ЕКОЛОГІЧНЕ ҐРУНТОЗНАВСТВО

UDK 631.4

A. P. Travleyev, N. A. Bilova

SCIENTIFIC PRINCIPLES OF FOREST SOIL BIODIVERSITY RESEARCH

O . Gonchar Dnipropetrovsk National University

Fundamental soil properties defining their genetic biodiversity in compliance with the types of biogeocoenotic systems are stated.

Key words: soil, biodiversity, biogeocoenotic systems.

А. П. Травлеев, Н. А. Белова

Днепропетровский национальный университет им. О. Гончара

НАУЧНЫЕ ПРИНЦИПЫ ИССЛЕДОВАНИЯ БИОРАЗНООБРАЗИЯ ЛЕСНЫХ ПОЧВ

Излагаются основные свойства почв, которые определяют их генетическое биоразнообразие в соответствии с типами биогеоценотических систем.

Ключевые слова: почва, биоразнообразие, биогеоценотические системы.

А. П. Травлєєв, Н. А. Білова

Дніпропетровський національний університет ім. О. Гончара

НАУКОВІ ПРИНЦИПИ ДОСЛІДЖЕННЯ БІОРІЗНОМАНІТТЯ ЛІСОВИХ ҐРУНТІВ

Наводяться основні властивості ґрунтів, які визначають їх генетичне біорізноманіття у відповідності до типів біогеоценотичних систем.

Ключові слова: ґрунт, біорізноманіття, біогеоценотичні системи.

Forest biogeocenoses passing through natural selection have perfect structural and functional arrangement, ensuring exchange material-energy processes and self-regulation of living creatures' biodiversity in ecosystem. Eventually integrity of biodiversity provides persistent biological cycle inherent in ecosystem.

Trophic structure and trophic function are presented in ecological pyramid form, the base of it is the first level – the level of producers; phytophages and zoophages of different order form the following levels.

Consortiums work on the principle, where multiplicity of pyramids reflected complex net of consortium relations of different types and levels form eventually synthetic integrated ecological pyramid characterizing biogeocenosis with its cycle of matters and energy flow.

Biodiversity of organisms occupying certain ecological (trophic) niche provides functioning of system. Sharp reduction of specific diversity leads to destruction of trophic relations, ecological niches, to impoverishment of biogeochemical exchange, to degradation of ecosystem and finally to collapse and death of biogeocenosis system.

Ch. Darvin told about biodiversity in "Origin of species".

For the argument of biological diversity of organisms origin Ch. Darvin used different breeds of animals and plants and showed that natural selection sequent of struggle for existence can only act for the benefit of the orgaism. "But to fully understand the action of natural selection we need to imagine, if possible, a complete picture of the universal struggle between the organic beings." (Timiryazev, 1905, p.128)

Biodiversity issues were studied by N.I. Vavilov (1921, 1931) in his classical works "Linnean Species as a system" and "The law of homology series in genetical mutability". Species composition reveals quite clearly the marks of parallelism in genetical mutability of allied species, allied generations, within the whole families.

Therefore, the basic rightness defining hereditary structure of Linnean species, its system N.I. Vavilov named "the law of homology series". Linnean species (Komarov, 1927) is a morphological system multiplied by geographical definiteness.

Linnean species, by definition of N.I.Vavilov, is an isolated complex mobile morphophysiological system connected in its genesis with certain environment and area, complied the law of homological series in its intraspecific genetical mutability.

Complex biogeocenosis system (type of forest biogeocenosis) is formed of species which correspond to ecotypes – groups of biotypes within the same Linnean species united near the hereditary constant characters and adapted to concrete conditions of habitation. Environment, by Vavilov, may further or destroy the development of species system. In consortium system subject to conditions of habitation, to anthropogenic press level on the basis of homological series the colossal form variety could be recognized, thousands of new types, races, unknown to science, could be discovered and have great practical interest. And, finally, the most interesting fact is geographism.

