Long-term research of natural forests on permanent plots founded by prof. A. Zlatník in protected areas of Transcarpathia.

Buček, A., Hrubý, Z., Lacina, J., Mendel University of Agriculture and Forestry, Department of Forest Botany, Dendrology and Geobiocoenology, Zemědělská 1, 613 00 Brno, Czech Republic. bucek@mendelu.cz., hruby@node.mendelu.cz, lacina@mendelu.cz

Introduction

The life-long scientific work of the founder of Czechoslovak geobiocoenology prof. RNDr. Ing. Alois Zlatník, DrSc. (1902-1979) culminated in a proposal of the geobiocoenological classification system. Professor A. Zlatník, a long-standing head of the Department of Forest Botany, Dendrology and Geobiocoenology at Mendel University of Agriculture and Forestry in Brno, developed the system for typological mapping of landscape and forests. In the autumn of his life, he published an overview of the groups of geobiocoene types in vegetation tiers and ecological series (ZLATNÍK 1976b). At this, he made use of results from his life-long field research, documented by several thousand phytocoenological relevés from typological plots established in various regions of Central Europe. Towards the end of the 20th century, results of geobiocoenological typology of landscape became in the Czech Republic one of material groundworks for landscape planning, namely in design and formation of the territorial systems of landscape ecological stability (BUČEK, LACINA, MÍCHAL 1996). First comprehensive knowledge about the regularities of relations between abiotic and biotic constituents of forest geobiocoenoses he gained already in the 1930s from his exemplary conceptional and detailed study on permanent plots that he founded in the natural forests of Eastern Carpathians. In cooperation with the Administration of the Carpathian Biosphere Reserve in Rachov and the Administration of the Uzhanski National Natural Park) in Velkiy Berezniy, the plots have been since 1996 subject to repetitive research.

Foundation of research plots, research methodology and results published in the 1930s

Eighty years ago, Alois Zlatník found rests of natural forests in the farthest ends of the Eastern Carpathians. He realized the importance of research in these by human untouched ecosystems for learning natural processes and linkages and their significance for practical forest management (ZLATNÍK 1935). He focused on establishing justification for using vegetation as an indicator of productivity class in forest stands. Together with Ivan Zvorykin – soil scientist, he designed in 1931-1935 an extensive network of 36 research plots in the most preserved and by humans as least as possible affected forest stands, covering diverse natural conditions. Each of these research plots was 3-11 ha in size. The plots were first geodetically surveyed including a detailed surface contour relief map and then permanently marked with paint in the field on boundary trees and by stone mans (cairns) in all points of boundary angles. The entire plot was subjected to detailed dendrometric surveys. For dendromass calculation, a method was chosen of measuring all trees already from the registration diameter in the breast height (hereinafter DBH) limit of 3 cm at only 2cm intervals. Counted were also all bachelor trees over 1.3 m in height but not reaching yet the registration limit of 3 cm DBH.

Volumes were calculated not by using the conventional volume tables constructed for even-aged pure stands, moreover in entirely different natural conditions, but local volume tables were created in each forest stand for all major tree species based on measuring the volume in a sufficient amount of standing trees. In phytocoenological terms, an irregular grid of several tens of points was ranged within each research plot, where simultaneous phytosociological surveys (relevés) were made connected with soil sampling for chemical and physical analyses from identical, precisely geodetically surveyed spots (ZLATNÍK et al. 1938). The points were to serve for zoological investigation, too. The first experimental research was made into collembolans (*Apterygota*) on Plot 11 at Pop Ivan – (KSENEMAN 1938).

Carrier idea for this research was to trace by repetitive measurements natural changes in tree species and their herbaceous undergrowth at long time segments without the influence of intentional human interventions and to assess the natural potential of habitats. With the above outlined methodology of complex interdisciplinary research, prof. A. Zlatník was ahead of his time by at least several tens of year(ZLATNÍK et al.1938).

However, only a small part of this immensely ambitious, extensive and methodologically well-thought project succeeded. Unfortunately, nothing has been preserved of an undoubtedly ample unprocessed research material. The only data preserved until these days are therefore only those published in ZLATNÍK et al. (1938). The team of prof. Zlatník measured on these 11 published research plots DBH in 61 000 trees of which 3 460 trees were also measured for standing volume. In addition, 108 000 bachelor trees were inventoried. Apart from this, prof. Zlatník recorded 870 phytocoenological relevés and analyzed samples from 432 soil pits. A review of 11 processed and published research plots (incl. subcompartments in lower-case letters) is presented in Table 1 by individual regions of Transcarpathia: from the west eastwards Stuzhitsa, Yavornk and Pop Ivan (ZLATNÍK et al. 1938).

