# Soil Science Education:
# Perceptions and Experiences of
# Soil and Water Science Students

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## INTRODUCTION

Soil science education has been at the forethought of soil science educators' mind within the past decade (Baveye, 2006; Baveye et al., 2006; Lal, 2007; Hopmans, 2007; Hansen et al., 2007; Collins, 2008; Havlin et al., 2010). This concern for soil science education was not only at the faculty and departmental level, but on the national scale as well. The National Academy of Sciences, concerned with the future of soil science and soil science education, established the National Committee for Soil Science (Collins, 2008). Within this committee, a subcommittee was created to monitor the trends in soil science undergraduate education (Collins, 2008).

Each of the authors mentioned above focused on how soil science education should be changed for the future. Baveye (2006), Hopmans (2007), and Lal (2007) discussed that soil science education can be reformed through the incorporation of an interdisciplinary focus. They believe this was needed in order for soil science to have a future in higher education. Baveye et al. (2006), Hansen et al. (2007), and Havlin et al. (2010) reported survey results from departmental programs about student enrollment and curriculum characterization in soil and agronomic sciences. With this data, they each offered solutions such as integration of soil science curricula in secondary education (i.e. high school), licensure of soil scientist, and expansion of the scope of soil science to improve enrollment and visibility to the public in soil science programs. Collins (2008) also offered solutions by the inclusion of the word 'soil' into job titles for visibility in the work environment, revision of the introductory course in soil science, and active recruitment from state or community colleges.

Soil science education reform has been discussed even as early as 1994 with the publication of the Soil Science Society of America Special Publication No. 37: Soil Science Education: Philosophy and Perspectives. Specific articles within this publication discussed (i) how there was need to make the science more interdisciplinary in scope,

rather than focused on the agronomic side (Letey, 1994); (ii) an example of a successful revision of an undergraduate program that incorporated this interdisciplinary approach and boosted enrollment numbers (Taskey, 1994); and (iii) perspectives of a soil science graduate on his work experience in the private sector in which an interdisciplinary program was highlighted (Reese, 1994).

## Soil Science Education in the Last 6 Years

Baveye (2006) discussed what direction he sees for the future of soil science dealing with the problematic situations of: (i) decline enrollment in soil science programs, (ii) lack of real world applications in the soil science curriculum at higher education facilities, and (iii) lack of intellectual stimulation for soil science professionals (most specifically, academics).

Baveye addressed the decline in enrollments with another article (Baveye et al., 2006) in which the authors gathered surveys of graduate students and soil science programs from the United States and Canada for the years 1992 and 2004. The results from the surveys showed that graduate programs (Master's and Ph.D.) in soil science have declined in enrollment on average of 40% during this time period. Also, Baveye et al. (2006) discussed the potential sources for the declines in enrollment through: (i) the soil science discipline only associated with agriculture (agronomy) and (ii) lack of promotion or identification of the discipline in the public's eye (even the lack of recognition from other academic disciplines). The authors' offered one solution to these concerns -- soil science programs needs to become interdisciplinary in focus through the incorporation of more environmental-based curriculum. Another solution is to have professionals of soil science become recognized through licensure/certification and encourage self-promotion of the discipline from soil science graduates and professionals.

From the Baveye (2006) article, "One of the comments most frequently made is that soil science education, in colleges and universities, is almost entirely estranged from the practice of soil science in the real world, and benefits little, if at all, from the experience of former students." This comment is echoed in the results from the study of current soil science students at the Soil and Water Science Department of the University of Florida that will be presented in the results portion of this paper. The article discussed that this problem is one of the most easily rectifiable to face soil science educators but does not offer any clear solutions for programs to adopt.

