



ELSEVIER

Landscape and Urban Planning 41 (1998) 209–227

LANDSCAPE
AND
URBAN PLANNING

Comparison of landscape features in organic and conventional farming systems

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Abstract

Four organic (biodynamic) farms coupled with conventional farms from their neighbourhood in The Netherlands, Germany and Sweden, and 3 organic farms and 4 conventional farms from the West Friesian region in The Netherlands were evaluated to compare their impact on landscape diversity. Materials used were soil-, water-, land use- and land-property maps, interviews with the farmers, repeated (several days) visits to the farms, allowing to make temporal transects, photographs and pictures of the farm-couples and their surroundings. Presence of diverse land use types, woody elements (plantings) and visual elements (vertical and horizontal coherence, colours and forms) were analysed. The results show that the diversity of landscapes and farming system was greater in organic farms. It regards to the land-use types, crops, livestock, plantings (hedges, solitary shrubs and trees), flora, sensorial information (more forms, colours, smells, sounds, spatial experiences) and labour (more on-farm processing and more people involved). Also, all forms of coherence were found to be greater in organic farms. In terms of landscape diversity the organic types of agriculture have a good potential for positive contributions to a sustainable agro-landscape management. © 1998 Published by Elsevier Science B.V. All rights reserved.

Keywords: Biodiversity; Rural landscape; Multifunctionality; Landscape production; Organic agriculture; Cross compliance

1. Introduction

FAO's position on Sustainable Agriculture and Rural Development (SARD), (FAO, 1991) and Chapter 21 of the United Nation's Conference on Environment and Development (UNCED, 1992) illustrate that global awareness of the need to redirect agriculture has fully reached the institutional level. In Europe, this awareness is reflected in the EU efforts to elaborate a common agricultural policy (CAP), including the MacSharry proposals (Greenpeace, 1992). Within the EU this awareness has been addressed while

designing policy for the management of Nature and Landscape, often in a Rural Development context (Baldock and Beaufoy, 1993; Anonymous, 1995; PEBLDS, 1995; Giorgis, 1995).

The problems of agriculture are multiple and complex, touching different levels and sectors of society, compliant to the sectorisation of policy and science (MacRae et al., 1989). They include the overproduction, over-consumption and over-emissions in the rich (mainly north-western) societies and underproduction, under-nourishment and exploitation of the poor (mainly south-eastern) ones. But, however different the developments in those two parts of the world, they both include the degradation of environment (soil, water, air), loss of nature (fauna, flora), depletion of

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natural resources (in particular fossil energy and fertile soils) and degradation of landscapes and rural communities (livelihood). Thereby, pollution and erosion are terms used in general to indicate unwanted effects of excessive use of products from agro-chemical and agro-pharmaceutical industry on one hand and those of wasteful uses of common property (nature's renewable and non-renewable resources in general) on the other.

Interacting effects of the mentioned problems result in the landscape: in the ways it appears and in the ways it functions. However, various single factors result in combined effects only (1) after various time-lags, (2) in many complex ways, (3) on a high level of integration (the landscape). Precisely because of that reason there is a strong tendency among all actors involved to roll-off the responsibilities of unwanted changes viz side effects of their actions. This problem of policy or management is shared with scientists, invited to analyze the causes of changes in the landscape as a whole. Sectorisation and short time research are seen as causal to that problem that goes along with a trend to look for technological end-of-pipe solutions (Baldock and Beaufoy, 1993; van Mansvelt and Mulder, 1993; Giorgis, 1995; de Putter, 1995).

In this paper the problems related to the degradation of the landscape are not seen as an isolated issue but as part of positivist-technological approach of society towards agriculture and land-use in general (MacRae et al., 1989; van Mansvelt and Mulder, 1993). Thereby, special attention is given to the actual and the potential contributions that types of organic agriculture can make to the landscape and the related issues. Because of the fundamentally integrative character of organic agriculture (OA) and of the landscape, it will be argued that both should be regulated by setting objectives instead of by the prescription of means. Thus, addressing the farmers' involvement by rewarding creativity is preferred over directing the farmers' behaviour by sets of constraints (van Mansvelt and van Elzakker, 1994).

The basic philosophy of organic agriculture and the cross compliant attitude of its implementation, allows the presumption that, at least in potential, they can contribute to the visible landscape quality in a positive way. To look for evidence in support of this presumption, a pilot study has been executed in a co-operation between the Department of Ecological Agriculture

and the Department of Landscape Architecture, Wageningen Agricultural University, The Netherlands, comparing four organic farms with their conventional neighbours (Stroeken et al., 1993). Thereby the aim was to find out in which ways the multitude of differences that were found between the farm-couples, could be defined, structured and valued.

However, as research on the landscape production of agriculture is rather new and established methodology as yet in development, such a study would need experience on methodologies that fit the object and the questions to be answered. The development of steps toward such a methodology was part of the objective of this pilot study. A wider methodological study ranging 4 years, elaborating on the methodology and findings presented here, has been started in early 1995, as part of an EC-project "Regional Guidelines to support sustainable land use in EU agri-environmental programmes". The results until now will be presented here.

2. Concepts and approaches in organic agriculture

2.1. *Landscape concepts and perceptions*

The way of the landscape perception is crucial for all decision making regarding landscape. The perceptions of landscape can differ considerably, depending on educational background and different schools of thought (Cobham, 1986; Stobbelaar and van Mansvelt, 1994).

Two crucial oppositions found in literature will be mentioned here to indicate the range of perceptions (Pedroli, 1988; Stobbelaar and van Mansvelt, 1994; Gastó et al., 1994).

(1) The opposition between the ideal landscape as a product of nature versus the ideal landscape as a product of culture. In the last position, the urban landscape can be seen as the most valuable, controlled, cultivated one, whereas in the first position the untouched wilderness is the most beautiful.

(2) The opposition between the landscape purely as an object, in a strict positivist science approach, versus the landscape purely as a human perception, and as such inaccessible for positivist science. In this opposition the outsider approach regards the landscape as

an inadequate object for research, restricting its research to the ecological screening of species and biotopes per surface unit and adequate soil–climate conditions (databanks, patterns, tables and graphs); or only looking at the landscape as a functional object for the production of food, fibre, forest or recreation. The other approach is looking for holistic and anthropocentric, unifying concepts. Herein one question of research is how the landscape can be studied as it is more than lists of species and biotopes. Another question is how to include the human involvement: a product of interacting perceptions, appreciation and goal-oriented actions of those involved in the landscape (Pedroli, 1988; van Mansvelt and Stobbelaar, 1997). A definition covering both aspects is used hereby, saying that landscape is “the visual part of the earth, with its interdependent interactions of climate, relief, soil, flora, fauna and human activities”. This includes the impression/perception part of the landscape as well as its ecological and socio-cultural bases (van Mansvelt, 1994).

From a sociological point of view, it is important to find out how much decisions, regarding land-use and landscape development are based on those living and working in the landscape at stake (bottom up), or mainly based on abstract ruling and scientific expert consultation (top down). In both cases the composition of deciding groups, users or experts, and the conceptual approaches they have in common, is crucial (Volker, 1992; Stobbelaar and van Mansvelt, 1994).

