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Evaluation of environmental impacts of crop production, with particular focus on biodiversity

External impacts of an intensive farm and an ecological farm

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"*That, I believe is our basic function [is] to develop alternatives to existing policies, to keep them alive and available until the politically impossible becomes the politically inevitable.*"

Milton Friedman: Capitalism and Freedom. Preface (1982 edition), p.ix.

Introduction

For a long time, agriculture has been one of the most important factors that transform our environment. Its history runs back over nearly ten thousand years, and as Warren, Lawson and Belcher (2008) noted, even though normally this amount of time is not enough to be of evolutionary significance, agriculture has reshaped our world fundamentally. Plants that had been relatively infrequent (cereals), cover a great part of the Earth's surface. Due to agricultural production a dramatic growth of the population became possible, so it can be said that all human activities (also the effects of these activities) are indirect environmental impacts of agriculture. Right now we are not trying to reach that far, the objective of this dissertation is to evaluate the environmental impacts of modern agriculture, more specifically crop production.

On the importance of agriculture Csete and Láng (2005, p.77) states that "the most significant natural resource in Hungary is the potential for agricultural production, the existence of the related conditions". The conditions of agricultural production (soil quality, climate, topography) are favourable, even when compared to international standards, agricultural soil is an important resource of the country. Agricultural areas cover 63% of the country's surface, 48.5% (4.5 million hectares) of the total area is arable land. Recently the proportion of agriculture in the GDP has dropped below 4%, with a declining tendency in its relative weight to the other sectors. The proportion of agriculture-related employment has fallen in the past decade, by 2009 it nearly halved, to below 5% (see NKP III., 2009; ÚMVST, 2007; ÚMVP, 2007; KSH, 2010a). In the past years the proportion between plant production and animal husbandry has been significantly distorted. It seems that the structure of agriculture in Hungary in the long run is based on the production of cereals. Recently an increase in the concentration of farms has been observable: the average size of land used by private farmers in Hungary has increased more than sevenfold (from 0.5 to 3.5 hectares) between 1991 and 2005. The country's agriculture is of relatively low mechanization and energy intensity compared to European standards. In the past years the use of fertilizers and pesticides has risen again. At the same time there has been an increase in intensification, while the total area of organic farming has decreased since 2004. Intensive production is the dominant technology in Hungary, the area of organic and integrated agriculture together accounts for 1% of the agricultural land at most (see NKP III., 2009; ÚMVST, 2007; ÚMVP, 2007; KSH, 2010a).

Following these dry statistics we shall turn back to the description by Csete and Láng (2005, p.125). They point out that despite of the decreasing indicators mentioned above

"agriculture has not lost its strategic importance, moreover, it acquired multiple roles, a definite multifunctionality." According to these authors agriculture in Hungary, closely intertwined with the rural areas, provides irreplaceable services. They bring food production, the use and protection of the natural environment and biodiversity, the maintenance of landscape and traditions, recreation and other social functions as examples.

The object and methodology of this dissertation arch over several fields, therefore – in regard to the number of pages – it may be more extensive than usual. The thorough understanding of our topic requires knowledge of economics as well as of agriculture1.

This dissertation has been inspired principally by our hypothesis formulated in the field of environmental economics, that we intend to test in the field of agriculture. Our hypothesis is that based on the evaluation of environmental impacts and/or externalities, a policy can be elaborated leading us closer to a social optimum reflecting environmental considerations. The corresponding hypothesis regarding agriculture is to evaluate the environmental impacts of agriculture, and devise agricultural subsidies (economic incentives) according to these values. Thus agricultural policy will result in improved environmental quality and a higher level of well-being. In our view a socially optimal level and structure (e.g. technology) of agricultural production exists that has to reflect both economic and environmental considerations. The aim of this dissertation is to contribute to the specification of the environmental considerations.

Similarly, Glebe (2007) analysed the environmental impacts of agriculture in Europe and assessed the legitimacy of agri-environment payments. Eloquently enough, he had to carry out a qualitative analysis, as hardly any quantitative assessments have been made on the evaluation of environmental impacts. It is clear to see that our society is not aware of the value of environmental impacts of agriculture, neither of the total environmental balance of agriculture, therefore we are not able to define exactly the socially optimal level and structure of the various agricultural activities. The recognition of the lack of quantitative information led us to the writing of this dissertation. Therefore **our main objective is to evaluate the external environmental impacts of crop production**.

It is not stated that it is possible to evaluate and accurately estimate the total economic value of the environmental impacts, the externalities of agriculture, but it is expected that better results than the currently available knowledge can be obtained. There are fields with respect

[1] We apologize in advance to our readers of agricultural background for the parts of the dissertation that may seem to be „popular science" to them. Our excuse is that supposedly the majority of the readers will be economists.

to environmental impacts of agriculture where a significantly larger part of the externalities can be evaluated by the application of new methods and further development of the existing ones. We believe that **the methods presented in this dissertation can help to define the balance of social costs and benefits more precisely**. A possible method for the evaluation of the environmental impacts of crop production is presented here. This method is supposed to provide suitable bases to build upon for the agricultural policies capable of handling the system of economic-environmental conflicts.

Randall's point (2002) is agreed on, stating that the analysis needs to be carried out on the farm level in order to arrive at the social optimum (balance of social costs and benefits). Therefore samples of two farms have been chosen which are similar regarding their circumstances, but are using substantially different technologies. The **evaluation of the environmental performance of the two farms may serve as an indication** for the later, more extensive (national, European) application of the methods used. Expectedly, this brings us closer to a consistent methodology of the performance assessment of multi-functional agriculture also regarded by Randall (2002) as a necessary and pioneer work.

The relatively few experiments aiming at the evaluation of environmental impacts of agriculture were based on aggregated regional data. A different approach is applied here. Whenever possible, conclusions are drawn from **farm-level data**. To our knowledge this bottom-up method has never been used before. Evaluating externalities involves a relatively high level of uncertainty, so it is expected that a new approach may help to confirm the validity of the results and to formulate the conclusions.

Experiments so far typically evaluated a single impact at a single site (e.g. nitrate pollution on two sites in East Anglia, impacts on landscape in Sweden). This dissertation moves forward in that respect as well: the **evaluation on a single site** (Middle-Mezőföld, Hungary) of **as many impacts as possible** (soil, water and air pollution, effects on human health, biodiversity, landscape) **at the same time** is intended, thus **forming a socially coherent system** of the performance assessment of crop production. To our knowledge hardly any attempts have been made to apply this **holistic approach**, and even when applied, not all impacts have been taken into consideration (Pretty et al., 2000; Tegtmeier and Duffy, 2004; Hartridge and Pearce, 2001.) Later on a critical analysis of the relevant literature shall be provided, but it can be pointed out that the evaluation of biodiversity can be regarded as the weakest spot.

Another blank space filled by this research is where two substantially different farming technologies are compared. The applied crop production technologies may have a significant impact on the size and characteristics of the environmental burden caused. This

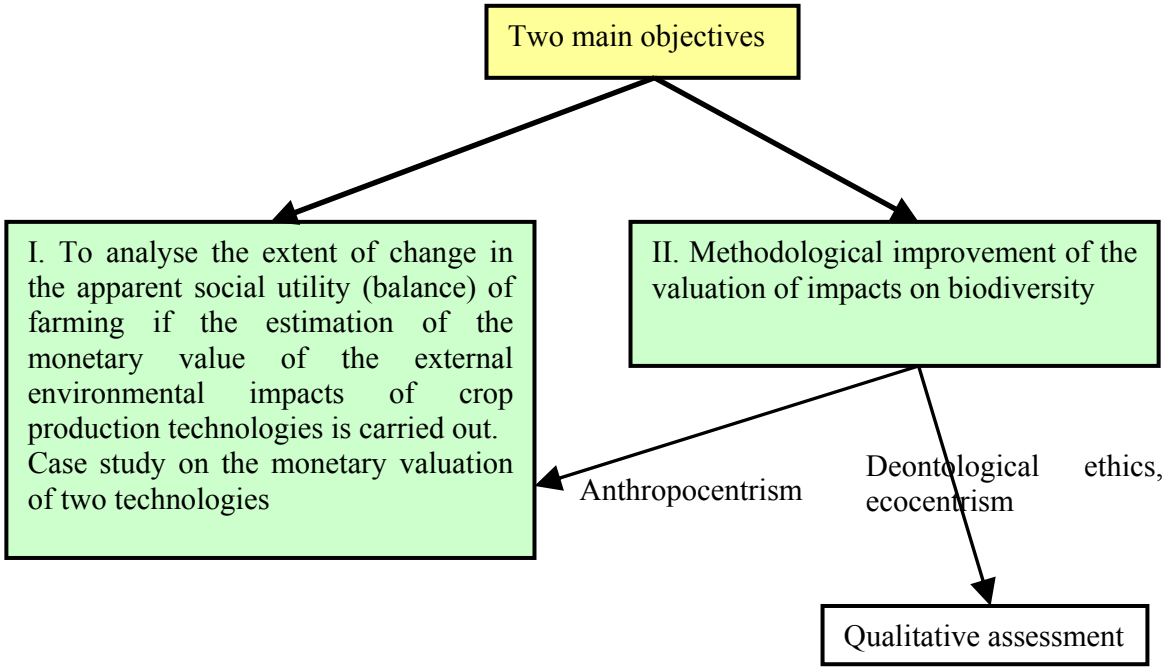
research is an opportunity not just to evaluate crop production per se, but more specifically, the **impacts of the typical technologies** as well. This feature can play a major role in formulating funding principles and practical policies for agriculture.

The issue of biodiversity constitutes the greatest challenge in the analysis of environmental impacts, due to its complexity as well as the methodological problems. The difficulties appear clearly by reviewing the relevant literature. We believe that regarding the **evaluation of impacts on biodiversity** our dissertation makes **a step forward in the methodology**, thus including impacts that so far had been lacking an exact monetary value.

Our holistic approach leads us to choose the methods applied for the rest of the impacts (apart from the impacts on biodiversity), that gives us a more complete picture of the external environmental impacts. Our **methods are determined by the topic**, that is, our methodological choices are determined principally by the characteristics of the environmental impacts.

It is supposed that such a comprehensive research can fulfil the role of a catalyst. In the field of climate change, it was the Stern report (2006) that gave a huge momentum to the economic valuation of the impacts. The TEEB report (2008) produced similar impacts regarding the evaluation of biodiversity. Both reports were pioneers regarding the scale of the challenge and succeeded in "bringing the numbers into the public discourse". It would be of immodesty to mention our dissertation in the same category as these two pieces, but perhaps in the case of agriculture the attention can be drawn to a possible method that spreads over more and more fields, "infecting" more and more disciplines. This pejorative term is used here on purpose, as later on it will be clear that monetary evaluation is not in every case desirable. Figure 1 shows the research objectives and structure of the dissertation.

Figure 1 Research objectives and structure of the dissertation



Among other things a practical use of our work can be that the results of this dissertation provide scientific basis from economics for the design of agricultural funding mechanisms. Confirming agri-environment funding principles by economic considerations is one of these possible uses. As Glebe (2007, p 88) noted, "there is a consensus among economists that agri-environmental payments should be linked as closely as possible to the environmental benefits sought". It has to be added that regrettably the environmental benefits are still unknown. Clearing the question of environmental benefits and of **positive externalities** is one of the reasons for preparing this dissertation.

Warren, Lawson and Belcher (2008, p.104) describe that the current agricultural funding systems are imperfect. According to their opinion "the current imperfect systems may be the best that is possible" also due to the lack of agreed units of nature conservation values. However, we believe that it is necessary and possible to develop systems with more robust economic foundations. The challenge is to establish policies that consider the interests of farmers and food production on one hand, and ensure environmental goods and services on the other hand, thus complying with the social expectations and achieve this in the most efficient way.

We agree with the point made by Pretty et al. (2000), which states that it is necessary to estimate the external costs when assessing policies, programmes and projects. Estimating social costs and benefits supports decision-making. The cost-benefit analyses help us define which agri-environmental measures are the most appropriate for the reduction of negative

externalities, or the fostering of positive ones (see also Fekete Farkas, Fogarassy and Szűcs, 2008). We can move closer to decide whether the costs of a planned program can be justified by social benefits. Our point is that a more equitable and efficient use of resources is possible if policies strive towards the internalization of externalities. Following Huylenbroeck et al. (2007) we would suggest to consider finding those community and private forms of arrangements, where agricultural efficiency is not considered only regarding the products, but the non-tradable outputs as well (multifunctional agriculture).
Of course, policies can be underpinned several ways. The method described in this dissertation is just one of them. But we believe that this method has so far been relatively undeveloped and inadequately covered in scientific publications. We intend to correct this situation further on.

Arable crop production has been selected as the main focus from the several branches of agriculture (plant production, animal husbandry, horticulture, etc.). The reason behind this is the realization of treading untrodden ground, so in any case we are facing a high level of uncertainty. The scale of our dissertation is also not appropriate for including several fields into the research. However, we would like to emphasize that using the method presented here it is possible to extend our research on other areas of agriculture in the future, and that these results can be useful in other areas as well. We believe that a significant part of this methodology is appropriate for the analysis of other areas as well, therefore we anticipate that our results can provide guidance on a more general scale. Due to the different characteristics of these activities, narrowing our focus on field crop production proved to be a relatively easy task.

The approach - and therefore the detailed structure- of the dissertation is not uniform. This is necessary because we intend to include the entirety of the environmental impacts of field crop production and also discuss specifically biodiversity issues. It is expected that we can provide **a methodological improvement regarding the assessment of biodiversity impacts of crop production**, therefore it is indispensable to **clear up the details of theory**. However, when assessing other environmental impacts of crop production only well-known methods are applied, so an overview of theories will not be provided, with which the reader is presumed to be familiar with. Therefore a theoretical overview of only one topic of this dissertation will be presented. Our opinion is that the assessment of soil and water loads, air pollution, health effects of pesticides and the impacts on landscape can be performed without a theoretical overview, since theory would only be of a character of popular

science, as we would not be adding to the knowledge found in current literature. The value added of our dissertation regarding these fields is the **combined evaluation of impacts**. These chapters of the dissertation provide novelty not on the theory side, but in the coherent, holistic approach. The case of biodiversity impacts of crop production is different. Presenting theory is inevitable in this case, since that is the only way to explain the (pluralistic) method that we apply.

Chapter 1 reviews the need for environmental valuation in agriculture, Chapter 2 discusses externalities. A detailed review of currently available scientific results is provided in the field of the valuation of environmental impacts of crop production. A deeper theoretical analysis is carried out in the case of the impacts on biodiversity, along with a critical assessment of the available methodologies (Chapter 3), which results in sketching the ways of improvement of the methodology. Chapter 4 presents the methods applied for the valuation of the impacts, in Chapter 5 the hypotheses are formulated, Chapter 6 presents the results of the empirical research, and finally conclusions for future policymaking are drawn.

I. The necessity of an agricultural subsidy system being based on the valuation of environmental impacts

The question may arise: is it worth to evaluate the impacts of agriculture on the environment? If so, is it accurate to evaluate on a monetary basis or another method (for instance qualitative assessment) is required? This chapter assesses the role of multifunctional agriculture, the social welfare balance of agricultural production, and the rationale for the subsidy system aiming to achieve this social welfare balance. Based on that, we will investigate the weaknesses of the subsidy system and draw conclusions for the necessity of evaluation.

I.1. The background of multifunctional production in European agriculture

According to Warren, Lawson and Belcher (2008) by 1980 the European Union managed to produce goods in different areas in a self-sufficient way (for instance butter, sugar, beef-production and commodities). Agricultural policy had reached one of its goals: production increased significantly, quantity (agricultural goods) was not an issue any longer in Europe. Since then the aim was not to increase the quantity produced as overproduction and excess supply became a problem that had to be solved. In order to reduce overproduction a new system was introduced in 1988; the 'set aside' system, where temporarily ceasing production on the land was subsidized by the European Union. However the latter mentioned subsidy system turned out to be not a proper solution for the problem of overproduction. It became obvious that production has to be separated from the subsidies of the Common Agricultural Policy (CAP). In 1992 'MacSharry reforms' were introduced: the subsidy system shifted from a product based subsidy system (a guarantee for high-prices) to a producer focused subsidy system (direct compensation payments). As Warren, Lawson and Belcher (2008) states, there were mainly two reasons for 'greening' the CAP: it could handle the problem of excess supply and on the other hand it could control the expenses (payments) of the subsidy system. Later, based on Bignal and Baldock (2002) the authors put forward an idea, that the agri-environmental programs were only by-products of agricultural policies.

The roots of the progress that made the agriculture more environment friendly were set in the conferences of the United Nations, which were held in Rio de Janeiro and Stockholm, as Csete and Láng states (1972, and 1992, Agenda-21). In the European agricultural policies, tackling environmental damages became significant after the reforms in 1992. The rationale behind reforms were rather political and not environmental (Baylis et al., 2008, p.755). Up

until the 1990's, the agricultural externalities played a minor role (secondary consideration) comparing to the importance of such aims as incomes, prices and trade (Shortle and Abler, 1999). Agri-environmental protection policies introduced in the 1980's served rather as a compensation for decreasing price supports. Theoretically agri-environmental programs were developed because of market failures. The market is unable to tackle some of the environmental damages, for instance increasing amount of nitrates in groundwater or decrease in biodiversity; but on the other hand, it is not guaranteed by the market alone that positive impacts, such as maintenance of landscape will be carried on. As a consequence of market imperfections, government intervenes.

Ángyán (2001, p.61) analysed the fundamentals of multifunctional agriculture. In his interpretation "the countryside is not only a location of agricultural production it also serves as biological and social habitat". In the introduction, based on Csete and Láng (2005), we already touched on some elements of multifunctional agriculture, we are now based on Ángyán (2001) listing the most important ones: production of goods (foodstuff); the sober use of non-renewable resources and energy; decrease or, if possible, avoidance of the pollution; sustaining biodiversity and cultural landscape; preserving rural cultural and agricultural values; providing employment and income (see Huylenbroeck et al., 2007). Based on Romstad et al. (2000) multifunctional output of agricultural production encompasses biodiversity, cultural heritage, openness, borders-mosaics, active landscape, recreation access, food security, food safety, food quality, rural settlement, scientific-educational value, and negative external effects. Naturally, environmental externalities[2] are not related to all the above, as the question of food safety and food-quality might be resolved via labelling the products, hence it can be solved by the market (see Randall, 2002).

Multifunctional agriculture differs from the one dimensional conceptions of agriculture that the latter focuses not only on the production of food, it also broadens its scope to functions that are socially deemed adequate (see environmental, cultural and regional aspects). A working-definition of multifunctional agriculture used by OECD (2001a) has two key elements. Firstly, agriculture jointly produces multiple commodity and non-commodity outputs, while secondly, some of the non-commodity outputs exhibit the characteristics of externalities, i.e. public goods with an inappropriate market value. Ángyán (2007) likewise categorises the tasks of multifunctional agriculture into two subdivisions: firstly, production functions that are controlled by the market (e.g. food, renewable resources, energy sources etc.), secondly, environmental, social and cultural functions related to environmental

[2] Environmental externalities will be discussed later.

conditions, landscape, soil (non-commodity outputs, public goods). Ángyán (2007, p.29) also points it out that CAP subsidy system reforms are based on these two pillars of multifunctional agriculture described above, where the first pillar focuses on the productivity of farming, while the second pillar focuses on the „eco-social performance of agriculture". Interestingly, Warren, Lawson and Belcher (2008, p.191) argued that environmental goods and services were, in the past, the by-product of agricultural activity and "with agri-environmental schemes they have become the product while food has become the by-product" (see also Huylenbroeck et al., 2007).

I.2. The motivations and reasons for the subsidy system in agriculture

According to Baylis et al. (2008) the notion whereby the multifunctional character of agricultural production having gained prominence, has three main factors: negotiations for free-trade agreements, rural development issues and the environmental concerns. After the GATT[3] Uruguay Round, the production subsidy system in place thus far in Europe was no longer acceptable, changes had to be made. However, the reasons behind the income support of rural populations were still there, out of political rationality the subsidy system could not be ceased. On the other hand the negative impacts of agricultural production on the environment became evident, nevertheless it was obvious as well that under market conditions agriculture would not provide certain services benefiting society to the extent matching the demands of society. Baylis et al. (2008) cite opinions (Agra Europe, 2001) that the actions taken were little else then the repackaging of previous subsidy systems[4].

Ángyán (2007) discusses the dead-end of the European agricultural policy and subsidy system. After the Second World War, because of the excess demand for food, direct production subsidies (linked to volume of production) were in place. Then, in order to avoid over production, the governments intervened to buying up excess supply. At last, because of the full storages, export-subsidies were introduced. Ángyán finds this pattern absurd, saying that "overproduction was funded by the incoming taxes (public money), later the excess supply will be bought up by the government and finally we try to dispose the excess supply by subsidizing exports which process is funded from taxes as well" (Ángyán, 2007, p.28). Later the subsidy system changed from a price based support to a direct payment system,

[3] General Agreement of Tariffs and Trade. World Trade Organization (WTO) replaced GATT after the inclusion of export subsidies and domestic support (Aggregate Measurement of Support, AMS).

[4] Warren, Lawson and Belcher (2008) referring to Diakosavvas (2003) state that the agri-environmental subsidies belong to the "green box" of the WTO's terminology, thus theoretically these do not have market-distortion effects. However, payments of the OECD countries that belong to the "green box" cover in most of the cases only the domestic food-aids and general offsets.

and rural development became imperative.[5] Analysis of Katona-Kovács (2007) failed to support the notion that agri-environmental measures in Hungary's New Rural Development Programme were not merely substitutes for traditional agricultural subsidies, but measures which could support rural development and environmentally sustainable agricultural production.

Warren, Lawson és Belcher (2008) states that agri-environmental payments to farmers are calculated to provide exact compensation for the reduction in income associated with additional requirements. Thus payments are unrelated to environmental gain achieved. According to the authors the reasoning behind this financial arrangement is that schemes are primarily and historically agricultural schemes, rather than environmental ones, and payments are associated with incomes from farming (levels of agricultural production) rather than environmental values. Moreover, this is advantageous as agricultural production is easier and less controversial to measure than environmental value. Further, it is difficult, expensive and at times controversial to assign an economic value to environmental goods and services, which do not appear on the market. In connection with the existence of the income compensation subsidy systems Warren, Lawson and Belcher (2008) states that those have more environmental disadvantages compared to the ones that do consider the ecological values as well. However they also determine that operation and monitoring of a system that does measure improvements in ecological conditions is too complicated. Describing agri-environmental systems, Szabó (2003) highlights the deficiencies in the justifications of agricultural policy and subsidy systems in the European Union, pointing out that meeting agri-environmental requirements payments are linked to foregone income and necessary incentives and calculated accordingly. The goal of agri-environmental subsidies is to compensate reduced income. We have discussed that when defining the size of the subsidies, social damages and benefits are little considered. In our opinion, one of the problems of agricultural payments (not just agri-environmental schemes) is that environmental externalities are not considered.

In brief, in view of justification of agricultural subsidies it is worth to recall the findings of Baylis (2008, p.760) that "EU policy is framed more by socio-economic goals such as maintaining farm income in less favoured areas than the reduction of strictly measurable negative externalities.

[5] Agenda 2000 (EU programming for the period of 2000-2006) continued the reform of Common Agricultural Policy. Warren et al. (2008) note that it was necessary on the one hand for WTO negotiations and on the other for the expansion of the EU. Price supports were to be reduced further and an EU of 25 members (from 2004) increased the pressure on the budget. Price support measures were planned to be replaced with direct payments and rural development brought to the fore. In 1999, as a second pillar, sustainable development policy was introduced.

From the foregoing it appears that the structure and the goals of agricultural subsidies in many cases suffer from a lack of economic rationality. It appears as well that in devising agricultural subsidies environmental concerns did not play a dominant role. The protection of the environment, it seems mostly a 'god-given', by which some measures could be justified. Several authors are on the opinion (for instance Baylis et al., 2008; Warren, Lawson and Belcher, 2008; Katona-Kovács, 2007) that the genuine reasons and motivations behind the decisions on the schemes are to be found somewhere else (see WTO and rural development). On this basis, we believe that there is a need for more solid justification of environmental aspects[6]. Environmental policy concerning agriculture can not be based on 'drifting on waters'.

I.3. Monetary valuation in agriculture

For seeing the rationale behind monetary valuation it is worthwhile to go back to one of the pioneering works in valuation of global ecosystem services. Costanza et al. (1997, p.255) claim that although ecosystem valuation is certainly difficult and fraught with uncertainties, one choice we do not have is whether or not to do it. Social decisions on ecosystems imply valuations, although not necessarily expressed in monetary terms. The authors declare that we can choose to make these valuations explicit or not; but as long as we are forced to make choices, we are going through the process of valuation. Nunes, van der Bergh and Nijkamp (2003, p.15) state that "making public or private decisions that affect biodiversity implicitly means attaching a value to it".

Monetary valuation is a possible way to assess environmental impacts. We agree with Kerekes' (2007, p.112) view that "most environmental economists would be satisfied to waive monetary valuation of natural resources, if dominant social paradigms did not lead to deterioration of natural capital, but help improve the state of the environment. The goal of monetary valuation, as of internalisation of externalities, is to reduce the speed of adverse development". Pearce (2001, 26.o.) argues that the measurement of the economic value of biodiversity is a fundamental step in conserving this resource. In his opinion as "the pressures to reduce biodiversity are so large that the chances that we will introduce incentives without demonstrating the economic value of biodiversity are much less than if

[6] Baylis et al. (2008) dissert at length about which is system is more efficient; the input focused European or the certain output focused American. According to the authors in many cases more then one area needs to be targeted, which are difficult to measure and quantify. It is latently stated in their opinion that how much easier it would be if damage on the environment made by the agriculture were known. However, since the quantified environmental impacts are unknown, assessments are being made that only come up with the idea of a second best solution (for comparison between the European and American system see Baylis et al., 2008).

we do engage in valuation". In order to support the above idea it is worth to quote Pretty et al. (2000, p.114), as „the current system of economic calculations grossly underestimates the current and future value of natural capital (Abramovitz, 1997; Costanza et al., 1997; Daily, 1997)".

Popp finds that the problem with non-commodity outputs, public goods character services provided by agriculture, is the low acceptance level in society. We believe that the societal acceptance could be achieved, what is however missing, is the economic valuation frameworks. Randall (2002) does not dispute that valuation of the environment in theory is able to provide acceptable estimates of willingness to pay for the agricultural (multifunctional) outputs, but believes that the valuation task is greater than the valuation community customarily encounters. Optimality of multifunctional agriculture involves variety, quantity, quality, location, and availability of substitutes and complements. Randall (2002) convincingly argues for monetary valuation of changes in welfare related to agriculture. According to the author economic valuation attempts to provide an empirical account of the social value of the services and amenities produced by multifunctional agriculture. This has two simultaneous aims: a utilitarian account of the contribution of multifunctional agriculture to human welfare and a source of efficient virtual prices to direct resource allocation. Randall finds contingent valuation and choice experiment methods the most appropriate for valuation. Later, he sets out that the principle should be that "farm-level green prices[7] should be calibrated as finely, and farm-level performance in multifunctional production should be monitored as rigorously, as is feasible" (Randall, 2002, p.304). Agreeing with Randall, we believe that agricultural policy systems established with the help of monetary valuations may lead to the social optimization of multifunctional services and benefits. In our interpretation social optimum (welfare balance) may be reached by complementing the valuation of economic performance with the valuation of environmental impacts (externalities). This will allow us to form opinions of a more thorough output of agricultural production (profitability and environmental impacts). In our opinion, social welfare balance of agricultural production needs to reflect both the economic and environmental aspects. We note that interpretation of social welfare balance always corresponds to a specific time. As Getzner et al. (2005, p.4) put it, biophysical as well as human systems are complex, and will never be fully understood, leading to the development of approaches favouring adaptive behaviour and learning processes. Therefore, valuations will regularly need to be revisited.

[7] Meaning: the prices of agriculture' multifunctional outputs

I.4. The possible consequences of agri-environmental policies lacking economic rationale

We believe that, as discussed so far, agricultural subsidies, especially agri-environmental schemes, suffer from a lack of solid economic foundations. As discussed in a historical context, it has been put forward that efforts to internalise agricultural externalities could be best described as incidental. The theoretical economics foundations of establishing policies striving for a thorough social welfare balance are weak.

It is pertinently described by Warren, Lawson and Belcher (2008, p.191) that „the future of agri-environmental systems, while influenced by agri-environmental policy, will be largely dependent on broader agricultural policy developed to meet primarily non-environmental objectives." Katona-Kovács et al. (2008, p.1) raise that „globalisation, climate- and demographic changes, as well as the current global financial crisis, are likely to have a strong influence on the future of the Common Agricultural Policy (CAP)." Current signs show that the international trade policy will be transformed following the failure of the Doha Round[8] (see the growing importance of bilateral agreements). It is not inconceivable that also the environment-based (agri-environmental) funding is to be in for changes. During such possible changes the lack of economic justification can be an obstacle to the maximization of social welfare.

One can argue how the social costs and benefits can be balanced against each other until the total environmental cost of agriculture is known. Until the value of the environmental burden of agriculture is estimated hardly any cost-benefit analysis can be carried out to find the social optimum. Few attempts have been made to evaluate and define the numerical value of the externalities of agriculture (this issue shall be discussed in detail later on). Agri-environmental funding faces the threat of losing its current position in case of changes in certain structures. For example, changes in the objectives of international trade policy or of rural development may result in choosing other tools than agri-environmental funding to achieve actual political objectives. That would put an end to the favourable circumstances fostering agri-environmental processes. Motivators, indirect reasons would disappear and suddenly only the pure economic rationality would remain. In that case the environmental benefits of agri-environmental funding will have to be justified. Being aware of the value of the social costs and benefits of agriculture can then gain a particular political importance. A special role can be attributed also to the evaluation of external environmental costs and the maximization of social welfare based on that. We thus agree with Nijkamp et al. (2008)

[8] The Doha Development Round of the World Trade Organization (WTO) negotiations started in 2001 in Doha, Qatar.

who states that the subsidy system behind biodiversity conservation programmes are in general, rather poorly underpinned, moreover, are not based on solid and explicit economic choice mechanisms.

Beyond the lack of economic justification another problem is that the current practice stands open to the actual prevailing lobby interests. In case the motivators from international trade or rural development weakened or ceased, interest groups of the agrarian industry (being one of the most powerful lobby groups in the world) can significantly influence policy-making. Thus political decision-making may follow partial interests, and the effort to maximize social welfare may be hindered. We reckon that these often severe conflicts can make agricultural policies with weaker economic foundations quite vulnerable.

Glebe (2007) claims that agri-environmental policy and subsidies are not production neutral. According to the author, in the WTO negotiations some trading partners regard the EU's 'green' agricultural policies as disguised protectionism. Many are sceptical and forecast that EU agri-environmental policy and subsidy system will be challenged within the WTO. It is no coincidence that the aim of the author's paper is to assess how legitimate are agri-environmental payments. Nevertheless, this aim could be (to some extent) fulfilled by qualitative assessments only. Assessing the impacts of EU's agricultural policy through prices on welfare Hartridge and Pearce (2001) assert that in the EU farmers gain whilst consumers lose, and in the rest of the world farmers suffer a welfare loss whilst consumers gain. It appears that the volume of agricultural payments needs to be put into a global context as well.

Climate change may also be a factor of crucial importance, as its consequences may lead to local, if not global food shortages, and high levels of uncertainty regarding production is not unimaginable (see IPCC, 2007). Warren, Lawson and Belcher (2008) assert that in that case, besides increasing support for production to ensure adequate food, the aim of a socially optimal policy may be to ensure agri-environmental health in order to increase the resilience of the agricultural systems under uncertain climate patterns (see also VAHAVA, 2006).

The Food and Agriculture Organization of the United Nations (FAO, 2007) concludes that in the future demand for environmental services from agriculture will increase, so better incentives to farmers are needed if agriculture is to meet this demand.

The section above proves the necessity of the evaluation of environmental effects of agriculture. As it was shown, the lack of economic justification may lead to problems. It is not stated though that the monetary valuation of environmental effects is a perfectly

satisfactory solution to avoid difficulties. As it will be discussed later, starting from a non-anthropocentric viewpoint a qualitative assessment and ranking may be a viable method for the case of biodiversity. We are positive that this method can be a useful tool to support agricultural policies leading us closer to the optimization of agricultural subsidy policies. In this respect it is worth to note Glebe's (2007, p.98) claim that one of the most „challenging task would be to value the overall environmental effect of farming".

From Chapter 3 onwards it will be presented how the numeric valuation of the environmental effects of agriculture can be fulfilled.

II. Externalities of crop production and their valuation in literature

In order to provide a basis for the analysis of external impacts of agriculture in the followings the topic of externalities will be reviewed, and an extension of the generally accepted definition will be attempted, then we will turn to the balance of social costs and benefits. However, a detailed analysis of the theoretical debate on handling externalities is not an aim of this dissertation, therefore the ways to achieve social optimum will not be discussed thoroughly. Then the external environmental effects of crop production will be presented, and we will conclude by an overview of the valuation of the impacts based on the relevant literature.

II.1. Social optimal level of externalities

Externalities, i.e. the concept of external costs and benefits were introduced a hundred years ago by Alfred Marshall. In Kerekes' (2007, p.117) interpretation Marshall used the term, externality for such events, when a financially independent unit (e.g. corporation) directly influences another financially independent unit (a corporation, or a consumer), without getting into direct contact on the market. Kerekes (2007) defines external economic impact in virtue of Mishan (1971), as an unintended economic impact of an actor on the level of economic welfare of another actor. Thus, externality is a fundamental manifestation of market failure. In the presence of externalities, markets do not reflect full social benefits or costs. As Baumol and Oates (1988, p.17) states "externality is present whenever a person's utility or production relationships include real variables, whose values are chosen by others without particular attention to the effects on the person's welfare". In addition, an essential feature of an external effect is non-deliberateness. "The effect produced is not a deliberate creation, but an unintended or incidental by-product of some otherwise legitimate activity" (Mishan, 1971, p.2). The reason behind the existence of externalities can be found in the absence of well-defined ownership. According to Verhoef (1999), the quality of the environment is typically a good, where property rights are not defined, thus the market is non-existent. The ExternE project[9], which aimed to quantify externalities, defines externalities as the following: an external cost, also known as an externality, arises when the social or economic activities of one group of persons have an impact on another group and when that impact is not fully accounted, or compensated for by the first group (EC, 1999). However, Vatn and Bromley (1997, p.135-137) state that disputes about definitions and

[9] ExtenE project aiming for the evaluation of external costs of different fuel cycles begun in 1991. Methodology was updated in 1998.

consistencies prevent the development of externality debate. From their point of view, it is not accurate to label externalities as a type of market failure, because „if market exist, the presence of externalities may be interpreted as a rational consequence, thus it is not appropriate to label it as failure of market". From their perspective difficulties arise when we attempt to determine the appropriate level of efficient intervention mechanisms; because the time gap between the emission and the awareness of external impacts may be long. Thus "fundamental questions about rights and duties must be determined ex post".

In conclusion, the main characteristics of externalities can be defined as perceived changes in welfare of a third person (other than consumer and producer), there is no compensation and the impact caused is unintended.

Environmental economics is specifically to deal with negative externalities. The negative external costs are typically in relation with public goods. However, in the field of agriculture, positive externalities related to the environment are significant as well. Maintenance of biodiversity and landscape is a positive externality, and a relatively few attempts has so far been made at incorporating them in valuation exercises.

Warren, Lawson and Belcher (2008) examine the question of excludability and rivalry in relation to public goods. They argue that, for instance, it is difficult to exclude others from the beneficial effects of biodiversity. Benefits enjoyed by a person normally do not reduce the quality and quantity of biodiversity available for others. As a result, the "producers" of biodiversity can hardly obtain economic rewards; and that results in external benefits.

During the assessment of broadly interpreted agricultural performance Randall (2002) underscores, that usually not only public goods are considered, rather *local public goods* serve as a subject of assessment.

Hodge (1991, p.181) raises an interesting point about the fact that it is not always unambiguous, if it is an external benefit or cost. Furthermore he states that "if a farmer refrains from destroying an area of valuable habitat, does this constitute the provision of an external benefit or, rather, would its destruction constitute an external cost"? The provision of agricultural subsidies assumes that from a social point of view, the production of a good or service is a valuable thing, and as there is no market, it is to be supported financially. But it is possible to get subsidy for the reduction of nitrates pollution, which action would otherwise result in an external damage. According to Hodge assessment will depend on the rights of the farmers. If they have the right to pollute, but the farmers waive their privilege to pollute, that can be regarded as producing an external benefit. We would like to note, that in the case of biodiversity this dilemma is clearly existent. Part of agricultural subsidies aim for an increase in the biodiversity. The farmer is subsidised in order to reduce pollution, and

that serves as compensation of the external benefit. That way, the producer has the right to pollute, though another system could also be considered, where the producer would not have the right to pollute, so his action would appear as an external damage instead.

Most methods assess biodiversity from an anthropocentric viewpoint (see Pearce 2007). Humans evaluate its importance, but it may have an intrinsic value (see III.1.1), as supporting the basic conditions of life on Earth.
The definitions of externalities presented in the previous section apply only for humans or groups of humans. Thus the external impacts affect people only. According to the traditional definitions of externalities the term "externalities" cannot be used if the damage affects some other unit of the biosphere than people. The question why this delimitation is necessary can be raised. Why does this concept exclude other living organisms? Why could not be a group of living beings considered to be damaged by the external effects? This step would undoubtedly extend the concept of externalities. As it will be shown later (III.1.1) some sets of moral values could justify such an extension. Our opinion is therefore to extend the concept of externalities so that other beings than humans can be considered the third party involved.
In principle the evaluation on a hypothetical market tackles this problem, as diminishing biodiversity may result in decreasing utility (see non-use values later on) at some groups of people who can express this through their willingness to pay. Thus the question whether the interests of other living organisms are represented can be answered. Humans can represent the interests of other living organisms, thus the negative effects on them can be indirectly included in externalities. The "silent voices" of other beings and future generations can thus be represented and the limits of evaluation can be extended.

Externalities have a series of unfavourable economic consequences. Based on Kerekes (2007) these are - among other things- the excessive level of the polluting activity, lack of incentives for pollution reduction and distorted relative prices. A possible way of eliminating external effects is internalization. Internalization is when the welfare loss caused is incorporated into the prices (see among others Pearce and Turner, 1990). Following Pigou (1932) external effects can be handled by making polluters responsible for the harm caused. Social optimum can be achieved by taxing pollution (the polluting production). On the other hand, Coase (1960) argues that well-defined property rights make

state intervention unnecessary, under certain conditions the market reaches social optimum spontaneously by the negotiation of the parties involved.[10]

Given environmental concerns that are caused by market failures in the agricultural industry, Warren, Lawson and Belcher (2008) assert that the fundamental motivation for agri-environmental policy is to maintain or enhance social well-being by addressing these concerns. Further, many ecological goods and services have public good characteristics, and from society's perspective it results in an inefficient allocation of resources since farmers do not have an incentive to provide them. As a consequence, the function of most agri-environmental policy measures is to internalise the external costs and benefits, in other words incentivise farmers to make management decisions that are more environmentally beneficial.

Glebe (2007) points out that in theory, the optimal policy instrument addressing a negative externality would be to levy a tax on pollution with its level equal to the marginal social damage. Analogously, the provision of environmental non-market goods (multifunctionality) would be best addressed by a subsidy with its level equal to the marginal social benefit. An efficient internalization of agriculture's provision of multifunctional benefits would be, as the author concludes, to subsidize farmers' contributions to environmental quality in terms of landscape or biodiversity improvements. Determining efficient level of subsidy would imply a considerable administrative burden in the case of abstract goods such as landscape. Similar difficulties would arise with respect to negative externalities (biodiversity, water contamination). As a consequence of Glebe's line of reasoning we can conclude that determining efficient level of taxes and subsidies would imply considerable administrative cost, thus it is difficult to accurately internalize. Moreover, agri-environmental policies and subsidies have multiple objectives. Payments for reducing environmentally harmful impacts for instance aim to mitigate water contamination as well as increase biodiversity and maintain landscape.

Farms show a significant level of heterogeneity according to social, economic and biophysical characteristics, even if located within the same region. Consequently, the environmental effects of agricultural origin are complex and quite varied in space and time.

[10] As mentioned earlier, we do not intend to discuss the ways to handle externalities in detail, thus – fortunately- we do not have to take a stand on this debate. However, one remark needs to be made: if the definition of externalities is extended, the Coase theorem hardly can serve as a basis, as other living beings bar humans are not able to represent their interests. Thus these other living beings were in need of an „attorney", not being entitled to representation, they could be represented by humans. As biodiversity is a concern for several people, the negotiations would involve too many actors, which is obviously absurd. The question can be easier addressed through environmental evaluation, as people's preferences can reflect several values attributed to the biosphere.

The farmers can be described by different parameters according to their performance in production and also in multifunctionality. Ángyán (2007, p.27) points out that the emphasis switches between the productive performance and the eco-social performance of agriculture according to whether the geographical area involved "on the one hand is of high agricultural potential and low environmental sensibility or on the other hand is of low production potential and high environmental vulnerability, furthermore it is usually struggling with social and employment problems, nevertheless it is of great natural values".

The expansion of the agricultural frontier constituted an irreversible loss of natural capital. However, on the other hand agricultural landscape is valued by many as open space (Shortle és Abler, 1999). According to Warren, Lawson and Belcher (2008) it is widely recognised that both the past expansion of agricultural production and the intensification of modern agricultural practices have had a profound impact on the natural environment. Csete and Láng (2005) accentuate that increased emphasis on production levels leads to excessive intensification of agricultural practices, resulting in the overuse of those natural resources (soil, water, air) on which agricultural production is based on.

Pretty et al. (2000, p.114) accentuate five features of the types of externalities encountered in the agricultural sector:

- „their costs are often neglected;
- they often occur with a time lag;
- they often damage groups whose interests are not represented;
- the identity of the producer of the externality is not always known;
- they result in sub-optimal economic and policy solutions".

Regarding the above list put forward by Pretty et al. it is noted here, that the first and the last elements are a typical feature of nearly all types of externalities.

Perhaps it is no coincidence that only relatively few attempts have so far been made to value in quantitative terms the thorough environmental impacts of agriculture (see III.3). There is a considerable shortage of data, as the EEA concludes, on the character and magnitude of many environmental issues. Changes in biodiversity and landscape are two prominent fields.

Valuation of externalities is burdened with difficulties for several reasons. It would be essential to know all environmental goods and services and the related non use values. The pioneering experiment of Costanza et al. (1997) demonstrated what methodological hurdles monetary valuation of natural resources needs to face.

II.2. Specifics of externalities associated with crop production

Warren, Lawson and Belcher (2008, pp.151-156) present a lengthy and detailed analysis concerning the characteristic features of each of the farming technologies (organic, permaculture, integrated farming, etc.). It appears from this discussion that the borderlines between these technologies are blurred, and that farming intensity levels are not precisely defined. The authors are only able to provide rough outlines regarding the characteristics of environmentally sound farming (and the same can also be said about the key features of conventional farming). According to a definition formulated by Füleky (1999, p.142), "the opposite of crop rotation is the monocultural agricultural production system, where a specific plant species is being grown for several years on the same area". Within plant cultivation, industrialized (also known as intensive) farming is characterized by "high-efficiency specialization, with the aim of achieving high average yields by using large quantities of chemicals and only little live labour" (Füleky, 1999, p.143). On the other hand, the author claims that ecological (also known as organic) farming can be distinguished "by the use of as much materials of natural origin as possible; by the retention of nutrients to the maximum possible degree within the farm and within the soil-plant-animal cycle; and by the exclusion of chemical fertilizers and pesticides use" (Füleky, 1999, p.144) (Table 1).

Table 1 Materials used in the nutrient supply and plant protection of each of the farming modes

	Intensive	**Organic**
Fertilizing	mineral fertilizers	exclusively livestock manure
N chemical fertilizing	economical optimum	none
Plant protection, weed control		
- mechanical	limited	exclusively
- herbicides	yes	no
- natural	if economically optimal	as much as possible

Source: relevant parts based on Füleky (1999, p.143)

Huylenbroeck et al. (2007) accentuate that the ecological impact of multifunctional agriculture is little studied and hard data are scarce. Warren, Lawson and Belcher (2008) expound that agriculture is a substantial source of pollution, hence its impact on natural environment; namely quality (in same cases quantity as well) of air, water and soil is significant. As seen previously (section I.1), Romstad et al. (2000) describes the various functions of agriculture. Regarding the importance of environmental impacts Glebe (2007)

distinguishes on the one hand negative non-market effects on water, air, soil and biodiversity and on the other positive non-market effects on food security, food safety, cultural landscape, rural development, and biodiversity (including fishing and hunting services). The author further concludes that food safety, food security and rural development are distinguishable from agricultural production; therefore in the assessments of impacts these can be detached from agricultural production. Based on this line of reasoning our assessment covers the following externalities:

- negative non-market effects on water, air, soil and biodiversity;
- positive non-market effects on agricultural landscape and biodiversity.

Interestingly, following the above line of reasoning, both positive and negative externality may be associated with biodiversity. This, obviously, is a matter of interpretation, depending on our choice of baseline as a point of reference and in which direction the change is interpreted. If we relate to the current decreased biodiversity, some agricultural technologies may bring improvements, however, if our point of reference is the state without agricultural impacts, the reverse is true.

In the followings it is discussed what impacts of crop production have on individual elements of the environment. Impacts often cohere, so the following sections many times overlap with one other. Some impacts, which are particularly relevant in the assessed area, Middle-Mezőföld, are discussed in detail (e.g. nitrification).

II.2.1. Soil degradation/destruction

Soil is a conditionally renewable resource, i.e. it is capable of counterbalancing some small damage, but its renewal will not happen automatically (see Várallyay, 1997). Agricultural practices may have the following main effect on soils (Szabó and Pál, 2007): erosion, soil acidification (use of artificial fertilizers), reduction of the organic matter content, deterioration of the soil structure, secondary sodification (irrigation), enrichment of harmful materials (heavy metals). Based on EEA (2004) the main pressures on soil caused by agriculture are compaction (due to the use of heavy machinery), diffuse contamination with chemicals (pesticides), acidification (caused by ammonia emissions) and erosion.

EEA finds that because of the general decrease of agricultural production intensity the first three problems have become less prominent in Central and Eastern Europe. Further it is erosion only where more detailed information is available. Since 1950, due to inappropriate land use (land consolidation, field enlargement (amalgamation), inappropriate machinery and tillage practices) and natural vulnerability soil erosion has increased in the region.

Additionally, Láng[11] notes the decrease in natural nitrogen content of soils. Food production has profoundly disturbed nitrogen cycle. The massive perturbation in the nitrogen cycle by nitrogen fixation of anthropocentric activities is considered by an increasing number of ecologists as large-scale nitrogen pollution of the environment. As a consequence, many habitats are now regarded to be polluted with nutrients from agricultural activities (Warren, Lawson and Belcher, 2008). The authors note that the effects of increased nutrient availability on species diversity and plant community composition are well documented. Bobbink, Hornung and Roefofs (1998) describe the impacts of atmospheric deposition of nitrogen.

Among agricultural practices crop rotation and its beneficial environmental effects must be noted. Based on Ángyán (2001) crop rotation is beneficial for soil organisms and soil productivity as well as different crops followed one another in sequence. Besides, the author accentuates the role of field protective shelter belts and field margins (field strips or conservation strips) as well as their soil protection and other beneficial ecological effects.

Soil erosion is given a particular emphasis here as this is a soil related impact which externality is associated with. Erosion may be most significant in the case of arable crop fields with frequent soil disturbance and lack of soil protective vegetation (see Ángyán and Menyhért, 1997; Stefanovits, 1977; Várallyay, 2001). The destruction of soil is detrimental to plant community compositions and the diversity of life in soils. Deflation (wind erosion) may also cause damages in agriculture and in other sectors (see damages to vehicles or buildings caused by earth carried by wind).

Contrary to most external impacts of agriculture (e.g. water or air pollution), on-farm costs of soil degradation is principally borne by the owners of land (farmers) rather than society at large. Provided that farmers (land owners) have sufficient information about the impacts of farming practices on soil and there is a well-functioning market for agricultural inputs and outputs, according to Shortle and Abler (1999) land degradation does not present any environmental externalities. Disagreeing with the author's assertion in one respect, it must be noted that eroded soil may be transported on to field margins, neighbouring habitats or loess-valleys[12] (Horváth, 2002). Moreover, run-off from agricultural land may enter sewage systems, reservoirs or water bodies eventually causing siltation (i.e. sediment).

[11] Oral information by Láng I., 2009.

[12] All valleys-chains are surrounded by arable fields, therefore loess-valleys are impacted by surface water run-off from the direction of the arable fields. Rainwater entering valleys carry substantial portion of soils from arable fields, containing pesticides and artificial fertilisers (Horváth, 2002). Following heavier summer showers and rainstorms the magnitude of rainwater run-off (and silt) entering the valleys may be substantial (Marosi 1959).

In conclusion, *in situ* soil degradation is not considered an externality, since its negative impacts are principally borne by farmers, however, *ex situ* damages, i.e. eroded soil transported to other areas (see loess-valleys and siltation), are considered an externality because these costs are borne by society in general[13].

II.2.2. Impacts on ground- and surface waters

Agriculture may have negative impacts on both water quality and quantity. Among the main environmental problems in Central and Eastern Europe characterised by EEA (2004) the followings are relevant here. Due to the poor management and excessive application of mineral fertilisers and animal manures diffuse pollution of ground and surface waters with nitrates and phosphates may be important, especially on highly vulnerable soils. Local problems may persist. Due to poor application and management another problem is point source pollution of ground and surface waters with pesticides. Use of contaminated water for irrigation may pollute land. Further, the study notes that data on pesticide residues concentrations are currently not available. Due to intensive cropping and livestock production nutrients related pollution, despite its decreasing tendency since the transition to market economy, remains to be a serious threat to water quality. Pollution will continue to be found, as the EEA concludes, until management practices are changed and environmental requirements are enforced.

Phosphorous can easily enter water bodies. Phosphorous entering fresh-water bodies may cause eutrophication. Eutrophication is a consequence of nutrients (especially phosphorous and nitrogen) accumulated in surface waters. Artificial fertiliser ingredients may enter surface waters through the loss of soil through erosion and leaching. According to Ángyán (2001) in a given year only 50-60% of nitrogen and 10-15% of phosphorous input to farming systems are taken up and removed as output in crop products. The remaining substantial volume either fixed in soil or leach into water bodies (groundwater, surface water).

It is emphasised that eutrophication is not covered in this dissertation. Our decision is primarily based on the fact that this impact in not relevant in the assessed region (Middle-Mezőföld). Middle-Mezőföld is located relatively far from fresh-waters bodies so locally, eutrophication is not a significant problem.

[13] Regarding soil deterioration, the point may be raised that organisms living in soil may also be negatively impacted, and soil degradation may contribute to the deterioration of diversity of life in soils. This impact, however, is indirectly detected in the deterioration of soil quality, for 'extinct' lifeforms in soil may negatively influence (impede) farming.

Among impacts on ground- and surface water, nitrification is especially relevant in Middle-Mezőföld, therefore this topic is assessed in more detail. The use of fertilizer and pesticide14 may have a negative impact on natural water bodies. In the case of groundwater the main agricultural pollutants are nitrates and, to a lesser extent, pesticides (Glebe, 2007; Shortle and Abler, 1999). Nitrogen may contribute to water contamination in so far as nitrate leaches from the soil into groundwater. Leaching of nitrate is determined among other things by farming practice (choice of crops, crop rotation, soil cultivation, irrigation, fertiliser use, timing etc.). Where groundwater is the primary source of drinking water increased levels of nitrate constitute a potential health risk. It is not surprising that in 1980 maximum allowable level of nitrate (50 mg NO3/l) in drinking water was introduced in the EU. From 1991 onwards in nitrate vulnerable areas the use of artificial fertiliser and manure is restricted in the EU. Ángyán (2001) lists three fundamental sources of nitrate:

- Sewage, sludge and artificial fertilisers, which directly enter ground and surface waters through treatments or irrigation.
- Atmospheric deposition of nitrogen as a natural process.
- Mineralization of organic matters in soils, which process is speeded up if decomposition of organic compounds in an oxygen-rich environment or nitrification is increased. This may be triggered by frequent disturbance, cultivation or tillage of soil.

