Master Degree Project in Urban Forestry and Urban Greening

Swedish University of Agricultural Sciences

Landscape Architecture Level C

A landscape laboratory in Germany – reaching out for new landscape concepts

By

Astrid Hamm

Supervisor: Prof. Roland Gustavsson, SLU Alnarp
Supervisor: Anders Busse Nielsen, Ph.D. Student KVL Copenhagen

A landscape laboratory

In Germany's „Ruhr" region

Summary

The highly industrialised “Ruhr” region in north-western Germany has undergone considerate structural changes over the past four decades, as industrialisation has seized and left the region with major challenges for its regional development in terms of urban planning, as well as social, economic, and environmental aspects. As many heavy industries, such as coal and steel mining, have moved away, they have left vast amounts of “useless” industrial land behind. New land use concepts have to be developed for some of this land that cannot be used for urban development (housing, industries). Biomass production has become an important source of renewable energy for the future. However, its potential has not been fully exploited in Germany, and more research is required, especially in terms of woody biomass production (energy forests). As recreation connected with nature has become an important factor in a highly urbanised area like “Ruhr”, this report investigates the possibility of linking energy forests with recreational urban forests on post-industrial land in Germany’s “Ruhr” region, using the conceptual framework of a landscape laboratory as a tool to combine and implement these different concepts. Furthermore, it presents a concept for a German landscape laboratory where biomass production can be implemented as part of a recreational landscape.

Introduction

Germany's “Ruhr” region, in the north-east of the state ‘Nordrhein-Westfalen’, has been Europe's 'heart of industrialisation' and urban agglomeration for over more than 100 years. With 18 million people spread over an area of approx. 70 000 km², ‘Nordrhein-Westfalen’ has the highest population density of all German states. (Average population density: 520 people/km², in urban areas beyond 1000/km², Landesumweltamt Nordrhein-Westfalen, 2000). Since the end of industrialisation (in the late 20th century) it has undergone major structural changes, as many heavy industries (predominantly coal and steel) have moved away. As a consequence, the area's economic structure has changed dramatically. This resulted in multi-scaled challenges in terms of urban planning and social changes, as well as the new-orientation of the areas' functionality and values in terms of social, economic, and environmental aspects. Large numbers of post-industrial land sites, including many brown field sites that have developed during the past 30 years, being classified as 'non-functional' land, present one of the challenges for regional development in the “Ruhr” region. Some of this land is still 'unused' and cannot be integrated into the context of urban (housing) development for various reasons.
One of the questions the region faces is: how can these land sites be used and provide benefits for a highly urbanised environment in terms of economy and recreation?
The State Government of 'Nordrhein-Westfalen', Germany, supports new concepts for using these land sites for urban forestry and urban agriculture (e.g. project 'Industrial Forests') that will aid in creating a more sustainable and functional future landscape. Some of these landscape models combine commercial production with recreational use, as well as providing educational facilities. Furthermore, artists are given the opportunity to express the strong connection of the area's history with art and nature. Projekt Ruhr (2005) states that 'Art serves the purpose of making the forest known better and encourage local residents to visit it'.

Biomass production for energy purposes has become an important alternative worldwide to replace fossil fuels and nuclear energy in the future. In Germany, extensive research into renewable energy production has resulted in the commercial use of renewable energy in many fields. Commercial energy forest production has only been addressed to a limited degree at this

point in time. However, they may become more important over time to meet future energy demands in many countries all over the world. More research is required to explore the potential of energy forests as a further addition to biomass production in agriculture and other fields that are already commercially exploited in Germany.

The concept of landscape laboratories was developed by the Swedish University of Agricultural Sciences, SLU in 1990, with Prof. Roland Gustavsson as one of the key stakeholders involved. The main idea behind this concept is to create a platform where scientists and practitioners with different professional backgrounds can meet and collaborate on the development and test of new concepts for design, establishment and management of urban forests and urban greening.

By testing innovative ideas in full scale, landscape laboratories also serve the education of students, young managers and forest owners within the area by inspiring them to be creative in their management approach, 'dare to be different'.

Another important design concept of a landscape laboratory lies in its function to accommodate recreational use by various stakeholders from the general public. Therefore, its concept strongly involves research into social sciences, as well as focusing on its role as a part of public green resources where people enjoy their time and experiences with nature, and learn about the importance of nature close to urban settlements.

Furthermore, it presents an overall concept where research into commercial production of forest products can be integrated into the concept of recreation (trial plots for different forest types: Snogeholm land-lab) as well as other concepts, for example ecology (e.g. biotope design, seed source).

This study examines the question: how can the concept of a landscape laboratory with focus on biomass production linked with recreational use be applied to post-industrial land sites in Germany's „Ruhr“ region, in terms of design, environment, landscape, recreation, research, and cultural (industrial) context? What challenges will existing conditions of post-industrial land present in order to develop a concept for a German landscape laboratory?

A landscape laboratory that could integrate trial plots for research in energy forest production

as a future option for biomass production into its design, linking it with recreational goals for urban green spaces, would present a considerable gain for post-industrial land use in the “Ruhr” region.
It could develop into an urban green space with its main focus on recreational use, as well as providing education for the general public and experts in terms of renewable energies and biomass production.
Therefore, it may become a scientific as well as practical standard of reference for transformation of post-industrial landscapes elsewhere, linking recreation and research for commercial forestry purposes on one hand, and using vast areas of 'non-functional' post-industrial land on the other.

Based on assessment and analysis of the “Ruhr” regions historical background with special focus on its recent developments (past 40 years), and their multi-scaled impacts on regional development in terms of social and economical issues, recreation and environmental conditions, and the assessment and analysis of the contextual profile of three existing landscape laboratories in Sweden and Denmark, this paper presents a proposal for a conceptual framework for a German landscape laboratory with focus on biomass production linked with recreational use in Germany’s “Ruhr” region.

Key words

Landscape laboratory, post-industrial landscapes, new landscape concepts, biomass production, energy forests, creative management, recreation, multifunctional, sustainability.

Objectives

- To investigate the possibilities of connecting woody biomass production and recreational use in a German landscape laboratory, and how these two concepts can overlap.
- To investigate how woody biomass production could be integrated into the concept of a landscape laboratory in Germany's “Ruhr” region, with recreation as the main focus.

Limitations

Due to certain constraints, this report has been limited in producing the desired outcomes:

- Time and language constraints (time available for this project: 9 weeks / most literature on landscape laboratories has been published in Swedish and was, therefore, inaccessible).
- No scientific assessment of prospective project sites was possible, therefore, no scientific data such as soil testing (quality of growing medium)and other environmental data of sites (available water, geographic data, topography, weather conditions, etc.) were available.
- Personal contacts were limited to a small number of stakeholders (refer to personal communication in report).

Methods

Interviews with some of the key stakeholders

- Personal communication (interview-based) with some of the key stakeholders from the Ministry for the Environment in 'Nordrhein-Westfalen' Germany, involved with Urban Forestry and energy forests in the “Ruhr” region (Renate Späth, Roland Damen, Ministry for the Environment, “Nordrhein-Westfalen”MUNLV).
- Personal communication (interview-based) with some of the key stakeholders involved in the existing landscape laboratories in Sweden and Denmark (Roland Gustavsson, Anders Busse-Nielsen), exploring questions in regards to design, context, development, management for landscape laboratories

The majority of information on design concepts and management of existing landscape laboratories was obtained through personal communication with R. Gustavsson and A.Busse Nielsen

(April 2006). All landscape laboratories were visited and assessed with the information collected from this personal communication, as well as some information from book chapters and scientific papers written by R. Gustavsson.

Site visits

- Visits of several post-industrial sites in the “Ruhr” region ('Graf Bismarck', 'Rheinelbe', 'Lohberg', former Collieries)
- Visit of all existing landscape laboratories ('Alnarp' and 'Snogeholm' in Sweden, 'Holstebro' in Denmark)

Literature research

- Existing information on landscape laboratories in English from the library and the Internet was assessed and analysed
- Reports on past and present developments in Germany's „Ruhr“ region were assessed and analysed (provided by the Ministry for the Environment Nordrhein-Westfalen, MUNVL)
- Reports on existing concepts for Urban forestry on derelict land in Germany's 'Ruhr' region were assessed and analysed (provided by MUNVL)
- Woody biomass production: short-rotation crops and alley cropping as the two systems for energy forest production chosen for this report were assessed and analysed for their potential use as an integrated part of a recreational forest system.

Assessment and analysis

- Site conditions (see limitations)
- Local context
- Socio-economic context
- Suitability for recreational purposes
- Conceptual framework of a landscape laboratory

Information was assessed and analysed for its potential to combine the concept of landscape laboratories, recreational forest and energy forest.

