

## Existing long term ecological research in western Ukraine

**Ihor Kozak**

*International Centre of Ecology, Polish Academy of Sciences,  
Dziekanów Leśny, 05-092 Łomianki, Poland  
mce-pan@mail.unicom.pl*

and

*Institute of Ecology of the Carpathians,  
National Academy of Sciences of Ukraine,  
Kozelnytska str 4, UA-290026 Lviv, Ukraine*

Ukraine encompasses 603,700 km<sup>2</sup>, is home to 52 million people and is situated in three geographical zones: steppe, forest-steppe, and mixed forests covering 40, 34, and 26 percent respectively of its territory. In the northern part of the country, in the Carpathians and in the Crimean mountains there are coniferous, mixed and broad-leaf forests. These gradually turn into a wide belt of scattered forests of forest-steppe zone in the central part of the country, which then becomes the steppe zone near Black and Azov Seas (Fig. 1).

Long-term ecological research has a long tradition in western Ukraine (120,000 km<sup>2</sup>), mainly in the Carpathian region (37,000 km<sup>2</sup>).



The diverse geology and topography in the Carpathian region influence the richness and diversity of the plant cover, fauna and ecosystems. For example, the flora of vascular plants in the Ukrainian Carpathians includes 2,120 species, of which 92 are endemic species (Stojko and Tashenkevich 1991).

Long-term ecosystem research in the

Fig. 1 Geographical zones of the Ukraine.

Ukrainian Carpathians can be divided into four main periods: Before World War II (Zapalowicz 1889; Stenz 1925; Tolpa 1928; Maloch 1932; Swederski 1931; Swederski and Szafran 1931; Zlatnik 1938; Deyl 1940); post-World War II through 1970 – a period of estimating the natural resources in the region (Lazarenko 1955; Gerenczuk 1968); from 1970 until 1980 the international scientific program MAB stimulated many productivity and terrestrial ecosystem studies (Malinowskij 1973, 1974, 1980; Golubets 1975, 1978); and from 1980 to the present – the study of anthropogenic changes of ecosystems (Golubets 1982; Golubets and Kozak 1996) and of nature protection (Stojko and Milkina 1980; Golubets 1988; Stojko 1982, 1993).

After World War II the ecological investigations in the Ukrainian Carpathians region were conducted both by research institutions (Institute of Ecology of the Carpathians, Institute of Botany, Institute of Zoology and Museum of Natural History of the National Academy of Sciences of Ukraine; Institute of Mountain Forestry of the Ministry of Forestry of Ukraine) and universities (Lviv, Uzgorod, Chernivtsi and Kyiv State Universities, Ukraine State University of Forestry at Lviv). Long-term data on biotic and abiotic parameters of ecosystems also were collected. Parallel data are available from governmental (State Monitoring System provided by State hydro-meteorological Committee of Ukraine) and regional organizations, from routine monitoring activity. However, most of these data are not digitized. These data help interpret the status of watersheds situated in different ecological regions of the Ukrainian Carpathians posts (Golubets and Kozak 1996).

The long-term research included studies of below- and above-ground phytomass, seasonal productivity dynamics, efficiency of organic matter production in spruce, beech and oak forest ecosystems, and in subalpine and alpine scrub and grassland stands. The relationships between productivity and age classes and soil types in oak, beech and spruce forests also were studied (Golubets 1982; Golubets and Kozak 1996; Kozak, 1990).

One can find many interesting subjects for International Long Term Ecological Research in western Ukraine, such as state protected areas (Carpathians Biosphere Reserve, Carpathians National Park, Beskidy National Park, Shatskiy National Park, Roztochya Reserve and Medobory Reserve), where many scientific institutions have established their research stations and study plots. The most interesting may be the investigations conducted in the Chornohora and Beskidy regions of the Ukrainian Carpathians.

The Chornohora region is the highest in the Ukrainian Carpathians (Goverla mountain is 2068 m a.s.l.). Research is conducted at the Pozyzevska field station, of the Institute of Ecology of the Carpathians, National Academy of Sciences of Ukraine (Malinovskij 1993). This station is 1420 m a.s.l. The investigations have been conducted since 1958 in alpine meadow ecosystems, subalpine meadow and scrub ecosystems and spruce forest ecosystems on the timber-line. At the Pozyzevska station, detailed research was conducted on the structure, productivity and succession within ecosystems of a 100 ha study area (Malinovskij 1984).

