"The quality of rural life – Investigating the relationship between farming styles and biodiversity in Austrian agricultural landscapes"

I. Schmitzberger, T. Wrbka, J. Peterseil, B. Steurer, G. Aschenbrenner and H. Zechmeister*

Abstract

Austria is characterised by a great variety of different landscapes. Not only wilderness areas, but also traditionally maintained agricultural landscapes are a major contribution to Austria's high biodiversity. Seen from a wider perspective, some agricultural landscapes in Austria are showing even higher levels of eco-diversity than natural or semi-natural areas. The full range of human activities has created a distinctive and rich landscape character which is maintained by a system of adaptive management. Farming is the main activity in rural areas, especially in mountainous parts of Austria, although it is largely dependent on agro-environmental subsidies. The presented article investigates the relationship between biodiversity and farming activities in representative Austrian agricultural landscapes. The concept of farming styles is used to show the very different ecological performance of Austrian farmers. As a main result it has been found that there is a close link between mentality of farmers, land use intensity and biodiversity. The farming styles also differ in their dependency on subsidies. We come to the conclusion that agro-environmental subsidies, which are the main factor to guarantee sustainable farming in less favoured areas in Austria, would have a much better effect, if they were tailor suited to the individual needs of different regions and predominant farming styles.

Introduction

Situated in the heart of central Europe, Austria comprises a high variety of natural, semi-natural and agricultural landscapes (Wrbka 1992, Wrbka et al. 2002b). A climatic gradient from the west to the east and the large extent of mountainous areas with a pronounced inner differentiation and vertical zonation are responsible for the comparably high biodiversity in our country. Moreover, the long history of human interference and different cultural influences have also contributed to a high eco-diversity.

Among the economic activities that have shaped the rural areas in Austria, farming has been and still is the most important one. Therefore we find a large variety of different agricultural landscape types. Some of them are still showing the patterns of traditional land use and are among Austria's biodiversity hot-spots (Ellmauer 1995). High nature value of habitats and landscapes is not only found in wilderness regions, but also in some agricultural regions. These traditionally maintained agricultural landscapes are either found under less suitable bio-physical conditions for agriculture – as this is the case for mountainous areas - or in regions that have been marginalised due to political and economic processes. Almost one fifth of the Austrian territory is occupied by agriculture landscapes, that can be regarded as national biodiversity hot-spot regions (Wrbka et al. 2004 in print). Consequently, the maintenance of

* I. Schmitzberger, T. Wrbka, J. Peterseil, H. Zechmeister - Institute of Ecology and Conservation Biology, University of Vienna, Department of Conservation Biology, Vegetation Ecology and Landscape Ecology, Althanstraße 14, 1090 Vienna, Austria, Phone +43-1-4277-54371, Fax +43-1-4277-9542, http://www.univie.ac.at/IECB. B. Steurer, G. Aschenbrenner - Austrian Council for Agricultural Engineering and Rural Development (ÖKL), Gußhausstraße 6, 1040 Vienna, Austria, Phone: + 43 1 5051891, Fax: + 43 1 5051891-16. e-mail of corresponding author: ingrid@pflaphy.pph.univie.ac.at

high biodiversity values in Austrian landscapes cannot only rely on the preservation of natural and semi-natural areas, but has also to include large regions with agricultural activities. An efficient strategy for nature conservation, with the aim to maintain the high biodiversity values in agricultural landscapes, has to be embedded in a sustainable regional development.

Eco-diversity (Naveh 1994, 2000) can be seen as an amplification of the biodiversity concept: It includes also the diversity, which is added to the landscapes by human activities and the economical, cultural and spiritual values that are assigned to it. In that sense, traditional management techniques, that often differ regionally, such as hedgelaying in mountain hedgerow landscapes, contribute to eco-diversity. For landscape and regional planning, but also for successful nature conservation this implies that farmers who are practising such traditional management techniques are the most important target group for maintaining this high cultural and natural values.

Agro-environmental subsidies are an important political measure to sustain eco-diversity (Marggraf, 2003). But the question is whether they are targeted enough to direct economic activities into a desirable direction.

Farming and biodiversity – the research project "RURAL LIFE"

Farmers are not a homogeneous part of the population but on the contrary a highly diverse group of individuals (Falconer 2000). Farmers decision are influenced by many factors, such as external pressures or vocation, hardly ever aiming at the unique goal of profit (Willock et al. 1999). Farmers are not passively determined by technology and market, the observed heterogeneity in farming is proof of that. But technology and market constitute the space in which farmers take individual rather than uniform decisions (van der Ploeg, 1993) with highly diverse consequences. The implementation of the targets of a national agro-environmental programme into regional and local activities, given the voluntary participation, may encounter difficulties.

The need for sustainability is agreed on by farmers but also citizens and politicians all over Europe (e.g. European Comission 2001, BMLUW 2002, DEFRA 2003). But how is sustainability defined on the farm level and on the regional scale, especially when we take into account the maintenance of high biodiversity values? To fill this knowledge gap at the local level, the here presented research project "RURAL LIFE"[1] aimed at the investigation of the relationship between farmers activities and biodiversity. Our goals were to illustrate the influence of individual farmers on local biodiversity, to investigate which farming style has the best performance in producing public goods, like biodiversity, and finally we reflect on future agricultural policies.