2.2. Biodiversity in organic farming systems

During recent decades new, ecology inspired streams in landscape design emphasised the importance of including a wider range of natural values in the landscapes, to restore resilience and recreational values that had been lost by neglect in the previous decades (Bradshaw et al., 1986). Thereby the interest for plant and animal species presence in agricultural lands has increased in the framework of an awakening consciousness for the values of nature and of the debate between separatists and integrationists of agriculture and nature-protection (Loening and Colquhoun, 1995; Stroeken et al., 1993). In several countries researchers have reported the decreasing diversity of floral and faunal elements, as well as that of biotopes, in agricultural areas. On a higher level of integration,

others talk about the loss of ecological infrastructures and the degradation of the landscape (Kirby, 1986; Grigg, 1987; Birks et al., 1988; Braat and Vereijken, 1992). Older terms like landscape desertification (Albrecht, 1975; Pfeiffer, 1947) indicate that perceptions of loss of landscape values were present already early in this century.

However, it lies in the nature of a reductionist/positivist approach of natural sciences that the research on and assessment of landscape values has mainly focused on measurable components of landscape. Although landscapes as such are recognised as wholes per se, comprising all measurable and (as yet) unmeasurable components, perceived in their actual relationships and with their ecological, economic and aesthetic impacts and meanings (Pedroli, 1988; Stroeken et al., 1993, 1992; Vereijken and van Mansvelt, 1994).

As far as types of OA are concerned, the issue of landscape, at least as a concept, has always been a consistent part of its holistic approach (Steiner, 1924; Draghetti, 1991; Aubert, 1977; Koepf, 1980; Bockemühl, 1986). In empirical research, however, most studies on landscape values focused on monitoring of (sets of) single landscape elements (Smeding, 1994). For obvious reasons (complexity of the matter, duration and costs), experimental agro-landscape research has not yet resulted in publications. Studies published on landscape elements, mainly about flora and fauna, give clear indications that these types of agriculture can play an interesting role in conservation of species' diversity. In their literature survey, Braat and Vereijken (1992) found for example that:

- in/on the soils of organic farms and orchards in Denmark, Germany and The Netherlands, 200% to 2000% more beetles and earthworms (individuals per unit soil surface or soil volume) have been counted than in/on soils of neighbouring conventional farms. Compliant data on earthworms have been found in New Zealand in a comparative study on soil quality and financial performance (Reganold et al., 1993);
- other invertebrates like bees, butterflies, bumblebees and spiders were found to range from 50–700% more species per unit surface in organic farms;
- farm-flora comparisons in Austria, Germany, The Netherlands and Switzerland showed figures

ranging from 130–700% more weed (herb, non-crop) species in organic farms as compared to their conventional neighbours;

– reports on birds counting from Germany, The Netherlands and USA, mentioned 30–800% more birds (individuals) and 600–4000% more area for occasional birds in organic farms. For common bird species an area surplus in organic farms was found in the range of 50–1000%.

Smeding (1992) specified that in The Netherlands, amongst the mentioned species, 27 figured on the list of “arable field species to be conserved” and six on the Dutch “red list” (rare species), in Germany and Austria these figures were 48 and 22 respectively, the red list here being the German one. Smeding (1994) reported on a comparison of a farm under integrated and biodynamic management, where a 40% decrease of grassland species was found after 12 years integrated, as compared to a 0% decrease after 9 years under biodynamic management. Further data on differences in soil, flora and fauna differences between organic and conventional agro-ecosystems have been published by Niggli et al. (1995) and Isart and Llerena (1995).

This material on biodiversity, together with the evidence on comparatively favourable effects of OA on the environment, gave rise to the hypothesis that organic types of agriculture might have a comparatively positive effect on the landscape as a whole. A first pilot study supported the hypothesis and, more important, it gave indications that the landscape production of farms could be studied at all (Stroeken et al., 1993). This was implemented in a follow-up study, comparing clusters of farms in The Netherlands (Hendriks et al., 1998a, b).

2.3. Multiple paradoxes in dualistic or in holistic perspective

In discussions on how to manage the criteria for rural landscape validation when it comes to their implementation, an interesting range of paradoxes can be met.

A first couple of paradoxes met in landscape research and design are:

(1) ordered culture (strict control) vs. wild nature (*laissez faire*),

(2) reductionism (emissions, species) vs. holism (images, qualities and characteristic identities),

A next couple of paradoxes met in landscape discussion are:

(3) generic top-down planning vs. specific bottom-up self organisation,

(4) policy and management approaches that are stick-oriented (prohibitions and punishment) vs. such that are carrot-oriented (rewarding and stimulating) (van Mansvelt and van Elzakker, 1994),

(5) economic growth and farm productivity vs. rural agro-ecology and (natural, relict) landscape conservation.

It is important how those involved in the dialogue or discussion perceive such paradoxes as mentioned. From a dualistic position they can be perceived as mutually exclusive and definitely incompatible. However, they can also be perceived as polar positions along one or more gradients, within a larger unity on a higher level. This is like, for example, the N and S poles of the globe are absolute opposing ends but at the same time, intrinsic sides of that globe are as an inseparable whole. An approach of the polarity paradox that is still quite interesting can be found in the aesthetic letters of the German philosopher Schiller (1981). He describes the opposition between:

- the “urge to form”, leading eventually to over-rationalisation, to over organisation and deadly structures, to static barbarianism, and,
- the “urge to live”, to let life processes go their irrational ways, eventually leading to uncontrolled vitality, to festering growth and completely chaotic wildness.

Schiller indicates both as intrinsic potentials of the human being, but at the same time, as challenges for a humane development. According to his ideas, the full human potential is displayed in the creative interaction between both extremes where the “urge to play” is in charge. The solution lies in balancing the strong points of both other urges according to needs and possibilities of the relevant situation, to time, place and socio-cultural conditions. Needless to stress that solutions found according to the “play” principle are far from

average, middle of the road, or loose–loose compromises. Here also the Goethe's dynamic concept of metamorphosis or transformation should be mentioned, as one linking polar position within a developmental process (for example from young and vegetative to old, generative and ripe, as in soils, plants, crops, vegetation etc.; Goethe, 1974).

In line with the ways indicated above, the problem of handling opposing positions can be opened for a constructive dialogue, respecting the relative rationales of different positions and looking for ways in which various polarities can be made to interact synergistically. It shows how positions originally perceived as mutually exclusive, and how they can be found to be synergistically linked on a higher level of integration.

3. Material and methods

3.1. Values and criteria for landscape valuation

The criteria for rural landscape validation should basically cover all levels of human needs, as for example distinguished by Maslow (1954), and as included in the requirements of UNCED (1992). These criteria can be represented by four subgroups (Table 1):

1. food sufficiency: the criteria related to the peoples physical and physiological survival; they cover Maslow's need for food and shelter, being the

most fundamental needs of sustainable life in the biosphere;

2. labour sufficiency: the criteria related to the peoples socio-economic survival; they cover Maslow's needs for acceptance and recognition, being the conditions for acceptable life in the sociosphere;
3. human development: the criteria for ethical survival; they cover Maslow's needs for individual development, for the realisation of the human being's potentials, including all iterative steps in emancipation and participation that are essential for humane life in the cultural sphere;
4. sustainable production (land use): the criteria related to the earth's survival: conservation of species and habitats (coherent diversity) in the global ecosystem; this type of criteria can be seen as resulting from humane development, but at the same time it can be argued that they are a pre-requisite for it.

Now to allow steps toward an implementation of these rather general criteria, they are specified as requirements in Table 1. These criteria can be understood as projections of the anthropocentric wordings to the complementary ones for the compliant quality of the landscape. These specifications are based on a meeting of some 25 scientists from various EU countries and different disciplines, all active in the field of landscape research and development. The meeting was the first of an EC Concerted Action (Stobbelaar and van Mansvelt, 1994).

