Vegetation and Geobiocoenological Typology of the Soqotra Island

Habrova\textsuperscript{a}, Hana and Bucek\textsuperscript{b}, Antonin

\textsuperscript{a} Mendel University in Brno, Zemedelska 3, 61300 Brno, Czech Republic, habrova@mendelu.cz
\textsuperscript{b} Mendel University in Brno, Zemedelska 3, 61300 Brno, Czech Republic, bucek@mendelu.cz

Introduction & Methods

During the years 2001-2004, complex field observations on more than 250 localities of Soqotra Island (Republic of Yemen, 12°19´-12°42´ N latitude and 53°18´-54°32´ E longitude) were made. Field notes and phytosociological releves served as a basis for specifying and processing the characteristics of geobiocoenological units. In the records, main features of ecotopes are characterized: altitude, aspect and slope inclination, general characteristics of the parent rock, topography and soil properties; and synusia of trees (general level of the upper canopy, layering /stratification/, degree of coverage of particular species).

Differentiation of the natural (potential) condition of geobiocoenoses, i.e. of a condition which would occur in the present landscape after elimination of man impacts, is the objective of geobiocoenological typology based on the application of the theory of geobiocene type (Zlatnik 1975). As a result, a geobiocoenological typological system describing vegetation of the island has been produced, as it can provide necessary data for the landscape protection, frameworks for differentiated landscape cultivation and bases for planning the landscape sustainable use.

Results

Superstructural Units

Altitudinal vegetation zones

Altitudinal vegetation zones (AVZ) express connection of the sequence of vegetation differences with the sequence of differences in altitude and aspect climate. Vegetation zonation is particularly dependent on air and soil temperatures and on the amount and time distribution of atmospheric precipitation including horizontal precipitation. 5 AVZ of Soqotra Island (delimited by means of the computer image analysis of multitemporal data of the MODIS satellite [Kral & Pavlis 2006]) are already described in detail in the paper by Habrova (2004).

1. Altitudinal Vegetation Zone: \textit{planar}, \textit{(meterhel)}
2. Altitudinal Vegetation Zone: \textit{collinean}, \textit{(emhar)}
3. Altitudinal Vegetation Zone: \textit{submontane}, \textit{(ariob)}
4. Altitudinal Vegetation Zone: \textit{montane}, \textit{(dagesh)}
5. Altitudinal Vegetation Zone: \textit{alto-montane}, \textit{(azabzabahan)}
Trophic ranges
Trophic ranges (TR) and inter-ranges (IR) express conditions of the biota, given by soil nutrient contents and soil reaction. Classification of geobiocoenose segments into TR and IR is more unambiguous than their classification into AVZ. In natural and near-natural geobiocoenoses one may use sets of plant bioindicators, often with a narrow ecological amplitude, which can clearly indicate mineral supply and soil environment acidity in the rhizosphere. In the geobiocoenological system, TR are marked by capital letters of alphabet.

Trophic range D – bazic: Alkalic litic soils on limestone and karren fields, soils are only slightly developed. Trees on D TR: Dracaena cinnabari, various frankincense trees i.e. Boswellia dioscorides, B. bullata, B. nana, B. popoviana.

Trophic inter-range BD – mesotrophic-bazic: Neutral to slightly alkalic soils (pH > 6,5), very well reserved soils on limestone substrates and other calcic sediments, on basalt and loess. This trophic range dominates on most of island area.

Trophic range C - nitrophilous: Very rich soils in mineral supply, high content of nitrogen, on transit-accumulation and accumulation shapes of relief, mainly on slope debris. Presence of nitrophilous bio-indicators, i.e. Dioscorea lanata, Ledebouria grandifolia, Trichodesma scottii, centre of presence of trees: Sterculia africana var. socotrana and Lannea transulta.

Trophic inter-range CD – nitrophilous-bazic: very well saturated soils with higher nitrogen supply on slope debris on limestone

Trophic inter-range BC – mesotrophic-nitrophilous: Present only on limited area of mountain slope debris on granite substrate.

Trophic range B – mesotrophic: Soils well supplied with minerals, slightly acid (pH 5,5-6,5), present mainly on igneous rocks with high supply of alkaline minerals.

