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PLANT ECOLOGICAL SURVEY OF THE KATARÉTI STREAM CATCHMENT

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Intorduction

On the NE pediments of the Mátra Mts, on the catchment of the Katarét Brook, the Physical Geographical Department of the JATE carried out a plany survey in the frame of a complex geoecological investigation, the aim of which being the completion of a geoecological map. Such a map cannot ignore the survey of plant associations affected by human activity.

The method of Marks, R., Müller, M.J., Lesser, H. and Klink, H.J. (1989) to examine the landscape potential, offers a possibility to digitize and evaluate the functions and processes within landscape. From among these functions the ecotop-building and the areal nature conservation ones are introduced in brief in this study, then, after choosing some associations with characteristic differences, the temperature budget (T), water budget (W), the soil reaction (R) and the nitrogene demand (N) of their ecological requirements are described in turns, species by species. The evaluation of ecological indicator values reveals the tendencies of change in the natural and in the disturbed associations.

The ***association types*** of the area are various due to morphology (Figure 1). On the upper surfaces (5-700 m), ***mainly natural, mesophyllic, mixed deciduous woods*** can be found. In smaller spots, there are rather disturbed ***dry rock*** and ***pusta grassy associations*** on a surface covered with shallow soil. In the valleys and around the springs there are ***hygrophytic associations*** along the brooks in strips, easy to be detected on maps. These associations link the areas under natural and technical effects and the areas being already seperated by the effects of human activity. In this sense they function as ecological corridors and support plant life to spread and survive. In this catchment, ecological corridors are especially important, since the E-W parts along the brooks are seperated by extensive cultivated lands. The associations along the brooks in the N and S parts of the catchment area play an especially important key role in it, since they have preserved their natural condition rather than the associations along the brooks in the middle of the catchment. Unfortunately, these hygrophytic associations are also disturbed, owing to agricultural activity in their immediate neighbourhood; or because they border associations being highly degraded. ***Clearing meadows*** are also found here. They are secondary associations and consequently they are rather poor in species, their diversity is low. In and around Bodony village situated in the middle of the catchment, there are ***wine*** and ***fruit plantations, orchards and parks*** as well. In a previous study (Mezősi G.- Kevei Bárány I.- Balogh I.- Mucsi I.- Farsang A. 1993) the stability of the association types was

