The College of Agriculture and Life Sciences offers degree programs in a unique combination of disciplines incorporating the basic life sciences and applied agricultural sciences. The college offers 7 associate, 22 baccalaureate and 32 graduate degree programs to 5,926 students. In addition, the College serves the university community by offering general education science courses in biology, zoology, entomology, botany, biochemistry, microbiology, plant pathology, toxicology, genetics, food science, nutrition, poultry science, soil science, animal science, and crop science. With an emphasis on teaching about and with the latest technology, the Educational Technology Fund (ETF) is essential to the successful delivery of laboratory intensive courses. ETF dollars are crucial for meeting student Information Technology needs. CALS also provides ETF support for shared facilities PAMS (Chemistry/Biochemistry and Statistics). The College’s 2012 – 2013 ETF base allocation was $1,906,394 (including $382,708.22 for Biotechnology). The College received an additional one-time allocation of $86,150 enabling laboratory and instructional technology upgrades in Bostian Clark Hall. Students from CALS and from across the campus benefitted from these acquisitions.

1. Categorized ETF Expenditure Summary

Expenditures reported in the narrative represent the College of Agriculture and Life Sciences’ departmental expenditures and do not include the Biotechnology ETF expenditures. At the end of this document a “Education and Technology Fee Expenditure Report Summary for FY 2012-13” describes the Biotechnology, CALS only and summary expenditures.

a. Personnel expenditures represented 21% of the CALS ETF allocation.
   - $307,267.20 was expended for professional support staff and student workers. At the College level a computer consultant position and computer instructional technologist were dedicated to providing better computing services to students. Student-workers/staff include computer lab proctors and “wet” laboratory student assistants.

b. IT infrastructure, equipment and services (computing labs, networking, etc.)
   - $218,511.29 or 15% was expended for IT infrastructure, equipment and services. $115,718 was spent for PC computers to be placed in student labs and learning centers across the college. Additional IT equipment included scanners, DVD burners/player, Flip cameras, video camera replacement and other digital equipment permitting students to integrate technology into their projects. CAAT provided poster printing services for fall, spring and summer research symposia sponsored by the university. For 2012-13, the college printed 1153 posters.

c. Non-IT infrastructure, equipment (experimental labs, wet labs, etc.)
   - $617,004.99 or 36% of the allocation was spent for non-IT or laboratory equipment. With an infusion of one-time money, Life Sciences invested in equipment teaching the latest technology. In addition, one-time funds allocated from the CALS base dollars enhanced and expanded available capacity in laboratory experiences for students in Horticulture and Crop Science.

d. Facilities (repairs and renovations etc.)
   - $73367.12 or 5% was expended for repairs and maintenance of teaching laboratories, laboratory bench work centers and equipment. Microscopes and other laboratory equipment must be serviced in order to function properly in the laboratories. This cost ranges from $200 to $6,000 per scope.

e. Discipline/instructional related field trips, professional development/experiences, travel, conferences, services etc.
   - $130,766.04 or 9% was expended for travel. Funds support field trips to business and industry but primarily are used for transportation to off campus field facilities for hands-on laboratory experiences in biology, horticulture, zoology, plant biology, poultry science, entomology, and animal science. Students must travel to these sites in order to conduct laboratory work and view plant and animal specimens in their natural habitats. The students also learn the appropriate management techniques and implement the latest technological practices at the animal research facilities.

f. Other
   - $175725.25 or 14 % was expended on maintenance repairs to equipment, wet lab expendables, paper for student handouts, plants, reagent supplies, chemicals, soil, etc. Many departments had to utilize these funds to keep their student laboratories running since operating expenses were cut at the college level.

2. Justification/Purpose of Expenditures—strategic overview

a. New and/or transformative initiatives undertaken with ETF
   - Describe how your unit has used funds in progressive and innovative ways
Undergraduate teaching laboratory space was expanded in 2011-2012 through the addition of Thomas 2577 for GN 425, Advanced Genetics Laboratory, a course required for Genetics majors. In spring 2011, Thomas 2577 was renovated to become an undergraduate research laboratory that can be used for GN 425 as well as independent undergraduate research projects. Equipment up-fit for this space continued in 2012 and 2013. GN 425 was taught for the fourth time in spring 2013.

Plant Biology is continuing to move our laboratory exercises in both introductory and advanced courses to increased focus on molecular biology and biotechnology. Building on past investments for equipment for transgene screening, gene expression, sequencing, and high-end imaging, this year we purchased updated spectrophotometers for the labs as well as a new imaging camera.

