Sauteria 10, 1999 Biotopkartierung im Alpenraum 11-22

THE HABITAT SURVEY OF SLOVENIAN ALPS AND DINARIC MOUNTAINS, AND FUTURE PERSPECTIVES

Habitatuntersuchungen der Alpen und der Dinariden und die Perspektive für die Zukunft

by

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Key words: Habitat mapping, Alps, Dinaric mountains, vegetation, flora, fauna-*Coleoptera*.

Schlagwörter: Biotopkartierung, Alpen, Dinarische Gebirge, Vegetation, Flora, Fauna-*Coleoptera*.

Summary: The habitat mapping that includes different information of the research area as vegetation, flora and fauna in correlation to the geological, pedological, geomorphological or other abiotical factors give us a set of basic data. They are useful for studies of biological diversity or might be implemented in nature protection activities.

Two examples of habitat mapping and researching are discussed and some GIS techniques and methods were examined for future application. First locality was Kamniško sedlo in the Kamnik and Savinja Alps, the another one was Smrekova draga in the Trnovski gozd mountain. In the first locality six habitats with different plant communities were detected: high mountain beech forests on calcareous bedrock (Homogyno sylvestris-Fagetum, Ranunculo platanifolii-Fagetum), heather (Rhodothamno-Pinetum mugo), subalpine meadows (Caricetum ferrugineae, Seslerio-Caricetum sempervirentis, Gentiano terglouensis-Caricetum firmae), screes and rubbles (Papaveri kerneri-Thlaspeetum kerneri, Rumicetum scutati), vegetation in rock crevices (Potentillo clusianae-Campanuletum zoysii) and vegetation of snow-beds (Salici retusae-Homogynetum

discoloris). Smrekova draga is characterised by habitats: spruce forests (Lonicero caeruleae-Piceetum), fir and beech forests (Omphalodo-Fagetum), subalpine forests (Polysticho lonchitis-Fagetum var. geogr. Allium victorialis, Ranunculo platanifolii-Fagetum var. geogr. Calamintha grandiflora) and heather (Sphagno-Pinetum mugo, Rhododendro-Pinetum mugo). Some species of beetles (Coleoptera) are mentioned for each habitat, as well.

Zusammenfassung: Habitatkartierung, die verschiedene Informationen der Vegetations-, Flora- und Faunaforschungen in der Korrelation mit geologischen, pedologischen, geomorphologischen und anderen abiotischen Faktoren umfaßt, vermittelt uns eine ganze Reihe der Daten. Die kann man sowohl für das Studium der Biodiversität als auch für Naturschutz gebrauchen.

Es wurden zwei Beispiele der Habitatkartierung behandelt und einige GIS Methoden für die weiteren Kartierungen überprüft. Erste Stelle war Kamniško sedlo in den Steiner Alpen, zweite Smrekova draga in Trnovski gozd. Auf Kamniško sedlo wurden sechs Habitate mit verschieden Vegetationsassoziationen entdeckt: hochmontane Buchenwälder auf Kalk (Homogyno sylvestris-Fagetum, Ranunculo platanifolii-Fagetum), Latschengebüsche (Rhodothamno-Pinetum mugo), subalpine Blaugras- und Rostseggenrasen (Caricetum ferrugineae, Seslerio-Caricetum sempervirentis, Gentiano terglouensis-Caricetum firmae), Steinschuttfluren (Papaveri kerneri-Thlaspeetum kerneri, Rumicetum scutati), Felsspaltenfluren (Potentillo clusianae-Campanuletum zoysii) und Kalkschneeboden (Salici retusae-Homogynetum discoloris). Für Smrekova draga sind Fichtenwälder (Lonicero caeruleae-Piceetum), Tannen-Buchen-Wälder (Omphalodo-Fagetum), subalpine Wälder (Polysticho lonchitis-Fagetum var. geogr. Allium victorialis, Ranunculo platanifolii-Fagetum var. geogr. Calamintha grandiflora) und Latschengebüsche (Sphagno-Pinetum mugo, Rhododendro-Pinetum mugo) charakteristisch. Für jedes Habitat sind einige Käferarten genannt.

Introduction

The biotic diversity in Slovenia is very high due to its geographical position among different climatic regions, diverse relief, different mountain systems - Alps and Dinarics and other influences. This diversity reflects in different levels. High diversity is on the level of species; very often it is specific and the evidence is a great number of endemics. Because of rather well preserved nature extensive diversity is established on the level of biocoenosis so phytocoenosis as zoocoenosis. The whole diversity is the reflection of biotic and abiotic factors in historical development and is nowadays seen in the reach spectrum of natural, partly natural and anthropogenous habitats.