Results

Assessment and analysis of recent regional development of “Ruhr”

Already in the beginning of the 20th century, Robert Schmidt, (Town Planner, Essen Municipality) recognised a need for a green structure in the „Ruhr“ region that he considered vital for the ever-growing region's development due to industrialisation. He presented his vision of a green belt throughout the region, consisting of meadows and forests easily accessible for everybody, and connecting the region as a green network being part of the urban environment, rather than a „National Park“ far away from urban areas. His strategic recommendation for the Municipalities in the region was to integrate his vision not only in regards to the development of green areas, but to include it as a part of an overall concept for urban planning in the future. (Projekt Ruhr, 2005)

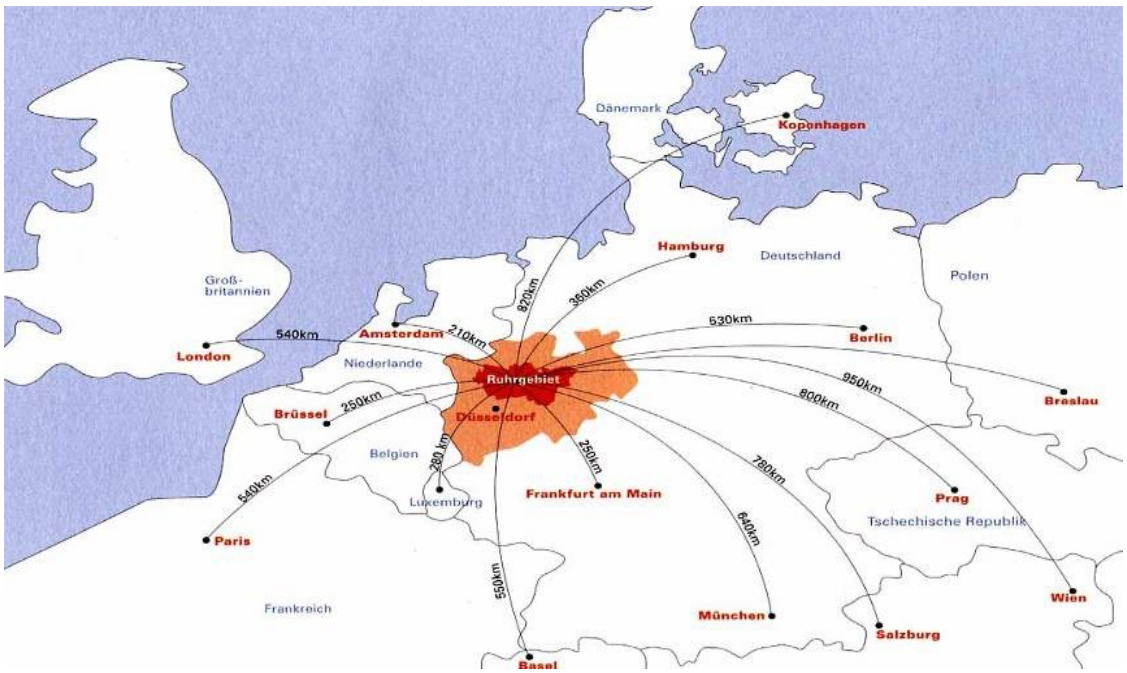

Figure 1: Map of the "Ruhr" region in Germany

Post-industrial land use in Germany's 'Ruhr' region

Introducing new planning concepts:

International Building Exhibition "Emscher Park" (IBA, Stage 1: 1989-1999)

After the dramatic impacts of the end of industrialisation in the past 40 years, new impulses and innovative concepts for future economic and regional development in the „Ruhr" region were presented and put into place with the start of IBA in 1989. Its concepts for Stage1 were predominantly based on sustainable development of the region after the enormous changes and their many folded impacts on the region's economic, cultural, social, and environmental structures.

Müller (2001) referred to the IBA project „Emscher Park" (Stage 1: 1989-99) as a 'Transformation Laboratory', where long-term plans and programs were replaced by mid-range projects that could be realised in concisely defined steps, striving for decentralised projects, and, therefore, presenting models with realistic goals. These should furthermore enhance the ecological, economical, and social renewal as well as presenting opportunities fort the integration of the arts and culture.

Therefore, a framework for innovation and new concepts, in relation to the region's historical and social background has been established with IBA in the 1990s.

Stage 2 (2000 – 2010), developed after the IBA, has added a new dimension to the original concept: to establish and trial various new and innovative concepts in urban forestry and urban greening.

Figure 2: 'Lohberg' Colliery

Concepts in Stage 2 were developed further to create a more sustainable and functional future landscape, and to provide more urban forests and green spaces for recreation and education, as well as to acknowledge the region's cultural heritage as an integrated part of this landscape. This has resulted in a well-connected network of urban forestry projects within the “Ruhr” region. (Projekt Ruhr GmbH, 2005)

Concept “Emscher Landschaftspark”

“Emscher Landschaftspark” is a globally unique concept that presents a network of spaces and projects within the highly agglomerated “Ruhr” region on a total land area of 140 800 ha. It connects the cultural, social, urban, economical, ecological, maintenance, and utilisation dimensions, trying to create a sustainable environment on all levels. A “Master Plan Emscher Landschaftspark 2010” provides guidelines for the second stage of the project for regional development strategies and concepts. Its aim for the concept 'Urban Forestry and Urban Agriculture' is to develop the region with its strongly industrial background as a modern urban, cultural, social, agricultural and forestry landscape, and connect it with design demands of an urban cultural landscape. (Projekt Ruhr GmbH, 2005)

Furthermore, it puts a strong emphasis on communication amongst land users from forestry and agriculture to form communication platforms for both stakeholder groups in order to

co- operate and communicate to try new landscape concepts.

'Platform Urban Forestry' ('Platform Urbane Waldnutzung') was initiated by 'Projekt Ruhr 2005' and MUNLV (Ministry for the Environment, Nordrhein-Westfalen, Germany) in the „Ruhr“ region, where all stakeholders involved with forestry are invited to join and exchange information on a macro – and micro level.(Platform Urbane Waldnutzung im Ruhrgebiet, 2005).

„Emscher Landschaftspark“ is just one of the new concepts that have been developed in Germany in regards to sustainable development in post-industrial regions.

Therefore, the concept of a landscape laboratory would present a new and innovative approach for further developments in this field.

Figure 3: Urban context of post-industrial land in the “Ruhr” region

“Projekt Industriewald” (Project “Industrial Forest”)

Today, approximately 10 000 ha of post-industrial derelict land (Projekt Ruhr GmbH, 2005) still exist. Many post-industrial land sites of different sizes are still spread over the region, some of these already being converted into recreational forests and landscape parks, but many others still remaining 'unused' as yet.

Project “Industrial Forests” commenced in 2002 as one of the many projects within the framework of “Emscher Landschaftspark”.

It consists of almost 180 ha post-industrial land sites that have been abandoned for many years, and nature has reclaimed them in form of succession forests in various stages. They are neither natural nor man-made. Growing media have been heavily altered through industrial activities. However, their natural development is a process that is not controlled by humans. These forests are only managed on a marginal level in terms of public safety and can develop into different types of ‘wilderness’. (Projekt Ruhr, 2005).

Figure 4: "Industrial Forests"

This project presented a new innovative concept to let nature take over land that has been altered heavily by human activities for many decades. With minimal management, it has lead to a concept that has evolved to a 'new' type of nature/wilderness (refer to: Kowarik & Körner, 2005).

Urban recreation

Urban forests and urban green spaces have played an increasingly important role in urban development over time. Especially during the past century, their importance has increased even more, due to industrialisation and increasing urban agglomeration, and their effects on human health and well being. Many publications by human geographers as well as sociologists, psychologists and other professionals have researched the impacts of urban forests and urban green spaces on the urban society in Germany, especially in regards to their role for human recreation in densely populated areas in Germany's highly industrialised "Ruhr" region (for example Keil, 2002; Kowarik & Körner, 2004; Keil & Loos 2005).

Most derelict land sites that cannot be developed into urban housing or industrial/business parks present a high potential for new projects to develop different types of land uses, especially in a recreational context for urban woodlands and urban green.

Energy forests have always been a part of this region (e.g. The historical "Niederwald" to harvest firewood and fodder for animals, App.1A) and during the industrial revolution, wood was used for coal- and steel mining, e.g. by "Hauberg Cooperative" (App. 1C). These forests

have had especially strong and important links to the „Ruhr“ regions' industrial history, as well as becoming increasingly important as a possible energy source for future energy demands of our urban society. Traditional 'models' of 'energy forests' such as the “Hauberg low forest” (App.1B) also present important social models in terms of human communities who 'own' a forest together and work it in a sustainable way to maintain their livelihood. Furthermore, recreational spaces were integrated in these historic models, and could be integrated in a landscape laboratory combining recreation with biomass production.

As there is still a high demand for fire wood as a traditional method for residential heating in the region* this aspect could also be integrated as a sub-concept to serve local demands.

Conceptual assessment and analysis of a landscape laboratory

Concept of existing Landscape Laboratories in Sweden and Denmark and their links to human recreation (App. 2)

The concept of landscape laboratories concentrates on spatial configuration, and how it affects human preferences, links to cultural and natural heritage, as well as the survival and distribution of species (SLU, date unknown).

