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 9 associate, 41 baccalaureate and 31 graduate degree programs to 5,592 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 in CHASS (Sociology & Anthropology) and PAMS (Chemistry/Biochemistry and Statistics). The College’s 2008 – 2009 ETF base allocation was $1,705,673 (including $354,144.00 for Biotechnology). The College received an additional one-time allocation of $136,500 to support replacement laboratory computers and new laboratory equipment for the Biological Sciences, Genetics, and Food Science departments. Students from CALS and from across the campus benefitted from these acquisitions. CALS also used $5,000 one-time monies from DUAP to support poster production for four NCSU Undergraduate Research Symposia. CALS coordinated and printed 2,311 research symposium posters.

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. An itemized list of expenditures by account code including the Biotechnology funds managed through CALS follows in Section 3 of this report.

a. Personnel expenditures represented 17.25% of the CALS ETF allocation. ($258,942.05).
   • $110,559.12 plus benefits was expended for professional support staff. At the College level a computer consultant position and computer instructional technologist were dedicated to providing better computing services to students.
   • $117,561.15 plus benefits was spent for student-workers/staff. These individuals include computer lab proctors and “wet” laboratory student assistants.

b. IT infrastructure, equipment and services (computing labs, networking, etc.)
   • $180,165.85 or 12% was expended for IT infrastructure, equipment and services. This included replacing 53 Biology laboratory computers and purchasing computers integrated into 15 departmental initiatives. Additional IT equipment included scanners, DVD burners/player, Smart Board, 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 2008-09, the college printed 2311 posters.

c. Non-IT infrastructure, equipment (experimental labs, wet labs, etc.)
   • $909,623.49 or 60.58% of the allocation was spent for non-IT or laboratory equipment. Life Sciences invested in equipment teaching the latest technology. In addition, one-time funds enhanced and expanded available capacity in laboratory experiences for Genetics as well as Food, Bioprocessing and Nutrition Sciences. FBNS equipped a new laboratory with fermentation equipment to control bioreactors. By adding seats in Biology 105 and Biology 181 for new freshmen, additional equipment was needed for lecture/labs.

d. Facilities (repairs and renovations etc.)
   • $69,164 or 4.61% was expended for repairs and maintenance of 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.
   • $83,486.51 or 5.56% 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, 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.
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

Efforts to improve the Entomology teaching collections were increased this year through field collections and through sorting, culling, and categorizing current collections and by incorporating student collected materials into the general teaching materials. One new course, Forensic Entomology, and one course, Insect Pathology, that had not been taught in eight years following a faculty retirement, were taught in spring 2008. ETF funds allowed us to up fit each of those classes with extensive materials and supplies required for their lab sections. A multi-departmental effort to offer a curriculum in Agro-Ecology was supported by being able to provide ETF funds to purchase small grounds maintenance equipment for demonstration and hands-on teaching at a field site on the Lake Wheeler Field Lab Research Unit.

In Food Science, Bioprocessing and Nutrition Science, progressive and innovative teaching facilitated by ETF this year was the purchase of a high-performance liquid chromatography (HPLC) system and introduction of a new course, respectively. The Waters Breeze HPLC will play an integral part in undergraduate and graduate teaching programs, as well as our graduates’ education though laboratory based research, for years ahead. At the undergraduate level, the HPLC will be used in our Food Science and Bioprocessing Science courses as a means of instructing students on use of HPLC, options and use of various detectors and compound specific methods for analysis and quantification of reaction and fermentation products. While at one time the HPLC was reserved for graduate level research, it has now become a standard method employed by the food and biopharmaceutical industries in raw ingredient and product analysis.

Crop Science purchased supplies needed to enhance the W. T. “Bill” Fike Agronomy Teaching Field Lab and the Turfgrass Field Lab and to establish an Agroecology Teaching Field Lab. These teaching facilities are extremely essential educational tools and served students in numerous Turfgrass Science, Agronomy and Field Crop Technology classes.

The Department of Genetics was fortunate to increase teaching laboratory space from one to two laboratories (1503 and 1512 Gardner) as part of the Gardner Addition renovation. Equipment from the old teaching laboratory was transferred to 1503 Gardner and faculty began teaching there in fall 2007. The department’s 2008-2009 request for one-time ETF funds included laboratory up-fit items for 1512 Gardner which did not have any teaching equipment. Both laboratories are currently used for GN 312 (Elementary Genetics Laboratory; previously GN 412), a course required for several life sciences majors and the Genetics minor.

Soil Science, responded to employer feedback that our graduates needed more skills in analytical techniques in the field, so SSC expanded the available field instrumentation and training to measure a variety of in situ properties and utilize GPS technology to handle the data.

Plant Pathology, Plant Biology, and Zoology brought in world-renowned scientists to speak and meet with students.