Methods

The "RURAL-LIFE" approach was to combine a socio-economic survey of farms and a biodiversity assessment of the related farms, including singular land parcels and the adjacent landscape in which the farm was embedded.

The survey was performed in eight study areas (each between 1 and 3 km²) distributed over Austria in order to reproduce the variety of different landscape types in Austria (Fig. 1). Each study area represents predominantly one cultural landscape type (Wrbka et al., 1997, 2002b).

[1] The project "RURAL LIFE – diversity and quality of life in rural Austria in the 21st century" was conducted between 2000 and 2002 by an interdisciplinary project team of agro-economists and ecologists from different research institutions.

Socio-economic farm survey

Within each study area, one to three farms where selected with the help of the responsible district farmers chamber, resulting in a total of 23 farms. All farms in our study were within the typical variation of their region in regard to farm size, livestock and crop types, and the typical economic values for the farming branch (Statistik Austria, 2001).

The farmers were interviewed intensively on their economical, but also personal situation using a structured interview technique based on a questionnaire. The interview was organised in several subsections, including questions on (1) the economic situation, (2) management actions on each individual field parcel in a very detailed way, (3) opinions and attitudes, and (4) perception of landscape and nature. All interviewees approved with the use the data they provided to the official database of agro-environmental subsidies.

The information gathered by the farmer interviews allowed to calculate economic characteristics, such as the profit margin, both on farm level as well as for each individual field. Profit margin per area unit (ha) and profit margin per working hour (profit margin/wh) were used. Land use intensity data are available for fertilising as Nitrogen input (kg N/ha) and for mowing intensity as number of cuttings per year (1, 2, 3 ,>3). Intensity of silage use was assessed in eight classes defined by the proportions of harvests used as silage.

Biodiversity assessment

For the whole landscape of each study area detailed land use and hemerobic state of all landscape elements were mapped. At the farm level a total survey of valuable habitats including an assessment of biotope quality was performed to determine the overall ecological performance of the investigated farms. At the landscape element level vegetation was recorded in a random sample of individual parcels of each farm and adjacent biotope structures. These samples include species lists of vascular plants with abundance values using the Braun-Blanquet (1964) method. Bryophyte species lists were recorded in ten 1m² quadrats per field.

The human impact on nature can be addressed by single parameters (for example nitrogen input, e.g. Bobbink et al. 1998; Vitousek et al. 1997), but data are often not available (e.g for semi-natural habitats). which is

Hemeroby as the “degree of human impact” is a qualitative measure of the naturalness of vegetation and an integrated measure for the anthropogenic influence on landscapes or habitats. It takes into account rather the reaction of vegetation to human impact over time than the human impact per se. Hemeroby is assessed in seven classes in the field by the trained ecologist. The concept was introduced by Jalas (1955) and further developed by several authors (e.g. Blume and Sukopp 1976; Kowarik 1988; Sukopp 1969, 1976). An overview is given in Steinhardt et al. (1999) and Zechmeister & Moser (2001).

Finally, species richness of bryophytes and vascular plants, as well as the hemerobiotic state on landscape element and on farm level were used to assess the biodiversity status. These biodiversity factors could be related to the economic and land use intensity data from the farm survey.

Statistical analyses include non parametric Spearman Rank Correlation of economic and land use parameters against biodiversity factors on the landscape element level. To test for differences in biodiversity features between groups e.g. of farming styles, variance analysis (One-Way-ANOVA) was used where appropriate, followed by a Games-Howell post hoc test. In other cases, non parametric Mann Whitney U-test was used. The results are presented as box and whisker plots

Farming styles

The observation that under similar production conditions and in comparable locations farms are managed quite differently lead to the introduction of a typology of farmers, the so called "farming styles". The classification was based on the economic, social and attitudinal data from the socio-economic survey and included previous data (Holzner et al. 1995, 2001), and experience brought in by the socio-economists. A total of about 84 farm interviews built the basis on which finally eight farming styles could be identified. The main objective underlying this typology is to stress the broad spectrum of motives, attitudes and goals in farmers and how these are linked to different economic performances. The classification thus followed both personal and economic criteria.

Economic criteria included: Input of labour time and production means, machinery, farm development (in the past as well as future perspectives), economic situation, dependence from subsidies. Personal criteria included: Attitude towards agriculture, attitude towards nature conservation, landscape perception.

Results and Discussion

Farming styles

farming style classification resulted in the definition and description of eight farming styles, four major types: the traditionalist (D), the yield optimiser (A) the support optimiser (B), the innovative farmer (C); Four farming styles with minor importance are: the idealist (E), the part-time farmer (F), the forced farmer (G), the social farm (H)

The "traditionalist" is mainly found in mountain or marginalised areas. Such farmers identify highly with traditional rural culture and prefer "long proofed" management to increased yields. They refuse new developments and changes and show low flexibility. Traditionalist are often old farmers, many retired, others part time farmers. The economic situation is comparatively weak, with a proportion of support above average. In many cases traditionalist farmers have no successors or, if they have, the successors will change their lifestyle entirely or will give up farming at all. Their landscape and nature perception is characterised by the quote: "Landscape is there for working and living." Traditionalist farmers keep cultivating labour intensive and little productive areas due to tradition. Nature conservation is basically seen negative, although they often practice conservation work incidentally - purely due to the traditional farming methods. Consequently they have to be seen as forced partners for nature conservation. Very often they do not receive specifically targeted subsidies for conservation work or extensive land use, because they simply do not know or are not interested in it. Their attitude towards agriculture is best illustrated by the quote: "I hope that agriculture will turn away again from industrial production."

