Gregor Levin
National Environmental Research Institute (NERI), Department of Policy Analysis
Postbox 358, Frederiksborgvej 399, 4000 Roskilde
e-mail: gl[at]dmu.dk

Paper for: SOAR – summer school: Research Methodologies in relation to Principles and Practice of Organic Agriculture, October 02.

A holistic framework for the analysis of landscape changes following organic farming

Abstract

In this paper I reflect on the design of an appropriate methodological framework for my Ph.D.-project. Holism is widely recognised a vital concept for research on human-environment relationships. This is especially the case when agriculture's impact on landscapes is studied. Thus, for my study on landscape changes following conversion to organic farming, I discuss holism in terms of its relevance in principal and in terms of its actual practicability. I recognise that a holistic angle is decisive in order to analyse and understand the spatial and temporal dynamics of the landscape and the multitude forces and processes that have a bearing on them. Keeping a general holistic concept in mind can elucidate factors and processes that might be overlooked in a purely reductionistic approach and a holistic concept can thus prevent from drawing inadequate and premature conclusions. Additionally, in order to explain spatial and temporal dynamics in the physical landscape, I discuss the integration of quantitative and qualitative methods. Quantitative data can point to statistical tendencies and relations. However, the underlying causes and processes, especially when these concern human activities and decision taking, can only be detected with qualitative information. Based on these considerations I suggest a holistic framework for my study where quantitative and qualitative methods in a complementary sense can contribute to a to a profound description and understanding of landscape changes following conversion to organic farming.

Introduction

My Ph.D. project, which is currently in its design phase, concerns landscape changes as a consequence of the last 10-15 years' growing conversion into organic farming in Denmark. It is generally expected that this conversion can improve richness and diversity of landscapes' nature content and thereby to some extent counteract the negative impacts of landscape-impoverishment and -homogenisation that followed the general process of agricultural intensification after World War II (Strukturdirektoratet 1999; Wilhjelmudvalget 2001). However, for organic farming, there exist no specific rules or guidelines concerning the conservation or improvement of nature values at landscape scale. Furthermore, such relations are not very well documented, and the few existing studies lack the appropriate spatial and temporal scales in order to draw reasonable conclusions on organic agriculture's impact on landscape dynamics (Tybirk & Alrøe 2001). Based on this discrepancy between general expectations and what is actually known or documented, I have formulated the following project title:

Landscape changes following organic farming
-To what extend and why?

The title contains two main study questions:
The *first* question: "To what extent does a growing conversion to organic farming affect the Danish landscape?" has a rather quantitative approach. Landscapes' spatial pattern and structures as well as their temporal dynamics are to be registered mainly through in-

terpretation of aerial photos and are then in a geographic information system (GIS) spatially related to organically vs. conventionally farmed areas.
The *second* question "Why (and how) does organic farming cause landscape changes?" concerns the elucidation of factors and processes that have a bearing on – and thus may explain – landscape dynamics and spatial variations that are revealed in the first part. This means that landscape dynamics and variations are to be investigated in relation to different, both socio-economic, cultural and biophysical parameters.
In continuation of the two first questions a *third* question arises: "What is the potential of organic agriculture to contribute to an improved nature content at landscape scale in the future?" Based on results and conclusions from the first two parts, this third question can aim at putting the project into a forward looking perspective.
From this brief description of the intentions with my Ph.D. project, it turns out that multiple kinds of data, ranging from aerial photos, agricultural statistics and spatial information to questionnaires and key person interviews are needed to answer the different questions. As a consequence I need to establish a methodological framework that gives the possibility to gather and analyse these data in an appropriate and complementary way. A holistic approach, perceiving the world as a whole that is constituted of interrelated sub-wholes, can constitute such overall framework.

A holistic conceptual framework

Holism can be understood as the contrary of reductionism. Reductionism attempts to reveal the properties of nature by separating the single components from their wholeness. Hereby, the study is simplified and the interpretation of scientific results is facilitated. This scientific method is useful for finding governing relationships in basic natural sciences, like physics or chemistry. However, the method has obvious shortcomings when research concerns the investigation of more complex systems like agroecosystems or landscapes. A system's properties cannot be revealed by studying the components separately (Jørgensen 1997).
Holism perceives the world as a whole, where a supra-whole is made up of interrelated sub-wholes. Each whole contains a set of sub-wholes while it is itself a sub-whole of a supra-whole. A holistic approach can therefore reveal interdependencies and interrelationships between the different parts of a system and between supra- and sub-wholes. As a consequence, within such holistic approach, it must be stated that the whole is more than just the sum of its parts. It is the ability to analyse and understand the function of complex systems that separates holism from reductionism. It is important to understand that the idea of holism does not mean that everything that somehow could be connected to the study subject needs to be studied in detail. Such task is, in terms of accessible data and time and financial resources, impracticable. Rather, holism should be used as a general concept, in order not to overlook or obscure relevant factors and processes (Bawden 1991; Sriskandarajah et. al. 1991).

