Conducting socio-economic Field Schools with local communities and students

*A Field School guideline with experiences from the
WoodCluster project in East Africa*

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Summary

Based on Socio-economic Field Laboratory concept, we put forward the need to amplify locally-embedded innovation to address nationwide challenges. The WoodCluster project (2017-2021) aimed to seek solutions to close the national wood supply gap based on farm-wood production in East African countries. Towards achieving the objective, one of the project activities is the implementation of Field School. A field school is understood as a practical element of a thematic study course module, supplementing theoretical teaching. It shall provide the opportunity for students to learn and test research methods in a practical manner and get in contact with the local community to exchange knowledge. It serves as a framework that requires adaptation to the local research demand and context, with its cultural, socio-economic, and environmental features. Two field schools within the framework of the project were conducted in Tanzania in 2018 and in Ethiopia in 2019. The focus of the field school was on local-level wood production from smallholder farmers and market dynamics, but the guideline can be adapted to other thematic areas. Based on the experiences within the WoodCluster project in East Africa, this guideline elaborates the theoretical fundamentals, steps, methods, and examples in conducting socio-economic field schools with local communities and graduate students.

1. Introduction

1.1 Justification: Why a Field School and a Guideline?

A **field school**, as defined and promoted in this guideline, is a **practical element of a thematic study course module**, supplementing theoretical teaching. It shall provide the opportunity for students to learn and test research methods in a practical manner and get in contact with the local community to exchange knowledge. It is not intended that students teach farmers but enable social learning between them.

Students gain technical as well as social skills and competences. Using theoretical knowledge learned in class and study site related information, they prepare and conduct field research in groups in a local setting. They learn how to interact with their study fellows as well as with local actors. They analyze their findings for conclusion, and are challenged to communicate them to the local community and discuss with them.

The field school can only be conducted and successful with the **consent of the local community**, which requires their motivation with a purpose and benefits for them, as well as trust. Acquiring new tools or getting hands-on support in their activities can be direct benefits. Gaining expertise to improve activities or solving problems as well as building relationships with a higher learning institution are possible long-term motives.

This field school guideline builds on the knowledge and experiences of the WoodCluster project (see chapter 1.2), but can be applied to other thematic areas. It serves as a framework that requires adaptation to the local research demand and context, with its cultural, socio-economic, and environmental features.

This **guideline** shall provide for higher learning teachers and development practitioners a **fundament for designing, planning and conducting practical exercises and empirical research** units with students and local community on the ground. It starts with a theoretical discourse on constructivist and action research approaches in human-ecosystem interactions (chapter 2). For the practical part, the planning phase highlights relevant preparation aspects (chapter 3). The implementation phase (chapter 4) introduces exemplary student exercises and the involvement of the community to play an active role. Boxes in the chapters 3 to 5 give exemplary insights on the implementation in the WoodCluster project.

1.2 Background of the WoodCluster project

The WoodCluster project (2017-2021) focused on national bio-economies based on farm wood production in East African Countries. It investigates the dynamics and resulting problems of an increasing wood supply gap. The project consortium is a South-South-North network with partners from Ethiopia, Tanzania, Uganda and Germany. Teaching concepts and material for the MSc module on "Wood based bio-economy" was developed, with a theoretical and practical part, namely the field school. During the project duration, two field schools have been conducted each in the project countries (Tanzania and Ethiopia), involving students, university instructors and local communities. The focus is on local-level wood production from smallholder farmers and market dynamics. Through this process, the field school concept has been tested and this guideline elaborated.

2. Theoretical fundamentals: Constructivist and action-oriented approaches in human-ecosystem interaction

2.1 Human-ecosystem interaction: the social-ecological co-evolution model as a framework

Increasing demands towards forests, their ongoing destruction and the time pressure to implement solutions call for new innovative approaches, which do not follow the conventional “linear” analytical concept of science. Innovative approaches need to involve a large number of actors, permit rapid action, combine research and development and thus need to follow an interdisciplinary approach.

Because of the above mentioned dynamics in the context of forestry and ecological conditions, a social-ecological model is applied to structure the research field (see Figure 1): The ecological conditions of forestry are changing directly by human actions (II), and indirectly by ecosystem responses like land degradation, biodiversity loss and climate change (I). As feedback, changes in the human system (III) are induced by the variation of demand patterns, destructive practices, competing land uses and related conflicts.

Fig. 1: The co-evolution model for developing countries. Spheres of action for future tropical forest management and rural development: (I) ecosystems, (II) forest and tree management systems, (III) social systems, (IV) formal and informal institutions (Pretzsch et al., 2014: 376).

The social-ecological co-evolution model combines two systems, with each of them is characterized by complexity and dynamics. An interdisciplinary approach is recommended for handling this complexity and dynamics in research. By this the diversity in the studied systems is mirrored in the diversity of sectors and disciplines of the research team which is conducting the study. Especially a joint research of natural and social scientists is a good base for understanding the complex interactions of the social-ecological co-evolution model.