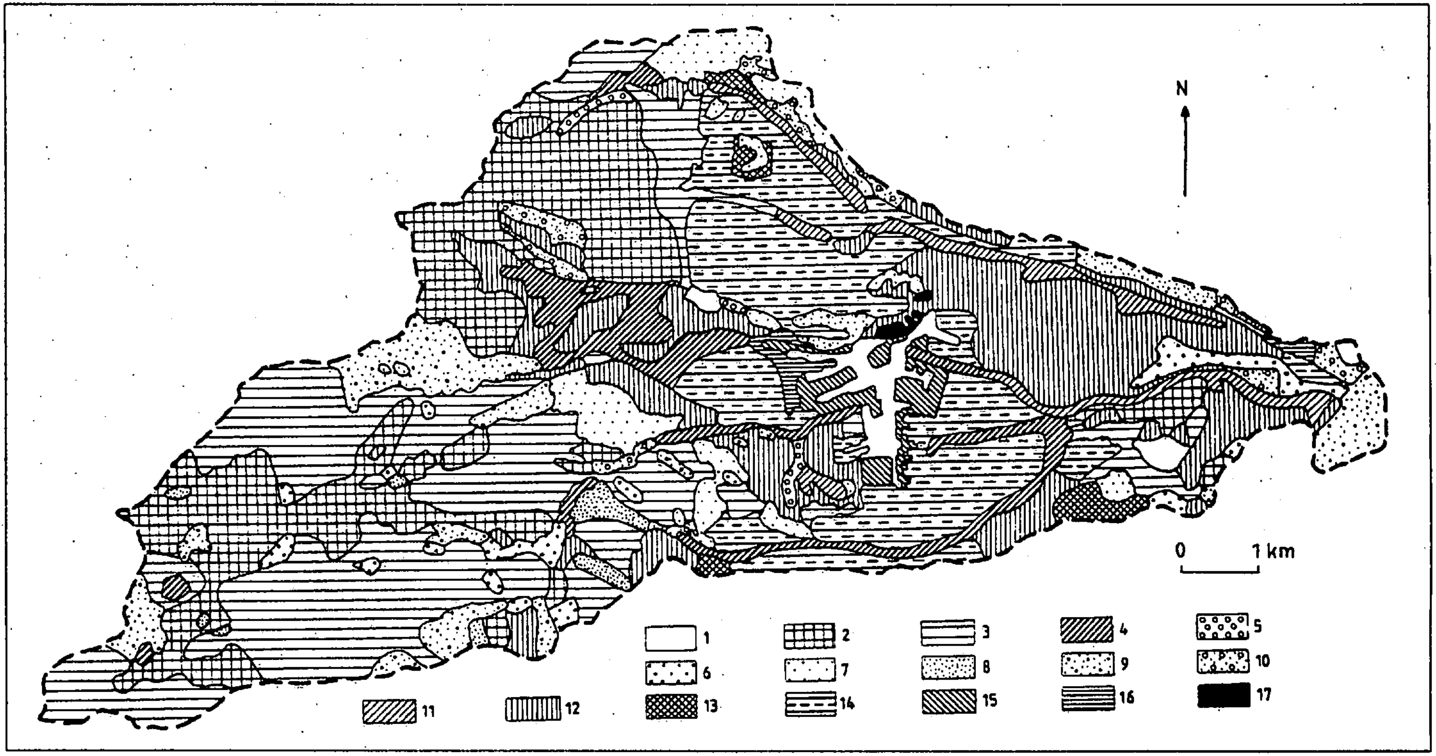

Figure 1 *Types of vegetation on the Katurét Brook Catchment*
1= settlement, quarry, 2=mesophytic deciduous and mixed forest, 3=dry groves, bushy associations, 4=swamp and marsh woods, 5=humid groves, 6=planted forest pinery, 7=planted deciduous woods, 8=young, planted deciduous woods, 9=planted mixed woods, 10=bushy associations, 11=associations of eutrophic waters and springs, 12=associations of calciphilous meadows, 13=perennial rudeal and weedy meadows, 14=croplands, 15=little orchards, parks and sportfields, 16=fruit trees, 17=vineyards and hop plantations