   - Describe how your unit continues to rethink and reassess use of funds to improve teaching/learning/business models to maintain nimbleness, adaptability, etc.

Biological Sciences continuously tries to improve our 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 resources were allocated 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.

In Biological Sciences, enrollment in introductory biology has doubled over the past 5 years. To provide the highest return on ETF investments in these courses we have rearranged the laboratory settings and schedule to accommodate as many students as possible within a physical laboratory. We also have moved instrumentation among laboratories and courses to allow maximum use of the instrumentation. We have introduced new approaches to teaching some of the labs to allow pairs and teams of students to use more expensive consumables and instrumentation without sacrificing the hands-on experience of the individual student.

More CALS classrooms, laboratories and building open spaces are wireless. Thus students have opportunities for real time activities in class, can work anytime via their computers and are not reliant on computer laboratories.
Laboratories are scheduled for classes from 5.9% to 7.5% of the time. However, Scott 105 is scheduled 17.6% of the time and has been designated as the preferred lab for instructors to use who integrate computer instruction into their classes. Other times are independent and group student project work.

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

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

The replacement computers had higher processor speeds and increased memory so students are able to process data, design and manipulate graphics and multitask quicker and more efficiently. The college maintained the same operating hours within our student labs this year, which totaled 6666 total operating hours. This was accomplished by overlapping the Lab Assistant’s roaming schedules and the effort of the Multimedia Facilities Manager. These labs continue to be used for both student computing use and classes. However, no lab was scheduled for classes more than 17.6% of its available time. Overall, CALS labs were used more for classes this year than the previous year.

When reasonable, purchases are made in bulk to reduce the unit cost. Annual scheduled maintenance is promoted to extend the functional life of equipment purchased with ETF funds. ETF equipment and supplies are purchased with ETF dollars and used in several different classes to get the most “life expectancy” from the high-end equipment.

Enrollment in BIO105/106, BIO 181, and BIO 183 has doubled over the past 5-6 years. To provide the highest return on ETF investments in these courses we have rearranged the laboratory settings and schedule to accommodate as many students as possible within a physical laboratory. We also have moved instrumentation among laboratories and courses to allow maximum use of the instrumentation. We have introduced new approaches to teaching some of the labs to allow pairs and teams of students to use more expensive consumables and instrumentation without sacrificing the hands-on experience of the individual student, and we have introduced virtual labs via the internet.

Faculty research laboratories are not intended for teaching classes. This results in wear and tear on equipment purchased for research, not teaching. When ETF can match grant funds it helps with partial replacement of such equipment, or an equitable share of it in given labs for UG student researcher’s use.

ETF investments in the up-fit of 1512 Gardner will be used to teach two different courses (GN 312 and GN 425) next year. In addition, the capacity of GN 312 was increased to 20 sections in 2008-2009 (452 students) from the level of 14 sections in 2007-2008 (329 students) resulting in more efficient use of the equipment and facilities. The increase in GN 312 sections is part of a long term plan to work through the backlog of students who require this course so that it is possible for students to take it concurrently with Principles of Genetics (GN 311) in the second half of the sophomore year.

ETF funds continue to support an undergraduate computer facility in the horticulture student study lounge that was moved into a larger room in the building. Horticulture students use this computer lab to prepare numerous documents and projects in their horticulture classes. ETF funds have allowed for the continual improvement and expansion of these facilities. Two new computer stations have been added and a larger more efficient printer has been added to this facility. 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.

Full-time Microbiology SPA staff will now prepare all media and reagents for Microbiology instructional labs, eliminating or substantially reducing, temporary wages paid from ETF funds. This should increase resources available for direct ETF investments in the labs. Negotiated rates with Steris Corp. on autoclave and washer maintenance contracts have remained at prior year rates, with substantial savings on ETF expenditures.

In partnership with the Biotechnology Program, Plant Biology purchased a new fluorescence microscope for use in teaching basic microscopy techniques in confocal microscopy course and graduate plant form and function course. ETF provided matching funds to support portion of new confocal microscope purchased from an NSF grant and used for confocal microscopy course and for undergraduate and graduate supervised research. Matching funds were provided as a one-time supplement ($25,000) to our ETF allocation.
c. Unmet ETF-eligible needs
   • Describe funding shortfalls for needs that could be funded by ETF

The College 2008-2009 Base and One-time funds were approximately $500,000 short of the dollars requested by departments. By spring 2008, departments projected a deficit of $710,099 in laboratory and related funds for the 2008-09 academic year. The 2008-09 one-time allocation of $136,500 was applied to departmental purchases of new computing equipment in Biological Sciences and to genetics laboratories addressing changing technology and student enrollment increases. The incremental increase to the CALS base allocation in 2008-09 was used for maintenance and replacement of antiquated equipment thereby restoring some of the laboratories that were dropped or modified with minimal instructional value. Increasing numbers of students in CALS and to the university challenges the College in providing sufficient numbers of well-equipped laboratories and field experiences.

