Economic Aspects in Landscape Decision-making: a Participatory Planning Tool based on a Representative Approach

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Abstract— **In this paper, we develop a method for spatial decision support that combines economic efficiency – measured by the concept op willingness to pay – with a participatory planning tool, that allows for an active collaboration among the actors involved, in such a way that decision makers can draw on the outcomes in their spatial planning and design process. The method is called RITAM, a Dutch acronym for spatially explicit, participatory and interdisciplinary trade-off method, and combines features of three different approaches to achieve an 'optimal' landscape. These three approaches are (i) choice experiment approach; (ii) consumer versus citizen approach; and (iii) participatory approach. As such, RITAM can be seen as a valuation technique that makes explicit use of a participatory approach, in which people managing the landscape – in particular the representatives of the different stakeholder groups that use the landscape for different purposes – are engaged. We applied this new method to a case study in the Frisian Lake District (the Netherlands). The result give an indication of the spatial preferences of the population living in and around the area. Although future works is required, RITAM appears to be a suitable method for landscape planning and design processes, taken into account the preferences of the different organised interest groups in an area.**

Keywords— **Landscape economics, Choice experiment, Stakeholder analysis.**

I. INTRODUCTION

The world is composed of landscapes, be they natural or man-made.[1] A fundamental characteristic of all landscapes is that they are never finished. In fact, landscapes are continuously changing and evolving though natural and human induced processes and activities. Due to population growth and changes in lifestyles, demands for land, water, wood, forage and other natural resources has gone up substantially. Increasing demand for land and its natural resources will induce the expansion of agricultural land as well as the intensification of agricultural production. At the same time, however, there is continuing pressure on land from recreation, urban and suburban growth and infrastructure development. All in all, the competition for scarce space is intensifying between the different functions, and many actors, such as farmers, nature conservationists, residents and tourists, compete for the same space. Because land is a finite resource, spatial policies formulated and implemented to increase the area allocated to one use imply a decrease in land available for other uses.

Facing the land constraint and the various interests involved, spatial planners and decision makers have to make careful choices between alternative landscapes. As a consequent, planning and designing a future landscape will require the achievement of a balance between the various functions of the landscape (Opdam *et al.*, 2006) [1]. The difficult question, however, is how to accomplish this delicate balance. The aim of this paper is, therefore, to develop a method for spatial decision support that combines economic efficiency, measured by the concept of willingness to pay (WTP), with a participatory

[1] Following Opdam *et al.* (2006) [1] we define a landscape as a geographical unit of physical planning, with identifiable features, such as a specific pattern of ecosystem types or urban geography.

planning tool, that allows for an active collaboration among the actors involved, in such a way that decision makers can draw on the outcomes in their planning and design processes.

Traditionally, (landscape) professionals and experts have developed 'objective' principles and practices for landscape planning and design. Although the knowledge of these experts and professionals is indeed indisputable and indispensable, the assumption of objectivity has been questioned, or at least has been subjected to critical reflection, in recent years. After all, spatial planning and design is highly subjective – beauty is in the eye of the beholder. It involves, in other words, inherently subjective decisions.

The importance and necessity of including individual and subjective perspectives in the planning and design of landscapes has encouraged the development of a range of collaborative approaches and methodologies that are based on some kind of citizen involvement. These methods and approaches are referred to by a variety of different names, including deliberative valuation, stakeholder-oriented approaches, group-based approaches, and participatory decision making (for example, Macmillan *et al.,* 2002 [2]; Howarth and Wilson, 2006 [3]; Lynam *et al.*, 2007 [4]; O'Neill, 2007 [5]). Despite the attention focused on these methods and approaches, less emphasis has been placed on how to use these kind of collaborative tools to gauge people's WTP for spatial changes in landscapes. That is, the process of citizen involvement in landscape planning and design is often based on negotiation (and on achieving consensus), without any explicit reference to people's WTP.

We explicitly framed the following three research questions to guide our study:

- Which (economic) theories and principles are behind combining sound economics with landscape planning?
- Is it possible to derive the individual's WTP by surveying representatives who represent the diversity of interest in the area of concern?
- How can the analysed theoretical-methodological considerations be applied into practice; that is, how can they support planners, designers and policy makers?