By tragical events of dismembering the Czechoslovak state in 1939, all works had to be discontinued. In spite of trying hard to be able to return to his research plots, Alois Zlatník had visited them never more until his death in 1979. Continuation or repetition of research was impossible both during World War II under the occupation by the fascist Hungary, and in the period of Communist regime when the territory fell to the Soviet Union.

Professor Zlatník and his colleagues succeeded in the detailed capturing of conditions existing in various types of natural forests and in the characterization of their species and structural diversity. Only a repeated research could have revealed changes and occurring processes, which was however not made possible by ill fortune.

Repetitive research on permanent research plots

The radical change of political situation in Central and Eastern Europe after fall of the iron curtain in 1989-1991 made it possible to return to the mostly still intact forests, now in the Ukrainian Eastern Carpathians.

The first one to take the chance was a team of the Tatra National Park from Slovakia under leadership of prof. Vološčuk. They succeeded in re-establishing at Pop Ivan and in other localities where Zlatník worked a network of own regular hectare plots of modern conception that were adjacent to or even partly overlapping with the original research plots of prof. Zlatník. Results of their research were characterized in VOLOŠČUK (2003) and their links to stages and phases summarized in VOLOŠČUK (2007).

In 1996, researchers from the Department of Forest Botany, Dendrology and Geobiocoenology at Mendel University of Agriculture and Forestry in Brno succeeded in finding traces of paint on the bark of spruce and fir trees (11c) and later also locations of boundary stone mans(cairns) – first on Plot 7.

The detailed geodetic plans published in ZLATNÍK et al. 1938 were necessary groundworks and condition for refinding the individual research plots after more than 60 years. Without the plans and without the diligent piling of stone man (cairns) on the boundaries, a precise localization of the plots would have not been possible after such a long time. Individual postgraduate students restored eight of a total number of eleven plots. The restored plots with the names of persons leading the restoration works and years of restoration are in Tables 1 and 2 marked in bold letters .

Table 1 Prof.Zlatník's Investigation Plots State Synopsis - Zlatník et al. 1938

Region (Group)	Plot number	Area ha	Actual state of plots (human/natural influence)	Plot restoration status
Stuzhitsa	1	1,65	intacted	localized - NOTrestored (Hrubý)
	2	4,67	completly clearcutted 50's	localized - NOTrestored (Hrubý)
	3a	**1,79**	intacted	**restored 2007 Kolář-Šebesta**
	3b	**3,95**	intacted	**restored 2007 Kolář-Šebesta**
	3c	**0,87**	intacted	**restored 2007 Kolář-Šebesta**
	3d	**0,60**	intacted	**restored 2007 Kolář-Šebesta**
	4	6,58	completly clearcutted 50's	localized - NOTrestored (Hrubý)
Yavornik	5a	5,06	partly logged 60's	finded-NOT restored (Buček)
	5b	**3,09**	intacted	**restored 2002 Žárník**
	6	**6,83**	intacted	**restored 1996 Hrubý**
	7	**6,05**	2/3 clearcutted 1999	**restored 1996 Hrubý**
Pop Ivan	**11a**	**1,38**	intacted	**restored 1997 Hrubý**
	11b	**1,50**	intacted(new windbreak)	**restored 1997 Hrubý**
	11c	**2,33**	intacted (new windbreak)	**restored 1997 Hrubý**
	11d	**3,03**	intacted (old windbreak)	**restored 1997 Hrubý**
	11e	**1,58**	intacted	**restored 1997 Hrubý**
	11f	**3,87**	intacted(recent windbreak)	**restored 1997 Hrubý**
	12	**3,58**	intacted	**restored 2004 Veska**
	13	**4,07**	partly logged 60's	**restored 2006 Kolář-Šebesta**
	14	**3,31**	intacted	**restored 2005 Veska**
		65,8	Total Area of all Prof.Zlatník's elaborated investigation plots	
		47,8	Total area of **restored** investigation plots	

These 8 restored plots covering a total of 47.8 ha represent 73% of the area of 11 published plots (ZLATNÍK et al. 1938). It follows out from the column named "State of plots" in Tab. 1 that plots not restored so far are in general heavily affected by forest activities and in future, they could give answer to an interesting question how the process of regeneration proceeds after severe unnatural disturbance. Table 2 summarizes changes in the species composition of tree layer, quantified by means of basal area share.