The College of Agriculture and Life Sciences was scheduled to replace 68 computers in their college-wide facilities. However, budget restrictions prevented the college from making these purchases. The College spent approximately 6% less on Instructional Technology last year. The computers used in 2/3rds of Biology teaching laboratories are out of warranty. We replaced 1/3rd this year; we need funds to replace the remaining 2/3rds next year and a plan to replace these every 4 years. We have other upper division courses with non-working and antiquated equipment, mostly microscopes. Almost half the computers in Sociology & anthropology are over four years old.

Biological Sciences/Zoology is not meeting student demand in BIO 105/106, BIO 181, and BIO 183 introductory courses, BIO 212, and several advanced undergraduate and graduate level courses. We need funding to duplicate a physical laboratory for BIO 106 to be able offer enough sections and to duplicate a BIO181/183 laboratory so that we can offer those two courses in the “off semester” (BIO 181 in spring and BIO 183 in fall). We also are the only institution in the UNC System that has no laboratory for the advanced biology courses in Cell Biology and Physiology. We need funds to outfit laboratories in these two courses. We also have an unmet demand in introductory human anatomy and physiology (BIO 301/302 and ZO 212) and would require funds to increase capacity in these courses. Demand is approximately double what we can provide. Due to these unmet eligible needs we had to cancel our BIO 301/302 sequence which has disadvantaged 240 students each year. We also continue to disadvantage our upper division students by not offering advanced biology laboratories offered at all other major universities.

Agricultural and Extension Education used departmental resources to supplement expenditures on technology related equipment in the past. Last year we spent more than twice what is in the ETF budget for technology expenditures. When we write grants, we typically include technology related expenses in the budget. However, because of the budget situation this year we have not been able to spend the money that we have in our budget on technology or other needs. Specifically, upgrade the software on the laptop computers used in room 2 of Ricks Hall. Field trips in two of the classes did not happen because of the level of available funding and questions about spending guidelines this year.

For 2008/2009, Animal Science needs approximately $5,000 more than was allocated for the year to cover all of the educational supplies. ANS will be starting the upcoming year with that deficit to make up. In addition, we limited our graduate student computer expenditures because we knew that money would be tight given the current economic situation. The Motor Pool costs have escalated dramatically; for the previous three years, Motor Pool averaged $13,230 and the cost for this year was $18,842 (a 42% increase). Without the ETF allocation, ANS would not be able to provide students with laboratory supplies and transportation to the Animal Educational Units, which means we would not be able to provide labs with hands-on livestock and horse experience.

Horticultural Science has increasing needs for transportation vehicles for travel to and from classroom to field laboratory between Kilgore Hall and our new greenhouse facility and at the Horticultural Field Laboratory. Students are able to learn how to operate this equipment during lab. Drafting tables currently used in two landscape design studios are very old and in great need of replacement. We have begun to replace those tables with some ETF funds and will continue to do so when able. Students using these out-dated tables are at a disadvantage as they perform their design work in laboratory. The department envisions an increasing need for computer aided design. That would require the development of a computer aided design lab. The teaching committee and student representatives are working to develop a plan and budget for this facility.

The Department of Microbiology has unmet ETF needs to 1) enhance & maintain current laboratory courses; 2) develop new undergraduate Microbiology laboratory courses in advanced topics relevant to the biotechnology and
public health interests of the state; and 3) develop new Masters of Microbial Biotechnology modules focusing on innovative diagnostic and therapeutic reagents that MMB graduates can bring to jobs in the local biotechnology sector. In all cases, new laboratory instrumentation and reagent supply resources are needed. Computing and computer-controlled instrumentation resources in the educational laboratory are required.

Due to increasing student enrollment in this department (Poultry Science) and the combined laboratory based courses some of the laboratories (PO 201, 405 and 435 in particular) are at a maximum capacity of 24-25 students. We currently do not have sufficient laboratory microscopes to adequately meet the needs of laboratory sections of this size. An estimated $10,000 would be required to meet this need.

Plant Biology’s ETF allocations are inadequate to fund the cost of major equipment needed for cutting-edge laboratories for our students. With costs of supplies, student salaries, and field trip expenses, we have only modest amounts of money left for equipment. We need additional student microscopes and cameras for new microscopy lab; another research grade microscope for the microscopy lab; computers to go with microscopes in microscopy lab; and a new growth chamber to grow plant material for introductory labs.

