NAVOI STATE UNIVERSITY

BEK13412 BIOECOLOGY — COURSE SYLLABUS

Faculty of Natural Sciences & Medicine | Department of Biology | Program: 60520200 Ecology & Environmental Protection

COURSE PASSPORT & ACADEMIC METADATA

Course Title: Bioecology

Course Code: BEK13412

Course Type: Mandatory

Field of Study: 500000 Natural Sciences

Field: 520000 Environment

Program: 60520200 Ecology & Environmental Protection

Academic Year: 2026–2027

Semesters: 3 & 4

Form of Education: Full-time

Language: Uzbek

Total Workload Allocation: 180 Hours Contact (Lectures, Practical, Lab) + Independent Study |

Credits: 6 ECTS

Aligned UN SDGs: SDG 15 (Life on Land), SDG 14 (Life Below Water), SDG 13 (Climate Action)







1. Course Description & Biological Systems Focus

Bioecology examines organism-environment interactions across all biological levels (individual, population, community, ecosystem, biosphere). The course covers autecology, synecology, physiological adaptations, poikilothermic/homeothermic survival tactics, ecosystem energy dynamics, biocoenosis structure, Vernadsky's biosphere doctrine, and bio-monitoring.

In alignment with SDG 15 and 14, students gain field and laboratory skills in bioindication, ecotoxicology, population demography, and biodiversity conservation strategies for terrestrial and aquatic organisms.

2. Course Aims & Scientific Competencies

Course Aim: To provide comprehensive theoretical knowledge and practical skills in organismic adaptations, ecological factor analysis, biocoenotic interactions, bio-monitoring, and ecosystem conservation.

- Autecological & Synecological Competency: Analyze abiotic/biotic factor limits, limiting factors, ecological niches, population dynamics, and biocoenotic stability.
- Laboratory & Bio-Indication Skills: Conduct hydrobioindication, lichenoindication, soil ecotoxicology, leaf asymmetrical fluctuation analysis, and bio-assays.
- Biosphere & Monitoring Competency: Understand Vernadsky's living matter theory, biogeochemical cycles, ecological forecasting, and Red Data Book conservation.
- SDG Competencies: Develop sustainable conservation plans for endangered endemic species and resilient ecosystem management (SDG 15).

3. Prerequisites

Prerequisites: General Zoology, General Botany, Cytology, General Chemistry, Physical Geography.

4. Course Structure & Workload Allocation

Semester / Activity	Curriculum & Laboratory Focus	Workload Allocation
Semester 3: Autecology & Abiotic Factors	Lectures, Practical & Lab Bio-Assays	Contact Hours
Semester 4: Synecology & Biosphere Dynamics	Lectures, Practical & Lab Bio-Assays	Contact Hours
Independent Research & Field Projects	Bio-Monitoring, Endemics & Climate Studies	Self-Directed Hours
Total Workload (Full Module)	2-Semester Comprehensive Module	180 Hours Contact + Self-Study

5. Detailed Course Curriculum Outline

5.1 Lecture Syllabus Outline

• **L1: Introduction & Scope of Bioecology:** Subject, history, Linnaeus and Uzbek scholars' contributions to bioecology.

• **L2: Organism-Environment Interactions & Abiotic Factors:** Abiotic drivers, limiting factors, and cardinal points in producer/consumer life cycles.

• **L3: Convention on Biological Diversity (CBD) & Producers:** Producer organisms, habitats, abiotic/biotic factor interactions, and CBD goals.

• **L4: Light as an Ecological Factor:** Solar radiation, photosynthesis, photoperiodism, and ecological plant/animal light groups.

• **L5: Temperature Regimes & Thermal Adaptations:** Temperature impacts on physiological processes, poikilotherms vs. homeotherms.

• **L6: Moisture Regimes & Aquatic Ecology:** Water balance, xerophytes/hydrophytes, water scarcity, and ecological role of water.

• **L7: Atmospheric Gas Balance & Gas Exchange:** Oxygen/carbon cycles, atmospheric composition, and terrestrial gas exchange dynamics.

• **L8: Edaphic & Soil Ecological Factors:** Soil acidification, forest degradation, mineral nutrient cycling, and soil physical properties.

• **L9: Orographic Factors & Topography:** Slope orientation, elevation belts, aspect, and topography effects on vegetation cover.

• **L10: Biotic Factors & Interspecific Relationships:** Symbiosis, mutualism, competition, predation, parasitism, and stress factors.