Ángyán (2001) asserts that nitrate pollution may not entirely be attributed to the intensification of agriculture (artificial fertiliser use), nevertheless it is one of the primary causes. Füleky (1999) points out that from the early 1980s in Hungary the deterioration of water quality was associated with fertiliser use. Sisák (2008, p.3) accentuates, however, that "efficient instruments for preventing nitrate pollution from non-point agricultural sources are available and widely known". According to Warren, Lawson and Belcher (2008) 50-80 % of nitrate leaching into European water bodies can be attributed to agriculture. Schreiber et al. (2003) assessed nitrogen and phosphorous emissions in the transboundary Danube river basin in the period of 1998 and 2000 and found that nutrient emissions caused by agricultural activities into the Pannonian Danube and its tributaries (from Nussdorf to Upper-Tisza) was 2.1 times of background level in the case of nitrogen. On this 60.4 thousand km^2 2.76 kg/ha/year nitrogen from agricultural activities was emitted to the Pannonian Danube and its tributaries, while total diffuse emission was 4.14 kg/ha/year.

[14] Pesticides pose a threat to life forms in water bodies and human health. In 1988 the EU Directive (98/83/EC, drinking water quality directive) set quality standards for pesticide residues in drinking water (0,1 μg/l).

These figures show that in the assessed area two-thirds of nitrogen emissions was attributed to agricultural activities in the period of 1998 and 2000.

Nitrate contamination of drinking water in Hungary became widespread in by the decade of 1980s. The number of nitrate contaminated drinking-water pumps were nearly 100 in 1983. Based on KvVM (2005) approximately 70% of monitoring pumps in settlements in Hungary showed a level of contamination greater than 50 mg/l. The accumulated impacts of fertiliser and manure applications in the past 20-50 years can be detected in the water pumps in agricultural areas. The shallower pumps (<20m) show a sporadic nitrate contamination, while in pumps of higher depth a level of contamination greater than 50 mg/l was measured in a couple of instances only. Based on drinking water related reports Füleky (1999) describes, that in 15-20% of villages in Hungary groundwater was severely contaminated and nitrate contamination in many areas in Hungary reaches a level between 50 and 200 mg/liter, moreover, in some places 500 or even 1000 mg/l was measured, despite the fact that water quality standards regard a level of contamination of 20 mg/liter as acceptable and 40 mg/liter as tolerable. It is noted tough that considerable efforts have since been put into increasing drinking water quality. The Water Framework Directive (2000/60/EC) prescribes that surface water bodies meet the condition of good ecological status by 2015. Warren, Lawson and Belcher (2008) consider it likely that the directive will have a huge impact on agricultural practice, such as the use of fertilisers and manure or control of run-off and soil erosion. In certain cases, the authors purport, in order to meet the requirements set out in the directive, the removal of land from agricultural production may be the only solution.

II.2.3. Air pollution

Concerning air pollution associated with agricultural activities, in terms of their relative importance, it is greenhouse-gas and ammonia emissions as well as surplus of nitrogen that need to be mentioned.

Agriculture contributes to climate change by the emissions of three greenhouse-gases; emissions from agricultural activities of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are all substantial. Animal farming (rumination, manure treatment) and rice cultivation are primarily responsible for methane emissions. Carbon dioxide emissions were mainly due to land use changes. Carbon stored in soil and plants were released to air as a result of land use change. This source is not covered in this dissertation as land use change is not specific to modern agricultural production. Energy use is both directly and indirectly responsible for carbon dioxide emissions. Among other things emissions of carbon dioxide

(CO_2) and nitrous oxide (N_2O) are associated with diesel consumption of various agricultural machinery. Electricity use, dependent on the type of fuel used in electricity production, also produces various air emissions (CO_2, NO_X, SO_X).

The production of nitrogen fertiliser and its raw materials (ammonia and nitric acid) involves emissions of greenhouse gases (CO_2, N_2O) and nitrogen oxides (NO_X), while its and application involves emissions of ammonia (NH_3) and nitrous oxide (N_2O), the latter which is released directly from the soil as a result of decomposition processes. Therefore, fertilisation with green manure is also associated with emissions to air (see Szabó and Pál, 2007). Manure (organic manure, slurry) spread on agricultural fields involves emissions of ammonia to air.

Warren, Lawson and Belcher (2008) expound the excessive amount of nitrogen applied over agricultural fields due to increasing use of nitrogen fertilisers over the past 60 years. This surplus of nitrogen can be measured by the imbalance between the amount of inputs and outputs. The authors conclude that the surplus is usually lost to the environment. (The problem is most severe around intensive animal farms.) Atmospheric accumulation of nitrogen may lead to acidification. It is noted that after the transition to market economy in the 1990s in Hungary application of artificial fertiliser, and as a consequence, also surplus of nitrogen lost to the environment have decreased substantially.

Through the process of denitrification nitrous oxide (N_2O) is formed in the soil out of nitrate which subsequently diffuses into the air. Therefore, emission of nitrous oxide is due indirectly to (excess) use of nitrogen fertilisers (EEA, 2004).

Ammonia (NH_3), being very reactive, after changing, may have adverse effects on ecosystems, since it often leads to potassium or magnesium deficiencies, or may act as a plant nutrient, contributing to increased weed cover (Glebe, 2007). Ammonia emissions also contribute to eutrophication and acidification. Ammonia emissions are primarily caused by animal farming, however, manure spreading on fields also releases it to the atmosphere.

II.2.4. Impacts of pesticide use (human health)

The U.S. Environmental Protection Agency defines pesticides as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pests can be insects, mice and other animals, unwanted plants (weeds), fungi, or microorganisms like bacteria and viruses. Though often misunderstood to refer only to insecticides, the term pesticide also applies to herbicides, fungicides, and various other substances used to control pests.

Pesticides may have a negative impact on wildlife (agro-ecosystems) and human health (Travisi and Nijkamp, 2008). Pesticides may endanger human health, firstly, through direct exposure, secondly, through entering the environment, and thirdly, through residues on food (Tegtmeier and Duffy, 2004). Based on literature, Warren, Lawson and Belcher (2008) describe the considerable damage of pesticide use to wildlife; many species of mammals, birds, invertebrates and plants are directly and indirectly impacted. Damages to wildlife are not restricted to agricultural fields but may extend to field margins (conservation strips) and adjacent semi-natural habitats. Some of the active substances (active ingredients) of pesticides currently on market may represent a threat to human health. Poisonings associated with pesticides may be incidental, profession related or water-, soil- and airborne (Bordás, 2006). Pesticide-residues entering human bodies through food consumption need to be underscored[15] (Pearce and Tinch, 1998; Pretty et al., 2000). Dési et al. (1983) stress that „effects of pesticides may aggregate and add to those of other substances, and it is inconceivable that a substance is absolutely risk-free". Although some information about acute effects is available in the literature, that of chronic effects are even rarer as the pesticide products (composition of active substances) are changed too often and epidemiology has little chance[16]. Information on human health effects of a low-dose pesticide intake (through nutrition) for an extended period of time (e.g. cancer) is especially lacking (Pearce and Tinch, 1998; MethodEx, 2007).

Apparently, the use of pesticides may have recently declined in Europe, statistics, however, will need to be taken with a pinch of salt as data on overall application masks the increasingly targeted and biologically active substance compositions. There are no available common units of measurement for pesticides based on commensurability of active substances, thus environmental impacts are difficult to commensurate.

II.2.5. Impacts on biodiversity

The term biodiversity refers to „the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part" (CBD, 1992, Art. 2). The concept includes diversity within species (genetic diversity) , between species and of ecosystems as well as functional diversity (Nunes, van den Bergh and Nijkamp, 2003). "Biodiversity contributes directly

[15] The Hungarian Central Agricultural Office (Mezőgazdasági Szakigazgatási Hivatal, 2007) states that due to pesticide-residues content being found above thresholds and thus breaching official limit values, 0.9% of samples in Hungary is classified problematic. While due to the use of unauthorised pesticide products, 0.3% of samples in Hungary is classified so.

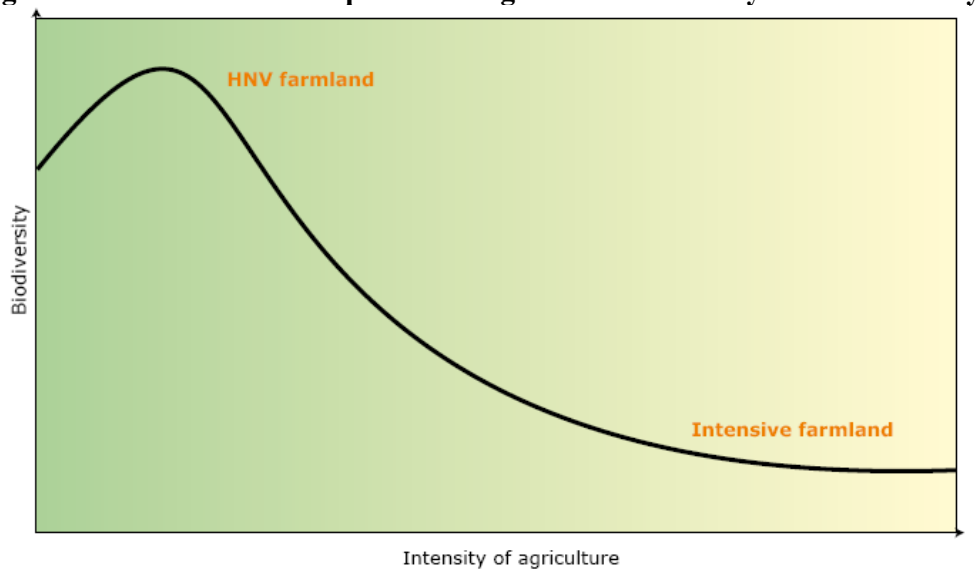
[16] As set out in a European Union directive adopted in 2009 and to be implemented in national legislations by 2011 the use of certain chemicals will be gradually put to an end (EP, 2009).

(through provisioning, regulating, and cultural ecosystem services) and indirectly (through supporting ecosystem services) to many constituents of human well-being" (MEA, 2005, p.5). Declining biodiversity damages the functioning of ecosystems, which leads to both quantitative and qualitative deterioration of essential ecosystem services.

Only lands that have over the past hundred years been continuously under agricultural production are covered in this dissertation, so earlier drivers of decline in biodiversity (expansion of agricultural frontier resulting in conversion of natural areas to agricultural land) fall out of reach of our assessment.

Around 1700 to 1800 a plateau of high biodiversity was reached in Europe after agriculture "opened up" forested landscapes (EEA, 2006). As Figure 2 shows biodiversity decreased as agriculture intensified (the initial increase in biodiversity is attributed to the opening up of forest cover a couple of hundred years ago).

Figure 2 General relationship between agricultural intensity and biodiversity



Source: EEA (2006, p.25) adapted from Hoogeveen et al. (2001)
Note: HNV – High Nature Value

In the second half of the last century, as Horváth and Szitár (2007) describe, due to the increasing in the intensity of agricultural land use biodiversity decreased and the structure and functioning of ecological systems deteriorated in Hungary. As reasons behind these processes, the authors underscore field enlargements (increasing patches of lands cultivated uniformly), use of pesticides and fertilisers and changes in grazing patterns. (As of field mosaics, see Jørgensen, 2006).

Agriculture, based on Ángyán (2001), may increase or decrease biological diversity. The author argues that the use of pesticides impacts biodiversity of agricultural lands the most, but field sizes and changes in the diversity of agricultural practices are also important

factors. Ángyán associates biodiversity increasing effect with changes in land use (new agricultural habitats instead of forested land), however our dissertation does not pursue valuing impacts that far back in time, so the biological diversity increasing effect is not assessed.

Ángyán (2001) describes that extensive farming methods provide favourable living conditions for some plant and animal species. These conditions for instance are: higher rate of natural vegetation cover; natural nutrient content of soil (corresponding to the type of soil); higher structural diversity; slow changes; low level of nutrient input; lack of or low level use of plant protection products (pesticides); and 'conventional' methods (e.g. late-season reaping).

Besides decreasing the area of natural habitats, agriculture also contributes in other ways to the decline in biodiversity. Robinson and Sutherland (2002) list four elements that decreased the availability of suitable habitats for several species of mammals, birds, invertebrates and plants and consequently reduced the diversity of farmland. These are: due to the polarisation of arable and animal farming the structure and scale of the agricultural landscape changed, therefore the diverse small-scale mixture of habitats (cereals and grassland) declined; subsidies led to huge changes in types of crops and production patterns, mechanisation allowed the simplification and concentration of farming operations into a shortened period of time (previously, cereal stubbles could not be ploughed immediately); increasing level of inputs (fertilisers, pesticides) allowed the continuous production of one crop on the same field (see Warren, Lawson and Belcher, 2008).

The changes were very rapid and subsequently radically changed the appearance of rural landscape. Warren, Lawson and Belcher (2008) accentuate the reduction in both spatial and temporal diversity in agricultural landscape, which as a consequence few species were able to adapt to. Further, the authors argue, it is increasingly recognised that, in the conservation of several habitats and the species they support, low-intensity farming systems are of crucial importance. Henle et al. (2003) point out that changes in the scale and organisation of farming practices (monocultivation, loss of landscape heterogeneity, and destruction of ecological corridors) deteriorate natural habitats adjacent to arable fields (see Horváth and Szitár, 2007). Based on Ángyán (2001, p.150) many of the reasons behind agriculture threatening and/or reducing biological diversity are associated with intensity in land use and farming practices which do not respect, thus abuse the natural endowments of fields or environmental sensitivity. The author lists several factors: ever more intensive land use, of which results in decreasing natural habitats for wildlife; a disappearance of a single species may lead to endanger other species depending on it in the food chain (the extinction of a

single plant species leads to an estimated decline of on average approximately 30 specialised different organisms); species living in soils under agricultural cultivation are in general not investigated, not taken into account; spreading of monocropping; introduction of non-native (invasive) species; grazing of excessive intensity; use of pesticides (use of artificial fertilisers may have similar impacts); modern veterinary treatments (medicine residues; soil deterioration due to improper soil cultivation technologies; draining of wetlands; farm and field sizes determined corresponding to economics of size; intensity of farming practice. Moreover, Ángyán underscores that the above list of factors not just alone, but in combination with one other reinforcing one other impact on biological diversity. Additionally to the above, Glebe (2007) lists the increase in plot size and the removal of hedges as reasons behind a decline in the diversity of plants and animals. The author concludes that the impacts of farming on landscape and biodiversity are mainly determined by the type of farming system considered.

The change in arable weeds composition is a main element of the impacts on biodiversity. Warren, Lawson and Belcher (2008, p.60-61) note that as a result of the decline in the arable weed flora the availability of a valuable food resource for birds decreased. Prior to intensive, modern crop production technologies, a variety of weed species existed on arable lands, but were subsequently removed by among other things the use of synthetic herbicides and fertilisers as well as changes in the timing of cultivation, and consequently, as the authors put it, “the agricultural landscape has become increasingly uniform in nature”.

Perhaps, one of the most tangible impacts of changes in agricultural practices is the observed decline in the population and diversity of farmland bird species. Based on Warren, Lawson and Belcher (2008) the population of farmland bird species declined by 45% in the period of 1970-1999 in the United Kingdom. The decline is attributed to several factors: the loss of habitats adjacent to agricultural fields (field margins, hedgerows, shelterbelts); changes in grassland structure; decrease in food supplies (availability) due to increasing use of pesticides; switch from hay to silage making and the subsequent uniform grassland as well as reduced availability of winter feed resulting from the change from spring- to winter-sown cereals.

In view of many species of wildlife field margins (weedy field strips adjacent to arable fields), forest belts and shelterbelts, in other words those remaining semi-natural patches of habitats can be considered islands stuck between intensively cultivated, practically uninhabitable arable lands. Horváth and Szitár (2007, p.23) stress that environmental impacts of modern industrial agriculture are “most severe in the case of remaining semi-

natural field margins and patches of habitats stuck between large-scale arable fields". Findings of Ryszkowski and Karg (2007) underscore the role of these biogeochemical boundaries in sustaining biodiversity.

Some habitats are more dynamic than others, despite the fact that change is considered a universal constant. Accordingly, Warren, Lawson and Belcher (2008) describe how evolution has equipped those species which inhabit rapidly changing environments (sand-dunes, retreating ice-sheets, recently active volcanoes) with the ability to cope with disturbance and change. These habitats aside, species need not have to adapt to rapid changes. Without human interference, large-scale disturbance events are generally rare. Agricultural land are composed of rapidly changing, complex mosaics, and as Warren, Lawson and Belcher (2008, p.169) put it "the farmed landscape is the most dynamic and managed of all landscapes". Further, the authors assert that species typically associated with agriculture tend to be highly mobile and less habitat-specific than those found in the islands of semi-natural habitat.

As regards the impact of agriculture upon nature, Hodge (1991, p.183) states that "most conservationists could probably agree on what changes would constitute improvements within a given context". Conversely, we know relatively little about the impacts of the different agricultural technologies upon biodiversity. On this subject, the most comprehensive investigation so far was conducted by Hole et al. (2005). Upon reviewing the relevant literature, they have not found clear correlations between environmentally sound farming and higher biodiversity. Results showed that as compared to lands cultivated by conventional methods, on areas of organic farming the density of populations and/or species richness was higher in 66.7 % of all cases and lower in 8 % of the cases, while no changes were experienced or changes in both directions occurred in 25.3 % of all cases (see Tóth and Báldi, 2006, p.23). In a review of studies, Bengtsson et al. (2005) showed that on average, species richness was by 30 % higher on organic farms than on conventional ones. It appears that less intensive farming methods not only benefit species richness, but also promote population sizes, as organisms were by 50 % more abundant on areas with organic farming. However, they also found that in 16 % of all studies organic farming was associated with a decline in species richness (see Warren, Lawson and Belcher, 2008). A Hungarian survey by Báldi and Faragó (2005) concluded that the intensification of agricultural production reduced the size of brown hare and partridge populations. Sturrock (1981) claims that on account of the impacts of ecosystem services, good shelters boost crop yield by 35 percent in New Zealand (see Sandhu et al., 2008). From the foregoing it is

evident (and Podmaniczky[17] also stresses) that further research work is needed in the field of monitoring.

II.2.6. Impacts on landscape

Agriculture, being one of the major land user, plays a prominent role in shaping the appearance of landscape. Based on the definition by OECD (2001b) agricultural landscapes are the visible outcomes from the interaction between agriculture, natural resources and the environment. Landscape structures or appearance include environmental features (e.g. habitats), land use types (e.g. crops), and man-made objects or cultural features (e.g. hedges).

Hodge (1991) notes that, as a consequence of its definition, landscape gains its value from its scale. The pleasing view of landscape is a result of the relationships between and the combination of its components (trees, hedges, water courses etc). Accordingly, important elements of the value of landscape are comprised of its cultural, historical or ecological contexts. The notion of a cultural landscape, as Glebe (2007, p.90) defines, is not a static concept, but involves natural and cultural process. Quoting Jones and Daugstad (1997, p.270) the author notes that it is widely recognised that "a cultural landscape can be viewed as a historical development which had left remnants of different land uses from different time periods". Many view agricultural landscape as a preserver of open space and, complemented with shelterbelts, enhances the provision of aesthetic value of European land. Traditional agricultural landscape, therefore, constitutes a positive externality (Glebe, 2007; Shortle és Abler, 1999).

Traditional landscape in Europe after the Second World War moved towards modern agricultural landscape. The former can be characterised by smaller farms with more diversified and extensive production systems, while the latter by large, specialized and highly productive farm units. As Glebe (2007) describes the number of farms declined, while the average farm size increased and traditional landscape was transformed into less diversified, larger-scaled landscapes, featuring fewer boundaries. The author stresses that although people's opinion on what constitutes the best quality landscape may be divergent, most publications attach a positive value to traditional landscapes, for their provision of identity, personality, and cultural significance for local communities in Europe. Based on Jones and Daugstad (1997) Glebe (2007) asserts that few publications associate modern landscapes with positive attributes, these are largely regarded as negative. The reason

[17] Oral information by Podmaniczky, L., 2008

behind this is, according to the author, that traditional cultural landscapes are mainly characterized by cultural-historical variation, while a more uniform and homogeneous structures are attached to modern agricultural landscapes. The diversity of landscapes is associated with vertical and horizontal coherence, colors, and forms.

Based on IEEP (2002) reports on Central and Eastern Europe the EEA (2004) finds considerable landscape changes and lists threats to landscape diversity among other things as follows: removal of (linear) landscape elements due to field enlargement; overgrowing by shrubs, weeds and forests following land abandonment; simplification of cropping patterns, specialisation of farming, monocultures; lack of maintenance of certain man-made landscape elements such as stone walls.

Warren (1995) notes that society considers ecological communities associated with former agricultural practices to be more aesthetically pleasing than those associated with modern agricultural practices. The author asserts that in the future the general public may look back nostalgically on the beautiful view of set-aside (uncultivated) land in the 1990s (see Warren, Lawson and Belcher, 2008).

In the case of landscape, it is usually not possible to exclude people from the appreciation of a landscape (public good), and consequently farmers are unable to sell these goods, hence are not incentivised in their production (prevention). As a result, landscape as a public good is inadequately provided by private producers in a conventional market (Hodge, 1991).

II.2.7. Other impacts

Besides the functions of agriculture discussed in chapter II so far, there are further functions as well (see section I.1). Agreeing with Glebe (2007) we believe that in the assessments of impacts they can be detached from agricultural production. Therefore, food safety (impacts of food quality on health), food security and rural development are not covered in this dissertation.

We are on the position that in theory market is adequate for maintaining and preserving agro-biodiversity, since option value is attached to local varieties. Local crop varieties may better adapt to the agro-ecological conditions of the given region, which may constitute a positive value to farmers. This value may be represented in market conditions. As a conclusion, agro-biodiversity is not included in our assessment. It is noted, however, that investigations of Bela et al. (2004) arrived at findings contradictory to our line of reasoning in the sense that observations showed that in some regions in Hungary local varieties had disappeared entirely. Thus, we believe further research is needed.

II.3. Reviewing literature on valuation of environmental impacts of agriculture

By way of introduction it is noted that studies available in the literature are difficult to compare to one other, as well as to what is pursued in this dissertation. Applying different methods makes comparisons difficult. Studies mostly focus on negative externalities and to the best of our knowledge, bar Hartridge and Pearce (2001) no attempt is made to include positive externalities in the valuation. Altogether three studies (Pretty et al., 2000; Tegtmeier and Duffy, 2004; Hartridge and Pearce, 2001) are considered relatively comprehensive, which pursue valuation of total environmental impacts of agriculture. These three studies are reviewed in detail in the following subsection. All three of them used aggregated data and pursued a national level valuation, while our aim is to follow as far as possible a bottom up approach with the use of farm level data. Moreover, none of the studies reviewed pursue distinguishing farming technologies.

Studies reviewed in subsection III.3.2 cover some of the agricultural impacts only. Despite not being comprehensive, it is considered worthwhile to briefly review them, because many of these studies carry out assessments of individual agricultural impacts to greater depths.

II.3.1. Valuation of total environmental impacts of agriculture

There have been several attempt at estimating and valuing externalities in agricultural production (Pretty et al., 2000, 2001; Tegtmeier and Duffy, 2004; Hartridge and Pearce, 2001; Pimentel et al., 1992, 1995; Steiner et al., 1995; Fleischer and Waibel, 1998; Ribaudo, Horan and Smith, 1999; Foster et al., 1998; Foster and Mourato, 2000; Travisi and Nijkamp, 2008; Hanley, 1991; Crutchfield, Cooper and Hellerstein, 1997; Hackl and Pruckner, 1997; Drake, 1992; Christie et al., 2006). Most of the studies resorted to estimating some of the externalities (soil erosion, pesticide use etc.) only. In this respect, Pretty et al. (2000) may have been the most prominent one. The authors, however, did not evaluate the external impacts themselves; they resorted to those that give rise to financial costs. Only those financial costs in the United Kingdom were estimated at a social level, which arise at tackling damages resulting from externalities. Thus, the authors argue, uncertainties with valuation in hypothetical markets may be overcome. This approach arrived at a conservative estimate of measured external costs, since estimating costs associated for instance with acute and chronic health incidences or restoration of the environment involves high uncertainties. Obviously, the method applied by the authors did not allow for measuring and estimating positive externalities.

Pretty et al. (2000) assessed two types of damage costs incurring financial costs: on the one hand treatment and prevention costs, on the other hand administration and monitoring costs. Neither positive externalities nor additional private costs borne by farmers themselves (e.g. increased pest or weed resistance to pesticides) were included in the estimations. Estimated externalities comprised 89% of average net farm income, amounting to 208 GBP per hectare per year. Within this, estimated average external cost of arable crop production amounted to 229 GBP per hectare per year (55 thousand HUF, applying the exchange rate in 1996). Results were dominated by emissions of nitrous oxide (N_2O). Substantial damage costs are associated with emissions of methane (CH_4), pesticides entering sources of drinking water and removal of hedgerows and drystone walls. Table 2 shows estimates of Pretty et al. (2000) which we recalculated to hectare basis and narrowed down to include crop productions figures only.

Table 2 Estimated annual external costs of arable crop production in the UK in 1996 (GBP/ha)

Cost Category	GBP/ hectare, (1996)	Range (1990-1996)
Damage to Natural Capital: Water		
Pesticides in sources of drinking water	21	15-23
Nitrate in sources of drinking water	1.7	0.9-3.6
Phosphate and soil in sources of drinking water	6	2.4-9.8
Eutrophication and pollution incidents (fertilizers, animal wastes, sheep dips)	0.7	0.4-0.8
Monitoring and advice on pesticides and nutrients	1.2	0.9-1.2
Damage to Natural Capital: Air		
Emissions of methane	31	27-41
Emissions of nitrous oxide	129	73-297
Emissions of carbon dioxide	5	3.8-9.3
Damage to Natural Capital: Soil		
Off-site damage caused by erosion	1.5	0.9-3.3
Organic matter and carbon dioxide losses from soils	9	6.4-15.3
Damage to Natural Capital: Biodiversity and Landscape		
Biodiversity/wildlife losses (habitats and species)	2.7	1.1-3.8
Hedgerows and drystone walls	11	8-13.3
Bee colony losses	0.2	0.1-0.2
Agricultural biodiversity	+	+
Damage to Human Health: Pesticides		
Acute effects	0.1	0-0.2
Chronic effects		
Damage to Human Health: Nitrate	0	0
Damage to Human Health: Microorganisms and Other Disease Agents		
Bacterial and viral outbreaks in food	9	5-13
Total	**229**	**145-435**

Source Estimates in Pretty et al. (2000) recalculated to hectare basis and including crop productions figures only.
Note: exchange rate of 1996, yearly average: 238.41 HUF/GBP (Source: MNB)

For several reasons the authors consider their assessment a conservative estimate of the true costs. Some cost categories are known to be substantial underestimates (e.g. limited to certain geographical areas); returning to pristine (i.e. original) conditions are prohibitively expensive (e.g. water pollution by pesticides) or can not be completely returned (e.g. biodiversity), thus restoration to acceptable levels only was assessed; estimates mostly accounted for use values only; and some damages arise with a time lag. Raising

methodological concerns in Pretty et al. (2000), Hartridge and Pearce (2001) accentuate substantial elements in the estimates of the authors, which, although debited to agriculture and due to mismanagement of agriculture incur social costs, should not be regarded as environmental externalities. Such substantial elements for instance are food risks or BSE (Bovine Spongiform Encephalopathy, or mad-cow disease).

Based on the methods applied in Pretty et al. (2000), another study was carried out to arrive at a monetary estimate of external costs of agricultural production in the United States. Tegtmeier and Duffy (2004) calculated external cost per cropland hectare at USD 29.44-95.68 (calculated in 2002 prices). The authors estimated technical externalities with public good characteristics. It must be noted that in our opinion the method applied, besides excluding several environmental impacts from the assessment, contain a fundamental methodological flaw. This flaw is revealed in the valuation of greenhouse gas emissions. In the interest of being conservative, in the estimations Tegtmeier and Duffy (2004) used USD 0.98 per ton of carbon dioxide equivalents. This value corresponds to the closing price for 2003 in the Chicago Climate Exchange. Although the authors note that participation in the Chicago Climate Exchange is strictly voluntary, they stop short of drawing conclusions from this fact. However the point is obvious; how can a market price used in the estimations, which market is not a function of real supply and demand (i.e. scarcity)? Emissions of greenhouse gases are not restricted in a mandatory form, thus, with no scarcity, there is no real demand for emission rights. With respect to this notion, a figure for emissions of carbon dioxide equivalents being so low is not surprising. Seeing the various available social cost estimates of CO_2 emissions, in our view the application of such a figure does not provide for a conservative estimate but a flawed one. As will be discussed later, relatively well-founded figures may be found in the literature (see ExternE, 1999 and 2005), and these are twenty times higher than the one used by Tegtmeier and Duffy. If this methodological flaw is corrected by using a more sound figure, lower bound estimates of external costs in Tegtmeier and Duffy (2004) will be doubled (USD 60.35-126.59).

Final conclusion of Tegtmeier and Duffy (2004, p.1) is that “the societal burden of these costs calls for the restructuring of agricultural policy that shifts production towards methods that lessen external impacts”. Moreover, the authors accentuate the need for comparative valuation studies allowing for comparing impacts of different production technologies (monocropping vs. diverse cropping systems).

Pretty et al. (2001) compared their own estimates to a German and a US study (Pretty et al., 2000; Pimentel et al., 1992, 1995; Fleischer and Waibel, 1998; Ribaudo, Horan and Smith, 1999). The authors found that average external cost of arable crop production was estimated

at 229 GBP per hectare in the United Kingdom, it was estimated at 68 GBP/ha in the US, and 166 GBP/ha in Germany (adjusted to 1996 prices). It must be emphasised again that only externalities giving rise to financial costs were estimated, and within those, substantial differences may be found in cost categories. The authors expound that with respect to positive external impacts there is no comprehensive valuation framework. Based on literature the authors suggest that annual external benefits were in the range of 10-30 GBP/household, and expressed on a per hectare basis 20-60 GBP/hectare (16-49 USD/household and 32-100 USD/hectare). It is important to note that no distinction was made in the above figures between arable lands and pastures. With respect to our research, it needs to be mentioned that these figures include costs which are categorised differently in our framework (i.e. impacts on biodiversity), nevertheless the authors consider their estimates conservative.

It is Hartridge and Pearce (2001) who comes closest to what we pursue in this dissertation. When estimating costs, Hartridge and Pearce based their assessment on willingness-to-pay studies, while both Pretty et al. (2000) and Tegtmeier and Duffy (2004) used treatment and prevention costs arising for third parties (restoring, returning the environment to its original state). Although Hartridge and Pearce (2001) extended the scope of their assessment to include positive externalities, they stopped short of moving beyond use values. Non use values were – decidedly – left out from the assessment. Estimated negative externalities in the United Kingdom (1072 million GBP/year) were twice as much as positive externalities (595 million GBP/year), but if illustrative figures for non-use value and option value were to be included (1.2 billion GBP/year), balance would be shifted towards positive externalities. The authors regard their estimates of damage to natural capital as almost certainly an underestimate. Methodological concerns may be raised regarding the authors' estimation of non-use values, for in our opinion it is not the same as multiplying values of willingness to pay per household also by non-rural households (as carried out in Hartridge and Pearce 2001). It is also surprising that biodiversity and landscape impacts only amounted to 3.5% of negative externalities (38 million GBP/year). Assessments were carried out on national level only, so results were not expressed on a per hectare basis. Hartridge and Pearce (2001) found that despite methodological differences between Pretty et al. (2000) and their own estimates, the results of the two studies on negative agricultural externalities were fairly consistent. Further, the authors argue that the results are highly supportive of those who argue that modern agricultural production has "a major part of their justification in the provision of environmental services rather than food" (Hartridge and Pearce, 2001, p.30) (see importance of non-use values).

II.3.2. Valuation of individual environmental impacts of agriculture

Reviewing the literature and using qualitative methodology for valuation Glebe (2007) concludes that in Europe the overall environmental impact of modern agriculture characterized by intensively managed production techniques is negative. However, if agri-environmental policies are implemented there is evidence that the net environmental impact of European farming will be positive. The methodological shortcomings in Glebe's assessment are evident but also understandable, for not being primary research, the author relied on literature only (reviewing case studies), where research gaps are excessive.

Proxy variables for environmental impacts of pesticide use such as volume of active substances applied or expenditure on pesticides are widely used. The assumption behind these proxies implies that environmental damage is directly proportionate with the quantity of pesticides used, irrespective of their specific chemical compositions and formulations. Brethour and Weersink (2001) conclude that due to the costs of measuring and monitoring its effects, it is not possible to accurately determine the actual damage of a pesticide used. Instead, damages are measured through changes in the relative risks in relation to environmental and human health categories.

Besides epidemiological difficulties, pesticide use practices are diversified and change quite often posing further problems. Therefore the majority of damage cost estimates of pesticides found in the literature are simply based on willingness to pay surveys (MethodEx, 2007).

Páldy et al. (1988a) analysed health effects of exposure to pesticides in four typical agricultural villages in Hungary. The authors showed that pesticides poisonings were most frequent among both pesticide applicators and general population in the village where pesticide use were highest. Reviewing epidemiological literature Páldy et al. (1988b) found that in relation to the extent of exposure to pesticides health incidents were highest among pesticide applicators. Relative risk was reported to be around 5-6, meaning that among pesticide applicators the chance of a health incident was five to six times higher compared to an 'average' citizen.

Foster et al. (1998) applied contingent ranking method to value the avoidance of pesticide residues in food as well as the concern for the safety of birds. Willingness to pay estimates shows that the damage cost of one kg pesticide amounted to GBP 12 (see Hartridge and Pearce, 2001).

Foster and Mourato (2000) using contingent ranking found that an average British household was willing to pay 3 Euros per year to avoid one case of human illness. Travisi

and Nijkamp (2008) applying choice experiment method to the same proposal found willingness to pay of an average North-Italian household of about Euros 5.1 per year. Based on this, the authors estimate willingness to pay (WTP) of an average Italian household at Euros 1286 per year to eliminate all the cases of acute pesticide intoxication (250 cases a year).

A survey of 2000 respondents found that 5% of pesticide users had consulted a doctor for at least one symptom in the past year (Pretty et al., 2000). Estimating acute health incidents among farmers Pretty et al. (2000) found that external cost of pesticides per kilogram of active substance amounted to GBP 8.6 (33 GBP/hectare). External cost of pesticides per kilogram of active substance amounted to GBP 2.2 in the USA and GBP 3.9 in Germany (see Pretty et al., 2001). Results were dominated by pesticides residues in sources of drinking water.

Besides direct costs Pimentel et al. (1992) attempted to estimate indirect costs as well. According to the findings of the study annual environmental and social costs of pesticides use in the USA totalled approximately USD 8 billion (see Table 3). This corresponds to approximately USD 16 per kilogram of pesticides (i.e. not active substances). The authors accentuate that if the full environmental and social costs of pesticides could be measured, total cost would be significantly higher than the estimate presented. Further, they conclude that out of the USD 8 billion, approximately USD 5 billion is considered external costs.

Table 3 Total estimated annual environmental and social costs from pesticides in the United States

Cost categories	Million USD/year
Public health impacts	787
Domestic animals deaths and contamination	30
Loss of natural enemies (predators)	520
Cost of pesticide resistance	1400
Honeybee and pollination losses	320
Crop losses	942
Fishery losses	24
Bird losses	2100
Groundwater contamination	1800
Government regulations to prevent damage	200
Total	**8123**

Source: Pimentel et al. (1992, p.757)

In our opinion the authors' estimate of the costs of bird losses is based on applying arbitrary values. Out of the 67 million killed annually by pesticide Pimentel et al. (1992) placed the average value of a bird at USD 30, and this amounted to a total of more than USD 2 million in damage cost. The figure of USD 30, as the average value of a bird, is calculated 'somehow' by the money spent by bird hunters (216 USD/bird felled), spending of birdwatchers (0.4 USD/ bird), and the money spent on rearing and releasing a bird in the wild (800 USD/bird). However the authors are unclear on how this average value was arrived at. Based on Pimentel et al. (1992), Tegtmeier and Duffy (2004) estimated human health impacts of pesticide use on croplands at a level of USD 5.98 per hectare annually. This impact to human health translates to USD 2.26 per kilogram active substance. It is underscored that this figure only includes poisonings and deaths associated with exposure to pesticides.

Many of the pesticides are neurotoxic, therefore Rabl (2006) applied an analogy with lead (Pb) and mercury (Hg), two neurotoxic pollutants, for which the damage costs have been estimated. Reference dose of pesticides may be one to two orders of magnitude lower than those of lead and mercury. Applying intake fraction of 1.0E-04 Rabl argues by analogy to lead and mercury that the damage cost of pesticides might be on the order of 60 Euros/kg. The uncertainty is extreme, the author notes, with a confidence interval extending at least from 6 to 600 Euros/kg.

Many studies refer to Hanley's (1991) willingness to pay survey to value nitrate in drinking water. Hanley estimated willingness to pay at 12.97 GBP/household/year in a areas of East Anglia. Hartridge and Pearce (2001) note, however, that concentration level applied by Hanley (reducing nitrate concentrations below 50 mg per litre) is infrequent. Crutchfield, Cooper and Hellerstein (1997) estimated willingness to pay of households in the USA for a hypothetical water filter, which would filter and thus reduce nitrates in their drinking water to the EPA minimum safety standard. The authors found that households were willing to pay $45 to $60, per month. Additionally, respondents were willing to pay $45 to $70 per month for totally nitrate-free drinking water. With respect to the latter finding however, the necessity of pursuing a totally nitrate-free drinking water may be contested. Valuing the water quality improvements in lake Balaton, Hungary Mourato et al. (1999) found that willingness to pay amounted to approximately 1% of net income of respondents.

Pimentel et al. (1995) sought to estimate environmental and economic costs related to soil. Although assessing at a global level, thus their estimates are not relevant to our dissertation,

the authors found significant costs of soil erosion (*in situ* and *ex situ*) and estimated a cost/benefit ratio of 5.24 in the USA (i.e. benefits of controlling soil erosion is more than five times as much as its costs).

Reviewing literature Glebe (2007) came across four studies only which assess impacts on landscape on a local level and an additional two which assess social value of landscape on a national level. Eurobarometer surveys (EC, 2004, see Baylis, 2008) have shown a consistently high appreciation for the cultivated landscape. Hackl and Pruckner (1997, see Baylis, 2008) estimated the willingness to pay of rural tourists in Austria and found that respondents' willingness to pay exceeded local agri-environmental subsidies. Pruckner, presenting the results of the above survey of 1991, in another paper (Pruckner, 1995) estimates willingness to pay of tourists visiting Austria at ATS 9.2 (median: ATS 3.5) per person per day for benefits associated with agricultural landscape-cultivation. Drake (1992) used contingent valuation method to estimate the willingness to pay to preserve the agricultural landscape in Sweden. The author found that in 1986 respondents were willing to pay about SEK 541 (78 Euros) per person per year or expressed on a per hectare basis SEK 975 (140 Euros) per year. The willingness to pay estimates differed due to land use and regional location. The author thus concludes that subsidies should be determined on a per hectare basis instead of price support scheme.

II.3.3. Valuation of impacts on biodiversity

The Millennium Ecosystem Assessment (2005, p.6) asserts that „improved valuation techniques and information on ecosystem services tells us that although many individuals benefit from the actions and activities that lead to biodiversity loss and ecosystem change, the costs borne by society of such changes is often higher".

Warren, Lawson and Belcher (2008) describe what alternative methods of ascribing conservation value (biodiversity related value in our terminology) have been explored. Christie et al. (2006) applied willingness to pay estimates. Other approaches ascribe economic values to agricultural habitats based on the ecological functions and services that they provide to society at large, or relate to the cost of regaining the original environmental state or function of the habitat lost (e.g. Randall, 2002). Based on an important literature review Christie et al. (2006) show that the majority of surveys do not attempt to estimate the value of the diversity of biodiversity, rather, resort to estimate the value of a biological resource (a particular species or habitat, or an ecosystem service). It is not unambiguous

whether valuation surveys targeted to elicit WTP for of a biological resource at the same time value biodiversity itself? To avoid confusion and respondent fatigue from conveying a large volume of new information Christie et al. (2006) used a Power Point slideshow. The authors aimed for the valuation of anthropocentric (e.g. charismatic or rare species) and ecological (e.g. keystone or umbrella species) concepts, but reached no further than concluding that "it appears that the public does value most, but not all, of the biodiversity attributes" (Christie et al., 2006, p.315). Besides estimating WTP by a choice experiment survey, valuation workshops were also held, where the authors find that the extra discussions improved understanding of biodiversity related concepts and consequently allowed participants to state their WTP more precisely. However, this increased level of knowledge did not significantly influenced WTP. The choice experiment survey based on agri-environmental schemes (conservation headlands, reduced use of pesticides and fertilisers) showed in the form of increased taxes an average willingness to pay of households of 74.24 GBP/year for the assessed scenario.

In Macmillan et al. (2002) a contingent valuation survey are compared with a group-based approach, called the 'Market Stall'. The latter basically is a Deliberative Monetary Valuation (see later) used by the authors to estimate the value placed on wild-goose conservation. This method will be discussed later in our dissertation, nevertheless we believe the results can meaningfully be shown even before the approach are discussed in detail. Macmillan et al. (2002) applied six deliberative forums (DMV) with overall 52 participants, while 251 participants in the contingent valuation survey. Willingness to pay of DMV participants were 3.5 times lower (definitely pay 4.5 GBP/household/year, probably pay 8.8 GBP/household/year) than the interview estimates (definitely pay 15.2 GBP/household/year, probably pay 23 GBP/household/year). The authors allowed for respondents to indicate the degree of certainty about their responses and found that respondents who were interviewed were considerably more certain about their stated WTP than those who participated in DMV. We note, however, that the authors appear to be relatively uncertain how to interpret results.

Results of Desaigues and Ami (2001) show that local residents were willing to pay an average of 137 francs per person for the restoration of biodiversity in a riparian forest along the Garrone river. Since the stated values appear to best characterised by an outcome of a donation attitude, the authors interpret them as a minimum of social benefits, i.e. respondents stated a 'no regret' lump sum.

Reviewing the literature on contingent valuation Nunes, van den Bergh and Nijkamp (2003) found that valuations for single species range from $5 to $126 per household per year, and

for multiple species range from $18 to $194, however uncertainty about the values are very high.

The project NEEDS (2006) developed a habitat restoration cost approach. potentially disappeared fractions (PDFs) due to damages of land use changes and air pollution (SO_X, NO_X and NH_3) were estimated by restoration costs. The approach shows that external cost related to biodiversity of for instance an intensive arable land in Hungary to be restored to broad-leafed forest (target biotope) is estimated at Euros 3.94 per PDF and per m^2 [repair cost per PDF, €/(m^2*PDF)].

Spash et al. (2006) investigated respondent's valuation of biodiversity improvement (wetland) resulting from increasing river flows from a hydro-system (hydro-power) in Scotland. With the Theory of Planned Behavior, a concept of social psychology, applied as a major thread of the investigation, the explanatory power of the economic valuation model was substantially improved. While explanatory power of the normal model based on socio-economic variables resulted in adjusted R^2 of 0.22, the combined model including variables on deontological ethics and social psychology explained 57% of the variance (adj. R^2 = 0.57). It is noticeable that the explanatory power of the ethics model itself with variables on consequentialist and deontological ethics (adj. R^2 = 0.23) was nearly the same as that of the normal model based on socio-economic variables. The strong influence on WTP of ethical categories deviated from what "might be expected on the basis of standard economic explanations" (Spash et al., 2006, p.4). Respondents characterised by deontological ethics[18] were found to have the highest average willingness to pay (10.6 GBP), despite the fact that based on standard economic approach they were supposed to give protest responses. The authors therefore conclude that "intentions to pay cannot be easily interpreted as a trade price for environmental change or an economic welfare measure" (Spash et al., 2006, p.8).

[18] In the definition of the authors: strong species rights position. It is noted that Zsolnai (2001, p.95) defines *rights-based ethics* as ethical theories with respect to rights positions.

III. Critical assessment of methods applicable in valuation of the impacts on biodiversity

Lampkin's (1997) work on comparing environmental impacts of organic and conventional dairy farms is revealing (see Warren, Lawson and Belcher, 2008). When the comparison included some environmental factors only (e.g. energy use), conventional dairy was found to be of a lesser impact. But when the comparison was extended to include more factors (e.g. energy budget of fertiliser production for feed production), organic system scored better. Inclusion of food miles changed the balance again, and so on. Therefore it can be argued that all environmental factors are to be assessed (included) to the most possible extent. If some environmental impacts (factors) are not taken into account overall assessment results (social balance) may be distorted. A number of authors consider some factors only, and draw conclusions accordingly (see II.3.). However, we believe that this approach may lead to inappropriate conclusions; environmental assessments based on partial balance (inclusion of some factors only) may not generate results which are in line with assessments of all factors.

Considering the valuation of the outputs of multifunctional agriculture, Randall (2002) unequivocally underscores stated preference methods. The author suggests two strategies to estimate the value of multifunctional agriculture on a continental scale. In this dissertation, due to resource constraints, none of those strategies are achievable, rather, our intention is to provide a valuation scheme through estimates of two farms. Nevertheless, it is worth considering Randall's warning that independent estimation of the value of each component (function) of multifunctional agriculture is not the same as estimating the value in one area of all the aggregated components.

Randall (2002) also draws attention to the notion that getting 'green prices' wrong (i.e. overestimating) would entail welfare losses and trade distortions. The author defines the term green prices as the prices of agriculture's multifunctional output and its related subsidies (payments to farmers). The author purports that resource allocation and welfare will be altered for the worse if multifunctionality related payments are based on evaluations that are grossly inaccurate and imprecise. In the reasoning of Randall welfare loss may result from agriculture providing too much multifunctional outputs, or in other words too much protection of the environment. And making world prices decreased, in our oversimplified interpretation, trade distortions follow. Although both of these outcomes are deemed possible, we consider the consequences are of minor threat. We belive that the world is not moving in the direction where overemphasizing the environment (and culture etc.) poses risks (see e.g. Millennium Ecosystem Assessment, 2005) and besides, the

primacy of free trade is also deemed questionable (for the impacts of free trade on biodiversity see e.g. Alam and Quyen, 2007).

III.1. Total Economic Value and its ethical aspects

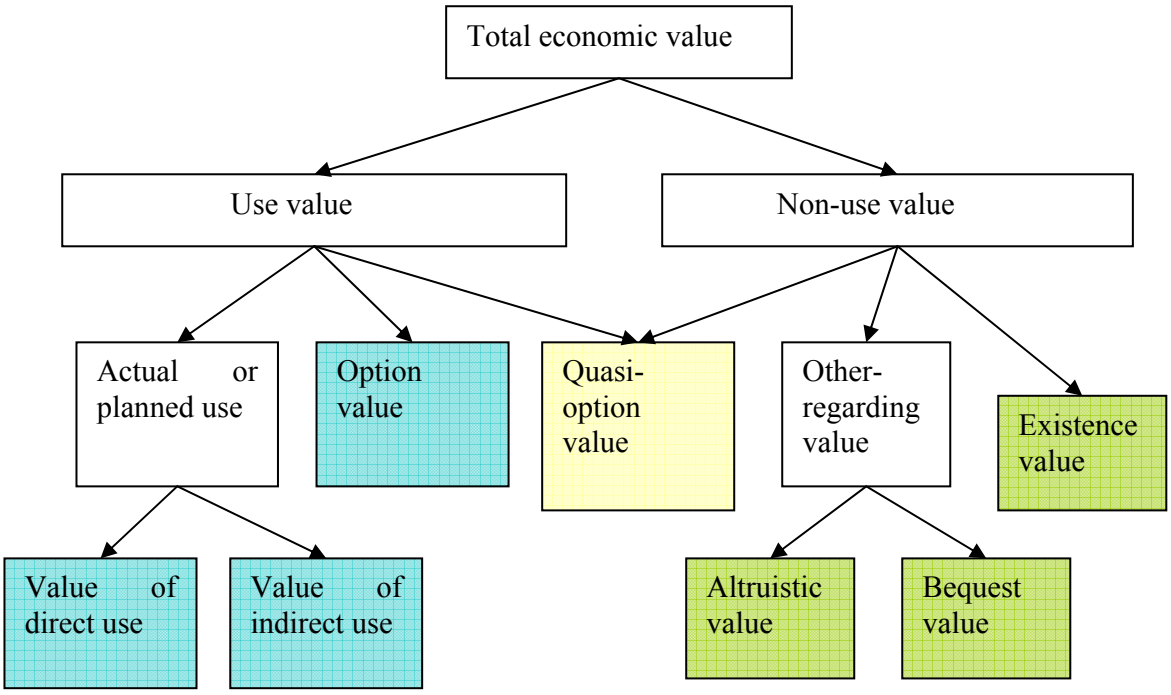
The questions may be raised as to why protection of the environment is of importance and what sort of environment we prefer? Norton (1987) summarises the answers to these questions as for economic anthropocentric, economic non-anthropocentric, moral and aesthetical reasons. The Total Economic Value, a framework associated with David Pearce, offers a more sophisticated approach (see Pearce et al., 1989). Marjainé Szerényi (2000, p.23) argues that in the classification of economic values of the natural environment the „basis of valuation is the conventional relationship between the appraiser, people and the good being valued". Explanations abound why people tend to ascribe a positive value to environmental goods. In the interpretation of Marjainé Szerényi (2000, p.23) „the aggregation of values may be conceived as the Total Economic Value framework".

For our aims with this dissertation, Total Economic Value is considered particularly useful because it captures both use and non-use (passive) values and is thus capable to provide a total account of economic values (see Pearce and Turner, 1990). However, as shown in the followings, there are values which lie outside the Total Economic Value framework. If intrinsic value (III.1.1.) is to be assessed, valuation needs to move beyond the boundaries of Total Economic Value. Randall (2002) underscores that there are several different methods of capturing (the totality of) value and the Total Economic Value only represents a comprehensible application of the economic way of valuing.

Total Economic Value comprises direct use value (e.g. crops, birding, fishing), indirect use value (ecosystem services such as pollination, clean water, soil productivity), option value[19], non-use values (existence[20], bequest[21], altruistic[22]) and quasi-option value[23] (see Figure 2). (For Total Economic Value see e.g. Pearce and Turner, 1990; Marjainé Szerényi, 2005, DEFRA, 2007, Nijkamp et al., 2008, Vatn and Bromley, 1994.)

[19] Optional demand for use the resource in the future, i.e. the resource will be available for future use.
[20] Value derived from the fact that the resource (species) will continue to exist, independently from any possible present or future use of it.
[21] The benefits of the individuals derived from the awareness that the resource will be passed on to future generations, i.e. future generations may benefit from the use of the resource.
[22] The benefits of the individuals derived from the awareness that the resource is available to other individuals in the current generation.
[23] It is noted that quasi-option value is not classified uniformly by all authors. Quasi-option value refers to the notion that given some expectation of increase of knowledge in the future, there is opportunity to learn by delaying a decision, i.e. preservation of the future potential use of the resource constitutes a value.

