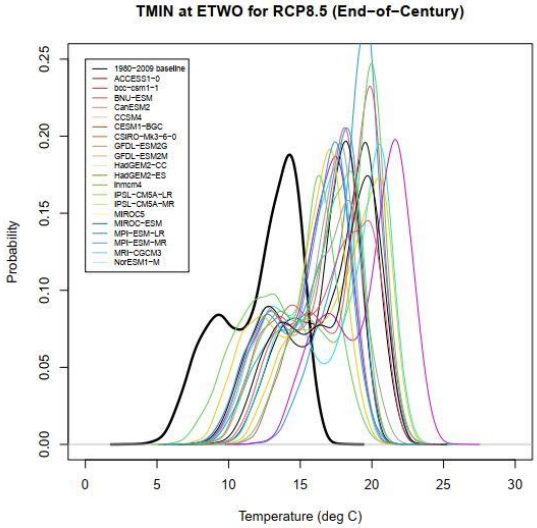

TMIN at ETWO for RCP8.5 2040−2069 (Mid−Century)
Temperature (deg C)
6
8
10
12
14
16
18
20
1980−2009 baseline
BNU−ESM
MIROC5
CCSM4
CESM1−BGC
NorESM1−M
MIROC−ESM
FDL−ESM2G
inmcm4
bcc−csm1−1
MRI−CGCM3
MPI−ESM−MR
FDL−ESM2M
ACCESS1−0
MPI−ESM−LR
CSIRO−Mk3−6−0
IPSL−CM5A−LR
adGEM2−CC
adGEM2−ES
CanESM2
IPSL−CM5A−MR

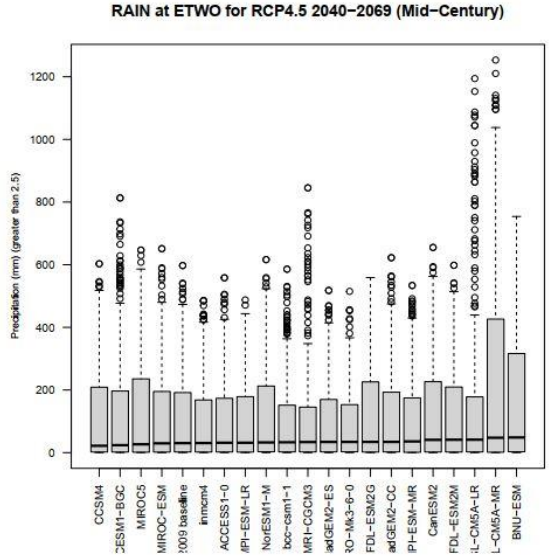

TMIN at ETWO for RCP8.5 2040−2069 (Mid−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M

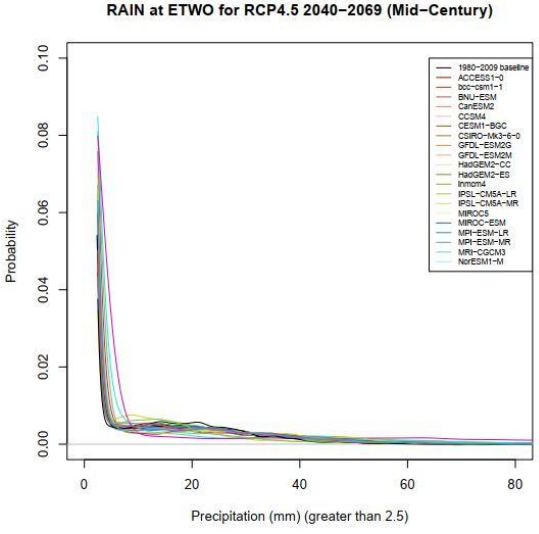

TMIN at ETWO for RCP4.5 (End−of−Century)
Temperature (deg C)
20
15
10
5
1009 baseline
BNU−ESM
FDL−ESM2G
inmcm4
CESM1−BGC
CCSM4
MIROC5
NorESM1−M
bcc−csm1−1
MIROC−ESM
FDL−ESM2M
MRI−CGCM3
MPI−ESM−MR
MPI−ESM−LR
ACCESS1−0
adGEM2−CC
IL−CM5A−LR
RO−Mk3−6−0
CanESM2
adGEM2−ES
L−CM5A−MR

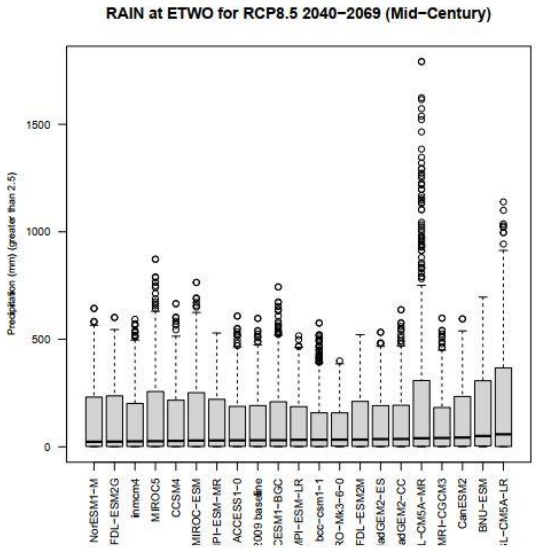

TMIN at ETWO for RCP4.5 (End−of−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M

