Environmental threats of the Central Asia region

The 1st summer school within the framework of the program “We have only one planet”

12th-15th October 2012, Warsaw
The summer school “Environmental threats of the Central Asia region. Lectures, workshops, discussions – developing methods of teaching about ecosystem services” is taken under patronage by
His Magnificence Rector of the University of Warsaw
professor Marcin Pałys
WELCOME ADDRESS

The summer school “Environmental threats of the Central Asia region. Lectures, workshops, discussions – developing methods of teaching about ecosystem services” is a part of an ongoing summer school series, which focuses on global environmental problems from the perspective of the European Union members, as well as the countries from Eastern Europe and Central Asia. The oncoming meetings integrate plenary presentations, workshops and round-table discussions for a comprehensive examination of environmental threats in the Central Asia region. This school addresses issues related to the identification and evaluation of scientific knowledge that can be used to solve a broad range of environmental problems.

Some of the Participants: National University of Uzbekistan, Institute of Geology and Geophysics (Uzbekistan) and Institute of Soil Science (Kazakhstan), worked formerly in the FP 6 project SYR DARYA coordinated by the University of Warsaw. The cooperation in this project was very effective, which gave us hope for the fruitful work in the future.
During the final conference of the SYR DARYA project, the consortium suggested the necessity of further cooperation and investigations on the Central Asian territory, which is the model area for biodiversity threats of the human-changed ecosystems. This school is one of many interesting results of our further cooperation.

On behalf of the Organizing Committee and the Executive Board, this is my honour to invite You to the 1st thematic summer school “Environmental threats of the Central Asia region”, which takes place in Warsaw, on 12th - 15th of October 2012.

Małgorzata Suska -Malawska
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Bogusław Wilkomirski professor, Department of Plant Ecology and Nature Protection, University of Warsaw, Poland
TABLE OF CONTENTS

1. Schedule summary
2. General information
3. Detailed program
4. Our lecturers
5. Summer school compendium
6. Excursion site: Białowieża National Park

ORGANIZING COMMITTEE

Agnieszka Krzyk
Monika Mętrak
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Beata Zając
Ewa Kral
Iwona Jasser
<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Place</th>
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<tbody>
<tr>
<td>Opening of the summer school</td>
<td>10:00 – 10:15</td>
<td>room 103B, 1st floor</td>
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<tr>
<td>Lecture by Kristina Toderich</td>
<td>10:15 – 11:45</td>
<td>room 103B, 1st floor</td>
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<td>Coffee break</td>
<td>11:45 – 12:15</td>
<td>main hall, 1st floor</td>
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<td>Lecture by Natalya Marmazinskaya</td>
<td>12:15 – 13:45</td>
<td>room 103B, 1st floor</td>
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<td>Warm lunch</td>
<td>14:00 – 15:30</td>
<td>main hall, 1st floor</td>
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<tr>
<td>Presentation by Monika Mętrak and Agnieszka Krzyk</td>
<td>15:45 – 16:45</td>
<td>room 103B, 1st floor</td>
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<td>Open discussion</td>
<td>16:45 – 19:00</td>
<td>room 103B, 1st floor</td>
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<td>Welcome reception</td>
<td>19:00 – 21:00</td>
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<td>Lecture by Azimbay Otarov</td>
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<td>Coffee break</td>
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<td>main hall, 1st floor</td>
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<td>Lecture by Mariya Ibraeva</td>
<td>11:30 – 13:00</td>
<td>room 103B, 1st floor</td>
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<td>Lecture by Maxim Petrov</td>
<td>13:00 – 14:30</td>
<td>room 103B, 1st floor</td>
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<td>Warm lunch</td>
<td>14:30 – 16:00</td>
<td>main hall, 1st floor</td>
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<td>Short lecture by Bogusław Wilkomirski</td>
<td>16:00 – 17:00</td>
<td>room 103B, 1st floor</td>
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<td>Open discussion</td>
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<tr>
<th>Event</th>
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<th>Place</th>
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<tr>
<td>Workshops for executive board</td>
<td>10:00 – 12:00</td>
<td>Professors’ room, 4th floor</td>
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<tr>
<td>Coffee break</td>
<td>12:00 – 12:30</td>
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<td>Round-table discussion for executive board</td>
<td>12:30 – 14:30</td>
<td>Professors’ room, 4th floor</td>
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<td>Summary meeting</td>
<td>14:30 – 15:30</td>
<td>Professors’ room, 4th floor</td>
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<td>Closing of the summer school</td>
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<td>Excursion to the Białowieża National Park</td>
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### GENERAL INFORMATION

