Nature Quality in Organic Farming

– Localisation, farm practice, biological conservation, ecosystem functioning and landscape aesthetics

Proposal to the research programme in organic farming: DARCOF II
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Dansk Sammendrag

Økologisk jordbrug er et alternativ til jordbrugets intensivering og specialisering. Der er imidlertid ikke megen dokumentation for den udbredte forventning, at økologisk jordbrug, ud over at fremme et alsidigt afgrødevalg og nænsomme og effektive landbrugsmetoder samtidig i høj grad fremmer naturkvaliteten.

Det foreslåede projekt afvejer både de *biologiske*, de *produktionsmæssige* og de *æstetiske* aspekter af naturkvalitet i økologisk jordbrug. Det overordnede formål med projektet er at undersøge under hvilke betingelser, det er muligt at fremme den biologiske diversitet i et højtydende økologisk dyrkningssystem, der samtidig tager hensyn til de æstetiske og rekreative muligheder, og dermed angive nye udviklingsmuligheder for økologisk jordbrug. Jordbrugeren og offentligheden har måske nok forskellige ønsker hertil, men kun ved at inddrage alle tre overordnede aspekter, kan der gives et fuldstændigt svar på mulighederne.

- Work Package 1 bringer forskerne fra hele projektet sammen og sikrer en smidig udveksling af fælles data, af resultater og af ideer. Dermed sikres den nødvendige udvikling af relevante og brugbare metoder, indikatorer og implementeringsværktøjer. Et meget vigtigt element i projektet som helhed er de tværgående forskningsemner (cross-cuttings), der, baseret på projektgruppens store faglige bredde og fælles data, er forudsætningen for at løse de komplekse, overordnede spørgsmål.
- Omlægningsprocessen og landmandens motivationer herfor bliver analyseret i Work Package 2, hvor den geografiske fordeling og diversifikations- og ekstensiveringstendenserne relateres til landskabsværdier og bedrifternes naturkvalitet.
- Work Package 3 udvikler modeller og principper for bevarelse af den biologiske mangfoldighed på økologiske brug, herunder metoder til udpegning af de værdifulde arealer og indikatorer til at følge udviklingen med.
- Work Package 4 undersøger betingelserne for en positiv relation mellem et højt afgrødeudbytte og et artsrigt og varieret økosystem både over og under jorden på de økologiske marker.
- Work Package 5 analyserer landmandens værdiopfattelser og hvorledes de er afspejlet i de faktiske æstetiske og naturmæssige værdier på bedriften. Desuden udvikles nye metoder og indikatorer til italesættelsen af natur- og landskabskvaliteter.

1. Summary

Organic farming is an alternative to the intensification and specialisation of agriculture. However, the expectation that organic farming also favours land use and farm practises that supports ecosystem functioning and to a higher extent contribute to nature qualities are generally not well documented.

The proposed project considers the *biological*, the *agricultural* and the *esthetical* aspects of nature quality in organic farming. The overall research question is under which conditions it is possible to favour a high biological diversity in a high yielding organic production system that supports esthetical and recreational opportunities. The farmer and the public may have different priorities, but all three aspects need to be addressed in order to give complete answers.

- Work Package 1 is the forum that brings the researcher in the project together to exchange data, results and ideas, and ensures that appropriate indicators and necessary tools for communication and planning are developed. An important feature is the interrelated research topics (cross-cuttings) based on the broad interdisciplinarity of the project group and the exchange of common data.
- The conversion process and the motivations behind will be analysed in WorkPackage 2 where the geographical localisation, the diversification and the extensification of the farms is related to the landscape and nature qualities of the farms.
- Work Package 3 develops models and principles for the conservation of biological diversity on organic farms including methods to identify areas of interest and indicators to follow the development.
- Work Package 4 examines the conditions for a positive relation between a high crop production and species rich and varied ecosystems on the cultivated fields.
- Work Package 5 analyse the farmer's conception and how it is reflected in the aesthetics and nature values on the farm and develops new instruments of communication on nature and landscape quality.

2. Research group

Jesper Fredshavn, Head of Department, Lic. agro.: Project leader: WP 1
Pia Frederiksen, Senior researcher, ph.d.: WP 2
Rasmus Ejrnæs, Researcher, ph.d.WP 3
Jørgen A. Axelsen, Senior researcher, Ph.d. WP 4
Katrine Højring, Researcher, MA, WP 5
A total of 19 scientist will work on the project and the international collaboration of the experienced research group is broad.

3. Introduction

In 1999, the Ministry of Food, Agriculture and Fisheries published the 'Action Plan II – developments in organic farming' prepared by The Organic Food Board. The Action Plan recommended more research focus on various aspects of nature conservation and environmental protection and to develop indicators for nature values. The Action Plan also recommended to initiate research and to develop tools to be used by farmers and advisors to integrate on-farm nature values and the food production. Such tools should be used to monitor the development of nature values in collaboration between farmers, advisors and regional authorities (recommendations no 66 and 68). Furthermore, long term and holistic research on soil fertility in relation to organic farming practices was recommended as well as an analysis of the potentials of organic farming as an environmentally sound agricultural system for future landscape planning (recommendations no 69 and 74).

Bearing in mind the numerous conceptions and interpretations of nature quality in organic farming it was decided to precede the research activities with a State of the art, i.e. a synthesis of knowledge (Tybirk & Alrøe 2001). The synthesis addressed the questions on how organic farming could contribute to the national and international obligations to conserve biological diversity and benefit from ecosystem functioning (soil fertility and pest control of direct interest of the farmer). Furthermore, the synthesis addressed the driving forces in the localisation and development of organic farms and their associated nature values. Finally, landscape qualities and esthetical aspects were included in the list of future research topics. A strong linkage between these research topics was recommended to facilitate the necessary balancing of these –sometimes-conflicting considerations.

4. State of the art

The increase in agricultural productivity achieved by drainage, intensive soil cultivation, nutrient input and pesticide application has narrowed the ecological variability of the environment (OECD 1999, Buller et al. 2000), with a consequent loss of biological diversity (Hodgson 1986). Organic farming is often considered an alternative to this development based on numerous results of a more varied biota in the organically grown fields (e.g. Stoltze et al. 2000). However, there is only little evidence that organic farming also favours the

areas where the majority of species are found, namely the permanent grasslands and the uncultivated areas. The expectation that organic farming favours land use and farm practises that supports ecosystem functioning and to a higher extent contribute to nature qualities (Azeez 2000, Stoltze et al. 2000) are thus generally not well documented.

Organic farming has increased rapidly in Denmark from 400 farms in 1990 to more than 3,800 farms in year 2000, now covering more than 160,000 ha or around 6% of the total agricultural area (E.S. Kristensen, pers. comm.). The specialisation has changed from primarily dairy farms in mid 1990ies to plant production farms in late 1990ies. Likewise, the motivation behind conversion has changed from more ideologically related causes to a broader variety of motives including expectations of economic benefit (Noe 2000). The conversion process and the motivations behind will be analysed in WorkPackage 2 where the geographical localisation, the diversification and the extensification of the farms is related to the landscape and nature qualities of the farms.

Nature quality and biological diversity in organic agriculture needs to be considered both on the cultivated fields and on the uncultivated areas. The cultivated areas may benefit from the ecological services provided by numerous polyphageous predators (spiders, beetles etc.) and a living and well-structured soil (Strukturdirektoratet 2000, Axelsen & Langer 2001). At the same time weeds, pests and pathogens may compromise possibilities for high crop yields. Thus, Work Package 4 examines the conditions for a positive relation between a high crop production and species rich and varied ecosystems on the cultivated fields and seeks to identify useful indicators.

The uncultivated areas' including the permanent grasslands houses the majority of species in the agricultural landscape. These areas may contribute substantially to the biological diversity if treated properly, and organic agriculture could constitute an attractive farming practice in landscapes designated for the protection of biological diversity (Reddersen et al. 1999, Ejrnæs et. al. 1999). Work Package 3 develops models and principles for the conservation of biological diversity on organic farms including methods to identify areas of interest and indicators to follow the development.

The farmers as well as the public in general is increasingly interested in environmental quality, landscape aesthetics and recreational opportunities (Porteous 1996, Jensen 1998, 1999). How well this awareness from the farmer's side is actually reflected in the aesthetics and nature values on the farm, needs to be further analysed. The public awareness and involvement in the decision-making processes has politically been acknowledged by the Aarhus Convention, 1998. This situation calls for new instruments of communication between the general public and farmers on nature and landscape quality (Noe 1999, Halberg et al. 2000). These issues will be addressed in Work Package 5

Considering nature quality in organic farming is a consideration between the *biological*, the *agricultural* and the *esthetical* aspects (Tybirk & Alrøe 2001). The question is under which conditions it is possible to favour a high biological diversity in a high yielding organic production system that supports esthetical and recreational opportunities? The farmer and the public may have different priorities, but all three aspects need to be addressed in order to give complete answers. Work Package 1 is the forum that brings the researcher in the project together to exchange data, results and ideas, and ensures that appropriate indicators and necessary tools for communication and planning are developed. This research proposal analyse the present Danish situation on the three aspects individually in order to reach high scientific standard, but the project also allocates considerable resources to the interdisciplinary integration of results and to workshops that will answer relevant research questions and develop useful indicators.

Research methodology

Different research methodologies and different disciplines from natural and social sciences are needed to build up the necessary knowledge to solve the questions of integrating nature conservation and esthetical considerations in the organic farming system. Specific attention must be paid to the integration of results, synthesis of the overall project and development of useful indicators.

The project works at various levels and scales. A national statistical analysis of the present organic farm location will form the basis for selection of three regional areas with a high density of organic farms. These areas covers some 2-300 farms representing the variety of farm types and natural abiotic conditions (soil

types, climate) from which farm data concerning land use, management and production intensity will be gathered from databases and questionnaires. 20-50 of these farms will be selected for on-farm registration and analysis of biological quality. 18 farmers will be selected for in-depth interviews about their conceptions and considerations concerning nature and landscape qualities. In addition to this, specific experimental studies will be carried out in other supplementary areas for testing specific hypothesis under controlled conditions.

The research covers the habitat level (e.g. rotational field, hedge, dike and permanent grassland), the farm level (e.g. farming practice, crop rotation and farm type) and the regional landscape level (landscape scenarios and landscape perception).

The methods cover geographical, biological and conceptional analysis. This includes a geographical-statistical description of organic farm localisation, landscape analysis with respect to esthetical aspects, on-farm analysis of production, nature related practise and nature conceptions. It involves individual and group interviews, workshops and development of indicators facilitating the communication with the farmers involved. The biological parts of the research include experimental manipulation of the farming practice, surveys of the wild flora and fauna and experiments on colonisation of uncultivated habitats. Statistical modelling of consequences of different management practices will be carried out for cultivated fields, models to predict habitat quality and biological consequences of conversion to organic farming at landscape level. The specific methods are described for each WP.

A challenging part of the methodology is the synthesis and the suggested cross-cuttings presented in WP 1. This includes internal workshops where the process of understanding and integration of results from the different WPs will take place. Furthermore, the external presentation and discussion of the results with the scientific community, with political decision-makers and with the involved farmers and their advisors are crucial indicators for the success of the proposal.