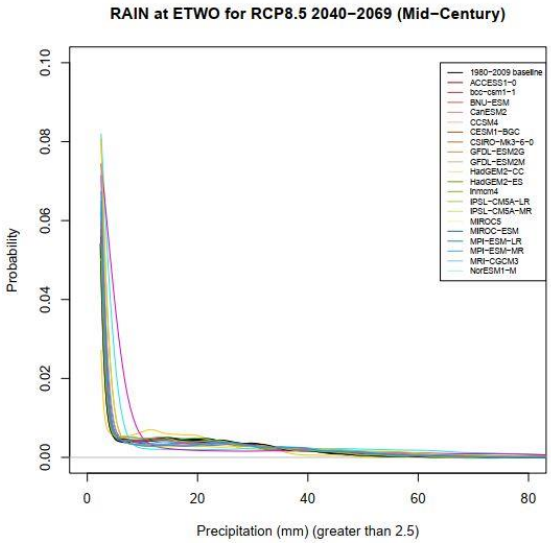

TMIN at ETWO for RCP8.5 (End−of−Century)
Temperature (deg C)
20
15
10
1009 baseline
BNU−ESM
MIROC5
CCSM4
CESM1−BGC
NorESM1−M
FDL−ESM2G
MIROC−ESM
MRI−CGCM3
FDL−ESM2M
inmcm4
bcc−csm1−1
IPI−ESM−MR
ACCESS1−0
MPI−ESM−LR
RO−Mk3−6−0
IL−CM5A−LR
adGEM2−CC
CanESM2
adGEM2−ES
L−CM5A−MR

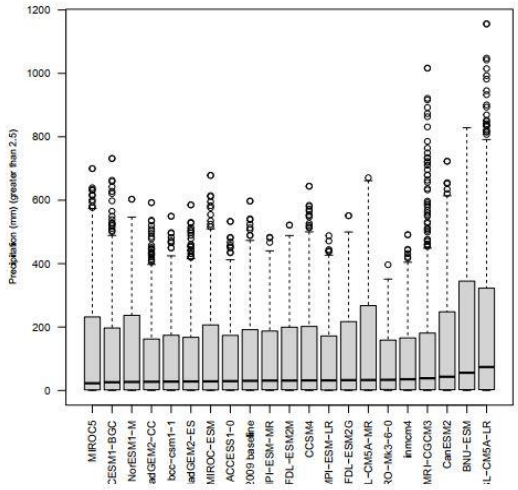

TMIN at ETWO for RCP8.5 (End−of−Century)
Probability
Temperature (deg C)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M

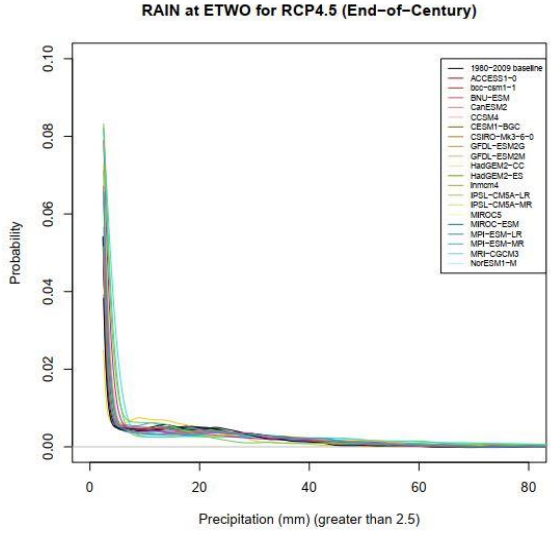

RAIN at ETWO for RCP4.5 2040−2069 (Mid−Century)
Precipitation (mm) (greater than 2.5)
1200
1000
800
600
400
200
0
CCSM4
CESM1−BGC
MIROC5
MIROC−ESM
1009 baseline
inmcm4
ACCESS1−0
MPI−ESM−LR
NorESM1−M
bcc−csm1−1
MRI−CGCM3
adGEM2−ES
RO−Mk3−6−0
FDL−ESM2G
adGEM2−CC
IPI−ESM−MR
CanESM2
FDL−ESM2M
IL−CM5A−LR
L−CM5A−MR
BNU−ESM

