Forestry Research Directorate

Research Directory 2013



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Plantation and Agroforestry Research Case Team

Commodity: Agroforestry

Project 1: Evaluation and optimization of promising agroforestry technologies and practices

Coordinating center: FRC Project coordinator: Shimelis Tadesse Implementing centers: FRC, Holetta ARC, Kulumssa ARC and Haromaya University

General objective: The overall objective of the project is to demonstrate the effectiveness of promising agroforestry technologies and to optimize the management and economic performances of traditional agroforestry practices in Ethiopia

Specific objectives:

To demonstrate and transfer knowledge and skills on promising agroforestry technologies by evaluating their performances on smallholder conditions for diversifying livelihoods and improving the adaptive capacity of farming systems to climate change

To optimize and promote traditional home-garden agroforestry practices for increased economic and ecological effects and

To build and strengthen the capacity of stakeholders and FRC itself (poor farmers/communities, development agents and government staffs)

To test and evaluate the performance of taungya on hillside farms farming on hill slopes: A win-win situation for poverty alleviation and climate change mitigation

To determine the effectiveness of green manure application on productivity of agricultural crops on farmer managed fields and

To examine the feasibility of windbreaks in the drylands in Central Rift valley

To increase coffee productivity by increasing light and nutrient availability to understorey coffee crop

To evaluate the performances of selected high value trees (medicine, spice, fruits) and shrubs under the agroforestry (shade) conditions

To increase awareness of local communities and DAS on agroforestry technologies and

To increase the capacity of FRC to support the huge demand for agroforestry technologies in light of the NAMA activities

To develop sustainable planting materials supply system for best performing species by promoting seed orchards and nurseries in cooperation with the private sector and NGOs

Expected outputs:

Wood and crop yields from the taungya and conventional farming will be compared and the reports will be delivered every year after the third year (2014). A manuscript on the comparative agronomic/silvicultural and economic performances of Taungya and conventional crop production will be prepared in June 2016.

Optimal fertilizer, lime and light levels for enhancing the yield of traditional coffee agroforestry will be made available

Best performing high value trees, shrubs, fruits, grass etc and their management will be identified and promoted. Other improved technologies (e.g., poultry and beekeeping) along with high value trees/shrubs will be enhanced

Carbon sequestration, and climate change mitigation and adaptation potential of small holder homegarden agroforestry practices will be determined and recognized

Economic profitability and social acceptance of homegarden will be known and documented

At the end of the project, a germ-plasm of diverse tree and shrub species will be established. At least one nursery and tree growing manual will be produced in June 2013.

At least 3 seed orchards (one at each agro-ecological zone) consisting of important species will be established for sustainable seed supply. One manuscript on performances of high value trees and shrubs will be prepared at the end of the project period

Duration: Five years (2011-2016)

		Duration In		Implementing		
Component	Activity	From	То	centers	Locations	Persons responsible
					-	
					-	
					-	
					_	
					-	
					-	

Table 1. Activities under the project evaluation and optimization of promising agroforestry technologies and practices

Project 2: Agroforestry for rural livelihood improvement and natural resources management

Coordinating center: FRC Project coordinator: Shimelis Tadesse Implementing centers: FRC, Mehoni ARC, Holetta ARC, Kulumssa ARC, Jimma ARC, Melkassa ARC, Tepi RC

General objective: The project has a general objective of analyzing and describing various traditional agroforestry systems and practices and promotes the promising practices to improve the livelihood of smallholder farmers while sustainably managing meager natural resources

Specific objectives:

To identify and characterize the existing structural composition and functional attribute of the traditional agroforestry systems and practices in selected agro-ecologies

To identify the opportunities and challenges associated with traditional agroforestry practice and systems

To examine and describe the different tree management techniques in different agroforestry practices

To promote/expand home garden agroforestry practices with selected fruit trees in different agro-ecologies

- To promote/expand woodlot with selected tree species in different agro ecologies
- To promote/expand feedlot with selected tree species in different agro ecologies
- To determine carbon storage potentials of different species in two agroforestry practices
- To identify the type of tree species used as shade and/or support for spice production

To assess the economic and environmental contributions of shade trees-spice agroforestry

Expected outputs:

Potential traditional agro forestry practices identified and characterized in the highland midland lowland referring to structural and functional compositions and tree planting techniques

Agro forestry technologies that can be used for food and income source promoted and expanded

Major constraints and potentials of spice crop shade and /or support trees identified under small scale spice production system

Suitable, fast growing, and widely used spice shade and/or support tree species identified for major spice crop producing agro-ecologies in southwestern part of Ethiopia

Socio-economic importance of spice and support and shade trees to the local community production identified

Duration: Five years (2013-2018)

agroforestry for rural livelihood improvement and natural resources management

Project 3: Conservation agriculture with trees (CAWT) for improved livelihoods and climate change mitigation in drylands of Ethiopia

Coordinating center: FRC Project coordinator: Shimelis Tadesse Implementing centers: FRC, Melkassa ARC

General objective: The general objective of the project is to assess adoption potential of CAWT and evaluate the bio-physical effectiveness of CAWT

Specific objectives:

To identify the potential synergies, and risks associated with promotion of conservation agriculture

To assess farmers' perception towards CAWT before and after experiments and To assess the cost: benefit aspects of conservation agriculture practices as compared to conventional practices

To identify the major barriers in the adoption of CAWT

To assess the impact of silvicultural and agronomic practice on effectiveness of CAWT (from research question set as number one for both components)

To determine the level of tree crop interactions in CAWT

To evaluate the effects of CAWT on soil water conservation and fertility improvement

To determine biological productivity of CAWT as compared to conventional agriculture and thus its implications for food security and

To evaluate carbon sequestration potential of CAWT and its overall significance for environmental sustainability

Expected outputs:

Impact of CAWT on crop productivity and carbon sequestration determined

Economic performance of CAWT evaluated

Overall workability of CAWT determined in Ethiopian conditions

At least 2 scientific publications developed

Duration: Five years (2010-2015)

Table 3. Activities under the project conservation agriculture with trees (CAWT) for improved livelihoods and climate change mitigation in drylands of Ethiopia

		Dur	ation	Implementing		Persons
Component	Activity	From	То	centers	Locations	responsible

Commodity: Industrial Plantation and Tree Improvement

Project 1: Eucalyptus ecological management: Comparing of impacts of eucalyptus and other common tree species on soil and water in selected agroecology of Ethiopia

Coordinating center: FRC Project coordinator: Diriba Niguse Implementing centers: FRC, Debrezeit ARC, WondoGenet ARC, Jimma ARC

General objective: To generate technologies and information that enable the sustainable ecological management of eucalyptus species in turn to improve social, and ecological benefits of eucalyptus growing people

Specific objectives:

To review the various works on environmental services of eucalyptus species

To review the role of eucalyptus on fostering native flora and fauna

To review the impact of eucalyptus on wet lands and seasonal water sources

To review the impact of eucalyptus on agricultural land and crops

To review the role of eucalyptus on carbon sequestration

To compare water uptake of eucalyptus species and some common tree species

To compare litter dynamics of eucalyptus species and common tree species

To compare the litter dynamics and water uptake of eucalyptus species and some common tree species

To evaluate site productivity of Eucalyptus species at different agroecological zones of Ethiopia

Expected outputs:

Report on the role of eucalyptus on native flora and fauna

Report on the impact of eucalyptus wet lands and seasonal water sources and management techniques

Report on the impact of eucalyptus on agricultural land and crops

Report on the role of eucalyptus on carbon sequestration

Reports on water uptake of 24 plant species

Report on litter dynamics of six Eucalyptus species and 18 other tree species in mid altitude.