2.2 A constructivist perspective: development, action and sustainability

The term ‘constructivism’ refers to the idea that learners or actors “construct knowledge for themselves - each learner [or actor] individually [...] as he or she learns” (Hein 2018: 1). Therefore, knowledge is never independent, it depends on the meaning attributed to experience by the learner/actor (ibid.). Relevance and benefit of a constructivist approach have been visible in the field of rural development and extension, where the transfer of technology approach has largely failed and has been replaced by participative learning approaches (Hoffmann et al. 2009). Generally, it is assumed that the scientist delivers just a solution for a problem, but in fact, the scientist is always part of the problem reality. It is thus very important to practice research steps with a maximum of transparency and inter-subjectively comprehensive.

Abundant knowledge has been accumulated in the different fields of forest sciences. Beside the typical reductionist scientific knowledge, more insights in processes of decision-making and politics permit a broadening of understanding. Much of the available knowledge is not applied in practice. This is due to a far-reaching differentiation between formal scientific research which is determined by an exogenous research agenda, which often follows fashions. On the other hand, the local situation is characterized by endogenous, often very complex land use processes, which are determined by powerful driving forces. In the present situation of rapid change in forestry and the respective context situation, the generation of new knowledge and its accumulation is necessary, but this will not per se initiate the necessary change towards the sustainable use of forests. Often, the knowledge is not used in an adequate way to have an influence on practice. Following the needs for a rapid intervention for change and taking into account scientific as well as local knowledge, a constructivist approach facilitates action orientation.

The constructivist research approach has led to the elaboration, testing and further application of the complex research instrument presented: ‘Socio-Economic Field Laboratories’ (SFL).

2.3 Action Research and Social Learning

Action research became part and parcel of applied research designs, especially where a group of non-academic actors are systematically researching for solutions and insights by themselves in an emancipatory self-understanding. The term “action research” was coined by Kurt Lewin (1946: 35):

“The research needed for social practice can best be characterized as research for social management or social engineering. It is a type of action-research, a comparative research on the conditions and effects of various forms of social action, and research leading to social action. Research that produces nothing but books will not suffice. This by no means implies that the research needed is in any aspect less scientific or “lower” than what would be required for pure science in the field of social events. I am inclined to hold the opposite to be true.”

Usually, there are no theories and concepts for the particular situation of the people in place or accessible, therefore the action is based on learning from trial and error, organized in the ongoing loops of adaptive management (Fig. 2).

Fig. 2: Learning loops in action research (under use of O'Leary, 2004: 342, Koshy et al., 2011: 8)

The Social Learning Approach represents a philosophy which is focusing on an actor-oriented, participatory processes of social change where social processes are accepted as non-linear and non-deterministic as well as systemic (Rist et al. 2006: 220). It highlights the role of learning in emancipatory action research, as “action research thus recognises that solutions to ‘real-world problems’ can only be developed on the basis of an integration of scientific and non-scientific forms of knowledge” (ibid.). The integration diverse knowledge sources (scientific and non-scientific) is a core element of Socio-economic field laboratories for the local level. While scientific knowledge can be characterized as general, rather theory based and encouraged by external scientists, the non-scientific knowledge is rather experience based, time and case specific and advocated for by local actors. Both complement each other in the social learning process, and both groups, the scientists and local actors, interact and learn mutually and develop in a synergetic process new knowledge and innovations.

Social learning is understood as changes in knowledge, which lead to long-lasting changes in behaviour and/or to the capacity to behave in a particular way (Siebenhüner 2002: 421, Dedeurwaerdere 2009: 197). Social learning taking place in groups, it is leading to a level of learning, creation of knowledge and changes of procedures, structures, shared beliefs on top of the individual members’ learning, which is referred to “organizational learning” (Argyris and Schön 1996, cited in Dedeurwaerdere 2009: 197, GIZ 2015:19 ff.).

3. Planning phase: What has to be done?

3.1 Study site selection and needs assessment

The selection of the study site and a suitable village requires the consideration of thematic and practical criteria.

Thematically, the selected site needs to be appropriate for the relevant learning objectives of the study course. A concise baseline study prior to the field school activity is recommended to derive detailed information about the study site and its suitability for the thematic learning objectives. This pre-study should cover environmental and socio-economic characteristics and thematic relevant information. A

household survey and key informant interviews with the village leaders and administration are potential tools. Through this activity, key actors and their contact details can be already captured and documented.

