

GROWING THE FUTURE

The Strategic Plan of the Department of Crop and Soil Sciences



NC STATE
UNIVERSITY

College of Agriculture
and Life Sciences



GROWING THE FUTURE

NC State's Department of Crop and Soil Sciences has a rich and successful history of outstanding innovation and discovery, rigorous academic programs leading students to successful careers in agriculture and environmental sciences, and delivery of science-based information through strong extension programs. Today, thanks to the exceptional faculty, staff and students we have the human capacity to develop solutions to global grand challenges like food security, protection of soil and water resources and air quality, and sustainable production of food, feed and fiber. Our department is well positioned for Growing the Future.

Our strategic plan represents the collective wisdom and forward thinking of the combined department and our stakeholders. We now have the framework to plan strategically for the challenging path forward.

The strategic plan centers on five strategic directions – student learning and innovative instruction; global crop science innovation; enhanced crop/turf production and sustainable food systems; soil management and environmental protection across the agricultural to urban landscape continuum; and people, partnerships and advancement – that will serve as the foundation for the future of the department.

Each strategic direction contains approaches and tactics that we will continuously evaluate for success and modify as needed. By focusing on students, interdisciplinary research, and outreach, our plan aligns well with those of the university and the college.

Agriculture and the environment have never been more important to the future of our state, country and the world. The Department of Crop and Soil Sciences will be a leader in developing science-based solutions to local and global agricultural and environmental challenges as we focus on Growing the Future.

A handwritten signature in black ink, appearing to read 'J. Mullahey', with a long horizontal line extending to the right.

J. Jeffrey Mullahey
Department Head



HISTORY OF CROP AND SOIL SCIENCES

The merger of the Crop and Soil Sciences in 2016 represents the reunification of the original Agronomy Department. During the early 1900s, research and extension activities focused on crop production and soil management for North Carolina crops such as forages, cotton, tobacco and upland rice. Classes in crops and soils were first offered at NC State in 1914, and two student clubs were organized, including the present-day Agronomy Club.

In 1924 the Division of Agronomy was renamed the Department of Agronomy, led by Dr. C.B. Williams and housed in Patterson Hall. World War I and the Great Depression had a strong impact on the department's agronomic programs. Following World War II, the department experienced significant growth in faculty, students, new programs in plant breeding, and the start of the Official Variety Testing Program (OVT). In 1952, the department moved to Williams Hall. In 1956, the department was divided into a Field Crops Department and a Soil Science Department. Both new departments experienced rapid growth in the 1960s with the addition of new research and extension faculty. Since then both departments have continued their growth and evolution, with Crop Science focusing on key discipline areas of plant breeding/genetics, crop management, crop physiology, turfgrass science, weed management and agroecology, and Soil Science concentrating on soil management, waste management, soil fertility, and environmental and water quality protection.

Facilities to support educational programs in crop and soil sciences include buildings on main campus (Williams Hall, greenhouses, Phytotron), the Method Road greenhouse complex and field facilities at the Reedy Creek Field Operations Unit and Lake Wheeler Field Lab for turf, crops and agroecology research, and hands-on soil sediment and erosion control and on-site wastewater management training and research facilities. Faculty conducting field research also use the 18 N.C. Research Stations located throughout North Carolina and work on farms across the state.

In the past 25 years both the Crop and Soil Science departments developed new programs, received national recognition for research and discovery, and benefited from shareholder support. Our new combined department continues to advance the crop and soil sciences mission while generating even more of its own resources from grants and partnerships with industry, state regulatory agencies and federal programs.



