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Rethinking Forestry and Natural Resources Higher Education in Ethiopia: An Education for Sustainable Development Perspective

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Abstract

This article reports on an action research project to reorient forestry and natural resources higher education in Ethiopia. The study used a combination of methods, including questionnaires and secondary information, to understand the existing higher-education system in Ethiopia. Based on the initial analysis, a workshop was held to deliberate the findings and to draw up guidelines for forestry and natural resources higher education that reflect education for sustainable development (ESD) approaches.

The results of the study show that the state of higher education with regard to forestry and natural resources has, in about half a century of such education, been influenced by several internal and external factors. It progressively evolved from endeavours dependent on foreign aid to a self-sufficient Ethiopian system. During this time, the structural distribution of graduates moved in emphasis from an earlier emphasis on the diploma to a BSc-level emphasis. Little progress has been made with regard to female graduates, student enrolment is limited and the desirability of forestry education has declined. Despite this, most of the 31 public universities in the country offer natural resources education. Curricula were found to be inadequate for the challenges of the times, as was the national demand for expert professionals. Existing epistemological foundation adheres to forestry as a commodity rather than as a social-ecological system influencing conceptual definitions of forest, forestry and forester.

Within an ESD perspective, forests are identified as social–ecological systems, forestry is seen as a sustainability science and a sustainable development sector, and the forester is viewed as a systems thinker and change agent. It is agreed that higher education relating to forestry and natural resources in Ethiopia requires guidelines that encompass a non-reductionist and comprehensive disciplinary base where synergy of multidisciplinary approaches is emphasised, as in ESD. The guidelines outlined indicate how to adapt higher education in respect of forestry and natural resources to changing societal needs in Ethiopia. The emerging guidelines also point to a reorientation of academic institutional foundations and leadership and to the need for a relevant epistemological framework to guide higher-education curricula on forestry and natural resources. The emerging guidelines further stress that higher education should engage more strongly with pertinent global and national issues.

Introduction

The importance of forests for sustainable development is increasingly being recognised, not only as a source of wood and timber, but also for carbon sequestration, as a source of renewable energy, for cultural and spiritual values, and recreation, among others (Morell, 2001; Neeff, Luepke & Schoeme, 2006; Dieter & Bernier, 2012; Sisay, Menale & Mungatana, 2009). Even

so, deforestation has not abated. The United Nations Environment Programme (UNEP, 2008) reports, for example, that deforestation is the most widespread environmental issue affecting the African continent.

A sound scientific base can play an invaluable role in the protection, as well as sustainable management and use, of forests (Rebugio, 1998; Werland, 2009; FAO, 2011). However, effective utilisation of this knowledge base requires 'strong' development and extension services. Worrying in this regard are reports that forestry education and extension are weakening and declining. Declining student enrolment, dwindling education quality, and compromised practical components are but some of the issues reported (Dourojeanni, 1986; El-Lakany, 2004; Temu, Chamshama, Kung'u, Kaboggoza, Chikamai & Kiwia, 2008; Hull, 2011). Such reports and associated cases of this phenomenon (Brown, 2003; El-Lakany, 2004; Green, 2006; IFSA, 2009) call for transformations in forestry education.

The current global context, however, provides for various global and national opportunities that can help to revitalise forestry education, such as the Millennium Development Goals (MDGs), climate protocols such as Kyoto, the scientific work of the Intergovernmental Panel on Climate Change (IPCC) and the establishment of the United Nations Forum on Forests (UNFF). Nationally, the environmental policy of Ethiopia integrates environmental education in all school curricula, at tertiary level, and in courses in sustainable resources and environmental management. One of the four pillars of the recently established Ethiopian Climate-Resilient Green Economy (CRGE) strategy is protecting and re-establishing forests for their economic and ecosystem services, including carbon stocks (FDRE, 2011).

Studies reporting the weakening of forestry education, such as that of Temu *et al.* (2008), invariably recommend the revitalisation of forestry education. Specific approaches suggested, however, are extremely varied. There is also a lack of baseline data on the meaning(s) of quality forestry education. In addition, analysing the problem through reviews of temporal change in terms of enrolment, desirability, quality and curriculum may indicate what has happened (i.e. reveal the trend) without necessarily disclosing the reasons for the trend (Harcharik, 1995; Innes, 2009). One of the critical issues that this article responds to is the range of diverse and 'unsettled' definitions of forestry, and the implications that this can have for science and curricula (Legilisho-Kiyiapi, 2004; Miller, 2004). Meanings of 'forest', 'forestry' and 'forester' ground the epistemology of forestry education on which curricula are formulated and evaluated (Morell, 2001; Neeff *et al.*, 2006; Orenius & Rekola, 2008). This furthermore helps to justify the relevance of forestry education in order to relieve it from the prevailing predicament of being seen as an undesirable discipline.

The relevance of forestry is furthermore confirmed by massive deforestation in recent years in Ethiopia and by contemporary national development initiatives (EFAP, 1994; WGCF-NR, 2003). Ethiopia is currently pursuing watershed-based rural development initiatives, including the construction of large-scale irrigation and hydroelectric dams (PASDEP, 2006; FDRE, 2010). This requires functioning upstream conservation schemes using forests. The urban areas, which are growing rapidly, also need forests to improve the human well-being of the urbanite by creating green spaces. Besides this, forests provide multiple ecosystem services for people living in rural areas.

In the past, the ideological stances and a sense of urgency created within the state apparatus and funding agencies pertaining to environmental problems led to top-down forestry management activities where local realities were effectively ignored (Hoben, 1995). As a result, forests have become a 'battleground' between dissatisfied local populations and the forestry departments. There was also unparalleled forest loss preceding the change in government in 1991 (Melaku, 2003). Part of the inconsistency and discontinuity in respect of the forestry sector is attributed to these situations. As a result, forestry as an economic sector lost its importance (Sisay *et al.*, 2009; Demel, 2002), which has also influenced education. Similarly, forestry education is confronted by a lack of strategic support, diminished organisational power, and declining rigour and relevance (WGCF-NR, 2003; MoE, 2008; HESC 2008).

Therefore, there is a need to examine the state of higher education in general and forestry education in particular in Ethiopia in order to establish a guideline that can help in the design of curricula relevant to the national need and global discourses (Negarit Gazeta, 2009). This article analyses the state of Ethiopian forestry education in line with the ESD perspective and proposes guidelines for revitalising forestry education by addressing epistemological and ontological foundations with regard to definition and curriculum guidelines. Specifically, it sketches the history and desirability of the existing curriculum.

Study Methods

The methods used for this study included a critical review of the system of higher education related to forestry and natural resources, with special emphasis on existing predicaments. This informed an action phase involving the development of guidelines for reorienting the system using a search conference method (O'Brien, 2001). One of the purposes of the search conference method was the participatory engagement of concerned bodies needing to develop a new strategy, direction and action. Three main steps were followed:

1. Exploring experiences of higher education in forestry and natural resources by reviewing published works with the expectation of identifying major issues;
2. Examining experiences from Ethiopia with regard to history, quality, desirability and curricula based on secondary information, interviews and reflections on the authors' lengthy experience of forestry and natural resources education; and
3. Holding a search conference of scholars and faculty members of the College to sketch guidelines with the potential for reorienting education.