The "yield optimiser" is mainly oriented towards achieving maximal yield. Management of the farm and also of individual parcels is carried out as efficient as possible. A strong tendency towards farm enlargement, optimisation of working stock and the use of very modern machinery are predominant features. They produce for global markets and are not interested in marketing their products directly locally and regionally. They are showing a strong tendency to give up labour intensive or less productive areas. The economic situation of yield optimisers is strong, the proportion of support below average and the profit margin above average. "Farming is a profession and not a vocation" expresses the attitude towards agriculture. Landscape is seen primarily as "a place of production" and thus reduced to economic parameters. Nature conservation is seen as interference or "expropriation" and therefore not appreciated.

"Support optimisers" are aiming at receiving as much financial support as possible with minimal expenditure. Farm management is aligned to specifications of support programmes, e.g. set aside or destocking. Yields from agricultural production are of secondary interest. The farm size among support optimisers is above average, but with extensive management, and there is a tendency to give up labour intensive areas. In many cases farmers do not have a successor. The perception of landscape and nature is quite simple in a way that farming is necessary to keep the landscape open and tidy. The attitude towards nature conservation is basically positive as long as incentives are high enough to be interesting. The economic situation of support optimisers includes a high dependency of subsidies and in return the profit margin is below average. Food production becomes increasingly less important for support optimisers, and their attitude towards agriculture is characterised by the following quote: "Set aside is the only way of farming in our region!"

Mainly younger farmers are belonging to the "innovative farmer"-group. Not surprisingly, their general attitude is optimistic, open minded towards new ideas and developments and highly flexible. They are willing to co-operate with other farmers, but also with consumers and conservation authorities. They explore market niches and produce for regional and local markets. They value high quality of their products and dedicate their work strongly to consumer demands, which often leads to high labour expenditure and personal engagement. Often several branches of income are combined. Innovative concepts including organic farming or seminars on farm, holiday on farm etc. are widespread among this group. The attitude towards landscape and nature conservation is heterogeneous but basically positive as nature conservation may be seen as a chance on a diversified market. Sometimes nature conservation is part of the individual marketing concept. In some cases charismatic species are specifically used as a brand to demonstrate the co-operation between agriculture and nature conservation. Economically, innovative farmers are less dependent of support and have a profit margin above average. Farming is not only a profession but a vocation. This attitude towards agriculture can be characterised by the quote: "Consumers want to see beautiful landscapes and happy cattle. It is more and more important for farmers to meet these wishes!"

Apart from these four major types also four minor farming styles have been found.". Lack of time is a characteristic feature of the "part-time farmer. This generates the necessity for good up-to-date machinery and effective management, which includes the abandonment of labour intensive areas and the necessity to intensify productive fields. Landscape and nature perception tends to not influence the farm management. The loss of landscape elements and biodiversity is regretted but accepted, as agriculture is seen as a self-chosen source for additional income.

The "forced farmer" regards agriculture as a burden but necessary to earn a living out of a lack of other perspectives. He stays on the farm involuntarily and has a weak economic performance, as the proportion of support is above and the profit margin is below average. He gives up labour intensive areas and has no interest in becoming a partner in conservation programmes.

The "idealist", in contrast, spends a lot of time and efforts in cultivating little productive and labour intensive areas. Agriculture is a leisure activity and regarded as a self-fulfilling lifestyle. The size of farms is below average, but the proportion of support is high above average, income and profit margin are far below average.

Finally, the "social farm" is a rural phenomenon illustrating a change in social structure and family relations. Agriculture is seen as a as possibility to combine income and family, mostly by women with partners not interested in agriculture, or by one divorced partner that is staying on the farm. But there is no time for labour intensive production or conservation work, so that set aside of labour intensive areas and a high proportion of support combined with low profit margin are characteristic features of this farming style.

The farming styles differ in their position in a space created by a gradient of dynamics, and an economic axis displaying the composition of their income (dependency from subsidies versus self reliance) (Fig. 2). The farming styles occupy different areas in this space, their position indicating the farmers potential of behavioural change. The position along the dynamic axis indicates the likelihood of a shift. A traditionalist, for example, will hardly become an innovative farmer, whereas a shift between a yield optimiser and an innovative is more likely.

Potter & Lobley (1992) also stress the importance of elderly farmers for conservation and found them to be willing to enrol in environmental schemes as long as changes can be accommodated with existing management.

In many fields of social life, lifestyle typologies are used successfully, such as the Euro Socio Styles (Cathelat, 1993) that are used to focus marketing efforts. Life style concepts use attitudes, social status and manifest behaviour (Georg, 1998), all of which are part of our farming styles. Many authors - implicitly or explicitly – use typologies of farmers, but often defined only by economic criteria, such as farm size and type of production (Kristensen, 2003). An emphasis on economic constraints underlies the distinction in "survivor farms" and "accumulators" (Mardsen et al., 1986), two groups that resemble our "traditionalist" and "yield optimiser". Also in colloquial language knowledge about such differences is present e.g. "machine farmer". Salomon's (1985) "commercially orientated" and "farming-as-a-way-of-life" types indirectly imply attitude. The term "farming styles" was coined by van der Ploeg (1993) as a "unity of thinking and doing", stressing the necessity of a holistic view on farmers as actors in rural landscapes.

