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How do biodiversity and conservation values relate to landscape preferences? A case study from the Swiss Alps

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Abstract The importance of the values underlying different concepts of biodiversity conservation and landscape planning is increasingly recognised, and yet these value judgements of the public and of experts are still poorly understood. Although landscape and conservation management are closely interrelated and measures in one field are likely to have effects on the other, the relationship between biodiversity and conservation values on the one hand, and landscape preferences on the other hand, has been hardly explored so far. This study represents a first attempt to empirically examine this relationship from an integrated perspective, considering philosophical, ecological and economic aspects and using items focused on biodiversity. We used a quantitative survey of the general Swiss population with visualisations of potential landscape developments in the Swiss Alps and items related to biodiversity- and conservation-values. Our research shows that respondents who prefer reforested landscapes tend to be more concerned about the conservation of species, landscapes, and natural processes than people preferring cultural landscapes. Respondents who prefer cultural landscapes are more oriented towards utilitarian values and are overrepresented in mountain areas as compared to the lowlands, thus in areas that are more likely to become the target of conservation measures. Our findings have practical implications for conservation in Switzerland and other mountainous areas, particularly in times of agricultural decline and land abandonment and their associated changes in landscape and biodiversity.

Keywords Biodiversity values · Cultural landscapes · Landscape preferences · Public · Reforestation · Switzerland

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Introduction

Landscape changes in the Swiss Alps: a political issue

There is growing concern about the future of mountain landscapes and biodiversity in Switzerland and in other parts of Europe. At present, it is controversially discussed in Switzerland whether or not mountain agriculture should generally continue to receive substantial financial support, even in steep and remote valleys where it is not profitable. Abolishing subsidies would lead to an abandonment of agricultural land use in these areas, which in turn would have far-reaching consequences regarding landscape structure and biodiversity (Bolliger et al. 2007). The political debate surrounding this issue is multidimensional, and little is known regarding which societal groups tend to have which attitudes toward potential landscape changes, and which values may influence their position. Landscape preferences and conservation priorities seem to be intertwined in a conflictive and political way, and it has been recognised that the values underlying the different positions must be made transparent in order to enable a factual debate (Barry and Oelschlaeger 1996; Duelli et al. 2007; Fischer and van der Wal 2007).

The causes of landscape changes in the Swiss Alps include tourism, agricultural use, abandonment of agricultural use, industry, traffic and settlement spread. In the more peripheral areas, agricultural decline is the main driver of landscape change: after the abandonment of agronomically marginal land, spontaneous reforestation usually sets in (Gellrich et al. 2007). On the one hand, this creates new opportunities for wilderness areas, which at present are very rare in Switzerland, but increasingly sought after for recreational purposes by parts of the public (Bauer 2005). From a nature conservation point of view, this offers the chance to protect large areas where natural processes can unfold more or less freely. On the other hand, there are growing efforts to preserve the "traditional" cultural landscapes with their high scenic value and biodiversity. While in the lowlands, traditional cultural landscapes are mainly threatened by settlement spread, industry, traffic and agricultural intensification, the main threat in peripheral mountain areas is land abandonment followed by spontaneous reforestation. The present study focuses on potential landscape changes in the Swiss Alps due to changes in agriculture—in terms of agricultural decline and land abandonment on the one hand, and an enhancement of landscape and biological diversity on the other hand.

Landscape preferences

There is a large body of theoretical and empirical literature on landscape preferences (see e.g. reviews by Bourassa 1991; Aoki 1999; Lothian 1999; Daniel 2001; Hunziker et al. 2007). Usually, landscape preferences are explained with psychological, biological and aesthetic approaches. There are, however, other explanatory factors, such as economic interests, leisure and recreational interests, but also people's values of nature and biodiversity, and conservation priorities. While several studies in social psychology deal with psychological restoration needs as determinants of landscape preferences (e.g. Purcell et al. 2001; Hartig and Staats 2006), the links between people's landscape preferences and their nature- and conservation-related values have so far received very little attention in empirical research. The interrelationship between environmental values (in a broader sense) and landscape preferences have been studied by de Groot and van den Born (2003) using verbal descriptions of landscape types, by van den Berg et al. (2006) using colour slides as a stimulus, and by Kaltenborn and Bjerke (2002) using colour photographs as

visual input. These studies are concerned with existing, present-day natural and agricultural landscapes in the Netherlands and in Norway. In contrast, the present study focuses on potential landscape *changes*, a topic that has so far been less studied in landscape preferences research (see e.g. Sell and Zube 1986; Palmer 1997; Hunziker 2000). Gehring (2006) and Tress and Tress (2003) provide recent examples of studies exploring preferences for potential future landscape appearances (using photo-realistic visualisations), considering a broad range of possible changes (e.g. tourism and recreation, settlement sprawl, agricultural changes). However, they do not link these preferences to nature values. Moreover, there are at present no studies linking landscape preferences with the conservation priorities of the public. This study aims to close this gap. The issue is relevant for conservation policy and planning for the following reasons:

- Nature conservation measures have an impact on the landscape. If a landscape changes due to conservation measures (e.g. it becomes reforested) this may influence the public's acceptance of conservation measures and of the protected area. If there is information about the interrelation between conservation priorities (and their associated conservation measures, respectively) and landscape preferences, and if the likely landscape consequences of the conservation measures are known, it may be possible to predict which conservation priorities and associated measures are likely to be accepted from a landscape preferences point of view. If in addition it is known which social groups tend towards which landscape preferences and nature values, conservation education programmes may be designed more target-group oriented and thus become more effective.
- Conflicts in nature conservation and in landscape planning may arise due to different underlying nature values supporting the same policy (Norton 1991). It is therefore necessary to become aware of the values behind particular policies and measures.

Conservation concepts

In Central Europe, especially in Germany and Switzerland, there has been an ongoing debate between advocates of two competing conservation concepts (Soliva 2007): a traditional, "heritage-oriented" concept that aims to preserve an 'ideal' state of nature as manifested in the historically developed cultural landscape, and a newer process-oriented conservation concept that wishes to protect nature as much as possible in a state where it can freely develop and does not address preserving the remnants of history (Körner 2005). While the focus of the traditional concept is on the protection of (especially threatened, endemic, and charismatic) species and biotopes (Piechocki 2001), process-oriented conservation strives toward the protection of natural processes and entire eco-systems. From a process-oriented conservation point of view, traditional landscape conservation is criticised as 'unnatural' because it misconceives the dynamic character of nature and protects only the species and biotopes of the historic landscape (e.g. Scherzinger 1997). To our knowledge, the public's attitudes towards these conservation concepts have not been examined explicitly before. However, some studies dealing with the attitudes regarding wilderness (e.g. Bauer 2005) examine some aspects of these conservation concepts.

