FEDERAL UNIVERSITY OF VIÇOSA
GRADUATE PROGRAM IN SOILS AND PLANT NUTRITION
PPGSNP-UFV

PEDAGOGICAL PROJECT OF THE PPGSNP-UFV

Vicosa
2024

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PRESENTATION

The starting point for the Pedagogical Planning of the PPGSNP-UFV has been the input provided by the Working Group created by the Dean of Research and Graduate Studies at UFV, which sought to outline general institutional guidelines in an advisory manner for UFV Programs.

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The general objective of the PPGSNP-UFV has been defined as to administer, disseminate, develop, and improve graduate education, aiming at training human resources in its specific area of activity, and to stimulate, promote, and execute scientific research, both articulated with university extension, aiming to contribute to solving problems and challenges faced by Soil Science and society. Within this approach, the Federal University of Viçosa (UFV) has been offering Graduate courses in Soils and Plant Nutrition, at Master's and Doctoral levels, with the purpose of providing students with a broad, critical, and in-depth scientific education, developing their research capacity and creative power and talent.

THE PPGSNP - HISTORY

The Higher School of Agriculture and Veterinary (ESAV) was created in the mid-1920s, and in 1928 the activities of the Soils and Fertilizers Department began, which included studies in the areas of

Geology, Mineralogy, Meteorology, Physics, Chemistry, and Surveying. In addition to teaching functions, the Department was responsible for evaluating fertilization methods for various crops important to the region and the country.

In 1948, the Rural University of the State of Minas Gerais (UREMG) was created, maintaining the previous organization of ESAV and, consequently, the Soils and Fertilizers Department. In 1965, with the restructuring of UREMG, the University gained administrative, economic, disciplinary, and didactic autonomy, and its organization was based on Institutes. The newly created Institute of Plant Science was subordinated, among others, to the Soils and Fertilizers Sector. Upon achieving federalization as the Federal University of Viçosa in 1969, UFV did not immediately change its organization. Thus, the structure of the former ESAV and the UREMG Institute of Plant Science remained.

Even without yet reaching the current "status" of a Department and recognizing the importance of Soil Science for the country's development, the group of professors involved in the Soils area of the then Institute of Plant Science managed to implement the Master's in Soils and Plant Nutrition in 1977. Subsequently, the soils area at UFV consolidated with the creation of the current Soil Department in 1978.

The Graduate Program in Soils and Plant Nutrition (PPGSNP) was completed in 1982 with the implementation of the Doctorate. Initially emphasizing studies on Fertility and Soil Genesis and Classification, the Program established itself as one of the most important in training human resources specialized in tropical soil studies. With strong investment in the qualification and hiring of new professors, other sub-areas of Soil Science were incorporated.

Soil Chemistry and Mineralogy have evolved since the first works in the mid-1980s, contributing with basic studies and emphasis on the knowledge of iron oxides, behavior and dynamics of heavy metals and soil pollution, also considering the interference of organic matter in this behavior and dynamics.

Soil Physics and Management have especially addressed aspects associated with soil degradation, cultivated soil erosion, soil quality, and the environmental impact of land use from agricultural and non-agricultural activities. Lately, studies on the recovery of degraded areas have received special attention. Studies on agroecological soil management, oriented towards actions aimed at small family farmers and their organizations, have gained prominence in the Program and have even motivated interesting international partnerships.

Soil Fertility maintains the protagonism achieved in the work carried out since the 1970s with Cerrado soils, plant nutrients and nutrition, fertilizers, and fertilization recommendation tables. Innovation is constant, especially regarding fertilizer studies and modeling in plant nutrition. A highlight in this area is the NUTREE Program (www.nutreeufv.com.br/), whose multidisciplinary projects, carried out in partnership with companies, seek to solve problems and develop technologies to increase Brazilian forest production, in addition to several registered patents for products related to fertilization.

The area of Pedometrics has emerged more recently and tends to increase its expression, largely due to more modern techniques and the consolidation of Pronassolos (National Soil Program of Brazil).

The Program has sought to dedicate attention to soil education and the popularization of Soil Science. The main initiative for this centers on the activities of the Soil and Environmental Education Program, carried out by the Alexis Dorofeev Earth Sciences Museum

(www.mctad.ufv.br/), a unit within the PPGSNP infrastructure. The actions are aimed at teacher training and the development of projects with elementary and high schools.

The PPGSNP strives to consolidate itself on solid foundations, integrating basic and applied knowledge in Soil Science. In its proposal, the Program focuses its actions on training human resources in the bases and fundamentals of Soil Science, through teaching and research activities, both in permanent articulation with university extension.

MISSION, VISION, AND VALUES OF THE PPGSNP

The definition of the Mission, Vision, and Values took place at an event attended by over 80 graduate students, alumni, professors, and program staff. At the end of the work, the following consensus was reached:

- Program Mission: To train professionals with analytical and critical capacity and advance knowledge in Soil Science and its interfaces, to respond to social, economic, and environmental challenges.

- Program Vision: To be a national and international reference in tropical soils.

- Program Values: Ethics. Excellence. Cooperation. Social and Environmental Responsibility. Respect for diversity.

OBJECTIVES

The general objective of the Program is to administer, disseminate, develop, and improve graduate education, aiming at training qualified human resources in the area of Soil Science, in addition to stimulating, promoting, and executing scientific research, both articulated with university extension, aiming to contribute to solving problems and challenges faced by Soil Science and society.

In view of the aforementioned general objective, the following specific objectives are indicated:

- To provide technical and humanistic training through graduate-level training of professionals in the different areas of Soil Science and its interrelationships with other areas of science;

- To deliver to society Masters and Doctors with qualified and robust training in the different areas of Soil Science and its interrelationships;

- To promote the development of critical awareness and theoretical deepening, with a broad view of science and the scientific method, but anchored in reality and the socioeconomic and environmental context, and in the application and multidisciplinary nature of Soil Science;

- To promote the development and conduct of high-quality scientific research focused on the different areas of knowledge in Soil Science and its interrelationships;

- To promote exchanges and exercise solidarity with other national or international Programs and/or Research Groups, always focused on the development of science, technology, and innovation and on the common good and well-being of society;

- To make multi-user infrastructure obtained with public resources available for scientific or academic cooperation projects with national and international teaching, research, and extension institutions;

- To promote the dissemination of Soil Science and, specifically, of the natural resource soil as an important component of nature and the basis for humanity's existence;

- To produce and disseminate quality scientific results and data, based on initiatives that use both scientific language and language more accessible to a large portion of society;

- To promote and support academic-scientific events in the different areas of knowledge of Soil Science and its interrelationships, as well as other university extension activities and initiatives;

- To foster the production of data, results, products, and processes aimed at scientific and technological development and applied to solving societal problems;

- To promote the establishment and consolidation of partnerships, focusing on scientific production and the training of students, professors, and researchers;

- To increase the international insertion of the Program through partnerships and cooperation projects, mobility of professors and students, and exchange of experiences.