Biodiversity and farming practice

Despite a high variation in the data resulting from the spreading of our investigations over eight quite different regions a negative correlation between parameters of land use intensity and biodiversity features could be shown (Table 1 and 2). For meadows this is discussed extensively in Zechmeister et al. (2003). Also on arable fields a negative correlation between vascular plant species richness and land use intensity in terms of fertiliser input was found (Table 2), although species richness in arable fields is influenced by many factors not directly correlated to land use intensity: Crops differ in their vegetation cover during the growth season and consequently e.g. in light conditions for segetal plant species. Only Bryophyte species number in arable fields seems to be influenced more by factors other than fertilising intensity. These results agree with numerous previous investigations confirming the detrimental effect of high land use intensity on biodiversity (Soule, 1986; Schuhmacher, 1997; Bunce et al., 1999; Zechmeister and Moser, 2001; Moser et al., 2002, Smart et al. 2003). Many of the correlations and differences presented we also found in the individual test areas.

It has sometimes been argued, that farmers have to be economically strong to be able to "afford" the maintenance of biodiversity on their land. But in focussing our analysis to that question we found the opposite relationship: A negative correlation was found between profit gained from a parcel as a measure for economic performance and biodiversity features such as hemerobic value, vascular plant species richness, and in grasslands also bryophyte species richness (Table 1 and 2).

This means, that farmers with a very good economic performance have less biodiversity and nature value regardless which farming style they are belonging to. In our interpretation this finding is an indication, that caretaking for biodiversity on farms is not limited by financial resources but more a matter of awareness and mentality of farmers.

Ecological performance of farming styles

After validating the general trends of land use intensity and economic performance on biodiverstiy and stating major differences in attitudes and farming practices between farmers, it seem very interesting to look for the possible consequences for nature values in their sphere of influence. We investigated whether there are differences in selected biodiversity features between the different farming styles. 21 farms of 3 major farming styles could be used for this assessment. Fig. 3 shows the difference in vascular plant species richness between the main three farming styles. Data sets here are all sampled landscape elements, regardless of their land use type. This leads to a very high variance, nevertheless the differences between yield optimisers and traditionalists resp. innovatives is highly significant. Bryophyte species richness shows the same trend (ANOVA $F = 9.611$ $p < 0.001$), as well as hemerobic value, where traditionalists' land is being less strongly transformed than that of yield optimisers (Mann Whitney U-test $p < 0,05$). In subsamples of various land use types, the same trend can be observed. Fig. 4 illustrates how field margins on the land of traditionalists show higher vascular plant species richness. Bryophyte richness on small biotops such as woodlots, hedges and grass strips is lowest for yield optimisers and highest for traditionalists (Fig.5). We can sum up that farmers who rationalise all their activities according to economic efficiency to maximise the yield of agricultural production, have the lowest level of biodiversity. On the other hand traditionalists and innovatives have significantly more species on their farms. Whereas traditionalist farmers are caring for nature because they are doing their work in the old way, it is very promising that also young open-minded farmers are making their living in concordance with nature. Our findings support the notion that farming styles have consequences eg. in term of pressures they exert on the environment and are highly relevant in assessing all sorts of problems in rural areas (van der Ploeg 1993). We are drawing the conclusion, that the agro-environmental support system should specifically support the innovative farmers by helping them to make wise use of biodiversity, not only with respect to land management but also in regard to marketing possibilities.

Farming styles, biodiversity and subsidies

The traditionalists are showing the highest percentage of farm income made up by agro-environmental subsidies. Innovative farmers are achieving up to 25 percent of their income from agro-environmental programmes, whereas yield optimisers are depending only to about 10 percent on that source of income (Fig.6). This demonstrates the high importance of agro-environmental measures for farmers' income.

But these public supports do not positively influence biodiversity. No statistical correlation between the amount of agro-environmental subsidies per hectare and any of our investigated biodiversity features, both on farm level and on field level could be detected.

Most of the agro-environmental measures are rather promoting a more environmentally friendly way of agriculture, like reduction of fertilisers and pesticides, than strictly nature conservation targets. Only very small proportion of the agro-environmental funds are directly targeting ecologically valuable objects (3%, or 10 % in a wider sense in 2002; BMLFUW, 2003), like extensively used areas such as dry grasslands or wet meadows. Although in our study only a marginal number of fields were funded under the header of "ecologically valuable area" in grasslands, those meadows showed significantly higher species richness than the rest. (Fig. 7).

Many studies try to enlighten the question why farmers are not sufficiently participating in agro-environmental schemes (e.g. Battershill & Gilg, 1997, Beedell & Rehman 1999, Falconer 2000, de Buck et al. 2001,Willock et al. 2001). Considering the adoption of more environmentally friendly farming practices as just another technology is inadequate (Vanclay & Lawrence, 1994). In this context, it is vital to acknowledge the role of farmers as actors with individual decisions, that are not solely lead by

economic considerations (van der Ploeg 1985, Ward & Lowe 1994, Battershill & Gilg 1997). Battershill & Gilg (1997) found attitudes to be more important than external factors such as economic constraints.

