

MOVING BEYOND THE PRODUCTIVITY PARADIGM – INCORPORATING SUSTAINABILITY IN FORESTRY EDUCATION IN DENMARK

S. LETH, N. SRISKANDARAJAH

Unit for Learning and Interdisciplinary Methods, Department of Economics and Natural Resources, The Royal Veterinary and Agricultural University, Rolighedsvej 23, DK - 1958 Frederiksberg

Abstract

The paper describes a case study in tertiary forestry education in Denmark in which the interaction between students' aspirations and expectations and their choice of education on the one hand, and the efforts to integrate sustainability in an actual course in silviculture are examined. Through a description of this interaction and the implications to be seen, the challenges for education and research are discussed. The most obvious implication to be seen from our case study is the difference between students' perception of forestry and silviculture, grounded in the paradigm of productivity, and the teachers' beliefs in and intention to leave this particular paradigm behind. A major task was, therefore, to handle the students' different perspectives and create a shared understanding. The chosen approach in the course is seen to be systemic in nature. It therefore calls for the attention to a level of epistemic cognition to reach, enabling a systemic way of thinking. A way to help the students to reach this level is to focus on a learning process that would support ethical reflectivity as desired in the epistemic level of cognition. A systemic approach in the efforts to achieve sustainability is of interest to anyone dealing with natural resource management and rural systems because it enables a desired integration of social dimensions. The case study though, showed a need for a fundamental rethinking of the nature of research in the natural sciences and technologies if it is to be part of such a system. Paying attention to the kind of cognitive level to be reached to enable a systemic way of thinking and awareness of the learning processes seem important when designing curricula which incorporate cross-cutting issues such as sustainability.

Introduction

During the last few decades, increasing attention has been paid to the change from a paradigm of productivity towards a paradigm of persistence or sustainability (Bawden 1991, 2000). This has led to a greater focus being placed on the social dimensions and learning processes in natural resource management than before. There are many examples of attention being paid to the role of extensionists and their education, especially in the field of agriculture more so than forestry. The agenda seems to place focus on merging social justice and ecological sustainability (King 2000, Röling 2000), social learning (Röling 2001) and conflict management (Leeuwis 2001). In practice, this means paying attention to a closer interaction between practitioners, extensionists and educators as, for example, described in the work of Röling (2000) and Taylor (2000). However, such considerations, and especially examples concerning the paradigmatic consequences for the actual educational context and practice at university level, are still few.

The impact of the paradigm of sustainability and its inclusion in education has obvious consequences for the programs (Wals & Bawden 2000, Wals & Jickling 2000), such as through the questioning of competencies such education is meant to provide. Inclusion of the concept of sustainability must, therefore, have clear didactical consequences concerning aim, content, objectives and arrangements in education in general. However, successful integration of the concept of sustainability raises important questions about how to change, reformulate

and rewrite curricula, study plans and course plans. Students' aspirations, including more specific expectations regarding their education, have a profound impact on the practical educational context and the discourses taking place (Simonsen & Ulriksen 1998).

This paper will describe a case study in forestry education in Denmark and the efforts to integrate sustainability in a course on silviculture. Through this description, the challenges for education and research involving sustainability as a conceptual foundation in natural resource management are discussed.

Forestry education in Denmark at tertiary level

Forestry in Denmark is a small sector in natural resource management in comparison to agriculture and with a relatively small economic contribution. Though a small sector, with an overall traditional focus on productivity, the social and recreational functions of the forests actually have a strong and almost embodied place in people's minds. This local identity is very much related to the form and function of traditionally grown forests, for example, mono-cultural beech growing. For the last 250 years, sustainability has been seen as a conceptual foundation for forestry, but in a classical sense concentrated on sustained tree production (Larsen 1998). During the last decades, societal discourses about environmental issues have grown and placed focus on not only silvicultural issues, but also on the function of the forests. In the Brundtland version of sustainability, sustainable development is described, as "one that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987) in a more global context. In forestry, this demand for sustainability can be seen as an agreement across generations about the multifunctional use of forests and the need for balancing not only economic and ecologic dimensions, but also the social dimension of practising forestry (Larsen 1997). Today, this interpretation of sustainability has a profound implication for forestry education through its influence in the policies related to forestry.