The station is in a protected area in the Carpathians National Park, which was founded in 1980. On the south side the Park borders the Carpathians Biosphere Reserve, which was established in 1968 and designated a Biosphere Reserve in 1990 to preserve and investigate the natural complexes of the Carpathians at altitudes from 200 to 2061 meters a.s.l. (Fig. 2).





Fig 2. Potential Long Term Ecological Research sites in Ukrainian Carpathians.

- A – Chornohora site,
- E – Beskid site
- 1 – Carpathian National Park
- 2 – Carpathian Biosphere Reserve
- 2I – Chornohorskiy and Svydovetskiy range
- 2II – Uhol'sko-Szyrokoluzanskiy range
- 2III – Valey of Narcissi
- 2IV – Marmoroshski and Kuziyskiy range
- 3 – East Carpathian Biosphere Reserve, Stuzhitsa range
- + – Pozyzevska Station

Tyachiv district) reaches 400–1350 m a.s.l. in the central part of the Ukrainian Carpathians. This range enjoys distinction as the greatest area of beech primeval forests in Europe. The relict groups of the berry-like yew and Kozak juniper are preserved on lime stones. Here a great number of caves was also found.

The Valey of Narcissi range (256.2 ha, near the town of Khust) is a natural complex with the only site in Europe where the narrow-leaved narcissus (*Narcissus angustifolius* Curt.) grows – a rare type in the northern zone.

The Kuziyskiy range (747 ha in Rakhiv district) is typical for a primeval oak nad beech forest covering the mountain slopes.

The Marmorosh range (3970 ha in the Rakhiv district ) is situated within the boundaries of the Marmaros crystalline mountains. The unique beech, spruce and fir forests and pure spruce primeval forests are preserved here between 850–1700 m, and significant features include: high productivity and biological stability. Marmorosh range

The Carpa- thians Bio- sphere Reserve comprises:

The Chornohorskiy range (4677 ha in Rakhiv district) on the southern slope of Chornohora at altitudes from 800 to 2061 m a.s.l. The altitudinal belts are clearly expressed: clean beech primeval forests changing into mixed communities composed of beech, spruce and fir. Beginning from 1200 m a.s.l., the clean spruce primeval forests reach the upper limit of forests at the altitude of 1500–1550 m. The mossy forests of rock pine, green alder and Siberian juniper are spread throughout the subalpine zone, with a rich species composition of flora in the subalpine and alpine meadows.

The Svydovetskiy range (2010 ha in Rakhiv district) is characterised by large diversity of flora and fauna, typical for the primeval forest and by the upland areas.

The Uhol'sko-Szyroko- luzanskiy range (11,252 ha in

(where the highest peak is Pop Ivan, 1940 m a.s.l.) is situated on the Ukrainian-Romanian border. Virgin forest and scrub ecosystems (*Pinetum mugi*, *Dushekietum viridi*, *Juniperetum sibirici*) are dominant in this area. Czech botanists A. Zlatnik (1938) and M. Deyl (1940) studied the forest soils and the climate on the Ukrainian side of Pop Ivan before World War II. In order to continue monitoring the valuable virgin ecosystems of the Marmarosh range it is necessary to organize a Ukrainian-Romanian co-operation.

The most common investigations on the Ukrainian-Hungarian border in the Tisa basin concern primary flood forests, which have significant value for water quality and the estimation of the hydrological role of the coastal forest ecosystems (Stojko 1996).

The Beskid region of the Ukrainian Carpathians exhibits the best example of ecological cooperation between Ukrainian, Polish and Slovak scientists. The Stuzhitsa range (14,665 ha) is a part of the trilateral East Carpathian Biosphere Reserve. This Reserve has a very long history. The first forest reserve in the East Carpathians was established in 1912 on an area of 331.8 ha. With the help of Prof. A. Zlatnik, the protected area was enlarged to 560 ha in 1932. In 1974, Ukraine established a 2592 ha state landscape reserve in the Stuzhitsa range. In 1992 this area was increased to 14,665 ha to benefit the organization of the trilateral Biosphere Reserve. The common characteristics of the East Carpathian Biosphere Reserve were cited in a special publication (Denisiuk and Stojko 1993). Beech forest ecosystems dominate the Ukrainian section, forming a wide belt from 400 to 1260 m a.s.l. (Stojko 1996).