Photo by John A. Kelley

EXCELLENCE UNEARTHED

- The Department has an integral presence at the Center for Environmental Farming Systems (CEFS) at the Cherry Farm facility near Goldsboro. From work at CEFS, two courses – Introduction to Agroecology and Advanced Agroecology – were developed in 2006, followed by the creation of an undergraduate concentration in Agroecology. In addition, a new research and extension program was started with a focus in organic cropping systems.
- The greatest development in the area of plant breeding has been the adoption of molecular techniques in crop improvement. The plant breeding program has maintained its national and international prominence despite a challenging fiscal climate. This outcome is in part attributable to the formation of the Center for Plant Breeding and Applied Plant Genomics, which procured funding for training 25 graduate students from 2007 to 2014.
- Lake Wheeler Soil Science Learning Laboratory is a unique hands-on training center that provides continuing education credits to over 3,000 on-site wastewater professionals and approximately the same number of sediment and erosion control professionals on a yearly basis. This state-of-the-art research facility and the training provided is a unique resource for the state of North Carolina. Other states have adopted this model.
- Turfgrass Science at NC State is highly regarded both nationally and internationally. Bolstering this reputation is the Center for Turfgrass Environmental Research & Education, which supports both research and graduate education. In addition, a significant change for the turfgrass program was the relocation of the turf field laboratory from the University Club to the present Lake Wheeler Road location.
- Distance education began in the late 1990s and has become a vehicle to reach both enrolled and place-bound students with such programs as a Masters of Soil Science and a certificate in either Soil Science or Crop Science.
- The department received one endowment in 2013 and two endowments in 2014:
 - The Ross Lester Andrews Soil Science Environmental Research Award for Outstanding Doctoral Candidate
 - Dr. William K. Collins Distinguished Professorship along with the Dr. William K. Collins Tobacco Agronomist Position
 - Bayer CropScience Distinguished Professorship in Soybean Breeding



VISION

We will be a world leader in crop and soil science education and in the generation and application of knowledge required for economically and environmentally sustainable crop systems and products, as well as in developing land management strategies that protect the quality of North Carolina's soil, water and air resources.

MISSION

We develop future leaders in crop, soil and environmental sciences, improve crop plants and products, devise effective and sustainable crop production systems, devise effective and sustainable soil management techniques in both agricultural and urban settings; and disseminate crop, soil and environmental science knowledge for the benefit of users and producers of food, feed, turf, biofuels and fiber in North Carolina, the nation and the world.

CORE VALUES

As leaders in Crop and Soil Sciences,
we embrace our core values to create success.

We are Growing the Future through:

Leadership

We manifest leadership in all our endeavors
through transparency, integrity and professionalism
to advance the land-grant mission.

Excellence

We pursue excellence through creating an environment
that encourages innovation and success.

Accomplishment

We develop and implement innovative solutions to challenging
problems in crop, soil, and environmental sciences.

Diversity

We include diverse approaches, perspectives, opinions and people
to enhance our collective effectiveness and continuing development.

Education

We engage students, staff, faculty members and clientele
in impactful learning and professional development opportunities.

Responsiveness

We disseminate timely science-based information
to stakeholders in North Carolina, our region and around the world.

Stewardship

We promote the wellbeing of consumers of agricultural products,
farming communities, agricultural industries and workers,
and agricultural and urban ecosystems.



STUDENT LEARNING AND INNOVATIVE INSTRUCTION

We will address the challenges of society by excelling in the education, training and development of people involved in the diverse fields of crop and soil sciences.

STRATEGY 1.1

- 1.1 Increase Enrollment and Diversity of Students in Educational Programs about Crop Plants and Agricultural Systems, as well as Natural Resources, and Soil and Land Development.

TACTICS

- 1.1A Recruit, attract and enroll more students in programs offered by the Crop and Soil Sciences Department through existing and new student pipelines and use of diverse communication tools.
- 1.1B Attract greater numbers of talented students into a curriculum that better prepares them for graduate school.
- 1.1C Maintain a critical mass of faculty members who are deeply engaged in teaching and academic programs.

STRATEGY 1.2

- 1.2 Enhance Curriculum Design to Address Emerging Trends and Challenges.

TACTICS

- 1.2A Review and revise majors and concentrations to keep up with changes in the field while maintaining the core mission of education about crop plants and agricultural systems, as well as in land management techniques that protect soil and water quality in both agricultural and urban settings.
- 1.2B Promote an understanding of societal and global challenges throughout the Crop and Soil Sciences curricula to broaden the perspectives of students.
- 1.2C Enhance student career opportunities through a 'curriculum to careers' strategy that highlights many career paths in crop, soil, and environmental sciences.

- 1.2D Broaden the undergraduate curriculum, including approaches that enhance cooperation with other departments and team teaching.
- 1.2E Strengthen graduate student education through revised and expanded courses, including interdepartmental collaborations.

STRATEGY 1.3

- 1.3 Expand Educational Opportunities for Students through Effective Use of Distance Education and other Online Learning Tools and Platforms.