Figure 3 The Total Economic Value framework



Source: based on Marjainé Szerényi (2005) and DEFRA (2007)

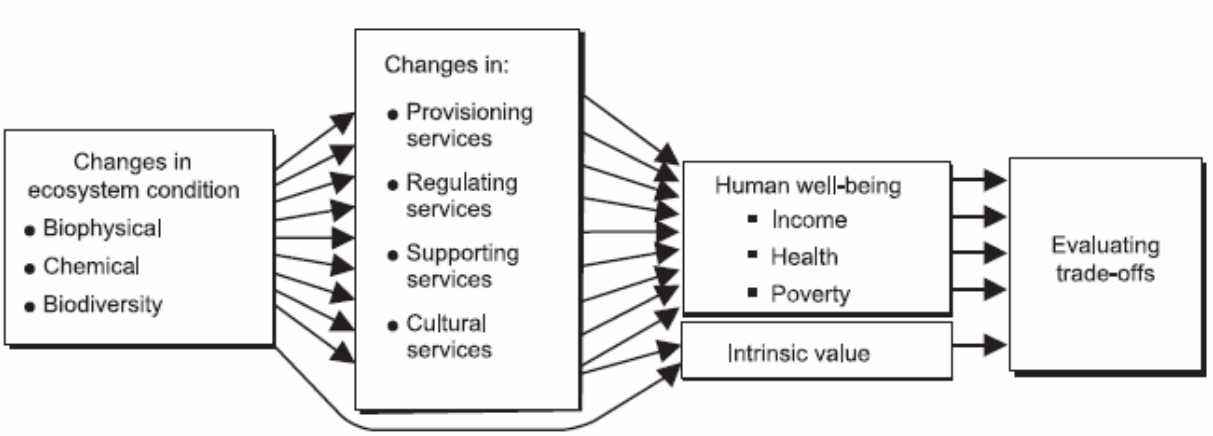
People often regard services and goods derived from ecosystems evident, their provision is not noticed of, people are often unaware of. Ecosystem services may represent use value, as each service may be defined, specified and to some extent delineated[24]. Although indirect use value, that is indirect ecosystem services will be discussed later, it is worthwhile covering them here as well, as this field is relatively novel in the area of environmental valuation. For defining ecosystem services Daily's (1997, p.3) interpretation is worth quoting: „ecosystem services are the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life". Some of these ecosystem services are indispensable for human life, others enrich it and maintain the production of goods (foodstuff, timber, industrial products, pharmaceuticals). The author notes that ecosystem services are actual life-support functions (cleansing, recycling etc.) and „they confer many intangible aesthetic and cultural benefits as well" (Daily, 1997, p.3). de Groot, Wilson and Boumans (2002) group ecosystem functions into four primary categories: regulation functions (functions which regulate essential ecological processes

[24] The question may adequately be raised that where does it lead to if more and more ecosystem services are 'discovered'? Additional values are attached to the new ones, thereby increasing the overall value of ecosystem? Only known things may come under valuation. This is underscored by Fromm (2000) who argues that up to relatively recently economics long viewed many factors (services) as being irrelevant. Hence, valuation (monetisation) of recreation become possible with the development of the travel cost method in the 1960s, existence value become so since 1967, pharmaceutical uses of biodiversity (bioprospecting) since the end of the 1970s, and carbon or nitrogen cycles become possible to come under valuation since the early 1970s.

such as climate, soil formation or pollination), habitat functions (refugium or nursery function), production functions (in essence provide direct material goods such as food, energy, raw materials and genetic resources) and information functions (aesthetic pleasure, recreational benefit, cultural and spiritual value and contribution to scientific and educational functions).

In view of valuation figure 3 shows the link between biodiversity, ecosystem services functions and human wellbeing. Changes in ecosystem conditions modify individual functions, which impacts on human wellbeing and consequently valuation. Changes in ecosystem directly impact on valuation through intrinsic value (see later in III.1.2.).

Figure 4 Mapping the link between biodiversity, ecosystem services and human wellbeing



Source: Markandya et al. (2008, p.3)

Due to non-use values, particularly in the case of biodiversity, it is true that the relevant population is often not local, but covers a larger area (global relevance), that is many times even people living far away from the site are concerned (cf. Nijkamp et al., 2008).

In the following section we apparently detour to discussing ethical issues, however the second section returns to Total Economic Value.

III.1.1. Ethical considerations

It is widely known since Amartya Sen (1982) that the economic theory based on a model of rational actor aiming for maximizing individual utility (personal gains) is flawed. Sen argues convincingly that although the assumption of seeking self-interest and the related revealed preference methods or rational choice ensure internal consistency of the theory, but fail to adequately reflect people's day-to-day behaviours, that is it is overly restricted (economic theory of utility has "too little structure", ibid. p.99.). The author introduces the concept of commitment, which refers to an individual's choice (action) being independent

from maximizing the person's own welfare. Sen's concept, of commitment is principally based on moral considerations. 'Commitment' is most important in the area of public goods. Glasser (1999) separates the ethical foundations for environmental concerns into three principal categories: humanism (in our typology: anthropocentrism), ethical extensionism (in our typology: extended-anthropocentrism) and strong-non-anthropocentrism (in our typology: ecocentrism). Based on Glasser's categorisation *anthropocentric* ethical base entails nature having no independent moral status, and nature being characterised in broad instrumental terms from where a broad array of goods and services are provided to humans. Value derived from nature only in so far it bears on people's ideals and interests. The author notes that economists developed the concept of bequest value in order to grant future generation moral standing. Extended-anthropocentrism is, based on Glasser, an expanded form of anthropocentrism in the sense that certain species (primarily those that manifest characteristics that humans also manifest) are granted moral standing (see also Pearce and Turner, 1990). Glasser explains that from the perspective of *ecocentrism* the continued existence and flourishing of ecosystems, species and individual living beings (non-humans) by themselves constitute a significant good in the world. Moral standings of non-humans are independent from their impacts on human welfare. Thus nature has an intrinsic value. In the interpretation of Pearce and Turner (1990) ecocentric ethics requires that non-human systems not just individuals (non-humans) possess moral rights. Glasser (1999) asserts that from the standpoint of ecocentrism biogeophysical systems values would continue to exist even if humans never existed. Humanity does not, therefore, simply need to consider the efficiency in the use of natural resources, but has obligations to use those with respect and restraint. It is the responsibility of humans to protect nature even if it conflicts with their personal wants and even if it results in a substantial loss of utility. (For ecocentrism see also works by Naess, Leopold, Rodman, Rolston and Taylor.) The US Endangered Species Act is based on this moral principle. Uniquely in the world, the Constitution of Ecuador, adopted in 2008, states that nature "has the right to exist, persist, maintain and regenerate its vital cycles, structure, functions and its processes in evolution". In our opinion, the principal distinction between the two worldviews (anthropocentrism and ecocentrism) may be captured by the notion *whether nature has intrinsic value*. This is also what may lie behind the categorisation of Glasser.

Reviewing the literature and classifying arguments in the field of valuation and ethics in environmental economics Blamey and Common (1999) raise the point that ethical considerations are not to be restricted to humans, that animals and plants (and by some authors non-living entities) are also to have moral standings. Blamey and Common

underscore the role of altruistic motives. Randall (1986) distinguishes three different objects of altruistic motives: philanthropic motives (directed towards other individuals in the same generation), bequest motivation (directed towards future generations) and q-altruism (directed towards non-humans, i.e. species) (see Blamey and Common, 1999). Q-altruism, in our typology, may correspond to ecocentric value orientation.
Blamey and Common (1999) categorise ethical attitudes into two groups; one of them being distributive, the other procedural justice. In this dissertation the emphasis is rather placed on distributive justice concerns, which are exemplified by the authors as follows: benefits of present and future generations, benefits of non-humans (other species), opportunity cost of environmental protection and financial cost of preservation. From the procedural concerns of ethical attitudes, desirability and acceptability of monetary evaluation is underscored here.

From the outlook of *deontological ethics*, some acts are restricted regardless of the fact that the act may even increase social welfare. On a moral basis it is unacceptable for instance to kill someone or taking of species or impair the integrity of the environment. There are thus right and wrong acts; the acts themselves can take on moral significance. In contrast to *consequentialism*, which considers acts on the basis of what consequences (effects) are expected to flow, deontological ethics judges the rightness of the acts in terms of adherence to current rules, constraints or norms. In the interpretation of Zsolnai (2001, p.51) deontological ethics "view the value of alternative actions through value principles, rather than through the consequences that might result from such actions". It may be unjustifiable to construct a long-awaited and needed hospital, if it results in extermination of endangered species (see also O'Neill and Spash, 2000; Blamey and Common, 1999; Glasser, 1999; Gelso and Peterson, 2005; Sagoff, 1998; Schultz and Zelezny, 1999). Based on Gelso and Peterson (2005) value orientations, ethics (ethical attitudes) and some of their features relevant in our research are summarised in Table 4. Anthropocentric ethics only views consequences to humans, while extended-anthropocentric ethics grants certain living entities moral standing. From the perspective of ecocentrism the entire ecosystem needs to be considered, and certain acts are deemed unacceptable. Anthropocentric ethics is manifest in Fromm's (2000, p.303) approach, whereby „biodiversity … must be seen as an asset, with biodiversity conservation as an investment and the neglect of conservation to be interpreted as a de-investment, which leads to a reduction of valuable services and, in turn, to economic costs".

Table 4 Value orientations and some of their aspects

	Humanist	**Naturalist**
Consequentialist ethics	*Anthropocentrism* o Neoclassical economics o utilitarianism	*Extended-anthropocentrism* o Moral base for self-conscious or sentient living entities
Deontological ethics		*Ecocentrism* o intrinsic value o lexicographic preferences

Source: Based on Gelso and Peterson (2005)

Spash (2006) analysed the association of biospheric[25], altruistic, and egoistic motives with on the one hand species rights-based (i.e. deontological) and on the one hand consequentialist (utilitarian) ethics. Contrary to certain claims, the survey did not provide evidence for establishing a link between consequentialist ethics and egoistic motive. However, the author found some evidence for rights-based ethical beliefs being associated with altruism and biospheric value orientations.

It is worthwhile assessing what is the proportion in societies of people with ecocentric value orientations? Glasser (1999) accentuates that an increasing number of public opinion surveys demonstrate that a growing proportion (majority) of the general populations consider the non-human world (natural environment) having intrinsic (inherent) value, and the non-human world itself deserves to have moral consideration. Spash's (2006) survey in the UK shows that 21% of respondents were associated with species inalienable right[26], while an additional 16% would cease to defend these rights at the cost of their living standard being severely reduced (i.e. extreme costs). The point may be raised that although many may hold ecocentric value orientations, these values may not manifest in their day-to-day decisions as production and consumption decisions of actors are separated, distanced and obscured. Since effects of individual choices on ecosystems are obscured, decisions are excessively distanced, hence individuals are not subsequently faced with the consequences of their decisions (see Princen, 1997).

After the previous discussions on ethical considerations it may be worth to direct attention to the notion that biodiversity or ecosystem services are of importance not just for us, humans, but they are necessary for the functioning of the system as well. From this point of

25 Biospheric value orientation means an individual expresses and acts upon moral principles which extended "beyond kin and beyond all of humanity to other species, to places, and to the biosphere itself.
26 See ecocentric value orientation

view the value judgements of people are irrelevant. Mankind seems to be in charge of making decisions on the importance of elements by, for instance, attempting to eliminate mosquitos, but keeping ladybugs, or disliking weed, but appreciating grass. Certain charismatic species, which for instance are fast or beautiful, are assigned a high value, notwithstanding these features from an ecological perspective may not be of much importance (see Christie et al., 2006).

In contrast to the Total Economic Value framework, another value orientation may be worthy of consideration. As previously discussed, individuals with ecocentric value orientation view nature or wildlife of being intrinsically valuable. Intrinsic or inherent value is a value that resides in the good/concept in question and that is unrelated to human beings altogether (valuable in itself, or by definition intrinsic value is the value of the resource *per se* without a subject attaching a value to it). This type of value is mostly of relevance in the field of public goods. Zsolnai (2001, p.53) notes that environmental ethics is based on the principle that "each living entities has inherent value, irrespective of their human uses". Pearce and Moran (1994) accentuate an important aspect of intrinsic value, that it is independent from human preferences. Therefore, the framework of Total Economic Value (which by definition relates to preferences of individual human beings) can not encompass an intrinsic value (see Nijkamp et al., 2008). Instead of intrinsic value, Turner, Pearce and Bateman (1993) use the term 'primary value', as opposed to use and non-use values, which the authors call 'secondary values' (see Marjainé Szerényi, 2005b).

Intrinsic (inherent) value, as opposed to other elements in the framework of Total Economic Value, will by its definition need to be considered very differently. Pearce and Turner (1990) conclude that intrinsic value in nature is justified either at an intuitive level only, or via appeals to 'expert judgement'. The authors deem both of these forms of justification problematic.

III.1.2. Applicability of Cost-Benefit Analysis

It is Cost-Benefit Analysis (CBA) which is used most often in order to determine any social optimum. Cost-Benefit Analysis in OECD (1999, p.123) terminology is "a procedure whereby for any change in the status quo the benefits of the change may be compared to the costs. A benefit is defined as any positive change, i.e. any gain, in human well-being (also known as welfare or utility) regardless of who secures that gain. A cost is defined as any loss of well-being regardless of who suffers that loss." In practice it is only the pecuniary elements (monetary costs and benefits) that are most often calculated. This is reflected in Marjainé Szerényi (2005b) whereby an investment is only viable in monetary terms if

monetary benefits exceed monetary costs. Cost-Benefit Analysis in practice mostly implies assessments of monetary (marketed) aspects only.

In our view Cost-Benefit Analysis focusing on financial costs and benefits only is considered inadequate, as they generally neglect a range of areas, which are of crucial importance in environmental issues. One of the prominent areas for instance is biodiversity. Damages or benefits to biodiversity are rarely estimated in a Cost-Benefit Analysis focused on financial aspects. Obviously, the reasons behind it are well-known. These are attributed to methodological shortcomings. Attempts to monetary valuation of changes in biodiversity have been faced with many difficulties. If Cost-Benefit Analysis is accepted as a possible method (general practice tends to do so), in our opinion it is important that the most comprehensive analysis needs to be pursued, with as many impacts as possible, not just ones that give rise to financial costs or benefits, included in the valuation. Use and non-use values are needed to be accounted for in the most comprehensive way (see Total Economic Value). Failing to do so, the assessment aiming to derive social utility will be biased. In our view this is the only way forward to increase validity of the method.

A particular emphasis thus needs to be placed on non-monetary impacts (see change in biodiversity, non use values). Nijkamp et al. (2008) note that economists value biodiversity because it allows for a direct comparison of economic values of alternative options, hence enabling a cost-benefit analysis to be carried out. Further, valuation reveals the opinion of individual consumers about certain biodiversity management proposals.

III.2. Some deficiencies of contingent valuation method in valuing biodiversity

There are various methods for valuing environmental goods in monetary terms. One of the most prominent methods of valuation on a hypothetical market is contingent valuation (CV, see Mitchell and Carlson, 1989). Marjainé Szerényi (2000, p.14) depicts that with the application of this environmental valuation method "respondents are asked to state their willingness to pay for a change in the quality of an environmental good, or state their willingness to accept compensation for a decrease in the quality of the good". Willingness to pay (WTP) and willingness to accept (WTA) indicates the monetary value of a change. Environmental economists view contingent valuation as being of particular relevance, because in theory a wide range of non-marketed impacts can be estimated with the use of

the method (see Kerekes, 2007) [27]. Contingent valuation gained prominence in the end of 1980s and early 1990s in the United States[28].

One of the main aims of this dissertation is to advance the methodology of valuing the impacts on biodiversity. Some of the deficiencies of the most widely used method, CV, are underscored and methods which increase the validity and acceptability of valuation of change in complex and unfamiliar public goods such as biodiversity are proposed instead (as well as applied in a later stage).

In theory, CV is "capable of estimating the Total Economic Value of non-market goods, including the non-use value components of natural resources" (Marjainé Szerényi, 2000, p.39.). We note however, that, as we will discuss in the followings, in the case of biodiversity the validity of the method applied in the usual sense is problematic. Urama (2003) accentuates the fact that although CV surveys produce numbers, but the numbers are controversial regarding both in terms of content and meaning (see Spash et al., 2006). In regards to CV, Randall (2002) underscores the accumulating evidence that data generated by 'real money' experiments may also exhibit findings ('quirks') similar in direction, although not always in degree. The author cite as an example the volume of charitable contributions intended for the families of victims of the September 11 attack on the World Trade Center, which quickly exceeded the amount required for 'reasonable' compensation of those families.

It is emphasized that we do not pursue a thorough critique of CV, given that extensive literature already exists (see e.g. Clark et. al., 2000; Gowdy and Erickson, 2005; Kahneman and Knetsch, 1992; Sagoff, 1998; Blamey and Common, 1999), the method is assessed in relation to biodiversity only. In the followings firstly the characteristics and properties of biodiversity as a particular good are discussed, next, in relation to that, lexicographic preference orderings, lack of knowledge and information, protest responses are discussed in detail and finally a conclusion is reached as to whether contingent valuation method is an appropriate tool for valuing the impacts on biodiversity.

III.2.1. 2-1 ≠ 1-0, or valuing the impacts on biodiversity, a particular good

With impacts on biodiversity being a prominent element in this dissertation, a particular emphasis is placed in this field. In our view, due to its complexity as well as the

[27] It is noted that choice experiment method has been gaining prominence, sometimes at the expense of wide-spread application of the contingent valuation method, nevertheless it is applied still a lot less frequently.

[28] The first surveys in Hungary were carried out by Sándor Kerekes et al., Zsuzsanna Marjainé Szerényi, Péter Kaderják and Szabolcs Szekeres (Marjainé Szerényi, 2000).

methodological problems, the issue of biodiversity constitutes the greatest challenge in the analysis of environmental impacts. Biodiversity is a complex public good, in ever decreasing supply. As a consequence of the absence of a market, biodiversity has no price. There is a paucity of research literature relating to improving methods to set price values. As Nijkamp et al. (2008, p.224) put it, the valuation of biodiversity is "perhaps the most challenging issue in the context of economic valuation".

In the context of biodiversity, non-use values (such as existence value) and intrinsic value (III.1.) are of crucial importance. Assessing non-use values has proven to be difficult. Blamey and Common (1999) list problems associated with inputs to cost-benefit analysis including: protest responses, implausibly high WTP, low sensitivity of choices to price variations, embedding effect, large difference between WTP and willingness to accept (WTA). The authors divide critics of CV into two groups. The first group is of the opinion that further refinement of CV survey practice can reduce the problems mentioned above. The second group questions the validity of CV and believes that elicited WTP based on non-economic motivations can not be used in cost-benefit analysis (cf. Cooper, Poe and Bateman, 2004). The latter group's view derives from, among other things, the influence of ethical attitudes on responses.

Vatn and Bromley (1994) emphasize functional transparency[29], where the respondent is unaware of all the functions of the good under valuation. Marjainé Szerényi (2000, p.64) stresses five elements which constrain the applicability of CV in environmental policy decisions: lexicographic preferences, information effects, embedding, the warm glow effect and uncertainty of elicited value. In the case of valuing biodiversity as a particular good, we outline in the following sections why it is suggested that the lack of *a priori* preferences needs to be added to this list. In this paper we focus only on those problematic elements to which our proposed methods may provide some solutions.

Biodiversity can often be characterised as a particular good, because its dynamic is non-linear (exponential) and is burdened with irreversibility and uncertainty (Farber, Costanza and Wilson, 2002; Vatn and Bromley, 1994; Limburg et al., 2002). Moreover, attitudes towards species are driven primarily by ethical considerations. Accordingly, it is not insignificant at which end of the axis marginal change in biodiversity is assessed, as the disappearance of the last specimen constitutes the same marginal change in absolute terms as that of any specimen in a stable population. However, it leads to different outcomes both

[29] Functional transparency: "Environmental assets are, to a large extent, characterised by their quintessential invisibility … (T)he precise contribution of a functional element in the ecosystem is not known – indeed is probably unknowable – until it ceases to function (Vatn and Bromley, 1994, p.133).

from an ecological as well as a psychological points of view. Thus is the 'equation' in the section title, where 2 minus 1 is not equal with 1 minus 0. Farber, Costanza and Wilson (2002) pointed out that it is not a given that ecological critical thresholds necessarily equal economic thresholds. It is not unlikely that the given situation can be treated economically in the normal way, while it is unacceptable in ecological terms due to the effect of tipping points being crossed.

III.2.2. Lexicographic preferences

Non-compensatory, conflict-avoiding strategic choices are in the domain of cognitive psychology. Lexicographic preference orderings may result in non-compensatory choices. Blamey and Common (1999) defines lexicographic preference orderings in which alternatives are compared on the most important dimension only. The second most important dimension is considered only in the case if equal scores were obtained for the first dimension. Thus decision is reached. A prime example if avoiding extinction of species is always preferred to additional income, thus ethical considerations may result in lexicographic preference orderings. Marjainé Szerényi (2000, p.70-71) presents a practical point of view. In the interpretation of the author, individuals with lexicographic preferences under all circumstances prefer environmental quality to any increase in income, so "willingness to accept compensation for any change in the quality of the environment (deterioration) is infinite (there is no upper limit of compensation for which individual will accept degradation in the environment), and willingness to pay equals the total wealth of the individual". As a consequence indifference curves for the trading off quality of environment against money can not be drawn.

Stevens et al. (1991) found that around 25% of responses could be described as lexicographic (see Spash and Hanley, 1995). 23.2% of respondents (46 respondents) surveyed by Spash and Hanley (1995) were characterised similarly. Common et al. (1997) conducted experiments to investigate the possibility of lexicographic preferences and found that approximately a quarter of respondents had such preferences (see Blamey and Common, 1999).

Lexicographic preference orderings may be a possible implication of eco-centric attitudes. The refusal to trade-off natural resources is logically consistent with the notion that nature has intrinsic value irrespective of its utility function to humanity.

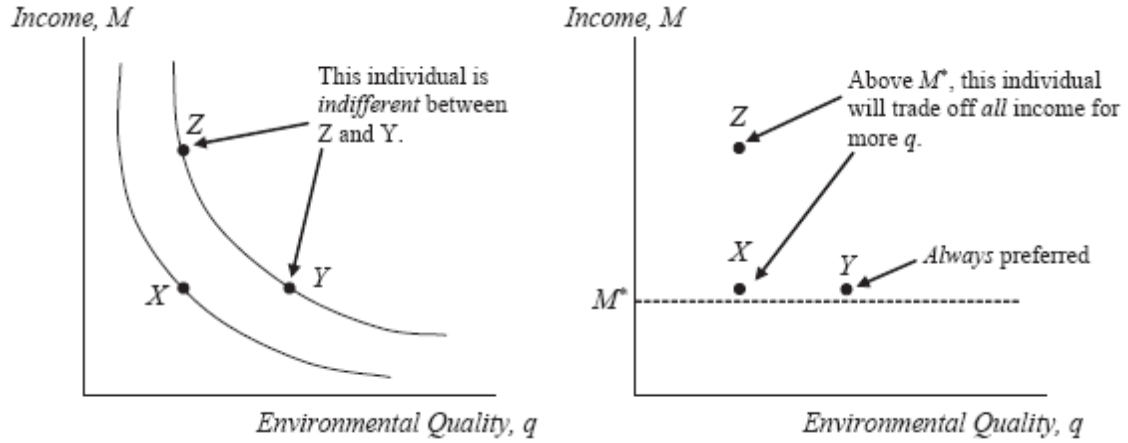
It is not only ethical commitments which may be a source of lexicographic preferences. Blamey and Common (1999) point out that it is known in psychology that when dealing with information-processing difficulties or with uncertainty as to the consequence of choice,

people may adopt a rule-of-thumb strategy consistent with lexicographic preference orderings. Common et al.'s (1997) survey, mentioned above, identified an additional quarter of respondents whose preferences were incomplete or intransitive. It is worthwhile to assess the extent to which lack of information and knowledge regarding biodiversity may be linked to lexicographic preference orderings. Spash and Hanley (1995, p.195.) argue that individuals with lack of information may rely on lexicographic preferences, or, more generally, when facing ignorance they refuse trade-off increases/decreases in biodiversity against losses/gains in income. The authors, nevertheless, reject the hypothesis that any simple relationship exists between information provision and ethical commitments.

The presence of lexicographic preference orderings implies that utility functions for wildlife are undefinable (Spash and Hanley, 1995; Blamey and Common, 1999). Spash and Hanley, 1995 assert that cost-benefit analysis is meaningless under non-compensatory preferences (individual's refusal to trade-off).

Some authors argue that a minimum living standard may be a constraint on standard lexicographic preference orderings (Spash and Hanley, 1995; Gelso and Peterson, 2005). O'Neill and Spash (2000) define modified lexicographic preferences as a minimum living standard which is required for lexicographic preference orderings to be activated. It is the author's option that if modified lexicographic preferences exist, they must also be culturally determined. Based on Gelso and Peterson (2005) figure 4 shows utilitarian and bounded (modified) lexicographic preferences for environmental quality and income. The left panel of the figure depicts the preferences of a utilitarian individual for whom point Z and Y are indifferent, and both these points are always preferred to point X. The right panel of the figure bounded lexicographic preferences, who will trade-off all income above M* (income deemed necessary for a certain level of standard of living) for better environmental quality. Such an individual is indifferent between point X and Z but prefers point Y to either of these. Above M* trade-offs between M and q are not considered, irrespective of changes in income bigger changes in environmental quality is always preferred to lesser changes in environmental quality.

Figure 5 Utilitarian and bounded (modified) lexicographic preferences



Source: Gelso and Peterson (2005, p.38)

III.2.3. Information provision and knowledge

Nunes, van den Bergh and Nijkamp (2003) accentuate that in economic valuation of biodiversity social values in general are based on individual values, irrespective of information provision and knowledge of the given individuals about biodiversity-related issues.

When valuing biodiversity, surveys naturally cover topics which are unusual and hence extend beyond the boundaries of ordinary contexts. Respondents face an unusual position where they may not have well-formed preferences. Spash and Hanley (1995) stress two problems of economic valuation of biodiversity. Firstly, individuals may be unwilling to trade off biodiversity against income; and secondly, many individuals are unsure about the meaning of the term biodiversity and the implications for themselves.

Biodiversity is a complex concept. In most instances, the subject is characterised by deficient knowledge. To many individuals the characteristics and properties of biodiversity as a good are unclear. Miller (2005) dwells on the subject of the extinction of experience. Szabó (2008a) found a weak level of associations of ideas related to biodiversity among inner city residents of Budapest. Spash and Hanley (1995) found that the most common responses to the question 'What does the word biodiversity suggest to you?' were "don't know", "haven't a clue" and "nothing". To 71% of the respondents in the UK the definition of biodiversity was entirely unfamiliar. Another survey (Defra, 2002) found similar results: 26% of respondents had previously heard of the term 'biodiversity' (see Christie et al., 2006). Only 5% of respondents surveyed by Getzner (2005) were at least familiar with the concept. Eurobarometer (2010) survey finds that 38% of EU citizens surveyed knew the meaning of the term biodiversity and an additional 28% stated they had heard of

"biodiversity" but did not know its meaning (in Hungary 32% and 23%, respectively). In light of these it is worth considering the argument of Christie et al. (2006, p.305.) whereby "if one is unaware of the characteristics of a good, then it is unlikely that one has well-developed preferences for it which can be uncovered in a stated preference survey". Brouwer et al. (1999) found that the understanding of the majority of participants in a CV survey of the questionnaire and the WTP question in particular would have been improved if they had been able to discuss the issues beforehand (see Macmillan et al., 2002).
Focus group studies carried out by Christie et al. (2006) demonstrated that despite the fact that half of the participants had never heard of the concept of biodiversity, most of them appeared to be capable of quickly grasping a basic understanding of biodiversity concepts. This finding is encouraging for our proposed method, to be discussed later.

The assumption seems logical that in the eyes of individuals the value of a good may increase, if more information on the good under valuation is given. Hanley and Munro (1994) show, however, that additional information about the desired characteristic of biodiversity only increases WTP under certain circumstances. Moreover, more information about the undesired characteristics of the good may decrease its value. The authors find that relatively uninformed individuals seem likely to place a lower value on the environment and biodiversity in particular. As a conclusion Hanley and Munro state that for the impact of additional information on the variance of WTP, no general conclusion can be drawn (see Spash and Hanley, 1995). As previously discussed, Christie et al. (2006) find that increased level of knowledge did not have a significant influence on WTP.
It is not unambiguous how much information *should* be provided to respondents in a valuation survey (hypothetical scenario). Nevertheless, along the lines of reasoning of Spash and Hanley (1995), individuals need to be provided with as much information as they can assimilate.

III.2.4. Protest responses

A general difficulty of CV surveys is the prevalence of protest responses, i.e. respondent protesting some elements of the survey (Szabó, 2008b). One of the manifestations of protesting in a hypothetical valuation survey is when an individual chooses a zero WTP to express unwillingness to trade-off the right of species to exist against the prospect of money (Spash and Hanley, 1995). Spash (2006) presents reasons which could lead to protest responses, including dislike of the payment vehicle and institution and lack of information. Macmillan et al. (2002, p.51) argues that "oversimplified information could generate protest

or perhaps flippant responses". Clark et. al. (2000) emphasise that some respondents, in order to terminate the interview quickly, may opt for a quick escape strategy such as 'yea-saying' or protesting. Besides these issues, protesting may arise when the respondent already contributes financially or demands alternative approaches (Spash, 2006). Blamey and Common (1999) argue that responsibility consideration may lead to protest responses as CV questions may implicitly suggest that the respondent has some responsibility to protect the environment, thereby justifying financial contribution. Individuals, however, may believe that financial contributions are the responsibility of those who caused the problems in the first place. Using a typology of consumer psychology Fischer and Hanley (2007) suggest that there may be a link between impulsive behaviour[30] and protest responses. The authors found that most protest responses were cognitively controlled, thus signalling a rejection of some aspects of the survey.

Spash and Hanley (1995) argue that those respondents with lexicographic preference orderings who regard themselves as having a minimal standard of living will reject any financial contribution to improvements in biodiversity (can not afford to), but will give an infinite value for any decrease in biodiversity. Contrary to this, some CV surveys indicate that ecocentric attitudes (believing in the inalienable right of wildlife to exist), instead of leading to protest responses, leads to higher WTP (see Spash, 2000; Kotchen and Reiling, 2002).

Findings on the prevalence of protest responses in CV surveys are somewhat similar, although reasons for protesting vary greatly over the different aspects of the environment, making comparisons difficult. Spash and Hanley (1995) reported 32.3% protest responses in a CV survey, while Kenyon and Hanley (2005) 29%. Stevens et al. (1991) found that 40% of zero WTP responses protested against the payment vehicle on the grounds that taxes should provide for financial needs, while 25% protested for ethical considerations, claiming that wildlife values can not be monetised (see Blamey and Common, 1999). In Spash's (2006) survey we find the real motivation behind responses difficult to decipher because of the high rate of 'don't know' responses (11% protested, 5% declined the choice and 26% chose 'don't know'), so all we can see is that protest responses were between 11-42%. The choice experiment survey of Christie et al. (2006) showed 20.7% protest responses, of which 6.5% protested against the payment vehicle, while in the CV survey 38.4% protested.

[30] Consumer choices are determined by emotions, revealing little about the consumer's preferences.

Meyerhoff (2005) excluded 56% of the sample from valuation on the grounds of being protest responses.[31].

We stress the methodological importance of general exclusions of protest responses in stated preference surveys. Researchers exclude protest responses from the analysis on the grounds of being illegitimate choices (see Blamey and Common, 1999; Spash and Hanley, 1995; Spash, 2006; Gelso and Peterson, 2005). Spash (2006, p.608) argues that this practice results in a "systematic exclusion of respondents' opinion" and "censoring biases CV samples". We are of the opinion that by excluding protest responses from the analysis of results, reality, modelled by stated preference surveys, is tailored and restricted to standard economic models. By eliminating protest responses, practitioners reduce the sample to contain only those individuals who conform to the methodological requirements of Stated Preference surveys. Moreover, exclusion of protest responses may result in the sample being non-representative of the population from which it was drawn.

III.2.5. The applicability of CV surveys to valuing biodiversity: unformed preferences

As discussed previously (III.2.2.), according to Spash and Hanley (1995) the prevalence of lexicographic preference orderings has significant implications on the acceptability of CV surveys in the valuation of change in biodiversity. Marjainé Szerényi (2000, p.71) also refers to difficulties posed by lexicographic preferences, as "if there are individuals who refuse to accept any amount of compensation for the degradation in the environment, then it makes it impossible to carry out a valuation based on cost-benefit analysis of the proposals".

Spash and Hanley (1995) accentuate that the high degree of individuals' ignorance concerning understanding of biodiversity concepts also raises concerns over valuations by consulting the general public. We agree with the authors who claim that, given the general public's lack of knowledge about this particular public good, the information provided to respondents will stimulate the formation of preferences rather than inform existing preferences. Moreover, James and Blamey (2005) highlight the limited time and information available for CV respondents to make their choices and the lack of opportunity to seek clarification on any issues of concern.

There are several indications of individuals having to form values (preferences) during the survey concerning the valuation of biodiversity rather than simply relying on and eliciting

[31] It is noted that exclusion from the analysis of more than half of the data in a survey raises question regarding the validity of the exercise.

existing preferences (see Macmillan, Hanley and Lienhoop, 2006.). From a psychological perspective Kumar and Kumar (2007) emphasize that the perceptions of ecosystem are quite different depending on whether they are conceptualized by lay persons or conventional economists. Spash (2007, p.693.) notes that "assumptions that preferences are pre-existing, stable, and complete across all choice sets, and can therefore merely be called upon, no longer seem tenable". Preferences seem "labile and constructed with susceptibility to framing effects and variations in context and elicitation procedures" (Spash 2006, p.603.). Bateman et al. (2008) tested the conception of individuals' preferences as a priori well-formed and readily divined and revealed through a single dichotomous choice question. Their findings rejected the conception. The notion of the prevalence of unformed or poorly-formed preferences for non-marketed public goods seems to be well-established in the literature (see Vatn and Bromley, 1994; Spash and Hanley, 1995; Sagoff, 1998; Lienhoop and MacMillan, 2007b), yet we believe it does not receive adequate attention.

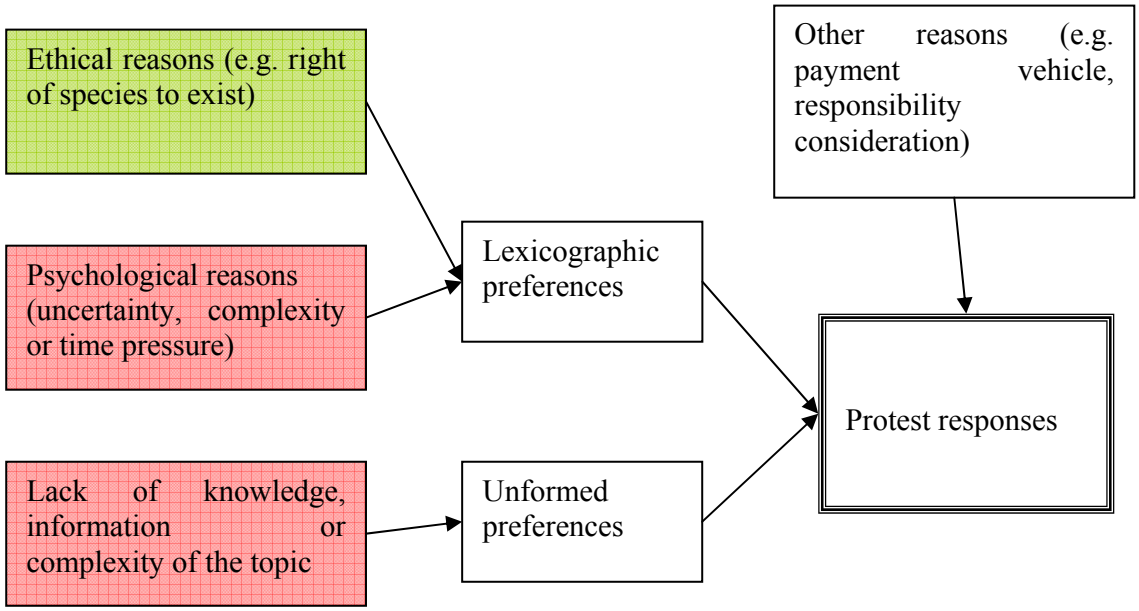
We argue that the problems of valuing of a change in biodiversity by contingent valuation method are mainly due to the following two reasons:

- prevalence of lexicographic preference orderings;
- lack of a priori well-formed (unformed) preferences.

Lexicographic preference orderings are closely linked to ecocentric attitudes and intrinsic value of nature. In addition to ethical considerations, lexicographic answers may serve as a decision-making heuristic when facing uncertainty, complexity or time pressure (psychological reasons) (see III.2.2.). The sources of unformed preferences can be attributed to lack of knowledge, understanding and information as well as the complexity of the valuation scenario.

Any of the above two 'unwanted' factors may result in protest responses in a CV survey. Protesting based on ethical considerations only is considered to be legitimate. The remaining reasons should be regarded as methodological shortcomings. Hence protesting, as a manifestation of the following two reasons are deemed illegitimate: lexicographic preference orderings based on psychological reasons, and unformed preferences as a result of lack of knowledge, information or complexity of the topic. Figure 5 shows legitimate and methodological (illegitimate) reasons for protesting in the field of valuation of change in biodiversity (methodological reasons marked with red colour).

Figure 6 Structure of legitimate and methodological reasons for protesting in the field of valuation of change in biodiversity



Note: Methodological reasons are marked with red colour, legitimate reason with green.

It is important to avoid the methodological causes of protest responses. Therefore, we suggest reducing the influence of unwanted (methodological) factors by reducing the rate of protest responses. This will consequently increase the validity and acceptability of valuation of the impacts on biodiversity (Szabó, 2009). Naturally, total elimination of protest responses would be a mistake, as some such responses are in fact the result of legitimate lexicographic preferences based on ethical considerations.

III.3. The role of value orientation and social context in valuation

A general aim of valuations of environmental goods and services is to provide inputs to cost-benefit analysis used for social decisions making. Blamey and Common (1999) raise the question, whether contingent valuation surveys can provide useful inputs to cost-benefit analysis in the fields where existence value is at issue? The authors are ready to provide an answer that it is a matter of judgement since there is no independent source of measurement of that value against which the results of contingent valuations can be verified (tested).

III.3.1. Choice of value orientations

One of the most important questions remaining to be unanswered is how to approach those values which are beyond the boundaries of the framework of Total Economic Value? Intrinsic (inherent) value discussed in previous sections is not encompassed in Total

Economic Value, therefore can not be accounted for by cost-benefit analysis. As a possible solution the choice of value orientation is suggested as by choosing anthropocentrism as a point of reference regarding value orientations this value is irrelevant. Whereas, by choosing ecocentrism as a point of reference monetary valuation may not be adequately carried out since a crucial element, intrinsic value, can not be accounted for by this method, as its assigned monetary value will be infinite. Thus, in the case of biodiversity this choice of value orientation is considered of essential relevance. We believe that with anthropocentrism as a point of reference cost-benefit analysis is an adequate tool, however, ecocentrism requires an entirely different approach. It is not the task of this dissertation to pinpoint theoretical grounds in this respect. Further research is necessary in the field of value orientations[32]. The choice of value orientations may well reflect social decisions. In our opinion, however, a debate on this issue is yet to be fully fledged, consequently our position is not firmly settled. In conclusion, plurality of views seems to be an adequate approach.

It is a relatively widely held belief that individuals who hold values corresponding to non human species' inalienable (inviolable) right to exist, or put it differently, whose value orientations are not consistent with monetary valuation of wildlife will refuse to take part in any surveys which implies trading-off nature against money (e.g. contingent valuation). The point is adequately raised that cost-benefit analysis based on contingent valuation survey inputs loses its grounds if any of the respondents refuse trading-off biodiversity against money (for instance by giving a protest response). In practice, the issue seems to be more complex. It is worthwhile to consult the survey of Spash et al. (2006) where separate questions sought to reveal value orientations of respondents. The authors found for the contingent valuation survey applied in the context of improvements in a water ecosystem that 42% of those who choose a positive WTP bid did so on the basis of non-economic reasoning, that is, they held ecocentric values consistent with deontological ethics[33]. Respondents with ecocentric value orientation (together with consequentialist and at the same time favouring species right) were overrepresented in positive bid categories, whereas underrepresented in genuine zero bid category. Among those defined by Spash as strong species right (deontological ethic) there were also some who bid positively, or gave a zero WTP bid, or protested, or chose the 'don't know' option. Spash's (2006) survey shows that half the respondents took an ethical position consistent with neoclassical economic theory, that is, consequentialist ethics. Spash' (2006) finding is somewhat surprising and may have

[32] How can value orientations be depicted in a global context, Europe, or Hungary? How do they change in time, if any? What sort of consequences may be drawn with respect to environmental valuation?
[33] In the definition of the authors: strong and weak species rights

far-reaching consequences that positive environmental attitudes are associated with protest bids but rather than increasing the prevalence of protesting, positive environmental attitudes reduce the occurrence of protest bids. Kotchen and Reiling (2000) likewise show that respondents with stronger pro-environmental attitudes (pro-NEP[34]) were found to give higher WTP bid, and this attitude were also found to be associated with views on species having inalienable rights, moreover, were more likely to induce participation in the valuation procedure. As a consequence, it can not be claimed that contingent valuation method exercises are generally refused by those who on grounds of deontological ethics hold a view that changes in biodiversity can not be valued in monetary terms. It is an important conclusion regarding the applicability of methods.

In this dissertation anthropocentric value orientation is chosen as a point of reference. The reason behind this is our belief that even choosing this point of reference allows us to considerably improve on existing methodological deficiencies. The methodological challenge is yet substantial. Besides, *our aim is to offer in indicative manner methods for ecocentric value orientations as well*, it is noted, however, that difficulties are even larger, so future studies are no doubt necessary in this respect.
It is underscored again, that, as seen in previous sections, some authors (see Glasser, 1999) note that ecocentric value orientations have been getting widespread, thus in our opinion increased attention need to be paid to this area. Further, lexicographic preferences activating with respect to increase in income or living standard may prove to be an promising subject of research (see section III.2.2.). An interesting topic may be to assess the prevalence of lexicographic preferences in relation to growth in GDP.

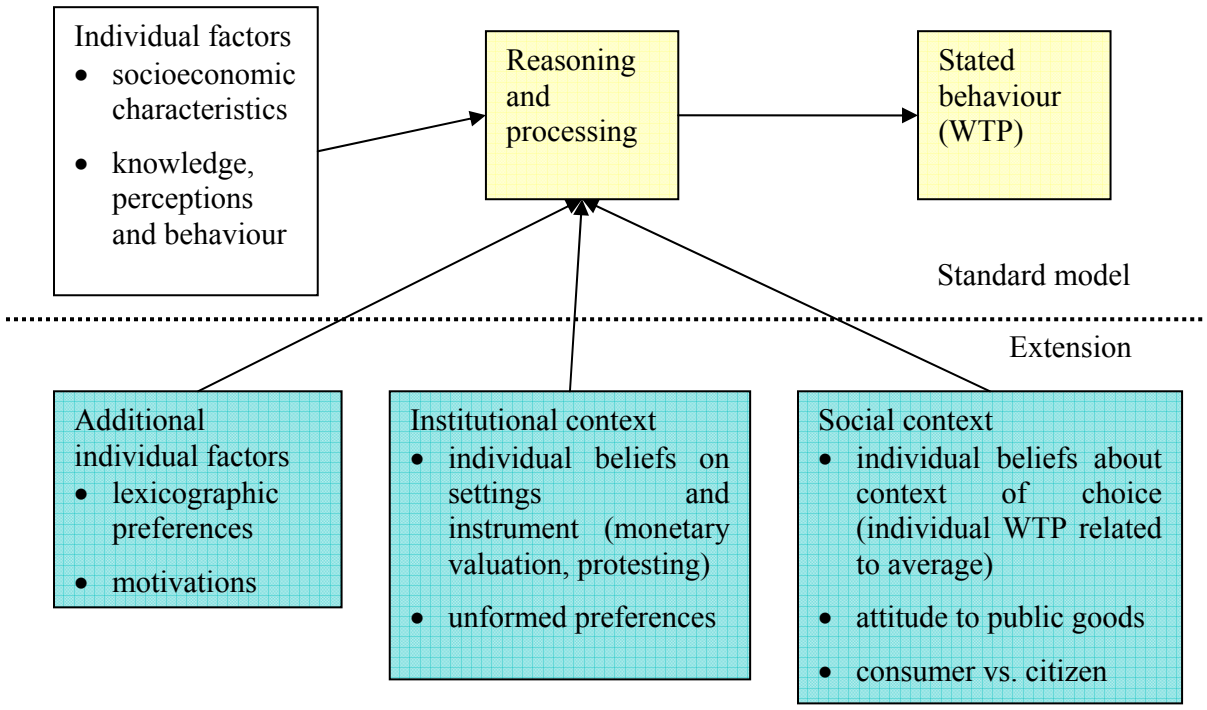
III.3.2. Context of valuation

Standard economic models assume complete, pre-existing invariant and transitive preferences, while models in social psychology are focused on the influence of specific psychological attributes (such as attitudes) on cognitive decision-making processes (Spash et al., 2006). Individual behaviour and acts are the results of the interaction between the individual and their psychological, social and institutional environments, accordingly, in the survey of Spash et al. (2006), besides economic factors, willingness to pay estimates for improvements in biodiversity are assessed using social psychological as well as ethical motives. Svedsater (2003) notes that if WTP is an expression of views on ethical rightness, than the resulting value is argued to be rather a political gesture of a social citizen than a

[34] We will come back to NEP scale in the next section.

choice of a self-orientated consumer (see Spash, 2006). Choices made in isolation and those made in a small group setting, the latter being is more akin to societal contexts, may result in different values. Getzner (2005) argues that standard valuation models need to be expanded. Lexicographic preferences, as additional individual factors, institutional context and social context need to be accounted for. Getzner's valuation framework is complemented by motivations and unformed preferences, but valuation's hypothetical nature is not considered in our extended model (see Figure 6). Lexicographic preferences, lack of information and knowledge, protesting, and unformed preferences have been discussed (section III.2), in the followings motivations and attitudes related to stated WTP values are discussed, followed by investigation of the role of social context.

Figure 7 Standard an extended model of valuation



Source: Modified figure of Getzner (2005, p.25)

Examining value orientations is a crucial part of our dissertation, accordingly, attitudes of respondents are one of the parameters to be examined in our research. Based on Kotchen and Reiling (2000) motivation sources of non-use values are as follows: optional (desire to preserve options for future use), bequest (desire to bequeath natural resource to heirs or future generations), altruistic (to others in the current generation), existence (recognition of

intrinsic value for non-human species and their environments[35]) and ethical belief or feeling of moral responsibility. Some research findings appear to counter our expectations of attitude having explanatory power, as these studies show environmental attitudinal scales as rather weak explanatory variables for the variance in WTP (see Spash, 2006). Spash (2006), however, claims that these conflicting findings may be attributed to multiple methodological shortcomings. The author considers employing attitudinal scales as quantitative measures in contingent valuation surveys. Cooper, Poe and Bateman (2004) argue that motivation is irrelevant to contingent valuation surveys only where it is certain that the researcher's vision of the good under valuation and the respondent's interpretation of the good are identical (same good). The authors found no significant positive relationship between one of the most often used environmental attitude scale, NEP score and WTP. A widely applied measurement of the strength of pro-environmental attitude is the New Ecological Paradigm (NEP) consisting of 15 items (statements) on a Likert-scale. This scale aims to measure respondents' endorsement (agreement/disagreement) of an ecological worldview (Dunlap et al., 2000). The NEP environmental attitude scale has over three decades of global application behind it. Agreeing with Meyerhoff (2005) the NEP is rather considered an instrument to measure value orientations than attitudes. In a comprehensive value survey in the American continent Schultz and Zelezny (1999) found that ecocentrism was positively correlated to NEP scores, while anthropocentrism was negatively correlated to NEP scores in several samples.

It is important to note though, that pro-environmental orientation measured on the NEP scale does not necessarily imply a refusal of monetary valuation. Pro-NEP attitude may be consistent with both deontological and consequentialist ethics. A problem arises for standard neoclassical economic models if an individual believes that natural environment needs to be protected and its related values preserved regardless of the costs.

Another instrument for understanding and assessing attitude is the Theory of Planned Behavior (Ajzen, 1991). This concept of social psychology offers insights into how to improve understanding of human behaviour. The theory seeks to explain (and attempts to predict) intention to perform behaviour through an individual's attitude, subjective norms and perceived behavioural control.

Besides attitude, equity issues are also prominent in the literature. Wilson and Howarth (2002, p.435) raises the issue of social fairness which is defined by the authors in terms of a deliberative forum that „protects participants from uncompensated harms and ensures that

[35] Note that the authors' definition of existence value is rather different from ours and closer to our interpretation of intrinsic value.

participants have a common set of rights or capabilities". The public goods character of the goods under valuation (biodiversity) makes deliberative methods appropriate to achieve social equity goals.

III.3.3. Deliberative forums and monetary valuations

After the previous theoretical discussions this section covers in greater detail the so called deliberative valuation methods. Regarding deliberative methods a brief history of the development of the method is presented, followed by a description of the method of monetary valuation carried out in deliberative forums.

For tackling unformed preferences and protest responses discussed in earlier sections limited possible approaches have been available in the literature. One of the few attempts is deliberative valuation. This vaguely defined method has not been applied in Hungary, and experience on the international field is also rather limited (see Macmillan et al., 2002; Spash, 2007, 2008; Álvarez-Farizo et al., 2007; Sagoff, 1998, Getzner et al., 2005).

The *Deliberative Monetary Valuation (DMV)* combines stated preference methods with deliberative techniques known from political sciences. Deliberative Monetary Valuation, in our interpretation, is a two-session method, where the aim of the first session is discussing the good in question and deliberation, and the second session is about monetary valuation. Deliberation takes place in a small-group setting, and the time elapsed between the two sessions (one or two weeks) allows for participants to think, seek additional information and form preferences.

Although in literature we found limited experience with DMV, the methodology, in theory, appears to tackle the problem of unformed preferences and allow preferences to be formed during the discussions. The theoretical benefits of Deliberative Monetary Valuation are that on the one hand it provides more time for reflection and potential for information gathering, and on the other it allows for deep discussions and deliberation. In the case of biodiversity, deliberative valuation processes (DMV) may thus lead to more valid outcomes than contingent valuation (stated preference) surveys. As Getzner (2005) notes DMV could validate the information content of hypothetical techniques (CV surveys). According to Spash, Stagl and Getzner (2005) the recognised inadequacies in the economic model of human behaviour have brought DMV to the fore.

An interesting finding of Lienhoop and MacMillan (2007a) is that in the two sessions deliberative survey (DMV) the number of participants with lexicographic motives increased following some respondents revised their choices during the week long break between the sessions (see Spash, 2008). Based on this finding it would be adequately raised that DMV is

unable to tackle deficiencies of contingent valuation method with regard to lexicographic preferences. However, it would be a premature conclusion, since elimination of lexicographic preferences themselves can not be an appropriate aim. As discussed earlier (see III.2.2) ethical and psychological reasons may also lead to lexicographic preference orderings. A legitimate aim is to tackle both unformed preferences and lack of information and knowledge, whereby the occurrence of illegitimate protesting may be reduced (see III.2.5). It is noted though, that Spash (2008), reading the political process literature, argues that deliberation would be expected to lead to an increased occurrence of lexicographic preferences, further explanation for the author's conclusion, however, is not provided. In our opinion information processing difficulties and uncertainty as to the consequence of choice may in theory be reduced by the provision of deliberative forums, hence it may be a legitimate aim to reduce the occurrence of lexicographic preferences based on psychological reasons. Nevertheless, we believe that further research is warranted in the field of psychological reasons leading to lexicographic preference orderings.

A literature review reveals two major aims of DMV. Firstly, it may increase the validity of stated preference methods. Secondly, it may create a new value theory. In this paper we primarily focus on increasing the validity of the survey (i.e. reduction of protest responses). The question as to the meaning of the value resulting from DMV seems to have been adequately raised. Spash (2006, 2007, 2008) puts forward detailed analyses of the meanings and realms of value expression in DMV. Spash interprets the meaning of value in two dimensions; on the one hand whether the terms in which WTP are specified is regarded as being social or individual (aggregated or disaggregated value); on the other hand, whether the value provider is a group or an individual in a group setting. He places particular emphasis on the aggregated value elicited in small group setting. Spash (2007, p.696) argues that "social value under stated preference techniques is normally calculated by asking individually focussed valuation questions of respondents, who decided as individuals, and then conducting some aggregation procedure (with or without weighting, exclusion of protestors and outliers, and discounting)". However, there is no reason to assume that this will equate with an already aggregated response (value)[36]. Spash's literature review (Macmillan et al., 2002; Kenyon and Hanley, 2005; MacMillan, Hanley and Lienhoop, 2006; Urama and Hodge 2006; Lienhoop and MacMillan, 2007a, 2007b; Alvarez-Farizo and Hanley, 2006) reaches the conclusion that although most studies used

[36] For the problems with spatial aggregation and 'distance-decay' (values are assumed to decrease with increasing distance from the site), see also Bateman et al (2006), Hanley, Schläpfer and Spurgeon (2003), Wang et al (2007).

small-scale group deliberation processes, they arrived at disaggregated individual WTP rather than social value. Thus Spash (2008) regards the resulting WTP and WTA values as charitable contribution.