It is sometimes argued that biodiversity is supported as a by-product of environmentally friendly farming, an idea that is clearly rejected by our findings. In contrast, they suggest that the maintenance of high biodiversity values in agricultural landscapes cannot be safeguarded with the current programme. Much more targeted measures have to be developed, which includes different lines that better reach the different farming styles.

Conclusions

- Traditional farming has maintained a high eco-diversity in Austrian agriculture landscapes and is therefore still delivering a wide range of public goods.
- Farmers are important stakeholders for sustaining biodiversity in cultural landscapes but have to be seen as a heterogeneous group.
- Distinct farming styles can be identified and classified with respect to attributes describing the mentality, attitude towards agriculture and nature, and the economic situation.
- Farming styles correlate strongly with biodiversity values at the farm level. Economy-oriented farmers have a comparatively bad ecological performance, at least regarding the maintenance of biodiversity.
- Agro-environmental support is a constituent part of farmers income in Austria and has so far stabilized the loss of nature value on the average, but it has failed to do so in regions having very high and high nature value.
- Farming styles could therefore be used to improve the effectiveness of agro-environmental support measures by creating tailor-suited support packages for the different regions and landscape types.

References

Battershill, M.R. J. & A.W. Gilg, 1997. Socio-economic constraints and environmentally friendly farming in the southwest of England. Journal of Rural Studies 13 (2), 213-228.

Beedell. J. D. C. & T. Rehman, 1999. Explaining farmers' conservation behaviour: Why do farmers behave the way they do? Journal of Environmental Management 57, 165-176.

Blume, H.-P., Sukopp, H., 1976. Ökologische Bedeutung anthropogener Bodenveränderungen. Schriftenreihe für Vegetationskunde 10, 75-89.

BMLFUW (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft), 2002. Österreichs Zukunft nachhaltig gestalten. Die österreichische Strategie zur Nachhaltigen Entwicklung. Wien.

BMLFUW (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft), 2003. 44. Grüner Bericht. Bericht über die Lage der österreichischen Landwirtschaft 2002. Wien.

Bobbink, R., Hornung, M., Roelofs, J.G.M., 1998. The effects of air-born nitrogen pollutants on species diversity in natural and semi-natural European vegetation. Journal of Ecology 86, 717-738.

Braun-Blanquet, J., 1964. Pflanzensoziologie. Grundzüge der Vegetationskunde. 3.Auflage. Springer-Verlag, Wien.

Bunce, R.G.H., Smart, S.M., van de Poll, H.M., Watkins, J.W., Scott, W.A., 1999. Measuring change in British vegetation. ECOFACT Vol. 2. ITE Merlewood.

Cathelat, B., 1993. Socio-Styles: The new Lifestyles Classification System for Identifiying and Targeting Consumers and Markets. Kogan Page, London.

de Buck, A.J., van Rijn, I., Röling, N.G. & G.A.A. Wossink, 2001, Farmers' reasons for changing or not changing to more sustainable practices: an exploratory study of arable farming in the Netherlands. The journal of agricultural education and extension 7 (3),153-166 (http://library.wur.nl/ejae/v7n3t.html)

DEFRA (Department for Environment, Food & Rural Affairs, UK), 2003, Achieving a better quality of life. Review of progress towards sustainable development. Government annual report 2002

Ellmauer, T. 1995, Biodiversity hot-spots in Österreich - eine erste Annäherung. Zeitschr. f. Ökologie u. Naturschutz 3, 271-279.

European Comission, 2001, Strategy for sustainable development. http://europa.eu.int/scadplus/leg/en/lvb/l28117.htm

Falconer, K. 2000, Farm-level constraints on agri-environmental scheme participation: a transactional perspective. Journal of Rural Studies 16, 379-394.

Georg, W., 1998. Soziale Lage und Lebensstil. Leske & Budrich, Opladen.

Holzner, W. et al., 2001 , Nachhaltige Nutzung traditioneller Kulturlandschaften: Berglandökosysteme. Endbericht. Forschungsprogramm Kulturlandschaft, Bundesministerium für Bildung, Wissenschaft und Kultur, Wien.

Holzner, W. Wagl, B. Aschenbrenner, G., 1995, Wienerwaldwiesen - Eine Studie zur Problematik der Erhaltung von Wiesen und Weiden im Bereich des Wienerwaldes, Verein Wien - Niederösterreich gemeinsame Erholungsräume.

Jalas, J., 1955. Hemerobe und hemerochore Pflanzenarten. Ein terminologischer Reformversuch. Acta Fauna Flora Fennica 72(11), 1-15.

Kowarik, I. 1988. Zum menschlichen Einfluss auf Flora und Vegetation. Landschaftsentwicklung und Umweltforschung 56, 1-280.

Kristensen, S.P., 2003. Multivariate analysis of landscape changes and farm characteristics in a study area in central Jutland, Denmark. Ecological Modelling 168: 303-318.

Mardsen, T., Whatmore, S., Munton, R. & J. Little. 1986. The restructuring process and economic centrality in capitalist agriculture. Journal of Rural Studies 2, 271-280.

Marggraf, R., 2003. Comparative Assessment of agri-environment programmes in federal states of Germany. Agriculture, Ecosystems & Environment 98, 507-516.

Moser, D., Zechmeister, H.G., Plutzar, C., Sauberer, N., Wrbka, T., Grabherr, G., 2002. Landscape shape complexity as an effective measure for plant species richness in rural landscapes. Landscape Ecology 17 (7), 657-669.