The structure of this paper is as follows. Section 2 deals with the economic principles and theories that are relevant for understanding how to develop a scientifically sound yet practical approach that integrates WTP into the spatial participatory planning tools. Section 3 describes the underlying economic model. In section 4 we apply our approach to a Dutch case study area and present and discuss our findings. Section 5 concludes and suggests a number of issues for discussion.

II. METHODOLOGICAL ISSUES IN DEVELOPING AN INTEGRATED PARTICPATORY PLANNING TOOL

This article makes use of a broader range of concepts found in the social and economic literature; namely, (i) choice experiment approach; (ii) consumer and citizen preferences; and (iii) participatory approach. These are briefly discussed in the following subsections. Because the issue we first raise, choice experiments, is well founded in the current literature, only a brief description of the choice experiment approach will be given here, with references for further information and reading

A. Choice experiments

As mentioned before, landscape configuration – that is, spatial attributes (such as type and quantity of nature, the length and location of bicycle paths, and recreational facilities) and distribution of landscape elements – is influenced by landscape planning and design. So in order to assess people's WTP for changes in the structure and character of landscapes, a valuation approach is required, which captures the relevant spatial attributes. Moreover, the public good character and non-market nature of landscapes favour the use of a stated preference methodology so that both use values and non-values of landscapes are revealed.[2] When considering the existing stated

[2] Louviere *et al.* (2000) [6] point out the advantages of stated preference techniques over revealed preference techniques. For example, stated preference techniques can assess demand for products which are not traded in real economic markets, they avoid issues of low collinearity and low variability in explanatory variables, they are less time-consuming and less expensive to

preference valuation techniques, it becomes evident that the method of choice experiments is most appropriate, because it is capable to measure multiple (and spatial) attributes. The economic theory underlying the method of choice experiments is Lancaster's model of consumer choice, which hypothesizes that consumers derive satisfaction not from goods themselves, but from the attributes they provide (Lancaster, 1966) [7]. Garrod and Willis (1999) [8] and Louviere *et al.* (2000) [6] provide full overviews of the choice experiment approach.

B. Social versus personal preferences

Rather than taking a (random) sample of individuals who are asked to participate in the choice experiment, we suggest an approach that is based on the collaboration of representatives of relevant organisations, agencies and government levels in the area under consideration. Such a representative approach has two main advantages. The first advantage is that by involving the representatives from the beginning of the choice experiment, a wealth of local knowledge becomes available, which can be used to develop the relevant scenarios in an efficient and timely manner. Second, representatives are, in general, more concerned with and actively involved in the area under consideration than random participants, and are therefore assumed to be more willing to participate in the choice experiment.

An additional, more practical advantage of a representative approach that we want to mention here, is that it reduces time and money. After all, previous experiences have shown that 'regular' choice experiments (which are based on representative samples of individuals) are usually extremely time-consuming and expensive to undertake. See, for example, the choice experiments in Johnston *et al.* (2002) [9] and in Rambonilaza and Dachary-Bernard (2007) [10].

The idea to use representatives instead of a sample of individuals needs the assumption that the selected representatives represent all the individuals in the relevant population. In addition, representatives are assumed to know what the spatial preferences are of the people they represent, and even more important, they are supposed to answer the trade-off questions in a choice experiment according to these preferences. In more political-philosophical terms, in our suggested approach participants are asked to take the role of a community-minded Homo Politicus rather than a self-centred Homo Economicus.

The concept of Homo Economicus is firmly embedded in neoclassical economics. It refers to the portrayal of individuals as entirely self-interested and utility maximizing economic agents, who are rational in the sense that well-being is optimized given perceived opportunities. However, in recent years it has become increasingly acknowledged that consumers may not only be conceived as consumers concerned with the maximization of their own individual welfare, but also as citizens who can fulfill social responsibilty by trying to consider what is best for society. Individuals who make choices that are good for the society as a whole are referred to as Homo Politicus. Thus, whereas a Homo Economicus aims to maximize his own well-being, a Homo Politicus strives to maximize social welfare (Nyborg, 2000) [11]. Despite this distinction, the Homo Politicus is, like the Homo Economicus, assumed to be rational. The notion that people have social welfare preferences can be incorporated formally into the model of rational choice (see, for example, Frank, 2006) [12]. Moreover, Curtis and McConnell (2002) [13] cite an article by Kalt and Zupan, in which it is suggested that individuals who profess social welfare concerns are not necessarily behaving in a non-economic way; on the contrary, their willingness to do what is best for society can be economically rational.