DESIRED PROFESSIONAL PROFILE

scientific work and teamwork, aimed at solving hypotheses or questions of a scientific nature. In the doctorate, efforts are directed towards consolidating scientific training that will enable the future professional to generate original knowledge, present independent scientific production, undertake, and innovate.

It is part of the tradition of UFV, as well as the Program, to require great dedication during courses. Thus, assessment through exams, laboratory reports, and participation in discussions in theoretical and practical classes has helped in the final training. The concepts discussed aim to narrow the relationship between theory and practice, seeking to understand the complexity of the soil system and its relationship with other components of the environment and people's lives.

AREAS OF CONCENTRATION AND RESEARCH LINES

The PPGSNP operates in three areas of concentration: Nutritional Management of Crops; Soil Management and Environment; and Geochemistry and Pedogenetic Processes, which are organized into the following research lines:

– Soil Geochemistry, Mineralogy and Remediation of Environmental Impacts: Soil properties and physical-chemical phenomena. Waste treatment and recycling. Heavy metals in the soil-plant system. Acid drainage. Recovery of degraded areas. Genesis, structure, and identification of minerals. Redox mechanisms. Adsorption and ion exchange in variable charge soils.

– Pedogenetic Processes and Soil-Environment Relationship: Processes of genesis of Brazilian soil classes (chemical, physical, mineralogical, and micromorphological attributes). Pedogeomorphological evolution, soil surveying, and agricultural aptitude, with emphasis on geoprocessing techniques.

– Changes in Edaphic Properties in Different Management Systems: Watersheds as a soil management unit. Dynamics of water and solutes in the soil-plant system. Compaction, densification, and crusting of soils. Water retention in substrates for ornamental plants. Erosion losses.

– Nutritional Management of Agroecosystems: Efficiency of nutrient absorption and utilization, nutrient forms, and cationic and anionic balances in plants; nutrient compartmentalization and translocation. Plant nutritional status; soil correction and fertilization for crops.

– Organic Matter and Sustainability of Agroecosystems: Input and dynamics of organic matter in the soil. Characteristics of humic substances. Green manure. Soil biology. Mathematical models applied to soil organic matter dynamics.

– Factors and Processes in Soils of Forest Ecosystems: Carbon and nutrient cycling in forest formations. Mineral nutrition of forest species. Correction and fertilization of soils cultivated with forest species. Site classification. Implications of management techniques on forest productivity.

CURRICULAR STRUCTURE AND COURSES

The study plan with the courses to be taken is prepared based on the incoming student's background and previous experience, and according to the Program's objectives and their research project. The maximum time for completion of the Master's and Doctorate is two and four years, respectively. Deadlines must be met for registering the Research Project, taking the Qualifying Examination, and proving foreign language proficiency (English).

Master's and doctoral students must complete at least 24 credits exclusively through courses, which may be from the Program itself, from other UFV departments, or even from other Federal Higher Education Institutions (IFES). Even though they can take courses outside the Program, training strongly based on the different sub-areas of Soil Science is required. Thus, it is mandatory to take, in the master's and doctorate, at least five courses, in addition to the Seminar course. Of these five courses, at least three must belong to three different Groups. The Groups are an internal organization of the Program's courses according to three thematic lines:

- Group 1: Pedology (Soil genesis, classification, pedometrics, geochemistry, and mineralogy)
- Group 2: Soil Management (Soil physics, agroecology, organic matter, and soil biology)
- Group 3 – Edaphology (Soil chemistry, fertility, and plant nutrition)

PPGSNP COURSES

At UFV, one credit represents 15 class hours in a 15-week semester. The course code brings its main information, so a code like SOL613 - 5(3-2)II indicates a 5-credit course (5 hours per week, with 3 theoretical hours and 2 practical hours), 75 hours of semester workload, offered in the second (II) academic semester. Here, the courses will be presented by Groups.

GROUP 1 - Pedology

- SOL613 – The Earth System: Dynamics and Processes 5(3-2)II
The earth system: components, flows, and processes. Dynamic interactions between terrestrial (sub)systems. Geological record and earth history. Minerals and rocks. Weathering and formation of secondary minerals. Geological maps and reports. General aspects of Brazilian geology. Field trip: iron quadrangle and karst province.

- SOL626 – Soil Genesis and Classification 6(2-4)I
Philosophy and principles of soil genesis and classification. Soil formation factors. Basic and general soil formation processes. Genesis and general characteristics of tropical soils. Soil classification. Brazilian pedological domains.

- SOL681 – Pedometrics 6(2-4)II
Digital mapping of soil attributes and classes. Remote sensing. Proximal sensing. Instrumentation. Geoprocessing. Machine learning. Classifier algorithms.

- SOL730 – Pedogeomorphology 6(2-4)II
Fundamentals of geology. Biogeochemical cycles, geotectonics, Paleosols. Pedosphere: soil as an open system. Tropical soils: constituents and physical-chemical and biological processes. General and tropical geomorphology: pedoform and landscape. Soil micromorphology and ultrastructure: techniques and applications. Geography of major pedological systems.

- SOL735 – Geosystems, landscapes and land uses in Brazil and West Africa; convergences and scenarios 3(3-0)II
Introduction: Geosystems in Brazil and West Africa. Agriculture, Land Use and Food Production: the great plant globalization. Historical and Social connections Brazil–West Africa. A big river with interconnected margins: Brazil and West Africa.

- SOLXXX – Introduction to R Language and Topics in Machine Learning I 5(1-4)
Introduction to R language. Installation and interaction with the program, syntax and commands. Variable types in R. Data structure and data types in R. Function and arguments. Control structures in R Language. Introduction to machine learning. Learning types. Supervised techniques: Classification and Regression. Unsupervised techniques: PCA and Cluster. Multiple classifiers: bagging and boosting.

- SOL615 – Soil Mineralogy 6(2-4)II
Basic concepts. Importance of soil mineralogy. Chemical crystallography. Notions of crystallography. Genesis and structure of major soil minerals. Theoretical aspects of colloid dispersion and soil fractionation. Methods for identifying soil minerals by chemical analysis, thermal analysis, and X-ray diffractometry.

- SOL655 – Environmental Geochemistry 5(3-2)II
The atomic nucleus and the origin of elements. Geochemical abundance of elements. Principles of thermodynamics applied to natural systems. Lithogeochemistry. Surface geochemistry. Chemical equilibria and interaction of major heavy metals in soil. Major global biogeochemical cycles. Eutrophication and contamination of water resources and soils. Heavy metals as pollutants and as nutrients.

GROUP 2 - Soil Management

- SOL640 – Soil Physics 6(2-4)II
The solid phase of soil: textural fractions, colloids, particle size analysis, soil structure, soil consistency. Soil water: water properties, soil water potential,

soil water characteristic curve, soil water movement. Soil air. Soil temperature.

- SOL641 – Soil Physics Applied to Transport Processes 6(2-4)I
Water structure and properties. Soil water storage. Thermodynamic bases in the study of the soil-water system. Soil water movement. Soil water balance. Solute movement in soil. Heat transfer in soil.