It is known that the position in conditions of certain climatic zone is determined by ecotope – type of habitat. Hence the zonality impact on biodiversity of plants and animals species occurs. S. A. Direnkov, V. N. Fedorov, C. O. Grigoryeva (1981) established, that species diversity of plant associations of aboriginal taiga spruce forests is joined at first with trophic habitat conditions, then – with variability of ecological conditions and, finally, with edificatoric characteristics of certain species in basic layers of cenoses. When we question inevitability of forest podzolic soil formation – we take into account the geographism, geographic specificity. The truth is clear: the plant impact on the soils is not biogenic, but bioclimatogenic (Zonn, 1964). New generated paradigm in soil science and biogeocenology: properties ← processes ← factors, when the researcher examines the influence of factors through processional block (blackbox), which is controlled by ecological system developing in certain physiographic zone environment, is a "cornerstone" of ecology, biogeocenology and nature conservation. Here the resources and properties of structural-functional organization of biogeocenosis, its exchange of materials and energy are appeared. Mentioned consortium, structural-functional formations in nature first were developed by V.N.Beklimishev (1951) and L.G.Ramensky (1952).

Developing the ideas of consortium biological diversity in biogeocenosis T.A.Rabotnov (1973), V.V.Mazing (1976) suggested the scheme of consortium ctructure. Consortium associates organisms – consorts, joined in their activity with certain autotrophic non-epiphitic plant-determinant.

It is known that structural-functional organization of biogeocenosis is formed of spatial and functional (Dilis, 1964; Byallovich, 1973; Manuel Angel Duenas Lopes, Yose Vanuel Recio Espejo.- 2000). Studying biodiversity we analyse vertical structure – biogeohorizons (laterals, radials, biogeomasses) and horizontal (parcels, catenas, etc.).

Functional structure of biogecenosis is presented by consortiums. Consortiums and usable by organisms constituent stagnant environment could be considered as primary biostagnant unit, composing biogeocenoses (Rabotnov, 1974). In consortiums the groups of species are concentrated. They are formed as a result of conjugated evolution, consisting of coenotic population of autotrophic plant and of dependent on it organisms, generally of trophically dependent heterotrophs. It should be noted that conjugacy, by A.A.Uranov (1931), is a parallel change in quantity of two species in the same cenosis. He recognized: negative conjugacy, positive, two-figure and indifferent, and he also established competitive conjugacy.

Structural-functional organization of different life forms generates biological diversity of its components, which is determined by heredity, variability, natural selection defining "appropriateness" which ensure ecological accordance of organisms to habitat conditions.

Unfortunally scientific-and-technological advance does not always develop in a balanced manner sparing the interests of natural environment, preserving its multiform system organization. When we suggest fastness of forest biogeocenosis, we mean the fastness, vitality of its species biodiversity, which provides functional life activity of all holocoenotic system, of soil and biogeocenosis.

When the destructive factors (lack of care, ungrounded cuttings, overpasturing, fires, underfloodings, pesticide poisoning, etc.) influence on a forest biogeocenosis, ecological niches are being destroyed, the trophic relations are being interrupted, species composition is decreasing. Monocoenosis (Belgard, 1971) replaced by amphicoenosis, in which the divergence of cycles is happened (Sibirtsev, 1914).

Here two or sometimes several types of matter cycles and energy flow are crossed: forest and steppe, steppe and semidesert; in other cases - semidesert and desert, forest and marsh, meadow and saline, etc. Ecological pyramids, biological matter cycle become deformed, go to ruin. Former biogeicenoses together with their soil are replased with new ecosystems, extrinsic for steppe nature.

Under optimal species composition of biota forest associations and soils, rich in their diversity, are formed. Forest soils are the most interesting; they have perfectly unique biogeochemical and classification properties, worthy of recording in Red data book of soils. Their biological diversity appear on kingdom, division, association, family, type, subtype, generation, species, variety, rank levels (Tichonenko, 2001).

The processes of desertification (other destructive phenomena) reduce species diversity of forest associations and the diversity of forest steppe zone soils where the manifestation of type, subtype, generic features concentrates. Forest soils are divided into groups according to depth of humus horizon, humus content, leaching degree, alkalinity, salinization, destruction, eroding, depth of carbonate bedding, groundwater level.