All in all, our decision to work with representatives is based on the explicit distinction between social (Homo Politicus) and personal (Homo Economicus) preferences. Such a distinction seems to be supported by existing (economic) literature. We refer interested readers to, for example, Ovaskainen and Kniivilä, (2005) [14], and Faber *et al.* (2002) [15]. Empirical support for a social/citizen versus personal/consumer distinction is provided by van Rensburg *et al.* (2002) [16].

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undertake, and they can be experimentally designed to provide clear and easily-interpretable results.

C. Participatory approach

To implement landscape and nature planning and design, physical landscape changes are necessary. Changes are more likely to be initiated when the attitudes and preferences of the people managing or depending on the landscape characteristics and landscape services are considered in the construction and implementation of the landscape plan. Due to this reason, the planning tool that we attempt to develop makes explicit use of a participatory approach in which people managing the landscape – in particular the representatives of the different stakeholder groups (or organized interest groups) that use the landscape for different purposes – are engaged.

In a participatory approach, it is important to give attention to the fact that community-level decision making is a political process. The researchers must be sensitive to the local reality when engaging stakeholders or representatives. Furthermore, a suitable participatory approach can change the attitudes and preferences of the people involved, bringing about 'reversals' or major insights into the mental how-it-works constructs of (local) actors. A more practical point of attention is that pre-testing of the tool is most often not possible and that a facilitator is necessary. In addition, it is worth noting that it is necessary to have a communication strategy for the outcomes. Not only the communicating of the conclusions is important, but also the understanding of where these conclusions come from should not be neglected (Lynam *et al.*, 2007) [4].

Based on the abovementioned points of attention, a participatory tool has to fulfil some requirements. First of all, a clear question or objective has to be formulated for the participatory process. The aim of making use of a participatory tool in the case of landscape planning is to extract knowledge of a specific landscape, such as goals and preferences for a specific landscape design, to achieve an 'optimal' landscape plan that is acceptable for implementation. A second requirement is to include all the relevant (local) interest groups and their representatives. It is important to be aware of the relationships among the representatives of these groups. A third requirement is that the researcher involved in the process need to be credible, scientifically objective and independent of interest group influence (Lynam *et al.*, 2007) [4].

The current research is thought to be the first study of combining a representative approach with social preference valuation. This inherently means that we have to answer the question whether the recognition of community-minded thinking allows us to work with representatives who, together, represent the interests of the society within the area under consideration. A more practical econometric question relates to the necessary sample size required for the choice experiment survey. Depending on the number of attributes, their levels and other design factors, choice experiments may require sample sizes of up to hundreds. This is a serious drawback to the use of choice experiments, especially when a representative approach is chosen. It is thus not surprisingly that several authors have examined various methods to reduce the number of sampled respondents required to complete choice experiments without sacrificing the reliability of the obtained results (Bliemer and Rose, 2005) [17].

III. A SPATIALLY EXPLICIT, PARTICPATORY AND INTERDISCIPLINARY TRADE-OFF METHOD: RITAM

The spatially explicit, participatory and interdisciplinary trade-off method (in Dutch: RITAM, which stands for *Ruimtelijke*, *Interactieve en Transdisciplinaire Afwegingmethode*) is economically founded in utility theory. The basic assumption that underlies our method, is that each individual stakeholder *s* (or representative) wants to maximize his utility U_s under a number of constraints. The variables x_i in the utility function represent significant landscape characteristics. The utility function is assumed to be differentiable and concave. The constraints in the model concern the available budget, the total available area, as well as possible minimum quantities of hectares necessary to fulfil a function and maximum quantities of hectares available for a function. The model representing a representative's choice can now be presented as follows (see Claassen *et al.*, 2007) [18]:

$$\text{Max} \quad U_s = U_s(x_1, x_2, x_3, ..., x_i, ... x_n), \qquad (1)$$

s.t.

$$
\begin{aligned}
&p_1x_1 + p_2x_2 + p_3x_3 + \ldots + p_ix_i + \ldots + p_nx_n \le B, \\
&x_1 + x_2 + x_3 + \ldots + x_i + \ldots + x_n \le C, \\
&x_i \ge D_i, \quad \left(i \in \mathrm{I}^+\right) \\
&x_i \le E_i, \quad \left(i \in \mathrm{I}^-\right)
\end{aligned} \tag{2}
$$

with B and C for the available budget and available area respectively; D_i and E_i for the constraints related to each individual variable x_i, and I^+ and I^- for all elements i with the designated restrictions. These type of problems can be solved by way of formulating the Lagrange equation and the Karush-Kuhn-Tucker conditions (details available upon inquiry).