Baveye's article (2006) talked extensively about the perceived lack of intellectual stimulation in the science for soil science educators as he offered a story of how soil science professionals do not encourage constructive "debates" through publications or professional meetings with one another. If "debates" were part of the discussion, individuals would know that there is engaging work being done in soil science and invigorate the morale of soil science professionals! One problem he stated for the lack of intellectual discussions is the workload placed on faculty to find funding, which has diminished the amount of time soil science educators can talk with colleagues about research or read-up on the literature.

In the Hopmans (2007) and Lal (2007) articles, emphasis was placed on how soil science has to become interdisciplinary in scope for a hopeful future. Hopmans (2007) offered three points for soil science to consider in becoming interdisciplinary: (i) development and redesign of curriculum to incorporate more environmental-based knowledge, (ii) engagement of faculty in interdisciplinary research programs within and beyond their higher education facilities, and (iii) increased awareness and outreach to the general and scientific community. Lal (2007) offered a model of how a successful interdisciplinary soil science program should function in order to respond to the change of global and societal needs. The author incorporated points mentioned in the Hopmans

(2007) article, such as increased awareness and incorporation of an interdisciplinary focus in programs. The model is shown in Figure 1 (Appendix A).

Decline in enrollment for soil science not only has occurred in graduate students, but the undergraduate program as well. The overall objectives of Havlin et al. (2010) was to quantify trends in student enrollment, faculty employment, pertinent education issues in soil science, and career or job opportunities for students. The authors' intentions were to represent both undergraduate and graduate students, but their results focused more on graduate students. The authors offered suggestions to increase enrollment in soil science programs through the evaluation of effectiveness of introductory soil science courses, offer internships and projects to promote interest in soil, and incorporate soil science into earlier stages of education (K-12). The authors also provided recommendations to promote the discipline through the enhancement of public knowledge of soil science, the hire of marketing experts to help re-evaluate image of soil science in relation to agriculture and the environment, and develop the relationship between industry and academia by asking employer's input on curriculum changes. As both of these articles focused on graduate students, Hansen et al. (2007) focused solely on undergraduates.

Hansen et al. (2007) gathered collegiate and departmental data from all fifty 1862 land grant institutions that have a focus on soil and agronomic sciences to discuss the decline in enrollment of undergraduates. The authors' focuses were to establish the status of soil and agronomic programs at the collegiate and departmental level and the amount of tuition fees for these programs. From the departmental data on soil science programs, there are 48% (out of 61 observations) that have 'soil' in the departmental name and 31% (out of 116 observations) that have 'soil' in the name of undergraduate majors. Even among the departments and majors that list 'soil' in the name, there is a broad variation of how the science is presented. For example, the most common name for departments with 'soil' in the title is "Soil and Crop Sciences." This title makes up

approximately a third of the soils department names. The most common name for undergraduate majors with soil in the name is "Soil Science". This makes up approximately a fifth of the majors that have 'soil' in the name of the major. The tables that catalog the academic departments and undergraduate majors of the 1862 land grant institutions are listed in Appendix A (Tables 1 and 2 respectively). The conclusions from the article suggested that with these changes in the programs of soil and agronomic sciences, institutions should accept that the traditional focus of the programs should be modified to an interdisciplinary approach. The difference in the names of soil science departments and majors is also discussed in Collins (2008).

Collins (2008) discussed the decline in enrollment issue in Soil Science programs and offered solutions for programs to increase enrollment in soil science through proactive recruitment in freshman students from high schools, undecided majors at the university, and transfer students from state or community colleges. She also detailed how the perceptions of the major, loss of identity among departmental names/majors, and lack of curriculum revision have attributed to the decline in enrollment of soil science programs. She offered solutions to these problems as well. For perceptions: incorporate changes into the K-12 curriculum to include soil science so it becomes visible to younger students and parents, increased advocacy from professionals in soil science, and creation of activities such as the "Dig It: The Secrets of Soil" museum exhibit to inform the public about the wonders of soil. The loss of identity (as shown in Hansen et al, 2007 by less than 50% of departments and 31% of undergraduate majors retain the 'soil' in the title) can be rectified if the support of administrators can be obtained to keep programs a separate and visible entity.