A comparison revealed only negligible differences on most of the restored plots in the period longer than 60 years. The share of beech generally increased with an exception of Plot 1, which was dominated by disintegration and is dominated by maturity now, and Plot 3b where the share of sycamore maple slightly increased at the expense of beech, which still exhibits a crushing dominance, because the concerned plot is a scene of continual disturbances. Plots with the fir show a general withdrawal of the species on Plots 3, 7 and 12 while the species' share on plots 11c, 11d and 11e slightly increased. The representation of fir on Plot 11f remained identical in spite of the fact that the stand was severely affected by windbreak and the beech compensated for a great loss of spruce (by half).

Table 2 Prof.Zlatník's Plot Tree Species Composition Development

Region (Group)	Plot number	Area ha	Former tree composition Korsuň (1938)	Actual tree composition (% according basal area)
Stuzhitsa	1	1,65	**F**56 **B**42 M1 (E)	**B**, M , F
	2	4,67		planted **S** allochtone
	3a	**1,79**	**B**82 M14 F4	**B**80 M18 (F,nM)
	3b	**3,95**	**B**80 M19 F1	**B**78 M22 /-F1935/
	3c	**0,87**	**B**91 M9	elfin forest **B** (M)
	3d	**0,60**	**B**61 **M**39	dwarf **B** M
	4	6,58	**B**94 F5 (M,E,Hz)	**B** /even-age/after clearcut
Yavornik	5a	5,06	**B**94 F3 H2 E1(Hz)	**B** M F disturbed
	5b	**3,09**	**B**69 **F**31 (M,Hz)	**B76** F24 (M,H,Ch,Hz,L,E)
	6	**6,83**	**B** 99 M 1	**B** 98 M 2 (nM)
	7	**6,05**	**B**84 F16 (E)	**B**99 F1 (M,E,W,Bi)
Pop Ivan	**11a**	**1,38**	**S**100 (B,A)	**S**100 (B,A)
	11b	**1,50**	**S**100 (R,B,A,F)	**S**100 (R,B,A,F)
	11c	**2,33**	**S**98 B1 M1 (R,F)	**S**96 B3 F1 (R,M)
	11d	**3,03**	**S**65**B**22F12M1(R,Bi,W)	**S**51 **B**36 F13 (M,R,Bi,W)
	11e	**1,58**	**B**64 **S**29 M5 F2	**B**59 **S**33 M5 F3
	11f	**3,87**	**F**39**B**38S22M1(R,E,W)	**B**49 **F**39 S11 M1 (R,E,W)
	12	**3,58**	**B**57 **F2**7 S13 M3 (Bi)	**B**56 **F**24 S11 M2 (R,E,W,Bi)
	13	**4,07**	**S**44**F**43B9M4(R,E,W,nM)	**F**35**S**32B24M8(R,E,W,nM,Y)
	14	**3,31**	**S**100 (F,B,M)	**S**95 **B**3 **F**2 (R,M,sW,Bi)

Former data from Stuzhica and Yavornik region-1932 ( ) minor admixture

Former data from Pop Ivan region-1934 **bold** more than 25% share

Actual data repetition years see Table1

Tree names follows MITCHELL, WILKINSON(1988)

Legend:			
Beech	B	Fagus sylvatica	
Norway **S**pruce	S	Picea abies	
Silver **F**ir	F	Abies alba	
Sycamore **M**aple	M	Acer pseudoplatanus	
norway **M**aple	nM	Acer platanoides	only on plots 6,13
Silver **Bi**rch	Bi	Betula pendula	
Goat **W**illow	W	Salix caprea	
Sile**s**ian **W**illow	sW	Salix silesiaca	only newly appears 2006 on pl. 14
Rowan(Mount.ash)	R	Sorbus aucuparia	
Green **A**lder	A	Alnus viridis	only on pl. 11a, 11b
Yew	Y	Taxus baccata	only newly appears 2005 on plot 13
Hornbeam	H	Carpinus betulus	only on plot 5
Common **L**ime	L	Tilia cordata	only newly appears 2002 on plot5b
Wych **E**lm	E	Ulmus glabra	plots 1&2,4,5,7,11f,13
Hazel	Hz	Corylus avellana	plots 4,5
Sour **Ch**erry	Ch	Cerasus avium	only newly appears 2002 on plot 5b

Table 3 shows development of basic dendrometric characteristics in all restored stands: numbers of live trees with DBH>3cm, basal area and woody biomass (dendromass) of live trees (all parameters converted to hectare). All above mentioned characteristics exhibited on the average of all 13 plots/sub-compartments shows a decrease in absolute values of all parameters. Greatest changes were observed in the number of trees per hectare – av. decrease by 15%. Nevertheless, the most stable parameter is live dendromass, which decreased on average of all plots only by 2 insignificant percent. Most oscillating in the assessment of development of the respective plots were dendromass volume values on research plots with a significant share of conifers, and on the other hand, plots with dominant beech succeeded after more than a sixty year (on Plot 3 even 75-year) repetition in utilizing very well and relatively quickly the potential given by site conditions.

