



Marin Drăcea
1885-1958

INCDS MARIN DRĂCEA

“MARIN DRĂCEA”
NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT IN FORESTRY
90 YEARS OF ACTIVITY



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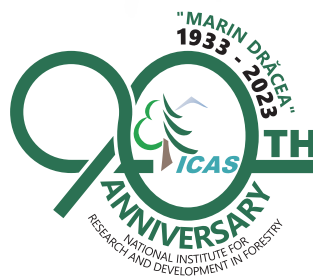
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90 YEARS OF ACTIVITY



“Un local propriu, cu personal suficient, perfect pregătit din toate punctele de vedere pentru activitatea de cercetare, înzestrarea laboratoarelor și oficiilor, din dotarea institutului, cu ocoale silvice experimentale și stațiuni regionale pe întregul cuprins al țării, constituie punctele esențiale ale programului nostru de lucru”.

“A proper location with sufficient personnel, perfectly prepared from all points of view for the research activity, equipping the laboratories and offices, endowing the institute with experimental forest districts and regional stations throughout the country, are the essential aims of our working program”.

Marin Drăcea, 1936



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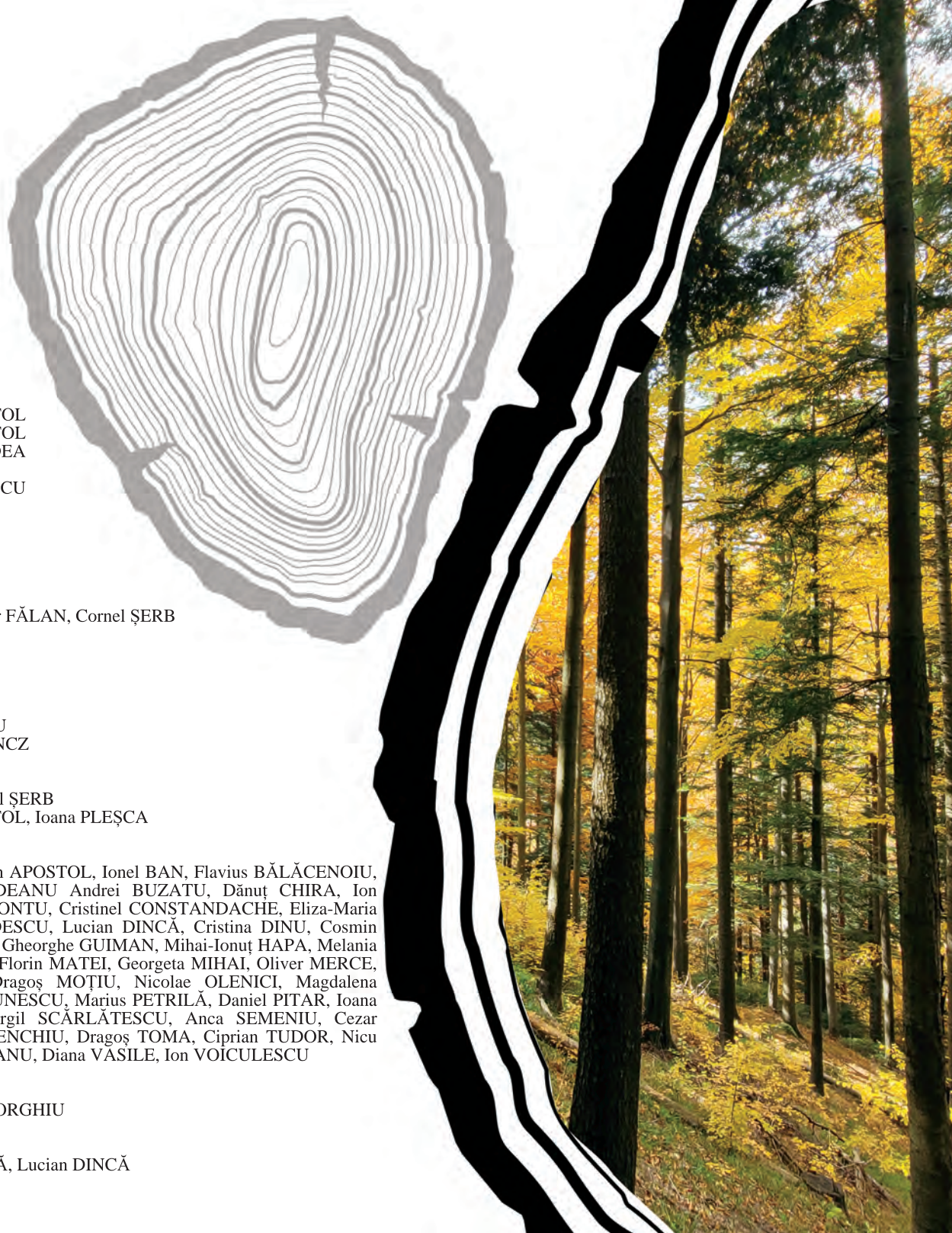
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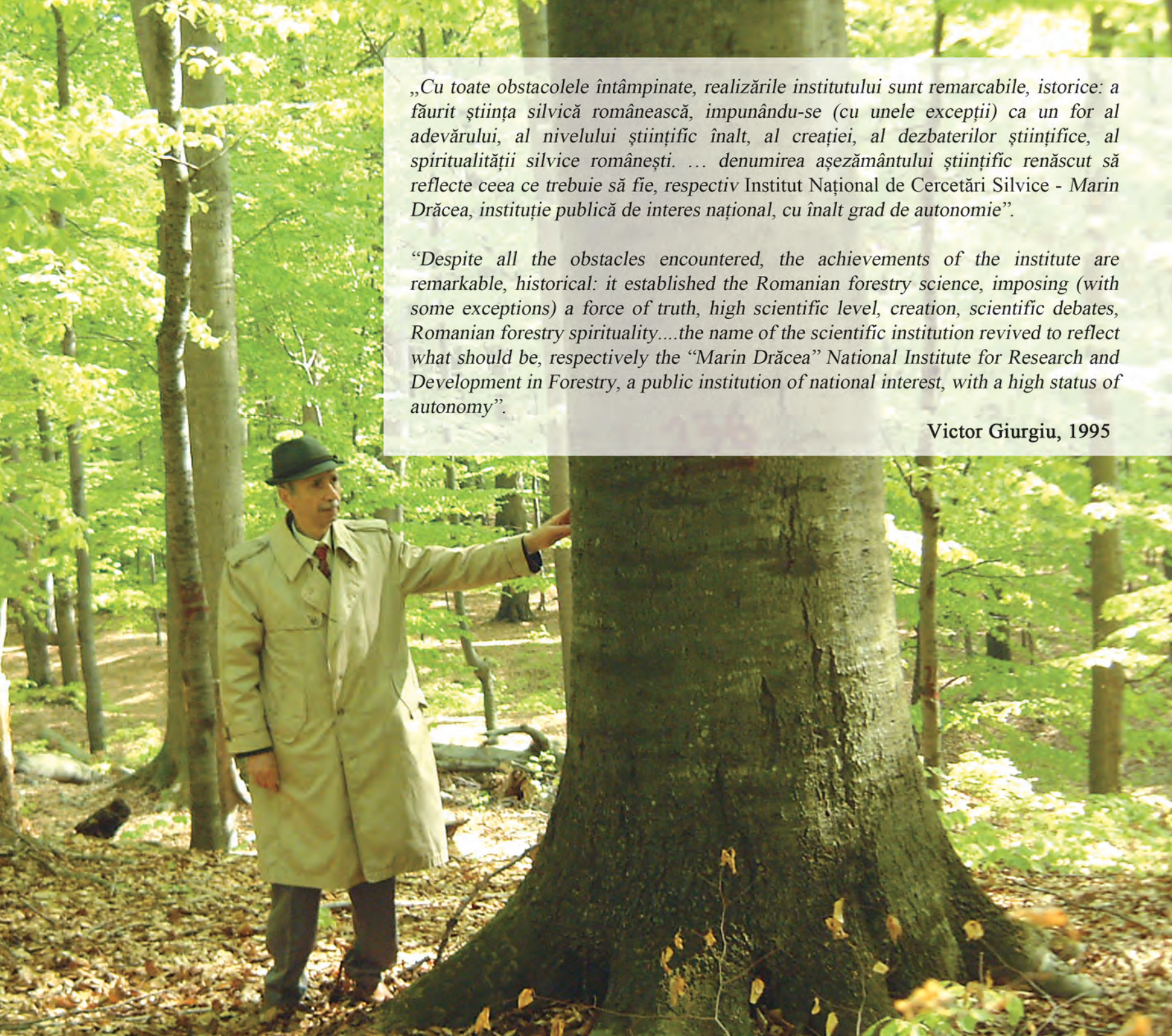
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A man wearing a dark hat, a light-colored trench coat, and dark trousers stands in a forest. He is looking towards a large, thick tree trunk on the right and has his right hand resting on it. The forest floor is covered with fallen leaves, and the background is filled with green trees and foliage.

„Cu toate obstacolele întâmpinate, realizările institutului sunt remarcabile, istorice: a făurit știința silvică românească, impunându-se (cu unele excepții) ca un for al adevărului, al nivelului științific înalt, al creației, al dezbaterilor științifice, al spiritualității silvice românești. ... denumirea așezământului științific renăscut să reflecte ceea ce trebuie să fie, respectiv Institut Național de Cercetări Silvice - Marin Drăcea, instituție publică de interes național, cu înalt grad de autonomie”.

“Despite all the obstacles encountered, the achievements of the institute are remarkable, historical: it established the Romanian forestry science, imposing (with some exceptions) a force of truth, high scientific level, creation, scientific debates, Romanian forestry spirituality....the name of the scientific institution revived to reflect what should be, respectively the “Marin Drăcea” National Institute for Research and Development in Forestry, a public institution of national interest, with a high status of autonomy”.

Victor Giurgiu, 1995

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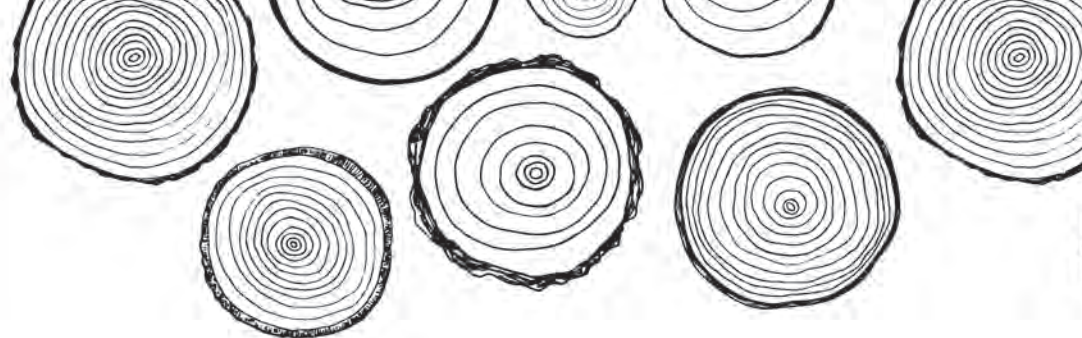


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FOREWORD



Through their clairvoyance and attachment to the country's invaluable natural heritage, renowned Romanian intellectual personalities from the 19th century were the first to militate for the prohibition of deforestation, a scientific understanding of forests, and the creation of a national silviculture based on the examples of countries from West and Central Europe.

Even in those ages, the idea that *all Romanian forests* need an adequate management based on scientific knowledge, together with a selected silvicultural corpus was understood and promoted, in order to have better scientific knowledge, the conservation of forests and *the creation of a national silviculture in accordance to the soil types, climate, native forest tree species requirements and country's economic situation*.

The first scientific foundations of our national silviculture were conceived in the academic community and then, enlarged and transcended in forestry research institutes and universities. Furthermore, aspects of exceptional importance for the respective *creation period of our national silviculture, strongly correlated with the European silviculture* were tackled, debated, and mostly resolved.

In this context, the necessity of a Romanian silviculture science was so well delineated and publicly expressed that, under its imperative, the main objective of the academic personality was to fight for spreading modern science ideas concerning the silvicultural treatments of forests, as well as the general development of silviculture as a science.

The institutionalization of scientific research in the silviculture domain in Romania was possible only in 1933, when the ***Institute of Research and Experimentation in Forestry*** (ICEF) was established under the leadership of the famous professor Marin Drăcea. This followed a long preparation period, in which an important role was played by numerous members of the Romanian Academy. The idea of forest research in Romania, of creating a vernacular silvicultural science, is as old as the Romanian Academy (the second half of the 19th century). Without the contribution of this high scientific and cultural forum, the institutionalization of silvicultural science and its further development could not have been possible at the date and the qualitative level reached.

Before 1933 the most important scientific interest were concerning the experimentation of exotic forest species cultures with the purpose of acclimatization and their introduction in the Romanian silviculture. Many publications of this period had an important scientific character, i.e.: "Cestiunea împăduririlor artificiale în România" ("The issue of artificial afforestation in Romania"), "Harta apelor freatice în Bărăgan" ("The map of phreatic waters in Bărăgan") and "Harta împăduririi Bărăganului" ("The map of Bărăgan afforestation") by D.R. Russescu (1906); the first "Tabele de cubaj pentru unele specii forestiere" ("Volume tables for some forest species") by I.R. Droc (1912); "Zonele de vegetație lemnoasă din România" ("Wood vegetation zones in Romania") by R. Enculescu (1924); "Cercetări complexe asupra salcâmului" ("Complex researches regarding the black locust") by M. Drăcea (1926) and numerous specialty articles published in "Revista Pădurilor" ("Forests Journal"), the oldest technical journal in Romania.



Among the most important accomplishments of investigations realized by ICEF during the period 1933 - 1947 it can be noticed: establishing the natural distribution of oaks, common beech and pines; oaks, pines, ashes, poplars and alders biological systematics; geographic distribution of forests from certain areas of the country (Vrancea, Oltenia high plains, South Field); identifying and characterizing some genetic types of soils (sandy soils from South Moldavia and Oltenia, forest soils with morphogenetic degradation, etc.); identifying some forest diseases and harmful agents. The contribution of Professor M. Drăcea is remarkable in silvo-technics, i.e.: adapting the group **selection** management for the oak's regeneration, the establishment of seed analysis methods; determination of some species culture techniques; testing the establishment of hybrid black poplars; installing experimental trials with different provenances of spruce and pines; afforestation technique in steppe zone (Dobrogea); technique for creating forest shelterbelts in order to protect fields, etc. We must also mention the contributions from the forest biometry domain: elaborating the volume tables and the tree form factor for Oltenia's black locust and Călimani Massif's Spruce, as well as the installation of 32 permanent experimental plots. 59 scientific reservations were identified and **established** in different forest structure in Romania. Furthermore, memoirs for the acknowledgment of some forests as natural monuments were realized, while the Dendrology Garden of Tîncăbești - Ciolpani (near Bucharest) was created in 1934. Progressively, the institute's material basis was completed with a forest herbarium, while the wood technology and soil laboratories that functioned within Bucharest's Polytechnic Forest Faculty were equipped with testing machines and modern research equipment.

During the 1933 - 1947, the Forest Research Institute and the University of Bucharest shared the personnel with superior education and the equipment. The research activity content was centered on the necessity of adapting the results of scientific investigations realized abroad to our countries forest specific, progressively adding new contributions resulted from our own investigations. From a thematic point of view, silviculture themes had a priority in comparison with the ones regarding wood exploitation and processing, a fact that is correlated with the socio - economic conditions of that era.

After the Second World War, profound transformations, accentuated later by the transferring act of all forests in the state's patrimony (1948), have influenced the developing of the national silviculture process. Through the Law 173/1947, the institute took on another legal basis, as a unitary institute for forest economic problems. The research activity was oriented towards fathoming the knowledge of the natural forest environment, towards establishing methods and technologies that can help the forest production units in achieving the objectives of developing a forest economy (the afforestation of approximately 100,000 ha, degraded lands amelioration, creating protection **shelterbelts** in order to improve the climatic factors from Dobrogea, the afforestation of empty fields from torrential hydrographical basins etc.).

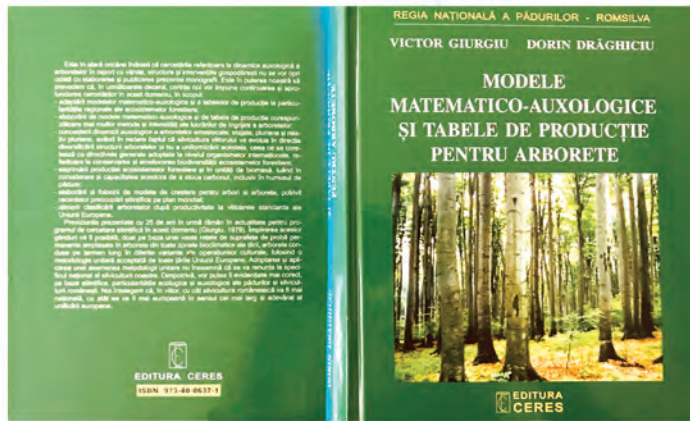


In the period 1948 - 1960, remarkable progresses were recorded in the silvobiology, including forest soil science, silvo-technics, forest protection, forest biometrics, forest management planning, wildlife biology, forest exploitation and wood industrialisation domains. Numerous original scientific papers were elaborated with a practical value and that were used for establishing technical directives and technical norms of the highest importance for consolidating Romania's silviculture. In all this period, the scientific creation of two distinct generations of researchers was **harmonized**: the one of the institute's founding members which have reached their creative maturity, and the one of young researchers, ready to develop and continue the scientific accomplishments realized until then.

In the context of an intensification and pressure of the wood manufacturing industry, starting with the year 1960, the scientific research has amplified its preoccupations towards increasing forest productivity. Unfortunately, this has led to some errors that encouraged short termed economical interest in contrast with traditional silviculture concepts, mainly concerns about artificial afforestation.

