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Gladiolus tenuis, Yutsa Mountain, Stavropol Krai, Russia.

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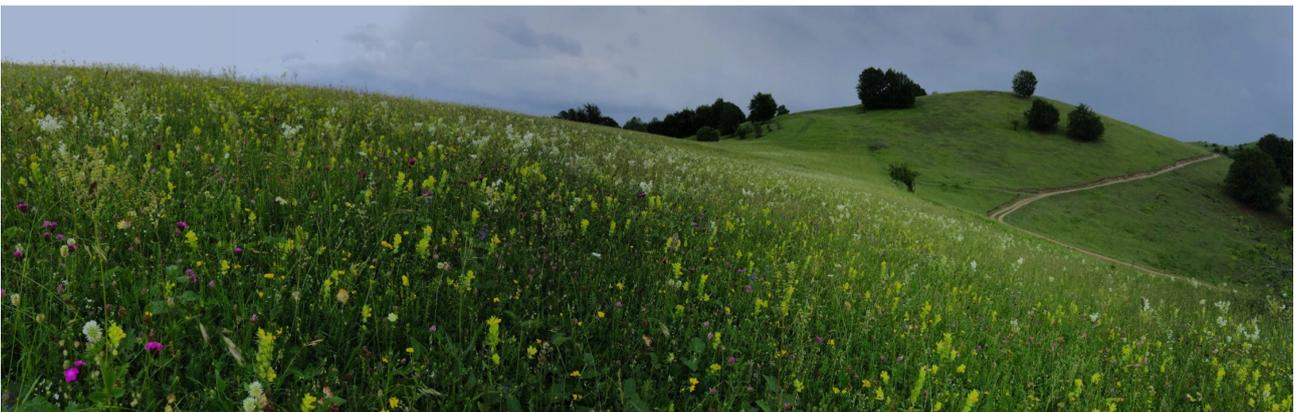
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A Message from the Editor

In my homeland, June is a month when the vegetation is lush and very green. In the gardens this green is combined with pink and red of roses, in the countryside it is only interrupted by whitish dots of rocky outcrops, or sheep flocks, which are already on their summer pastures in the mountains. The mountain meadows are full of colours and noise of insects. Some of them are mown in June to be transformed into a smelly winter fodder for our animals. In such a month, it is not easy to prepare a Bulletin. Especially for grassland scientists, who have to sample their grassland plots in a tiny period after the stands grow ripe enough, but before they get cut or grazed. I also tried to do my best during June and visited lovely regions of Romanian Apuseni and Czech White Carpathians. And I am very grateful to people who helped me to produce this Bulletin issue. To all the authors who contributed with interesting articles. To Susan Wiser and Bob Peet, who provided careful linguistic editing. To Denys Vynokurov, Vilma Gudyniene, and Phillip Sengl who shared the picture memories from their fieldwork, EDGG Field Workshop in Switzerland, and Eurasian Grassland Conference in Graz. To Anna Kuzemko who spent many evenings during her fieldwork with the layout and designing. Enjoy the reading!

Monika Janišová
Editor of the IAVS Bulletin



June in the Carpathian Mountains. Photos: M. Janišová.



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View from the Zolotoy Kurgan Mountain, Stavropol Krai, Russia, 05.06.19. Mesic steppe community with *Stipa pulcherrima*, *Dictamnus caucasicus*, *Cytisus ruthenicus*. On the horizon you can see the other laccolite mountains Yutsa, Beshtau and Mashuk.



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Lilium monadelphum - Yutsa Mountain, Stavropol Krai, Russia, 06.06.19. Xero-mesic grasslands with *Lilium monadelphum*, *Brachypodium rupestre*, *Dictamnus caucasicus*, *Psephellus dealbatus*.



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Borgustan Range, near Kislovodsk city, Stavropol Krai, Russia, 01.06.19. Dry grasslands on limestone outcrops with *Elytrigia stipifolia*, *Stipa pulcherrima*, *Euphorbia petrophila*, *Genista compacta*. Before the storm.



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Borgustan Range, near Podkumok village, Stavropol Krai, Russia, 08.06.19. Dry grasslands on limestone outcrops with *Carex humilis*, *Stipa pulcherrima* and endemic species *Genista compacta*, *Hedysarum biebersteinii*, *Bromopsis biebersteinii*.

Yurii Kleopov (1902-1943)

Ukrainian botanist and unsurpassed scholar of the origin and genesis of floristic complexes

By *D. Dubyna and D. Vynokurov*

The establishment of the Ukrainian school of geobotany occurred concurrently with the broader rise of this field. Its founding representatives, J. Paczoski and V. Vysotsky, formulated the basic principles of modern phytocoenology and the next generation of geobotanists was heavily influenced by their works, most prominent among them being Ukrainian scientist Yurii Dmytrovych Kleopov.

In the history of Ukrainian geobotany, Yu.D. Kleopov is known primarily as a pioneer in the study of the origin and development of floristic complexes. In the Soviet Union his works were long kept secret because he continued his explorations during the Nazi German occupation of Ukraine (1941-1943). Only a narrow circle of

specialists was familiar with his research and it was not until the 1960s that a few publications analysing Yurii Kleopov's work began to appear.