The search conference was set up to engage four pertinent issues:

1. Employers' reports and concerns related to the decline of graduate competence (quality of education);
2. Loss of desirability of forestry education among students joining Ethiopian universities;
3. Emerging global and national opportunities that had brought forestry back into the limelight; and

4. The need for increasing the visibility of Wondo Genet College of Forestry and Natural Resources (WGCFNR) (a key forestry education centre for Ethiopia) as a centre of excellence where the academic programmes are rigorous and relevant.

Three groups were formed to deliberate on one issue each:

1. Adapting higher education in respect of forestry and natural resources to changing societal needs in Ethiopia;
2. Necessary academic institutional foundations and leadership for the future of forestry and natural resources education; and
3. Epistemological framework for higher-education curricula with regard to forestry and natural resources.

Each issue was subdivided into key discussion points and assigned measures of expected outcomes. In this regard, Issue 1 addressed:

- Possible links between landmark development programmes in Ethiopia (e.g. the Growth and Transformation Plan, and the Climate-Resilient Green Economy Strategy) and the forestry sector; hence forestry education;
- The required needs of occupational competence and knowledge mix relating to future foresters;
- Ways to address the dilemma of undergraduate education whether to produce subject specialists or generalists; and
- Effective forestry and natural resources-related outreach programmes that academic institutions can adopt.

The group was asked to deliver the following: strategic development–academic collaboration *modalities*; occupational competence and skills mix *guidelines*; subject specialist or generalist *measures*; and forestry outreach *standards*.

Issue 2 addressed:

- Establishing the need for centres of excellence for higher education in forestry and natural resources;
- Types of research/theses models needed that simultaneously fulfil the quality requirement and development relevance;
- Identifying strategic collaborative partners at national, regional and global level; and
- Working at achieving a balance between implementing new technologies and learning from indigenous knowledge.

The group was asked to deliver the following: centre-of-excellence *measures*; research/theses *guidelines*; relevant *principles* for identifying collaborative partners; and mainstreaming indigenous knowledge *standards*.

Issue 3 addressed:

- Outlining conceptual and operational definitions of 'forest', 'forestry' and 'forester' in the Ethiopian context;
- Defining guiding principles in respect of forestry and natural resources education in the context of sustainable development;
- Listing measures of rigour and relevance regarding higher education in forestry and natural resources in the context of changing societal demand; and
- Strategising proactive forestry and natural resources education in relation to emerging challenges and as a reaction to the ongoing strategies and development endeavours.

The group was asked to deliver the following: conceptual and operational *definitions*; academic and research strategy *guidelines*; rigour and relevance quality *standards*; and dynamic curricula-implementation modalities *measures*.

Conceptual Framework

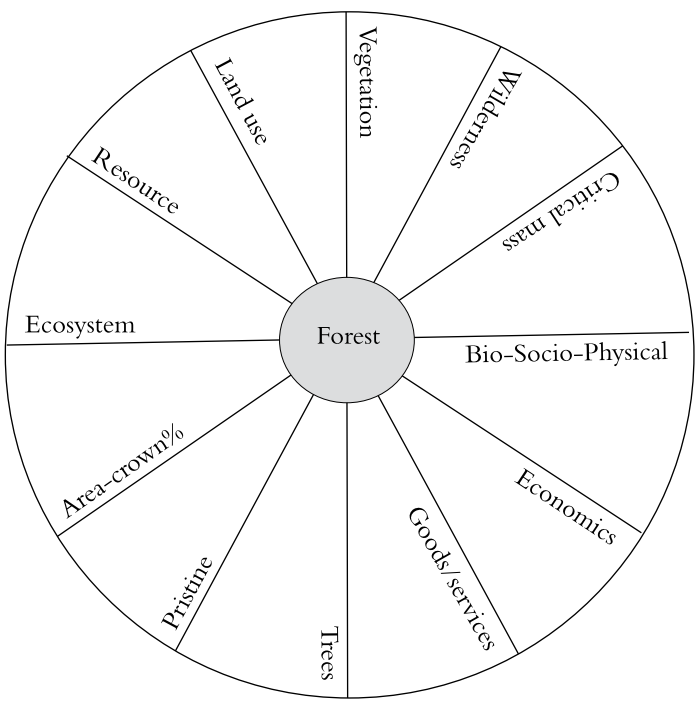
Achieving a sustainable way of life requires a change of mind and heart, as well as a new sense of global interdependence and universal responsibility (ECC, 1992). It also requires interdisciplinary and problem-solving approaches in education (Clark, 2010). Forests are unique natural resource systems that involve biophysical, socio-economic and governance concerns and have a strong link with sustainability, and are continuously evolving as we understand more about our socio-environmental system (Bagheri & Hjorth, 2007).

Sustainable development involves a synergy of several knowledge systems and complex conceptual constructions covering a diversity of perspectives provided for in sustainable economic thinking and/or sustainable sciences (Munasigghe, 1994, Clark & Dickson, 2003). Complementary to this, ESD (UNESCO, 2006) recognises the interdependence of environmental, social and economic perspectives and the dependence of humanity on a healthy biosphere. It seeks to reorient education towards the needs and components of sustainable development (SD) (SWEDESD, 2008). The working definition for ESD, as used in this study, is founded on social–ecological systems thinking (e.g. Holling & Gunderson, 2002), is centred on sustainable-development ideals (e.g. Clark, 2010), and embraces adaptive management (e.g. Folke, Hahn, Olsson & Norberg, 2005) within a transformative learning approach (e.g. Mezirow, 2003). It also includes the consideration of transdisciplinary/interdisciplinary/multidisciplinary approaches, adheres to higher-education rigour and relevance measures (e.g. McKeown, 2002; Mogensen & Schnack, 2010), and aims at producing professionals that are systems thinkers and change agents (e.g. Maguire, 2000). It has been strongly recommended that the need to embed ESD in curricula include different types of knowing that embrace value-based concerns and competence development (Willy, 2008). Equally important are the epistemological foundations of the curricula and course objectives viewed within a quality, relevance and social-change perspective (Bourgeault, Kuhlmann, Neiterman, & Wrede, 2008). Forestry education today requires a multidisciplinary foundation and a comprehensive approach (Brown, 2003) that

can weave the knowledge from existing disciplines into new concepts and methods so as to address the many facets of sustainable development, that is, from concept to actual practice. This is similar to what ESD promotes (Willy, 2008); hence ESD can potentially provide a useful conceptual framework to revitalise forestry education and address pertinent sustainable-development ideals.

The foundations of forestry education are determined by the way in which forests are defined. This influences the terms 'forestry' and 'forester', as well as the demand for sustainable development by the forestry sector. However, it is important to note that definitions and interpretations are always contentious, because meanings change over time (Evans, Carle & Del Lungo, 2009). Figure 1 shows that forests are holistic resources. In consequence, a comprehensive understanding of the value, goods and services that they render to society and the environment, as well as of their relevance to wider anthropogenic and natural landscapes and systems, is needed (Neeff *et al.*, 2006; EEA, 2007; FAO, 2005; Temu *et al.*, 2008). This will place the resource in a broader perspective with respect to purpose-goods/services in different temporal settings (the past, the present and the future), societal demands in respect of forests, and the ability to utilise forests wisely (UNFF, 2011). Such a contextual setting can establish forestry as a conceptual and scientific foundation for forestry education.