Its main focus is to create diversity for human perception, to have experiences that vary in time and space and to increase recreational qualities of a landscape on various levels. It tries to connect people to the forest on an emotional level and attempts to 'give ownership' to people, as they connect, maybe participate, and feel that the forest is a part of their lives, just like in the “Hauberg Cooperative” (App.1C).

Structure and vegetation are the main design foci in all landscape laboratories, as their impact can change human perceptions quite dramatically. Therefore, adding new elements involves to carefully balance variation within and between different concepts. Furthermore, existing elements shall be part of such a concept. This also applies for artists to work with existing vegetation and water as some of the elements*.

There are three existing landscape laboratories in Scandinavia where these concepts have been applied (App.2: Concepts of existing landscape laboratories and conceptual framework).

Biomass production and energy forests

Energy forests have been grown to produce fire wood for the past 2000 years (LWF Merkblatt 19, date unknown).

*Späth R., MUNLV, personal communication, April 2006

*Gustavsson R., personal communication (April 2006)

Today, biomass production has proven its high potential as a renewable energy source in various fields (Bauen et al, 2004; Scurlock&Hall, 1993; Sharai&Welling, 1999).

Scholz V. & Ellerbrock R. (2002) suggested that energy plants, cultivated on set-aside land, could substitute nearly 3% of the primary energy in Germany and could raise the income of farmers. However, the substitution of fossil fuels by plants requires the selection of plant species with high site suitability, an ecologically benign farming system and high yields.

There are many methods for commercial woody biomass production (energy forests). However, two methods for energy forests, short-rotation crops and alley cropping, have been specifically chosen for this report, as the author considers these two as most suitable for a German landscape laboratory for the purpose of linking energy forest production with recreation.

These 'new' methods are in parts based on various 'old' forest concepts combining silvicultural and agricultural methods (e.g. alley cropping, presenting some aspects of Germany's „Hauberg“ concept, short-rotation crops presenting similarities to the traditional “Niederwald” App.1A) have been tested in Germany to some extent to date (Höhere Forstbehörde Westfalen-Lippe,1990/ LWF Merkblatt 19, July 2005/Natural Resource Conservation Service (NRCS) April 1997/Agroforestry Research Trust, date unknown/ Burger F., date unknown).

“New” energy forestry methods present systems with enough flexibility where recreational purposes as well as the integration of test plots for energy forestry could be combined in a landscape laboratory. Therefore, they allow space for creative design and management, which makes them appropriate for a concept of ‘landscape laboratory-recreation-energy forest-post-industrial land use’ in the “Ruhr” region.

Methods investigated for biomass production in a German landscape laboratory

Short-rotation crops

Short-rotation crops of woody plants for energy production have been used to some extent in countries such as Sweden and Finland in the past decades (Dimitriou&Aronsson, date unknown/ Verwijst T. date unknown/ Spinelli et al, Sept. 1996).

Their use has been investigated as a „new“ land use concept for agricultural fallow land in Bavaria since 1992. Tree species such as Willow, Aspen, Poplar, Robinia, Alder and their clones are used due to their capacity to produce rapid basal regrowth that can be harvested in rotation cycles between 3 and 8 years. Trees in such energy plantations can grow to an age of approx. 20 years.

New plantations are established with 12 month old cuttings of the 'old' trees. They are stored in a cold store before planting in spring. (Burger, date unknown)

Figure 5: Harvesting of Short-rotation crops

Cultivation of short-rotation crops is still in its experimental stage (Pallast et al, 2005) in other European countries like Germany, due to concerns regarding economical viability (high land use demands, economic viability of existing harvesting methods). (Pallast et al, 2005/ Wright et al, June 2000/ Scurlock & Hall, 1993).

Except for several experimental short-rotation test sites on agricultural fallow land in the south of Germany, and more recently in the „Brandenburg“ and „Sachsen“ States (latest projects: 'Agrorum' and 'Dendrum'), where different types of woody plants are tested for their qualities for commercial viability as energy crops especially on derelict land sites, not much research has been committed to energy forest production.

Alley-cropping

Alley-cropping systems are Agroforestry systems that have been predominantly used in tropical and sub-tropical agriculture to improve site conditions and ensure steady incomes for farmers (Kang&Gutteridge, date unknown).

NRCS (1997) defined alley-cropping as “the planting of trees or shrubs in two or more sets of single or multiple rows with agronomic, horticultural or forage crops cultivated between the alleys of woody plants”.

This system has many advantages that have been extensively researched in many countries worldwide (Agroforestry Research Trust, date unknown/Kang&Gutteridge, date unknown/NRCS, April 1997).

It can improve crop performance through adding organic matter and nutrients to the soil, and, therefore, reduce the use of chemical fertilisers. It also improves soil structure and utilisation of nutrients, increases biodiversity, reduces soil erosion, evaporation, and water run-off, modifies micro climate for improved crop production, improves weed control (shading of inter-spaces), provides additional products (e.g. forage, firewood, stakes), enhances and diversifies various agricultural, horticultural, and woody crops, provides additional income through product diversity, and enhances landscape aesthetics. (Kang&Gutteridge, date unknown).

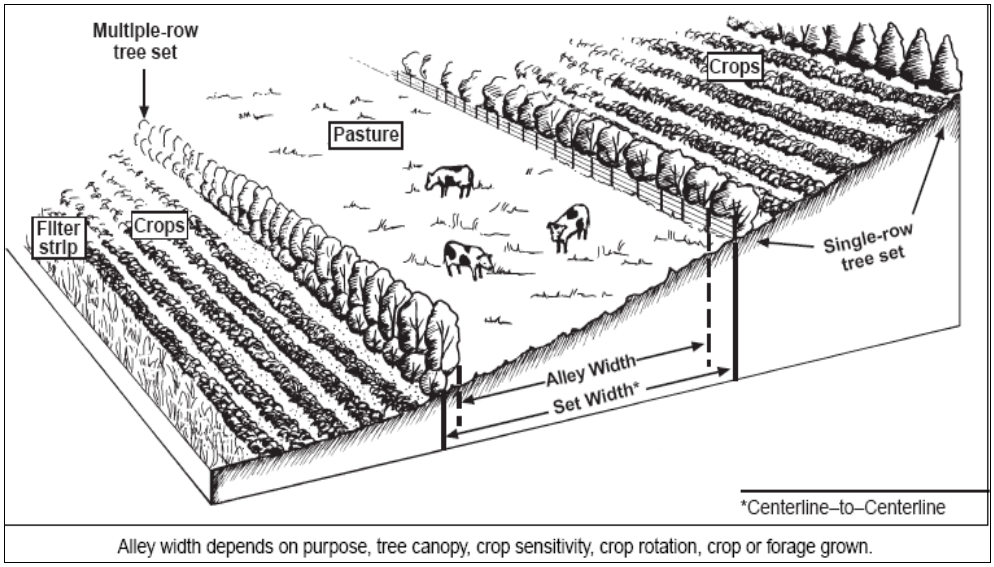

Figure 6: Alley-cropping system

Recent research has been conducted in the U.S. and European countries, choosing a context different to agricultural use, for example silvo-arable systems in the UK (Agro-forestry Research Trust, date unknown) , and alley-cropping as an alternative land use for post-mining sites in Eastern Germany' (Grünewald et al, 2005).

Grünewald (2004) describes research that has started in 1996 at the Technical University of Brandenburg, Germany, and has shown that alley-cropping systems used for commercial biomass production on post-mining land sites have presented the same commercial yields after 6 years than energy crops that have been grown on 'natural' (arable) land. The crop combination of Robinia (woody crop) and Lucerne (arable crop) has proven to be most suitable for marginal land sites such as post-mining areas. They also have the advantage of rapidly improving soil conditions due to their N-fixing abilities. As this study shows that soil conditions can improve rather quickly, considering the original substrate when the system was established, tree species and arable crops used in the initial stage may be altered over time to accommodate higher yields and more landscape variations. Furthermore, these changes can lead to an increasing variety in vegetation types used, vegetation structure, and visual effects that can greatly improve recreational amenity.

Assessment and analysis of energy forests and post-industrial land use

The project „Bioregio“ in the „Ruhr“ region sees the (already existing) various competences for energy production (e.g. solar and wind energy, some types of biomass production) in this industrial area as a good basis to develop similar competences for renewable energies. The „Ruhr“ region possesses significant potentials for further development of biomass production and aims for the development of a strategy for logistics and biomass use. (Projekt Ruhr, 2005)

Energy forests are no new concept to forestry. Different models have been applied over time in Germany (App.1A/B: “Niederwald”, “Hauberg”), and in many other regions of the world.

One of the main distinctions between today's and past energy forests lies in the use of different production methods (e.g. short-rotation cycles), and breeding of tree clones to produce higher yields (LWF Merkblatt 19, date unknown). Also, further developments in this area will most likely include use of genetically modified trees in the future.*

Energy forests on agricultural fallow land sites have the potential for producing viable economic gains. The amount of wood that can grow per year and per hectare can equal the energy produced for heating of approx. 5000 litres of heating oil. (LWF Merkblatt 19, date unknown).