Visions of nature and related concepts

In a recent edited book on people's philosophies regarding nature (van den Born et al. 2006), de Groot, van den Born and Lenders define "visions of nature" as the ideas that

people hold of what nature is and how they should relate to it. It is an umbrella concept that encompasses three main aspects of people's ideas on nature (van den Born 2006):

- Values of nature: these are the reasons why nature is perceived to be important (see below).
- Images of nature: these are people's general cognitions of what nature is. People who perceive landscapes that are visibly influenced by human interventions (such as cultural landscapes) as typically natural are usually classified as having an anthropocentric image of nature, while people who find seemingly untouched landscapes as typical examples of nature are described as having an ecocentric image of nature (van den Berg et al. 2006).
- Images of relationships: This term refers to the images that people have of the appropriate relation between humans and nature. Examples include "dominion over nature" or "stewardship".

A review of literature exploring visions of nature is given by van den Born et al. (2001). The present paper deals with values of nature only.

Values of nature

Values of nature are often classified according to their position in a continuum ranging from anthropocentric to ecocentric (e.g. Gagnon Thompson and Barton 1994; Bjerke and Kaltenborn 1999). Anthropocentric values of nature are instrumental values in advancing human interests and well-being, either now or in the future. From an anthropocentric point of view, nature and biodiversity ought to be preserved because doing otherwise would harm humanity (Oksanen 1997). The terms "ecocentric", "biocentric", and "biospheric" values are used in environmental psychology to refer to a notion of an intrinsic value in nature (i.e. a value independent of any other entity). Here we use "biocentric" in the sense of Lockwood (1999) and Oksanen (1997) to refer to beliefs regarding an intrinsic value associated with individual life forms and species, and "ecocentric" to refer to a wider conception of intrinsic value that besides individual life forms and species also includes ecosystems, the biosphere, or the processes which promote and maintain those entities. A particular form of biocentrism is environmental or biological egalitarianism (e.g. Michael 1997), that is, the belief that all living things are equal. Some proponents of egalitarianism limit the scope of this claim to certain "higher" animals, while the most radical egalitarianists, such as Paul Taylor (1986), extend the equality claim over the entire spectrum of living things. A more moderate position within biocentrism is sentientism or pathocentrism (e.g. Singer 1979; Krebs 1999), which is the belief that sentient creatures (i.e. being able to feel pleasure and pain) are of higher value than non-sentient creatures.

Kellert (1996) maintains that the values of nature are rooted in human biology, and identifies nine basic values. Many of them can be positioned in the anthropocentrism–ecocentrism–continuum (Bjerke and Kaltenborn 1999). It is important to note that these basic nature values are not mutually exclusive. Rather, an individual may exhibit a dominant value, while also expressing perceptions reflecting other—even conflicting—values (Hunter and Brehm 2004).

Values of biodiversity and conservation values

Regarding the value of biodiversity as a particular aspect of nature, most research has been conducted in conservation ecology and ecological economics. In the social sciences, there

are a few recent examples of qualitative empirical research exploring people's constructions of biodiversity, such as Soini and Aakkula (2007) and Fischer and Young (2007).

Conservation biology has been criticised as being positivistic, i.e. claiming to be value-free, and thus denying its normative character (e.g. Barry and Oelschlaeger 1996). Although there have been some studies investigating the value-judgements underlying biodiversity and conservation—e.g. Takacs' (1996) interviews of conservation biologists—there is still a considerable research gap in this field (Fischer and van der Wal 2007). At the level of species, conservation biologists often implicitly attach particular value to endemic species, rare species, endangered species (Duelli et al. 2007), keystones species (defined by Power et al. 1996, as a species whose impact on its community or ecosystem is large, and disproportionately large relative to its abundance), umbrella species (defined as a species whose conservation is expected to confer protection to a large number of naturally co-occurring species, Roberge and Angelstam 2004), and flagship species (charismatic species that serve as a symbol and rallying point to stimulate conservation awareness and action, Caro et al. 2003). Biodiversity and conservation values seen from an ecological perspective can thus be described as ecologically grounded reasons to protect particular aspects and elements of biodiversity.

An entirely different approach at valuating biodiversity is taken by ecological economics. In this approach biodiversity is viewed from a utilitarian perspective: if biological resources are varied, this allows more scope for serving different purposes that people want (Wood 1997). These purposes may be related to the human use of existing or potential biological resources for food, shelter, energy, clothing, medicines, but also to indirect benefit for humans in that some biological entities contribute to the functioning of healthy ecosystems which in turn produce more directly useful goods and services. Ecological economists try to calculate and estimate the monetary value of species, ecosystems, ecosystem services etc., thus expressing values quantitatively. This of course raises the question of how the value of nature and biodiversity can be measured.

Measuring values of nature and biodiversity

An important field of research in environmental psychology is concerned with the general public's environmental behaviour, attitudes and values. The most popular measuring instrument used in this literature is the 15-item NEP-scale devised by Dunlap and Van Liere (1978) and revised by Dunlap et al. (2000). Other widely used scales to measure individuals' environmental attitudes are those developed by Stern and Dietz (1994) and by Gagnon Thompson and Barton (1994). The latter aims to measure ecocentric and anthropocentric value orientations, and includes as a third dimension items measuring environmental apathy.

Both the NEP-scale and the anthropocentric-ecocentric scale developed by Gagnon Thompson and Barton (1994) measure relatively general environmental attitudes, rather than specific nature and biodiversity values. These two scales have been criticised as being largely anthropocentric, as they contain only one or two items that clearly relate to the intrinsic value of nature (Lockwood 1999). In fact, Lockwood (1999) claims that there is currently no psychometrically sound instrument that uses a philosophically robust concept of intrinsic value. Kellert's typology (1996) is more specifically focused on people's values of nature. These nine basic values are less abstract and more differentiated than the crude distinction between anthropocentric and ecocentric/biocentric and are thus often appropriate theoretical concepts for empirical research. However, some of these values (e.g. dominionistic and humanistic) refer primarily to the relationship between humans and animals, especially wildlife, rather than the entire scope of living organisms. Also, the much-debated

distinction between individualism (as in biocentrism) and holism (as in ecocentrism) in environmental philosophy (see e.g. Oksanen 1997) is missing in Kellert's typology.