5. Objectives and expected achievements

The overall aim of the project is to identify the key components that ensure a continuous development of organic farming towards a closer integration of nature quality with food production. To accomplish this, the project will develop a common platform of understanding of how the localisation, diversity and intensity of organic farms influence landscape and nature quality (Driving forces and Pressure indicators). WP 2 will achieve this. This platform will qualify and give perspective to the discussion of how the three major components (State-Impact indicators) of nature quality as identified recently (Tybirk & Alrøe 2001) can be combined locally and regionally:

- biological diversity (WP 3)
- ecosystem functioning (WP 4)
- esthetical landscape perception (WP 5)

The project will develop relevant definitions and simple indicators to identify each aspect separately. However, the multi-disciplinarity of this project gives us an opportunity bring the separate analysis together and investigate how these potentially conflicting considerations can be integrated (WP 1) and suggest future pathways for the development of organic farming. The project will focus on identifying relationships between the three aspects separately and in combination, and scenarios will be used to show the consequences of organic farming practices for selected nature quality aspects.

The project is expected to achieve detailed information on the historic development of localisation of organic farms and the conditions that influence this. The organic farmers, their farming practices, their intentions and actual ability to conserve and promote biological and ecological as well as esthetical qualities will be characterised in details with the aim of identifying barriers and possible solutions for the development of organic farming. The project will be able to characterise organic farmed landscapes and their biological attributes and develop tools for communication of different conceptions of nature.

Relevant indicators will be developed to enable farmers, the public and the administrative bodies to set goals for an integration of nature quality considerations in the future development of a sustainable organic farming on the habitat, the farm and the landscape level. These indicators will also be appropriate to measure whether organic farming is actually approaching these goals.

6. Description of workpackages including methods

Table 1. List of Workpackages.

Work-package no	Title	Budget (Mill. Dkr)	Respon-sible	Start	End	Delivera-ble no
1	Project management and interactions	0.4	JFr	2000	2004	D1-12
2	Localisation, diversification and extensification in organic farming	2.0	PFr	2000	2004	D13-22
3	Biological diversity and organic farming	3.2	REj	2000	2004	D23-30
4	Ecosystem diversity and function of the fields in organic farming	3.8	JAA	2000	2004	D31-39
5	Organic Farming and Landscape Quality – Perceptions and Practices	2.0	KHø	2000	2004	D40-48

Table 2. Description of Workpackages 1-5.

WP 1: Project management and interactions – *cross-cuttings between workpackages*

Workpackage number:	**1**
Start date or starting event:	**01.04.2001**
Responsible person:	**Jesper Fredshavn (NERI)**
Contributing persons:	**Knud Tybirk (NERI) and all project participants**
Person-months:	**5 (The resources of the cross-cuttings 1-9 are part of the contributing Workpackages 2-5)**

Objectives:

- **to co-ordinate the work and the exchange of knowledge generated in WP 2-5,**
- **to ensure the production of common interdisciplinary syntheses contribution to the overall objectives of the project and**
- **to develop tools and indicators for application of results**

Description of work:

The workpackage consist of the general project management and co-ordination activities including annual meetings, reporting procedures etc. A number of interrelated, complex and synthesising analysis (cross-cuttings) has been identified and found most appropriately to be undertaken on a level above the specific project parts in a close collaboration between the scientists from the different disciplines. WP 1 describes these cross-cuttings, the general management plan and the common activities.

Task 1. Project co-ordination.

The synchronous progress of the work in the different workpackages requires close co-ordination and keeping of internal deadlines. Data generated in one WP should be readily available in other WPs as describes in the cross-cuttings below. A yearly meeting to present the progress and exchange of data is required.

Task 2. Cross-cuttings (i.e. interrelated objectives/tasks/data exchanges between the separate WP 2-5)**:**

The identified cross-cuttings will analyse common problems and questions arising from the WP 2-5. To analyse the many facets of the relations between organic farming and nature quality, a close integration of

data, methodologies and results are needed.

CC_1: *Impact of farm localisation and character on biological diversity.* The objective of this cross-cutting between WP 2 and WP 3 is to quantify the impact of farm localisation and land use in relation to habitat quality and biological diversity. If biological diversity is inherited from the landscape, with some landscapes being particularly rich in habitats and species (Brandt et al. 1991) biological diversity can be predicted from the localisation of farms. Probably, historical land use and the farmer's motivation to conserve biodiversity also influence the presence of species and habitats. Data for the analysis will be produced in WP 3 (Task 1) and WP 2 (Task 1, 5 and 6).

CC_2: *Farm management, ownership, collaboration network and value conceptions in relation to nature values.* The farmers' management and renewal of nature values are in this cross-cutting related to structural diversity, differences in ownership, the farmers collaboration network and differences in value conceptions. The objective is to investigate the relationship between the various parameters and their significance on the farmers' nature management practices. The analysis will be based on results concerning structural diversity, ownership and collaboration in WP 2 and results concerning value conceptions and production logic in WP 5.

CC_3: *Farmers conception of nature and actual biological quality of his farm.* The farmer is a key actor in enhancing nature quality on organic farms. However, it is the question, whether there is a relationship between the organic farmer's conceptions of nature and landscape values, his practical management of these values, and the natural quality of his farm seen from a biological point of view, as defined in WP 3 and 4. In this cross-cutting the results from the analysis of value conceptions in WP 5, task 2, will be tested against the actual identified biological qualities in WP 3 and 4 to quantify the role of the farmer's value conceptions and motivation in developing valuable natural areas.

CC_4: *Workshop on the aesthetic perception of biological quality.* Aesthetic perception is holistic, qualitative and emotional (Porteous 1996, Højring & Caspersen 1999). Aesthetic understanding is thus able to supplement and extend environmental understanding based on conventional analytical observations in the natural sciences. The objective of the workshop is to transform conventional biological data on nature and landscape quality into information, which is of relevance in an aesthetic understanding of nature and landscape. The results will be utilised in the creation of the landscape descriptions in WP 5 and CC_7 and in the creation of perceivable and meaningful indicators (CC_9/WP 5).

CC_5: *Functional interpretation of the response of arthropods to the organically farmed landscape.*
The functional approach to community ecology is becoming increasingly important (e.g. Weiher & Keddy, 1999, Smith, et al. 1997) and the objective of this cross-cutting is to characterise the functional types of arthropod species able to colonise and survive in contrasting habitat types of the organically farmed landscape. This cross-cutting is a collaboration between WP 3 and WP 4. The two workpackages achieves a unique dataset from sampling spiders, weevils and bugs across a variety of fields and grasslands (cf. WP 3, Task 3 and WP 4, Task 1). The cross-cutting analyse patterns and gradients in diversity across habitat types and presents a functional interpretation of species affinities to certain habitat types (cf. Hodgson 1993).

CC_6: *Correlations between vegetation and beetles in hedges.* The hedges surrounding the fields are used as overwintering sites for carabid beetles. The quality and quantity of the herb vegetation in the bottom layer of the hedges plays a significant role for the diversity and number of overwintering beetles (Kromp, 1999). However, the results are based on scattered observations and some are unpublished. The vegetation of the hedges and field margins is characterised in WP 3, and in WP 4 beetles will be sampled in the fields. Thus it is possible to correlate the vegetation composition to the density (and probably diversity) of beetles in the adjacent fields by use of multivariate statistical methods.

CC_7: *Landscape scenarios*. Based on the landscape analysis in WP 2 and WP 5 realistic landscape scenarios is constructed, and in the Animal, Landscape and Man Simulation Model (ALMSS) modified in WP 4, the consequences for selected mobile insects, birds and mammals populations will be calculated. The scenarios will describe the quantitative and qualitative changes of the landscape, when converting to organic farming in terms of the structural, esthetical and biological aspects.

CC_8: *Workshop on identified correlations.* Differentiation of organic farmers and their effect on nature conservation. How does organic farming contribute to the conservation of nature quality and what is the perception of nature quality among farmers, researches and local authorities? Which recommendations could such possible correlations implicate for the future integration of conservation efforts (e.g. the Habitats Directive) and food production? The workshop should integrate all involved disciplines and give significant contribution to the overall objective of the project. Deliverable: International paper summarising the conclusions of the project on the issue.

CC_9: *Workshop on Indicators.* Each Work Package will identify the most relevant indicators in relation to biological, aesthetical, agronomical and other considerations. The focus of the workshop is to communicate this internally, discuss how they influence other indicators and under which conditions they alone or in combination would be relevant to use. How can we identify (count, measure, understand and communicate) the most relevant indicators of nature quality and landscape quality of organic farming. Deliverable: International paper summarising the conclusions of the project on the issue.

Deliverables:
1. Starting-up seminar
2. Annual co-ordination meeting
3. Annual status report
4. CC_1*: Impact of farm localisation and character on biological diversity.*
5. CC_2*: Farm management, ownership, collaboration, value conceptions and nature values.*
6. CC_3: *Farmers conception of nature and actual biological quality of his farm.*
7. CC_4: *Workshop on the aesthetic perception of biological quality.*
8. CC_5*: Functional interpretation of the response of arthropods to the organically farmed landscape.*
9. CC_6: *Correlation between vegetation and beetles in hedges.*
10. CC_7*: Landscape scenarios*.
11. CC_8*: Workshop on identified correlations.*
12. CC_9: *Workshop on Indicators.*

Milestones: See timetable.

WP 2: Localisation, diversification and extensification in organic farming

Workpackage number:	**2**
Start date or starting event:	**01.05.2001**
Responsible person:	**Pia Frederiksen**
Contributing persons:	**Pia Frederiksen (NERI), Vibeke Langer (RVAU), Peter Eigaard (NERI), Pernille Kaltoft (NERI)**
Person-months:	**36 man-months, covering tasks 1, 2, 3 and part of 4 and 8.** Parts of WP 2 is already financed from other sources: The Danish Agricultural and Veterinary Research Council has financed 18 mm covering task 5 and 6 and part of 4 Task 7 is covered by a PhD study, financed by The Danish Research Training Council and the National Environmental Research Institute.

Objectives:

Overall: To explore land use and farm practises in organic farming at the farm, local and regional level, and its impact on the landscape and nature quality, within the context of localisation, diversification and extensification processes.

1) To explore the present status of the national conversion to organic farming, by analysing the characteristics of the landscapes involved, the regional diversity and land use intensity of organic farms, and the spatial overlap of organic farms and valuable or protected nature types.
2) To analyse the spatial pattern of organic farm localisation as a basis for selection of case study areas.
3) To explore how and to which extent former and emerging local social relations and ways of knowledge and information dissemination influence the conversion process and its spatial character
4) For selected case areas to study the nature management practises, i.e. agricultural and other farm related practises and land use that impact nature and landscape qualities on the present organic farms. Moreover to explore how these management practises are related to certain characteristics of the farms, like production, ownership, structural diversity and farmers collaboration network.
5) To analyse if and how changes in nature management practise, land use and landscape structures can be related to the history of conversion from conventional to organic production.
6) To explore the importance and character of collaboration among organic farmers, in terms of potentials for system-level management of natural resources and nature qualities.

Description of work:
Organic farming is increasing in Denmark. However, farm specialisation seems to prevail (Langer, 2001), while collaboration among organic farmers is growing. In this perspective it is interesting if a shift in viewpoint from the farm to the local scale may offer another picture of diversity in land use, farm practises and possibilities for enhancement of nature and landscape qualities (Raupp, 2000).

Various farm types influence nature management practises on the farm differently, through differences in land use, crop rotations etc. It has been demonstrated that other issues are of equal importance for the nature practises, like ownership to the farm (Primdahl 1999) or part-time farming (Madsen et al. 2000, Tress 1999). Structural diversification (Bowler & Ilbery, 1998) on the farm (i.e. non-agricultural activities like tourism, hunting, on-farm sale of products) may additionally influence the way land is used and management practises are carried out. These aspects play different roles in different regions and combinations of these aspects may form different contexts for enhancement of nature and landscape qualities.