Previous research and gathered data of flora, fauna, vegetation and zoocoenosis in Slovenia have been comprehensive and results are saved in different ways and in different sources. Data about habitats are more scarce or are sometimes included in the data of flora, fauna, vegetation and zoocoenosis.

Existing information are crumbled and almost incompatible. Transparency and the use for different purposes are difficult. The development of geographical information system (GIS) and multimedia data bases give opportunity for better organisation of this data basis. Restoration of the system of related data basis of habitats, biotopes, flora, fauna, vegetation, zoocoenosis connected to geological and pedological maps or aspects of cultural landscape would give opportunity to find necessary information for nature protection agencies or other concerned institutions.

The aim and purpose of project Mapping of habitat types in Slovenia is to determine the habitat types, making an inventory, research work in the field and graphical presentation on the maps with explanatory text. This goal could be achieved by using available data and new researches in the field. One of important results would be the restoration of functional habitat data base for nature protection agencies, landscape planners, user of nature sources (agriculture, forestry, tourism, army, etc.). Preparing of such data base is recommended by EC Council (recommendation 92/43/EEC, May, 21. 1992). One of primary scope is the active incorporation into European projects (CORINE, Palearctic Habitat Classification, Natura 2000, etc.) as well as the development of national strategy.

History of researches

The very first beginning in mapping of habitats in Slovenia was in the year 1994. The outline scheme for habitat mapping of lowland Slovenia had been prepared (Čarni, Dakskobler & Seliškar 1994). The main habitat types were defined: forests, shrubs and forest edges, riparian vegetation, wetland vegetation, dry grasslands, salt marshes, urban vegetation and agricultural surfaces. Each group is divided into subgroups characterised by vegetation units (association, alliance, ordo, class), basic ecological conditions and floristic structure. The methodology of existing European projects has been used partly (CORINE, Biotopkartierung Bayern, Mapping of biotops in Carintia, Biotoptypen in Österreich).

In 1995 gathering of high mountain communities begun and the list of lowland communities and habitat types have been completed. Form of standard sample card for habitat mapping in the field was proposed.

With the aim of faster and more reliable getting of environmental data, we introduced a remote sensing in our working process. We have tested this methodology in the lowland area in NE part of Slovenia on the right side of the Mura river along the Austrian border. For determination of habitat types we used a satellite image (three channels of IR specter, resolution 30 x 30 meters). Data were classified into three groups with 6, 10 and 14 categories of vegetation.

The results were compared with data of field investigations. On the base of comparison we made a new classification, all ambiguities were inspected in the field again. All data were put into GIS and complemented with information of relief, geology, pedology and climate. The "key" for remote determination of vegetation types that are fundamental for habitat classification has been prepared. It is applicable for other similar areas.

After optimisation of all parameters we will be able to use this methodology in more heterogeneous areas, like Dinaric mountains and Alps.

Mapping of habitats in Dinaric and Alpine region

As an example for mapping in mountain region two localities, namely Smrekova draga in Trnovski gozd in Dinaric region and Kamniško sedlo in Kamnik and Savinja Alps were chosen.

The determination, analyses and mapping of habitats were provided by following procedure and methods:

- limitation of vegetation units in the maps and aerial photographs and checking in the field
- use of existing vegetation maps and additional vegetation mapping in the field
- determination of ecological parameters and their analysis (climate, soil, chemical and physical parameters)
- vegetation reléves
- floristic inventory
- faunistic inventory
- nature protection valorisation of habitats

Complete vegetation, floristic, favnistic and ecological determination of habitat enable corresponding evaluation for nature protection use and many other users. In this paper only characteristic species are presented.

Vertical projection of mountainous regions in the maps caused the deformation or diminishing of surfaces. For more precise presentations the digitised model of relief is useful. The alpine habitats cover small areas that are mosaic distributed. Appropriate scale for showing habitats in the maps is 1 : 10000 or larger scale.

The nomenclature of plant species follows TRPIN &VREŠ, 1995 and of beetles LUCHT, 1987.

a) Smrekova draga

Description: Smrekova draga is situated on the high karst plateau

Trnovski gozd, the very last north-western part of Dinaric mountain. It is typical freeze doline with characteristic vegetation inversion. The ground of sinkhole lies at 1100 m above sea level, the upper edge on 1300 m. Geological is prevailing Mesoszoian limestone and dolomite. The ground is covered by quaternary morainic rests.