Later on, starting with the ninth decade of the 20th century, the research from silviculture was reoriented towards a harmonious interfusion of the naturalistic (ecological) concept with the economical one. A special importance was placed on: the valuable autochthonous species, especially oaks and common beech (including their genetic improvement); the stand's natural regeneration; control of diseases and harmful agents; evaluation of the forest's protection functions; conservation of nature and environment; the complex and rational capitalization of all forest resources. Through **these**, a new development stage of Romanian forest research is reached, together with an important forward step regarding the investigation methods, passing to their application at large scale.

After 1990, the institute has intensified and developed its activity, both by approaching specific Romanian silviculture applicative research aspects recently connected with the free market economy, as well as by participating together with other European research institutes at international research programs and networks. In this context, the newly approached domains, besides the existing ones, refer to forest monitoring, forest inventory, dendrochronology and dendroclimatology, and long-term trans- and interdisciplinary research.



As such, investigations regarding the state of forest ecosystems situated under the action of climatic changes and other risk factors were initiated and developed in integrated monitoring networks and long-term ecological research. A remarkable scientific accomplishment is represented by the dendrometrics and mathematical-auxological models, the yield tables in a new, modern and extended version for a larger number of species (tables of volume) which reflects the effect of stand tending (thinning) intensity on the stand's dendrometrics characteristics. Furthermore, a national resonance was obtained by the accomplishments concerning the creation of a national dendrochronology series network for the main conifers and oaks, followed by the climate reconstruction over long periods of time and the elaboration of specific evaluation models of the carbon stock in the forest biomass. At the same time, forest protection methods have been improved based on the integrated control of forest diseases and harmful agents, by applying adequate silvicultural methods and using biological compounds with a reduced impact on the environment.

In conclusion, „Marin Drăcea” National Institute for Research and Development in Forestry (INCDS) (formerly named ICEF, ICES, ICF, INCEF, ICAS) was, and still is, the main producer and manager of scientific and technical information from the forest domain, having substantiating the entire sustainable forest management system in Romania.

The diversified and integrated activities of the institute, grouped after their inter- and trans-disciplinary principles, intend to protect, conserve and consolidate the sustainable forest management system, as well as manage and capitalize the wild fauna and other forest products.



1. “MARIN DRĂCEA” INCDS FROM PAST TO PRESENT

The historical transformations that occurred after the First World War, culminating in 1918 with the formation of Romania’s unitary national state, have also profoundly influenced the development of Romanian silviculture, accelerating the independent organization of scientific research. In this context, the arena of Romanian silviculture encounters the prominent figure of Professor Marin Drăcea, as chief of Țigănești Forest District (1919 - 1920), where he signaled the necessity of the research in the forest domain.

In 1922, within the State Forest House, the first silvicultural research station was established in Sinaia, with the purpose of realizing studies and investigations regarding the establishment of Norway spruce and extending fast growing conifers. One year later, the Romanian silviculture scientific research center is moved to Brănești, at the Forest Faculty created as “Silviculture Section” within Bucharest’s Polytechnic University.

In 1930, together with the creation of the Autonomous State Forests House (Casa Autonomă a Pădurilor Statului - CAPS), where Professor M. Drăcea was the general director, the first Research and Documentation Office was created within it. The office included a study compartment, a documentation office and three scientific research laboratories (soil, botany and entomology), that functioned within Bucharest’s Polytechnics. Three years later (1933), an old desideratum of the silvicultural corpus was achieved by the creation of the **Forest** Research and Experimentation Institute – ICEF (the Ministry Council Journal number 561/16 May 1933 – registered in the Official Register Number 115/22 May 1933), under the leadership of Professor M. Drăcea.



Forest Research and Experimentation Institute – ICEF first Headquarters, no. 1, Clopotarii Vechi Avenue, Bucharest, 1933



Forest Research and Experimentation Institute – ICEF first Headquarters, no. 1, Clopotarii Vechi Avenue, Bucharest, 2018

The stage of scientific research accomplishments up until 1933 remains for our silvicultural sciences a period of problem enunciation, clarification and debates in congresses and public conferences, as well as promulgation of forestry ideas through publications in order to create a silvicultural conscience for protecting the country's forests within the population.

To start with, the institute's role was to scientifically substantiate forest economic problems and to prepare the necessary material used for a profitable practical economy. In this regard, professor M. Drăcea affirmed in the first ICEF Annals volume (1934): "The fundamental role of the newly created institute is to create the solid basis for our silvicultural economy and to rationally solve forest problems based on properly sustained investigations that should take into consideration our country's specific, in regard with both the conditions in which the forest economy is developing as well as its future goals".

The institution's organization was approved through the Agriculture and Domain Ministry's Decision (published in the Official Register Number 194/22 August 1936). Based on these regulations, the institute was organized as follows:

- Institute's center: 5 research sections: 1 – forest culture; 2 – forest management plans and volume estimations; 3 – natural production factors, dendrology, genetics, pedology, botany and forest phytopathology; 4 – forest genetics and tree breeding; 5 – rational administration, work organization, forest economy and statistics. The three laboratories (soils, entomology, botany) assumed from the old Research and Documentation Office have continued to function besides the Silvicultural Section (Forest Faculty) of Bucharest's Polytechnics, as well as the newly created Wood Technology Laboratory.
- Subunits in the country: Station of Sinaia (1922); Station of Gurghiu - Mureș (1935), Station "Casa Verde" of Timișoara; Dobrogea Experimental Station of Comarova (1938).

As material basis, the institute has taken under its management Comarova forest and the forest districts of Țigănești (Snagov), Mihăești and Snagov (1942), in which long-term experiences were installed.

In regard to the future ICEF program, Professor M. Drăcea asserted (1936): "A proper location, sufficient personnel and perfectly prepared from all points of view for the research activity, modernised laboratory and offices, endowment with experimental forest districts and regional stations all around the country are the main essential points of our program in the near future".



The research activity's content was centered on the necessity of adapting the scientific research results in forestry conducted abroad on the specific of Romanian forests and progressively adding the contributions from own research in forestry. From the point of view of the research issue, the priority of the forestry themes to the ones regarding the exploitation and processing of wood is noted, this being in line with the socio-economic conditions of the decades. After the Second World War, **significant** changes occurred in the process of developing Romanian silvicultural sciences, later accentuated by the passage of all forests in the patrimony of the state (1948). In 1947, through Law number 147, the institute was considered "a unitary institute for forest economic problems", with 8 research sections and 25 laboratories within the institute's centre (Forest culture and exploitation; Botany, ecology, genetics, and phytopathology; Forest protection, phenology, zoology, **entomology** and wildlife management; Forest pedology; Forest management, cubage, growths and estimations; Technology and industrialization of wood and other forest products; Forest constructions, transport installations and cadastre; Economy, forest administration and politics, work study), while on the outside it encompassed 6 research stations (Banat, Bărăgan, Dobrogea, Mihăești, Sinaia, Snagov) and several experimental points (the Țigănești - Snagov and Mihăești forests districts and Comarova forest).



Forest Research and Experimentation Institute – ICEF second Headquarters, no. 55-65 Kisselef Avenue, Bucharest, 1948

The personnel with superior studies have increased from 14 in 1933 to 31 in 1940 and 45 in 1947, while the technicians and workers have increased from 10 in 1933 to 36 in 1940-1947. In 1948, the institute received a proper localization on 55-65 Kisselef Avenue (Bucharest), allowing for the first time the establishment of all research laboratories in the same location. The research was oriented towards the understanding the natural conditions of the Romanian forests, as well as establishing methods and technologies to increase the forest economy production.

In 1951, the Institute of Research and Experimentation in Forestry (ICEF) was reorganized and two new institutes were created, namely the Institute of Research and Experimentation in Silviculture (ICES) and the Institute of Wood Exploitation and Industrialization Research (ICEIL).

In 1956, a new institute was created in order to support the mechanization research for silvicultural and forest exploitation works (ICMSE). In 1958, this institute merged with ICES (through Order 50/15 May regarding the appliance of HCM 530/1958), resulting in the Forestry Research Institute (ICF). This institute was organized in a central office with 5 research sections, 22 laboratories and externally with 17 research stations, 22 experimental points and 12 observation points. In that period, 164 researchers (from which 85 were at exterior units) and 207 technical personnel were working at the institute.

The year 1960 witnesses, as a consequence of ministerial changes, a return to the grouping of forest research in a complex research institute – INCEF – in which the silviculture scientific research was organized in a central unit with 7 sections (two new sections were created – silvo-technics, respectively wildlife management and non-wood products), while the exterior kept its previous organization.

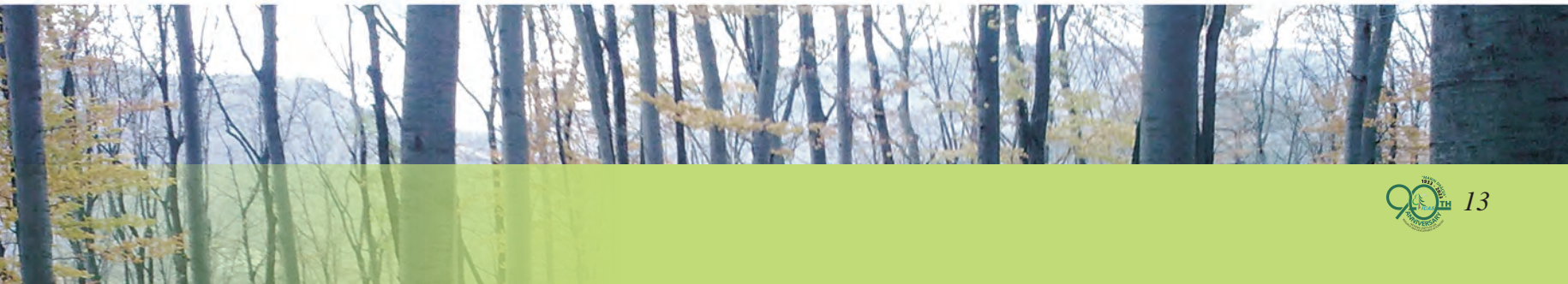
In 1969, the same institute (Institute of Research, Studies and Projections in Silviculture – ICSPS) integrated the research activities (National Institute of Research and Experimentation in Forestry – INCEF), forest management planning (Institute of Studies and Projections in Forestry – ISPF) and forest documentation (Forest Documentation Centre – CDF). Based on the main activities, the new institute was structured into three distinct activities (sectors): scientific research, forest management planning, and forest projection and production. In the projection activity, more than 70% of the work capacity was used to create forest management plans, which led on 1 May 1974 to the renaming of the institute in the Forest Research and Management Institute (ICAS). During this period, the silviculture scientific research activity was organized in research sections (that varied between 5 and 8), laboratories (between 10 and 12), stations (16-17) and a variable number of experimental points.

In 1976, the institute was integrally organized on six main forest regions: Moldova, Danube Field and Dobrogea, Carpathians and South Subcarpathians, Banat and Lower Mureș, North-West Transylvania, and South-East Transylvania. Each forest region had its own ICAS branch responsible for solving all the research and forest management problems from that area. Within the branches mixed or separated research and/or forest management stations functioned: research and management stations of Hemeiuș, Foçșani, Craiova, Cornetu, Pitești, Timișoara, Caransebeș, **Bistrița**, Brașov. research stations of Câmpulung - Moldovencsc, Tulcea, Bărgan, Mihăești, Bușteni, Simeria, and Cluj, forest management stations of Roman and Oradea.

In the institute's headquarters eight research departments have functioned, namely: forest genetics; silvobiology; silvo-technic; the use of chemical products in silviculture; management of forest economy; wildlife and salmon management; management of degraded lands; forest fruits and mushrooms. Furthermore, two machinery workshops, six forest management planning and investment projection departments, and administration services also functioned. The institute was responsible for managing over 93,000 hectares of forests through six experimental forest districts (**Caransebeș**, Lechința, Tomnatec, Vidra, Săcele and Mihăești). This entire area was necessary for locating experiments and testing the research results before applying them in the silviculture practice at national or regional level. Research and development (R&D) staff included 180 researchers and 222 technical personnel.

In 1990, ICAS was encompassed in the Autonomous Forest State Administration, according to Government Decision no.1335/1990, keeping its six experimental silvicultural districts until 2015, with the exception of the period 2003 - 2006 when, through an abusive manner, this state forest management structure, that has become the National Forest Administration (RNP Romsilva), has disposed the institute from their management (with the exception of Mihăești Forest District).

Until 2015, the administered forest area managed by the institute was reduced to 47 706 hectares, due to the application of property restitution laws.



2. “MARIN DRĂCEA” INCDS NOWADAYS

In 2015, based on the Government's Decision 318/2015, the former ICAS was reorganized as “Marin Drăcea” National Institute for Research and Development in Forestry (INCDS), under the coordination of the National Authority for Scientific Research and Innovation (ANCSI) of the Ministry of Education and Scientific Research.

The mission of “Marin Drăcea” INCDS is *to develop science, technology, and innovation in the fields of forestry and environmental protection, with the aim of ensuring, on a scientific basis, the increase in the capacity, quality, and competitiveness of research - development and innovation for the development of the forestry sector, increasing its economic competitiveness by finding solutions to societal challenges, with an impact on people's quality of life.*

The scientific research and technical development of “Marin Drăcea” INCDS contributes to achieving towards priority objectives of the forest sector, in the framework of national and international research programs, specific to the following domains: dendrometrics and forest monitoring, forest ecology, genetics, protection, silvo-technics, management planning, watershed management, forest shelterbelts and ecological reconstruction, wildlife and fish management.

The research and development activity of the institute benefits from its experimental forest patrimony, covering 48 214 ha represented by the experimental bases for research (forests, nurseries, seed orchards, arboretums, dendrological collections, and long-term plots), that are used for experimentation, in the pilot phase, of research results and acknowledge transfer in the forestry practice, before the full implementation at regional and national level.



Headquarters of “Marin Drăcea” INCDS

At the international level, “Marin Drăcea” INCDS is a full member or cooperating with prestigious international entities: e.g. International Union of Forest Research Organizations (IUFRO), European Forest Institute (EFI), International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP - Forests), Long Term Ecological Research European (LTER-Europe) and International Networks, International Long Term Social and Ecological Research (ILTSEr), International Plant Genetic Resources Institute (IPGRI), International Seed Testing Association (ISTA), European Association of Remote Sensing Laboratories (EARSeL), Forest-based Sector Technology Platform (FTP), National Roadmap of Research Infrastructures in Romania (ICOS Romania - affiliated), Central and Eastern European Initiative for Knowledge-based Agriculture, Aquaculture and Forestry in the Bioeconomy (BIOEAST).

The main beneficiaries/users of the results obtained through the R&D activity are represented at national level by the central public authorities (for the research, forestry, environment, agriculture, wood industry, energy, transport and tourism industries) and the economic actors that activate on the forest products market. These last users are very diverse and can be grouped in three main categories: forest administrators/owners, economic units for exploitation, industrialization, and capitalization of forest products (wood, game, non-wood forest products, etc.) and units that offer or request services in the forestry domain.





The contribution of INCDS "Marin Drăcea" to the improvement of the socio-economic environment:

- increasing the capacity, quality, and competitiveness of forestry research - development and experimentation - production in order to obtain the multiple benefits that sustainable forestry provides to society;
- the development of high-quality products and services, for a diversified demand and the growth of society based on a source of renewable raw material;
- the development of technologies necessary for a strong and dynamic forestry sector, able to respond to the challenges of climate change and societal challenges;
- the identification of complex and viable solutions to the problems faced by the forestry sector;
- attracting extrabudgetary funds and concluding public-private partnerships in the field of Romanian forestry research.

The advancement of R&D activities particularly contributes to strengthening and fostering excellence, to smart specialization in scientific research, technological development and innovation in the priority smart specialization domains – *Bioeconomy* (subdomain - Technologies for organic agriculture, agroecology and forestry), *Environment and eco-technologies* (subdomain - Technologies for environmental management, monitoring and depollution) and *Digital economy and space technologies* (subdomain - Technologies for the space economy).

Romanian Forestry, in general, and the "Marin Drăcea" INCDS, in particular, through the research and development activities in the field of forestry are considered national priorities and key components of the “National Strategy for Research, Innovation and Smart Specialization SNCISI for 2022-2027 period”, the “National Forest Strategy – for the period 2022-2030” SP30), the new EU Forest Strategy for 2030, The forest-based sector 2014 – 2020, and the National Strategy on adaptation to climate change for the period 2023-2030, with the perspective of 2050 (SNASC) and the **National** Action Plan for the implementation of the National Strategy on adaptation to climate change for the period 2023-2030 (PNASC).

The total number of employees is 796, from which 289 are research-development attested personnel and 175 are specialized technical personnel (engineers and technicians).



Human resources distribution over time



Financial income sources over time

Financial sources

The main funding sources for the research - development activity realized within the Institute arise from the Ministry of Research, Innovation and Digitalization (PNCDI III and IV - National Research-Development and Innovation Plans for the periods 2014-2020 and 2022-2027, respectively, Nucleu Program), RNP Romsilva - Forest National Administration (the Program for the technological transfer of research results and for the elaboration of forest management plans for public state forests), the Ministry of Environment, Waters and Forest and Ministry for Implementation of European Projects (Romanian National Recovery and Resilience Plan-PNRR). These are completed by economic state and private enterprises or units from the forestry sector that need consultancy, knowledge transfer, technical assistance or ecological reconstruction studies, as well as numerous European and international institutes that coordinate research programs (LIFE Program, Horizon 2020, Horizon Europe, Era-Net, COST Cooperation Framework).