Tasks in WP 2 are centred on 3 foci.
The first focus is on the integration of spatial and social processes in the conversion to and practise of organic farming (Ilbery 2000, Edwards 1992, Hägerstrand 1973)(tasks 1 to 3) and its impact on organically cultivated landscapes. As aggregations of organic farms may contain complementary aspects for management of landscape and nature qualities, it is interesting how the spatial patterns of location are related to the social forces of conversion (Ilbery et al. 1999, Ilbery 2000). While former studies of conversion focus on individual motives and perceptions in the conversion process (Østergaard 1998, Kaltoft 1997 and 1999, Blekesaune and Vartdal 1992, Noe 1999), recent case studies point to local actor-network relationships as driving forces for the conversion (Noe 2000). These studies confirm the importance of selected parameters such as dissemination of knowledge and experience, innovative farmers and the role of the advisory service which have formerly been discussed in social theories of innovation diffusion (Edwards 1992). The actor-network theories (Latour 1996, Goodman 1999) may even have potentials for contributing to explanations of spatial patterns.

Task 1 related to objective 1:
The geographical distribution of present organic farms will be mapped for the year 2000, resulting in a spatial, statistical description of farm types. The landscape context in terms of soil, topography and geomorphology as well as proximity or overlap with valuable nature types or habitat areas is analysed using a digital database of environmental map layers. Analysis of regional diversity and intensity in farm types and land use based on the national husbandry and agricultural registry will be related to the landscapes. A historical analysis of the development of the spatial patterns in the period from 1994 to 2000 is carried out based of yearly lists of organic producers, producing information on spatial processes. The results will feed into cross-cutting 1, as well as forming a general framework for discussion of the results obtained in the project as a whole in cross-cutting 8 and 9.

Task 2 related to objective 2:
Based on the GIS-based localisation of organic farmsteads two case areas with a high density and aggregation of organic farms are selected. Other selection criteria will be regional landscape types and farm

production types. After more detailed analysis of environmental context and farm types based in registry information and field block maps, one to three more areas are selected - one with a scattered distribution of farms.

Task 3 related to objective 3:
Explanations for high densities of organic farms in a local area must be explored in the historical and environmental context as well as the social dynamic and cultural identity. A number of issues will enter into a preliminary approach to these explanations, but special emphasis will be allocated to exploration of local social structures, farm collaboration and knowledge dissemination. A qualitative study will be carried out in the first two case areas parallel with task 4, aiming at identification of central local dimensions of the conversion processes. The study will be based on key-person interviews, including recently and older established organic farmers, local extension service, innovators etc. Selection of persons for in-depth interviews will be based on data on the structure of conversion (who, when, farm-type) and on collaboration, produced in task 1 and 4, as well as through data from key-person interviews. The aim is to identify dominating local factors for the conversion or a set of factors, which can be identified as forming a positive conversion context.

The second focus of WP 2 is on the relationship between various aspects of farm diversity and their impact on nature practises on the farm (tasks 4 to 7). Land use, farm practise and quantity and quality of uncultivated areas depend on the system of resource utilisation that a given farm represents. This is partly related to the farmer's active protection or improvement of nature elements on the farm, partly a consequence of decisions taken in relation to farm production. Apart from the natural resource context and the farm type, also the farmers positions as owner or user of the land (Primdahl 1999) or as full-time, part-time or hobby farmer (Madsen et al. 2000, Tress 1999) influences the specific nature management practise on the farm. Moreover structural diversity (Bowler & Ilbery, 1998) on the farm in terms of other income-generating activities may influence nature practises as well. Whether the practise on the organic farms is in fact supportive of nature qualities is not well investigated. As farm type and structure to some extent seem to be inherited from the former conventional farm, certain inertia is expected to prevail within the organic production (Larsen & Clausen 1995). The impact of organic production on nature practises and landscape structures should therefore be explored in a historical context.

Task 4 related to objective 4:
Within the case-areas, information will be collected on present production and land-use (including uncultivated areas). Moreover information on other income-sources, extent and character of collaboration with other farms, reception of public subsidies, history (year of conversion) will be collected. Information will be extracted from relevant registers, followed by a quantitative survey for supplementing missing information. To facilitate cross-cuttings 1 and 2, data will be made available to all project participants in a database.

Task 5 related to objective 4:
Farm data obtained under task 4 are analysed with a focus on the relationship between the diversity of productive and other activities on the farm, collaboration and ownership and the present nature practises. Diverse and specialised farms are analysed in terms of land use, management of permanent grasslands in terms of grazing and fertilisation, protection, improvement and creation of nature elements, field size and crop diversity on areas in rotation. Results on farm diversity and nature practise will feed into analyses in cross-cutting 2.

Task 6 related to objective 5:
Changes in nature management practises resulting directly from conversion to organic production will be studied. The study will use the applications for authorisation (stating production before conversion) and interviews on selected farms within the case areas, belonging to three groups: recently converted farms, farms converted with start in 1997 and conversion from the years 1990-1992. Feed into cross-cutting 7.

Task 7 related to objective 5 (PhD study):
Through GIS-based mapping of landscape, the relation between conversion of farms to organic production and structural development is described in a 10-year perspective in selected landscapes within the case areas. Topographical maps, aerial photos and data from activity 1 will form the database for analysis of structural

information related to landscape elements. Landscape ecology will form the methodological basis for the study, and changes in landscape structure will be related to the farm and landscape information generated in task 1 and 2.

The third focus of WP 2 concerns management forms and levels for nature and landscape qualities (task 8). Rule-based regulation stands as an increasing problem within the organic farmers' organisations, which have initiated studies of farm development plans as a means for a renewed vision- or goal oriented development (Beck 2000). Within the sustainable development discourse public participation has attracted increased attention, but experience have mostly been collected within urban contexts. Farmer dialogue has, however, been positively evaluated as an important tool for the design and implementation of nature management projects (Direktoratet for Fødevarer og Erhverv, 2000). In a western perspective management of common resources have been discussed in terms of a concept for local management 'platforms' based on systems thinking and social learning (Röling & Marleveld 1999). Thus it should be explored whether certain aspects of management of nature and landscape qualities are best dealt with at the system – or landscape – level, recognising multiple actors interests in the agricultural landscape.

Task 8 related to objective 6:
A number of collaborative ventures are selected and in-depth interviews are carried out with participating farmers focussing on the character of collaboration, the value attributed to natural resource management and nature qualities and the potentials within different types of collaboration for including management objectives related to nature quality.

Deliverables:
13. Spatial statistical description of farm types, densities and land use intensity
14. Regional processes in Danish organic production
15. Social relations and spatial pattern: case area 1
16. Social relations and spatial pattern: case area 2 and 3
17. Integration of spatial and social processes in organic farming
18. Database fully available for cross-cuttings
19. Production, diversity and nature practise on existing organic farms in Denmark
20. Changes in farm diversity and nature practise with conversion to organic farming
21. The impact of organic farming on landscape structure and –change
22. Potentials of among-farm collaboration for management of nature and landscape qualities

Milestones: see time table

WP 3: Biological diversity and organic farming
– past destruction, present condition and future opportunities

Workpackage number:	**3**
Start date or starting event:	**01.05.2001**
Responsible person:	**Rasmus Ejrnæs**
Contributing persons:	**NERI: Rasmus Ejrnæs, Jens Reddersen, Anna Bodil Hald, Erik Aude** **NHMA: Thomas Secher Jensen** **AAU: Søren Toft** **DIAS: Kasia Debosz**
Person-months:	**37 scientific and 18 technical**

Objectives:
Overall objective: To develop principles and models for conservation and promotion of biological diversity on organic farms

In order to achieve this, the following underlying objectives will be pursued:

1) To identify and describe the distribution of biological diversity within organic farms
2) To analyse the preconditions for biological diversity on organic farms
3) To develop indicators and methods for evaluating the influence of farm management on the biological conditions

Description of work:
It is a widely held belief that organic farming implies a protection of the environment, including the wild plants and animals. Whereas there is evidence of the protection of the physical and chemical environment by organic farming, there is a lack of information regarding the impact of organic farming on prioritised aspects of biological diversity (e.g. vulnerable and declining species). It is on the uncultivated areas and the permanent grasslands of organic farms (pastures, meadows, hedgerows etc.) that we may expect to find the vast majority of the uncommon, specialised species (Stolze & Pihl 1998). A large fraction of these has been declining in the agricultural landscape as a consequence of intensified conventional farming over the last decades as well as the last centuries (Ejrnæs 2000a). We may hypothesise that organic farming affects these species less than conventional farming, but is this sufficient to ensure their long-term survival?

The aim of WP 3 is to investigate the opportunities for organic farming to integrate the protection of biological diversity with farm management along with other environmental concerns. Such integration would improve the public image of organic farming, and emphasise organic farming as the preferred type of agriculture in landscapes designated for the protection of biological diversity (e.g. habitat areas in the EEC-Habitats Directive).

Biological diversity is not easily defined and consequently we consider several ways of looking at biological diversity, including scale-dependent measures such as α-diversity, β-diversity and γ-diversity (Whittaker 1972), and also concepts specifically related to conservation strategies, e.g. rarity and originality.

The major objective of WP 3 is to develop the required knowledge for the integration of biological conservation concerns in organic farming – no matter whether such integration is reached by a set of common standards or by personal interest from the farmer himself. In order to achieve this we need to be able to locate the actual distribution of biological diversity and relate this to farm localisation, habitat type and land use.

At present, available information on the distribution and quality of habitats within the Danish agricultural landscape is very scarce (Ejrnæs unpubl.). The first step of WP 3 is therefore to carry out a field inventory of the vegetation of all uncultivated areas on a large number of organic farms covering the variation found in Denmark. This broad inventory will result in a unique data set describing the contribution to biological diversity of 1) different types of habitat (hedgerows, pastures, scrubs etc.) 2) different types of farms (dairy farms, plant producers etc.) and 3) farm localisation (topography, prevailing soil types, hydrology etc.). The actual mechanisms behind diversity however will remain hidden after this first step.

The second step will imply a search for the explanatory factors behind diversity within an appropriate subset of the uncultivated areas. The purpose of this analysis will be to relate diversity to habitat quality using a gradient analysis (sensu Økland 1990) that will result in a statistical description of the preferred habitat conditions of different species. It will be tested if habitat quality of plant species may be a useful indicator for habitat quality of herbivorous and predatory arthropods, and thus we may establish the relationships between plant and arthropod diversity that pattern analysis often fails to do (e.g. Panzer & Schwartz 1998, Steffan-Dewenter & Tscharntke 2000). .

It is generally agreed that habitat condition is crucial for biological diversity, but it is also well known that many low-mobile species experience great difficulties in colonising the fragmented habitats of the present day landscape (Hanski, 1997). An important implication for organic farming is that the statistical description of habitat quality reached in this project is the description of the "realised diversity" and not the "potential diversity" that would take place without colonisation barriers. The vast majority of organic farms have inherited a landscape formerly subjected to application, misplacement and drift of pesticides and artificial fertilisers. We may thus imagine that organic farmers inherit landscapes impoverished of the most sensitive species. These species will have difficulties in re-colonising habitats made suitable after conversion to organic farming. We therefore include an experiment to test whether the biological diversity on organic

farms is colonisation-limited. The results of the experiment may have implications not only for validation of the concept of "potential diversity" (see above), but also for recommendations regarding the localisation of future organic farms and the construction of new habitats in general for wildlife.