- SOL646 – Recovery of Degraded Areas 6(2-4)I
Characterization of degraded area (DA). Sources of environmental degradation, ore exploitation, and environment. Objectives of DA recovery. Recovery plan for degraded areas (PRAD). Soil

formation processes and DA recovery. Geomorphology and topographic reconstruction in the context of DA recovery. Sulfide geochemistry and acid drainage generation. Topsoil storage and return and use of litter. Revegetation and ecological principles applied to DA recovery. Monitoring and evaluation of the DA recovery process.

- SOL647 – Research Methodology in Agroecology – Emphasis on Soils 5(3-2)II
Philosophy of science. Agroecology: concepts, bases, and principles. Pre-research project. Scientific writing. Agroecological indicators. Ethnopedology. Research project.

- SOL648 – Soil Use in the Tropics 5(3-2)I
Soils and agricultural activities in the tropics, with emphasis on Brazil. Soil use in the tropics related to climatic aspects. Reversible and irreversible soil use. Soil use in agriculture. Soil use in relation to water quantity and quality. Soil use under irrigation. Agriculture on steep slopes. Quantitative indicators of soil quality.

- SOL660 – Soil Organic Matter 6(3-3)II

GROUP 3 - Edaphology

- SOL650 – Soil Chemistry 5(3-2)I
Soil composition. Chemical equilibrium. Surface interaction of the solid phase with the soil solution. Cation adsorption and exchange in soil. Anion adsorption by soil. Common solubility equilibria in soil. Salt-affected soils.

- SOLXXX - Chemistry and Fertility of Tropical Soils 5(5-0)
Introduction. Basic concepts of soil chemistry and mineralogy. Plant nutrients and beneficial elements. Nutrient dynamics in the soil-plant-atmosphere continuum. Soil acidity, liming and dynamics of Ca and Mg in the soil-plant system. Nitrogen. Phosphorus. Potassium. Sulfur. Micronutrients. Basic concepts for soil fertility evaluation and control. Fertilizers. Nutrient management in agriculture and forestry.

- SOL600 – Methods of Soil and Plant Analysis 6(2-4)I
Theory and fundamentals of performing physical and chemical analyses of soils and plants. Soil Analysis: sampling; chemical and physical-chemical analyses. Plant Analysis: Sampling; determination of total and soluble forms; interpretation of results.

- SOL645 – Soils of Forest Ecosystems 5(3-2)I
Concept of Forest Soils. Forest soils and tree nutrition in the face of environmental problems. Soils associated with forest biomes. Productivity and classification of forest sites. Dynamics of forest growth. Soil properties and forest growth. Biomass and nutrient cycling in forest ecosystems. Mineral nutrition of forest species. Forest fertilization: nursery and field. Fertilization of forest species. Intensive forest management and sustainability of soil productivity.

- SOL670 – Soil Fertility 5(5-0)I
Concept of soil fertility. Clays. Ionic adsorption. Soil acidity. Soil acidity correction. Nitrogen in soil. Phosphorus in soil. Potassium in soil. Sulfur in soil.

Micronutrients in soil. Soil fertility evaluation. Fertilizer recommendation. Fertilizer mixing and application. Soil organic matter and heavy metals.

- SOL771 – Soil Fertility Evaluation 6(2-4)II

Soil Fertility. Available elements. Fertilization laws. Reliability of recommendations. Evaluation methods. Soil Chemical Analysis. Theory and fundamentals. Sampling. Intensity, quantity, and buffer capacity factors. Correlation and calibration methods. Soil correction. Foliar diagnosis. Advantages and limitations. Sampling. Analysis processes. Interpretation methods. Experimental Techniques of Biological Assays. In greenhouse. Microplots. Field experiments. Response curves and surfaces. Economic analysis. Fertilizer Recommendation.

The two courses with code SOLXXX refer to courses in the process of being created. The two courses with titles in English are the first in this language, an effort to consolidate the internationalization of the Program.

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Two other PPGSNP courses are dedicated to teaching qualification: SOL776 and SOL777. These aim to provide teaching experience through planning, preparation, and teaching of undergraduate courses, under the supervision and monitoring of the professor.

Non-regularly offered courses are grouped as Special Topics or Special Problems. The first group consists of courses taught by visiting professors or from the institution itself, covering variable content relevant to topics important for the student's overall education not covered in regular courses. They are:

-SOL791–Special Topics in Soil Science 2(2-0)
-SOL792–Special Topics in Soil Science 3(3-0)
-SOL793–Special Topics in Soil Science 5(5-0)

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The Special Problems courses group aims to offer the opportunity to study topics of specific interest related to the graduate student's research. They are:

-SOL794–Special Problems 1(1-0)
-SOL795–Special Problems 2(2-0)
-SOL796–Special Problems 3(3-0)

The PPGSNP also includes SOL797–Seminar 2(2-0). Graduate students are required to participate and attend two academic semesters in this course, and in the third semester, they present the seminar on their dissertation or thesis research project.

The course SOL799–Research is used as a form of continuous assessment during training. Graduate students are enrolled in it every semester, being evaluated by their supervisor at the end of each semester, based on performance against the activities planned for the period.

Other UFV courses frequently taken by PPGSNP graduate students:

BQI 701 – Mass Spectrometry Applied to Biomolecule Analysis
BVE 644 – Plant Ecology
BVE 645 – Phytogeography of Brazil
BVE 671 – Plant Nutrition and Metabolism
BVE 673 – Production Physiology
BVE 674 – Plant Ecophysiology
BVE 677 – Plant Mineral Metabolism
BVE 678 – Physiology of Woody Plants
BVE 746 – Phytoindicators of Environmental Impact
BVE 770 – Physiology of Abiotic Stress in Plants
CIV 631 – Geology for Engineers

EDU 660 – Higher Education Methodology
ENF 608 – Ecology and Forest Restoration
ENF 610 – Remote Sensing
ENF 612 – Introduction to Geographic Information Systems
ENF 613 – Advanced Topics in Geographic Information Systems
ENF 625 – Statistical Methods in Forest Science
ENF 645 – Agroforestry
ENF 685 – Environmental Impact Assessment
ENF 687 – Forest Hydrology and Watershed Management

ENG 610 – Soil-Plant-Atmosphere System
ENG 641 – Hydrology
ENG 646 – Soil and Water Conservation Engineering
ENG 647 – Quality of the Physical Environment
ENG 723 – Climate Change and Agriculture
ENG 744 – Water-Plant Management in Saline Soils
EST 620 – Applied Statistics
EST 622 – Experimental Statistics I
EST 630 – Statistical Methods I
EST 631 – Statistical Methods II
EST 635 – Applied Spatial Statistics
EST 734 – Geostatistics
FIT 600 – Soil Management and Conservation
FIT 611 – Plant Mineral Nutrition
FIT 690 – Experimental Techniques in Plant Science I
FIT 691 – Agroecology
FIT 692 – Planning and Analysis of Agricultural Experiments
FIT 710 – Soil-Plant Relations
FIT 713 – Scientific Communication in Agriculture
LET 610 – Instrumental English I
MBI 650 – Soil Microbiology
MBI 651 – Soil Microbiology Laboratory
MBI 652 – Plant-Microorganism Interactions
MBI 665 – Geomicrobiology
QUI 673 – Environmental Chemistry
QUI 750 – Equilibrium Thermodynamics
QUI 752 – Physical Chemistry of Colloidal Systems

Assessments in courses occur essentially through exams, although reports and assignments may also be used. For approval, it is necessary to meet the requirements of minimum attendance of 75% and a final grade equal to or greater than 60% or a grade of S. Courses with grades S (Satisfactory) or N (Unsatisfactory) are only SOL797–Seminar and SOL799–Research.