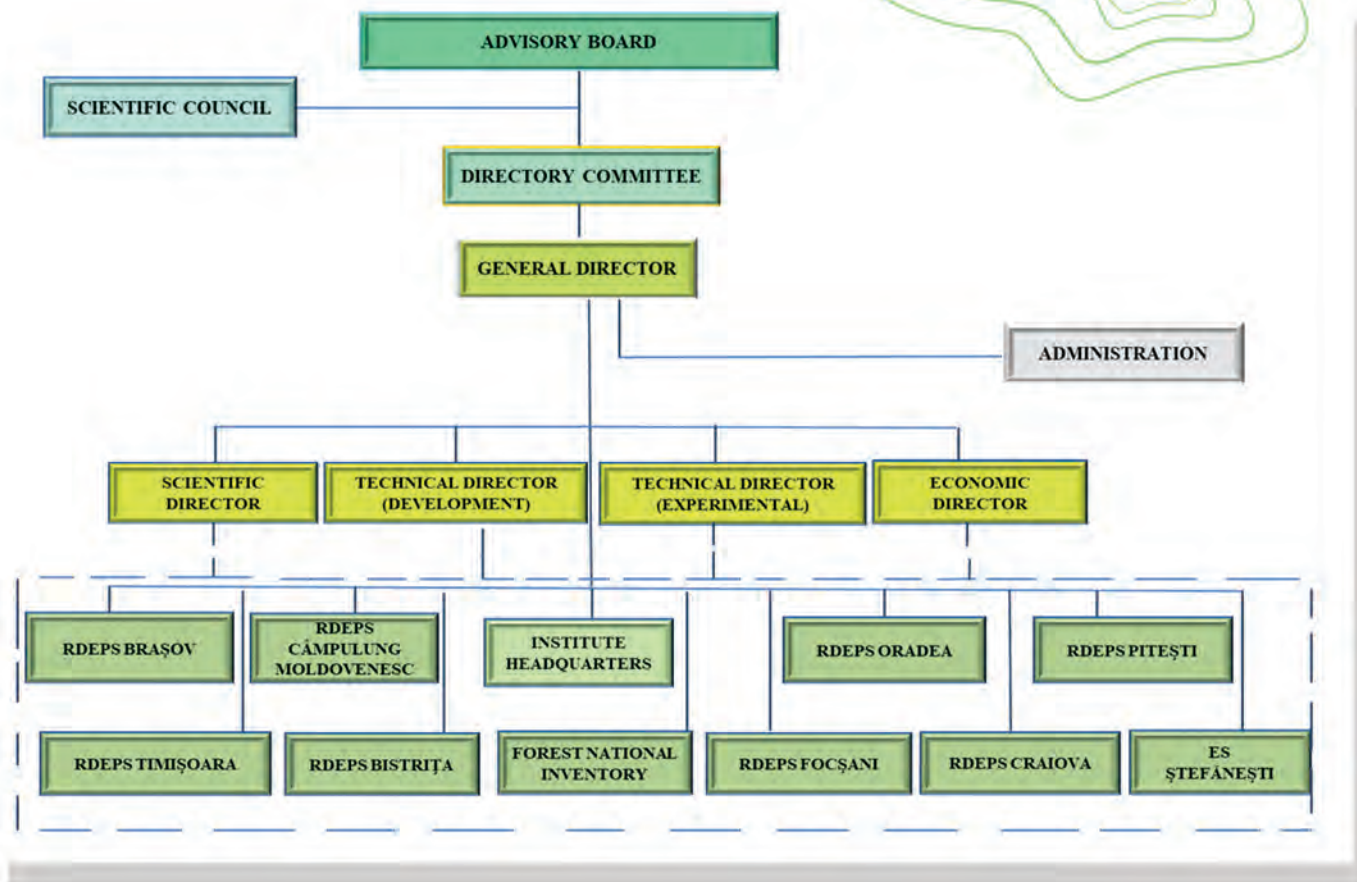


Research domains (based on the experience offered)

Dendrometry, forest management plans and national forest inventory

- Forest monitoring
- Protected areas
- Forest ecology
- Tree breeding
- Population genetics
- Forest entomology
- Phytopathology and forest mycology
- Silvo-technics
- Ecological reconstruction, the management of torrential hydrographic basins, forest shelterbelts and the improvement of degraded fields
- Forest geomatics (GIS, remote sensing/photogrammetry and terrestrial measurements).





The organizational structure of the „Marin Drăcea” National Institute for Research and Development in Forestry



**STRATEGIC PLAN FOR
INSTITUTIONAL DEVELOPMENT OF THE
“Marin Drăcea” NATIONAL INSTITUTE FOR RESEARCH
AND DEVELOPMENT IN FORESTRY (SPID-INCDS) –
2023-2027**

**Strategic Scientific Objectives and Directions for
Institutional Development Capacity of
“Marin Drăcea” INCDS**

Strategic scientific Objectives:

- Supporting the promotion of excellence in the activity of scientific research and technological development.
- The progress of scientific research for the sustainable management of forests adapted to climate change and societal challenges.
- Supporting technological transfer as a key element of intelligent specialization for increasing the economic competitiveness of the forestry sector.
- Concentration of RDI activities in areas of public relevance.
- Focusing efforts on the development of the digitization component.

Strategic scientific Directions:

- Evaluation of the actions of climate factors, atmospheric pollution, pests and pathogens on the state of forest ecosystems.
- Ensuring the stability, management and increase of functional efficacy for forest ecosystems under the conditions of climatic changes.
- Conserving and improving the genetic diversity of forests in order to increase their productive, protective, and adaptive potential. The scientific capitalization of silvo-technical and ecological reconstruction works.
- Increasing and evaluating the biological diversity of forests and their associated ecosystems.
- Conserving biodiversity and increasing the productivity in game and salmon trout farm funds.

Strengthening Capacity of Institutional Development

Objectives:

- Promoting excellence in scientific research and technological development and innovation.
- Increasing the socio-economic and public relevance of RDI.
- Development and consolidation of the excellence RDI activity in INCDS "Marin Drăcea" through digitalization.
- Increasing the RDI competitiveness of INCDS through communication and digitalization.
- Digitalization of scientific and technical information of INCDS Marin Drăcea support for increasing.

Future measures:

- the improvement and development of the institutional and regulatory framework of the research activity (Horizon Europe, PN IV for 2022-2027, PNASC for 2030, POCIDIF, POR, SNCISI for 2022-2027, SP30, SNASC for 2022-2030, SPID-INCDS etc.);
- adaptation of the organizational and functional structure of INCDS in relation to the research offer, the objectives and priority scientific directions, and the financial resources (attracted through research-development, knowledge transfer and innovation projects);
- strengthening the institute's role in the assessment and sustainable management of forest resources (by analyzing and quantifying the effects of environmental changes and social-economic conditions on forest ecosystems);
- increasing of the competitiveness of research, technological development and innovation activities and strengthening the capacity of the Institute for national, European and international cooperation;
- including the results of forestry research and the innovation in forestry in the national, European and international scientific information system and intensifying the transfer of knowledge to forestry enterprises;
- increasing the share of specialists from top specializations/fields of competence in order to meet the requirements of forestry research and practice at the European, national and regional level;
- stimulating the development of high-performance laboratories with multiple inter-institutional uses and the access of researchers to high-performance national and international research infrastructures;
- maintaining and developing of the dedicated long-term research and experimentation permanent plots network;
- improving the representation level of INCDS through its experts in institutions and representative RDI bodies at European and international level;
- intensifying of the INCDS participation at national, European and international inter - and transdisciplinary research networks in the field of environmental sciences and climate change (ICP Forests, ILTER, ICOS, ALTERNET, EIONET, BIOEAST).





In line with the strategic scientific objectives and directions for the institutional development capacity of “Marin Drăcea” INCDS, institutional multi-disciplinary projects are implemented:

- Increasing the institutional capacity and performance of INCDS "Marin Drăcea" in the CDI activity – CresPerfInst, Program 1 - Development of the national research and development system, Subprogramme 1.2 - Institutional performance Institutional development projects - Projects for financing excellence in CDI, PNCDI III - C1.2.PFE-CDI.2021 (2021-2024).
- Increasing the economic competitiveness of the forestry sector and the quality of life through the transfer of knowledge, technology and CDI competencies - CRESFORLIFE, Competitiveness Operational Program, Ctr. 15/2016 (2016-2023).
 - Study development project for the new Forestry Code and the structuring model of the subsequent forestry legislation, The National Recovery and Resilience Plan (2023).
 - Simplified procedures for Forest Protection. SIPOCA 395 *"The implementation and development of common systems and standards for the optimization of decision-making processes in the field of water and forests, the application of the evidence-based policy system in the Ministry of Water and Forests for the systematization and simplification of legislation in the field of water and the implementation of simplified procedures to reduce the administrative burden for the business environment in the field of forestry"* (SIPOCA 395, POCA, 2016-2021).
 - ForestValue2 - Innovating forest-based bioeconomy, HORIZON-WIDERA-2022-ERA-01 (2023-2027).



3. RESEARCH - DEVELOPMENT AND EXPERIMENTATION - PRODUCTION STATIONS

“Marin Drăcea” National Institute for Research and Development in Forestry enterprises research - development and experimentation - production activities in the headquarter and its nine Regional Stations, most of them accomplishing integrated activities. The Institute has an optimum organizational and functional structure, both at central and regional level. This structure is achieved by grouping traditional research - development domains based on their inter- and trans-disciplinary principle, as well as regarding the research-development directions and strategic objectives. The research - development and experimentation - production stations are grouped based on the regional research-development needs and also around an experimentation basis, with the purpose of properly capitalizing their own forest fund in order to experiment with the research results.





3.1 HEADQUARTERS OF “MARIN DRĂCEA” INCDS


The headquarters of “Marin Drăcea” INCDS is situated in Voluntari City, Ilfov County and it ensures the management of the entire institute for all activities (research, development and experimentation-production) in all its subunits.

From an organizational point of view, the headquarters of INCDS includes:

- Administration (General Director, Scientific Director, Technical Production Director, Technical Development Director, Scientific Secretary);
- Research (Forest management, Silvobiology and Silvotechnics), Development (GIS and digital cartography) sections, National Forest Inventory (NFI) and two experimental and production sections.
- Financial and administrative departments.

The total number of employees is 162, of which 64 are research - development attested personnel and 57 are technical personnel.





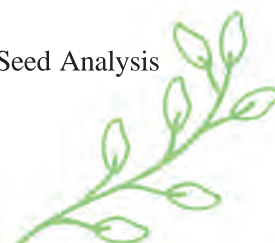
The main research activities developed within the headquarters of the institute are specific to a large number of national and international projects from the following domains: dendrometrics and forest monitoring, forest ecology, genetics, forest protection, silvo-technics, forest management planning, Remote sensing, watershed management, forest shelterbelts and ecological reconstruction, wild game and fish management.



Technological development approaches photogrammetry and digital cartography activities, as well as the GIS elaboration of forest management plans. Furthermore, starting in 2008, through the National Forest Inventory (NFI) an activity for the assessment and analysis of medium and long-term forest resources dynamics.

The Experimental and Production sections technically coordinate the activities developed within the Experimentation Basis of the institute's (EB).

The headquarters also includes four laboratories (Soil Analysis, Seed Analysis Biotechnologies, Remote sensing and Digital Photogrammetry).



3.2 BISTRIȚA RESEARCH - DEVELOPMENT AND EXPERIMENTATION - PRODUCTION (RDEP) STATION

The Bistrita Research-Development and Experimentation-Production Station subordinated to the National Institute for Research and Development in Forestry (INCDS) “Marin Drăcea”, the successor of the Cluj Research-Experimentation Station - established in 1950, also includes the Bistrita Development Section - established in 1976 and the Experimental Base (EB) Lechința - established in 1973 and currently managing an area of 4226.86 ha, of which 2939.8 hectares public property of the state. Also part of the RDEPS is Târgu Mureș Experimental Base with an area of 178.62 ha and the Gilău Trout farm established in 1987 with a water surface of 1842 square meters.

Within the RDEPS Bistrita, scientific research addresses priority objectives of the forestry sector, contained in international, European, national and sectoral research programs, specific to the following priority areas: forest management, dendrometry and forest auxology, forest monitoring, forest genetics, forest protection, silvotechnics, improvement on degraded lands and shelter-belt, hunting and salmon farming.

At present, Bistrița RDEP Station focuses on research, development and experimentation-production activities with the help of its 67 employees, from which 25 are certified R&D personnel.

Research activities are approaching mainly silvo-technics and forest protection themes, such as:

- Rehabilitation of degraded forests and reinstalling forest vegetation in extreme site conditions.
- Elaborating silvicultural systems and ecological technologies for harvesting wooden mass.
- Improving identification, survey, prevention, and control methods for forest diseases and harmful pests.
- Promoting new pest biological control methods, with a minimum impact on the environment.
- Evaluating biotic risk in forest ecosystems.
- Evaluating the genetic diversity of forest species in order to increase their adaptability to climatic changes.
- Creating new techniques for managing regular and degraded stands.



The development activity includes the elaboration of forest management plans for over 45 000 ha of forest annually, especially for regions from North-Eastern Transylvania and Moldavia. Furthermore, aspects concerning the design of specific ecological restoration works are also approached in order to reintroduce certain degraded lands in the productive cycle.

Lechința and Târgu Mureș Experimental Base are administrating 4226,86 ha, and the main goal is technological transfer, over time various research projects have been carried out in various fields such as: restoration of degraded stands, accessibility of forests, protection of forests, afforestation, etc. In the past period, various research themes have been placed that correspond to the destination of this forest body.

Gilău Trout farm, built in the period 1985-1986, had as its main activity the research and, as a subsidiary, the growth of trout for consumption. With a water surface area of 1842 square meters, it is composed of 73 ponds, which has allowed salmonid field research to be carried out over time. Studies have been carried out on relative prolificacy and average losses during incubation, the prophylaxis of certain salmonid diseases in trout farms under high-density conditions has been investigated, while new pellet food recipes have been established.

The Bistrita Station has a large network of long-term experimental plots (both in the experimental base and in other forest areas), a forest protection laboratory and specific equipment for the development of forest management plans in the GIS system.



3.3 BRAȘOV RESEARCH - DEVELOPMENT AND EXPERIMENTATION - PRODUCTION (RDEP) STATION

In 1949, one year after the Faculty of Forestry was moved to the University of Brașov from the Polytechnic Institute of Bucharest, an Experimental Forest Station was founded, as the first nucleus of forestry research in Brașov. In 1953, the station was encompassed by the institute from Bucharest together with the other three experimental locations: Sinaia, Brașov – Noua and Sibiu. Brașov Experimental Station belonging to the Silvicultural Exploitation and Mechanization Research Institute was also appropriated four years later (1957). In 1960 the station's activity was extended by the creation of a wide congregation of 60 forest management planning specialists (engineers and technicians).

In 1963, the Game and Pisciculture Laboratory was created within Brașov Station, followed in 1966 by the National Conifer Seeds Conservation Centre. Ten years later (1976), the Biochemical Analysis Laboratory started analysing the chemical and biochemical characteristics of trees. In 1978, Săcele Experimental Base was taken under the administration of Brașov Station in order to test and apply the research results realized by the institute in mixed forests with common beech and conifers. Two years later (1980), the personnel belonging to the Torrent Correction Department from the Wood Industrialization Research & Design Institute of Brașov (ICPIL) was also encompassed. At present, the station has 111 employees, of which 62 are certified R&D personnel, grouped in the following administrative structures: Research Section, Cynegetics Section, Development Section and Săcele EB.

The approached research themes are specific to silviculture, dendrometrics, forest auxology, forest monitoring and management, ecology, genetics, forest protection, torrential watershed management, wildlife biology and management. Some detailed examples are rendered below:

- Evaluating and analysing the actions of the climate changes and the quality of environment and socio-economic factors on forest ecosystems.
- The dendrometrics and auxological substantiation of the information system for establishing the forest management plans.
- Knowledge of the ecological behaviour of forest species in normal and modified environmental conditions.
- Analysing the genetic diversity of the main forest tree species in order to improve their productive, adaptive and protective capacities.
- Identifying endangered, vulnerable and rare forest habitats in Romania.
- Improving identification, monitoring, prevention and control methods of forest diseases and pests.
- Promoting new biological or environmentally friendly control methods of harmful organisms.



- Optimising stand tending operations and regeneration cuttings.

- Analysing the genetic diversity of the main forest tree species in order to improve their productive, adaptive and protective capacities.

- Identifying endangered, vulnerable and rare forest habitats in Romania.

- Improving identification, monitoring, prevention and control methods of forest diseases and pests.

- Promoting new biological or environmentally friendly control methods of harmful organisms.

- Evaluation of health status and stability of trees in green areas and urban forests.

- Evaluating and monitoring the biological diversity (woody and herbal plants, mammals, birds, invertebrates, fungi etc.) of forest ecosystems.

- Evaluating and monitoring the biological diversity of forest ecosystems.

- Managing game and salmon resources.

- Promoting new culture technologies for species of community or national interest, including the recovery of the historical area of some extinct or endangered species.

- Monitoring and promoting technical solutions in order to increase the efficiency and duration of hydrotechnical works.

- Researching and advancing climate service development by advanced co-development with users considering their needs.

- Environmentally friendly solutions to manage torrential riverbeds located in protected areas.

- Developed engineering project for torrential watershed management based on hydrological modeling.

- The preparation of technical-economic documentation and the provision of technological services for the afforestation of degraded lands and the establishment of forest shelterbelts

- Assessing the water resources vulnerability under climate change and land use change scenarios in order to identify the measures required to secure their availability over time.



The development activity includes the elaboration of forest management plans in the GIS system for about 50 000 ha of forest, annually, with a focus on forests of Central Romania. Furthermore, other aspects are also approached: transfer of scientific knowledge and design of specific ecological reconstruction works for damaged forests and degraded lands, management of the torrential watershed, and forest cadastre.

Săcele EB currently manages 2 487 ha of public state forest. In this regard, 119 long-term experimental plots were dedicated to various studies, as follows:

- Experimenting tending of stands by applying long-term regeneration treatments (selection system, group selection system and shelterwood system).

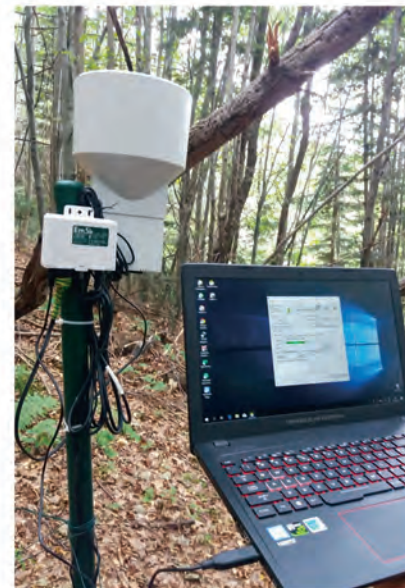
- Applying certain improvement methods for tracking, monitoring, preventing and controlling harmful pests and diseases in beech and resinous forests.