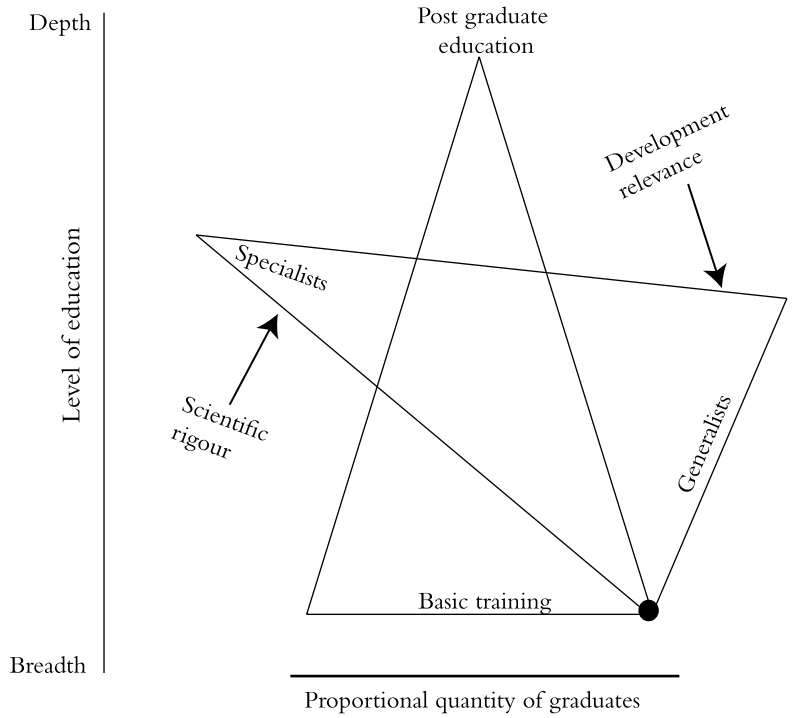
Figure 1. Comprehensive foundation for the definition of forests



As ESD is aimed at achieving sustainable development, forestry education's objective has to be sustainable forest management, because this maintains and enhances the economic, social and environmental values of all types of forests for the benefit of present and future generations (FAO, 2005). Sustainable management of forest ecosystems requires knowledge of their main functions, and of the effects of human practices on them, in order to ensure sufficient understanding of the potential long-term impacts of current practices on sustainable development. The IPCC (2007) has stated that important environmental, social and economic ancillary benefits can be gained by considering forestry-mitigation options as an element of the broad land-management plans, by pursuing sustainable-development paths, by involving local people and stakeholders, and by developing adequate policy frameworks.

Forestry education, like any other higher-education discipline, seeks to achieve a balance between depth or breadth and the requirement of rigour, at the same time seeking relevance. While the rigour dilemma imposes challenges to promote learning that is both intellectually demanding and provides appropriate preparation for professional practice, breadth versus depth assumes that insufficient knowledge rather than inappropriate types of learning causes the theory practice gap (Brown, 2003). The checks and balances of optimal curricula involve assessing the educational dynamics of maintaining the balance between rigour and relevance, as shown in Figure 2.

Figure 2. Conceptual foundation/checks and balances in respect of curricula formulation



Higher Education in Forestry and Natural Resources in Ethiopia

Higher education in Ethiopia

Understanding the higher-education landscape of Ethiopia is important in planning for rigour and for relevant higher education in respect of forestry and natural resources in line with ESD. In Ethiopia today, a massive expansion of tertiary-level education is under way. Between 1991 and 2008, the number of public universities increased from just two to 22 (FSS, 2009), Today, they number 31. Similarly, in 2010/2011, higher-education enrolment reached over 0.46 million, 95% of which were undergraduates, 5% postgraduates (4% masters' and 1% doctoral), and 26% female (MoE, 2011). Since 2008, public universities in the country have adopted common education guidelines that contain six bands with different importance levels (MoE, 2008). The six bands are engineering and technology (40%), natural and computational sciences (20%), medicine and health sciences (5%), agriculture and life sciences (5%), business and economics (20%), and social sciences and humanities (10%). All higher-education institutions in the country have established academic management that suits this division and are designing curricula under each band (MoE, 2008). Universities are free to offer curricula from all the bands as long as they adhere to the enrolment allocations: 70% science and 30% social science and the humanities.

While this open system has given universities the freedom to chose and to ensure required minimum enrolment of students, it has undermined centres of excellence, particularly in institutions where long-standing disciplinary specialisation has existed. Furthermore, strategic disciplines which may not be desired by students can easily be affected, as government budgets are allocated as per student numbers. One can argue that centres of excellence may, in time, survive such competition, yet existing experiences and capacities of specialised universities can erode in the process of adhering to the blanket prescription regarding higher education in the country. Massification in the form of increasing the number of universities (30 universities in 20 years) and the extent of student enrolment (half a million today) is a very considerable achievement. Nonetheless, the mismatch between required facilities and expected rigour and relevance of higher education (HERQA, 2009) can have undesired outcomes relating to inadequate quality of graduates for development needs.

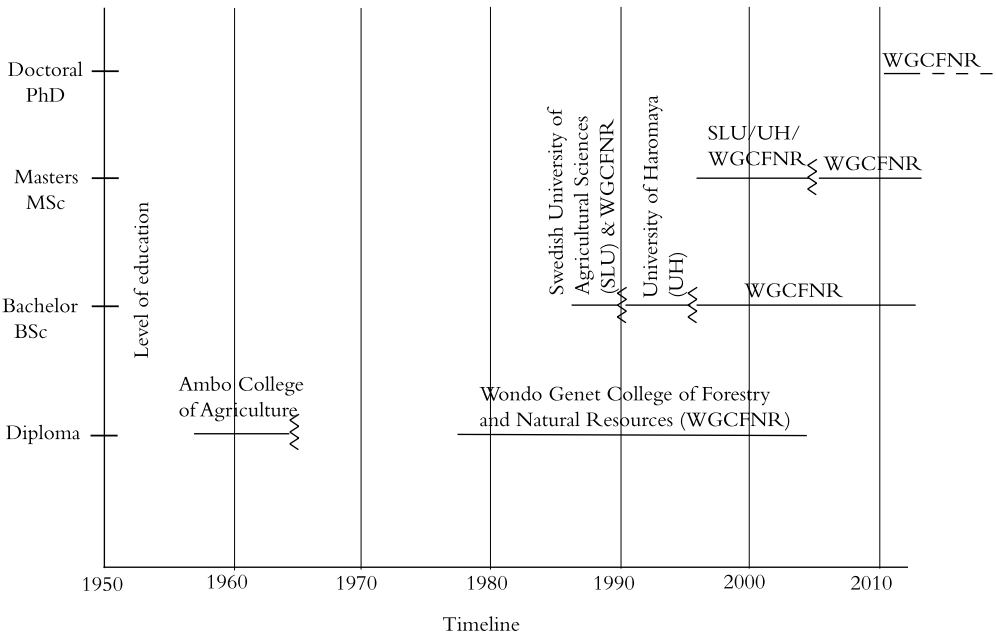
History of forestry and natural resources education

Higher education in respect of forestry in Ethiopia has, over the period of half a century, evolved from a diploma to the PhD level, is offered in three places and has been transformed from an external, fund-driven activity to one of local self-sufficiency. During this time, the focus of curricula shifted from general forestry to subdivisions of programmes including agroforestry, production forestry and forest management.