Table 1
Criteria for rural landscape validation ordered according to adapted UNCED mode

1. Food sufficiency/ Biological survival	2. Labour sufficiency/ Social survival	3. Humane development/ Ethical survival	4. Sustainable production/ Earth's survival
Sufficient agricultural production (food and fibre)	Socio-economic welfare (jobs and money)	Individual, site- and region- characteristic, species and habitats	Sustainable development of the sites and regions in their surrounding ecosystems
Clean environment	Harmonic integration of functions and human actors	Intrinsic consistency of the parts within the wholes	Protection of nature at large, including resource efficiency
Minimally needed diversity of flora and fauna (species and biotopes)	Participative development,	Unity, coherence and Continuity of transformative development (history)	
Internal (local) recycling	Aesthetics, harmony and recreational value		
Optimized ecological self-regulation			

3.2. Landscapes on four organic farms and their conventional neighbours

For this pilot study four organic (biodynamic) farms together with their neighbouring (conventional) farms, have been selected. The biodynamic ones were selected as well known for their long-time management in favour of landscape production (stratified sampling). This seemed the appropriate approach to find out about the practical potential for landscape production of OA. The selected farms were:

- Noorderhoeve in Schoorl/NW coastal area of The Netherlands and its conventional neighbour farm (in Tables 2–5 indicated as O_a and C_a, correspondingly),
- Dottenfelderhof in Bad Vilbel/Frankurter region in Germany and its conventional neighbour farm (in Tables 2–5 indicated as O_b and C_b),
- Marienhöhe in Bad Saarow/morain area in NE of Germany and its conventional neighbour farm (in Tables 2–5 indicated as O_c and C_c),
- Nibble GDrd in Järna/SW coastal area of Sweden (and its conventional neighbour farm, indicated as O_d and C_d).

The research methods used were partly based on those usual in landscape planning (Kerkstra and Vrijlandt, 1976; Poel de et al., 1981), partly on the holistic/phenomenological approach presented by Bockemühl (1986). In both approaches, the analyses of abstract, mainly quantitative data as well as the relationships between visual appearances: farm-internal, farm-external and the landscape surrounding the farm are considered. However, in the latter the focus is on qualitative issues, compliant to the way the landscape is visually experienced by its (multitude of) users. Leading questions in this research were:

1. How are the farms situated in the landscape (physical, geographical)?,
2. Which are the most striking landscape elements of the farm?,
3. How is the visual structure of these elements?,
4. Which are the visual differences between structures and elements within the farms, and how are the transitions between them?,
5. Which are the visual differences between the farms?,
6. How and in which respect do the organic farms differ from their neighbours?.

Table 2

Basic information on the structure of studied farms. O – organic (bio-dynamic) farms; C – conventional farms (Stroeken et al., 1993). Explanations on farms a–d and 1–4 (both in indices) see in text

Basic information	Stroeken et al., 1993								Hendriks et al., 1998a, b							
	Farms A in The Netherlands, B and C in Germany and D in Sweden								Farms in The Netherlands							
	O _a	C _a	O _b	C _b	O _c	C _c	O _d	C _d	O ₁	O ₂	O ₃	C ₁	C ₂	C ₃	C ₄	
Size (ha)	18	30	150	100	86	168	185	135	14	6	6	12	10	28	30	
Number of people	8	4	60	10	30	6	22	10	5	3	2	4	5	5	6	
Farming since	1980	1950	1946	1972	1928	1989	1965	1967	1971	1977	1970	1972	1971	1972	1973	
Number of land use types	14	5	15	8	16	8	11	8	11	8	7	5	5	4	1	
Area of natural/seminatural elements (%)	20	2.6	6.3	0.3	55	11.1	47	6.5	3.5	7.4	0.6	2.1	2.3	1.1	0.6	
Forest (%)	6	–	3.3	–	35	11	45	–	–	–	–	–	–	–	–	
Field margins (%)	14	2.6	3.0	0.3	20	0.1	2	6.5	2.1	2.7	0.6	1.5	2.4	1.2	0.6	
Arable crop rotation	–	–	1:12	1:3	1:6/8	1:6	1:8	1:7	1:5	1:5	1:5	1:2	1:3	1:1a2	1:1a2	
Number of woody elements (plantations)	9	4	9	3	9	3	7	5	5	4	2	3	2	2	–	
Number of elements on yard ^a	10	3	8	5	10	4	6	4	9	5	4	3	3	3	1	

^aThese elements refer to: housing, vegetable garden, flowers, fruit, herbs, small livestock, planting, tree nursery, compost place, house garden, on-farm shop.

Table 3

Overview on differences in presence (x) of land-use types in studied organic and conventional farms. Same source as in the Table 2

Types of land use	Stroeken et al., 1993 Farms A in The Netherlands, B and C in Germany and D in Sweden								Hendriks et al., 1996 Farms in The Netherlands						
	O _a	C _a	O _b	C _b	O _c	C _c	O _d	C _d	O ₁	O ₂	O ₃	C ₁	C ₂	C ₃	C ₄
Arable land															
Cereals			x	x	x	x	x	x							
Ley grassland			x		x	x	x	x							
Rootcrops			x	x	x	x	x								
Fallow						x									
Grassland															
Permanent	x	x	x	x	x	x	x	x							
Semi-permanent	x						x	x							
Orchard (low/middle)			x												
Orchard (high)			x	x	x										
Horticulture															
Cereals	x								x		x				
Rootcrops	x		x		x				x	x	x	x	x		
Leafcrops	x		x		x				x	x		x			
Fruitcrops	x		x		x				x	x					
Cabbage									x	x	x	x	x	x	x
Ley										x	x				
Flowers	x				x				x						
Wood	x		x		x		x	x							
Woody elements	x	x	x	x	x	x	x	x	x	x	x	x			xx
Trees nursery	x				x										
Small livestock	x	x	x	x	x		x			x					xx
Vegetable garden	x	x	x	x	x	x	x	x	x	x	x				
Flower garden	x	x	x	x	x	x	x	x	x	x	x	x			xx
Off-farm sale	x		x		x	x	x		x						
Total number of types	14	5	15	8	16	8	11	8	11	8	7	5			541
Farms ranking	O _c	O _b	O _a	O _d	O ₁	O ₂	C _b	C _c	C _d	O ₃	C ₁	C ₂			C _a C ₃ C ₄
Total number of types	16	15	14	11	11	8	8	8	8	7	5	5			541

Materials used to answer these questions were soil-, water-, land use- and land-property maps, interviews with the farmers, repeated (several days) visits of the farms, allowing to make transects, photographs and pictures of the farm-couples and their surroundings. The interviews covered issues of the farms history, their agriculture, economy, social structure and nature and landscape related attitudes and objectives.

3.3. Landscapes on two clusters of vegetable farms in West Friesland (The Netherlands): 3 organic and 4 conventional farms

Another part of this complex study was undertaken on landscapes in two clusters of vegetable farms in

West Friesland (NL): 3 organic and 4 conventional ones (in Tables 2–5 indicated as O₁–O₃ and C₁–C₄). For that purpose, a 4 years methodological study, elaborating on the methodology and findings presented here, has been started early 1995, as part of the EC-AIR3 project “Regional Guidelines to support sustainable landuse in EU agri-environmental programmes”. In this part of the project, the landscape production in clusters of organic (including biodynamic) and conventional farms will be studied in three regions of The Netherlands named after dominating soil type: Clay (West Friesland, vegetable crops), Peat (Waterland, dairy) and Sand (Drenthe, mixed farms).