The workpackage is divided into 4 tasks with significant contributions to cross-cuttings 1, 5, 6, 8 and 9:
task 1) Floristic inventory of organic farms
task 2) Experimental test of colonisation limitation
task 3) Gradient analysis and modelling of biological diversity
task 4) Synthesis – models, indicators and principles

Task 1: Floristic inventory
20-30 organic farms will be selected to represent contrasting categories of organic farms, landscapes and regions. Within the selected farms uncultivated terrestrial areas (e.g. pastures, meadows, hedgerows and field margins) will be identified on aerial photos and subjected to a field inventory including subjective classification and delimitation of homogenous areas, and recording of documentary lists of vascular plant species.

Task 2: Experimental test of colonisation limitation
The strategic background of this task is the notion that biological diversity is not only related to the actual management and hence habitat quality on a site but also to past habitat changes and isolation of less common species (e.g. Hanski 1997, Eriksson & Kiviniemi 1999). If it can be shown that colonisation limitation is a serious impediment to diversity (e.g. Tilman 1997), we have to consider the localisation of farms and distribution of habitats in the landscape. If on the other hand habitat quality appears to be of prime importance (e.g. Harrison 1994), we should focus more on habitat management. Task 3 develops a statistical description of habitat quality and hence potential biological diversity. This experiment explores the difference between potential and realised diversity and should consequently be seen as complementary to the gradient analysis (Task 3).
The basic hypotheses are:
a) Vascular plant species richness is colonisation-limited (fewer species disperse to a site than can actually establish and survive there)
b) Site invasibility is limited by productivity (the importance of asymmetric competition increases along a productivity gradient – e.g. Campbell et al. 1991, Keddy et al. 1997)
Twenty experimental plots of 16 m^2 will be selected, 10 from hedgerows and 10 from permanent dry grasslands. Within each habitat type 5 plots under fertile conditions and 5 plots under infertile conditions will be selected. Fertility will be assessed using mean Ellenberg values for soil fertility calculated from species lists (Hill & Carey 1997) obtained under the survey of Task 1. Complete species lists will be collected from the experimental plots.
Based on the species lists from the survey of Task 1 two pools of potential species (Zobel 1997) will be defined for the low and high fertility conditions. From each of these "species pools" a selection of typical species will be drawn. Only species that do not occur in the experimental plots of the type considered will be included in the selection.
Each plot will be divided into four squares (4m^2 each) and the existing vegetation will be removed in two of these. The selection of typical species will be sown out and transplanted respectively, in autumn, in the centre (1 m^2) of the disturbed and undisturbed squares. Establishment and survival will be studied during the two consecutive years.

Task 3: Gradient analysis and modelling of biological diversity
Based on multivariate statistics (ordination, clustering and classification), a subset of 200 sampling areas will be selected from the inventory data produced in Task 1 to represent the observed variation (landscape, farm types, environment and vegetation) in uncultivated areas on organic farms. The selected areas will be digitised in a GIS. A statistical summary of all visited areas divided in categories will be produced.
In each selected sampling area a 7x7-m plot will be placed at random. Within these plots abundance data will be collected for each of the following taxonomical groups:

- Vascular plants
- Bryophytes & lichens
- Leaf hoppers (*Auchenorrhyncha*)

- Bugs (*Heteroptera*)
- Leaf beetles (*Chrysomelidae*)
- Weevils (*Curculionidae s.l.*)
- Spiders (*Arachnidae*)

Plants will be sampled once (mid-summer) by cover-abundance estimation, whereas arthropods will be sampled twice (mid- and late summer) by D-vac suction. The plots will be characterised by plant production, mineralisation, soil type, vegetation structure, land use, land-use history etc.

Floristic, faunistic and environmental data will be subjected to ordination (Ejrnæs 2000), classification and modern regression (Chambers & Hastie 1993, Venables & Ripley 1997, Ejrnæs & Bruun 2000), in order to test the following hypothesised relationships:
1) A unimodal relationship between productivity and diversity (cf. Grime 1979)
2) Vegetation composition is a significant predictor of invertebrate community composition
3) A positive relationship between plant and invertebrate diversity
4) A positive relationship between area and species richness

Finally, statistical models of diversity (plant, herbivore and carnivore) as a function of habitat quality will be constructed.

Task 4: Synthesis – models, indicators and principles
The objective of Task 4 is to set up a nature management decisions-support system on farm level based on the results from the colonisation limitation tests and models of the relationship between habitat quality and biological diversity. The synthesis will imply methods (including statistical models) for categorisation of areas according to e.g. habitat type, habitat quality and colonisation potential as well as models for evaluation of farm-level decisions regarding land use and habitat management.
Development of methods will include:
1) Statistical and practical analyses regarding indicators (state indicators as well as response indicators). Such an evaluation of indicators will consider species as well as other site indicators and indicators related to land use collected under Task 3.
2) Development of methods for evaluation and prioritisation of land-use changes.

Deliverables:
23. The contribution of organic agriculture to biological diversity
24. Manuscript: The importance of colonisation limitation for the diversity of grassland and hedgerows on organic farms
25. Manuscript: Gradient analysis of plant and invertebrate communities in organic farms
26. Manuscript: Predicting plant and invertebrate diversity in grassland habitats of organic farms
27. Manuscript: Functional interpretation of the distribution of arthropods in the agricultural landscape
28. Indicators for habitat quality in organic agriculture
29. Impact of farm localisation and land use on biological diversity
30. Integration of biological conservation into organic agriculture

Milestones: See time table

WP 4: Ecosystem diversity and function of the fields in organic farming

Workpackage number:	**4**
Start date or starting event:	**01-05-2001**
Responsible person:	**Jørgen Aagaard Axelsen (NERI)**
Contributing persons:	**Paul Henning Krogh (NERI), Søren Toft (AAU), Gabor Lövei (DIAS), Chris Topping (NERI)**
Person-months:	**54 scientific+38 technical**

Objectives:
To provide knowledge on how to optimise, at the same time, both nature quality and crop yield in organic fields.
Sub-objectives:

- **To develop an indicator system of nature quality in organic fields**
- **To test the hypotheses that enhanced biodiversity favours beneficial ecological processes**
- **Evaluate the consequences of various organic agricultural practices and changes in landscape structures on mobile organisms use of the landscape**

Description of work:

One of the important questions in organic farming (and ecology) is whether ecosystem functioning is related to diversity, and in turn, whether high diversity contributes to enhance the positive processes (Ekschmitt & Griffiths, 1998; Bengtsson, 1998) including a higher crop yield. There is no consensus on this question in the scientific literature, but the general opinion among scientists active in this area is that 1) the biodiversity is strongly correlated to the rates of the processes in the ecosystem, and 2) that these processes are important (although to variable extent) to the ecosystem services (Schläpfer et al, 1999). This is encouraging for organic agriculture, which relies on natural ecological mechanisms to produce food. Thus, the life in and on the soil is both a means to improve yield and a goal in terms of nature quality in organic agriculture.

A further aspect of nature quality in organic farming is scale-related. A group of species relies on the field for one or more of their basic needs, e.g. food, but are dependent on other habitats for e.g. hibernation sites. These species are parts of the food web, often predators, in the fields. Thus, both the diversity and the total effect of these species are dependent on the diversity at lower trophic levels within the fields, but also on surrounding structures in the landscape.

The work within this subproject has been split into three tasks that all are concerning biodiversity in organic fields, how to enhance biodiversity, and the positive effects of biodiversity. Furthermore, the WP will contribute significantly to cross-cutting 3, 5, 7, 8 and 9.

Task 1. Development of indicators of nature quality on organic fields.
An easily used system that can indicate nature quality in and on the soil in organic farming, will be an important tool for the farmers and advisors, to optimise both nature quality and ecosystem services. There is currently no accepted indicator system for nature quality in fields or for soil quality. Numerous functions and biodiversity measures have been suggested. The soil environment is inhabited by a diversity of life forms. Their interaction is not well known and very few of these interactions have been quantified. Thus, it is currently not possible to select indicators based on quantifiable importance for ecosystem functions.

The data sampling in this project will investigate the following two possible indicators:

1) The habitat quality of the agricultural land for plants, animals and microorganisms depends on what extend they can survive and fulfil their basic demands. For immobile organisms like plants and most of the soil fauna, the habitat quality within the single field is crucial. The habitat quality within the fields is basically dependent on the crop rotation and the agricultural practice. Therefore, an indicator system must take these two factors into consideration. An indicator might be an index that is the sum of points given for different agricultural practices and crop rotations, equation 1.

$$NQI_{Farm} = \sum_{F}\sum_{T} P \qquad (1)$$

where NQI_{Farm} is the **N**ature **Q**uality **I**ndex of the fields of the farm, F is all fields of a farm, T is all treatments carried out on the field (or important growth characteristics) in one year and P is the "nature quality effect points" given to the treatments. The points (P) must be scaled according to the effect of the treatments on the nature content of the field.

2) The soil fauna plays a role for both the availability of nutrients for the field crops and the control of pests and pathogens (Didden et al. 1994, Bardgett and Chan 1999; Scheu et al. 1999, Lootsma and Scholte 1998; Scholte and Lootsma 1998; Sabatini and Innocenti 2000, Riechert and Bishop 1990). This leads to

the assumption that a relatively good crop yield may be caused by a rich soil fauna, and a relatively poor crop yield may be due to a poor soil fauna (no matter the reasons for either a poor or rich soil fauna). The yield is also affected by other factors such as climate, soil type, plant variety and weeds, which must be taken into consideration if the yield should be used as an indicator of nature quality in the field soil.

The sampling procedure to test the validity of these indicator systems will be split into two phases: an initial one of two years with sampling on relatively few farms (5 – 10 incl. the ones from task 2), and an extensive one in the third year encompassing 20 – 40 fields.

Sampling and identification of target groups:
Appropriately sized soil cores will be collected (larger for beetles & spiders, smaller for springtails, etc.) and extraction by Tullgren apparatus or hand-sorted. The target groups will be handled as follows:

- beetles: soil samples, ground beetles (Carabidae) identified to species;
- spiders: soil samples identified to species (larvae are often not possible to identify to species)
- earthworms: identified to species, biomass weighed
- mites: total numbers in soil samples counted
- springtails: density of individual species

Task 2. Testing the hypothesis that increased biodiversity enhances the beneficial ecological mechanisms

Generally, our knowledge of below-ground ecological mechanisms are less developed than of above-ground ones (Brown & Gange 1990). The above- and below-ground compartments of an ecosystem are dependent on each other, as plants are the main source of carbon for soil biota, and in turn, soil biota release nutrients in a form that is easily absorbed by plants. It is known that the decomposer food web has a role in altering nutrient availability in plants (Wardle 1999), and recently, the idea of soil food webs subsidising above-ground arthropod species has been recognised (Sunderland & Samu 2000). Many of these are biocontrol agents that are active on the soil surface. Therefore, we can expect that the soil food web can "support" their aboveground effect by providing food for these arthropod species early in the season. This could also allow an early population build-up, prevent emigration and allow early reproduction, all resulting in enhanced biological control potential. The fundamental ideas behind the experiments are:

1. to enhance biodiversity of the soil fauna, and
2. investigate whether this leads to enhanced biodiversity of surface living predators, and in turn
3. to investigate whether this leads to better aphid control (an example of ecological service).

Field sites, treatments, sampling method and target groups:
We are going to utilise crop rotation experiments set up by colleagues working with FØJO (Olesen et al. 2000). These are crop rotation systems for grain production, and composed of winter wheat – clover, spring oats, spring barley, and lupine. Overlaid on this are two additional treatments, adding (or not) of animal manure, and growing (or not) of catch crops. Replicated treatment of this experimental set-up is established at 4 locations in Denmark, but we are going to work on two locations only, at Flakkebjerg (Sjælland) and Foulum (Jylland). Based on existing knowledge on the effect of addition of animal manure (Pimentel and Warneke 1989; Kromp 1999; Sunderland and Samu 2000), catch crops (Axelsen and Thorup-Kristensen 2000) and undersown crops Axelsen (unpubl.) on the soil fauna, we expect these experimental crop rotations to give a wide range of biodiversity within the soil compartment.