The graduate student's performance is measured by an academic performance coefficient (CR), requiring a CR greater than or equal to 65 in the first semester of the course, and greater than or equal to 75 from the second semester onwards. Failure to achieve this CR, two failures in the same course, or two N grades result in the graduate student's dismissal.

The Graduate Program in Soils and Plant Nutrition requires, in addition to completing the minimum 24 credits:

– By the end of the first semester, the graduate student must finalize the Study Plan, a document containing all the courses to be taken in the PPGSNP;
– In every semester, the graduate student must be enrolled in the course SOL 799 Research; in the first two semesters, the graduate student must be enrolled in the course SOL 797 – Seminar, and by the second semester, present their seminar;
– At least five courses must be taken in addition to SOL 797 and SOL 799; and of the five courses to be taken, at least three must belong to three different Course Groups (**);
– Once the requirement of the previous item is met, the choice of courses is free, always in line with the research project and with the agreement of the supervisor.
– The course SOL 797 – Seminar does not count towards the completion of the 24 credits in the Master's and Doctorate.

(**) Courses taken during the Master's program will be considered to satisfy this requirement for doctoral students, i.e., for these graduate students, previously taken courses may be used to fully or partially satisfy this requirement.

Professors of the Soil Department who taught graduate courses and their research lines:

Group 1: Pedology (Soil genesis, classification, pedometrics, geochemistry, and mineralogy)
Prof. Carlos Ernesto G. Schaefer:
Area of Expertise: Genesis and Mineralogy, Soil-Environment Relationship
Prof. Elpídio Inácio Fernandes Filho:
Area of Expertise: Geoprocessing and Digital Soil Mapping
Profa. Isabela Cristina Filardi Vasques:
Area of Expertise: Biogeochemistry
Prof. José João Lelis Leal de Souza:
Area of Expertise: Soil Genesis and Classification, Soil-environment relationship

Prof. João Carlos Ker:
Area of Expertise: Soil Genesis, Classification, Mapping
Prof. Márcio Rocha Francelino:
Area of Expertise: Geoprocessing and Soil Management
Prof. Maurício Paulo Ferreira Fontes:
Area of Expertise: Soil Mineralogy and Chemistry

Group 2: Soil Management (Soil physics, agroecology, organic matter, and soil biology)
Profa. Emanuelle Mercês Barros Soares:
Area of Expertise: Soil Organic Matter / Biogeochemistry of Soil Organic Matter
Prof. Igor Rodrigues de Assis:
Area of Expertise: Soil Physics, Recovery of Degraded Areas
Profa. Irene Maria Cardoso:
Area of Expertise: Geology, Mineralogy, Soil Genesis and Agroecology
Prof. Raphael B. A. Fernandes:
Area of Expertise: Soil Physics and Chemistry
Prof. Teógenes Senna de Oliveira:
Area of Expertise: Soil and Water Management and Conservation / Agroecology

Group 3 – Edaphology (Soil chemistry, fertility, and plant nutrition)
Prof. Edson Márcio Mattiello:
Area of Expertise: Fertility/Fertilizers
Prof. Júlio César Lima Neves:
Area of Expertise: Soil Fertility
Prof. Hidelblandi Farias de Melo:
Area of Expertise: Soil Chemistry
Prof. Nairam Félix de Barros:
Area of Expertise: Soil Fertility / Forest Soils

Prof. Rafael da Silva Teixeira:
Area of Expertise: Soil Fertility and organic matter
Prof. Reinaldo B. Cantarutti:
Area of Expertise: Soil Fertility
Prof. Renildes Lúcio Ferreira Fontes:
Area of Expertise: Soil Fertility and Plant Mineral Nutrition
Prof. Samuel Vasconcelos Valadares:
Area of Expertise: Soil Fertility / Forest Soils

FACULTY QUALIFICATION

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The program has 20 highly qualified supervising professors (permanent and collaborating professors), most with training at foreign institutions, in addition to participating in area committees of agencies such as CNPQ, FAPEMIG, CAPES.
The planning for continued faculty training is prepared annually according to the Soil Department's Training Plan, which constantly consults professors to verify interest in undergoing training, in this case, a post-doctoral internship, checking the number of requests (by internal regulations, it cannot exceed 30% of the number of professors belonging to the department) and the institutions of interest, always valuing internationally renowned ones.

ACCREDITATION AND DISACCREDITATION OF SUPERVISORS

The accreditation of professors as supervisors shall be valid for two years. To remain as a supervisor in the PPGSNP, the professor must present minimum scientific production, which will be defined annually based on the productivity of the previous two-year period. The value up to the 25th percentile of the distribution of scientific production (Eq. A1/year) of the permanent faculty body will be considered. This criterion may be updated upon initiative of the Coordinating Committee and must be approved by the Supervisory Committee. For newly accredited professors, this criterion will only be applied after the fourth year.
The supervising professor may receive a student for supervision if they have produced at least 03 (three) articles published in journals with a Qualis A level originating from theses or dissertations under their supervision in the previous two-year period.

SELECTION PROCESS

The student selection process occurs every semester and has been improved each year, aiming to select the most qualified candidates for graduate studies. For admission to the PPGSNP, the candidate must meet the specific requirements of the UFV Stricto Sensu Graduate Studies Regulations, the General Graduate Studies Notice (UFV Dean of Research and Graduate Studies), and

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the PPGSNP Selection Process Notice.

Currently, the selection process involves three stages. The first is a knowledge test with topics related to the area of Soil Science, with subjective questions and higher weights for questions in the area selected by the candidate. The test is administered remotely to expand the reach of the selection process. In recent years, the participation of foreign candidates has progressively increased. The questions are in Portuguese and English, and answers can be in Portuguese, English, or Spanish. The second stage is the evaluation of the curriculum and the research project, which is presented as a pitch video. The third stage is an oral interview with candidates approved in the previous stages, mainly addressing topics from the curriculum and the proposed research project.