60-75 years later, eight research plots were fully restored in the natural forests of Eastern Carpathians according to the original methodology, each sized 1.5-6 ha, containing 13 homogeneous stands (subcompartments). These 8 restored research plots on a total area of 47.8 ha represent 73% of the size of research plots published in ZLATNÍK et al. (1938). As to the developmental dynamics, we can divide the plots into two groups: 1) forest stands with the beech as a predominant tree species, and 2) forest stands with the predominant spruce or fir.

In the first group, none of stands with the prevailing beech showed extensive natural disturbances during 63-75 years. All investigated stands with the predominant beech exhibited either an increased dendromass of live trees or its insignificant decrease. In some cases, the dendromass of live trees increased in spite of a slightly decreased basal area (e.g. in subcompartment 5b). Changes in the species composition of these stands did not exceed 10% in the individual tree species and usually ranged from 2-3%. All stands with the predominant beech exhibit after 60-75 years the stability of constancy or high resistance type (sensu MÍCHAL 1992 & 1992a).

In the second group of studied stands where the species composition was dominated by conifers (namely spruce or fir), major natural disturbances occurred during 63-70 years in all stands, which reflected in the species composition, spatial structure, and often also in quantitative indicators such as tree numbers per hectare, basal area and dendromass volume of live trees. All prevailingly coniferous stands (with an exception of subcompartment 11a where secondary succession is likely taking place in the course of mountain meadow overgrowing) showed the dendromass of live trees decreased by at least 10%. The lowest decrease of live dendromass was recorded in subcompartment 11c (by 11%), where the number of trees markedly increased (by 34%) thanks to advanced regeneration – apparently after a wind disturbance. The representation of individual tree species changed in many cases by more than 10%, too – e.g. on Plots 11d, 11f and 13. The prevailingly coniferous stands of natural forests sized 1.5-4 ha were observed to exhibit a greater dynamics of changes in both the composition and the volume of live dendromass and tree species representation. The type of stability is in these stands mostly resilience with a wide amplitude (according to MÍCHAL 1992 & 1992a).

Significance of research on permanent plots for geobiocoenological typology

Characterizing plant communities of the Ukrainian Carpathians and their differentiation in relation to habitat, A. Zlatník used in the 1930s a hierarchy of syntaxa in the sense of phytocoenological schools, viz. alliance – association – subassociation. The last mentioned lowest unit he also named "type" and specified its "variants", too. We can guess that this classification of forest communities, only little informing of their abiotic environment, was gradually becoming less and less satisfactory for his work (ZLATNÍK 1956 & 1960 & 1962).

In the course of following decennia, prof. Zlatník arrived at the geobiocoenological typology. Landscape geobiocoenological typology dwells on the application of the theory of geobiocoene type (ZLATNÍK 1976a). Geobiocoene type is a complex containing the natural geobiocoenosis and all geobiocoenoses and geobiocoenoids descending from this natural geobiocoenosis and changed to various degrees including developmental stages that can take turns within a segment of certain permanent ecological conditions. Geobiocoenological classification system in the concept of A. Zlatník consists of basic and collective (superstructural) units. Basic units are groups of geobiocoene types (hereinafter STG); collective units are vegetation tiers, trophic and hydric series (ZLATNÍK 1976b).

In the Ukrainian Carpathians, we can study some groups of geobiocoene types (STG), which we study also in other regions of Central Europe, namely in the Carpathian parts of Czech Republic and Slovakia. However, some extensive remainders of natural forests preserved in Transcarpathia have no analogy in other regions of Central Europe. Therefore, the restored research plots of prof. Zlatník serve to compare the most diverse geographic variants of similar forest communities.

In the below presented list, vegetation units (ZLATNÍK 1938) are converted to STG (ZLATNÍK 1976b) as it followed out from repetitive phytocoenological surveys on the restored Zlatník plots in 1996-2007 (with the occurrence on repeated research traverses in brackets).