A start has been made in 1995, on the West Friesean clay soils with four organic and four conventional

Table 4

Overview on differences in presence (x) of woody elements in studied organic and conventional farms. Same source as in the Table 2

Woody elements	Stroeken et al., 1993 Farms A in The Netherlands, B & C in Germany and D in Sweden								Hendriks et al., 1998a, b Farms in The Netherlands						
	O _a	C _a	O _b	C _b	O _c	C _c	O _d	C _d	O ₁	O ₂	O ₃	C ₁	C ₂	C ₃	C ₄
Wood (>0.5 ha)	x		x		x	x	x								
Thicket (0.5 ha)	x		x		x		x	x							
Shrubbery	x	x	x	x	x		x	x	x	x		x			
Hedge (Height >3 m)	x		x		x				x	x		x	x	x	
Hedge (Height ≤3 m)	x		x		x		x		x			x			
Tree row	x	x	x		x		x	x							
Tree row with understory	x		x		x										
Solitary tree (>3 m)	x	x	x	x	x	x	x	x	x	x	x	x		x	x
Solitary shrub (<3 m)	x	x	x	x	x	x	x	x	x	x	x				
Total number	9	4	9	3	9	3	7	5	5	4	2	3	2	2	0
Farms ranking	O _a	O _b	O _c	O _d	C _d	O ₁	C _a	O ₂	C _b	C _c	C ₁	C ₃	C ₂	C ₃	C ₄
Total number	9	9	9	7	5	5	4	4	3	3	3	2	2	2	0

farms. One organic flower production farm was included later but in this paper only three organic farms are reported. The cluster approach has been chosen to avoid the impossible task to find fully matching pairs that still differ in approach to agriculture (organic vs. conventional agriculture). In our approach, the relative positions toward landscape

production of organic and conventional farms can become more clear. That is for the time being: of the farms that have been selected for participation and accepting to do so. The methodology applied is fairly in line with the one indicated in Section 3.2. It is extended by a four time per year farm visit, to make pictures and experience the farm as it appears to the

Table 5

Overview on differences in presence (x) of visual qualities in studied organic and conventional farms. Same source as in the Table 2

Visual qualities	Stroeken et al., 1993 Farms A in The Netherlands, B and C in Germany and D in Sweden								Hendriks et al., 1996 Farms in The Netherlands							
	O _a	C _a	O _b	C _b	O _c	C _c	O _d	C _d	O ₁	O ₂	O ₃	C ₁	C ₂	C ₃	C ₄	
Vertical coherence	xx	-	x	o	xx	o	xx	x	o	o	o	o	o	o	o	
Horizontal coherence																
Functional	x	o	xx	o	xx	o	x	o	x	x	-	x	-	-	-	
Visual-spatial	xx	o	xx	-	xx	o	x	-	xx	x	-	o	-	-	-	
Colours																
Yard	xx	o	xx	o	xx	-	x	-	xx	x	o	-	o	o	-	
Fields	xx	-	xx	-	xx	-	o	o	xx	xx	x	o	o	-	-	
Margins	x	o	xx	-	xx	o	xx	o	-	x	-	o	-	-	-	
Forms																
Yard	xx	o	xx	-	xx	-	xx	-	xx	x	-	o	o	-	-	
Fields	xx	-	x	-	x	-	x	o	xx	xx	x	o	o	-	-	
Margins	x	o	x	-	xx	o	xx	o	o	xx	-	x	o	o	-	
Farms ranking	O _c	O _a	O _b	O _d	O ₁	O ₂	C ₁	C _d	O ₃	C _a	C ₂	C _c	C ₃	C _b	C ₄	
Total points	45	42	42	39	38	38	28	26	24	24	24	23	21	19	15	

Visual qualities: – very little; - little; o moderate; x many; xx very many.

observer in the sequence of each of all four seasons. This is meant to strengthen the evidence of biodiversity and temporal coherences in the farm's landscape, which again is an important feature for the consumers of the landscape (Coeterier, 1987; Bockemühl et al., 1992). Details are given in Hendriks et al., 1998a, b. Based on the methodological experiences and final results of this study, decisions can be made for a wider, representative farm-landscape production monitoring program.

4. Results

4.1. Size, land use types and woody elements

The situation in the two parts of the complex research, differs considerably, because the first part regards a survey of four organic farms that had especially been selected because of their renown care for the landscape, whereas the other part looks for a range of organic and conventional farmers. Moreover, in the first study the 4 organic farms (+neighbours) were situated in different regions (even in different countries), whereas the organic and conventional farms chosen have been selected in a particular region, though not as neighbours.

These differences being considered, a comparison of basic farm information (Table 2), their types of land use (Table 3) and of the woody elements present on the farms (Table 4) was made.

Table 2 shows that the vegetable farms in West Friesland are much smaller (6–30 ha) than the mixed farms in Germany and Sweden (86–185 ha). However, the Dutch organic mixed farm (18 ha, near West Friesland in the north of The Netherlands) is smaller than the conventional vegetable farms (28–30 ha).

- Land-use types ranged from 16 to 11 in the organic mixed farms and from 8 to 5 in the conventional neighbours, whereas in the Dutch vegetable region the organic farms ranged from 11 to 7 and the conventional ones from 5 to 1: a similarly distinct trend, but on a lower level. This lower level seems largely due to the specialisation (only vegetable production; see also Table 3).
- The farmland surface dedicated to natural elements ranged from 55% to 20% in the mixed

organic farms, from 11% to 0.3% in the conventional neighbours, whereas in the Dutch vegetable farms the range was 7.4% to 0.6% in organic and 2.3% to 0.6% in conventional vegetable growing farms. Here the difference between the organic and the conventional vegetable farms is absent.

- The crop rotations ranged from 1:12 to 1:6 in organic mixed farms and from 1:7 to 1:3 in the conventional neighbours, whereas in the Dutch vegetable farms they ranged from 1:7 in all organic to 1:3 to 1:1 in conventional. Complementary to situation found in the percentage for natural elements, here the Dutch organic farms differed clearly from the conventional ones, whereas the differences between the mixed organic farms (NL, DE, SW) and their neighbours were less striking.
- Number of woody elements ranged from 9 to 7 in the mixed organic farms and from 5 to 3 in the conventional neighbours, whereas in the Dutch vegetable farms they ranged from 5 to 2 in the organic cluster and from 3 to 0 in the conventional one. Here the same pattern is found as in the land-use types: same trend but on a lower level (see also Table 4).
- Elements on the yard ranged from 10 to 6 in the mixed organic farms and from 5 to 3 in the conventional neighbours, whereas in the Dutch vegetable farms they ranged from 9 to 4 in organic and from 3 to 1 in the conventional farms.

These data on Dutch vegetable farming seem to support the findings of the pilot study on mixed farms in three countries: as a tendency, diversity of species and habitats is higher on organic farms than in conventional ones.

Table 3 shows an elaboration of the types of land-use mentioned before, and in particular the specialisation on horticultural crops in the Dutch vegetable production.

Table 4 shows the woody elements (planting types), indicating that in the vegetable farms in the West Friesean clay area, woodlands, thickets and all types of tree-rows were missing. Solitary shrubs were present in all organic farms and in none of the conventional farms.