INTEGRATION WITH UNDERGRADUATE STUDIES

The interaction between graduate and undergraduate students can also be evidenced in our program by the participation of most graduate students in the Teaching Internship course, institutionalized for CAPES scholarship holders, but also adopted by scholarship holders from other funding agencies. Student participation involves teaching classes in undergraduate courses, supervised by the course professor, supporting undergraduate students taking the course, assisting professors in executing pedagogical projects and preparing materials or experiments to be demonstrated in undergraduate practical classes in the field and laboratory, grading exams and assignments, among other teaching activities. Thus, the teaching internship has provided integration between MS and DS students with undergraduate students and has trained graduate students as future teachers quickly and effectively.

At the end of the teaching internship, the student prepares a report, which is submitted to the Coordinator of the undergraduate course in which they worked and to their supervisor, who in turn forward it to the PPGSNP Coordination for approval and grade entry in the course, a grade issued by the professor who supervised them during the internship.

The teaching internship course is offered at 2 levels according to the workload

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(Teaching Internship I – 1 credit, Teaching Internship II – 2 credits).

Integration with undergraduate studies has been effective with the participation of undergraduate students as scientific initiation scholarship holders or voluntary interns, following the work of Professors, Graduate Students, seminars, courses, among others.

The scientific initiation programs favor interaction and have served as a stimulus for undergraduate students to be initiated into scientific methods and procedures, generating interest in research and Graduate Studies. Program supervisors have been encouraged to include resources in their research projects for granting scientific initiation scholarships, whether in institutional projects or with the private sector.

Most scholarships come mainly from CNPQ and FAPEMIG (Foundation for Research Support of Minas Gerais). Furthermore, there is the possibility of obtaining scholarships from FUNARBE (Arthur Bernardes Foundation), which annually provides a quota of scholarships for young doctorate professors, called FUNARBIC. More recently, there has also been an increase in the number of high school scholarship holders through programs such as BICJr.

The involvement of undergraduate students in research related to Scientific Initiation and/or Supervised Internship allows them to acquire technical and practical knowledge of the subjects involved, become familiar with experimentation techniques, constituting an important step towards becoming qualified and motivated to apply for graduate studies.

ALUMNI MONITORING

The PPGSNP is consolidated and recognized throughout the country and abroad, acting strongly in the training of human resources, always being very well evaluated by CAPES. It has been contributing significantly to the scientific and technological development of the country, and the Program's alumni have a high rate of professional insertion.

In 47 years of existence, the Graduate Program in Soils and Plant Nutrition at the Federal University of Viçosa has trained 694 professionals (data as of December 13, 2024), granting 520 Master's degrees (59.4%) and 353 Doctoral degrees (40.6

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%). The number of degrees (520 + 353 = 873) exceeds the number of professionals, as some completed both the Master's and Doctorate at the PPGSNP.

Since the year 2000, the Coordinating Committee has been monitoring the destination and professional activities of the Program's alumni. Thus, data from these alumni from 2000 to 2021, when the last survey was conducted, will be presented.

Data is being updated for the year 2024, but it is not yet complete. The search is carried out through messages sent to alumni, as well as internet searches. Additionally, alumni are asked to complete a monitoring form. This document aims to keep the registration updated, with an access link provided on the page (https://forms.gle/iNc9FVPNoD7se1399).

INTERNATIONALIZATION

The internationalization of the PPGSNP-UFV can be measured through different actions described below.

1- CAPES-PRINT Program

The PPGSNP is part of the Capes Internationalization Program (Notice 41/2017 – Capes-PrInt). This is an institutional program (http://print.ufv.br/) and the PPGSNP is included in two thematic lines, with the projects "Innovations in the management of tropical soils beyond food and bioenergy production", coordinated by Professor Edson Mattielo, and "Soil and water governance: basis for environmental quality", coordinated by Professor Teogenes Oliveira.

PrInt has benefited Program students with sandwich doctorate scholarships, in addition to professors with post-doctoral training at renowned foreign institutions.

2 – Review for international journals

3- Participation in the editorial board of international scientific journals

Professor Carlos Schaefer is Assistant Editor of Soil Research (formerly Australian Journal of Soil Research) and Professor Edson Mattiello is a member of the Editorial Board of the Revista de la Facultad de Ciencias Agrícolas of the Universidad de Nariño, Colombia.

4- Co-tutelle agreements (dual-degree)

In August 2018, the PPGSNP achieved its first dual-degree doctoral thesis defense. The agreement was signed with the School of Earth and Environmental Sciences at the University of Queensland, Australia. Doctoral student Gisely Souza Barcelos defended her thesis entitled "Removal of lanthanum, cerium, europium and holmium from water by co-precipitation with iron and aluminium (hydr)oxides". The thesis was supervised by Professors Jaime Mello (UFV) and Massimo Gasparon (University of Queensland).

In 2020, there were two thesis defenses under the Double Degree regime. In January 2020, student Heitor Mancini Teixeira defended his Doctoral thesis at Wageningen University (WUR, Netherlands), in double degree with UFV. The thesis "Linking biodiversity, ecosystem services and social actors to promote Agroecological transitions" was supervised by Professors Marielos Peña

Claros (WU) and Irene Cardoso (UFV). In May 2020, the thesis defense of student Lucas de Carvalho Gomes took place, "Land use change and ecosystem services: linking social and ecological systems across time". The thesis was supervised by Professors Irene Cardoso and R. Schulte (WUR). Both theses are part of the cooperation agreement associated with the international research program FOREFRONT, a partnership highlighted further below.

In 2020, negotiations continued for the consolidation of the Dual Degree with Murdoch University, Australia, in line with the PPGSNP's strategies under the Print-Capes Project.

Other partnerships are being established with universities in Poland, the Czech Republic, among others.

5- Sandwich doctorate training abroad

Since 2009, the PPGSNP-UFV has managed to maintain scholarship holders abroad for sandwich doctorate training. This is a priority for the Program, but it was greatly affected by international mobility restrictions during the 2020 pandemic. In recent years, in addition to opportunities from the Print Program, funding agencies such as CAPES, CNPq, and FAPEMIG have launched several notices with calls for this type of training, and several Program students have been contemplated. In 2023, the PPGSNP signed an agreement with a language school to offer a course aimed at training students to take foreign language tests.

6- Reception of foreign professors and students

One of the PPGSNP's initiatives is to seek to promote academic and scientific cooperation agreements that allow foreign professors and graduate students to stay with the Program. This is considered an enriching experience for our students, but also an opportunity for partnerships and the realization of future

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7- Planning of sabbatical leaves for professors
Continuously, PPGSNP professors undertake post-doctorates abroad. Recently, the main destinations were the United States (Igor Assis - Virginia Polytechnic Institute and State University and José João Lelis – Alburn University), Australia (Teogenes Oliveira – Mudroch University), Germany (Carlos Schaefer- University of Gottingen), and Spain (Profª Isabela Vasques - Universidade de Santiago de Compostela).

8 - Participation of professors and students in international events

Professors and students have an active participation in international scientific events. Worth highlighting is the World Congress of Soil Science held in Rio de Janeiro in 2018, which included the participation of PPGSNP professors in the organization and a large part of the Program's students.

