



SETOF Soil Erosion and TOrrential Flood
*Prevention: Curriculum Development at the
Universities of Western Balkan Countries*

FOREST RESEARCH INSTITUTE – Bulgarian Academy of Sciences



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Forest Research Institute was established in 1928 as specific Service for Forest Science, studying management and utilisation of forests in Bulgaria.

1940 - the Service has been renamed into Institute for Forest Investigations and Experiments.

1954 - independent structure unit at the Bulgarian Academy of Sciences.



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Mission

The mission of the Forest Research Institute is to carry out fundamental and scientific-and-applied investigations of forest ecosystems, which play a key role in the environment, both in its entity and inviolability and in conditions of anthropogenic impact, including mitigation of climate change consequences.

The Forest Research Institute makes the theoretical and scientific basis for practical decisions with regard to forestry systems for management, forest genetic resources, protection of forests, erosion and flood control, as well as support of policies and legislation in the field of forest and nature conservation.

Specific research activities of the Forest Research Institute include:

- Studies on structure, functioning and adaptation of forest ecosystems to climate change and other natural and anthropogenic impacts;
- Development of programmes for ecological management and utilisation of forests and their products;
- Study on biological resources and protection of forest flora and fauna.





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International collaboration

The **Forest Research Institute** participates in international investigations of the European Union – frame programmes,

INCO-Copernicus,

Leonardo da Vinci,

EUFORGEN (European Forest Genetic Resources Programme),

COST (European Cooperation in Science and Technology),

EFI (European Forest Institute);

IUFRO (International Union of Forestry Research Organisations);

FAO (Food and Agricultural Organisation);

UNEP (United Nations Environmental Programme),

INRA (French National Institute for Agricultural Research),

as well as of bilateral collaboration with European, American and Asian research units.

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Priority fields of study

Research activity of the Forest Research Institute is directed to the following basic priority fields of study:

- Biological diversity in forest flora and fauna, genetic resources – peculiarities, dissemination and possibilities for conservation and utilisation.
- Structure, functioning and adaptation of forest ecosystems to climate change.
- Monitoring, protection and restoration of forests.
- Silvicultural and social-economic bases for sustainable and multifunctional management and utilisation of forest resources.





Current structure

The Forest Research Institute includes **four departments:**

- Silviculture and Management of Forest Resources;
- Forest Ecology;
- Forest Genetics, Physiology and Plantations;
- Forest Entomology, Phytopathology and Game Fauna).

4 experimental stations:

- Afforestation and erosion control, Sandanski;
- Coniferous forests in the Rhodopes, Velingrad;
- Coniferous forests in Rila Mt., Govedartsi;
- Beech forests in Stara Planina Mt., Etropole)

7 stations for bioecological research:

- Govedartsi, State Forest Enterprise (SFE) Samokov;
- Vasil Serafimov, SFE Yakoruda;
- Igralishte, SFE Strumyani;
- Gabra, SFE Elin Pelin;
- Parangalitsa, National Park Rila;
- Balkanets, SFE Troyan;
- Yassenkovo, SFE Shumen)

Arboretum.