Report on the most productive site for Eucalyptus production and its ecological limitation

Duration: Five years (2011-2016)

 Table 4. Activities under the project eucalyptus ecological management: Comparing of impacts of eucalyptus and other common tree species on soil and water in selected agroecology of Ethiopia

		Duration		Implementi		Persons
Component	Activity	From	То	ng centers	Locations	responsible
Reviewing of the environmental services of eucalyptus species	Reviewing the role of eucalyptus on fostering native flora and fauna	2011/12	2012	FRC	FRC	Dr.Abayneh D., Negash M.
	Reviewing the impact of eucalyptus on wet lands and seasonal water sources	2011/12	2012	FRC, Debrezeit ARC	FRC, Debrezeit	- -

Project 2: Evaluation, promotion and management of industrial plantation

Coordinating center: FRC Project coordinator: Diriba Nigussie Implementing centers: FRC

General objective: The general objective of this study is to evaluate, promote and manage different tree species for industrial purposes in different parts of the country with the participation of different stakeholders

Specific objectives:

Promote stakeholder-based tree planting activity for sources of seed, construction wood, fuel wood and food

To evaluate the impact of different spacing and fertilizer treatment along different altitudinal gradient on growth performance and productivity of *P. canariensis* and *P. pinea* in the study sites.

To evaluate optimum rootability period of Populus cutting

To determine nursery life span of Populus

To determine optimum spacing level (1m, 1.5m 2m and 3m) for populus planting in the field

To evaluate the impact of different pruning levels on biomass and seed production capacity of existing *Pinus patula* plantation in Galama area

The impact of different thinning levels on productivity of *Acacia decurrence*: the case of in Holeta and Gafarsa; two plots of *Juniperus procera* to estimate change in its carbon stock

Evaluating the impact of coppice management (rotation period) on productivity of *Eucalyptus globules*

Expected outputs:

Forest plantation established for seed sources, timber and food

Two pine plantation established (the two regions)

Information on impact of spacing and fertilizer on biomass and timber productivity released

Populus planting material produced and populus plantation established

Research report developed and published on populus

Full package of populus training material developed

Poplar orchard established

Technology on thinning and pruning released

Tree ring analysis will be added to the toolbox of research methods for our forest management (Recommendation)

Manual on silvicultural management of some pinus, and Acacia released

[10]

Duration: Five years (2005-2011)

		Dura	ation	Implementing		Persons
Component	Activity	From	То	centers	Locations	responsible
	Pinus cabariensis P. pinea				-	
	P cabariensis P. pinea					
	P patula					
	Acacia decurrence ; J procera					

evaluation, promotion and management of industrial plantation

Project 3: Selection and enhancement of industrial tree crops

Coordinating center: FRC Project coordinator: Diriba Nigussie Implementing centers: FRC

General objective: The general objective of this project is to promote industrial plantation development through tree improvement program

Specific objectives:

To determine the effect of provenance on the performance of Juniperus procera To study the adaptability of recently introduced pine species and select the best adapted provenance

To compare the growth and yield of Pinus patula at different sites

To develop growth models for Juniperus procera and Pinus patula plantations To enhance the seed production in Grevillea robusta and Eucalyptus globulus To compare the volume increment of E. globulus clones (propagated by cuttings) from Spain and seedlings from an Ethiopian landrace and establish seed orchard To select best performing progenies/provenances of Cordia africana Lam for four planting areas

To select best performing individuals/provenances of Hagenia abyssinica for two growing regions

To investigate socioeconomic attributes of tree planting practices

To evaluate the growth performance of various introduced species (*E. viminalis, E. regnans, E. deglupta, Tectona grandis, Gmelina arborea* and *Cordia alliodora*) at different sites

Expected outputs:

The best provenances of *Juniperus procera* will be identified for at least two growing regions of the species

The best provenances of four pines species and *Eucalyptus globulus* will be selected for future scaling up schemes on the species

Seed production problems on existing *Grevillea robusta* and *Eucalyptus globulus* overcome and enhanced

The growth and yield of existing *Pinus patula* stands characterized appropriate growing regions for optimum productivity recommended

The relative growth performance of *E. viminalis, E. deglupta, Tectona grandis, Gmelina arborea* and *Cordia alliodora* over various sites determined and scaling up options identified

Pests and diseases of economic significance identified and characterized in selected plantations

[12]

Sound growth models developed for *Juniperus procera* and *Pinus patula* developed that will be of vital use for management of large scale plantations

The best performing individuals/provenances identified and seed orchards initiated for *Cordia africana* for northern and southeastern highlands

Duration: Five years (2009-2014)

selection of superior provenances and promotion of industrial plantations

Juniperus procera				
pine				
Eucalyptus globulus				
Grevillea robusta Eucalyptus globulus				
Pinus patula				
-E. viminalis, E. regnans, E. deglupta, Tectona grandis, Gmelina arborea Cordia alliodora				
Juniperus procera Pinus patula				
Cordia africana				

Commodity: Wild Edible and Medicinal Plants

Project 1: Domestication of high priority indigenous woody plant species in selected pastoral and agropastoral areas

Coordinating center: FRC Project coordinator: Dr. Abayneh Derero Implementing centers: FRC

General objective: To domesticate high priority indigenous fruit, fodder, medicinal and salt tolerant woody plant species thereby enhance tree planting and to address the food, feed and health problems in the selected pastoral and agropastoral areas

Specific objectives:

To identify and prioritize woody plant species for domestication, determine planting scheme preferences, investigate the experiences of the local people in their uses, tree establishment and management and determine the role of woody plant species and their products in household economy

To investigate the phenology of the target fruit, fodder and medicinal woody plant species and determine their seed production capacity

To determine the germination and storage behaviors of seeds of the target species

To determine the nutrient content of the food and feed parts of the selected woody plant species

To determine the soil salinity and/or sodicity status of the area under investigation

To design appropriate nursery techniques, determine the nursery life, and produce high quality seedlings from selected individuals

To select best performing individuals simultaneously both on station and on farm for the areas

To develop better ways of pre and post harvest handling techniques of fruits

To equip the local people with tree nursery and silvicultural skills and disseminate the information generated through the project for furthering tree domestication and planting

Expected outputs:

Report on species identification, prioritization and socioeconomic importance of the species

Flowering and fruiting phenology of target species known. Seed production capacity of natural stands of target species known

Appropriate germination techniques and storage methods determined

[14]

Nutrient content of the target food and feed species determined generation of information on some soil properties Appropriate nursery techniques developed for the target Woody plant species Best performing individuals selected from each of the target species develop better techniques for pre and post harvest handling of fruits Knowledge of local community in seedling preparation, tree planting and management improved and information on domestication disseminated

Duration: Five years (2010/11-2014/15)

Table 7. Activities under the project domestication of high priority indigenous fruit and fodder tree species

	Duration						
Component	From	То	Implementing centers	Locations	Persons responsible		
			-				
			-				
			-				
				-			
			-				
			-				
			-	-			
			-	-			

Commodity: Rehabilitation of degraded lands

Project 1: Rehabilitation of degraded lands for sustainable natural resources management and utilization

Coordinating center: Melkassa ARC

Project coordinator: Ermias Alemu

Implementing centers: FRC, Melkassa ARC, Holetta ARC, Debrezeit ARC, Mehoni ARC, Kulumsa ARC, Wondo Genet ARC

General objective: The general objective of this research is to generate technologies and information on the structural and functional recovery of the differently rehabilitated areas as this information is necessary for designing future restoration projects optimized for their economic, social and ecological efficiencies

Specific objectives:

To evaluate the structural and functional recovery of different restoration treatments To assess the role of beekeeping practices for sustainable utilization of degraded land

To evaluate the success of gully stabilization techniques

To scale-up the tree planting and soil and water conservation measures through farmers participation for successful rehabilitation of degraded lands

To identify the socio-economic determinants that determine farmers investment on degraded lands

To investigate the social, economic and environmental impact of community-based rehabilitation programs

To assess the restoration capability and C-stock of woody species

Expected outputs:

Technologies that maximize the economic returns from rehabilitation of degraded lands will be known

Information/technologies on the rate of gully stabilization using different check dams will be generated

Promising rehabilitation techniques will be scaled up at Debre Zeit and Debre Birhan to reclaim highly degraded lands through the participation of farmers

Information on the recovery of woody species, their diversity and C-sequestration potential will be known and documented for the selected community-based programs Socio-economic determinants that affect investment on degraded lands will be identified

Duration: Five years (2013-2018)

Table 8. Activities under the project rehabilitation of degraded lands for sustainable natural resources management and utilization

		Duration		Implementing		Persons
Component	Activity	From	То	centers	Locations	responsible

Commodity: Agroforestry

Project 3: Urban forests for ecosystem services and livelihood improvement in Addis Ababa and Adama Cities