Desertification deforms characteristics, peculiarities of evolution and genesis of forest biogeocenosis, created over a period of long history of its existence.

Spesial meaning we give to works of N.A.Dimo. He was one of the first who discovered forest chernozem in forests of Moldavia.

Our long-term researches (Belgard, Zonn, Karpachevsky, Krupenikov, Travleyev, Bilova and others) show clearly, that forest vegetation does not have fatal inevitability to podzolize the soils. Accumulation of humus and cindery matters is inherent for forest as well as for steppe vegetation. Quite interesting information K.B. Novosad (2001) adduces in his works. He discovered and corroborated not only the absence of degradation processes under the forest vegetation in wooded steppe, but also its positive role that set conditions for forest chernozem formation under forest canopy.

Protection of biota and soils biological diversity is dictated by necessity of Ukrainian natural environment preservation. Generated biological diversity of forest soils in steppe is a great national heritage. It is known how excited was V.V.Dokuchaev when created (with the help of V.I.Vernadsky) Russian section in Paris, where for the first time the soils of then Russia, chernozems in the first place, were presented. In October 1900 V.I.Vernadsky reported from Paris that on the exhibition the collection of soils got a gold medal. Dokuchaev obtained the world recognition of his genetic soil science.

At present, when 118 years passed after the appearance of Docuchaev's Russian chernozem in the world, considerable negative changes happened in soil cover of steppe zone of Ukraine and Moldova. Once the curator of V.P.Viliams Soil Museum of K.A.Timirjazev Agricultural Academy – N.P.Kolpenskaja (disciple of V.P.Viliams) – persuaded us in necessity of ravine forest chernozem samples delivery for replenishment of museum collection. In many museums of Ukraine there are collections of soils of our country. But even the most perfect keeping of soils, delicate herbarium could not be like a natural soil and plant cover of a region. It could be only a witness of former flora and vegetation as monitoring value for ecologists.

It is necessary to pay attention to preservation of biological diversity of soils, plant species, animals, microorganisms straight in nature. Conservation of unique worldwide famous Samara forest is sacred duty of steppe Dnieper residents.

In Samara biospheric station of DNU by Cabinet Council of Ukraine the wildlife preserve is established with the aim of conservation of biological diversity of ravines and small woods, floodplain forests, meadows, marshes, lakes Samara region, forest and forest-improved chernozems.

Only in Samara area we discovered 111 forest associations worthy of recording in green book of forest associations and more than 240 soil individuals which are of great historical-geographical and genetic-evolutional interest.

Uniqueness of biological diversity of forest associations and soils consists is in the fact that ravine forests, growing in steppe zone with peculiarity of water deficiency, being under the cross influence of other environment factors, form types of forest and soil of great biological potential. Methodological base of steppe forest biogeocenoses restoration and preservation is to direct scientific and practical forces for conservation for future generations still extant unique forest associations and forest chernozems, for ability not to allowed the destruction of consortiums, trophical pyramides, biological cycles, to prevent desertification of natural environment of our region.

It is known that as early as 1989 ecological programme of U.N.O. (UNEP) was the initiator in preparation of global Convention on biological diversity. In 1992 in Rio (de) Janeiro (Brasil) the Convention was accepted on the conference of U.N.O. on environment and development. In Constitution of Ukraine nature and environment conservation issues are elucidated in 9, 13, 16, 66 articles.

Convention is ratified by Supreme Council of Ukraine on November, 29th 1994.

Biological diversity, its preservation has not only conservation aspect, but social, connected with mentality of Ukrainian people, with its history and fortunes of future generations.

REFERENCES

Адерихин П. Г. Влияние лесной растительности на черноземы П. Г. Адерихин, А. Л. Бельгард, С. В. Зонн, И. А. Крупеников, А. П. Травлеев / Русский чернозем. 100 лет после Докучаева. – М. : Наука, 1983. – С. 117-126.