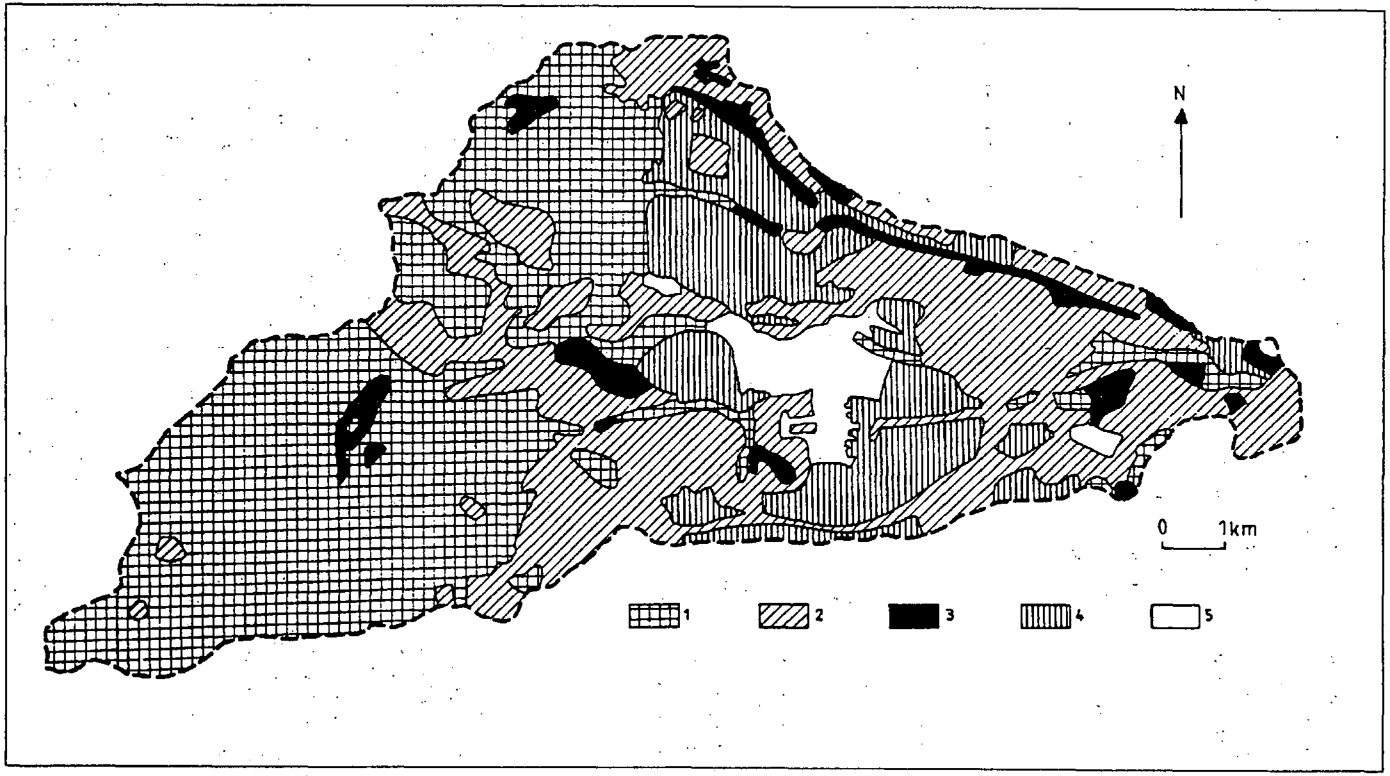

Figure 2 *The place of the Katarét Brook Catchment associations in the natural succession sequence*
1=mature (closing) associations, 2=degrading associations, 3=initial or developing associations, 4=agricultural field, 5=settlement

examined in this test area. The ***mixed woods*** and the ***grassy associations*** were found to have a ***strong relative stability***. The ***hygrophytic plants*** have low or prestable condition, while the associations under the effects of human activity are ***unstable***. The nature conservation value to be described in detail further on, also proves the low stability of hygrophytic plants.

The degree of human effects, the diversity, naturality and maturity of the associations define the ecotop-buildig function of the plants. The ***stage of the natural succession sequence of the association*** has also to be considered in the evaluation. From this viewpoint there are three types chosen (Figure 2). The maturity, structuredness and diversity are lower with the associations being in an initial phase than those of the mature asociations. Such ***initial associations*** are most of the ***rock and pusta grassy*** and ***bushy*** ones. The ***mature (closing) associations*** have the highest number of species and structurednesss for each type. This phase is represented in the investigated area by ***beeches, hornbeam and oak groves, mixed deciduous woods and pineries***. The third phase of ***degradation*** represents the unfavourable human effects. There are large sites, especially on the ***clearings; clearing meadows, patches of rock and pusta grass*** and a part of the eutrophic aquatic associations. The territory of the settlement and the croplands are not evaluated from this aspect, since they can only contribute to the extention of the degraded areas, their natural indicators being too low in values.

Ecotop-building function of assotiation

The quality of the ***ecotop-building function*** is the output of summarizing the values of maturity, naturality, diversity, structuredness and harmful human effects. The values range from 1.5 to 20 in the test area (Table 1). The values of the ecotop-building factor are high in the mixed deciduous woods, especially in the beeches and hornbeam-oak groves (16-20). The mixed and pine woods have slightly lower values (8.5-16), while cultivated lands, orchards, vineyards have very low (1.5-8.0) values. The ***ecotop-building function represents the stability of the associations*** of a given area. If the ecotop-building value is higher, the stability, the renewing and regenerating capability of the plants will be stronger. The ecotop-building function have values higher than 10 in more than half of the test area. Thus the present use of the environment cannot be considered dangerous.

Nature conservation function of assotiation

When establishing the nature conservation function, the rarity and endangeredness of the domestic plant species were examined. Their being endangered was calculated from their degree of protection. There are three stages of protection answering their nominal values. Species worth 10 000 Forints were considered as directly endangered. Between 10-5000 Fts they were classified as actually endangered, while at 5000 Fts, potentially endangered.

The volume of protected plants is little in this catchment area though, so the ***nature conservation function*** is defined mostly by the ***present value of the vegetation***, its ***renewing capacity*** and the ***period of its development***. The nature conservation value changes between 4 and 50 (Table 2). The deciduous forest and the adjoining underwood have high nature conservation values, though their nature conservation function is versatile.

Table 1.
Ecotop-building function of the different assotiations in the Katarét Brook Catchment

Assotiation type	M	N	A	S	D	B	ÖBW
2	5	5	5	3	4	5	19.00
3	4	5	4	3.3	3.65	4	16.65
4	5	5	4	3.5	3.75	5	18.75
5	4	5	3	2.6	2.80	4	15.80
6	4	3	2	1.7	1.85	3	11.85
7	4	3	4	3.3	3.65	4	14.65
8	3	3	3	2.4	2.70	3	11.70
9	4	3	4	3.1	3.55	4	14.55
10	3	3	3	2.4	2.70	3	11.70
11	4	5	4	1.8	2.90	5	16.90
12	3	3	3	1.1	2.05	3	11.50
13	2	1	2	1.5	1.75	2	6.75
14	1	0	1	1.0	1.00	1	3.00
15	2	0	1	1.9	1.95	2	5.95
16	2	0	1	0.9	0.95	1	3.95
17	2	0	1	0.5	0.75	1	3.75