At the level of biodiversity, several studies both in ecological economics and conservation ecology have shown the difficulties involved in measuring the value of biodiversity. From a conservation ecology point of view, Duelli and Obrist (2003) conclude that the choice of indicators to measure biodiversity depends on the aspect or entity of biodiversity to be evaluated and is guided by a value system based on the researchers' personal and/or professional motivation. Moreover, is has been shown that the conservation value of a particular site depends on the metrics used and on the spatial scale (see e.g. Salomon et al. 2006).

Economic research on environmental values can be divided into (1) expert-based estimations of the monetary value of biodiversity, ecosystem services etc. in a certain area or globally (e.g. Costanza et al. 1997), and (2) measuring the environmental values held by individuals and expressed in actual behaviour (revealed value expression) or as stated willingness to pay for environmental goods and services (see Lockwood 1999 for a short overview).

Measuring individuals' environmental values has so far only been attempted by environmental psychologists using scales such as those presented above, and by environmental economists using methods such as contingent valuation. However, the psychological scales are too broad to measure people's values regarding specific aspects of the environment such as biodiversity (they include, for instance, items on recycling or ozone depletion). Economic methods face the problem that not all aspects of biodiversity can easily be valuated in monetary terms, especially not by lay people (for a critical discussion of the monetary valuation of biodiversity see O'Neill 1997).

In view of these advantages and limitations, we set up a preliminary collection of items tailored to the exploration of nature and biodiversity values (Table 5). They represent an integration of philosophical, psychological, economic and ecological approaches, combining Kellert's basic values, the anthropocentrism-ecocentrism continuum (complemented by environmental apathy), biodiversity values as seen from a conservation ecology and from an economic point of view, and the philosophical positions of pathocentrism and environmental egalitarianism. The latter two are important fields of theoretical reasoning and discourse in environmental philosophy that have not yet been included in empirical studies of people's values of nature and landscape preferences.

Summing up, the present study aims to:

- group the Swiss public into landscape preference types and examine their principal socio-demographic characteristics
- examine the Swiss public's biodiversity and conservation values using an integrated approach
- explore the differences between the landscape preference types regarding their nature and conservation values.

Methods

Landscape preference types

The present study is based on a survey of the Swiss population. Respondents were asked to rate photo-realistic visualisations of potential future landscape developments, and to answer a number of text items dealing with biodiversity concepts and values.

We grouped individuals according to their landscape preferences. This means that we identified preference types regarding different landscape developments, and that these preference types are each as homogenous as possible and as distinct from each other as possible. Generalisations based on such preference types are usually of greater validity than those on the basis of single preference judgements. According to de Haan et al. (2001), type-differentiating methods are appropriate tools to make the analysis of ecological issues in the social sciences more socially differentiated and take them closer to societal reality. However, there are as yet only few type-differentiating studies regarding landscape preferences. A recent example from the Swiss Alps is provided by Gehring (2006) who analyses her landscape preference types referring to psychological theories. Bauer et al. (2009) generate a typology of man-nature relationship for the Swiss population.

Landscape visualisations

We visualised possible future landscape appearances in the Surses valley in the Swiss canton of Grisons. The Surses valley is a peripheral area of the Swiss Alps situated at an altitude ranging between 1,000 and 3,400 m.a.s.l. and counting approx. 2,500 inhabitants. It is a typical example of an area where agriculture has been declining over the last years; forest cover, on the other hand, has increased by 8% between 1985 and 1997, mostly at the expense of agricultural land (BFS 2000; BFS 2001). We selected six sites for the visualisations, representing various habitats and landscape types at different altitudinal belts, from the valley bottom to alpine pastures (see Soliva et al. 2009, for a detailed description of the sites).

Landscapes can be visualised in a number of ways, and visualisation techniques are ever becoming more sophisticated (e.g. Lange 1994, 2001; Nakamae et al. 2001; Orland et al. 2001). We opted for photo-realistic visualisations as they provide the most natural-looking images and are relatively easy to generate. The software used was Adobe Photoshop®. Even though the visualisations may look quite naturalistic and colour photographs have been found to be valid representations of real landscapes (Lange 2001), it must be kept in mind that they are only representations of reality and not the real experience.

For each selected site we developed four visualisations:

1) An image showing the landscape in 25 years if the land use trends of the past 15 years continue (TREND, Fig. 1);
2) An image showing the landscape in 25 years if measures are taken to enhance the biodiversity of open land (BIO, Fig. 2);
3) An image showing the landscape in 25 years if agronomically marginal land is abandoned and spontaneous reforestation sets in (FOREST 1, Fig. 3);
4) An image showing the landscape at an undefined point in time if agronomically marginal land is abandoned and spontaneous reforestation reaches an advanced stage (FOREST 2, Fig. 4).

The four images for each site thus illustrate thinkable, albeit extreme landscape consequences of the two main trends in peripheral mountain areas that have been sketched above: agricultural decline, spontaneous reforestation and rewilding on the one hand (FOREST 1 and 2), and the preservation of the cultural landscape and its high biodiversity on the other hand (BIO). The TREND-images illustrate more moderately the preservation of the cultural landscape, but focused on the agricultural production of food and fibre (as has been the case in the past) rather than on the production and preservation of

Fig. 1 Example of a TREND-visualisation

Fig. 2 Example of a BIO-visualisation

biodiversity. The TREND-images illustrate both the abandonment of the most marginal agricultural land, and the intensification of the most fertile and accessible land. Figure 1 gives an example of a visualisation series.

Fig. 3 Example of a FOREST 1-visualisation

Fig. 4 Example of a FOREST 2-visualisation

The sample

Landscape preferences and attitudes towards nature and conservation were examined in a postal survey covering all of Switzerland. Questionnaires were sent out to 4,000 households that had been randomly selected by the Swiss Federal Statistical Office based on the

national telephone directory. In order to minimise age- and gender biases, the first person in a household aged sixteen or over to have a birthday in the calendar year was asked to complete the questionnaire. A reminder was sent to all recipients of the questionnaire 3 weeks later. Out of the 4,000 questionnaires, 126 were undeliverable and 628 were returned completed so as to be included in the analysis, giving a response rate of 16.2%. Due to an over-sampling in the sampling procedure the respondents of the Italian-speaking part were over-represented, which was corrected by weighting the data set. The resulting stratification of the weighted sample, as entered in the statistical analysis, corresponds to census estimates of proportions among language strata in Switzerland: 72% German-speakers, 24% French-speakers, and 4% Italian-speakers.

A comparison with national statistics from the Swiss Federal Statistical Office (BFS 2006) showed some slight deviations of the sample regarding other socio-demographic characteristics. The surveyed sample is almost representative in terms of cantonal distribution, but women, foreign citizens, the age-group of 16–39 years and residents of mountain areas were under-represented. The participants were on average better educated than the Swiss population, and members of conservation organisations and sympathisers of the Green (environmentalist) Party were over-represented.