The two-year diploma programme in general forestry offered by the WGCFNR was in existence for 25 years before it was officially terminated in 2004. The WGCFNR is a college that has specialised in forestry, and its offering is unlike other earlier forestry programmes located in the agriculture-focused college in Ambo. When bachelor-level forestry education commenced, its aim was to educate mature students who had completed the two-year diploma programme and who had served in the field for at least two years. This was a 'sandwich'

arrangement between the SLU (Swedish University of Agriculture) and the WGCFNR, with the former controlling all academics and issuing the degree, while the latter provides physical space and some lecturers. After 45 students were trained in Swedish, East African and Ethiopian experiences, a local programme was initiated at the University of Haromaya that lasted for four batches and terminated after 120 students had graduated. Another interruption occurred here before forestry education was transferred to the WGCFNR in 1999 (see the timeline in Figure 3). The WGCFNR was one of the three founding colleges of Hawassa University when it was established in April 2000.

Figure 3. Timeline in respect of forestry education in Ethiopia



Postgraduate programmes were introduced in a similar way as the bachelor sandwich programme and mainly involved external lecturers in the fields of natural forest management, farm forestry and production forestry. Today, the postgraduate programme runs eight academic programmes, including climate change and development programmes.

Ethiopian forestry education is founded mainly on Swedish aid, Swedish experts and Swedish forestry practices. Swedish International Development Cooperation Agency (SIDA), which was the sole supporter of the College, invested 10 million krona per year in the College between 1987 and 2007 (SLU, 2009). Another experience that influenced forestry education in Ethiopia was African in nature and in the form of diploma-level curricula, particularly at Nyabyeya Forestry College in Uganda. Curriculum design and review are, in general, externally and internally derived. Some examples are the Ethiopian Forestry Action Plan (EFAP, 1994), a landmark forestry action plan that shaped forestry management in general and forestry

education in particular, and the formation of the Ministry of Natural Resources Development and Environmental Protection immediately after the Rio Summit.

In the changing paradigm shifts, institutional memory is important yet a challenge. While adapting to the changes demands transforming curricula and scholarship, sudden shifts can derail the established epistemological foundation and institutional set-ups. The challenge here is to maintain dynamism and at the same time consistency, and continuity and at the same time stability. Figure 3 shows that forestry education in Ethiopia has undergone a progressive evolution, yet has not been free of destabilisation owing to lack of independence (being placed in the agriculture college or big universities), having to move from place to place, and instability of the employment sector.

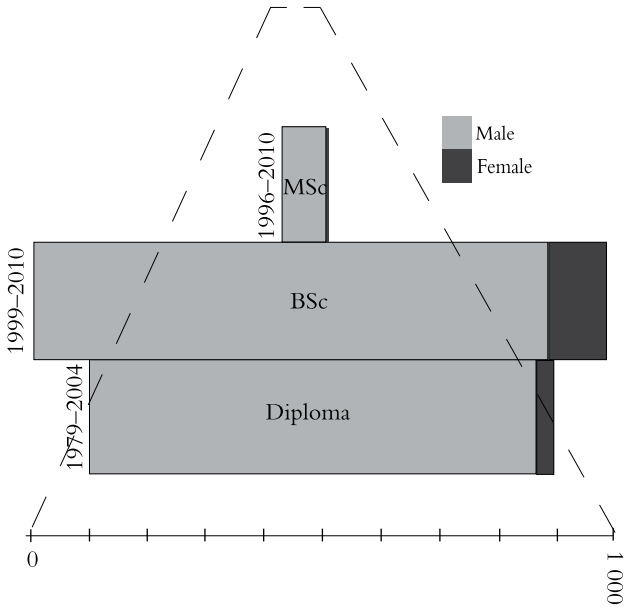
The Ethiopian experience in respect of forestry education is not different in terms of knowledge flow from non-African foresters and comprises mainly European forestry knowledge. This has not only brought with it forest-management strategies, but has also shaped the direction in which science has developed, as scholarship is oriented through the funds made available. While productivity-based forest management was emphasised and sustainable flow of cut was targeted, sustainable forest management was not addressed. This contributed to the delinking of the forests from the ideals of sustainability without comprehensive integration of their environmental, social and economic significance. Ethiopian forestry education has, as yet, not been given an opportunity to emphasise the locally important eco-zone and indigenous forestry system of the country. Nonetheless, changes in Ethiopian forestry education curricula over time seem to correspond with paradigm shifts that involve plantation forestry, agroforestry, social forestry, community forestry, biodiversity and climate change during the past 50 years (Nair, 2008).

Distribution structure of forestry and natural resources professionals in Ethiopia

A survey of the distribution structure of professionals includes number at different levels (i.e. sufficiency) and quality in line with relevance to the types of available and emerging employment sectors. The Ethiopian forestry expert pool comprises mainly graduates from local higher-education institutions, most of whom are graduates of the WGCFNR. High-level experts at MSc and PhD levels have been educated in European and American universities, most significantly the SLU in Sweden. Figure 4 shows the distribution structure in respect of forestry experts in Ethiopia based on the total number of graduates from the WGCFNR. The figure also shows that BSc graduates constitute the larger proportion (with the number increasing), while the diploma programme was terminated in 2004. Female graduates at all levels are very small in number. The broken line is shown in order to indicate the optimal proportion of experts required, assuming that the structure tapers from the base, where more are needed at the grassroots level.

The quantitative structure pertaining to the experts in Figure 4 implicitly indicates the qualitative structure in a form of theory:practice ratio where, at the lower level for example, diploma: practical is emphasised, while theory and scientific research tend to be emphasised higher up. The termination of the diploma programme at universities, which was moved to the technical and vocational schools, implied de-emphasis of the practical component of education in universities. While this can be seen as a 'shift of place', the shift has failed to address the type of education university diplomas used to offer.

Figure 4. Sample structure of forestry experts distribution in Ethiopia



In order to plan for the future, in addition to the structure in the form of proportional number of experts, it is important to consider the number of graduates. This is determined not only by the existing employment capacity of the sector, as this can be reactive, but also by assessing future demand and needs, including changes in emphasis and direction.