Naveh, Z., 1994, Biodiversity and Landscape Management; in: KIM K. C. & WEAVER R. D. (Ed.), 1994, Biodiversity and Landscapes – A Paradox of Humanity, Cambridge University Press, S. 187 – 209;

Naveh, Z., 2000, The Total Human Ecosystem: Integrating Ecology and Economics. BioScience 50(4),357-361.

Potter, C. & M. Lobley, 1992. The conservation status and potential of elderly farmers: Results from a survey in England and Wales, Journal of Rural Studies 8 (2), 133-143.

Salomon, S. 1985. Ethnic influences ant the structure of agriculture. Rural Sociology 50 (3), 323-340.

Schumacher, W., 1997. Naturschutz in agrarisch geprägten Landschaften. In: Erdmann, K.H., Spandua, L., (Eds.), Naturschutz in Deutschland. Ulmer, Stuttgart.

Smart, S. M., Clarke, R. T. , van de Poll, H. M. , Robertson E. J., Shield, E. R., Bunce R. G. H., & L. C. Maskell, 2003, National-scale vegetation change across Britain; an analysis of sample-based surveillance data from the Countryside Surveys of 1990 and 1998. Journal of Environmental Management 67 (3), 239-254.

Soulè, M.E. (Ed.) 1986. Conservation Biology. The science of scarcity and diversity. Sinauer Associates, Inc., Sunderland, Massachusetts.

Statistik Austria, 2001, Agrarstrukturerhebung 1999. Gesamtergebnisse. Verl. Österreich, Wien.

Steinhardt, U., Herzog, F., Lausch, A., Müller, E., Lehmann, S., 1999. Hemeroby index for landscape monitoring and evaluation. In: Pykh, Y.A., Hyatt, D.E., Lenz, R.J. (Eds.), Environmental Indices – System Analysis Approach. Oxford, EOLSS Publishers, pp. 237-257.

Sukopp, H., 1969. Der Einfluß des Menschen auf die Vegetation. Vegetatio 17, 360-371.

Sukopp, H., 1976. Dynamik und Konstanz in der Flora der Bundesrepublik Deutschland. Schriftenreihe Vegetationskunde 10, 9-26.

Van der Ploeg, J.D., 1993. Rural sociology and the new agrarian question. Sociologia Ruralis 33 (2), 240-260.

Vanclay, F. & G. Lawrence, 1994, Farmer rationality and the adoption of environmentally sound practices: a critique of the assumptions of traditional agricultural extension. The journal of agricultural education and extension 1 (1), 16pp.(http://library.wur.nl/ejae/v1n1t.html)

Vitousek P.M., Aber J.D., Howarth R.W., Likens G.E., Matson P.A., Schindler D.W., Schlesinger W.H. & Tilman D.G., 1997. Human alteration of the global nitrogen cycle: sources and consequences. Ecological Applications 7, 737–750

Ward, N. & Ph. Lowe, 1994. Shifting values in agriculture: the farm family and pollution regulation. Journal of Rural Studies 10 (2), 173-184.

Willock, J., Deary, M., McGregor, A., Sutherland, G.E.J., Morgan, O, Dent, B., Grieve,R., Gibson. G. & E. Austin. 1999. Farmers' Attitudes, Objectives, Behaviors, and Personality Traits: The Edinburgh Study of Decision Making on Farms. Journal of Vocational Behavior 54, 5–36

Wrbka T., Aschenbrenner G., Kiss A., Lughofer S., Matouch S., Peterseil J., Pollheimer M., Schmitzberger I., Scholl S., Steurer B., Thurner B., Zechmeister H.G., 2002a, Landleben – Erhaltung von Vielfalt und Qualität des Lebens im ländlichen Raum Österreichs im 21. Jahrhundert; Endbericht des gleichnamigen Forschungsprojekts. Forschungsprogramm Kulturlandschaft, Bundesministerium für Bildung, Wissenschaft und Kultur, Wien; http://www.pph.univie.ac.at/landleben.

Wrbka T., Fink M.H., Beissmann H., SchneIder W., Reiter K., Fussenegger K., Suppan F., Schmitzberger I., Pühringer M., Kiss A., Thurner B., 2002b, Kulturlandschaftsgliederung Österreich - Endbericht des gleichnamigen Forschungsprojekts. Forschungsprogramm Kulturlandschaft 13. BM für Bildung, Wissenschaft und Kultur, Wien. (CD-ROM).

Wrbka T., Reiter K., Szerencsits E., Fussenegger K., Kiss A., 2004, in press, Kulturlandschaften von nationaler Bedeutung für die Biodiversitätserhaltung; Studie im Auftrag des Umweltbundesamtes. Eigenverlag.

Wrbka, T., Szerencsits, E., Reiter, K., 1997. Classification of Austrian Cultural Landscapes - Implications for Nature Conservation and Sustainable Development In: Miklos, L. (Ed.), Sustainable Cultural Landscapes in the Danube-Carpathian Region - Proc. II Intern. Conferernce on Culture and Environment; Banska Stiavnica. pp. 31-41.

Zechmeister, H.G., Moser, D., 2001. The influence of agricultural land-use intensity on bryophyte species richness. Biodiversity and Conservation 10, 1609-1625.