Another prospective question addresses land-use changes in the Ukrainian Beskidy and Polish Bieszczady transboundary region. The degree of human influence differs between Polish and Ukrainian sections, and is most moderate in Poland (Bieszczady) and very strong within Ukrainian Beskidy (Augustyn and Kozak 1997). In the Ukrainian part of Beskidy (Starosambirskij district) ecological research has been conducted since 1980 (Golubets and Kozak 1996).

The long-term data from Chornohora and Beskidy may be used to identify impacts of recent environmental changes connected with the political and economic transformation in eastern Europe. Moreover the data can be used to assess the magnitude and causes of deterioration of ecosystem function and to predict the future development of these ecosystems.

Chornohora and Beskidy may be the potential Long Term Ecological Research sites in the Ukrainian Carpathians.

**In Chornohora** the site may include research plots on the Pozyzevska mountain near Goverla (Station of Institute of Ecology of the Carpathians, National Academy of Sciences of Ukraine), and research plots situated on the territory of neighbouring ranges of Carpathians Biosphere Reserve and Carpathians National Park (Fig. 2).

The main biomes and communities are:

- alpine meadows,
- subalpine ecosystems,
- primeval spruce forest,
- mixed beech-spruce-fir forests, and
- spruce monocultures.



Research topics:

- biomass structure and production of forest and meadow ecosystems;
- cycling of major elements in the forest and in sub-alpine and alpine ecosystems; and
- decomposition processes and soil biological activity in the forest and meadow ecosystems.

**In Beskidy** the site may include research plots in the territory of Stuzhitsa range of the trilateral East Carpathians Biosphere Reserve and in the Starosambirskij district.

Main biomes and communities are:

- natural beech and beech–fir forests,
- man-made spruce forests,
- meadows and agricultural lands.

Research topics:

- mapping of the potential natural vegetation cover;
- conservation of biodiversity; and
- evaluation of anthropogenic impact on ecosystem changes.

## References

- Augustyn, M., Kozak, I. 1997 - The trends of anthropogenic pressure in Polish and Ukrainian Carpathians. In: Perzanowski, K., Augustyn, M. [Eds.] *Selected ecological problems of Polish–Ukrainian Carpathians*. Bieszczady, Poland. 15-23.
- Denisiuk, Z., Stojko, S. 1993 - International Polish–Slovak–Ukrainian Biosphere Reserve Eastern Carpathians. *Ukrainian botanical Journal*, 50 (3):96–113.
- Deyl, M. 1940 - Plants, soil and climate of Pop Ivan: Synecological study from Carpathian Ukraine. - Praha: *Opera Bot. Cechica*, vol. 2. 290 pp.
- Gerenczuk, K. I. [Ed] 1968 - *Nature of the Ukrainian Carpathians*. Kyiv. Naukova Dumka Press. 232 pp. (In Ukrainian)
- Golubets, M. A. [Ed] 1975 - *Biological productivity of spruce forest of the Ukrainian Carpathians*. Kyiv. Naukova Dumka Press. 239 pp. (In Russian)
- Golubets, M. A. 1978 - *Spruce Forests of the Ukrainian Carpathians*. Kyiv. Naukova Dumka Press. 261 pp. (In Russian)
- Golubets, M. A. [Ed]. 1982 - *Biogeocoenotic cover of Beskids and his anthropogenic changes*. Kyiv. Naukova Dumka Press. 247 pp. (In Russian)
- Golubets, M. A [Ed]. 1988 - *Ukrainian Carpathians Nature*. Kyiv. Naukova Dumka Press. 207 pp. (In Russian)
- Golubets, M. A., Kozak, I. I. 1996 - The principal features of anthropogenic transformation of biogeocoenotic cover in Carpathian region. In: Golubets, M. A., [Ed] *Anthropogenic changes of the biogeocoenotic cover in the Carpathians region*. Kyiv. Naukova Dumka Press. 17-22. (In Ukrainian)
- Kozak, I. I. 1990 - Anthropogenic forest transformation in the mountain basin of the river Prut (Ukrainian Carpathians). *Lesovedenie*, 3: 3-10. (In Russian)
- Lazarenko, A. S. [Ed]. 1955 - *Nardus stricta* pastures of subalpine belt in Carpathians. Publ. Inst. Agrobiology, 6: 47-76. (In Ukrainian).
- Malinovskij, K. A. [Ed]. 1973 - *Biological productivity of Pinus mugo communities in the Ukrainian Carpathians*. Kyiv. Naukova Dumka Press. 170 pp. (In Ukrainian)