M = maturity
N = naturality
S = structural diversity
A = abundance of species
D = diversity
B = human impact
ÖBW = ecotop-building function

2 = mesophytic deciduous and mixed forest
3 = dry groves, bushy assotiation
4 = swamp and marsh woods
5 = humid groves
6 = planted forest pinery
7 = planted decidous woods
8 = young, planted decidous woods
9 = planted mixed woods
10 = bushy assotiation
11 = assotiations of eutriphic waters and springs
12 = assotiation of calciphilous meadow
13 = perennial rudeal and weedy meadow
14 = croplands
15 = little orchards, parks and sportfield
16 = fruit trees
17 = vineyards and hop plantations

Table 2.
Nature conservation function of the different assotiationsin the Katarét Brook Catchment

Assotiation type	ÖBW	RL	G	P	E	NSW
2	19.00	2	2	2	10	35.00
3	16.65	2	2	2	10	32.65
4	18.75	1	1	3	10	33.75
5	15.80	0	1	5	5	26.80
6	11.85	0	1	2	4	18.85
7	14.65	1	1	2	4	22.65
8	11.70	0	1	2	4	18.70
9	14.55	2	2	2	4	24.55
10	11.70	1	1	4	3	20.70
11	16.90	2	1	3	1	23.90
12	11.05	2	2	2	3	20.05
13	6.75	0	1	1	1	9.75
14	3.00	0	1	1	1	6.00
15	5.95	0	1	1	3	10.95
16	3.95	0	1	1	3	8.95
17	3.75	0	1	1	3	8.75

ÖBW = ecotop building function
RL = number of species from the red list
G = degree of potential danger
P = Present value
E = cycle of development
NSW = nature conservation function

2 = mesophytic deciduous and mixed forest
3 = dry groves, bushy assotiation
4 = swamp and marsh woods
5 = humid groves
6 = planted forest pinery
7 = planted decidous woods
8 = young, planted decidous woods
9 = planted mixed woods
10 = bushy assotiation
11 = assotiations of eutriphic waters and springs
12 = assotiation of calciphilous meadow
13 = perennial rudeal and weedy meadow
14 = croplands
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Its very low in and around settlements and croplands. The patches under human influence wedge into natural or quasi-natural associationsin the east and west. Thus they decrease the potential renewal and help uniformization.

In the forthcoming part of this study the evaluation of the species of a beech wood, an oak-hornbeam grove, a pusta-grassy slope, an alder marsh, a riverside highweed and a clearing meadow association is presented, on the basis of their temperature budget (T), water budget (W), soil reaction (R) and nitrogene indication (N). The above ecologocal indicators describe the growing site's potential or its change. The letters preceding the names of the species indicate their domestic categories classified by their nature conservation value (see in Simon T. 1988).

Species of beech woods

	T	W	R	N
E Fagus silvatica	5	5	4	2-3
K Lusula albida	5	4	2	2
K Asperula odorata	5	5	3	2-3
K Crataegus oxycantha	5	5	3	2
K Sorbus tominális	5	4	4	2-3
K Campanula persicif	5	4	3	2
K Dyopterys filix-mas	5	7	3	2-3
TZ Lapsana communis	5	4	3	3-4
K Oxalis acetosella	5	7	3	2-3
K Viola silvestris	5	5	3	2-3
K Galium silvaticum	5	6	3	2
TZ Atropa belladonna	5	5	3	4-5
TZ Hypericum perforatum	5	3	0	2-3

Species of oak-hornbeam groves

	T	W	R	N
E Carpinus betulus	5	5	3	2-4
TZ Salix caprea	5	5	4	0
K Tilia cordata	5	5	3	3
K Silene cucubalus	5	4	3	2
K Campanula persicifolia	5	4	3	2
K Galium schultesi	5	4	3	2
K Campanula trachelium	5	6	3	3-4
E Quercus robur	5	6	0	2-3
TZ Hypericum perforatum	5	3	0	2-3
K Euonymus verrucosus	5	4	4	3
K Corylus avellana	5	5	3	2-3
E Quercus cerris	5	3	3	2-3
TZ Campanula ranunculus	7	3	3	2
K Anthericum ramosum	5	3	4	2-3
K Trifolium rubens	5	3	4	2
TZ Scabiosa ochroleuca	6	2	4	1-2
TZ Lotus corniculatus	5	4	0	2-3
TZ Populus tremula	3	4	2	2-3
K Cornus sanquinea	5	4	4	3