One example of curriculum modification is the revision and development of a new soil science curriculum by the faculty located at California Polytechnic State University at San Luis Obispo (Taskey, 1994). This also serves an example of how a revision to the curriculum (interdisciplinary in scope) can change the enrollment of

students. In the 1990s, the Soil Science Department at California Polytechnic State University (Taskey, 1994) made changes to the curriculum and in two years the enrollment increased from a low of 46 to 120 undergraduates. The reason was the threat of the loss of department and even worse, the loss of the program! Faced with this dilemma, faculty of the department gathered information from alumni, private industry, and governmental agencies on the goals and outcomes the departmental curriculum needed to address. The establishment of these goals and criteria helped gained insight on what the industry expects students to be competent in when they graduate, gained a greater flexibility in the curriculum for students, and identified professional opportunities for students (i.e. employment). Through the incorporation of these goals and criteria, the program at California Polytechnic State University has flourished.

Some of the other questions raised by the authors (Baveye, 2006; Baveye et al., 2006; Lal, 2007; Hopmans, 2007; Hansen et al., 2007; Collins, 2008; Havlin et al., 2010) relate to the preparedness of undergraduate/graduate students in soil science programs. These questions were raised to the alumni, undergraduates, and graduate students in the Soil and Water Science Department at the University of Florida. A survey was created and the results of the survey are discussed in this paper.

## Objectives

The objectives of this paper are to (i) describe personal experiences that have affected the author's educational and professional decisions in his pre-UF years; (ii) relate the experiences the author encountered during his years as an undergraduate and graduate student in the Soil and Water Science Department; (iii) create a survey to be distributed to alumni, undergraduate and graduate students in the department, (iv) discuss the

results and perceptions of the survey; and (v) compare the author's experiences to survey respondents as well as the other authors cited.

## AUTHOR'S EXPERIENCES

### Personal Experiences (Prior to UF)

As educators we realize that not only do the experiences we gain in school influence our decisions, but our life experiences outside the classroom have probably the greatest effect on our actions or decisions. This is why I will describe briefly some of the major events that had happened in my life that had major impacts on my educational and professional decisions.

I grew up in a small, farm-based community in north-central Florida. My family has owned the land I was raised on for decades and have used the land through various stages of vegetable and livestock production. Even the high school (Santa Fe High School, Alachua, Florida) I attended was centered on agricultural production (for example, the high school raised cattle each year to be shown in the local livestock fair). During my sophomore year in high school, I started to volunteer at the Alachua County Farmers' Market. This farmers' market has been the location my family sold our produce to consumers. At the same time I began to work at a local feed store. Both of these experiences, along with my agricultural upbringing, influenced my choice to consider agriculture as a career. From my agricultural upbringing, I recall some of my first encounters with agriculture that dealt specifically with soil. One was when I was a young boy; I would be quite fascinated with the 'black-sucking mud' around my family's natural pond and the 'dark dirt' from which we collected earthworms to fish with at the pond. Another time I can recall as a young boy, was being intrigued as to why the dirt was different colors the further we dug down to install fences to keep the livestock contained. The culmination of these experiences led me to find a career/major

that dealt with agriculture. After high school I continued my education at Santa Fe Community College. The community college was the best choice for me because I felt I was not ready for a large university. I was thrilled that the community college had an Agriculture option for their Associate of Arts (A.A.) Degree, but disappointed that they did not offer any agricultural-based classes.

After enrolling in the community college, I decided to quit the feed store position but continued to work at the local farmers' market (was hired shortly after I started to volunteer). One of the nurserymen at the farmers' markets had an environmental consulting firm and asked if I would be interested to work on wetlands delineations with him. I thought the opportunity would be beneficial in regards to finances and experience gained, so I accepted. When I went to the field for the first time, it was winter and, thus, could not identify the 'dead' vines that covered our field site. The vines turned out to be poison ivy, and learned I was allergic to the secretions. But even with this unfortunate first experience in an environmental field-based setting, I thoroughly enjoyed the work. This experience as well as experiences I had as a child led me to find a major that dealt with aspects of soil.