I. **Flysh zone** (sediment rocks) - Stuzhitsa and Yavornik regions

Alliance *Fagion sylvaticae*

1. as. *Fagus sylvatica – Dentaria bulbifera* (Yavornik 5b,6,7)
   = STG: 4-5 B 3 Fageta paupera inferiora et superiora
2. as. *Fagus sylvatica – Abies alba –* (*Picea excelsa*) *– Rubus hirtus – Asperula odorata*
   Type *Rubus hirtus* (Yavornik 6)
   = STG: 5 B 3 Abieti-fageta typica
   Type *Asperula odorata* (Yavornik 6)
   = STG: 5 B 3 Abieti-fageta typica
   Type *Mercurialis perennis* (Yavornik 6)
   = STG: 5 BC 3 Aceri-fageta inferiora
   Type *Impatiens noli-tangere* (Yavornik 6)
   = STG: 5 BC 3 Aceri-fageta inferiora
3. as. *Fagus sylvatica – Acer pseudoplatanus – Athyrium – Symphytum cordatum*
   Type *Filices – Symphytum cordatum* (Stuzhitsa 3)
   = STG: Lower elevations of 5 B 3 Abieti-fageta typica
   Higher elevations of 6 B 3 Abieti-fageta piceae typica
   Highest elevations with retarded growth (clearly manifested summit phenomenon) 6 B 2 Fageta subhumilia
   variants with *Rumex arifolius* and *Sedum carpaticum* (Stuzhitsa 3)
   = STG: Lower elevations of 5 C 3 Fagi-acereta inferiora
   Higher elevations of 6 C 3 Fagi-acereta superiora
   Highest elevations with retarded growth (clearly manifested summit phenomenon) 6 C 2 Fagi-acereta subhumilia

II. **Schist zone** (metamorphosed rocks) - **Pop Ivan region**

1. as. *Fagus sylvatica – Abies alba –* (*Picea excelsa*) *– Rubus hirtus – Asperula odorata*
   Type *Asperula odorata* + variant with *Lamium luteum* (Pop Ivan 11 f, 12)
   = STG: 6 B 3 Abieti-fageta piceae typica
   Type *Mercurialis perennis* (Pop Ivan 11 f, 12)
   = STG: 6 BC 3 Aceri-fageta superiora
2. as. *Fagus sylvatica – Acer pseudopatanus – Athyrium - Symphytum cordatum*
   Type *Filices – Symphytum cordatum* (Pop Ivan 11 e)
   = STG: 6 B 3 Abieti-fageta piceae typica

Alliance *Piceion excelsae*

1. as. *Fagus sylvatica – Picea excelsa – Calamagrostis arundinacea*
   Type *Lonicera - Spiraea ulmifolia* (Pop Ivan 13)
   = STG: 6 BC-BD 3 Aceri-fageta superiora – Abieti- fageta ulmi superiora

Note: This is an exceptional community that is likely to have no analogy in the territory of the former Czechoslovakia. It would definitely deserve a special name to point out that *Picea excelsa* reaches exceptional size here.

Type *Calamagrostis arundinacea* (Pop Ivan 11 d, 12)
= STG: 6 AB 3 Abieti-fageta piceae

2.as. *Picea excelsa – Vaccinium myrtillus – Luzula sylvatica*
Type *Luzula sylvatica* (Pop Ivan 11 b, c, d, 14)
= STG 7 AB 3 Sorbi aucupariae-piceeta
Type *Myrtillus – Musci* (Pop Ivan 14)
= STG : 7 A 3 Piceeta sorbina, on the lower boundary transition to 6 A 3 Fageta abietino-piceosa

Subassociation *Myrtillus – Festuca picta* (Pop Ivan 11 a)
= STG: 7 A 3 Piceeta sorbina

It follows from the above list that associations occurring on the restored Zlatník plots are those of Vegetation Tiers 4 Beech, 5 Fir-Beech, 6 Spruce-Fir-Beech and 7 Spruce, and of nearly all trophic series and intermediate series (A, AB, B, BC, BD and C). Of hydric categories, represented is only the normal hydric series (3) with singular transitions to the water-logged hydric series (4) and to the restrained hydric series (2), in which prof. Zlatník classified also communities with the pronounced manifestation of summit phenomenon. There are 15 groups of geobiocoene types differentiated on the restored plots (sensu ZLATNÍK 1976b) as follows:

4 B 3 : Fageta paupera inferiora (Yavornik 5b,7)
5 B 3 : Abieti-fageta typica (part Fageta paupera superior) (Stuzhitsa3;Yavornik6)
5 BC 3: Aceri – fageta inferiora (Yavornik 6)
5 C 3 : Fagi – acereta inferiora (Stuzhitsa 3; Yavornik 6)
6 A 3 : Fageta abietino-piceosa
6AB 3: Abieti- fageta piceae (Pop Ivan 11 d, 12)
6 B 2 : Fageta subhumilia (Stuzhitsa 3d)
6 B 3: Abieti-fageta piceae typical (Stuzhitsa3;Yavornik6; P.Ivan 11e, f, 12)
6 BC 3: Aceri – fageta superiora (Pop Ivan 11 f, 12)
6 BC-BD 3: Aceri-fageta – Abieti-fageta ulmi superiora (Pop Ivan 13)
6 C 2: Fagi – acereta subhumilia (Stuzhitsa 3d)
6 C 3: Fagi-acereta superiora (Stuzhitsa 3)
7 A 3 : Piceeta sorbina (Pop Ivan 11 a,14)
7 AB 3: Sorbi aucupariae-piceeta (Pop Ivan 11 b, c, d, 14)

Predominant STGs on the respective research plots are summarised in Table 3 and example of geobiocoenosis mapping are displayed in map Table 4.

We can generally speak of a very representative collection of specimens of the middle-mountain to alpine groups of geobiocoene types, mostly in natural condition that cannot be found elsewhere in mountains of the biogeographic province of Central European broadleaved forests.

Significance of results for the creation of ecological network

Forest geobiocoenoses with a relatively high ecological stability are important parts of ecological network. The conception of territorial systems formation in the Czech Republic links up with the European trend of setting-up an ecological network within the European Ecological Network programme of the European Union (BENNET 1994, ROZEMAIJER 2007). Landscape ecological data necessary for demarcation, design, establishment and management of biocentres and biocorridors are summarized in the methodological procedure of landscape biogeographic differentiation in the geobiocoenological conception (BUČEK, LACINA, MÍCHAL 1996, BUČEK, MADĚRA, ÚRADNÍČEK 2007). The methodological procedure issues from the theory of geobiocoene type (ZLATNÍK 1976), which is based on a hypothesis about the unity of natural and anthropogenically modified communities within a segment of certain permanent ecological conditions. The very first step for this procedure is geobiocoenological typification of landscape, which enables to create a model of the natural (potential) state of geobiocoenoses in the landscape. These pieces of knowledge have to be complemented and the hypothesis verified by necessary targeted research focused on the assessment of forest geobiocoenosis development and changes. The landscape geobiocoenological typology is widely utilized in the Czech Republic (BUČEK, LACINA 2007) and the first example of its use is available also from the territory of the Ukrainian Eastern Carpathians (HOLUŠA, FRIEDL 2008).

Repeated studies on permanent research plots and research traverses established in the past are of essential importance for gaining knowledge about the changes and developmental trends of forest geobiocoenoses. The research results will contribute to the testing of spatial, temporal and structural parameters used for projecting the territorial systems of landscape ecological stability (BUČEK, LACINA 1996) today. The knowledge will be used in the management of forest reserves and other structural elements of ecological network in the landscape. Very important is to precise concepts about the target condition of forest geobiocoenoses in biocentres and biocorridors, which has to be based on the knowledge of the long-term dynamics of forest communities (BUČEK, JELÍNEK 2006). The long-term research of forest geobiocoenoses is also important in the verification of hypothesis about a possible impact of climate changes on ecosystems and landscapes.

Conclusion

The life’s credo of prof. A. Zlatník read as follows: "research of nature is impossible without conservation". It was in the Ukrainian Carpathians where he began to develop at full the life concept of his as early as in 1926. Already in 1927, he submitted the first proposal for reserves in the territory of today’s Transcarpathia, which he five years later published in extended and more precised form (ZLATNÍK, HILITZER 1932). In the proposed reserves, he situated a grid of permanent research plots intended for the long-term research of changes in natural forests.

Sustainability of Transcarpathian natural forests, which are of extremely high significance on a European scale, is assured by conservation within the framework of the global network of biosphere reserves. Our repetitive research on the plots established by prof. A. Zlatník is possible only thanks to excellent cooperation with the Carpathian Biosphere Reserve Administration and with the Uzhanski National Nature Park Administration, which is a part of the Eastern Carpathians International Biosphere Reserve. Thus, we endeavour with our colleagues to accomplish the legacy of prof. Alois Zlatník.

Note: The paper was prepared within the framework of research project MSM 6215648902-04-1 at the Faculty of Forestry and Wood Technology, Mendel University of Agriculture and Forestry Brno

References

AMBROS Z., ŠTYKAR J.,VESKA J., (2007): Dynamika vegetace na Pop Ivanu. In: Križová E., Ujházy K. (eds.): Dynamika, stabilita a diverzita lesných ekosystémov. Technická univerzita vo Zvolene,Zvolen. p. 115–119.