With the beginning of the 21st century, Yurii Kleopov's life started seeing more coverage in the media, with a special focus on the adversity he experienced during the Second World War. In 2002, a conference titled "Yu.D. Kleopov and Modern Botany" was held in honour of the great scholar on the 100th anniversary of his birth at the M.G. Kholodny Institute of Botany, the National Academy of Sciences of Ukraine. After the conference, a collection of research papers was published showing the current state of botanical science in Ukraine. Some of the articles analysed the scientific



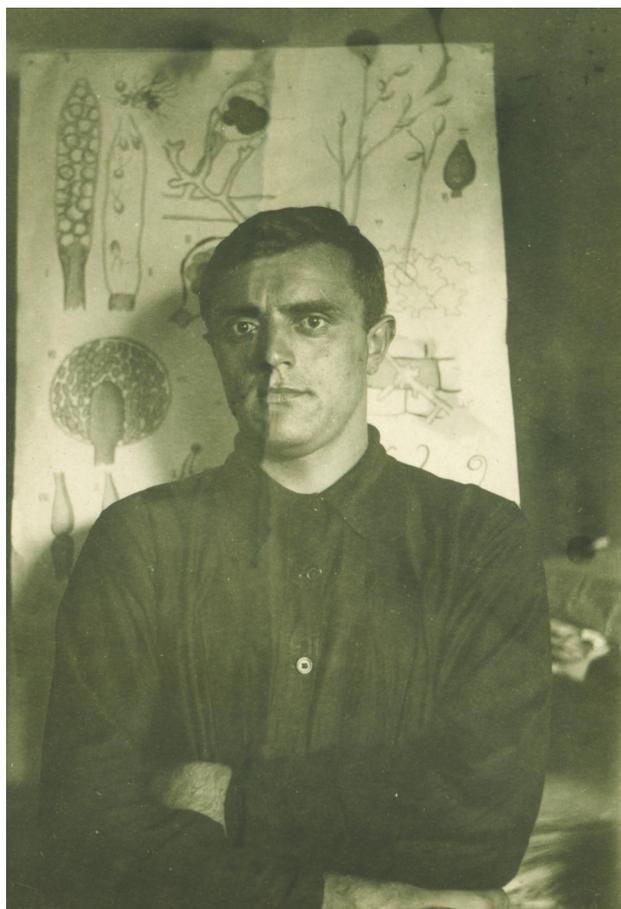
Father's House in Velyka Yablunivka.

heritage of Kleopov, while others examined the development of his thoughts and methods of analysis. A significant proportion of the papers was devoted to issues of geobotany, evolution, and plant conservation. For Ukrainian botanists, Kleopov's research is a shining example to follow.

Yurii Kleopov was born on August 9, 1902 in the culturally-rich city of Horodyshe (present day Cherkasy Oblast), which is associated with many important events in the history of Ukraine such as the Koliyivshchyna, a widespread rebellion of the haidamaks (Cossack paramilitary bands) against the oppression of bonded peasants by the Polish nobility. Horodyshe was the birthplace of Semen Hulak-Artemovsky, a composer of Ukrainian opera, actor and dramatist, and the author of the first national comedic opera *Zaporozhets za Dunayem*. The city was also visited by poets Taras Shevchenko and Lesya Ukrainka, historian Mykola Kostomarov, political figure Mykhailo Drahomanov, ethnographer Pavlo Chubynsky, pomologist-selectionist Levko Symyrenko, and many other famous Ukrainians. What attracted them to this region was its glorious past, beautiful nature, and its people.

Yurii Kleopov's father, Dmytro Stepura, was descended from a wealthy Cossack family. He studied medicine at the University of St. Volodymyr (present day Taras Shevchenko National University). However, he did not find his vocation in medicine or even in education (he worked as a public teacher for some time), but in serving God. At Dmytro Stepura's ordination to the priesthood, he was given a new name as Pastor Kleopov (from the Greek "κλέος" meaning "glory, renown, glorious"). He received a parish in the village of Velyka Yablunivka, where his son Yurii Kleopov grew up. There is some evidence that Dmytro Stepura was also actively involved in the treatment of parishioners suffering from various diseases. In 1919 or 1921, during a period of repression, he was executed by a firing squad by order of the authorities. Dmytro Stepura was buried near the church of St. John the Divine in the village of Velyka Yablunivka. Yurii Kleopov's mother Oleksandra Tatarova (Kleopova) came from a family of priests. She had three brothers who had parishes in Cherkasy Oblast who also became victims of repression. Oleksandra Kleopova died in 1944 and was buried next to Yurii Kleopov at an old Polish cemetery in Smila, Cherkasy Oblast.

Yurii Kleopov's scientific character made itself known from a very young age. Starting as a 15-year-old gymnasium pupil, he was fascinated by the world of insects. His first amateur work was a collection of insects he gathered on the outskirts of the village of Velyka Yablunivka and the town of Smila (Cherkasy Oblast). Kleopov later published the results of this study in the *Journal of the Zoological Museum* (Kleopov 1926a). Perhaps the close relationship he observed between insects and the world of plants was what later inspired him to study botany.



Student Yurii Kleopov after graduation in the Higher Institute of Public Education (now the Taras Shevchenko National University) in Kyiv.

During 1920–1924 Yurii Kleopov studied at the Higher Institute of Public Education (present day Taras Shevchenko National University) in Kyiv. He attended the lectures of such outstanding scientists such O.V. Fomin, A.A. Yanata, I.I. Schmalhausen, V.I. Luchytsky, P.A. Tutkovsky, and others. As a student, he always spent the holidays in his home village of Velyka Yablunivka. Together with his friends, he staged various plays by Ukrainian authors. His favourite part was Bonaventura the digger in *One Hundred Thousand*, a play by the famous Ukrainian playwright of the 18th century I. Karpenko-Kary.