Landscape research across scales

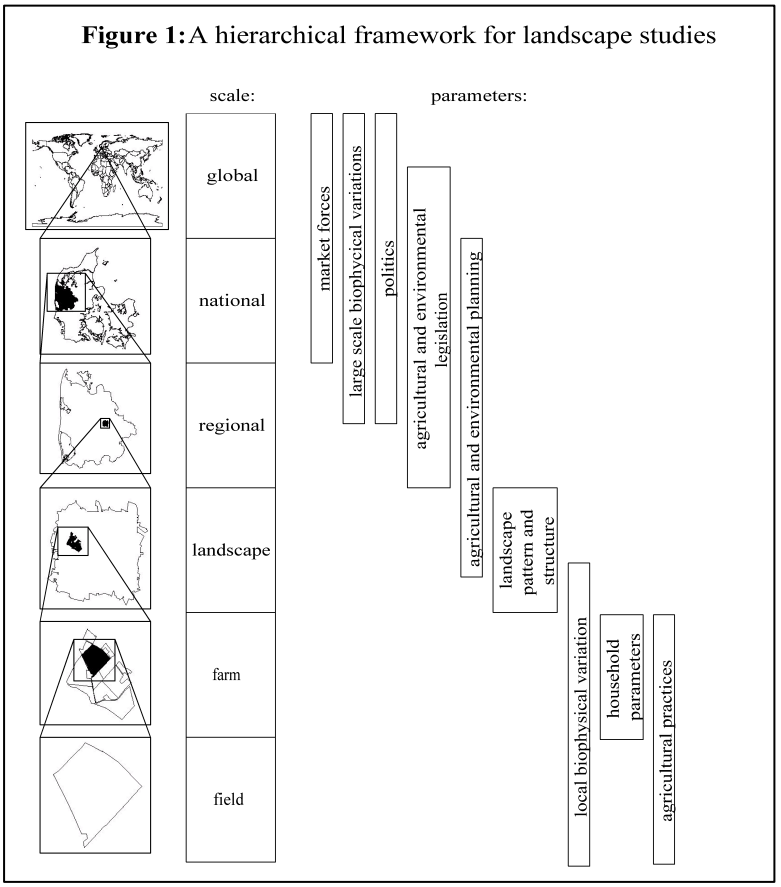
The concept of holism is generally recognised an important methodological concept for landscape research and thus for the emerging science of landscape ecology (Naveh 2000; Naveh & Lieberman 1994). Within a general landscape ecological framework, the term landscape can be defined as a system of interacting subsystems *"...forming (also by virtue of its physiognomy) a recognisable part of the earth's surface, and (...) formed and maintained by the mutual action of biotic and abiotic forces as well as human actions."* (Zonneveld, 1995:4). The landscape can thus be seen as a hierarchy of subsystems – "building blocks" – at different scales, where the interaction between subsystems at one level constitutes a whole at a higher level. This landscape definition has much in common with the above mentioned concept of holism, where wholes contain a set of sub-wholes and so on.

In my project, a holistic concept will thus form a useful framework for the elucidation, analysis and understanding of factors and processes that impact landscapes' nature content. Figure 1 illustrates such hierarchic holistic concept as it could be used it in practice. The central subject of study in my study is the physical landscape. I attempt to register the spatial character of specific landscape elements (e.g. hedgerows, small biotopes, ditches etc.) that can be assumed to influence nature content or biological values at landscape scale. However, pattern and structures at landscape level (i.e. the spatial distribution and variation of at landscape elements) are usually a function of the farmer's or land owner's decision taking at a smaller field or even sub-field level. Farmers' decision taking and thus their actual interventions at field or sub-field level are themselves influenced by parameters or processes at other, often higher levels in this spatial hierarchy. (Reenberg 1996; Cocklin et al. 1997). E.g. household economy, regional administration, national politics or even global markets can all have a significant bearing on land use decision taking at field level and thus on spatial pattern and structures at landscape level.