BENNET, G. /ed./ (1994): Conserving Europe's natural heritage. Towards a European Ecological Network. London, Dordrecht, Boston. 334 pp.

BUČEK, A., JELÍNEK, P. (2006): Forests in Ecological Network. In: Kantor P. (ed.): Welche Bestandesstruktur für welche Waldfunktion. XVI. Waldbau-Kolloquium „Brno-Tharandt", 4.-6.10.2005 Kutná Hora. MZLU v Brně, p. 117-124.

BUČEK, A., LACINA, J., MÍCHAL, I. (1996): An ecological network in the Czech republic. Veronica Brno. 44 pp.

BUČEK, A., LACINA, J. (1996): Supraregional territorial system of landscape ecological stability of the former Czechoslovakia. Ekológia Bratislava, 15:1:71-76.

BUČEK, A., LACINA, J. (2006): Biogeografická diferenciace krajiny v geobiocenologickém pojetí a její využití v krajinném plánování.. Sborník ekologie krajiny 2. Česká společnost pro krajinnou ekologii, Lednice s. 18-29.

BUČEK, A., MADĚRA, P., ÚRADNÍČEK, L.(2007): Ecological network creation in the Czech Republic. Ekologie krajiny, CZ-IALE Brno. p.12-24..

HOLUŠA, O., FRIEDL, M (2008): Naslidki proektu „Metody regionalnogo lisogospodarskogo planuvannja dlja Ukraini". In: Fitoriznomanittja Karpat: sučasnyj stan, ochorona, ta vidtvorenije. Lira Užgorod. p. 49-52.(in.ucrainian)

HRUBÝ Z. (1999): Studium proměny přírodního lesa na výzkumných polygonech prof. A. Zlatníka na Podkarpatské Rusi po 60 letech. In Kučera, Kirschnerová (eds.): Změny rostlinstva a jejich sledování [Monitoring vegetation change]. Zprávy České botanické společnosti 34: 79–88. Praha..

HRUBÝ Z. (2001): Dynamika vývoje přirozených lesních geobiocenóz ve Východních Karpatech: Svazek I. Doktorská disertační práce. Ústav lesnické botaniky, dendrologie a typologie, Lesnická a dřevařská fakulta, Mendelova zemědělská a lesnická univerzita v Brně. 104 p.+ 39 p. suppl.

KOLÁŘ T. (2005): Vývoj synusie dřevin lesních geobiocenóz na výzkumném polygonu prof. A. Zlatníka ve Východních Karpatech. Thesis.manuscript Mendel University of Agriculture and Forestry, Department of Forest Botany, Dendrology and Geobiocoenology 57 p. + 37 p. suppl.

KOLÁŘ T.,ŠEBESTA J. (2007):Závěrečná zpráva řešení projektu 2518/G4/2007: Obnova plochy prof.A.Zlatníka v biosférické rezervaci Východní Karpaty.manuscript.. Mendel University of Agriculture and Forestry, Department of Forest Botany, Dendrology and Geobiocoenology. 11p.+2suppl

KORSUŇ F.(1938):Taxační prozkum reservace Pop Ivan-Taxative Durchforschung des Stužica-, Javorník-u. Pop Ivan –Naturschutzgebietes. In: Zlatník et al.: Prozkum přirozených lesů na Podkarpatské Rusi - Durchforschung der Naturwalder in Podkarpatská Rus, Díl první - Erster Teil. - In: Sborník výzkumných ústavů zemědělských ČSR, Ministerstvo zemědělství republiky Československé, Brno Sv.152, Vol.1:245-372&438-448.(in czech and german)

KSENEMAN M. (1938): Apterygota z reservace"Pop Ivan"-Apterygoten aus der Reservation"Pop Ivan". In: Zlatník et al.: Prozkum přirozených lesů na Podkarpatské Rusi - Durchforschung der Naturwalder in Podkarpatská Rus, Díl první - Erster Teil. - In: Sborník výzkumných ústavů zemědělských ČSR, Ministerstvo zemědělství republiky Československé, Brno Sv.152, Vol.1:449-522.(in czech and german)

MÍCHAL I.(1992):Obnova ekologické stability. Academia, Praha. 170 pp.

MÍCHAL I.(1992a):Ekologická stabilita. Ministry of Envirinment of the Czech Rep., Pratur. 244 pp.