Белова Н. А. Лес и степные почвы / Н. А. Белова, А. П. Травлеев. – Д. : ДНУ, 2000. – 345 с.

Бельгард А. Л. Степное лесоведение / А. Л. Бельгард. – М. : Лесная промышленность, 1971. – 335 с.

Бяллович Ю. П. Системы биогеоценозов / Ю. П. Бяллович // Биогеоценотические основы теории системы лесов. – М. : Наука, 1973. – С. 37-47.

Вавилов Н. И. Закон гомологических рядов в наследственной изменчивости / Н. И. Вавилов // Сельское и лесное хозяйство. – 1921. – № 1-3. – С. 84-99.

Вавилов Н. И. Линеевский вид как система / Н. И. Вавилов // Тр. по прикл. бот., ген., и сел. – 1931. – Т. XXVI, вып.3. – С. 109-134.

Дарвин Ч. Происхождение видов путем естественного отбора / Ч. Дарвин // Сочинения. Т. 3. – М. ; Л. : Изд-во АН СССР, 1939. – 832 с.

Димо Н. А. Почвы Молдавии, задачи изучения и главнейшие особенности / Н. А. Димо. – Кишинев : Картя Молдовеняскэ, 1958. – 24 с.

Зонн С. В. Высокогорные лесные почвы восточного Тибета / С. В. Зонн. – М. : Наука, 1964. – 235 с.

Зонн С. В. Географо-генетические аспекты почвообразования эволюции и охраны почв / С. В. Зонн, А. П. Травлеев. – К. : Наук. думка, 1989. – 220 с.

Зонн С. В. Алюминий. Роль в почвообразовании и влияние на растения / С. В. Зонн, А. П. Травлеев. – Д. : ДГУ, 1992. – 224 с.

Мазинг В. В. Что такое структура биогеоценоза / В. В. Мазинг // Проблемы биогеоценологии. – М. : Изд-во Наука, 1973. – С. 148-156.

Медведев В. В. К вопросу об использовании баз данных в агропочвоведении / В. В. Медведев, Т. Н. Лактионова и др. / Вісник ХДАУ, серія «Грунтознавство, агрохімія, землеробство, лісове господарство». – 2001. – № 3. – С. 79-82.

Новосад К. Б. Еволюція чорноземів типових глибоких південно-східного Лісостепу України під різними фітоценозами / К. Б. Новосад / Вісник ХДАУ : зб. Нук. пр. / Харк. Держ.аграр. ун-т. – 2000. – № 1. – С. 143-153.

Работнов Т. А. Некоторые вопросы изучения почвы как компонента биогеоценоза / Т. А. Работнов // Вестник МГУ. – 1974. – № 3. – 1974. – С. 10-18.

Сибирцев Н. М. Почвоведение / Н. М. Сибирцев. – СПб., 1914. – 504 с.

Тимирязев К. А. Чарльз Дарвин и его учение / К. А. Тимирязев. – М. : Типо-литография Т-ва И. Н. Кушнеров и К, 1905. – С. 128-129.

Тихоненко Д. Г. Про класифікацію грунтів України / Д. Г. Тихоненок / Вісник ХДАУ, серія "Грунтознавство, агрохімія, землеробство, лісове господарство. – 2001. – № 3. – С. 33-39.

Уранов А. А. О сопряженности компонентов растительного ценоза / А. А. Уранов // Уч. Записки Моск. госуд. педагог. ин-та. – 1931. – С. 59-85.

Шеляг-Сосонко Ю. Р. Концептуальні засади наукового розуміння біорозмаїття / Ю. Р. Шеляг-Сосонко, І. Г. Ємельянов / Конвенція про біологічне розмаїття: громадська обізнаність та участь. – К., 1997. – С. 11-23.

Duenas Lopes M. A., Recio Espejo J. M. Bases ecologicas para la restauracion de los humedales de La J anda (Cadiz, Espana). – Servicio de Publicaciones Universidad de Cordoba, 2000. – P. 433-445.

Надійшла до редколегії 08.12.10