In addition to spatial scale, attention must be paid to different parameters or processes having different time horizons (Dalgaard 2002). Crop rotation is usually discernible at an annual time scale, while the investigation of spatial dynamics of hedgerows or small biotopes needs much longer time scales.

Consequently, in order to thoroughly understand spatial pattern and variations that are registered at landscape level, I need to analyse them in relation to variables, factors and parameters at very different both spatial and temporal scales. This means that in a holistic hierarchical framework, the single parts are investigated but related to wholes. It is through this system thinking that cross-scale relationships can be detected and the whole becomes more than just the sum of its parts (Sriskandarajah et. al. 1991). The "more" in the above statement does, however, not refer to any measurable quantity. Or as Naveh (2000:12) expresses it: "*...not every thing which can be counted, counts, but there are many things that cannot be counted, which count.*" Interdependencies and interrelationships between parts and across scales have a qualitative character and cannot be detected or even understood with the use of quantitative methods alone. In order to comprehensively understand landscape dynamics, qualitative information and thus qualitative methods are needed to complement quantitative data.

Figure 1: A hierarchical framework for landscape studies

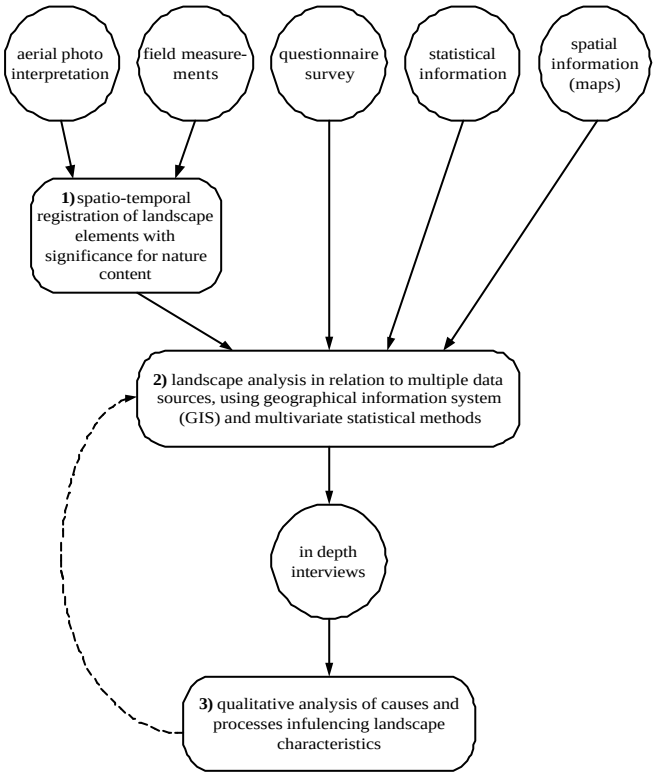


Integration of quantitative and qualitative methods in a complementary holistic framework

Quantitative analyses can detect statistical tendencies and thus point to relationships between different parameters or phenomena. In addition, quantitative methods have the advantage of being able to analyse very large sets of data, if these are accessible (e.g. agricultural statistics). Yet, irrespective of how large data sets are, or of the grade of sophistication of analyses (e.g. multi factor analysis or multiple regression), quantitative methods, particularly when concerning the investigation of human-environment relations, cannot reveal or even explain the casual relationships or processes that lie behind statistical relationships (Sayer 1992). Furthermore, agricultural or land use decision making is to a high degree affected by the farmers' personal values, attitudes and perceptions (Kaltoft 1997). Therefore, when the understanding of phenomena and processes is a key subject, qualitative methods need to be adopted.

In spite of their methodological opportunities, qualitative methods have several disadvantages. In comparison with quantitative methods, adopting qualitative methods, is much more time consuming. The amount of data possible to gather is thus relatively small. Furthermore, the gathered information is, of course, of a qualitative character and can therefore only to a limited degree be used in a statistical manner. Consequently, with qualitative information alone, it is difficult, if not impossible, to achieve any form of representative information that allows the generalisation of results.