Zechmeister, H.G., Schmitzberger, I., Steurer, B., Peterseil, J., Wrbka, T., 2003, The influence of land-use practices and economics on plant species richness in meadows. Biological Conservation 114, 165-177.

Table 1: Spearman Rank Correlations between economic, land use intensity and biodiversity factors in arable fields. N°spec (VP)… species number of vascular plants (n = 33), N°spec (Bryo)… species number of bryophytes (n = 40), hemerobic value (n = 114)

		Profit margin/wh	N (kg/ha)	N°spec (VP)	N°spec (Bryo)	Hemerobic value
Economic	Profit margin/ha	0.648**	/	-0.367*	ns	-0.591**
	Profit margin/wh		/	-0.557**	ns	-0.486**
Intensity	N (kg/ha)			-0.552**	ns	-0.591**
Biodiversity	N° species (VP)				/	0.433*
	N° species (Bryo)					ns
	Hemerobic value					

Table 2: Spearman Rank Correlations between economic, land use intensity and biodiversity factors in grassland. N°spec (VP)… species number of vascular plants (n = 42), N°spec (Bryo)… species number of bryophytes (n = 43), hemerobic value (n = 95)

		Profit margin/wh	N (kg/ha)	Cutting	Silage	N°spec (VP)	N°spec (Bryo)	Hemerobic value
Economic	Profit margin/ha	0.654**	/	/	/	-0.467**	-0.301	-0.376*
	Profit margin/wh		/	/	/	ns	-0.344*	ns
Intensity	N (kg/ha)			0.736**	0.536**	-0.350*	-0.394*	-0.340*
	Cutting				0.760**	-0.404**	-0.647**	ns
	Silage					ns	-0.377*	ns
Biodiversity	N°spec (VP)						/	0.695**
	N°spec (Bryo)							0.333*
	Hemerobic value							

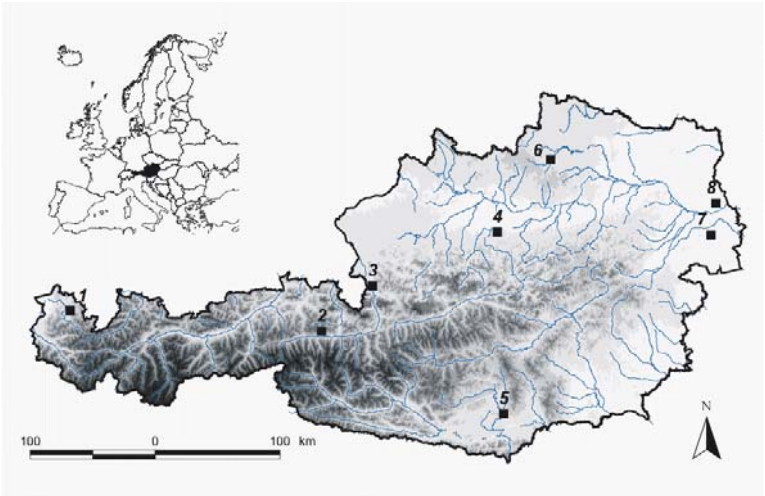

Fig. 1: Map of Austria showing the location of study sites.

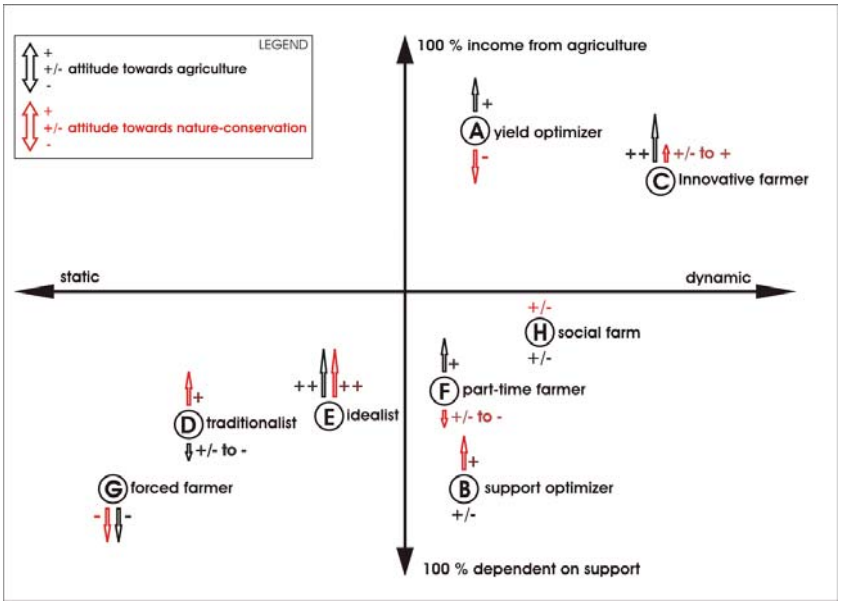

Fig. 2: Position of the different farming styles in the gradients between static and dynamic, dependent and self-reliant and their attitude towards agriculture and nature conservation.