The individual utility functions for all the representatives can be established by way of a choice experiment. In order to arrive at the optimum landscape these have to be aggregated to one representative utility function. To do this, weights have to be attached to each individual utility function. In the case of linear utility functions the weighted arithmetic mean will do the job. Then the aggregated utility function U equals:

$$U = \sum_{s=1}^{m} \omega_s U_s, \qquad \sum_{s=1}^{m} \omega_s = 1. \tag{3}$$

In the case of non-linear individual utility functions other ways of aggregation may be more appropriate. For example, in the case of utility functions of the Cobb-Douglas type the weighted geometric average is a more practical way of establishing the aggregate utility function. In that case:

$$U = U_1^{\omega_1} U_2^{\omega_2} U_3^{\omega_3} \ldots U_s^{\omega_s} \ldots U_m^{\omega_m}, \qquad \sum_{s=1}^{m} \omega_s = 1. \tag{4}$$

Of course the establishment of the weights ω_s presents the real challenge here.

For our research we applied a choice experiment, with the available budget B not explicitly taken into account. This means that the design of the experiment was such that the participants were requested to choose between different financially feasible scenario's. The utility function used was a linear one:

$$U_{si} = \sum_{k=1}^{K} \beta_{sik} x_{ik} + \beta_{sip} p_i, \tag{5}$$

with U_{is} for the utility of scenario i for representative s, x_{ik} for the physical elements of scenario i, p_i for the cost of the landscape scenario i, and β_{sik} and β_{sip} for coefficients. By using this utility function for landscape planning it is possible to obtain the amount of money an individual is willing to forfeit in order to obtain (the benefits from) a specific landscape attribute. In other words, the amount of income (payments) required to make the average individual as well off with the improvement of a landscape characteristic as her of she was in the current landscape scenario. This amount is known as the marginal WTP and is the marginal rate of substitution between two attributes. The marginal rate of substitution is calculated as the ratio between two parameters, in which one attribute is valued in terms of a numeraire attribute, such as the price of a landscape scenario.

In this specific exercise, the implicit price of a landscape attribute, is computed as the population or (sample) average of the marginal rate of substitution between price and the landscape characteristic. So, if the derivative of U_{si} with respect to the landscape attribute x_{ik} is divided by its derivative with respect to costs p_i, the implicit price of the landscape attribute can be computed:

$$\frac{\partial U_{si} / \partial x_{ik}}{\partial U_{si} / \partial p_i} = \frac{\partial p_i}{\partial x_{ik}} = \frac{\beta_{sik}}{\beta_{sip}}. \tag{6}$$

In words, the marginal rate of substitution between a landscape characteristic coefficient and the price coefficient gives the marginal WTP for the landscape characteristic. The unit is Euro per unit landscape attribute.

IV. APPLICATION OF THE METHOD IN THE FRISIAN LAKE DISTRICT

In order to test our approach, we applied it to a case study area. That is, by means of a case study, we can test how the method works in practice, and whether it supports spatial planners and policy makers in their (local or regional) spatial planning decisions. This section deals with this case study.

A. Study area: Frisian Lake District

The case study location in this paper is the south-western part of Frisian Lake District, between the towns of Sneek and Joure. The Frisian Lake District is part of the northernmost province of the Netherlands called Friesland. Friesland's economic structure reflects a high level of involvement in agriculture, especially in the dairy sector. This is obvious in the Frisian landscape, which is not highly urbanised but is still predominantly open space, consisting mainly of (never-ending) grasslands. Because of the combination of quietness and open space, the province of Friesland is a popular tourist site in the Netherlands. The Frisian lakes are popular boating, sailing and waterskiing venues, and in the area, there are several sailing schools and water sports centres. In addition to water-based recreation sites and facilities, the Frisian Lake district is also quite popular with bikers. Camping sites and bungalow parks are located all over the area. There is no fee to access the Frisian Lake District.