The purpose and intention for the field school activity shall be presented to the hosting community, and the community's expectations and needs have to be listened to and assessed for its feasibility. A negotiation process to reach a win-win situation for the students and community is desired. Formulated needs of the community can be met through hands-on support in the communal area (i.e. planting, constructing, silvicultural practices) appropriate to the season. Furthermore, needed or new material and tools can be provided in line with the culture and livelihood activities. Knowledge sharing and handing over the documentation of the field school outcome in an appropriate form is another option. Each option needs to be prepared for.

Practicality, the following aspects need to be considered and checked:

- Location of the site to be accessible in distance and infrastructure
- Season with specific climatic conditions and livelihood activities (accessibility of area and people)
- Legal aspects on ownership for acquiring permissions (who owns and manages the targeted site)
- Safety of all participants (students, community)
- Ethical and cultural aspects (social norms, traditions, festivities)
- Willingness and confirmation of the community to collaborate (permits, letter of agreement)

An essential element for a mutual understanding and trustful relationship is an agreement, in the best case in written form, which allows students to conduct research and state the community's readiness to cooperate.

Example WoodCluster

The study sites in Ethiopia, Tanzania and Uganda have been selected according to the criteria of being a production area of wood at small-scale farms and market locations nearby. The baseline study collected data, besides general environmental and socio-economic characteristics, particularly on the situation of small-scale farmers regarding, land use, land rights, wood production and markets. The location of the study site is close to the University and towns (max. 3 hrs by road) proved to be optimal to ensure the accessibility and hosting facilities for a group excursion. The local authorities at district and village level were approached at first to introduce the universities and intended activity.

Meeting with the village leader in Igowole, Mufindi district, Iringa, Tanzania (©TUD)

3.2 Resources and specifications for overall organization and students' group work

Conducting a field school requires an intensive preparation phase to organize materials, logistics, and coordinate responsibilities. The following checklist provides an overview of essential resources and processes. Different study sites and thematic fields might require adjustments and additional points.

Program	Determining time and activities of field school (fieldwork, excursions) in a detailed daily plan.
Logistics	Arranging accommodation for students and staff, vehicles (bus, small vehicle for organizational trips), catering.
Equipment	Technical equipment and tools for conducting field work and potential joint activities with the community.
Budget	To cover transport, accommodation, food, material, stationary, compensation for coordination and administrative expenses.
Contacts	Compile contact list and identify key contact persons.
Facilitation of group exercises	Allocation experts from the university or affiliated institutions as thematic group supervisors with the task of designing and supervising the students' exercise. Engagement of translators and field assistants based on certain criteria (e.g. personality, hardworking, able to work under unfavorable weather conditions; knowledge of local language, customary laws, culture, local farming practices and farm conditions; education level and honesty)
Code of Conduct	Prepare checklist for Do's and Don'ts with respect to local culture
Excursion Guide	Compiling folder for each student with necessary information on detailed program, information on study site, literature, code of conduct, etc.

Participation in a field school is compulsory for all students that subscribed to the theoretical course. Why and how it will be conducted is explained to the students.

The students receive information on the concrete study site (e.g. location, season/agro-ecological characteristics, socio-economic snapshot, technical issues on transportation) as well as on the thematic groups and supervisors. The students are distributed to the thematic groups according to their choice or following certain criteria. The concrete group exercise description and further group specific reading material shall be provided to the specific groups. Besides the research topic related information, the students are instructed on the program, the code of conduct, the individual preparation (e.g. clothes, equipment).

Example WoodCluster

Reconnaissance trips to the study villages have been conducted in all countries where field schools were carried out. Officials and community leaders have been informed. Accommodation and other logistics were also arranged during these trips. The program as well as the budget were set up 4 to 5 months before and continuously developed and adjusted.

The students chose a group according to their interests but with keeping a balance of gender and number in the groups. In the beginning of the activity, the student received a field school folder containing the following:

- *Daily program*
- *Photos of all participants incl. their names, responsibilities and contact details*
- *Information on the country (as students from 4 countries participated) and the study site*
- *Code of conduct and travel/field work advices*
- *Information on group exercises*

International students conceptualize their task and fieldwork in their selected group (©TUD)

4. Implementation phase: How to do?

4.1 Overall program

The field school program consists of different elements and phases, which are listed with their suggested duration in the following table. The order is not fully chronological as excursions and joint activities with the community can take place between the field work days.

Field school elements	Suggested days
Introduction visit at community site and talk with community leaders	0,5
Preparation of the field work instrument and testing	0,5 – 1,5
Actual field work	2 - 3
Analyzing data, preparing findings and presenting within the team	1
Presentation and discussion with community	0,5
Joint activity with the community	0,5 - 1
Excursion	1 - 2

Excursion in and around the study area enables the group to get a wider perspective beyond the study topic. A joint activity with the community is seen at one hand as appreciation for the community's participation but at the other hand as a social learning event for students and farmers.