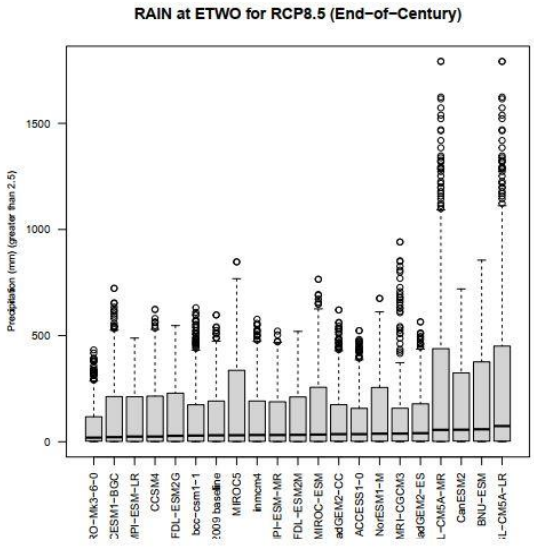

RAIN at ETWO for RCP4.5 2040−2069 (Mid−Century)
Probability
Precipitation (mm) (greater than 2.5)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M

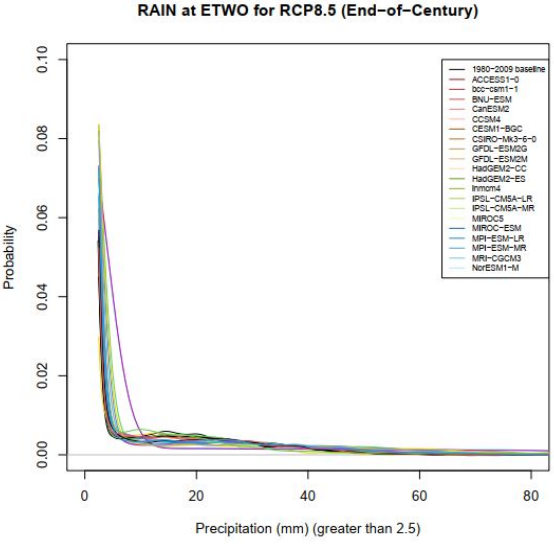

RAIN at ETWO for RCP8.5 2040−2069 (Mid−Century)
Precipitation (mm) (greater than 2.5)
0
500
1000
1500
NorESM1−M
FDL−ESM2G
inmcm4
MIROC5
CCSM4
MIROC−ESM
MPI−ESM−MR
ACCESS1−0
1980−2009 baseline
CESM1−BGC
MPI−ESM−LR
bcc−csm1−1
CSIRO−Mk3−6−0
FDL−ESM2M
HadGEM2−ES
HadGEM2−CC
IPSL−CM5A−LR
MRI−CGCM3
CanESM2
BNU−ESM
IPSL−CM5A−LR


RAIN at ETWO for RCP8.5 2040−2069 (Mid−Century)
Probability
0.00
0.02
0.04
0.06
0.08
0.10
0
20
40
60
80
Precipitation (mm) (greater than 2.5)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M


RAIN at ETWO for RCP4.5 (End−of−Century)
Precipitation (mm) (greater than 2.5)
0
200
400
600
800
1000
1200
MIROC5
CESM1−BGC
NorESM1−M
adGEM2−CC
bcc−csm1−1
adGEM2−ES
MIROC−ESM
ACCESS1−0
1980−2009 baseline
MPI−ESM−MR
FDL−ESM2M
CCSM4
MPI−ESM−LR
FDL−ESM2G
L−CM5A−MR
CSIRO−Mk3−6−0
inmcm4
MRI−CGCM3
CanESM2
BNU−ESM
IPSL−CM5A−LR


RAIN at ETWO for RCP4.5 (End−of−Century)
Probability
0.00
0.02
0.04
0.06
0.08
0.10
0
20
40
60
80
Precipitation (mm) (greater than 2.5)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M


RAIN at ETWO for RCP8.5 (End−of−Century)
Precipitation (mm) (greater than 2.5)
0
500
1000
1500
CSIRO−Mk3−6−0
CESM1−BGC
MPI−ESM−LR
CCSM4
FDL−ESM2G
bcc−csm1−1
1980−2009 baseline
MIROC5
inmcm4
MPI−ESM−MR
FDL−ESM2M
MIROC−ESM
adGEM2−CC
ACCESS1−0
NorESM1−M
MRI−CGCM3
adGEM2−ES
L−CM5A−MR
CanESM2
BNU−ESM
IPSL−CM5A−LR


RAIN at ETWO for RCP8.5 (End−of−Century)
Probability
0.00
0.02
0.04
0.06
0.08
0.10
0
20
40
60
80
Precipitation (mm) (greater than 2.5)
1980−2009 baseline
ACCESS1−0
bcc−csm1−1
BNU−ESM
CanESM2
CCSM4
CESM1−BGC
CSIRO−Mk3−6−0
GFDL−ESM2G
GFDL−ESM2M
HadGEM2−CC
HadGEM2−ES
inmcm4
IPSL−CM5A−LR
IPSL−CM5A−MR
MIROC5
MIROC−ESM
MPI−ESM−LR
MPI−ESM−MR
MRI−CGCM3
NorESM1−M