It is important to emphasise that in the empirical studies reviewed by Spash (2008) a monetary valuation questionnaire was conducted during the first session of the deliberative process. We believe researchers thus missed the opportunity for participants to acquire knowledge and information regarding the good. Relatively early in the process, participants realised the aim of the studies (having to make a choice, i.e. monetary valuation), and thus the process could not entirely serve to introduce the good (biodiversity) and the formation of preferences. Therefore, we believe the above studies missed the opportunity to decrease the uncertainty regarding the good of participants in the deliberative process, as the time period between the two sessions of DMV could have been used for preference formation. Besides, there is reason to expect the problematic occurrence of strategic behaviour following monetary valuation in the first session, as respondents – having realised the value elicitation aim of the survey – may speculate on what the most expedient response could be.

Spash (2008) highlights the unclear meanings of values resulting from DMV. The author dwells on the issue of aggregated values and put forward the idea of a new value theory, as resulting aggregated value (social WTP) does not appear to be based on economic theories or models. Spash (2008) regards the social value, which is based on asking for a small group to make a decision about what an individual should pay for the good, as *fair price.* The theoretical foundations of this non-aggregated form of value are laid down by Sagoff (1998), who differentiates consumer and citizen preferences. Getzner (2005) sees justification behind the dichotomy of consumer vs. citizen as citizens do not maximise their individual utility in order to seek personal advantages only but include broader societal arguments in their decisions as well. Households (respondents) act differently in the case of marketed goods and public goods. By using variables on social contexts[37] Getzner doubled the explanatory power of his model (Adj. R^2 = 24% vs. 45%). Regarding social contexts it is worthwhile to note Harsányi's (1995) dual structure which distinguishes ethical and subjective preferences. The former refers to what the individual prefers on the basis of social considerations alone, while the latter expresses the individual's personal interest. This dual structure enables us to distinguish between what a person believes is good from the social viewpoint and what he believes is good from his own personal viewpoint (see Sen, 1982). Pearce and Turner (1990, p.237) notes that, as public preferences do not involve

[37] Examples of variables: consumer vs. citizen preferences; believes whether contribution is above the average; thinks that the majority would vote for a nature protection tax.

desires or wants but opinions or beliefs, it has been argued that they belong to different logical categories than private preferences.

Agreeing with Spash (2008), it is not unambiguous that the different social value outcomes are necessarily commensurable with results of cost-benefit analysis. In our opinion the necessity of plurality may be reflected in the various forms of value derived from DMV applications (see ethical orientations). *Fair price* may be closely linked to exchange value used in economic models, but *social fair price* expressed by small groups (group decision in a DMV on how much individuals should pay for the good in question, see VI.2.4) may be regarded as a new form of value. It is noted that social context (see deliberative forum) may be influential in both cases; basically, the presence or lack of group decision distinguishes the two.

Testing Sagoff's (1998) hypothesis was the aim of Álvarez-Farizo et al. (2007), focusing on how changes in decision-making affects welfare measures. The authors focused on the differences firstly between choices made in isolation and those made in a group setting, and secondly between choices made on individual well being versus collective criteria. Citizens' jury was combined with choice experiment method in the empirical context of a water ecosystem. In the first session participants completed individually a choice experiment questionnaire, followed by debate, and in the second session, after a debate, a second questionnaire was implemented (respondents considering their choices from a self-interested perspective), while in the third session participants were asked to make their choices from a community perspective. Sagoff termed the latter citizen preferences. In the interpretation of Álvarez-Farizo et al. (2007) community perspective is pursued when participants make their choices individually on the basis of what they thought would be best for the community and the environment. This value is reflected in our interpretation of *fair price*. The authors found no significant difference between individual and collective values. However, when analysis was restricted to include individuals with 'non-selfish interest'[38] only, the authors saw a rise in willingness to pay for improvements in river ecology and river surroundings (that is, attributes related to non-use values). Nevertheless, we believe that further research is warranted since sample size appears to be too small to draw conclusions (N=24), moreover, underpinnings of the motivational variable appears to be rather poor[39].

Wilson and Howarth (2002) focus on social equity interpreted both within the same generation and across current generations (see also III.3.2). In our opinion eliciting *fair*

[38] members of environmental pressure groups or work in public sector with decision responsibilities

[39] To what degree does 'membership of environmental NGOs' variable reflect altruism or ecocentric value orientation?

price values is in accordance with the aim of social equity in the sense that respondents need to engage in thinking of other individuals in the society. Deliberative forum encourages participants to engage in collective thinking. Individuals, Wilson and Howarth (2002) argue, will not only state their own preferences, but will subsequently revise those preferences in terms of consensus values. With regard to social problems Getzner (2005) argues that besides the outcome of a decision, the process of decision making also matters. Furthermore, in the context of valuing public goods collective decision-making and public debate is necessary.

To deviate from the forms of value applied in standard neoclassical economic assessments may be justified in the field of valuing public goods where deontological ethics play a decisive role (see biodiversity). This is the reason behind our aim of pursuing various social values, deriving plural forms of value. The claim by Spash et al. (2006, p.9) needs to be highlighted that "monetary valuation which aggregates and assumes commensurability without cross-checking motives will fail to represent public opinion". Standard neoclassical economic models generally exclude responses from the analysis which do not conform to its theoretical foundations (see III.2.4). Hence it prevents certain beliefs (see deontological ethics, ecocentric value orientation) from playing a role in and influencing the optimisation of social outcomes being based on cost-benefit analysis. We believe that deriving plural forms of value may lead to valuation being more elaborated. The perceived necessity of using plural forms of value is not undermined by the recognition that these new forms of value warrant future research. Using *fair price, social fair price*, aggregated social WTP or other forms of value (see Spash, 2008) may lead closer to social welfare balances each reflecting different ethics (anthropocentric, ecocentric).

IV. Methods applied for the valuation of external impacts of crop production

The essential aim of the methods used in the empirical research is to value agriculture's impacts on the environment. Due to the distinct attributes of impacts, it would not be appropriate to apply a single method only. Table 5 shows the methods applied for each environmental element and receptor.

Table 5 Structure of methods applied

Receptors	Methods
Soil degradation (siltation)	Costs-based assessment
Groundwater load (nitrate)	Choice Experiment
Air pollution	Impact-Pathway Analysis
Pesticide use (health)	Impact-Pathway Analysis
Impact on biodiversity	Qualitative valuation, Ranking, Deliberative Monetary Valuation, Contingent Valuation, Choice Experiment
Landscape impact	Choice Experiment

Following a brief outline of the assessed farms, each method is detailed with regard to receptors of the environmental impacts of agriculture. In order to avoid repetition the description of methods follows the structure of methods, not the receptors. Giving emphasis to a possible theoretical advance in methodology, firstly, a plurality of methods applied for valuing the impacts on biodiversity is described. Next, choice experiment method is described, which is used for valuing groundwater load and impacts on landscape, followed by Impact-Pathway Analysis applied for valuing air pollution and pesticide use, and lastly, description of costs-based assessment used for valuing the external cost of soil destruction is provided.

IV.1. Selection of the farms to be assessed in Middle-Mezőföld

Mezőföld is a traditional agricultural region of Hungary; therefore, it is an ideal location for our research project. Within the region of Mezőföld, we have further narrowed down the area to be evaluated, which is primarily justified by geographical and ecological reasons. Middle-Mezőföld constitutes a unit that can be relatively clearly marked off from its surroundings, and it is a more or less homogeneous region as to its characteristic features. Since this smaller region has no watercourses on it (the Sárvíz River does not belong to this area), from an ecological viewpoint it is much more uniform than Mezőföld. This

delimitation of the area to be assessed will make it easier to formulate our conclusions (Figure 8).

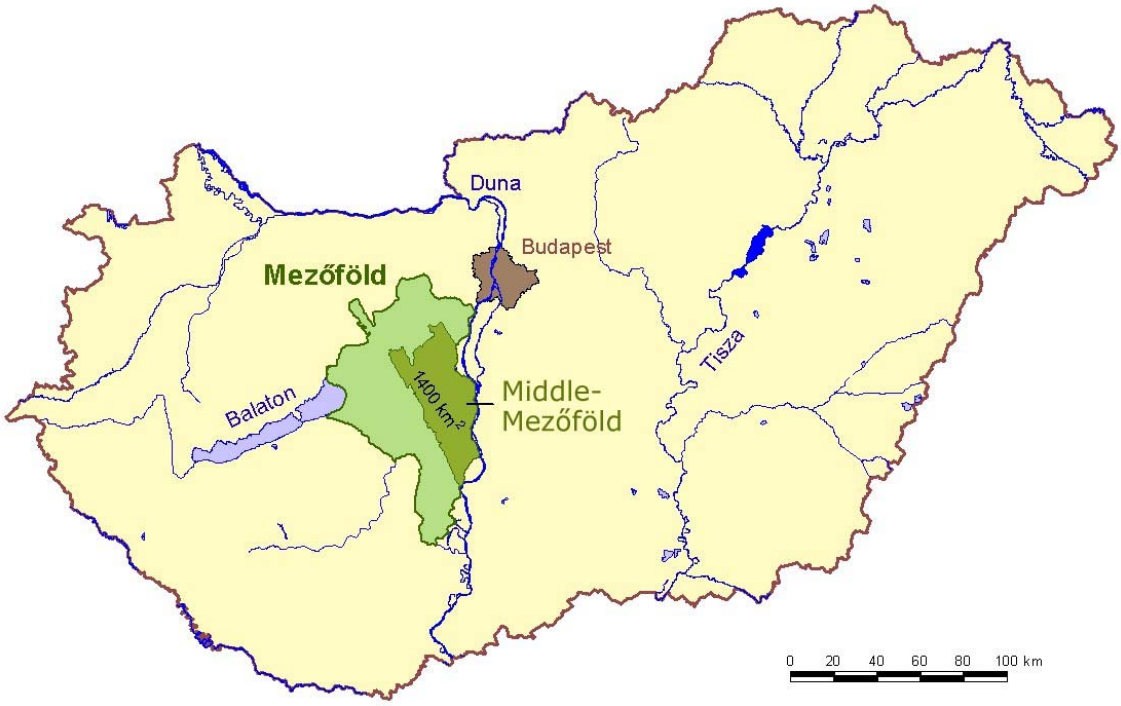
Middle-Mezőföld's natural values are attached to the loess grasslands. Within the entire territory of Hungary, hirsute catnip (Nepeta parviflora)[40] can only be found in Mezőföld. Recently, the region has started to shift towards large-sized estates and towards a concentration of land ownership. Agriculture has traditionally been a dominant sector here; however, farming activities are currently undergoing a transformation[41]. On the assessed lands of Middle-Mezőföld[42], both the intensive and the environmentally friendly agricultural technologies are currently being used.

[40] "If there is any plant that truly belongs to Mezőföld, then it is the hirsute catnip (*Nepeta parviflora*), since it only lives here within the entire territory of Hungary. … Formerly, hirsute catnip had probably been a characteristic (even though not commonly growing) plant of Mezőföld's wooded steppes, which is indicated by the large number of its former and current localities. In addition to its rarity, the local occurrences of this species are particularly important because they provide proof for the close interrelation between the steppes of Mezőföld and the remote Eastern European steppes, as well as for the ancient natural presence of wooded steppes in Mezőföld. … However, it is not only due to the hirsute catnip that the area of Nagyvölgy (Great Valley) of Nagykarácsony is a noteworthy area. This valley … is one of the most important and richest relics of the Hungarian wooded steppe wildlife, which survived here in its ancient condition, featuring a joint occurrence of several characteristic plant and animal species. … Therefore, the residents of Nagykarácsony have every reason to be proud of this valley, and to boast about its greatest rarity: the hirsute catnip." (Lendvai, 2005, p.6)

[41] By applying the Millennium Ecosystem Assessment (2005) scenarios, a shift towards TechnoGarden is taking place now: the providing and regulatory functions are improving, while the cultural function is degrading.

[42] The Corin50 land cover map showed 1078 km^2. Uncertainty factor: at least +/- 100 km^2. Besides that, it is to be taken into account that the satellite photographs serving as a basis for the map were taken in the years between 1990 and 1992, and so it is possible that even more discrepancy may exist.

Figure 8 Middle-Mezőföld



Source: Edited by András Horváth on the basis of Molnár et al. (2008)

Randall (2002) expounds that in order to determine the welfare optimum of agricultural production, assessments are to be conducted at farm level. We can agree with the conclusion of Steiner et al. (1995) that external costs should ideally be calculated on a location-specific basis. In the opinion of the authors, however, this is currently impossible because of the lack of relevant information (see Tegtmeier and Duffy, 2004). With the intention of narrowing this gap, we use, wherever it is possible, farm-level data for assessing the environmental performance. This can be best achieved in the case of air pollution and pesticide use (and to some extent in the case of ground water pollution); however, as regards the impacts on biodiversity and landscape, or the issue of nitrification, it is advisable to consider phenomena on a larger scale, i.e. at (small) regional level. For that reason, we will conduct the assessment in the entire Middle-Mezőföld region. When doing so, regional level values are divided back to the two farms; thus, in these cases the farm-level values are derived from aggregate data.

The research project evaluates the data of two farms. For the assessment we have selected two farms which are similar to each other in terms of their natural endowments (same region and proximity of location), and which correspond to the region's characteristic farming methods, i.e. to the conventional and the environmentally sound arable crop production technologies. One of the farms uses intensive technology, while the other one carries on ecological farming. In the case of these two farms, the key differences of crop

production technologies can be identified in the following factors: use of chemical fertilizers; pesticide use; use of agricultural machines (soil structure); crop rotation; varieties; cultivated plot sizes. More detailed descriptions of the two farms can be found in Appendix VI.

We believe that the assessment of the environmental performance of these two farms using distinctly different agricultural technologies can be significant and promising for a possible larger-scale (national and European) application of the methodology in the future. Consequently, our aim is not only to assess the environmental performance of the two farms (technologies), but also to present a methodology that provides a holistic approach for the evaluation of crop production's environmental externalities. Ultimately, this may bring us closer to a consistent assessment of the multifunctional performance of agriculture.

IV.2. Plurality of methods applied for biodiversity valuation

In the valuation of agriculture's impacts why do we need several methods to assess a single area? Moreover, O'Neill and Spash (2000) raise the questions as to what extent policy-making can be made responsive to different ethical values and to what extent are existing decision-making institutions capable to incorporate different modes of articulating environmental values?

In our view application of plural methods in the case of valuing the impacts on biodiversity are justified on grounds that, besides anthropocentric worldview, large portions of the general public may be characterised by ecocentric value orientation (see Glasser, 1999). The two value orientations are incompatible in the context of living beings' right to exist. As discussed before, there is a value orientation from the standpoint of which living beings' right to exist is inviolable, irrespective of their utility function to humankind. In the field of biodiversity valuation this aspect is in a central position as valuation of the impacts on biodiversity involves scenarios which have implications to life conditions of living beings. Consequently, we believe that the choice of value orientation as a frame of reference influences to a great extent the selection of methods.

As ecocentric orientation, in the presence of lexicographic preference orderings, may imply a refusal to trade-off (species against compensation), thus, monetary valuation is presumably not an appropriate method to apply in this case. From the perspective of ecocentrism it is only qualitative assessment or ranking that may be acceptable. However, if anthropocentric value orientation is considered as a frame of reference, monetary valuation methods may be appropriate tools. Anthropocentric perspective is based on the notion of utility functions to humans, therefore monetary valuation of biodiversity may be considered

a legitimate tool. As described earlier, Glasser (1999), based on public opinion surveys, accentuates that the proportion of population who view the non-human world as having intrinsic value has been growing. However, Spash et al. (2006) shows that it is not unambiguous. Individuals with ecocentric value orientation also actively engage in monetary valuation exercises (see III.2.). Revealing its causes warrants future research.
Should the previous reasoning be accepted, in our opinion, following ethical considerations a single method for assessing impacts on biodiversity is inappropriate. Therefore qualitative as well as quantitative approaches are applied in our research. Due to the complexity in biodiversity valuations, plurality of methods is considered of essential importance. Having discussed plurality of methods, our attention is again focused on description of methods chosen.

The two forms of value, *fair price* and *social fair price* (see III.3.3), applied in our research is based on argumentation on social equity put forward by Wilson and Howarth (2002). Participants of deliberative forums exchange views as citizens (see Sagoff, 1998) and bearing in mind social equity, debate revolves around the social value of biodiversity improvements. *Fair price* reflects individual decision made in social context, while *social fair price* is based on consensus seeking group decision-making. It is noted, that our interpretation of *fair price* is different from WTP only in a sense that on individual level it respects social equity, but *social fair price*, due to group decision-making and consensus-seeking may be regarded as a new form of value.
An unusually large number of deliberative forums provided the basis for the application of a relatively unproven methodology. The large number of deliberative forums applied during this research was aimed at ensuring comparability with the CV survey at a significant level. To test the impacts of deliberative forums, using the same questionnaire, a contingent valuation survey was also conducted on a sample of more than 150 respondents (see following section).
Acknowledging Spash's approach (see e.g. Spash 2006, 2008) in our surveys, besides usual socio-demographics variables, a particular emphasis is placed on applying attitude variables. Based on literature Schläpfer (2008) accentuates the low explanatory power of income variable, if statistically significant at all. Membership in environmental non-governmental organisations is widely used as an indication (i.e. variable) of the respondent's environmental attitude and beliefs. However, in our opinion this method only allows for a weak form of assessment of attitude. Therefore, in the contingent valuation survey NEP scale, one of the most widely used attitude scale, is applied instead (III.3.2.).

In deliberative forums moderation is essential on the one hand for providing a neutral, natural, and informal atmosphere, and on the other hand for respecting the rules set up (see discussion guide in Appendices II-IV) (Vicsek, 2006). Participants of deliberative forums are in general characterised by possessing different levels of knowledge and information (Wilson and Howarth, 2002). Therefore the role of the moderator was identified in facilitating the surfacing of knowledge and information which are particular to some participant only, otherwise debate would revolve around common knowledge and information. In the latter case group knowledge would not be more complex than the aggregated knowledge of each participant.

The use of the term 'biodiversity' was intentionally avoided both in deliberative forums and contingent valuation survey. Although we are not aware of Hungarian surveys in this field, eloquent international experiences shown in Section III.2.3 are considered a point of orientation. The challenge is not negligible: phrasings needed to be used which are clear to respondents and at the same time are in accordance with the principles of ecology.

Overall, 12 deliberative forums were held in Middle-Mezőföld, with a total of more than 100 participants. (see Table Table 6)[43]. The first three deliberative forums were held with farmers, with the aim of discussing direct ecosystem services. Out of the three groups, two comprised farmers applying intensive agricultural technology and one that of ecological agricultural technology. Eight deliberative forums were held with local residents. The deliberative forums with local residents had a double aim; on the one hand a qualitative valuation of indirect ecosystem services, on the other a monetary valuation in the second session with the help of a contingent valuation survey. All deliberative forums with local residents consisted of two sessions, whereby the first sessions were thus iterated as a deliberative monetary valuation. The second session began with the completion of the questionnaire followed by consensus seeking deliberation. One deliberative forum was held with hunters to evaluate indirect ecosystem services. (For the testing of the questionnaire a separate focus group was held in Hantos.)

[43] To illustrate the methodological challenge Arzt's (2005) research is cited. The author aimed for a citizen jury consisting of six meetings, however in the first three meetings discussions still revolved around the framework of the debate, moreover, in the sixth meeting only three farmers showed up. The difficulties encountered by the author illustrate the time and human resource intensive characteristic of deliberative methods. Organising deliberative forums is a difficult feat. We believe that having seen the experiences of Arzt, the outcome of deliberative forums held in our research may be considered fruitful.

Table 6 Structure of deliberative forums, Middle-Mezőföld

Participants	Number of deliberative forums	Locations
local residents	8	Alsószentiván (including farmers), Mezőfalva, Perkáta, Sárbogárd (twice), Sárosd, Szabadegyháza, Zichyújfalu
farmers	3	Előszállás, Kishantos, Németkér
hunters	1	Alap
Overall	**12**	

IV.2.1. Qualitative assessment, ranking

In addition to being a relatively unknown concept, biodiversity is a rather complex concept in the eyes of laymen. Therefore, even using qualitative techniques, it is difficult to reveal its importance, that is, what values people attach to it. It is considered a viable approach to assess biodiversity indirectly. The diversity of species and habitats is an essential precondition for the maintenance of ecosystem services. Biodiversity underpins wildlife's services provided for humankind. Based on this assumption, by focusing on ecosystem services and asking deliberative forum participants' to express their opinions, views and values concerning ecosystem services, a qualitative valuation of biodiversity may thus indirectly be derived. Accordingly, deliberative forum were built around valuation of ecosystem services. In addition to focusing on the different ecosystem services, the discussion guide, of course, also contained themes directly related to biodiversity.

The method (deliberative forums) assessed in the first place how are residents of Middle-Mezőföld related to biodiversity and using qualitative techniques attempted to reveal the importance of biodiversity. Participants ranked the orders of concepts refined in deliberative forums. Concepts emerging were such as cleanliness of settlements or recreation activities (for instance opportunities for physical exercise, being similar in nature to nature walks). The result of ranking constitutes an aggregated social value category. Thus, it is aggregated values which were compared in the qualitative assessment. Without monetary valuation, the main aim of this exercise using qualitative techniques is to draw a picture of how residents of Middle-Mezőföld value change in biodiversity.

Based on literature review (de Groot, Wilson és Boumans, 2002; Sandhu et al., 2008; Swinton et al., 2007; Zhang et al., 2007[44]; Dale and Polasky, 2007; Kroeger and Casey,

[44] Zhang et al. (2007) discuss dis-service as a negative ecosystem service; weeds (competition for resources such as soil nutrients, sunlight or water), pests, pathogens decrease agriculture's productivity. In

2007) ecosystem services relevant from the point of view of our research are identified as follows:

1. Direct use:
   - Recreation (birding), tourism
   - Aesthetics (landscape)
   - Cultural inspiration of wildlife in Mezőföld
   - Spiritual function (religion, worldview)
   - Groundwater quality
   - Food quality
2. Indirect use:
   - Soil fertility (improvement of soil structure by earthworms and other invertebrates, and vegetation cover)
   - Minerals and nutrient cycling (symbiotic relationship with fungi, bacteria thus increased retention or uptake of nutrients and minerals)
   - Pollination
   - Biological control (by natural enemies) of pests
   - Control of invasive species
   - Services provided by field margins (uncultivated field strips), and shelterbelts (reduced wind speed, reduced soil erosion, improved microclimate and higher level of soil moisture + refugium to pollinators and natural predators of pests).

The main aim of deliberative forums with farmers was to discuss indirect use values, since these ecosystem services are primarily related to agriculture. Deliberative forums with local residents focused on direct use values. Deliberative forums followed a semi-structured guide (Vicsek, 2006). Different semi-structured guides were constructed and used for each type of deliberative forums (farmers, local residents, hunters) (see Appendix II-IV).

IV.2.2. Deliberative Monetary Valuation (DMV)

It is underscored that valuation of biodiversity itself is not pursued, our aim is merely to value the changes, that is valuing the changes in biodiversity from the point of view of society. In contrast to general practice (see II.3.3 and Pearce, 2001) rather than pursuing a valuation of a single natural resource impacts on biological diversity *per se* were evaluated (see questionnaire in Appendix VII).

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our position dis-service is a flawed concept, since this reasoning implicitly renders nature a subsystem of agriculture.

According to Spash (2008) standard theory regards DMV a citizen's jury-type process (see e.g. Wilson and Howarth, 2002, Álvarez-Farizo et al., 2007, Macmillan et al., 2002, Pataki and Takács-Sánta, 2005). Following the standards of citizen's jury, however, was not our aim. Rather, we pursued an extensive use of deliberative forums, that is to involve as many local residents in the valuation exercise as possible. Admittedly, this is an area even more untested methodologically, nevertheless allows for greater flexibility in choosing the elements of the method.

Besides estimating social value obtained by aggregating individual preferences, our aim with DMV also includes collective valuations (social preferences). Individuals are regarded as citizens, who make their value judgements embedded in social context (see III.3.). This is consistent with the description of Spash (2007) who regard DMV a social process of valuation because individuals are engaged in representing social groups. Deliberative Monetary Valuation may provide an interactive setting which imitates some of the social process in which people value the environment (see Spash, 2008).

Many authors regard consensus seeking the primary aim of Deliberative Monetary Valuation (see Spash, 2008). In our view seeking consensus, however, is a questionable aim, since expressions of plural values are of no lesser importance (see Wilson and Howarth, 2002). Consensus seeking aims to find a common ground for the many views of different value orientations and if reached, presumably no one will truly adhere to the resulting consensual value orientation. Consequently, it is also considered an important outcome of deliberative forums if eventually consensus is failed to be reached.

Macmillan et al. (2002, p.52) consider an important attribute of DMV its provision of opportunity for participants to re-evaluate their WTP. The interval between the sessions "following further thought, information searching, and crucially for household economic decisions, discussions with family members and/or friends" may result in re-evaluated WTP. In our view based on two reasons this proposed attribute of DMV, however, is of lesser relevance. Firstly, contingent valuation also allows for re-evaluation (see Marjainé Szerényi, 2000, Mourato et al., 1999), secondly, deviating from currently dominant practice in our interpretation of DMV no valuation is pursued in the first session.

It is important to underscore that there is a crucial distinction between our interpretation of DMV method and the approach having been used in most studies in this field (see III.3.3). In our approach enabling the formation of preferences is deemed of essential importance in the case of complex and unfamiliar goods. Therefore, in a DMV of two steps, in the first session participants are free to discuss the issue of biodiversity, and quantitative valuation (monetary) is conducted in the second session only. In our reasoning, it is not only

discussions in the forums, but also the time period elapsing between the two sessions which enable the formation of preferences. The first session, together with the time elapsing between the two sessions may contribute to tackling the lack of knowledge as well as reducing the uncertainty as to the meaning of the good.

In the process of deriving social fair price the focus is on seeking consensus. Consensual decision-making may be reached in several ways. Álvarez-Farizo and Hanley (2006) regard majority voting appropriate if the verdict makes no jury member (see Citizen's jury) unhappy. In our approach a more concrete and stricter rules of reaching a consensual decision are determined. Each participant in the deliberative forum has a right of veto, so deliberation is continued until a decision is reached by majority voting, subject no one wanting to veto the choice. In the case such a decision is not reached, the process of deliberation has not concluded by consensus. It is noted that the instrument of veto is applied in order to stimulate discussions and deliberations and possibly ensure that all opinions in the group are expressed.

Spash (2008) presents convincing arguments regarding representativity of DMV that representation is unnecessary in the social science (statistical) sense, as the aim in political science is to allow for the expression of legitimate views in order to elicit plural values. Consequently, it is needless to pursue statistical representation in the case of DMV. It is noted though, that Spash are concerned primarily with citizen's jury based DMV.

Deliberative forum participants were instructed to keep a diary between the two sessions (see Appendix V). The diary had a double aim: on the one hand it let us know regarding biodiversity in Middle-Mezőföld what thoughts of participants arose following the first session and where additional information and knowledge was gathered from, on the other hand kept reinforcing the focus on the subject serving in theory the formation of preferences.

The question seems appropriate as to what extent responses are influenced by additional information (see also III.2.3.)? Information effect is known is the literature as a possible source of bias. We accept the reasoning of Spash and Hanley (1995) that individuals need to be provided with as much information as they can assimilate, however the concern seems to be valid as one of the aims of deliberative forums is to tackle unformed preferences. It is important to emphasize that researches do not influence the process of valuation in the deliberative forums (see the role of the moderator). However, placing the topic in the focus of the discussion in the deliberative forums may conceivably lead to increased importance of the good (biodiversity) in the eyes of the participants. If such an influence is at work, it is reasonable to assume that it will recede and become neutralised with time. Therefore, to

tackle a possible bias resulting from information effect, the second sessions of deliberative forums follow the first ones with a varying time interval. In one of the locations second session followed the first one in a week time, in other instances several weeks lapsed between the two sessions. (Macmillan et al. (2002) market stall survey included two 1 hour meetings held 1 week apart.) Consequently, this approach may allow us to draw some conclusions on the relevance of such an effect, if any.

IV.2.3. Contingent Valuation (CV)

The same questionnaire is applied in the contingent valuation survey as in the Deliberative Monetary Valuation (Appendix VII). As several authors accentuate (see Nijkamp et al., 2008) it is a considerable challenge to describe a relatively unknown good (biodiversity) in a questionnaire in simple, accurate and comprehensible terms, so, in our view drawing on experiences in the literature is indispensable. With regard to our topic and aims the survey of Christie et al. (2006) was considered similar, consequently the experience of the authors' survey is exploited. The questionnaire thus builds on the agri-environmental scenario used in the survey of Christie et al. (2006).

Considering the specifics of our research agenda and the characteristics of Middle-Mezőföld a special attention was paid to developing scenarios, which describe complex terminologies in simple terms and yet conform to ecological and environmental valuation requirements. Bearing in mind the uncertainties in ecological impacts (see Hole et al. (2005) we applied our own survey for estimating the impacts. Based on Szabó and Pál (2007) comparing two farms in Middle-Mezőföld, the one with environmentally friendly production had 13% more plant species on the filed strips. Samu et al. (2008) found in Mezőföld that the diversity of spiders were nearly double on agricultural fields with an adjacent grassland habitat patch (field margins). Estimations based on literature (Horváth, 2008, Horváth and Kállayné Szerényi, 2008) suggest that with land use oriented, environmentally friendly agricultural production the diversity of natural plant species nearby agricultural fields could be up to doubled. This provides as a basis for our two scenarios concerning a modification in agricultural production practices (see Appendix I.).

The primary objective of the contingent valuation survey was to increase the sample size of residents of Middle-Mezőföld – if possible, keeping representativity in mind. Deliberative Monetary Valuation can inherently be applied on small samples only. For statistical reasons the number of individuals participating in the survey (i.e. respondents) is expedient to increase. Covering individuals not participating in deliberative forums may enable

comparisons. Consequently, it makes possible to assess the extent to which participation in deliberative forums influenced results.
With the use of the NEP scale (III.3.2) respondents' environmental attitude is assessed in both surveys, thus an answer may be found to the question whether individuals with environmental orientation (pro-NEP) value differently, or how much explanatory power attitude has?

IV.3. Choice Experiment survey (CE)

The choice experiment is a non-market valuation method where respondents are asked to choose the most preferred option from a hypothetical set of alternatives (choice sets). Each hypothetical set of alternatives describes different conditions of the good (or bundle of goods) under valuation identified by attributes and related levels. One of the alternatives to be compared in the choice sets is a *status quo* option (a constant base), choosing which infer that the respondent prefers the present condition of the good. Analysing choice patterns the marginal rate of trade-off between the attributes and their levels can be estimated (i.e. implicit price). One of the attributes is price (opportunity cost or bid) that allows estimates of marginal willingness to pay for a discrete change in an attribute level to be made. The method, with the use of attributes indirectly infers the monetary value of the environmental good in question and/or the value of a change in the condition of the good. Using several attributes (and their respective levels) requires for the analysis the application of complex statistical models (see Hensher et al., 2005; Christie et al., 2006; Marjainé Szerényi, 2000; ExternE, 2005; Rolfe, Bennett and Louviere, 2000). The choice experiment method is described in detail in Hungarian by Krajnyik (2008).

Besides the surveys and investigations discussed so far, a choice experiment survey was also aimed in Middle-Mezőföld on a sample of at least 300 respondents. The use of choice experiment method is justified on the grounds that, as opposed to contingent valuation, it is able to deal with several goods (attributes) in one survey. The primary objective of this survey was to assess the impacts of crop production on groundwater and landscape. The survey shed some light on willingness-to-pay of the local population in the case of both goods. Besides, the choice experiment complements the valuations of the impacts on biodiversity. Consequently, the valuation scenarios are identical to the ones used both in the DMV and the contingent valuation survey. Apart from attributes for groundwater load and landscape, attributes for changes in biodiversity and, naturally, cost were also applied in the CE survey (see Appendix VIII). Biodiversity, as a separate attribute, is included in the

choice experiment survey in order to avoid double counting at the aggregation of external cost estimates. Aggregating results of valuations of impacts is an important element of the dissertation. Embedding, or part-whole bias is a widely know problem is CV surveys (Kahneman és Knetsch, 1992). Due to difficulties in differentiating and decoupling the goods, in the case of methods based on eliciting preferences of the population a particular attention needs to be paid to avoid double counting. The exclusion of biodiversity attribute from the choice experiment survey and at the same time inclusion of results of any other biodiversity valuation in the aggregation of external cost estimates most likely would lead to such an outcome. As discussed previously (Chapter III), in the field of valuing the impacts on biodiversity the DMV method is consider more valid, hence in the aggregation of results, instead of incorporating the results of the contingent valuation survey, results of DMV are used in the case of biodiversity.

Developing scenarios for valuation of landscape impacts must be carried out with particular care. Besides crop fields, respondents' interpretation of agricultural landscape may well include semi-natural habitats in the forms of field margins, shelterbelts or forest belts, thus indirectly involving biodiversity.

As qualitative ranking (see IV.1.1.) during the deliberative forums proved to be viable, for the sake of a larger sample size, this ranking was also used in the choice experiment questionnaire. Outcomes of the first sessions of deliberative forums were applied in the rankings. Concepts and things arisen in qualitative discussions served as baseline elements of comparisons in pairs. In the questionnaire respondents were asked to assign priority ranks to the selected concepts and things.

Individual attitude is an important variable in the choice experiment survey as well. The Theory of Planned Behavior (III.3.2) was partially applied in our survey as only the attitude toward the behaviour (specific attitudes) determinant was included (see Appendix VIII). The attitude toward a behaviour refers to the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question (Spash et al., 2006).

IV.4. Impact Pathway Approach

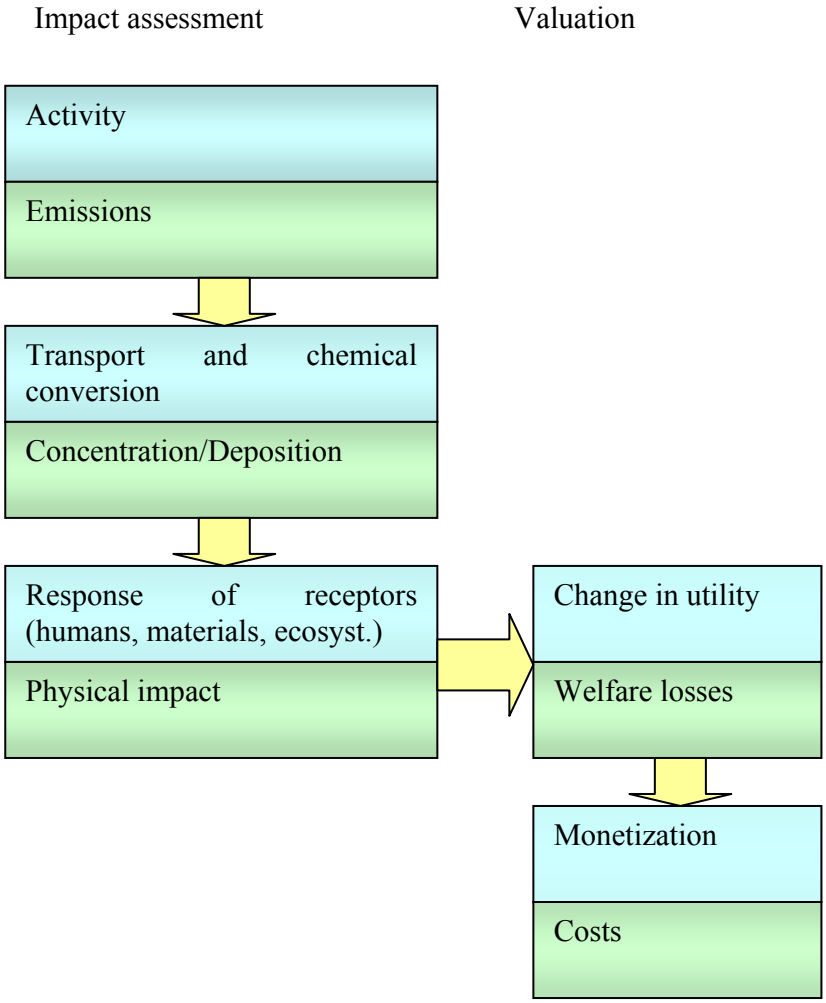
The Impact Pathway Approach was devised in the ExternE research project (European Commission, 1999; ExternE, 2005). The method allows for estimating the impacts of air pollutants due to energy use in monetary terms. The principal steps can be grouped as follows (ExternE, 2005):

1. Emission. Specification of the relevant technologies and pollutants.

2. Dispersion models. Calculation of increased pollutant concentrations in all affected regions.
3. Dose-response function (exposure-response function): calculation of the dose from the increased concentration, followed by calculation of impacts (damage in physical units) from this dose, using a dose-response function.
4. Cost assessment. Economic valuation of impacts.

Figure 8 shows the process of the Impact Pathway Approach in the case of air pollutants.

Figure 9 The Impact Pathway Approach for the quantification of marginal external costs caused by air pollution



Source: Bickel and Friedrich (2001, p.2)

Based on van Beukering, Cesar and Janssen (2003) Marjainé Szerényi et al. (2003 and 2004) applied Impact Pathway Approach to estimate the change in the value of natural capital with regard to the Water Framework Directive and the so called Improvement of the Vásárhelyi-Plan (concerning the Tisza-river) in Hungary. The elements of the assessment

were as follows: a.) defining the boundaries of the study; b.) quantifying the physical impacts that are economically significant; c.) quantifying the significant socio-economic impacts; d.) calculating monetary values and conducting a sensitivity analysis. Assessment of Marjainé Szerényi et al. was carried out by a modified method, since emissions were not calculated.

In the case of crop production, the estimated costs of air pollution cover the fields of fossil fuel use, electricity use and artificial fertiliser use and production. The monetary unit costs applied in the calculations are taken from MethodEx policy toolbox (2007). The quantified emissions to air cover greenhouse gases, classical air pollutants (SO_2, NOx, PM, CO, NH_3, NMVOC) and heavy-metals.

Valuation of the impact of pesticide use on health was also carried out by Impact Pathway Approach. Obviously, pesticide use is not related to emissions of air pollutants, nevertheless Impact Pathway Approach may serve as an appropriate method for valuing its impacts, assuming that dose-response functions for health damages are determined.

There is no doubt that valuation of the impact of pesticide use is seriously burdened with uncertainties. This can be attributed to each pesticide having different dose-response functions. A common unit of measurement for pesticides is nonexistent. Due to their nature (specific chemical and formulation), active substances have different effects on human health and the environment. Several order of magnitude differences may be assumed among estimates of effects of different active substances, therefore a general investigation of pesticides is deemed difficult.

Concerning high uncertainty a sensitivity analysis needs to be conducted, i.e. how much variance in the unit costs of pesticides influence results.

IV.5. Costs-based assessment

Not having a suitable method readily available, an attempt was made to carry out an estimation of external cost of soil destruction based on literature data analysis. As discussed earlier, it is costs resulting from siltation which are covered here as these are the costs which are associated with external cost related to soil (II.2.1).

Data on costs associated with siltation may be gathered from local or regional water works. As long as the volume of silt (degree of siltation) entering the water systems and the resulting additional costs arising in the operations of the water works and related facilities are known the external cost of *ex situ* burdens from soil degradation may be estimated.

V. Hypothesises

1. Valuation of externalities of crop production may lead us closer to a crop production practice reflecting environmental considerations.
    a. Externalities of crop production are large enough to necessitate the finding of new grounds for policies.
    b. Valuations of external environmental impacts of intensive and environmentally friendly crop production technologies result in substantially different outcomes.
2. An outcome significantly different from direct economic value is arrived at if external environmental impacts are also quantified and monetised, i.e. the generally unaccounted for cost categories amount to a significant share.
    a. A more complete picture of the environmental impacts of crop production can be derived if impacts on biodiversity are valued as well.
    b. A more complete picture of the environmental impacts of crop production can be derived if soil degradation, groundwater load, air pollution, impacts on human health and landscape are valued as well.
3. Results of valuation of impacts on biodiversity and validity of the valuation exercise are significantly influenced by the provision of deliberative forum.
    a. The application of deliberative method (DMV) contributes to tackling lack of knowledge and information as well as unformed preferences, thus the occurrence of protest responses may be reduced.
    b. The valuation of impacts on biodiversity produces significantly different results, depending on if carried out by contingent valuation survey only, or monetary valuation combined with deliberative forums (DMV).

VI. Findings of the research

VI.1. Yields of the farms under assessment

The intensive farm produced crops on 1442 hectares in 2004, while the ecological farm's production area covered 452 hectares, although the latter included land set aside each year in conformity to regulations (i.e. net 417 ha). In ecological farming land is left fallow to provide habitat for wildlife. There is no such regulation for conventional farming. Table 7 summarises main production data of both farms.

Table 7 Yields of the two farms

Crop type	Intensive farm, 2004		Ecological farm, 2005		Average yields in Hungary	
	Production area (ha)	Average yield (kg/ha)	Production area (ha)	Average yield (kg/ha)	2004 (kg/ha)	2005 (kg/ha)
Spring Wheat	N/A	N/A	16.0	3000	5120	4500
Autumn Wheat	454	6760	101.8	3500		
Traditional Wheat	N/A	N/A	51.7	2996		
Barley	44	6060	N/A	N/A	4270	3750
Corn	334	9170	27.3	4915	7000	7560
Seed Corn	N/A	N/A	15.0	3562	N/A	N/A
Alfalfa	N/A	N/A	27.3	10777	6090	5240
Rape	164	4650	N/A	N/A	2770	2310
Pea	130	4280	37.2	3868	2960	2520
Sunflower	316	3760	65.6	1524	2470	2170
Oat	N/A	N/A	37.4	2151	3120	2520
Flax	N/A	N/A	37.3	1457	1540	1400
Overall	**1442**		**416.6**			

Source: farm data and KSH (2010b)
Note: N/A – crop not produced

Data of the farm using intensive technology (in the followings: intensive farm) correspond to the year 2004, while that of the ecological farm to the year 2005. This fact may restrict comparability as to some extent weather conditions of a given year determine yields. To overcome this problem Table 7 also shows average yields in Hungary. Both of the years 2004 and 2005 may be considered beneficial in terms of weather conditions, with 2004 perhaps being slightly better. Both of the years may be characterised by 'normal' temperature, few extreme weather conditions (anomalies) and higher than average precipitation levels. In the case of most crops both years saw higher than average yields in

Hungary (corn production and yield set new record in Hungary in 2005). To neutralise the impacts of different weather conditions data of each crops were standardised on the year 2005. (Thereby yields in the intensive farm decreased on average by 12%[45].)

VI.2. Valuation of the impact on biodiversity

VI.2.1. Qualitative results of the deliberative forums

Altogether 12+1 deliberative forums, involving 127 persons, constituted the basis for our qualitative assessments. Eight deliberative forums were held with the participation of local residents, three forums were organized for farmers, and one for hunters. The extra one deliberative forum's primary aim was to deal with questionnaire testing (focus group) (Table 6). When performing the qualitative assessment we departed from traditional focus group analysis (Vicsek, 2006) because we believe that such a large sample size allows us to draw general conclusions as well, and that the results obtained presumably do have a relevance going beyond specific situations and the actual deliberative forums. This opinion of ours is also underpinned by the fact that the deliberative forums did not change the environmental attitude and stance of the respondents (see the NEP results in Section VI.2.3 below); consequently, this will not restrict the possibility to interpret the results in a broader context.

It is to be noted that the topics emerging during the deliberative forums did not remain within the boundaries of Middle-Mezőföld; it would have been difficult to limit the participants' thoughts and views to any geographical unit smaller than the entire Mezőföld region[46]. When citing the names of species we do not aim to use the relevant scientific denominations, since we believe that the names actually mentioned during the deliberative forums may often be more "evocative". The assessment was conducted as follows: professional moderation during the discussion made it possible for the researcher to take notes throughout the session; then, after the deliberative forums, the notes were transcribed and supplemented to make a fair copy, and the key elements were highlighted. All this, with the added support of audio recordings, provided an appropriate basis for the qualitative assessment.

With respect to the diversity of wildlife and habitats in Mezőföld, it can be concluded that **the ongoing changes were perceived** almost consistently **by the participants** of the

[45] Average yield of the nine crops produced in 2005 were 88.4% of average yield in 2004.
[46] Although we managed to keep the discussions within the limits of Mezőföld, the presumed transformation of the seasons (i.e. "spring and autumn are disappearing") came up as an issue on two of the deliberative forums.

various deliberative forums: the disappearance of certain species (partridge) and the less frequent occurrence of other species (eryngo, Abessinian cale, spring adonis, earthworm, ladybird, pheasant, swallow, lark, sparrow, hare[47]), as well as the appearance of species not known earlier (golden jackal, ragweed), and the loss of habitats[48]. Only a very small portion of all opinions claimed that the disappearance of species did not represent any problem, since "they are not an essential necessity for life" (József, Zichyújfalu), or "the mammoth had become extinct in the ice age but thereafter new species came" (András, Zichyújfalu); there were also some individuals who simply did not perceive any changes in biodiversity (Mária, Mezőfalva). We have also met with the idea expressed by one participant that "as the area of natural habitats becomes ever more restricted, so does the space available for the life of humans"[49] (Tibor, Perkáta). The views voiced by Gizi (Mezőfalva) might perhaps be regarded as typical: "it does not mean any problem for an average man if certain species disappear", which was reinforced by Margit when she said that "if we did not talk about it, no one would even notice it". On the other hand, a statement made by Mária ("this will become more important in the future") brought into the discussion the issue of long-term effects. With a simile used by Tibor (Perkáta): this process "is like when the old trades become extinct: no one is concerned about it right now, but when the very last of the blacksmith grandfathers dies…"

Several participants claimed that the populations of certain species, such as roe deer, are too large as compared to the area's carrying capacity. In the opinion of Tibor (Perkáta), the stock of game must be controlled because this region has only a limited carrying capacity

[47] When listing specific species the populations of which were disappearing/decreasing, forum participants occasionally also mentioned fairy-ring mushroom, lepiota, blackberry, wild mallow, honeylocust, poppy, salt camomile, orchis, corn cockle, feathergrass, Siberian statice, iris, common larkspur, crocus, cork elm, stag-beetle, meadow loach, meadow frog, lizards, turtle, black stork, jackdaw, quail, squirrel and souslik. Among specific species the populations of which were growing, forum participants mentioned meadow camomile and the reappearing cornflower. Hare was mostly described as a species of decreasing population, but on some occasions people deemed that its population was growing.

48 A discussion recorded on the deliberative forum of Szabadegyháza vividly illustrates the participants' perceptions and views related to the changes that are taking place:

> "Zoltán: Living organisms are forced to go out into agricultural areas where pesticides are sprayed…
> Ibolya: They migrate away from here.
> Gábor: But where?
> Pál: As a child, I used to see lots of stag-beetles.
> Marika: I am very pleased that I have a stag-beetle pair living in my garden.
> Anikó: On the other hand, there are more frogs today than in the past.
> Ilona: Just as lizards and grass-snakes.
> Csilla: There are many doves.
> Anna: Doves there are none.
> Ilona: Ants are plentiful... around the house... because of the dry weather."

[49] Subsequently, Tibor also referred to the "huge benefits that insects bring about by ensuring pollination".

for wild animals. The issue of ticks' increased occurrence was also brought up by many participants. This problem was attributed to the fact that the populations of the tick's natural enemies have contracted; to that nowadays people do not cut the grass on the banks of ditches; and to the transformation of winters[50]. As a consequence of "the spraying of Reglon (a pesticide), animals die off" (Fecó, Zichyújfalu). Since there are less insects (animal keeping has become less prevalent, and pesticides are widely used), the swallows, too, only appear is smaller numbers (according to Marika, formerly it was common that one could see 4 or 5 swallow nests on the tent-roofed houses of Németkér). As regards angling, Zoltán (Sárbogárd) noticed some changes in the way the fish shoal: he used to know where to find fish and what types of fish he could find at a certain place; today, however, he has to use other angling methods and different fishing rods. Timi (Hantos) believes that "everyone would be ready to make efforts for the sake of the environment, but the goal is to keep up the standard". The changes perceived in biodiversity (considered to be unfavourable changes) were characterized by János (Szabadegyháza) as follows: "in former times, there used to be cornflower and corn-cockle, too, not just ragweed". Irreversible losses were graphically described by Anikó (Szabadegyháza) when she said that "in the hypermarket you cannot buy an oak tree with three pairs of tits nesting on it". "Today's youth will not be able to see the species that have already disappeared" (Tibor, Zichyújfalu). Gabi (Sárbogárd) related how she felt upon learning that in England a radio channel was launched to continuously broadcast birdsong; at first, she thought it was a silly idea because all she needed was to open the window and she could hear the birds sing, but after a while she realized that not everyone lived in a place where this was possible.

Another subject which came up during the discussions of the deliberative forums was that **today' agriculture poses much less load** on the environment than it did in the period prior to the change of political regime in Hungary (1989-1990). This was first and foremost put down to the fact that these days in the agriculture there are less funds available to be spent on fertilizers and pesticides. At the time of the former agricultural cooperatives, "the chemicals then used (which were toxins marked by five crosses, i.e. very drastic toxins) killed and destroyed everything; recently, however, bird species have re-appeared" (András, Zichyújfalu). Birds, as was to be expected, were regarded by forum participants as indicator species, and so they were repeatedly mentioned when describing the changes taking place. Some participants also perceived that certain species (e.g. wagtail) propagated and became prevalent. On the other hand, the blame for a regularly mentioned and consistently

[50] Owing to the significant media attention surrounding the risks carried by ticks, the issue of ticks cannot necessarily be regarded as an objective theme.

evaluated problem (i.e. that the formerly existing lines of trees were cut down) was put on the need of larger agricultural machines for open spaces to allow easier movement[51]. "These were the strips of land where animals used to move along" (József, Zichyújfalu). Field margins and forest belts have been ploughed under in order to make it easier for large-sized machines to turn, which resulted in the disappearance of nesting habitats (Zoltán, Szabadegyháza). As ironically described by Ferenc (Perkáta), "shrubberies must be eradicated so that tractors can thunder along unhindered". These attitudes, however, were opposed by opinions like the one expressed by János (Sárbogárd), who said that he considered it an enrichment that sumach trees were growing and propagating on the unmowed cart-roads, and that vital weeds were occupying ever more ground. Most of the participants already considered the presence of black locust as natural; it seems that black locust has by now become integrated into the flora of Mezőföld. People told about their experience of seeing only reduced populations of butterflies and ladybirds, "but, well, it is a must to spray pesticides" (Ilonka, Sárbogárd). The conflict between plant cultivation and wildlife was expressed by Jenő (Perkáta) as follows: "you cannot post boards along the agricultural fields for living organisms to warn them that they should not come to this area now because Reglon has just been sprayed out here".

Some residents mentioned the diversity of animal species living in their **gardens** (golden oriole, hedgehog), emphasizing how much they were doing for the benefit of these animals (e.g. feeding of birds in the winter). Nevertheless, as the discussions of the deliberative forum held in Szabadegyháza revealed, the reason why foxes were entering the yards was because their natural habitats were contracting; thus, "they are driven to the houses by necessity" (Ilona). In the opinion of Gabi (Sárbogárd), hedgehogs are already regarded as domestic animals.

Loess-valleys were also mentioned as important natural values of Mezőföld. Some participants underlined that in their region certain species still existed which had already disappeared from elsewhere ("steppe"). Several residents were aware of it that bee-eaters breed here and that feathergrass is rippling in the wind.

Summing up the foregoing, it appears on the basis of the experience gained during the deliberative forums that the disappearance of species and habitats was considered to be a serious problem. The following excerpt from a dialogue recorded on the forum held in Mezőfalva covers several use values and non-use values in connection with the **importance of biodiversity**, and even the notion of intrinsic value can be recognized (III.1.1.):

[51] The clearing of forests was also often mentioned as a problem (e.g. the ancient oak-forest of Vajta). Residents repeatedly expressed their regret for the destruction of the wooded and tree-covered areas that had existed until the change of the political regime.

"Sándor: It takes all kinds to make a world.

Marika: The balance is being lost. Harmful species may propagate and spread.

László: Of course, it is a problem if in the morning there is no birdsong to wake you up.

Marika: If living organisms become extinct, it will also affect us. We will also be endangered."

In a broader context, however, it seems that the priorities are set elsewhere because in relation to other areas, participants already attached less importance to the problems they had cited. A typical opinion from Ferenc (Alsószentiván): "there are many things that are more important than the protection of habitats", which was endorsed by József who said that "in our village there is not such a great danger ecologically as, for instance, with respect to the school".