Student enrolment in forestry and natural resources education

Examining the enrolment level with regard to academic programmes can on the one hand indicate the priority given by government as well as highlight the employing sectors' preferences. On the other hand, it emphasises the future prospects of the programmes. As indicated above, the Ethiopian government's 70:30 ratio undermines agricultural education in general and forestry education in particular. For example, forestry education is part of the Agriculture and Life Sciences Programme, together with resources management and natural resource economics. The number of students allocated for forestry and natural resources is 8% of the target share of students under the Agricultural and Life Sciences Programme, to be shared by all public universities offering forestry and natural resources education. Currently, the students enrolled in the forestry and natural resources programme are divided among 15 programmes and 22 universities (MoE, 2011). Natural resources management is most dominant among all bachelor programmes and is provided for in 14 out of 22 universities, while three universities each offer forestry, soil resources and watershed management, and wildlife management.

Desirability of forestry and natural resources education

Examining desirability from the students' perspectives can highlight the prevailing perception about the academic programme that is often held based on employment prospects, personal benefits and career development. Low desirability can have a lasting impact on the future of forestry and natural resources education, among other things because low-performing students who cannot enter other popular disciplines tend to be those who enrol. Enrolment is forced rather than desired, academically weak rather than scholastically superior, and unmotivated rather than passionate.

There is a general trend among Ethiopian university students for agriculture and natural resources education to be the least desired. Table 1 shows that the desirability of forestry is 3 to 47 for every 100 available spaces. Student enrolment for 2011/2012 at Hawassa University indicates that the desirability index of agriculture is better at 19 to 46 for every 100 available spaces. The level of desirability decreased over time for forestry from 500 to 700 applicants for every 100 spaces available when the College offered the diploma programme, particularly in the late 1970s and in the 1980s. The quality of students enrolled has also declined from a minimum 75% ESLCE (Ethiopian School Leaving Certificate Examination) score to less than 60% today (see Table 1).

Table 1. Desirability index of agriculture and natural resources education among students enrolling at Hawassa University during 2011

Educational programme	College location	Enrolled students			ESLCE points	Desirability index*
		M	F	Total		
Animal and Range Science	Hawassa	29	9	38	55.3	34
Plant Science	Hawassa	30	10	40	55.6	46
Horticulture	Hawassa	29	10	39	55.5	34
Rural Development	Hawassa	26	16	42	60.3	396
Agricultural Resource Economics and Management	Hawassa	29	9	38	55.3	400
Food Science and Post-harvest Technology	Hawassa	25	9	34	54.6	19
Human Nutrition	Hawassa	28	12	40	66.3	436
Natural Resource Economics and Policy	WGCFNR	30	10	40	55.1	47
General Forestry	WGCFNR	30	12	40	54.8	37
Geographic Information Science	WGCFNR	22	8	30	56.1	36
Forest Product Management and Utilization	WGCFNR	22	8	40	54.4	3
Agroforestry	WGCFNR	30	10	40	54.1	31
Natural Resources Management	WGCFNR	30	11	41	55.6	57
Wildlife Wetland and Fishery Management	WGCFNR	33	2	35	54.3	3
Soil Resources and Watershed Management	WGCFNR	30	10	40	54.3	12
Ecotourism and Cultural Heritage Management	WGCFNR	25	10	35	54.2	10

* Index value shows the number of students desiring the programme as the average of first, second and third choices for every 100 spaces available per programme.

Source: Hawassa University student placement data, Office of the Registrar WGCFNR.

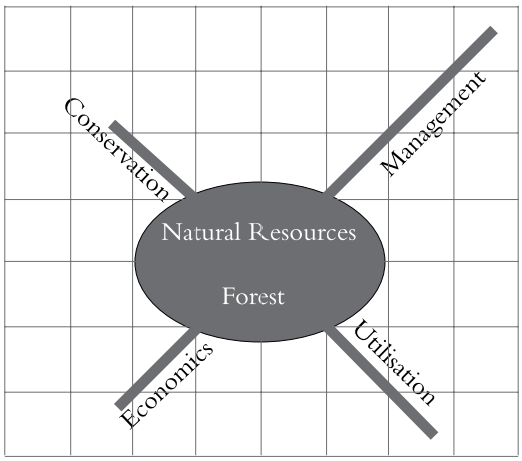
The location of the forestry college in a forested area in a rural location contributes to low desirability in Ethiopia. Table 1 shows that agriculture that is located in a regional town had a higher desirability index compared with forestry and similar courses located at rural sites. The two places have very different indices. Agricultural Resource Economics and Management located in Hawassa has a desirability index of 400, while Natural Resource Economics and Policy located at the WGCFNR has a desirability index of 47. The location factor is further explained by a survey of Natural Resources Management students at the WGCFNR. A pairwise ranking survey of the desirability of forestry among third-year Natural Resources Management students at the WGCFNR reveals a different picture. Forestry was chosen instead of engineering, agriculture, teaching and geology, but rejected in comparison with medicine, computer/information technology, economics, law, and natural resources management. Medicine and natural resources management are highly valued disciplines. The low desirability of forestry education is not unique to Ethiopia. Several studies from different part of the world report the same trend (Wanjohi & Muthuri, 2008; Brown, 2003; Rodriguez, 2004; Temu & Kiyiapi, 2008). This phenomenon is linked to many factors (Akande, 2008), such as lower priority given to the profession by governments, curriculum issues, minimal private involvement in forestry, lack of scholarships, and the popularity and status associated with white-collar jobs, among others.

Rigour and relevance of forestry and natural resources curricula

'Rigour' is generally defined as intellectual challenge and scholastic demand, while 'relevance' refers to the contribution of higher education to the economic, social and environmental advancement of the country. Experts who were interviewed asserted that one of the major problems with forestry curricula in Ethiopia is an inability to follow the frequently changing direction of forestry development. A survey evaluating forestry education in Ethiopia (HESC, 2008) showed limitations with regard to course administration, theory as opposed to practical skills, graduate competence, and mode of course delivery, instructional media and endogenous experience. The same source suggests that forestry education in Ethiopia is failing to produce experts who are committed, knowledgeable, equipped with practical skills and self-employing. There is also the issue of lack of harmonisation of curricula that gives rise to other rigour challenges (MoE, 2011).

In the Ethiopian public university system, natural resources programmes in general and forestry programmes in particular coexist mainly with conservation and economic management and utilisation (MoE, 2011). In the light of sustainable development, where three pillars are emphasised, here the social aspect seems less emphasised. However, this Ethiopian example seems universal (Vanhof, 2010). In the context of ESD, where systems thinking is important, the approach here is mainly commodity-oriented (Alemu 2008; Demel, 2002; EFAP, 1994). Management is strongly emphasised in the form of forest management, natural resources management, watershed management, land management and wildlife management (Figure 5). Utilisation, the next highest, is linked with forests in the form of production, processing, harvesting and technology. Conservation and economics are linked with natural resources and the environment in the form of soil conservation and natural resources economics. The social aspects of forestry are generally absent or poorly covered.