Habitat types:

a- Spruce forests

Lonicero caeruleae-Piceetum ZUPANČIČ (1976) 1994 *(Rhytidiadelphus loreus, Lonicera nigra, Lycopodium annotinum, Luzula luzulina, Moneses uniflora, Listera cordata, Pyrola minor, Listera cordata, Cicerbita alpina, Saxifraga rotundifolia)*

Coleoptera: *Trechus alpicola, Leistus nitidus, Calathus micropterus, Nebria dahli, Pterostichus cognatus, Carabus irregularis bucephalus, Pterostichus variolatus carniolicus*

Upper Triassic limestone, mixed with dolomite

Brown soil

pH (KCl): 4,6-5,6

Soil temperature (July, 23., 12h, -5 cm): 7.2° C

b- Fir-beech forests

Omphalodo-Fagetum (TREGUBOV 1957) MARINČEK et al. 1993 *(Abies alba, Calamintha grandiflora, Cardamine trifolia, Dentaria enneaphyllos, Aremonia agrimonioides, Rhamnus fallax)*

Omphalodo-Fagetum adenostyletosum *(Adenostyles glabra)*

Omphalodo-Fagetum rhododendretosum *(Rhododendron hirsutum)*

Omphalodo-Fagetum calamagrostidetosum *(Calamagrostis arundinacea)*

Omphalodo-Fagetum aceretosum *(Acer pseudoplatanus, Athyrium filix-femina, Dryopteris filix-mas, Impatiens noli-tangere, Circaea alpina).*

Coleoptera: *Pterostichus unctulatus, Carabus creutzeri, Carabus carinthiacus, Molops striolatus, Dyschrius rotundipennis*

Soil temperature (July, 23., 12h, -5 cm): 10,4° C

c- Subalpine beech forests

Polysticho lonchitis-Fagetum var. geogr. Allium victorialis MARINČEK (1988) 1996 *(Polystichum lonchitis, Carex ferruginea, Pinus mugo, Clematis alpina, Rhododendron hirsutum, Ribes alpinum, Salix appendiculata, Sorbus chamaemespilus, Ribes petraeum, Lonicera caerulea, Allium victorialis, Calamintha grandiflora).*

Ranunculo platanifolii-Fagetum var. geogr. Calamintha grandiflora MARINČEK 1982 *(Adenostyles glabra, A. alliariae, Polygonatum verticillatum, Ranunculus platanifolius, Cicerbita alpina, Luzula sylvatica* subsp. *sylvatica, Veratrum album)*

d- Heather

Sphagno-Pinetum mugo (BARTSCH 1940) R. KUOCH 1954 *(Pinus mugo, Vaccinium myrtillus, V. uliginosum, V. vitis-idaea, Oxycoccus palustris, Cetraria islandica, Cladonia rangiferina, Sphagnum* s. lat.)

Coleoptera: *Nebria diaphana bohiniensis, Carabus carinthiacus, Calathus micropterus, Pterostichus cognatus, P. variolatus carniolicus, Leistus nitidus, Trechus alpicola*

Soil temperature (July, 23., 12h, -5 cm): 2,2° C

Rhodothamno-Pinetum mugo ZUPANČIČ & ŽAGAR 1980 *(Juniperus sibirica, Rhododendron hirsutum, Salix appendiculata, Homogyne alpina, Valeriana saxatilis, Carex humilis)*

e- Talus, grave

Protorendzina, raw to half raw, partly mineralised humus

pH (KCl): 2,8 - 3,0

b) Kamniško sedlo

Description: Kamniško sedlo is situated in the central part of Kamnik and Savinja Alps, the top of saddle is on 1900 m above sea level. Southern slopes on Triassic limestone were examined. The timberline varies among 1400 and 1600 m, above it the heather, subalpine meadows, vegetation in rock and other biotopes expand (fig 1.). Subalpine meadows are used as sheep pastures.

Habitat types:

a- High mountain beech forests on calcareous bedrocs

Homogyno sylvestris-Fagetum MARINČEK et al. 1993 *(Cardamine trifolia, Dentaria enneaphyllos, Festuca altissima, Ranunculus platanifolius, Polygonatum verticillatum)*

Ranunculo platanifolii-Fagetum var. geogr. Hepatica nobilis MARINČEK 1993 *(Polygonatum verticillatum, Adenostyles glabra, Cicerbita alpina, Ranunculus platanifolius, Saxifraga rotundifolia, Luzula sylvatica* subsp. *sylvatica, Astrantia carniolica)*

Coleoptera: *Carabus cancellatus emerginatus, Carabus creutzeri subalpinus, Carabus germari savinicus, Nebria dahli, Licinus hoffmannseggi, Trichtichnus laevicollis, Stomis rostratus, Pterostichus variolatus*

Triassic limestone

Rendzina to skeletal brown soil

pH: 5,8 - 6,7

b- Heather

Rhodothamno-Pinetum mugo ZUPANČIČ & ŽAGAR 1980 *(Rhododendron hirsutum, Rhodothamnus chamaecistus, Sorbus chamaemespilus, Homogyne sylvestris)*