Kleopov had a penchant for poetry. As he grew older, he started writing poems, praising the world of plants, its natural beauty and greatness not yet widely understood by others. The rhyming botanist also wrote poems about love and philosophy. According to his peers, Yurii Kleopov recited poems perfectly, was fond of opera and romances, loved dancing, and attended a dance studio.

Everyone who knew Yurii Kleopov remarked on his extraordinary attractiveness, decency, excellent moral qualities, willpower and energy, which were complemented by his romanticism, humour, and wit. These features of his character contributed to his creative

growth and high level of scientific knowledge. Kleopov's openness and the beauty of his mind naturally attracted many people to him. In her last memoir (2013), the Russian botanist Anastasia Semyonova-Tyan-Shanskaya devoted a few paragraphs to Yuril Kleopov noting that he was interested not only in science but also in literature, loved and understood music, and was gallant despite living in the harsh Soviet times. Semyonova-Tyan-Shanskaya also told an interesting story in her memoirs. According to her, Kleopov asked his friend, prominent scientist Yevhen M. Lavrenko, to send flowers from a flower shop regularly to a woman he liked who lived in Leningrad. Yevhen Lavrenko certainly carried out his friend's wish.

While still a student, Yurii Kleopov worked in the laboratory of Academy Fellow O.V. Fomin, an outstanding botanist, taxonomist, and botanical geographer who founded the Institute of Botany of the Soviet Ukrainian Academy of Sciences. In 1922 Kleopov became a member of the Ukrainian Botanical Society. A year before graduation in 1924 Kleopov was hired as a freelance researcher of the Botanical Cabinet and the Herbarium of the Soviet Ukrainian Academy of Sciences. In 1925, he became a postgraduate student in the Botany Department of the Kyiv University Botanical Garden. Throughout this period Academy Fellow O.V. Fomin was his supervisor. Kleopov also taught at the Military-Political School (1925–1927) and at the Kyiv Forestry Institute (Kyiv Agricultural Institute, 1927–1929). In 1929 Kleopov became a researcher at the Institute of Botany of the Soviet Ukrainian Academy of Sciences

where he served as Head of the Laboratory of Geobotany from 1927 through 1939, and as Head of the Department of Geobotany starting in 1931. In 1930 Yurii Kleopov earned his PhD (Candidate of Sciences) in Biological Science and in 1934 received the title of Professor. In addition to research, Yurii Kleopov was active in the field of education, heading the Department of Botanical Geography at Kharkiv State University from 1935 through 1941.

At the time when the Laboratory of Geobotany was established, Ukrainian botanists had already made significant progress in regional studies of such vegetation types as forests, steppes, swamps, wetlands and sands that retain still today their relevance. G.I. Tanfiliev, G.M. Vysotsky and J.K. Paczosi were the founders of Ukrainian geobotany and botanical geography. Later, the publications of E.M. Lavrenko, G.M. Vysotsky, M.I. Kotov, G.I. Dokhman, F.Ya. Levina, O.V. Fomin and others saw the light of day. Their work formed the foundation on which the Laboratory of Geobotany developed.

The first years after establishment of the Laboratory were marked by significant scientific achievements, particularly in the study of vegetation in the steppe, forest steppe, and the Donbas regions. Most of these achievements belong to Yu.D. Kleopov. His first papers were devoted to numerous floristic findings and the description of the floristic features of different areas of Eastern Europe (Kleopov 1925, 1926b, 1926c, 1926d, 1927a, 1928a, 1929b, 1929c, 1929d, 1929e, 1939, 2002d; Kleopov & Dubovyk 1926). In these and other works one can see clearly Kleopov's interest in histori-



Yu. Kleopov (leftmost) with his students in the field.

cal ties, the time of occurrence of endemics and relicts, and the features of plant communities, including their variation with soil, moisture and relief. Soon after its establishment in 1931, the Department of Geobotany was joined by Kleopov's postgraduate students, namely D.Ya. Afanasiev, G.I. Bilyk, G.M. Zozulin, and later G.G. Chornoholovko, F.O. Gryn, and M.I. Kosets making for a staff of eight employees. Yurii Kleopov's talent for science came out particularly clearly at this time as can be seen in several theoretical papers on botanical geography and the history of vegetation development that have not lost their relevance to this day (Kleopov 1930a, 1930b, 1931b, 1932, 1935c, 1938b, 1938c, 1938d, 1941a, 1941b, 2002e; Kleopov et Gryn 1934). Particularly illustrative is his publication "On the geomorphological motives of the vegetation cover of the UkrSSR" in which he described the influence of epeirogenic movements of the Earth's crust on the development and nature of vegetation and the processes of its historical formation (Kleopov 1935).

From the early days of his research, Yurii Kleopov paid much attention to steppe vegetation, its zonation and classification, as well as its origin and time of emergence (Kleopov 1927b, 1928c, 1928d, 1929a, 1933a, 1933b, 1934b, 1941b; Kleopov & Lavrenko 1933). He considered steppes and forests as a holistic phenomenon caused by natural processes (Kleopov 2002a). In his

work "Periglacial Steppes of the European part of the USSR" (Kleopov 1941b), Kleopov came to the conclusion that the most characteristic dominant of the relict communities of periglacial steppes is *Carex humilis*. He called such relict communities the "Caricion humilis" chain and published many papers on problems in the taxonomy of associated species (Kleopov 1928b, 1931a, 1935b, 1935d, 1936c, 1936d, 1936e, 1938a). As an expert in flora, especially that of the southern regions of Ukraine, Kleopov described a number of new taxa, particularly from the genera *Centaurea*, *Dianthus*, *Cerastium*, *Silene*, and *Vincetoxicum*. He also paid attention to floristic, geobotanical, and geographical zonation (Kleopov 1934a, 1936a, 1936b, 2002b, and 2002c), a synthesis of which can be seen in his legend for the vegetation map of Ukraine (Kleopov et Lavrenko 1938).