The duration of the field and excursion phase is around one week, whereby the duration varies depending on, e.g.:

- time needed for conceptualizing within the group if not done, before at university;
- the number of groups for presentation time;
- distance and travel to the study area;
- potential excursion places and accessibility.

Example WoodCluster

The field schools were 7 to 10 days long, However, here, students and staff came from different countries and universities so that time was needed to get to know each other and the respective country's characteristics for the wood sector. The field and excursion phase were 5 to 6 days. Two excursions to relevant sites were scheduled for each field school. The whole team visited large-scale plantations and large-scale wood processing enterprises to understand their functionality and be able to compare it with the small-scale sector. Furthermore, trips to wood markets and agroforestry farming systems were arranged.

Visiting the biggest saw mill enterprise in Mufindi District, Iringa Region, Tanzania (©TUD)

As contribution to the community and appreciating the farmers participation in Tanzania, the field school team brought different saws for pruning. In a joint activity, the farmers presented at first their traditional method of pruning with a Panga. Afterwards the students and farmers tried the brought saw and did pruning jointly in a woodlot. The tools remained in the village, and were handed over to the village leaders.

Farmers and students pruning with new saws in Igowole, Mufindi district, Iringa, Tanzania (©TUD)

4.2 Student research group work

The group research work enables students to apply and train technical knowledge in a real setting. Additionally, the activity strengthens the students' social competence in working teams and with the community. Experts from university or other institutions guide and supervise the students. The supervisor is recommended to accompany the group for at least the first day of empirical data collection. If needed, field assistants and translators are integrated in the data collection. The data analysis and presentation preparation happen parallel and after finalizing the data collection. The presentations are prepared already in the form of how they shall be presented to the community, but are at first presented to the field school team of students and staff for feedback and evaluation. Time for revision is essential.

Example WoodCluster

The three thematic groups exercises were: (1) farm mapping, (2) woodlot inventory, (3) value chain and market analysis. Under the guidance of respective experts, the intercultural student groups conceptualized their fieldwork. The students had two days of data collection in the village and nearby towns. Within one day, the data was analyzed and prepared for presentation to the team. (WoodCluster student group tasks and material are available in chapter 8 Appendix)

Students interviewing small-scale farmers about wood production and marketing Chefasine Kebele, Sidama Zone, Ethiopia (©TUD)

The woodlot inventory group measuring the trees' height and volume in farmers' woodlots

Students analyzing their data and preparing their findings for presentation (©TUD)

Presentation the outcome at first to the student colleagues and academic staff and experts (©TUD)

4.3 Engaging and communicating results to local communities

As part of the field school, engaging and communicating results to the local community is of paramount importance to maintain trust and build ownership among the local community. Action research entails active participation of the target group at every stage of the development process. Communicating with local communities comes with multiple challenges, which are associated with language barrier, literacy, social and cultural contexts (Del Castello and Braun 2006). Selecting the kind of information to be conveyed and the modes used for communication is important (Hoffmann 2000). The overview of communication modes and their constituencies is presented in the following (ibid: 49).

Modes of communication	Modes of expression	Codes	Signs
Verbal	Poetry, prose	Writing systems Spoken languages	Written signs Phonetic signs
Facial, gestural	Mime, dance	Facial expression Body language	Facial signs Gestural signs
Pictorial	Graphic art, painting, sculpture, photography, film	Picture languages	Pictorial signs
Musical	Song, dance music, symphony, sonata	Note system	Musical signs

Pictorial mode of communication is utilized to complement spoken or written language (Hoffmann 2000). Pictures are drawn in the simplest form and depicting objects familiar to the target audience. The time required to create such posters in a group work is not to be underestimated, as it can take a few hours. The use of posters alone is complemented with the use of verbal communication to convey the messages to the target group.

For the community meeting to present and discuss the results, local traditions and rules must be respected, e.g. the following:

- Venue in the village area, selected by the community leader and members, enables ownership and transparency and is short distance for the community participants
- Sitting arrangement according to cultural rules and norms (e.g. gender, hierarchies, interviewed farmers in front)
- Arrangement of translation in local language to be ensured, time for translation to be calculated

At the beginning of the presentations, the students introduce themselves and express gratitude for the cooperation of the interviewed farmers and the opportunity to learn from the farmers. The messages conveyed by the students are kept simple and are explained with the poster. Students may end the presentation with some recommendations of how farmers can improve their situation. Generous time is allocated for feedback and questions from the community. To initiate the discussion potential questions could be, e.g. “What do you think about our recommendation?”, “Could it work in your case?”, “Why or why not?”, “What do you think is needed to implement the recommendation?”.

At the end, it will be agreed, if the posters from the students are handed over to the village leaders or interviewed community members. Pictures of the posters are taken for documentation.