B. Research methodology

The first step in our proposed methodology is to make an inventory of the organised interest groups that are more or less actively involved in the Frisian Lake District. These interest groups and their representatives are important and central to the method, because of their specific perspectives on the landscape. For each interest groups it was assessed what their goals and objectives for the area at the landscape level were.

The second step relates to the survey instrument, namely the choice experiment, and its design. In this step, we defined the good to be valued in terms of its attributes and levels these attributes take. Our starting point involved the loosely identified goals and objectives of the various interest groups, as well as the attributes and attribute levels described in reports and policy documents relevant to the area. Additionally, the development of this larger list was guided by the notion that the attributes included in this list should be 'important' or 'salient', and are expected to affect respondents' choices.

A workshop was held, in which representatives of various organised interest groups were invited to reflect on the larger list with attributes. Together with these representatives (ten in total, representing different interests), we determined a final list of attributes. Moreover, attribute levels were identified and discussed with the participants of the workshop. This workshop approach allowed representatives free reign to indentify those attributes they perceived most important.

The third step in our methodology is the design and implementation of the choice experiment. On the basis of the outcomes of the workshop (step two), six spatial attributes and one non-spatial attribute (namely, a monetary one, which is required to estimate welfare changes) were selected. The selected attributes (and their number of levels) are: (i) type of nature (6 levels); (ii) area of water (3); (iii) bicycle paths (3); (iv) landing stages for yachts (3); (v) recreational facilities (3); (vi) water quality (3); and (vii) WTP.

With 7 attributes (1 with 6 levels and 6 with 3 levels), we have a possible 4,374 ($6^1 \times 3^6$) different combinations of attribute levels, and thus also 4,374 different landscape scenarios. A design, in which all possible combinations of the attribute levels that characterise the different scenarios are enumerated, is, however, not tractable in our choice experiment. Therefore, a fractional factorial design was produced, generating 27 scenarios. These 27 scenarios were randomly blocked to 13 different questions. Each question contained three different landscape scenarios, one of which remained fixed. This fixed scenario described the current landscape. By representing the current situation in each question, respondents – who were asked to participate in the choice experiment – could compare the 26 alternative spatial scenarios to the current landscape.

In the choice experiment, respondents were informed about the ecological consequences of the alternative scenarios. To this end, we used ecological knowledge and experiences to identify the implications of a certain type of nature for the survival of certain types of target species. This is based on the assumption that each of the six levels that can be attached to the attribute 'type of nature' has concrete implications for the spatial and ecological conditions under which specific target species can maintain sustainable populations. Even stronger, the six pre-defined levels of nature lead to such an improvement of conditions that, theoretically, sustainable populations of specific target species can be realised. In order to inform the respondents about the ecological implications of a spatial scenario, we attached to each scenario a picture of a certain target species (as a kind of indicator). This picture 'tells' the respondent at a glance that the realisation of a scenario would improve the conditions in such a way that sustainable populations of the depicted 'indicator' species can be established and maintained in the area.

The choice experiment was administered by an Internet survey. This survey consisted of three parts. The first part collected some background information of the survey respondent, such as the organisation (s)he is affiliated with and the interests (s)he advocates. The second part included the 13 choice experiment questions, with the 27 different landscape scenarios. For each question, the respondent had to indicate which of the three presented scenarios is most desired, or preferred, by the people (s)he speaks for. The third part of the survey gave the respondent the opportunity to submit their comments and remarks on the matter.

After a round of testing and improvement, the final version of the Internet survey was administered in June 2007. We sent a letter to 59 representatives of 30 organised interest groups, varying from agricultural to environmental and from housing corporations to tourist offices. As such, the number of survey recipients was substantially higher than the number of workshop participants. Moreover, the composition of the group of survey recipients was more diverse – in the sense of represented interests – than those of the workshop.

The letter that we sent described the goal and scope of the survey, and gave the recipients the details (website address and password) for accessing the survey. Survey recipients had approximately two weeks to complete the survey. All survey recipients were sent a reminder letter after one week. Of the 59 recipients, 29 responded, yielding a response rate of about 49%. However, not all the returned surveys were completely filled out, because some respondents indicated that they were ignorant of the spatial preferences of the people they represent. As a result, only 18 completed surveys were suitable for analysis, reducing the response rate to 31%.