Coordinating center: FRC

Project coordinator: Dr. Abayneh Derero

Implementing centers: FRC, Melkassa ARC, Holetta ARC

General objective: The overall objective of the project is generate knowledge and information that will help promote urban forests for ecosystem services and livelihood support and contribute to restoration of indigenous trees and tree planting in Addis Ababa and Adama

Specific objectives:

- Assess perceptions of urban people towards urban forestry, the recreational and educational uses
- Identify policy related instruments, institutional arrangements and constraints of policies and institutions in relation to the expansion of urban forestry.
- Study woody species diversity and growing niches, biomass and carbon stock, and insect pest damages in various urban forest types.
- Identify tree species preferences of urban dweller groups for planting on different tree growing niches
- Evaluate the tolerance to and uptake potential of contaminants by different tree/shrub species under nursery and field conditions.
- Identify seed systems and seedlings production systems in urban and peri-urban nurseries.
- Restore indigenous forest tree species, undertake river bank management and support tree planting activities of urban dwellers

Expected outputs:

- Tree diversity, biomass and carbon stocks in aboveground and below ground quantitatively determined
- The extent of contamination in each sub-city will be known and the information will be shared among responsible bodies for future action
- The uptake potential of selected species will be quantified and the best performing species on contaminated soils will be identified
- Plants that survived best in highly contaminated sites will be recommended for prescaling up schemes
- Different policy related instruments developed/implemented to promote urban forestry identified/characterized
- Constraints/challenges that affect policy implementation identified

Policy processes involved and institutions responsible for urban forestry related policies will be identified and their major challenges for planning effective policy and its implementation will be known The purposes of urban forestry policy related instruments identified Current systems of urban forest nurseries are identified Challenges of urban forest nurseries are identified Public perception to urban forestry known The role of urban forestry for recreational and educational uses known Role of trees, peri-urban plantation, wood and non wood products for livelihood of the urban poor known Planting niche and tree species preference of urban dwellers of the selected cities known Seed pretreatment requirements, soil mix, pot size and nursery life span determined for lesser known indigenous woody species Half a million quality seedlings produced for over fifty indigenous woody species At least 50 indigenous woody species planted for restoration purpose Tree cover increased by 100% on riverbanks and farms in urban areas

Duration: Five years (2012-2017)

Table 9. Activities under the project urban forests for ecosystem services and livelihood improvement in Addis Ababa and Adama cities

		Duration		Implementing		Persons
Component	Activity	From	То	centers	Locations	responsible

Commodity: Industrial Plantation and Tree Improvement

Project 3: Forest tree seed improvement

Coordinating center: FRC **Project coordinator:** Girma Eshete **Implementing centers:** FRC

General objective: The goal of the current project is to contribute for sustainable development and management of natural resource in Ethiopia by ensuring the availability of genetically suitable tree and plant material of good quality from selected well adapted and protected seed sources of both indigenous and exotic woody species nationwide through research. This is to respond the ever increasing demands for quality tree seed of the massive afforestation and tree planting thrusts in the country. Also it is the objective of the project to the protection and restoration of genetic material.

Specific objectives:

To archive the above goal the following specific objective are outlined. In this case all specific objectives are considered as the project components

To insure superior genetic quality for effective propagation field establishment techniques

To develop technology for effective propagation field establishment techniques that can use to evaluate the best performed existing well adapted seed source

To develop optimum limit of fertilization and spacing on seed yield in *Gravilia* robusta seed source

To determine optimum seed maturation stages which is suitable for effective germination

To determine storage behavior of some indigenous tree species

Expected outputs:

Various indigenous and exotic species tree species screened and selected as seed source for supply of genetically improved material and conservation of genetic material

Morphological, physiological and biochemical seed quality along other diagnosis characteristics determined and seed maturity indicators for appropriate collection time established for the priority species

Nature of seed dormancy and appropriate handling to overcome it determined for all priority species along the germination pre treatment methods

Duration: Five years (2013-2018)

Table 10. Activities under the project forest tree seed improvement

		Duration		Implementing		Persons
Component	Activity	From	То	centers	Locations	responsible
Croton macrosrtachya Afrocurpus falctus, Cordia africana Albizia gummeferia						
Gravilia robusta	-				-	

Faidherbia albida, Afrocarpus falcatus,Olea europea,Juniperus procera Croton macrostachys			
Afrocarpus gracilior, Juniperus procera, Melia azedarach Olea europaea			

Non Timber Forest products Case Team

Commodity: Bamboo, Reeds and Palms

Project 1: Bamboo management and utilization in selected districts of Ethiopia

Coordinating center: FRC

Project coordinator: Dr. Yigardu Mulatu

Implementing centers: Tikure Inchine, Assossa, Pawe, Holetta, Addis Ababa University, Bore, Gambo, FRC and Injibara

General objective: To develop improved technologies of bamboo for sustainable production and utilization thereby contribute to environmental protection and food security of the country.

Specific objectives:

Determine the best propagation techniques for bamboo employing offset and layering Techniques

To develop an efficient micro-propagation and *in vitro* regeneration protocol for bamboo

Investigate regeneration, culm characteristics and yield of bamboo under different harvesting intensities

To determine best weeding frequencies on the early performance of *Oxytenanthera abyssinica* seedlings.

Investigate the suitability of Ethiopian highland bamboo for bamboo mat board production, determine the best drying method and determine nutrient content of bamboo shoots

Evaluate the performance introduced bamboo species

Identify the genetic variation among different provenances of Ethiopian highland bamboo.

Assess important pests and diseases.

To determine the best storage medium and storage time for *Oxytenanthera abyssinica* seeds.

Develop silvicultural management techniques to maximize productivity of lowland bamboo stands (Technique and intensity of harvesting)

Expected outputs:

The best propagation techniques of bamboos will be identified;

Efficient micro-propagation and *in vitro* regeneration protocol will be developed.

Regeneration, stand characteristics and yield of bamboo under different harvesting intensities will be investigated;

The suitability of Ethiopian bamboo for bamboo mat board production will be known Effective drying method of bamboo determined

Nutritive value and preservation techniques of bamboo shoots will be identified

[25]

The performance of exotic bamboo species will be known and the best performing ones will be selected for different agro-ecologies

The phenotypic variation of different provenances and genetic variability of Ethiopian highland bamboo will be known and the best performing and with desirable characteristics will be selected

Important pests and diseases of bamboo will be known

Duration: Five years (2008-2013)

Table 11. Activities under the project Bamboo management and utilization in selected districts of Ethiopia

		Duration		Implementing		Persons
Component	Activity	From	То	centers	Locations	responsible
					-	
				-	-	
				-		
				-	-	
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	O abuasinias					
	0.abyssinica					
					-	
				-	-	
				-		
				-	-	
					_	
				-		
				-	-	
					-	
				-	-	
Oxytenanthera abyssinica	O.					
	abyssinica and					
	Yushinia alpina					
				-	-	

Project 2: Technology generation, adaptation and promotion of bamboo in selected Agroecologies of Ethiopia

Coordinating center: FRC

Project coordinator: Dr. Yigardu Mulatu

Implementing centers: Holetta, Jimma, Pawe, FRC, Assossa, Dawro, Masha, Debrezeit, Chagni, Tikureinchine, Injibara and Hagereselam

General objective:

To generate, introduce and promote technologies for sustainable utilization and development of bamboo in selected agro ecological zones of Ethiopia To The best soil mixture to be used for raising of bamboo in the nursery will be known

Table 12. Activities under the project technology generation, adaptation and promotion of bamboo in selected Agroecologies of Ethiopia

		Duration		Implementing		
Component	Activity	From	То	centers	Locations	Persons responsible
				_	_	
					-	
_	-					
	-					
-						

Commodity: Natural Gum, Resin and Latex

Project 1: Developing technologies for improving sustainable management of Natural gum and resin production from Drylands of Ethiopia

Coordinating center: FRC

Provenances effect on seed characteristic identified Bark anatomy and resin structure of the targeted tree species will be identified Effect of tapping on yield and physiology of gum and resin bearing species known Physico-chemical characteristics of targeted species known Major insects and diseases and their controlling mechanisms devised Developed technologies demonstrated and promoted

Duration: Five years (2008-2013)

Table 13. Activities under the project Developing technologies for improving sustainable management of Natural gum and resin production from Drylands of Ethiopia