A topic that came up regularly on the deliberative forums was the far-reaching changes that were caused in nature by **leading away the water-courses** and by completing draining in Mezőföld (the region taken here in a broader sense)[52]. During the discussions this process was unanimously considered to be harmful, since, as people put it, as a consequence of the drying landscape, the lowering groundwater level, the disappearing excess surface waters, water-covered low-lying areas and natural sinkholes, "wildlife becomes rarified" (András, Zichyújfalu). Field-voles and gulls used to be common species, and "not even earthworms can live without adequate water" (József, Alsószentiván). In connection with the latter phenomenon, people were in agreement to state that the disappearance of species also causes damage to the economy. This is because when a specific species becomes eliminated from the food chain, it will be felt by the entire chain. The latter view reflects the utilitarian approach. According to György (Perkáta), at the time of bird migration the electric wires used to be fully covered by migratory birds in the past, but nowadays less birds come here as a result of the draining (Ferenc, Perkáta). We believe that the changes perceived can be aptly illustrated by the following quote from the deliberative forum held in Perkáta:

"Ferenc: Thirty years ago, we could drink the water of the streams in Mezőföld.

Tibor: Today, we do not even have streams anymore."

[52] "In the past, we used to have 17 lakes in the neighbourhood; today, there are only two lakes". For instance, even Lake Vályi dried up; Lake Békaréka was built up; the brook Selyemmajori-ér ran dry. Even two decades ago, there were positive stream wells (springs) in the environs of Alap, from which we could drink water. In the wake of the deluge-like rainfalls of the year 1999, a system of ditches was constructed; "our grandfathers were familiar with these areas; they knew where the ditches should have been led" (István, Sárbogárd). As a child, János (Szabadegyháza) sometimes bathed in two-metre deep water standing on certain depressed lands; Anna occasionally filched the large wash tub from her mother, and she used it for boating.

As regards nature-related attitudes in Mezőföld, the opinion of József (Alsószentiván) seems to express the consensus view of participants: "much more things should be left to the care of nature, and we should give nature back what originally belongs to it"[53]. It was regularly emphasized during the discussions that knowing and loving nature is self-evident for the inhabitants of Mezőföld because day after day they live in the landscape and they live together with it. Throughout their childhood, they saw a lot of animals around them (István, Sárbogárd). Local residents believed that this could not be said at all about townspeople. These views were contradicted by the opinion of József (Zichyújfalu), who claimed that his "only relation to nature was the football field and the ticks".

From among the local problems of environmental protection, the most frequently mentioned concerns were the **stealing of wood and littering**. While the former one is primarily related to biodiversity (the diversity of habitats), the latter one is attached to landscape values. It was a common feature of the two problems that local citizens felt themselves helpless when they had to face and tackle them.

All in all it can be concluded that both the deliberative forums held with the participation of agricultural producers and those organized for the local residents observed and reported on a degrading biodiversity; this was a commonly perceived issue in Mezőföld. People noticed the unfavourable impacts of agricultural activities upon the region's habitats (e.g. disappearing lines of trees). Conflicts pertaining to this topic were vividly depicted by the forums' participants. The views and opinions concerning biodiversity included a presentiment of the ongoing irreversible processes and of nature's vulnerability, a feeling of loss, as well as an awareness of the dominance of human impacts.

The foregoing may have served as a basis for several elements of the Total Economic Value. A separate guiding theme was the **option value** and of **quasi-option value**, and the assessment of the extent this value category can be detected. Our exploratory questions concerning the option value and of quasi-option value were typically followed by dead silence, which may allow us to draw the conclusion that deliberative forum participants were not "consciously" thinking along such questions. We were unable to find any clear evidence to prove the existence of these two value categories. When we asked the question "what could be the consequences of the disappearance of species and habitats, or if a certain species becomes extinct or a specific habitat is lost, what are the consequences that this may lead to?", the option value did not emerge spontaneously during the discussions of the

[53] "We deliberately destroy our environment" (László II, Mezőfalva). "It is in the heads that a change would be required" (Gizella, Mezőfalva). "We exploit and abuse nature" (several participants in the Szabadegyháza forum). "Humans lost contact with nature; people just live for the moment" (Zoltán, Sárbogárd). "By itself, nature would not even be able to renew anymore" (Laci, Németkér).

deliberative forums. Nevertheless, it is possible that a remark by Éva (Alsószentiván) suggesting that "probably it is worth postponing the <social> decision, for we cannot know the consequences beforehand" refers to a quasi-option value.

Hereafter, the experience gathered during the deliberative forums on the subject of use values will be presented. Concerning **hiking, excursions and bird-watching**, a consensus was reached on what was worded by Erika (Zichyújfalu) as follows: "people have become lazy, and also there is the risk of tick infections; thus, they go out into nature less frequently". In addition to that, privatizations implemented after the change of political regime in Hungary also restricted the possibilities of hiking[54]; several residents claimed that they were kept back from making excursions by the danger of being scolded if they accidentally enter a privately owned land. Anikó (Szabadegyháza) thought that this trend was also reinforced by the school curriculum which comprised less and less outdoor programmes (e.g. the so-called "number war" outdoor game). As revealed by the deliberative forums, the majority of the participants do not make regular excursions; nature walks is not as popular as it used to be. Typically, people "do not have the time for it". "Everyone is busy earning one's living" (Bulcsú, Sárbogárd). As put by Rita (Perkáta), "those who have the required time and money, will rather visit the aquapark at weekends because that is a trendy leisure activity". On this subject, the reaction of Ferenc was also meaningful: "what can you like in an arboretum?" A debate was provoked by Erika's (Zichyújfalu) opinion, who claimed that "hiking is not so relaxing and recharging an activity for people living in the country as it is for town-dwellers". "They live together with the landscape day after day, that is why they do not attach to it any special value" (Bulcsú, Sárbogárd). It was an almost unanimously voiced opinion that as compared to other Hungarian regions, the natural endowments of Mezőföld are rather poor. Local residents typically thought that this was the reason why tourists did not come to visit Mezőföld. Even the participants themselves prefer travelling to more distant regions when they seek a hiking destination; they do not stay within Mezőföld. When listing their outdoor activities, people mentioned excursions, mushroom-gathering[55], bike-riding, angling and bird-watching. Ilonka (Sárosd) said she was motivated by the good feeling that nature provided; Csaba (Sárosd) gained a lot of energy by spending 3 or 4 hours outdoors; while Pál (Szabadegyháza) highlighted the sight of buzzards swooping down on their prey. Black locust smell and the remembrance of bunches of meadow flowers from the childhood were

[54] For example, the fencing-in of Lake Hantosi was referred to on several deliberative forums.
[55] Rudolf (Sárosd) mentioned that only very few people were keeping any animals nowadays; therefore, there were no cow-pats on the land, and so one could hardly find any mushrooms.

mentioned as imperishable memories (Gizi, Mezőfalva). László (Mezőfalva) has been recording the arrival time of storks for the past 15 years, and each year in the spring he excitedly awaits them. It was told as an anecdote in Sárosd that a painter known by the forum participants used to paint characteristically dark pictures; however, since he got into the habit of going outdoors and spending time in nature, his style changed. Many residents regretted that the bird-banding camp, which used to be held regularly in Zichyújfalu, was not organized anymore, since "this event attracted people here".

On the deliberative forums it was revealed that the **beauty of the landscape** typically carried a value for people, but beauty itself was given a different definition by virtually each individual. Some liked the cultivated fields, others admired the wild nature, and there were also people who appreciated both. The majority of the forum participants were able to formulate what they meant by a beautiful landscape and what by an unattractive landscape[56], although Eszter (Sárbogárd) thought that this also depended on her mood. We believe that the remark made by Sándor (Mezőfalva) was a very apt representation of landscapes; "there are landscapes that are rippling". According to Ibolya (Szabadegyháza), the drying Mezőföld "has become drab and discoloured". Variegated landscapes were considered to be beautiful by several participants; nonetheless, the "neatly cultivated agricultural fields" were also deemed attractive. As depicted by Fecó (Zichyújfalu), the thin strips of land were like mottled bean. For others, however, the cut-up lands did not represent any aesthetic value. According to János (Sárbogárd), it is the proportions that make up the beauty. As characterized by László (Mezőfalva), "the landscape has the rhythm in it"; while Anikó (Szabadegyháza) liked the simplicity of the Mezőföld landscape. Unattractiveness was usually identified as a weed-grown, neglected and barren landscape. Beauty was exemplified, among others, by meadows covered with wild flowers or by the sight of grazing cows. Tibor (Perkáta) used this simile: "after hay-making, those hundreds of trusses are so beautiful that if someone is not careful enough, they may suffer a heart attack". The landscape of Mezőföld is aesthetically pleasing and attractive because "it is integrated, with all of its variedness" (Anikó, Sárbogárd). In the opinion of Anna (Perkáta) it is not only the spectacle that is important, but also the smell. "When you go out into the fields on the outskirts of the village, it has a smell, a breeze" (Anikó, Sárbogárd). In the case of several forum participants it was revealed that their attachment to the landscape was fairly strong, which was vividly illustrated by a remark of Margit (Mezőfalva): "we just cross the bridge, and everything is more beautiful over here than on the Great Plain". In

[56] Some participants did like the landscape of Mezőföld, others less so. Mountainous and hilly landscapes were preferred by many over the local landscape.

contrast, Tibor (Perkáta) believed that excursion target locations could be mountainous or waterside regions but not "a dusty cart-road". It came up on virtually each of the forums that people missed the lines of trees and the wooded areas. In the wake of the formation of large agricultural fields (in the 1980s) and land privatization, most of these trees and shelterbelts were cut down completely. Thereby, the landscape has lost some of its potential to offer an aesthetic experience.

Concerning the **impacts on culture**, typically just very few associations of ideas were put forward by participants. It is a telling phenomenon that in most of the cases this question was interpreted in the reverse sense, i.e. how culture affects nature. This cannot be said to be surprising, though, since Mezőföld's current population was formed as a result of several phases of immigration (of various ethnic groups) in the course of the past centuries; this fact was regularly pointed out by forum participants who also emphasized that they themselves only knew just a few Mezőföld-specific cultural elements. On the deliberative forum of Perkáta, it was mentioned that the coat of arms of the village comprised a representation of bindweed (morning-glory), and that even the great Hungarian novelist Jókai "wrote about this plant as Perkáta-flower". It came up as an issue that culture would also be transformed and traditions might become extinct because "in the past people did not use any machines for harvesting, and they came together to carry out the work" (Erika, Zichyújfalu). The destruction of earthworks was also mentioned (István, Sárbogárd). On virtually each of the deliberative forums, people spoke on a positive note about the so-called "Bolondvár" (earthwork in the vicinity). Tibor's opinion also expressed the ongoing transformation of the prevailing system of values: "Today, it is a fashionable thing to cut down the vegetation on the side of the road. It is trendy that one walks into the house wearing just flip-flops, and while doing so, the nettle should not sting one. Animals, however, cannot survive in the mowed grass. The common buzzard may sit all day long on the tree; it is to no avail if there are no mice. We have cleaned up even the forest." Changes have also been observed by several deliberative forum participants in people's attitudes to gardens; namely, orchards are being cut down and trees are being replaced by grass; flowers are already purchased in the market; vegetable gardens are becoming ornamental gardens. An interesting point was raised by György (Sárbogárd), predicting that the names of specific lands and territories (e.g. Halomi-field) would be lost. Today the lands and territories are only identified by numbers; thus, with the disappearance of the old names (e.g. Kenderáztató (meaning retting-pit) or Csalános (meaning nettle-covered area)) "culture would grow poorer".

In terms of the **impact on people's worldview** and spirituality, associations of ideas again came very sparsely from the forum participants. Biodiversity was interpreted as nature in

this context, and the associated ideas and thoughts were put forward by participants accordingly. “It is good to come home and to sit out <into the garden> in the evening when the black locust is blossoming” (Etelka, Alsószentiván). It often came up that computers and other modern games were competing with nature; therefore, today’s young generations “do not have the time to care for nature” (Ákos, Alsószentiván). According to József (Alsószentiván), alienation from nature can be observed. From among the elder participants, many expressed their regrets that they did not have anybody that they could pass their knowledge on to because nowadays young people were interested in other things. In connection with this topic, though, it is to be noted that several participants admitted that they did not know at all the species and their names. A story told by Ferenc (Alsószentiván) indicated that value orientations and attitudes were justified: once, when he was harrowing a field with disk-harrow, he got out from the tractor to shoo away a little hare, “then the harrier came and took it away”. Fecó (Zichyújfalu) felt “attached to the trees”, and this might be the reason why he was annoyed that in the course of privatization “lands were acquired by persons who do not appreciate and do not respect it”, even though “the inhabitants of Mezőföld always lived by the land and respected it”. Similarly, the opinion of János (Sárbogárd) can also be considered to be related to value orientations: “nature is more predictable than human nature”. Anikó (Sárbogárd) referred to peacefulness, tranquillity, a well-balanced state of mind and release of stress when she said that “constraints cease to exist when we are out there in nature”, which was confirmed by Ágnes (Perkáta) who believed that “it is easier for us to accept life”. As put by Csaba (Sárosd), it is not indifferent that “one is strolling in a forest or on the streets of a city”. In addition to the above factors, people also mentioned harmony and inner balance. Besides mental impacts, health effects were also often cited, e.g. by Ilonka (Sárosd) who said that “people living in the countryside are scratching about in their gardens while townspeople are window-shopping”. The importance of awareness raising was regularly emphasized; according to Rita, who works as a nursery school teacher in Perkáta, out of one hundred nursery-school children only ten have ever been in a forest. As compared to the aspects described in the literature we reviewed and processed, the idea put forward by Bulcsú (Sárbogárd) may perhaps be regarded as a new element: he thought that the impact of nature might also have an influence upon the relation of individuals to the community. Ferenc (Perkáta) believed that this was one of the reasons why “human relations still do work in the villages”.

Concerning the quality of water in the ground (**drinking water from the ground**), participants of the deliberative forums were aware of it that the groundwater in Mezőföld has an excessive nitrate content. This was usually blamed on the agriculture (fertilizers),

and to a smaller extent it was attributed to the incomplete sewerage system. Nitrate contamination was regarded as a problem; e.g. Fecó (Zichyújfalu) preferred the taste of water from the dug wells (in the old days when it still did not contain as much nitrate) to the taste of tap water from the drinking water system implemented in recent decades. Gizi (Mezőfalva) likes the taste of local water: when arriving home from holidays spent elsewhere "it is good to open the tap". Anikó (Szabadegyháza) expressed her fears from the well-water. It emerged as a special problem that public wells (artesian wells) still existed in some places, but they were contaminated due to infiltrations. Today, the water drawn from garden wells is only suited for watering, it is not potable anymore owing to its nitrate content (Perkáta). Forum participants highlighted the fact that "water disappeared from the wells" (Szabadegyháza), i.e. in addition to quality problems, insufficiency of water was also perceived.

When talking about **food quality**, deliberative forum participants mostly thought of foods being healthy and free from chemicals (they know what is in the food that they themselves produce). Some participants expressed the opinion that due to the soil contamination, the vegetables grown would also be contaminated (Erika, Zichyújfalu). According to Bulcsú (Sárbogárd), people living in the countryside are often not aware of it how much better food they consume than city-dwellers. Local quality was typically trusted more[57]. Many local residents buy and sell among themselves the meat, fruit, vegetables, etc. they produce. Even though small private household farming was not considered to be of organic quality, yet people trusted it more than the produces of large-scale farming.

All in all, the experience gained during the deliberative forums reveals that biodiversity has very little and rather hard-to-detect impacts upon Mezőföld's culture and upon the worldview of its inhabitants. On the other hand, the possibilities of hiking in nature or the aesthetic experience offered by the landscape have proved to be more relevant direct ecosystem services. The majority of participants had a strong (unfavourable) opinion about the nitrate contamination of groundwater. It can be concluded that the deliberative forums in general found it rather difficult to determine any **ranking** or order of priority among the direct ecosystem services. Participants were usually of the opinion that each element adds to the quality of life, and they could hardly find any element that could be omitted from the list presented for discussion (see Appendix II). When ranking the elements, people mostly applied a way of thinking which focussed on the elements that were not vitally important,

[57] Although it is not closely related to plant cultivation, but we mention here as an interesting feature that the deliberative forum held in Sárosd went into a lengthy description of how much more beautiful and better-built the pigs living by pig-wash had been as compared to today's pigs grown by feeding them nutriments.

i.e. they sought the ones that could be omitted. The forums that used this way of thinking typically highlighted groundwater quality and sometimes food quality as the elements that could not be left out from the list. Other deliberative forums, however, stressed the importance of worldview, claiming that this would determine people's attitude to the remaining elements, too.

Participants were also interested in, and concerned about, the **trading-off economic and natural values**. On one of the deliberative forums (in Sárbogárd) it came up as a dilemma that the planned motorway M8 might create jobs but it might also destroy habitats. People typically believed that money dominates everything today. We could register it as a prevailing opinion that forum participants would devote and spend some of their resources on services provided by the diversity of species and habitats. The importance of financial well-being was underlined on the deliberative forum held in Sárbogárd. For many participants, pecuniary contribution was not acceptable ("it will be filched"; "citizens would be unable to bear the burden of it"; "those responsible should pay"); however, several participants claimed that they would be ready to undertake volunteer work, which was suggested as an alternative to pecuniary contribution. They were able to list numerous examples for such volunteer work (e.g. tidying up the football field and the cemetery, or cleaning up the forest in Zichyújfalu). In Mezőfalva, people emphasized that they were devoting time and money to such goals on a continuous basis (birdseeds, nesting boxes). It is, of course, questionable for us how it would be possible to facilitate the continued existence of ecosystem services merely by volunteer work.

As expected, many local resident participants had strong links to land and farming in particular. Relevant remarks covered on the one hand the affection felt toward farming such as "we do it with the eyes of a good husbandman" (András, Zichyújfalu) or "some keep looking a lot at their lands; no eye like the eyes of the master (György, Sárbogárd)", on the other hand the expression of bitterness with regard to current farming practices; "the land has no scent anymore" (György, Németkér), and "in the old days, peasants respected the land; but today's new farmers ruthlessly exploit the land" (Mihály, Alap).

All the deliberative forums would endorse a **transformation of the farming practice** that would be better for the ecosystem services and for biodiversity. If they saw the sense and rationality of it, they would support such a goal. On the other hand, some participants were sceptical because, as put by Tibor in Perkáta, "behind the desk there sits a bureaucrat who has never in his life stumbled over a root of tree".

The qualitative assessment of values indirectly related to use, i.e. of **ecosystem services**, was primarily based on the experience gained during the **deliberative forums held with the participation of farmers**. Numerous themes came up on these forums, including among others: nature's feedback processes, through which it attempts to restore diversity (weeds versus monoculture); water retention capability (in connection with soil structure); the "self-adjusting system"; the spreading of invasive plants (common milkweed or silkweed); the lack of pests' natural enemies; the importance of pollination (especially in the case of sunflower). On the other hand, water erosion was not considered by farmers to be a significant problem (thanks to Mezőföld being a relatively flat area). Another experience from the deliberative forums was that in general the role of field margins was rarely discussed; thus, this was regarded as a relatively new element. It is a telling phenomenon that the deliberative forum organized for farmers using intensive agricultural methods misunderstood the role of nutrient cycling; participants performed their assessment and ranking by focusing on what humans give to nature, rather than what we receive from wildlife (see fertilizing). "We must provide the preconditions so that we can get something" (János, intensive farmer). A number of services were taken for granted, i.e. those were considered to be natural endowments (good soil fertility in Mezőföld). Some farmers thought that the use of chemicals was a second-best solution that they were forced to apply ("today, nobody wants to work on the fields anymore"; "there are no animals around the houses anymore" to graze off the ragweed and the grass on the banks of ditches).

Attitudinal differences between **the ecological and the intensive** agricultural farming methods manifested themselves on the deliberative forums, too. According to János (intensive farmer), "organic must be forgotten, it is necessary to intervene". While field margins may provide positive services ("they were created by nature, and animals can hide there", István), its opponents believed that "there is no need for them, they only cause problems" (János, intensive farmer). As far as the detrimental impacts of chemicals use were concerned, there was no disagreement among forum participants; regarding its necessity and justification, however, opinions greatly varied. It came up regularly that these days there were already new weeds and pests, which had been unknown earlier: as a young boy, György (Németkér) still "received a bar of chocolate when he found a Colorado beetle". Participants mentioned on several occasions that not even the earthworms can survive in the soils treated by chemicals; nevertheless, farmers practising intensive plant cultivation were not concerned about that, saying that this had hardly any effect upon fertility, i.e. in their opinion, earthworms did not count. On the other hand, there were farmers who recently found that the number of earthworms was insufficient, and even those

that remained in the soils were "thicker and also deformed and accreted" (Pál, Szabadegyháza). Kálmán ("integrated" farmer) reported that on his lands there were earthworms in the soil, which meant that his soils were good.

With respect to indirect ecosystem services, the deliberative forums organized for agricultural producers provided us with markedly different experiences. For the ecological farmers and for those sympathizing with such technology, these indirect ecosystem services were of crucial importance, as they were considered to be contributing significantly to agricultural production, what is more, they were believed to be determining its results. Farmers using intensive agricultural technologies, however, emphasized the artificial replacement of such services, not attaching much importance to the indirect ecosystem services.

One of the goals set for the deliberative forums was to discuss the name to be used for referring to the ecosystem services. As preliminary suggestions, the following designations were offered for the deliberative forums: ecosystem services; wildlife's services; gifts of communities of living beings; live nature's gifts. From among the offered choices plus the alternatives suggested by forum participants (positive effects of possibilities provided by nature), the **designation wildlife services** proved to be the most understandable and most appropriate.

In connection with **region-specific plant varieties** (agro-biodiversity), it was mentioned that most of the ancient genetic stock of fruits had disappeared. Marika (Németkér) even knew about the special varieties of the so-called strudel apple, cinnamon apple, wine-apple, as well as several pear varieties, ancient plum and ancient apricot varieties. Many of the forum participants claimed that in the case of those ancient fruit varieties there had been no need to use any pesticides yet. Deliberative forums gave voice to the opinion that it also held true for vegetables (tomatoes) that the currently available varieties could not be grown without pesticides. As regards the most important cultivated agricultural plants (rape, wheat, corn, sunflower), local farmers did not know about any Mezőföld-specific regional plant varieties.

Agricultural producers were aware of the detrimental consequences ensuing from the less prevalent practice of animal husbandry, namely that soil fertility was degrading in the absence of manure, and that the land (arable lands) were getting worn out. Opinions differed regarding the question of how much attention was paid by farmers to the "land" (they only took away from it, or they also replaced the elements). Nutrient replacement (manure and artificial fertilizers, bacterium fertilizers) was typically a key issue. It was recounted by participants as an anecdote about Mezőföld that their ancestors still claimed

that “even if we just threw out the seeds randomly, we would have a good harvest”. As an experience of the attending farmers it was mentioned that the process of cutting down trees increased soil erosion. In her childhood, Ilona (Szabadegyháza) had never seen flying dust, whereas “today the wind carries along the clods of earth”. On the forum organized for residents in Sárbogárd, the example of an elder farmer was cited who left a bush strip in its place (despite being a hindrance when moving and turning with his agricultural machines) because he had experienced it himself that it was good to have that bush strip there, and so he did not cut it down. Ecological farmers underlined that it was not accidental that “so much brown leaf weevils could not be destroyed by their natural enemies” because by spraying out pesticides, the neighbouring agricultural cooperative was continuously killing off the natural enemies of pests, too. According to Éva (ecological farmer), in the first years of the transition to ecological farming, one must face all the difficulties and disadvantages; and in connection with that situation she used the term “artificial treadwheel” to describe that they were forced to continue using fertilizers and pesticides because of that. The words of János (intensive farmer) succinctly expressed the disbelief against organic farming: “corn rootworm’s natural enemy is pesticides spraying”. It came up as an issue that on account of “winter pests”, pesticides were already being used on field margins, too (Hantos).

On the deliberative forums organized for farmers, it often emerged that they considered the **privatization of agricultural cooperatives** to be the main cause of the changes perceived in environmental conditions. According to the opinions expressed by participants, the breaking up of agricultural cooperatives at the time of the change of political regime in Hungary (1989-90) was followed by the transformation of farming practices, including a drop in the use of pesticides and fertilizers. It was claimed by several deliberative forum participants that the general standard of farming expertise and skills diminished, given that many “new farmers who worked on small-sized fields” did not possess the knowledge required by modern agricultural technologies. These smallholders did not pay as much attention to the careful use of pesticides[58]. Participants mentioned it as an additional problem that the lines of trees and the forest belts were cut down in order to facilitate the field amalgamation and also to make the movement of agricultural machines easier.

As already discussed above, one of the fundamental goals set for the deliberative forums was to discuss and rank the ecosystem services. Having reviewed the pertinent literature, we set up a list of indirect ecosystem services and adapted it to Middle-Mezőföld region. This list, originally comprising nine elements (IV.2.1.), was narrowed down by the deliberative

[58] András (Németkér) expounded that bees died off the previous year because “certain types of pesticides were sprayed that should not have been used at that time of the year”. Marika added that birds, too, were perished through such pesticides use.

forums (after lengthy debates) to just four elements, to those that were regarded to be the **most important ones**:

- soil fertility (nutrient cycling was also implied here by some participants);
- existence of the natural predators of pests;
- pollination;
- putting a curb on invasive species (surge weeds).

There was not a single deliberative forum where the participants were able to prioritize among these elements, since "lacking any of them is a problem". It is important to note here that the attending farmers were aware of the benefits brought about by ecosystem services; however, they were unable to give an estimate for the monetary values of such services.

A key experience gained during the deliberative forum held with the participation of **hunters** was that with the current practice of agricultural subsidies they deemed it inconceivable that agriculture would pay attention to the interests of hunting as well. The reason for that is because land-based subsidies encourage farmers to take as much land under cultivation as possible, since this will increase the amount of subsidies they are eligible for. As a consequence, the owners of large estates ploughed under even the fringes of lands and the field margins, and they also cut down the lines of trees and broke up the grasslands; even though such places would be important habitats for the small game. Hunters reported that it was not rare that farmers "ploughed right up to the roads", eliminating thereby the weed-grown strips, only a few metres wide, which were often vitally important for the survival of the stock of game. Until the current system of land-based subsidies was not put an end to, the hunters attending the deliberative forum did not consider it a realistic expectation that the interests of hunting would be taken into account, too. Therefore, hunters regarded it of primary importance that plant cultivation should be transformed in a manner that it could provide more space for the life of wild animals. They believed that this would necessitate increasing the share of uncultivated lands, which could be achieved either by retaining the field margins or by forming so-called wild lands. Wild lands are fairly large-sized uncultivated lands the principal function of which is to provide habitats for wild animals.

According to the hunters, virtually all the small game disappeared from the region[59]. Twenty years earlier, partridge shootings were still regularly organized; recently, however, not a single partridge has been seen on the area. There appeared to be a consensus about it

[59] According to Mihály, "within ten years, pheasants will have to be artificially grown because there will be no natural stock of these wildfowl anymore".

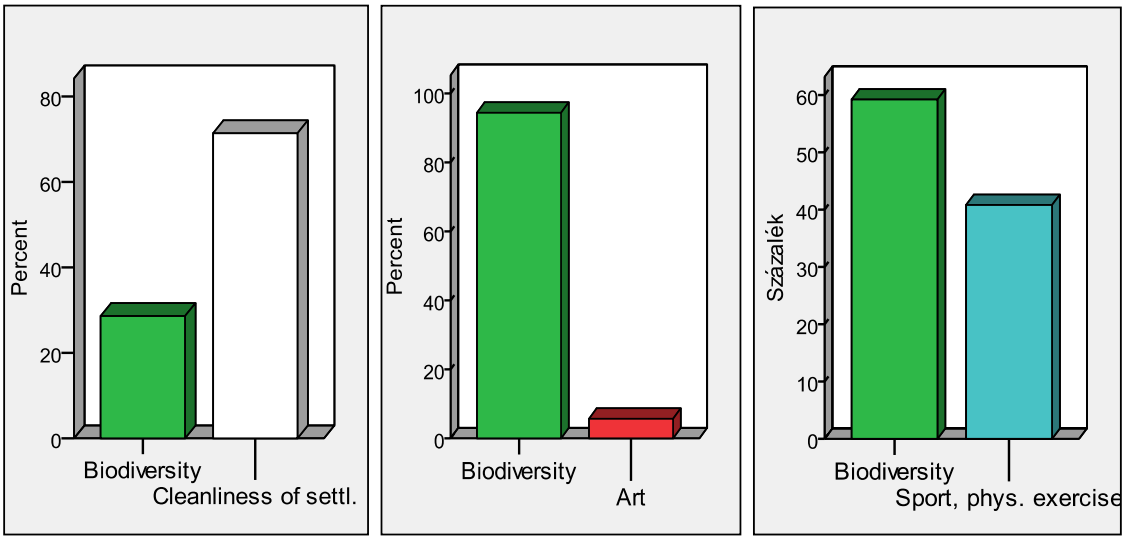
that this could be attributed to the use of chemicals. Lajos expounded that after the change of regime in Hungary, the large farms were broken up into smaller ones, which resulted in a significantly greater number of smallholders. While in the former agricultural cooperatives the pesticides were sprayed out in set phases and concurrently on relatively large areas, today "there is almost always someone out there spraying". The partridge population was still able to survive despite occasionally consumed larger quantities of poisoned dead insects; after the change of regime, however, their exposure to the practically continuous poison load has already proved fatal for them. This was coupled with the generally declining standard of agricultural expertise. Even though chemicals-free farming was not typical at all in the period preceding the change of political regime in Hungary, at that time, as told by the hunters, the poisons were handled by competent specialists. Today, however, it may well happen that they spray over everything haphazardly with very cheap chemicals (that might even have been stolen), causing general destruction and killing. Thus, according to the hunters attending the deliberative forum, it was because of the unskilled and inappropriately scheduled use of agrochemicals that partridges disappeared from Middle-Mezőföld. Similar trends can be observed in the case of the regional populations of pheasants, and, to a smaller extent, hares. As regards pheasants, artificial propagation is more or less compensating for the recent drop in the natural stock of these wildfowl.

VI.2.2. Comparisons in pairs

As seen in Chapter IV.2.1, the issue of "littering" often emerged during the deliberative forums. Comparing the value of direct ecosystem services (direct use values) with other concepts and things was a special discussion guide theme on the forums held with the participation of local residents. Cleanliness of settlement was derived from the theme of littering, and it was supplemented with the topics of arts and of physical exercise and sports (see Appendix II). During the deliberative forums, this mainly served the purpose of generating a lively discussion and evaluating the viability of comparisons. The comparison bases so determined were used in the choice experiment assessment. Respondents were asked (valid N = 325) the question: "In your opinion, which one of the following things would be more important to improve in Middle-Mezőföld?" (see Appendix II). Improvement of the state of biodiversity was paired with the advancement of cleanliness of settlement, arts, as well as physical exercise and sports, respectively. Results of the rankings are shown in Figure 10. Improvement of the situation of cleanliness of settlement was considered to be more important than the enhancement of biodiversity by nearly three-fourth part of all respondents (71.4 % versus 28.6 %). On the other hand, betterment of the

situation of arts was hardly preferred at all (5.6 %) to upgrading the diversity of species and habitats (94.4 %). Similarly, only a smaller portion of all respondents (40.8 %) regarded the improvement of possibilities for physical exercise and sports more important than the enhancement of biodiversity (59.2 %).

Figure 10 Which one of the following things would be more important to improve in Middle-Mezőföld?



As regards ethical attitudes, we found no significant differences in the rankings, i.e. deontological and consequentialist (utilitarian) individuals set up similar rankings.

According to data included in the 2008 consolidated[60] functional balance of the Hungarian state finances (ÁHT, 2008), national expenditures on "sports and leisure activities and services" totalled HUF 67,360 million, while expenditures on "cultural activities and services" amounted to HUF 184,863 million; within the latter item, "art activities" represented HUF 43,227 million. The 2009 estimates of state finances comprise similar sums for these items (HUF 71,628 million and HUF 187,134 million, respectively). Regarding cleanliness of settlement, however, we were unfortunately unable to extract any national expenditure data, since there is no such item among the expenditures of Hungary's state finances. Assuming that each Hungarian citizen shared equally in the above funds, the per capita amount spent by the state in 2008 on physical exercise and sports was HUF 6700, and the amount spent on arts was HUF 4300. Our survey revealed that, based on the preferences of Middle-Mezőföld residents, funds exceeding these sums should be devoted to the improvement of biodiversity. We believe that the comparisons in pairs provided significant and meaningful results, even without any numerical comparisons. In fact, these

[60] After the elimination of accumulations.

may be regarded as monetary social values (III.3.3.); thus, they show social preferences from a different aspect. By applying this methodology, we obtained social values for the changes taking place in biodiversity without any aggregation made (just by simple averaging).

VI.2.3. Analysis of CV and DMV surveys

During the focus group serving the preparation of the questionnaire a complete distrust of the usual payment vehicles (i.e. taxes, dedicated funds) was found, therefore a – to the best of our knowledge – novel payment vehicle; 'increase in the price of bread' as was invented. It is based on the assumption that contributions to proposed measures (programmes) or, from a different perspective, additional costs may be expressed in and paid by the increase in the price of a good which everyone consumes[61]. The focus groups also made it clear that the term 'biodiversity' is not advisable to use because most participants are unfamiliar with it.

Out of the 242 respondents to the questionnaire, 90 people participated in deliberative forums. For the results to be comparable, it is important that the two samples (CV and DMV) resemble one another as much as possible. It turned out to be difficult to recruit representative samples for the deliberative forums. According to Vicsek (2006) due to small sample sizes and non-random recruitment procedure, results of deliberative forums (focus groups) can not be generalised. However one of the main novelties of this research is that on the one hand particular attention was dedicated to have a non-biased recruitment procedure and on the other hand a relatively large sample size was pursued. Hence, across the two samples (CV and DMV, with the formed labelled 'CV-only' in the followings), based on independent-samples t-test, no significant differences can be found in terms of gender ($p = 0.135$), size of household ($p = 0.593$), number of dependents ($p = 0.179$), education ($p = 0.303$) and income ($p = 0.840$). The only demographic indices where the independence of sample means is significantly rejected is age ($p = 0.000$). The average age of deliberative forum participants was 47.96 as opposed to the 40.46 of CV-only respondents. Age turned out not to be a significant factor in the case of whether society should pay for biodiversity improvements ($r = 0.068$, $p = 0.291$), although, there is a significant correlation between age and the amount of fair price. Since age negatively correlated with fair price in both programs ($r = -0.161$ and -0.191 respectively) and average age was higher amongst deliberative forum participants, without this sample bias the

[61] One participant's remark was well received in the focus group, whereby bread is a suitable payment vehicle, as it is "the centre of rural life".

difference in fair price bids as a result of deliberative forum participation would be even larger.

Besides demographics, two more possible biases could have occurred. The first one concerns farming. Respondents with income from farming were overrepresented in deliberative forums ($t = -2{,}851$, $p = 0.005$). However no significant correlation between farming background and responses of whether society should pay for biodiversity improvements ($r = 0.110$, $p = 0.089$) was found. In the case of fair price amount a t-test carried out at both programs rejects the independence of sample means ($p = 0.194$ and 0.256 respectively), in other words fair price results are not biased by the differences in farming background.

Lastly, another possible bias concerns environmental attitudes. The average NEP score of CV-only respondents was 53.55 and of deliberative forum participants 54.77. The means of those who participated in deliberative forums and those who filled out the questionnaire only do not differ significantly ($p = 0.219$), signalling that no bias was made through the process of recruiting participants; i.e. the environmental attitudes of the two samples are alike (see Table 8).

Table 8 Similarity of the sample means of the CV and DMV surveys (equality of means)

Variables	Mean		Independent-samples t-test	
	CV-only (N = 152)	Deliberative forum (N = 90)	t-value	Sign. level (p)
Gender (1=male, 2=female)	1.47	1.57	1.498	0.135
Size of household (persons, incl. respondent)	3.24	3.14	-0.536	0.593
Number of dependents (children)	0.99	0.8	-1.348	0.179
Education (1 = primary school or less, 2 = secondary school without graduation, 3 = graduation, 4 = collage, university degree)	2.59	2.73	1.032	0.303
Household monthly net income (1= <50.000 Ft, 2=50.000-100.000, …)	3.65	3.69	0.203	0.840
Age (year)	40.46	47.96	3.540	0.000
Farming income (1=yes, 2=no)	1.8	1.62	-2.851	0.005
NEP score	53.55	54.77	1.234	0.219

As discussed in the Section III.2, the reduction in the prevalence of protest responses is considered to be of primary importance. In this survey respondents may have protested against the payment vehicle (increase in the price of bread) or the overall concept of monetary valuation, which itself includes the former. As Table 9 shows, DMV significantly

reduced the prevalence of protest bids (more than halved its rate). Protest bids amounted to 29% of responses in the contingent valuation survey (CV-only), and only 13% of deliberative forum participants. As shown in earlier section (III.2.4), protest responses usually comprise about a third of the responses, so our CV-only result appear to conform to general practice. An important finding is that the 13% of protest bids among those who participated in deliberative forums (DMV) is the lowest level to be found in the literature we are aware of.

As refusal of monetary valuation had been expected in relatively great numbers (III.2), it is in apparent contradiction though, that two-thirds of protest bids in DMV protested against the payment vehicle. Many of the protesters, however, also indicated other motivations as secondary reasons for protesting, being in line with our expectations. The payment vehicle (increase in the price of bread) is admittedly imperfect (although better received than any other proposed payment vehicle), so future research on alternative payment vehicle issues may provide additional ground for our results.

Table 9 Occurrence of protest bids in CV and DMV samples

Protesting	CV-only (N = 152)	Deliberative forum (N = 90)
Protest payment vehicle	21	8
Protest bid (incl. payment vehicle)	44 (29%)	12 (13%)

Based on the two similar samples, evidence is provided that the prevalence of protest responses may be reduced and this reduction may be a result of DMV tackling some of the limitations of CV surveys. With the favourable outcome of significantly reduced protest responses it is suggested that the DMV methodology used in this research improves the validity of monetary valuation of biodiversity. Consequently, the notion is put forward that a crucial aspect of deliberative methodology is its contribution to reducing methodological (illegitimate) protest responses.

After excluding protest bids, overall 186 responses in the CV and DMV samples provided the basis for analysing monetary results. Fair price was calculated using the stated amount regarding an increase in the price of bread used as a payment vehicle and income. Increase in the price of bread stated by respondent[62] was multiplied by stated expenditures on

[62] Please indicate the maximum contribution of residents of Middle-Mezőföld over a period of 5 years to the improvement of the diversity of species and habitats of Middle-Mezőföld by the switch from

bread[63]. Since it is a calculated indirect value, it is preferred to call it *implied fair price*. Based on combined samples (CV and DMV) the mean of the implied fair price was calculated at 5053 HUF/year/person of the *Switch from a conventional to environment friendly crop production program* and at 7859 HUF/year/person for the *Agro-Environmental Program* (see descriptions of the programmes in Appendix I).

Participation in a deliberative forum had a significant impact on the fair price. Deliberative forum respondents placed significantly higher bids in the case of both programs. Among deliberative forum participants the mean of the implied fair price of a modest improvement in biodiversity (Switch from a conventional to environment friendly crop production program) was calculated at 6273 HUF/year/person, while among CV-only respondents 4330 HUF/year/person. The other scenario, a healthy land use structure with up to doubling the diversity (Agro-Environmental Program) resulted in a mean implied fair price of 9848 HUF/year/person, while among CV-only respondents 6682 HUF/year/person. Between the mean of the implied fair price of deliberative forum participants and that of CV-only respondents nearly one and a half times difference can be found (Table 10).

Table 10 Influence of participation in deliberative forums on implied fair price

Scenarios	Mean (HUF/person/year)	
	CV-only (N = 108)	Deliberative forum (N = 78)
Switch from a conventional to environment friendly crop production program	4330	6273
Agro-Environmental Program	6682	9848

A curious result of the analysis is that only age and participation in deliberative forums correlate significantly with fair price amounts. Contrary to expectations, neither gender, income, education, farming background nor pro NEP attitudes correlate significantly with implied fair price. This may be due to small sample size or the additionally uncertainty introduced by implying indirect price. The lack of correlation prevents the estimation of a linear regression model with a good fit.

Based on responses average yearly net income per person amounted to HUF 679104. Related to that implied fair price may be considered a high figure. Results show that at the social level 0.92% of disposable incomes should be dedicated to a modest improvement in biodiversity (captured in the 1st programme) and 1.45% to improve the health of land in

conventional to environment friendly crop production / Agro-Environmental Program. What do you think is the maximum price increase necessary to be accepted/tolerated/approved?

[63] „What do you think a resident of Middle-Mezőföld spends monthly on average on bread? (Include the home-made bread.)"

Middle-Mezőföld (Agro-Environmental Program). Participation in deliberative forums significantly increased implied fair price amounts in both scenarios (Table 11).

Table 11 Implied fair price in per cent of average net income

Scenarios	CV-only (N = 108)	Deliberative forum (N = 78)
Switch from a conventional to environment friendly crop production program	0.64%	0.92%
Agro-Environmental Program	0.98%	1.45%

To the best of our knowledge no other research in Hungary aimed at eliciting social price. Although not directly comparable to our survey, outcomes of general contingent valuation studies in Hungary are somewhat similar (Kerekes et al., 1998; Kerekes and Tardi, 1999; Marjainé Szerényi, 2005a; Marjainé Szerényi, 2005b).

Respondents' bids placed on average increase in the price of bread indicate the social value of a change in biodiversity derived without aggregation procedure[64]. In the case of the Switch from a conventional to environment friendly crop production program it was found to be 11% in the CV-only sample (N=108), 14.8% in the deliberative forums (N=78) and 12.6% in the combined sample (N=186). As discussed earlier, the results of deliberative forums are considered more valid. The focus group also made it clear that the price of bread has a symbolic meaning, thereby providing ground for the assumption that in view of respondents it is considered indicative of agricultural prices in general. Thus, if changes in the price of bread are related to average procurement prices of crops a value of biodiversity improvements may be derived. As the forecasted outcomes in the scenario 'switch to environment friendly crop production program' were tailored to match the impacts of assessed farming technologies on biodiversity, it is suggested in this respect that respondents actually placed a value on the environmental externalities of intensive farming. Following this line of reasoning the external impact on biodiversity at the intensive farm calculated to 2009 amounted to HUF 4435 per ton of wheat produced (14.8% of HUF 29872, see Table 35). This external cost is estimated at HUF 3966 per ton of barley, HUF 4332 per ton of corn, HUF 10628 per ton of rape, HUF 17302 per ton of pea and HUF 8788 per ton of sunflower.

[64] What do you think is the maximum contribution of residents of Middle-Mezőföld over a period of 5 years to the improvement of the diversity of species and habitats of Middle-Mezőföld by the switch from conventional to environment friendly crop production?

VI.2.4. Social fair price (consensus seeking)

Deriving *social fair price* was based on group consensual decision-making. In the second session of the deliberative forums with local residents administering the questionnaire was followed by a debate on valuation. Participants debated whether residents of Middle-Mezőföld are to contribute to biodiversity improvements. Participants were asked if possible to form an opinion which encompasses all the views of each participant in the group, that is what would be considered best for the environment (biodiversity) from a social point of view. Following consensus seeking majority voting was applied on how much individuals should pay for biodiversity improvements in Middle-Mezőföld, in which process each participant had a veto right. Social fair price is thus a consensual decision on fair price, aggregated by population.

As the nature of deliberations were not of 'actual consequences', the point may be raised that participants may incline to refrain from exercising their right of veto for the debate to terminate quickly. Our finding did not however confirm this anticipation; consensus seeking was taken seriously by the participants. An important conclusion is that it was difficult to achieve consensus. Consensus-seeking collective valuation was not achieved in the majority of the cases, because participants having opposite views exercised their power of veto. In most deliberative forums opinions were so divergent that, although views tended to converge during the deliberation in the second session, the veto provision prevented a consensus from emerging. A consensus was achieved in only those deliberative forums (3 out of 8), where every participant's initial position was similar. This may indicate that after a discussion session preferences were formed (solidified by the second session of the deliberations). However preferences so formed in any of the forums were not always alike (not allowing for forming a consensual opinion).

Social fair price amounted to 10-25% of the price of bread (3730-9330 HUF/person/year), which multiplied by the population of Middle-Mezőföld of 86 thousand (KSH, 2006a) produced an estimate of 320-800 million HUF/year in the case of 'Switch to environment friendly crop production program'. In the case of 'Agro-Environmental Program' social fair price amounted to 10-50% of the price of bread (5600-18650 HUF/person/year), and was estimated at 480-1600 million HUF/year. It is important to emphasize that due to the small number of participants these consensus values are to be regarded as indicative only.

VI.3. Evaluation of air pollution

In the assessment of environmental load of emissions to air of crop production impacts of nutrient replacement (application and use of inorganic fertilisers, application of organic and

green manure) and energy consumption are analysed. A more detailed assessment is presented in Szabó and Pál (2007).

Nitrogen, phosphor and potassium (N, P, K) are applied in agricultural fertilisers. N and P fertiliser use is one of the primary causes of eutrophication. The production and application of nitrogen fertiliser and its raw materials (ammonia and nitric acid) involves emissions of greenhouse gases (CO_2, N_2O) and ammonia (NH_3). Release of heavy metals is also significant. Due to unavailable methodology for calculating many of the upstream emissions (life-cycle assessment), here, mostly N fertilizer use is assessed. For upstream emissions from nitrogen fertiliser use emission factors based on SusTools (von Blottnitz et al., 2004) were applied, derived by kg of inorganic nitrogen fertiliser produced (see also von Blottnitz et al., 2006).

Inorganic fertilisers were used in all the fields of the intensive farm (Table 12). In the case of autumn barley, autumn wheat and rape NPK fertilisers were applied to the fields for the following year's productions as well. This was also included in the calculations.

Table 12 Inorganic fertiliser use of the two farms (kg/ton of product output)

Crop type	Intensive farm			Ecofarm		
	N fertiliser	P fertiliser	K fertiliser	N fertiliser	P fertiliser	K fertiliser
Spring Wheat	N/A	N/A	N/A	0	0	0
Autumn Wheat	29.9	10.1	10.1	0	0	0
Traditional Wheat	N/A	N/A	N/A	0	0	0
Barley	25.9	11.3	11.3	N/A	N/A	N/A
Corn	17.1	7.4	7.4	0	0	0
Seed Corn	N/A	N/A	N/A	0	0	0
Alfalfa	N/A	N/A	N/A	0	0	0
Rape*	36.7	11.6	11.6	N/A	N/A	N/A
Pea	23.1	16.4	16.4	0	0	0
Sunflower	4.5	9.1	16.7	0	0	0
Oat	N/A	N/A	N/A	0	0	0
Flax	N/A	N/A	N/A	0	0	0

Note: * Fertiliser Boron of 0.12 kg/ton of rape was also used.
N/A – crop not produced

Ecological agricultural practice implies that no inorganic fertiliser is used. Therefore, in the ecological farm the burden on the environment from the use of inorganic fertilisers was zero. Only liquid plant nutrient and conditioner, authorised for organic farming practices, were applied. 4.5 litres of this organic nutrient (Hungavit) per hectare were used only on autumn wheat plant leafs. Although the application of organic manure is permissible, it was

not applied in the given year at the ecological farm, because in previous years organic manure had been applied (organic manure is usually not applied every year). Besides, the ecological farm prefers the application of papilionaceae to organic manure. Since organic manure was not applied at the intensive farm either, this burden is not calculated.

Release of ammonia (NH_3) and nitrous oxide (N_2O) emissions to air are associated with inorganic nitrogen fertiliser use. The amount of these gases is calculated according to the methodology of Emep/Corinair (2003) (Table 13).

Table 13 Air emissions due to inorganic N fertiliser use (kg/ton of product output)

Crop type	Intensive farm		Ecofarm	
	NH_3	N_2O	NH_3	N_2O
Spring Wheat	N/A	N/A	0	0
Autumn Wheat	0.545	0.591	0	0
Traditional Wheat	N/A	N/A	0	0
Barley	0.472	0.512	N/A	N/A
Corn	0.311	0.338	0	0
Seed Corn	N/A	N/A	0	0
Alfalfa	N/A	N/A	0	0
Rape	0.668	0.725	N/A	N/A
Pea	0.421	0.456	0	0
Sunflower	0.082	0.089	0	0
Oat	N/A	N/A	0	0
Flax	N/A	N/A	0	0

Source: own calculation based on farm data
Note: N/A – crop not produced

The production of inorganic N fertiliser implies a range of emissions to air. NO_X, CO_2 and N_2O are released during production (von Blottnitz et al., 2004). Table 14 shows relevant farm data.

Table 14 Emissions due to inorganic N fertiliser production (kg/ton of product output)

Crop type	Intensive farm			Ecofarm		
	NO_X	CO_2	N_2O	NO_X	CO_2	N_2O
Spring Wheat	N/A	N/A	N/A	0	0	0
Autumn Wheat	0.090	83.720	0.405	0	0	0
Traditional Wheat	N/A	N/A	N/A	0	0	0
Barley	0.078	72.520	0.351	N/A	N/A	N/A
Corn	0.051	47.880	0.232	0	0	0
Seed Corn	N/A	N/A	N/A	0	0	0
Alfalfa	N/A	N/A	N/A	0	0	0
Rape	0.110	102.760	0.497	N/A	N/A	N/A
Pea	0.069	64.681	0.313	0	0	0
Sunflower	0.013	12.600	0.061	0	0	0
Oat	N/A	N/A	N/A	0	0	0
Flax	N/A	N/A	N/A	0	0	0

Source: own calculation based on farm data
Note: N/A – crop not produced

At the extensive technology farm, not using inorganic fertilisers, replacement of nutrients in the soil is mostly ensured by fertilisation with green manure. In general, fertilisation with green manure is used when the soil would be free of vegetation for a longer period of time (e.g. after the July harvesting of cereals); but it can also be applied throughout an entire year. The essence of the method is to sow a plant which can relatively quickly develop a large green mass, and has significant nutrient absorbing capacity or binds nitrogen (e.g. papilionaceae, legumes), when the plant is adequately grown (when it is budding), it is harrowed with disc-harrow and then ploughed into the soil. Papilionaceae may thus be applied to replace nutrients. Legumes forming a symbiotic relationship with nitrogen fixing bacteria, can fix atmospheric nitrogen and convert it into nitrogen compounds useful for building plant protein. Release of ammonia and nitrous oxide arise as direct soil emissions. Emissions of NH_3 from crops of agricultural legumes may be expected to be similar to those from fertilised agricultural crops. N_2O emissions may take place during the breakdown of crop residues. In the given year vetch mixed with oat or alfalfa was applied on sunflower fields, and vetch mixed with oat was applied on autumn wheat, oat, pea and corn fields. Emissions of fertilisation with green manure were calculated based on Antal (1999), Emep/Corinair (2003) and expert judgements (Table 15).

Table 15 Emissions to air due to fertilization with green manure (kg/ton of product output)

Crop type	Intensive farm		Ecofarm	
	NH_3	N_2O	NH_3	N_2O
Spring Wheat	N/A	N/A	0	0
Autumn Wheat	0	0	0.243	0.101
Traditional Wheat	N/A	N/A	0	0
Barley	0	0	N/A	N/A
Corn	0	0	0.173	0.072
Seed Corn	N/A	N/A	0	0
Alfalfa	N/A	N/A	0	0
Rape	0	0	N/A	N/A
Pea	0	0	0.220	0.092
Sunflower	0	0	0.637	0.232
Oat	N/A	N/A	0.395	0.164
Flax	N/A	N/A	0	0

Source: own calculation based on farm data
Note: N/A – crop not produced

It is important to stress that crop residues also release air emissions of ammonia and nitrous oxide. Emissions, though on a smaller scale, will arise on all fields covered with vegetation, including natural habitats; therefore in an ideal case it would also be included in the calculations. Evaluation of emissions of ammonia and nitrous oxide from the decomposition of organic substances however could not be carried out for insufficient data were available regarding the volume of crop residues on harvested areas, which gives an unbalanced picture of quantification of the burden of fertilisation with green manure (i.e. neglecting the burden of crop residues).

Electricity is used and on-site fossil fuel (diesel) is combusted at the farms, resulting in emissions to air. The following emissions were calculated:

- Greenhouse gas emissions (CO_2, N_2O, CH_4,);
- Classical air pollutants (NO_2, SO_2, NH_3, NMVOC, PM_{10}, $PM_{2.5}$);
- Heavy metals (Cadmium, Copper, Chromium, Nickel, Selenium, Zink);
- Persistent Organic Pollutants (Benz(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Benzo(a)pyrene, Chrysene, Fluoranthene, Phenanthene)

The farms use diesel in their agricultural machines (ploughing, harvesting, tillage, etc.). The use of electricity for office purposes is also included in the database. The intensive technology farm's natural gas consumption was by a harvest drier and office heating, while electricity was used for electric motors of the drier and cleaner. The ecological farm did not

use natural gas, electricity was used for office heating and by grain-cleaner. The machinery of the ecological farm were not new, therefore its fuel consumption ratio was higher than expected.