In line with the developments described above, The Royal Veterinary and Agricultural University (KVL) in Denmark has been aiming at including ecological, economic, social, recreational and technical aspects in the forestry curriculum. Even though social and recreational aspects are mentioned as issues to be dealt with in the education, the curriculum is still very focused on aspects of natural science and economics. This means that, in practice, the curriculum still embraces a concept of sustainability grounded mainly in economics and ecology with the classical focus on production. This contradiction between the stated intentions of the curriculum and the content of the courses in practice can be related to questions among an otherwise very qualified, but also very specialized teaching staff, regarding not only what the actual content concerning social and recreational aspects could be, but also about how to implement these aspects in practice.

The silviculture course

Silviculture is a two-semester course offered in the eight and ninth semesters of a five-year education. It includes an excursion and field trips during the semesters and a week's summer course placed between the semesters. The first of the two semesters, dealt with in this case study, emphasises giving the students a broad foundation of a range of silvicultural issues mainly through lectures. The students also work with smaller projects during the semester connected to issues handled and discussed in the lectures.

Teachers in the course argue that social aspects should be touched on in this course in line with the Brundtland interpretation of sustainability also because no other course is dealing with these aspects. This is reflected in the course outline as follows:

“The course aims at creating a basic understanding of the frames for managing the forest as an ecological system and for the tools available for this management. The frames are defined from biological as well as socio- economic criteria. The long-term perspectives of the management is prioritised as well as a balance between use and protection of the forest (sustainability)” (KVL Study Handbook 1999-2000, p.165)

The case study described here focuses on the lectures given in the course during Spring 2000. As a way of paying special attention to the social dimension of forestry in the course, the silviculture course in 2000 was merged with a course in natural resource planning given in the second semester, focussing on introducing conflict management as a theme. The educational implications of the introduction of conflict management are discussed in Leth et. al. 2001.

The approach used

The teaching situation in the classroom became the focus of this study with the aim of following the practical interactions and their implications in the effort to integrate sustainability. The primary emphasis was therefore on the discourses and happenings in practice rather than on the intentions with this practice. The discourses in the classroom setting were followed by participant observation, with everyone involved having been fully informed about the procedures and the purpose behind them. As a basis for the analysis of the practical situation, the aspirations and expectations of the students were also uncovered, as these were believed to have a profound impact on the interaction in the classroom setting. These were determined through a questionnaire given to them in the beginning of the course. The outline of the questionnaire can be described as qualitative with open-ended questions allowing room for the students to write freely their responses to the questions. All the quotes given in this paper have been translated from Danish.

The data from the study is analysed and presented as follows:

- The students’ aspirations and expectations have been analysed with the view of uncovering the paradigm they primarily tend to relate to.
- The content area presented in the course has been analysed in order to characterise the framework used by the teachers to integrate the intended paradigm of sustainability.
- The interaction and discourses between teachers and students has been analysed to uncover how the students received this framework and how it influenced a successful integration.

The empirical findings have been discussed by comparing the framework used by the teachers with similar theoretical approaches to teaching and research, in order to establish the implications. Through the theoretical exploration and information of the empirical findings, the challenges to incorporating sustainability in education and research have been discussed.

Aspirations and expectations of students

The student’s aspirations and expectations to their education and the silviculture course can be described from their answers in the questionnaire. Of the 34 students participating in the course, 26 answered the questionnaire (78%). Most of the students were male (only 7 were female) and began their studies at the same time, in 1996. Their average age was 25 years. In broad terms, the student’s reasons for studying forestry, uncovered from the questionnaires, can be grouped as follows:

- Interest in the nature/ecology
- Interest in management of nature
- General interests in management (including economics).