- Continuous monitoring of the state mountain forest ecosystems situated under the influence of climate changes, atmospheric pollution and other abiotic and biotic stress factors.

- Analysing the growth dynamic of pure vs mixed forest of beech and conifers.

- Genetically testing of trees and seed sources, phenotypically selected, in order to promote valuable provenances.

- Managing Norway spruce, Scots pine and Black pine for celluloses and resinous production (a unique scientific experiment in Romania) amelioration arboretum.



Braşov Station has three laboratories: Soil analysis, Animal genetics and Forest protection (microbiology, mycology, phytopathology, and entomology). These are completed by meteorological stations for monitoring climatic parameters as well as equipment and instruments for „in situ” monitoring of wild fauna.

3.4 CÂMPULUNG MOLDOVENESC RESEARCH - DEVELOPMENT AND EXPERIMENTATION - PRODUCTION (RDEP) STATION



Câmpulung Moldovenesc RDEP Station was established in 1949, in the same year as the Forestry Faculty of Câmpulung Moldovenesc. Starting in 1955, the development teams of Roman and Hemeiuş (Bacău) were functioning within the station. In 1967, the station was named “Experimental Station for Norway Spruce Culture”, with the purpose of expanding research, development and experimentation activities on conifer silviculture. Starting in 1976, the Tomnatic Experimental Base was included within the station, having the purpose of testing, and transferring research results in the production sector.

At present, 111 employees activate within the station (from which 46 are certified R&D specialists), ensuring the activity of the following sections: Câmpulung Moldovenesc Research Station, Tomnatic EB, Hemeiuş EB, Roman Development Section and Bacău R&D Section.

Research activities approach aspects specific to forest biometry, dendrochronology, forest monitoring, silvo-technics, forest management, ecology, forest protection and genetics, as follows:

- Improving and developing procedures and models for regulating the production process.
- Developing long-term inter- and transdisciplinary ecological concerning the state of forest ecosystems under the action of climate changes, atmospheric pollution, and other risk factors.
- Knowledge of the destabilizing biotic and abiotic factors and their influence on forest ecosystems, together with establishing their integrated control measures.
- Evaluating the genetic diversity of forest species in order to increase their adaptability to climate changes.
- Optimizing the silvicultural treatments and the technologies of stand regeneration, maintenance, and management, with a special focus on mountain forest ecosystems.
- Reconstructing the climate and dynamic of past ecosystem events based on dendrochronological analyses.
- Estimating wood biomass.
- Improving the methods for detecting, monitoring, preventing and controlling forest harmful agents and diseases, including the promotion of new biological control methods.

The technological development activity includes the elaboration of the forest management plans in GIS system for over 60 000 ha/year, in Eastern, North-Eastern and South-Eastern parts of Romania. Furthermore, aspects regarding ecological restoration of degraded lands, forest cadastre, biodiversity conservation and evaluation of forest resources are also approached.

Tomnatic EB manages an area of over 6 800 ha (public state forest property) and the Hemeiuş Arboretum (48.37 ha), where activities concerning the below-mentioned domains are undertaken:

- The multifunctional management of conifer and mixed (common beech and resinous species) forests.
- Monitoring long-term experiments (dating as back as 6-7 decades) in regard with: tending operation, stand regeneration, the intensive survey of forest ecosystems, and managing stands with resonance wood.
- Applying close-to-nature treatments with a long regeneration period: selection system, irregular shelterwood system, group shelterwood system.
 - Managing larch seed orchard and ensuring conservation of Hemeiuş Arboretum.
 - Testing acclimatization and management of ornamental exotic tree species.
 - Experimenting research results in all forest domains in order to transfer them towards national silvicultural administration structures.

Câmpulung Moldovenesc RDEP Station disposes of an integrated network of over 30 experimental plots and comparative plantations focusing on the dynamic, stability and productivity of resinous stands. The laboratory infrastructure is specialised for analysing humid atmospheric deposits (originating from precipitations and soil solutions), **polluting** agents (ozone, NO_x), soil and foliar analysis, wood anatomy and xylological processes. Performing meteorological recorders are used for the integrated monitoring of the local climate.





3.5 CRAIOVA RESEARCH

- DEVELOPMENT AND EXPERIMENTATION - PRODUCTION (RDEP) STATION



Craiova RDEP Station was founded in 1954, as belonging to the Institute from Bucharest, with the purpose of realizing research activities concerning the culture of locust on sandy soils from South-Western Romania. Starting in 1969, two new activities were developed within the institute (forest management planning, and forest road designing) through the union with the Craiova Branch of Forest Projections and Studies Institute. In the present, the station focuses on research, development and experimentation - production activities, with the help of its 35 employees of which 18 are certified R&D personnel.

The following sections are constituents of the station: Craiova Research Section, Craiova Development Section and Craiova Experimental Base (EB).

The research activity approaches different aspects of forest protection, genetics and tree breeding, and ecological reconstruction of degraded lands, as follows:

- Improving tracking, monitoring, preventing, and controlling methods for forest harmful agents.
- Testing modern technologies for applying treatments against defoliator insects.
- Development of methods of monitoring and assessment of injuries, using remote sensing techniques.
- Development of technologies for the control of pest populations in deciduous forests by using entomopathogenic microorganisms and entomophagous insects.
- Assessment of the phytosanitary state of the forests and the potential risks of injury.
- Knowledge of the bioecology of some invasive insects harmful to broad-leaved forests.
- The “in situ” and “ex situ” conservation of the black locust genetic resources (*Robinia pseudoacacia* var. *oltenica*).
- The ecological reconstruction of waste heaps and ash deposits in Rovinari coal mining basin.
- Evaluating the productive and adaptive (towards hydric stress) potential of certain forest species in improper lands for agricultural cultures.





The development activity includes the elaboration of forest management plans (in GIS system) for approximately 30 000 ha of forest annually, with a focus on the forest of South-Western Romania. Furthermore, aspects concerning the ecological reconstruction of degraded lands and the design of forest shelterbelts for protecting communication and agricultural fields have also been studied.

The experimental base manages a forest surface of about 20 ha (public state property) where the following activities are undertaken: sustainable management of mixed hardwood stands with a long regeneration period, and long-term experiments regarding the evolution of deciduous forests under the influence of insect defoliations.

Craiova RDEP Station has at its disposal a Forest entomology laboratory, while the Development Section has specific equipment for gathering field data and elaborating management plans in GIS system.

Through the activities carried out, Craiova RDEP Station contributes to maintaining and improving the health of the forests in the Oltenia region (southern Romania), ensuring their sustainable development.

Specialists from the station are involved in various projects from national and international research programs, such as SIPOCA, CRESFORLIFE, Nucleu Program s.a. The Craiova RDEP Station has an important contribution to the scientific foundation of practices and decisions in the regional and national forestry sector.



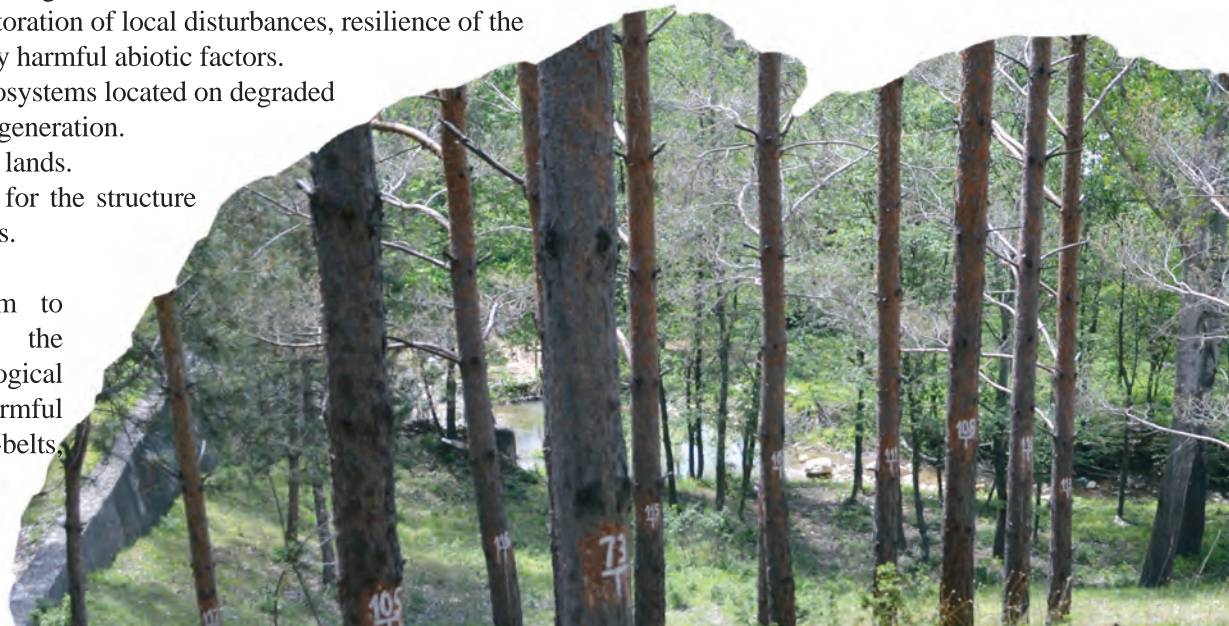
3.6 FOCȘANI RESEARCH - DEVELOPMENT AND EXPERIMENTATION - PRODUCTION (RDEP) STATION

Focșani RDEP Station was founded in 1962, under the name Focșani Experimentation Station for the Afforestation of Degraded Lands and Torrents Control. Its main purpose was to substantiate technical solutions for the afforestation of degraded lands of Vrancea County (Eastern Romania). In 1977 the station was extended by including Vidra Experimental Base (EB) in its structure. At present, 49 employees of which 37 are technical-engineering staff (4 certified R&D personnel), and are working in the Focșani R&D Section and Vidra EB.

The research activities are mainly approaching aspects of silvotechnics and ecological restoration of different categories of degraded lands, the forestry stands installed on them and the forests affected by harmful abiotic factors, as follows:

- The scientific substantiation of arrangement/consolidation/improvement technologies and the methods and techniques of afforestation of different categories of degraded lands: eroded, ravined; sliding, meadows, disturbed, polluted lands, etc.
- Improving tending and management techniques of the stands.
- Improving methods, techniques and technologies for the creation of forest shelter-belts.
- Ecological restoration (improvement, restoration of local disturbances, resilience of the stands) of unstable forest stands or affected by harmful abiotic factors.
- Monitoring the evolution of the forest ecosystems located on degraded lands and establishing the methods of their regeneration.
- Improving the site typology for degraded lands.
- Designing digital and statistical models for the structure and quality optimization of the affected stands.

The research-development activities aim to technological transferring regarding the afforestation of degraded lands, the ecological reconstruction of stands affected by harmful factors, creating forest protection shelter-belts, design and rehabilitation of forest roads and managing torrent control structures in watersheds.



Within Vidra EB, a surface of approximately 8 500 ha is dedicated to applying and experimenting and validating the Institute's research results, in order to implement them in the silvicultural practice. This basis includes the Protected Forest Area of ROSPA 0075 - Măgura Odobești, within which a project is being developed regarding the updating and implementation of the management plan, including ecological reconstruction activities of approx. 60 ha of degraded ecosystems.

Focșani RDEP Station manages a network of 117 experimental plots (1054 ha), from which 79 plots (211 ha) have the main objective of researching restored degraded lands (and the evolution of their forest plantations) in Vidra EB. The other 6 experimental surfaces have special equipment for registering precipitations and drainage from afforested slopes. Furthermore, Focșani Station also manages a network of about 80 research surfaces from South-Eastern Romania (monitoring of restored degraded lands, afforestation technologies and agro - forestry cultures).



3.7 ORADEA RESEARCH - DEVELOPMENT AND EXPERIMENTATION - PRODUCTION (RDEP) STATION

Oradea RDEP Station was established in 1952 through the III North Oradea Expedition belonging to Bucharest's Silvicultural Projection Institute which operated in Satu Mare between 1952 - 1954.

The purpose of establishing the station was to elaborate forest management plans for the North, North-West and West regions of the country. Currently, Oradea Station focuses on development activities (forest management plans for 32000 ha/year and national forest inventory) with the help of 23 employees (17 certified personnel).



The main activity includes aspects specific to the region, as follows:

- Managing Norway spruce stands from areas vulnerable to windfalls in Oriental Carpathians and drought in Apuseni Mt.
- Ecological reconstruction and afforestation for destructured stands with species corresponding to the natural type of forest.
- Tending sandy stands from the western silvo-steppe zone.
- Coppicing black locust forests by proper treatment.
- Characterizing new forest types for Romanian taxonomy: “Western black locust stands on sand dunes with medium productivity” and “Western black locust stands on sand dunes with lower productivity”.
- Managing oak forests from the West part of Romania that vegetate in edaphic and extreme climatic conditions, situated at the limit between steppe and silvo-steppe, where the regeneration with species resistant to these conditions is hard to obtain.

Another activity is achieved by the National Forest Inventory team and consists of collecting, managing, and analyzing information regarding the forest resources from the West and North-Western parts of Romania.

The main activity of Oradea Station is to elaborate the forest management plans.

Oradea Station has specific and modern equipment for collecting field data and elaborating forest management plans in GIS system.



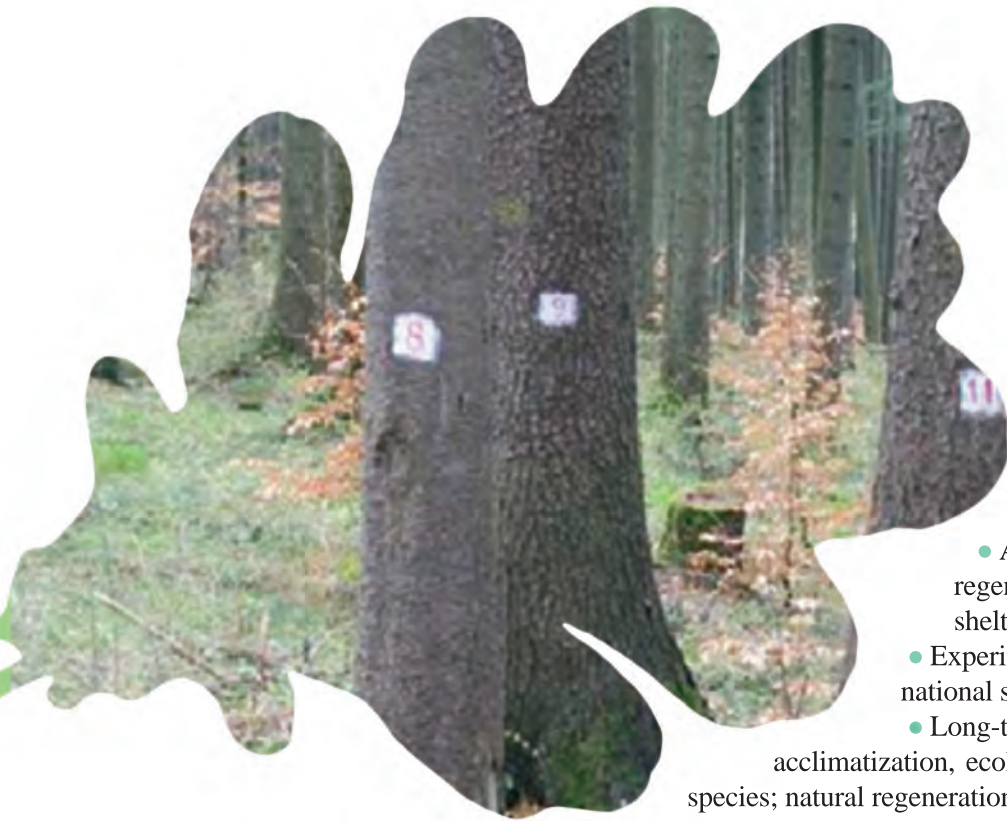
3.8 PITEȘTI RESEARCH - DEVELOPMENT AND EXPERIMENTATION - PRODUCTION (RDEP) STATION

Pitești RDEP Station was founded in 1976, as a branch of the institute from Bucharest, with the purpose of realizing research, development and experimentation-production activities for the Carpathian and South Subcarpathian area. Mihăești EB was included in its structure by the Forest Research Institute even from 1942, its intended purpose being to apply and generalize the investigation results in the silviculture practice. At present, the station focuses on research, development and experimentation - production activities, with a number of 118 specialists (32 R&D certified personnel) that are working in Mihăești Research Section, Pitești Development Section and Mihăești Experimental Base.

Research activities approach aspects specific to forest biometry, forest management, silvotechnics, ecology and forest genetics, as follows:

- Improving and developing procedures and models for regulating the forest production process.
- Improving the informatic systems for elaborating forest management plans.
- Developing long-term inter- and transdisciplinary ecological research for forest ecosystems situated under climatic changes, atmospheric pollution, and other risk factors.
- Understanding destabilizing biotic and abiotic factors and their action on forest ecosystems, as well as establishing integrated control measures.
- Evaluating the genetic diversity of forest species in order to increase their adaptability towards climatic changes.
- Optimising of the silvicultural treatments, forest stand regeneration and tending of forest stands.





The development activity includes the elaboration of the forest management plans, annually, for over 90 000 ha of forest from South, South-Eastern and South-Western Romania, in GIS system. Furthermore, aspects regarding ecological reconstruction of degraded lands, forest cadastre and biodiversity conservation are also under study.