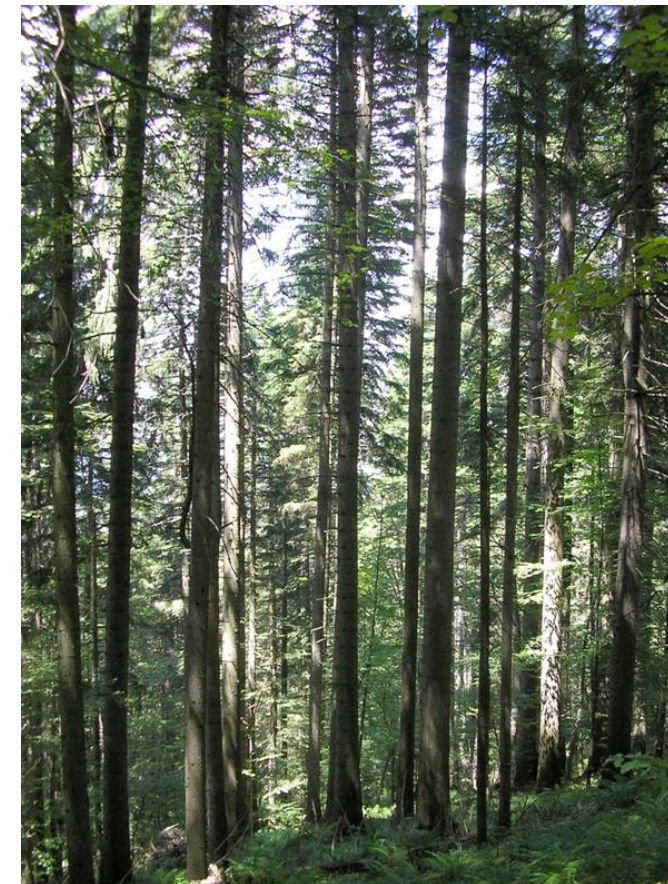


Department of Silviculture and Management of Forest Resources

The department is successor of the first unit of general silviculture in the Service for Forest Science.

Basic fields of research

- forestry,
 - silviculture,
 - forest inventory,
 - forest biometry, growth and productivity of tree stands,
 - botany and phytocenology,
 - forest economy,
 - forest techniques and technology,
 - non-wood forest resources.
- **Current staff of the unit:** 18 employees, from them 15 researchers.



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Basic research achievements in the last years

The following systems, methods, norms and technologies were developed in the department:

- Forestry system for:
 - 1/ coniferous plantations out of their natural habitat; 2/ for coppice cerris oak stands in lowlands; 3/ for Oriental hornbeam forests;
- Norms of labour in wood industry;
- Methods for carrying out of national inventory of forests with sample plots;
- Preliminary planning of parameters of national inventory of forests;
- Development of up-to-date technologies, machines and facilities for wood production.

- Contribution to the establishment of information system of the forestry
- Bulgarian State Standard for:
 - 1/timber quality – more than 30; 2/ for firewood; 3/ for seedlings from coniferous, deciduous, ornamental and climbing species.

PhD students in the last 10 years: 13.



Department of Forest Ecology

Department of Reinforcement of Torrents and Afforestation, established in the Institute in 1940 **together with** the **Department of Soil Investigations**, established in 1948, are considered **founders of the department**.

In 1974, Department of Conservation and Regeneration of Forest Ecosystems was differentiated, which from 1986 has the name Ecology and Environmental Protection.

Since 1994 until today the name of the department is Forest Ecology.

In 1989 it includes the erosion control. Since 2013 the Department of Forest Ecology and laboratory Forest Soil Science merged into Department of Forest Ecology.

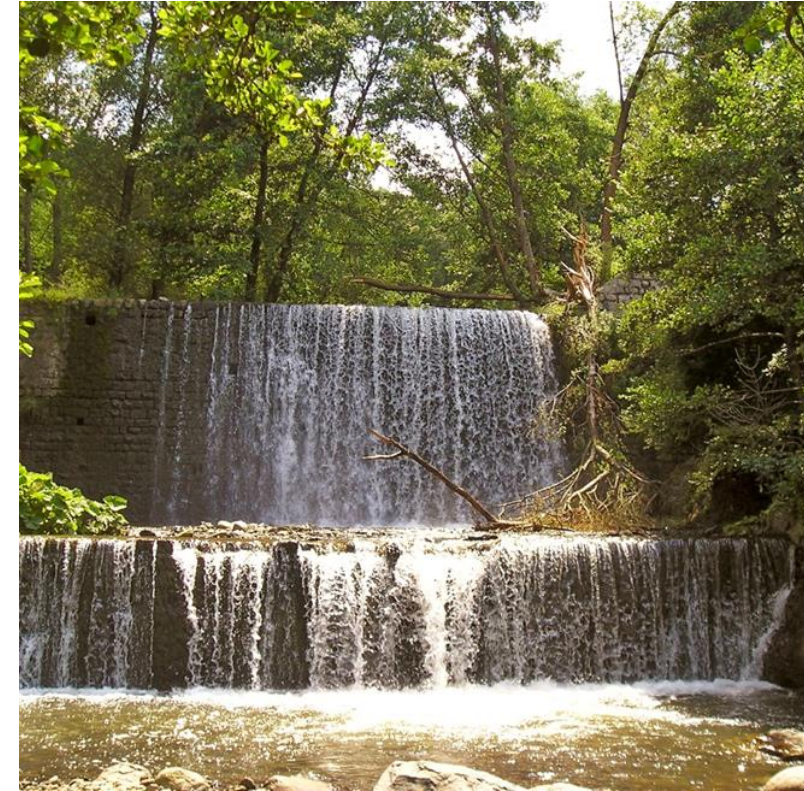
Current staff of the unit: 14 employees, from them 10 researchers, including 4 PhD students.





