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, 40 baccalaureate and 26 graduate degree programs to 4,942 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 2005 – 2006 ETF allocation was $1,695,080 and included $354,144.00 for Biotechnology and $1,136,856.00 for CALS program needs. The College received an additional one-time allocation of $204,080 to support technologically enhanced teaching in the life sciences, a BAE rapid prototype machine and university wide research poster printing.

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 13% of the CALS ETF allocation ($174,688.85).
   - $80,978.72 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.
   - $71,321.81 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.)
   - $377,560.03 or 28% was expended for IT infrastructure, equipment and services. This included replacing 68 laboratory computers and 100 departmental computers. PDAs were replaced for CALS Introductory classes, the Crop Science department’s plant identification initiative and Dairy Science. Additional IT equipment included scanners, DVD burners/player, Smart Board and other digital equipment permitting students to integrate technology into their projects. Biology replaced 4 labs of interactive computing equipment with help from the one-time allocation.

c. Non-IT infrastructure, equipment (experimental labs, wet labs, etc.)
   - $673,739.78 or 50% of the allocation was spent for non-IT or laboratory equipment. New David Clark labs were equipped. Life Sciences invested in equipment teaching the latest technology in Plant Biology, Genetics, Entomology, and Microbiology. Poultry Sciences purchased for the new Feed Mill minor program. Introductory Biology purchased equipment for additional lecture/labs.

d. Facilities (repairs and renovations, furniture, etc.)
   - $54,046.14 or 4% 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. One-time funds assisted greatly in repairing equipment.

e. Discipline/instructional related field trips, professional development/experiences, travel, conferences, services etc.
   - $62,667 or 5% was expended for field trips to business and industry but primarily 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

In AEE, the focus this year was to teach future educators how to use the latest technology in their teaching. Accordingly students were taught how to use an electronic smart board, DVD production equipment and interactive gaming equipment.

Plant Biology used funds to support the purchase of a Liquid Chromatograph-Mass Spectrometer (LC-MS) for Phytochemistry courses and to train students in natural products separation and identification; expanded biotechnology education in plant physiology (BO422) and introductory plant biology (BO250) labs; and obtained digital imaging cameras for students to record images in field labs in ecology and systematics courses.

Funds were used to purchase Arboricultural climbing equipment to expand the scope of the arboricultural portions of the Tree and Grounds Maintenance course. Each student had the opportunity to climb and perform detailed tree work. In past years only some were able to due to limited equipment.

Microbiology funds were prioritized to ensure that the minimum standard content of each course could be covered. The department received a one-time allocation that was used to purchase a laboratory glassware washer, a critical piece of equipment for the teaching laboratory preparation room. The renovation of our teaching space in Gardner Hall necessitated the purchase of this equipment.

Zoology used one time dollars to finish equipping the David Clark laboratory and Introductory Biology creatively configured lab stations to accommodate the additional students enrolled in the introductory classes. Teaching web based or blended courses is being explored.

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

The ETF allocation was invaluable in the support of essential laboratory activities in BIO 106 (Biology in the Modern World Laboratory) and BIO 181L and BIO 183L (Laboratories for Introductory Biology I and II, respectively). Thus we obtained laboratory equipment as well as supplies and specimens required to operate multi-section laboratories for approximately 2,400 students in the above laboratories. The equipment included fourteen (14) mini centrifuges, water sampling equipment, and a Safeaire safety cabinet. Additionally, one Genesis 5 Spectrophotometer was purchased to supplement existing instruments used in studies of enzymes, plant pigments, and other biological molecules.

ETF funds were also used to obtain compact discs and videotapes as a supplement to enhance students' awareness and understanding of major biological concepts, processes, and techniques. The current high, effective utilization of this and related equipment is expected to increase with increasing enrollment.

In Zoology, more than 1200 undergraduate students and 70 graduate students benefited from ETF funds. This translates to an efficiency of approximately $70 dollars per student, a very conservative figure considering the expense of modern lab equipment, biotechnology reagents and computer technology. This efficiency is attained by teaching labs of 24 students, having shared computer facilities for undergraduate and graduate students, and having students work together whenever possible.