Mihăești EB manages a surface of 8 468 ha (public state forest), with a focus on the following activities:

- Managing forests, starting in 1964, from an experimental plan based on naturalistic principles (experimental management series), unique in Romanian silviculture.
- Monitoring long-term experiments (dating back to 6 - 7 decades) in regard with: tending operation, stand regeneration, acclimatization of exotic species, breeding the forest species, and the intensive surveillance of forest ecosystems status.
- Applying close-to-nature silvicultural treatments with a long regeneration period: selection system, shelterwood system, group shelterwood system.
- Experimenting new research results before transferring towards national silvicultural administrative structures.
- Long-term experiments in the Mihăești Arboretum, concerning: acclimatization, ecological compatibility, and possible extension of exotic forest species; natural regeneration of different exotic and local species; the genetic amelioration of Norway spruce.

Pitești Station has an integrated network of 57 experimental plots (the majority located in Mihăești EB). Laboratory and field equipment ensure the forest ecosystem monitoring (ICP, Level II), in situ survey of greenhouse effect gases and special equipment for elaborating forest management plans in GIS system.

3.9 TIMIȘOARA RESEARCH - DEVELOPMENT AND EXPERIMENTATION - PRODUCTION (RDEP) STATION

Timișoara RDEP Station was founded in 1935 under the name “Casa Verde Timișoara Silvicultural Experimentation Station”. Even from the start, the institution benefited from a complex Experimental Base consisting of the Bazoș Arboretum. In 1969, the forest research activity merges with the forest management activity.

Nowadays, the station includes Timișoara R&D Section, Simeria Research Section, Caransebeș Research Section, Caransebeș EB (17 733 ha experimental forests), Timișoara EB (64.3 ha - Bazos Arboretum, 2.7 ha - Bazoș nursery, 11.4 ha Timișoara nursery), Simeria EB (67 ha - Simeria Arboretum and 12 ha - Dobra nursery) and performs research, development and experimentation - production activities with the help of its 93 employees, from which 21 are certified R&D personnel.



Research activities are approaching specific aspects of the forest ecology, forest protection, genetics and forest engineering domains, as follows:

- Studying the forest ecosystems with high degree of naturalness: structure, dynamics, biodiversity.
- Developing long-term inter- and transdisciplinary ecological research concerning the state of forest ecosystems under the action of climatic changes, atmospheric pollution and other risk factors.
- Substantiation of management plans for protected areas from the western part of Romania (National Parks and Natura 2000 sites): identification, mapping (GIS) and description of forest ecosystems/Natura 2000 forest habitats, evaluation of their conservation status, issuing adequate management measures.
- Identification, mapping and characterisation of virgin and quasi-virgin forests and their respective inscription in the National Catalogue for long-term protection and conservation.
- Developing studies regarding the Outstanding Universal Value and the preservation of the Romanian beech forest ecosystems included in the UNESCO World Heritage.
- Analysing genetic diversity of forest tree species.
- Selecting and breeding the most valuable genotypes to environment changes and invasive fungi.
- Identifying and describing new Forest Genetic Resources (FGR) in order to increase the adaptive capacity of forest ecosystems towards global climatic changes.
- Developing new advanced biotechnologies in order to preserve ex situ the FGR.
- Transferring forest protection knowledge towards forest districts in the western part of Romania.
- Elaborating ecotechnologies for forest engineering.



The development activities are related to the elaboration of forest management plans for approx. 20 000 ha of forest, annually, for Western Romania, as well as offering prognosis and studies concerning regional wood resources.

Experimental bases are represented by:

- Forests designated to testing the silvicultural operations (Caransebeş EB – 17 733 ha), sheltering 27 long-term experimental plots concerning tending operations, stand regeneration, substantiation of beech silvicultural systems with long period of regeneration (selection system, irregular and group shelterwood system).
- Forest species breeding and scientific collections (Simeria Arboretum – 67 ha, Bazoş Arboretum – 64.3 ha, Timișoara EB – 11.4 ha), where exotic species and taxa adaptation and development are monitored.
- Nurseries Dobra (12 ha) and Bazoş (2.7 ha) ensure seedling production of forest and ornamental plants.

Simeria Research Section has a laboratory of molecular analyses, that develop the genetic diversity studies on forest tree species.



3.10 ȘTEFĂNEȘTI EXPERIMENTATION - PRODUCTION (EP) STATION

Ștefănești EP Station was founded in 1954 for experimenting and applying in forest practice the research results. For the beginning, in order to ensure optimal activities and achieve its intended purpose, the station was allocated a total surface of 435.71 ha (forest, forest nursery and forest fruit crops etc.) which was dedicated to studying and experimenting in the silvicultural research activity.

At present, Ștefănești EP Station includes besides Ștefănești EP Station, other three Experimental Bases (EB): Bărăgan (founded in 1945), Cornetu (founded in 1957) and Tulcea (founded in 1988) and manages over 1 276 ha of forest lands (forests, forest nursery etc.).

Through its 37 employees, from which 15 are certified technical personnel, the following research-experimentation activities are achieved:

- Intensive monitoring (Level II) of the health status of the local forest ecosystems (based on common oak mixed with other broadleaved species).
- Evaluation of ecosystem services provided by periurban forests.
- Management of peri-urban forest with recreational functions.
- Management and improvement of the mixed forests of oak and different broadleaved species from the plain region.
- The technique of installing and managing forests in steppe and silvo-steppe regions.
- Breeding, culture and protection of poplars and willows.
- Selection and culture of common and xerophytic oaks (*Q. pedunculiflora* and *Q. pubescens*).
- Mechanization of forest works in the plain and arid zone.
- The technique of setting up and cultivating energetic species.
- Acclimatisation of ornamental tree species.



The main activity realized within the forest nursery from Ștefănești EP Station, occupying a total surface of 82 hectares, is represented by the production of:

- Seedlings, saplings and young trees or bushes of forest or ornamental species (Ștefănești EB and Bărăgan EB).
- Seedlings of forest species resistant to drought for afforestation in the southern and south-eastern zones of the country exposed to the aridization process (Bărăgan EB).
- Seedlings of forest species with high longevity and resistant to wind and snow action for use in forest belts for protection of the field and communications (Cornetu EB and Bărăgan EB).
- Reproduction material with certain clone identity from *Populus* and *Salix* Genus, both for installing poplar and willow cultures selected in forest fields from Danube's and other river meadows (Tulcea Experimental Station), as well as for conserving ex situ these species by creating mother plant cultures of poplar and willow (cuttings from cultivars/clones allowed in production through actual technical norms).



Ștefănești EP Station manages a number of 46 permanent plots for evaluating and analysing the state of oak and different mixtures of broad-leaved forest ecosystems. This is complemented by the Intensive monitoring plot (ICP-Forests – Level II) “Ștefănești – oak”.





4. RESEARCH TEAMS, DEVELOPMENT AND EXPERIMENTATION ACTIVITY

4.1 DENDROMETRICS, FOREST MANAGEMENT PLANNING AND FOREST MONITORING TEAM (T1)

4.2 FOREST ECOLOGY TEAM (T2)

4.3 FOREST GENETICS AND TREE BREEDING TEAM (T3)

4.4 WILDLIFE BIOLOGY AND MANAGEMENT TEAM (T4)

4.5 SILVO-TECHNICS TEAM (T5)

4.6 FOREST PROTECTION TEAM (T6)

4.7 FORESTRY GEOMATICS TEAM (T7)

4.8 TECHNOLOGICAL DEVELOPMENT

4.9 NATIONAL FOREST INVENTORY

4.10 EXPERIMENTAL PATRIMONY

4.1 DENDROMETRICS, FOREST MANAGEMENT PLANNING AND FOREST MONITORING TEAM (T1)

The **main objective** of the research team is to integrate inter- and multidisciplinary issues specific to dendrometrics, forest management planning, dendrochronology for long-term ecological research/monitoring of forest ecosystems under the action of diverse stress factors, mainly climatic changes and atmospheric pollution.

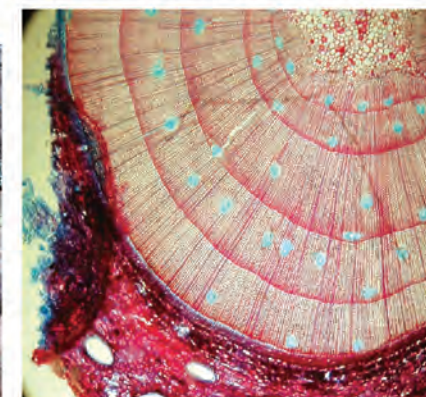
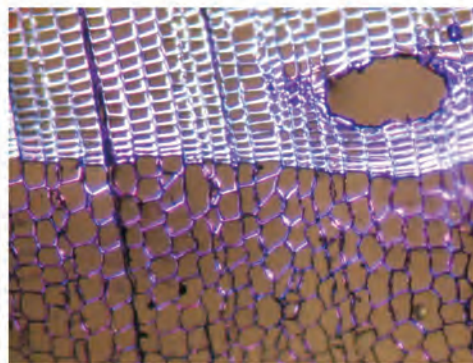
The research **team** is well structured in research departments based on their specific degrees, age and competencies. As such, the research team is composed of 24 members, from which 9 senior researchers, 7 researchers, 3 technological development engineers and 5 technical staff.

Major research achievements

The team in charge with research in dendrometry, forest management planning and forest monitoring is a fundamental component of INCDS scientific activities, proven by its significant achievements and results both at a national and international level, such as the following:

Dendrometry and forest management

- Improving and developing procedures and methods for regulating the production process, evaluating and predicting forest resources, together with their exploitation and usage.
- Determining the size and structure of the real production of stands led by applying intensive treatments (group shelterwood cutting with a long regeneration period, and selection cutting).
- Quantifying productive, protective and landscape functions of forests together with the ecosystem services offered by them.
- Elaborating and implementing new dendrometry and mathematical-auxological methods and models in practical silviculture, forest management plans and in the National Forest Inventory.
- Estimating the structure, dynamic, production and productivity of forest ecosystems.
- The biometric characterisation of stands by applying methods for interpreting data obtained through LIDAR images and Terrestrial Laser Scanners.
- Elaborating forest management plans on ecological and economic basis.
- Elaborating and implementing specific models for determining carbon stocks of the forest biomass.



4.1 DENDROMETRICS, FOREST MANAGEMENT PLANNING AND FOREST MONITORING TEAM (T1)



Forest monitoring

- The long-term, inter- and multidisciplinary analysis, evaluation and research/monitoring of forest ecosystems and their biodiversity under the action of climatic changes and other biotic and abiotic stress factors.
- Implementing long-term research networks for monitoring the health of forest ecosystems.
- Evaluating the resistance, resilience and adaptability of forest species towards long-term climatic changes by using multiproxy dendrochronological series networks.
- The intra-annual evaluation and monitoring of processes for the annual ring formation by using automatic xylological and dendrometrics methods.
- Reconstructing the old-century variation of the paleoclimate as well as the regime of disruptive factors.
- Evaluating the impact of global changes over the structural characteristics of forests.
- The continuous surveillance of disruptive abiotic factors and risk zoning (pollution, snow, wind, drought, etc.).



4.1 DENDROMETRICS, FOREST MANAGEMENT PLANNING AND FOREST MONITORING TEAM (T1)

The integrated research is implemented by nationally (PNCDI III, IV, economic forest enterprises) or internationally (EEA, Life+, Horizon 2020) funded research projects, like as:

- Adaptation and resilience to climate change in Carpathians forests. Multi-species and multi-time scale approach. PNCDI III, Exploratory Research Projects (PCE 2021) PN-III-P4-PCE-2021-1002 (2022-2024).
- Prototyping an Earth-Observation based monitoring and forecasting system for the Romanian forest – EO-ROFORMON, Contract 90/09.09.2016 (P_37_651). Competitiveness Operational Programme 2014-2020, Axis 1, Section E, (2016 –2020).
- Growth phenology and response to climate change of trees and dwarf shrubs species in treeline ecotone from Carpathians. a multispecies and multiproxy approach. PNCDI III, Exploratory Research Projects (PCE 2021) PN-III-P4-ID-PCE-2016-0253 (2017-2019).
- Long-term dynamics of the state of some representative forest ecosystems in protected areas (LTER Retezat, Bucegi-Piatra Craiului and Lunca Mureșului Natural Park sites). Nucleu Program GENERESERV, Ctr. 26N/2018, PN 19070101 (2019-2022).
- Monitoring of forest ecosystems in Romania in accordance with the forest surveillance systems adopted at European level (Level I and II), Nucleu Program GENERESERV, Ctr. 26N/2018, PN 19070102 (2019-2022).
- Research on increasing productivity in the forest management activity by organizing production and work in relation to the current applied technologies, Nucleu Program GENERESERV, Ctr. 26N/2018, PN 19070105 (2019-2022).
- Optimizing the system of organization and structural management of forests in order to ensure their sustainable management, Nucleu Program GENERESERV, Ctr. 26N/2018, PN 19070103 (2019-2022).
- Perfecting the long-term multifunctional ecological research system of the state of some representative forest ecosystems in Romania in order to develop new scientific knowledge regarding the effects of atmospheric pollution, climate change and other stress factors and their utilization for decision-making purposes, Nucleu Program FORCLIMSOC, Ctr. 12N/2023, PN 23090101 (2023-2026).
- New scientific foundations for the development of integrated solutions, models and methods specific to a climate-smart forest management, sustainable and adapted to the socio-economic system, Nucleu Program FORCLIMSOC, Ctr. 12N/2023, PN 23090201 (2023-2026).
- Scientific contributions regarding the substantiation of methods and models for establishing the value of ecosystem functions and services provided by forests, adapted to the Romanian system of classification and functional zoning, Nucleu Program FORCLIMSOC, Ctr. 12N/2023, PN 23090202 (2023-2026).
- Forest response to climate change predicted from multicentury climate proxy-records in the Charpathian region, CLIMFOR, EEA Grants (2014-2017).
- MOnitoring ozone injury for seTTing new critical LEvelS (MOTTLES), LIFE15 ENV/IT/000183 (2016-2020).

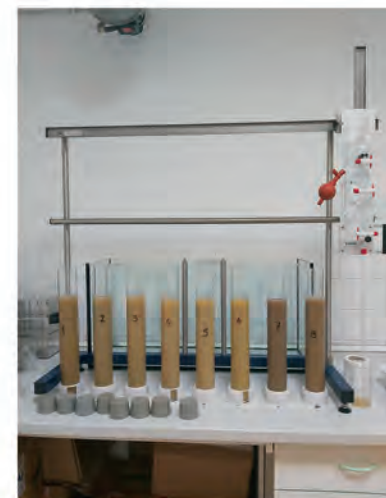
4.2 FOREST ECOLOGY TEAM (T2)

The **main objective** of the Forest Ecology team consists of research on forest ecosystems, covering a broad spectrum of forest topics from soil sciences and forest sites to ecology, typology, physiology, conservation biology and biodiversity. Investigations are mainly focused on analyzing the relationships between forest vegetation and different environmental conditions under the action of climate change and other stress factors.

The research **team** consists of 3 senior researchers, 15 researchers, and 4 technical staff. Four of them are associate professors in forest sciences.

The **main achievements** of the Forest Ecology team on the approached research aspects are:

- Evaluating and monitoring the impact generated by the change of ecological, economic and social factors on the biological diversity of forests.
- Establishing conservation measures for natural habitats and forest ecosystem flora.
- Knowledge of the ecological behaviour of forest species in normal and perturbed environment conditions.
- Identifying and mapping the types of forest ecosystems valuable from a biodiversity point of view.
- Establishing methodologies for identifying, evaluating and classifying rare, threatened or vulnerable forest habitats.
- Identifying and assessing endangered, vulnerable or rare Romanian forest habitats, including forests with high conservation values.
 - Updating the red list of rare, threatened or vulnerable forest habitats and their classification in Romania's forest types.
 - Developing research on soil and forest site systematics, as well as creating and updating their database.
 - Developing the database for mapping the forest ecosystems in Romania.
 - Assessing forest sites from the Lower Danube Floodplain and Danube Delta, with a special emphasis placed on highly anthropically transformed areas.
 - Promoting technical solutions for the ecological reconstruction of valuable forest ecosystems.
 - Evaluating and monitoring greenhouse gases, their impact on forest management and carbon stock in all ecosystem components (soil and litter, dead and living wood) together with studying their inner processes (mineralization, respiration).
 - The scientific substantiation of management plans for protected areas (National Parks and Natura 2000 sites): identification, mapping and description of forest ecosystems/Natura 2000 forest habitats, evaluation of their conservation status, issuing the adequate management measures, GIS and databases.
 - Studies on the forest ecosystems with high degree of naturality: structure, dynamics, biodiversity.
 - Identification, mapping and characterisation of virgin and quasi-virgin forests and their respective inscription in the National Catalogue for long-term protection and conservation.
 - Studies regarding the Outstanding Universal Value and the preservation of beech forest ecosystems included in the UNESCO World Heritage.
 - Identifying and assessing the monumental trees from Romania.



Pedology laboratory



Monumental silver fir tree from RPL Pădurile, (Braşov county)

4.2 FOREST ECOLOGY TEAM (T2)

- Assessing the health status of urban trees by using sonic tomography.
- Assessing the biological resources of wild berries, medicinal and aromatic plants, edible mushrooms and truffles from the forests managed by RNP Romsilva.
- Ensuring the maintenance of BUCF “Alexandru Beldie” Herbarium.

The research team participates in many projects at the national (PNCDI III, IV, structural funds, economic agents) and international levels, like:

- Above- and below-ground biomass and carbon content of a virgin beech-fir mixed forest (BIOCARB), PNCDI III, National research grant for young teams (TE 2016), PN-III-P1-1.1-TE-2016-1508 (2018-2020).
- Evaluating the structural, functional and specific diversification of natural and cvasi-natural forests in order to protect biodiversity in the context of climatic changes”, Nucleu Program FORCLIMSOC, Ctr. 12N/2023, PN 23090301 (2023-2026).
- The health status and conservation of monumental trees from Romania in the context of climatic changes, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070505, (2019-2022).
- Shaping extreme climatic factors over forest ecosystems, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070506 (2019-2022).
- The impact of forest exploitation works on the main components of forest ecosystems and establishing the tolerance thresholds, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070507 (2019-2022).
- Agreement 162. MMAP: „A study for elaborating the National Strategy for preventing and fighting against desertification and field degradation 2019-2030”.