		Duration		Duration Implementing		Persons
Component	Activity	From	То	centers	Locations	responsible
	Acacia senegal, Sterculia setigera Boswellia neglecta Acacia seyal Commiphora myrrha			-	-	
	Sterculia setigera, Boswellia neglecta, Commiphora myrrha					
	Boswellia papyrifera					
	Acacia senegal Boswellia neglecta Acacia seyal Boswellia papyrifera Sterculia setigera Commiphora myrrha			-	-	
	Acacia senegal Boswellia neglecta Boswellia papyrifera Sterculia setigera Commiphora myrrha			-	-	
	Acacia senegal, Acacia seyal, Boswellia papyrifera Sterculia setigera					
	Acacia senegal Acacia seyal, Boswellia papyrifera Sterculia setigera			-		
	Acacia senegal, Boswellia negelecta, Sterculia setigera Commiphora myrrha					
	Acacia senegal, Boswellia neglecta, Acacia seyal Sterculia setigera Commiphora myrrha			-	-	
	Acacia senegal Acacia polyachanta					
	Acacia senegal Acacia polyachanta					
Boswellia papyrifera		-				
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Acacia senegal						

Project 2: Developing tapping technologies for optimum production of gum and resin from economically important tree species in drywoodland areas of Ethiopia

Coordinating centre: FRC Project coordinator: Tatek Dejene Implementing centers: Metema, Liben and Yabello

General objective: The overall objective of this project is to develop scientific workable techniques and knowledge of gum and resin production through exploring of the characteristics of resin secretary structures and their responses in relation to tapping for production of gum and resin in order to contribute to the improvement of current production methods by developing a more sustainable tapping regimes through sustainable utilization of the dryland resources of the country

Specific objectives:

To examine bark anatomy and features of resin secretary structures of targeted tree species

To examine anatomical responses of targeted tree species to tapping/production

To design and develop tapping techniques for targeted tree species

To evaluate the influence of season, stem size and tapping intensity on yield, survival and wound recovery of targeted tree species

To evaluate the influence of stimulant application on resin production, survival and wound recovery of targeted tree species

To evaluate the economic profitability of stimulant application for gum-resin production from targeted tree species

To pre-scale up and evaluate the social acceptability of the developed technologies

Expected outputs:

Bark anatomy and resin structure of the targeted tree species identified

Anatomical responses of the targeted tree species evaluated

The best design selected for the targeted trees

The best tapping tools for the targeted species identified

Impact of season, size, position and spot intensity for the targeted tree species examined

Optimum tapping height, depth, and angles for commercial production of gum and resin from targeted tree species examined

Bark recovery ability of the targeted tree species examined

The impact of stimulant on gum yield of the targeted species identified

Tapping time and stimulant application on yield of targeted tree species identified the profitability of using chemicals for gum production evaluated

[35]

Developed technologies demonstrated and promoted

Duration: Five years (2007-2011E.C.)

Table 14. Activities under the project developing tapping technologies for optimum production of gum and resin from economically important tree species in dry woodland areas of Ethiopia

		Dura	tion	Implementin		
Component	Activity	From	То	g centers	Locations	Persons responsible
-						
-						
-						
-						
-						
				1	1	1

Project 3: Characterization and Promotion of Economically Important but underutilized Gum and Resin Products from Tree Species of the Dry woodlands of Ethiopia

Coordinating center: FRC

Project coordinator: Tatek Dejene

Implementing centers: Addis Ababa (FRC/FPURC, WGARC), Ethiopian Standard Authority and other relevant institutions, Liben Zone, Afder Zone, Borena Zone, South Omo Zone, Nuer Zone, Assosa Zone, Metekel Zone, Kamashi Zone, Awra Woreda, Chifra Woreda, Amaibara Woreda, Berhale Woreda, Addis Ababa

General objective: To broaden and maximize a benefit from the dry wood lands of Ethiopia through promoting new products for producers and marketers engaged in gum and resin sector so as to improve the overall economy of the country in accordance with the CRGE Policy

Specific objectives:

To develop a list of spices of Ethiopia with internationally marketable gum and resin product but not yet or under utilized

To develop a list of gum and resin spices of Ethiopia which have different local application and which can potentially be popularized or commercialize as a new product or commodity

To identify and document the indigenous knowledge related to the utilization of underutilized gum and resin products of Ethiopia

To produce a spatial map for the location and distribution of the underutilized gum and resin bearing species

Determination of physico-chemical Characteristics of the gum and resin species Comparative study of the gum and resin products with international standard parameters

Opportunities and challenges to promote and commercialize these gum and resin products

Popularization of these gum and resin products to potential users and stake holders

Expected outputs:

A list of gum and resin bearing species found in Ethiopia which have a local potential use and not yet or underutilized for industrial purpose but can be feasibly transformed into industrial application will be sorted out.

A desktop map showing the location and distribution of prioritized underutilized gum and resin species will be produced

The physico chemical attribute of prioritized underutilized gum and resin products will be delivered

Information as to the potential as well as barrier for utilization of underutilized gum and resin products will be delivered.

Developed technologies demonstrated and promoted

Duration: Five years (2006-2010E.C.)

 Table 15. Activities under the project characterization and Promotion of Economically Important but underutilized Gum and Resin Products from Tree Species of the Dry woodlands of Ethiopia

	, 	Dura	ation			Persons
Component	Activity	From	То	Implementing centers	Locations	responsible
						-
				_	_	
				-		
1	1	1	1	1	1	1

Project 4: Developing technologies for the rehabilitation of degraded *Boswellia papyrifera* dominated woodlands for sustainable frankincense production

Coordinating center: FRC

Project coordinator: Tatek Dejene **Implementing centers:** Assosa, Abergelle, Metema and Humera

General objective: The general objective of the project is to develop comprehensive packages of technologies and scientific knowledge that promote the rehabilitation of the degraded frankincense producing forest resources to their former natural conditions to enhance their contribution to livelihoods, poverty reduction and national economy while maintaining ecological integrity.

Specific objectives:

To identify local people's perceptions on land degradation

To develop effective rehabilitation techniques/methods that enhance natural regeneration processes and accelerate biodiversity restoration

To determine the ecological requirements of *B. papyrifera* and selected co-existing tree species at seedling stages for success of efforts on restoration of these forests

To provide important information for the application of techniques to rehabilitate degraded tropical forests

To produce high impact knowledge, information and technology and generate lessons that could improve sustainable management policy, extension and practices

To characterize stand structure (basal area, biomass), species richness, species composition and population structure of tree species along succession

To identify the major regeneration strategy (seed or sprouting) of tree species in the *Boswellia* dominated woodlands

To assess the mycorrhizal status of *Boswellia* dominated woodlands along succession To determine the patterns of nutrient elements accumulation in the vegetation and soil

Expected outputs:

Knowledge on ecological requirements of seedlings of dry forest species, silvicultural techniques for enhancing natural regeneration

Best rehabilitation techniques for restoring degraded *Boswellia* woodlands will be determined

Duration: Five years (2006-2010)

Table 16. Activities under the project developing technologies for the rehabilitation ofdegraded Boswellia papyrifera dominated woodlands for sustainable frankincenseproduction

			Duration		Implementing		Persons
Compone	nt	Activity	From	То	centers	Locations	responsible

-

Project 5: Characterization, Evaluation and Introduction of technologies for rubber latex production from *Hevea brasiliensis* in Ethiopia

Coordinating center: FRC

Project coordinator: Tatek Dejene

Implementing centers: Bench Maji zone, Bebeka, Tole Kobo, Afar and South Omo

General objective: The general objective of this project is to adopt rubber production technologies and approaches from *H. brasiliensis* clones in Ethiopia so as to contribute for climate resilience green economy policy which is geared towards bringing rapid economic growth of the country while maintaining the social and environmental integrity.