TACTICS

- 1.3A Identify areas where distance education may increase educational access and efficiency for enrolled and place-bound students.
- 1.3B Increase educational effectiveness through appropriate use of online learning tools.

STRATEGY 1.4

- 1.4 Increase Student Engagement through Experiential Learning.

TACTICS

- 1.4A Increase research, internships and international opportunities to enhance student learning and development.
- 1.4B Enhance hands-on learning and skills development in the curriculum using resources such as laboratories and greenhouses as well as the Agroecology Education Farm, Fike Crop Science Teaching Garden, Land-application Demonstration and Training Facility, On-site Waste Water Demonstration and Training Facility, Sediment and Erosion control Research and Educational Facility, and Turfgrass Field Laboratory, all located at the NC State University Lake Wheeler Research farm.
- 1.4C Enable career success for students through fostering professional and leadership development opportunities and experiences.



GLOBAL CROP AND SOIL SCIENCE INNOVATION

We will create innovative approaches to enhance food security and agricultural systems while protecting the environment.

STRATEGY 2.1

- 2.1 Discover and Apply Fundamental Knowledge in Plant and Soil Sciences to Improve Crop Performance.

TACTICS

- 2.1A Solve systems-level problems through formation of interdisciplinary teams of agronomists, breeders, crop ecologists, modelers, plant physiologists, soil scientists, weed scientists and others.
- 2.1B Enhance faculty expertise in fundamental plant and soil science disciplines required to fulfill our science mission through departmental and university cluster hires.
- 2.1C Enhance access to quantitative and computational tools in plant breeding, such as quantitative genetics, genomic selection, Bayesian techniques and mining of large data sets.
- 2.1D Foster innovation and discovery through interactions and synergies between multi-disciplinary and multi-sector research programs.

STRATEGY 2.2

- 2.2 Develop New Methods for the Collection, Analysis and Application of Agricultural Data.

TACTICS

- 2.2A Generate faster paths to crop improvement through building and characterizing large germplasm sets, including use of technologies such as genome editing, DNA/RNA sequencing and high throughput phenotyping.
- 2.2B Improve crop production and decision tools through collaborative development and use of advanced precision agriculture, agroclimatology tools and remote sensing and spatial georeferencing using unmanned aerial vehicles and other technologies.

STRATEGY 2.3

- 2.3 Develop and Apply Knowledge of Interactions between Agricultural Inputs and Agroecosystems to Minimize Environmental Impacts.

TACTICS

- 2.3A Identify opportunities for multidisciplinary and collaborative research in the area of sustainable agriculture.
- 2.3B Discover, develop and apply knowledge of plant biology and genetics, ecology, soil science and agri-chemistry to improve weed management systems and mitigate herbicide resistance.
- 2.3C Expand research in 'green' landscapes and turf irrigation systems.
- 2.3D Develop improved cultivars to increase environmental sustainability related to crop production and other land uses.



LAMPHOLDER CAPS MUST BE PUSHED COMPLETELY ON TO THE LAMPHOLDER BASE

CROP/TURF PRODUCTION AND SUSTAINABLE FOOD SYSTEMS

We will develop economically and environmentally sound systems for crop production and turf management with value to producers, industrial users and consumers.

STRATEGY 3.1

- 3.1 Solve Emerging Problems in Crop and Turf Production, Quality and Management.

TACTICS

- 3.1A Improve the efficiency and effectiveness of field research facilities to allow us to be more responsive to the needs of clientele.
- 3.1B Establish a sustainable Extension structure through organizing specialists and agents into teams to create solutions in crop production and turf management.
- 3.1C Continue to improve production practices through developing new technologies related to stress resistance, weed control, yield improvement, water and nutrient use efficiency, and soil and water quality.

STRATEGY 3.2

- 3.2 Disseminate Timely Information about Solutions to Problems in Crop Systems.

TACTICS

- 3.2A Increase the efficiency of technology transfer to producers through the Extension portal and other resources such as websites, webinars, phone applications and social media.
- 3.2B Apply new communication tools and expertise to meet the needs of our clientele and society.



MANAGING SOIL AND WATER RESOURCES TO PROTECT ENVIRONMENTAL QUALITY

We will develop management strategies that protect soil and water resources from degradation associated with agricultural and urban land uses and develop remediation strategies for existing programs.

STRATEGY 4.1

- 4.1 Provide Guidance to Growers on Sustainable Application of Nutrients.