While in the final semester of my Associate of Arts degree, I applied and was accepted to the University of Florida. I then had the task of declaring a major. Therefore, I started to seek advice on the majors at UF which contained the disciplines of wetlands and soil. As I read through the University of Florida undergraduate catalog, I discovered a major called Soil and Water Science. After review of the requirements to transfer (and discovered my credits qualified for the program), I called the Undergraduate Coordinator for that department. I had almost 100% confidence in the decision to enroll into the program, but wanted more explanation about the major from the Undergraduate Coordinator. She personally met with me right after graduation from community college and spoke with me about the department. She told me that

from the experiences I had in wetlands and soil, the Soil and Water Science major would be the most appropriate choice for me.

## Undergraduate and Graduate Experiences in Soil and Water Science

### *Undergraduate Experiences in the Soil and Water Science Department*

The Soil and Water Science Department has a long history at the University of Florida. Newell Hall, where the department chair and administration reside, was built in 1909 when it served as the Agricultural Experiment Station. Prior to this, the Agriculture Experiment Station was located in Lake City. The building was renamed in 1944 in honor of Dr. Wilmon Newell (former Dean of the College of Agricultural and Life Sciences, Director of Agricultural Experiment Station, and Provost of Agriculture for the University of Florida). This building is listed in the National Register of Historical Places (University of Florida Foundation, 2012). The other main building in Soil and Water Science is McCarty Hall A. This building is one of four McCarty Halls on the UF Campus. Built in 1956, this building houses over half of the on-campus faculty in the department.

The department was officially created in 1933 as the Department of Chemistry and Soil during the peak of the Dust Bowls of the Great Depression. In 1939, the name was changed to the Soils Department. The department then changed its name again in 1971 as the Department of Soil Science. The current name for the department, Soil and Water Science, was adopted in 1992 to reflect the new programs undertaken in the department in areas such as water quality (SWS, 2012).

The department currently offers undergraduate students over 20 courses in areas of soil science; such as morphology in Environmental Pedology/Soil Judging, biota in Soil Microbial Ecology, and nutrient cycling in Soil and Water Chemistry/ Environmental Nutrient Management; and areas of water science; such as water quality in Ecology of Waterborne Pathogens/Wetlands and resource longevity in Water

Resource Sustainability/Soil and Water Conservation. The departmental faculty are split into on-campus and off-campus faculty in the thirteen Research and Education Centers (REC) across the state. The on-campus faculty are split between the two main buildings, Newell Hall and McCarty Hall A.

In choosing Soil and Water Science as a major, there were specific items that appealed to me. These three items resonated to choose this major:

1) Diverse research areas
2) Student-to-Faculty ratio/Individualized attention
3) Scholarship availability

The Soil and Water Science Department had a large number of faculty members that were involved in various research projects. These projects ranged from studying the environment from the micro-scale to the macro-scale. This was very appealing to me. The low enrollment of undergraduate majors (<10) in the department versus the number of faculty members (43) meant one would receive individual attention, similar to what I was accustomed to at the community college. The availability of scholarship opportunities rated high due to the fact I come from a low-income family and relied on scholarships and grants to fund my education.

The first semester at the university, I enrolled in one pre-requisite course that I did not complete at the community college and three introductory courses in the department. I thoroughly enjoyed my first semester at the university in the introductory courses because I learned about the wide-world of the soil beneath our feet. Something I was completely unaware of. After the first semester, I knew I had made the right decision.

The Undergraduate Coordinator made sure that the majors in the department socially interacted with one another. This was accomplished at meetings, or at

'Undergrad Lunches' as they were called. Since the number of undergraduates was so small (<10), and were taking many of the departmental classes together, we became fairly close to one another.