2022
- Professors Marcio Francelino and Carlos Schaefer participated in the Brazilian Antarctic Operation - OPERANTAR XLI;

2023:
- Profª Isabela Vasques participated in the 1st joint ICOBTE & ICHMET;
- Prof. José João Lelis participated in Urban Pedology in St. Louis MO and Eastd, in the United States, and in the WRB Soil Field Excursion to Catalonia, Spain.
- Professors Carlos Schaefer, Igor Assis, Raphael Bragança, Marcio Francelino, Reinaldo Cantarutti, Teogenes Oliveira, among others, participated in the XXIII Latin American Congress of Soil Science

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- Prof. Carlos Schaefer participated in the Brazilian Antarctic Operation - OPERANTAR XLII;
- Profª Irene Cardoso and Prof. Raphael Bragança participated in the 1st International Research Workshop of the Consortium Germany, Brazil, Holland and Argentina, in Germany.
- Professors Carlos Schaefer and Marcio Francelino participated in a scientific expedition to the Falkland Islands.
- Professor Marcio Francelino carried out a scientific expedition in Peru and Bolivia to study climate change;
- Professor Marcio Francelino participated in a scientific expedition in Ushuaia, Argentina.

2024
- Professors Márcio Francelino, Elpidio Inácio, and Carlos Schaefer participated in the Centennial Celebration and Congress of the International Union of Soil Sciences, held in Italy;
- Professors Carlos Schaefer and Marcio Francelino participated in the XIª SCAR – Open Science Conference, held in Chile, which also included the participation of 13 Program students, who presented 38 works (oral and posters), in addition to the professors chairing a section on Permafrost.
- Prof. Teogenes Oliveira gave a lecture at the XXI Congreso Colombiano de la Ciência del Suelo. Soil health as the basis for the sustainable development
- Professors Marcio Francelino and Carlos Schaefer participated in a scientific expedition to Greenland;
- Professor Carlos Schaefer participated in a scientific expedition to the Falkland Islands.

9- Organization of an international event – the 21 wcss

Professors Carlos Schaefer and Marcio Francelino chaired a session during the XIª SCAR – Open Science Conference, held in Chile.

10 - Reception of students from cooperation agreements
The PPGSNP-UFV receives students from other countries through different mechanisms, mainly from existing partnerships with graduate programs in other countries, with emphasis on students from the Netherlands and South America.

11 - Short-term trips abroad

As part of the PPGSNP's internationalization initiatives, some professors have managed to make short-term trips to visit teaching and research institutions abroad.

12- International cooperation activities

International cooperation is a constant concern of the PPGSNP-UFV. Several initiatives are underway in this regard, and all have a direct or indirect relationship with Graduate Studies. The main activities are listed below.

- Scientific Committee on Antarctic Research (SCAR): in 2005, the Terrantar Project, which conducts research in Antarctica, coordinated by Professors Carlos Schaefer and Márcio Francelino, was officially included within the International Research Activities supported by SCAR under code ANTPAS (Activity No. 33 – ANTPAS website). Several research projects from the Terrantar Project are ongoing involving various master's and doctoral students from PPGSNP-UFV. Since 2012, missions are carried out annually to collect data and samples on the frozen continent.

- University of Wisconsin (USA): Professor Maurício Paulo Ferreira Fontes was at this university between 2019 and 2020 as a Tinker Visiting Professor, where he taught the course Soils of

Amazon: Genesis and Mineralogy to graduate students of the Latin American, Caribbean and Iberian Studies Program (LACIS).

- Coimbra Group of Brazilian Universities Program (PAEC-OEA/GCUB): cooperation started in 2012, when PPGSNP-UFV offered master's and doctoral scholarships for the Alliance for Education and Training Program, with support from PAEC-OEA/GCUB. In the four-year period, the last fruit of this cooperation was in 2017, with the doctoral thesis defense of a benefited Colombian student (Jose Alexander Rodriguez).

- University of Wollongong (Australia): cooperation work began in 2022 with Professor Marcio Francelino, with Professor Sharon Robsison as the counterpart. This agreement supported the participation of a doctoral student in an Antarctic Operation and the training of a post-doctoral student for one year at that institution.

- Aarhus University – Professors Carlos Schaefer and Márcio Francelino partnered with Professor Alexander Gamble and Mogens Humlekrog to carry out the expedition to Greenland, with the participation of PPGSNP alumnus Lucas Gomes;

- Wageningen University (WUR, Netherlands): the PPGSNP maintains a research and international cooperation program with WUR that also includes the Mexican universities Colegio de la Frontera Sur and Universidad Autonoma de Mexico. In Brazil, the general coordinator of the Program is Professor Irene Cardoso. The cooperation program entitled FOREFRONT - Benefits of nature in agricultural-forest frontiers: connecting actors, strategies, functional biodiversity and ecosystem services aims to bring together efforts to study the reality and challenges of environmental services in the three countries. The project provides for student mobility and the execution of research work. From this project, two double-degree processes already approved by UFV and WUR were made possible. These two processes allowed the double degree of two Brazilian students (Heitor Teixeira and Lucas Gomes). In 2018, the PPGSNP received Professor Marielos Peña-Claros (WUR) for field visits, in addition to some Dutch students already mentioned. Just before the complications of the pandemic in Brazil, in March 2020, the Program organized the International Seminar of the FOREFRONT Program, an event to conclude the projects developed, with the objective of evaluating and debating the main results, learnings, and possible paths for future collaborations. The Program has been funded since 2015 by the Interdisciplinary Research and Education Fund (INREF) of the Netherlands. In addition to Dutch professors and students, the event was attended by representatives from Colombia, Suriname, and Bolivia, as well as participants from the Dutch foundation Tropenbos.

- North Carolina State University (USA): this cooperation began in 2014, when the PPGSNP obtained approval from CAPES for a Special Visiting Researcher (PVE) project, which financed the visit of researcher Dean Hesterberg from the Department

of Crop and Soil Sciences to UFV for seminars, project discussions with PPGSNP professors and students, and offering a mini-course (Special topics in soil chemistry: Principles and practice of X-ray absorption spectroscopy). The project was coordinated by Professor Leonardus Vergutz and allowed the mobility of students and professors between the two institutions during these years. Dr. Hesterberg received some PPGSNP doctoral students as sandwich training supervisors and, in 2019, was in Brazil to work with LNLS on joint projects, including with PPGSNP students and professors.

- Stanford University (USA): partnership started in 2017 and coordinated by Professor Leonardus Vergutz, with Professor Robert Jackson from the Stanford Woods Institute for the Environment as

the counterpart. From this project, an American doctoral student was in Brazil carrying out part of her fieldwork, and new partnerships are being articulated for the near future.

- University of Adelaide (Australia): international cooperation aims to develop new fertilizers and is coordinated by Professor Edson Mattiello, with international partner Professor Michael McLaughlinim from the Fertiliser Technology Research Centre.