Efforts in Poultry Science to provide students with technologies and innovations that are utilized in the poultry industry and research continues to be a priority in the poultry science and feed milling courses. Purchases and maintenance of specialized equipment and software; and field trip opportunities continue to support these efforts. Examples include use of the feed mill and poultry processing equipment to provide students with “hands on” opportunities. Field trips offer students insight on “scale” of commercial facilities.

Soil Science purchased new equipment purchased for measuring soil water potential and soil quality analysis. This greatly expanded the learning opportunities for the students and updated old equipment. Plate counter and Nanodrop equipment have expanded our training capabilities in soil microbiology.

Crop Science was allotted additional $10,000 one-time money from the CALS base ET dollars which was used for the purchase of technology needed to startup a student technology resource center in Williams Hall. This center will be used by students to work on projects using new computer technologies.

Entomology was able to purchase essential equipment and supplies to provide state of the art molecular biology and biochemistry laboratory exercises in ENT 503 (Morphology and Physiology of Insects)and ENT 531 (Insect Ecology) ENT 550 Fundamentals of Insect Control & ENT 560 (Techniques in Molecular Ecology and Evolution).

Biology utilized funds for the purchase of new equipment, computers, software and laboratory supplies to continue the operation and modernization of our laboratory courses. Much of the one-time allocation was spent on much-needed upgrades to equipment that serves multiple courses, including BIO 181, 183, 106, 227, 250, 350, 360, 375, and 426. With ETF support, we have positioned ourselves to open additional seats in BIO 212 as well (also dependent on funding for teaching assistants). Using some of the ETF funds, we are once again offering BIO 315 for the first time in many years either spring of 2013 or 2014 (depending on the instructor’s teaching schedule, which was impacted by the departure of another faculty member).

The Department of Animal Science used ETF funds to be able to allow students to gain hands-on experience at the Animal Educational Units (horse, beef, dairy, swine, metabolism, and small ruminant). For example, milk test or blood test kits allow students to learn real-life procedures for obtaining biological samples, to process the samples appropriately, and to interpret the results in a manner that will allow the students to learn to make management decisions similar to what would be encountered in an Animal Science career. Students also learn first-hand about the life cycles of the domestic species at the Animal Educational Units, and are involved in the breeding, parturition, and processing of newborns for all species. For our on-campus labs, the ETF funds are used to purchase novel teaching items such as the dissectible cow, pig, and horse models. These quarter-life sized models enable students to learn detailed Anatomy and Physiology concepts that would be difficult to conceptualize without the three-dimensional models that come apart and can be put back together. The ETF funds are also used to purchase preserved animal tracts that enable the students to perform dissections on reproductive tracts, digestive tracts, and other biological systems. Having the opportunity to gain hands-on experience in such a manner is a huge benefit for the learning process, and this is always emphasized by students when they complete evaluations of Animal Science courses.

ETF funds continue to support an undergraduate computer facility in the horticulture student study lounge, and computer technology for the landscape design studios. Horticulture students use this computer lab to prepare numerous documents and projects in their horticulture classes and they use the computers in the landscape studios for design work they do in their respective studio labs. ETF funds have allowed for the continual improvement and expansion of these facilities. All the computers and monitors were replaced in the lab this past year with one time $10,000 allocation monies from the CALS base ETF dollars with state of the art technology.
• Describe how your unit continues to rethink and reassess use of funds to improve teaching/learning/business models to maintain nimbleness, adaptability, etc.

Poultry Science faculty and industry representatives continue to interact to insure the industry goals and needs are incorporated into the lectures and laboratory exercises. As technology improves, it is extremely important for instructors to include use of these innovations into the lectures and labs. The technology may be in the form of a modeling program or hardware with field demonstrations.

The ETF funds allow our Soil Science faculty to consider new offerings within their lab courses that require expenditures for equipment and supplies that were never possible before the availability of these funds. Examples include computer-based exercises that require specific, specialized software plus availability of laptops and desktop computers and the ability to incorporate state-of-the-art molecular biology exercises in entomology classes to provide students with exposure to and training in the use of the most up-to-date techniques.

In the Biotechnology Center the model used of the basic molecular techniques core-course followed with half-semester advanced module courses allows for rapid updating of course content and satisfies interests in a broad range of advanced topics.

In Biology, this year, we continued to re-allocate some resources to developing virtual labs to improve efficiency of content delivery and also to be able to demonstrate some techniques and data generation/manipulation that are too costly to perform in "live" laboratories. We also continued development of upper division labs and a GEP interdisciplinary perspectives course (BIO 227) with lab to better meet student needs. We have also used some ETF funds to help support undergraduate research projects conducted with research faculty, a valuable experience for our undergraduate students. ETF funds used to cover supplies and small equipment items critical to undergraduate research experiences enable faculty to take on more undergraduate researchers in their laboratories.

b. Actions taken to improve efficiency/return on ETF investments

• Describe your unit’s efforts to increase/maximize the value of ETF expenditures

Animal Science maximizes the value of our ETF expenditures by involving students in the planning process, by soliciting input from students and faculty, and by carefully monitoring expenditures. When equipment and supplies are purchased, the "life expectancy" of the equipment/supplies is a consideration. Equipment and supplies are used and re-used by many different courses, which demonstrates efficient use of items purchased with ETF dollars.