After the first semester, I talked with the instructor of the introductory soils course (who also happened to be the Undergraduate Coordinator), and discussed with her options for my undergraduate career. She told me of the combined degree program, in which an individual takes graduate level courses during their undergraduate program. The appeal of this degree program was that the graduate courses would fulfill course requirements for the students' undergraduate and graduate degrees. I decided this program would work well for me, thus I enrolled summer of 2008.

Another option discussed was the searching of additional employment which would work within my school schedule. The main reason for seeking another job was the accident my mother had which resulted in her not being able to work. My father was already disabled from a work-related accident a couple of years prior. Therefore being the oldest child, I became the "breadwinner" for my family. I was hired as a Student Assistant, first to help the Undergraduate Coordinator on research during the summer, and then in the fall as a teaching assistant with the introductory soils class. I enjoyed the experience greatly and I stayed in the teaching position through the remainder of my undergraduate career.

The increased responsibility in my personal life increased the demands to complete my undergraduate program as quick as I could. Even with the added teaching responsibility, I decided I should minor in a program that caught my interest at the community college, Anthropology. This idea of a minor was amplified by a guest speaker who spoke in the introductory soils class. His research was an integration of Archaeology (subset of Anthropology) and Soil Science, studying graves at local cemeteries using ground-penetrating radar.

One activity which continued throughout my undergraduate career was the 'Undergrad Lunches'. Not only was the undergraduates invited for the lunches, the entire faculty (on-campus) in the department were also encouraged to attend. As undergraduate events occurred through the year, I noticed the participation by the faculty decreased. The lack of faculty interest in undergraduates was further affirmed by the observation that most of the faculty seem to pay a significant amount of their attention to the graduate students in the department. Another observation made was our undergraduate classes were mixed with graduate sections. This was done because the population of undergrads was too small to hold a class only for them. So we as undergraduates thought we were going to get individualize attention from the faculty, but the attitude portrayed by most faculty was quite the opposite. This is a generalization because there were a few faculty members who did show significant interest and attention into undergraduate relations and programs. Without these faculty members, my entire undergraduate experience would have been significantly different.

In my final year of being an undergraduate, I enrolled in three graduate level courses (ten credit hours) and completed the required classes for the Anthropology minor. The responsibilities of my personal life had shrunken down enough to entertain the idea of going straight from my undergraduate program to the graduate program in Soil and Water Science at the University of Florida. I applied for graduate school and was accepted into the department to work with the Undergraduate Coordinator as my major advisor beginning in the Fall 2009. My workload had diminished as well. I no longer worked at the consulting firm due to the harsh economic times of the 2009 year.

Lastly, beginning in Fall 2009, the Soil and Water Science major was split into two specializations; Soil Science and Water Science. Students who were in the Soil and Water Science program prior to the specializations were not required to choose one, but any student enrolled after Fall 2009 would be required to declare one. I felt relieved I did not have to pick a specific specialization, because I felt it limited the experiences a

student would have in the department. The final semester of my undergraduate program was during the summer semester, only a little over a year after enrolling in the program at the university (Spring 2008 – Summer 2009). I graduated in the summer of 2009.

***Graduate Experience in Soil and Water Science***

Due to my experience with the introductory soils course as an undergraduate, I had applied for a teaching assistantship and was awarded one with the stipulation to continue to assist with the introductory undergraduate soils course. This was met with extreme pleasure as I enjoyed the experience working with the diverse group of students we have had in the course. During one of the semesters, approximately 175 students from over 40 majors at the university enrolled in the course. The diversity of the students was important as they brought different views and experiences from my own. These differences/views helped to expand my understanding of diverse ideologies and cultures.

During my first semester of graduate school, one of the courses I took was "Teaching Large-Classes" course offered by the Soil and Water Science Department. Not only did this course confirm how much I enjoyed the teaching atmosphere, but also would give me the opportunity for my first real public speaking experience.