Basic fields of research

- Forest ecosystems – factor for mitigation of climate changes
- Forest hydrology, erosion processes and assessment of the risk of erosion
- Climate changes and their impact on forest ecosystems and water resources
- Peculiarities of soils from natural and anthropogenically influenced forest ecosystems. Characteristics of the humus system in forest soils
- Cycle of matters and elements in forest ecosystems
- Assessment of ecosystem services from the green infrastructure in periurban territories
- Assessment of the atmospheric pollution in forest ecosystems and of their capacity for reduction of toxic elements impact
- Forest fires – influence on functions of soil and risk assessment
- Biomonitoring of components from polar ecosystems
- Dendrochronological investigations



Basic research achievements in the last years

- Measures were developed for adaptation of forests in Bulgaria and mitigation of the negative impact of climate changes on them.
- The basic groups of processes in the Dystric/Eutric Cambisols in the country were determined on the basis of summarised results from long-term observations.
- The influence of changes in land use and management of forests on the carbon accumulation was analysed in relation with climate change, in direct support of the reports about greenhouse gases.
- New data was obtained about the erosion processes from lands managed in different ways in forest territories. The established data base can be used in the development of models for prognosis of soil losses.
- Assessment of the status and mapping of available ecosystem benefits and services from urbanised systems on national level was done and methods for assessment were developed.
- Method for assessment of changes of ecological conditions in forest ecosystems due to expected climate changes was developed.
- A method was developed for assessment of the risk of forest fires, which is applicable on difficultly accessible high-mountain terrains.
- **PhD students in the last 10 years: 14.**



Department of Forest Genetics, Physiology and Plantations

The Department unites **three research areas**: Genetics, Improvement and Seed Growing , Ecology and Physiology of Forest Tree Species and Artificial Forest Ecosystems.

Main task of the unit in the current period is

to give additional and new knowledge about green technology for production of qualitative wood and biomass, namely:

selection of species, forms, progenies, clones for afforestation;
methods and methodological approaches for propagation and preservation of improved material;
composition and density of plantations, preparation of soil and methods for afforestation,
biological diversity and methods for its conservation.

Current staff of the unit: 13 employees, from them 11 researchers.





Basic fields of research

- Biological diversity and methods for its conservation;
- Variability and intraspecific diversity of forest tree species and selection of valuable forms;
- Population genetics of tree species;
- Study, conservation and utilisation of forest genetic resources;
- In vitro cloning of valuable forest tree species;
- Physiological-and-biochemical investigations on forest tree species;
- Theoretical fundamentals of forest seed production;
- Selection of tree species, provenances, clones and methods for establishment of high-productive forest plantations, including energy plantations;
- Models for 1) regulation of the density of forest plantations and 2) growth and structure of forest plantations.





Basic research achievements in the last years

- The results are studied on afforestation activities on good and extreme sites; the phenotypic plasticity of a clone of *Paulownia tomentosa* and *Populus nigra* was determined; parameters of productivity of poplar and willow clones were specified; the influence of biofertilisers was determined for increasing of carbon accumulation in soils; a model of the stem biomass of trees from several *Paulownia* clones was made,
- Methodological system was developed for deduction, verification and validation of biometric subordinations for above ground biomass of single stems of fast-growing deciduous species in young age,
- Established: provenance, progeny and clone experimental plantations from native and non-native species of economic importance like European beech, common oak, aspen, cork oak, black locust, poplars, willows, Scots pine, Norway spruce, Douglas fir,
- PineManageTool – programme for determination of the growth, productivity and structure and for modelling of economic alternatives in growing of Scots pine plantations,
- SilveStruct – programme for the structure of Scots pine plantations in Bulgaria according to diameter and height.