**Venue:**

All activities during the summer school “Environmental threats of the Central Asia region” will be held at the Faculty of Biology of the University of Warsaw, Miecznikowa 1.

In the year 2000 the Faculty of Biology was transferred into a modern building situated amidst a beautiful park in the quiet Ochota district. Fully equipped labs, huge library and friendly canteen enable students and employees to carry advance research in warm and inspiring atmosphere.
DETAILED PROGRAM

12.10. (Friday)

10:00 – Opening address of the summer school “Environmental threats of the Central Asia region. Lectures, workshops, discussions – developing methods of teaching about ecosystem services.” – prof. Agnieszka Mostowska, Dean of The Faculty of Biology
10:15 – “Domestication of under-utilized wild fodder and medicinal halophytes for improvement of degraded desert marginal lands and better livelihood of agropastoralists in Central Asia” lecture by Kristina Toderich, Ph.D.
11:45 – coffee break
12:15 – “Threats for mammals in Uzbekistan and measures of their preservation on an example of two species – Goitred Gazelle (Gazella subgutturosa) and Buchara Deer (Cervus elaphus bactrianus)” lecture by Natalya Marmazinskaya Ph.D.
14:15 – warm lunch
15:45 – „Broken dreams and hidden treasures – discovering Central Asia” presentation by Monika Mętrak Ph.D. and Agnieszka Krzyk M.Sc. – outcomes of an official visit of the Polish academic teachers to the National University of Uzbekistan (Tashkent) and Institute of Soil Science and Agrochemistry (Almaty, Kazakhstan)
16:45 – “Solving problems of Central Asia: Building knowledge by research” open discussion presenting up-to-date knowledge on environmental threats in the region with K. Toderich, N. Marmazinskaya, A. Otarov, M.Ibraeva M. Petrov (chairperson: Monika Mętrak)
19:00 – Welcome reception

13.10. (Saturday)

9:30 – “Modern condition of topsoils in Kazakhstan - main ecological problems and their solutions” lecture by Azimbay Otarov Ph.D.
11:00 – coffee break
11:30 – “Issues of organic matter in irrigated soils of Kazakhstan” lecture by Mariya Ibraeva Ph.D.
13:00 – “Climate impact on glacial-ecologic situation in the upstream of Pskem river basin (Western Tian-Shan, Uzbekistan)” lecture by Maxim Petrov Ph.D.
14:30 – warm lunch
16:00 – “History and future of student exchange between Poland and the Central Asian Countries” – short lecture by prof. Bogusław Wiłkomirski

17:00 – “Exchanging ideas – how exchange of students and employees can influence methods of teaching” open discussion with K. Toderich, N. Marmazinskaya, A. Otarov, M. Ibraeva, M. Petrov (chairperson: Bogusław Wiłkomirski)

14.10. (Sunday)
10:00 – “Solving problems of Central Asia: Raising social awareness by complex education” workshops for the members of the executive board (chairperson: Małgorzata Suska – Malawska)
12:00 – coffee break
12:30 – “Modern methods of education in teaching environmental management and ecosystem services” – round-table discussion for the members of the executive board (chairperson: Agnieszka Krzyk)
14:30 – summary meeting and closing comments
15:30 – closing of the summer school “Environmental threats of the Central Asia region. Lectures, workshops, discussions – developing methods of teaching about ecosystem services.”

15.10. (Monday)
09:00 – Excursion to the Białowieża National Park and the Geobotanical Station of the Faculty of Biology
OUR LECTURERS

Mariya Ibraeva Ph.D., Institute of Soil Science and Agrochemistry, Almaty, Kazakhstan, ibraeva@netmail.kz
Mariya is an expert in the field of irrigated soils, halophytes, and chemical properties of cultivated soils. Together with Azimbay, they participated in an international project INCO-Copernicus “Improvement of irrigation management in the Syr Darya delta” as experts on landscape – ecological monitoring in the natural and degraded regions of Kazakhstan.