Specific objectives:

To conduct a preliminarily identification of the existing clones based on marker traits To evaluate the field performance of the identified clones of *H. brasiliensis*

To compare and select a candidate clones based on yield and yield quality of latex

To conduct the pest and disease assessment in the nurseries and plantation *H*. *brasiliensis*

Screening of chemical stimulants for rubber latex production in Birhan area

To determine time and mode of application of stimulants for rubber latex production in Birhan area

To introduce and adapt new promising *H. brasiliensis* clones for latex production To conduct multi trial adaptation trial at different location with potentially similar biophysical condition

To test the possibility of adapting rubber trees under modified environment in arid and hot area of Ethiopia

To identify the socio-economic and environmental issues relevant to rubber plantation and production in Ethiopia

To identify the possible approaches and opportunities to promote and facilitate rubber production by out growers and private investors in Ethiopia.

Expected outputs:

Information about the already adapted clones will be generated

Information about the field performance of already adapted clones will be generated

High yielder will be selected

Information about the pest and diseases problem of already adapted clones will be generated

The best stimulant for latex yield identified

The best adapted clones selected

The best adapted clones under irrigation selected

[41]

The best adapted clones based on its performance in growth and yield selected The socio-economic determinants of rubber production identified

Duration: Five years (2006-2010E.C.)

Table 17. Activities under the project characterization,	Evaluation and Introduction	of technologies for	rubber latex production
from Hevea brasiliensis in Ethiopia			

		Dura	tion	Implementi		Persons
Component	Activity	From	То	ng centers	Locations	responsible
H. brasiliensis	H.brasiliensis					
	H. brasiliensis					
	H. brasiliensis					
	H. brasiliensis					
H. brasiliensis						
H. brasiliensis	H.brasiliensis					
	H.brasiliensis					

Commodity: Bio Energy

Project 1: Assessment, development, and promotion of appropriate wood fuel technologies in different Agroecological areas of Ethiopia

Coordinating centre: FRC

Project coordinator: Dr. Abeje Eshete

Implementing centers: Addis Ababa, Deber Birhan ARC, Asella, Ambo, Ziway, Shashemene, Awash, Dire Dawa, KARC, WARC, DZARC, Yerer, MARC, Diksis, Miesso/Adami Tulu/Alage

General objective: To assess the household energy consumption patterns and develops appropriate wood fuel technologies for the household energy demand in highland, mid altitude and lowland ecologies of Ethiopia.

Specific objectives:

To review past and current efforts of wood fuel initiatives.

To assess inflows into major cities and/or towns, the demand, supply and *per capita* consumption trend of wood fuel by households including the marketing and pricing of wood fuel along the supply chain at selected highland, mid altitude and lowland areas.

To select more appropriate wood fuel species for plantation at highland, mid altitude and lowland areas.

To determine the rotation period for the optimum biomass yield of wood fuel species in the respective agro-ecological areas (probably need extension).

To determine carbon storage potentials of different carbon pool by species and agro ecologies.

To determine the quality of species for alternative wood fuel products such as firewood, briquette and or char bricks, charcoal.

To demonstrate and promote improved wood fuel technologies to end users.

Expected outputs:

Per capita wood fuel consumption of households will be known

Demand-supply relationship of wood fuel to households will be known

Wood fuel inflows and/or outflows into and/or from major cities will be recognized

Marketing and pricing of wood fuel will be investigated along the supply chain Past and current efforts of wood fuel programs will be reviewed and documented Species with high adaptation and high growth performance will be selected and recommended for further plantation for different agro-ecologies The rotation period of the fast growing species will be determined for optimum production of biomass

- Species with high calorific value will be identified for further plantation establishment.
- Carbon storage potential of species will be determined for different Agroecologies.
- Percentage of net carbon storage against the loss of each species will be determined for different Agroecologies
- The quality of different species for charcoal will be determined and tree species for good quality will be identified.
- Best quality of bricks to use charcoal in alternative ways will be developed and promoted for selected associations

Duration: Five years (2011-2016)

Table 18. Activities under the project assessment, development, and promotion of appropriate wood fuel technologies in different Agroecological areas of Ethiopia

		Dura	ation			Persons
0	A - 41 - 24 -	F	T	Implementing	Lesstere	responsibl
Component	Activity	From	10	centers	Locations	е
-						
				-	-	
				1		

Commodity: Wild Edible and Medicinal Plants

Project 1: Adoption and Development of Technologies for Utilizing Fruit Products, Vegetable Oil and Other Extracts from Trees of Ethiopia

Coordinating centre: FRC

Project coordinator: Omarsherif Mohammed

Implementing centers: Awssa (Afar region), Pawe, Dolo Mena, Humera, Gambella, South Omo, Woldiya, Bati, Addis Ababa, Moyale, Werer, Adami Tulu, Liben, Sirinka, Dedesa, Gibe, Showa Robit, Melkassa

General objectives:

To develop packages of technologies and scientific information that facilitate and promote the effective utilization of fruit products, vegetable oil and other extracts from the woodland and tree resources of Ethiopia

To improve food security and increase household income, while contributing for national economy and improving the environmental wellbeing.

Specific objectives:

To assess the resource base, production potentials and main threats/challenges affecting effective and efficient utilization of targeted species

To investigate the current contribution of the targeted products and species for household and local economy

To determine seed germination, storing and treatment property of the targeted species To deliver the suitable propagation and field establishment methods of targeted species

To improve the yield and quality of produces from targeted species through selection, adaptation, grafting and other techniques for economical production of fruit products, vegetable oil and other extracts

To adopt fruit production technologies of each target species for economical production of fruit products, vegetable oil and other extracts

Fruit and seed handling, processing and value adding technologies of targeted species To adopt fruits products, oil and other extract producing technologies from the targeted species to the local communities

To assess the possible options to utilize the benefits from carbon trading in the lowland areas of the country as one form of NTFPs

To promote fruits products, oil and other by extracts producing technologies from the targeted species to the local communities

Expected outputs:

Resources base, potential and current population status will be known

Production including oil yield potential of the targeted species will be known

oil and butter from Sclerocarya birrea, Borassus aethopium and Vitellaria will be characterized

The social, economical and cultural values, the market and supply chain, the treat, challenge and opportunities of fruit and vegetables oil production will be known

Seed storage, handling, germination capacity, storage and viability will be determined

Suitable propagation method of the targeted species will be known

Effective propagation of the targeted species will be known

The Phonological information for four species delivered

Appropriate field establishment technique will be developed

Adaptability of the targeted species to the different locality is known

The best top grafting method will be selected

Optimum fruit production technologies for Zizyphus species, Sclerocarya birrea, Vitellaria paradoxa, Vitex doniana, Phoenix dactylifera and Borassus aethopium will be adopted

New fruit processing and handling as well as value adding technology adopted

Improved *Shea* butter technology adopted

Technology for local biopestcide production for animal pest control adopted

Vegetable oil production from fruit and kernel of *Sclerocarya birrea* and *Borassus aethopium* will be adopted

Technology taping technology of *Borassus aethopium* for sugar/ ethanol production will be adapted

The carbon capital of the targeted species will be quantified

Fruit production and its value addition technologies of the targeted spies promoted

Shea butter production technology demonstrated and promoted

Vegetable oil production from *Sclerocarya birrea and Borassus aethopium* fruits demonstrated and promoted

Bio-pesticide production demonstrated and promoted

Duration: Five years (2011-2016)

		Dura	ation	Implement		
Component	Activity	From	То	ing centers	Locations	Persons responsible
	tree species (Sclerocarya birrea, Vitex doniana, Phoenix dactylifera, Borassus aethopium, Tamarindus indica, Zizyphus spina- christii) in			-	-	
	(Vitellaria paradoxa, Sclerocarya birrea and Borassus aethopium) species					
	the targeted species (Borassus aethopium, Sclerocarya birrea and Vitelliria paradoxa) of Ethiopia					
	Borassus aethopium, Vitex doniana, Sclerocarya birrea, Melia volkensii					
	Borassus aethopium, Vitex doniana, Sclerocarya birrea, Melia volkensii					
	Vitellaria paradoxa					
	Vitex doniana, Sclerocarya birre, Tamarindus indica, Ziziphus, Vitellaria paradoxa, Melia volkensii, Phoenix dactylifera and Borassus aethopium.					,

Table 19. Activities under the project Adoption and Development of Technologies for Utilizing Fruit Products, Vegetable Oil and Other Extracts from Trees of Ethiopia

Sclerocarya birrea Vitex Melia volkensii and Vitellaria paradoxa				
Phoenix dactylifera				
Zizyphus spina-christi -				
Vitellaria paradoxa Vitex doniana				
Phoenix dactylifera and Borassus aethopium				
				-
vitex doniana, Tamarind, Zizyphus species, Sclerocarya birrea, Borassus aethopium P .dactylifera				
Vitellaria paradoxa		-	-	
Melia volkensii, tamarinda indica and Vitex dodonea				
Sclerocarya birrea Borassus aethopium				

Vitellaria paradoxa			
B. aethopium Sclerocarya birrea			

Project 2: Ethno-botany assessment, chemical analysis and establishment of botanical garden for major indigenous woody medicinal trees/shrubs in South and Southwest Ethiopia

Coordinating centre: Wondo Genet ARC

Project coordinator: Wondimagen Amanuel

Implementing centers: Wondo Genet, Tepi, FRC, WGARC and TARC

General objectives: The general objective of the Mega Project will be to conduct an ethnobotanical survey; select and prioritize; evaluate the phytochemical and biochemical ingredients of woody medicinal trees/shrubs commonly used by local community and traditional practitioners as well as establishment of botanical garden so as to domesticate and promote them to improve the general health care system in the society and hence contribute for the proper utilization, management and conservation of these resources.