The Teaching Large Classes course was offered in cooperation with a study two instructors were conducting on teaching large enrollment classes offered by the Soil and Water Science Department. The instructors taught the two largest enrolled courses in the department so they were very well qualified to teach the course. The results of the study were to be presented at the 2009 American Society of Agronomy-Crop Science Society of America-Soil Science Society of America (ASA-CSSA-SSSA) International meetings held in Pittsburgh, PA. (Collins et al., 2009). I and one of the instructors were chosen to attend and present the study at the meetings, thus giving me my first public speaking appearance in a professional environment. Also, this event was significant as

I had never flown in an airplane! On top of that, the instructor at the last minute could not attend the meeting. Therefore, I had to present the study. The benefits of the experiences I gained were immeasurable.

Also during this semester, I got my first field-teaching experience with the University of Florida Soil Judging team as the Teaching Assistant/Assistant Coach. This teaching/coaching experience and accompanying the team to the Southeast Regional Soil Judging Contest hosted by the University of Tennessee allowed me to study soils I never had seen or would ever experience being from the sandy soils of Florida. This experience also showed me the vast difference in teaching lecture courses versus field-based courses.

Both of these experiences, presenting at the meeting and assisting in Soil Judging, were important as they helped me to develop as a professional soil scientist. The meeting gave me the opportunity to learn how to network with fellow colleagues and develop contacts at other institutions for possible enrollment after Master's program. The meetings also taught me the importance of time management because numerous presentations were offered at the same time and had to schedule which and when I viewed presentations. The teaching/coaching experiences of Soil Judging also help me to develop confidence in the application of my pedological knowledge, even in an unfamiliar environment/field conditions.

During my second year of graduate school, my original idea of researching soil formation and genesis with an emphasis on hydric soils had morphed into studying soil science undergraduate education. This change came from observations on the Soil and Water Science undergraduate program (i.e. low enrollment numbers), reading an article on soil students' disappearance (Collins, 2008), and the possibility of a merger of the Soil and Water Science Department into another program. This became my core idea (soil science education) for my presentation at the next year's ASA-CSSA-SSSA meeting.

I still continued with my teaching responsibilities and truly enjoyed the interactions I had with the undergraduates (majors and non-majors) in the introductory class.

The instructor of the introductory course had decided to move out-of-state, and the class was taken over by a new instructor. I had worked for the new instructor as he was the Laboratory Coordinator for the introductory soils class (which I had taken as an undergraduate). I also had outside interactions with the instructor (mostly discussions about the program and when he was co-instructor on the Teaching Large Classes course in the Soil and Water Science Department). The new instructor not only kept me in-charge of the introductory soils class, but also assigned me to assist with the introductory water course: SWS 2007. As a result, I became the Lead Teaching Assistant for both courses. This responsibility entailed management of other graduate students (roughly three-to-six each semester) to ensure grading was efficiently completed and grading through all teaching assistants was consistent. Also, I proctored all exams for the courses. Throughout the remainder of my graduate experience, (with the exception of the last year) I was the teaching assistant for the introductory soil science and the introductory water science course. I had been a teaching assistant for the introductory classes six times (six semesters) in my four year tenure at the University of Florida. During this time, the introductory soils course had 182 (Spring 2010), 166 (Fall 2010), and 176 (Spring 2011) student enrollment. The introductory water science course had 219 (Spring 2010), 237 (Fall 2010), and 240 (Spring 2011) student enrollment. The diversity of the students ranged from 35 to 45 different majors in each semester.

Also during this time, I had taken over a soil consulting business that exposed me to self-management practices of writing reports for clients on the existence of shrink-swell materials and handling business-ownership responsibilities that I had not been previously exposed. This also helped to reinforce my desire to study soil morphology and genesis as I had to understand these processes to determine the soil conditions for development sites. This opportunity allowed me to continue my original

research idea of studying soil morphology in a business outlet while curtailing my academic research to undergraduate education.