Trophic range S - salty: Alkaline soils with high salt supply, mainly on seacoast and coastal plains with influence of seawater. Vegetation halophitic: Limonium socotrana, Limonium paulayanum, Atriplex grifithii, Atriplex farinose, Zygophyllum decumbens, Tamarix nilotica and Acacia edgeworthii, trees: Avicennia marina.

Hydric ranges
Hydric ranges describe differences in moisture regime of soils, with individual ranges differing in amounts of water available within the soil space. The differences in humid regime of soils are in the framework of relatively homogenous climatic conditions of AVZ given principally by differences in relief morphology and in a soil character. In basic normal range, roots of plants usually use atmospheric precipitations. In dry and limited ranges, there occurs an abnormal drainage, vapour or infiltration; rhizospheres of waterlogged and wet ranges are influenced by accessory water, which come to a locality by overflow or subirrigation. In the geobiocoenological system, numbers mark hydric ranges from driest to wettest.

1. dry HR: - cliffs, slopes, rocks, sand dunes etc. with very quite runoff, strong evaporation or quick infiltration; vegetation sporadic, scarce; presence of succulents.
2. limited HR: shallow soils on steep slopes, usually influenced by sun or wind desiccation, the growth of woody plants is limited, presence of succulents.
3. normal HR: deeper soils without quick runoff or infiltration, atmospheric precipitation is utilised by plants for evapo-transpiration.
4. humid HR: rhizosphere is periodically or permanently influenced by additional groundwater, present usually in wadis in river valleys, around springs and permanent watercourses.
5. wet HR: permanently waterlogged soils, drying only on surface even in dry periods; on Soqotra only around coastal platforms influenced by salted groundwater.
Basic Units – Groups of Geobiocoene Types, Biotope Types

5 altitudinal vegetation zones, 4 trophic ranges and 3 inter-ranges (expressing soil conditions), 5 hydric ranges (expressing water condition in soil), 26 groups of geobiocoene types and within them (with respect to their actual condition of vegetation) 39 biotope types were delimited. Geobiocoenological formula originates from the abbreviations of AVZ, hydric range and trophic range and it characterizes 26 groups of geobiocoene types (GGT). Each GGT is named according to one or two dominant tree (shrub) species typically growing in potential climax plant communities in given abiotic conditions. Each GGT is characterized by composition of Biotope types as a result of different succession stages.

Classification of biotopes is based on differences in physiognomy, structure and species composition of the vegetation component of present biocoenoses. Biotope types are divided according to differences in the species composition of dominant species, GGT are divided according to physiognomy and vertical structure of vegetation. Biotope types are usually named according to key species of plants in English.


3–B–1: Dorstenia gigas - granite rocks without soil cover Biotope types: R.2. Granite and basalt rocks.
3–D–1: Boswellia dioscorides – limestone rocks **Biotope types:** R.1. Limestone rocks.

3–BD(D)–2(3): Euphorbia spiralis - exposed sites mainly on edges of limestone plateaus. **Biotope types:** S.3.4. Eolic dwarf shrubland.


3–CD–4: Ficus vasta – bases of slopes and wadis, area is very limited. **Biotope types:** Wa. Wadis.

4–B–1: Begonia socotrana - granite rocks without soil cover or with litosols. **Biotope types:** R.2. Granite and basalt rocks.


4–B(BC)–3: Euphorbia socotrana – mainly steep debris slopes in Haggeher mountains, in fourth AVZ only on limited area. **Biotope types:** F.4. Montane forest.

4–BD–3: Buxanthus pedicellatus – peaks of limestone plateaus. **Biotope types:** S.2.4. Low shrubland with Croton socotranus and/or Buxanthus pedicellatus, S.3.2. Dwarf shrubland of higher locations and G.2. Pastures on limestone plateaus.

5–B–1: Helichrysum rosulatum – granite rocks without soil cover or on litosols. **Biotope types:** R.2. Granite and basalt rocks.


**Acknowledgement**

This study was financially supported by Czech grant MSM: 6215648902. Further, we highly appreciate kind logistical backing of the Environmental Protection Authority of Yemen.

**References**