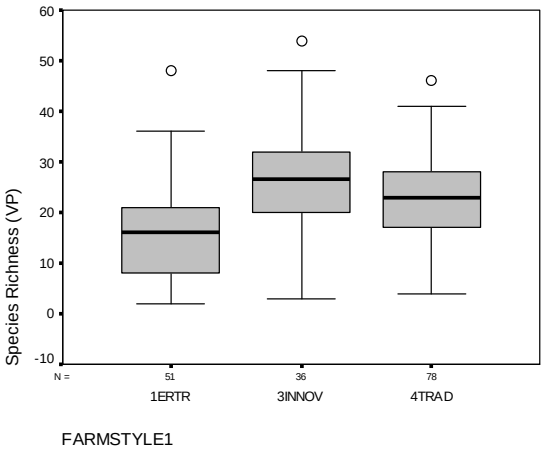

Fig. 3: Differences between Farming Styles in vascular plant species richness on their farmland; 1ERTR…"Yield Optimiser", 3 INNOV…. "Innovative", 4 TRAD…"Traditionalist"; (Anova: F = 9,195 **p < 0.001; Games Howell-test reveals the difference between 1 Yield Optimiser and 3 Innovative and between 1 Yield Optimiser and 4 Traditionalist to be highly significant: **p < 0.001).

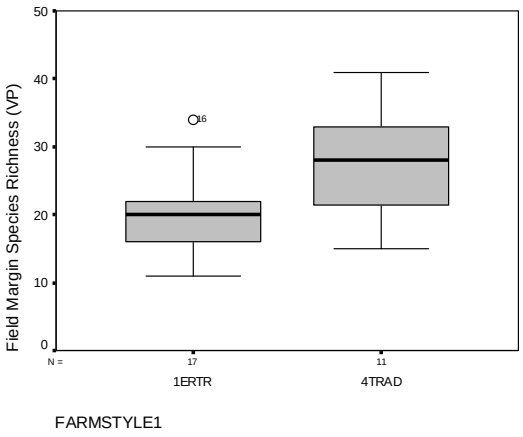

Fig. 4: Differences between Farming Styles in vascular plant species richness on field margins. 1ERTR…"Yield Optimiser", 4 TRAD…"Traditionalist". (Mann Whitney U-Test *p = 0.025)

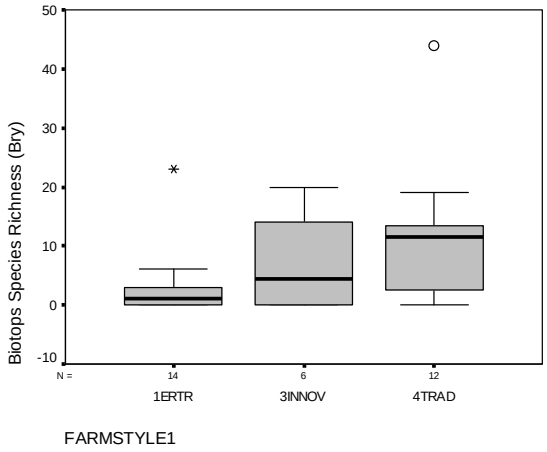

Fig. 5: Differences between Farming Styles in bryophyte species richness on small structures (Field margins and small woodlots).. 1ERTR…"Yield Optimiser", 3 INNOV…. "Innovative", 4 TRAD…"Traditionalist". Difference between 1 Yield Optimiser and 4 Traditionalist is significant (Mann Whitney U-Test: *p = 0.027)

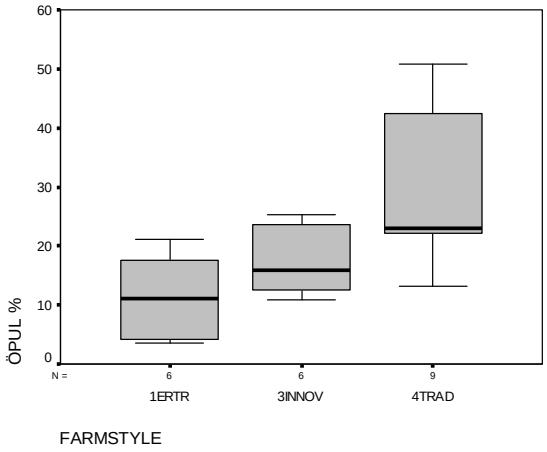

Fig 6: Proportion of agro-environmental subsidies on total income (Profit Margin II) of farmers belonging to different farming styles: 1ERTR…"Yield Optimiser", 3 INNOV…. "Innovative", 4 TRAD…"Traditionalist". (Anova F = 5,974 *p = 0.010, Games-Howell 1vs 4 0,014*)

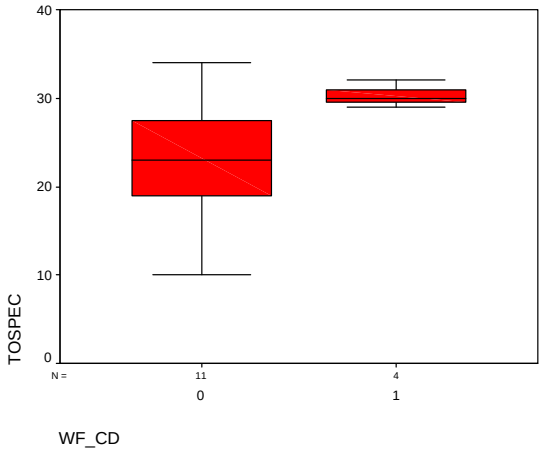

Fig. 7: Difference in vascular plant species richness [TOSPEC] in meadows taking part in the measure "maintenance of ecologically valuable areas" [1] and without this measure [0] (Mann Whitney U-Test: **p < 0.01)