My third year in graduate school began with taking the Fall Semester, 2011 off from school due to a medical issue, which now has been resolved. At the end of the fall semester, other teaching opportunities had become available to me. One of the instructors in my department had remembered my background in Biology for my Associate of Arts degree, knew of my commitment to teach, and thus recommended me to interview for a teaching assignment in the Biology Department in the College of Liberal Arts and Sciences. After the interview I was offered a teaching assistantship to teach three sections of Principles of Core Biology I (Introductory Biology) Lab. I quickly accepted the position as I was overjoyed with the opportunity to teach in another scientific field. This experience exposed me in the creation of the lesson plan for each class, being provided a general template of the material to be covered in lab. I had never experience this as a teaching assistant for the introductory soil and water science classes. I found that this process allowed for flexibility and creativity in how you deliver the material to the undergraduates.

***Reflections on Undergraduate vs. Graduate Student***

As I progressed through my graduate program, the more I became aware of the differences in my experience in the department as a graduate student versus as an undergraduate student. The Soil and Water Science Department graduate program is fairly large (the largest in the 21 graduate programs of the College of Agriculture and Life Sciences). Figure 2 (Appendix A) shows the number of graduate students for the top five enrolled College of Agricultural and Life Sciences programs from 2007 to 2011. Because of this large number of graduate students (125 in Fall 2011), they are located in three buildings on campus. As a result I felt I did not have as great of a rapport or closeness with fellow graduate students as with my fellow undergraduates. I also became more aware of the division between the faculty, mostly stemming from the

faculty body being split between two main but separate buildings (Newell and McCarty Hall A) on campus. There are some faculty who are housed in other buildings on campus as well, but the overall majority of on-campus faculty is housed in these two main buildings. I felt that the faculty members limit themselves to the building they were housed and there was little interactions between them. An example of this is when the undergraduate lunches were held near McCarty Hall, we rarely would get faculty from Newell Hall. This is validated further due to the repetition of curriculum material in quite a few courses (both graduate and undergraduate). One example is the number of courses that teach the Nitrogen Cycle. As an undergraduate, I was taught this in SWS 3022: Soils in the Environment, SWS 4303C: Soil Microbial Ecology, SWS 4244: Wetlands, and ALS 3133: Agriculture & Environmental Quality! It is possible that with the extensive reliability of electronic communications that the faculty was discussing with one another through email; but after a few discussions with some faculty in the department, faculty members did not seem to respond to one another in emails in timely manners. These differences I noticed from my undergraduate and graduate student experience became the focus of the questions of the survey.

## SURVEY OF ALUMNI, UNDERGRADUATE, AND GRADUATE STUDENTS

### Survey Creation

This survey was created to obtain information and opinions of alumni as well as undergraduate and graduate students' experiences and perceptions of the soil science programs at the University of Florida. Most of the literature on soil science education focuses on ways to reform the curriculum and reports the enrollment in soil science programs. These questions were designed from the author's experiences in the Soil and Water Science Department and discussions from fellow students while in the program. The questions asked (Appendix A, Table 3) are frequently asked questions about

interest in soil and water science, opinions on revisions to the undergraduate major, suggestions for curriculum revision, perceptions of the program, interactions among faculty/staff/students and offer changes to improve the relations between the faculty/staff/students.

**Survey Results**

At the beginning of the 2012 academic year, a link to an online survey was sent out to current students and alumni (a total of 182 students; 131 graduate students; 51 undergraduate students) of the Soil and Water Science Department of the University of Florida. The survey contained ten questions (Appendix A. Table 3). The survey contained seven free responses questions and three questions where selection of only one answer is allowed (one question is a Likert item). In general, the survey asked them about their current enrollment status, how they chose Soil and Water Science (SWS) as a major, aspects they felt needed to change in the department, and how they believed the specializations helped with the undergraduate program.