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. Roving lab proctors increased assistance by 12% while maintaining the same operating hours.
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.

The provision of one-time funds for an electronic balance for use in ENT503 Insect Morphology and Physiology was a great help in providing shared equipment to a lab used by student researchers. The mentor was very much appreciated by the instructor as some compensation for use of his many pieces of dedicated, high dollar research equipment.

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.

Implementing web base courses may present some efficiencies in classroom and laboratory space as well as equipment needs.

c. Unmet ETF-eligible needs

- Describe funding shortfalls for needs that could be funded by ETF

College 2006 – 2007 Base ($1,296,568) and One-time ($832,629) requests exceed the current ETF allocation by $992,000. Purchasing new equipment is essential. However, without an incremental increase in the base allocation for maintenance and replacement, the equipment becomes antiquated and useless to students. Increasing numbers of students in CALS and to the university challenges the College in providing sufficient numbers of well-equipped laboratories and field experiences.

Costs of student assistants exceeded what was allocated; travel costs for field laboratories and guest speakers exceeded what was allocated; departments need upgrades for microscopes for graduate classes; we need more equipment for Video Microscopy/Confocal Microscopy technique courses: There is also a need for Environmental growth cabinets and refrigerated centrifuge for plant physiology courses.

Life sciences programs are unable to make major equipment purchases to provide students with hands-on experience with some of the latest technology used in molecular biology. For example, much of the “omic” approach to understanding fundamental and applied molecular biological sciences is making a natural progression from “genomic” techniques to “proteomic and metabolomic” techniques. These newer approaches require expensive instrumentation that is presently unavailable to either graduate or undergraduate students at NC State.

Faculty research laboratories are not intended for teaching classes. This results in wear and tear on equipment purchased for research, not teaching. Some funds are needed to help with partial replacement of such equipment, or an equitable share of it in given labs for UG student researchers use.

Zoology needs to outfit the new Yates Mill Pond ecology/environmental field lab with computers and laboratory equipment.

In Plant Pathology the development of an international plant disease diagnostic facility is hampered by the lack of funds to equip such a facility with modern technological equipment and microscopy systems.

New degree programs in the College including Nutrition Science, Turfgrass Management, Bioprocessing Science will submit ETF requests for lab and computing supplies. They will impact the base allocation to the detriment of other departments if the base remains constant.
Wireless Internet access in Williams 1403 and 2405. This is needed for student presentations and group work. Other CALS buildings without wireless access need to be included in the campus wireless plan.

The Microbiology Department has delayed some routine equipment replacements due to the breakdown of critical equipment. The CO₂ incubators needed to teach Medical Microbiology Laboratory have not worked properly for the last several years. We have been able to make do by using incubators in near-by research laboratories, however, the research laboratories will move too far away next year, so it was necessary to purchase new incubators for the teaching laboratory in Bostian Hall. Similarly, the inverted microscopes were very old and not adequate for the video-microscopy that the students need to use to document their results. Therefore, we delayed replacement of other microscopes to purchase new inverted microscopes. We have delayed purchasing new spectrophotometers and new pipetters for several years. The department needs approximately $35,000 more to catch up with the equipment needs in order to continue to keep our courses up-to-date and to continue to serve the growing number of students interested in microbiology.

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.

Through exams, quizzes, presentations and lab reports students demonstrate proficiency with the equipment and mastery of new technology. Successful graduates are employed in agencies using new and emerging technology and employers indicate satisfaction with graduates.

- 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 2005-06, the college printed 1547 posters, including posters for three undergraduate research symposia 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. ETF made it possible for the College to equip additional labs in Biology to meet the growth in student population thus students were able to progress in their degree programs.

The Elementary Genetics Laboratory course (GN 412) relies on ETF Funding for supplies and equipment. Without this funding, the Genetics department would not be able to offer students the opportunity to take this course and to gain exposure to laboratory techniques in Genetics.