Example WoodCluster

The field school in Ethiopia took place in the late morning, after people finished their first daily tasks. Snacks and drinks were provided by the field school team. The meeting took place in the yard of the village office under a tree, where official community meetings typically take place. The audience comprised of the interviewed farmers, the village officials and interested villagers. Student participants spoke in English, which was interpreted to Amharic (Ethiopian national language) by a staff member of the partner university, and interpreted to Sidamo (the local language) by one of the local community members. This two-step interpretation was time-consuming and entailed the risk of misinterpretation, but at the same time was inevitable and essential for the interaction and knowledge exchange.

Meeting under the shade of a *Podocarpus* tree, where official community meetings typically take place (©TUD)

Students presenting their drawn posters to the community joined by the translators (©TUD)

Students used a pictorial mode of posters presentation, enabling an inclusive way of communicating results. For the students, it took partly up to six hours to draw the posters suitable for the community presentation. After the end of the presentation, it was agreed that the posters were to be displayed in the agricultural extension office of the village administration office. Another option considered was to give the posters to the interviewed farmers themselves.

The poster on value chain analysis shows everyday objects familiar to the community, such as the hut, a person holding an axe and a gari (donkey cart) to illustrate the pathway of wood products from smallholders' farms to the market. (©TUD)

The poster of the farm mapping exercise is equipped with pictorial signs of the mapped crops, such as maize, coffee, enset (false banana), and khat. (©TUD)

5. Post-field school phase: Reporting & Evaluation

A post-field school evaluation phase is essential in order to capture the knowledge and findings and continuously improve the field school program in the future.

Besides the active empirical work, the students submit a concise **group research report** on their objectives, methods, results and conclusion. Optionally, each student can be assigned to submit an individual self-reflecting diary from the field school summarizing key insights and experiences gained as well as critical reflections of each day (topic, group performance, community interaction, organization). The supervisors evaluate the written work together with the level of active participation during the fieldwork to formulate the final grade for the practical module.

An **evaluation** of the activity itself, from the planning up to the implementation stage, can be done in various ways, such as by self-evaluation through the group itself or an independent external entity. Self-evaluation is a low cost opportunity capturing the subjective experiences of the participants, but lacks impartiality.

The SWOT matrix (strengths, weaknesses, opportunities and threats) is a basic tool for situational analysis and strategic planning. Strengths and weaknesses are internal factors and characteristics of the field school, whereas opportunities and threats (or challenges) refer to external conditions affecting the field school situation. The elaborated elements may shed light on how to utilize the strengths to improve weaknesses, and how to make use of the opportunities to anticipate for possible future threats or challenges. The following table shows recommended criteria for the SWOT analysis to undertake self-evaluation among student participants and the team members.

Strengths What do we do well?	Weaknesses What could we improve?
Opportunities What opportunities could you take advantage of?	Threats What threats could harm you?

	Students	Staff
Internal criteria	- Preparatory workshop	- Timing
	- Timing	- Capital & budget
<i>Strengths - Weaknesses</i>	- Guide book	- Tasks distribution
	- Content & relevance of practical course	- Student motivation & engagement
	- group work performance	

External criteria	- Cooperation with study village
	- Engagement of target group
	- Gender balance & empowerment
<i>Opportunities - Threats</i>	- Interpreter/ translator
	- Accommodation during Field School
	- Catering services
	- Transportation/mobility
	- Weather
	- Political situation

In the logic of the project cycle, the evaluation phase can be considered as a starting point for a new strategic planning process for research topics and methodological approaches in future field schools.

Example WoodCluster

On the last day of the Field School, we self-evaluated our experiences and brainstormed the strengths, weaknesses, opportunities and threats (SWOT) from the planning up to the implementation stages. This was done in two main groups, the student participants and the project staff. Afterwards, each group presented the outcomes leading to a final discussion. The outcomes of the SWOT analysis and discussion were taken up to further develop the following field schools regarding organization, thematic and methodological matters and the documentation for this Field School guideline.

International students and staff from three countries at Wondo Genet College of Forestry and Natural Resources, Ethiopia (©TUD)

6. Further reading

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8. Appendix: WoodCluster student group tasks and materials

8.1 Farm mapping

Elaborated by: Dr. Fritz Haubold, TU Dresden

Objectives:	1. Analysis/comparison of 2-3 farms from ecological and economic perspectives 2. Classifying the farm in terms of cropping systems.
Expected Output	Map of the farm's cropping system.

Relevant terms

Cropping system refers to the crops and crop sequences and the management techniques used on a particular field over a period of years. Crop rotation is a primary aspect of cropping systems.