C. Results and analysis

Step four in our methodology is the analysis of the results of the choice experiment. For this purpose, we made a distinction between two different groups of representatives. The first group (n = 5) consisted of respondents that represented the interests of nature protection groups, while the respondents of the second group (n = 13) could be broadly classified as representatives of economic interests (especially tourism and agriculture). Figures 1 and 2 show the preferred landscapes of these two groups.

From these two figures, it can be clearly seen that there are no major differences in the spatial preferences of the 'nature representatives' and the 'economic representatives'. However, although both groups of representatives prefer more nature in the area, they have different opinions about what type of nature this should be. 'Nature representatives' strongly preferred the establishment of additional reed and rough growth in the southern part of the area, whereas the 'economic representatives' seemed to have a preference for natural grasslands in the north-eastern part of the area. To put it in more ecological terms, the former group of representatives preferred the establishment and maintenance of the Western Marsh Harrier, whereas the latter group of representatives had a preferences for the Ruff, a medium sized meadow bird. Another difference between the spatial preferences of the two groups of representatives relates to whether or not an extra bicycle path should be built in the area. 'Economic representatives' prefer such a new bike-way in the southern half of the area – straight across agricultural land – whereas 'nature representatives' do not share this enthusiasm and appeared not to be in favour of creating new bicycle trails.

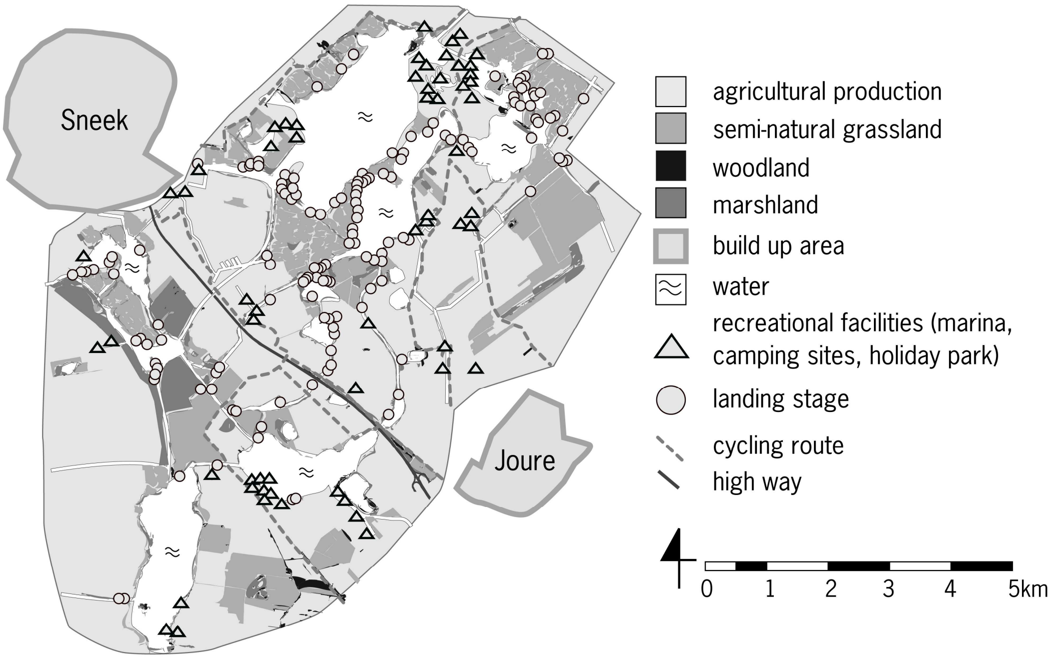

Fig. 1 The ‘optimal’ landscape according to ‘nature representatives’