Natalya Marmazinskaya Ph.D., Samarkand State University, WWF, Uzbekistan, n-marmazinskaya@rambler.ru
Natalya is a zoologist, working as an expert on Bukhara deer (Cervus elaphus bactrianus) and goitred gazelle (Gazella subgutturosa) in the WWF Central Asia Program “Supporting conservation of Bukhara deer (Cervus elaphus bactrianus) in natural habitats”. Her field of studies are endangered species of birds and mammals in Central Asia. She also works as an academic teacher at the Samarkand State University.

Azimbay Otarov Ph.D., Institute of Soil Science and Agrochemistry, Almaty, Kazakhstan, azimbay@bk.ru
Azimbay has worked for 25 years dealing with the problem of fertility, reestablishment, rational use and conservation of irrigated soils, ecology of vegetation and contamination of soil with radio nuclides and heavy metals. Now he is a head of the Institute of Soil Science, where together with Mariya, they perform their academic work with Ph.D. students.
Maxim Petrov Ph.D., Institute of Geology and Geophysics, Academy of Sciences of Republic Uzbekistan, maxpetr3@rambler.ru
As an expert glaciologist, Maxim is a head of Glacial Geology Laboratory, where he deals with glacial geomorphology, mountain hydrology and Pleistocene geochronology. In his research, he widely uses GIS-technology. As a participant of NATO Cooperative Linkage Project, Maxim was also involved in studying the changes of physical and chemical parameters of the drying Aral Lake. Apart from his scientific work, he is one of the coordinators of student scientific exchange with Germany.

Kristina Toderich Ph.D., Regional Representative of the International Center for Biosaline Agriculture, CGIAR-PFU ICARDA regional office, Tashkent and Samarkand State University, Uzbekistan, ktoderich@yahoo.com
Kristina is a botanist specializing in biometric studies of morpho-anatomical features of arid plant population, and dynamics, ecology and conservation of semi-desert ecosystems. In her research she focuses on halophytic plant communities and domestication of wild halophytes that can be used for fodder production. She also works on reclamation of saline prone and waterlogged soils. She passes her field experience to many home and foreign students.
Causes of the Aral Lake disaster

The Aral Lake, once the fourth biggest lake in the world, was an oasis for plants, animals and people, located in the middle of a hostile desert on the Kazakh-Uzbek border. In the 1940-ties construction of irrigating channels had begun. These channels led waters from the rivers Syr Darya and Amu Darya into newly established agricultural regions, where rice, melons, grains and, mostly, cotton – the white gold – were planted. Unfortunately, quickly built channels were defective – even 75% of carried water irreversibly evaporated or leaked out into the hot desert sands. Both Syr and Amu Darya fed the Aral Lake, therefore the water level in this waterbody dropped quite fast – in the years 1960-2000 the surface of the lake decreased by 60%. Simultaneously, salinity of the lake increased tenfold, which resulted in extinction of its plants and animals. Exposed lake sediments started to erode quickly and huge amounts of dust were emitted into the air. The dust turned out to be toxic, because waters from the fields enriched the lake and its sediments in pesticides, including DDT. Frequent dust emissions deteriorated general heath of local population, leading to higher mortality and incidence of diseases. Nowadays, consequences of the Aral Lake disaster begin to be mitigated – in 2005 the Kokaral Dam was operational and resulted in an increase of water level in the northern part of the Aral Lake.
Nature-climatic conditions and water resources of the southern areas of Kazakhstan

Intensive development of irrigated agriculture in the basin of the river Syr Darya, especially in the middle reaches of the river, has led to considerable reduction of water resources in that region. The volume of the runoff decreased to 3.0 km$^3$ during the years of intensive land development between the hydro posts Shardara and Tomenaryk. The water resources of the river Keles were exhausted in the 1960-ties. Therefore, the influence of Keles massif on the reduction of Syr Darya river runoff was estimated by the increase of water intake volume from the river Chirchik by the canals Zakh and Khanym. The volume increased by 1.5 times during this period of time.