Fritsche et al (2005) suggest that timber as energy resource with an overall amount of 1,5 % of primary energy supplies do not play a considerable role in Germany at this point in time. However, in rural areas, timber currently covers a significant part of the sectoral and local demands.

DGfH („Deutsche Gesellschaft für Holzforschung“, date unknown) states that the potential of timber as an energy resource is not sufficiently exploited, and that a much larger capacity of timber could be used for energy production than it is the case at present.

Under consideration of efforts to achieve a long-term reduction of energy demands, especially considering heating of buildings and traffic, timber and timber products could produce more than 5% of the energy demands without compromising sustainable development, or the need to increase forest areas (Fritsche et al, 2005).

To date, limited research has been done in regards to energy forests and woody biomass as potential renewable energy source in Germany, compared to other European countries like Sweden and Finland. Also, research and technology have not been developed yet to produce economically viable methods of exploiting energy forests as a source of income.

However, as demands for renewable energies will increase in the near future, energy forests will gain more importance in Germany and other countries in the world.

* Dame R., MUNVL, personal communication (May 2006).

Advantages and constraints of post-industrial land use for biomass production

Scientific and economic constraints

A large amount of post-industrial derelict land has become available over the past decades.

These sites present unique opportunities for new land use concepts, and to conduct more research in fields where high land availability is a major constraint, such as research and commercial exploitation of energy forests.

However, site conditions on most available derelict land sites, such as former collieries, are considered to be harsh and marginal, due to their previous alteration by human activities.

This could be of great advantage for research into how to improve existing site conditions, soil conditions, plant growth and development, crop production, harvesting methods, etc. for economic viability of growing energy crops on derelict land.

Figure 7: "New" post-industrial land ('Lohberg' Colliery, closed in 2005)

Furthermore, an assessment of financial viability for investing resources in such sites should be investigated:

- Is it a viable option in financial terms? Can a landscape laboratory fulfil research requirements for energy forest production integrated into recreational use?
- Which and how much resources are necessary to establish such a landscape laboratory?

- Is it possible to integrate parts of already existing succession forests on some derelict land sites into the overall concept of a landscape laboratory as Stage 1, where some of the original design concepts, such as generality/individuality, complexity/simplicity, dynamic/static, large/small scale, etc. can be applied, and other elements will be added at a later stage?
- Can some sub-concepts already be integrated into Stage 1? If yes, then, it needs to be clearly communicated to all stakeholders that Stage 1 (succession forests) may be short-term, as its aim is to improve site conditions for further development, and that it may change in time to move on to Stage 2 (recreational & energy forest). This would involve extensive communication, and a communication framework would be required to eradicate possible misunderstandings.
- If yes, can the general public become involved in management, similar to Alnarp's landscape laboratory, where public involvement has been a part of management from the very beginning?
- Can it eventually be developed into a full-scale landscape laboratory (Stage 2), with new concepts aimed at recreational forests including energy forests?
- Further, could a landscape laboratory include both, „wild“ industrial forests in different succession stages that remain untouched, as well as a landscape laboratory managed and shaped by humans?
- And how about common sub-concepts in existing landscape laboratories, such as various plots with exotic tree species? Most of these used in the existing landscape laboratories require medium to good soil conditions, which are, at this point in time, not provided on derelict land sites. However, a German landscape laboratory concept may integrate such common sub-concepts at a later stage, when environmental conditions on site allow implementing these.

Furthermore, there are questions in terms of nature protection, as the current discussion in regards to genetically modified plant material also involves the forestry sector.

- Should genetically manipulated trees be used for energy forest production? How will the general public react to this issue?
- What impact will it have on our natural environment?

There are many questions that need to be addressed in order to develop a design concept for a German landscape laboratory for the combination of energy forest production and recreational development of derelict sites in the “Ruhr” region.

Discussion

Post-industrial land use in Germany's „Ruhr“ region - the future

Industrial landscapes should be preserved as a testimony to their history, and to show the enormous changes that human impact can have on, and how it can change natural landscapes. On the other hand, urban recreation and landscape aesthetics have to be re-defined, so people learn to appreciate these 'new' landscapes and their unique appeal as part of their 'new' urban environment.

Part of this 're-discovery' as a multifunctional environment to accommodate human needs at a different scope than in the past, or to even combine different aspects of land use (livelihood/survival and. well being/recreation) will also lead to further changes.

Due to significant structural changes in the „Ruhr“ region during the past decades, new planning - and development strategies were established for a sustainable economical, social and environmental development. One of the main focuses lies in the development of sustainable landscapes simultaneously to the region's urban and economic growth.

Recreational values of the „Ruhr“ region's derelict land in a social and historical context

The beginning of industrialisation in the mid 1850's represented continuous increase in employment opportunities. This, of course, entailed a rapid agglomeration of people working and living in the „Ruhr“ region until the mid 20th century, with all problems affiliated with urban agglomeration combined with heavy industry, such as health and hygiene problems, poor housing and recreational facilities/green infrastructure, and many others.

When coal- and steel industries commenced closing their industrial plants, many people lost their work and had to find new employment opportunities.(Projekt Ruhr, 2005)
However, the region's recent history (past 150 years) plays a significant role for its future development. Even though it has changed dramatically over the past 30 - 40 years in terms of economic, social, and environmental development, its industrial history is still very much alive and present as part of its recent cultural heritage. This is not only expressed through various remnants (e.g. buildings, collieries, shaft towers) of Germany's industrial age, some of them that are now heritage-listed, but also by many derelict industrial sites that have been “useless” land since the 1960s, when many heavy industries disappeared due to major economical changes. Many people who have worked in this industry still identify themselves very much with the area's industrial history.
Therefore, it is important on many levels to maintain a close relationship to the “Ruhr”regions traditions and history, but also to try to create a link to the new regional development that is aimed at a 'better future' for this region in terms of creating new concepts for its social, economic, and environmental improvement.
As for the “useless” land sites in the area that have been left untouched since closing down

industrial facilities, new land use concepts for recreation, developed in the “Emscher Landschaftspark” have been embraced by the majority of people who live in this area. Sub-projects of this have resulted in the development of urban parks as well as 'wild urban forests'. On some post-industrial land sites, formal parks have been developed and present a more common concept of urban green recreational spaces. This is not only expressed through various remnants (e.g. buildings, collieries, shaft towers) of Germany's industrial age that are now heritage-listed, but also by many derelict industrial sites that are to some extent overgrown by succession forests at various stages, some with typical pioneer species dominating, but also some with 'various new floral and woody communities that consist of native and exotic species, 'escapees' from human activities' (Keil P.&Loos G.H.,2005).
Some of these sites have been developed into projects like “Industrial Forests”, with 'wild forests' on former mining sites in different stages of succession, completely unmanaged, except for maintaining public safety along pathways etc.
These sites have also gained a high recreational status, as they are not developed as urban green spaces and, therefore, offer significant „free space“ for residents to follow recreational activities* Keil (2005) suggested that the wild structure of abandoned industrial land gives people, especially children and adolescents, the feeling of freedom and adventure.
Therefore, the region's recent changes clearly show that Schmidt's conceptual framework for urban forestry and urban greening in the „Ruhr“ region is still topical today.

Recreational land use combined with 'energy forestry' as a concept for the „Ruhr“ region

The IBA “Emscher Park” created an overall planning framework for new innovative concepts in all areas of regional development for the “Ruhr” region. A landscape laboratory with its main focus on recreation, trying to combine recreation with energy forestry would follow up on some of the existing concepts (e.g.” Industrial Forests”) in open space planning. This combined concept of recreation and production in urban forestry could demonstrate a new approach for landscape development where production is integrated into a recreational landscape taking away some of the limitations of production forestry and agriculture from the past centuries, and open it for recreational use. Furthermore, it could show that recreation does not have to interfere with production in a forest landscape, but that theses two land use concepts can harmonise within a carefully planned but creatively designed and managed, and flexible conceptual framework. This concept will have to accommodate room for commercial production on the one hand, but also open the area for recreational use, and, as part of this, helping people to understand and be more open to commercial land use concepts. Also it will educate business involved in commercial land use for biomass production that it is possible to adjust production methods in order to accommodate recreational use, and, at the same time, gain a better understanding and a more positive perception from the general public as recreational land users.

*personal communication, 2 dog walkers, names unknown, April 2006.

Recreational impacts of short-rotation crops

Short-rotation (woody plant) crops are typical monoculture plantations.

However, the impact of frequent cutting in short rotation cycles (standard rotation cycles: 3 to 8 years can lead to a higher biodiversity due to factors such as more light available for plant growth (on the herb level/under-storey).

Results from test sites in 'Bavaria' produced up to 10 times more species variety in short-rotation crops than in adjacent arable land, and 110 times more species within the vegetation that is located within close proximity to short-rotation crop testing fields. Furthermore, Nitrate concentration in run-off water decreased significantly after testing sites were planted with short-rotation crops, compared with results taken before planting. (LWF Merkblatt 19, date unknown)

More variety in plant species and structure will lead to more variety in habitat and shelter. Therefore, a landscape with short-rotation crops will have more ecological diversity than standard forest monoculture stands, as well as more structural diversity that changes over time due to rotation cycles. This makes such a landscape more interesting in terms of visual changes over time and space.