Questionnaire design

The standardised 12-page questionnaire was largely based on semi-structured interviews and focus group discussions in the Surses valley in the preceding inductive project phase (Soliva 2007; Soliva et al. 2008; Soliva and Hunziker 2009). A first section of the questionnaire contained the 24 landscape visualisations, which had to be rated on a seven-point Likert-scale. The visualisations were placed in random order within each series, and no further information was given (e.g. about the state of the landscape they were representing). In addition to the visualisations the questionnaire contained various batteries of text items, of which the present study considers those dealing with nature and biodiversity values, conservation concepts, and the socio-demographic variables. The questionnaire was developed in German and translated by professional translators to French and Italian.

Statistical analyses

All statistical analyses reported here were conducted using SPSS 11 for Mac OS X. Besides a principal components analysis of variables related to nature and biodiversity values and conservation concepts, a hierarchical cluster analysis was conducted in order to split the sample into groups of respondents with similar landscape preferences. After applying the single linkage procedure to eliminate outliers from the data set, Ward's minimum variance cluster analysis with squared euclidean distance was conducted. It is a widely used, conservative procedure that is considered as a very good algorithm (Backhaus et al. 2006). The ratings of the 24 landscape visualisations described above were introduced into the cluster analysis. Missing values were deleted casewise, leading to 522 cases being included.

The cluster analysis revealed several possible cluster solutions. In order to identify the most appropriate solution, the differences between the landscape preference types were analysed by means of analyses of variance and post hoc tests for the 2-, 3-, 4-, 5-, and 6-cluster solutions. The 2-cluster solution had the lowest percentage of non-significant post hoc comparisons and is thus the most adequate regarding between-group variance (Table 1). In addition, the F-values were calculated for all variables in the two clusters in order to analyse the homogeneity of the clusters. This F-value is defined as the variance of

Table 1 Percentages of non-significant post hoc tests in the different cluster solutions

Number of clusters	2	3	4	5	6
% of non-significant post hoc tests	12.5	19.4	23.6	30.8	32.6

a variable J in a cluster G over the variance of a variable J in the survey population. A cluster is considered completely homogenous if all *F*-values are smaller than one (Backhaus et al. 2006). In our two-cluster solution the first cluster contained five out of 24 *F*-values larger than one, and the second cluster six *F*-values out of 24, meaning that the present cluster solution is nearly homogenous. In the other cluster solutions the number of *F*-values larger than one in a cluster was on average higher.

Independent samples *t*-tests were used to compare means of the two landscape preference clusters regarding socio-demographic characteristics and individual items. The homogeneity of variances in the *t*-tests was examined by means of Levene-tests. In those cases where the Levene-test revealed significant results, the *t*-values for which equal variances are not assumed were used. Kolmogorov–Smirnov statistics showed deviations from normal distribution. However, due to the large sample size the *t*-tests are still valid (Bortz 1999).

Results

Landscape preference types

The two landscape preference types emerging from the cluster analysis can be labelled "reforestation type" and "cultural landscape type". Table 2 shows the means, standard deviations and between-type differences for the two clusters for all 24 landscape visualisations.

The first landscape preference type can be labelled "reforestation type", as it generally preferred reforested landscapes (especially at an early stage of reforestation) over cultural landscapes. The other type, called "cultural landscape type", showed the opposite preference pattern: it preferred cultural landscapes and especially the low-intensity, biodiversity-optimised landscapes of the BIO-visualisations over the reforested landscapes of the FOREST-visualisations. 65.1% of respondents belong to the reforestation type and 34.9% to the cultural landscape type.

Variations in socio-demographic variables were examined for the two preference types (Table 3). Cultural landscape sympathisers are significantly older and more likely to be male, living in the mountains, and working in agriculture, than reforestation sympathisers. On the other hand, reforestation sympathisers are on average better educated and more likely to have a preference for the Green party than cultural landscape sympathisers. No significant differences were found regarding language, provenance (mountains or lowlands), and membership in an environmental NGO.

Nature and biodiversity values and conservation priorities

Tables 4 and 5 show the means, the degree of acceptance and the underlying theoretical concepts of the questionnaire items dealing with nature and conservation values.

The items representing nature and biodiversity values and conservation priorities were factor-analysed (PCA with Varimax rotation). As both four-point and five-point scales had been used, the values of the items measured in a four-point scale were transformed into a five-

Table 2 Mean scores of the preference types and comparison of means (*t*-test) regarding the 24 visualisations (dependent variable) representing four states of landscapes

	Reforestation type ($N = 340$)		Cultural landscape type ($N = 182$)		t
	M	SD	M	SD	
TREND A	3.84	1.53	4.22	1.96	−2.282*
TREND B	4.26	1.49	5.22	1.39	−7.139***
TREND C	5.35	1.57	4.94	1.57	2.892**
TREND D	5.18	1.43	5.20	1.21	−.199 ($P = .842$)
TREND E	5.08	1.50	5.98	1.05	−7.925***
TREND F	4.35	1.54	5.07	1.34	−5.627***
BIO A	2.85	1.77	3.41	2.38	−2.798**
BIO B	5.62	1.18	5.54	1.42	.626 ($P = .532$)
BIO C	5.39	1.47	6.17	0.95	−7.268***
BIO D	4.75	1.46	5.34	1.49	−4.359***
BIO E	5.26	1.43	5.98	1.12	−6.297***
BIO F	4.48	1.63	5.04	1.62	−3.748***
FOREST 1 A	5.74	1.18	5.56	1.40	1.542 ($P = .124$)
FOREST 1 B	5.61	1.34	3.18	1.39	19.535***
FOREST 1 C	5.15	1.31	4.16	1.32	8.242***
FOREST 1 D	5.28	1.22	3.49	1.49	13.936***
FOREST 1 E	5.71	1.17	4.52	1.40	9.750***
FOREST 1 F	4.71	1.45	4.38	1.56	2.396*
FOREST 2 A	5.82	1.29	3.80	1.57	15.734***
FOREST 2 B	4.95	1.67	2.24	1.23	21.066***
FOREST 2 C	4.86	1.58	2.27	1.23	20.738***
FOREST 2 D	5.01	1.62	2.60	1.44	17.456***
FOREST 2 E	4.70	1.56	2.31	1.23	19.273***
FOREST 2 F	5.19	1.50	3.22	1.64	13.836***

Means are based on a seven-point preference scale ranging from 1 = "do not like at all" to 7 = "like very much"

* $P < .05$, ** $P < .01$, *** $P < .001$

point scale. The Kaiser-Meyer-Olkin measure of sampling adequacy gave a value of .845, meaning that the sample is adequate for factor analysis. Bartlett's Test of Sphericity was significant, indicating that there are relationships worthwhile to investigate in a factor analysis.