Nowadays the major part of irrigation and tail-drain network is in unsatisfactory condition, that has led to the increase of water loss. The difference between the water intake from the rivers and water supply of the fields achieves significant values – from 13.8% to 35.1%. A tendency of tail-drain runoff increase is
observed. The volume of tail-drain waters made up 679,85 mln cubic meters in 2005. The maximum volume of drainage runoff achieved 46.7% of water-submission volume.

Water economy is in a difficult condition in the period of transition economy. Water-users do not have enough financial means for the payment of water-submission service, for the conducting of exploitation and repair-rehabilitation works. The given budgetary funds are insufficient. These causes make the technical condition of irrigation and drainage network unsatisfactory and they do not meet the current requirements of exploitation. The insufficient organization of hydrometric works (poor financial means of water economy organizations), absence of modern devices for water control, communication means, transport means and etc. should be taken into consideration.

Summarizing the above-stated, it is possible to make a conclusion that the increase of irrigated areas and their water-supply during the years of “great amelioration” had rather negative outcome. It resulted in the increase of irrevocable water-consumption, rise of ground water level, aggravation of soil-ameliorative conditions and decrease in crops-yielding ability of soils.

2. PREVENTING DAMAGE: ENDANGERED ECOSYSTEMS AND SPECIES
Maxim Petrov, Natalya Marmazinskaya

Glacier recession in Uzbekistan and its consequences

One of the most critical impacts of future recession and disappearance of glaciers will incontestably occur in Uzbekistan. Here, the dry continental climate provides little annual rainfall and high evaporation rates at low altitude. The growing need of water is emphasised by urban centres’ increasing demands for high-quality water for drinking and industrial purposes and rural regions’ dependence on irrigation for production of primarily
cotton. Also, hydroelectric power plants, trying to secure local electricity supply, have huge influence on the water level in rivers. As per the data from the field studies the glaciation in Oygaing river basin has reduced by 29%, and glacial runoff by 27% in comparison with the level of 1970. Retreat of Tekeshsay-1 glacier leads to temperature increase in periglacial zone and changing in biodiversity. As an example the appearance of Mensbir marmot was noticed in this geographic range. A short-reception of melting glacial waters in total runoff of the river and increase in carbonate hardness of water are observed due to decrease of the glacier area.

Glacial meltwater is the main water source for the rivers in Uzbekistan. Glaciers store water during the accumulation season (winter-spring) and release it during the ablation season (summer-autumn). This balance is primarily controlled by the amount of solid winter precipitation and summer temperatures. Increasing winter precipitation or decreasing summer temperatures lead to growing and advancing glaciers (positive glacier mass budget), whereas reduced winter precipitation or increasing summer temperatures result in diminishing and receding glaciers (negative glacier mass budget). The ability of glaciers to store water during the wet season and gradually release it during the dry season is vital to local agriculture and industry. If the glaciers disappear, snowmelt in the mountain ranges will feed rivers only during the spring and early summer, but then the rivers will dry out with devastating consequences for the population (drought, failed harvest and famine) and for local ecology and ecosystems.

**Threats for mammals and measures of their preservation in Uzbekistan**

A variety of ecosystems of Uzbekistan includes mountains, foothills, and deserts of different types, water and wetland ecosystems, Tugai riparian forests. Ecosystems of Uzbekistan are of global value - desert, mountain and wetland biomes, Tugai riparian forests are included in the Global List of WWF «Ekoregions 200».
The species variety of fauna depends directly on a condition of ecosystems, which are subjected to many antropogenous threats such as destruction of habitats, overgrazing, human disturbance, poaching and trapping, disturbance by stray dogs, decline of main prey numbers (predators).

As a result 24 species of mammals are included in the Red Book of the Republic of Uzbekistan (2009) as exposed to disappearance threat. The Asian Cheetah, Caspian Tiger and Turkmen Kulan are included in the Red Book as extinct in the country. Honey Badger, the Centralasian Otter, Striped Hyaena, Turkmen Caracal, North Persian Leopard, Snow Leopard, Tadjik Markhor, Transcaspian Urial, Afghan Urial are critically endangered. Many of these species are included also in the IUCN Red List.