Cupboards with the samples of species from “Alexandru Beldie” Herbarium



Arbotom ABTO 5S, 2D/3D-Sonic-Tree-Tomography

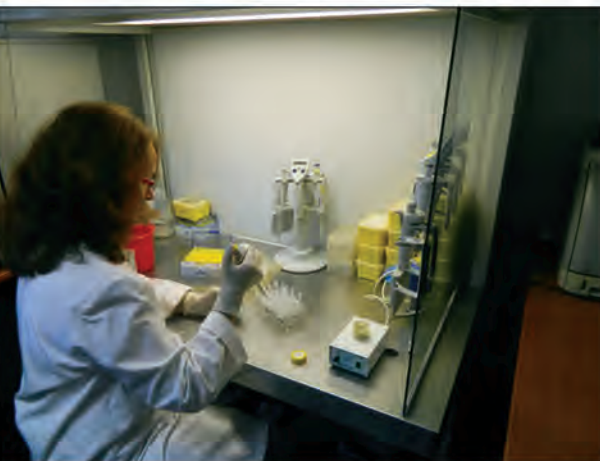


Beech virgin forest, Domogled – Valea Cernei National Park



High conservation value forest 1 (HCVF 1)

4.3 FOREST GENETICS AND TREE BREEDING TEAM (T3)



The **main objective** is assessing and monitoring the genetic diversity in the forest tree populations in order to promote the conservation and sustainable use of forest genetic resources. The overall goal is to develop knowledge, coordinate strategies and promote the proper use of genetic resources, as an integral part of sustainable forest management.

The genetic **team's** research is structured in departments, within 7 research stations, based on technical facilities, personnel competencies and local needs. The team is composed of 30 members: 5 senior researchers, 10 researchers, 5 technological engineers and 10 technical staff.

Major research achievements

The research activity carried out by the Genetic team in the past (over the last 10 years) is characterized by integrated interdisciplinary and multidisciplinary approaches specific to genetics and tree breeding. The main achievements of the genetic team were in the field of:

Quantitative genetics and breeding programs

- Assessing the intra and inter-population genetic variability for establishing the most valuable seed stands, based on provenance and progeny tests, and identifying basic materials sources.
- Identifying the most valuable genotypes (hybrid families, individuals within-families, parents) for silver fir and larch, in order to establish the second generation of seed orchards.
- Introducing and testing new poplar and willow clones with high productivity and resistance against diseases and developing new technologies for poplar cultivation.
- Databases development for 200 long-term experimental trials (including their tested genetic units) and 118 seed orchards.

Establishment, conservation and sustainable management of FGR

- Establishing and selecting new valuable genetic resources.
- Monitoring the genetic resources from the National Catalog of Forest Genetic Units and National Catalogue of Forest Reproductive Material and updating the GIS database.
- Developing Technical Guidelines for sustainable management and use of forest reproductive material.
- Delineating Provenance Regions according to national and European legislation.
- Developing and implementing advanced techniques in seed conservation (for oaks, beech, silver fir, larch, and Norway spruce).
- Implementing new biotechnology-based techniques for the micropropagation of valuable genotypes and *ex situ* conservation of FGR.



Sequencing Lab

4.3 FOREST GENETICS AND TREE BREEDING TEAM (T3)

Molecular genetics

- Assessing genetic diversity and population structure in white oaks (subgenus *Lepidobalanus*), using nuclear and chloroplast molecular markers (EST-SSRs, nSSRs, cpSSRs).

- Assessing genetic diversity and population structure in silver fir and Norway spruce using nuclear molecular markers (EST-SSRs, nSSRs).

- Developing new genomic and transcriptomic resources for the main forest tree species, for sustainable management in order to improve the adaptability of ecosystems to global environmental changes.

- Phylogeographic structure and postglacial evolutionary history of broadleaved forest species and silver fir in the Balkan region.

- Development of DNA - based methods for tracing forest reproductive material using molecular markers.



In vitro culture



The team's research is implemented by nationally and internationally funded research projects, like as:

- Identification and characterization through advanced models of forest genetic resources with high adaptive potential, as well as their conservation under the conditions of climate sustainable forest management, Nucleu Program FORCLIMSOC, Ctr. 12N/2023, PN 23090302 (2023-2026).

- Ex situ* conservation of forest species with climate resilience and the scientific foundation of advanced technologies for obtaining genetically improved seedlings, Nucleu Program FORCLIMSOC, Ctr. 12N/2023, PN 23090303 (2023-2026).

- Increasing the resilience of fragmented and degraded forest ecosystems through the conservation, use and sustainable management of Forest Genetic Resources, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070301 (2019-2022).

- Improving the productive and adaptation potential of spruce forests by promoting valuable provenances, ideotype trees, as well as by increasing the number of sources of genetically improved seeds, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070302 (2019-2022).

- Review of the regions of provenance for the production and use of reproductive forest materials in Romania in order to increase the adaptation capacity of forest ecosystems to climate change, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070303 (2019-2022).

- Estimating the adaptive potential and resilience capacity of oak forest ecosystems vulnerable to climate change through multidisciplinary analyzes and the development of genomic resources, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070304 (2019-2022).

- New approaches regarding the installation and management of resinous seed orchards, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070305 (2019-2022).

- Harnessing forest genetic resources for increasing options in the face of environmental and societal challenges – OptFOREST - HORIZON-CL6-2022-BIODIV-01-07 (2022-2027).

- Improving access to FOREst GENetic Resources Information and Services for End-Users – FORGENIUS - H2020-SFS-2019-2 (2021-2025).

4.4 WILDLIFE BIOLOGY AND MANAGEMENT TEAM (T4)

The **main objective** of the Wildlife Biology and Management research team consists of studying wildlife in the context of the society developments and the mitigation of its impact on Romanian wildlife populations.

The research **team** consists of 2 senior researcher, 12 researchers and 5 technical staff. Two of them are associate professors in forest sciences.

The team approaches inter/multidisciplinary research related to: wildlife management, monitoring, ecology and ethology; human-wildlife conflicts; wildlife population genetics; landscape genetics and forensic studies; species and habitats conservation (including protected areas and wetlands); connectivity and strategies for adapting to climate changes; policy and strategies at large landscape level; species reintroductions.



4.4 WILDLIFE BIOLOGY AND MANAGEMENT TEAM (T4)

Major research achievements:

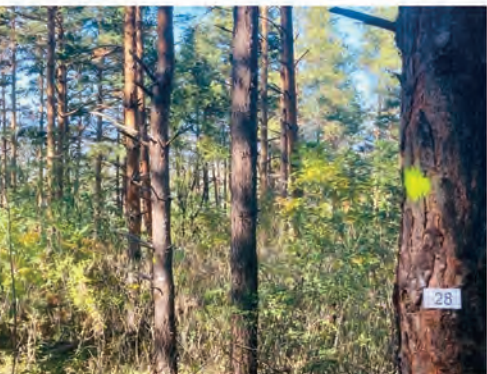
- Species reintroduction: Eurasian beaver and marmot.
- Monitoring of wildlife species using last generation equipment (noninvasive genetics, GPS collars, photo trap cameras, night vision and thermal camera, and drones).
- First molecular genetics analyses of wildlife species in Romania using our own Genetic lab.
- Determining the best strategies for wildlife adaptation to climate change.
- The intercalibration of the Animal Genetic laboratory with European research laboratories.
- Implementing national monitoring schemes and reports on the conservation status for mammal species under the Habitats Directive.
 - Monitoring human wildlife conflicts and elaborating the national management plan for brown bears.
 - Participating in the elaboration of national long - term monitoring and management systems of large carnivores and game species.
 - Advocating for connectivity and conservation of the wildlife species at national and international level, as well as elaborating strategies for their long - term preservation.
 - Transferring the research results to stakeholders in order to improve the management of wildlife species.
 - Technologies for wild boars, roe deer and fallow deer breeding.
 - Identification and protection of ecological corridors.
 - Promoting new culture technologies for endangered species of animals, including remaking the historical distribution areal of some species situated in a conservation state.

The team's activity is realized within R&D **projects** supported by international (Life+, Horizon 2020, SEE) and national funds (PNCDI III, POS Mediu, Nucleu), such as:

- Preventing animal-vehicle collisions – demonstration of best practices targeting priority species in SE Europe, LIFE SAFE-CROSSING LIFE 17 NAT/IT/000464 (2019-2023).
- Implementation of the national action plan for the conservation of the brown bear population in Romania, IPAURS, POIM COD SMIS - 136899 Program (2019-2023).
 - Ecological corridors for habitat and species in Romania, COREHABS, European Economic Area (EEA) Financial Mechanism, Biodiversity and Ecosystem Services - Programme ID RO02 (2015-2017).
 - Environmental restoration and support of natural processes in the forests and eutrophic marshes from Prejmer and Hărman, LIFE 11NAT/RO 828 (2012-2017).
 - Conservation of brown bear (*Ursus arctos*) population in Romania, LIFE FOR BEAR, LIFE13 NAT/RO/001154 (2014-2019).



4.5 SILVO-TECHNICS TEAM (T5)



The **main objective** is substantiating and improving the specific technologies for managing and regenerating forest stands, ecological reconstructing, and torrential watershed managing, in the context of climate change.

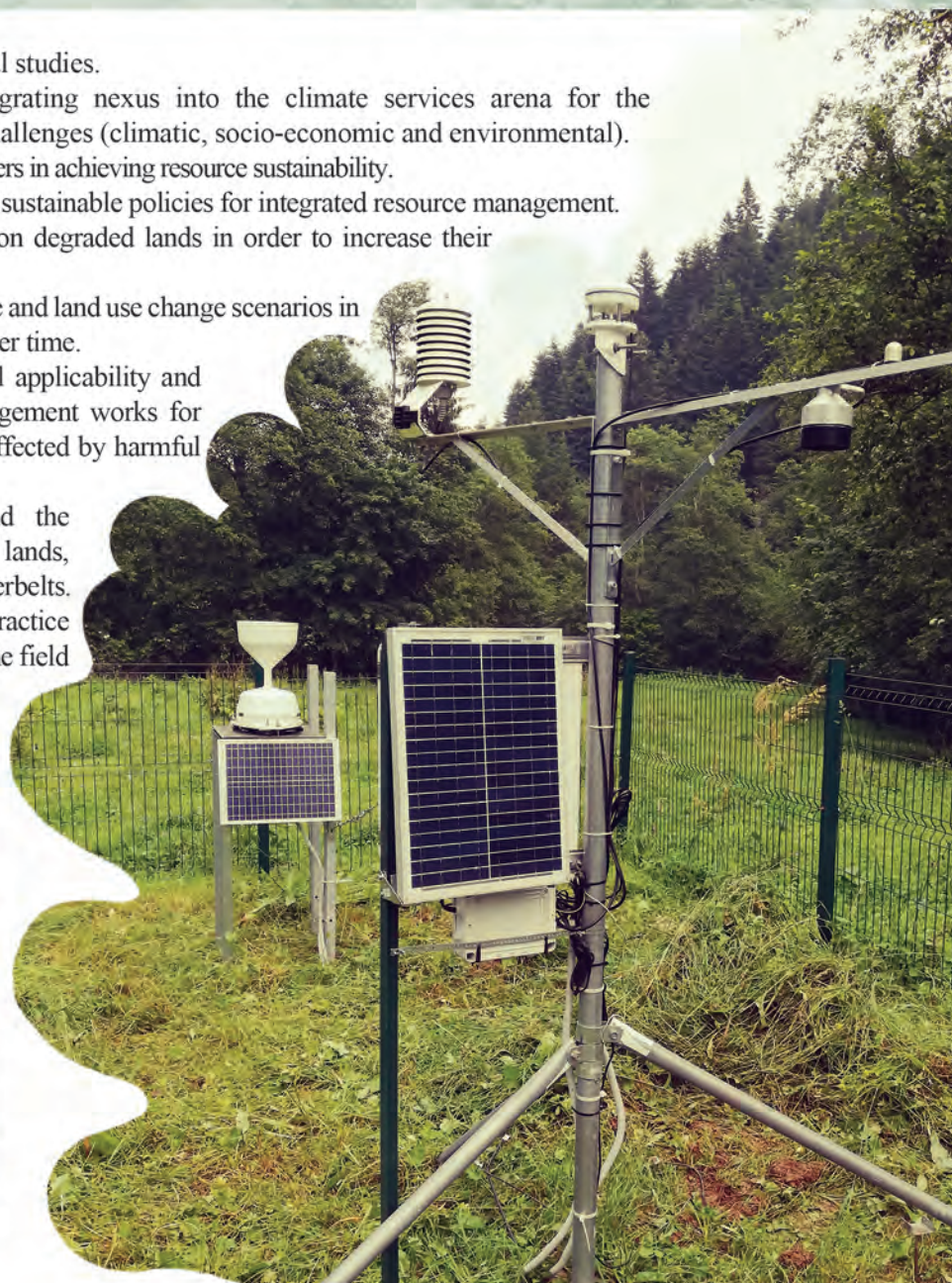
The **team** is composed of 32 members, from which 13 senior researchers, 4 researchers, 11 technological development engineers and 4 technical staff.

Major research achievements:

- Improving forest regeneration and tending technologies in order to adapt them to socio-economic and environment changes.
- Establishing the methods of mapping and seasonal framing of the compositions and techniques of afforestation of degraded lands (Technical Norms no. 1/2022, part II).
- Improving forest regeneration and tending technologies in order to adapt them to socio-economic and environmental changes.
- Establishing methods for applying long-term regeneration treatments (selective cutting, group shelterwood cutting) in beech and beech mixed with conifers forests.
- Elaborating restoration/substitution methods for stands affected by harmful factors.
- Testing management methods for stands exposed to risk factors.
- Analyzing the structural-functional dynamics of representative forest ecosystems and forest plantations from degraded lands.
- Planning forest shelterbelts to protect agricultural lands against aridization.
- Founding methods for environment and agricultural land protection in areas with an increased desertification risk.
- Monitoring and promoting technical solutions for increasing the efficiency and functioning of hydrotechnical works.
- Designing and technological transferring degraded land improvement works.
- Monitoring and evaluating the state of hydrotechnical works for torrent control in watersheds.
- Hydrological modeling under climate changes, land-use and socio-economic scenarios in order to simulate best land management options, to comprehensively evaluate hydrological discharge, alleviate soil erosion, and understand how to reduce climate change risks.
- Establishing solutions for integrated management of torrential watersheds.
- Performing research regarding the hydrological processes from small, mainly forested watersheds located in mountainous areas.
- Design hydro-technical works for torrential river basins.
- Technical assistance regarding the application of silvotechnical works.
- Technical assistance regarding the execution of torrent control works, forest roads, and shelterbelts.

4.5 SILVO-TECHNICS TEAM (T5)

- Conceiving the water management approvals and hydrological studies.
- Development of a new cross-sectoral framework for integrating nexus into the climate services arena for the development of cross-sectoral policies in the context of current challenges (climatic, socio-economic and environmental).
 - Development of climate services to support and guide decision-makers in achieving resource sustainability.
 - Co-creation together with local and regional decision-makers of sustainable policies for integrated resource management.
 - Research regarding the assessment and monitoring of forests on degraded lands in order to increase their resilience under climate change.
 - Assessing the water resources vulnerability under climate change and land use change scenarios in order to identify the measures required to secure their availability over time.
 - The development of technical recommendations with practical applicability and useful in production, regarding the application of care and management works for stands on degraded lands, the ecological reconstruction of stands affected by harmful factors, and the management of torrential river basins.
 - The preparation of technical-economic documentation and the provision of technological services for the afforestation of degraded lands, planning of the torrential river basins, and the establishment of shelterbelts.
 - Elaboration of studies regarding the foundation of good practice guidelines, common to the countries of the Danube River basin, in the field of water resources, land management and land uses.



4.5 SILVO-TECHNICS TEAM (T5)

The team of Silvotechnics is involved in realizing national (PNCDI III, IV, POC, RNP, MMAP) and international (Horizon 2020, Interreg) funded R&D **projects**, such as:

- Combating the aridification process and protecting agricultural lands in the plain area in the south of the country by establishing county networks of forest curtains, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070401 (2019-2022).
- Evaluation and analysis of the influence of care works and disturbing factors on the quality of representative resinous ecosystems (spruce, pine) for the foundation of silvo-technical works, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070402 (2019-2022).
- The establishment of new agroforestry systems in Romania, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070403 (2019-2022).
- Integrated management of forest lands and riverbeds in order to reduce the risks induced by water surplus, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070404 (2019-2022).

- Implementation of the Management Plan for the protected natural area ROSPA 0075 Măgura Odobești, Ctr. 313/2020 POIM

- Climate services for Water-Energy-Land-Nexus – CLISWELN, PN III – ERA NET - ERA4CS (<https://ms.hereon.de/clisweln/index.php.en>) (2017-2020).

- OptFor-EU – OPTimising FORest management decisions for a low-carbon, climate resilient future in Europe, HORIZON-CL6-2021-CLIMATE-01, (www.optforeu.eu) (2023-2027).

- CAMARO-D (*Cooperating towards Advanced MAanagement ROutines for land use impacts on the water regime in the Danube River basin*) –Interreg Program (2017-2019).



4.6 FOREST PROTECTION TEAM (T6)

The **main objective** of the Forest Protection Team consists in understanding the biotic (harmful invertebrates and vertebrates, pathogenic cryptogrammic agents) and abiotic factors that are affecting forest species, followed by improving surveillance, identifying, preventing, and controlling methods, techniques and technologies.

The research **team** is composed of 10 senior researchers, 11 researchers and 10 support & technical staff.