Triassic limestone
Rendzina
pH (KCl): 5,7-6,3

c- Subalpine meadows

Caricetum ferrugineae LÜDI 1921 *(Carex ferruginea, Pedicularis rostrato-spicata, Phleum hirsutum, Koeleria eriostachya, Ranunculus montanus, Rhinanthus aristatus, Heliosperma alpestre, Dianthus sternbergii)*

Seslerio-Caricetum sempervirentis BR.-BL. IN BR.-BL. et JENNY 1926 *(Hieracium villosum, Senecio doronicum, Hieracium pallescens, Allium kermesinum)*

Coleoptera: *Carabus germari savinicus, Carabus silvestris kolbi, Carabus creutzeri subalipinus, Pterostichus mühlfeldi, Pterostichus variolatus, Oreina speciosa, Oreina liturata, Oreina bifrons stussineri, Abax beckenhaupti, Carabus alpestris.*

Gentiano terglouensis-Caricetum firmae T. WRABER 1970 *(Carex firma, Helianthemum alpestre, Saxifraga caesia, Gentiana froelichii, Gentiana terglouensis, Sesleria sphaerocephala, Primula wulfeniana, Dryas octopetala, Silene acaulis)*

Coleoptera: *Amara spectabilis, Trechus pseudopiceus, Pterostichus ziegleri, Cychrus schmidti.*

Triassic limestone
Rendzina
pH (KCl): 5,5-6,4

d- Screes and rubbles

Papaveri kerneri-Thlaspeetum kerneri T. WRABER 1970 *(Thlaspi kerneri, Achillea atrata, Linaria alpina, Taraxacum alpinum, Saxifraga hohenwarthii, Cerastium julicum, Leucanthemum lithopolitanicum)*

Rumicetum scutati FABER 1936 *(Rumex scutatus, Myosotis alpestris, Androsace chamaejasme, Coeloglossum viride, Dianthus sternbergii, Cerastium carintiacum, Heliosperma alpestre)*

Coleoptera: *Nebria diaphana, Nebria germari*

Talus, grave

e- Vegetation in rock crevices

Potentillo clusianae-Campanuletum zoysii AICHINGER 1933 *(Potentilla clusiana, Campanula zoysii, Rhodothamnus chamaecistus, Carex mucronata, Valeriana saxatilis, Bupleurum petraeum, Paederota lutea, Sesleria sphaerocephala, Minuartia sedoides)*

Triassic limestone
Protorendzina

f- Vegetation of snow-beds

Salici retusae-Homogynetum discoloris AICHINGER 1933 *(Salix retusa, Ranunculus traunfelneri, Achillea atrata, Dryas octopetala, Polygonum viviparum, Soldanella alpina, Poa alpina)*
Triassic limestone
Row humus
pH: 4,8-5,4

Conclusions

Two examples of biotop mapping and researching are discussed: first is the Kamniško sedlo in the Kamnik and Savinja Alps, the another one is Smrekova draga in the mountain Trnovski gozd. Many new habitat types have been discovered by using more precise mapping. The survey of flora, beetles *(Coleoptera)* and soil types including their physical and chemical properties showed direct correlation between habitat types, floristical composition, and ecological parameters.

Future intensive and more detailed habitat mapping in the Alpine region in Slovenia is necessary for different reasons, the most important are as follows:

1 Knowledge of habitats and their functions will be thorough.
2 Participation in the international projects, e.g. Natura 2000 and others will be more successful.
3 Results will be implemented in nature protection activities.

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Vegetation map and habitat types of the Kamniško sedlo

1 : 10.000

Fig. 1.: Kamniško sedlo: habitat types and plant communities

Legend:
a- High mountain beech forests on calcareous bedrock
1. Homogyno sylvestris-Fagetum
2. Ranunculo platanifolii-Fagetum var. geogr. Hepatica nobilis facies ***Larix decidua***
b- Mixture of beech, heather and larch
3. *Fagus sylvatica, Pinus mugo, Larix decidua*

c- Heather
4. Rhodothamno-Pinetum mugo

d- Subalpine grasslands:
5. Caricetum ferrugineae
6. Seslerio-Caricetum sempervirentis
7. Gentiano terglouensis-Caricetum firmae

e- Screes and rubbles
8. Papaveri kerneri-Thlaspeetum kerneri
9. Rumicetum scutati

f- Vegetation in rock crevices (and steep mountain stream)
10. Potentillo clusianae-Campanuletum zoysii

g- Vegetation of snow-beds
11. Salici retusae-Homogynetum discoloris