Flagship species of the Tugai riparian forests is the Bukhara Deer (*Cervus elaphus bactrianus*) – endemic of Central Asia. The status in the country – endangered, locally distributed subspecies. Threats for this animal are destruction of habitats (riparian Tugai forests), and poaching. Included in the UCN Red List and in Appendix II of CITES, and also in the Convention on Migratory Species (CMS) (a cross-border species as inhabiting the territory of four adjacent countries - Uzbekistan, Turkmenistan, Tajikistan and Afghanistan). Since 1995 with support of WWF and other international funds and organizations, active work on preservation of the Bukhara Deer in the region has been conducted. As a result of this work the total number of Bukhara Deer increased from 300 to 1600 individuals.

Flagship species of desert territories of Uzbekistan is Goitred Gazelle (*Gazella subgutturosa*). This species is a unique representative of the genus Gazella in the fauna of Central Asia and Uzbekistan in particular. The status in the country – vulnerable, declining, mosaic-distributed subspecies. Included in the UCN Red List and in the CMS. Threats for this species are economic development of desert territories (construction of roads, gas pipelines, cattle pasture), and also poaching. In the country there are few protected natural territories in a desert zone where it
could be protected. During the last thirty years no investigations on distribution and number of gazelles were conducted and there are no data on current status of this species. Now there are no special programs directed toward conservation of gazelle. Thus, Goitred Gazelle is the forgotten ungulate species in Uzbekistan. Measures of conservation of the mammals in Uzbekistan are legislative protection, accession to the international conventions, maintaining the National Red List (Red Book), creation of system of protected natural territories and international cooperation.

3. LOOKING FOR SOLUTION: SOIL SALINIZATION
Małgorzata Suska-Malawska, Azimbay Otarov

Causes of salinization in the Central Asia region

Central Asian countries belong to the continental climate zone, which is characterized by huge amplitudes between summer and winter temperatures, and by lack of precipitation in summer. In spring, considerable amount of rain, together with meltwater from the mountains, cause significant increase of groundwater level in the rivers’ basins. Thanks to capillary action, groundwater rich in various salts (easily soluble sulphates and acidic carbonates of magnesium and calcium) is transferred upwards to the surface of the soil. There, it quickly evaporates, leaving salt crystals behind. These mechanisms lead to development of saline solonchak and solonetz soils, in which the salt content can be as high as 20-30%. Surface waters, on the other hand, are the main drivers of takyr soils build-up. Takyrs are usually formed in depressed areas with a heavy clay soil, which is submerged by water after seasonal rains. After evaporation of water, a dried hard crust with fissures forms on the surface. In the past, these soils were used by caravan guides as natural roads for camels. Though they may seem inhabitable, saline soils are populated by salt tolerating plants – the halophytes.

Unfortunately, many agricultural regions in Central Asia are
subjected to secondary salinization which is a result of inadequate and obsolete irrigation systems and by permanent lack of crop rotation. According to the estimates, in the Syr Darya basin strongly salinized irrigated regions cover 240 000 ha and in the Amu Darya basin – more than 700 000 ha. Secondarily salinized soils usually yield much lesser crops or are not suitable for further agricultural practices. Therefore, nowadays many soil rehabilitation programs are being implemented in the Central Asian countries.
Modern condition of soil cover of the southern areas of Kazakhstan

Modern condition of Kazakh soils is shaped by many interweaving factors, which can be roughly divided into two categories – natural and anthropogenic. Today the structure of natural landscapes is changed and on the considerable areas agricultural irrigated landscapes are created. In the irrigated agrocenoses, anthropogenic activity is a powerful factor of development not only for agricultural landscape but also for the natural system of the whole region. More than 800 000 ha or almost 50% of the whole surveyed territory is subjected to wind erosion, which is clearly visible in the west part of Shardara and Shieli massifs, where the weakly fixed sands of the vast Kyzylkum sandy massif prevail. More than 400 000 ha or almost 20% of the whole surveyed territory of the region are subjected to water erosion. Water erosion and erosion resulting from irrigation are very common in the basin of the river Keles.