Major achievements:

Forest entomology

- Continuous improvement of methods and procedures for identifying and monitoring harmful biotic factors that are affecting forest species and have a negative impact on forest health.
- Elaborating methods for forest protection actions: prognosis, risk attack evaluation, and the impact of main defoliators and bark beetles over the stability of forest cultures.
- Testing biological products (pesticides or repellents) that have a reduced impact on the environment and are accepted by forest certification systems.
- Testing and gradually improving integrated methods and modern technologies for preventing and controlling the main insects that have a negative impact on the health of forest cultures.
- Evaluating the entrance and spreading of the risk of invasive insects in forest ecosystems.
- Estimating the impact of climate change over the dynamic of forest damaging agents.
- Evaluating of conservation of the biodiversity of *Coleoptera* (and other groups of insects) from protected forest ecosystems.

Forest phytopathology

- Identifying cryptogrammic agent species (fungi, oomycetes, bacteria, mycoplasma, and viruses) that are provoking diseases in forest species from nurseries, plantations and stands.
- Improving the methods for identifying and monitoring pathogen species from forest cultures, urban areas, and ecosystems.
- Analyzing the risk of the apparition, colonization and establishment of the allochthonous pathogens capable to threaten forest cultures.
- Testing fungicides and bactericides (biological or environmentally friendly) to prevent and control forest pathogens.
- Elaborating prevention and controlling measures for fungi and oomycetes, which are dangerous pathogens for woody species in nurseries, plantations, and stands.
- Evaluating the health status, economic and ecologic impact of the harmful organisms in forest ecosystems, ornamental woody cultures, and green urban areas.
- Understanding the role of the different factors that compete towards the occurrence of complex forest diseases.
- Testing (selection, breeding) forest species' resistance to invasive pathogens.



4.6 FOREST PROTECTION TEAM (T6)

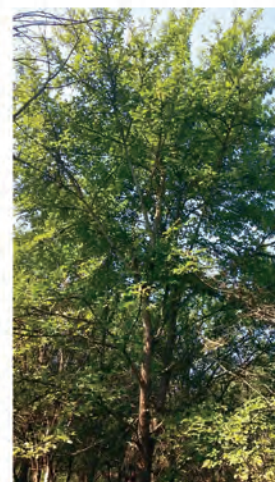


Forest mycology

- Identifying, elaborating experimental biopesticides, and testing cryptogrammic agents to biologically control the harmful/invasive forest insects and fungi.
- Emphasizing the spectrum and role of the mushrooms (mycorrhizal, saprophytic, and parasitic) within forest ecosystems.
- Testing the controlled inoculation methods for truffles and other mycorrhizal mushrooms.
- Elaborating mushroom culture methods and extracting substances that have a medicinal or nutritional interest.

The Forest Protection team has been involved in numerous international (Life+, bilateral, POIM/POC) and national research programs financed by the Romanian public authorities (Ministry of Research and Innovation, Ministry of Environment, Water and Forest, Ministry of Agriculture and Rural Development) and by state and private companies. We mention some of the most relevant **projects**:

- Conservative management for 4070 and 9260 habitats of ROSCI0129 North of Western Gorj (LIFE+11 NAT/RO/825, 2012-2019).
- Assessment of the risk of the appearance of new species of harmful insects with the potential for mass reproduction in deciduous forests in Romania (PN19070201).
- Improving the methods of monitoring and control of harmful insects by using modern technologies (PN19070202).
- *Xylosandrus germanus* – an invasive species in forest ecosystems in Romania (PN19070203).
- New biological components used in integrated pest management in conifers (PN19070204).



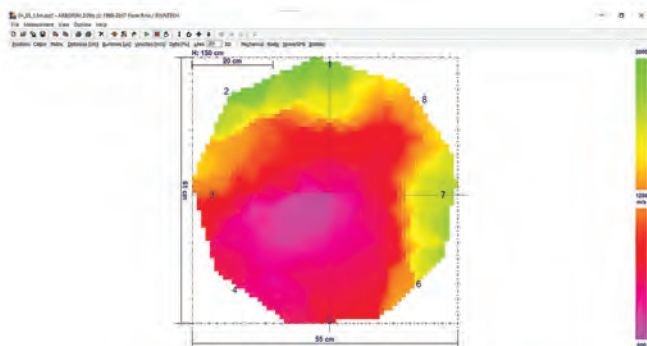
4.6 FOREST PROTECTION TEAM (T6)

- Modernization of technologies for the control of pathogens in forest cultures, in the current climate context (PN19070205).

- Management of forest ecosystems highly destructured by the allochthonous fungi (PN19070206) (Nucleu Program BIOSERV, 2019-2022).

- Biological treatment of the Asian fungus *Cryphonectria parasitica* (POIM, 2021).

- Identification and surveillance of damages caused by *Acrobasis repandana* in the Turkey oak stands in the south-eastern Romania (RNP-Romsilva, 2018-2019).



4.7 FORESTRY GEOMATICS TEAM (T7)



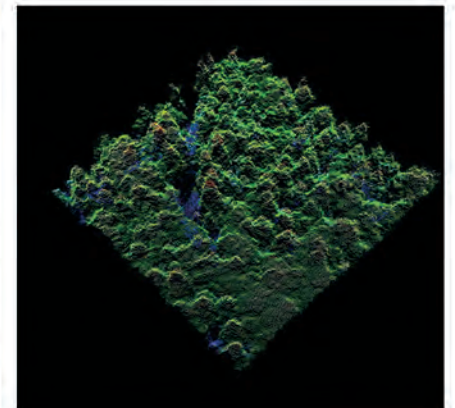
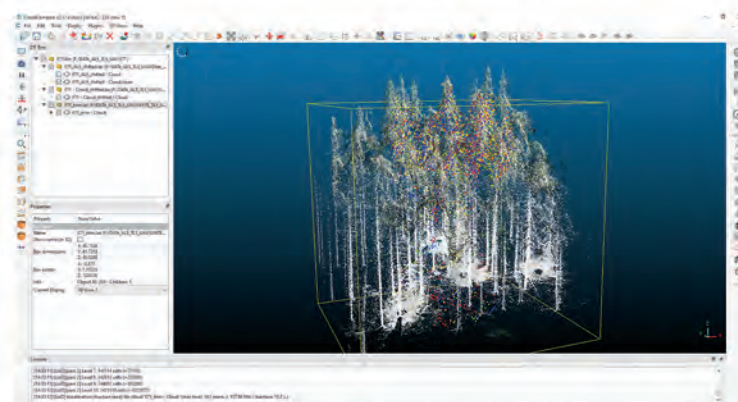
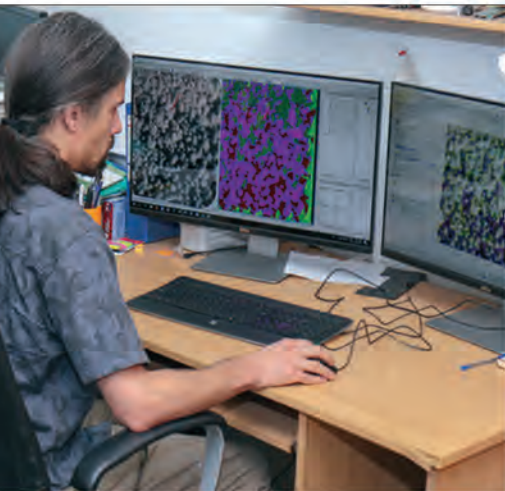
The **main objectives** consist in developing and applying geomatics technologies in forestry: Geographic Information System (GIS), Remote sensing (including ALS - Airborne LASER Scanner, TLS - Terrestrial LASER Scanner), digital photogrammetry (including UAV - Unmanned Aerial Vehicle (Drone) imagery), Terrestrial measurements (GNSS - Global Navigation Satellite Systems, terrestrial data acquisition, etc.) and to develop specific methodologies for forestry practical purposes in order to promote the use of technologies in all forestry domains.

The 4.7 Forestry Geomatics **team** is composed of 23 employees, 1 senior researcher, 4 researchers, 10 technological development engineers and 8 technical staff.

Major research achievements:

Geographical Information System (GIS)

- Mapping the melliferous forest resources for Tulcea and Brăila counties and publishing the results via a Web-GIS platform, for public access.
- GDB - Geospatial DataBase and digital map of: Romanian forests based on forest ecosystems types; the forest management units located into Natura 2000 sites; the provenance regions for basic materials for forest reproductive material; in situ and ex situ conserved forest genetic resources.
- Methodology for forest habitat mapping and GDB building.
- Design and production of GDB templates and the user guide for protected areas of Romania.
- Design, digital maps and GDB of forest protection belts using aerial imagery and geospatial analyze.
- GDBs management planning and digital maps for 321 forest districts (state owned, managed by National Forest Administration - ROMSILVA), from 2001 to 2022.



4.7 FORESTRY GEOMATICS TEAM (T7)

Remote sensing and digital photogrammetry

- Integrated use of point clouds acquired through airborne and terrestrial laser scanning, as well as point clouds derived from unmanned aerial vehicles (UAVs), for the assessment of biometric parameters of individual trees and forest
- Geo-spatial based methodologies for the assessment of hazard, vulnerability, impact, and risk for the natural disasters caused by forest fires
- Using optical multispectral satellite imagery and aero imagery obtained with drone mapping to evaluate the burned area and the severity of forest fires
- Methodology for using very high-resolution digital terrain models (DTM), extracted from ALS data, for torrential watersheds mitigation projects.
- Use of optical satellite medium resolution imagery for detecting and evaluating forest areas affected by forest windthrow using multi-temporal satellite imagery and geospatial analysis, as well as land cover classification and segmentation of the satellite imagery using object classification-oriented software.
- Using very high-resolution satellite and airborne imagery to improve the elaboration of forest management maps.
- Use of ALS data for digital terrain model (DTM) and digital surface/canopy model (DSM/DCM) extraction and developing methodologies for assessing biometric characteristics of trees and forest stands.



The members of the Forestry Geomatics team are involved either as coordinators or as consortium members in projects that receive funding from both national sources (such as PNCDI III for the period 2014-2020 and IV for the period 2022-2027 respectively, structural funds, and economic agents) and European programs, like LIFE +, H2020 and Horizon Europe . The most significant projects from the last 5 years are:

- Scientific foundations for a digital forestry by integrating geospatial solutions and technologies, Nucleu Program FORCLIMSOC, Ctr. 12N/2023, PN 23090204 (2023- 2026).
- Application of remote sensing techniques for an integrated management of forest ecosystems, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070109 (2019-2022).
- Development of methods for estimating and mitigating the effects of fires in Romanian forests, based on geospatial technologies, Nucleu Program BIOSERV, Ctr. 12N/2019, PN 19070108 (2019-2022).
- The improvement of forest resource assessment methods by using satellite images, image capture systems using unmanned aerial vehicles and airborne and terrestrial laser scanning (PN18040102), Nucleu Program GENERESERV, Ctr. 26N/2018 (2018).
- Development of methods for assessing the hazard and risk of forest fires based on geospatial technologies (PN 18040104), Nucleu Program GENERESERV, Ctr. 26N/2018 (2018).
- FirEUrisk - Developing A Holistic, Risk-Wise Strategy For European Wildfire Management, H2020-LC-CLA-2020-2 (2021-2025), <https://fireurisk.eu/>.

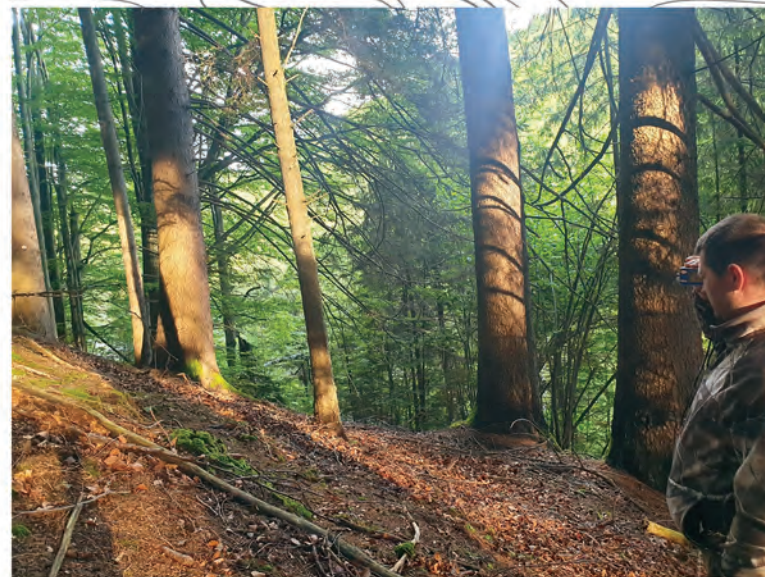
4.8 TECHNOLOGICAL DEVELOPMENT

Forest management planning team ensures a proper framework for promoting a sustainable management system, as well as concerning the conservation and improvement of biodiversity. This also extends towards the rational and continuous capitalization of multiple ecosystem functions and services offered by forests.

Controlling the administration of forests through management plans in order to ensure an optimum state is strongly correlated with the continuous surveillance of their state and functional efficiency under the influence of different disruptive factors, represented mainly by climatic changes. At the same time, the purpose also extends towards implementing and consolidating the informatics system of forest fund, as well as using simulation methods for elaborating medium and long-term forest prognosis.

Annually, through the technological development activity, are elaborated forest management plans for a surface ranging between 300.000 and 400.000 ha, using GIS technics. This area is managed by Romsilva – National Forest Administration – who is the main beneficiary of these works.

Additionally, our work brings contributions and technological advances, through the involvement of specialists in major projects (SIPOCA, Nucleu Program, CRESFORLIFE, CresPerfInst etc.), in the development of the forest management system for sustainable, climate-smart, and socially responsive silviculture, adapted to current societal challenges (climate change, well-being, social inclusion, etc.), as well as in supporting technology transfer as a key element of smart specialization for enhancing the economic competitiveness of the forestry sector. By ensuring the sustainable management of forests, we contribute to mitigating the effects of climate change and other stressors that affect them. Complex problems of forest management planning activity are emphasized and solved with the help of forest cadastre within the general cadastre and by using, at a general scale, of remote sensing technologies and GIS tools.



4.8 TECHNOLOGICAL DEVELOPMENT

Results:

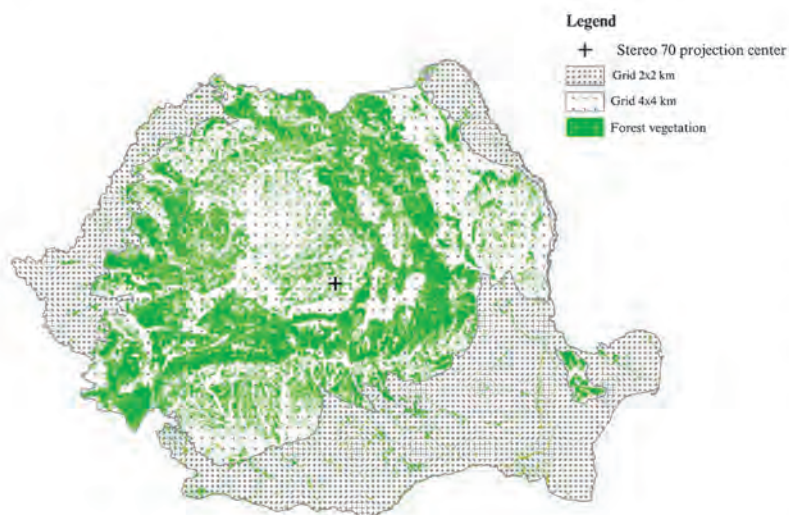
- The development of instructions and technical standards for forest management in 1948, and their subsequent revisions in 1949, 1951, 1953, 1959, 1969, 1980, 1986, and 2000, were carried out by leveraging the accumulated expertise and research findings in the field.
- The development of new Romanian-conceived forest management methods for assessing the prescribed yield: the yield regulation method by indicator increment for regular high forest, procedures for determining the prescribed yield for coppice forest, also for the conversion from coppice forest to high forest, and for quasi-selection system (periodic revocable block).
- Enhancing work procedures and techniques by harnessing research outcomes in dendrometry, pedology, typology, biodiversity conservation, etc., concerning the utilization of volume tables, yield tables, assortment tables, soil determination keys, stand type keys, and forest type keys, etc.
- The development of a specialized forest management software program (AS2 – amenajări silvice) and subsequently, its updating and expansion (AS2007 - amenajări silvice), enabling the automated processing of forest management unit's description data.
- Enhancing the methods for determining the size of the prescribed yield for principal yield for regular high forests and coppice forests.
- The planning of the entire forest area of Romania from 1948 to 1956, with subsequent revisions of the forest management plans every 10 years.
- The implementation of GIS technology into Romanian forestry management at national level and the establishment of GIS databases for the forest management.
- Modernizing the conceptual framework of Romanian forest management by giving increased importance to ecological objectives in forestry management, expanding and interpreting the principles of forest management from an ecological perspective, and approaching forest management as a cybernetic system.
- The establishment of a technical archive containing the forest management plans developed, starting from the period of 1948-1956 and continuing to the present day.

Relevant projects:

- Forest management plans for the state-owned public forest areas.
- Environmental studies for the adequate assessment of potential effects of forest management plans (Adequate assessment studies and Environmental reports).
- Works on the utilization of GIS technology in the development of forest management plans.
- The calculation of income losses and additional costs incurred by forest owners as a result of the voluntary implementation of environmental forestry measures, 2014.
- The development of the „AS2007 - Amenajamente silvice” version of the software product used in forest management.
- The study for enhancing the accessibility of the national forest area, 2006.
- The study for developing the methodology and calculating Natura 2000 payments from forested areas within protected natural areas, in accordance with the restrictions outlined in the management plans.
- The development of studies to establish standard costs for interventions related to forestry-environment payments, afforestation of agricultural land, and the establishment of narrow natural protection belts for agricultural crops at the farm level, including orchards and vineyards, in accordance with art.65 and art.68 of the proposed Regulation on the Strategic Plans for the Common Agricultural Policy (CAP) 2021-2027.



4.9 NATIONAL FOREST INVENTORY



The **main objective** of the National Forest Inventory (NFI) team is the assessment and analysis of forest resources dynamics on medium and long term in Romania, in an integrated and reproductive manner, at the country and regional level. The main task of NFI consists of collecting, verifying, storing, managing and analyzing data and information regarding the dynamic of forest resources.