Figure 5. Scale of hybridisation of programmes and forestry and natural resources curricula at technical, bachelor's and master's level in Ethiopia



Another form of hybridisation in Ethiopia links forest with climatic conditions in the form of dry-land forestry, with mixed land uses such as agroforestry, and with settlement patterns like urban forestry (WGCFNR, 2009). This is no different from the general practices in Africa (Temu *et al.*, 2008) that also include temporal paradigm shifts with regard to global forestry (Nair, 2008). The manner of mix is not only about combining subjects, but also about bringing together different levels, for example: introduction, basics, fundamentals, synthesis levels (including watersheds and agro forestry systems), and functional levels (including processing, planning and management). With regard to courses, the number of subjects mixed in forestry and related areas varies between 1.93 and 2.45 (Table 2) NRE and AF respectively. While NRE emphasises one-subject courses, AF stresses courses that combine two and three subjects.

Table 2. Mix of subjects in a course and frequencies of the number of mixes for different academic programmes at the WGCFNR

Academic programmes	Number of courses	Average competence	Mix of competence			
			4	3	2	1
AF (Agroforestry)	47	2.45	6	16	18	7
FMU (Forest Management and Utilisation)	45	2.02	1	13	17	14
GF (General Forestry)	49	2.02	1	12	23	13
GIS (Geographic Information Science)	39	1.95	1	7	20	11
NRM (Natural Resources Management)	46	2.17	3	16	13	14
NRE (Natural Resources Economics)	44	1.93	1	12	14	17
SRWM (Soil Resources and Watershed Management)	41	2.07	2	13	12	14
WLM (Wildlife Management)	42	2.36	6	13	15	8

Source: Summarised from the WGCFNR academic programmes course list and description.

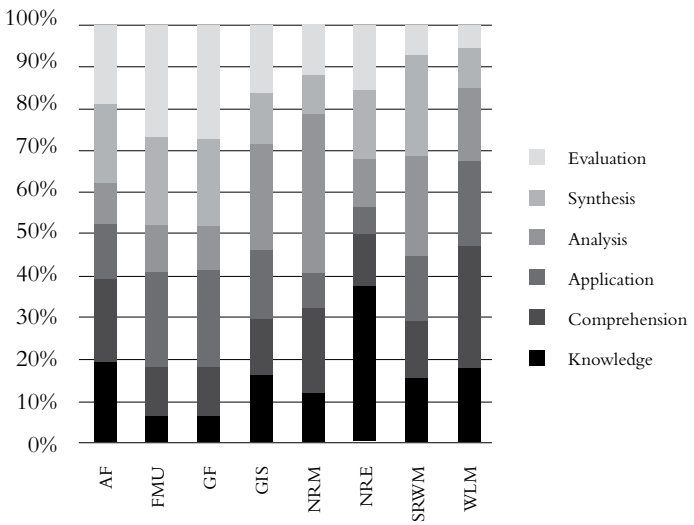
The table shows courses that: are non-mixed, for example introduction to economics; comprise two subjects, namely remote sensing and GIS; combine three subjects, namely tree seed and nursery technology; and integrate four subjects, namely watershed management and land use planning. The assumption is that the student needs to cover concepts and/or subjects that can be stand-alone courses in other circumstances.

By analysing the graduate profiles for programmes based on Bloom's taxonomy (Bloom, 1956), differences can be observed (see Figure 6). In NRM, more emphasis is placed on analysis, while application is minimal; in NRE more emphasis is placed on knowledge, while application is minimal. In AF and WLM, application is assigned a high value. What is interesting are FMU and GF; here, evaluation and application are strongly emphasised. The level of emphasis distinguishes generalists from specialists.

In the context of ESD, 'rigour' can mean an understanding of complexity in its heuristic nature where multidisciplinary synthesis and analysis are a prerequisite. One of the challenges here is disentangling human and environmental perspectives while at the same time comprehending the synergistic effect of the two on temporal and spatial scales. Knowing complexity on the one hand requires dynamic system-level modelling, but, on the other, demands simplified articulation of development implications to augment policy frameworks.

By the same token, 'relevance' is mainly adherence to the knowledge production in the country that supports national and local development strategies. This implicitly requires creating a critical knowledge hub and databank, understanding the field setting where the graduates are expected to operate, the institutional setting that can be elastic in order to address proactive and reactive engagements, and a system that can maintain institutional memory.

Figure 6. The level of emphasis placed on different learning outcomes by the curricula of academic programs at the WGCFNR, with reference to Bloom's taxonomy



Source: Summarised from graduate profiles stated in the curriculums of academic programmes of the WGCFNR.

Epistemological foundations of forestry and natural resources education

Texts, curricula documents, course objectives, field guides, emphasis of visits, and project plans have shown the epistemological foundation of forestry education in Ethiopia to be oriented towards productivity of forests.

The orientation is towards a plantation-prioritised knowledge system where silviculture, management, utilisation, inventory, protection and economics form the foundation of the curricula. Production per hectare in terms of volume or biomass is an important guideline, and, with it, sustainable flow of cut governs the orientation. The objectives of all the management plans of the campus forest emphasise sustainable cut rotation. Similarly, major plantation operations have been established after the natural forests were clear-felled. Moreover, graduates are trained to perform as competent field rangers equipped with practice-oriented knowledge/skill and the behavioural orientation of exotic-tree managers.

The definition of 'forest', concepts of the forestry sector and knowledge system, and the competences of the expert and practitioner are closely linked. 'Forests' are defined as commodities that are physically characterised, where forestry is considered as a stand-alone knowledge system harvested from forest land alone. 'Foresters' are specialists in respect of timber at least and trees in a given landscape at best. The Ethiopian forest sector organisation was, in the past, a commodity arrangement comprising four pillars:

1. State forests made up mainly of plantation forests and natural forests;
2. Community forests encompassing community plantations and homestead trees;
3. Soil and water, comprising mainly soil-conservation practices; and
4. Wildlife, that is, responsibility for national parks, sanctuaries and hunting areas.

This prevailing epistemological foundation differs from what is required in the context of ESD, as shown in Table 3 below.

It has also been noted that forest systems are more likely to have sustainable outcomes with regard to high-tree species richness and subsistent livelihoods when local forest users participate in forest rule-making, whereas unsustainable forest system outcomes are more likely when users do not participate in rule-making (Persha, Agrawal & Chhatre, 2011). Consequently, forestry changed from emphasising trees and forests to incorporating the landscape in general and social issues, as well as from wood-restricted values to environmental services (UNFF, 2011). This transformation called for sustainable forest management that defined forestry education in line with ESD.

Characteristics of such education (Table 3) include sustainable forest management thematic elements (UNFF 2006), a framework of course subjects (Temu & Kiyiapi, 2008; Arevalo, Pitkanen, Tahvananinen & Enkenberg, 2009; Langin & Ackerman, 2008), non-forestry complementarities (Temu, Okali & Bishaw, 2006), the contents of forestry curricula (Koffa & Nyenka, 2008), and non-technical knowledge (Werland, 2009; Brown, 2003). Additionally, such education needs to overcome major challenges of higher education (UNESCO 1998) and global forest governance (Werland, 2009).