Species of rocky grasslands

	T	W	R	N
K Festuca ovinae	5	4	2	1-2
TZ Dianthus armeria	5	3	3	2
K Trifolium pratense	5	6	3	2-3
TZ Centaureum minus	5	5	3	2-3
TZ Achillea millefolium	5	3	0	2-3
K Coronilla varia	4	3	5	1-2
GY Agropyron repens	5	3	0	4
K Galium verum	5	3	4	1-2
K Centaurea triumfetti	5	2	5	2
V Prunella vilgaris	0	6	0	0
GY Inula britannica	5	6	0	3
TZ Ranunculus acer	5	7	0	3
TZ Eryngium campestre	7	2	4	0
GY Euphorbia cyperissias	5	3	0	2
K Thymus glabrescens	5	2	4	1-2
K Briza media	5	6	0	1-2
GY Convolvulus arvensis	0	3	0	0
TZ Plantago media	5	5	0	2-3
K Dorychnium herbaceum	6	3	4	2
TZ Anthyllis vulneraria	5	4	4	2
GY Ononis spinosa	5	3	0	3
GY Cichorium intibus	5	4	0	3-4
GY Dipsacus laciniatus	7	8	4	3
Gy Cirsium arvense	5	4	0	3-4
K Thymus marschallianus	6	2	4	1
TZ Agrimonia eupatoria	5	3	3	3

Species of pusta-grassy slopes

	T	W	R	N
K Chrysanthemum vulgare	5	7	0	3
K Galium verum	5	3	4	1-2
K Knautia drymeia	5	6	3	2-3
K Knautia arvensis	5	3	4	2
TZ Achillea millefolium	5	3	0	2-3
K Centaurium minus	5	5	3	2-3
TZ Agrimonia eupetoria	5	3	3	3
GY Plantago major	5	7	0	3
TZ Dactylis glomerata	5	6	4	3
K Primula veris	5	3	5	2
GY Lathyrus tuberosus	7	3	4	2
K Campanula trachelium	5	6	3	3-4
K Briza media	5	6	0	1-2
GY Equisetum arvense	3	8	0	- -
K Cytisus nigricans	6	4	2	1-2
TZ Anthyllis vulneraria	5	4	4	2
K Melampyrum nemorosum	5	5	3	2-3
K Betonica officinalis	5	3	0	2

Species of the alder marsh in Lake Fekete

	T	W	R	N
K Mycelis muralis	5	5	3	3
E Alnus glutinosa	6	10	0	2-3
K Corylus avellana	5	5	3	2-3
GY Euphorbia cyparissias	5	3	0	2
K Astragalus glyciphyllos	5	5	4	2
TZ Eupaatorium cannabium	5	9	5	2
K Dentaria bulbiphera	5	5	4	3
K Aegopodium podagraria	5	7	3	4
K Galium Schultesi	5	4	3	2
K Asperula odorata	5	5	3	2-3
K Impatiens noli-tangere	5	6	4	3-4
K Acer pseudoplatanus	5	6	3	3-4
K Oxalis acetosella	5	7	3	2-3
K Sorbus acuparia	4	5	2	2
K Campanula persicifolia	5	4	3	2
K Viola mirabilis	5	5	4	0
GY Echium vulgare	6	3	0	0
TZ Prunella vulgaris	0	6	0	0
K Trifolium aureum	5	3	0	1-2
TZ Hypericum perforatum	5	3	0	2-3
TZ Salix caprea	5	5	4	0
TZ Dactylis glomerata	5	6	4	3
K Campanula trachelium	5	6	3	3-4
GY Senecio viscossus	4	6	3	-
K Ribes uva-orispa	5	6	5	3
TZ Solanum dulcamara	5	9	4	3-4
K Stachys silvatica	5	6	3	3-4
Gy Dryopteris filix-mas	5	7	3	2-3

Species of riverside highweed associations

	T	W	R	N
GY Sambucus ebulus	5	5	3	4
TZ Saponaria officinalis	5	4	0	2-3
GY Lamium purpureum	0	5	0	3-4
K Heracleum spondylium	5	6	3	2
K Aegopodium podagraria	5	7	3	4
GY Artemisia vulgaris	5	4	0	3-4
GY Artium lappa	5	6	4	5
E Phragmites communis	0	10	4	2-3
TZ Urtica dioica	5	5	4	4-5
GY Sambucus nigra	5	5	3	4-5
K Calystegia sepium	5	9	4	4
GY Conicum maculatum	5	5	3	4-5
TZ Vicia cracca	5	4	3	0
TZ Dactylis glomerata	5	6	4	3
GY Melandrium album	5	4	0	3-4
K Mentha longifolia	5	9	4	3-4
K Clematis vitalba	5	5	3	3-4
TZ Rubus idaeus	5	5	3	4
TZ Humulus lupulus	5	7	0	3-4
TZ Sisymbrium strichtissimum	4	5	4	3-4