In the bottom lines of the Tables 3, 4, 5, the data as presented in the larger upper parts of those tables, have been re-arranged according to all 15 farms' ranking in

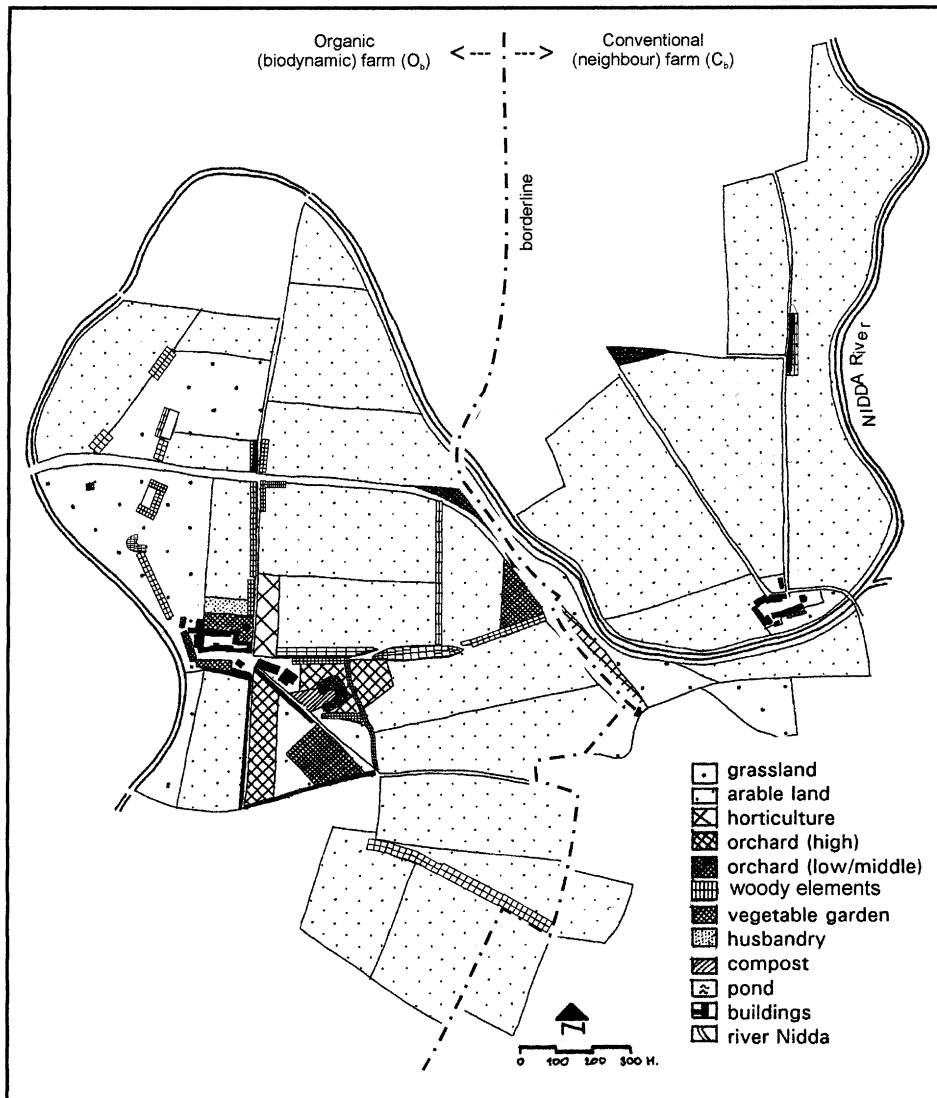


Fig. 1. Land use *patterns* from a selected organic (biodynamic) farm (O_b) and its conventional neighbour (C_b), (Stroeken et al., 1993). See also Fig. 5 in the right part.

types of land-use, woody elements and visual qualities. This re-arrangement presumes a comparability of the farms on the general level of the indicated systems parameters. Although crop species and arrangements in the rotations, plantations, natural elements, etc. may differ according to the specific features of the region (geomorphology, climate, culture), the numeric diversity of the organic systems seems to be larger anyhow. From this rearrangement it can be easily seen that the

organic mixed farms are found on the left (O_a to O_d), whereas Dutch conventional vegetable farms are found on the far right (C_2 , C_3 , C_4).

4.2. Diversity and coherence

The selected organic (biodynamic) farms were found to differ rather consistently from their (conventional) neighbours. These differences will be pre-

sented under two main headings: diversity and coherence.

Diversity was found to be greater in organic farms regarding:

- Land-use; more types of land use per farm (mixed farming: crops, grasslands, husbandry, vegetables, fruits, shrubs), going along with greater diversity in biotopes) (Fig. 1 and 2; Tables 2 and 3, left part),
- Crops; more arable crops in the wider rotations and larger surfaces with more species of vegetables and fruits, (Fig. 2; Tables 2 and 3, left part),
- Livestock; more species of animals, such as pigs, horses, sheep, chickens, bees in addition to cattle,
- Shrubs and trees; larger surfaces with more species of trees and shrubs, present in more types of spatial arrangements (forests, hedges, bushes,

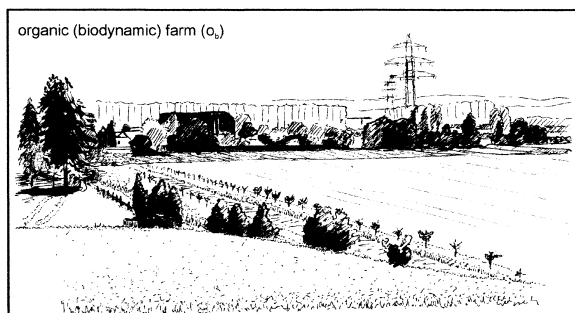
lanes, yard-plantations) (Fig. 3; Table 4, left part),

- Flora; more species of herbs in the grasslands, the (verges of the) crops, along the roads, around the compost heaps, in the orchards, the hedges etc. (Fig. 4),

- Sensorial information; more forms, colours, smells, sounds, spatial experiences,

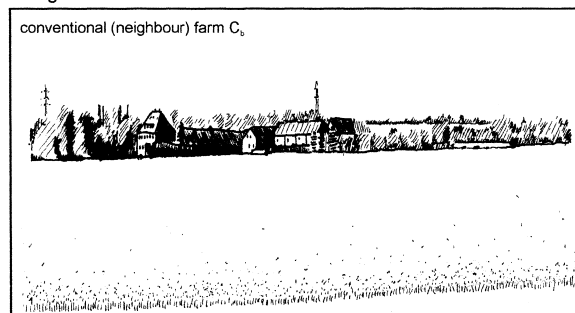
- Labour; greater diversity of labour going along with the greater diversity in land-use and because of on-farm processing (dairy, bread) and more people involved in the production (diversity of part-time and full time jobs),

- Community composition; the above mentioned diversities went along with a more diverse composition of the farm-community; more families and more singles, ranging from leading responsibilities to short-time stages; Table 2).



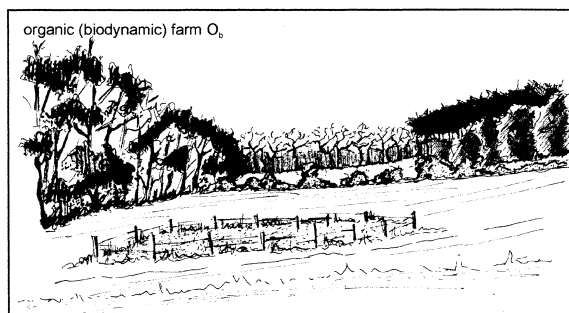
Diversity of land use types

Extensive grassland, a young orchard and horticulture in the foreground, farmbuildings surrounded by trees and shrubs in the background.