In 1941, Yurii Kleopov completed his most profound work "Analysis of the flora of deciduous forests of the European part of the USSR" (only later published, Kleopov 1990). This classical study of floristics and geobotany was submitted to the V.M. Komarov Botanical Institute of the USSR Academy of Sciences in Leningrad as a habilitation dissertation. In the study, Kleopov provided a classification of floral elements, described their origin, and explained the role they play in the formation of deciduous forests in Eastern Europe. He proposed a system of floristic elements that combines the



Eugenia Polonska, first wife of Yu. Kleopov with her students (second from the right in the bottom row).

categories of geoelement (geographical element, including macrogeoelement and microgeoelement), genoelement (genetic element, including paleogeoelement and neogeoelement), chronoelement (historical element, including genochronoelement and migrochronoelement), migroelement (migration element) and coeoelement (coenotic element). The last category was first introduced by the author and combines species closely related to a certain association or formation. In the broadleaved forest flora, Kleopov singled out nemoral, betular, quercetal, and vacciniatal coeoelements. Additionally, he paid much attention to analysis of geoelements. He distinguished the following types within the flora of Eastern European deciduous forests: Holarctic, Eurasian, Boreal, Southern-Siberian, European, Atlantic, Submediterranean, Nomadian, Ural and Mountain. Also included were special categories for endemic, disjunct, connecting, pluriregional and adventive species. For each group identified, he provided a detailed description that included characteristic species, centers and time of origin, factors that predetermined the transformation of its predecessors, migration paths, and its importance in the broadleaved forests of different provinces. He also analysed the floristic features of particular forest vegetation associations. The relict forest complex in particular was studied in great detail. Kleopov found that temperate deciduous forests of Eastern Europe developed under East-Asian

and North American influence. The late-Pliocene flora of the deciduous forests of the middle part of the temperate zone of Europe is genetically linked with the Turgai region. Kleopov logically concluded that the forests of Eastern Europe are a complex system from the standpoint of history and genetics as their development was influenced by various genetic, historical, migration, and coenotic factors.

Yurii Kleopov's first wife was Yevhenia T. Polonska, formerly a fellow student in the same university department. She studied Ukrainian flora, collected a large herbarium, and taught several generations of botany students at the Kyiv National University in pre-war times. In 1935, Yurii was invited to the Kharkiv University. At the time, Yevhenia Polonska had only recently become an employee of the Kyiv University, a position she did not dare to leave. Before the war, Kleopov married again, this time his former student Kateryna Domontovich. Yurii had two sons, Leo and Oleksii, by his first and second wife, respectively. His younger son was born during the war in April 1943.

The Second World War put an abrupt end to Yuri Kleopov's research-related plans. As a member of the teaching staff of the Kharkiv University, Kleopov worked on the construction of defence installations. In late October 1941, when fierce battles were fought on the streets and squares of Kharkiv, the Kharkiv intelligent-



Expedition in Moldova, Yurii Kleopov is second from the left.

sia, including university teachers, were evacuated under the supervision of Soviet punitive agencies. For this reason, Yurii would have been able to stay with his family only after he left the city. However, when they reached the city limit he took his belongings, bid farewell to his colleagues, and returned to Kharkiv.

Prior to 1942, acting on behalf of the Kharkiv City Council, Yurii Kleopov performed the duties of the Dean of the Faculty of Natural History of Kharkiv University and the Commissioner for the preservation of property. Due to his perception of a need for the long-term preservation of the university, he returned to the Institute of Botany in Kyiv in early 1942 (then called the Regional Institute of Agricultural Botany). The Director of the Institute was German botanist Heinrich Walter, who invited Yurii Kleopov to serve as co-director of the Institute ("Ukrainian Acting Director"). At the Institute, he worked with his ex-wife and other staff who could not evacuate. Together with them, he made a vegetation map of Ukraine and completed the legend. This map and one hard copy of Yurii Kleopov's dissertation are still preserved at the Department of Geobotany and

Ecology of the M.G.Kholodny Institute of Botany of the National Academy of Sciences of Ukraine.

The year 1943 saw dramatic events visited upon the life of Yurii Kleopov. As the Soviet troops approached Kyiv, he realized he was faced with a difficult choice. If he emigrated, he would lose all his relatives in Ukraine. If he stayed, he would be considered a collaborator in the eyes of the Soviet government, which would endanger his family as well.

At the conference dedicated to Yurii Kleopov's 100th birthday in 2002 his nephew, Professor Yevhen Vovchenko, now a Doctor of Medical Science, spoke about his uncle's last days. Yevhen Vovchenko emphasised that when Yurii Kleopov visited Smila for the last time, he contracted malaria and had to undergo treatment. He and his mother spent hours in conversation for several nights. Yevhen Vovchenko understood that they were discussing something very important, judging by the tone and content of these conversations. According to him, Yurii Kleopov had already made some decision and his mother was trying to persuade him to change his mind. Unfortunately, we will never know



Yurii Kleopov is first from the right in the bottom row, Eugenia Polonska is third from the left in the bottom row.

what that decision was. Yurii Kleopov died on July 13, 1943, the exact cause of his unknown. The most common interpretation is an overdose of quinine.