Table 6 shows the results of the Principal Components Analysis. The elbow-criterion of the scree-plot and the interpretability of the factors suggest a four-factor solution, explaining 54.0% of the variance. Moreover, these four factors all show eigenvalues >1. Variables expressing an intrinsic value of nature loaded highest on the first factor, explaining 20.4% of the variance. The second factor assembles items related to the conservation of natural heritage of a region, emphasising the conservation of typical and threatened species and the importance of biodiversity for tourism (13.7% of variance). Utilitarian nature values loaded highest on the third factor (11.6% of variance), and the fourth factor represents items related to process-oriented nature conservation (8.3% of variance). The items "priority of landscape conservation over species conservation" and "pathocentrism" could not be assigned to any of the four factors.

Table 3 *t*-test comparing mean values of the two landscape preference types (independent variable) regarding socio-demographic characteristics (dependent variable)

Socio-demographic variable	Result of *t*-test	Relation
Age	$t(515) = -6.811$***	Cult. landsc > reforest
Language: German	$t(520) = .-426$ ($P = .671$)	
Language: French	$t(520) = .634$ ($P = .526$)	
Language: Italian	$t(520) = .-416$ ($P = .678$)	
Residence: mountains	$t(290) = -3.034$**	Cult. landsc > reforest
Grown up in mountains	$t(313) = -1.657$ ($P = .099$)	
Gender: male	$t(385) = -2.710$**	Cult. landsc > reforest
Environmental NGO: member	$t(382) = 1.766$ ($P = .078$)	
Green Party: sympathiser	$t(443) = 2.474$*	Reforest > cult. landsc
Education: college and university	$t(499) = 3.016$**	Reforest > cult. landsc
Profession: agriculture	$t(176) = -2.263$*	Cult. landsc > reforest

Degrees of freedom in parentheses

* $P < .05$, ** $P < .01$, *** $P < .001$

Association between nature and conservation values and landscape preference types

Differences between the landscape preference types regarding the four factors expressing nature and conservation values were investigated by means of independent samples *t*-tests (Table 7). Respondents belonging to the reforestation-type clearly emphasised intrinsic value of nature, while respondents of the cultural landscape type tended significantly more towards utilitarian value of nature. As the *t*-tests did not reveal any significant results for the factors "natural heritage conservation" and "protection of natural processes", *t*-tests were also conducted with all individual nature and conservation value items (Table 8), revealing significant relationships for most of the items.

Discussion and conclusion

Methodological limitations

This study represents a first attempt to empirically examine the relationship between nature values and landscape preferences from an integrated perspective, considering philosophical, ecological and economic aspects and using items focused on biodiversity rather than the very broad range of items of the widely used NEP-scale or similar scales. Despite its preliminary character, we believe the study has yielded some interesting results. Nevertheless, some methodological limitations have to be kept in mind, and further research is needed to improve the validity of the items.

- The sample is not free from biases: for instance, highly educated respondents and members of conservation organisations were over-represented. These (slight) biases are difficult to completely avoid in a mailed survey, and they are comparable to other, similar surveys in Switzerland.

Table 4 Nature and conservation values: agreement to statements and underlying theoretical concepts

	Theoretical concept	Item	*N*	Mean	SD	*A* (%)
Environmental ethics	Egalitarianism (e.g. Taylor 1986; Oksanen 1997; Michael 1997)	1.1 All living organisms, regardless of which species, are of the same value and equally worthy of protection.	611	3.72	1.24	62.5
	Biocentrism (Krebs 1999); moralistic value (Kellert 1996)	1.2 All living organisms have a right of existence and are worthy of protection, even if they are of no use to humankind.	616	4.32	.90	85.0
	Biocentrism (Krebs 1999); aesthetic, ecologistic-scientific and symbolic values (Kellert 1996); conservation ecology: umbrella species (Roberge and Angelstam 2004)	1.3 If bears, wolves or lynx spread out in mountain areas without any human intervention, we should accept this.	617	3.52	1.36	60.7
	Pathocentrism (Singer 1979; Krebs 1999)	1.4 Sentient creatures deserve more protection than other creatures.	610	3.04	1.24	40.8
	Ecological economics; utilitarian value (Kellert 1996)	1.5 Areas rich in biodiversity are particularly interesting for tourism.	619	3.98	.93	76.5
	Classical economic theory: utility maximisation; utilitarian and dominionistic values (Kellert 1996)	1.6 A high-yielding mountain meadow is more important than a species-rich mountain meadow.	619	2.13	1.01	10.1
	Negativistic value (Kellert 1996)	1.7 Living organisms that are dangerous to humankind do not deserve any protection.	615	2.33	1.24	18.7
	Environmental apathy (Gagnon Thompson and Barton 1994; Bjerke and Kaltenborn 1999)	1.8 I do not care about the conservation of plant and animal species.	612	1.47	.90	5.3
Conservation values	Process-oriented nature conservation (Scherzinger 1997; Körner 2005)	1.9 Man should not try to save certain animal and plant species by means of conservation interventions, but rather let nature take its own course.	616	2.91	1.24	34.7
	Process-oriented nature conservation (Scherzinger 1997; Körner 2005); moralistic value (Kellert 1996)	1.10 Man should intervene in nature as little as possible, so that it can unfold freely.	617	3.63	1.01	62.1
	Landscape diversity protection vs. species conservation (Ermischer 2004)	1.11 The conservation of manifold mountain landscapes is more important than the protection of certain animal and plant species.	612	2.98	1.14	29.5

Questions 1 and 2: How much do you agree with the following statements? Five-point scale ranging from 1 = "strongly disagree" to 5 = "strongly agree"

A Acceptance: Percentage of respondents agreeing mildly or strongly to the statement