Examples of cropping systems	Explanation
Monoculture or Monocropping	Growing only one crop on the land in a given crop season. Often used to refer to growing the same crop year after year in the same field. Better described as <u>continuous cropping</u> , or <u>continuous monocropping</u> . Important to know it sometimes is called monoculture even if this single crop species is replaced by a different crop in the next growing season.
Intercropping	Presence of two or more crops in the same field at the same time, planted in an arrangement that results in the crops competing with one another.
Mixed cropping	Growing two or more crops simultaneously in the same field without rows.
Multiple cropping	Practice of growing more than one crop on the same land in one year. It involves several alternative patterns of crop arrangement in space and time such as mixed cropping, intercropping, sequential cropping, double cropping, triple cropping, etc.
Sequential cropping or Double-cropping	Growing two or more crops in a sequence, planting succeeding crop after the harvesting of the previous one.
Strip cropping	Growing two or more crops simultaneously in different strips widely enough to permit independent cultivation but sufficiently narrow for the crops to interact agronomically.

Glossary taken from: Sustainable dryland cropping in relation to soil productivity - FAO soils bulletin 72

Methods and guiding questions

- a) Draw a sketch map of the farm including land use. For the measurements of the distances apply a measuring tape and/or stick.

- b) Classify each field of the farm according to its cropping system such as the above-mentioned examples.

- c) Attach to each field the respective species of a crop clearly indicating the source of the seeds/seedlings.

- d) Arrange the farm's patterns of crop rotation in time according to the following figure.

8.2 Woodlot inventory:

Elaborated by: Manuel Göbel, TU Dresden

Objectives:	<ol style="list-style-type: none"> 1. Determine size and shape of woodlots 2. Assess tree parameters like DBH and height 3. Calculation of standing stock 4. Determine present value of woodlot (after market analysis)
Expected Output	Size and present value of the woodlot

Relevant terms

Variable	Values/ units	Definition of value	How to measure/determine
Diameter	DBH, d _{1,3} [cm]	Diameter of tree at breast height (1.3 meters)	Caliper Circumference tape (d = π/c)
Tree height	H [m]	Measuring tree height based on trigonometric principles	- digital hypsometer - angle measurement
Form factor	f	Form factors indicate the ratio of the true volume of the tree to the content of a reference roll.	<i>Eucalyptus globulus</i> : 0,402 (Uhlig 1989, Ethiopia) <i>E. camaldulensis</i> : 0,62 (Mandal et al. 2013, Nepal) <i>E. camaludensis</i> : 0,613 (Mushaka 1998, Zimbabwe) <i>E. grandis</i> : 0,397 (old stands) – 0,42 (young stands) (Alder et al. 2003, Uganda)
Shaft quality	Normal	Can be used as post, pole, stick etc.	Visual assessment
	Poor	Twisted, bowed, forked etc., hardly useful for poles	
	Superior	Straight, no big branches, not twisted, full form, potential for high quality saw log	
Health	Shaft damaged	Mechanically or by pest	
	Sick	Crown infected by pest	

Methods and guiding questions

<p>a) Interview of farmer / household head</p>	<ul style="list-style-type: none"> • Age of stand • Tree species • intended use of harvested wood (poles, firewood)
<p>b) Sample design</p>	<ul style="list-style-type: none"> • determine shape and size of woodlot • if necessary, set sample plots (see field sheet)
<p>c) Measurement in the stand</p>	<ul style="list-style-type: none"> • Counting of stem number in woodlot / sample plot • Measurement of stem diameter at breast height ($d_{1,3}$) <div data-bbox="654 667 1328 1115"> </div> <p>Definition of the diameter at breast height ($d_{1,3}$) (Kramer & Akca 2008)</p> <ul style="list-style-type: none"> • Measurement of tree height (h) according to trigonometric principle <div data-bbox="646 1297 1122 1577"> </div> <p>Trigonometric tree height determination (Kramer & Akca 2008)</p> <p>Trigonometric principle: $\tan(x) = a/b$</p> <div data-bbox="605 1692 1073 1864"> </div>

d) Calculations	<ul style="list-style-type: none"> Volume of single tree: $v = \frac{\pi}{4} * (d_{1,3})^2 * h * f$ Basal area of single tree: $g = \frac{\pi}{4} * (d_{1,3})^2$ Basal area of the woodlot: $G = \sum_{k=1}^n g$ Standing stock of the woodlot: $V = G * f * H$
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Sample plots

Shape	Complete inventory	Sampling	Sample plot (SP) size	Spatial layout of SP
Plot (planting dist. $\geq$ 0.4 m)	$\leq$ 10m length AND $\leq$ 10m width	$>$ 10m length AND $>$ 10m width	Radius = 3.0 m	Grid, starting in the N-corner, in a line diagonal to the SE-corner
Plot-dense (planting dist. $<$ 0.4 m)	$\leq$ 3m length AND $\leq$ 3m width	$>$ 3m length AND $>$ 3m width	Radius = 1.0 m	
Belt (planting dist. $\geq$ 0.4 m)	$\leq$ 5m length	$>$ 6m length	Sections of 3m	Distance between sections: 5m, last sample plot has to be shifted to the stand.
Belt-dense (planting dist. $<$ 0.4 m)	$\leq$ 3m length	$>$ 3m length	Sections of 1m	Distance between sections: 2m, last sample plot has to be shifted to the stand
Single-line	$\leq$ 50m length	$>$ 50m length	Sections of 10m	Distance between sections: 10m, last sample plot has to be shifted to the stand.
Multi-line	$\leq$ 20m length	$>$ 20m length	Sections of 10m	Distance between sections: 10m, last sample plot has to be shifted to the stand.
Single-tree	all			