Yurii Kleopov's friends and colleagues wrote in his obituary, "Professor Yu.D. Kleopov is a botanist of global significance. No branch of this science was beyond his competence. A scrupulous taxonomist and a flora researcher, he had intimate knowledge of flora not only in Ukraine but in all of Russia, the Balkan Peninsula, and Central Europe. Yu.D. Kleopov had a great erudition in various branches of natural science. He is the author of brilliant hypotheses that contain deep generalisations and are based on his exclusive knowledge of vegetation and his personal direct observations."

According to Yurii Kleopov's student Daryna Dobrochaeva, before his death, the accomplished botanist asked his ex-wife Yevhenia Polonska to take care of his second wife and his younger son. With the support of

Heinrich Walter, both of his wives and his sons were evacuated from Kyiv at the end of 1943. They lived together in Germany in a camp for returnees. After the war Kateryna Domontovich-Kleopova returned with her son Oleksii to Ukraine, while Yevhenia Polonska-Kleopova moved with Leo to Colorado in the United States. Leo Kleopov became a geographer and a cartographer and later moved to Germany. At the invitation of Daryna Dobrochaeva, he came to Kyiv and visited the Institute. The first author of this essay met him during this visit. Leo Kleopov is just as tall and thin as his father was, and he impressed the author of this essay with his erudition and skill at making jokes.

In the Soviet Union, the name of Yurii Kleopov was swept under the carpet and forgotten for a long time because he continued his research when Ukraine was occupied by Nazi Germany. Other botanists could not cite his works or to use his materials. His family members were also forgotten. After the war the name of Yevhenia Polonska was removed from all the herbarium



Yurii Kleopov with his second wife, Kateryna Domontovich.

specimens she had mounted. When she left Ukraine in 1943, Yevhenia Polonska took with her the manuscripts of Yurii Kleopov's undefended dissertation and research papers. She handed them to Heinrich Walter who partly disclosed the views of Kleopov in his monograph "*Die Vegetation Osteuropas, Nord-und Zentralasiens*" (1974).

The immediate intellectual successor to Yurii Kleopov was his student G.M. Zozulin. After the war he published a series of works wherein he described the nemoral forests in the south of the central part of the Russian plain and proposed their genetic classification. Later, based on the concept of "coenoelements", he suggested the idea of the "historical retinue of vegetation" and applied it to the analysis of nemoral forests and other terrestrial types of vegetation (Zozulin 1973). Yu.R. Sheliag-Sosonko later used the ideas of Yu.D. Kleopov to develop a genetic classification of nemoral forests in Ukraine (Sheliag-Sosonko 1974).

Yurii Kleopov made his greatest contribution to botanical science as a flora researcher, taxonomist, geobotanist, botanist-geographer, and flora geneticist. As an expert in the flora of Ukraine and Eastern Europe, he had few rivals. He was a careful and observant taxonomist who described a series of new taxa and had unique ideas and views on the origin of the flora and vegetation of the nemoral forests and steppes of Eurasia. Some of his works long remained only as manuscripts, but are now emerging. Other ideas were only in his mind and unfortunately were never implemented. While Yurii's monumental work was long forgotten except among a small circle of scientists, his impressive contributions are now becoming evident to the greater scientific community and we are honoured to be able to at least partially tell the story behind them.

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Recently defended thesis in Vegetation Science

In this issue we introduce the three recently defended PhD theses in vegetation science provided to the bulletin. You are welcome to present your work to a broad audience of vegetation scientists throughout the world this way. Your message can be published in the forthcoming issues if you send your contribution to monika.janisova@gmail.com containing the following information: 1) Name and affiliation of the student (photo appreciated); 2) Name and affiliation of the supervisor (photo appreciated); 3) Topic of the thesis; 4) Summary of the thesis; 5) Date of defense; 6) Publications related to the thesis.

Ecological assessment of Cantabrian landscapes; A study of soil and vegetation quality at two Biscayan locations

(defended on 22 July 2016 at University of the Basque Country, Bilbao, Spain)



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In the current study the ecological assessment of semi-natural and artificial vegetation types encountered at two sites of the Biscayan territory (North Atlantic Spain) was undertaken. A phytosociologically-based index had been used to examine the landscape in terms of vegetation units. Soil analysis was performed to establish connections between vegetation and topsoil biological qualities, resistance to drought and temperature changes. It was assumed that ecological quality would covary with anthropic pressures that transform landscapes.

Accordingly, the composite index constructed (Conservation Interest) was formed by three sets of

indices based on vegetation, soil quality and territorial need for ecosystem protection. The vegetation index was called “Biological value” and was based on a phytosociological description of the territory, where vegetation was analyzed at a landscape level and classified onto broader “vegetation units”: grasslands, scrublands, forests, plantations -coniferous, *Eucalyptus* and broadleaved- and rural and urban areas. The vegetation and terrestrial need for ecosystem protection indices were derived based upon the experience of the botanist of the Department of Plant Biology and Ecology of the University of the Basque Country. The soil quality index was based on field observations.