• **L11: Human Impacts & Agro-Biodiversity:** Anthropogenic pressure on producer communities, ecosystem stability, and new crop breeding.

• **L12: Adaptation Mechanisms of Poikilotherms & Homeotherms:** Morphological, physiological, and behavioral thermoregulation adaptations.

• **L13-14: Protected Areas: Reserves, National Parks & Sanctuaries:** IUCN categories, zapovedniks, national parks, nature monuments, and human-nature ethics.

• **L15: Environment Protection & Biodiversity Preservation (Sem 4):** Legal aspects of nature protection, ethological, morphological, and physiological adaptations.

• **L16: Population Ecology & Structural Dynamics:** Population definition, density, birth/death rates, age structure, spatial distribution, and stability.

• **L17-18: Biological Communities (Biocoenoses):** Community concepts, functional structure, interspecies interactions, and ecosystem classification.

• **L19: Vernadsky's Biosphere Doctrine & Living Matter:** Biosphere concept, living matter functions, population dynamics, and migration drivers.

• **L20: Ecosystem Dynamics & Regional Eco-Problems:** Central Asian socio-ecological challenges, Aral Sea disaster, and environmental monitoring.

• **L21: Environmental Impact Assessment & Economic Policy:** Ecological expertise, forecasting, natural resource economics, and green political frameworks.

• **L22: Concept of Sustainable Development in Uzbekistan:** National sustainable growth strategy, biosphere-noosphere transition, and ecological safety.

5.2 Practical & Seminar Discussion Outline

- Sem 3: Branches and research methodologies of ecology; Biosphere structural analysis.
- Sem 3: Ecosystem structural modeling and landscape classification/ecological roles.
- Sem 3: Quantifying population spatial and numerical indices under environmental stress.
- Sem 3: Abiotic, biotic, and anthropogenic factor analysis; Biocoenotic diversity measurement.
- Sem 3: Evaluating environmental factor impacts on human health; Ecological safety frameworks.
- Sem 3: Agricultural ecology: Cultivating eco-friendly agricultural products and food safety.
- Sem 4: Environmental monitoring networks and international environmental cooperation.
- Sem 4: Environmental legislation and legal enforcement in nature protection.
- Sem 4: Atmospheric protection protocols and air quality monitoring systems.
- Sem 4: Water resource conservation and soil/land protection strategies.
- Sem 4: Flora and fauna conservation; Red Data Book classification and endangered species protection.

5.3 Laboratory & Field Diagnostics Outline

- Sem 3: Determining environmental abiotic parameters; Ecotoxicology and bio-testing protocols.
- Sem 3: Assessing ecological significance of indoor plants and plant physiological ecology.
- Sem 3: Hydrobioindication: Evaluating water quality using aquatic bioindicator organisms.
- Sem 3: Measuring atmospheric dust deposition and ambient noise levels in urban zones.
- Sem 3: Visual and chemical assessment of water pollution; Soil mechanical texture & bioindication.
- Sem 4: Analyzing biosphere water circulation and natural water body chemical testing.
- Sem 4: Waste categorization, ecological analysis, and identifying recyclable materials.
- Sem 4: Determining population age structure and studying ecological culture & behavior.
- Sem 4: GIS ecological mapping: Identifying regional hot spots and proposing mitigation measures.

5.4 Independent Study & Analytical Projects

- Sem 3: Theoretical analysis of green building technologies and urban microclimate optimization.
- Sem 3: Plastic pollution crisis: Environmental impacts and eco-friendly biodegradable alternatives.
- Sem 3: Industrial ecotoxicology: Analyzing and assessing industrial environmental risks.
- Sem 3: Compiling water pollutant discharge data and municipal solid waste management plans.
- Sem 4: Ecological analysis of endemic and endangered flora/fauna species in Uzbekistan.
- Sem 4: Global climate change impacts on Central Asian biodiversity and range shifts.
- Sem 4: Formulating actionable regional biodiversity conservation proposals for protected areas.

6. Recommended Literature & Information Sources

- Boyirov Z.R., Kilicheva D.I. Environmental Biology (Study Guide). Qarshi, 2024.
- Boyirov Z.R. Fundamentals of Environmental Management (Textbook). Qarshi, 2024.
- Fisher M.R. Environmental Biology. Oregon Coast Community College, 2026.
- Ergashev A.E. General Ecology. Tashkent: O'qituvchi, 2003.
- Schulze E.D. et al. Plant Ecology. Springer, 2005.