Species of clearing meadows

	T	W	R	N
K Rumex sanquineus	5	7	4	3-4
GY Galeopsis tetrachit	5	4	2	3-4
K Senecio jacobea	6	4	4	2-3
GY Inula britannica	5	6	0	3
GY Matricaria maritima	5	6	1	3-4
TZ Rubus idaeus	5	5	3	4
TZ Rubus caesius	5	8	4	5
TZ Urtica dioica	5	5	4	4-5
TZ Hipericum perforatum	5	3	0	2-3
K Mentha longifolia	5	9	4	3-4
GY Erigeron canadensis	0	4	0	3
TZ Prunella vulgaris	0	6	0	0
TZ Scrophularia nodosa	5	6	3	3
TZ Linaria vulgaris	5	3	3	3
TZ Vicia cracca	5	4	3	0
K Tripholium hybridum	5	8	4	2-3
GY Cirsium arvense	5	4	0	3-4

The beech woods and the oak-hornbeam groves are natural associations among the above ones and the alder marsh is a natural aquatic one. The pusta-grassy slope and the rocky grassland are quasi-natural associations. The riverside highweed and the clearing meadow associations are highly disturbed. Knowing the species of the associations, their ecological indicators were examined on the basis of their temperature and water budgets, their soil reaction and nitrogene demand (after Zólyomi B. 1966).

Kovács M (1975) examined the connection between soils and vegetation in the Mátra Mts, and evaluated the growing site conditions of the characteristic forest types, using TWR values. It was found that T value was 5.09-5.03 in the zonal Turkey oak-oak-hornbeam groves in the north of the Mátra Mts. These values meet the temperature demand of the deciduous woods of the subcontinental-Atlantic climate. This value is somewhat lower with the grassy and hygrophytic association that can be due to micro and mesoclimatic features here.

From among the (10) categories of ***temperature budget indicators***, the values of the batural and quasi-natural associations range between 4.8-5.0, showing the demands meeting the endowments. The indicator value of the strongly degraded highweed association and the clearing meadow is below 4.5, showing the change due to human effects or the above mentioned microclimatic features.

With the ***water budget indicators*** the differences springing from morphology can be felt (0 is for extremely dry environment, while 10 is for humid). The indicator values of the species stand for temperate fresh, fresh and temperate humid growing sites.

The ***values of soil reaction*** represent slightly acid and almost neutral soils that is in harmony with the properties of rankers, mull-rankers and brown forest soils having been formed on the volcanic parent rock and on its products accumulated in the valleys.

The ***nitrogene indicator*** is the highest in the riverside wetlands and in the clearing meadows. The forests have a medium nitrogene indication, while the psuta-grassy slopes have the lowest values.

The weed and disturbance resistant species of the natural and quasi-natural associations are left out of the average calculation in the next table:

	T	W	R	N
Beeches	5,00	5,20	3,1	2,25
Oak-hornbeam	5,00	4,35	3,14	3,85
Rocky grass	4,60	3,70	3,10	1,56
Pusta-grassy slope	5,09	4,36	2,46	2,22
Alder marsh	5,00	5,55	2,94	2,87

The values, apart from a few exeptions, are higher than the formerly calculated averages. The species of the ***natural associations prefer the humid, almost neutral and nitrogene abundant environment.*** The rocky grass, developing on shallow, nitrogene-poor soil is the only exeption.

There are only few species belonging to the natural associations among the very much disturbed riverside highweed associations and the clearing meadows. Average calculation was limited to only a few species occurring in natural associations, but the tendency remained the sae as above. The difference was manifested here with the water budget and soil reaction indicators.

	T	W	R	N
Riverside highweed association	4,16	7,66	3,50	3,22
Clearing meadow	5,25	7,001	4,00	3,00

After comparing the demands of disturbance and weed resistant species to the previous ones:

	T	W	R	N
Riverside highweed association	4,57	5,20	2,21	3,60
Clearing meadow	4,23	4,92	1,76	3,10

In the first case the high demands for water and for favourable chemical reaction are manifested with the species building up natural associations. In the second case, where only the species inducing disturbances are considered, the low indicator figures of water budget and soil reaction are due to environmental damages. It is so, especially the riverside association is neighbouring agricultural lands, while the clearing meadow is an assotiation occurring after clear-felling, giving way to the disturbance resistant species to spread.