We will establish aphid densities during the season and correlate this with the density of predators and effects of different soil manipulations (influencing the belowground food web). Further, we aim to establish manipulated aphid colonies early in the season and follow their fate in relation to expected subsidies from the soil.

A large background data material is available from these field plots, e.g. yield, time of tillage events, soil mineral nitrogen in spring, occurrence of weeds, diseases & pests, nitrogen and potassium leaching, etc. (Olesen et al, 2000, I. Rasmussen, DJF Flakkebjerg, pers. comm.).

Sampling methods and identification of the target groups: similar to task 1, but without the earthworms, and instead including aphid densities and percentage of aphid colonies surviving (in small-scale manipulation

experiments).

Task 3. Model calculations of the consequences of various organic crop rotations, tillage practices and landscape structures on mobile organisms

Some organisms use a larger habitat area than a single field or even a single farm. They are, therefore, influenced by other factors that are usually considered by traditional experimental techniques. A possible way of evaluating the effect of various crop rotations, tillage practice and landscape structures on these organisms is spatial modelling techniques capable of integrating effects of local differences in farm management, habitat quality and animal ecology.

To meet this task we will utilise the individual based modelling system ALMSS (**A**nimal **M**an and **L**andscape **S**imulation **S**ystem), developed by NERI to model the consequences for different animal populations of various landscape scenarios. ALMSS uses a GIS based landscape model with which the different individual based species models interact. The landscape scenarios consider three aspects:

1. The effect of local conditions on the numbers of beetles and spiders predicted to be present on organic fields (local conditions scenario).
2. The impact of changes in crop rotation or variation in organic farming practices on the distribution and abundance of mobile organisms in a Danish landscape (farm management scenario).
3. The impact of the total number and actual location of organic farms in the landscape on selected mobile organisms (farm location scenario in collaboration with WP 2

The above scenarios will be modelled using a selection of species combinations from the list of available ALMSS species. The 'local conditions' scenario will concentrate on spider and carabid models together with bird species actively feeding from the field surface. The other two scenarios will also utilise mammal models (e.g. roe deer and field vole), as representatives of other more mobile species interacting with other non-agricultural habitats.

ALMSS demands very detailed GIS information for the landscape and the agricultural information on farm management, crop rotation etc. In order to develop more generalised predictions for different landscape types in Denmark an important feature must be added to ALMSS. This involves a facility to automatically construct new landscapes with features corresponding to general landscapes from different areas of Denmark. Hence, the same scenarios can be run on landscapes from pastural areas, mixed or arable areas, and areas with a high content of semi-natural habitats. Both existing landscapes and constructed landscapes will be used in the scenarios.

Deliverables:
31. Suggestion to indicator system
32. Scientific paper on indicator system
33. Suggestions for changes in management practice to promote desirable species in organic fields
34. Scientific paper on crop rotations and polyphageous predators
35. Scientific paper on the connection between soil fauna and polyphageous predators
36. Scientific paper on the relation between biodiversity and aphid control
37. Entry at the Danish Plant Protection conference
38. Scientific paper on the impacts of various organic farm practices on the mobile organisms
39. Scientific paper on the impacts of farm location on the mobile organisms

Milestones: See timetable

WP 5: Organic Farming and Landscape Quality – Perceptions and Practices

Work package number: **5**

Start date or starting event:	**01-06-01**
Responsible person:	**Katrine Højring (DFLRI)**
Contributing persons:	**Egon Noe (DIAS)**
Person-months:	**40.5**

Objectives:

- To investigate the relationship between the organic farmers' value conceptions and management practices, and the aesthetic qualities of the landscape.
- To investigate potentials and obstacles on the individual level for the integration of nature and landscape considerations in food production.

Task 1: – to analyse and describe the aesthetic consequences of organic farming on landscape and farm level.

Task 2: – to analyse the role of the farmer's value conceptions and production logic in the production and maintenance of nature and landscape values.

Task 3: – to develop methods for awareness raising and communication about nature and landscape quality in decision-making processes.

Description of work:

Organic farming aims at interacting in a constructive and life-enhancing way with natural systems and cycles, to encourage and enhance biological cycles within the farming systems, and to maintain the genetic diversity of the production system and its surroundings (from IFOAM's basic standards 1998). This commitment of organic farming is the point of departure of this work package, as it implies a willingness of the organic farmer to contribute to the nature values of the landscape through his agricultural conduct. The physical realisation of this objective depends on a chain of elements ranging from the degree to which the farmer commits himself to the value conceptions of organic farming, via his decisions and actions, to the way in which these conceptions and decisions are actually manifested under particular natural preconditions.

The nature and landscape conception implemented in this study is adopted from the other project parts (WP 2-4), but primarily treated from the point of view of aesthetic learning. Aesthetic perception represents a different kind of seeing and understanding than analytical perception, as it is holistic, qualitative and emotional (Porteous 1996, Højring & Caspersen 1999). It presents the perceiver with a dissimilar image of the surroundings compared to the one provided through a conventional scientific analysis, which is segmenting, quantitative and rational. Aesthetic understanding is thus able to supplement and extend environmental understanding based on analytical observations. An integration of aesthetic perception in the analysis of nature and landscape quality represents a return to the science ideals as represented i. a. by Alexander Humboldt (Fechner 1986, Gobster 1995), namely scientific knowledge as a result of a combination of rational analysis and aesthetic sensation.

Apart from being an aid in a holistic understanding of the environment, aesthetic experience is also a basic human sensation and need (Porteous 1996). In the Danish research project '*Man in landscape management'* it was found that the discussion of nature and landscape quality from an aesthetic point of view has have great appeal to farmers as a basis for the discussion of landscape management strategies. Aesthetic perception will be implemented both in the landscape analysis and in the development of indicators.

The work consists of three tasks and significant contributions to cross-cutting 2, 3, 4, 7 and 9.

Task 1. Analysis and description of the aesthetic consequences of organic farming on landscape and farm level. The landscape is both an object of perception and an object of action. On the one hand, it is seen, heard, felt and smelled, and, on the other hand, it is manipulated and modified in accordance with social and individual interests. In this study both these aspects of the landscape are approached to establish the relationship between an organic farming practice and it's landscape aesthetic consequences.

The analysis of the physical landscape will be based on

- A geographical and aesthetic landscape analysis

- Interviews with farmers about land management initiatives related to nature and landscape quality
- Experts' workshops, with experts related to organic farming, generating information on the natural qualities of organic farming landscapes (CC 4).

The analysis will be based on the method developed in two previous research projects on the aesthetic quality of agricultural landscapes (Højring & Caspersen 1999). The method was developed in areas mainly farmed conventionally. The results from these areas will therefore, as far as possible, be employed as a standard of reference for the results from organically farmed areas. The analysis will also draw on experience from the participation in the EU-Concerted Action: "The landscape and nature production capacity of organic/sustainable types of agriculture". For the geographical analysis the work package will draw on the data collected and structured within WP 2.

The history of most organic farms is relatively short in relation to cartographic and statistical information. Therefore the geographical and aesthetic analysis will have to be backed up with interviews with landowners and farmers about their farming practises and nature and landscape management initiatives.

One of the objectives of task 1 is to convert nature and landscape quality treated as a biological scientific issue into an aesthetic issue. This opens up opportunities for the participation of non-professionals in the discussion of nature and landscape quality on a basis, which has an immediate appeal to the individual. However, for information about flora, fauna, ecology etc. to be useful in this connection it has to be transformed into types of information, which are relevant in an aesthetic perception.

To generate the necessary information on the sensuous qualities of the biological phenomena it is the intention to organise two expert workshops, involving biologists and agronomists engaged in organic farming. The method employed will be Goethe's method for landscape analysis as described among others by Colquhoun (1997), supplemented with methods for environmental sensitivity training as developed in Britain in the nineteen seventies and eighties (Porteous 1996). The workshops will be oriented, on the one side, towards the biological qualities of uncultivated areas, on the other side, towards the biological qualities of cultivated areas.

Task 2: analysis of the farmer's role in the production and maintenance of nature and landscape quality

The farmer's value conceptions form one of the factors influencing his decision-making. Principally the value conceptions of the organic farmer should be different from the value conceptions of the conventional farmer, as he commits himself to a certain set of objectives including the interaction with and the enhancement of biological cycles. In reality, however, organic farmers commit themselves to a variety of value conceptions with differing degrees of environmental consideration.

The approach to understanding the relationship between farming strategies, implemented by the farmer and his family, and their values and attitudes includes the logic they employ in the organisation of the production. This production logic is integrated in a socio-technical system of knowledge, technology, market conditions, legislation and other external factors.

A theoretical and methodological basis for the analysis of the correlation between values, rationality and farming strategies has been developed through a series of research projects describing this logic as recursive communicative networks of farming styles (Noe 1999, Noe 2000, Halberg et. al. 2000). The methods demonstrate that it is an advantage to study both the single farmer and the group constituting the farmer's local network to get a differentiated image of the relationship between farming strategies and nature and landscape quality. The study of the individual farmer is oriented towards understanding the relationship between the appreciation of environment and nature and the technical, cultural and social organisation of farming. The study of groups is oriented towards the recognition of regional differences.

The analysis of the farmers role in the creation and maintenance of nature and landscape qualities formally consist of three parts

- an analysis of the farmers' value conceptions and attitudes in relation to nature and landscape
- an analysis of the farmers production logic

– an analysis of the practical management of the farm

The analyses will be based on individual in depth interviews with 18 organic farmers and group interviews with three focus groups in the study areas. Data concerning farm production will be collected in two study areas to be able to link the qualitative data with a technical and economic description of the local farming strategies. The analysis will also draw on data concerning production collected in connection with WP 2.

Task 3: development of methods for awareness-raising and communication about nature and landscape quality in decision-making processes

Politically there has been an explicit recognition of public interests in the landscape and the natural environment. This has lead to a realisation of the democratic necessity for public involvement in the discussion of these questions and in decision-making (Aarhus Convention 1998). To implement public participation in decision-making procedures it is necessary to generate knowledge concerning landscape and nature quality and make it accessible in a way, which is suited for communication and decision-making among non-experts. The objective is therefore to utilise the knowledge gained in connection with task 1 and 2, concerning the relationship between landscape, landscape perception, value conceptions and production procedures, to develop a common platform for communication about questions concerning the quality of landscapes and natural environments.

The objective of this work package is to develop indicators, which are fairly easily perceived also by non-experts, which are appealing and meaningful in a local normative and practical context, and which are useful in a local communicative process about landscape and natural and environmental quality. As Halberg et al. (2000) demonstrate the same types of indicators may not be useful and appealing to all types of decision-makers. The hypothesis of this study is that indicators based on aesthetic conception are more easily accepted and implemented on a local decision-making level than technical indicators.

The development of indicators will be based on input from the individual and the focus group interviews and from the experts' workshops. It will utilise the results from the project *Farming Practices in Relation to Environmental and Natural Values 1996-99* (Halberg et al. 2000). It is the intention to test the instrumentality of the indicators in relation to the quality criteria developed by the researchers in the other work packages of the project (e.g. Ejrnæs 1998, Reddersen et al. 1999). This will happen in collaboration with the research team of the whole project and the farmers in the study areas. The objective of this work package is to test whether the indicators are perceivable, meaningful and operative in relation to the organic farmer's decision-making processes.