NFI is one of data provider for reporting on Criteria and indicators for sustainable forest management, according to the Romanian commitments within the framework of the Ministerial Conference on the Protection of Forest in Europe (MCPFE). It also provides essential data on forest resources assessment regularly reporting to FAO, UN-Framework Convention on Climate Change/Kyoto Protocol (partial) and to Convention on Biological Diversity.

The activity of NFI is various, consisting of field data collection, GIS analyses and digital photogrammetry, laboratory analyses and processing, and statistical analyses of very large amounts of data.

The NFI **team** is structured in offices based on their specific activities. As such, the NFI team is composed of 78 members, from which 25 senior technological development engineers, 38 technological development engineers and 15 technical staff. The NFI department has 21 field teams, which are working in each INCDS branch.

Major achievements:

The team in charge of NFI is a component of INCDS activities, proven by its significant achievements and results both at the national and international levels, as follows:

- Elaborating the methods and models for Romanian NFI, the sampling and measurement techniques, according to the spatial distribution of forest area and forest characteristics.
- Finalizing the first NFI cycles and assessment of forest area, growing stock and estimation of forest increment for all forest vegetation (forest and other wooded land) and trees outside the forest in Romania. The third cycle is being implemented, also.

The integrated investigations are realized in national and international research **projects**, such as:

- Distributed, Integrated and Harmonised Forest Information for Bioeconomy Outlooks, Program H2020 – DIABOLO, H2020-ISIB-2014-2.
- Forest Carbon Flux and Storage Mapping Service - Forest Flux, H2020-SPACE-2018.
- Further Development and Implementation of an EU-level Forest Monitoring System (FutMon), LIFE+ Program.
- Harmonisation of National Forest Inventories in Europe: Techniques for Common Reporting, COST Program– Action E43.
- Improving Data and Information on the Potential Supply of Wood Resources: A European Approach from Multisource National Forest Inventories (USEWOOD), COST Program – Action FP1001.

4.10 EXPERIMENTAL PATRIMONY

INCDS benefits from its own experimental forest patrimony on a surface of 47 706 ha, represented by the experimental research basis (forest and 7 forest nurseries, 3 seed orchards, 5 arboretums, dendrological collections, trout farms and over 200 long-term sites). These sites are used for experimenting research results, in the pilot phase, and then transferring them in the forestry practice for full implementation at the regional and national levels. This implementation is realized through technical silvicultural rules as well as methodologies, technologies and specific models for applying in the Romanian silvicultural practice.

The experimentation-production activity is carried out both in the Institute's Headquarters and in the territorial resorts and has as its main objective the application of research results within its own experimental bases and the sustainable management of the publicly owned forestry under the institute's administration.

The development of scientific forestry research led to the installation in the forest fund of a rich network of experimental areas for scientific exploitation in order to scientifically substantiate multiple aspects in the fields of: forest ecology, forest physiology, the improvement of forest species and the acclimatization of exotic forest species, afforestation technologies and restoration of stands, natural regeneration of stands, forest auxology and dendrometry, care of stands, afforestation of degraded lands, forest hydrology, arrangement of torrential hydrographic basins, protective forest crops, the influence of harmful factors on forest ecosystems, protection of forests, arrangement of forests, the influence of chemical fertilizers on forest ecosystems, the drying of oak trees, the culture of fruit bushes in the forest floor, crops of melliferous species and medicinal plants in the forest floor, resinage, etc.

With the integration into the former Institute of Forestry Research and Development (ICAS) of the experimental forestry areas, the regional peculiarities of Romanian forestry were taken into account so that at the level of the entire country all practical aspects are addressed and solved through specific research issues. Thus, the Caransebeș Experimental Base, located in an area with beech stands, is ideal for research on beech trees, just as the Mihăești Experimental Base is ideal for the study of sessile oak stands and hill mixed hardwood forests. The Tomnatic Experimental Base provides the necessary land for experiments in softwood forests, and the **Săcele** Experimental Base for beech and softwood mixtures. The Vidra and Lechința Experimental Bases are suitable for ecological reconstruction research. The Lechința Experimental Base is mostly composed of derivative trees (hornbeams) that must be brought back to the fundamental natural type of forest. Over time, specific research and experimentation of their results have proven relevant, representative and effective with applicability in forestry practice. The specialists from the experimentation-production activity have made a special contribution to carrying out the research-experimentation works in optimal conditions.



4.10 EXPERIMENTAL PATRIMONY

Specifically, each of the experimental bases has a certain purpose specific to the Romanian silvicultural research, as follows:

The culture of Norway spruce;

- The silviculture of quality wood;
- Applying the selection system treatments;
- Applying treatments in common beech and sessile oak forest stands;
- Replacing derived forest stands;
- Improving the state of degraded terrains;
- Producing seedlings destined for creating protection shelter belts;
- Producing seedlings for introduction in cultures of the hybrid poplars;
- Producing ornamental trees and shrubs.

INCDS's forest patrimony are considered as true "live laboratories" that are materialized, signalled and described in "The Catalogue of Experimental Surfaces", while the experimental activities are continued and properly capitalized to their destination.



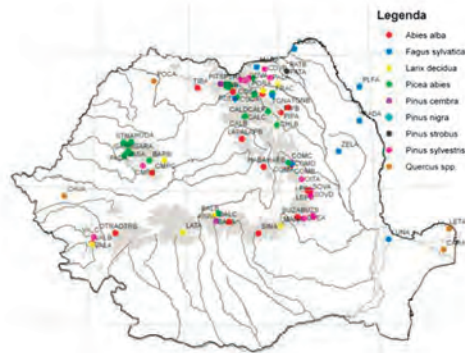


5. INFRASTRUCTURE

The Marin Drăcea INCDS infrastructure is built under a continuous process of revision, updating and development and is planned to realize and consolidate the potential of forest-based research and innovation and is available on-line on the European Research and Technology Infrastructures System (<https://eertis.eu/erio-2300-000w-4354>). It consists of long-term research networks placed in situ and specialized laboratories for the most important issues of forest research related to: forest monitoring, ecology, forest genetics and tree breeding, wildlife biology and management, silvotechnics and ecological reconstruction, forest protection, geomatics and knowledge transfer into practice.

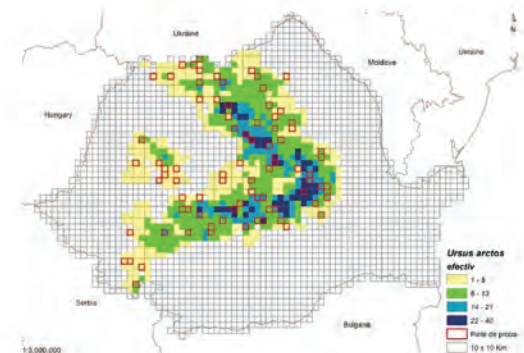
INCDS is a member of Lifewatch Romania Association and it follows be affiliated to ICOS ERIC and new forthcoming related to international RIs, in order to provide relevant R&D services to partners. Also, INCDS it is a member of pan-European eLTER Research Infrastructure (eLTER RI).

Both these, research networks and field specific, are focused on increasing the research capacity of INCDS and its attendance in the European research infrastructure (ESFRI) and to set up national and regional infrastructures.



The main research networks under the INCDS administration:

- Forest monitoring (intensive forest monitoring - Level II; large scale survey 16x16 km-Level I) and National Forest Inventory (NFI) networks.
- Long-term ecosystem research network regarding (RO LTER forest sites: Retezat, Bucegi-Piatra Craiului, Rodna - Călimani, Stefănești, Mihăești, Predeal, Fundata).
- Carpathian research network for the evaluation of ozone pollution over the forest ecosystems, as well as evaluating vegetation biodiversity in Carpathian forests (26 sites from which 6 are located in Romania and managed by INCDS).
- Dendrochronological network RODENDRONET (with over 200 dendrochronological series).
- Long-term provenance trials, full-sib and half-sib progeny trials, interspecific hybrids, seed orchards, clone trials, mother-tree cultures, greenhouses, and nurseries.
- Network on long-term monitoring of the conservation status under the Habitat Directive Article 17 for *Ursus arctos*, *Lynx lynx*, *Rupicapra rupicapra*, *Canis lupus*;
- Networks of forest and nursery plots highly affected by biotic and abiotic factors all over the country; experimental plantations testing inter- and intraspecific resistance to diseases; short-term testing plots for pest treatments.



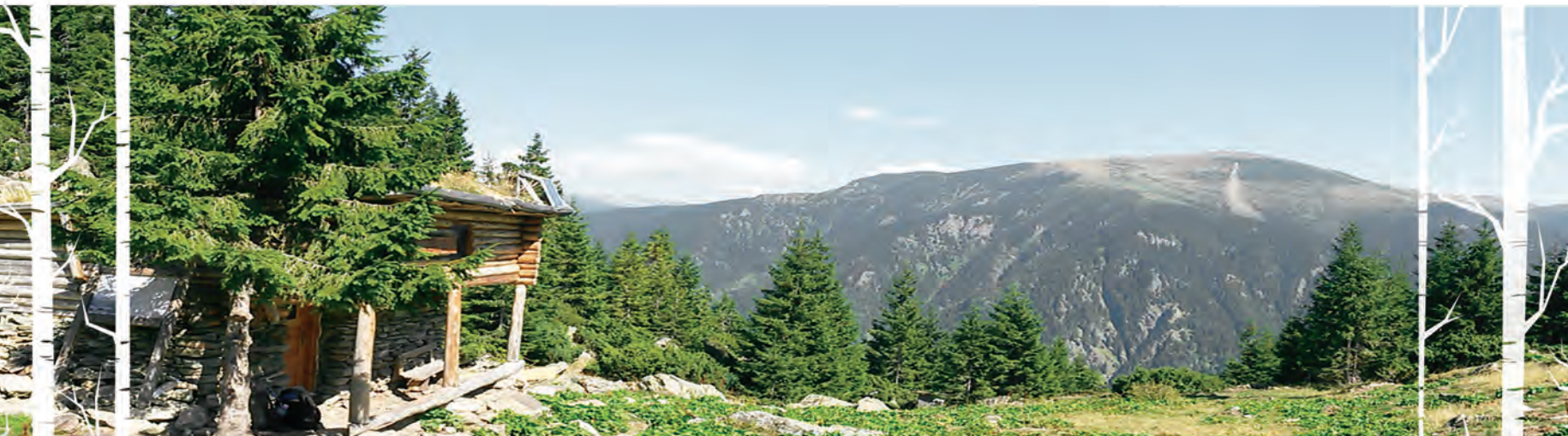
Laboratories

The INCDS has laboratories equipped with high-performance equipment and apparatus specific to the main research areas of the institute, as follows:

- Forest Soil Analysis Laboratory
- Laboratory for Analysis of Pollutant Deposits and Air Quality
- Laboratories of Molecular Genetics for plants and animals
- Laboratory for the Analysis of Forest Seeds
- Laboratory of Dendrochronology and Wood Anatomy
- Remote Sensing and Digital Cartography Laboratory

These laboratories play a particularly important role in:

- Continuing and developing long-term inter- and transdisciplinary ecological research on the state of forest ecosystems under the action of climate change and various risk factors.
- Continuous improvement of the forest management plans elaboration.
- The improvement of quality-specific methods of forestry as well as the assessment of forest resources on large areas.
- The implementation of new geological methods and technologies in forestry research and practice.
- Assessing the genetic diversity of forest species.
- Selecting valuable genotypes, identifying, and describing new genetic resources to increase the adaptive capacity of forest ecosystems to climate change.



Herbarium

The BUCF “Alexandru Beldie” Herbarium has remarkable specimens that can offer important scientific and practical information.

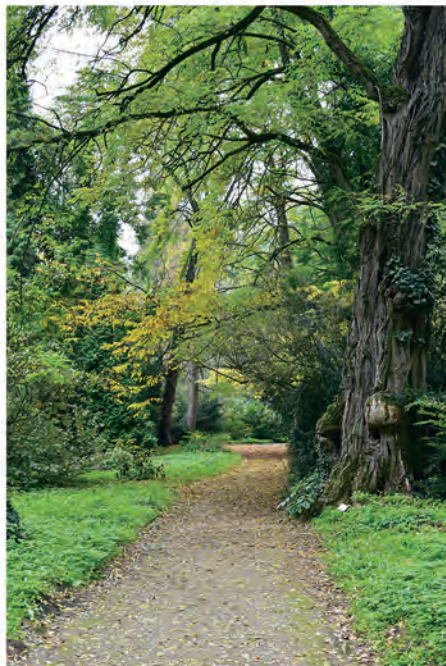
The herbarium has approximately 40 000 plates of certain plant species, kept in their original maps and deposited in 20 modules, each with 20 drawers. This collection is composed of donated private collections and pieces of foreign collections that were bought through exchanges. Furthermore, the herbarium is listed in the Index Herbarium.



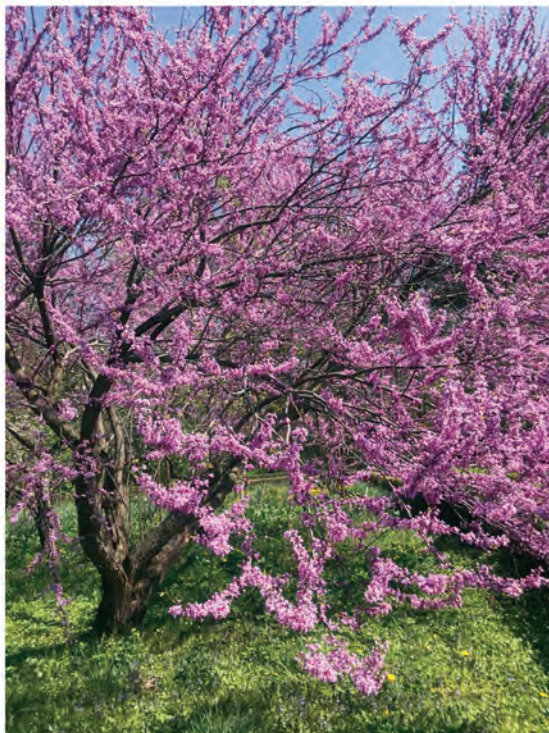
The Network of Arboretums

The Institute patrimony includes a network composed of four Arboretums (Simeria, Hemeius, Bazos and Mihăiesti) that ensure the conservation of important germplasm genetic resources, for a large number of taxa, forming the largest collection of woody plants in Romania (trees, shrubs, lianas), cultivated in four regions and different stationary conditions.

The **Simeria Arboretum** (Hunedoara county) was initiated at the beginning of the 18th century, being the oldest center for the introduction and expansion of exotic wood species in the country. Initially, established as a recreational forest by arranging some natural meadows from the Mureș River, it has evolved into an Arboretum, currently gathering 2133 indigenous and exotic taxa on an area of 67 ha.

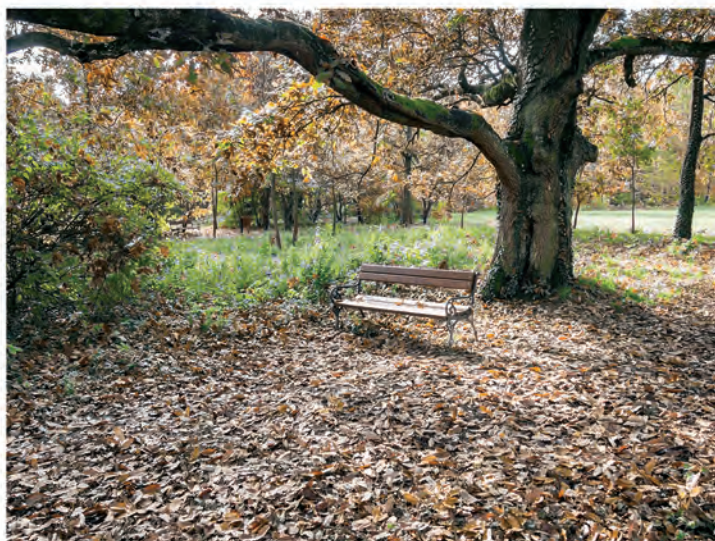


The **Hemeiuș Arboretum** (Bacău county) covers 48.37 ha and is located near Bacău city, on the right bank of the Bistrița River. It was designed at the end of the 19th century in English style by arranging a floodplain mixed hardwood forest. Currently, the collection includes 831 woody species and a rosary with 208 varieties.





The **Bazoș Arboretum** (Timiș county) was created between 1909-1914, at Bazoșul Nou and it has an area of 63.4 ha. It was designed in an English style and includes 818 taxa systematized in thematic collections (the collection of Asian plants, the collection of American plants, the collection of shrubs, and pilot trials).





The arrangement of the **Mihăiești Arboretum** (Argeș county) was carried out between 1895-1901 and is due to the great forester Iuliu Moldovan. It was designed specifically for studying the acclimatization of non-native species. It currently hosts about 300 taxa spread over an area of 58.8 ha.

The rich collection of woody taxa, including rare, vulnerable and endangered trees, the high longevity of the specimens, the diversity, originality and beauty of landscapes, together with the numerous research possibilities they offer (*in situ* and *ex situ* conservation of valuable or endangered species, selection and breeding of exotic species, dendrochronological studies on secular specimens, etc.) confer them outstanding botanical, forestry, landscape, educational, socio-cultural and scientific importance.

At the same time, these arboretums are considered “*living laboratories*” offering the possibility to study the systematics and ecology of plants, the adaptability of exotic woody species in a particular region, their growth and, respectively, their state of vegetation.



Editura Silvică Publishing House

Editura Silvică (Forestry Publishing House) is the publishing house of the Institute, an important vector of dissemination (www.editurasilvica.ro) - publishes scientific and technical books in the field of forestry and environmental sciences, is a member of the European Association of University Presses (AEUP). The scientific journal *Annals of Forest Research* (www.afrjournal.org), issued by „Marin Drăcea” INCDS (exclusively in English) became an ISI journal, since 2011 (IF 2022=1,964).

www.afrjournal.org

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Forest protection

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