Table 3. Components of forestry education in the realm of ESD

Key areas	Descriptions
Sustainable forest management thematic elements	1. Extent of forest resources; 2. Forest biological diversity; 3. Forest health and vitality; 4. Productive functions of forest resources; 5. Protective functions of forest resources; 6. Socio-economic functions of forests; and 7. Legal, policy and institutional framework.
Forestry education framework of subjects	Fibre products, genetic resources, water quality and yield management, landscape values and environment, science and innovation, climate change, and non-wood products.
Non-forestry complementarity	Integrating social, cultural and environmental aspects.
Modern forestry education curricula	1. Public sector and community joint management of forest resources; 2. Forestry and its role in biodiversity conservation and protection; 3. Forests as recreation sites, including ecotourism; 4. Partnerships with the private sector for purposes of research, management and timber processing; 5. Forests as carbon sinks and the international implications of trading in carbon sink credits; 6. Civil society information delivery relating to forests and forestry issues; 7. Forest policy formulation and implementation; 8. Forestry education and training for non-traditional target groups; and 9. Interrelationship of forestry with other sectors such as agriculture, natural resources management, education, tourism, infrastructure and trade
Non-technical knowledge	Propositional knowledge: skilled action and deliberative analysis in decision-making, problem-solving and planning; Process knowledge: experiences, personal theories and memories; Personal knowledge: socialisation into the professional approach; and Ethical principles: gaining a sense of professional identity.
Higher-education challenges	High-quality education based on societal demands; partnerships involving higher education and the public and private sectors; innovative multidisciplinary and interdisciplinary approaches in higher education; and enhanced international cooperation and exchange in higher education.

Towards guidelines for forestry and natural resources curricula in higher education, aligned with ESD

As indicated, the analysis above informed the conference search result deliberations (see Appendix A). The conference search, in its deliberations, focused on issues of adapting higher education in respect of forestry to changing societal needs, on necessary academic institutional

foundations to that end, on the desired epistemological framework for curricula, and on ensuring dynamism and continuity of programmes. The outcomes were achieved as a result of the participants' representativeness, first-hand experience, as well as practical and academic knowledge.

In addition to the wider context of forestry education as described above, and the related contours of the higher-education system, the following more specific issues arose in the plenary discussions and the search conference workshop as a whole, all of which helped to formulate the guidelines (see Appendix A for further details):

- *The role of higher education:* Universal science is, it was stated, brought about by the level of rigour of academic teaching and research, but the contribution to strategic development was emphasised in terms of relevance of the programmes and social engagement of the higher-education institution. In this regard, the WGCFNR was criticised for not having strong units that could provide appropriate technologies, information and data to meet the serious demand in the country in relation to forestry and natural resources, implying a need for a reorientation of emphasis and a change in the institutional set-up in forestry and natural resources higher education system management towards greater emphasis on technological support and extension.
- *The role of graduates:* Expected roles for graduates were outlined as: (a) contributing to overall poverty reduction and the economic development of the country; (b) planning, managing and executing forestry activities; (c) involvement in village forestry, agroforestry, industrial forestry and environmental forestry; (d) understanding emerging forestry-related issues and converting them into action nationally; (e) being well versed in modern spatial information science and survey techniques; (f) contributing to the value-adding process in respect of forestry products and services; (g) creating networks with other professionals; and (h) working in multidisciplinary teams. These sets of roles were linked to the conceptual and operational definitions given to 'forest' and 'forestry' (see Appendix A). To strengthen the role of graduates, two important definitional elements were recommended: the legal definitions given in the country's forestry proclamation and the popular definitions as per the perceptions held in respect of forests.
- *Policy framework evaluation:* This refers to the need for engagement in critical and pragmatic evaluation of policy frameworks and strategic directions of the country. In the existing policies that govern education, the forestry sector may have limited higher-education value, but changes are already occurring at national strategic level (e.g. FDRE, 2011; FDRE, 2010). In this regard, higher education needs to adapt to the demands of such strategies in the form of green economies and sustainable development, thereby also helping to contribute to, and participate in, upscaling schemes of working forest management models, for example the participatory forest management schemes of the country.
- *Theory–practice relationship:* It was acknowledged that an imbalance between theory and abstraction at higher levels, and practice as emphasised at lower levels was occurring. A suggestion was made to reinstitute the diploma programme (Figure 4), as it had a 50%

practical-education emphasis. Moreover, its success in the past had been recognised. The need for postgraduate programmes (MSc and PhD) to address the emerging demand for academicians, researchers and decision-makers was also noted. In so doing, guidelines were established for minimising trade-off and maximising synergies in the curricula-formulation processes. This involves ensuring smooth and progressive links between undergraduate and graduate levels of education.

- *Non-reductionist approach:* It was said that an inclusive and system-oriented education in the form of ESD should be set up which also shows a deep understanding of the sector and the employment system. Higher education should not be detached from state and employer demands, and should pay attention to employers' needs and aspirations regarding graduates. A strong case was made for the introduction of quality measures and verification methods in addition to conventional criteria (HERQA, 2009). Particular mention was made of improving the quality of postgraduate theses as a way of overcoming the prevailing ethical decay. A suggestion was made that a modular research approach be introduced in which well-thought-out thematic areas, standardised methodologies, and explicit development implication measures determine theses production. The justification for this was ensuring quality, at the same time minimising theses that are shelved in libraries without practical contributions.
- *Networking:* Networking was suggested as a strategy for benefitting wisely from resources, experiences and knowledge exchange. While actively following the emerging global narrative and evolving scholarship is necessary for sharing in the universally growing knowledge field, establishing a degree of stability in accordance with the demands of the country was strongly emphasised. It was also strongly emphasised that higher-education institutions play a stronger leading role in guiding and informing forestry and natural resources knowledge management in the country.

Concluding Discussion

Enrolment in forestry education has declined all over the world mainly as a result of the failure to respond adequately to rapidly changing social, economic and political environments. This seems a generally accepted notion in several forestry education studies and it tends to form the bases for revitalising the discipline in the higher-education system. Of course, it is imperative to articulate clearly what constitutes 'the decline of forestry education' before the reasons are sought and solutions prescribed.

Can forestry be a stand-alone field that can contribute reasonably to global sustainability or will it be a better contributor if linked with other disciplines technically and scientifically? Forestry as a discipline borrows its scientific foundation from many other basic sciences. At the same time, its societal benefits are judged in relation to other natural resources. Becoming a viable form of education requires clarity on the epistemology and purpose of forestry education, as outlined in this article. As shown in this study, this requires engagement with sustainable-development concerns, as well as contextual, field-specific concerns, employment and policy concerns, and practice and theoretical concerns. There is also a need for broadening

from a production-only narrative guiding forestry education, to wider concerns. A review of the status of forestry education is also required in order to increase the desirability of the profession among students. In the light of the current decline in forestry education, there appears to be a pressing need for universities strong in forestry to change their vision in view of the changing knowledge and practice context. In particular, forestry education needs to embrace principles of ESD in order to play its role in responding to serious environmental concerns such as deforestation, climate change and the energy crisis. This can potentially also provide a new epistemological path for forestry education.

Forestry education is inseparable from the way forests, forestry and foresters are conceptualised. Engaging the interrelated environmental, economic and social aspects of sustainable development shifts the conceptualisation of forests from a 'plantation' to a social–ecological system with a local to global spatial setting. This gives forestry education more content, a more relevant and contemporary approach, and direction that involves multidisciplinary knowledge where the three pillars of SD are combined. This requires a new kind of curriculum that is rigorous and relevant and allows prospective foresters to attain a different knowledge, competence level, values base and skill mix from that which is currently on offer.