Deliverables:

40. The aesthetic perception of biological quality
41. The aesthetic perception of biological quality
42. The aesthetic quality of organically farmed landscapes
43. Nature and landscape quality – organic farmers value conceptions
44. Value conceptions, farm maintenance and biological quality
45. The contribution of farming practice to aesthetic quality
46. Local participation in nature and landscape quality assessment
47. Operational indicators in communication and decision-making processes
48. Indicators for nature and landscape quality as instruments in awareness raising and decision-making

Milestones: See timetable

7. Implementation and time schedule

Table 3: Deliverables list

No	Deliverable title	Date	Meeting	Nature[1]
WP 1. Project management and interactions *– cross-cuttings between workpackages*				
1	Starting-up seminar	04.01	G 1	
2	Annual co-ordination meeting	01.02-04	G 2-4	
3	Annual status report	01.02-04		Re
4	CC_1 *Impact of farm localisation and character on biological diversity.*	03.02		Re
5	CC_2 *Farm management, ownership, collaboration, value conceptions and nature values.*	10.04		Re
6	CC_3 *Farmers conception of nature and actual biological quality of his farm.*	12.03		Re, Oral
7	CC_4: *Workshop on the aesthetic perception of biological quality.*	10.02	Workshop	Re
8	CC_5 *Functional interpretation of the response of arthropods to the organically farmed landscape.*	03.04		Re
9	CC_6: *Correlation between vegetation and beetles in hedges.*	06.04		Pu
10	CC_7 *Landscape scenarios*.	06.03		Re
11	CC_8 *Workshop on identified correlations.*	09.03	Workshop	Pu
12	CC_9: *Workshop on Indicators.*	03.04	Workshop	Pu
WP 2. Localisation, diversification and extensification in organic farming				
13	Spatial statistical description of farm types, densities and land use intensity	05.02	CC_1	O [1)]
14	Regional processes in Danish organic production	04.04		Pu
15	Social relations and spatial pattern: case area 1	03.03		O [2)]
16	Social relations and spatial pattern: case area 2 and 3	12.03		O [2)]
17	Integration of spatial and social processes in organic farming	12.04		Pu
18	Database fully available for cross-cuttings	02.03	CC_{1+2+7}	O [3)]
19	Production, diversity and nature practise on existing organic farms in Denmark	12.03		Pu
20	Changes in farm diversity and nature practise with conversion to organic farming	05.04	CC_6	Pro-in.
21	The impact of organic farming on landscape structure and –change	09.03		Th.
22	Potentials of among-farm collaboration for management of nature and landscape qualities	05.04		Pro-in.

[1] Pu: Int. Publ.,
Re: report
Pro-in: Int. proceedings/abstacts,
Pro-na: National proceedings/abstacts,
Pop: Popular papers,
Oral: oral presentation.
Th: Thesis,
O: others
2) Internet available working paper
3) Database available for all project participants

WP 3. Biological diversity and organic agriculture				
23	The contribution of organic agriculture to biological diversity	07.02	CC_1	Pop
24	Manuscript: The importance of colonisation limitation for the diversity of grassland and hedgerows on organic farms	12.03		Pu
25	Manuscript: Gradient analysis of plant and invertebrate communities in organic farms	03.04		Pu
26	Manuscript: Predicting plant and invertebrate diversity in grassland habitats of organic farms	03.04		Pu
27	Manuscript: Functional interpretation of the distribution of arthropods in the agricultural landscape	05.04		Pu
28	Indicators for habitat quality in organic agriculture	09.04	CC_9	Pro-in
29	Impact of farm localisation and land use on biological diversity	09.04	CC_1	Pu
30	Integration of biological conservation into organic agriculture	12.04	CC_{5+6}	Re
WP 4. Ecosystem diversity and function of the fields in organic farming				
31	Suggestion to indicator system	09.04	CC_9	Pop/Re
32	Scientific paper on indicator system	12.04		Pu
33	Suggestions for changes in management practice to promote desirable species in organic fields	12.03		Pop/Re
34	Scientific paper on crop rotations and polyphageous predators	12.02		Pu
35	Scientific paper on the connection between soil fauna and polyphageous predators	12.03		Pu
36	Scientific paper on the relation between biodiversity and aphid control	12.03		Pu
37	Entry at the Danish Plant Protection conference	Every March		Oral+Prona
38	Scientific paper on the impacts of various organic farm practices on the mobile organisms	09.03		Pu
39	Scientific paper on the impacts of farm location on the mobile organisms	09.03		Pu
WP 5. Organic Farming and Landscape Quality – Perceptions and Practices				
40	The aesthetic perception of biological quality	06.02	CC_4	other
41	The aesthetic perception of biological quality	12.02		Re
42	The aesthetic quality of organically farmed landscapes	02.04		Re
43	Nature and landscape quality – organic farmers value conceptions	12.03		Pu
44	Value conceptions, farm maintenance and biological quality	08.04	CC_2	oral
45	The contribution of farming practice to aesthetic quality	08.04	CC_5	oral
46	Local participation in nature and landscape quality assessment	12.04		Pu
47	Operational indicators in communication and decision-making processes	10.04	CC_9	oral
48	Indicators for nature and landscape quality as instruments in awareness raising and decision-making	12.04		Pu

Table 4. Timetable and milestones (see separate sheets)

8. Collaborative partners

Danish Research Center for Organic Farming (DARCOF)
National Environmental Research Institute, NERI, Dept. of Landscape Ecology, Dept of Policy analysis and Dept. of Terrestrial Ecology.
Royal Veterinary and Agricultural University, RVAU
Danish Forest and Landscape Research Institute (DFLRI)
The Natural History Museum, Aarhus (NHMA)
University of Aarhus, AAU
Danish Institute of Agricultural Sciences (DIAS)
Tromsø University, Institute for Planning and Community Studies, Tromsø, Norway
Stiftelsen for naturforskning og kulturminneforskning, Oslo, NINA,
Tartu University, Inst. of Botany and Ecology, Estonia
Institute of Local Government Studies, Copenhagen
University of Southern Denmark, Centre for History, Esbjerg

9. Budget

Project Total (1000 Dkr.)						**Total**
All Institutions	2001	2002	2003	2004	Total	
Months (scientific)	25	52	51	32	159	
Months (technical)	16	24	22	8	69	
hours (student)		400			400	
Salary (scientific)	962	1.972	1.962	1.292	6.188	
Salary (technical)	395	631	550	233	1.809	
Salary (student)		45			45	
Operation – equipment	85	95	65	0	245	
Operation - other	259	396	410	140	1.205	
sum	1.701	3.139	2.987	1.665	9.492	
Overhead	340	628	597	333	1.898	
Total	2.041	3.767	3.585	1.998	11.390	**11.390**

WP 1 budget (1000 Dkr)						**Total**
NERI, Landscape Ecology	2001	2002	2003	2004	Total	
Months (scientific)	1	1	1	1	4	
Months (technical)				1	1	
Salary (scientific)	40	40	40	40	160	
Salary (technical)				30	30	
Operation – equipment					0	
Operation – other	20	40	40	40	140	
sum	60	80	80	110	330	
Overhead	12	16	16	22	66	
Total	72	96	96	132	396	**396**

WP 2* budget (1000 Dkr)						**Total**
NERI, Policy Analysis	2001	2002	2003	2004	Total	
Months (scientific)	5	10	10	7	32	
Months (technical)	1	1		1	3	
hours (student)		400			400	
Salary (scientific)	200	400	400	280	1.280	
Salary (technical)	30	30		30	90	
Salary (student)		45			45	
Operation – equipment (data purchase)	60	10			70	
Operation - other	20	67	74	20	181	
sum	310	552	474	330	1.666	
Overhead	62	110	95	66	333	
Total	372	662	569	396	1.999	**1.999**

* Covering activities 1, 2, 3, part of 4 and 7 (activities part of 4, 5 and 6 covered from other side)

WP 3 budget (1000 Dkr)						**Total**
NERI, Landscape Ecology	2001	2002	2003	2004	Total	
Months (scientific)	7	8	8	10	33	
Months (technical)	5	2	2		8	
Salary (scientific)	280	320	320	400	1.320	
Salary (technical)	135	60	45	0	240	
Operation – equipment		60	40		100	
Operation – other	138	144	135	40	457	
sum	553	584	540	440	2.117	
Overhead	111	117	108	88	423	
Total	664	701	648	528	2.540	
Nat.His.Mus.	2001	2002	2003	2004	Total	
Months (scientific)		1	1		1	
Months (technical)		6	2		8	
Salary (scientific)		20	20		40	
Salary (technical)		180	60		240	
Operation – equipment					0	
Operation – other		40			40	
sum		240	80		320	
Overhead		48	16		64	
Total		288	96		384	
University of Århus	2001	2002	2003	2004	Total	
Months (scientific)		1	1		1	
Months (technical)		1	1		2	
Salary (scientific)		20	20		40	
Salary (technical)		30	30		60	
Operation – equipment					0	
Operation – other					0	
sum		50	50		100	
Overhead		10	10		20	
Total		60	60		120	
DIAS	2001	2002	2003	2004	Total	
Months (scientific)			2		2	
Months (technical)					0	
Salary (scientific)			80		80	
Salary (technical)					0	
Operation – equipment					0	
Operation – other			46		46	
sum			126		126	
Overhead			25		25	
Total			151		151	**3.196**

WP 4 budget (1000 Dkr)						**Total**
NERI-TERI	2001	2002	2003	2004	Total	
Months (scientific)	4	5	5	4	18	
Months (technical)	4	5	8	2	19	
Salary (scientific)	151	198	208	172	729	
Salary (technical)	91	119	200	53	463	
Operation – equipment					0	
Operation - other	30	25	40	10	105	
sum	272	342	448	235	1.297	
Overhead	54	68	90	47	259	
Total	326	411	538	282	1.557	
DIAS-Flakkebjerg	2001	2002	2003	2004	Total	
Months (scientific)	2	2	3		7	
Months (technical)	3	4	5		12	
Salary (scientific)	73	77	114		264	
Salary (technical)	69	92	115		276	
Operation – equipment					0	
Operation - other	15	25	25		65	
sum	157	194	254		605	
Overhead	31	39	51	0	121	
Total	188	232	305	0	726	
Aarhus University	2001	2002	2003	2004	Total	
Months (scientific)	0	6	6		12	
Months (technical)	2	3	2		7	
Salary (scientific)	0	181	181		362	
Salary (technical)	40	60	40		140	
Operation – equipment	25	25	25		75	
Operation - other	20	0	0		20	
sum	85	266	246		597	
Overhead	17	53	49	0	119	
Total	102	319	295	0	716	
NERI-LAND	2001	2002	2003	2004	Total	
Months (scientific)	4	9	4		17	
Months (technical)	0	0	0		0	
Salary (scientific)	138	336	159		633	
Salary (technical)					0	
Operation – equipment					0	
Operation - other	10	15	10		35	
sum	148	351	169		668	
Overhead	30	70	34	0	134	
Total	178	421	203	0	802	**3.800**

WP 5 budget (1000 Dkr)						Total
DFLRI	2001	2002	2003	2004	Total	
Months (scientific)	1	6	6	5	17	
Months (technical)	1	1	1	2	5	
Salary (scientific)	40	220	220	200	680	
Salary (technical)	15	30	30	60	135	
Operation – equipment	0	0	0	0	0	
Operation - other	3	24	24	14	65	
sum	58	274	274	274	880	
Overhead	12	55	55	55	176	
Total	70	329	329	329	1.056	
DIAS	2001	2002	2003	2004	Total	
Months (scientific)	1	4	5	5	15	
Months (technical)	1	1	1	2	5	
Salary (scientific)	40	160	200	200	600	
Salary (technical)	15	30	30	60	135	
Operation – equipment	0	0	0	0	0	
Operation - other	3	16	16	16	51	
sum	58	206	246	276	786	
Overhead	12	41	49	55	157	
Total	70	247	295	331	943	**1.999**

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Appendix. Short curriculum vitae of project participants

Workpackage 1

CURRICULUM VITAE: Jesper Fredshavn,

- Director of research department, National Environmental Research Institute, Dept. of Landscape Ecology, Grenåvej 14, DK-8410 Rønde, Denmark. e-mail: jfr@dmu.dk.