Defining the degree of harmful human effects or naturality is not always enough in ecological evaluation as it can be concluded from the above. Analysing evaluation wants the description of detailed ecological demands too.

Considering the above, the water budget and the soil reactions are the subjects of further investigation from among the ecological indicators. From the relative distribution of W and R values for the five associations (as shown in Figure 3), the beech wood is found to consist of species having the same level of water and soil reaction demands. There is only one plant, the disturbance resistant Hypericum perforatum, having different demands. The demands of the species of the hornbeam - oak grove are similar, though the values range a bit wider than with the beech.

More than one third of the species of the pusta-grassy slope and the riverside highweed association have different water demands and the soil reaction quality is not essential for them. Also, the highweed association and the clearing meadow have quite different water demands. All these verify the latter associations needing no special ecological endowments and their being capable to accomodate themselves to the changing environment.

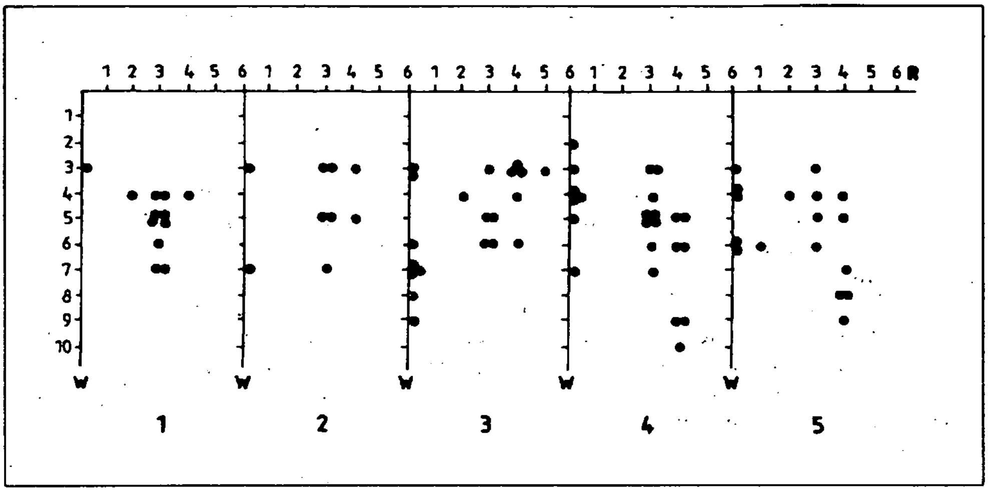

Figure 3 *Ecological indicators of water budget (W) and soil reaction (R) of a few characteristic associations in the catchment area*

Simon T. (1992) assigned rank scores to the species of Hungarian endemic vascular plants according to their nature conservation value. In his classification there are ten groups of species: native, subendemic, relic or unique (U), strongly protected (KV), protected (V), natural dominating (E), natural adjacent (K), natural pioneer (TP), disturbance resistant, natural (TZ), adventive or neophytic (A), weed (Gy). While the first six groups represent the naturality of the associations, the last four stand for the different degrees of degradation.

On the basis of the above groupping, Figure 4 shows the nature conservation value diagram of the natural and secondary associations. In the investigated associations there are very few unique, protected, or strongly protected species. The number of natural adjacent species is, however, very large (included in the dotted columns of the diagram representing the natural associations). The disturbance resistant species and weeds are increasing in the associations under human impact. Figure 4 also displays the woody associations of high stability reducing the weeds. On the other hand, if they are clear-felled only a very few association-building natural species are to be left and the degradation replaces development. Agricultural overuse may also result in degradation. The large number of weed and disturbance resistant species emerging into the riverside highweed association may be an example of the above.

Conclusions

The intensified ***protection of the mixed deciduous and mesphylic woods*** in the catchment ought to be declared. In the test area, several patches of beech and oak groves are being shrunk and slowly disappearing with degradation signing associations emerging into their place.