Specific objectives:

To conduct an ethnobotanical assessment of woody medicinal trees/shrubs commonly used by local community

To document indigenous knowledge of local communities and traditional practitioners in a particular social context

To select and prioritize woody medicinal trees/shrubs commonly used by local community

To evaluate and determine the phytochemical and biochemical analysis of prioritized and selected woody medicinal trees/shrubs commonly used by local community

To establish Botanical gardens at and/or around Wondo Genet and Tepi

To determine the moisture content, purity analysis and number of seeds per kg of targeted species

To determine the seed ecology, seed storage behaviour and best seed storage media of targeted species

To investigate seedlings' survival rate and early growth performance of targeted species under Green House conditions and at botanical garden

Expected outputs:

An ethnobotanical assessment of woody medicinal trees/shrubs commonly used by local community will be conducted

Indigenous knowledge of local communities and traditional practitioners in a particular social context will collected and documented

Woody medicinal trees/shrubs commonly used by local community will be selected and prioritised

Prioritized woody medicinal trees/shrubs commonly used by local community will be collected, identified and their scientific names known

The phytochemical and biochemical analysis of prioritized and selected woody medicinal trees/shrubs will be evaluated and determined

Site selection, design and infrastructure of the botanical garden will be established

All the selected and prioritized woody medicinal trees/shrubs will be collected, identified, scientific names labeled, tagged and preserved in the bamboo garden

Site clearance, land preparation, seedling multiplication and establishment of botanical garden will carried out

The total selected woody medicinal trees/shrubs list and their important descriptions will be tagged for customers

Proper silivicultural management of botanical garden will be developed and practiced

Provision of information and on-site visit of botanical garden will be delivered and partnership and collaboration will be establish

The seed ecology, storage behaviour and best storage media of targeted species will be determined

The survival rate and early growth performance of seedlings' of targeted species at green house and at botanical gardens will be determined and identified

Duration: 2005-2010

Table 20. Activities under the project ethno-botany Assessment, Chemical Analysis and establishment of botanical garden for Major Indigenous Woody Medicinal Trees/Shrubs in South and Southwest Ethiopia

		Dura	ation	Implementing		Persons
Component	Activity	From	То	centers	Locations	responsible

Natural Forest Case Team

Commodity: Dry and Moist Montane Forests

Project 1: Exploring social, economic and ecological challenges and opportunities of sustainable forest management in dry Afromontane forests

Coordinating center: FRC

Project coordinator: Girma Shumi

Implementing centers: Arbagugu, Chilalo-Galema and Munesa-Shashemene

General objective: The overall objective of the project is to contribute to sustainable dry afromontane forest management for increased food security, livelihood improvement, climate change adaptation and mitigation. With this general objective and the above mentioned background and justification the proposed project has the following specific objectives, which are hereafter defined as project components.

Specific objectives:

Investigate and describe population dynamics and structure of dry Afromontane forest in relation to degree of anthropogenic disturbances

- Assess spatial and temporal forest cover change and map the extent of forest cover
- Investigate the restoration of deforested and degraded forest where multiple factors limit the rate of tree establishment
- Assess socio-economic values of forests and document indigenous knowledge and attitudes on forests and forest products
- Estimate and determine carbon sequestration potential and its temporal and spatial variation in forest and restoration sites, and develop carbon sequestration estimation model

Disseminate lesson learned and develop sustainable forest management strategies

Expected outputs:

The diversity, population structure, and early growth dynamics of woody species will be known and documented

Species with soil seed bank will be identified

Regeneration status of major and endangered tree species will be recognized

Forest use or logging history and long term stand dynamics of Arbagugu Forest will be known and documented

The temporal and spatial forest cover changes and its driving forces will be determined and documented

[54]

The extent of the forest area will be known and mapped

Project 2: Research on sustainable management of woodlands in selected drylands of Ethiopia

Coordinating center: FRC Project coordinator: Mahedere Mulugeta Implementing centers: Guji Zone and Metama

General objective: To develop integrated sustainable utilization of the Dryland forests to address food security and improvement of the livelihood of the local community

Specific objectives:

To describe the vegetation structure and population dynamics of the woodland vegetation in relation to the degrees of anthropogenic disturbances and natural calamities

To investigate the socio-economic contribution of woodland forest resources for the improvement of the livelihood of the community

- To assess the impact of fire on vegetation structure and composition
- To develop appropriate control techniques for managing aggressive species
- To generate technologies for degraded woodland rehabilitation.

Expected outputs:

Vegetation composition of the selected woodland known The causes and consequence of woodland forest fire recognized The impact of fire on woodland forest vegetation structure and composition investigated. Local knowledge of the community on wood land forest management will be known Woodland fire management guidelines developed Encroacher species control methods compared and effective method identified Demonstration site established Awareness on control methods created Causes and consequences of wood land degradation identified Soil Seed Bank status of degraded woodlands known Rehabilitation/restoration technologies for degraded woodlands identified

Duration: Five years (2003-2008)

Table 22. Activities under the pro	ject research on Sustainable	Management of Woodlands	in selected drylands of Ethiopia

		Duration		Implementin		Persons
Component	Activity	From	То	g centers	Locations	responsible

Project 3: Characterization of Natural Regeneration, Species Composition, and Ecosystem in Asebot Monastery, Oromiya Regional State

Coordinating center: Haramaya University Project coordinator: Dr. Lisanework Negatu Implementing centers: Asebot Monastery

General objective: The general objective of the study is to assess natural regeneration status, species composition and ecosystem functions of the natural vegetation in Asebot Monastery.

Specific objectives:

To evaluate the status and its ecosystem function in relation with biodiversity conservation

To develop framework on some specific natural interaction within the flora and fauna of the ecosystem

To assess and examine the existing limitations and opportunities available at hand

Expected outputs:

The Asebot Monastery Natural Forest Regeneration Status, species composition will be identified

Ecosystem functions of the natural vegetation in Asebot Monastery Natural Forest will be known

Duration: 5 years (2004 - 2010E.C.)