- Malinovskij, K. A. [Ed]. 1974 - *Biological productivity of meadow community of Ukrainian Carpathians*. Kyiv. Naukova Dumka Press. 236 pp. (In Russian).
- Malinovskij, K. A. 1980 - *Vegetation of subalpine belt of the Ukrainian Carpathians*. Kyiv. Naukova Dumka Press. 278 pp. (In Ukrainian).
- Malinovskij, K. A. [Ed]. 1984 - *Digression of biogeocoenotic cover between forest and subalpine zone in Chornohora*. Kyiv. Naukova Dumka Press. 208 pp. (In Russian).
- Malinovskij, K. A. 1993 - Aims and results of stationary investigations of high mountains plants in Ukrainian Carpathians. In: Malinovskij, K. A. [Ed] *Structure of high mountains fitocoenosis in Ukrainian Carpathians*. 5-19. (In Ukrainian)
- Maloch, M. 1932 - Agrobotanicka studie o nardetach borzawských polonin na Podkarpatske Rusi. *Sb. Vyzk. Ustavu zemedel.*, 83: 191. (In Czech).
- Stenz, E. 1925 - Spostrzeżenia pyrhelimetryczne w Karpatach Wschodnich. *Kosmos*. 50: 480-489. (in Polish).
- Stoiko, S. M. [Ed]. 1982 - *Flora and Vegetation of Carpathians Reserve*. Naukova Dumka Press, Kyiv, 218 pp. (In Ukrainian).
- Stoiko S. M. [Ed]. 1993 - *Nature of the Carpathian National Park*. Naukova Dumka Press, Kyiv, 212 pp. (In Ukrainian).
- Stoiko, S. M., Milkina, L. I. 1980 - *Nature protection in the Ukrainian Carpathians and Adjacent Territories*, Naukova Dumka Press, Kyiv, 262 pp. (In Ukrainian).
- Stoiko, S. M., Tasenkevich, L.O. 1991 - Pflanzengeographische Stellung und Schutz von Flora und Vegetation der Ukrainischen Karpaten, *Verhandlung-Zool.-Bot. Ges., Osterreich*, 165-177.
- Stoiko, S. 1996 - Problems in transboundary protected areas in Ukraine. In: Alicja Breymeyer, A. and Noble, R. [Eds.] *Proceedings of an International Workshop Bieszczady and Tatra National Parks*, Poland, May 15-25. National Academy Press, Washington, DC. 80-85.
- Swederski, W. 1931 - Studia nad glebami górskimi w Karpatach Wschodnich. Cz. 1. Gleby północno-zachodniej części pasma Chornohory. *Pamiętnik Inst. Gosp. Wiejskiego*, 12: 115-154. (In Polish).
- Swederski, W., Szafran, B. 1931 - Typy florystyczne połonin w Karpatach Wschodnich. *Pamiętnik Inst. Gosp. Wiejskiego*, 12: 61-114. (In Polish).
- Tolpa, S. 1928 - Study of bogs in Czarnohora. *Acta Soc. Bot. Pol.* 5: 221-245. (in Polish).
- Zapałowicz, H. 1889 - Roślinna szata gór Pokucko-Marmaroskich. *Sprawozdanie komisji fizjograficznej*, 24: 1-398. (In Polish).
- Zlatnik, A. 1938 - *Prozkum prirozenych lesu na Podkarpatske Rusi, Dil prvni, Vegetace a stanoviste rezervace Stuzica, Javornik a Pop Ivan*, Prague, pp. 244 (In Czech).