Table 5 Conservation priorities and underlying theoretical concepts

Concept	Item	*N*	Mean	SD	*A* (%)
Environmental ethics: ecologistic-scientific value (Kellert 1996); socio-cultural motives (Duelli et al. 2007)	2.1 Threatened and rare species and varieties	618	3.55	.65	93.6
Environmental ethics: aesthetic value (Kellert 1996); conservation ecology: flagship species (Caro et al. 2003)	2.2 Visually attractive species	614	2.74	.92	60.6
Environmental ethics: utilitarian value (Kellert 1996)	2.3 Species and varieties that are of particular interest to humankind for the production of pharmaceuticals and food	616	3.00	.88	74.7
Environmental ethics: utilitarian value (Kellert 1996)	2.4 High-yielding animal races and plant varieties	617	2.43	.92	44.7
Environmental ethics: symbolic value (Kellert 1996)	2.5 Species and varieties that are typical for a particular region	617	3.58	.58	96.4
Environmental ethics: biocentrism (Krebs 1999); aesthetic, ecologistic-scientific and symbolic values (Kellert 1996); conservation ecology: umbrella species (Roberge and Angelstam 2004)	2.6 Large predators such as wolf, lynx and bear	616	2.42	1.01	45.8
Environmental ethics: ecologistic-scientific and moralistic values (Kellert 1996); conservation ecology: keystone species (Power et al. 1996)	2.7 Species that are of particular importance for the functioning of an ecosystem	614	3.62	.60	95.6

Question 3: How important is it to you that the following categories of animal and plant species can live in the Swiss mountains? Four-point scale ranging from 1 = "unimportant" to 4 = "important"

A Acceptance: percentage of the responses "important" or "somewhat important"

- The response rate of 16% may seem extremely low by international standards. In nature-related postal surveys in Switzerland, response rates of around 25% are quite normal. The low response rate may be partly due to the length of the questionnaire (12 pages) but also to some unpredictable or underestimated influencing variables, such as the very sunny and warm weather, and the football world championship taking place during the period of our survey.
- Nature and conservation values were measured by one or two items per theoretical concept, which is rather the minimum in terms of scale reliability. However, for the purpose of this study this was deemed appropriate, as we did not primarily aim at developing a new scale to measure values but focussed on the relationship between preferences and values. Moreover, there was a trade-off between the reliability of the scales and the response rate, as high reliability requires a high number of items and thus a longer questionnaire. This, in turn, lowers the response rate, a risk we could not take.
- It may have been difficult for lay-people to grasp the implications of philosophical concepts such as egalitarianism, as the items were formulated in a relatively abstract way. Further work should be directed toward an "applied environmental philosophy", e.g. by constructing short items that capture the essence of these philosophical concepts in a more concrete and easily understandable way.

Table 6 Factor loadings from principal components analysis with varimax rotation for nature and biodiversity values and conservation priorities ($N = 555$)

Variables (short description)	Component				
	1 Intrinsic value of nature	2 Natural heritage conservation	3 Utilitarian value of nature	4 Protection of natural processes	Communalities
2.6 Conservation priority for large predators	**0.83**	0.13	0.01	0.08	0.70
1.3 Acceptance of large predators	**0.80**	0.11	−0.13	0.11	0.69
1.7 No protection of dangerous creatures	**−0.79**	−0.14	0.19	0.12	0.69
1.1 All living organisms are equal	**0.66**	0.20	−0.21	−0.02	0.52
1.2 All living organisms have a right to exist	**0.54**	0.45	−0.14	−0.04	0.51
2.1 Conservation priority for threatened and rare species	**0.51**	**0.54**	0.13	−0.06	0.57
2.5 Conservation priority for typical species	0.03	**0.65**	0.24	−0.03	0.48
2.7 Conservation priority for keystone-species	0.33	**0.65**	−0.05	−0.10	0.59
1.5 Biodiversity supports tourism	−0.04	**0.61**	0.12	0.22	0.43
1.8 Apathy regarding species conservation	−0.27	**−0.54**	0.22	0.35	0.53
1.6 Priority of agricultural yield	−0.29	**−0.52**	0.43	0.09	0.55
2.4 Conservation priority for high-yielding varieties	−0.15	−0.09	**0.76**	−0.05	0.61
2.2 Conservation priority for visually attractive species	0.05	0.15	**0.70**	0.02	0.52
2.3 Conservation priority for useful species	−0.23	0.08	**0.68**	0.03	0.53
1.9 No human interventions for species conservation	−0.15	−0.21	−0.07	**0.75**	0.63
1.10 No human interventions into nature	0.39	0.10	−0.20	**0.68**	0.66
1.11 Priority of landscape conservation over species conservation	−0.47	0.00	0.06	0.26	0.29
1.4 Pathocentrism	−0.11	0.08	0.27	0.42	0.27
Eigenvalues	3.68	2.46	2.09	1.49	
% of variance	20.41	13.67	11.64	8.28	

Note Bold indicates factor loadings higher than 0.5

Table 7 *t*-test comparing mean values of the two landscape preference types (independent variable) regarding the rotated factor solutions

Factors of nature and conservation values	Result of *t*-test	Relation
Intrinsic value of nature	$t(315) = 5.503$***	Reforest. > cult. landscape
Natural heritage conservation	$t(497) = 1.041$ n.s.	
Utilitarian value of nature	$t(497) = -3.070$**	Cult. landscape > reforest
Protection of natural processes	$t(308) = 1.241$ n.s.	

Degrees of freedom in parentheses

* $P < .05$, ** $P < .01$, *** $P < .001$

Landscape preferences

Landscape preferences are discussed here only regarding the two preference types; a thorough discussion of the landscape preferences of respondents in general and regarding different socio-demographic groups is presented in Soliva et al. (2009).

A recent study of the preferences of the Swiss public regarding different possible landscape development in the Alps (Gehring 2006) yielded three distinct preference types: an Arcadian type preferring well-kept cultural landscapes without any clear signs of extreme landscape developments; a Utilitarian type with a preference for human-used landscapes, even with drastic and artificial-looking signs of human use; and a Wilderness type preferring wild, reforested landscapes. Gehring's landscape visualisations illustrate a broader range of possible landscape developments than the present, agriculture-focused study. They include images of settlement sprawl and tourist infrastructure that were rated significantly higher by the Utilitarian type than by the others. The human interventions in the agricultural landscapes of the present study are in comparison not nearly as drastic, which may explain the absence of a Utilitarian type. There are, however, great similarities between Gehring's Wilderness type and our Reforestation type, and between Gehring's Arcadian type and our Cultural landscape type, both in terms of landscape preference and socio-demographic characteristics.

Nature values of the Swiss population

A vast majority of 85% of respondents in this study agreed strongly or mildly to the biocentric statement that all living organisms have a right of existence, even if they are of no use to humankind (item 1.2). A similar degree of biocentrism was found in Norway, where 83% of a sample of 965 members of the general public strongly or mildly agreed that all ecosystems have a right to exist (Grendstad and Wollebaek 1998), in Sweden where 78% of a sample of 1,011 respondents from the general public agreed to a similar statement (Widegren 1998), in the USA where approximately 80% of a sample of 71 college students expressed a biocentric view (Gagnon Thompson and Barton 1994), and in the Netherlands, where 92% of 1,999 members of the general public found the intrinsic value of nature to be very important or important (Buijs and Volker 1997, quoted in van den Born et al. 2001).