MITCHELL A., WILKINSON J.(2001):Trees of Britain and Northern Europe. Collins,London.288pp.

ROZEMAIJER, N.G., /ed./ (2007): Summary report on the seminar „Building capacity to strenghten public support for ecological networks in Central, Eastern Europe and the Balkan". The Netherlands. 60 p.

ŠEBESTA J., KOLÁŘ T.(2007):Studie vztahu vývojových stádií a fází přirozeného lesa k jejich fytocenóze- Závěrečná zpráva o řešení projektu FR 470401. manuscript Mendel University of Agriculture and Forestry, Brno, 45pp.
VESKA J.(2007): Sledování trvalých čtverců prof.Aloise Zlatníka v pralesích Ukrajinských Karpat. In:Hrubá V.,Štykar J.(eds.): Geobiocenologie a její aplikace.Geobiocenologické spisy 11:133-137.
VOLOŠČUK, I. (2003): Geobiocenologický výskum prírodných lesných ekosystémov v chránených územich Karpát. Monografické štúdie o národných parkoch, sv. 3. ŠOP Správa Tatranského národného parku v Tatranskej Štrbe. 122 p.
VOLOŠČUK I.(2007):Divrezita rastových procesov a dlhodobá stabilita bukových pralesov Karpát. In: Križová E., Ujházy K. (eds.): Dynamika, stabilita a diverzita lesných ekosystémov. Technická univerzita vo Zvolene,Zvolen. p. 127–133.
ZLATNÍK, A. (1935): Studie o státních lesích na Podkarpatské Rusi - Studien über die Staatswälder in Podkarpatská Rus, Díl třetí - Dritter Teil. - In: Sborník výzkumných ústavů zemědělských ČSR, Ministerstvo zemědělství republiky Československé, Praha Sv. 127. Vol.: 1-66, 156-167.
ZLATNÍK, A. et al. (1938): Prozkum přirozených lesů na Podkarpatské Rusi - Durchforschung der Naturwalder in Podkarpatská Rus, Díl první - Erster Teil. - In: Sborník výzkumných ústavů zemědělských ČSR, Ministerstvo zemědělství republiky Československé, Brno Sv.152, Vol.1: 1-525.
ZLATNÍK, A. (1956):Obosnovaniye kompleksnovo tipologicheskovo issledovanija i obsledovaniya lesov i obzor grup lesnych tipov v Chekhoslovakiyi. – Za socialisticheskuyu selskokhozyaystvenuyu nauku 5A:397-434 Praga (in.russian).
ZLATNÍK, A. (1960): Waldtypengruppen der Slowakei. – Schriften des Wissenschaftlichen Laboratoriums für Landwirtschaftlichen Hochschule in Brno 4:84+195 p. Brno. (in german)
ZLATNÍK, A. (1962): Die Vegetationsstufen und deren Indikation durch Pflanzenarten am Beispiel der Wälder der ČSSR. Preslia 35:31-51 Praha. (in german)
ZLATNÍK, A. (1976a): Lesnická fytocenologie. Státní zemědělské nakladatelství Praha. 495 pp.
ZLATNÍK (1976b): Přehled skupin typů geobiocénů původně lesních a křovinných v ČSSR(předběžné sdělení)-Groups of the types of originally woodand shrub geobiocoenes in The Czechoslovak Socialist Republic(Preliminary report) . Zprávy Geografického ústavu ČSAV v Brně, 13:3-4:55-64+1 table. (in czech and english).
ZLATNÍK A., HILITZER A. (1932): Přehled přírodních reservací a jejich návrhů v západní a střední Podkarpatské Rusi. In: Sborník Masarykovy akademie práce VI/2: 33–84.
ŽÁRNÍK M., SAMEC P. a kol., 2004: Výzkum přirozených lesů Východních Karpat (bývalá Podkarpatská Rus) - výzkumná plocha (č. 5b) Aloise Zlatníka na Javorníku. In Polehla (ed.): Hodnocení stavu a vývoje lesních geobiocenóz. Sborník z konference 15.–16.10.2004, Brno. Ústav lesnické botaniky, dendrologie a typologie, Lesnická a dřevařská fakulta MZLU v Brně. Geobiocenologické spisy 9: 50–57.

Citace:
BUČEK, A., HRUBÝ, Z., LACINA, J.: Long-term research of natural forests on permanent plots founded by prof. A. Zlatník in protected areas of Transcarpathia.
In: Protected area system development in Ukraine and formation of the Pan-european ecological network. Proceed. of the Int. Conf. Carpathian Biosphere Reserve, Rakhiv, 2008. p. 80-94