HABIT-CHANGE

adaptive management for protected areas

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Data Description: Sensitivity maps

Extract from HABIT-CHANGE Output 4.6 Sensitivity Impact Report

01/2013

CENTRAL EUROPE COOPERATING FOR SUCCESS.

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

1. Introduction

The framework for the assessment follows the concept defined by the IPCC (2001):

Sensitivity is defined as "the degree to which a system is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g. change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g. damages caused by an increase in the frequency of coastal flooding due to sea-level rise)".

2. Methods

2.1. Sensitivity

In HABIT-CHANGE the sensitivity of a habitat is considered a result of its characteristics and existing or future pressures. The characteristics of habitats are the results of the effective abiotic factors like climate conditions, topography, soil type or disturbance regimes and biotic factors like species distributions, competition or regeneration rates. These characteristics describe the ecological envelope of the habitats. However, existing non-climatic pressures like land use changes modify the resilience of habitats to climate change on the local level.

The sensitivity of habitats was assessed by two approaches (Figure 3). One is focusing on regional expert knowledge and the other incorporates the ecological envelope of the habitat by assessing the current plant community composition.

Figure 1: **Framework for the Sensitivity assessment**
(Source: own preparation, 2012)

2.1.1. Regional expert knowledge

The framework for the **regional expert knowledge** was based on the approach developed during the sensitivity assessment of Natura 2000 habitats in Germany by Petermann et al. (2007). The assessment was structured into seven sensitivity criteria (Table 1):

1. Average or reduced conservation status: habitats which are already marked as endangered are more sensitive;
2. Ability to regenerate: how long habitats need to recover after disturbance;
3. Horizontal distribution (range): species migrations due to climate change (e.g. from Northwest to East)
4. Altitudinal distribution (range): species are forced to migrate upwards (e.g. summit areas)
5. Decrease of territorial coverage: remnants of habitats which are already endangered
6. Influence of neophytes: potential danger of neophytes due to new invasive species or changing territorial coverage;

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7. Dependency on groundwater and surface water in water balance: sensitivity of habitats which depend on water to changing temperature and precipitation patterns

Table 1: **Sensitivity criteria for the regional expert knowledge assessment**
(Source: modified after Petermann et al. 2007)

Values	CONS	REGE	HORI	ALTI	COVER	NEOP	WATER
low	≥3	marginal	no limits, closed range	planar collin	no change	no invasives	no
med	≥2	difficult	no limit but fragmented	montane	medium decrease	one invasive species	only for some forms
high	≥1	none, barely	limits or disjoint habitats	subalpine and alpine	strong decrease	more than one invasive species	for most forms

Abbreviations: CONS: Average or reduced conservation status; REGE: Ability to regenerate; HORI: Horizontal distribution; ALTI: Altitudinal distribution; COVER: Decrease of territorial coverage; NEOP: Influence of neophytes; WATER: Dependency on ground- and surface water in water balance;

For each habitat type each criteria was evaluated from the experts between the values "*low*" (1), "*medium*" (2), and "*high*" (3) sensitive. Afterwards, these values are summed and categorised to describe the overall sensitivity of a habitat type. Thereby, the categories were named similar to the evaluation values (Table 2). This evaluation was done from regional experts for the Alpine, Continental and Pannonian biogeographical region.

Table 2: **Sensitivity categories**
(Source: modified after Petermann et al. 2007)

Sum	Value	Category
> 14	3	high
14-16	2	medium
< 16	1	low

2.1.2. Indicator values

The variability of the ecological envelope of habitats was assessed by **indicator values** which were derived from the characteristic species composition in the habitats. As above, the biogeographical regions define the type of plant indicator scheme used for the assessment (Table 3). This differentiation was made because indicator schemes are based on the plant species response to climatic (e.g. temperature) and edaphic (e.g. moisture) habitat parameters, which are varying between the biogeographical regions (Englisch and Karrer 2001). Following Ellenberg (1992), different authors adapted the ecological preference of plants for their region. Each scheme categorizes this ecological preference into ordinal scaled systems.

Table 3: **Indicator schemes per biogeographical region**
(Source: own preparation, 2012)

Region	Indicator scheme	Ordinal scale	New Scale
Alpine	Landolt et al. (2010)	1 – 5 (Temp., Moist.)	1 - 3
Continental	Ellenberg (1992)	1 – 9 (Temp.); 1 – 12 (Moist.)	1 - 3
Pannonian	Borhidi (1995)	1 – 9 (Temp.); 1 – 12 (Moist.)	1 - 3

Temperature values as climatic parameter and **moisture** values as edaphic parameter were selected in the framework. The temperature describes the plants response to air temperature gradients during the vegetation period. Moisture values indicate the degree of soil moisture needed by the plant during the vegetation period. Since the approach should be locally valid and transferrable to other biogeographical regions, the indicator schemes were re-categorized into three values each (Table 4, Table 5). Thereafter, the categorized indicator values were used to calculate an overall indicator value based on the statistical median for each habitat type listed by the investigation area.

Table 4: **Categories for the indicator temperature**
(Source: own preparation, 2012)

Scale	Category	Description
1	low	Species from high elevations, sustainable of low air temperature during the growth period
2	medium	Species from the midlands, need average air temperature during the growth period
3	high	Species from low elevations, need higher air temperature during the growth period

Table 5: **Categories for the indicator moisture**
(Source: own preparation, 2012)

Scale	Category	Description
1	dry	Species sustain low soil moisture during growth period
2	moist	Species need average soil moisture during growth period
3	wet	Species need high soil moisture during growth period

The frequency of the categorised indicator values per habitat, investigation area and biogeographical region was used in the sensitivity assessment. The proportion of the categories defined the main direction, therefore also the sensitivity of the habitat against changes in direction of the other category (Table 6). For instance, freshwater habitats are characterised in their moisture by moist to wet category and therefore are sensitive to drought periods.

Table 6: **Example sensitivity assessment of the indicator values for three habitat types**
(Source: own preparation, 2012)

Habitat	Dry	Moist	Wet	PRESENT	Sensitivity
Freshwater habitats	1	15	58	Moist/Wet	> Dry
Grassland formations	72	196	24	Dry/Moist	> Wet
Forests	14	174	43	Moist	indifferent

Note:

For a detailed description of methods and results can be found in HABIT-CHANGE Output 4.6 Sensitivity Impact Report.

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