It can also provide interesting features such as climbing trees for children, as well as observing various animals and plants as part of a “production crop”. Short-rotation crops present an opportunity to include certain landscape design elements, such as 'willow halls' for example, or creating small 'tents' or 'rooms' for children in connecting the tips of trees (Fig.8). There are also opportunities to design a maze-like structure, where children and adults can hide and play.

These are just few ideas how to accommodate recreation as part of a short-rotation plantation in a landscape laboratory as discussed in this report. Furthermore, short-rotation crops are harvested in winter only, therefore they can be used for recreation during the warmer times of the year, when most outdoor recreational activities take place. This prevents typical conflicts in regards to harvesting and recreational use in production forests.

Therefore, their recreational values are increased to a great extent in terms of visual amenity, environmental values, as well as less user restrictions, compared to production crops in agriculture and forestry. They can present dramatic landscape effects as part of a landscape laboratory where rapid changes can occur that have an impact of human perception on many levels.

Recreational impacts of alley-cropping

The major advantages of alley-cropping systems from a recreational as well as ecological point of view are that they enhance landscape amenity and increase biodiversity to a large extent, and in the long run, maintain soil fertility while requiring low management input (Grünewald et al, 2005).

Due to their variety of different types of crops (trees as well as shrubs and agricultural crops)

growing next to each other at the same time, and the concept of rotation of various crops, as well as using parts of the system for rotational grazing (as a further sub-concept), it's visual impact will continuously change and present many variations that enhance its use for recreational activities.

Therefore, alley-cropping presents a more sustainable system for land use in the long-term, compared to conventional agricultural and silvicultural systems. It also provides a vast variety of recreational opportunities through its variety in crops and crop cycles.

Due to these values, it would present a highly suitable concept for a German landscape laboratory with the purpose of connecting recreation with energy forest production.

A landscape laboratory as a tool for new landscape concepts

Landscape design and management has gained a new status in our post-modernistic urban society. Today, urban green space is strongly connected to human recreation/ well-being, and social and cultural development. Furthermore, the concept of environmental aesthetics as an expression of human perception is going through a new 'renaissance', after been abandoned by the modernistic definition of aesthetics during the past three decades.

Multi-functionality, therefore, requires an open-minded, multi-skilled (multi-professional), multidisciplinary, multicultural/multi-social approach on all levels, where communication and coordination play crucial roles for our society to develop sustainable design and management solutions.

Knowledge that currently exists needs to be communicated and shared across various levels involved in the process of social and environmental development, landscape design and future management.

Professionals need to be able to share knowledge and expertise on a level that will enable cross-professional landscape design and creative management where various aspects of landscape development and human interactions meet.

Communication shall not only occur amongst experts and managers, but also involve the public and, therefore, provide opportunities to express their ideas and emotions as part of sustainable and innovative landscape management practices that will lead us into the future.

Furthermore, concepts that are considered as opposing each other can be combined and integrated in the context of a landscape as concepts that can harmonise and accommodate various different needs.

Today's urban society clearly presents that it no longer agrees with the 'traditional' way of public authorities' decision making processes. People want to have a say in the way their immediate environment is developed.

The era of modernism has limited opportunities for humans to develop relationships with their

natural environment during the past decades. However, urban development has shown that there is an emerging need to create and 'rediscover' the natural environment that has become more and more important with increasing urban sprawl all over the world.

The need for recreational urban forests and green spaces are increasing on a parallel scale to increasing urbanisation, especially in areas like Germany's “Ruhr” region. However, new industrial

developments of the future may reclaim some of this land that is – at this point in time – considered as 'useless'. Therefore, developing concepts for the future on a social as well as ecological level to combine recreation with production may be of high significance to the well being of our urban society, as well as the increasing need for products such as biomass for energy production.

Concept for a German landscape laboratory

A landscape laboratory in Germany's industrial “Ruhr” region will present a new concept with trial plots for energy forest research that are part of the green recreational resource.

Similar to the project “Industrial Forests”, a new type of open space could be developed that would serve the purpose of observing the impact on its environment and local residents, as well as to research possibilities to connect biomass production, post-industrial vegetation types, and recreational use of such an area (Projekt Ruhr, 2005).

In this report, short-rotation crops and alley-cropping have been chosen as compatible methods for this purpose. These systems allow flexibility to produce energy plantations of woody biomass as well as integrating arable and horticultural crops.

Furthermore, alley-cropping systems can accommodate people to produce and harvest their own products (similar to „Hauberg“), as well as trees that can be harvested individually for fire wood.

Also it could be an educational facility, teaching people about energy forestry and creating a historical link between past – and – future energy production. Another main benefit of this system is the production of multiple crops, and, therefore, it provides additional income all year (this could be relevant for future employment opportunities for local people). At last there is its large variety of environmental benefits, such as soil - and micro climate improvement, reduction of soil erosion and weed growth, higher biodiversity, which would be of high significance for post-industrial land, such as former coal-mining sites where environmental conditions are rather poor after mining has seized.

Using a combination of alley cropping and short-rotation crops in a context of former mining areas to produce biomass could present extensive social, economical, and environmental benefits.

The growing potential of open (green) space as a place for projects in social development has been recognised in other cities, such as the project „Inter cultural Gardens“ in Göttingen,

Germany, where migrants have established small production gardens and created a meeting point for the neighbourhood (Projekt Ruhr, 2005).

In London, two projects have developed where local residents established some kind of garden colony on fallow land. These areas have established themselves in their suburbs and are not only used for horticultural production, but also for recreational purposes.

Such production gardens could be a central part of the recreational centre of a German landscape laboratory and present one type of an alley-cropping system, with existing features such as water and old trees (if present) as features or landmarks for the „heart“ of the laboratory, surrounded by gardens for horticultural production (edible products) as well as aesthetic purposes (flowers and various garden plants). This „garden centre“ could be framed by nut and fruit trees as the tree component of traditional alley-cropping systems as well as including shrubs and bushes that produce berries. As moving away from the 'centre' within our alley-cropping system, its traditional approach can then slowly be transformed into establishing several trial plots of woody biomass in short-rotation systems, such as Willow, Poplar, Robinia, etc., and create a rather dense mass as a further landscape element.

Figure 8: ‚Willow Hall’

The first rows adjacent to the 'garden' area could be developed into 'tunnels' similar to

Alnarp's 'Hazel Hall', or the 'Willow Hall' (Fig. 8) to create a transition to the alley crops. Within these energy plots, a kind of maze can be created that provides small holes in the 'walls' of woody biomass to create interesting opportunities to walk through the plantation and have the feeling

of 'enclosure'. These holes shall be kept very small so they do not have an impact on biomass yield. Such spaces can provide feelings of enclosure as well as 'openness' after they have been harvested, and create variety in space and time due to new rotation cycles, and how they influence the appearance and development of the vegetation in structural as well as vegetation

terms (more variety in ground layer next to short-rotation crops).

Another alley-cropping element can be established adjacent to the short-rotation crop, establishing several tree rows of Robinia, Willow, Poplar, etc. combined with Lucerne, Rape, Miscanthus grass, and other arable crops used for biomass production, but also leaving some flowering meadows in strips in-between tree rows that enable people to 'step out' of the enclosure and enjoy an open view framed by the trees. Trees used could also be Birches and Poplars (if working with existing trees), or the tree species that are used for energy production, or even a mix of Oak and Beech trees in rows that are integrated into the system for fire wood production. Some of these trees are maintained as landscape features for longer periods of time (long rotation cycles, for example 20 years) and can be sold individually for firewood, or some of them can be maintained as individual landmark trees (trees close to pathways).

Short-rotation crops and alley-cropping systems that vary in design shall alternate throughout the entire area, employing different design concepts as well as integrating trial plots for biomass production, and combining these to present a creative and flexible, but productive concept combining urban recreation and forest production. As rotation cycles also alternate over time, there will never be 'empty' fields with no vegetation, as different trial plots are harvested at different times, using different rotation cycles.

The 'centre' of this laboratory will always be a meeting point for people and use the agricultural tradition of alley-cropping as a basis for a new type of community garden, as well as an educational centre where people can learn about biomass production, energy forests, and the increasing need to investigate such new energy production systems.

Figure 9: 'Rheinelbe Colliery': Succession forest at different stages

Due to the poor site conditions on 'new' post-industrial sites, it may take several years and high resources to implement such a landscape laboratory. However, there is the opportunity to work

with 'older' sites where succession forests are established at various succession stages already, and, therefore, growing conditions are already improved through added organic material in the soil and climate amelioration through existing vegetation.