The data regarding the share of energy use of each crop were unavailable. Therefore energy use was allocated on an area basis, based on the assumption that resources of the farms had been used equally on all crop fields. In case of mobile machinery use the above method of allocation of fossil fuel (diesel) consumption may be distorting results. Production of root crops (e.g. corn, sunflower) due to ploughing, spraying of pesticides, harvesting and handling of crop residues require intensive use of machinery. On the other hand other crops (e.g. wheat, rape, alfalfa) are less dependent on machines. The production of these latter crops therefore may in reality associated with fewer burdens than the allocation will imply. In terms of electricity consumption the distortion caused by allocation on an area basis is insignificant.

Agricultural machinery use produces various air emissions. All machinery covered here consumes diesel as a fuel. Use of diesel is divided by the crops produced based on the share of arable land use of the given crop. Emission factors are taken from Emep/Corinair (2006). As a result of on-site combustion of fossil fuels heavy metals and toxic pollutants are emitted to air, however the emissions for most pollutants were negligible. Benz(a)anthracene and Phenanthene were the most significant emissions, their mass were still very small though.

Emissions from electricity consumption were calculated according to the electricity generation mix of Hungary. Total electricity generation in 2004 was 33.708 GWh of which power stations' own consumption as well as transmission and distribution losses amounted to 2.456 GWh, so 31.252 GWh were supplied to end users (KSH, 2005). Assuming that the electricity consumed at the farms is representative of the average Hungarian electricity mix with no net imported electricity, emission factors derived by KSH (2006b) were applied to farms' consumption. Natural gas consumption was converted to electricity use and emissions were accordingly calculated. Table 16 shows energy use figures.

Table 16 Energy consumption of farms (unit/ ton of product output)

Crop type	Electricity (kWh)		Natural gas (kWh)		Diesel (liter)	
	Intensive farm	Ecofarm	Intensive farm	Ecofarm	Intensive farm	Ecofarm
Spring Wheat	N/A	16.003	N/A	0	N/A	25.604
Autumn Wheat	8.119	13.716	1.141	0	16.089	21.944
Traditional Wheat	N/A	16.025	N/A	0	N/A	25.641
Barley	9.057	N/A	1.272	N/A	17.948	N/A
Corn	5.986	9.768	0.841	0	11.861	15.629
Seed Corn	N/A	13.478	N/A	0	N/A	21.564
Alfalfa	N/A	4.454	N/A	0	N/A	7.128
Rape	11.804	N/A	1.658	N/A	23.390	N/A
Pea	12.824	12.412	1.801	0	25.412	19.859
Sunflower	14.598	31.506	2.051	0	28.926	50.409
Oat	N/A	22.323	N/A	0	N/A	35.718
Flax	N/A	32.959	N/A	0	N/A	52.735

Source: own calculation based on farm data
Note: N/A – crop not produced

In Impact Pathway Approach damage costs are assessed broken down by pollutants. Damages associated with each of the assessed burdens were quantified in accordance with the values provided in the MethodEx policy toolbox. The ExternE 2005 approach was applied: Life years lost for mortality, Value of Life Year (VOLY) for mortality valuation, Sum of Ozone Means Over 0 ppb (SOMO 0) for Ozone health metric. The evaluation of emissions of greenhouse gases was based on marginal abatement cost (MAC) of CO2, without discounting and with equity weighting not applied. The costs in Hungary per ton of the emitted substances are listed in Table 17.

Table 17 Unit costs of pollutants emitted in Hungary (Euro/ton)

	NH_3	NOx	$PM_{2.5}$*	SO_2	VOC	CO_2	CH_4	N_2O
Unit cost (€/t)	4 574	1 700	23 054	2 600	470	19	399	5 890

Source: ExternE, 2005
Note: * It is not taken into account that the case study farms' PM emissions occur at rural conditions, typically far from human settlements, therefore health impacts are considerably less than in urban areas. MethodEx policy toolbox damage unit cost of PM emissions does not differentiate between locales.

Considering inorganic fertiliser use monetary value is available for nitrogen fertiliser only. In the literature no indication were found that K fertilizer use causes damages. In Table 18 damage cost of fertiliser application is presented broken down by emissions of ammonia

(NH_3) and nitrous oxide (N_2O). Figures in Table 13 were multiplied by unit costs (Table 17) and converted to HUF at 2009 prices.

Table 18 Damage costs of emission of ammonia and nitrous oxide due to nitrogen fertiliser use (HUF/ton of product output, at 2009 prices)

Crop type	Intensive farm		Ecofarm	
	NH_3	N_2O	NH_3	N_2O
Spring Wheat	N/A	N/A	0	0
Autumn Wheat	786	1098	0	0
Traditional Wheat	N/A	N/A	0	0
Barley	681	951	N/A	N/A
Corn	450	628	0	0
Seed Corn	N/A	N/A	0	0
Alfalfa	N/A	N/A	0	0
Rape	965	1347	N/A	N/A
Pea	607	848	0	0
Sunflower	118	165	0	0
Oat	N/A	N/A	0	0
Flax	N/A	N/A	0	0

Note: N/A – crop not produced

Production of inorganic nitrogen fertilisers is associated with emissions of NOx, CO_2 and N_2O. In Table 19 damage cost of fertiliser production is presented broken down by pollutants. Figures in Table 14 were multiplied by unit costs (Table 17) and converted to HUF at 2009 prices.

Table 19 Damage costs of emissions from nitrogen fertiliser production (HUF/ton of product output, at 2009 prices)

Crop type	Intensive farm			Ecofarm		
	NO_X	CO_2	N_2O	NO_X	CO_2	N_2O
Spring Wheat	N/A	N/A	N/A	0	0	0
Autumn Wheat	49	502	753	0	0	0
Traditional Wheat	N/A	N/A	N/A	0	0	0
Barley	42	435	652	N/A	N/A	N/A
Corn	28	287	431	0	0	0
Seed Corn	N/A	N/A	N/A	0	0	0
Alfalfa	N/A	N/A	N/A	0	0	0
Rape	60	616	924	N/A	N/A	N/A
Pea	38	388	582	0	0	0
Sunflower	7	75	113	0	0	0
Oat	N/A	N/A	N/A	0	0	0
Flax	N/A	N/A	N/A	0	0	0

Note: N/A – crop not produced

The two table above show that overall damage costs are typically lower in the case of inorganic nitrogen fertiliser production than application.

In Table 20 damage cost of fertilisation with green manure is presented broken down by emissions of ammonia and nitrous oxide. Figures in Table 15 were multiplied by unit costs (Table 17) and converted to HUF at 2009 prices. In the case of autumn wheat, corn and pea combined damage cost of fertilisation with green manure at the ecological farm was lower than overall cost of inorganic nitrogen fertiliser production and application at the intensive farm. In the case of sunflower, mainly due to the great difference in crop yields, the opposite was found.

Table 20 Damage cost of emission of ammonia and nitrous oxide due to fertilisation with green manure (HUF/ton of product output, at 2009 prices)

Crop type	Intensive farm		Ecofarm	
	NH_3	N_2O	NH_3	N_2O
Spring Wheat	N/A	N/A	0	0
Autumn Wheat	0	0	343	184
Traditional Wheat	N/A	N/A	0	0
Barley	0	0	N/A	N/A
Corn	0	0	244	131
Seed Corn	N/A	N/A	0	0
Alfalfa	N/A	N/A	0	0
Rape	0	0	N/A	N/A
Pea	0	0	311	167
Sunflower	0	0	901	422
Oat	N/A	N/A	559	300
Flax	N/A	N/A	0	0

Note: N/A – crop not produced

Emissions to air of CO_2, N_2O, CH_4, NO_X, SO_2, NH_3, NMVOC, CO, PM_{10}, $PM_{2.5}$ and heavy metals and POPs are associated with energy use, of which CO_2, NO_X and $PM_{2.5}$ dominate results. Figures in Table 16 were multiplied by unit costs (Table 17) and converted to HUF at 2009 prices. The damage costs of electricity and fossil fuel use of both farms are reported in Table 21 below. Regarding diesel consumption, heavy metals and toxic pollutants emitted from mobile machinery use do not represent significant damage costs. Damage costs of emissions of Cadmium, Chromium and Nickel are negligible; at both farms and at each crops are below 1E-08 Euro per ton of product. Damage costs of fossil fuel use at both farms are at an order of magnitude higher than that of electricity use.

Table 21 Damage costs of energy use (HUF/ton of product output, at 2009 prices)

Crop type	Electricity		Natural gas		Diesel	
	Intensive farm	Ecofarm	Intensive farm	Ecofarm	Intensive farm	Ecofarm
Spring Wheat	N/A	112	N/A	0	N/A	1596
Autumn Wheat	58	96	8	0	1024	1368
Traditional Wheat	N/A	112	N/A	0	N/A	1598
Barley	65	N/A	9	N/A	1142	N/A
Corn	43	68	6	0	755	974
Seed Corn	N/A	94	N/A	0	N/A	1344
Alfalfa	N/A	31	N/A	0	N/A	444
Rape	84	N/A	12	N/A	1489	N/A
Pea	92	87	13	0	1617	1238
Sunflower	104	220	15	0	1841	3142
Oat	N/A	156	N/A	0	N/A	2227
Flax	N/A	230	N/A	0	N/A	3287

Note: N/A – crop not produced

In conclusion, results of environmental damage cost estimates for emissions of air pollutants show a great variety among crops and technology (see different input use). The damage costs are dominated by emissions from inorganic nitrogen fertiliser production and use, with the impacts associated with emissions of nitrous oxide to air being the most significant. However with ecological technology, not applying inorganic fertilisers, damage costs associated with emissions of on-site fossil fuel use dominate results. The total quantified damage costs are estimated at HUF 1990-4280 per ton of autumn wheat, HUF 1420-2630 per ton of corn, HUF 1800-4190 per ton of pea and HUF 2440-4690 per ton of sunflower, with the lower bound damages being associated with ecological technology (except sunflower). Results show that intensive technology for most crops, even with limited quantification of damages, fared significantly worse than ecological technology.

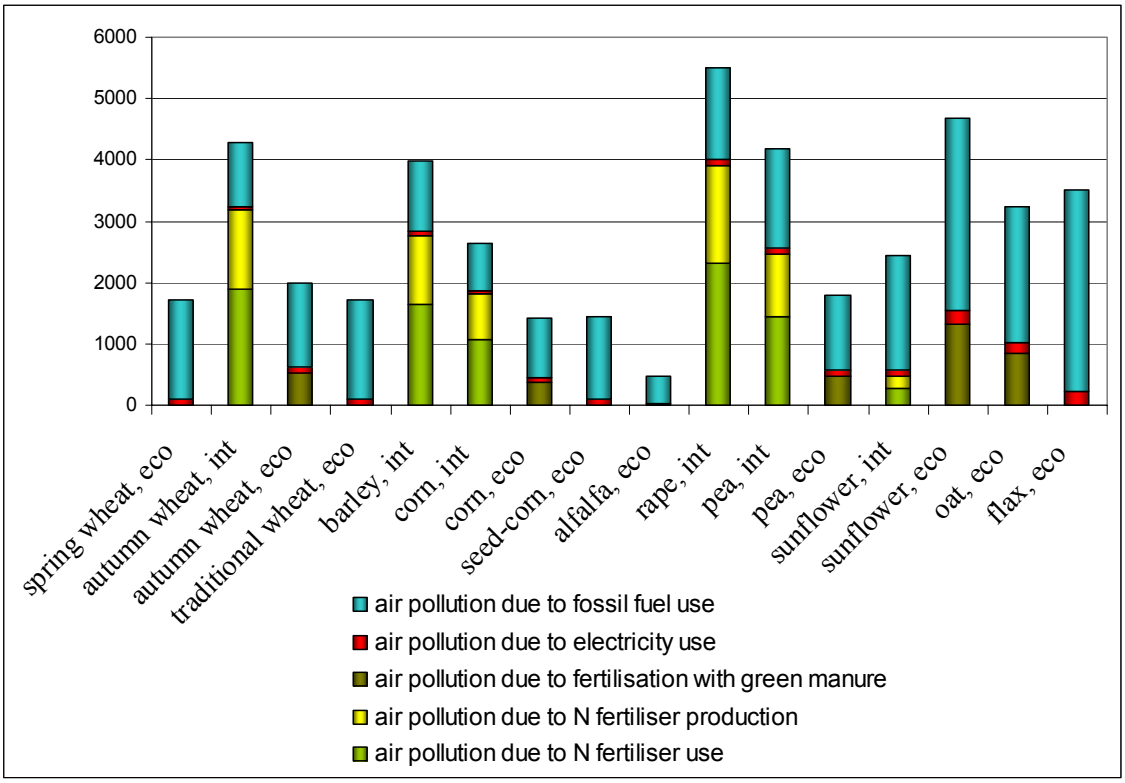
Quantified damages of the intensive technology farm were lowest in production of sunflower (2440 HUF/ton) and highest of rape (5500 HUF/ton). Inorganic fertiliser application together with its production embodied most of the estimated damage. Damages of electricity consumption were mostly negligible. Mobile machinery use was also an important contributor.

Quantified damages of the ecological technology farm were lowest in production of alfalfa (480 HUF/ton) and highest of sunflower (4690 HUF/ton). Mobile machinery use dominated results. Damages of electricity use were not an important factor. Fertilisation with green

manure represented significant contribution to results, though was not applied at all crops. This may seem odd, given that it is considered an environmentally friendly method. As discussed earlier, for methodological reasons damage cost of crop residues remaining on the fields after harvesting are not accounted for and this distorts results.

For the sake of comparability between the two farms (neutralising the impacts of weather) external costs were recalculated (adjusted) to conform to the weather of the year 2005 (see VI.1). Figure 10 shows the results of environmental damage cost estimates for emissions of air pollutants of the two farms disaggregated by impact category.

Figure 11 Estimated environmental damage cost of air pollution (HUF/ton of product output, at 2009 prices)



Note: eco – ecological, int – intensive farm

VI.4. Evaluation of pesticide use

A wide range of pesticides was used at the intensive farm; among them were herbicides, fungicides and insecticides. As the effects of pesticide products are determined by their active substances, the analysis, as a basis of assessing the burden of pesticides, focused on active substances used. The volume of pesticide products used was recalculated on the basis of active substances. Table 22 shows the sum of quantities of active substances (g/ton of product) applied on each crop at the intensive farm. Organic agricultural practice implies

that no pesticides are used. Therefore it is assumed that the burden on the environment from pesticide use at the ecological farm was zero[65].

Table 22 Pesticide use at the intensive farm (gram active substance/ton of product output)

Active Substance	Pesticide type	Autumn wheat	Barley	Corn	Rape	Pea	Sunflo wer
Atrazine	herbicide			67.68			
Azoxistrobin	fungicide	22.19					
Bentazon*	herbicide					345.79	
Cipermetrin	insecticide				12.9		
Cyproconazole	fungicide	5.92	13.2				
Difenoconazole	fungicide					10.51	
Diquat Dibromid**	herbicide						212.77
Fluorchloridon	herbicide						166.22
Hexaconazole	fungicide	13.87					
Chlorpyrifos	insecticide				129.03		
Lambda cyhalothrin	insecticide	1.48	1.65			4.67	
Mezotrion	herbicide			13.91			
Primisulfuron-methyl	herbicide			0.13			
Prometrin	herbicide						265.96
Propiconazole	fungicide	18.49	41.25			10.51	
Prosulfuron	herbicide			0.21			
Sulphur-hydroxide	fungicide					719.63	
S-Metolachlor	herbicide			151.13			382.98
Spiroxamin	fungicide					23.36	
Tebuconazole	fungicide					15.61	
Teflutrin	insecticide			45.2			
Triadimenol	fungicide					4.02	
Triasulfuron	herbicide	0.69	0.77				
Tribenuron-methyl	herbicide	0.63					

Note : * + Octifenol, ** + humidifier

Estimating the environmental damage cost of pesticide use is problematic. Information on dose-response functions (exposure-response functions) is scarce by which human health

[65] A biological insecticide however was used on oat fields (Novodor, 4 litre/hectare). Its active substance consists of 3% Bacillus thuringiensis var. tenebrionis. This is considered harmless to warm-blooded living beings.

effects of pesticide use can be anticipated or predicted. Although some studies contain information about the incidence of effects at some dose levels, it would require considerable effort to convert these to dose-response function suitable for adequate quantification of effects in humans. Moreover, such functions for quantifying human health effects would be burdened with uncertainty regarding relevance and reliability. It needs to be stressed that using the sum of quantities of active substances (g/ton of product) as a basis of assessing the burden of pesticides use does not address the issue that each active substance has a different effect. In some cases these effects vary greatly in significance. Health effects of each active substance are described in MethodEx (2007).

From the approaches described in Section II.3.2 estimation of Rabl (2006) is considered methodologically most grounded and applicable. The author estimated environmental cost of pesticide use in the order of magnitude of 60 Euros/kg (although uncertainty is considered extreme). Table 23 provides a summary of indicative environmental damage costs of pesticide use. Indicative external cost of pesticide use showed great variety across crops ranging from the lowest value of 1000 HUF per ton of barley to 26000 HUF per ton of pea.

Table 23 Indicative external costs of pesticide use (HUF/ton of product output, at 2009 prices)

Crop type	Intensive farm			Ecofarm		
	Insecticide	Fungicide	Herbicide	Insecticide	Fungicide	Herbicide
Spring Wheat	N/A	N/A	N/A	0	0	0
Autumn Wheat	28	1146	25	0	0	0
Traditional Wheat	N/A	N/A	N/A	0	0	0
Barley	32	1032	16	N/A	N/A	N/A
Corn	855	0	4412	0	0	0
Seed Corn	N/A	N/A	N/A	0	0	0
Alfalfa	N/A	N/A	N/A	0	0	0
Rape	2689	0	0	N/A	N/A	N/A
Pea	88	14838	10935	0	0	0
Sunflower	0	0	19465	0	0	0
Oat	N/A	N/A	N/A	0	0	0
Flax	N/A	N/A	N/A	0	0	0

Note: N/A – crop not produced

VI.5. Evaluation of groundwater pollution (nitrification) and landscape impacts

Estimating damage costs of groundwater contamination needs to be carried out from two directions. Firstly, it needs to be known what proportion of nitrate contamination of groundwater agriculture, or arable crop production is responsible for. Secondly, it also needs to be known how much nitrate contamination is caused by nutrient replacement (N) on arable fields, that is, through what chain of effects and by what confidence interval application of organic manure and artificial fertiliser on arable fields contributes to nitrate contamination. (How much of the manure and artificial fertiliser applied is actually absorbed, and consequently what proportion enters the environment, and eventually, through denitrification, what nitrate concentration level is resulted in groundwater.) Furthermore, due to long-term nature of the processes, the current nitrate concentration may mainly be attributed to high N load of 20-40 years before. Assessments of all these would, however, stretch the frame of the dissertation. As an alternative approach, data on fertiliser use of the farms were compared to average fertiliser use of test farms in Middle-Mezőföld, and the assumption was made that if the farm uses more fertiliser than the average use of test farms, then its contribution to nitrification of groundwater is proportionally more. Difficulties in pinpointing causes of contamination were bridged in a way that in the choice experiment survey only problems related to crop production were mentioned. Both the scenarios in the introductory slideshow and the questionnaire discussed nitrification attributed to crop production (see Appendices I and IX). Therefore factors apart from crop production (animal farming, communal sewage etc.) were avoided influencing respondents' valuations of the importance of quality of groundwater. It may rightly be raised that current nitrate contamination is a result of activities (i.e. excessive N applications) decades ago, hence today's farming may not be made responsible for current problems, moreover, current artificial fertiliser use is substantially less than that of times before the change of political regime. With respect to this, respondents were asked about a change from the current situation, furthermore, actual levels of nitrate contaminations were not, only the direction of the change in contamination were covered ("cleaner water in wells", see Appendices VIII-IX).

Survey design draws heavily on the Contingent Valuation and Deliberative Monetary Valuation survey. Especially the deliberative forums provided us with ample terms of reference regarding the attitudes and perceptions of residents, average values concerning biodiversity and so on. The choice experiment questionnaire was developed with the use of the results of these surveys. Qualitative discussions in deliberative forums provided

sufficient information for the attribute selection. During discussions groundwater quality frequently turned up as a perceived major concern, so did landscape issues. Levels of attributes were chosen to conform to the scenarios in order to provide a coherent valuation context. It was found to be difficult to outline the levels of the landscape attribute, as perceptions regarding preferred landscape types varied substantially among deliberative forums participants. The following two tables present the final attributes and their levels applied in the CE survey. In Table 24 a brief description is given (as used in the questionnaires, see Appendix IX), and in Table 25 a more detailed description is provided (as used in the slideshow).

Table 24 Description of attributes and their levels in the choice experiment questionnaire

Attributes	Levels
Variety of species and habitats	○ Status quo (Continued decline in diversity of species and habitats.) ○ 10-20% increase in diversity of plant species. Healthier field margins provide more food sources for birds ○ Up to doubling the diversity of plant species. Extended and healthier field margins and loess-valleys provide a lot more food sources for birds and are better habitats for insects, butterflies and mammals.
Landscape (Aesthetics)	○ Status quo (Current landscape.) ○ More diverse crops, more mosaic and smaller arable fields. ○ More diverse crops, more mosaic arable fields. More field margins and shelterbelts, less eroded fields, more flowering loess-valleys.
Groundwater	○ Status quo (Continued degradation in the quality of groundwater.) ○ Better quality, cleaner water in wells.

Table 25 Description of attributes and their levels used in the slideshow

Attributes	Levels				
Variety of species and habitats	Continued degradation	10-20% increase	Up to doubling		
Landscape (Aesthetics)	Current landscape	More mosaic	More mosaic and more fieldstrips		
Groundwater	Continued degradation	Cleaner groundwater			
Financial cost per household HUF/year	0	2000	5000	9000	17000

During the deliberative forums and the focus groups a distrust of the usual payment vehicles (i.e. tax, fund) was found, nevertheless payment to a fund if perceived to be transparent was preferred.

Sampling for the choice experiment survey followed a specific process. As the survey is preceded by a slideshow presentation usual sampling methods were considered rather difficult to organise. The power point presentation required a portable computer and preferably a projector, and would take 10 minutes time additional to filling out the questionnaire (Appendix IX). Therefore individual face-to-face interviews were considered difficult to conduct, and time and money intensive to organise. Alternatively, events were sought, where at a given time a large number of people are present. The opening ceremonies of schools and kindergartens and parental meetings were selected as a convenient way to administer at one time a relatively large number of questionnaires.

This method clearly fails to result in a statistically representative sample. However our method achieved an unusually high representation in other ways. Due to the specific design of the survey we managed to achieve 100% response rate. As all people present at the events filled out the questionnaire there was no difference between the number of responses and the number of contacts. This way no possible respondent refused to fill out the questionnaire. A usual critique of stated preference methods is that concerning their preferences, attitudes and ethical stances no information of those contacted respondents who declines to answer is available, therefore the validity of the survey exercise may be questioned. It is noted that for instance in Hensher et al. (2005) the response rate was a mere 14%, meaning that no information on preferences, ethical stances or attitudes were available of 86% of the contacted individuals. The possible implication of our applied particular sampling method is that improved coverage of all attitudes in the population (see no one declined to answer) may make up for the weak statistical representation. This issue is particularly relevant in the field of ethical choices, such as ones concerning biodiversity (deontological ethics).

Overall 8 events (opening ceremonies, parental meetings) provided the basis for administering the survey, resulting in a sample size of 366.

From the original 90 (3*3*2*5)[66] the number of choice cards produced by the orthogonal fractional factorial design (see e.g. Hensher et al., 2005) was reduced to 16. After eliminating the inconsistent ones 14 cards remained. A cyclical design satisfying the principle of orthogonality, level balance, and minimal overlap (see Huber and Zwerina, 1996) was then applied arriving at 14 choice sets, each consisting of three alternative

[66] The product of the levels of each four attributes.

profiles (status quo plus two options). One set was eliminated as having a dominant option (levels are higher at each attribute but lower cost). The final 13 choice sets were divided into three groups (A, B, C with 4, 4 and 5 choice sets, respectively), so individuals need not face more than 5 choice sets, hence avoiding respondent fatigue. An example of a choice set is shown in Figure 11.

Figure 12 Example card of CE choice sets

	POLICY OPTION 'A'	POLICY OPTION 'B'	DO NOTHING
Variety of species and habitats	**10-20% increase**	**Up to doubling**	**Continued degradation**
Landscape (Aesthetics)	**More mosaic**	**Current landscape**	**Current landscape**
Groundwater	**Continued degradation**	**Cleaner groundwater in wells**	**Continued degradation**
Financial cost per household HUF/year	**5000**	**17000**	**No cost**

The questionnaire is composed of three parts (see Appendix VIII). The first part consists of the choice experiment questions, the second explores ethics, general environmental and scenario-specific attitudes of respondents (Theory of Planned Behaviour, see III.3.2), while the third part focuses on socio-demographic characteristics.

As discussed in the previous sections, due to our special sampling method the sample is not representative in a statistical sense. Young and middle-age mothers are overrepresented in the sample. Table 26 shows some socio-demographic statistics of the sample.

Table 26 Socio-demographic characteristics of the sample of choice experiment survey

Variable	Valid N	Min.	Max.	Mean	Standard Deviation
Gender (1=male, 2=female)	345	1	2	1.83	0.38
Age (year)	329	18	83	35.29	8.863
Size of household (persons, including respondent)	344	1	8	3.85	1.253
Number of dependents (children)	345	0	4	1.66	1.028
Education (1 = primary school or less, 2 = secondary school without graduation, 3 = graduation, 4 = collage, university degree)	343	1	4	2.52	0.903
Household monthly income (1= <50.000 HUF, 2=50.000-100.000, 3=100.000-150.000, …)	328	25000	450000	140014	89107

The analysis of respondent choices was based on random utility theory (see e.g. Hensher et al., 2005). Model estimations were carried out by using specialised software called Nlogit Limdep 3.0.

In case of biodiversity and landscape attributes the assumption of linear effects only was considered inappropriate[67], instead non-linear effects were assumed, thus these variables were dummy coded[68]. Table 27 shows the abbreviated names of the variables and their brief descriptions on the choice cards provided to respondents.

Table 27 Names and short descriptions of explanatory variables in the CE survey

Abbrev. of variables	Short description
Bid	Financial cost per household (HUF/year)
Bd_10_20	10-20% increase in variety of species and habitats
Bd_100	Up to doubling of species and habitats diversity
LsMosaic	More mosaic landscape
LsMosFie	More mosaic landscape and more fieldstrips
WatClean	Cleaner groundwater

To investigate the effect that the attributes (explanatory variables) may have on respondents' preferences for the agricultural scenarios under valuation, the following utility function was constructed:

$$V = \beta_0 + \beta_1*Bid + \beta_2*Bd\_10\_20 + \beta_3*Bd\_100 + \beta_4*LsMosaic + \beta_5*LsMosFie + \beta_6*WatClean ,$$

[67] Why would utility of one unit of improvement in biodiversity grow continuously in a constant rate at any point of the axis, or why would more field margin worth the same amount more as a more mosaic landscape?

[68] The variable can take on the value 0 or 1.

where β_0 is the alternative-specific constant (ASC), and $\beta_{1\text{-}6}$ are the parameters (coefficient) associated with the attributes.
With the status quo alternative being constant our experiment may be considered a labelled-choice experiment (see e.g. Hensher et al., 2005), therefore the use of alternative-specific parameter may make sense.

For the analysis of results, first, the basic Multinomial Logit model (MNL) was run. The model's robustness is acceptable (Adj. R2 = 0.152). All coefficients bar one are significant at least at the 5% level. Parameter signs are in accordance with a priori expectations (cost is negative, all others are positive). The results of the model run are presented in Table 28.

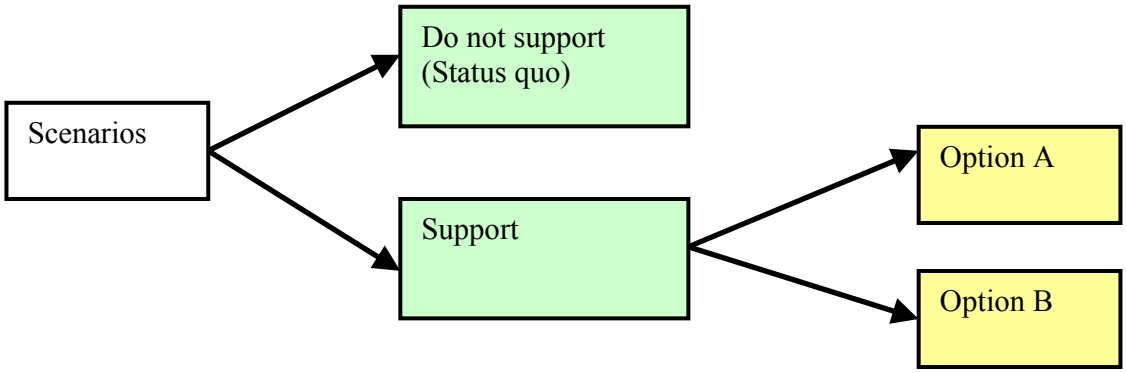
Table 28 Results of Multinomial Logit Model

	Coefficient	Std. Error	t-ratio	P-value
Asc	1.110	0,137	8,111	2,9e-015
Bid	-4.3e-05	5,9e-006	-7,275	3,5e-013
Bd_10_20	0.209	0,078	2,676	0,007
Bd_100	0.221	0,091	2,42	0,015
LsMosaic	0.172	0,076	2,247	0,025
LsMosFie	0.097	0,091	1,072	0,284
WatClean	0.549	0,063	8,664	2,9e-015
Observations	1591			
Adjusted R^2	0.1517			

The MNL make the assumption known as the Independence of Irrelevant Alternatives (IIA). IIA states that the relative probabilities of two alternatives being selected will not be affected by the removal (or introduction) of other options (Bateman et al., 2002). Violation of the IIA assumption may arise in situations where some alternatives are not distinct (not weighted independently in the eyes of respondents). Testing for the IIA property was done by using a test suggested by Hausman and McFadden (1984) (see Hensher et al., 2005). It is worthwhile to note though, that Long and Freese (2006) do not encourage the use of the IIA tests (Hausman test, Small-Hsiao test), claiming that they can produce contradictory results. The Hausman test showed strong evidence (at greater than 1% significance level) of IIA violation. In case of IIA violations the standard MNL is inappropriate and can not be applied. One of the solutions to violations of IIA is re-specification of the model as a Nested Logit Model (Bateman et al., 2002). We thus re-formulated the model as a two-stage nested model in which respondents are assumed to choose between supporting the proposals and

„Status quo" at the top level, and between „Option A" and „Option B" at the lower level (see Figure 13). It is noted here, that the Random Parameter Logit model, which relaxes the IIA assumption, thus also offer a solution to violations of IIA, was also constructed, but it resulted in an overall model fit (Adj. R2 = 0.15) inferior to Nested Logit model results. In the followings, Nested Logit model results are analysed.

Figure 13 Tree structure specified for the Nested logit model



The Nested Logit Model resulted in a good overall model fit. The pseudo-R2 value is high (Adj. R2 = 0.284), which, according to Louviere et al. (2000) indicates a very good fit. In the Nested model, as in the MNL model, the parameter signs are in accordance with our original expectations. Apart from the bid attribute (which is negatively related to the probability of choosing an option), all other attributes are positively related to utility. All coefficients bar one are significant at the 1% level. The second level of landscape attribute (LsMosFie) is insignificant (p=0.235). The tree structure results show that 12% of respondents chose the status quo (SQ) option, 88% chose either Option A or B (OPT). The results are presented in Table 29.

Table 29 Results of Nested logit model

	Coefficient	Std. Error	t-ratio	P-value
Bid	-3.7e-05	5,1e-006	-7,303	2,8e-013
Bd_10_20	0.238	0,072	3,3	0,001
Bd_100	0.237	0,082	2,874	0,004
LsMosaic	0.202	0,07	2,892	0,004
LsMosFie	0.099	0,084	1,188	0,235
WatClean	0.572	0,06	9,429	2,9e-015
SQ	1	0	1,00e+10	2,9e-015
OPT	2.04	0,207	9,84	2,9e-015
Observations	1591			
Adjusted R^2	0.28372			

Besides socio-demographic variables, attitudinal, belief and ethics variables were used to explain the choices. These can only be brought into the model in the form of interactions, so interaction variables were thus created. The incorporations of these possibly explanatory variables somewhat improved the overall model fit. The inclusion of education, attitude and ethics produced the highest pseudo R^2 (0.32). In this case, however, due to introducing multicollinearity, some parameter signs changed for the worse and with most attributes significance levels decreased, so the augmented model was considered inferior, thus not reported here.

Welfare estimates in the form of implicit prices were derived from the nested logit model using the following formula:

$$\text{Implicit price} = \beta_{\text{attribute}} / -\beta_{\text{bid}},$$

where $\beta_{attribute}$ is the coefficient on any of the attributes and β_{bid} is the coefficient of the cost variable (payment to a special fund, with a negative sign). Implicit prices show WTP for a change in level of any of the attributes.

Table 30 shows that WTP values bar the second level of landscape attribute are highly significant ($p<0.005$). Cleaner groundwater represents the highest value, for which WTP amounts to HUF 15387 per households per year. For a 10 to 20 percent improvement in biodiversity respondents are willing to pay HUF 6399 annually, while the doubling of biodiversity is worth an additional HUF 6376. Overall, in the eyes of households contacted the implicit price of doubling of biodiversity is HUF 12775. Respondents are willing to pay HUF 5435/household/year for a more mosaic landscape. The landscape attribute of being

more mosaic and more fieldstrips represents the lowest WTP value (HUF 2674/household/year), but this attribute is highly insignificant (p=0.23).

Table 30 Willingness to pay (WTP) estimates (at 2009 prices)

Attributes	WTP (HUF)	WTP (euro)
Bd_10_20	6399***	22.8***
Bd_100	6376***	22.7***
LsMosaic	5435***	19.4***
LsMosFie	2674	9.5
WatClean	15387***	54.8***

Note: Significance is indicated by *** at 1% level.

Separate nested logit models were then estimated to measure the preferences of two groups of respondents; those characterised by deontological ethics and those holding consequentialist ones. The classification of ethical positions on a deontological versus consequentialist basis was conducted based on Spash et al. (2006) and Spash (2006) typology. About two thirds (218 responses, 1056 observations[69]) the sample holds a consequentialist ethical position consistent with the ethics underlying mainstream economic theory and about one third (122 responses, 535 observations) holds a deontological ethics. As can be seen from Table 31 the second level of landscape attribute (LsMosFie) is significant at 10% in this augmented model. The pseudo-R^2 value is basically unchanged (Adj. $R^2 = 0.278$).

Table 31 Nested Logit Model results, respondents with deontological ethics excluded

	Coefficient	Std. Error	t-ratio	P-value
Bid	-4.8e-05	6,6e-006	-7,223	5,1e-013
Bd_10_20	0.333	0,094	3,541	3,9e-04
Bd_100	0.328	0,107	3,066	0,002
LsMosaic	0.265	0,089	2,99	0,003
LsMosFie	0.196	0,108	1,809	0,07
WatClean	0.652	0,077	8,455	2,9e-015
SQ	1	0	1,00e+10	2,9e-015
OPT	1.775	0,22	8,06743	2,9e-015
Observations	1056			
Adjusted R^2	0.27753			

[69] The software Nlogit Limdep creates so called observations from the responses by certain statistical methods.

Results of this model indicate that deontological versus consequentialist ethical categories may not have a strong influence on implicit price. Willingness to pay results are rather similar to the basic nested model, with the exception of 'more mosaic landscape and more fieldstrips' (LsMosFie) attribute. Table 32 shows that four WTP values are highly significant ($p<0.005$), while the second level of landscape attribute (LsMosFie) is significant only at 10% level.

Respondents with consequentialist ethics value cleaner groundwater less than the overall sample does; with a WTP value of HUF 13686 per households per year this is the second highest ranked attribute behind biodiversity. For a 10 to 20 percent improvement in biodiversity consequentialist respondents are willing to pay HUF 6993 annually, while the implicit price of a 100% increase in biodiversity is found to be HUF 13871 (6993+6878). Consequentialist respondents are willing to pay HUF 5568 /household/year for a more mosaic landscape, while the implicit price of a more mosaic landscape with more fieldstrips is 9677 HUF/household/year (5568+4109).

Table 32 Willingness to pay (WTP) estimates (at 2009 prices), respondents with deontological ethics excluded

Attributes	WTP (HUF)	WTP (euro)
Bd_10_20	6993***	24.9***
Bd_100	6878***	24.5***
LsMosaic	5568***	19.8***
LsMosFie	4109*	14.6*
WatClean	13686***	48.8***

Note: Significance is indicated by *** at 1% and * at 10% level.

From the standpoint of the dissertation it is willingness to pay estimates for changes corresponding to outcomes of farming technologies which are of primary interest. As discussed earlier, concerning biodiversity and landscape as well as groundwater quality impacts a Switch from a conventional to environment friendly crop production corresponds to the first level of the attributes in the choice experiment survey. The second levels in the choice experiment correspond to the scenarios of a complex land use program (Agro-Environmental Program). According to our baseline assumption the impacts of the expansion of agricultural frontier are not assessed in this dissertation, therefore it is assumed that Mezőföld is mainly an agricultural land; its primary land use form is arable crop production (see II.2.5). It is also discussed earlier that concerning the valuation of the impacts on biodiversity results of DMV is considered more valid. Consequently, the results

of attribute levels ‘more mosaic landscape’ (LsMosaic) and ‘cleaner groundwater’ (WatClean) are of particular interest.

Concerning landscape impacts survey results show that for households in Middle-Mezőföld switching from conventional to environment friendly crop production was worth 5435 HUF/year. Regarding quality of groundwater it was worth 15387 HUF/year. Multiplying these two figures by the size of population (86 thousand; KSH, 2006a) and dividing it by the average size of households in the survey sample (3.85 persons) results in an aggregated willingness to pay of residents of Middle-Mezőföld (HUF 121 and 342 million). If these are projected to arable land in Middle-Mezőföld (107800 ha), external cost of landscape impacts was estimated at 1121 HUF/ha, and external cost of groundwater pollution was estimated at 3175 HUF/ha. Multiplying by average yields (Table 7) external costs of ton of crops produced were estimated (see Table 33). Estimated external cost of impacts on landscape was found to be lowest in the case of corn (122 HUF/ton) and highest in the case of sunflower (298 HUF/ton).

Table 33 Valuation of impacts on landscape and groundwater in Middle-Mezőföld

	Impacts on landscape	Impacts on groundwater
Willingness to pay (implicit price, HUF/year/household)	5435	15387
Population (persons)	85744	85744
Size of households in the sample (persons)	3.85	3.85
Aggregated willingness to pay of residents of Middle-Mezőföld (million HUF)	121	342
arable land in Middle-Mezőföld (hectare)	107800	107800
External cost (HUF/ha)	1121	3175
External cost (HUF/ton of wheat)	166	470
External cost (HUF/ton of barley)	185	524
External cost (HUF/ton of corn)	122	346
External cost (HUF/ton of rape)	241	683
External cost (HUF/ton of pea)	262	742
External cost (HUF/ton of sunflower)	298	844

Source: KSH, 2006a, Corine50 (Corine Land Cover 1:50000)

As shown above, concerning groundwater pollution in Middle-Mezőföld willingness to pay estimates were derived by the choice experiment survey. However farm level data are also available on impacts on groundwater bodies, therefore figures in Table 33 were weighted by

farm level data. Accordingly, farm level data on N fertiliser use (see VI.3)[70] were compared to data of test farms[71] in Middle-Mezőföld and the differences between the two datasets provided the basis for modifying external cost estimates presented in Table 33. In general, compared to the average uses of test farms, more N agents were applied on fields of the intensive farm, hence, except for the case of sunflower, external cost estimates for groundwater pollution were increased in functions of the differences in data on uses (see Table 34). External cost of groundwater pollution of the intensive farm were estimated lowest for sunflower production (171 HUF/ton) and highest for rape production (946 HUF/ton).

Table 34 N fertiliser use in the intensive farm compared to Middle-Mezőföld average (2004), and modified external cost of groundwater pollution

Crop type	Intensive farm (N agents kg/ha)	Test farms averages (N agents kg/ha)	Differences between farm data and test farm averages	External cost of groundwater pollution in the intensive farm (HUF/ton of crop produced, at 2009 prices)
Autumn wheat	202	132	153%	718
Barley	157	88	178%	932
Corn	157	94	167%	579
Rape	171	123	138%	946
Pea	99	90*	110%	813
Sunflower	17	84	20%	171

Source: farm level data and AKI, test farms database, 2010
Note:* National average of test farms data, since pea was not produced in test farms in Middle-Mezőföld in 2004.

VI.6. Valuation of soil degradation (siltation)

As discussed in Section II.2.1, soil degradation's impact on soil quality (soil fertility) may not be considered an externality, for the owners of land (farmers) themselves suffer from the damages of such an impact. However a significant proportion of eroded soil enters canals, rivers, lakes, constituting an impact which is considered an externality. One of the two elements of this externality is that pesticides and artificial fertilisers enter water bodies through run-off (i.e. eroded soil) resulting in water contamination and/or eutrophication.

70 It is noted that from 120 kg/ha in the end of 1980s within a couple of years N fertiliser use in Hungary declined to 30 kg/ha, and in a slow increase since the early 1990s it has by now reached around 60 kg/ha. Including organic manure application, N-load on fields with nutrient inputs in Hungary averages 100 kg/ha (KvVM, 2005, p.45).
71 The database operated by AKI on test farms provides production data of various crops on an area basis in Hungary.

Externalities associated with water contamination are assessed in Section VI.5, so these impacts are not covered here.

Eroded soil transported and eventually deposited elsewhere (sedimentation) and the resulting siltation is an external impact which is considered and valued in this section. As a consequence of siltation cubic capacities of reservoirs (water systems) may be reduced and in the meantime maintenance costs of dikes may increase. Some thousands of tonnes of soil enter surface waters in Hungary each year, whereby making water flows more unpredictable, and increasing maintenance costs of canal-systems, because large-scale sedimentation increases risk of flooding. It is not only soil leaching into water courses but increased surface run-off as a result of deteriorating water management of fields which contributes to risk of flooding. Thus, expenditures spent on removing silt from rivers, canals or lakes constitute external costs.

Soil entering fresh-water aquifiers may constitute an externality. Settlements in Middle-Mezőföld extract fresh water from wells in aquifiers (from the depth of 100-200 meters) or by the Danube from groundwater filtrated by unconsolidated materials[72]. These are however not impacted by erosion, therefore additional cost due to soil erosion is not put on running water providers. There are some surface water bodies in Middle-Mezőföld, but to the best of our knowledge silt is not removed from these lakes, hence costs are not associated with siltation. Many of these are used for fishing (Felsőcikolapuszta, Kishantos, Seregélyes, Nagyvenyim, Előszállás, Nagykarácsony). These lakes are man-made, formed from water-courses or springs, and silt is not removed from the lakes used for fishing.

Not being aware of any suitable method, valuation of eroded soil deposited on loess-valleys (i.e. run-off) was not carried out. Perhaps, results of valuation of biodiversity (habitats) may serve as some sort of illustration for this external cost.

To put soil degradation resulting from erosion into a broader context, it is not straightforward weather silt entering the Danube River is beneficial or damaging? The Hungarian section of the Danube is characterised by silt-deficiency (see Platina, 2009), therefore silt entering the river may be considered beneficial. It is not the topic of this dissertation to take sides[73], therefore we do not consider this impact positive, nor negative, hence no external cost is associated with it.

[72] Water is extracted from wells in the following settlements: Alap, Alsószentiván, Besnyő, Előszállás, Mezőfalva, Nagykarácsony, Nagylók, Németkér, Perkáta, Sárbogárd, Sárosd, Seregélyes, Szabadegyháza, Zichyújfalu. Surface water filtrated by unconsolidated materials is extracted (from the Danube near Ercsi): Nagyvenyim, Pusztaszabolcs, Beloiannisz, Iváncsa, Kulcs, Rácalmás.

[73] See the debates in the past decades on Bős-Nagymaros Hydro Power Plant.

In conclusion, evidence for external cost of soil degradation (siltation) was not found. Our finding is reinforced by outcome of deliberative forums held with farmers (VI.2.1.), whereby soil erosion was not considered significant in Mezőföld.

VI.7. Results of assessing all the external impacts

It may be useful to relate the external cost estimates to average procurement prices[74]. Table 35 shows average procurement prices for each crop.

Table 35 Average procurement prices of crops (HUF/ton of product)

Crop type	2004	2005	2008	2009
Spring Wheat	24004	21015	41584	29872
Autumn Wheat	24004	21015	41584	29872
Traditional Wheat	30800	25276	60512	46553
Barley	23992	21272	36052	26715
Corn	23494	21662	29953	29179
Seed Corn	173139	155076	301306	254380
Alfalfa	11300	10953	16313	20090
Rape	55800	48725	104139	71592
Pea	86785	75876	105831	116548
Sunflower	56006	50232	80363	59198
Oat	23531	18139	33861	26953
Flax	92600	97465	146619	147523

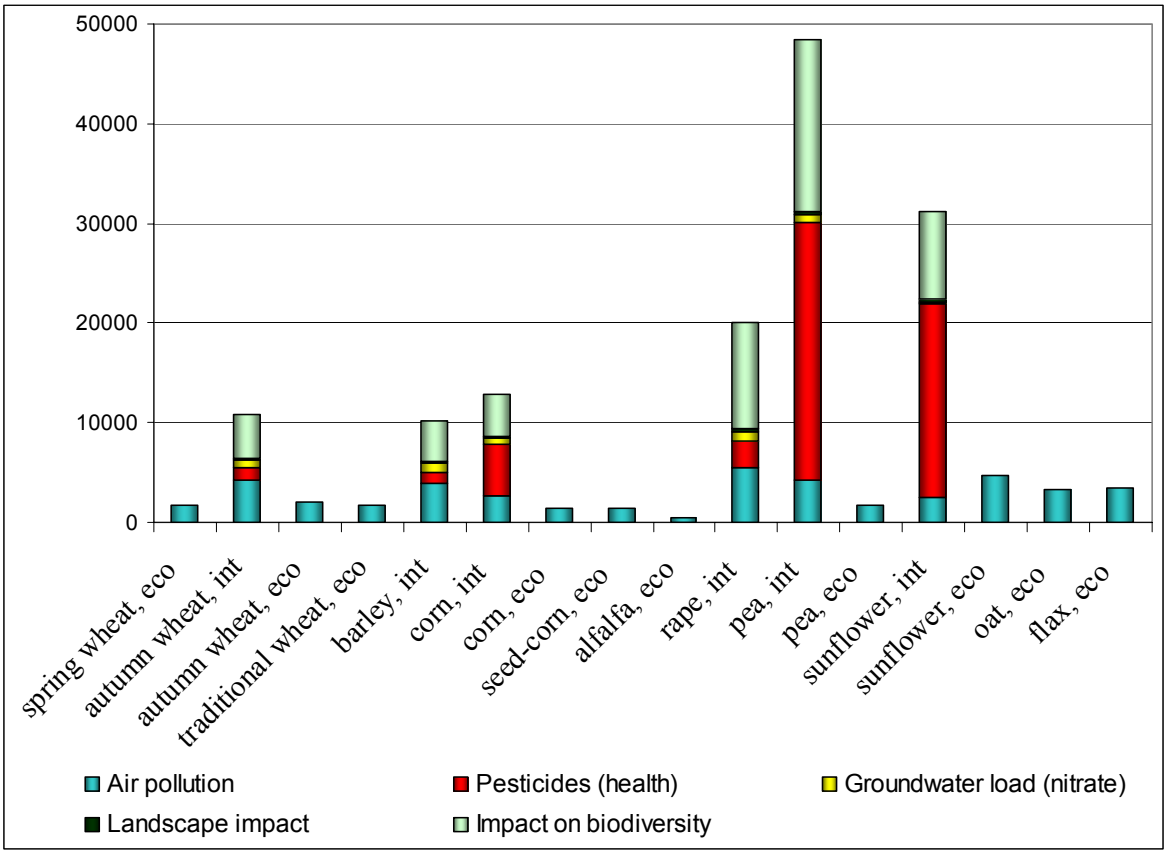
Source: KSH (2010b)

Figure 14 and Table 36 shows estimates for the valuation of all assessed external environmental impacts in both farms. For the sake of commensurability external costs are expressed at 2009 prices. We found that the selection of the plant cultivation technology resulted in marked differences. External costs of the intensive agricultural technology were up to an order of magnitude higher than those of the ecological farming technology (the largest difference was found in the case of pea: 48400 HUF/ton and 1800 HUF/ton, respectively). External cost of soil degradation is not shown in the figure, for, as discussed earlier, no evidence was found for siltation costs incurring in Middle-Mezőföld. Impacts on biodiversity, effects of pesticides on human health and air pollution constituted the three largest elements of external costs. Cost estimates for groundwater pollution and landscape

[74] Market prices exceed agricultural procurement prices but they are considered less relevant because the assessed case study farms are not in direct business relations with consumers. For the sake of uniform assessment, procurement prices are used. It is worth mentioning however that organic products can be sold with a price premium (additional 20-100%), which is not reflected in the prices given in Table 35.

impacts were found to be a lot less substantial. External cost of the ecological farm was estimated at 0.6-7.9% (with the former for corn seed, the latter for sunflower) of procurement prices in 2005 (at 2009 prices). In contrast, in 2004 estimated external cost of the intensive farm reached 27.9-52.6% (with the former being for rape, the latter for sunflower) of procurement prices in 2009. If impacts of weather is taken into account, and estimates are adjusted to respect respective weather conditions of the two years (VI.1), the difference between the external cost estimates for the two farming technologies were found to be even larger. Here, estimated external environmental cost of the intensive farm amounted to 30.5-57.9% of average procurement price. **As regards the overall magnitude of externalities, it can be estimated that in the year under review the ecological farm caused external costs equalling 5 % of the average procurement price of crops grown, whereas the farm applying intensive agricultural technologies caused external environmental costs coming close to half the average procurement price.** External cost for one hectare of agricultural land amounted to HUF 5100-7100 in the case of the ecological farm, while such costs reached HUF 66,600-230,500 in the case of the intensive farm. In the ecological farm only air pollution caused external cost, within which costs of energy use were dominant (see VI.3), and since these were expressed on an area basis, only fertilisation with green manure caused differences in estimates for crops produced. Estimating on an area basis, regarding external costs in the intensive farm corn and autumn wheat production fared relatively worse (113 and 79 thousand HUF/ha), unlike sunflower (129 thousand HUF/ha), therefore ranking in Figure 14 somewhat changed compared to estimates on an crop volume basis (external cost of corn expressed on a per hectare basis was higher than that of rape).

Figure 14 Estimated external costs of the two farms, broken down by crops (HUF/ton of crops produced; at 2009 prices)



Note: eco – ecological, int – intensive farm

Table 36 Estimated external costs of the two farms in per cent of average procurement price (at 2009 prices)

Ecofarm	Spring wheat	Autumn wheat	Traditional wheat	Corn	Corn seed	Alfalfa	Pea	Sunflower	Oat	Flax
External cost (thousand HUF/ton)	1.7	2	1.7	1.4	1.4	0.5	1.8	4.7	3.2	3.5
External cost (thousand HUF//ha)	5.1	7	5.1	7	5.1	5.1	7	7.1	7	5.1
External cost in per cent of price (%)	5.7	6.7	3.7	4.9	0.6	2.4	1.5	7.9	12	2.4

Intensive farm	Autumn wheat	Barley	Corn	Rape	Pea	Sunflower
External cost (thousand HUF/ton)	10.8	10.1	12.9	20	48.4	31.2
External cost (thousand HUF//ha)	78.9	66.6	112.7	101.7	230.5	128.8
External cost in per cent of price (%)	36.1	38	44.3	27.9	41.5	52.6
Weather-adjusted external cost (2004/2005) (thousand HUF/ton)	11.6	11	12.3	21.9	53.9	34.3
Adjusted external cost in per cent of price (%)	39.1	41.2	42.1	30.5	46.2	57.9

A qualitative valuation of agro-biodiversity was pursued in the deliberative forums. Findings show that with respect to crops produced farmers participating in the forums were not aware of varieties specific to Middle-Mezőföld (VI.2.1), therefore evidence for external cost associated with agro-biodiversity was not found. External impact of eroded soil transported by run-off to loess-valleys has not been assessed.