- Technische Universität München (Germany): contacts began in 2017, under the coordination of Professors Ivo Silva and Leonardus Vergutz. In Germany, the counterpart consists of Professors Carsten Muller, Djorc Prietzel, and Alix Vidal. In 2019, doctoral students Luís Fernando Almeida and Pedro Paulo de Carvalho Teixeira were at TUM for their sandwich training activities.

- University of Göttingen (Germany): Professor Carlos Schaefer has maintained contacts with Professor Herman Behling, head of the Department of Palynology and Climate Dynamics at this university, since the end of 2017, aiming for a partnership in the area of scenario modeling based on paleoecology and paleopedology studies. In 2019, doctoral student Guilherme Oliveira was at this university developing his sandwich training activities. This is the university where Professor Carlos Schaefer will go for his post-doctorate in 2021.

- University of Florida (USA): with work involving layered double hydroxides, the PPGSNP managed to establish a partnership with this University, which

made it possible in 2019 for doctoral student Gustavo to do his sandwich training at the Horticultural Sciences Department, under the supervision of Professor Lincoln Zotarelli.

- Murdoch University (Australia): partnership with Professor Richard Bell, who has been to the PPGSNP several times, coordinated in Brazil by Professors Teogenes Oliveira and Edson Mattiello. As a result of this partnership, a book with the provisional title "Subsoils Constraints" is being written by Springer Publisher, with several professors from UFV and Australia. This partnership enabled the sandwich internship of Leiliane Bozzi. In 2018, Professor Bell was at PPGSNP-UFV as an external evaluator for the Workshop on Evaluation of Teaching, Research, and Extension in Soil Science. In 2019, Professor Teogenes Oliveira was at this university to give a lecture, participate in an international seminar, and discuss granting double degrees to doctoral students from UFV and MU.

- University Mohammed VI Polytechnic (Morocco): partnership started in 2018, when Professor Edson Mattiello was on a previously mentioned technical visit to Morocco. A partnership under construction that allowed, in 2019, Professor Leonardus Vergutz to go to University Mohammed VI Polytechnic for post-doctoral training, where he moved after leaving UFV.

- ProSavana Project: ProSavana is an international cooperation program between the Governments of Brazil, Japan, and Mozambique. The project coordination is shared by the Ministry of Agriculture of Mozambique, the Japanese International Cooperation Agency (JICA), and the Brazilian Cooperation Agency (ABC). Cooperation started in 2017, when professors Teogenes Oliveira and Leonardus Vergütz were in Mozambique to teach courses on soil and water management and conservation and on soil fertility for researchers and technicians from the Mozambican Institute of Agricultural Research.

- Agreement with FARA (Forum for Agriculture Research in Africa): this is an agreement between UFV and that body, aimed at providing researchers from various African countries with the opportunity to take graduate courses at the Institution. As a result of this international cooperation, the PPGSNP selected, at the end of 2020, three Nigerians to begin their Master's courses in the Program: Bashir Hayatu (Kano University of Science and Technology), Ologunde Hameed (Federal University of Agriculture), and

12 – Courses in English

As a result of the maturation of the Program's supervising professors group and accelerated by the FARA agreement, the PPGSNP began offering two courses in English. The first was already taught in 2020 by Professor Carlos Shaefer: SOL 735– Geosystems, Landscapes and Land Uses in Brazil and West Africa: Convergences and Scenarios. Now in 2021, the second course is being offered: SOL 793– Chemistry and Fertility of Tropical Soils, with the participation of Professors Samuel Valadares, Maurício Fontes, and Edson Mattiello.

INFRASTRUCTURE

The Program's infrastructure includes facilities, equipment, personnel, and laboratories to support teaching, research, and extension activities. This infrastructure also serves other demands from external UFV users, such as rural producers, companies, city halls, and government agencies. The analytical services provided include: pedagogical, agronomic, hydrological, and environmental analysis studies, in addition to analyses of fertilizers, correctives, plant materials, organic and inorganic residues, substrates, sediments, among others.

Laboratories

The Program has 16 laboratories:

- Plant Analysis Laboratory
- Biogeochemistry Laboratory
- Trace Elements Laboratory
- Atomic Absorption Spectrometry Laboratory

- Soil Fertility Laboratory
- Fertilizers Laboratory
- Soil Physics Laboratory
- Geoprocessing Laboratory
- Geochemistry Laboratory
- Stable Isotopes Laboratory
- Organic Matter and Residues Laboratory
- Mineralogy Laboratory
- Laboratory for Soil and Plant Tissue Chemical Analysis Practices
- Sample Reception Laboratory
- Environmental Recovery Laboratory
- Routine Soil Fertility Laboratory

Each laboratory has a professor as coordinator, and all are open to graduate and undergraduate students (scientific initiation, scholarship holders, and interns of various categories) according to the specific needs of each ongoing project.

Other units

The Program also has the following units:

- Center for Land Use Study and Planning - NEPUT (www.neput.ufv.br)
- Post-doctoral room
- Alexis Dorofeev Earth Sciences Museum (www.mctad.ufv.br)
- Terrantar Center

Equipment

The Program's laboratories are relatively well equipped to meet the demands of Graduate activities, with equipment such as:

- Isotope ratio mass spectrometer (SERCON, ANCA GSL 2020) for stable isotope analysis;
- Inductively coupled plasma atomic emission spectrometers – ICP (Perkin Elmer OPTIMA 8300DV and OPTIMA 7300DV);

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- Atomic Absorption Spectrophotometers (Varian Spectra 220FS; and Agilent 240 FS), one with a hydride generation system and graphite furnace;
- Terrestrial laser scanner (RIEGL VZ 1000);
- Specfield 4 Spectroradiometer
- BET Surface Area Analyzer (Quantachrome Autosorb-iQ-C);
- CHNS elemental analyzer (Perkin Elmer 2400);
- Thermo-differential analysis equipment;
- X-ray diffractometer (Panalytical X'PERT PRO);
- Infrared gas analyzer (IRGA Licor 6400 XT);
- Micro X-ray fluorescence (Shimatzu microEDX-1300) for solid and liquid samples;
- Ion chromatograph (DX-600 Dionex Co.) equipped with an electrochemical detector;
- CRDS analyzer (Picarro G2000);
- Gas chromatography coupled with mass spectrometer (GC-MS, Shimadzu QP 2010 SE) and another coupled with a flame ionization detector (GC-FID, Shimadzu HP 6890);
- Portable X-ray fluorescence equipment;
- Ground Penetrating Radar (GPR) with 200, 400, and 900 MHz antennas;
- Geodetic GNSS receivers (L1/L2);
- Remotely Piloted Aircraft (Drones): 02 Mavic Pro; 02 Phantom 4Pro; 01 Mavic 3M and 01 Matrice 300 RTK.