The analysis of soil-ameliorative conditions on the main irrigated massifs showed that a catastrophic worsening of ameliorative condition of irrigated soils took place in the region. More than the half of all surveyed soil areas (303 600 ha) have saline soils (52,2%). Approximately the same share is occupied by the areas with groundwater level, occurring higher than the critical depth and subject to mineralization. Because of these reasons, unused lands start to salinize and paludify (6665 ha are not used because of these two processes).

In conclusion it can be noted that irreversible degradation of soils is in process on the irrigated lands in Central Asia, leading to the full loss of soil fertility and transformation into vast saline deserts. The main threats in the researched region are (1) reduction of the rivers runoff and as a result, shortage of fresh irrigation water; (2) menacing scales of salinization and paludification of soils at the irrigated massifs and adjacent territories; (3) development of wind and water erosion including erosion resulting from irrigation practices; (4) decrease in quality
of water for irrigation; (5) reduction of arable areas due to soil cover degradation; (6) beginning of soils and agricultural products contamination with heavy metals and as a result the reduction of qualitative and quantitative composition of flora and fauna; (7) reduction of biodiversity.

4. CREATING NEW HABITATS: MAN-MADE ECOSYSTEMS
Agnieszka Krzyk, Kristina Toderich

Genesis of the Aydarkul-Arnasay Lake System

In the 1960-ties on the Syr Darya river, which feeds the Aral lake, a dam was constructed and the Shardara reservoir created. This artificial waterbody was meant to ease irrigation of new agricultural areas, diminish the risk of flooding in the downstream part of the river and allow to generate hydroelectricity. However, the flood of 1969 caused overflowing of the reservoir. It was decided that the excess waters should be released into a uninhabited depression covered with saline soils (solonchaks) on the Kyzylkum desert. During the next 10 years almost 60% of Syr Darya waters was poured into this depression, which resulted in creating a system of brackish lakes called Aydarkul-Arnasay (almost 4000 sq km nowadays). Regular water inflow caused also an increase of groundwater level in this region and development of a wetland ecosystem (20 000 sq km) in the very heart of the desert. Desert plant communities were gradually substituted by halophytes and one third of animal species were characterized by population decrease. Nevertheless, after some time, Aydarkul-Arnasay lake system was colonized by new species of plants and animals, including endangered birds, among others Sibirian crane and white – headed duck. Today this area is an important stop on the birds’ migration routes.
Contemporary status of vegetation cover of Aydarkul-Arnasay-Tuzkan lake system and adjoining territories

Aydarkul-Arnasay-Tuzkan lake system and adjoining Molguzar-Nuratau-Koitash Mountains with a transitional/marginal lands of the south Kyzylkum desert is one of the most important areas of Central Asia biodiversity. The mentioned territories are situated on the juncture of two large, very contrasting biogeographical regions: the Turkestan province, enclosing the mountain regions of Tyan-Shan and Pamiro-Alay, and the Turan province, which includes the desert and semi-desert landscapes. Due to its location near the border of these areas, the singularities of the natural conditions, the complex geological history and the long-term influence of human activity in this area, the plant and animal wildlife which formed here is very unique. Our investigation found out that the flora of the Aydarkul-Arnasay lake system, including adjoining areas, is especially interesting due to its varied landscape, biogeographic location and biodiversity. The richest flora is observed in the Karatau-Nuratau mountains.
system that includes 1174 species of vascular plants from 475 genera and 84 families. The mountainous area of this territory forms the core of a unique botanical group as a part of the Afgani-Turkestan floristic district. The flora of plains including sandy desert, vegetation of salt depressions, delta plains and tugai forests along Aydarkul-Arnasay-Tuzkan shores contains about 1000 species of plants from 412 genera and 75 families (62 species of these are endemic). The semi-desert foothills contain approximately 300 species of plants. There are more than 200 endemic, rare and endangered species of flowering plants growing on these territories. Among them 47 species were included into the List of Red Book of the Republic of Uzbekistan. Many of these species have a potential value in agriculture and/or decorative, nut-bearing, medicinal, aromatic, oil-bearing, food purposes. A narrow belt of virgin desert psammophytic plant communities and well preserved fragments of natural tugai forest was described on the south-western shores of Aydarkul-Arnasay lakes. The natural self-reproduction of these species was also marked. We suggested taking under protection these virgin desert ecosystems including all wildlife biodiversity.
Some thoughts on student exchange with Central Asian countries