Field Sheet template for woodlot inventory

Village _____ Lat _____ Lon _____
 Woodlot area _____ Plot size _____ Est. year _____
 Processors: _____
 Production target: ☐ firewood ☐ poles | ☐ sale ☐ personal use

Tree	DBH [cm]	Tree height [m]	Branch H Dead (m)	Branch H Living (m)	Shaft quality	Observations
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
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31						
32						
33						
34						

8.3 Value chain and market analysis

Elaborated by: Kendisha S. Hintz and Maxi Domke, TU Dresden

Objectives:	<ol style="list-style-type: none">1. To diagnose the value chain of a selected wood product from the study village to the local market2. To conduct a market survey on costs, prices and actors involved in the eucalyptus value chain.
Expected Output	Value chain map of the selected wood product from tree growers in the study village to the local market.

Relevant terms

Value chain analysis: encompasses issues such as organization, coordination, power relation between actors, linkages and governance within the value chains. It is a descriptive and analytical approach for identification of opportunities for growth and development associated with certain commodities and services. (Alemu and Auch 2016)

Value chain mapping: often used to illustrate the relationship between the different stakeholders, the flow of products and values, and the services and business regulations that are critical for the functioning of the value chain. (Alemu and Auch 2016)

- A value chain can be seen as groups of independent actors (firms) and activities clustered in the different geographically dispersed nodes, or seen in a single enterprise where the different departments contribute to the production and marketing of a commodity (Kaplinsky 2000).
- Basic steps in a value chain:

- Value chain structures:
 - Vertical: the flow of products from the initial producer up to the last consumer
 - Horizontal: relationship between stakeholders in the same chain link, e.g. farmer to farmer.

Market analysis

- Market research aims to inform actors with the information needed to make informed business decisions about start-up, innovation, growth and the 4 Ps (Product, Price, Placement, Promotion).
- Market analysis focuses on the attractiveness and the dynamics of a market in order to identify the strengths, weaknesses, opportunities and threats (SWOT) of an enterprise.

Data collection

Basic data to be collected at each stage of the value chain (Alemu and Auch 2016)

Characteristics of the actors/firms	Market-related
Name and location (physical address and area of operation)	Demand and supply situations
Type of actor	Product procurement/ selling strategy
Major functions in the value chain	Markets for buying and selling
Firm size (number of workers/ family size)	Production costs and price (inputs, production costs)
Number of years in the business	Form of payment
	Market infrastructure (road, communication, marketplace)
Product characteristics	Intuitions, linkages and governance
Characteristics of the producer (type, varieties, and grades)	Type and level of support services
Production, post-harvest handling and processing activities performed	Formal and informal institutions governing access to resources
Type and value of inputs	Formal and informal institutions governing market access
Constraints and opportunities	Level of horizontal cooperation among actors
Risks and future prospects	Level of vertical integration, coordination
Willingness to upgrade	Legal requirements for in the business

Guiding interview questions (Source: Munuyee 2018)

Sub-group 1: Smallholder tree growers

Sampling strategy: Convenient sampling

Characteristics of the tree grower

- 1) Name: _____
Village & Sub-village: _____
- 2) How many plots of Eucalyptus woodlot do you have? What is the total size of your Eucalyptus woodlot? ____ ha.
- 3) How old is your existing Eucalyptus woodlot? ____ years.
- 4) How long have you been engaged in growing Eucalyptus trees? ____ years.
- 5) What is your motivation in growing Eucalyptus? ☐ Income generation; ☐ Future investment; ☐ Others

Product characteristics

- 6) What are the products you sell from your *Eucalyptus* woodlot? ☐ Pole (for fencing and construction); ☐ Fuelwood
- 7) What are the inputs used and the associated costs for your *Eucalyptus* woodlot?

Inputs Per ☐ season / ☐ year	Unit	Cost (ETB)
Fertilizer	Kg	
Pesticide	Liter	
Seedling	Number	
Seed	Kg	
Oxen	Number	
Land tax (per year)		
Others	Unit	

- 8) What are the management practices and the associated labor costs of your *Eucalyptus* woodlot?