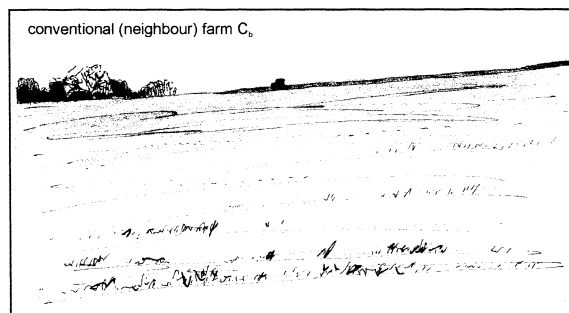
Diversity of land use types

Homogenous land use. One large arable field in the foreground and the farmbuildings in the background



Woody elements

Diversity of elements of woody vegetation: alley's, forest and hedgerows surrounding small fields.

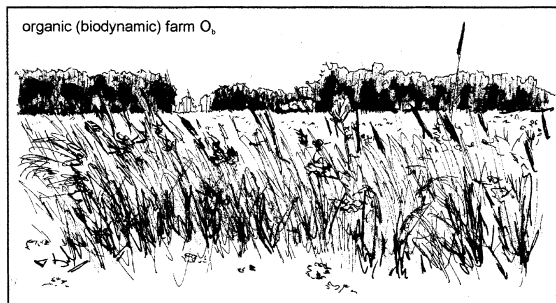


Woody elements

Large arable fields alternate plots of production forest that do not belong to the farm

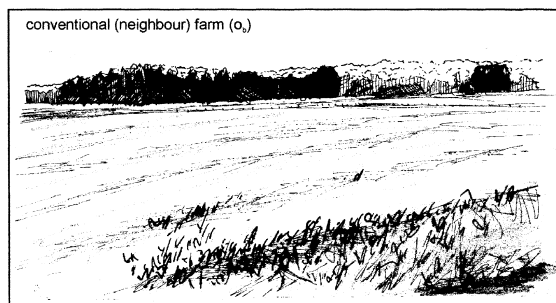
Fig. 2. Diversity of land use types: differences between a selected organic (biodynamic) farm (O_o) and its conventional neighbour (C_o), (Stroeken et al., 1993).

Fig. 3. Differences in woody elements between a selected organic (biodynamic) farm (O_o) and its conventional neighbour (C_o), (Stroeken et al., 1993).



Flora

A grassland before haying: a variety of plant species colouring from green to white, yellow, red and purple.



Flora

A homogeneous blue-green coloured grassland with few plant species.

Fig. 4. Differences in flora between a selected organic (biodynamic) farm (O_b) and its conventional neighbour (C_b), (Stroeken et al., 1993).

Coherence (Table 5) was found to be greater in organic farms between:

- Land-use and abiotic conditions; because of the self-supportive/autonomous ecosystem oriented low-external-input approach of OA, the management has to adapt to the local conditions (site specificity/site identity). Thus soil/water/climate/slope-exposure etc. appear in the ways the crops are positioned and in the ways they look (wet, dry, rich, poor, cold, warm etc.),
- Land use and farm-structure; interacting arguments of harmonic and logistic design merged in a more gradual arrangement of small-scale intensive land-use near the farm yard and buildings changing to large-scale extensive use further away (Figs. 5–7),
- Spatial structures; compliant with the clear gradient in land-use, the spatial structures showed

a clearer arrangement from smaller/enclosed to larger/open areas (Fig. 7).

Finally, Table 5 on visual qualities shows that:

- the vertical coherence (site specific crop and planting species) was not found to be relevant for the West Friesean vegetable production within the clusters: soil/moisture conditions were largely the same in the whole region;
- the horizontal coherences (functional and visual) followed the same trend as the land-use;
- colours and forms followed the same trend as well.

Thus it is stressed that the different elements, as analyzed in the previous tables, do indeed influence the landscapes as observed by consumers of the landscapes: they generally will experience visual qualities in the present arrangements (farmlands) as such (directly, authentic), even if they cannot express the diversity in the analytical way presented in the previous tables.

5. Discussion

The mentioned empirical results can only be taken as indicative, as the research was of a highly explorative pilot character. However, when the results are read in the context of the ideas and objectives underlying the organic and biodynamic approaches of agriculture, they comply quite nicely with these objectives. Thus, in context of the compliant theory, these few empirical results are at least supporting that theory. Also, they provide for good reasons to follow-up the research in a wider context and a larger scale, as planned in the EC-research mentioned above.

Now these results can also be used to look back at the criteria for landscape validation as mentioned in Table 1. In a provisional, general and retrospective way, the farming systems can be compared using the criteria 1 to 4 to see if and how they are matched. Thereby, the problem of hierarchy of landscape scales should be taken fully into account. It is important to keep in mind that the criteria for landscape validation should be carefully adapted and specified according to the scale-level of relevant landscape. Talking about the

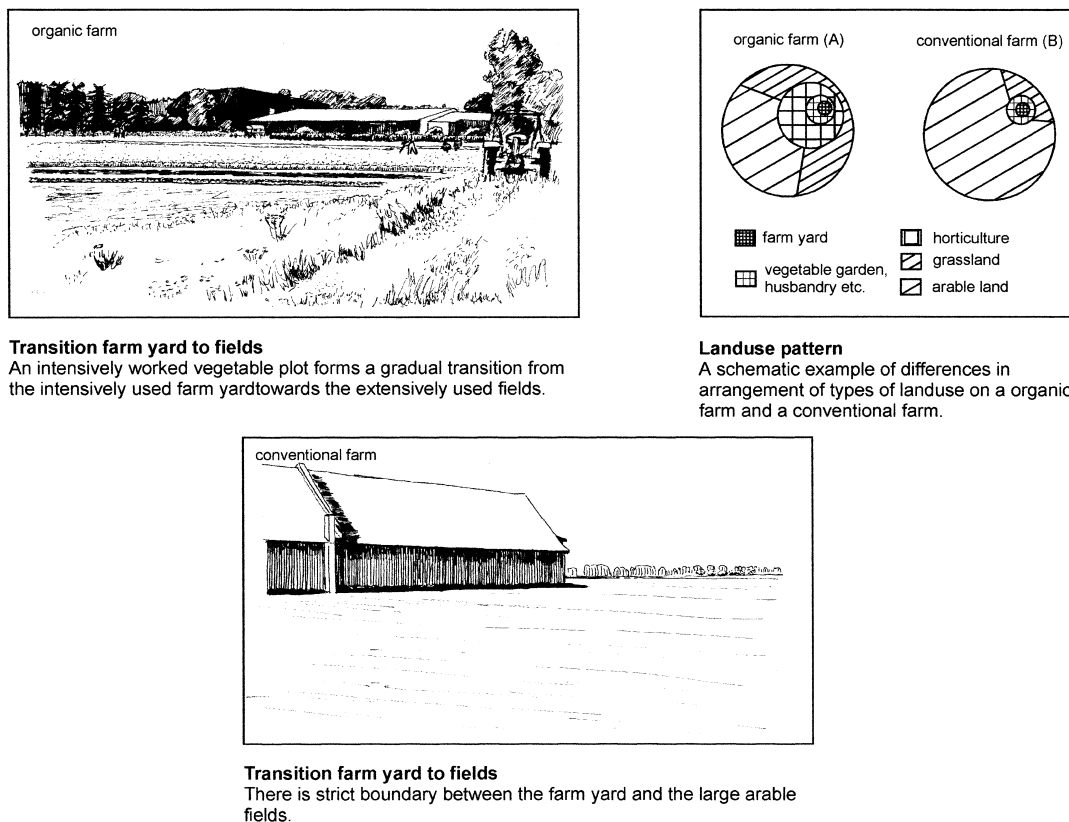
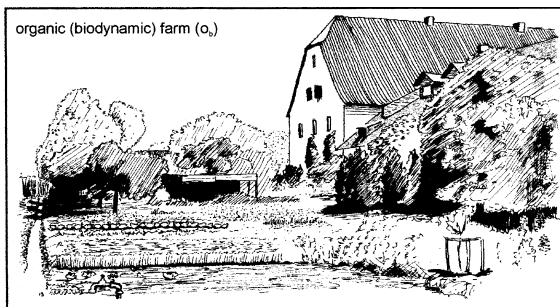


Fig. 5. Left: Differences in transition from farm yard to field between a selected organic (biodynamic) farm (O_b) and its conventional neighbour (C_b). Right: Land use pattern compared in a schematic way (Stroeken et al., 1993).

sustainability of a regional landscape gives another priority to the sustainability of a single farm or farming system than talking about the sustainability of a farm(ing system) only. Similarly, within a national context or again within an international one, the importance of regional landscapes' sustainability can differ from that on the higher levels: types and degrees of (mutual) dependence and autonomy, within such hierarchies of systems, should be clearly elaborated to use the scheme in a fruitful way. The mentioned EU Concerted Action is in the process of elaborating the (in)compatibilities of these functions, specifying their positive and negative interactions.