Linked to biocentrism (as shown by Bjerke and Kaltenborn 1999) is the acceptance and conservation priority of large predators (items 1.3 and 2.6). 60.7% of respondents would strongly or mildly accept bears, wolves and lynx to spread out in mountain areas without human intervention, while only 45.8% find it rather important or important that these animals can live in the Swiss mountains. The acceptance of large predators is similar to

Table 8 *t*-test comparing mean values of the two landscape preference types (independent variable) regarding individual nature and conservation value items (dependent variable)

Factor	Variables (short description)	Result of *t*-test	Relation
Intrinsic value of nature	2.6 Conservation priority for large predators	$t(519) = 5.596$***	Reforest > cult. landsc
	1.3 Acceptance of large predators	$t(345) = 4.646$***	Reforest > cult. landsc
	1.7 No protection of dangerous creatures	$t(311) = -4.942$***	Cult. landsc. > reforest
	1.1 All living organisms are equal	$t(515) = 3.689$***	Reforest > cult. landsc
	1.2 All living organisms have a right to exist	$t(518) = 3.784$***	Reforest > cult. landsc
	2.1 Conservation priority for threatened and rare species	$t(322) = 2.767$**	Reforest > cult. landsc
Natural heritage conservation	2.5 Conservation priority for typical species	$t(519) = .696$ n.s.	
	2.7 Conservation priority for keystone-species	$t(370) = 3.239$**	Reforest > cult. landsc
	1.5 Biodiversity supports tourism	$t(520) = -1.058$ n.s.	
	1.8 Apathy regarding species conservation	$tT(297) = -3.027$**	Cult. landsc. > reforest
	1.6 Priority of agricultural yield	$t(326) = -3.960$***	Cult. landsc. > reforest
Utilitarian value of nature	2.4 Conservation priority for high-yielding varieties	$t(518) = -2.393$*	Cult. landsc. > reforest.
	2.2 Conservation priority for visually attractive species	$t(405) = -1.455$ n.s.	
	2.3 Conservation priority for useful species	$t(425) = -4.728$***	Cult. landsc. > reforest
Protection of natural processes	1.9 No human interventions for species conservation	$t(517) = -.290$ n.s.	
	1.10 No human interventions into nature	$t(345) = 4.646$***	Reforest > cult. landsc
No factor assignment possible	1.11 Priority of landscape conservation over species conservation	$t(515) = -3.799$***	Cult. landsc. > reforest
	1.4 Pathocentrism	$t(514) = -3.175$**	Cult. landsc. > reforest

Degrees of freedom in parentheses

* $P < .05$, ** $P < .01$, *** $P < .001$

that reported by Hunziker et al. (2001) in an acceptance survey of the Swiss general public. Although they surveyed the acceptance of wolf, lynx and bear separately, they found that the acceptance of these three predators correlates so strongly that it can be summarised as "acceptance of predators". The results of the present study show that large predators are accepted by a majority of the Swiss public, but that in the mind of the general public—and in contrast to conservation organisations—they continue to have a relatively low conservation priority compared to other groups of species.

The other nature values and conservation priorities reported in Tables 5 and 6 cannot be compared with other empirical studies, as they have not been examined elsewhere in a comparable way.

The following results seem particularly noteworthy to us:

- The statement representing an egalitarian view (item 1.1), which in environmental philosophy is regarded as an extreme and highly contested position, was agreed to by a majority of respondents. It might be questioned, however, whether respondents were fully aware of the implications of this position when they assessed this relatively abstract statement. If they had been confronted with a concrete "who do you save?"-dilemma, as discussed in the environmental ethics literature (e.g. Michael 1997), they might have been more sceptical towards an egalitarian position.
- The finding that species that strongly contribute to the functioning of an ecosystem are given higher importance than visually attractive species contradicts Johnson's (1995) conclusion drawn from a number of studies that the public tends to be most concerned with aesthetically attractive, endangered species, while scientists might pay more attention to the contribution of the species to the functioning of ecosystems and diversity. Our finding might be partly explained by the over-representation of highly educated respondents (who are likely to be more familiar with ecological theories than average citizens) in our sample. However, the findings may also reflect a value change since Johnson's (1995) study, with values related to scientific concepts becoming more important to the public. In recent qualitative (Fischer and Young 2007) and quantitative (Fischer and van der Wal 2007) studies from Scotland, the (albeit somewhat outdated) scientific notion of "balance of nature" was attached very high importance by the public.
- Besides species with ecologistic-scientific value, species to which symbolic value is ascribed, are given very high importance. The importance of species that are typical for a particular region reflects the symbolic value these species have in that they contribute to the "sense of place" (Gustafson 2000) of that region.
- Statements expressing utilitarian nature value are generally less accepted than those expressing biocentric nature value. However, the fact that the potential of species for direct use (e.g. for pharmaceuticals and food as in item 2.3, or tourism as in 1.5) is considered important or somewhat important by a clear majority, shows that most people hold both biocentric and utilitarian nature values. This interpretation is corroborated by empirical findings from other studies (e.g. Bjerke and Kaltenborn 1999; Kaltenborn and Bjerke 2002), although some studies found no association between ecocentric and anthropocentric scores (e.g. Gagnon Thompson and Barton 1994). In item 1.6, where the utilitarian value of food production is traded off against other possible nature values of biodiversity, utilitarian values are clearly considered less important.
- There is no clear majority for either traditional species conservation or landscape- or natural processes-oriented conservation if these conservation focuses are traded off

against each other (items 1.11 and 1.9). We hypothesise that many people find conservation important at all levels, and that they are not aware of the "philosophical" conflict between "heritage-oriented" and process-oriented conservation. This hypothesis is supported by the relatively high acceptance of item 1.10: "Man should intervene in nature as little as possible, so that it can unfold freely". Many respondents probably understood "intervene in nature" in the sense of destructive interventions and were not aware that the conservation of many species (especially those bound to cultural landscapes) requires human interventions in nature. They find the conservation of species important, and at the same time they want nature to unfold freely. Further research would be needed to empirically explore this issue.