Initially, we proposed the use of Conservation Interest index under economic schemes such as the payment for environmental services as a management tool for protected sites, acknowledging the need for a tool based upon ecological functionality of the territory –an ecosystem capacity to function properly- for such economic valuations. We analysed the “Biological value” index in ten quadrats (250 ha) at Golako basin and in all forests (110 ha) present in the Alonsotegi municipality. Results gave a picture of actual anthropic pressure effects upon vegetation: on one side forestry promotes a general landscape homogenisation and low general biological values (<50%), while enhances forest fragmentation processes and reduces forest patch sizes, and on the other livestock decreases forest intrinsic value. Forest low distribution numbers show a high loss risk factor (<6% and 9% real to potential distribution ratio, at Golako and Alonsotegi respectively), with conservation policies not resulting in real protection as only inaccessibility or non-productivity preserves forests. After comparing the Biological value index with forest fragment size, it was found that a minimum patch size of five hectares is necessary to preserve forest ecological functions.

Alonsotegi top soils were assessed under different land uses and after a period of maximum drought. Variables differentiating soil groups were also examined obtaining direct relationships for the percentage of field water content and field capacity for holding water, the per-

centage of water content and organic matter in soils, and porosity and organic matter, and an inverse relationship between percentage of field water content and bulk density and bulk density and organic matter. Presence of organic matter in the topsoil reduces its bulk density and increases porosity, which increases water availability, reducing desiccation effects under drought conditions. *Eucalyptus* plantation was the driest and hottest unit, with high soil metabolic rates and the highest bulk density despite moderate values of organic matter content. Tukey/Kramer analysis results yielded ranking values by vegetation units, which supports the conclusions that actual forestry practices decrease soil capacity for water retention, soil water and organic matter content and therefore reduce soil quality. Finally, high temperature and metabolic rates in *Eucalyptus* plantation soils have a distinct warming effect not seen in deciduous units plantations and forests. Soil quality results show the need to differentiate broad-leaved plantations onto deciduous and evergreen plantations, especially considering that European climate change mitigation policies treat both units equally.

The patterns of landscape quality based on soil and vegetation analysis obtained are concordant with findings of other studies at regional and international level.

The originality of this research is that the same tool is used to compare vegetation units in the study area in a consistent way. This tool would allow future management proposals to be assessed with the aim to achieve an improvement of the ecological value of a territory.

Publications related to the thesis

- Orrantia Albizu, O., Ortega Hidalgo, M. M., Quirós Madrigal, O., & Loidi Arregui, J. (2008). Servicios ambientales del bosque: ensayo en una cuenca atlántica europea con base en la experiencia de Centroamérica. *Revista de Biología Tropical*, 56(4), 2087-2098. http://www.scielo.sa.cr/scielo.php?pid=S0034-77442008000400038&script=sci_arttext&tlng=en
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Lowland landscape at Golako river basin: several farms with orchards, pastures and/or meadows related to them and a main use of plantations of mostly *Pinus radiata* but with an increment in *Eucalyptus* spp. significance.

Traditional management and its impact on the vegetation of open lowland woodlands

(defended on 29 September 2016 at Masaryk University, Brno, Czech Republic)



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Lowland areas in central Europe have been densely inhabited since the Neolithic. Various management practices have profoundly shaped forest ecosystems, including understory plant communities. Coppicing, grazing of domestic animals and collecting of tree litter are considered among the most important historical management types that shaped forest vegetation in the past. The introduction of modern management systems for in the 19th century resulted in the decline of non-timber forest uses; such uses had almost disappeared after 1950 in most regions. As a result, open landscapes were largely transformed to landscapes with the predominance of high forests. To a large extent, the recent

decline of biodiversity, including the decline of light-demanding oligotrophic plant species, was attributed to this change. Remnants of traditionally managed forests often stand out in species richness and host many endangered species. Research based on the resurvey of historical vegetation plots confirmed that biodiversity at such sites was largely maintained by long-term traditional management. This theoretical background has resulted in increased interest in the reintroduction of historical management systems as a means of reversing the decline in biodiversity of plants and other organisms. As there are only few relevant studies on this topic, it is not clear if such measures will truly bring about the expected vegetation changes. There are concerns that reintroduction of historical management can cause adverse effects such as the spread of ruderal and alien species. It is necessary to examine ecosystem responses to assess the suitability of reintroducing traditional management into conservation practice.

The thesis addressed these issues using three experiments established in oak-dominated forests in a lowland region in the south-eastern Czech Republic. The reintroduction of coppice-with-standards, grazing of domestic animals and litter raking was studied by yearly monitoring of understory plant species composition in permanent plots. Additionally, the impact of grazing by wild ungulates was investigated by resurvey of historical semi-permanent plots from the 1960's. Particular attention was given to the response of plant species that are of conservation interest, i.e. light-demanding oligotrophic species. The potential expansion of ruderal and invasive species also was assessed.

Ungulate grazing and coppice-with-standards management led to significant change in species composition, whereas grazing of domestic animals and litter raking had no effect. The effect on species richness was positive across all management types, except for grazing of domestic animals. However, this increase mostly resulted from increases in ruderal species, while other species, and species valuable from the conservation point of view, were not affected. The exception was in the coppice-with-standards experiment where light demanding species benefited from decreased canopy cover.

Disturbances to the topsoil probably played a role in the changes of species assemblages. Such disturbances facilitated the spread of ruderal species, which can quickly disperse and colonize disturbed topsoil. The disturbances were caused directly by the hoofs of grazing animals, rakes during litter raking or indirectly by wild boar in the coppice-with-standards experiment, where it was attracted to the larvae of xylophagous invertebrates in decomposing tree stumps. Ruderal species were probably also facilitated by increased nitrogen mineralization and the resulting higher availability for plants. In the litter raking experiment, an increase in topsoil temperature resulted from the re-



Experimental sites: woodland pasture, coppice-with-standards forest and litter raking experiment.

removal of litter layer, which otherwise acts as a mechanical barrier buffering temperature and humidity fluctuations. Grazing animals probably enhanced the nutrient supply directly by the excretion of mineralized nutrients in the form of urine and feces and also maintained the open forest environment.