In Poultry Science general supplies are purchased by the teaching laboratory PI and UTC to insure efforts are streamlined and purchases are beneficial to students. This prevents excessive spending on certain supplies required for teaching laboratory maintenance.

The Soil Science Department makes every effort to share field and laboratory equipment among various courses and instructors and to select equipment that is as versatile as possible. The cost of some laboratory equipment can limit student exposure to certain analytical procedures.

In Microbiology the ETF base allocation was reduced from $85K to $70K in the 2012-2013 academic year; all expenditures were focused on maintaining the minimal resource needs to deliver labs and course sections.

Entomology always attempt to maximize use of our allocated ETF funds by purchasing supplies and equipment required for the normal and specialized needs of entomology lectures, wet labs, dry labs, and field lab experiences. The funds have allowed us to purchase teaching supplies during times when regular academic funds were woefully inadequate for this purpose. They helped us to minimize the use of research funds to meet teaching needs in the absence of sufficient support dollars from the academic lines.

In the Biotechnology Center, most of the advanced instruments are used in multiple courses. New courses are built upon the capabilities of current instrumentation. Equipment cost sharing with research units allows students in BIT courses to have access to the latest research instrumentation that otherwise would be too expensive for departments
teaching a single applied course to purchase and maintain. We are also continuously exploring ways to partner with other units on campus to fully utilize our teaching resources. Where appropriate, instrumentation and laboratories are made available for other departments to teach their courses. We continue to submit proposals to outside grant agencies seeking support for course exercise development and instrumentation updates.

Biology continuously tried to improve courses, culminating with end-of-semester meetings to discuss ways to improve teaching/learning and leading to decisions on what changes should be made using ETF resources. For example, this year we continued to re-allocate some resources to developing virtual labs to improve efficiency of content delivery and also to be able to demonstrate some techniques and data generation/manipulation that are too costly to perform in “live” laboratories. We also continued development of upper division labs and a GEP interdisciplinary perspectives course (BIO 227) with lab to better meet student needs. We have also used some ETF funds to help support undergraduate research projects conducted with research faculty, a valuable experience for our undergraduate students. ETF funds used to cover supplies and small equipment items critical to undergraduate research experiences enable faculty to take on more undergraduate researchers in their laboratories.

If not for the donations of plants, and additional supplies and materials made by private horticultural companies for specific course laboratories (Production of Floricultural Crops for example), our departmental ETF request would be that much greater. As a result, we have been able to maximize the value of the ETF expenditures. We have been able to maximize ETF expenditures for field trips by scheduling sections that are totally enrolled. Faculty work hard to stretch every ETF dollar. Much equipment is shared between instructors that teach similar courses in the 4-year program and the 2-year program.

c. Unmet ETF-eligible needs
   • Describe funding shortfalls for needs that could be funded by ETF

Animal Educational Units (teaching farms) were transferred to the Animal Science Department at the end of the 2009/2010 academic year. The farms did not come with an operating budget, ETF dollars are essential for keeping these valuable teaching farms open and available to our students. Numbers of animals and feed supplies are not sufficient for the demand.

Plant Biology has a goal to expand our ability to train students in molecular biology, biotechnology, and imaging techniques. We have prioritized for future funds a refrigerated centrifuge for metabolite and nucleic acid isolation, cutting-edge histology equipment for imaging, and updated stereomicroscopes to replace aging ones in the laboratory.

The development of an international plant disease diagnostic facility in Plant Pathology continues to be hampered by the lack of funds to equip such a facility with modern technological equipment and microscopy systems. This facility would utilize state-of-the-art laboratory, visual and molecular equipment that would provide access to education and training in this important aspect of Plant Pathology in laboratory classrooms, national and international workshops and distance learning settings.

In soil science one of the continuing needs for the renovated teaching labs is a forced air convection oven for the soil fertility lab with a cost estimated at $3500. The capability of the two teaching labs should be expanded with the addition of document cameras and computers. A document camera has been purchased for one lab, but dedicated computers for these 2 labs have not been available. Total cost of approximately $8000. Interactive educational displays will be developed and installed throughout the Soil Science Department common areas in Williams Hall. These may include but are not limited to: soil monoliths, research posters and opportunities for students, meetings and job information, interactive maps, as well as other displays not yet identified. Cost estimated at $10,000. The SSC teaching labs and classrooms that were renovated several years ago are lacking in smartboard technology. The technology will expand our teaching capacity and allow for more effective student-teacher interaction and multimedia education. Cost estimated at $14,000. GPS equipment and software needs to be constantly updated so that our students receive instruction on the equipment they will encounter once they graduate. We need to maintain capability in the GPS/GIS lab via a regular update and replacement of equipment at a cost of $8000.