Interests in ecology can be seen as the strongest argument for the students to take up this education, but a lot of them are also interested in management combined with ecology. From the students' answers, more personal aspirations and dreams about their future life can also be seen, for example, wishes for combining professional life with a hobby (box 1).

“The wish for a future occupation with possibilities for working with administration, and management of forest areas – probably coming from a general interest in nature and a great engagement in hunting and game management. Probably also a romantic wish for combining work and hobby.”

“It sounded interesting. I have always been interested in the nature. I would once like to have a small house in the forest.”

Box 1. Examples of student's reasons for studying forestry.

Asked about what they found interesting in their studies so far, and the topics they dealt with in their bachelor projects, the same picture emerged. In addition, the students value their achievement of competencies in biology and ecology very highly and often in combination with achievement of competencies in management. The students also value achievement of more personal competencies to do with leadership abilities, over viewing, planning, negotiation, analytic problem solving and learning.

Concerning their expectation of the Silviculture course, the students said that they expected to gain:

- A foundation for management in practice on the basis of ecological knowledge
- Practical understanding (*“How it should be done in practice!”*)
- Ability to synthesise knowledge from previous courses directed towards practice.

They expect basic knowledge from previous courses to be synthesised and to learn how to convert scientific knowledge in ecology into a practice about growing trees. The students found the course extremely relevant and, not surprisingly, necessary to hold a Masters degree in forestry. In the questionnaire, the students were asked about how they understood sustainable forestry. In their responses, most students tried to describe their personal understanding of the concept (see examples in box 2). 42 % described an understanding fitting very well with the Brundtland definition of the concept.

Another 42 % of the students gave answers which seem to be more related to an understanding of sustainability where all three dimensions of economics, ecology and social are included, but with the economic dimensions considered most important, or simply to an understanding of sustainability in the classical sense. The rest of the students expressed deep scepticism towards the concept.

Though approximately half of the students seemed to have adopted the Brundtland definition of sustainability, their understanding and expectations of their education and the competencies it should provide them with, still seemed to be grounded in the classical understanding of sustainable forestry, where the forest is seen as a production unit more or less detached from landscape as well as society.

Sustainability in relation to the Brundtland definition:

“To grow forest in such a way that the biological, the economic and the social sides are considered and taken into account. You can talk about sustainability in many ways, but which one to be put on the top or how to list them is a society/political issue? Sustainability is also not to diminish the foundation for growing in such a way that the future generations will be worse off than ourselves when they are to use the resource.”

Sustainability in relation to Brundtland, but prioritising economy:

“I understand silviculture that last in the long run. Silviculture shall be economically profitable, but also consider ecology and being accepted by the surrounding society.”

Classical sustainability:

“A sustainable silviculture is both economical and ecological sustainable.”

Scepticism:

“A raped concept that loose more and more dignity. I don’t think it is found in other places than literature in 10 years!”

Box 2: Examples of student’s different perceptions of sustainability**The lectures**

The content in the lectures during the first semester of the silviculture course were planned to handle the following issues:

- A historical introduction to forestry and silviculture in Denmark.
- Aims and methods in silviculture handled in relation to needs and expectations of shifting generations, with special attention to the demands about multi-functionality.
- Principles and methods for managing the ecosystem concerning selection of tree species, regeneration, care of growth etc.
- Policy for selection of tree species and growth plans

Observations of the lectures uncovered how the teachers understood sustainability in a forestry context, as well as how this perception influenced the choices of actual content in the teaching situation. This understanding of sustainability can be described through the following key phrases:

- Preservation for the future
- Multi-functionality
- Forestry’s roots in and communication with society
- An ongoing ability of forestry to adapt to changes in society

In the introductory lecture, the framework for silviculture according to the above key phrases and understanding of sustainability was set. Actual lecturing on the following issues then drew the frame further:

- The historical development in forestry practice and forestry’s interaction with society. The students were provided with an understanding of how Danish forestry and the silvicultural practice had moved from multi-sided to one-sided (characterised by mono-cultural growth) and now are to move towards multi-sided forestry again to enhance multi-functionality and thereby the desired sustainability.
- The function of the forests, through historical examples, as very dependent of the societal context.
- How the one-sided forestry had reached problems concerning: 1. Practice of silviculture where the mono-cultural growth has led to problems with stability, falls, “red spruces”, lack of biodiversity etc. and 2. Changes in society with dropping prices and rising wages in the

production sector, leading to solutions through mechanisation and use of pesticides to enhance effectivity.