Also available are several units of the following instruments: high-pressure microwave ovens for rock, soil, and plant solubilization; ultrasonic probe; UV-Visible spectrophotometers, flame photometers, plate extractor equipment for soil water characteristic curve, tension table, neutron probes, freeze dryers, nitrogen distillers, water baths, centrifuges (some refrigerated), muffle furnaces, freezers, ultrafreezers, mirror stereoscopes, aerophotographic transformers, topographic interpreters, stereopantometers, acid distillers, leaf area meters, industrial soil and rock mill, micro-osmometer, automated field and bench penetrometers, constant head permeameters, soil temperature and humidity sensors, and dataloggers, etc.
Simpler equipment available includes analytical balances, digital balances, potentiometers, conductivity meters, distillers, deionizers, digestion blocks,

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deionizers and distillers, magnetic stirrers, fume hoods, fans, weather stations, navigation GPS receivers, various shakers, refrigerators and freezers, drying ovens, vacuum pumps, voltage stabilizers, hot plates, drying ovens, regular microwaves, ball mills, soil augers and samplers, etc.

The demand for new equipment to integrate the infrastructure is constant in our Program. The budget constraints of recent years and the difficulties in obtaining research funding that allows the acquisition of capital items have led us to seek different other sources to supply and update the equipment pool available for research projects and students.

Sample preparation room and greenhouses

The Program has a space for storing larger volumes of different soils, commonly used in conducting various research works. This area includes sample preparation rooms for soils and plant material, with a total area of 400 m2. Also part of the infrastructure are three greenhouses for conducting trials under controlled conditions, with a total area of 600 m2.

Soil Bank

The Minas Gerais State Soil Bank is a product of a project carried out in partnership with the State Environmental Foundation, CETEC Foundation, and the Federal Universities of Lavras and Ouro Preto. The bank has a collection of 685 representative samples from non-anthropized areas of the main agricultural producing areas of the State of Minas Gerais, in addition to samples from 149 soil profiles from the Minas Gerais portion of the Rio Doce Basin.

It also has, at the Terrantar Center headquarters, the largest bank of Antarctic soils in the world, with over 3,000 samples from that region, obtained over more than 20 years of the Terrantar project, coordinated by PPGSNP professors.

Videoconference rooms

The PPGSNP building has two videoconference rooms, one exclusive to the Program, equipped with cameras, microphones, television, and Zoom videoconference software. The other room is also available to the Program upon prior scheduling.

Microscopy and microanalysis center

UFV has the Microscopy and Microanalysis Center (www.nmm.ufv.br), which provides: Zeiss EM109 Transmission Electron Microscope; Zeiss Libra 120 Transmission Electron Microscope; Zeiss LSM510 META Laser Scanning Confocal Microscope; Leo 1430VP Scanning Electron Microscope coupled with EDS probe, and SKYSCAN 1174v2 Microtomograph.

SISNANO

Computing resources and internet connection

The DPS-UFV makes various computing resources available to PPGSNP-UFV professors and students, including a local network connected to the internet via fiber optics, serving all laboratories, study rooms, and offices, in addition to wireless access in all its facilities.

The computing resources made available by DPS and PPGSNP include: 147 desktop microcomputers; 5 laptops; 40 printers, including one for size

A2; two digital whiteboards; 5 televisions for projections in classrooms; two plotters (HP A0 size and HP Desingjet Z6100ps); 4 A4 scanners; 18 digital cameras, in addition to 13 data projectors for seminars and undergraduate and graduate classes.

Sector Library

Other infrastructure

The Program's professors and students have access to their own amphitheater, located in the Soil Department, with 200 seats, where courses, lectures, and thesis seminar presentations are held.

It has specific spaces for the program's secretariat and coordination. The program's secretariat has two computers. The Soil Department also has

a computer lab where classes for statistics courses and practical courses in geoprocessing and machine learning software are taught.

Points to be improved

The PPGSNP, throughout its 47 years of existence, has shown constant evolution, striving for strategic planning that seeks to achieve pre-established goals each year to improve its performance. It is a consolidated program with social and international insertion. Quality production indicators have shown rates that improve each year or remain at very good levels, especially in terms of scientific production per professor, number of CNPq Productivity scholarship holders, consolidation of scientific production in high-impact journals, indicating an improvement in the quality of research carried out in dissertation and thesis work.

However, even with the improvement in the program's quality indicators, the main goal is to increase the number of scientific articles published in journals classified as Qualis level A, increasing the average impact factor of publications. Efforts have been made with supervisors and students to achieve this objective, notably the PPGSNP's financing of publication costs (translation of the article into English and processing and publication fees). However, the systematic reduction of resources allocated to Graduate Studies by research funding agencies, especially CAPES, has compromised the maintenance of this type of incentive.

The Program also aims to increase internationalization actions and, consequently, international visibility through technical cooperation agreements, development of joint research projects, and reception of professors and students from abroad.

The Program is going through a period of renewal of its permanent supervising faculty due to the retirement of some professors. Professors nearing retirement have reduced their number of publications, which is expected in some cases, as they are preparing to leave academia. On the other hand, newly hired professors are still starting their supervision activities and,

consequently, publications. The Program coordination is striving to ensure that these changes do not compromise the Program's regularity and efficiency in terms of publications.

A periodic evaluation of the Program is carried out by the students. The last one was conducted in 2023 and is an important tool for understanding, from the students' point of view, problems related to infrastructure, supervision, courses, and coexistence. The suggestions from the course students are welcomed, and efforts are made to improve methodology, faculty actions with emphasis on scientific research, and to prospect funding from development agencies for infrastructure improvement. The Course Coordination promotes meetings with students at the beginning of each academic semester, presenting the course to newcomers, rules and information about the program's daily life, as well as guidance on seeking quality publications.

Future Planning

In the evaluation of the 2017-2021 four-year period, the item related to the participation of students and alumni in articles published by the Program's professors was the only criterion that received a "Good" concept, which kept the PPGSNP with a score of 6 at Capes. This is currently the Program's main challenge in its intention to achieve the score of 7 for excellence and recognition by CAPES. To this end, some initiatives have been adopted by the coordinating

committee. In addition to meetings with supervisors on various topics such as updating the program's research lines, renewing the supervising faculty, raising financial resources through projects, adopting internationalization strategies seeking greater interaction with foreign universities, other strategies and goals comprise the planning for the future of the PPGSNP:

1. increase the flow of students in training abroad, on a reciprocal basis, undertaking sandwich internships abroad.
2. further increase the program's international insertion through the celebration of international agreements, which is already being implemented with Universities in the USA, Germany, Denmark, Poland, the Netherlands, and the Czech Republic.
3. emphasis on publishing scientific articles in high-impact journals in the area and in

English, preferably A1 and A2.
4. increase partnerships with research groups and/or research institutions abroad.
5. encourage double degree.
6. continuously improve the selection process for admission to graduate studies, in order to select the best students, with a profile focused on research and scientific and technological development.
7. offering courses in English.
8. resize the group, removing professors with reduced scientific publication from its staff.
9. Direct financial support for article publication to those involving student and/or alumni participation.
10. Conduct self-assessment periodically and promote evaluation by students every two years.

Final considerations

strengthening, visibility, recognition, and appreciation of the PPGSNP within Soil Science in Brazil and worldwide.