Born 20 August 1955

Education: Master of Science: horticulture
PhD: agronomy and statistics

Professional experiences:

1996 – present: Director of research department, National Environmental Research Institute, Dept. of Landscape Ecology, Member of boards, co-ordination groups and steering groups of a number of research programmes and projects. Member of DARCOFs contact group and Phd group.

1994 Senior Researcher, National Environmental Research Institute, Dept. of Landscape Ecology

1992 – 1994: Assistant Professor, the Royal Vet. and Agricultural University, Copenhagen, Dept. of Agricultural Sciences, Research topics: Environmental assessment of transgenic plants, Teaching topics: Organic agriculture and Plant Husbandry

1988 –1992: Junior Lecturer, the Royal Vet. and Agricultural University, Copenhagen, Dept. of Agricultural Sciences Research topics: Environmental assessment of transgenic plants, Teaching topics: Plant Husbandry

1984 – 1987: PhD-student, the Royal Vet. and Agricultural University, Copenhagen, Dept. of Botany. Research topic: Population dynamics of annual weeds

Role in the project: Project leader, responsible for workpackage 1 and for general co-ordination of the project.

Relevant publications:

Fredshavn JR 1993. Competition in monocultures of oilseed rape and barley. *Acta Agric. Scand., Sect. B, Soil and Plant Sci.* **43**, 38-44.

Fredshavn JR 1994. The use of substitution rates to describe competition in mixed plant populations. *Acta Agric. Scand., Sect. B, Soil and Plant Sci.* **44**, 47-54

Fredshavn JR, GS Poulsen, I Huybrechts & P Rüdelsheim 1995. Competitiveness of transgenic oilseed rape. *Transgenic Research* **4**, 142-148

Fredshavn JR, GS Poulsen 1996. Growth behavior and competitive ability of transgenic crops. *Field Crops Research* **45**, 11-18

Fredshavn JR 1999. Essential information needed for Policy makers – the perspectives and needs seen from the supply side. *Proceedings from European Conference: Bridging the Gap, Biodiversity Workshop, 4th June 1998*.

CURRICULUM VITAE: **Knud Tybirk**

- Senior adviser, National Environmental Research Institute, Department of Landscape Ecology, Grenåvej 14, DK-8410 Rønde, Denmark. e-mail: kty@dmu.dk.
- Born 13 August, 1960 in Denmark.
- Cand. Scient. Bio., Aarhus University, 1988
- Ph.D., Aarhus University, 1992

Professional experiences

1998-2000: Senior advisor, NERI, Dept. Terrestrial Ecology, Silkeborg, Denmark

1994-1998: Research scientist, NERI, Dept. Terrestrial Ecology, Silkeborg, Denmark

1992-1994: Associated Professional Officer in Agroforestry. FAO project "Participatory forestry development in the Andes". Quito, Ecuador.

1988-1991: Research associate, Biological Institute, Aarhus University, Denmark

Role in the project: Coordination and moderation of cross-cuttings, workshops etc.

Publication list includes more than 40 scientific publications, reports and book contributions and numerous popular publications

Selected relevant publications:

Tybirk, K. & Alrøe, H.F. (eds.) 2001. Naturkvalitet i økologisk jordbrug (Nature quality in organic farming), DARCOF report (in press)

Reddersen, J., Tybirk, K., Halberg, N., & Jensen, J. 1999. Mere og bedre natur i landbrugslandet (More and better nature in the agricultural landscape). NERI Technical Report no 288, 109pp.

Sørensen, M.M. & Tybirk, K. 2001. Vegetation analysis along a successional gradient from heath to oak forest. Nord. J. Bot 20(5) (In press).

Tybirk, K., M.-C. Nilsson, A. Michelsen, H. L. Kristensen, A. Shevtsova, M. T. Strandberg, M. Johansson, K.E. Nielsen, T. Riis-Nielsen, B. Strandberg and I. Johnsen. 2000. Nordic *Empetrum* dominated ecosystems: Function and susceptibility to environmental changes. Ambio 29(2): 90-97.

Tybirk, K. 1995. Metodología de validación de prácticas agroforestales. *(Method for validation of agroforestry practices*) Pp 5-29 in: Proyecto DFPA(ed.). Validación de prácticas agroforestales. Metodología y estudios de caso. DFPA, Quito.

Workpackage 2

CURRICULUM VITAE: **Pia Kærgaard Frederiksen**

- Senior researcher, National Environmental Research Institute, Department of Policy Analysis, Frederiksborgvej 399, DK-4000 Roskilde. Pfr@dmu.dk.

Born on 27th of June, 1955, Danish

Education: M.Sc. geography and chemistry, PhD

Key qualifications: Geographer with research qualifications and practical experience in assessment of land use and environmental change, land evaluation and the interaction of natural resources and rural livelihoods. Ph. D. in development of methodologies for mapping and monitoring of vegetation/soils by use of digital satellite image analysis. Experienced in interdisciplinary research.

Role in project: Responsible for work package 2, **r**esearch covering tasks 1, 2, contributing to tasks 3, 4 and 5

Publications:

Frederiksen P.K. (in press) Indikatorer i landbrugslandskabet (Indicators in the agricultural landscape): in Tybirk og Alrøe: Naturkvalitet in det økologiske Jordbrug. DARCOF-report nb 9

Frederiksen P.K. (in press) Økologisk omlægning i regionalt perspektiv – drivkræfter, processer og landskab: (Conversion to organic production – driving forces, processes and landscape) in Tybirk og Alrøe: Naturkvalitet in det økologiske Jordbrug. ADRCOF report nb 9.

Birch-Thomsen, T., Frederiksen P.K. and Sano, H.O. (forthcoming, jan 2001):A Livelihood Perspective on Natural Resaource Management and Environmental Change in semi-arid Tanzania. *Journal of Economic Geography*.

Frederiksen, P.K. 1999:Interpretation of Environmental Change.Paper presented at SASA International Workshop, Copenhagen, 17-18 November, 1999.

Frederiksen, P.K. 1995:Livelihood Strategies and Environmental Change - an analytical framework. Discussion Paper Presented at fifth SASA workshop in Dar es Salaam, 29-30 November, 1995.

CURRICULUM VITAE: **Vibeke Langer**

- Associate professor, Section of Agroecology, Dept. of Agricultural Science, The Royal Veterinary and Agricultural University (RVAU), Agrovej 10, 2630 Taastrup, +45 35282382 vl@kvl.dk

Born Dec. 15, 1953 in Copenhagen

Education: M.Sc. in Horticulture (Cand.Hort) 1980, Phd in Agricultural Entomology 1996

Key qualifications: Broad experience in research in ecological interactions in a range of systems in organic agriculture and horticulture, with special emphasis on impact of land use and farming practice on insects in agricultural landscapes.

Role in project: activities 4,5 and 6, WP 2. Responsible for collection and analysis of data on farm characteristics.

Relevant publications:

Langer, V. (red.) 2001. Omlægning til økologisk jordbrug i et lokalområde. Scenarier for natur, miljø og produktion. (Conversion to organic agriculture in a local agricultural landscape. Scenarios for nature, enviromment and production). DARCOF Report (Expected publication April 2001)

Axelsen, J. & Langer, V. 2001. Biologiske og produktionsmæssige hensyn på dyrkningsfladen og samspil med udyrkede habitater. I: K. Tybirk Alrøe, H.F. (red.) Naturkvalitet i økologisk jordbrug. DARCOF Report nr. 9

Langer, V. 2001. Farm level changes with conversion to organic agriculture in a region of intensive agriculture. American Journal of Alternative Agriculture (Accepted subject to revision)

Langer, V. 2001. Clover/grass ley and short rotation coppice hedges as reservoirs for parasitoids of cereal aphids in organic agriculture. Agriculture, Ecosystems and Environment (In press)

Langer, V. , Odderskær, P., Heimann, T., Dalgaard, T., Mogensen, L. 2000. Conversion to organic farming – estimated effects on environment and nature based on existing farm data from a study area. Alföldi, T., Lockeretz, W., Niggli, U. (eds.), Proceedings 13th International IFOAM Scientific Conference, p. 458

Langer, V. 1998. Effects of conversion to organic farming on Danish agricultural landscapes. In: P. Agger, R. Bjerregaard, J. Brandt (eds.), Landscape ecology and the dynamics of agricultural landscapes. Landskabsøkologiske skrifter 11, 311-319

Workpackage 3

CURRICULUM VITAE: **Rasmus Ejrnæs**

- Researcher, National Environmental Research Institute, Department of Landscape Ecology, Grenåvej 14, DK-8410 Rønde, Denmark. e-mail: Rej@dmu.dk.

Born: September 16, 1966

Education and Employment: Ph.D., biology, University of Copenhagen, Feb. 1998. Researcher at NERI 1998-ff.

Key Qualifications: Educated in vegetation science and community ecology. Scientific research on the impact of environmental pressures on the quality of habitats for wildlife. In-depth studies of ecology and management of

grassland habitats. Practical experiences with multivariate analysis and statistical modelling. Appointed member of the editorial board of Journal of Vegetation Science.
Role in the project: Responsible for WP 3, vegetation data, statistical modelling
Selected publications:
Ejrnæs, R. & Bruun, H.H. (1995): Prediction of Grassland Quality for Environmental Management. *Journal of Environmental Management* 43: 171-183.
Ejrnæs, R. (2000): Can we Trust Gradients Extracted by Detrended Correspondence Analysis?. - *Journal of Vegetation Science* 11:565-572.
Ejrnæs, R. & Bruun, H.H. (2000): Gradient Analysis of Dry Grassland Vegetation in Denmark. - *Journal of Vegetation Science* 11:573-584.
Ejrnæs, R. & Poulsen, R. (In Press): Trends in the bryophyte and lichen flora of Danish semi-natural grasslands over the last 50 years. - *Lindbergia*.
Ejrnæs, R. (2000)*:* Nature conservation in the agroecosystem. (In Danish) In: Holten-Andersen, J., Christensen, H.S., Pedersen, T.N., Manninen, S. (red): Dansk naturpolitik - viden og vurderinger. Temarapport nr. 1 2000. Naturrådet. s. 218-231.

CURRICULUM VITAE: **Jens Reddersen**
- Researcher**,** National Environmental Research Institute, Department of Landscape Ecology, Grenåvej 14, DK-8410 Rønde, Denmark. e-mail: jre@dmu.dk.