- How the silvicultural problems in growth of the forest and the society's demands for environmental care, biodiversity etc. has reached a point where the solution no longer can be found through rationalisations and where the only possibility was to question the paradigm of productivity.
- How the paradigm of productivity fitted a historical time with other value relations in tree production, meaning that the paradigm was not even profitable any longer.
- Multi-functionality as the solution where the forests in the future are able to fulfil functions within three areas: primary production, protection and recreation.

Through the above choice of content and the discourse that took place, the teacher set their desired frame and foundation for future discourses to take place in the classroom with students participating. The understanding of sustainability, clearly related to the Brundtland definition, was not explicitly put up for discussion, but the students were provided with the arguments for the need for changing forestry practice and silviculture into a paradigm of sustainability.

From following the lectures it became clear that the discourse from the teacher followed a specific pattern. At the outset was an overall approach to forestry, which can be characterised as holistic. A focus on multi-functionality became important, relating to a balancing of economic, ecologic and social dimension concerning the needs of the present society and a concern for the possibility of future generations use of the resource. The forest was not considered an isolated unit of production with only the interest of the stakeholders, but as part of an overall landscape management with the interests of society in mind. For the specific localities used for forestry, seen as a form of natural resource management, the question about silviculture became a question about which functions are desired for the particular locality, a desire that was negotiable with society. In dealing with these functions, sustainability is brought into practice in silviculture as a weighting between the three dimensions to be taken into account in formulations of policy plans. The actual choice of tree species then becomes closely related to the function of the forest.

The pattern described here reveals different levels of approaching the practice of forestry and silviculture, where the demand for multi-functionality can be seen as the highest level determining the approach in the levels to follow:

Multi-functionality → Locality functions → Silvicultural system → Policy plan → Tree species

The levels can also be described as going from a landscape level to a forest level where the management and growth of the forest is considered a part of the landscape management. Central to all of these seem to be the focus on functions to achieve through management.

The approach presented was seen successful in the interaction with the students in those cases dealing with more general levels as, for example, locality functions. One example concerning the effort to introduce and weight the importance of the function of the forest was a slide show session in the third lecture of the semester. The students were shown different forest settings and the functions obtained by the way silviculture was practiced were demonstrated. Following this, the questions of whether sustainability in the new understanding had been obtained and whether the classical understanding (the productivity paradigm) had in fact been challenged were taken up. The students enthusiastically participated in this session and the related discussion. They willingly challenged not only their own understanding of practicing forestry, grounded in the classical understanding, but also the new paradigm and how to understand it. The session can be considered a success because the students easily seemed to

adapt the idea of focusing on the functions of the forest, a keystone, as described above, in the new approach to forestry and silviculture.

Moving the focus to the more specific levels dealing with issues such as choice of tree species, the approach framed by the teacher seemed to be challenged. All through the semester, the students tended to ask very specific questions related to the practice of silviculture. Questions as to which kind of tree species should be chosen came up, fitting very well with their desire for exact knowledge about "*how it should be done*". This specific need on the part of the students was also revealed in their responses to the questionnaires. But more importantly, their questions could be seen closely related to their belief that the forest and silviculture were fulfilling a single function of productivity. This also fits the findings in the questionnaires where it was uncovered that the students' perceptions about forestry were grounded in the classical understanding of the forest as a production unit. Though the discussion about the specific silvicultural issues and the choices to make were intended by the teacher to relate to different possible functions of the forest, the discourse between teachers and students tended to stay in dealing with production as the most important issue. In those situations it seemed not possible to move beyond the paradigm of productivity