Rapid colonization of disturbed habitats and effective utilization of resources, such as light and nutrients, were probably the main attributes of ruderal plants contributing to their success. The lack of response of

other species can be attributed to two causes. Forest species are relatively long-lived and show lower colonization rates and thus respond slower to environmental changes. Therefore, the duration of experiments may not have been long enough to demonstrate a change. Second, insignificant species losses observed across the experiments can be explained by long-term intensive human impact in the lowland areas of Europe. Contemporary vegetation is partly composed of species adapted to disturbances by human management and grazing. Therefore, the reintroduction of such management does not result in further loss of species. Continuation of management and further monitoring is necessary to assess the response of slow colonizers, and to assess if management generally drives the ecosystems towards their historical states.

Publications related to the thesis:

Vild, O., Roleček, J., Hédl, R., Kopecký, M., Utinek, D. (2013): Experimental restoration of coppice-with-standards: Response of understorey vegetation from the conservation perspective. *Forest Ecology and Management* 310: 234–241.

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Syntaxonomical diversity of Strazhata hill, the central part of north Bulgaria

(defended on 12 October 2018 at University of Plovdiv, Bulgaria)



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Until now vegetation diversity of Strazhata hill have not been studied. The purpose of the study was to reveal the syntaxonomical diversity of all vegetation types present. The study area covers about 135 km² and is situated between Gabrovo, Dryanovo and Sevlievo towns in the central part of North Bulgaria. This region is characterized by mountain and semi-mountain relief with diverse soils that are predominantly a mosaic of Luvisol and Rendzic Leptosols. The bedrock type is limestone and there are limited surface water resources provided by the Yantra river, which divides the central part of the study area in half and a karst lake covering an area of about 1 ha. The climate is temperate continental with high summer (May - June) and low winter (January - February) precipitation. There are 4 NATURA 2000 zones as follows BG0000263 Skalsko, BG0000214 Dryanovski manastir, BG0000190 Vitata stena, BG0000610 Yantra river with total cover of 51.4 km² or 39,2% of the territory of the study area.

Materials and methods

During the 2018 summer season 303 phytocoenological reléves following the Braun-Blanquet approach (Braun-Blanquet 1965) were collected. The plot size used for grassland vegetation was 16 m², 64 m² for shrubland and 225 m² for woodland vegetation. All reléves were contributed to the Balkan Dry Grassland Database and (EU-BG-001) and the Balkan Vegetation Database (EU-00-013). The nomenclature of species was standardized according to the Euro+Med PlantBase. Vegetation classes were determined using the EuroVegChecklist Expert System and PC-ORD (McCune & Mefford 1999) classification. Hierarchical clustering was used for classification below the class level - from order to association and community levels. Diagnostic species were determined by calculating the Phi-coefficient (Chytrý et al. 2002). All clusters were standardized to equal size (Chytrý et al. 2006). For all syntaxa diagnostic, constant and dominant species were determined.

Existing syntaxonomical diversity

The syntaxonomical diversity on Strazhata hill is represented by 21 classes, 23 orders, 29 alliances, 30 associations, and 19 plant communities.

Woodland vegetation has the widest distribution in the study area. It is represented by four classes (*Carpino-Fagetea sylvaticae*, *Quercetum pubescentis*, *Salicetea purpureae*, and *Robinietaea*). Class *Quercetum pubescentis* Doing-Kraft ex Scamoni et Passarge 1959, which

is the most common woodland vegetation type, is found mainly on south- and east-facing slopes. It is represented by two associations (*Quercetum frainetto-cerridis* Rudski 1949 Trinajstić et al. 1996 (Fig. 1a), *Carpinetum orientalis* s.l.) and two communities (*Carpinus orientalis-Fraxinus ornus*, *Carpinus orientalis-Hedera helix*).

Class *Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968 includes communities of *Carpinus betulus* and *Tilia platyphyllos*. Those mesophytic forests are found on slopes along the Yantra river and on the north- and east-facing slopes with an inclination between 10° and 45°.

Class *Salicetea purpureae* Moor 1958 is represented by the association *Salicetum fragilis* Passarge 1957, which is found locally along Yantra river and its tributaries.

Class *Robinietaea* Jurko ex Hadač et Sofron 1980 is represented by the association *Chelidonio majoris-Robinietaea pseudoacaciae* Jurko 1963, which arise from *Robinia pseudoacacia* plantations in the region.

Shrubland vegetation is widespread in the territory of Strazhata hill around arable fields, forest edges, and grasslands, buildings, and villages. It is classified to class *Crataego-Prunetea* Tx. 1962 that includes two associations *Pruno spinosae-Ligustretum vulgaris* Tüxen 1952 (Fig. 1b) and *Rhamno cataracticae-Cornetum sanguineae* Passarge 1962.

Wetland and aquatic vegetation is localized in distribution. Class *Potamogetonetea* Klika in Klika et Novák 1941 is represented by the association *Elodeetum canadensis* Nedelcu 1967 which is found on the territory of Belyakovets Karst Lake. In comparison, class *Phragmito-Magnocaricetea* Klika in Klika et Novák 1941 is more widely distributed along the Yantra river and associated ditches. It is represented by two associations *Typhetum angustifoliae* Pignatti 1953 and *Typhetum latifoliae* Lang 1973 (Fig. 1c).