Our students' laboratory experience is comparable to that offered at peer institutions. One of our recent graduates, now a second year graduate student at UC Berkeley, reported that she felt she was better prepared than any of her cohorts, a great reflection on the department's teaching program.

e. Planning and review process

- Describe your internal review process and level of student participation

The College uses a team approach for identifying, prioritizing and assessing ETF needs. The College team includes: Dr. Barbara M. Kirby, Assistant Director for Academic Programs; Mr. Thomas Young, Assistant Director of CAAT; Dr. Any Hale from the Academic Computing Advisory Committee; and Dr. Gerry Luginbuhl, Undergraduate Teaching Coordinator and Department Head for Microbiology. College student representatives included Kathryn Price and Camber Howard. 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:
  
  **Plant Pathology Undergraduates**: Undergraduate survey and TAs Susan Colucci, Jim Kerns, Heather Olson, Courtney Reuter, and Damon Smith; **Microbiology**: Elizabeth Hutchison, undergraduate student, and Drew Devine, graduate student; **Poultry Science**: Sarah Walters, Heather Cutchin, and John Small; **Biological and Agricultural Engineering**: undergraduate students Joshua D. Reeves (Ag Institute) and Anne M. Hooper (Biological Engineer); **Toxicology**: Cynthia Ryder, Rebecca Heltsley; **Biology**: Bumgardner, Sara Ashley Hill, Lisa Marie McDowell, Kelli Ammiesha (President of the Biology Club); **Crop Science**: Walter Thomas (graduate student), Lloyd Winslow and Joni Williamson (undergraduate students); **Entomology**: We use the officers (President and VP) of the Entomology Graduate Student Association Dorit Eliyahu and Laura Jeffers; **Zoology**: Anna Austin, Heather Heinz, and Michael Harris; **Genetics**: Nathaniel Grubbs and Zachery Kimball. **Horticulture** Trey Warrick, Horticulture Club President, Lorna Allen, Horticulture Club Vice President Cody Yandle, ALCA team Captain, Brett Fisher, Agri-Life Representative; **Food Science**: Leslie Gentry (undergraduate), Tristan Berry (graduate); **Animal Science**: Warren A. Goodwin, Jason A. Wright, Bianca M. Thompson; **Anthropology & Sociology**: Jennifer P. Gerteisen Marks; **Agricultural and Extension Education**: Joy Morgan, Kate Bresaw, Danielle Risley: Agricultural and Resource Economics: Melanie Smith, undergraduate and graduate students Jaren Pope and Nick Cuminoff.
### Fiscal Report

<table>
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<tr>
<th>Object Code</th>
<th>Expense Category</th>
<th>Number or Comments</th>
<th>CALS</th>
<th>Biotech</th>
<th>Total Amount $</th>
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<td>Personnel</td>
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<td>Personnel Benefits</td>
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<td><strong>TOTAL PERSONNEL</strong></td>
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<td><strong>$174,688.85</strong></td>
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<td>Educational Supplies</td>
<td>Lab supplies and materials</td>
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<td>52800/52900</td>
<td>EDP Equipment/software</td>
<td>Computers; 71 replacement; 43 new; dept. computers; Equip/software &lt; $5000</td>
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<td>53100</td>
<td>Transportation</td>
<td>Motor pool, Field trips</td>
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<td>$125,334.82</td>
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<td>53xxx</td>
<td>Communication and current services</td>
<td>Network charges and data services; freight &amp; express; computer/micro services; lab service agree</td>
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<td>53500</td>
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<td>54400</td>
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<td>Rental equipment, insurance other fixed charges</td>
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<td>Capital Outlay: Educational Equipment</td>
<td>Hardware &amp; Software/systems; scientific laboratory equipment</td>
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<td><strong>$1,342,703.12</strong></td>
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<td><strong>$1,344,930.28</strong></td>
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The College and Departmental ETF end-of-year expenditure reports for last fiscal year (2005-06) 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 2005-2006 expenditure report may be viewed by selecting the College Home page [http://www.cals.ncsu.edu/](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