Discussion

The conceptual understanding of sustainability and the way it is translated into the practice of teaching a course in silviculture in this case study, could be very clearly related to the Brundtland definition of the concept and a further interpretation related to forestry. In this interpretation, the multi-functionality of forests and the three fold weighting between economic, ecologic and social dimensions are essential features. Therefore, forestry becomes contextualised, as being integrated in a social reality, and silvicultural considerations are not only closely related to, but also directed through interaction with this social reality. With these considerations in mind, in the actual teaching situation, a specific pattern with a holistic nature was followed, in an effort to provide the students with a framework for working with silviculture, which matches the demands of the desired sustainability. A keystone evident in this framework was the heavy emphasis placed on dealing with desired functions of the forests as guideline for practicing silviculture. Integrating the new concept of sustainability was also supposed to be a possibility and a tool for moving beyond the existing paradigm of productivity.

Even though approximately half of the students attending the course could agree with the teachers in the interpretation of sustainability, overall, they seemed to relate to a classical paradigm of productivity when expressing their aspirations and expectations towards their education and the silviculture course. In this way, the students' expectations to the course contradicted the teachers' intention. During the lectures, these contradictions were seen in the way the students continuously asked questions related to the classical silviculture. It could also be seen in the way the discourses about specific silvicultural issues tended to stay within the arena of production and productivity. This discourse fitted the students' perceptions about forestry, their knowledge gained during previous courses in their education and their sense of further specific knowledge in silviculture needed to identify with contemporary professional practice. As research done and teaching material developed so far, based on natural science, also primarily tend to support a perspective of production, it seemed very difficult to move the discourse beyond the paradigm of productivity, not only for the students, but actually also for the teachers.

If we look at the framework the teachers provided the students within the lectures, then it can be seen not simply as adding social dimensions and concerns. The holistic framework and the different levels of approaching forestry and silviculture to move beyond the productivity paradigm can be characterised as systemic in its nature. Salner (1986), based on her empirical

observations of students studying general systems theory, concluded that systemic competencies cannot be adequately acquired “until their thinking has reached a particular developmental level and they have integrated particular epistemological assumptions into their overall worldviews”. The ability to think in systems and thus act systemically only comes with a particular stage of epistemic development, which presume an elaboration of epistemic positions and ability to adapt these where appropriate. Salner (1986) drew from the work of Perry (1968) and the model of three levels of cognition from Kitchener (1983). The essence of Perry’s observations was that students passed from an initial developmental stage of epistemological dualism, through a stage of multiplicity to finally reach a state of contextual relativism, when awareness of the importance of contexts in defining truth and value is reached. Kitchener (1983) refers to this third stage of cognitive development as epistemic cognition, following dualistic cognition (one truth, and looking for that truth in the world) and meta cognition (many truths, looking for truth in the self). Salner concludes that students need to be assisted to examine their third level epistemic cognitive processes. The question here is whether the students in the Silviculture course in general had reached the level of epistemic development to be able adapt the systemic way of thinking, which characterised the nature of the provided framework. The second question would be whether appropriate pedagogic opportunities existed in the classroom to assist them to clarify their epistemic positions.

The slide show session did provide a learning environment which enabled students to reach at least a level of meta cognition and probably also to move towards the level of epistemic cognition. The experiential nature of the encounter in this session may have been an additional feature, which allowed this to happen. The new approach in the course and the essential focussing on functions of forests was in this situation easily accepted and adapted by the students. However successful this particular situation might have been in dealing with the general levels, when dealing with the specific levels, the students seemed to stay primarily in a level of dualistic cognition, expecting a single truth about how to practice forestry and only related to a function of productivity. In these cases, there seems to be a need for providing a learning environment to reach the level of epistemic cognition and thereby make systemic thinking possible for the students. This is not only a challenge for this particular course but also the previous courses taken by the students most of which were presumably built on the productivity paradigm.