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Department of Forest Entomology, Phytopathology and Game Fauna

Basic fields of research

- Biology, ecology, population dynamics and harmfulness of insect pests in forest ecosystems;
- Biology, ecology, spread and virulence of pathogens on forest and shrub vegetation;
- Faunistical and mycological diversity in forest ecosystems;
- Biological control of forest insect pests and diseases;
- Climate change impact on the spread and harmfulness of insect pests and pathogens in forest ecosystems;
- Invasive insect pests and fungal pathogens;
- Pests and diseases on tree and shrub vegetation in urban green systems;
- Biology, ecology and management of game fauna.

Current staff of the unit: 10 employees, from them 9 researchers, including 4 PhD students.



Lymantria dispar L.



Armillaria sp.

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Basic research achievements in the last years

- Main features of gypsy moth (*Lymantria dispar*) population dynamics and regulatory factors;
- Biology, ecology, diversity forms, egg parasitoids and expansion of pine processionary moth (*Thaumetopoea pityocampa*) in Europe;
- Biology, ecology and harmfulness of insect pests on poplars (*Populus* spp.);
- Diversity in the complex of leaf rollers in oak (*Quercus* spp.) stands;
- Faunistics and distribution of longhorn beetles (Coleoptera: Cerambycidae);
- First introduction of the entomopathogenic fungus *Entomophaga maimaiga* in Europe, evaluation of its impact on *Lymantria dispar* and non-target species;
- Spread and dynamics of the epiphytic root fungus *Heterobasidion annosum* in coniferous forests;
- Pathogens causing needle and shoot blight diseases on coniferous forests;
- Investigation into the resistance of different *Pseudotsuga menziesii* provenances to the most important fungal pathogens;
- Strain diversity and virulence of *Cryphonectria parasitica* on *Castanea sativa*;
- Establishment of insect pests and pathogens causing drying in oak (*Quercus* spp.) stands and pine (*Pinus* spp.) plantations.