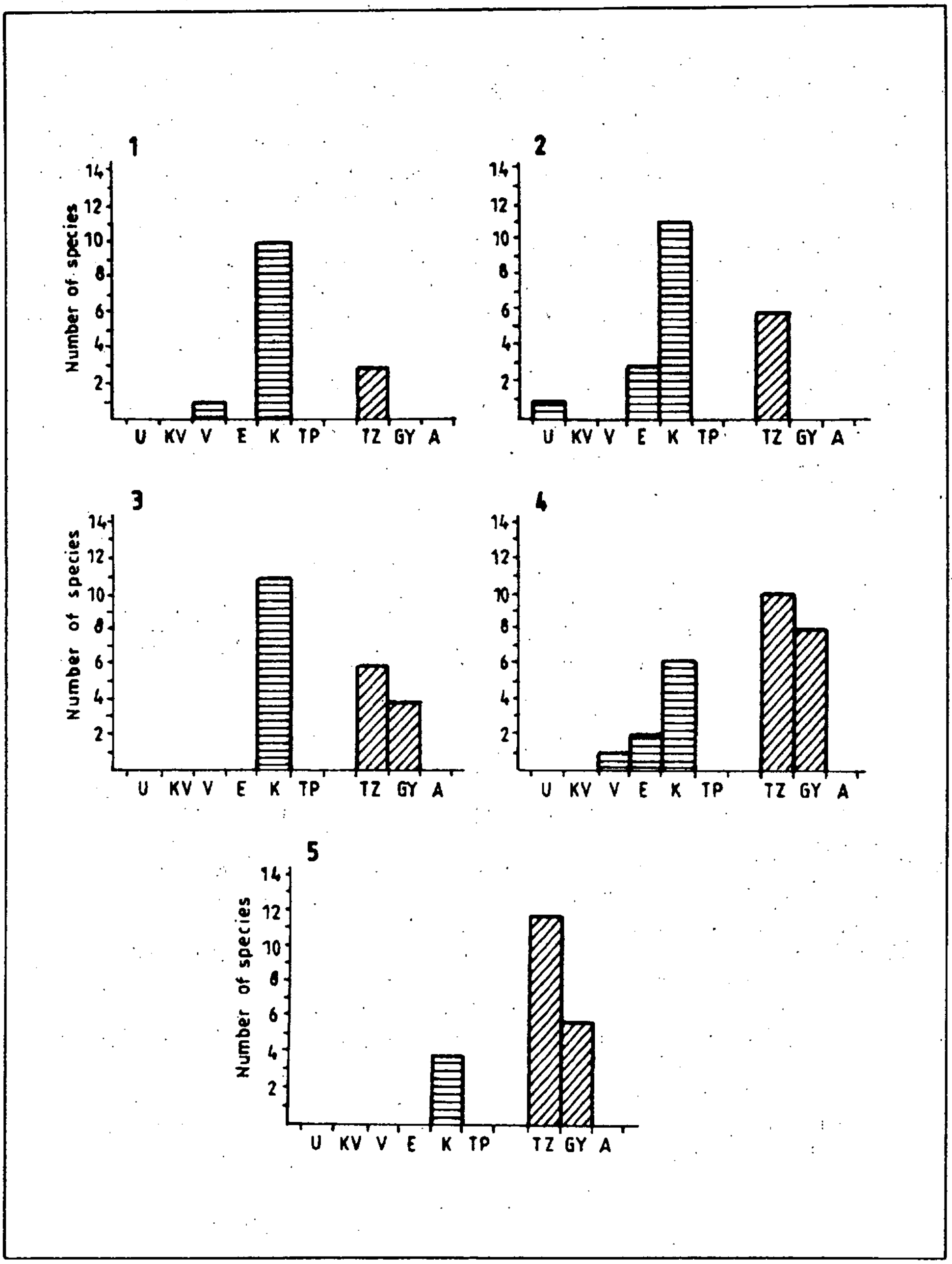

Figure 4 *Nature conservation value diagram of some natural and secondary associations in the test area (using the classification of Simon T.)*

Intensive land cultivation is not possible on the relatively very rough surface of the test area. A ***buffer zone*** ought to be outlined around the lesser spots and along the cultivated lands. The width of the zone should depend on the stability of the associations in order to slow down degradation. The ***dry groves, bushes and pusta-grassy patches*** have already played the role of the buffer zone at some places. The pusta-grassy patches, however, occupy too large territory and their ecotop-building function is low, and they are in the degrading stage or at least in the initial one. A part of the dry pusta grass (where the terrain is not so rough), is ***suitable for cultivation***. They have to be divided from the natural or quasi-natural associations with a couple of ten or a hundred metres wide buffer strips.

Summing it up: the territory of the Katarét Brook catchment has undergone a change due to human impact. Natural and quasi-natural associations have survived first of all on the relatively rough surfaces. ***Intensive agricultural land use made ecological endowments change and that is reflected in the rather low values of biotop-building and nature conservation functions***. The nature conservation diagrams of the different associations also sign this process. Disturbance resistant and weed species occur in large number in the associations. The above conclusions contribute to the complex geoecological evaluation of the area and to find optimum land use.

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