In Section II.2 we already referred to the role of interpretation, whereby in our view positive externalities are deemed expedient to interpret inversely. Thus, in the presentation of our results beneficial changes related to the impacts of a conventional farming technology are not regarded positive, but, choosing the state without environmental pollution as a point of reference, changes related to this latter state are regarded negative. Nevertheless, our results may contribute to grasping an idea of the impacts generally termed as positive externalities. In the scope of this dissertation these are impacts on biodiversity and landscape, but, in the terminology used by ecological farming, any positive impacts related to the negative

environmental impacts of intensive technology are generally interpreted as positive externalities.

Reliability of each elements of the external cost estimates presented in this dissertation and robustness of the results are of crucial importance. As already emphasised earlier, the biggest uncertainty concerns valuation of the pesticide use, for relatively little information is available on mechanisms and effects of pesticides (i.e. exposure-response functions). Consequently, external cost estimates for pesticide use was presented as indicative figures. Since this cost element dominated results of pea, sunflower and corn production, calculated overall external costs of these products need to be regarded as order of magnitude estimates. We believe that our results may be substantially refined in the future, presumably, more robust and reliable unit cost estimates will be available for future use in the estimations. If, for instance, reliable time-series data on human health effects of pesticides are available, the reliability of our cost estimates will improve. Whereby the reliability of the valuation methodology presented thus far may be improved.

Having no intention to bypass methodological problems with acceptability of monetary valuation, emphasis is again put on the importance of respecting ethical orientations in biodiversity-related issues (III.1.1). The choice experiment survey included questions on ethical orientations of respondents (regarding representativity, see VI.5, and regarding ethical categories, see CE questionnaire in Appendix VIII). Results show that in addition to 12.4% of respondents who demonstrated income-bounded preferences thus possibly characterised by bounded deontological ethics, a quarter of respondents (23.5%) were characterised by lexicographic preferences and deontological ethics. Furthermore, 6.5% of respondents held deontological ethics, not being concerned, however, about wildlife but humans (Table 37).

Table 37 Frequencies of ethical orientations in the CE survey (N=366, valid N=347)

Ethical orientation	Description	Share
Deontological, wildlife ethic	Wildlife's right to life cannot be traded against economic considerations.	23.5%
Deontological, bounded wildlife ethic	Below minimal standard of living, wildlife's right to life may be compromised.	12.4%
Consequentialist, wildlife ethic	Weighed against economic considerations, wildlife should come first.	32.4%
Consequentialist, human ethic	Weighed against economic considerations, people's livelihoods come first.	25.2%
Deontological, human ethic	Too much concern is shown for wildlife, resources are to help humans.	6.5%

For a large part of the population, due to the high proportion of respondents identifying themselves as holding deontological ethics, qualitative valuation is to be pursued (IV.2). In our view the large number of deliberative forums allows for drawing some general conclusions. Findings of qualitative valuations illustrate that deterioration of biodiversity and ecosystem services are interesting and not unusual topics to residents of Mezőföld. Using their own wordings participants were able to expound and illustrate the problems they perceived. Findings show that participants were capable to ranking the importance of (assigning priority rankings to) ecosystem services, although resulting rankings diverged. Comparisons with other tangible things were found to be a viable method.

Valuation of biodiversity faces many difficulties for various reasons. We presented possible ways to solve some of these problems. Evidence is provided that deliberative techniques improve on the limitations of conventional contingent valuation surveys. The DMV methodology applied in this research tackled to some degree the problem prevalent in contingent valuation surveys of lack of time and information being available for respondents. Thus we were able to reduce protest responses by half and as a consequence possibly increase validity of results as arriving at a significantly different fair price of biodiversity improvements. Concerning the limitations of contingent valuation methods for valuing such complex and unfamiliar goods as biodiversity, the results of deliberative forums are considered more valid than CV-only values. Results indicate a relatively high social value.

The relative failure of the consensus seeking exercises (social fair price) is considered an important outcome. This may be attributed to having participants' preferences formed (solidified) before the second sessions of deliberative forums. This notion may allow for

suggesting that DMV is an efficient tool for tackling unformed preferences, and fosters preference formation.

Valuation of change in biodiversity was pursued applying a variety of methods. The resulting (social) values may provide some answers to problems with valuations raised in Chapter 3, that is anthropocentric and ecocentric value orientations are based on different frames of reference. In our opinion the followings each tackle different elements of the problems with valuations:

- qualitative valuation (ecosystem services, and biodiversity underpinning them);
- ranking (comparisons in pairs);
- contingent valuation;
- deliberative monetary forum;
- consensus seeking;
- choice experiment.

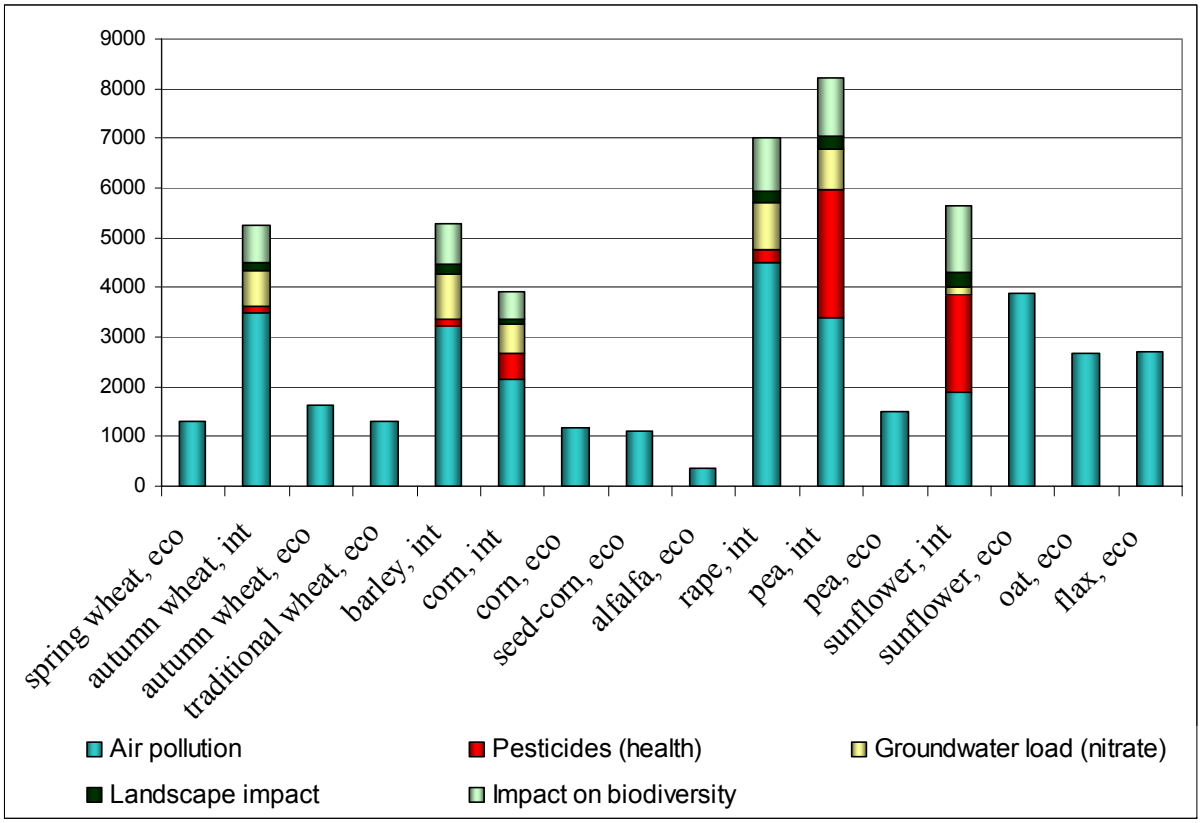
Contemplating all the outcomes of these methods, a picture of social value of a change in biodiversity may be drawn, which is possibly more sound and valid compared to 'usual pictures'.

Putting emphasis on uncertainties, estimating minimal external costs may not be without merit. It is nevertheless noted that flaws due to uncertainties in estimates may result in both overestimate and underestimate of true costs. An upper bound of estimate is not pursued because in our view costs may surge towards infinite values. The main assumptions behind estimating minimal external costs are as follows: unit cost of pesticide use is 6 Euros/kg (see II.3.2., Rabl, 2006); aggregated WTP value derived from contingent valuation survey is applied for valuation of impacts on biodiversity; ExternE GHG Low values[75] are used in estimating costs associated with greenhouse gas emissions. For the sake of commensurability external costs are expressed at 2009 prices, but here are not adjusted to neutralise the impacts of different weather conditions of the two years. Results are shown in Figure 15 and Table 38. Even in this case, the selection of crop production technologies proved to be a decisive factor for the results. Minimal external costs of the intensive agricultural technology were many times higher than those of the ecological farming technology (the largest difference was found in the case of pea: 8200 HUF/ton and 1500 HUF/ton, respectively). Costs of air pollution (N_2O) dominated results of minimal external cost estimates. Minimal external costs of the ecological farm was estimated at in the range

[75] The relevant differences from unit external cost figures shown in Section VI.3:
ExternE GHG low: 2 Euro/tCO_2, 5659 Euro/tN_2O (see ExternE, 2005).

of 360-3900 HUF/ton in 2005 (with the former being for alfalfa, the latter for sunflower; at 2009 prices), whereas those of the intensive farm was estimated at in the range of 3900-8200 HUF/ton in 2005 (with the former being for corn, the latter for pea; at 2009 prices). Projected to one hectare of land, the minimum external costs of crop production on the ecological farm were HUF 4 to 6 thousand, whereas on the intensive farm they reached HUF 21 to 36 thousand per crops (at 2009 prices).

Figure 15 Estimated minimal external costs of the two farms, broken down by crops (HUF/ton of crops produced; at 2009 prices)



Note: eco – ecological, int – intensive farm

Table 38 Estimated minimal external costs of the two farms, broken down by crops (thousand HUF/ha; at 2009 prices)

Ecofarm	Spring wheat	Autumn wheat	Traditional wheat	Corn	Corn seed	Alfalfa	Pea	Sunflower	Oat	Flax
External cost (thousand HUF/ha)	3.9	5.7	3.9	5.7	3.9	3.9	5.7	5.9	5.7	3.9

Intensive farm	Autumn wheat	Barley	Corn	Rape	Pea	Sunflower
External cost (thousand HUF/ha)	35.4	32.1	35.9	32.6	35.1	21.2

Results of estimates for minimal external costs are similar to findings of Pretty et al. (2000) (see II.3.1.). Substantial differences may, however, be found in the structure of cost categories and their weigh in results, nevertheless costs of emissions of N_2O were a major factor in both cases.

With respect to uncertainties, our results are to be best regarded as first guesses. The results presented may serve as a starting platform, on which future research may be based, so the reliability of estimations may improve in time. Our aim was no other than presenting a case study of practical application of the methodology, as to the best of our knowledge this has been the first comprehensive attempt to estimate all environmental impacts of crop production, with the estimation differentiating between technologies (i.e. ecological and intensive), and, where possible, using farm data. Some conclusions may nevertheless be drawn for policy considerations.

VII. Conclusions for policy setting

Considering location-specific nature of agriculture, it is, of course, difficult to draw general conclusions for Hungary from the results found in Middle-Mezőföld. Nevertheless, we are convinced that the methodology used in this dissertation may be applied in other locations as well. Adopting the policy implication conclusions in Pretty et al. (2000, p.131) the results „highlight the need for policy reform, … a more fair and efficient use of these public resources would be achieved if policy sought more explicitly to internalise these external costs". The authors state that more efficient policy solutions and significant contribution to the sustained viability of agriculture could be thus achieved. In our opinion, if these statements were true for the authors' study, than it is definitely true for our more comprehensive and methodologically improved research. Tegtmeier and Duffy (2004) conclude in a similar fashion stating that the market and policy structure discourage changes in farming practices. We believe that assessments presented in this dissertation may serve the aim of tackling externalities of crop production (internalisation). Eventually, it may lead to those public or private arrangements, advocated by Huylenbroeck et al. (2007), in which efficiency and competitiveness are measured not only in terms of tradable (i.e. products) but also in terms of non-tradable (i.e. multifunctional) outputs.

During the mid-term review of the New Hungary Rural Development Programme (NHRDP), certain issues regarding agri-environmental payments are rather sharply emerging: to what extent are these payments achieving their goal; what amounts of subsidies are justified; and for what purposes? The evaluation framework here outlined may provide assistance for deciding these matters. Furthermore, despite the fact that for the first pillar NHRDP subsidies (enhancement of competitiveness) other goals were set, we believe that even the measures pertaining to this pillar can be assessed and qualified by means of this evaluation framework because the "incidental" environmental balance cannot be neglected in the case of first pillar measures either. Looking forward into the future, it can be foreseen that the ongoing reform of the Common Agricultural Policy (CAP) may provide an opportunity (after 2013) for rethinking the principles of subsidies. It is worth considering that the evaluation of environmental impacts (externalities) may also be based on the methodology here presented, especially in the case of non-commodity outputs. On the other hand, it can be raised as a general concern that no consensus has been reached concerning the value of non-market type services (e.g. what values are generated through the operation of the agri-environmental measures; and this hinders policies in taking such non-commodity outputs consistently into account. We believe that the methodological part of our study

offers a possible method which can be used for the accomplishment of this task. Thereby, the justification and the efficiency of subsidies could be measured and interpreted in the case of non-commodity outputs, too (multifunctional agriculture), in contrast to the current situation when such measurement and interpretation can only be achieved in the case of products.

By now, a strong dependency from subsidies evolved in the agrarian sector, and the CAP budgets are expected to become increasingly tighter in the future. In our opinion, the volume or even the very existence of several first (and second) pillar subsidies could be questioned and the relevant subsidization pattern could be reconsidered on the basis of our study's results.

Estimates of external costs projected to an area unit of one hectare may offer a foundation for environmental subsidies. As we have mentioned above, this does not only mean second pillar subsidies. According to our calculations, in the year under review (2004) the farm using intensive agricultural technologies caused negative external impacts in the order of one hundred thousand Forints (HUF) per hectare (depending on the specific crops cultivated) as against the external costs of ecological farming, which only amounted to a couple of thousands of HUF. This difference of up to two orders of magnitude is not reflected in present-day crop production subsidies (see NHRDP 2007-2013). However, the uncertainty factors of the methodology we presented and the uncertainty of the calculated values (particularly in the case of pesticide use and the impact on biodiversity) should not be left out of consideration. Nevertheless, it is apparent that a significant disparity may exist between the two agricultural technologies in terms of their respective assessed environmental impacts.

The findings of our qualitative assessments, presented as an alternative to monetary valuation, clearly demonstrate that Middle-Mezőföld's residents (including local farmers and hunters) do attach an importance to ecosystem services and also to the conservation and enhancement of biodiversity to support such services. As regards positive externalities, during the deliberative forums we could frequently observe opinions, although not expressed in numerical terms, the vast majority of which indicated a need for policies to lay great emphasis on this area, irrespective of monetary valuation. It might perhaps be concluded that the enhancement of biodiversity should be given higher priority than it receives today, which is also evidenced by the comparisons with arts and with physical exercise and sports, respectively.

It is justified to raise the question: to what extent is it a realistic aspiration to spread environmentally friendly farming practices to the detriment of intensive farming? To what degree would a major shift in the intensity of farming modes influence food production volumes? Would not the lower crop yields, often associated with environmentally friendly farming, lead to problems caused by insufficient quantities of food supply? Answering this question goes beyond the scope of our dissertation; nevertheless, it can be noted that the situation of Hungary, being a country endowed with a good agrarian potential, is reassuring in this respect. On the other hand, when thinking on a global scale, we believe that it would be rather hard to give a reassuring answer at present.

Similarly, we think that it would be difficult to resolve globally the conflict between food production and biodiversity conservation. (With its open economy, Hungary cannot make itself independent from the global market; therefore, it makes no sense to only assess this issue within the country borders.) Since it is a must to provide people with primary products to meet their needs for foodstuffs, the issue of biodiversity, as related to agricultural production, has to be dealt with along paths determined by certain existing constraints (Láng, 2009)[76]. Referring to this, Warren, Lawson and Belcher (2008) note that with respect to arable land, areas being cultivated for long, two very different aspects of managing for conservation need consideration. Firstly, arable crop production will need to be reintroduced into former mixed farming enterprises, i.e. reconnect it to animal farming and secondly the intensity of production in specialist arable farms will need to be reduced.

[76] Verbal information

Summary

Two main goals have been set for this thesis: on the one hand, a technology-specific combined evaluation of all external environmental impacts of arable crop production (soil, water and air pollution, human health, biodiversity, landscape) at the level of individual farms, and on the other, improvement of the valuation methodology used for assessing the impacts on biodiversity.

As expounded by the paper, the current structure of agricultural subsidies and their set of objectives often lack any economic rationality. In our view, if the environmental impacts of crop production were evaluated and the subsidies (economic incentives) to be granted were assigned to such values, then agricultural policies could bring about improved environment and enhanced welfare as compared to the current situation. Accordingly, this work endeavours to evaluate the external environmental impacts of crop production. We believe that a more equitable and more efficient utilization of resources can be implemented if relevant policies strive to internalize such externalities.

Having reviewed the pertinent literature, this paper provides a critical overview of the rather small number of research projects which attempted to evaluate the overall environmental impact of agriculture. We found that none of these studies aimed at an all-encompassing valuation of such impacts by taking into consideration the agricultural technologies applied and by using individual farm data as a basis for the analysis. Our project, keeping these research criteria in mind, investigated two farms in Hungary's Middle-Mezőföld region as a kind of case study. The methods selected for the evaluation of impacts were applied with a view to ensuring a holistic approach. Method selection was primarily influenced by the research subject's characteristic features and by the prevailing practice as shown by the relevant literature. Five empirical investigations (qualitative valuation, deliberative monetary valuation, contingent valuation, choice experiment, impact-pathway analysis) served as a foundation for our research work.

Due to the methodological challenge it presents, special emphasis was put on the valuation of impacts on biodiversity. Value orientations and ethics play a particularly important role in the evaluation of biodiversity. Differences arising from anthropocentric and eco-centric value orientations were analyzed (i.e. whether nature has an intrinsic value or not), followed by an assessment of the possible appearance and role of consequentialist and deontological (certain acts are not permissible, regardless of their consequences) ethics in cost-benefit analyses. The task of taking into account use values and non-use values (see Total

Economic Value) involves particularly serious problems. Accordingly, the impacts that do not manifest themselves in monetary form must receive special attention.

Contingent valuation is the most widely used method for the monetary valuation of nature's goods on a hypothetical market. We pointed out some deficiencies of this method and attempted to elaborate and apply methods which enhance the validity and acceptability of valuations to be carried out with respect to changes occurring in complex and unfamiliar public goods such as biodiversity. As part of this work, lexicographic preferences, lack of awareness and knowledge, as well as protest responses were discussed in detail, and finally the issue of unformed preferences was reached and explored. Based on these analyses we concluded that the rate of illegitimate protest responses must be minimized. Furthermore, the context of valuations (i.e. isolated environment and small-sized groups setting offering a closer representation of societal situations) and the role of attitudes were also reviewed. In the end we focussed our attention on deliberative valuation methods. The Deliberative Monetary Valuation (DMV) method combines stated preference assessments with deliberative techniques. In our interpretation, DMV is a two step approach where the aim of the first session is to discuss the issue of the good concerned in small group deliberation, while the second session is about monetary valuation; thus, in theory, it provides an opportunity for preference formation. In our research work we did not follow the practice reflected by pertinent literature because those studies had already introduced monetary valuation in the first session, whereby, we believe, they missed the possibility of addressing unformed preferences.

On account of the need to consider the role of ethics, we applied multiple methods for the valuation of impacts on biodiversity. As shown by our survey, a considerable portion of the population (some one fourth or one third part) is thinking along the lines of deontological ethics; thus, qualitative assessments may be more acceptable to them. During the fairly large number (12) of deliberative forums, we found several examples that demonstrated the emotional attachment of participants to nature. Ecosystem services (which are underpinned by biodiversity) were discussed by following a deliberative guideline. The topic proved to be interesting for the participants: they readily talked about it and typically had a characteristic opinion on it. During all deliberative forums (i.e. those held with the participation of local residents, farmers and hunters), the economic aspects of the issue emerged (crop production benefits and damages), indirect use values (e.g. bird watching) and also non-use values (disappearance of certain species). Farmers were able to establish priorities and rank indirect ecosystem services, even though the priority orders established by the different groups diverged from one another. Our survey revealed that in Middle-

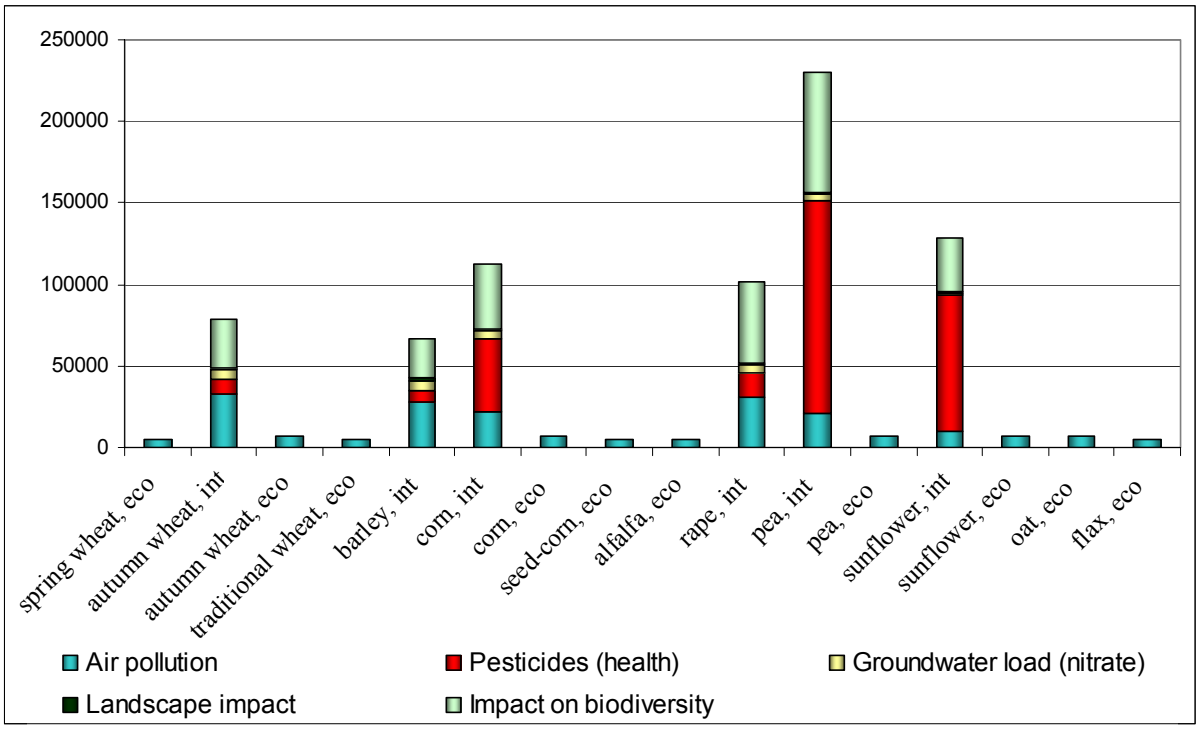
Mezőföld nearly three-quarters of the respondents (N = 325) considered improving the cleanliness of settlements more important than that of biodiversity (28.6 %), while the betterment of the situation of arts was hardly preferred at all to the increase of diversity of species and habitats (94.4 %). Similarly, only a few respondents regarded the expansion of possibilities for sports and physical exercise as more important than the improvement of biodiversity (59.2 %).

Our research found that Deliberative Monetary Valuation significantly reduced the rate of protest responses (cut it by more than half). As a consequence, it is a key feature of DMV that it can contribute to lowering the rate of illegitimate protest responses, whereby the validity of monetary valuations concerning impacts on biodiversity can be enhanced. Participation in deliberative forums led to significantly different fair price results. Among deliberative forum participants the mean of the calculated fair price of a modest improvement in biodiversity (Switch from a conventional to environment friendly crop production program) was HUF 6273/year/person, while among those who only completed the contingent valuation questionnaire this value was HUF 4330/year/person. Even without aggregation we managed to achieve a valuation of the impact on biodiversity, according to which the social fair price of a modest (10 to 20 per cent) improvement in biodiversity among deliberative forum participants (N=78) equalled 15 % of the price of bread. We also attempted to arrive at a social fair price through group consensus decision-making (it is possible that this can be considered as a new value category in view of the group decision-making and consensus seeking). In the majority of cases, however, consensus-seeking collective valuation was not achieved, which may have been a consequence of preference formation (solidification) by the second session of the deliberations.

On an indicative basis, we elaborated estimates for the valuation of all external environmental impacts in the case of two farms in Middle-Mezőföld, which apply different agricultural technologies. We found that the selection of the crop production technology resulted in marked differences in the combined valuation of impact on biodiversity, air pollution, pesticide use, impact on landscape, groundwater pollution and soil destruction (siltation). External costs of the intensive agricultural technology were up to an order of magnitude higher than those of the ecological farming technology. Impact on biodiversity, effects of pesticides on human health and air pollution constituted the three largest elements of external costs, whereas no external costs could be detected for soil destruction and agro-biodiversity. Aggregate external costs for one hectare of agricultural land came to HUF 5 to 7 thousand in the case of the ecological farm, while such costs reached HUF 65 to 230

thousand in the case of the intensive farm (at 2009 prices; see Figure 15). As regards the overall magnitude of externalities, it can be estimated that in the year under review the ecological farm caused external costs equalling 5 % of the average procurement price of crops grown, whereas the farm applying intensive agricultural technologies caused external environmental costs coming close to 50 % of the average procurement price. It is to be emphasized that these results comprise rather great uncertainties; thus our primary aim was to test the methodology and to lay the foundations for future research projects.

Figure 16 Estimated external costs of the two farms, broken down by crops (HUF/ha; at 2009 prices)



Note: eco – ecological, int – intensive farm

In order to allow for the uncertainties, minimum estimates were also prepared. Even in this case, the selection of crop production technologies proved to be a decisive factor for the results. Projected to one hectare of land, the minimum external costs of crop production on the ecological farm were HUF 4 to 6 thousand, whereas on the intensive farm they reached HUF 21 to 36 thousand per crop (at 2009 prices).

Valuations of the external impacts of the ecological farm and the farm applying intensive agricultural technologies may be indicative for a future larger-scale (national, European) application of the methods here used. It is worth considering that the valuation of environmental impacts (externalities), especially in the case of non-tradable outputs, may also be based on the methodology here presented. This could make it possible to measure

and/or interpret the justification and efficiency of agricultural subsidies not only for products but also for non-tradable outputs (multifunctional agriculture). When the justification underpinning monetary valuation is questionable (if the ecocentric value orientation is taken as a starting platform instead of the anthropocentric value orientation), then in the case of biodiversity it may probably be necessary to consider the qualitative methods for the above valuations. As a consequence, the valuation will not be consistent because qualitative values will be included next to monetary values. Nevertheless, we believe that even so, the results obtained may serve as a guideline for the refinement of agricultural policies. Our results seem to confirm that environmentally-friendly farming technologies do bring benefits to society.

Appendices

I. Scenarios for the questionnaire

Two scenarios were developed. One of them is a Switch from a conventional to environment friendly crop production. The other one is called Agro-Environmental Program.

Environment friendly crop production allows for farmers to cultivate their fields in a more environment friendly way. Environment friendly crop production is primary distinguished from intensive farming by its non or little use of pesticides and artificial fertilisers, smaller field sizes and application of crop rotation. By a switch to environment friendly crop production species diversity may be increased on land adjacent to arable fields.

The Agro-Environmental Program pursues an environmentally sustainable land use. It comprises a switch to environment friendly crop production, but goes beyond that. It is not only farming without using pesticides or artificial fertilisers plus applying crop rotation, but grassy field margins, shelterbelts of trees and shrubs would also be introduced. Field margins are important habitats for wildlife. The aim of the Agro-Environmental Program is a healthy land use structure. A healthy land comprises the protection and restoration of loess-valleys peculiar to Middle-Mezőföld. As a result of the Agro-Environmental Program, in addition to land adjacent to arable fields, diversity of species and habitats would be increased on the entire Middle-Mezőföld.

As a consequence of Switch from a conventional to environment friendly crop production in Middle-Mezőföld, it is likely that:

- 10-20% increase in diversity of plant species near crop fields.
- Healthier field margins provide more food sources for birds, such as skylark.

As a consequence of Agro-Environmental Program in Middle-Mezőföld, it is likely that:

- Up to doubling the diversity of plant species. The future of ‘Borzas macskamenta’, a plant species which can only be found in Mezőföld, will be ensured.
- Extended and healthier field margins and loess-valleys provide a lot more food sources for birds, such as skylark. Flowering loess-valleys provide food sources for birds, such as partridge.
- Healthier lands provide better habitats for insects, butterflies and mammals.

II. Discussion guide for deliberative forums with local residents

1. Introduction, 2 min.

The aim of the research is to better understand the changes in our natural environment, and in this context discuss agriculture and culture as well. The research is supported by the Corvinus University of Budapest and the Lélegzet Foundation. This event we are here for is part of an international research and it will benefit a dissertation as well. The main topic of today is the value of nature and the relationship between nature and agriculture.

The discussion will be recorded for the sole purpose of facilitating the analysis. The discussion will take approximately one and a half hours, followed by distribution of gifts.

We are interested to hear the opinions of each one of you, and the main point of this group discussion is to interact with each others. Please, respect others' views. Occasionally, due to time constraints, I will need to speed up the discussion.

Introduction: "My name is István. I am an economist. I would like to ask you all to share with us very briefly where you were born, and if you or anyone in your family has had any kind of farming background.

2. General warm up question, 5 min.

Here are some statements on the future of natural environment in our planet. What do you think of these? How do you see the future of Earth?

- When humans interfere with nature it often produces disastrous consequences.
- Human ingenuity will insure that we do not make the earth unlivable.
- The balance of nature is very delicate and easily upset.
- Humans will eventually learn enough about how nature works to be able to control it.

3. Values related to biodiversity, 15 min.

Let us discuss the diversity of species and habitats. The species of wildlife we are referring to includes plants, insects, birds and mammals. Habitats are sites where various animal and plant species live. Examples of habitats include meadow, forest or loess-valley.

What do you believe the diversity of plants, wildlife and their habitats in Mezőföld will be like in the future? Will we see a species decline, or increase, or it will not change?

<u>If they believe diversity of species will decline:</u>

What do you think how much it will decline? How many species will become extinct? Is it an important issue in Mezőföld, or not really? Are there other, more important problems?
Do you think it is important to prevent the disappearance of species and their habitats, or this is no so much of an importance?
If important: Why is it important to prevent the disappearance of species and their habitats?

4. Assessing the option value, 10 min.

If disappearance of species is important: Do you think the disappearance of species is already a big problem, or it is a problem of the future? Why?
If disappearance of species is not important: Even if disappearance of species is not a big problem now, do you believe it will become a problem in the future, or not really?

What do you think the consequences of the disappearance of species and habitats could be? If a species or a habitat becomes extinct than what do you reckon the consequences of this could be like? Can you think of examples of such possible consequences?

5. Direct ecosystem services, 30 min.

Now, let's talk about things which wildlife provides. We will discuss six things that the diversity of species and habitats may provide.

5.1. Recreation, excursions, birding, tourism

Possibilities of hiking, excursion. For instance watching birds or butterflies. We may view these from the perspective of foreign tourists or Hungarians arriving here from other parts of the country.

Do you go on excursions to other locations or short trips nearby the village? Do you often watch animals or plants in Mezőföld?
Does nature provide recreation services to you? Or is it not so important?
Are nature and wildlife important to foreign tourists and people coming here from other parts of Hungary? Or it is important to you only?

5.2. Aesthetics of landscape

Aesthetics of landscape. Land as an aesthetic beauty.

What is a beautiful scenery like? How would you describe a beautiful landscape in Mezőföld?
What is the sort of landscape in Mezőföld you do not like? Please describe a not beautiful landscape in Mezőföld.

Would you support the transformation of crop production to allow for more diverse crop fields? Or to allow for smaller plots (fields)?
Would you support a transformation to see more field margins and shelterbelts? Less eroded fields? More loess-valleys with wildflowers?

5.3. Nature in Mezőföld's culture

Appearance of Mezőföld's natural environment in culture. Preservation of cultural traditions, such as rural lifestyle, folklore, symbols, folk music, dance, fables, buildings. (For instance skylark's song in fables, or quails' peculiar call.) Inspiring in arts, folklore, or architecture.

What do you think is there a relationship between Mezőföld's culture and natural environment? Is wildlife present in Mezőföld's culture? Do you know examples?

5.4. Worldview

Appearance of Mezőföld's natural environment in worldviews. The role of wildlife in how you view the world. Social relationships may develop around common values and these values may be related to wildlife. It may offer spiritual experience.

What do you think is there a relationship between individuals' worldviews and natural environment?
What do you think is there a relationship between religion and natural environment?

5.5 Drinking water extracted from ground

What sort of water do you drink? Tap water of bottled water?
Are you aware of functioning wells in your neighbourhood area? Is the water drawn from the well drinkable?
Is the water clean? If not, what does it consist of?
Do you think it important to have clean, drinkable water in wells?

Would you support the transformation of crop production to lessen its impact on the quality of groundwater? What would you think of having better quality, cleaner water in wells by transforming crop production? Without pesticides and nitrate?

5.6. Food quality

What sort of food do you eat? Do you buy or produce them? Do you trust the quality of food?

Do you eat local food, or food brought from far?

What do you think is there a relationship between food quality and health?

If yes, what sort?

Do you think it important to eat healthy food? Do you eat biological foodstuff? If not, why?

Who would be prepared to pay for healthy food more than he/she pays for usual foodstuff?

What would you think of having better quality and healthy foodstuff by transforming crop production? Without pesticide residues?

5.7. Valuation of direct ecosystem services

Now, let's discuss wildlife services supposed to benefit people's life (Flip-chart 1). We will attempt to value these.

Flip-chart

Recreation, excursions, birding, tourism
Aesthetics of landscape
Nature in Mezőföld's culture
Worldview
Groundwater
Food quality

How important are the existence of these to you? What do you feel are these contribute to the quality of your life, or not really?

Are there any things nature provides with you which you feel contribute to your life but missing from the list? What other things related to nature can you think of which improves your life?

How important are each elements of the list?

Can you rank them?

Which element in the list is the most important, and why?

If it was possible, how would you have agriculture transformed for it to be more environmentally friendly? Concerning outcomes, what things do you see important?

5.8. Monetary valuation

Would you be prepared to pay for services provided by diversity of species and habitats what we have just discussed? For them to continue to exist? How important are these to you? Would you contribute for these things a lot or little?

How could you express the amount you would pay for these?

Assume a resulting price increase of foodstuff. Will you accept it?

How acceptable an increase in the price of bread would be for you?

What would you think if a tax was introduced to support the preservation of diversity of species and habitats?

Would you be prepared to contribute to a Fund in Mezőföld set up to support the diversity of species and habitats?

Which of the two methods would be more acceptable to you?

Do you know how much bread you consume a month? How much kilograms? How much do you spend on bread a month?

5.9. Comparative valuation, 15 min.

Now, let's try to express the value of the services provided by diversity of species and habitats (we have just discussed) in comparison to other things. Three such things are: art; sport, physical exercise; and cleanliness of settlements.

- What do you think which one is more important in Middle-Mezőföld: services provided by diversity of species and habitats or arts? Why?
- What do you think which one is more important in Middle-Mezőföld: services provided by diversity of species and habitats or sport, physical exercise? Why?
- What do you think which one is more important in Middle-Mezőföld: services provided by diversity of species and habitats or cleanliness of settlements? Why?

6. Value increase, 5 min.

What we have just discussed is now termed wildlife services. We call things which wildlife provides us with and may contribute to our life wildlife services. Let's assume that in addition to what we have covered more wildlife services will be identified in the future.

Whether will the value and importance of wildlife services change, if more and more wildlife services are identified? If yes, how will it change?

7. Wrap up, 5 min.

How do you feel about discussing this topic?

How difficult were the questions? Which question was difficult?

Have you realised new things during the discussion?

Has there been anything raised during the discussion which you had not thought of before? For instance, has it occurred to you before that extinction of species may result in decreasing the options in the future?

8. Follow up, 5 min.

Would you be willing to fill out a questionnaire in about two weeks? Administering the questionnaire takes 20 minutes, and will be followed by a half an hour discussion.

Please, think about how do you value all the things we have discussed today? How important are they? What would you sacrifice for them, or how much would you be willing to pay for them?

Please, regularly record your thoughts and ideas about the topic in the diary handed out now, and do not forget to bring it to the next meeting.

III. Discussion guide for deliberative forums with farmers

1. Introduction, 2 min.

The aim of the research is to better understand the changes in our natural environment, and in this context discuss agriculture. The research is supported by the Corvinus University of Budapest and the Lélegzet Foundation. This event we are here for is part of an international research and it will benefit a dissertation as well. The main topic of today is the value of nature and the relationship between nature and agriculture.

The discussion will be recorded for the sole purpose of facilitating the analysis. The discussion will take approximately one and a half hours, followed by distribution of gifts.

We are interested to hear the opinions of each one of you, and the main point of this group discussion is to interact with each others. Please, respect others' views. Occasionally, due to time constraints, I will need to speed up the discussion.

Introduction: "My name is István. I am an economist. I would like to ask you all to share with us very briefly where and your fields are located, how much hectares you farm, and what do you usually produce?

2. General warm up question, 5 min.

Here are some statements on the future of natural environment in our planet. What do you think of these? How do you see the future of Earth?

- When humans interfere with nature it often produces disastrous consequences.
- Human ingenuity will insure that we do not make the earth unlivable.
- The balance of nature is very delicate and easily upset.
- Humans will eventually learn enough about how nature works to be able to control it.

Does ecological farming have a different impact on the diversity of species and habitats, or there is no difference between conventional and ecological technologies?

<u>If has an impact:</u> how does it have an impact? What sort of information do you have and what do you think of it? How much knowledge do you have regarding the impacts? How certain are you that it has an impact?

<u>If it has no impact:</u> why do you think it has no impact?

Ask what else in addition to pesticide use? (And apart from use of chemicals does anything else have an impact?)

3. Wildlife services list, 30 min.

The species of wildlife we are referring to includes plants, insects, birds and mammals. Habitats are sites where various animal and plant species live. Examples of habitats include meadow, forest or loess-valley.

Here is a list of things which wildlife provides and may contribute to agricultural production. These are the followings:

- Soil fertility, that is improvement of soil structure by earthworms and other invertebrates, and vegetation cover to avoid erosion.
- Minerals and nutrient cycling, that is symbiotic relationship with fungi, bacteria thus increased retention or uptake of nutrients and minerals.
- Pollination.
- Biological control (by natural enemies) of pests.
- Control of invasive species. These are alien weed species which proliferate and hinder the growth of crops, for instance common milkweed (Asclepias syriaca).
- Services provided by field margins (uncultivated field strips), and shelterbelts. These are reduced wind speed, reduced soil erosion, improved microclimate and higher level of soil moisture as well as refugium to pollinators and natural predators of pests.
- Water cleaning, that is fresh water may be extracted from artesian wells.
- Existence of local crop varieties. Genetical diversity of plants produced.

Flip-chart
Soil fertility Minerals and nutrient cycling Pollination Natural predators of pests Control of invasive species Services of field margins and shelterbelts Water from artesian wells Local varieties

What do you think of this list?

Do they contribute to agricultural production, or not?

How important and how useful are the elements of the list with regard to your agricultural production?

If these things did not exist, how much more difficult would it make your farming?
Is there anything provided by nature, which contributes to your farming but missing from the list? By what else does wildlife contribute to plant production?

Do you have experience of actual benefits or damages?
Can you rank the elements?
Which are the three most important elements on the list in order, and why? The lack of which one would you suffer from most?

4. Terminology, 5 min.
What could be an appropriate term for the things or elements of the list we have just discussed?

What do you think of the following terms?

- Ecosystem services,
- Wildlife's services,
- Gifts of communities of living beings,
- Live nature's gifts.

Flip-chart
Ecosystem services Wildlife's services Gifts of communities of living beings Live nature's gifts

Which one do you like? And which one you do not like? Why?
Which one is the most appropriate, expressive?
Do you have other suggestions?

5. Value increase, 5 min.
What we have just discussed is now termed wildlife services. We call things which wildlife provides us with and may contribute to our life wildlife services. Let's assume that in addition to what we have covered more wildlife services will be identified in the future. Whether will the value and importance of wildlife services change, if more and more wildlife services are identified? If yes, how will it change?

6. Possible damages, 10 min.

Regarding today's agricultural production some characteristics of wildlife may hinder or be in the way of farming. Here is a possible list of these:

- Proliferation of weeds (competition for nutrients, sunlight or water)
- Presence of pests, pathogens

Flip-chart
Weeds Pests, pathogens

What do you think of this list?

Is there anything missing from the list?

Do they cause damage?

How big damages do you suffer from these, or what costs do they incur?

Can you rank them?

7. Costs, 10 min.

Regarding costs of farming, are there differences between conventional and ecological technology? Is it dependent on the choice of crops produced?

In what way and to what extent switching from conventional technology would influence the costs of farming?

Are there differences in risks? Using ecological technology can you predict yields and related incomes the same way you do with conventional technology?

Is ecological farming more costly? If yes, what kind of extra costs arise?

What kind of costs will a switch in technology dispense with?

Under what circumstances would you switch your production to ecological technology? What changes are needed for a switch?

8. Selling price, 10 min.

Are there differences in prices of crops depending on if produced by conventional or ecological technology? Can you sell eco-products for the same price as that of conventional ones?

Are there different risks in selling prices associated with the technology? The price of which crop is more predictable: produced by conventional or ecological technology?

9. Wrap up, 5 min.

How do you feel about discussing this topic?

How difficult were the questions?

Have you realised new things during the discussion?

Has there been anything raised during the discussion which you had not thought of before?

10. Follow up

Would you be willing to fill out a questionnaire in about one or two weeks?

IV. Discussion guide for deliberative forums with hunters

1. Introduction, 2 min.

The aim of the research is to better understand the changes in our natural environment, and in this context discuss agriculture and culture as well. The research is supported by the Corvinus University of Budapest and the Lélegzet Foundation. This event we are here for is part of an international research and it will benefit a dissertation as well. The main topic of today is the value of nature and the relationship between nature and agriculture.

The discussion will be recorded for the sole purpose of facilitating the analysis. The discussion will take approximately one and a half hours, followed by distribution of gifts.

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Introduction: "My name is István. I am an economist. I would like to ask you all to share with us very briefly where you were born, and if you or anyone in your family has had any kind of farming background.

2. General warm up question, 5 min.

Here are some statements on the future of natural environment in our planet. What do you think of these? How do you see the future of Earth?

- When humans interfere with nature it often produces disastrous consequences.
- Human ingenuity will insure that we do not make the earth unlivable.
- The balance of nature is very delicate and easily upset.
- Humans will eventually learn enough about how nature works to be able to control it.

3. Values related to biodiversity, 15 min.

Let us discuss the diversity of species and habitats. The species of wildlife we are referring to includes plants, insects, birds and mammals. Habitats are sites where various animal and plant species live. Examples of habitats include meadow, forest or loess-valley.

What do you believe the diversity of plants, wildlife and their habitats in Mezőföld will be like in the future? Will we see a species decline, or increase, or it will not change?

If they believe diversity of species will decline:

What do you think how much it will decline? How many species will become extinct? Is it an important issue in Mezőföld, or not really? Are there other, more important problems?

Do you think it is important to prevent the disappearance of species and their habitats, or this is no so much of an importance?

If important: Why is it important to prevent the disappearance of species and their habitats?

4. Assessing the option value, 10 min.

If disappearance of species is important: Do you think the disappearance of species is already a big problem, or it is a problem of the future? Why?

If disappearance of species is not important: Even if disappearance of species is not a big problem now, do you believe it will become a problem in the future, or not really?

What do you think the consequences of the disappearance of species and habitats could be? If a species or a habitat becomes extinct than what do you reckon the consequences of this could be like? Can you think of examples of such possible consequences?

5. Hunting, 30 min.

Let us now talk about hunting.

Why does it feel good to hunt? Why do you hunt? How did you become a hunter?

What do you think an ideal hunting is like? What do you feel when hunting?

Why do hunters from other regions come here to Mezőföld?

5.1. Hunting and nature

What does influence hunting most? Have you experienced changes in hunting opportunities? How could hunting opportunities be improved?

How do you see the relationship between natural environment and hunting? Does hunting exist without nature? Does nature have any role in hunting? If yes, what?

5.2. Hunting and agriculture

Does agriculture have any role in hunting? How agricultural production influences hunting, if any? How do you see the relationship between crop production and hunting was in the past and has been recently?

5.3. Hunting and stock of game

What game do you hunt for? Are there animal species you would like to hunt for but for some reason you are not allowed to?

How do you see the state of the stock of game in Mezőföld? What have impacts on the stock of game? Do you see the relationship between the stock of game and the state of natural environment?

5.4. Hunting and species diversity

Does it matter how many species of game you can hunt for? Do you see any relationship between the diversity of game and the state of natural environment? If yes, what sort of relationship? Is it important an issue?

6. Valuation

How much hunting is worth to you? How could you express that? How important are these to you? Would you contribute for this a lot or little?

If it was possible, how would you have agriculture transformed for it to serve more the interest of hunting? Would you support a programme which improves diversity of species and habitats in Mezőföld, and consequently improves opportunities for hunting?

7. Monetary valuation

Would you be prepared to pay for a programme which improves diversity of species and habitats in Mezőföld, and consequently improves hunting opportunities?

How could you express the amount you would pay for these?

8. Comparative valuation, 15 min.

Now, let's try to express the value of hunting in comparison to other things. Three such things are: art; sport, physical exercise; and cleanliness of settlements.

- What do you think which one is more important in Middle-Mezőföld: hunting or arts? Why?
- What do you think which one is more important in Middle-Mezőföld: hunting or sport, physical exercise? Why?
- What do you think which one is more important in Middle-Mezőföld: hunting or cleanliness of settlements? Why?

9. Wrap up, 5 min.

How do you feel about discussing this topic?

How difficult were the questions? Which question was difficult?

Have you realised new things during the discussion?

Has there been anything raised during the discussion which you had not thought of before? For instance, has it occurred to you before that extinction of species may result in decreasing the options in the future?

10. Follow up, 5 min.

Would you be willing to fill out a questionnaire in about two weeks? Administering the questionnaire takes 20 minutes, and will be followed by a half an hour discussion.

Please, think about how do you value all the things we have discussed today? How important are they? What would you sacrifice for them, or how much would you be willing to pay for them?

Please, regularly record your thoughts and ideas about the topic in the diary handed out now, and do not forget to bring it to the next meeting.

V. Diary for DMV participants

Some topic regarding preservation of diversity of species and habitats in Middle-Mezőföld:

- What is the current state of nature in Middle-Mezőföld?
- What are the perceived effects of current ecological problems in Middle-Mezőföld?
- What are the role of crop production (agriculture) in preservation of diversity of species and habitats in Middle-Mezőföld?
- What will happen if we do nothing?
- Do we need to do something? If yes, what can we do?
- If preservation of diversity of species and habitats in Middle-Mezőföld is important, who should pay for it and how?

Please describe some of your thoughts:

1. Thought arose in discussion with family:

2. Thought arose in discussion with friends, acquaintances:

3. Thought arose during targeted reading (searching info):

4. Thought arose during watching TV, listening to radio, reading newspaper:

5. Thought arose during searching the internet:

6. Other:

Location: ……

VI. Description of farms

Both farms are situated in the Transdanubia part of the Hungarian Great Plain, in the Mezőföld region, which is one of the best-endowed areas in Europe in terms of plant cultivation. Its soils are lime-coated chernozem soils formed upon deep-layer loess, characterised by good nutrient-providing and water-storing capabilities, as well as by relatively high humus content.

The area is practically a flatland, it is only structured by a few low-gradient slopes; consequently, water erosion does not cause damage here. As the terrain overhangs the Danube River, and its base rock (the loess) has a good water-conducting capability, inland water only causes minor problems. The area is not sensitive to wind erosion; nevertheless, this constitutes perhaps the most significant form of soil destruction here.

From the aspect of plant cultivation, the climate is quite favourable: annual precipitation volumes are adequate in general, and dryer summers favour the cultivation of grain crop and sowing-seeds.

On account of its favourable endowments, this territory has been used for field cultivation for a very long time; as a result, the natural loess vegetation is practically completely wiped out, and only very few natural values can be found in the area.

Intensive farm

The farm carries out large-field cultivation on the territory. Although its farming can be considered as intensive-type farming by Hungarian standards, it also meets the requirements of environmental-friendliness, currently in force in the European Union. Even if the farming is not integrated, it enjoys support from the Hungarian National Rural Development Plan's agri-environment management section, which means that the farming entity concerned undertakes, among others, not to perform excessive fertilizing on its agricultural lands.

In line with the territory's natural endowments, the fields are large in size. Although originally the roads were lined with trees and shrubby balks, today these are missing in many parts because local low-income inhabitants thin out arboraceous plants in the winter to acquire firewood.

The fields can be found in one block, but in some places larger grassy areas, used as hayfields, are also enclaved. The arable land area is 1442 hectares, the individual fields are typically of the size of 50 to 100 hectares, but the farm also has a field of 454 hectares.

The grown plants' crop structure complies with minimum requirements; the farm adheres to the expected follow-up times; however, the crop structure is adapted to the chemical and

fertiliser-based technology. From among nitrogen-collecting legumes, only peas are grown (to produce sowing-seed) on lands representing some 10 per cent of the entire farming area. No irrigation is applied on the fields.

Figure 17 Fields and margins at the intensive farm

Weed control is primarily implemented through the use of chemicals. The applied pesticides' environmental impacts greatly vary: e.g. in 2004 for weed control in maize cultivation atrazin was used (in a quantity of 0.6 g/ha), which was already banned in other EU countries because of its water contamination effect and its persistence. For weed control in sunflower cultivation, again an active substance classified in the „essential use" category, prometrin, was used in a quantity of 1kg/ha77. On the other hand, the environmental health impacts of copper hydroxide, used as fungicide in pea cultivation, are presumably significantly smaller than the earlier mentioned impacts. In terms of active substance content, herbicides and fungicides are used in larger quantities in the farm (2.5 and 3.4 kg/ha, respectively), whereas the average quantity of insecticides used for field cultivation is 20 g/ha. The pesticide sprays are prepared in the volume that is necessary for the field concerned. Flushing of the sprayer is performed next to the toxin storage facility; the small amount of diluted „washing liquid" is sprayed onto the neighbouring weed vegetation. The farm, "naturally", has a toxin storage facility, and the plant protection works are supervised by a qualified plant protection specialist.

[77] At Hungary's accession to the EU, both were classified in the „essential use" category. The use of atrazin and prometrin is banned in Hungary from 31/12/2007.