Key dimensions of nature and conservation values

The four factors identified in the Principal components analysis (PCA) reflect the two poles of nature values (intrinsic value of nature, i.e. ecocentrism and biocentrism, and utilitarian value of nature, i.e. anthropocentrism) and the two main concepts of nature conservation in Germany and Switzerland, i.e. heritage-oriented conservation ("Natur- und Heimatschutz") and process-oriented conservation. The notion of environmental apathy, the third dimension of nature values in the Gagnon Thompson and Barton scale, is manifested in the factor "natural heritage conservation" as a highly negative factor loading. This is consistent with the preoccupation of traditional heritage-oriented conservation with the protection of species (and biotopes), rather than of natural processes (Piechocki 2001).

The items referring to conservation priorities for threatened and rare, typical and keystone- species load quite neatly on the factor "natural heritage conservation"—the traditional focus of nature conservation in Switzerland, while the items representing conservation priorities for high-yielding varieties, visually attractive species, and useful species for food and pharmaceutical production can be clearly assigned to the factor "utilitarian value of nature". The latter do not coincide with the two most important conservation focuses in Switzerland, heritage-oriented conservation and process-oriented conservation, which points to a gap between the conservation priorities of parts of the Swiss population, and those of conservation agencies. The item "priority of landscape conservation over species conservation" does not load highly on any of the four factors. This is plausible in so far, as it relates to a different dimension of conservation; landscape protection is neither directly related to (species- and biotope-oriented) natural heritage protection nor to the protection of natural processes. Similarly, it is plausible that the items referring to large predators load highest on the factor "intrinsic value of nature" rather than on the conservation-related factors, as they seem to be perceived in terms of rights of existence of controversial animals. Moreover, the re-introduction of large predators is an aim of both conservation paradigms: from a natural heritage point of view, these are species that existed before in the Swiss Alps and should thus be part of the natural heritage, and from a natural processes point of view, they are species with large territorial requirements and a preference for pristine, forested areas. Thus, they represent natural processes and symbolise wilderness in the perception of the public (Caluori and Hunziker 2001).

Norton (2000), in an attempt to overcome the sharp distinction between intrinsic and instrumental values in environmental ethics, suggests recognising the "creativity of nature" as a universal environmental value, and from this concludes that biodiversity policy should focus on natural processes rather than on species and biodiversity elements. Our

empirical evidence does, however, not support the notion of a "value of creative processes in nature" as a common factor in most people's valuing of nature from which a process-oriented biodiversity-policy could be inferred. Although many people may appreciate the creativity of nature, there is no clear majority for a process-oriented conservation policy if traded-off against a species-oriented conservation policy.

Associations between landscape preference types and nature/conservation values

Our finding that people with a liking for reforested landscapes tend to emphasise intrinsic values of nature largely corresponds to Kaltenborn and Bjerke's (2002) results showing a positive correlation between ecocentrism and a preference for wildlands with water. In their study, ecocentrism was also positively correlated with cultural landscapes, while anthropocentrism was positively correlated with a preference for farm environments, and environmental apathy was negatively associated with a preference both for wildlands and cultural landscapes. Our finding of a significant positive relation between a preference for cultural landscapes and utilitarian nature values seems (intuitively) more plausible than Kaltenborn's and Bjerke's positive correlation between cultural landscapes and ecocentrism. The reasons for this difference may be manifold, and more information on Kaltenborn and Bjerke's visualisation would be needed for an in-depth comparison. A similar relationship was found in Van den Berg's et al. (2006) study, in which only the factor referring to "useful nature-images" was positively related to preference for landscapes with strong human influence.

Surprisingly, there is no significant difference between the two landscape preference types regarding their preference for heritage-oriented or process-oriented conservation. We had expected a clear preference of the reforestation type for process-oriented conservation, and a preference of the cultural landscape type for natural heritage conservation. Comparable results from other empirical studies are unfortunately lacking. However, at the level of individual items there is a significantly higher acceptance of item 1.10 ("Man should intervene in nature as little as possible, so that it can unfold freely") among people of the reforestation type than among people of the cultural landscape type. The reforestation type also attaches significantly higher importance to keystone species (item 2.7) and is significantly less apathetic towards species conservation (item 1.8). This points to the above-mentioned ambivalence between species-conservation and process-oriented conservation: it seems that particularly people belonging to the reforestation type care about species conservation, and that at the same time they like nature to unfold freely. They attach great importance to threatened species and keystone species, yet it remains unclear whether they have mostly forest species in mind (such as large predators, which they accept significantly more than people belonging to the cultural landscape type). Respondents belonging to the cultural landscape type agree significantly stronger to item 1.11 that prioritises landscape conservation over species conservation, which supports the interpretation that the cultural landscape type is somewhat less concerned about species conservation (and conservation in general) than the reforestation type. Looking at it from another angle, it may be argued that people who attach high value to conservation—both in the sense of species conservation and natural processes—and who may be quite knowledgeable about nature and biodiversity, often appreciate wild, reforested landscapes that to others might represent lack of care (see Gobster et al. 2007).

Although the pathocentric item (1.4) could not be assigned to any of the four factors, it is significantly more accepted by the cultural landscape type than by the reforestation type. This finding seems to fit in the value pattern of the cultural landscape type, which tends to

create a hierarchy of living organisms (rather than attributing intrinsic value to all of them), in which usefulness to humans may be one criterion, and the ability to feel pain and pleasure another.

Implications for management and research

This study has found some significant relationships between landscape preferences and biodiversity- and conservation-related values. Our data show that the people who prefer reforested landscapes tend to be more concerned about the conservation of species, landscapes, and natural processes than people preferring cultural landscapes. The cultural landscape type is more oriented towards utilitarian values of nature than the reforestation type, and it is found more often in mountain areas than in the lowlands, thus in areas that are more likely to become the target of conservation measures. This finding has practical implications for conservation agencies: as the process-oriented conservation concept is gaining ground in Switzerland, with an increasing number of wilderness reserves being planned and established, conservation agencies will need to increase local people's acceptance of wilderness and reforested landscapes. Conservation organisations should be aware that many of their supporters have a preference for wild and reforested landscapes, while the residents or neighbours of potential wilderness areas more often prefer well-tended cultural landscapes. They will have to focus more strongly on raising awareness among mountain residents (of the cultural landscape type) of the potential direct benefits of biodiversity conservation in terms of tourism and ecosystem functioning. It should be pointed out to mountain residents that reforested, wild landscapes often have a strong appeal to visitors from the lowlands. On the other hand, lowland residents (of the reforestation type) should become more aware of the importance of alpine cultural landscapes for biodiversity; their conservation requires the continuation of human interventions.

The importance of biodiversity- and conservation values for conservation planning and management must not be underestimated (see Duelli et al. 2007). In further research, the nature and conservation values of the general public, as examined here, could be compared with those of conservation experts and decision-makers, enabling an identification of potential sources of conflicts and reactance to conservation measures.

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