The Poultry Processing Teaching Laboratory is a new initiative in Poultry Science. Over 75% of the jobs in the poultry industry are within the processing area of our vertically-integrated broiler and turkey industries. The department routinely receives requests for trained students in this area and are currently unable to meet the demand. A pilot plant is under construction but a teaching laboratory needs to be equipped ($24,000).

With completion of the renovation of Soil Science’s two main undergraduate teaching laboratories, the opportunity exists to add new equipment to expand and improve the laboratory skills of students. One of these needs is a forced air convection oven for the soil fertility lab with a cost estimated at $3500. The lack of staff support for the overall teaching program often limits the intensity of some teaching activities, especially the field and laboratory components. Preparation of materials for labs, collection of soil materials from across the State, etc. are often less than desired. A staff person or instructor position would add needed continuity to the teaching program. Crop Science needs microscopes for the new teaching resources lab and student library in Williams Hall.

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.

   The explosive development in information technology has provided a new dimension to training in toxicology through the availability and use of bioinformatics tools. ETF funds have provided students the resources to learn new approaches in bioinformatics, generate new information using bioinformatic and biotechnological applications, and interact, both electronically and in person, with leaders in toxicological bioinformatics.

   • In brief, what is your unit’s assessment of the impact of ETF investments on student learning
   CALS students are continuing to use two large-format printers to create professional presentations for classes, symposiums and conferences. Quality posters provided students with a professional means to disseminate their research. Several won awards. For 2008-09, the college printed 2311 posters, an increase of 28% from last year, including posters for four undergraduate symposia, SCIBLS, graduate presentations and the undergraduate teaching symposium.

   ETF investments were invaluable to student learning in a variety of settings including the laboratories where computer workshops 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.

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 CSREES, NCATE, ABET and other accrediting agencies. The College uses a team approach for identifying, prioritizing and assessing ETF needs. The College team includes: Dr. Barbara M. Kirby, Associate Director for
Academic Programs; Dr. Gerry Luginbuhl, Assistant Director of Academic Programs; Mr. Jamie Dennis and Ms. Katie Lynch, CAAT; Dr. Andy Hale, Biological and Agricultural Engineering and Ms. Courtney Parnell, President of AgriLife Council. The administration discusses ETF issues with AgriLife Council members. Each of the 20 departmental committees includes the undergraduate and graduate coordinators, faculty members and students. 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. Each year the need far exceeds the available funds by at least $500,000. Every effort is made to provide funds for courses, equipment maintenance and computing. A small amount is allocated for new initiatives when possible.

- List the names of all students involved with your ETF committee:
  Agricultural and Extension Education: Kristin Stair, Emalou Phelps, Sarah Brierton, Katie Murray; Animal Science: Morgan B. Lee, SAS major and President of the Animal Science Club Elizabeth A. (Lisa) Whalen, SAS major and President of the Companion Animal Club Andrea N. Padgett, IAS major and Extension interest R. Scott Fry, Ph.D. student in Animal Science; Agriculture Resource Economics: Keri Jacobs Perez and Tanya Dunn represented the (graduate students) and Tonya Dunn undergraduate (President of the NAMA club); Biological and Agricultural Engineering: undergraduate Joe Amy Byrd; Biology/Zoology: Will Fields, Lindsey Glass, Allison Lyerly, Lauren Shute; Food, Bioprocessing, and Nutritionals Sciences: Thomas Fuller (undergraduate), Suzanne Johanningsmeier (graduate); Genetics: Alejandro Merchan and Juan Rosario; Horticultural Science: Christopher Hart Horticulture Club President, Robert Nichols PLANET Team Captain, Brandon Smith Horticulture Club Vice President, Hunter Casey Horticulture Club CALS Agri-Life Representative, Elizabeth Bridges Student at large; Entomology: Jake Doskici and Rachel Katz; Poultry Science: Sarah Tilley, Josh Duff, Brooke Phillips, Crystal Mitchell, April Lee, Shauna Christian, Daniel Miller, Milo Lewis and Catherine Smith; Sociology & anthropology: Megan Parker; Environmental and Molecular Toxicology: GSA representatives John House, Paul Ray, and Edward Croom. Other Departments report including students enrolled in courses in equipment/facilities assessments.

The College and Departmental ETF end-of-year expenditure reports for last fiscal year (2008-09) 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 2008-09 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 Barbara_Kirby@ncsu.edu

CALS Base Allocation: $1,351,529  
CALS One-time Allocation: $136,500  
Biotechnology Allocation: $354,144 (See Biotechnology Report)  
TOTAL: $1,842,173

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Due to funding restrictions, funds unable to JV from dept. account to correct post error.  
CALS encumbered funds not spent due to spending delays.

**TOTAL EXPENDITURES**  
1,488,029.00 | 354,144.00 | 1,842,173.00