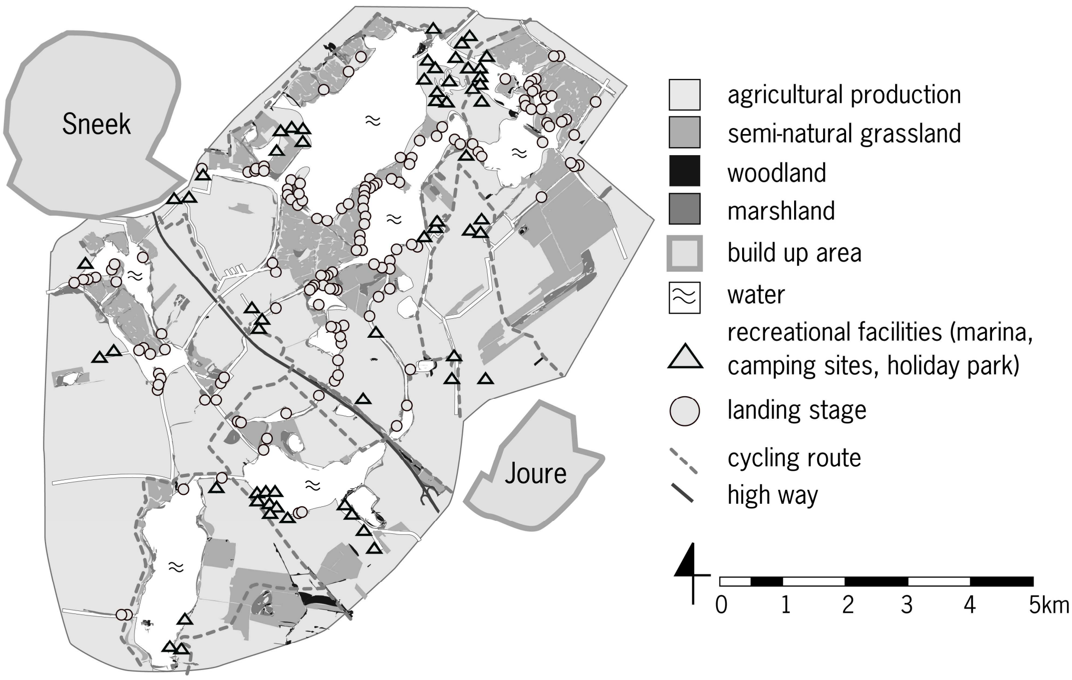

Fig. 2 The ‘optimal’ landscape according to ‘economic representatives’

A final, but remarkable difference between the two distinguished groups is their WTP. We expected that the higher the amount of WTP for a scenario, the less preferred this scenarios is. This negative relationship between preference and the amount of WTP was indeed found for the group of 'economic representatives' but, strangely enough, not for 'nature representatives'. This means that, when filling out the survey, 'nature representatives' appeared to refuse to trade-off spatial values against money – although this requires some further investigation.

Can we now, on the basis of Figures 1 and 2, design an 'optimal' landscape? In order to answer this question, we need to know the values and the distribution of the weights that policymakers attach to the various interests. If policymakers indicate that, say, economic development is more important than nature and environmental considerations, than this essentially means that the preferences of the 'economic representatives' should get a higher weight than those of the 'nature representatives'. So, if we know which weights to use, it should be at least theoretically possible to combine the preferences of the two groups of representatives, and design an 'optimal' landscape. Due to the current lack of information on the weights, we leave this exercise for future work.

V. CONCLUSIONS

Although participatory planning tools are relatively new to the field of spatial planning, they seem to be promising and practical in the future. In this paper, we developed a planning tool that (i) is based on the representation of individuals by representatives of relevant parties and organisations, and (ii) includes WTP a s measure of economic efficiency. It is our believe that the discipline of economics in general and the concept of WTP in particular can enrich the process of landscape decision-making.

We applied our planning tool to a Dutch case study area. Through the conduct of a choice experiment on representatives of various interest groups (rather than on a representative sample of individuals), we assessed the importance of various spatial attributes, and showed how these attributes determined the preferences of these respondents (and thus for the people they represent) for the structure and character of the landscape in the area. Unfortunately, due to the fact that the representatives of the nature interest groups seemed to be indifferent about the price of a landscape scenario (WTP), our case study work did not give statistically testable information about the WTP for the spatial changes in landscape patterns. Nevertheless, the case study allows tentative conclusions and recommendations to be drawn. First, an increase in the total area of nature, be it reed and rough growth or natural grasslands, is strongly preferred by the various representatives. Second, in contrast to 'nature representatives', respondents who represented economic interest preferred the construction of a bicycle path in the southern part of the case study area. Finally, there is still considerable potential for future works, especially with respect to (i) comparing our representative approach with a 'regular' approach (based on a representative sample of individuals), and (ii) designing an 'optimal' landscape by making use of the weights that policymakers attach to the various interests.

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