A landscape laboratory could become a part of such an existing 'wild forest', leaving part of it as it is, and developing the systems as discussed above, integrating existing vegetation and elements, such as water, topography, etc.
This would enable to show different stages of the new „industrial nature“ of the region:

'Industrial Forests' on derelict land can be:

1. Planted and managed urban forests
2. Wild untouched forests
3. Recreational and energy forests combined, also integrating arable and horticultural crops

Specifically the latter can serve the purpose of involving people from the beginning to enhance a more positive attitude towards land use for commercial production, even making them a part of it, allowing people to harvest and work in a similar concept to the „Hauberg Cooperative“. Art works and social events could further enhance people to learn about and relate to the area's industrial history in terms of energy production as well as creating a link to the new energy production as an integrated part of human recreation and well being, and for the region and its people to develop a new identity in close connection with the existing landscape.

Figure 10: 'Rheinelbe' Colliery: Art work „Stairway to Heaven“

Full-scale Recreational/Energy Forests on post-industrial derelict land

If considering recreational/energy forests on a large scale, where economic viability will play a major part for such a concept, there may be design constraints that have to be accommodated to achieve high economical yields. However, the combination of short-rotation crops combined with alley-cropping is still considered a viable option to link biomass production with recreation. Land users may not establish recreational centres like the gardens suggested for community use in a landscape laboratory. However, alterations in woody and arable crops as

well as rotation cycles, and maintaining some 'permanent' elements such as individual trees, or water streams/features can present important conceptual features for a large-scale biomass production/recreational forest.

The current situation presents a unique opportunity, as well as a great challenge for industrial land owners as well as local communes and regional authorities in Nordrhein-Westfalen to develop and apply new land use concepts for post-industrial derelict sites that will fit into the existing framework of regional development strategies, urban planning concepts, and environmental policies. Some of the current projects managed by 'Project Ruhr GmbH' and local authorities, such as project „Emscher Park“, also focus on the development and integration of new concepts of urban land use for agriculture and forestry within a conceptual framework of regional development in the „Ruhr“ region. (Projekt Ruhr GmbH, 2005).

Furthermore, it presents possibilities to continue and expand innovative concepts that have already been created and established during and after the IBA, and take them one step further.

Germany's intention to replace fossil fuels and nuclear power as main energy sources (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Feb. 2006) will result in an increasing need for exploration of renewable energies. Also, Germany’s ‘Renewable Energy Sources Act’ (March 2000) states that the German Government aims at sustainable development of energy supply in the interest of managing global warming and protecting the environment, and to achieve a substantial increase in the percentage contribution made by renewable energy sources to power supply. Therefore, biomass production presents additional potential for production of bio-energy for heating and electricity.

With rising energy demands, more research in this field will become necessary. As one of the main arguments against it has been high demands of land. Increasing availability of post-industrial sites in the „Ruhr“ region as well as agricultural fallow land show significant opportunities to addressand overcome this issue.

However, as growing conditions on derelict land are different to these on agricultural fallow land, in particular soil quality, some research has already been committed to growing biomass on post-industrial land (Grünewald, 2004, and others), but more research is required how to achieve economically viable plant growth on derelict land sites in the long-term. Therefore, a landscape laboratory in the „Ruhr“ region is considered an excellent opportunity to further investigate relevant research. It may also produce significant insights for future reference.

Linking biomass production with recreation would be a new innovative concept for post-industrial land use where human recreation and involvement could be enhanced in a way that radically changes common perceptions of post-industrial land and plantation forestry.

Final remarks

A landscape laboratory would not only be an environment where people can enjoy nature, but

also where they can connect with various 'new' types of nature here in the „Ruhr“ region in terms of certain activities where involvement of different actors is enhanced to shape the area according to people's individual needs, and giving people ownership of „their“ urban forests as part of their everyday living environment.

This will not only provide people with recreational facilities, but also add the concept of energy forest plantations on a large as well as a small scale (e.g. fire wood).

Combining various aspects of energy production with recreational use could integrate the production aspect into the forest as a recreational area, as it relates to people's immediate needs, and, therefore, may lead to greater acceptance within the community.

Furthermore, there is the aspect of income from forest production that can directly benefit the local community (App.1C: „Hauberg Cooperative“ as a traditional model from the region). A good example for a recent model has been developed in Finland, where heating entrepreneurships exist to produce energy from woody plants, from the initial stage of growing wood to operating a heating plant as the final stage. Heating entrepreneurs are individual entrepreneurs, cooperatives, limited companies, or entrepreneur consortia who sell heat. They work on a local level and earn an income based on the amount of heat they produce.(Renewable Energy for Europe). A similar model could also be developed and demonstrated in a German landscape laboratory as a way to help some people to overcome unemployment.

A landscape laboratory would be a place where more research can occur on a professional/academic level, as well as social aspects that can be integrated into 'green space management', such as investigating traditional socio-economic models like the „Hauberg Cooperative“ that have been practised for hundreds of years to provide sustainable living in a healthy environment, as well as people's livelihood. It could also familiarise residents with the concept of biomass production in order to overcome existing prejudices towards commercial plantation forests, as experienced in commercial forestry in the past.

Even though such concepts will have to be adapted to current conditions, they are still models that have partially been sustained in adapted form until today.

Conclusion

With the existing strategic basis for regional development created by the International Building Exhibition in the 1990s, it is possible to connect recreational use with biomass production in a new landscape laboratory on post-industrial land in Germany's “Ruhr” region. This can be done by employing concepts from the Swedish and Danish landscape laboratories as a tool for recreational concepts, linking it with biomass production through the selected biomass production systems of short-rotation crops and alley-cropping for post-industrial land use.

However, various conditions different to these of the existing landscape laboratories have to be addressed, considered and specified as part of the conceptional framework of a German landscape laboratory.

References

Books

1) Projekt Ruhr GmbH (2005). *Masterplan Emscher Landschaftspark 2010.* Klartext Verlag, Essen Germany

2)Keil A. (2002). *Industriebrachen. Innerstädtische Freiräume für die Bevölkerung.* Dortmunder Vertrieb für Bau und Planungsliteratur, Germany

3) Kowarik I.& Körner S. (Editors, 2004). *Wild Urban Woodlands. New perspectives for Urban Forestry.* Springer Verlag Germany

Book Chapters

1) Gobster P.H. (2001) *Foreword.* **In:** Sheppard S.R.J.& Harshaw H.W., eds. *Forests and landscapes: linking ecology, sustainability and aesthetics.* NY: CABI, Publishing: 21-28

2) Gustavsson R. (2004). *Design, ecology and management of naturalistic urban planting.*

In Dunnett N. & Hichmough J. *The dynamic landscape* (pp.184-214). Spoon Press, Taylor and Francis Group, London and New York

3) Gustavsson R. (2002). *Afforestation in and near Urban Areas. Dynamic Design Principles and Long-Term Management Aspects. Landscape Laboratories as Reference and Demonstration Areas for Urban and Urban-Rural Afforestation.* **In**: Cost Action E12, Proceeding No.1 EUR 19861. Directorate-General for Research. Brussels: 286-315

4) Keil A. (2005). *Use and Perception of Post-Industrial Urban Landscapes in the Ruhr*

In*:* Kowarik I.&Körner S. (2005). *Wild Urban Woodlands. New Perspectives for Urban Forestry.*

Springer Verlag Berlin, Heidelberg 2005, Germany

Reports

1) Grünewald H. (2004). *Dissertation: Anbau schnellwachsender Gehölze für die energetische Verwertung in einem Alley-Cropping-System auf Kippsubstraten des Lausitzer Braunkohlereviers.*

Fakultät für Umweltwissenschaften und Verfahrenstechnikder Brandenburgischen Technischen Universität Cottbus, Germany 2004

2) Projekt Ruhr (2005). *Platform Urbane Waldnutzung im Ruhrgebiet. Zwischenbericht: Arbeitsstand September 2005.*. Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen, Germany

3)

Journals

1) Burger F. (date unknown). *Technologie und Ökonomie des Anbaus und der Ernte von Feldholz.* Bayrische Landesanstalt für Wald und Forstwirtschaft, Freising, Germany

2) Grünewald H. et al (2005). *Alley-cropping as an alternative land use for post-mining sites.* Natur und Landschaft, Heft 9/10 (2005)

3) Keil P.& Loos G.H. (2005): *Urban woodland flora and vegetation on industrial fallow land in the Ruhrgebiet as a product of culture and nature – an outline of general tendencies.* Electronische Aufsätze der Biologischen Station Westliches Ruhrgebiet 2 (2005): 1-13

4) Scholz V.& Ellerbrock R. (2002). *The growth productivity, and environmental impact of the cultivation of energy crops on sandy soil in Germany.* Biomass and Bioenergy, Volume 23, Number 2, August 2002, pp. 81-92(12)

Brochures

1) Höhere Forstbehörde Westfalen-Lippe (1990). *Hauberg – Wesen, Geschichte, Bedeutung, Vegetation, Zukunft.* Der Direktor der Landwirtschaftskammer Westfalen-Lippe, Münster, Germany.