TACTICS

- 4.1A Develop tools that aid growers in precision application of nutrients in order to maximize yield, reduce production costs and minimizing loss to surface and ground water.
- 4.1B Continue to refine the most appropriate levels of nutrient application rates, timing and placement for the myriad of soil types and crops in North Carolina.
- 4.1C Develop additional conservation tools that minimize contamination of soil, water and air from applications of nutrients.

STRATEGY 4.2

- 4.2 Develop Effective Methods to Minimize Soil Erosion from Agricultural Fields, Construction Sites, and Shorelines.

TACTICS

- 4.2A Continue to develop and test new methods for reducing soil erosion and improving stormwater quality in agricultural, urban, and coastal areas.
- 4.2B Provide training in the use and application of the latest systems to reduce the impact of land development on water quality.

STRATEGY 4.3

- 4.3 Conduct Basic and Applied Research on the Fundamental Processes that Control the Cycling of Chemicals in the Soil, Water and Air.

TACTICS

- 4.3A Expand our understanding of how chemical and biological contaminants move through soil, water and air.
- 4.3B Enhance the development of sustainable management techniques for safe application of human and animal waste products to soil.

STRUCTURE matters

4 All soils have different particles of different sizes. Some are tiny, some are big, and some are in between. This is called soil texture.

5 Some soils have more sand than others. Sand is made of tiny pieces of rock that have broken apart. It is the largest particle size.

6 Some soils have more silt than others. Silt is made of tiny pieces of rock that have broken apart. It is the middle particle size.

7 Some soils have more clay than others. Clay is made of tiny pieces of rock that have broken apart. It is the smallest particle size.

SIZING *up* SOILS

WE SIZE UP SOILS EVERY DAY. WHY? Because we care about clean water and clean air, fresh tomatoes and fine wine, dams and dry basements, subway tunnels and superhighways, fields and forests, wildlife and weather.

START SIZING UP SOILS. YOU'RE READY FOR SURPRISES! Every soil has a story written in its structure and patterns. You can read it by taking a closer look from the ground down.

SINCE HUMANS FIRST SETTLED DOWN, WE HAVE BEEN SIZING UP SOILS. Today, soil scientists analyze soils and predict how they will behave. But soil scientists explore soils using tools and techniques—digging, touching, seeing, smelling—that everyone can use.



TAKE THESE "GIANT" SOIL PARTICLES for a spin!

Use the wheel to spin the soil particles. Watch them settle into layers. The top layer is sand, the middle is silt, and the bottom is clay.



Photo by John A. Kelley

PEOPLE, PARTNERSHIPS AND ADVANCEMENT

We will positively impact crop and soil sciences by developing people, focusing on partnerships and collaborations and creating advancement strategies to support departmental programs.

STRATEGY 5.1

- 5.1 Foster a Diverse, Creative and Effective Work Environment.

TACTICS

- 5.1A Plan strategically to address budgetary and resource needs to fulfill our mission.
- 5.1B Provide ongoing opportunities and incentives for professional and leadership development by staff and faculty to enhance effectiveness and success.
- 5.1C Foster a departmental climate of diversity and inclusiveness where faculty and staff can reach their full personal and professional potential.
- 5.1D Improve inter-departmental communications, workflow platforms and infrastructure to promote and enhance work effectiveness.

STRATEGY 5.2

- 5.2 Form Partnerships and Collaborations to Support Education, Research and Extension.

TACTICS

- 5.2A Enhance public-private partnerships with private companies and commodity groups, seeking their input and support on future research directions.
- 5.2B Address local and global challenges in agriculture through increased interdisciplinary collaborations and teams within NC State, other universities and the agricultural industry.
- 5.2C Identify partners, collaborators and agencies to provide students with experiential learning opportunities.

STRATEGY 5.3

- 5.3 Engage in Advancement Activities to Support Departmental Goals.

TACTICS

- 5.3A Communicate our departmental successes, outcomes and creative ideas to alumni, stakeholders, clientele groups and supporters of the department as a means of raising funds to support facilities and teaching, research and extension programs.
- 5.3B Advocate for increasing the current percentages of facilities and administration costs and royalties to the originating teams to reinvest in research.
- 5.3C Identify internal and external resources to remodel and improve facilities in order to promote all aspects of the Crop and Soil Sciences mission.



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