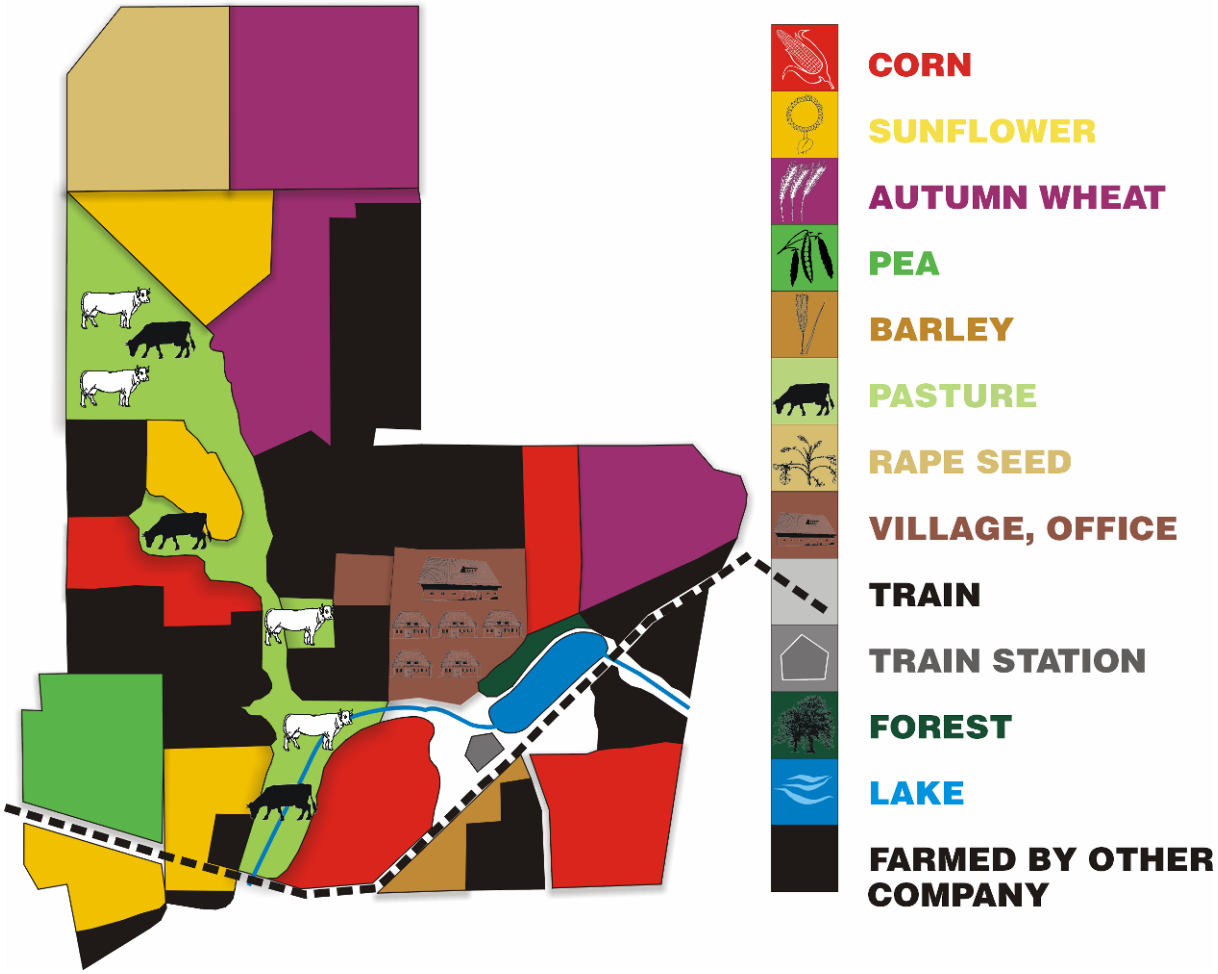
Nutrient replacement is ensured by spraying out liquid fertilizers, in the volume and of the composition calculated on the basis of the soil's nutrient content and the plants' requirements. The fertilizer to be sprayed out is prepared in a large concrete basin, and it is transported from there to the fields. The sprayed-out quantities of these fertilisers in the farm significantly exceed the national average: depending on the grown plant species, on average 150 to 200 kg nitrogen is sprayed out per hectare, while the quantity of sprayed out potassium and phosphorus is 65 to 70 kg. Nutrients are replaced by either 26-28 % Nitrosol preparations or 8x21x21 "NPK" fertilizers with a complex active substance. In compliance with environmental protection requirements, the nitrogen active substance is sprayed out on several (2-3) occasions annually, while the preparation of complex active substance content is sprayed out once a year.

Based on the territory's natural endowments, the farm grows grain crops (fodder). In addition to that, sowing-seed production, primarily for export purposes, also plays an important part (e.g. peas). Staple crops are: maize (with a typical average yield above 9 t/ha), oil crops (sunflower (3.7 t/ha), rape (4.6 t/ha)) and cereals (autumn wheat (6.7 t/ha), barley (6 t/ha)); peas (4.3 t/ha) are also grown.

The farm has an adequate supply of machines and a workshop for the maintenance of its machines. In keeping with Hungarian practice, soil cultivation is primarily based on the autumn deep ploughing. In accordance with good farming practice, the stubble of cereals is stubble-stripped with discs after the harvest, and if necessary, it is stubble-treated (with discs, mainly for weed control purposes) on 1 or 2 occasions in the remaining part of the year.

A smaller-sized pig-farm operated in a liquid manure system also belongs to the farm. Due to economic and environmental protection considerations, however, the long-term continuation of the pig-farm's operation is not ensured. This pig-farm was not taken into account in our calculations.

Figure 18 Map of the intensive farm, 2004



Ecological farm

Ecological farming is an agriculture that takes into account, and is based on, the laws of nature and the interconnections between natural elements. Such agricultural practice does not only focus on production for the market and on gaining profits, but also acts as a true owner of the land and nature in the area concerned. Since it does not use any synthetic fertilizers and pesticides, it is capable of producing foodstuffs free of any chemical residues. In ecological farming, genetically modified plants must not be grown, and it is recommended that the characteristic varieties of the specific area are used.

The Kishantos Ecological Model Farm was awarded the title 'Organic Farm of the Year 2000' (awarded by Biokultúra Egyesület). Besides the Hungarian and EU farming regulations, the farm also complies with the Bioswiss system of requirements (which is

stricter than the former ones). In sunflower cultivation, the US NOP (National Organic Program) requirements are also adhered to.

The idea of the ecological model farm – a program unique in its kind, recognized and appreciated both in Hungary and abroad – was the outcome of a search for environmentally friendly methods of large-scale farming.

Laying the foundations for the model farm began in 1992 by switching over to organic farming on 311 hectares of arable land. The "Ecological Agriculture Foundation" was established for this purpose and its founders achieved great results in Hungary by making use of the matured experiences of German ecological farming, gathered over a period of roughly 80 years. The final plans of the Kishantos Ecological Model Farm were completed in 1995. The integrated land use plan was prepared by German and American experts on the basis of satellite data, by using state-of-the-art spatial informatics software. As a result of this complex planning work, the ecological model farm's concept was elaborated: it is a self-contained agricultural and economic unit, and so it operates as a true model in the legal form of a public service company. The model farm's principal objectives are demonstration, education and research.

With a view to further developing the project, negotiations are carried on in order to purchase the Kishantos manor. As planned, the centre of the model farm could be constructed on this area, situated directly alongside the educational centre, in the heart of the farm. The Farm intends to start animal husbandry, indispensable in ecological farming (milk farm and cheese production), as well as organic corn processing and storing, with the ancillary machine-sheds and workshops necessary for production.

Today, the model farm operates on a total area of 452 hectares, out of which 311 hectares have been cultivated since 1992 without using any chemicals and inorganic fertilizers. Including the office, forest belt and dirt roads the farm consists of 524 hectares.

They primarily grow field crops: autumn and spring wheat, oat, sunflower, alfalfa, green peas, potatoes, soy bean, sweet corn and feeder corn, flax and vetch. In addition, they have a 0.5-hectare demonstration vegetable intended for the benefit of the owners of small gardens.

In line with market demand, they also produce seed-grains from ecological farming, both for the Hungarian and foreign markets.

Figure 19 Weed combing at the ecological farm

In line with the area's natural endowments, the fields are large in size. The fields are only lined by (semi-)natural vegetation in some places; the existing few shelter forest belts are owned by a company farming on the adjacent lands, which rarely take into consideration the interests of the Kishantos Farm when managing these forest belts.

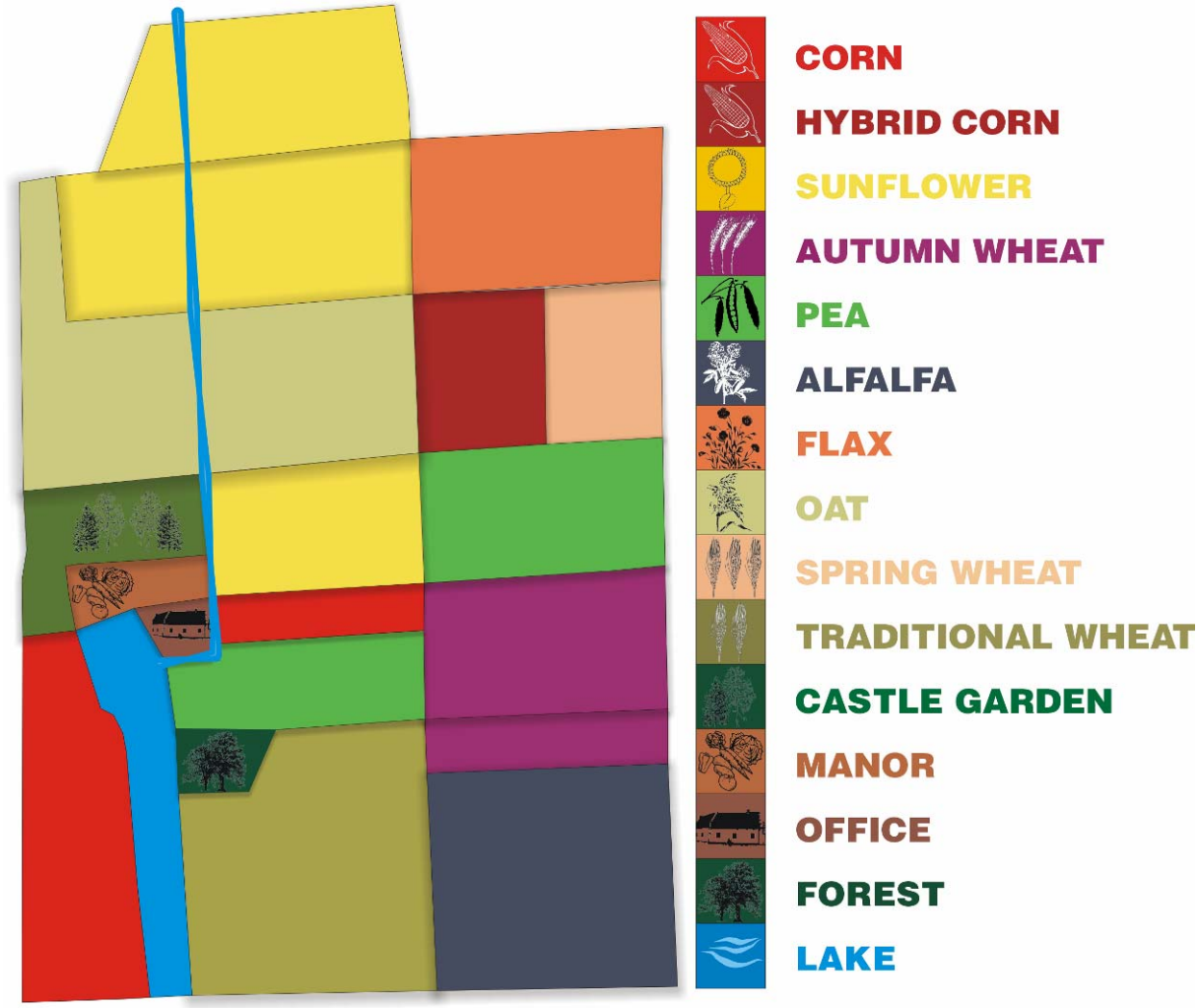
Since ecological farming does not use inorganic fertilizers, the replacement of nutrients in the soil is mostly ensured by fertilization with green manure. In general, fertilization with green manure is used when the soil would be free of vegetation for a longer period of time (e.g. after the July harvesting of cereals); but it can also be applied throughout an entire year. The essence of the method is to sow a plant which can relatively quickly develop a large green mass, and has significant nutrient absorbing capacity or binds nitrogen (e.g. papilionaceae), when the plant is adequately grown (when it is budding), it is harrowed with disc-harrow and then ploughed under into the soil.
Although up until now the Farm has not managed to organize and launch animal keeping, they try to purchase livestock manure from the neighbouring stock-raising farms. By spreading the manure in the autumn, they may improve soil quality in the long run.

From among nutrients, perhaps the nitrogen supply is the most important for plants. Legumes are excellent sources to replace nitrogen because they – with the assistance of their symbiotic micro-organisms – transform the atmospheric nitrogen into a form which can be readily absorbed by other plants as well. Legumes are cultivated in a considerable portion (approximately 15-20 per cent) of the sown area: they grow partly alfalfa, which

remains in the fields for several years, and partly one-year species (e.g. peas, vetch), primarily for the purpose of producing sowing seeds.

To control the quantity of weeds, in addition to prevention (e.g. the use of crop rotation), the farm mostly applies the Hatzenbichler weed comb. Hoed plants are treated 2 or 3 times with cultivators as well. In the case of more sensitive crops (soy bean, sweet corn and seed-corn production), hoers are also used. Similarly, against perennial weeds which may not be thinned out with weed comb and which pose particular hazards in ecological farming (e.g. Cirsium arvense), they use manual labour.

Figure 20 Map of the ecological farm, 2005



VII. Deliberative forum questionnaire

1. Introduction

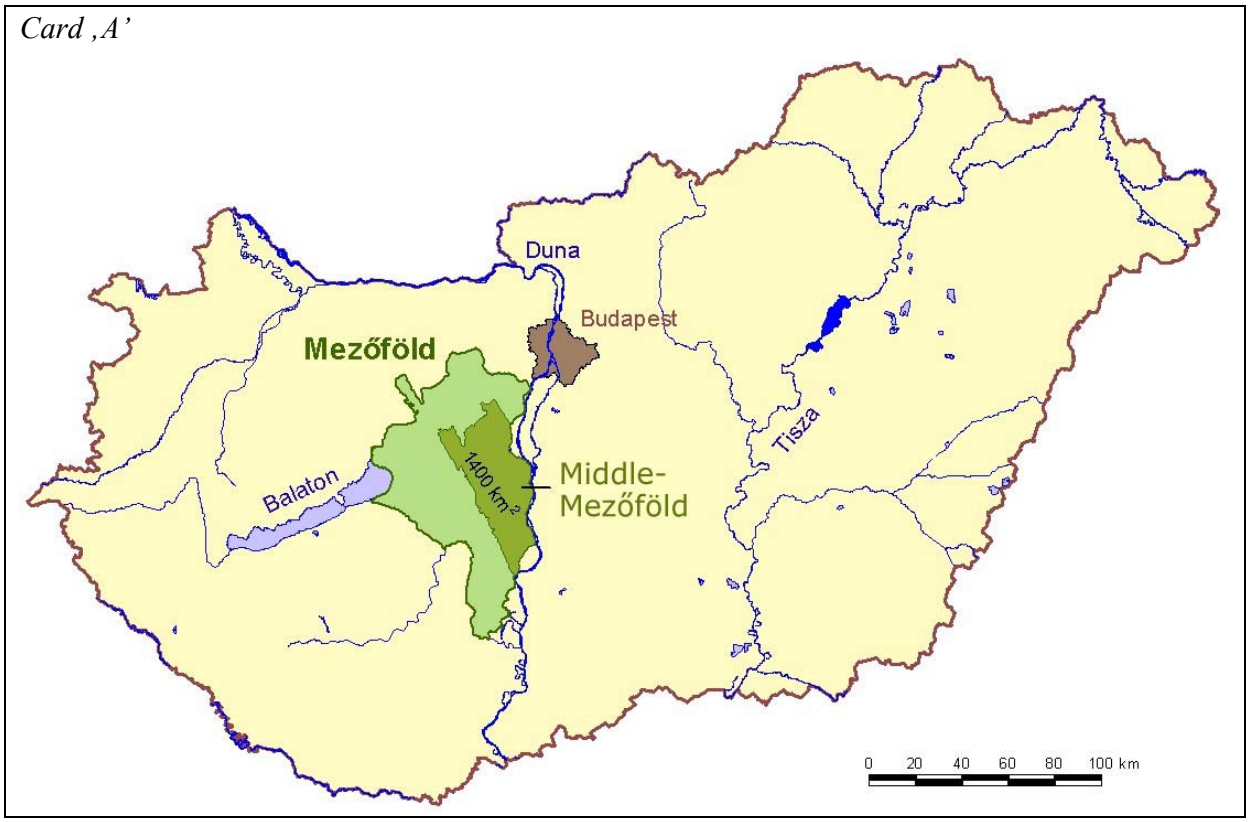
Last time we discussed diversity of species and habitats and its relationship with agriculture. It is continued now by an anonym questionnaire.

The questionnaire will last approximately 25 minutes.

Results will help improve existing farming policies and design new ones which benefit wildlife as well as local residents in Middle-Mezőföld.

2. Description of current situation

Card ‚A'



Middle-Mezőföld is characterised by intensive or industrial agricultural production. Industrial arable crop production means cultivation by applying pesticides, artificial fertilisers and machinery on large size fields. As a consequence, species disappear, habitats degrade, the health of land impairs.

3. Scenarios

Card ‚B'

Scenario 1:
Switch from intensive or industrial to **environment friendly crop production**.

Scenario 2:
Implementation of the **Agro-Environmental Program**. Switch to environment friendly crop production, and introduction of field margins, shelterbelts. Pursuing a healthy land use structure, including grassland management and loess-valleys.

What can we do to preserve the diversity of species and habitats in Middle-Mezőföld for the future?

There appear two alternatives. One of them is a switch to environment friendly crop production. This alternative is cheaper but offers fewer benefits. The other one is a so called Agro-Environmental Program. The implementation of this alternative is more expensive but offers more benefits.

Environment friendly crop production allows for farmers to cultivate their fields in a more environment friendly way. Environment friendly crop production is primary distinguished from intensive farming by its non or little use of pesticides and artificial fertilisers, smaller field sizes and application of crop rotation. By a switch to environment friendly crop production species diversity may be increased on land adjacent to arable fields.

The other option is to implement the Agro-Environmental Program. It pursues an environmentally sustainable land use. It comprises a switch to environment friendly crop production, but goes beyond that. It is not only farming without using pesticides or artificial fertilisers plus applying crop rotation, but grassy field margins, shelterbelts of trees and shrubs would also be introduced. Field margins are important habitats for wildlife. The aim of the Agro-Environmental Program is a healthy land use structure. A healthy land comprises the protection and restoration of loess-valleys peculiar to Middle-Mezőföld. As a result of the Agro-Environmental Program, in addition to land adjacent to arable fields, diversity of species and habitats would be increased on the entire Middle-Mezőföld.

4. Description of expected outcomes

Card ‚C'

Switch from a conventional to environment friendly crop production:
10-20% increase in diversity of plant species. Healthier field margins provide more food sources for birds.

Agro-Environmental Program:
Up to doubling the diversity of plant species. Extended and healthier field margins and loess-valleys provide a lot more food sources for birds and habitats for insects, butterflies and mammals.

What will happen to Middle-Mezőföld's diversity of animals, plants and habitats if present trends in agriculture continue and we do nothing to help protect and enhance it? It is likely that:

- The populations of some familiar species will continue to decline, thus you will be less likely to see these in Middle-Mezőföld. Such bird species is partridge or the windblown tumbleweed.
- The populations of some rare species will continue to decline. This decline may result in the extinction of some species from Middle-Mezőföld. Such extinct plant species is Pamacs laboda.
- The area of near-natural habitats is likely to be further reduced and the quality of remaining habitats will decline. The area of loess-valleys, typical in Middle-Mezőföld, and hedgerows, shelterbelts is likely to be further reduced and become more fragmented. The consequence of this will be a general reduction in species diversity.

As a consequence of Switch from a conventional to environment friendly crop production in Middle-Mezőföld, it is likely that:

- 10-20% increase in diversity of plant species near agricultural fields.
- Healthier field margins provide more food sources for birds, such as skylark.

As a consequence of Agro-Environmental Program in Middle-Mezőföld, it is likely that:

- Up to doubling the diversity of plant species. The future of 'Borzas macskamenta', a plant species which can only be found in Mezőföld, will be ensured.
- Extended and healthier field margins and loess-valleys provide a lot more food sources for birds, such as skylark. Flowering loess-valleys provide food sources for birds, such as partridge.
- Healthier lands provide better habitats for insects, butterflies and mammals.

5. Valuation

Implementation of any of the two programmes requires financial contributions from residents of Middle-Mezőföld. If residents are not willing to contribute financially, the programmes will not be introduced. Implementation of the programmes increases the cost of farming, which in turn leads to increases in the price of bread. Residents may contribute to the implementation of the programmes in the form of accepting/tolerating/approving increases in the price of bread.

Q1: Do you think that residents should contribute to the improvement of the diversity of species and habitats of Middle-Mezőföld?

Yes (1) → Turn to Q.2.a. and Q.3.a., Q.4.a.

No (2) → Turn to Q.2.b.

Q.2.a: Please indicate the maximum contribution of residents of Middle-Mezőföld over a period of 5 years to the improvement of the diversity of species and habitats of Middle-Mezőföld by the **Switch from a conventional to environment friendly crop production**. What do you think is the maximum price increase necessary to be accepted/tolerated/approved[78]?

[78] Only one word in Hungarian.

Before you answer this question, please consider the following:

- The increase in the price of bread that you state should reflect the benefit that you would receive from the improvement of the diversity of species and habitats of Middle-Mezőföld.
- Due to costlier bread you may need to reduce the amount that you spend on other things.
- If the price increase people are willing to accept/tolerate/approve is not enough, the programme may not be introduced.

What do you think is the maximum price increase necessary to be accepted/tolerated/approved79?

- not to increase the price of bread for the program (0)
- the price of 1 kg bread increases from 200 HUF to 205 (1)
- the price of 1 kg bread increases from 200 HUF to 210 (2)
- the price of 1 kg bread increases from 200 HUF to 220 (3)
- the price of 1 kg bread increases from 200 HUF to 250 (4)
- the price of 1 kg bread increases from 200 HUF to 300 (5)
- the price of 1 kg bread increases from 200 HUF to 400 (6)
- do not know (7)

Card ‚D'

Switch from a conventional to environment friendly crop production

not to increase the price of bread for the program
the price of 1 kg bread increases from 200 HUF to 205
the price of 1 kg bread increases from 200 HUF to 210
the price of 1 kg bread increases from 200 HUF to 220
the price of 1 kg bread increases from 200 HUF to 250
the price of 1 kg bread increases from 200 HUF to 300
the price of 1 kg bread increases from 200 HUF to 400

[79] Only one word in Hungarian.

Q.3.a: Please indicate the maximum contribution of residents of Middle-Mezőföld over a period of 5 years to the improvement of the diversity of species and habitats of Middle-Mezőföld by the **Agro-Environmental Program**. What do you think is the maximum price increase necessary to be accepted/ tolerated/approved[80]?

- not to increase the price of bread for the program (0)
- the price of 1 kg bread increases from 200 HUF to 205 (1)
- the price of 1 kg bread increases from 200 HUF to 210 (2)
- the price of 1 kg bread increases from 200 HUF to 220 (3)
- the price of 1 kg bread increases from 200 HUF to 250 (4)
- the price of 1 kg bread increases from 200 HUF to 300 (5)
- the price of 1 kg bread increases from 200 HUF to 400 (6)
- do not know (7)

Card ‚E'

Agro-Environmental Program

not to increase the price of bread for the program
the price of 1 kg bread increases from 200 HUF to 205
the price of 1 kg bread increases from 200 HUF to 210
the price of 1 kg bread increases from 200 HUF to 220
the price of 1 kg bread increases from 200 HUF to 250
the price of 1 kg bread increases from 200 HUF to 300
the price of 1 kg bread increases from 200 HUF to 400

Q.4.a: Which of the following statements most closely reflects your decision regarding the increase in the price of bread?

[80] Only one word in Hungarian.

1. It is important that residents could see that diversity of species and habitats of Middle-Mezőföld improves.
2. The amount I indicated reflects the benefits of improvement of the diversity of species and habitats of Middle-Mezőföld, even although residents are unlikely to see it first hand.
3. The value reflects how much I think the implementation of the programs would cost.
4. The amount reflects how much residents can afford to contribute.
5. I just picked a value at random.
6. Other (please specify)

Q.2.b: Listed below are some reasons why people may not be willing to contribute towards a change in agriculture that aims to improve the diversity of species and habitats of Middle-Mezőföld. Which do you most agree with?

1. The policies for improvements in the diversity of species and habitats of Middle-Mezőföld are not a good use of money.
2. I do not think that there is a need to improve the diversity of species and habitats of Middle-Mezőföld.
3. Residents of Middle-Mezőföld can not afford to pay towards improvements in the diversity of species and habitats.
4. Residents of Middle-Mezőföld already contribute towards improving in the diversity of species and habitats in other ways.
5. Residents of Middle-Mezőföld would be willing to contribute towards improving the diversity of species and habitats, but not by increasing the price of bread.
6. The costs of improving the diversity of species and habitats should be paid by those that contribute to loss of diversity of species and habitats.
7. Other (please specify).

Q.5. Please indicate how much you think you understand the topic of diversity of species and habitats now, after the completion of the survey?

1 – do not understand at all, 2 – rather do not understand, 3 – ensure, 4 – somewhat understand, 5 –understand well

1 – 2 – 3 – 4 - 5

NEP (New Ecological Paradigm) scale

Indicate how much you agree with each of the following statements
(1 – strongly disagree, 2 – somewhat disagree, 3 – ensure, 4 – somewhat agree, 5 – strongly agree).

1. We are approaching the limit of the number of people the earth can support.
   1 – 2 – 3 – 4 - 5

2. Humans have the right to modify the natural environment to suit their needs.
   1 – 2 – 3 – 4 - 5

3. When humans interfere with nature it often produces disastrous consequences.
   1 – 2 – 3 – 4 - 5

4. Human ingenuity will insure that we do not make the earth unlivable.
   1 – 2 – 3 – 4 - 5

5. Humans are severely abusing the environment.
   1 – 2 – 3 – 4 - 5

6. The earth has plenty of natural resources if we just learn how to develop them.
   1 – 2 – 3 – 4 - 5

7. Plants and animals have as much right as humans to exist.
   1 – 2 – 3 – 4 - 5

8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
   1 – 2 – 3 – 4 - 5

9. Despite our special abilities, humans are still subject to the laws of nature.
   1 – 2 – 3 – 4 - 5

10. The so-called 'ecological crisis' facing human kind has been greatly exaggerated.
    1 – 2 – 3 – 4 - 5

11. The earth is like a spaceship with very limited room and resources.
    1 – 2 – 3 – 4 - 5

12. Humans were meant to rule over the rest of nature.
    1 – 2 – 3 – 4 - 5

13. The balance of nature is very delicate and easily upset.
    1 – 2 – 3 – 4 - 5

14. Humans will eventually learn enough about how nature works to be able to control it.
    1 – 2 – 3 – 4 - 5

15. If things continue on their present course, we will soon experience a major ecological catastrophe.

1 – 2 – 3 – 4 - 5

Socio-demographics

Q 1: Gender

- male (1)
- female (2)

Q 2: Age

- ……. year

Q 3: Marital Status

- Married/living together (1)
- Single (2)
- Divorced or separated or widowed (3)

Q 4: Size of household (including you)

- 1 person (1)
- 2 persons (2)
- 3 persons (3)
- 4 persons (4)
- 5 persons (5)
- 6 persons (6)
- 7 persons (7)
- More than 7 persons (8)

Q 5: Dependents

- none (0)
- 1 child (1)
- 2 children (2)
- 3 children (3)
- More than 3 children (4)

Q 6: Education?

- Primary school or less (1)
- Secondary school without graduation (2)

- graduation (3)
- collage, university degree (4)

Q 7: Employment

- employed (1)
- part time or occasional job (2)
- unemployed (3)
- inactive (retired, maternal leave) (4)
- student (5)

Q 8: indicate your household's net monthly disposable income

- less than 50 thousand HUF (1)
- Between 50 000 and 100 000 HUF (2)
- Between 100 000 and 150 000 HUF (3)
- Between 150 000 and 200 000 HUF (4)
- Between 200 000 and 250 000 HUF (5)
- Between 250 000 and 300 000 HUF (6)
- More than 300 000 HUF (7)

Q 9: What do you think a resident of Middle-Mezőföld spends monthly on average on bread? (Include the home-made bread.)

- less than 1000 HUF (1)
- Between 1000 and 2000 HUF (2)
- Between 2000 and 3000 HUF (3)
- Between 3000 and 4000 HUF (4)
- Between 4000 and 5000 HUF (5)
- Between 5000 and 6000 HUF (6)
- Between 6000 and 7000 HUF (7)
- Between 7000 and 8000 HUF (8)
- Between 8000 and 9000 HUF (9)
- Between 9000 and 10000 HUF (10)
- Between 10000 and 11000 HUF (11)
- Between 11000 and 12000 HUF (12)
- Between 12000 and 13000 HUF (13)

- More than 13 000 HUF (14)
- Do not know (15)

Q 10: Were you born in Mezőföld?

- yes (1)
- no (2)

Q 11: What do you think you know Mezőföld

- know Mezőföld area (1)
- do not know Mezőföld area (2)

Farming background

Q 1: Do you have regular income from farming?

- yes (1)
- no (2)

Q 2: If yes, indicate the overall size of your farms?

- Less than 5 hectare (1)
- Between 5 and 20 hectare (2)
- Between 20 and 50 hectare (3)
- Between 50 and 100 hectare (4)
- More than 100 hectare (5)

Q 3: Where are your farms located? (If more areas, indicate the settlement closest to the largest of your farms.)

……

VIII. Choice Experiment Questionnaire

Please indicate at each card your choice.

1. Card: Option A ☐
Option B ☐
Do nothing ☐

2. Card: Option A ☐
Option B ☐
Do nothing ☐

3. Card: Option A ☐
Option B ☐
Do nothing ☐

4. Card: Option A ☐
Option B ☐
Do nothing ☐

5. Card: Option A ☐
Option B ☐
Do nothing ☐

Which of the following statements most closely reflects your decision? Which reason do you most agree with? (Please choose one.)

1. I chose either policy option A or B because I thought that they were good value for my money.
2. I did not consider that either policy options A or B to be good use of my money.
3. I do not think that setting up a Fund should be used to finance either policy options A or B.
4. I already contribute to environmental causes as much as I can afford
5. The costs should be paid for by those who are responsible for the degradation of the environment.
6. Other (please specify): ……..

Rankings

If you were to rank, which of the following things would you prefer to be improved in Middle-Mezőföld?

Please, indicate which of the two below you prefer to have improved.

□ diversity of species and habitats □ cleanliness of settlements

Please, indicate which of the two below you prefer to have improved.

□ diversity of species and habitats □ arts

Please, indicate which of the two below you prefer to have improved.

□ diversity of species and habitats □ sport, physical exercise

Ethical questions

Please, choose one statement.

1. Wild animals and plants need protection because they have a right to life which cannot be traded against economic considerations.
2. Protection of wild animals and plants must be weighed against economic considerations, but in this case, the species should come first.
3. Protection of wild animals and plants must be weighed against economic considerations, and in this case, people's livelihoods come first.
4. Too much concern is shown for wild animals and plants and not enough for humans, so I would rather see the resources used to help humans.
5. Can't answer, this is too complicated.

If you choose statement 1 above, please, answer the next question.

Assume protecting wildlife would mean you had to incur a personal cost which reduced your standard of living to what you regard as a minimum. Would you still be willing to protect their right to life or would you be prepared to see some species become extinct?
Please, choose one statement.
1. I would be prepared to see some species become extinct.
2. I would protect their right to life at the expense of my standard of living.

Specific attitude questions

Please, indicate on a five level scale your opinion on each of the following statements.

1.a. Paying more for environment friendly crop production will increase the diversity and abundance of wild plant and animal species in Middle-Mezőföld (*1 = extremely likely, 2 = rather likely, 3 = unsure, 4 = rather unlikely, 5 = extremely unlikely*)

1 – 2 – 3 – 4 – 5

1.b. Increasing the diversity and abundance of wild plant and animal species in Middle-Mezőföld is *(1 = extremely bad, 2 = rather bad, 3 = unsure, 4 = rather good, 5 = extremely good)*

1 – 2 – 3 – 4 – 5

2.a. Paying more for environment friendly crop production will help restore the health of land in Middle-Mezőföld (*1 = extremely likely, 2 = rather likely, 3 = unsure, 4 = rather unlikely, 5 = extremely unlikely*)

1 – 2 – 3 – 4 – 5

2.b. Restoring the health of land in Middle-Mezőföld is *(1 = extremely bad, 2 = rather bad, 3 = unsure, 4 = rather good, 5 = extremely good)*

1 – 2 – 3 – 4 – 5

3.a. Paying more for environment friendly crop production will enhance groundwater quality in Middle-Mezőföld (*1 = extremely likely, 2 = rather likely, 3 = unsure, 4 = rather unlikely, 5 = extremely unlikely*)

1 – 2 – 3 – 4 – 5

3.b. Enhancing groundwater quality in Middle-Mezőföld is *(1 = extremely bad, 2 = rather bad, 3 = unsure, 4 = rather good, 5 = extremely good)*

1 – 2 – 3 – 4 – 5

4.a. Paying more for environment friendly crop production will teach people to think more about the environmental impacts of agriculture (*1 = extremely likely, 2 = rather likely, 3 = unsure, 4 = rather unlikely, 5 = extremely unlikely*)

1 – 2 – 3 – 4 – 5

4.b. Teaching people to think more about the environmental impact of agriculture is *(1 = extremely bad, 2 = rather bad, 3 = unsure, 4 = rather good, 5 = extremely good)*

1 – 2 – 3 – 4 – 5

5.a. Paying more for environment friendly crop production will restore Middle-Mezőföld to a more natural state (*1 = extremely likely, 2 = rather likely, 3 = unsure, 4 = rather unlikely, 5 = extremely unlikely*)

1 – 2 – 3 – 4 – 5

5.b. Restoring Middle-Mezőföld to a more natural state is *(1 = extremely bad, 2 = rather bad, 3 = unsure, 4 = rather good, 5 = extremely good)*

1 – 2 – 3 – 4 – 5

6.a. Paying more for environment friendly crop production will restore Middle-Mezőföld to a more beautiful state (*1 = extremely likely, 2 = rather likely, 3 = unsure, 4 = rather unlikely, 5 = extremely unlikely*)

1 – 2 – 3 – 4 – 5

6.b. Restoring Middle-Mezőföld to a more beautiful state is *(1 = extremely bad, 2 = rather bad, 3 = unsure, 4 = rather good, 5 = extremely good)*

1 – 2 – 3 – 4 – 5

General belief questions

Please, indicate on a five level scale your opinion on each of the following statements.
(*1 – strongly disagree, 2 – rather disagree, 3 – unsure, 4 – rather agree, 5 – strongly agree*)

7. Environmental protection will provide a better world for me and my children.

1 – 2 – 3 – 4 – 5

8. Environmental protection is beneficial to my health.

1 – 2 – 3 – 4 – 5

9. A clean environment provides me with better opportunities for recreation.

1 – 2 – 3 – 4 – 5

10. Environmental protection benefits everyone.

1 – 2 – 3 – 4 – 5

11. Environmental protection will help people have a better quality of life.

1 – 2 – 3 – 4 – 5

Socio-demographic information

1. Gender
   - o male (1)
   - o female (2)

2. Age ……. year

3. Marital Status
   - o married/living together (1)
   - o single (2)
   - o divorced or separated or widowed (3)

4. Size of household (including you)
   - o 1 person (1)
   - o 2 persons (2)
   - o 3 persons (3)
   - o 4 persons (4)
   - o 5 persons (5)
   - o 6 persons (6)
   - o 7 persons (7)
   - o more than 7 persons (8)

5. Dependents
   - o none (0)
   - o 1 child (1)
   - o 2 children (2)
   - o 3 children (3)
   - o more than 3 children (4)

6. Education
   - o primary school or less (1)
   - o secondary school without graduation (2)
   - o graduation (3)
   - o collage, university degree (4)

7. Employment

- o employed (1)
- o part time or occasional job (2)
- o unemployed (3)
- o inactive (retired, maternal leave) (4)
- o student (5)

8. Indicate your household's monthly net income. (Monthly disposable money in your household)

- o less than 50 thousand HUF (1)
- o between 50 000 and 100 000 HUF (2)
- o between 100 000 and 150 000 HUF (3)
- o between 150 000 and 200 000 HUF (4)
- o between 200 000 and 250 000 HUF (5)
- o between 250 000 and 300 000 HUF (6)
- o between 300 000 and 350 000 HUF (7)
- o between 350 000 and 400 000 HUF (8)
- o more than 400 000 HUF (9)

9. Were you born in Mezőföld?

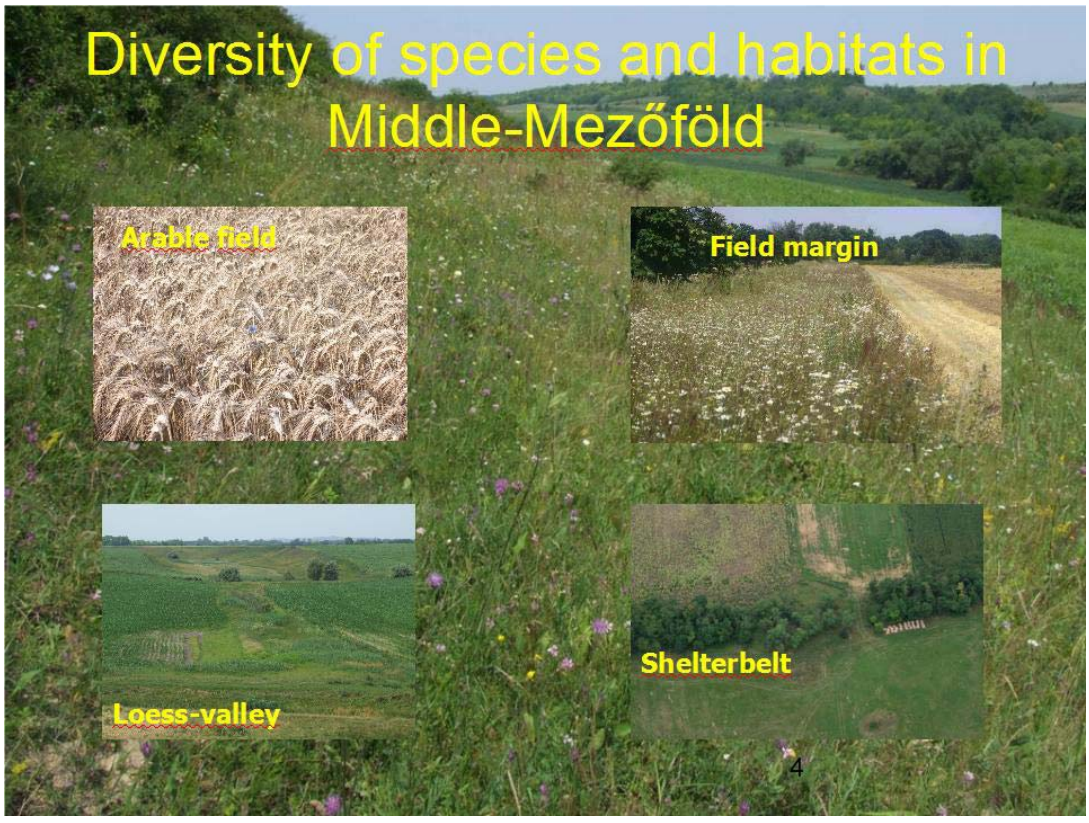
- o yes (1)
- o no (2)

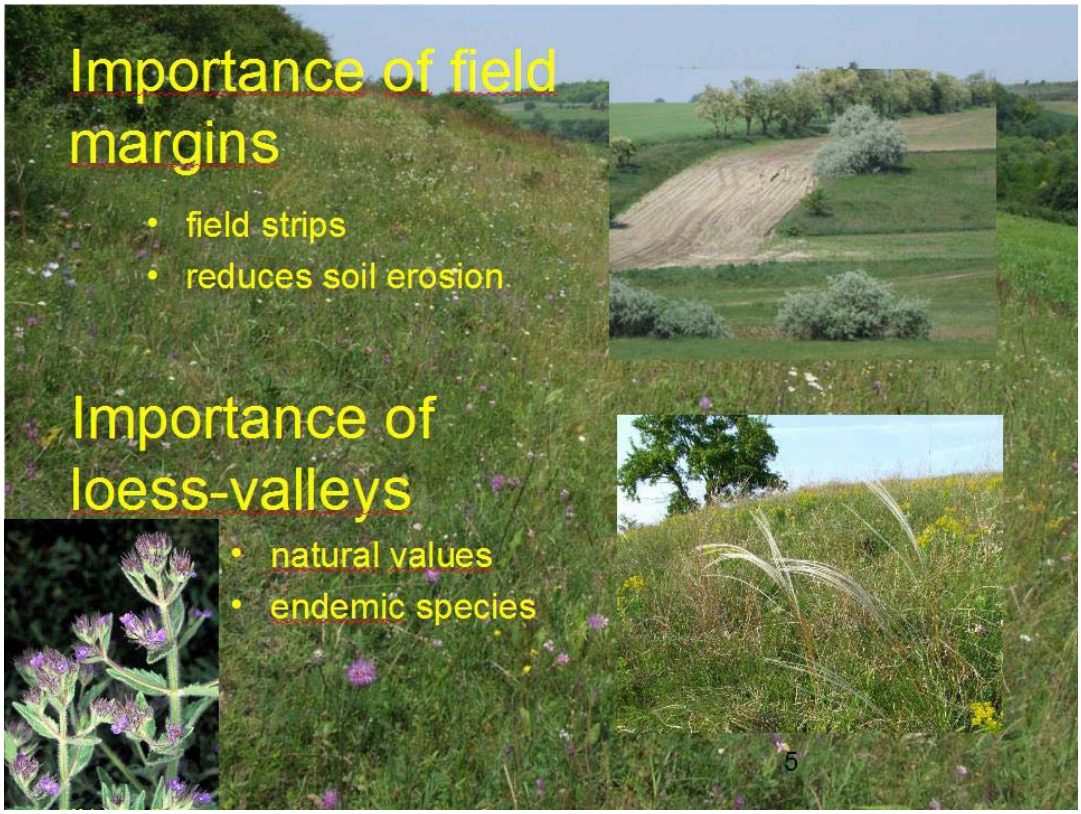
10. What do you think you know Mezőföld?

- o know Mezőföld area (1)
- o do not know Mezőföld area (2)

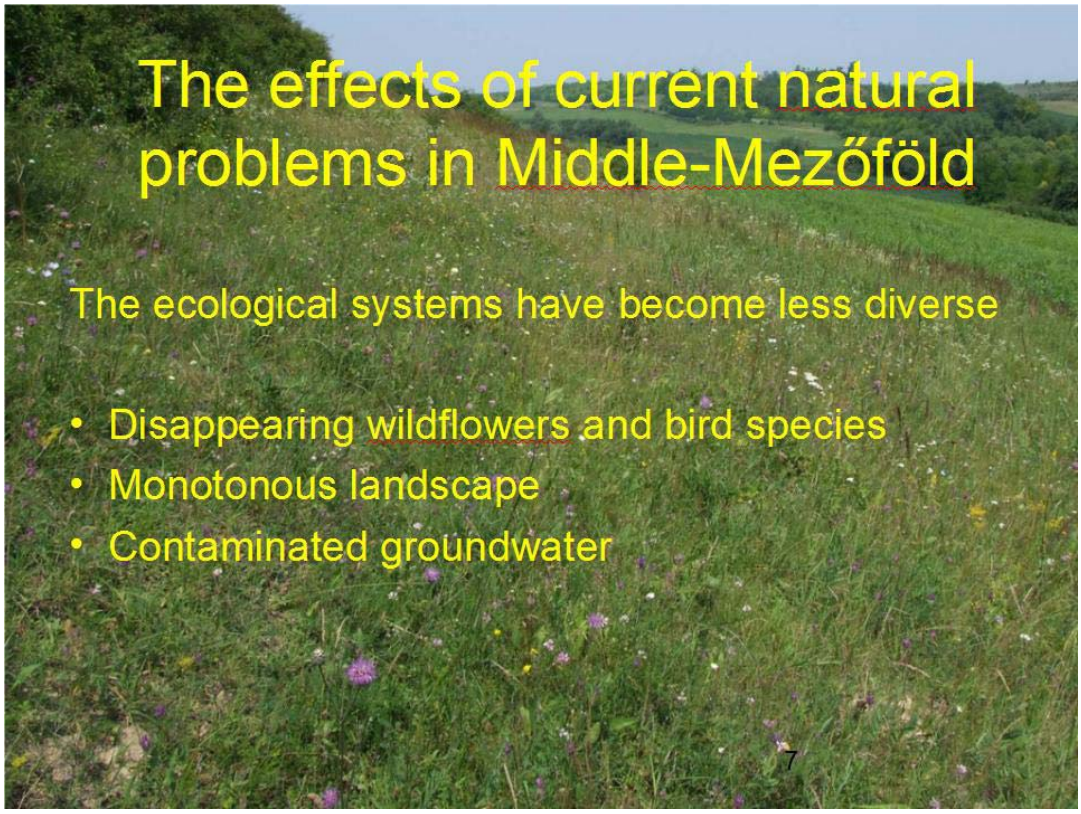
IX. Slideshow presented before the choice experiment survey

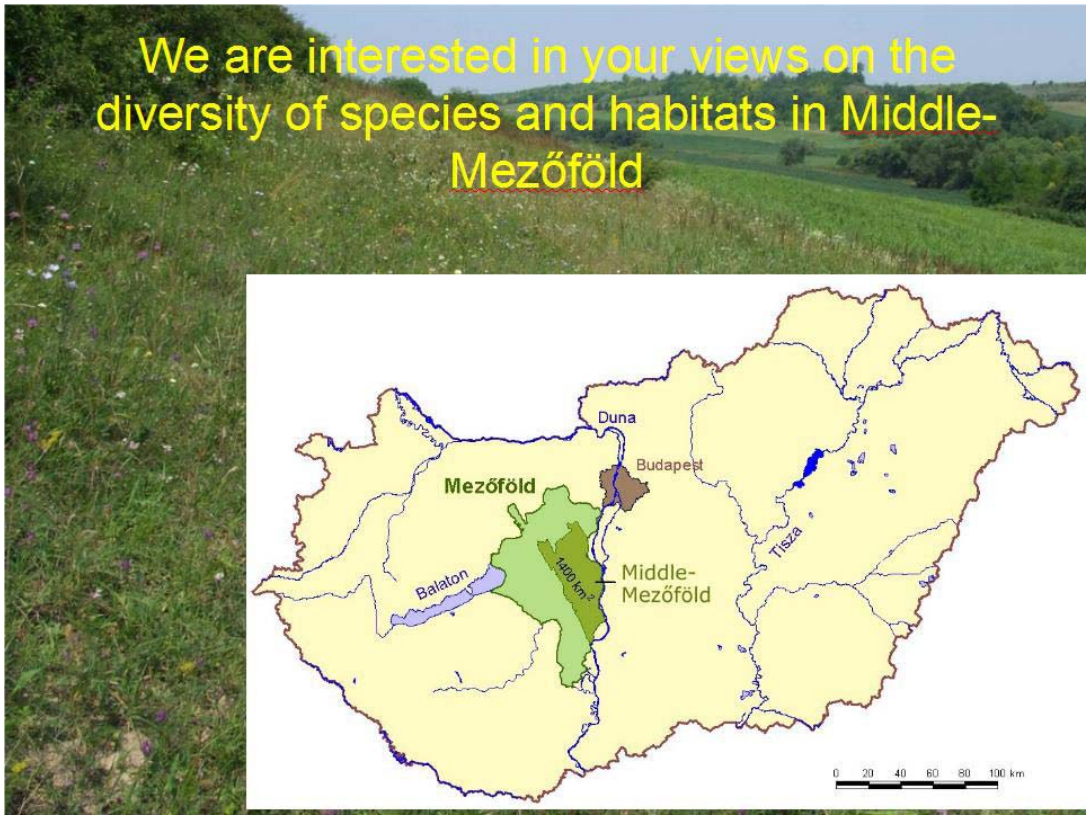

The concept of healthy land is analogous to human health
Evident if feel good
• land can get sick
• not all sickness can be cured
• prevention therefore is important
A precondition of healthy land is the diversity of species and habitats
3


Diversity of species and habitats in Middle-Mezőföld
Arable field
Field margin
Loess-valley
Shelterbelt
4


Importance of field margins
• field strips
• reduces soil erosion
Importance of loess-valleys
• natural values
• endemic species
5

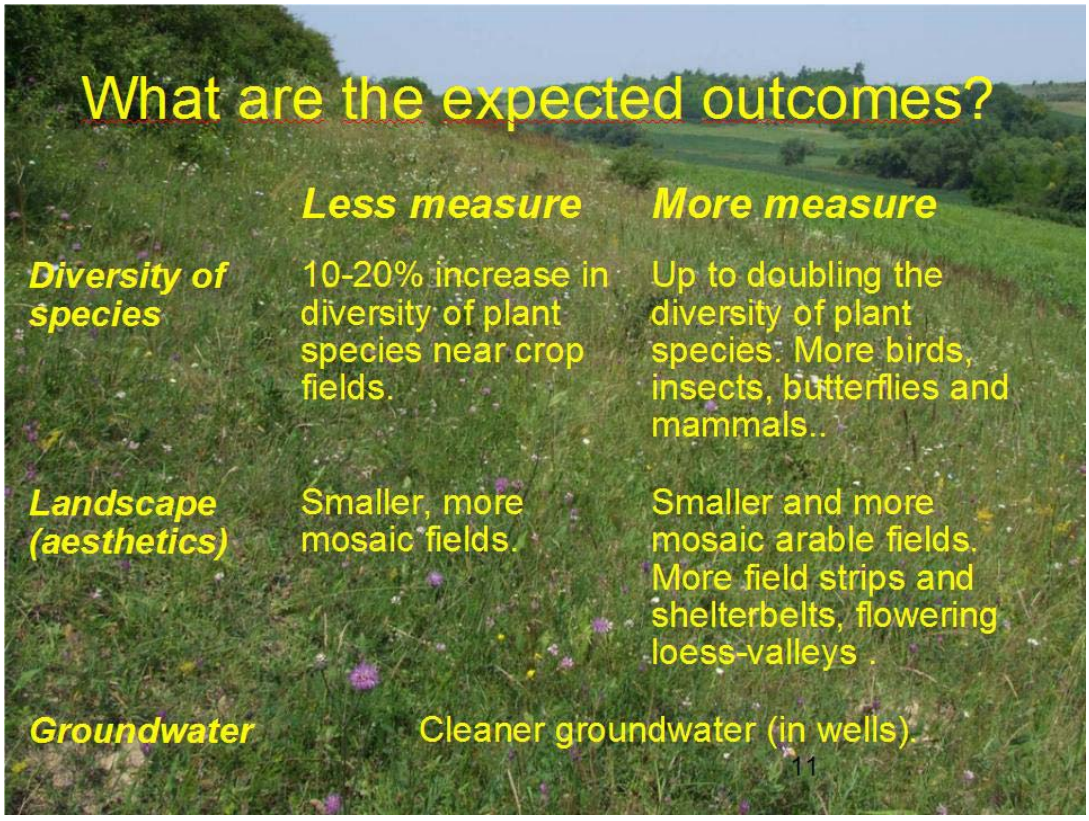

What is the current state of nature in Middle-Mezőföld?
Human activities are increasingly changing and reducing the diversity of species and habitats in Middle-Mezőföld.
6


The effects of current natural problems in Middle-Mezőföld
The ecological systems have become less diverse
• Disappearing wildflowers and bird species
• Monotonous landscape
• Contaminated groundwater
7


We are interested in your views on the diversity of species and habitats in Middle-Mezőföld
Duna
Budapest
Mezőföld
Balaton
1400 km²
Middle-Mezőföld
Tisza
0 20 40 60 80 100 km


What will happen if we do nothing?
• The populations of some familiar species will continue to decline, some rare species may become extinct in Middle-Mezőföld;
• The area of semi-natural habitats is likely to be further reduced;
• Middle-Mezőföld landscape will lose its
• Continued contamination of groundwat
9


What can we do about it?
Policies could be implemented to help improve the diversity of species and habitats in Middle-Mezőföld:
• Switch from a conventional to environmentally friendly crop production;
• Introduction of grassy field-margins and shelterbelts of trees and scrubs.
10


What are the expected outcomes?
Less measure
More measure
Diversity of species
10-20% increase in diversity of plant species near crop fields.
Up to doubling the diversity of plant species. More birds, insects, butterflies and mammals..
Landscape (aesthetics)
Smaller, more mosaic fields.
Smaller and more mosaic arable fields. More field strips and shelterbelts, flowering loess-valleys .
Groundwater
Cleaner groundwater (in wells).
11


What are the financial means?
Implementation of the policies would imply costs to households in Middle-Mezőföld.
Aims of the policies:
• Diversity of species and habitats;
• Landscape (aesthetics);
• Quality of groundwater.
12

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