2) LWF Merkblatt 19 (July 2005). *Anbau von Energiewäldern.* Bayrische Landesanstalt für Wald und Forstwirtschaft (LWF)

3) Ministerium für Wirtschaft und Mittelstand, Energie und Verkehr, Nordrhein-Westfalen (Germany, date unknown). *Emscher Lippe: Kompetenzregion für Zukunftsenergien.* Ministerium für Wirtschaft und Mittelstand, Energie und Verkehr, Nordrhein-Westfalen (Germany)

4) Müller S.(2001). *Transformationslabor Internationale Bauausstellung Emscher Park 1989 – 1999.* Gutachten für die Stiftung Bauhaus Dessau. (Publisher unknown)

5) Natural Resource Conservation Service (NRCS, April 1997). *Conservation Practice Job Sheet 311.* United States Department of Agriculture (USDA)

Internet

1) Agroforestry Research Trust (date unknown). Silvoarable – intercropping & alley cropping. http://www.agroforestry.co.uk/silvoar.html. Date accessed: April 2006

2) Burger F. (date unknown). *Technologie und Ökonomie des Anbaus und der Ernte von Feldholz.* Bayrische Landesanstalt für Wald und Forstwirtschaft. Date accessed: April 2006 http://www.fpp.at/pics/download/fpp_kurzumtrieb_endfassung_081104.pdf. Date acc.: March 2006

3) Informationsdienst Holz (date unknown). *Holz, Rohstoff der Zukunft.* Deutsche Gesellschaft für Holzforschung. Germany. http://www.koehldorfner.de/dl/wir/holz_rohstoff_zukunft.pdf. Date accessed: April 2006

4) Kang B.T.& Gutteridge R.C. (date unknown). *Forage Tree Legumes in Alley Cropping*

Systems. http://www.fao.org/ag/AGP/AGPC/doc/Publicat/Gutt-shel/x5556e0q.htm#alley%20cropping. Date accessed: April 2006

5) Renewable Energy for Europe (date unknown). *Biomass Heating Entrepreneur of the year 2000 competition. AFB net*-European Bioenergy Network Motiva. Date accessed: March 2006

6) SLU (Swedish University of Agricultural Sciences, date unknown). *Alnarp Landscape Laboratory.* www.lpal.slu.se . Date accessed: April 2006

7) Wikipedia (date unknown). *Wikipedia, die freie Enzyklopädie* Germany

http://de.wikipedia.org/wiki/Wikipedia. Date accessed: April 2006

Appendix 1

A) Historical links: German Coppice Forests (Niederwald)

Coppice forests, also called low forests, have been known in Middle Europe for about 2000 years (Burger, date unknown).

Tree species with a strong capacity for rapid regeneration from basal growth or major roots after being cut , such as Poplar, Willow, Aspen species, as well as Oak and Birch ('Siegerwald') were used for this type of silvicultural treatment in order to harvest fire wood for many hundreds of years.

Trees were cut several times until regeneration stopped (at approximately 20 - 30 years of age).

New plantations were established with cuttings from trees of the old plantations before they died.

Therefore, an ongoing cycle of fire wood production occurred in these forests until medieval times.

In Germany, the centre of coppice forest silviculture was predominantly west of the 'Rhine' -

('Oberes Mittelrheintal') and 'Mosel' rivers in Germany, as well as in the 'Hunsrück'-, 'Eifel'-, 'Westerwald'/'Siegerwald' areas, and parts of 'Rheinhessen' and 'Pfalz' areas.

In most European countries, such as Germany, it has become a rare type of forestry over the past two hundred years, as oil and electricity have developed into our main sources of energy supplies during the past decades.

There are only a few low forests remaining, most of them are slowly being transformed into high forests, or, as it was common until the 1990s, were transformed into spruce forests. In some areas coppice silviculture, or new establishment of coppice forests are promoted on limited areas in order to maintain this traditional way of silviculture and its typical vegetation communities. (Wikipedia, date unknown)

B) The „Hauberg“ low forest – a historical model of sustainable silviculture“

The „Hauberg“ forest in Germany's „Siegerland“ region (south- eastern fringe of „Ruhr“ region) represented a traditional type of low forest (coppice forest) in Germany.

This type of coppice forest is not only known for its traditional use of a combination of silvicultural and agricultural practices, but also for its self-administrated land use cooperative called 'Hauberg Cooperative' („Haubergsgenossenschaft“). This socio-economic model involved multiple uses of forest land in different rotation cycles for various crops, for example Oak to harvest Oak bark (tanning agents), Oak wood (coal production for local steel works and ore mining). Furthermore, it also combined agricultural rotation crops (such as Rye, Wheat and Barley), with the use of various trees for fire wood, as well as using the land for animal grazing at certain intercropping cycles. (Höhere Forstbehörde Westfalen-Lippe,1990)

Archaeological records show that this type of forestry for industrial purposes goes back to 700 PC where forests were cut successively in the area for ore mining. Harvest intensities changed over time and lead to overuse of the land on several occasions. After such periods, the land users started to develop more sustainable ways of harvesting the forest, which had a significant impact on biodiversity and species richness for flora and fauna, as it presents a way to use the land without destroying or harming its natural elements.

C) The „Hauberg Cooperative“ („Hauberggesellschaft“)

In the mid 14th century, the 'right to use' the „Hauberg“ forest was developed and established in a way that all users had the same contingent, but also the same restrictions for harvesting the forest. This legal structure was formalised at a later stage and added to the land register, and has been maintained as a valid and formalised law over various legislative changes until today (Höhere Forstbehörde Westfalen-Lippe,1990).

In many places in Germany's „Siegerland“ region, these historical 'community forests' have been maintained in terms of their socio-economic structure, and still present a traditional model of community forest that combined the need for income and producing peoples' livelihoods with values of community thinking and taking responsibility, working in cooperation, following principles of sustainable land use, and using the forest for recreation. However, nowadays these forests have lost their economic relevance, and many have been converted into high forest.

The historical „Hauberg Cooperative“ is a socio-economic model that presented sustainability on various levels. It still exists in an adapted form for some forest areas in this region.

Appendix 2

Landscape laboratory

Existing landscape laboratories

Currently, 3 landscape laboratories exist, two in Sweden (Alnarp, Snogeholm), and one in Denmark (Holstebro). Furthermore, there is a 4th landscape laboratory south of Uppsala that does not belong to the network established by SLU. It was developed by historians with its main focus on agriculture, cultural heritage, and conservation.*

Alnarp

The landscape laboratory in Alnarp (part of Swedish University of Agricultural Sciences in Sweden, SLU) was set up by SLU's faculty of Agriculture as part of its campus in Alnarp in 1990/91. (SLU, date unknown)

It is located on flat land, approx. 2 km from the south-western coast line (rather maritime climate) of the Scania region in southern Sweden. Sandy soils dominate, with shallow clay pans in some areas that do not allow deep root penetration.

It was developed by SLU in cooperation with various professionals and scientists from forestry, landscape architecture, and agriculture, as well as supported by SLU officials and politicians as a research and educational facility for professionals, scientists, students, managers, and the public (e.g. children, teachers, residents), where new ideas and concepts in landscape development can be tested and presented in full scale.

Full-scale experiments on a long-term basis will help to understand the processes and interactions within the landscape as a dynamic system.(SLU, date unknown)

The close connection to the University campus at Alnarp provides academics, professionals and students with the possibilities to closely observe these dynamics.

* Gustavsson R., personal communication (April 2006)

Figure 11: Aerial photograph of Alnarp landscape laboratory in Sweden

Sub-concepts involved in Alnarp's landscape laboratory are:

- The complexity ladder as a basis for landscape studies
- Plantations for environment and environmentally orientated timber production
- Creative management path and place management
- Woodland field layer
- Meadows
- Perception of small stands and glades
- Avenue and roadside plantations
- New water courses
- Tor Nitzelius Park – Exotic and indigenous species

Alnarp's landscape laboratory consists of two main parts, 'Tor Nitzelius Park' and 'Västerskog'.

Tor Nitzelius Park was planted in the early to mid 1980s. The intention was to create a multi-layered forest edge including a field layer that integrates exotic species as well as natives to increase variety and make it visually more interesting, as well as to study the interactions between various plant communities, and their interrelationships.*

'Västerskog', the second part, was planted between 1993 and 1999.

It focuses on developing methods in landscape management that can enable managers to have a more creative approach towards management of newly planted young landscapes, especially when it comes to managing young woodlands. During their first years of establishment and growth, young woodlands are most commonly not managed or managed for basic maintenance

*Gustavsson R., personal communication (April 2006)

purposes only, until they grow old and become 'more interesting'. Here, creative management practices were developed from the very start of woodland establishment, using traditional tools and techniques that have resulted in unusual impacts that change over time and space.

Furthermore, test groups of various other stakeholders, such as children, teachers, politicians, artists, park managers, foresters, landscape architects and professionals, have been invited to see and to take part in the development of the laboratory and inspire new management strategies with their ideas from the 'outside'.*

Therefore, the emphasis of this laboratory lies in the varying dynamics within as well as between its parts and sub-concepts that change over time (short- and long-term), its various levels of management methods that are strongly related to different scales and spaces within the laboratory, and how this may impact on its environment (different stakeholders, biodiversity, production) and the development of appropriate management practices.