Figure 2: A flow-chart of a methodological framework



According to the advantages and disadvantages of qualitative vs. quantitative methods, for my project I suggest a framework, where the two kinds of data and methods are used in a complementary way. In Figure 1 a number of different parameters are referred to the different scales in the hierarchical framework. Most parameters refer to more than one level in the hierarchy. E.g. planning schemes can be conducted at landscape, regional and even international scales. The figure is by far all embracing. Yet, it points to the multitude of different data and methods needed in landscape research. Based on the relevance of different methods, their opportunities and their practical applicability, Figure 2 outlines a methodological process, where quantitative and qualitative methods are used in a complementary iterative manner. In the *first* step of the process, the spatial and temporal dynamics of landscape elements with significance for nature content are registered mainly on basis of aerial photos and field measurements. In the *second* step, the spatio-temporal registration of landscape elements is analysed in relation to a wide set of different parameters that are derived through various quantitative data sources and methods. Based on the results of the first and second step, in the *third* step, processes and causal relationships are illuminated in a qualitative manner through the use of in depth interviews with single farmers.

The possibility to reconsider analyses and conclusions made in the quantitative analysis is represented by the stippled arrow pointing back to the second step. Qualitative methods do not only help to understand and explain tendencies observed through quantitative

data and methods. Integrating qualitative methods should also prevent from drawing false or inadequate conclusions. It is in this iterative manner that I attempt to use quantitative and qualitative methods in a complementary way in my study.

Discussion and conclusion:

The above outlined methodological framework must be perceived a first preliminary outline. Several issues, crucial to the practicability of the study, need clarification. How is the landscape scale defined and how can landscapes be appropriately demarcated for the study purpose? What nature perception forms the basis for the valuation of landscapes' nature content and how can nature content actually be registered on basis of aerial photos? What statistical data are actually accessible or can be generated, what is their accuracy and how can they be investigated in order to answer the study questions? Although it is not within the scope of this paper to discuss these and other issues, it becomes clear that the practical implementation of the outlined methodological framework needs thorough reflections on the practicability of the different data and methods. Their advantages and drawbacks have to be discussed and an appropriate way to use them in a complementary way must be developed.

This can be a difficult task, which may be constrained by a range of practical constraints. However, it is only the adoption of a holistic conceptual approach and the complementary integration of quantitative and qualitative methods that can give my project the ability to draw any profound conclusions about landscape changes following organic farming.

Literature:

Bawden, R.J., 1991. Systems thinking in practice in agriculture. Journal of Dairy Science 74:2362-2373.

Cocklin, C., Blunden, G. & Moran, W., 1997. Sustainability, spatial hierarchies and land-based production. In: Ilbery, B., Chiotti, Q. & Rickard, T., 1997. Agricultural restructuring and sustainability. CAB International. 1997.pp25-39

Dalgaard, T., Hutchings N. & Porter J. R., 2002: Agroecology, scaling, and interdisciplinarity. Preprint.

Jørgensen, S.E., 1997. Integration of ecosystem theories: A pattern. Kluwer Academic Publishers, Dordrecht.

Kaltoft, P., 1997. Naturetik som praksisbegreb: en undersøgelse af naturforståelse, praksis og viden i økologisk jordbrug. Institut for Teknologi og Samfund. Danmarks Tekniske Universitet, København.

Naveh, Z. 2000. What is holistic landscape ecology? A conceptual introduction. Landscape and Urban Planning 50:7-26.

Naveh, Z., Lieberman, A., 1994. Landscape ecology: Theory and application. Springer, New York.

Reenberg, A., 1996. A hierarchical approach to land use and sustainable agricultural systems in the Sahel. Quarterly Journal of International Agriculture 35(1):63-74.

Sayer, A., 1992. Method in social science: A realistic approach. Routledge, London and New York.

Sriskandarajah, N., Bawden, R.J. & Packham, R.G., 1991. Systems agriculture: a paradigm for sustainability. Association for Farming Systems Research-Extension Newsletter 2(3):1-5.

Strukturdirektoratet, 1999. Aktionsplan II: Økologi i udvikling. Ministeriet for Fødevarer, Landbrug og Fiskeri, København.

Tybirk, K. & Alrøe, H.F., 2001. Naturkvalitet i økologisk jordbrug. Forskningscenter for økologisk jordbrug, København.

Wilhjelmudvalget, 2001. En rig natur i et rigt samfund. Wilhjelmudvalget, København.

Zonneveld, I.S., 1995. Land Ecology: an introduction to landscape ecology as a base for land evaluation, land management and conservation. SPB Academic Publishing, Amsterdam.