Management practices	No of days	No of labor		Labor cost/day	Cost (ETB) per ha per year or season
		Family labor	Hired		
Site clearing					
Plowing					
Pit preparation					
Planting					
Watering					

Replanting					
Weeding					
Intermediate cutting					
Thinning					
Others					

9) In which form do you prefer to sell your *Eucalyptus* products?

Rank: 1 Most preferred; 2 Preferred; 3 Less preferred; 4 Not preferred)

Products	Pole	Fuelwood	Remark
Standing tree			
Felled tree			
Debranching			
Debarking			
Forwarding to landing			

Market-related information

10) Where do you sell your *Eucalyptus* products? (1 Farm gate; 2 Local market; 3 Others [specify])

Who is the buyer? (1 Consumers; 2 Middlemen; 3 Wholesalers; 4 Retailers; 5 Others [specify])

Product type	Place	Buyer	Why?
Pole			
Fuelwood			
Charcoal			
Others			

11) How is the payment mechanism arranged for your *Eucalyptus* products?

☐ In cash; ☐ In kind; ☐ Delayed payment; ☐ Bank transfer; ☐ Credit; ☐ Others, specify: _____

12) How is the price determined?

13) Do you have information on *Eucalyptus* price sold at ☐ other farm gate or ☐ the local market?

If yes, from whom? ☐ Friends or fellow tree growers/traders; ☐ From media; ☐ A direct visit to the market; ☐ Others, specify: _____

14) How do you know the buyer? Do they come to you or you contact them yourself?

15) Are you satisfied with the current price of your product? Yes ☐ No; If no, why?

Institutions, linkages and governance

16) Do you work together with fellow tree growers to complete tasks for your woodlot?

☐ Yes ☐ No; If yes, what kind of collaboration do you do with your fellow farmers?

- 17) Do you intend to collaborate with other farmers in Chefasine; if yes, with whom (*if they don't want to give names, ask for relationship types, e.g. neighbor*)?
- 18) What kind of support do you get from the government and other institutions during the process of growing your woodlot and selling the product?

Sub-group 2: Traders in a local market who purchase selected forest product from the local community

Characteristics of the trader

- 1) Name: _____ and location (address): _____
- 2) Which category of trader/commercial operator are you? ☐ Village merchant; ☐ City merchant; ☐ Company; ☐ Middlemen/broker; ☐ Agent for company
- 3) What kind of *Eucalyptus* products do you sell? ☐ Pole (for fencing and construction); ☐ Fuelwood; ☐ Splitted wood
- 4) How long have you been engaged in this activity? _____ years.

Product characteristics and market-related information

- 5) Where do you purchase your *Eucalyptus* products and what is the distance between producer's location and your marketplace? ☐ At the production site (farm gate), distance _____ km; ☐ At a local market, distance _____ km; ☐ Landing area, distance _____ km; ☐ Others, specify: _____, distance _____ km.
- 6) In which form do you purchase *Eucalyptus* products? ☐ Standing tree; ☐ Felled/processed; ☐ Fuelwood; ☐ Charcoal
- 7) What is the current purchasing price from producer? _____ ETB per ha or per tree
- 8) How many trees or how much volume of *Eucalyptus* products did you purchase in the last year? _____ tree or ha; or _____ volume
- 9) How is the purchasing price determined?
- 10) What factors are considered in setting up the price of *Eucalyptus* poles and fuelwood? ☐ Production costs; ☐ Transportation costs; ☐ Quality; ☐ Seasonality; ☐ Others
- 11) Where do you sell your *Eucalyptus* products?

Site	Products			Distance from landing (km)
	Pole	Fuelwood	Splitted wood	
Local market				
To regional market				
To export market				

Others, specify_____				
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12) What is the selling price currently and in the last 5 years? (in ETB per tree or per ha)

Selling price per unit of:	Year					
	2014	2015	2016	2017	2018	2019
Pole						
Fuelwood						
Splitted wood						
Others						

13) How is the price determined?

14) Do you add value-addition activities to increase your selling price? If yes, what kind of value addition?

15) What costs are associated with the purchasing and selling of Eucalyptus products in the last year?

Expenses	Unit	Unit costs (ETB)	Costs in one year (ETB)
Transportation ☐ Donkey cartload ☐ Vehicle	Per km		
Labor	Per man-day		
Tools	Per unit		
Storage (rent)	Per month		
Processing/value addition	Per year		
Tax and duties	Per year		
Security	Per year		
Others	Per year		

16) Please rank your primary sources to finance your business.

Sources	Revenues	Credit from bank	Credit from an organization	Mutual help	Others, specify:
Rank (1-5)					

17) What are the main challenges in your business?

Institutions, linkages and governance aspects

18) Do you have any collaboration with other traders in executing your trading business? ☐ Yes ☐ No; If yes, what kind of collaboration do you do with your fellow traders?

19) Do you intend to collaborate with other traders or other actors; if yes, with whom (*ask for actor types, e.g. trader, transporter*)?