Scientific-and-applied activity

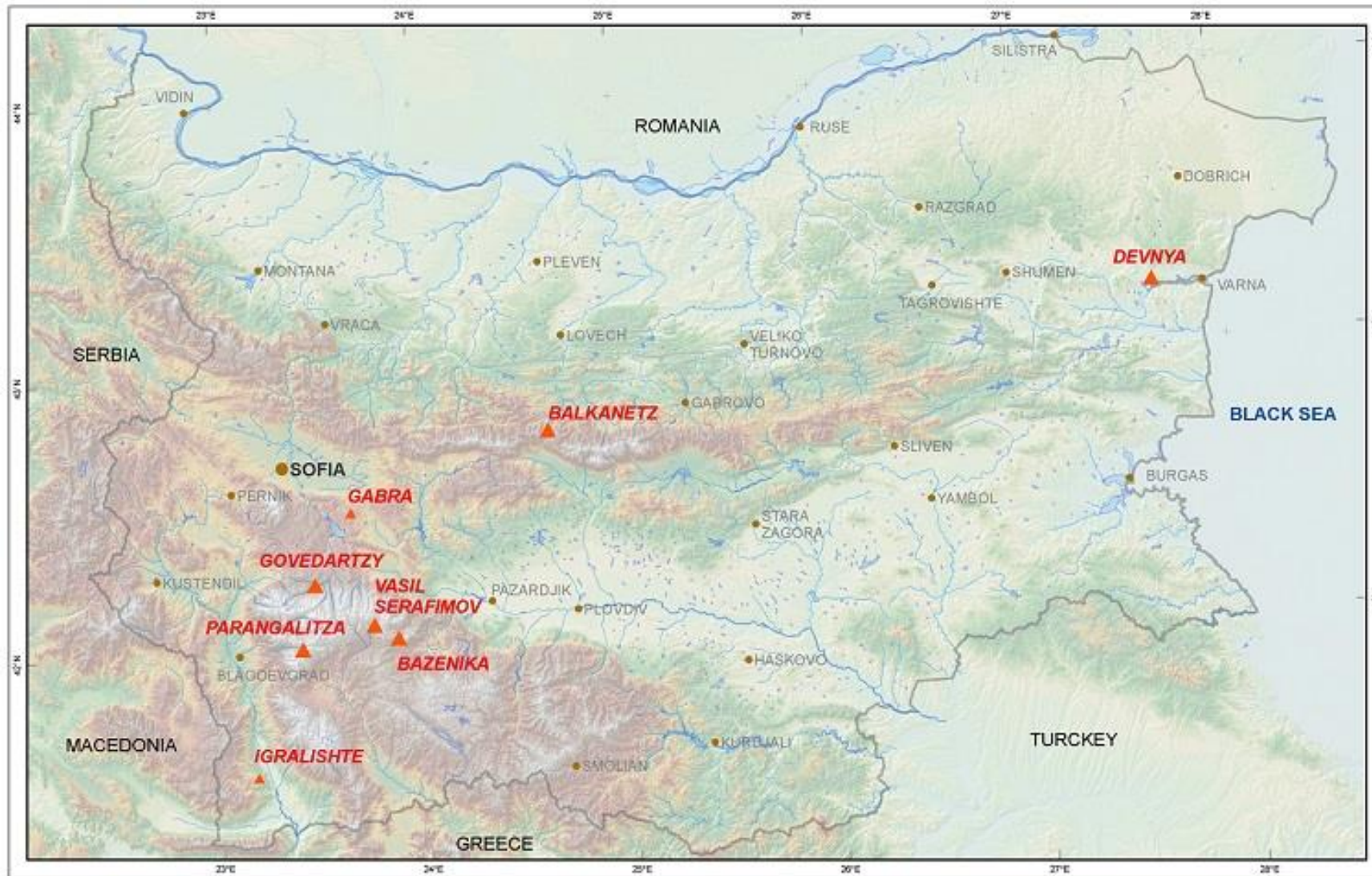
- Development and improvement of technologies for micro- and macrobiological control of the main forest insect pests (*Lymantria dispar*, *Thaumetopoea pityocampa*, *Neodiprion sertifer*, *Erannis defoliaria*, *Operophtera brumata*, *Tortrix viridana*, etc.);
- Implementation of *Entomophaga maimaiga* as a classical biological agent to gypsy moth (*Lymantria dispar*) control;
- Technological development of biological control against *Heterobassidion annosum* based on fungal antagonist *Peniophora gigantea*;
- Annual ecological monitoring of the forests in Bulgaria - evaluation of the health status, impact of biotic factors and abiotic influences;
- Application of forestry methods for control of highly aggressive bark beetles (*Ips typographus*, *Ips acuminatus*, etc.) in coniferous forests;
- Applying of remote sensing technics to assess the health status of forest ecosystems;
- Habitat assessment of the major game species in Bulgaria;
- Development of a management plan for the wild cat (*Felis silvestris*) population in Bulgaria.

PhD students in the last 10 years: 5.





Ecological stations



Ecological station “Vasil Serafimov”

This is the first ecological station of the Forest Research Institute, BAS, for hydrological investigations, which started activities in 1961.

It is situated in the Leeve area in the eastern ridge of Rila Mt.

Since 1982 it bears the name of its founder – Vasil Serafimov.

Measurements are carried out there of

- the precipitations quantity,
- air temperature,
- interception,
- flow on stems,
- snow cover,
- soil evaporation,
- surface water flow and
- depth infiltration

in representative Scots pine (*Pinus sylvestris*) forests.