In 1988 and 1989 professor Wiłkomirski was a supervisor of student practices in Uzbekistan. Each of these student exchanges lasted three weeks and was a bilateral barter, based on a previously signed agreement between the University of Warsaw and the hosting institutions. The next exchange took place after almost 20 years, in 2007. This time professor Wiłkomirski was its organizer.

Students of the University of Warsaw launched for Uzbekistan in June, which is the best moment to examine flora in this region. In turn, Uzbek students visited Poland in July.

One of the most important side of such enterprises is their didactic value. Both Polish and Uzbek students had a good opportunity to learn new research and didactic methods used in botany and ecology. These methods are quite contrasting, because of different teaching program and completely dissimilar climatic conditions. Moreover, students are introduced to different cultures and traditions, which is the best chance to broaden one’s horizons.

Teaching environmental issues – Polish point of view

Environmental protection is one of the most popular degree courses in Poland. It is offered by more than 60 state and non-state higher education institutions as the first, the second or the third level of studies according to the Bologna process. Such programs of studies are usually viewed as relatively easy to prepare and conduct, since they often consist mostly of theoretical law issues and various field courses, therefore having no need for professionally equipped laboratories and expensive reagents. That makes environmental protection highly attractive for small schools with willing staff but limited funds and poor
technical backup. However, being so popular with the authorities, environmental protection courses are not so among the students. Thus, a question arises – how should the environmental issues be taught to be interesting and useful for the students? What can we, the academic staff, offer our pupils to make them more competitive on the labour market in Poland and abroad? After graduating environmental protection programs concentrated on field biology and law, students are prepared mainly to perform valorizations of natural resources, which is not enough to find an attractive job position. Therefore, bigger institutions (mostly state universities) extend their programs adding chemistry part, which gives students some analytical background, enabling them to apply for jobs in environmental monitoring agencies and organizations.

With both students’ needs and labour market’s demands in mind, the University of Warsaw developed further these interdisciplinary approach to teaching environmental issues. With the help of specialists from three faculties – the Faculty of Biology, the Faculty of Chemistry and the Faculty of Management – a new interfaculty Master’s Degree program “Environmental Management” was launched in the year 2011. This program focuses on a modern approach to sustainable exploitation and protection of the natural environment, trying to present students with full scope of views on these subjects, held by specialists from different fields of science.

Coherent program of studies together with possibilities of implementing gained knowledge during various training courses and internships in business enterprises, help students to understand that modern knowledge on environment is complex, interdisciplinary and not purely theoretical.
EXCURSION SITE: BIAŁOWIEŻA NATIONAL PARK

Białowieża National Park

Białowieża National Park protects the best preserved fragment of Białowieża Forest – last natural forest at the European Lowland Area, having the primaevial character, identical with the one which covered the area of deciduous and coniferous forests years ago. The characteristic feature of the park is its biological diversity. The Park comprises, inter alia, 809 vascular plants species, over 3 thousand cryptogams and fungi species, almost 200 moss species and 283 lichen species. There have been more than 8 thousand invertebrates species, approximately 120 species of breeding birds and 52 mammal species. Old, primaevial forest stands in Białowieża National Park are characterized by large amounts of deadwood at the various stage of disintegration, and by the presence of typical natural forest species. The symbol of the Park is European bison – the biggest European land mammal.

Białowieża Geobotanical Station

Research and didactic activities of the station cover topics from the field of vegetational dynamics, biology of plant populations, biological diversity, invasive species and interactions between plants and animals. Some of these studies are long term. The station has guest rooms and a student hall, a kitchen with a common dining room, laboratories for analyses and plant breeding, a herbarium, a library, a scientific archive and an experimental garden. The head of the station is **Bogdan Jaroszewicz, Ph.D.**

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