Entomology continues to teach some classes in faculty research laboratories not intended for that purpose. This causes wear and tear on equipment purchased for research and significantly disrupts the on-going research activities in the laboratories. Some funds are needed to help with repair or payment of equitable share of replacement costs for research equipment that is frequently used in and essential to class laboratory exercises. ETF funds have allowed us to purchase some up-to-date laboratory equipment and supplies for use in laboratory sections involving molecular genetics and biochemistry techniques. Ultimately, we need funds to renovate our teaching labs to bring them up to the standards of modern teaching labs. Our teaching labs are located in Gardner Hall which was built in 1955 and they have not been substantially updated since then and therefore fallen far behind current standards. We continue to need additional equipment as well as high resolution microscopes with digital/video display capabilities for teaching graduate courses. We
also need to replace aging dissecting microscopes that are used routinely in the laboratory sections of many of our undergraduate and graduate courses.

Biotechnology Education relies solely upon ETF funding for supplies and equipment. Without ETF funding we would not be able to provide any courses and there would be no graduate or undergraduate minor curriculum in biotechnology.

Horticulture has an increasing and continued need for computer-aided design. That would require additional hardware and latest available state of the art software, to be placed in the design studios. The teaching committee and student representatives are working to develop a plan and budget for the facility.

d. Assessment of impact of ETF investments on student learning

- How and what does your unit measure to evaluate the effectiveness of ETF expenditures?

CALS uses a multiple approach including: freshmen computer survey to determine needs; course evaluation questions relative to the laboratory experience are contained with each course evaluation; exit interviews of graduating seniors by the department head also address the student’s perceptions of the quality of the laboratory experience. A majority of students express a high degree of satisfaction with the laboratories that they participate in. While these assessments indirectly measure the effectiveness of ETF expenditures, we believe that they adequately reflect student perceptions. Career Services employer surveys and feedback from professional and graduate schools indicated that students generally are meeting expectations in the work place and in graduate and professional schools. Inadequacies are also pointed out. ETF investments in equipment and improved processes address these learning deficiencies.

- In brief, what is your unit’s assessment of the impact of ETF investments on student learning

ETF investments were invaluable to student learning in a variety of settings including the laboratories where computer workstations are used substantially to enhance learning. Additionally, ETF funding enabled students to engage in experiential, hands-on learning with state of the art equipment at on-campus sites as well as during laboratory-related off-campus field trips. Employers, graduate and professional schools indicate that graduates tend to be better prepared from our institution because they are educated on state of the art equipment and learn scientific procedures and process through hands-on experiences.

e. Planning and review process

- Describe your internal review process and level of student participation

Each Department conducts its own planning and review process, often along with professional assessments such as NIFA, NCATE, ABET and other accrediting agencies. The College uses a team approach for identifying, prioritizing and assessing ETF needs. The College team included: Dr. John Cornwell, Interim Associate Director for Academic Programs; Ms. Leigh Jay Hicks and Ms. Katie Lynch, CAAT; Dr. Andy Hale, Biological and Agricultural Engineering; Dr. Stephanie Curtis, Genetics Department; Dr. Jan Spears, Crop Science Department; Dr. Brian Farkas, Food Bioprocessing and Nutrition Sciences; and the President an/or Treasurer of AgriLife Council. The Academic Programs office directors and manager meet with the CALS budget office to monitor ETF funding. The administration discusses ETF issues with AgriLife Council members. Each of the 18 departmental committees includes the undergraduate and graduate coordinators, faculty members and students. Names are available upon request. Departments submit ETF requests to the CALS ETF web site. The site is open for review. The College committee reviews the requests and recommends allocations to the Associate Dean for Academic Programs. Each Department reports its expenditures annually to the College. The College and Departmental ETF end-of-year expenditure reports for last fiscal year (2011-12) are available for student review upon request. All ETF expenditure reports will be posted to the Provost’s website and will be accessible by anyone who has a campus unity ID. In addition, the CALS ETF 2011-12 expenditure report may be viewed by selecting the College Home page http://www.cals.ncsu.edu/ Select For Faculty and Staff then ETF. A unity ID and login is required to access the ETF report. For questions, please contact Dr. Beth Wilson, Assistant Director of Academic Programs bwilson@ncsu.edu

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Unspent funds will be replaced in the new fiscal year by the department.