Chasmophytic vegetation is locally found in shady and humid places on cliffs and walls represented by two classes, two associations and one community. Class *Asplenietaea trichomanis* Br.-Bl. in Meier et Br.-Bl. 1934 Oberd. 1977 is represented by the associations *Cystopteridetum fragilis* Oberdorfer 1938 and *Asplenietum rutae-murario-trichomanis* Kuhn 1937 (Fig. 1d), whereas class *Thlaspietea rotundifolii* Br.-Bl. 1948 includes *Geranium macrorrhizum* communities.

Grassland vegetation is widespread in the study area and includes 3 classes (*Festuco-Brometea*, *Molionio-Arrhenatheretea*, and *Trifolio-Geranietaea sanguinei*). Class *Festuco-Brometea* Br.-Bl. & Tüxen 1943 ex Soó 1947 is the most common grassland vegetation type and it is represented by two orders, four alliances, three associations, and ten communities.

Xero-mesophytic grasslands are classified to the alliances *Cirsio-Brachypodium pinnati* Hadač et Klika in



Associations: a — *Quercetum frainetto-cerridis*, b — *Pruno spinosae-Ligustretum vulgaris*, c — *Typhetum latifoliae*, d — *Asplenietum rutae-murario-trichomanis*, e — *Ranunculo-Arrenatheretum*, f — *Calamagrostietum epigei*.

Klika ex Hadač 1944 and *Chrysopogono-Danthonion calycinae* Kojić 1959, whereas dry grasslands are classified to the alliances *Festucion valesiacae* Klika 1931 and *Saturejion montanae* Horvat in Horvat et al. 1974.

Class *Molinio-Arrenatheretea* Tx 1937 includes mesophytic communities used as pastures and meadows. Alliances *Calthion palustris* Tx 1937 and *Deschampsion caespitosae* Horvatić 1930 have are very limited in distribution. In comparison, the alliances *Arrenatherion elatioris* Luquet 1926 and *Cynosurion cristati* Tx. 1947 are widespread and are represented by the associations *Ranunculo-Arrenatherietum* Ellmauer in Mucina et al. 1993 (Fig. 1e) and *Lolio perennis-Cynosuretum cristati* Tüxen 1937, respectively.

The fringe vegetation is localized in distribution and is classified to class *Trifolio-Geranietea sanguinei* T. Müller 1962. It includes two associations *Trifolio alpestri-Geranietum sanguinei* Müller 1962 and *Trifolio medii-Agrimonietum eupatoriae* T. Müller 1962.

Ruderal vegetation is represented by eight classes, ten orders, eleven alliances, nine associations, and five communities. Class *Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow 1951 is found around landfills, cottages and abandoned arable fields. It is represented by *Erigeron annuus-Trifolium michelianum*, *Dipsacus laciniatus*, *Daucus carota* communities and the association *Convolvulo arvensis-Elytrigetum repentis* Felföldy 1943. Class *Epilobietea angustifoliae* Tx. et Preising ex von Rochow 1951 is locally distributed in abandoned pastures and meadows replacing semi-natural grassland vegetation. Its syntaxonomical diversity is represented by three associations - *Calamagrostietum epigei* Juraszek 1928 (Fig. 1f), *Pteridietum aquilini* Jouanne & Chouard 1929 and *Sambucetum ebuli* Felföldy 1942. Classes *Papaverietea rhoeadis* S. Bruno et al. 2001,

Chenopodietea Br.-Bl. in Br.-Bl. et al. 1952 and *Digitario sanguinalis-Eragrostietea minoris* (Mucina, Lososová et Šilc 2016) represent ruderal vegetation developed in arable fields. Class *Polygono-Poetea annuae* Rivas-Mart. et al. 1991 is characterized by trampled vegetation, which is classified to the association *Polygonetum arenastri* Gams 1927 corr. Láníková in Chytrý 2009.

Conclusion

Strazhata hill preserves a high level of syntaxonomical and habitat diversity. Two orders (*Potentilletalia caulescentis*, *Papaveretalia rhoeadis*), one alliance (*Cystopteridion*) and eight associations (*Cystopteridetum fragilis*, *Asplenietum rutae-murario-trichomanis*, *Lolio perennis-Cynosuretum cristati*, *Trifolio medii-Agrimonietum eupatoriae*, *Trifolio alpestri-Geranietum sanguinei*, *Stachyo annuae-Setarietum pumilae*, *Portulacetum oleraceae*, *Chenopodietum strictae*) were registered for the first time for the territory of Bulgaria.

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EDGG Field Workshop team in Feschilju-Schlucht, Leuk, Switzerland, 14.05.19.



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Field Workshop in Switzerland in Leuk, Switzerland, 14.05.19. *Stipa eriocalis* community.



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Excursion course on bryophytes in Central European grasslands was organised during the Eurasian Grassland Conference in Graz, Austria, 31 May 2019. The course was led by Christian Berg and the participants visited Semriach in the Grazer Bergland north of Graz.



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Crambe cordifolia on the foot of the mountain Yutsa, Stavropol Krai, Russia, 06.06.19. Xero-mesic community with *Brachypodium rupestre*, *Stipa pennata*, *Geranium sanguineum* and very high *Crambe cordifolia*, which could be up to two meters height.



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Cultural grassland in the yeard of Ulrichrunn Settlement, Semriach, Austria, Styria with *Leucanthemum vulgare*, *Tragopogon orientalis*, *Campanula patula*.



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Poster session during the Eurasian Grassland Conference in Graz, Austria.

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