In his paper about changing forestry education by enhancing Beta/Gamma professionalism, Röling (2000) advocates for attention and integration of the social dimensions in natural resource management. He states that the issue is not to replace the natural sciences (Beta), rather it is an issue of supplementing it with something more, in this case Gamma, which represents social sciences. We are in agreement with this argument as discussed in a previous paper (Leth et. al. 2001). Our observations in the present case study, also shows us that an inclusion of social dimensions and social sciences alone cannot contribute to a move beyond productivity. A desire to actually move towards sustainability leaves us with some fundamental questions to not only which issues natural science research should be concerned with, but also how.

The model of a hierarchy of interconnected learning subsystems adopted from the systemic approach at University of Western Sydney, Hawkesbury, Australia (Bawden 1991) can assist us in this area. This model has been used by the Hawkesbury faculty as a heuristic tool to assist students and researchers deal with complex issues of contemporary agriculture and rural development and to focus on the interrelationships between people and their environments (Sriskandarajah et. al. 1991). The learning process is integrated along a continuum stretching from holism to reductionism, and the open-ended model depicts at least four levels of inquiry nested in a hierarchy. From a researching or inquiring point of view, each level provides a

perspective and a clearer focus on intent for the subsequent level and each lower level provides insights for the higher levels.

A model of this nature can form the framework for designing of curriculum across forestry education linking the natural and social science disciplines. Within the structure of a course such as the silviculture course, the same framework can also provide the basis for linking the specific questions at the reductionist level, such as the specifics of growing trees, with the wider questions and issues of sustainability at the 'soft systems' level. The complexity and uncertainty associated with multi-functional forestry and the conflicts arising when such a system is managed do offer an adequate experiential base for the students to learn from. An essential feature of the model referred to here is the way in which experiential learning concept, following the ideas of Kolb (1984), is embedded in it at all the levels, enhancing the opportunity for reflections about aims, methods and processes at all levels. In a curriculum built along the lines of the Hawkesbury spiral, the focus on learning at the more holistic level also offer the possibility of taking the ethical, moral and political dimensions of sustainable forestry, thus extending beyond the Brundtland interpretation of the concept. Thus, the ability to meet the challenges for this particular course and courses in the rest of the curriculum could be fostered through a greater focus on learning and of the systemic nature in the effort to move towards a paradigm of sustainability.

Conclusion

The most obvious implication to be seen from our case study is the difference between students' perception of forestry and silviculture, grounded in the paradigm of productivity, and the teachers believes in and intentions to leave this paradigm behind. One of the major tasks for the teacher therefore became considerations about not only what the actual content should be, but also how to convert the vision into the educational practice, to handle the different perspectives the students carried and create a shared understanding. The approach in the paradigm of sustainability, as chosen by the teacher, could be described as systemic in its nature. It therefore calls for a greater attention to the level of cognition to be reached (a level of epistemic cognition) to enable an adoption of the systemic way of thinking. A way to enable the students to reach such a level is to focus on a learning process that would enable ethical reflectivity as desired in the epistemic level of cognition. Such an approach is seen in the model from Hawkesbury in the interconnected levels of learning systems based on ideas of experiential learning. The learning approach could also provide a foundation for reaching a shared understanding about sustainability.

A systemic approach in the efforts to incorporate sustainability is of interest in not only forestry education, but in any effort dealing with natural resource management and rural systems. The systemic approach can support a desired integration of social dimensions. Our single case in forestry education though, shows a need for a fundamental rethinking of research in the natural sciences and technologies and the way it provides knowledge if its to be part of such a system. The task here is not to question the reductionistic nature of research in natural science and technologies, but merely to enhance ethical reflectivity. Attention to the cognitive level that would enable a systemic way of thinking, exploring ways of assisting the students to move towards that level and designing learning processes that support the demands of such cognitive change seem necessary steps required prior to incorporating sustainability in education.

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