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Ecological station Govedartsi

- Established in 1963, situated in the Malyovitsa ridge of Rila Mt.
- Ten experimental polygons were established for ecological investigations in natural stands of Norway spruce (*Picea abies*), silver fir (*Abies alba*) and mountain pine (*Pinus mugo*) within the range 900-2100 m a.s.l. Genetic and improvement investigations are carried out in specialised geographic and provenance plantations of *Picea abies* and *Pinus sylvestris*.
- Main fields of research are: study on the biotope and biocoenosis; circle of matters; productivity of ecosystems; assessment and monitoring of impact of polluted air on forest ecosystems (ICP-Forest).





Ecological station Igralishte

- The ecological station Igralishte is established in Maleshevska Mt., Southwest Bulgaria. The investigations started in 1971.
- The experimental station includes four small watersheds.
- The forest vegetation is represented mainly by *Quercus* sp. and plantations of *Pinus sylvestris* and *Pinus nigra*.
- The experimental set-up concerns data collection at two scales:
 - on small drainage test plots and
 - in small watersheds.

At the plot level different crops and land use types, as well as sun exposure, are tested.

Data from four small watersheds was obtained on the basis of investigations on rainfall, water runoff and eroded soil. At the small watersheds level the influence of different management systems is tested.





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Ecological station Gabra

The experimental station Gabra was established in Sredna Gora Mt. The investigations started in 1973. The station is situated on south-facing slope, at an altitude of 850-900 m a.s.l.

The purpose of the investigations is to determine the dynamics of the precipitations, the interception, the surface runoff, and the soil losses for plantations of Scots pine (*Pinus sylvestris*), Austrian black pine (*Pinus nigra*), Norway spruce (*Picea abies*), birch (*Betula pendula*) and for grass and fallow lands.





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Station Gabra

In the beginning ...

... and now

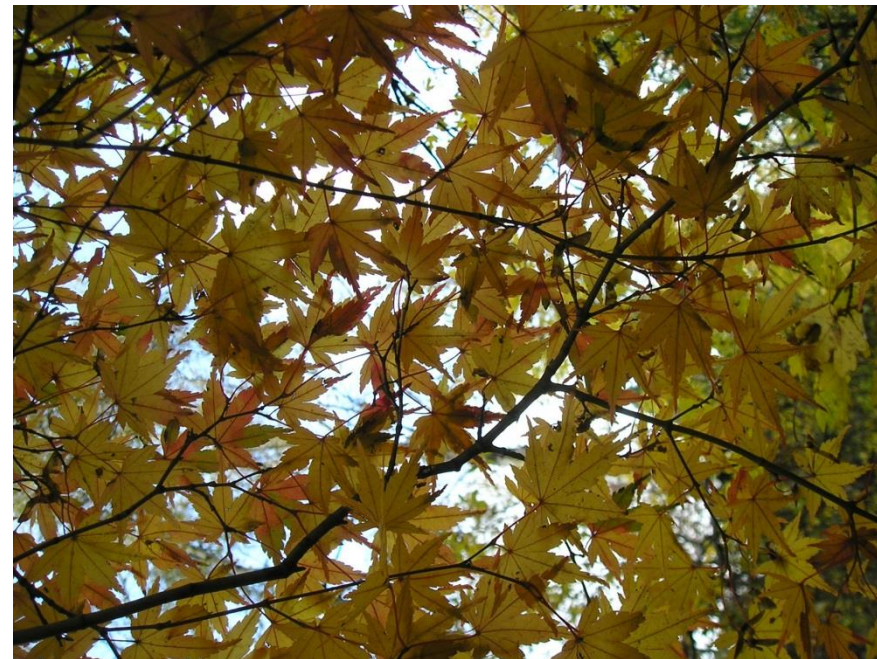


Ecological station Balkanets

- Established in 1971 with the aim to carry out complex investigations in **beech forests** in Stara planina Mt. (Balkan Range) within the range 900-1600 m a.s.l.
- Situated in the belt of beech forests in the watershed of Zhalna River – tributary of the Beli Osam River.

Arboretum of the Forest Research Institute

The establishment of the arboretum began in 1961 with main purpose to support the scientific and research activities of the researchers, as well as to help for the training and education of students from the University of Forestry and Sofia University St. Kliment Ohridski.



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