Snogeholm

Snogeholm landscape laboratory was established in 1994 in the moraine landscape of the south-eastern countryside of Sweden. It is located further away from the coast than Alnarp, therefore, the climatic and soil conditions are very different. Its topography was a very important factor for establishment of trial plots.

Its context differs from Alnarp predominantly due to the differences in location. Timber production has become a main focus, although biotope design has also been a significant part of the initial concept.

Figure 12: Aerial photograph of Snogeholm landscape laboratory in Sweden

*

Its division into various parcels allows to trial different combinations of forest tree species for their production values in different combinations. 25% of these are 'new' tree combinations that have also been established in Alnarp and Holstebro, presenting one of the concepts common to each landscape laboratory.

A future challenge in Snogeholm lies in the integration of common recreational aspects and creative management, as well as biodiversity and biotope design as sub-concepts to be further explored and developed.

Also, one of the aims is to integrate Snogeholm into the context of the surrounding rural landscapes in southern Sweden that are very much living landscapes with a strong tradition and cultural history.

As only 5% of the people who live in Sweden's countryside are working in forestry and agriculture, demands for recreational aspects and creative management in forestry will increasein rural areas in the future. *

Holstebro

Holstebro is the latest landscape laboratory, and the first one outside of Sweden. It was established between 1999 and 2004 in the Danish region of Jutland, approx. 30 km from Jutland's north-west coast, as part of a newly developed housing area (city park). Design focused very much on the local context, looking at existing landscape elements, such as the lake and existing water views, open landscape, and forests, in close proximity to urban areas. When new woodlands were established, it was important that they do not interfere with existing water views and allow sufficient sun light to penetrate houses and gardens. Also, some of the farmland and its landscape features such as existing tree belts between farm properties were retained to maintain the area's agricultural context.

Figure 13: Aerial photograph of Holstebro landscape laboratory Denmark

* Gustavsson R., personal communication (April 2006)

Furthermore, small biotopes were integrated into the design to increase biodiversity in the area. Therefore, the design attempted to refine existing landscapes in connection with their cultural identify, as well as trying to communicate a deeper understanding of the landscape, and its impact on human interactions as a part of it. Therefore, the locality of Holstebro, a highly urbanised environment, is very different to the landscape laboratories in Sweden, as it has a much stronger connection to urban agglomeration than Alnarp and Snogeholm. Its design is strongly based on an ongoing interaction between local people, municipal managers, and the development of existing plantings.
Its main concepts focus on:

- The habitat model (one-/two- or three-storey forest stands)
- The seedling model (pioneer species with „islands" or climax species)
- The gradient model (planting distances between trees range from 1,1x1m to 5x5 m between trees)*

Concept of existing Landscape Laboratories in Sweden and Denmark

The concept of landscape laboratories concentrates on spatial configuration, and how it affects human preferences, links to cultural and natural heritage, the survival and distribution of species (SLU, date unknown).

Structure and vegetation are the main design focus in all landscape laboratories. Therefore, adding new elements involves to carefully balancing variation. Furthermore, existing elements have to be involved into the concept as well. This also applies for artists to work with existing vegetation and water as some of the elements*.

However, concepts that are considered as opposing each other can be combined and integrated in the context of a landscape laboratory.

Conceptual framework

Overall context <u>and</u> individual concepts *

Each landscape laboratory should present its own unique concept. These concepts overlap with each other in parts so that each landscape laboratory is an individual project, but at the same time can be identified as part of a European network.

Yet it should be integrated into the local context in terms of environmental conditions as well as cultural and social interrelationships on a local level. All concepts and sub-concepts should be presented in a hierarchical manner to show differences as well as common factors, and their

* Gustavsson R., personal communication (April 2006)

* Gustavsson R., personal communication (April 2006)

*

interrelationships between each other. *

Generality and individuality

A landscape laboratory concept could be seen as a tool to avoid standardisation and oversimplification. At the same time, it attempts to simplify design principles, but also to lift them up and test them in various situations (e.g. in regards to climate, soil, human disturbance, etc.).

This will create space to develop individual concepts for each laboratory, but also maintain conceptual similarities to identify a landscape laboratory as such. Therefore, each individual presents its own identity, but also includes sub-concepts that clearly connect to other landscape laboratories, identifying it as component of a network.

Complexity and simplicity*

In the three existing landscape laboratories, the complexity ladder is a major focus of their design concept.

Therefore, allows an ongoing comparison of different types of structural components in the forest, as well as for small water features, meadow strips, avenues is possible, investigating their effects on various levels over time.

However, complexity and simplicity do not necessarily oppose each other, they emphasise conceptual intensity and possibilities of multiple use in many aspects of landscape architecture.

Rather than claiming that landscape architecture needs simplicity to be successful, it would be of great interest for the future to promote design concepts in which complexity plays a role (Gustavsson, 2004).

An overall framework concept for a landscape laboratory may be very simplistic, but its sub-concepts for different parts of it, and the relationship between these now and in future, can be rather complex. Changes in scale, structure and texture for example will emphasise the complexity of landscape systems on many layers. Complexity within a simplistic structure presents enormous challenges for researchers and professionals, and a landscape laboratory is the ideal environment for these to be explored.

***Dynamic and static** *

Another important aspect of a landscape laboratory is the ambition to recognise it as an experimental landscape that will change in time to allow testing of new ideas and long-term concepts. It will help to understand the dynamics of different natural processes and interactions on many levels. This also requires an open mind towards the development of different focal points, and how/ to what extent they are emphasized and connected with each other.

However, it does not necessarily mean that all elements of a landscape laboratory will

*

*

* Gustavsson R., personal communication (April 2006)

change/be exchanged over time. Integrating existing components with 'landmark values', such as existing old buildings, trees, works of art may promote features like focal points, visual limitations, links to cultural heritage, and so on.

Large- and small-scale *

The concept of landscape laboratories concentrates on different spatial configurations, and their impact on human perception, environmental factors such as biodiversity, species performance.

Working with different scales that also change over time as part of the landscape development, and in close connection to its developmental stages, will produce valuable research in natural sciences, landscape development, as well as social sciences.*

Human involvement: experts and laymen*

Involvement of the public, for example children, is as much part of the concept for a landscape laboratory as is guidance by various professionals and academics for its design and technical development. Recognition of the importance of professional and scientific knowledge for a project like this, also should consider the importance of non-professional input by people who use it to provide the experts with 'inside' information based on individual experiences and perception. Furthermore, it shall enhance social development connected with our natural and cultural environment.
However, human perceptions will change over time, and one of the aims is to accommodate changes in human perceptions and allow for flexibility and fluency in its long-term development. These changes also have to include laymen and experts' opinions, as well as relevant institutions and authorities, in order to achieve an outcome that is sustainable and open to further development.

Reference landscapes: tradition/history and innovation/creativity *

The development of our society, and its impacts on various levels of our environment over time is expressed in many different ways. In regards to our natural environment, reference landscapes

reflect the many changes of human intervention in different periods of time. They are an important tool to identify these changes and draw conclusions for future landscape management on all levels (agriculture, forestry, natural landscapes, urban parks, etc.). They also allow identifying positive and negative impacts in landscape management over time, and how the knowledge gained from these developments can aid in managing landscapes in a more sustainable way in the future.

Two types of reference landscapes have to be distinguished when talking about landscape laboratories. The first type links to history and tradition (historical woodlands, arable land) as a

*
*
*
* Gustavsson R., personal communication (April 2006)

reference to the past that may still exist today in some areas. Secondly, there are reference landscapes that need to be created to show future generations of students, young managers, and professionals how landscape design and management can combine ecological knowledge and environmentally sustainable practices using well tried (old) and innovative (new) landscape design concepts and ideas*.

This will help to create future landscapes that can fulfil the multi-scaled demands of our urban society today and in future.

Landscape aesthetics and ecology *

According to Gobster (2001), landscape aesthetics was only considered in terms of 'nature-as-scenery', with its emphasis on the dramatic, visual, and static elements of landscape. Also, many urban landscapes established in the past 30 years are based on minimalist concepts, predominantly aimed at functionality (maintenance) and short-term effects, not including human and ecological aspects for long-term development. He states that philosophy has in some ways been responsible for the problems inherent in the scenic model of landscape management, yet a new wave of environmentally oriented aesthetic philosophy now coming of age could provide fresh guidance in dealing with perceived conflicts between aesthetics and sustainability values.

Landscape laboratories can play an important role in presenting links between ecology and aesthetics. We have to redefine our appreciation of these concepts as closely connected with each other, and, in turn, being closely related to human health and well being. Aesthetic perception is not limited to 'experts'. It is rather a part of the vast spectrum of human emotions as a reaction to certain aspects of our environment that cannot be generalised. Therefore, a landscape laboratory can provide new 'training grounds' to be aware and to sharpen our senses towards environmental aesthetics and its implications on our lives.

* Busse Nielsen A., personal communication (April 2006)

* Gustavsson R., personal communication (April 2006