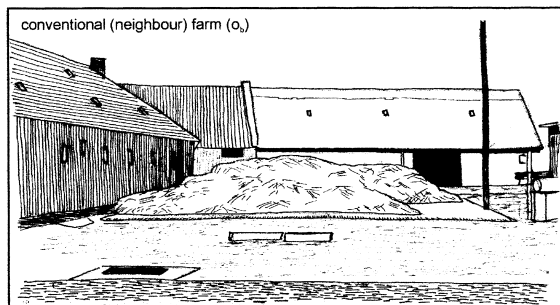
Thus, the physiological survival of the organic farm landscapes should be largely warranted by their compliance to the IFOAM or equivalent standards (all farms where "Demeter" label recognised; IFOAM,

1994). Average production figures of OA in several European countries show that, provided a moderate meat consumption, food self-sufficiency can be warranted (van Mansvelt and Mulder, 1993). Obviously on-site screening of productions and emissions, or at least an assessment of the farms mineral balance and production volumes, would be needed to prove a statement like this. However, available data from research together with the rationale of OA as such, show that there is reason to suppose that OA emissions are below those of the conventional neighbours (Braat and Vereijken, 1992; van Mansvelt and Mulder, 1993). Internal recycling is a prerequisite for feasible low-external input farming, contrary to the conventional high-external input approach. Species and biotope diversity have been mentioned as being considerably higher in OA in a number of studies (Braat and Vereijken, 1992).



Farm yard

A vegetable, a bakery, chicken and bees are gathered around the house, enclosed by old walls. There is very much variation in atmosphere (colours, smells, noises etc.) in and around the farm yard.



Farm yard

A manure heap dominates a bare area in the inner yard. There is not much variation in atmosphere.

Fig. 6. Differences in farm yard appearance (left) and field appearance (right), between a selected organic (biodynamic) farm (O_b) and its conventional neighbour (C_b), (Stroeken et al., 1993).

Social survival of the farms landscapes was only covered in the sideline of this research (discussions with farmers). The larger number of people working on the farms, the large numbers of stagiaires, visitors (farm-community relatives and friends, consumers, excursionists, experts) indicate an integration of functions and human actors. Moreover, the fact that all farms included in this research existed over two decades indicates that they found solutions for financial survival as well. The farms coherent diversity and multiple but clear structure are appreciated as aesthetic and energising by the visitors and those living on the farm. The level of production and the related economic welfare of the farms were matched in such a way that lower per hectare yields were compensated by lower costs of production and a wider range of raw and processed products and of services offered (coherent income diversification). Participative develop-

ment, referring to the participation of all users in the planning and implementation of the landscape development, was not yet included as an issue in this research (MacFadden and Groh, 1990; Bosshard, 1997).

The issues mentioned under ethical survival of the farms landscapes are largely covered by the results mentioned above. Because of the greater diversity in so many respects the farms become more unique as ecosystems, socio-economically and as (part of the) landscape: each level with its farm-specific development, merging in the farms unique histories and appearances. This contrasts with a tendency toward specialised uniformity in the conventional neighbours. So although in principle each farm has its physiognomy, its mimic and its gesture, aspects that can be studied to come to grips with the unique essence of the farm (its *genius loci* or individuality), it is precisely that study that can show the qualitative differences between the individual farms and between the systems of farming (Bockemühl, 1986).

Because of the relatively small scales of farming anyhow, the issues mentioned under the earth's survival, insofar as they exceed the issues mentioned under physical survival, could not be covered by this farm-oriented research. Here the need for a larger scaled research, to be extended over larger groups of farms and over several years, becomes evident as a prerequisite to confirm or adapt the indications found in the pilot.

An interesting quality aspect of the visual landscape, especially in the moderate climates, is that of the changing colours. Stobbelaar (1992) compared three sites in an agricultural landscape (polder behind the Dutch dunes) with three sites in the natural dune reserve. He found that the variety of colours and forms and the variety in their changes over the seasons, is larger in that natural landscape than in the agricultural polder type of landscape. The seasonal changes were found to proceed more continuous in the dunes than they did in the cultivated landscape: there they disappeared almost completely over winter whereas they continued to proceed in the natural (dune) landscape. The directions of autumns colouring goes from the canopy down to the ground in the dunes, whereas in the polder the colouring goes from the bottom upward. Here the link of the ongoing development of colouring patterns in the natural reserve can, at least provision-