Table 23. Activities under the project characterization of Natural Regeneration, Species Composition, and Ecosystem in Asebot Monastery, Oromiya Regional State

Component	Activity	Duration		Implementing	Locations	Persons
		From	То	centers		responsible

Project 4: Social, Economic and Ecological study on the attributes and challenges of sustainable forest management in high forests and woodlands

Coordinating center: FRC Project coordinator: Dr. Tesfaye Bekele Implementing centers: Debrezeit, Kulumsa, Melkasa, Tepi and Mohoni

General objective: The goal of the proposed research project is to develop conservation; sustainable utilization and forest management planning that address the achievement of government strategy in livelihood improvement, which is the millennium development goal (MDG) of the Ethiopian government

Specific objectives:

To describe vegetation structure in relation to selected environmental factors and varying degree of anthropogenic disturbances, to study the disturbance and logging history and vegetation dynamics through time of high forests and woodlands forest Characterise forest soil conditions and determine its relation to vegetation and degree of forest disturbances

To study the natural regeneration and its dynamics in relation to selected environmental factors and varying degree of anthropogenic disturbances in high forests and woodlands

To study the population dynamics of selected key species in relation to selected environmental factors and varying degree of anthropogenic disturbances in high forests and woodlands forest

To establish permanent sample plots for periodic measurement of changes in carbon pools, vegetation and species dynamics

Describe spatial and temporal changes and detect the driving forces of changes in forest cover

Map the extent of forest cover and, Estimate sequestered carbon in above ground vegetation, in soils for the natural high forests, woodlands, plantation forests and agro forestry systems

Estimate sequestered carbon in above ground vegetation and in soils for the selected dominant species

Describe the phenology of selected tree species and determine the relationship between the phenology of species and climate variability

Describe and determine the economic values and contribution of forests and forest products to the local community

Valuate the indirect values of the forest using different techniques, ecosystem services To identify and determine infestation rate, vectors and host range of forest parasitic plants Develop different options for the sustainable management of forests that integrates carbon sequestration, timber production, biodiversity, climate change adaptation and mitigation

Expected outputs:

Socio-economic importance of the forests to the local society and national economy known

Land use land cover change Maps of the forest obtained

Phenological calendar of different tree species known

Data sets on carbon sequestration potentials of Ethiopian forests, that assist developing carbon based forest management and planning obtained

Documents of indigenous knowledge on high value tree species and medicinal plants prepared

Manuals and scientific information's on seed biology and handling prepared

Duration: Five years (2013~2018)

Table 24. Activities under the project social	, Economic and Ecological	study on the attributes and	d challenges of sustainable
forest management in high forests	and woodlands		

		Duration		Imple			
				mentin			
				g			
Component	Activity	From	Та	center	Locations	Dereens reenensible	
Component	Activity	From	10	5	Locations	Persons responsible	
-							

-			

Wood Products Utilization Case Team

Commodity. Wood products utilization

Project 1: Suitability of *Prosopis Juliflora* for Specialty Wood Products and

Coordinating center: FRC **Project coordinator:** Dr. Seyoum Kelemwork **Implementing centers:** FRC, Werer ARC

General objective: To evaluate the suitability of *Prosopis juliflora* for specialty wood products

Specific objectives:

To evaluate physical, mechanical and machining properties of P. juliflora

To identify and produce at least 12 types of products

To demonstrate the products/organize workshops for the target groups in Melka Worer

To evaluate and recommend suitability of *Prosopis juliflora* (leaves, pods, chopped branches and stems, and mix) as substrate for Oyster (*Pleurotus sajor-caju, P. austreatus and P. florida*) and Shiitake (*Lentinula edodes*) mushrooms for mushroom cultivators.

Expected outputs:

Household furniture like beds shelves and tables will be produced from *Prosopis juliflora* stem

Recreation and garden chairs will be produced

Striking handles (for sledges, axes, etc.) hammer, axes chisel, etc. will be produced

Long-handled tools like shovels or hoes are matched handles will be produced

Posthole diggers and wheelbarrows will have handles

Woodworking equipment tools handles for rake, shovel, spade, garden fork and some other small hand tools.

Duration: Five years (2011-2015)

Table 25. Activities under the project suitability of Prosopis juliflora for Specialty Wood Products and for mushrooms' substrate

Project 2: Investigation of selected Eucalyptus species for improved Electric power and Telephone Distribution poles

Coordinating center: FRC

Project coordinator: Dr. Seyoum Kelemwork **Implementing centers:** Addis Ababa, Shashemene, Jima, Bore, Nekemt and Gimbi

General objective: To identify suitable eucalyptus species for improved electric power and telephone distribution poles

Specific objectives:

To identify suitable eucalyptus poles growing locations which have less defects.

To identify major natural defects those reduce pole quality

To select appropriate diameter ranges of poles stands those have less defects

To identify processing defects during conversion of timber to poles

To determine conditioning & handling methods of poles before preservative treatments

To determine drying and chemical treatment methods of poles

To quantify emissions to air, water and soil during growth period

To quantify emissions to air, water and soil during pole manufacturing

To quantify emissions to air, water and soil during service & disposal of poles

To quantify emissions to air, water and soil during manufacturing & disposal of concrete poles

To recommend grading rules used for poles utilization

To recommend silvicultural practice for planting improved quality poles

Expected outputs:

Suitable eucalyptus growing locations for improved quality poles will be identified Eucalyptus sub-species for quality pole application will be selected

Major natural defects of eucalyptus those reduce pole quality will be identified

Appropriate diameter ranges of eucalyptus stands for quality pole will be determined Harvesting seasons will be identified to obtain less defect poles

Methods for improving processing/harvesting defects will be determined

Methods/techniques for handling & drying of poles before chemical treatments will be determined

Suitable silvicultural practice for planting improved pole quality will be recommended

Chemical concentration, vacuum and pressure time for each species will be identified Cradle-to-grave comparative environmental burdens arising from the manufacture and use of eucalyptus and concrete poles will be available Institutional pole grading rule which will used for national standard of structural pole utilization will be released

Duration: Four years (2011-2015)

 Table 26. Activities under the project investigation of selected Eucalyptus species for improved Electric power and Telephone

 Distribution poles

		Duration		Implementing		
Component	Activity	From	То	centers	Locations	Persons responsible
-						

Project 3: Lumber characterization, rational utilization and modeling of selected timber species as industry and construction material sources

Coordinating center: FRC

Project coordinator: Getachew Desalegn

Implementing centers: FRC/FPURC

Table 27. Activities under the project *lumber characterization, rational utilization and modeling of selected timber species as industry and construction material sources*

		Dura	tion	Implementing		Persons
Component	Activity	From	То	centers	Locations	responsible
	Eucalyptus viminalis, Eucalyptus plularis Trichilia dergena					
	Eucalyptus viminalis, Eucalyptus plularis Trichilia dergena					
	Eucalyptus viminalis, Eucalyptus plularis Trichilia dergena					
	E.viminalis					

Project 4: Appraisal, Measurement, Evaluation and Improvement of Productivity and Efficiency of Green Manufacturing in Ethiopian Wood Industries

Coordinating center: FRC

Project coordinator: Dr. Anteneh Tesfaye

Implementing centers: Addis Ababa and South West Ethiopia

General objective: The general objective of this mega project is determining, appraising and improving green competitiveness of the Ethiopian wood industry through collectively adopted and mastered innovative manufacturing techniques which help to zero or minimize the integral of waste, rework and environmental emission

Specific objectives:

To characterize quality of Ethiopian timber and investigate potentials for its improvement.

To carry out sawn wood/lumber recovery studies and quantify its conversion efficiency into sawn wood or compute recovery factors.

To characterize quality of value added wood products and investigate potentials of its improvement.

To quantify the industrial wood waste generated and investigate potentials for its value added utilization.

To probe and diagnose value chains/networks of wood products from sawn wood to the finished value added product.

To identify and quantify suitable measures for manufacturing productivity and efficiency in wood industries.

To quantify environmental and social impacts of manufacturing in wood industry and identify optimal (least-cost & least-impact) manufacturing potentials.

To promote sustained and green competitiveness of the wood industry and assure its credibility through appropriate and mutually recognized national ranking and certification system.