In conclusion, this article has sought to argue that forestry education in the context of ESD needs a different epistemological stance that outlines the necessary and sufficient conditions of knowledge, the sources of knowledge, and the structure and its limits. However, for this to come about, there is a need to fully understand the history and profile of forestry education as it currently stands, and to engage stakeholders and members of the forestry education community in reconceptualising forestry education. Moreover, it is necessary to understand the creation and dissemination of knowledge in the forestry education context. Consequently, another ontological setting is required that deals with questions concerning the forests themselves, with issues of deforestation, and with forestry education entities that exist, and how such entities can be grouped, related within a hierarchy, and engaged within the new epistemological formations based on their similarities and differences. A new conceptualisation is demanded of forestry education today.

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Appendix A. Suggested guidelines for reorienting forestry and natural resources higher education in Ethiopia (summary of the search conference outcomes)

Group 1: Adapting higher education in respect of forestry to changing societal needs in Ethiopia

Key discussion points	Search conference outputs
• Possible links between landmark development programmes in Ethiopia, e.g. GTP and CRGE, and the forestry sector; hence forestry education	• Producing sufficient numbers of forest professionals so that they are better able to cater for needs in respect of conserving our forests, watershed management, soil conservation, plantations, etc. • Our curriculum should contribute to the uplifting of the local community and therefore the existing curriculum has to be revised. • Being the oldest and premier institute in the field of forestry education in the country, we should take the lead in updating and having common consensus on the development of uniform curricula among various institutions and universities.
• Required needs of occupational competence and knowledge mix for future foresters	• Our curriculum should be more field-based and our students should be competent enough to solve forest-related problems, something which is lacking in the existing curriculum. • Mixing of traditional knowledge with that of the modern system of forestry education.
• Ways to address the dilemma in undergraduate education whether to produce subject specialists or generalists	• We should have a General Forestry Programme for undergraduates (broader perspective: Ethnoforestry, GIS, Watershed Management, Wildlife, etc.). • However, the programme should be extended from 3 years to 4 years.
• Effective forestry and natural resources-related outreach programmes that academic institutions can adopt	• Our research activities should focus on community issues and should be carried out with its participation, e.g. technology village. • The outreach programme should be part of our curriculum.

Group 2*: Necessary academic institutional foundations and leadership to secure the future of forestry education

Key discussion points	Search conference outputs
• Establishing the need for centres of excellence for higher education in forestry and natural resources	• Go-to-place (strong service delivery). • Continuous curriculum revision that considers emerging issues (advanced knowledge). • Developing guidelines/manuals. • Alternative recruitment and promotion mechanisms (e.g. recruiting researchers through special contracts, staff incentives, etc.). • Validating studies conducted by regions and other stakeholders. • Sharing forestry knowledge with relevant institutions and partners. • Start within and extend to outside (addressing challenges within the college first). • Opening research and extension centres-where the institute has comparative advantage (e.g. GIS, environmental history, climate change mitigation, hydrology, etc.).
• Types of research/theses models needed that at the same time fulfil the quality requirement and development relevance	• Strengthening the research and extension capacity of the college. • Encouraging knowledge multiplication, as well as multidisciplinary and teamwork approach. • Publication should encourage institutional/individual collaboration. • Developing thematic research. • Modular thesis approach (to attract students and funding, and promote knowledge dissemination).
• Indicating strategic collaborative partners at national, regional and global level	• Enhancing research, teaching, and development collaboration with government and development partners. • Reviewing forestry and related curricula of other universities and taking the initiative to be a leader in advancing forest and environmental sciences.
• Achieving a working balance between implementing new technologies and learning from indigenous knowledge	• Documentation of indigenous knowledge and integrate with scientific knowledge (validating available knowledge). • Working in close relationship with local community. • Participatory research through appreciation of farmers' knowledge.

* The group suggested that the issue here should read: 'Necessary academic institutional foundations, leadership and policy to [secure] the future of forestry education'.

Group 3: Epistemological framework for higher education curricula in respect of forestry and natural resources

Key discussion points	Search conference outputs
• Outlining conceptual and operational definitions of 'forest', 'forestry' and 'forester' in the Ethiopian context	• A forest is a parcel of land >0.5 ha, with 10% canopy cover and being above 2 m in height. • If this is the current and historical definition, the future curriculum and student in forestry and NR need to redefine it based on emerging issues related to this definition. • We define it without enough knowledge on how much is located where. The old definition of 'forest' is being/should be redefined to include: (a) restored degraded lands; (b) woodlands; (c) agroforestry; (d) areas with carbon sequestration; and (e) urban forests. This implies a multidisciplinary knowledge pool comprising: (a) ecological; (b) silvicultural; (c) economic; and (d) social. Which of these knowledge pools are drying up and which ones are emerging? This could be a basis for reviewing the existing curricula. Other issues are: land-use change has been pushing the boundary of forests for the last 50 years – (a) curricula should seek the causes and give answers; (b) students should be encouraged to provide practical solutions for these challenges; (c) how can a working definition of forests include ownership, purpose and vegetation type (name) and local knowledge; (d) a working definition that is comprehensive enough but not complete to trigger discussion and questions in academia. Forestry • Knowledge of managing forests (scientific and indigenous). • The science that deals with the interaction of forests with their biotic and abiotic elements and the people around them. • Here also, emerging science, knowledge and practice should trigger questions for academia and the curricula should try to answer. • Forestry should evolve from growing trees to sustainability of ecosystems..

Key discussion points	Search conference outputs
• Defining guiding principles in respect of forestry and natural resources education in the context of sustainable development	• Could start from basic biology/silviculture/systems thinking/interactions. • But the cutting edge is not to grow trees but to make them marketable in respect of services and values: This will help buffer deforestation. • Look for the intersection among the four capitals (biological, social, economic and cultural). • Do not look for fixed recommendations to optimise income, but for adaptive solutions suitable for local conditions.
• Listing measures of rigor and relevance of higher education in forestry and natural resources in the changing societal demand	• Centre of excellence. • Getting jobs for graduates. • Be able to solve practical problems. • Meet societal demands. • Create awareness about forest/forestry/ecosystems. • Evaluate the capacity of the current curricula to make the student think for long time period – modular as opposed to semester. • Involvement in macrolevel and microlevel issues: macro-earth system science and micro-ecosystem science.
• Strategising proactive forestry and natural resources education in relation to emerging challenges and as a reaction to the ongoing strategies and development endeavours	• Assessing emerging issues and their challenges. • Teaching not only subjects, but also problem-solving skills. • Teaching that is focused on mechanisms not events. • Updating with cutting-edge science. Maintaining the marriage between science and practice (especially community practice). (a) Start from what is known in both and develop to common ground. (b) Otherwise, science becomes irrelevant to people and society may no longer value science. • In creating jobs, discuss this with government departments (on a contractual basis) with a view to integrate their plan with the research plan of the university.