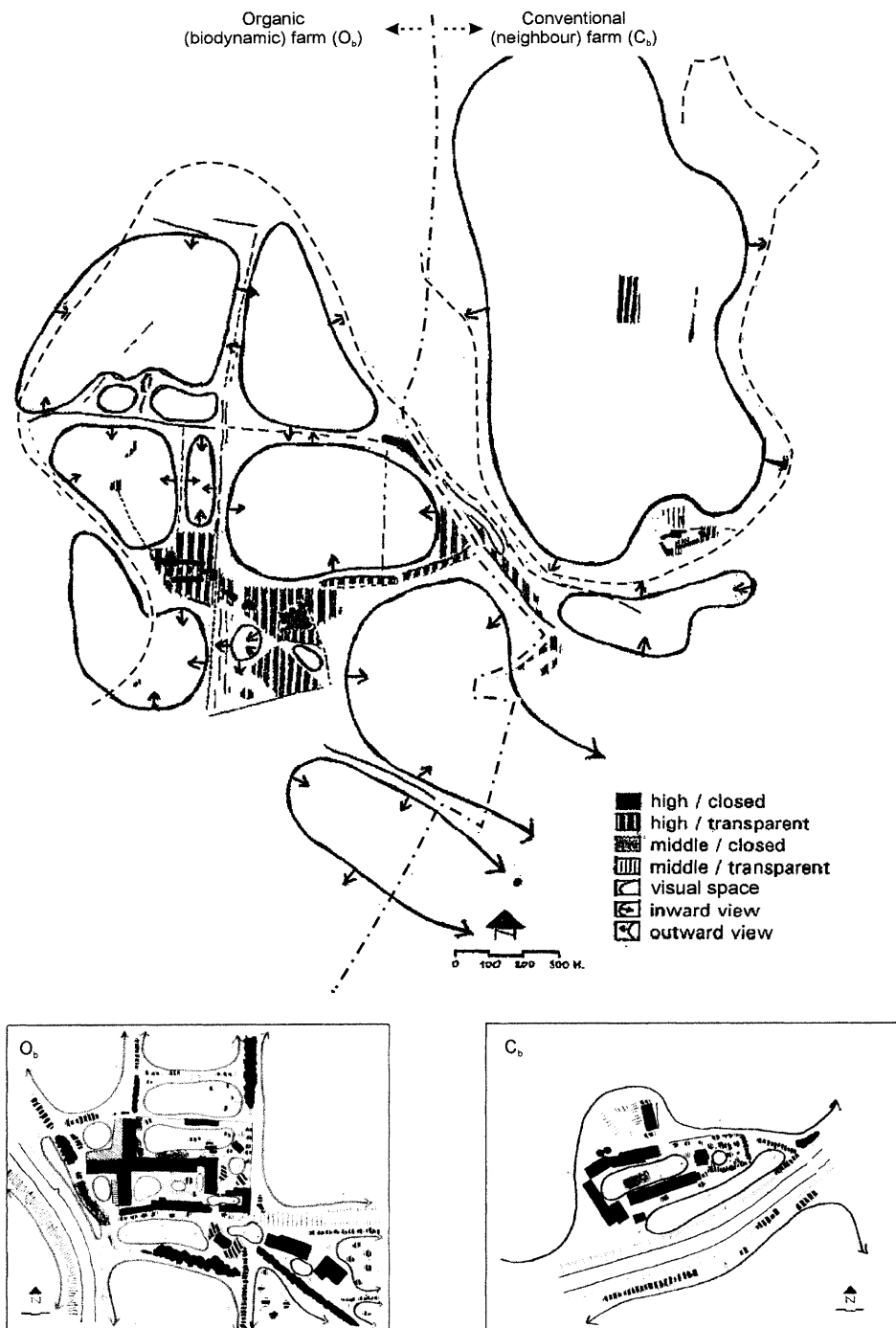


Fig. 7. Differences in spatial structure (farms above, farm's yards below) between a selected organic(biodynamic) farm (O_b) and its conventional neighbour (C_b), (see in text; Stroeken et al., 1993).

ally, be taken as indication for an year-round ongoing succession of living processes in the mentioned sub-ecosystems within the natural landscape. In the agro-landscape research mentioned in Section 3.2 this qualitative-parameter will be included to see in how much the OA in this aspect is also positioned as a plural production strategy between nature conservation and conventional agriculture. Especially for the assessment of recreational and aesthetic values, the changes of colourful patterns could be interesting parameters, as their qualities refer rather directly to the human affections (Coeterier, 1987; Bortoft, 1986; Miller, 1988).

In addition to what has been said on the striking tendency of increased biodiversity of species and habitats in organic farms, it should be stressed that in the Dutch vegetable farming on West Friesean clay, the farmland surface dedicated to natural elements and the number of planting types differed less strikingly than the types of land-use, planting types and elements on the yard. This may be interpreted as an indication that, for the organic vegetable growers of the sample, landscape as such was less of an intrinsic issue of their farm management than crop rotation and land-use. This complies with the fact that the standards for OA (IFOAM, 1994) do not (yet) demand nature and landscape production but limit themselves to requirements for crop production and husbandry, as yet primarily warranting environmental sustainability. Thus our preliminary results may be seen as indicating that the letter of the rule is complied to by all organic farmers, whereas the ideal of OA (the spirit of the rule as laid down in the introduction to the standards) is only complied to by some of them, on an optional base. Similarly, some conventional farmers do, on an optional basis, give much more attention to nature and landscape than their colleagues do. The latter live up to the Dutch rules on environmental care for agriculture, whereas the former seem to live up to the spirit of the regional landscape's history and development tradition.

The presence of more diversity in stronger coherences, as found for specific organic (biodynamic) mixed farms in three countries and on a lower level, for three organic vegetable farms in West Friesland, indicate that OA has a considerable potential to contribute to the landscape as compared with conventional agriculture.

The range in diversities and coherences within the organic and the conventional vegetable farms shows that, not denying the previous statement, the letter of the (organic) rule alone does not (yet) warrant a rich and coherent diversity. Similarly, the conventional approach leaves room for some coherent diversity if farmers are willing to organise their farm accordingly.

In this study, the nature and landscape production of OA were discussed from a theoretical point of view, referring to the empirical data available. However, as the evidence was based on stratified samples, it can only be seen as indicative. Together with their compliance to the theory of OA and the attitude of its practitioners, there seems to be good reasons to suppose that OA has a considerable potential to merge the new, multifunctional objectives of agriculture. But only after thorough research in several countries and countryside has proven to support this hypothesis can authority fully accept OA to be a spearhead/example for tomorrow's agriculture. Recent results from a study in a Dutch clay area seem to support this presumption.

Finally we want to stress that for ecologically consistent management and design of landscapes, the farm level is both crucial and at the same time only partially relevant. This because of the average farm size compared to that of landscapes, at least in Europe. To come away from a disjointed, patchwork type of incoherent landscape, based on completely individualised management approaches and land-ownership, social mechanisms to enhance inter-farm co-operation in landscaping, up to communal watershed management, must be developed. Here it could be stressed that OA as a way of cultivating nature, is not limited to any fixed number of hectares. In a well organised co-operative of a dozen or more neighbouring (organic) farmers of average farms' size, a common landscape management could be designed and implemented. Thereby a variety of options could be discussed, ranging from the minimally needed co-operation between highly autonomous one-family farmers, and a full co-operation between self-reliant, task-dividing individuals in a communal estate type of farm. Moreover, over the whole range of mentioned degrees of farmers' co-operation, appropriate forms of interactions with the local or regional community could be developed. Thereby again a range of interactions can be envisaged, from public debate to appro-

priate versions of community supported agriculture and farmers' supported communities (MacFadden and Groh, 1990). In all cases, the elaboration of guiding visions on the agro-communal landscape, its functionality and its aesthetics, is crucial for the future, sustainable development of land-use.

Obviously, to answer questions on representation and general validity of the findings made in this pilot study, a large-scale study, covering several years would be needed.

6. Conclusions

(1) Regarding the actual problems in redirecting agriculture toward a sustainable course, in the context of landscape management and land-use planning, considering a set of concepts and their intrinsic paradoxes, it is presumed that, in theory, organic types of agriculture should have a good potential for positive contributions to a sustainable agro-landscape management.

(2) To underpin this presumption, a survey of literature on empirical data is presented. These data show that under organic (including biodynamic) management the diversity of fauna and flora tends to increase considerably.

(3) These diversities seem to go together with increased diversities of land use in general (for example crop-rotation, livestock, woody elements), labour diversity and spatial structures.

(4) It was seen as important to find that the increased diversities mentioned, showed considerable coherence within the farming systems as a whole (local soil/climate conditions included), thus avoiding chaotic fragmentation from over-diversification.

(5) First results of a recently started farming systems comparative research showed tendencies which are quite in line with the mentioned findings. The results of those cluster comparisons (conventional versus organic) revealed the importance of the farmers' own attitude toward landscape production as a key factor in the realisation of the potential of organic agriculture.

(6) The concept of organic agriculture as such includes all instruments to produce quality landscapes together with the food and fibre. Depending on the farmers' attitude and motivation those options are more or less successfully implemented.

(7) Financial and social appreciation of the rural landscape production, together with the increase of available expertise, may enhance the full realisation of the potential mentioned.

Acknowledgements

The landscape research is largely funded by the EC-AIR3 project "Regional Guidelines to support sustainable landuse in EU agri-environmental programmes". The concerted action is funded by the EC-AIR3-project "The landscape and nature production capacity of organic/sustainable types of agriculture". The authors are grateful for the supportive interest of farmers of the farms studied, and of that of the keen interest of experts participating in the concerted action.

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