Expected outputs:

Information on primary and secondary survey data on demand and supply of timber Information on the quantity and characteristics of timber resources supplying the selected wood mills

Identified factors affecting timber quality (small and large diameter)

Identified root causes and implementation of corresponding solutions for timber quality Multi-scale model to forecast demand and supply of timber species

Information on comparative analysis of widely used sawing methods and other available alternatives
Quantitative information on volume recovery and grade yield of timber species in selected sawmills

Information on sawn wood recovery and productivity in southwest Ethiopia and Addis Ababa based on sample survey

Information on identified troubles causing a reduction in sawn wood recovery and grade yield and implemented corresponding solutions

After-intervention analytical information on sawn wood recovery rate

A mechanism for permanent (time-series) monitoring of sawn wood recovery rate

A theory of sawn wood recovery and grade yield

Model for the description and prediction of sawn wood recovery and grade yield Information on quality/ grade of lumber purchased and supplied to value added industries obtained from market survey

Time series description of volumetric efficiency of lumber and round wood utilization in selected value added industries

Information regarding types of value added wood products manufactured

Quantitative information on manufacturing capability of machines

Estimates for sawn wood and other raw materials utilization efficiency

Information regarding types of finishing materials and their utilization rate

Information regarding types and quantities of hardware applied on finished products

Comparative information between ideal and real manufacturing conditions regarding sawn wood utilization under

Information on socio-economic significance and demand for chemically processed woody biomass

Information regarding efficiency of recovering pulp and other products of hydrolysis from wood waste

Information on suitability of the various plastic and woody biomass combination for composites

Prototypes and information regarding wood-plastic composites applications in furniture and structures

Socio-economic information on demand for the various wood waste fuel products Information on fuel quality and suitability of the various wood biomass waste for fuel

Background information to mapping of wood products value chains/networks Review information on value chain studies for value added wood products and related

products Information on the use, perception, valuation and socio-economic aspect of value added

wood products

Information on value chain/network market for value added wood products Information on current and potential institutional support for value chain networks

Information on current and potential institutional support for value chain networks locally and nationally

A theory explaining and states and evolutions (transformation) scenarios of value chains Models to forecast states and evolutions (transformation) scenarios of value chains Synthesis report of the research on probing and diagnostics of wood products value chain/networks

Suitable productivity and efficiency measures for the Ethiopian wood industry Productivity measures and measurements from CSA and other regional organs Suitable measures and measurement methods of productivity and efficiency for the Ethiopian wood industry

Comparative and analytical information on productivity and efficiency of wood manufacturing

Information on regional, continental and global sources of productivity and efficiency reports and reviews

Quantitative information regarding productivity of wood industry at all levels based of the selected clusters/industries

Quantitative information on efficiency of the selected wood industries

Analytical information on relevant theories explaining the state and dynamics of productivity and efficiency in Ethiopian, regional and global wood industry

A theory sufficiently explaining the state and dynamics of productivity and efficiency in the Ethiopian wood industry

Models accurate enough to predict or forecast the state and dynamics of productivity and efficiency in the Ethiopian wood industry

Synthesis report of the research on productivity and efficiency in wood industries

Database of LCI of timber species in woodlots, on-farms and plantation

LCA of timber species in woodlots, on-farms and plantation

Database of LCI of sawn wood by species, dimension and grade

LCA of sawn wood by species, dimension and grade

Database of LCI of value added wood products manufacturing by type and dimension

LCA of value added wood products manufacturing by type and dimension

Analytical information on relevant theories explaining quantity/ diversity and dynamics of environmental emissions and impact

A theory explaining the state and dynamics of environmental emissions and impacts of the wood industry

Simulation and forecast models for wood and wood products manufacturing sustainability Synthesis report of the research on LCI and LCA of lumber and value added wood products

Baseline information on the current green competitiveness of Ethiopian wood industry Sufficient awareness on benefit of certification as marketing tool and as evidenced by establishment of competitiveness club or clubs

Manuals and guidelines for self/external certification of competitiveness

Time-series information on green competitiveness of the Ethiopian wood industry Green competitive wood industry cluster/network

Mechanism for time series follow up and investigation of post certification performance of the wood industry

Grand and final synthesis report of the of the mega research project on green competitiveness of Ethiopian wood industry

A final report on synthesis of the research activities

Duration: Five years (2005-2009E.C.)

Duration Implem enting Component Activity From То centers Locations Persons responsible --_

Table 28. Activities under the project appraisal, Measurement, Evaluation and Improvement of Productivity and Efficiency of Green Manufacturing in Ethiopian Wood Industries

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Project 5: A maximum utilization of biomass: Bio-fuel production and spent utilization from selected tree species grown in Ethiopia

Coordinating center: FRC

Project coordinator: Dr. Sisay Feleke **Implementing centers:** FRC/FPURC, Holetta, Afar, Borena, Dhedesa and Masha

General objective: To evaluate the Biofuel (Ethanol), compacted charcoal quality, possibility of mushroom cultivation on Ethanol spent and charcoal condensate as wood preservation material from *Arundinaria alpinia*, *Oxytenanthera abyssinica*, *Prosopis juliflora*, *Acacia melifera* and *Acacia drepanolobium*

Specific objectives:

To test suitability of the species for ethanol production

To test the quality of briquette from the selected species charcoal fines and urban waste

To test the suitability of ethanol production spent substrate for cultivation of edible mushrooms.

To evaluate the pyrolyse condensate as a control remedy of subterranean termites

Expected outputs:

The output of this activity is selecting suitable substrate in Ethanol production by fermenting from lignocellulosic materials and secondly the best age of bamboo for Ethanol production will be identified.

The output of the result will be an identified method of small and fine particles of charcoal compacting method and the suitable organic binder.

The output of the result will be an appropriate method of mushroom cultivation on Ethanol production residues.

The output of the result will indicate the suitability of charcoal gaseous condensate in wood preservation.

Duration: Five years (2013 - 2018)

	Dura	tion	Implementin		Persons
Activity	From	10	g centers	Locations	responsible
	Activity	Activity From Activity From	Activity From To Image: Activity Image: Activity Image: Activity Image: Activity Image: Activity	Activity From To g centers Implementin Implementin g centers Implementin Implementin Implementin Im	Activity From To g centers Locations Implementing Implementing Implementing Implementing Implementing Implementing I

Table 29. Activities under the project a maximum utilization of biomass: Bio-fuel production and spent utilization from selected tree species grown in Ethiopia

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Project 6: Production and Characterization of Microbial Enzymes to enhance the Delignification of wood chips

Coordinating center: FRC Project coordinator: Dr. Melaku Alemu Implementing centers: HARC, FRC/WURC

General objective: To produce and characterize enzymes from white rot fungi that improves the delignification of wood chips and reduces the chemical and energy consumption

Specific objectives:

To isolate and characterize microbial enzymes such as cellulases, xylanases, laccases and other lignolytic enzymes [lignin peroxidase (ligninase, LiP), manganese peroxidase (MnP), H_2O_2 -producing enzyme Glyoxal oxidase (GLOX) and versatile peroxidases (VPs)] that are capable of degrading fibers, cellulose, hemicellulose and lignin components wood

To identify and characterize the white-rot-fungi that produce the cellulosic and lignolytic enzymes based on cultural, physiological, biochemical and molecular methods

To evaluate the potential of these enzymes in improving and enhancing the delignification of wood chips and compare the advantages as compared to the conventional processes

To produce these enzymes in large scale and augment some of the thermochemical treatments and mechanical processing employed in delignification of wood chips.

Expected outputs:

The potential of white rot fungi to produce various cellulosic and lignolytic enzymes will be determined and characterized

Cellulosic and lignolytic enzymes and producer fungal isolates will be made available at WURC to augment the delignification of wood chips that used to employ thermochemical treatments and mechanical processes

Duration: Three years (2005-2007E.C)

		Dura	ation	Implementing		
Component	Activity	From	То	centers	Locations	Persons responsible
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	-					

Table 30. Activities under the project production and Characterization of Microbial Enzymes to enhance the Delignification of wood chips

Project 7: Characterizing fiber from Potential Eucalyptus and Bamboo Species for industrial application

Coordinating center: FRC

Project coordinator: Daniel Gebeyehu

Implementing centers: Entoto, Debretabor, and Arsi-negele, *Eucalyptus camaldulensis* from Gimbi, Kinbaba (behardarzuria) and Welayita, *Eucalyptus grandis* from Gimbi, Arsi-negele and Adolla whereas *Eucalyptus saligna* from Gimbi, Arsi-negele, and Adolla

General objective: Maximizing utilization of alternative raw materials forwood industries, and as well as substitution of imports

Specific objectives:

To characterize the designated anatomical and chemical properties of selected tree and bamboo species at different site, age, tree and culm height

To investigate the suitability of selected tree and bamboo species for different industrial application

Expected outputs:

The fiber anatomical properties of selected tree and bamboo species at different site, age, tree and culm height will be known

The suitability of selected wood and bamboo species for different industrial application will be known

The selected chemical properties of the designated tree and bamboo species at different site, age, tree and culm height will be known

The suitability of the selected wood and bamboo species for different industrial application will be known

Duration: Five years (2006-2010E.C)

Table 31. Activities under the project production and Characterization of Microbial Enzymes to enhance the Delignification of wood chips

		Duration		Implementing		
Component	Activity	From	То	centers	Locations	Persons responsible
	yushinia					
	alpine					