Born: August 14 1954
Education and Employment: MSc, biology, Aarhus University, Jan. 1982. Researcher at Aarhus University 1987-93 and at NERI 1994-ff.
Key Qualifications: Wide research experience: general and applied ecology of insect communities; almost any taxonomic and trophic group of insects; a wide range of biotope types (coniferous forest, dry grassland, agricultural fields, hedgerows and SRC-willow) – and within many applied aspects (conservation, trophic relationships, pesticide effects, organic farmning, grazing, etc.). Editor of National Natural History Journal 'Flora og Fauna'.
Role in the project: Analysis of interaction of vegetation and arthropods, development of indicators
Selected publications:
Reddersen, J. (1995): Feeding biology of fungivorous insects from Danish cereal fields. - *Pedobiologia* **39**: 370-384.
Reddersen, J. (1997): The arthropod fauna of organic versus conventional cereal fields in Denmark. - In *Entomological Research in Organic Agriculture* (B. Kromp & P. Meindl, eds.), *Biological Agriculture and Horticulture* **15**: 61-71.
Clausen, H., Holbeck, H. & Reddersen, J. (2001): Factors influencing abundance of butterflies and burnets in the uncultivated biotopes of organic farmland. – *Biological Conservation* 98:167-178.
Reddersen, J. (2001, in press): Age structure and growth in cereal field populations of fungivorous beetle larvae, *Atomaria* spp. (Cryptophagidae; Col.), and the indirect effects of pesticides. - *Pedobiologia* **45**: xx-xx..
Reddersen, J. (2001, in press): SRC-willow flowering as a resource for early flower-visiting insects. – *Biomass and Bioenergy.*

Workpackage 4

CURRICULUM VITAE: **Jørgen Aagaard Axelsen**,
- Senior Scientist, National Environmental Research Institute, Dept. of Terrestrial Ecology. Veljsøvej 25, DK 8600 Silkeborg.

Born 13 February 1959
Education: Master of Science: biology major, chemistry minor
PhD: biology
Professional experiences:
1993 – present: Senior Scientist, NERI, Dept of Terrestrial Ecology. Ecosystem modelling
1993 Scientist, University of Århus, Institute of Biological Researches. Modelling the predation of polyphagous predators, Centre for Agricultural Biodiversity, National Environmental Research Programme
1990 – 1992: Scientist, Århus University, Institute of Zoology and Zoophysiology. Collection and identification of soil dwelling diptera larvae. Modelling of the growth of oilseed rape and two important pests. Project financed by the Danish Agricultural and Veterinary Research council
1988 –1990: PhD-student. Århus University, Institute of Zoology and Zoophysiology. The impact of parasitoids on the host population in an agricultural ecosystem, investigated by field sampling, laboratory work and simulation modelling
Role in the project: Responsible for WP 4, Development of indicators for soil fauna
Publication list includes 23 refereed papers, all are of agro-ecological relevance.
Five relevant publications:
Axelsen, J.A.; Ruggle, P.; Holst, N. and Toft, S. 1997 Modelling natural control of cereal aphids III. Linyphid spiders and coccinellids. In : Powell, W (Ed.) Arthropod natural enemies in arable land III. The individual, the population and the community. Acta Jutlandica 72(2), 221 - 231.
Marcussen, BM., Axelsen, J.A. and Toft, S. The value of Isotoma viridis and Folsomia fimetaria (collembola: Isotomidae) as food for Erigone atra (Ara... Erigonidea). *Entomologia Exp. Appl, 92, 29 – 36.*.

Bilde, T. Axelsen, JA. & Toft, S. 2000. Value of Collembola from agricultural soils as food for a generalist predator. *Jouarnal of Applied Ecology*, 37, 672 – 683
Axelsen, J.A., Thorup-Kristensen, K. 2000. The Collembola community in plots fertilised with different types of green manure. Pedobiologia 44, 556 – 566
Elmholt, S. og Axelsen, J.A. 1998. "Jordbundens biologi". Bidrag til :"Økologisk jordbrug - miljø og husdyrvelfærd". Notat til Det Økologiske Fødevareråd i forbindelse med udarbejdelsen af Aktionsplan II for fremme af den økologiske fødevareproduktion i Danmark.

CURRICULUM VITAE Gábor L. Lövei

- Senior Scientist, Danish Institute of Agricultural Science, DJF Department of Crop Protection, Research Centre Flakkebjerg, 4200 Slagelse, Denmark

Born: 1952
Academic Qualifications:
PhD (Zoology) A. Jozsef University, Szeged, Hungary, 1977
MSc (Biology) A. Jozsef University, Szeged, Hungary, 1976
Years as a Practising Researcher: 20, with work experience in Hungary, Italy, U.K., New Zealand. Specialised in biological control, agroecology & sustainable agriculture, inc. research in organic agriculture in New Zealand.
Present Research/professional Speciality:
Ecology of pest and beneficial organisms in agricultural fields. Habitat manipulation for increased biocontrol. Ecological effects of genetically engineered plants.
Role in the project: Responsible for beetle identification, data treatment and development of indicators
Number of Refereed Publications: 84
Relevant publications:
Lövei, G.L.; Hickman, J.M.; McDougall, D.; Wratten, S.D. 1993: Field penetration of beneficial insects from habitat islands: hoverfly dispersal from flowering crop strips. *Proc. 46th N.Z. Plant Protection Conference*: 325-328.
Hodgson, D.J.; Lövei, G.L. 1993: Novel crops in cereal fields: habitat refuges for arthropod natural enemies. *Proc. 46th N.Z. Plant Protection Conference*: 329-333.
Lövei, G.L. Sutherland, K.D. 1996. The ecology and behaviour of ground beetles. *Annual Review of Entomology* **42**: 173-194.
Topping, C.J., Lövei, G.L**.** 1997. Spider density and diversity in relation to disturbance in agroecosystems in New Zealand, with a comparison to England. New Zealand Journal of Ecology 21, 121-128.
Lövei, G.L., Macleod, A., Hickman, J.M. 1998. Dispersal and effects of barriers on the movement of the New Zealand hover fly *Melanostoma fasciatum* (Dipt., Syrphidae) on cultivated land. Journal of Applied Entomology 122, 115-120.

CURRICULUM VITAE: **Søren Toft**

- Associate professor in zoological terrestrial ecology since July 1981 at Dept. of Zoology, AU.

Born 22.7.1946 in Copenhagen.
Biology candidate (Cand. scient.) Jan. 1975 from Aahus University (AU).
Ph.D. scholarship 1977 - 1980 at Dept. of Zoology, AU.
Ph.D. degree June 1980.
Role in the project: Responsible for spider identification, data treatment and development of indicators
Publication list includes 68 refereed papers, of which ca. 40 are of agroecological relevance.
Selected papers:
Toft, S. 1995. Value of the aphid *Rhopalosiphum padi* as food for cereal spiders. - Journal of Applied Ecology 32, 552-560.
Toft, S. & Riedel, W. (eds.) 1995. *Arthropod natural enemies in arable land.I. Density, spatial heterogeneity and dispersal.* Acta Jutlandica 70:2. Aarhus University Press.
Beck, J.B. & Toft, S. 2000. Artificial selection for aphid tolerance in the polyphagous predator, *Lepthyphantes tenuis* (Araneae: Linyphiidae). – Journal of Applied Ecology 37, 547-556.
Borg, C. & Toft, S. 2000. Importance of insect prey quality for grey partridge chicks (*Perdix perdix*): a self-selection experiment. – Journal of Applied Ecology 37, 557-563.
Toft, S. & Bilde, T. In press. Carabid diets and food value. In: Holland, J. (ed.) *Carabid beetles and agriculture*. Intercept

Workpackage 5

CURRICULUM VITAE: **Katrine Højring,**

- Researcher, Danish Forest and Landscape Research Institute (DFLRI), Hørsholm Kongevej 11, DK-2970 Hørsholm.

Born: October 2nd 1955
Education: MA, archaeology, Aarhus University, Feb. 1983
Key Qualifications: Practical and scientific analytical experience with landscape management and planning in general, and in particular with the management of cultural and aesthetic values in forests and in agricultural areas. Development

of tools for the facilitation of discussions with local inhabitants about cultural and aesthetic landscape values and landscape management. Development of methods for public participation in decision making concerning landscape management.

Selected honorary offices:

- Member of the Steering Committee of the COST-G2 "Ancient Landscapes and Rural Structures".
- Member of the Program Committee for the Norwegian research program "Landskap i endring" (Changing landscape). Approx. 65 mio. NKr. over 5 years.
- Member of the EU-Concerted Action on "The landscape and nature production capacity of organic/sustainable types of agriculture". 1994 – 1998

Role in the project: Responsible for WP 5, research realted to task 1, 2 and 3

Publications:

Højring, K. (1995): Landscape aesthetic considerations in agricultural landscape development. - In: Proceedings of the second plenary meeting of the EU-concerted action: "The landscape and nature production capacity of organic/sustainable types of farming. v.Mansvelt, J.D. & Stobbelaar, D.J. Department of Ecological Agriculture. Agricultural University, Wageningen, Netherlands, pp. 159-161.

Højring, K. (1995): Oplevelser i landbrugslandskabet. - I: Landbruget i den samfundsøkonomiske udvikling, rapport nr. 84. Flader, L. (ed.) Landbrugs- og Fiskeriministeriet. Statens Jordbrugs- og Fiskeriøkonomiske Institut. p 181-198

Højring, K. (1995): Landskab og æstetik. - Jord og Viden 13: pp. 18-20

Højring, K. og Caspersen, O.H (1999): Landbrug og landskabsæstetik - Udviklingen i landbruget 1950-1995 og dens konsekvenser for landskabets oplevelsesmæssige indhold. Park- og Landskabsserien nr. 25. Forskningscentret for Skov & Landskab, Hørsholm. 252 pp.

Højring, K. og Jensen, F.S (1999): Perception af landskaber - I: Skov & Landskabskonferencen 1999. Forskningscentret for Skov & Landskab, Hørsholm. pp. 152-157

CURRICULUM VITAE: **Egon Noe**

- Researcher, Dept. Agricultural Systems, Danish Institute of Agricultural Science (DIAS), Research Centre Foulum, PO box 50, DK 8830 Tjele

Born: August 25th, 1961

Education*:* M.Sc. Agronomy, The Royal Veterinary and Agricultural University.
Ph.D. Rural sociology, October 1999, the Royal Veterinary and Agricultural University.

Key qualifications: Holds a comprehensive theoretical and methodological knowledge and experience in farm management and decision making, built through a wide range of empirical studies of the role of non-economic values, regulation, advisors, other farmers, the common debates etc. in this process. Development and evaluation of tools to include nature and landscape quality concerns in farm management and of tools to enrol local actors in the decision making concerning environmental problems and landscape management

Role in the project: WP 5 tasks 2 and 3.

Selected publications

Noe, E. 2000. What is happening with "organic farming" in Denmark? - The Danish case analyzed from an Actor Network Theory perspective. Submitted to Sociologia Ruralis

Noe, E. & Halberg, N. 2000. Research Experience with Tools to Involve Farmers and Local Institutions in Developing More Environmentally Friendly Practices. In press in Berlin Co-operative Studies. Proceedings of the 64th EAAE-Seminar: Co-operative Strategies to cope with Agri-Environmental problems" Berlin, October 27-29, 1999.

Noe, E. 1999, Værdier, Rationalitet og Landbrugsproduktion. Belyst ved en microsociologisk undersøgelse blandt danske økologiske og konventionelle kvægbrugere. (Values, Rationality and Farming – Examined in a micro sociological study of organic and conventional dairy farmers) Ph.D. thesis. Department of Economic and Natural Resources at the Royal Veterinary and Agricultural University. (English abstract)

Noe, E. 1996. Heterogeneity, challenges and potentials of organic farming. Paper presented at the IFOAM Congress, Copenhagen, August 1996.

Noe, E. 1996. Dissemination of organic farming in Denmark: The case of the Lemvig-area in Northwest Jutland p. 20-27. In: Assouline et al.: Stimulating the implementation of environmentally sound agricultural practices in Europe. Final report to European Commission DG XI.