***Student Survey Responses***

The number of students who responded to the survey was 35. Most of the respondents were graduate students. The overall response rate from students in the Soil and Water Science Department was 19%. The classification of the students who responded is shown in Figure 3.

Question 1. Indicate Current Classification.

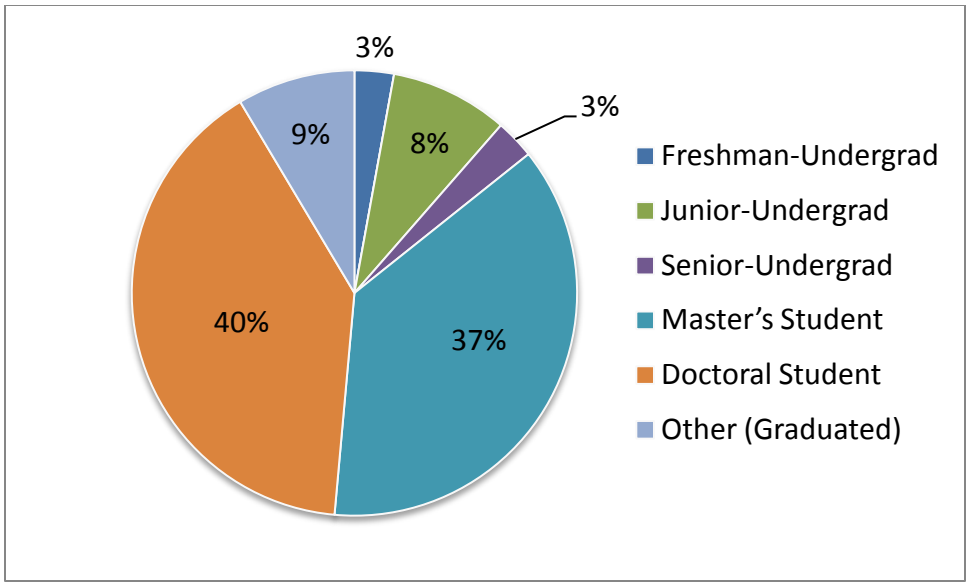


**Figure 3:** Classification of student respondents

Most of the individuals who responded to the survey were current graduate students (77%), with very little response from alumni (9%). There were no responses from the sophomore level undergraduates in the department. This is probably due to the overall low response of undergraduate students in the survey. The higher response from graduate students can be attributed to both a higher number of students in the department compared to undergraduates and willingness of graduate students to respond to fellow colleagues' request for assistance.

Question 2. If a Master's or Doctoral Student, please indicate undergraduate major.

The graduate students were asked to report their undergraduate major. This question was asked as it pertains to the comment raised about the preparedness of graduate students in soil science (Collins, 2008). She stated that graduate students of

today lack the fundamental knowledge of soil science due to their undergraduate program was in different, and sometimes unrelated, discipline. The undergraduate majors of the graduate students are listed in Table 4.

**Table 4:** Undergraduate majors of graduate students who responded to the survey.

| Undergraduate Major | Number of Graduate Students (n-27) |
|---|---|
| **Environmental Science** | 6 |
| **Soil and Water Science** | 3 |
| **Biology** | 2 |
| **Chemistry** | 2 |
| **Soil Science** | 2 |
| **Agronomy & Soils** | 1 |
| **Earth Science** | 1 |
| **Natural Resource Mgmt.** | 1 |
| **Interdisciplinary Studies** | 1 |
| **Forest Engineering** | 1 |
| **Geology** | 1 |
| **Food Resource Economics** | 1 |
| **Biology Environmental Science** | 1 |
| **Environmental Horticulture** | 1 |
| **Environmental Engineering** | 1 |
| **Marine Science/Biology** | 1 |
| **Zoology** | 1 |

The majority of the graduate students came from environmental-related fields, with only six individuals coming from other disciplines (Zoology, Biology, Chemistry, and Food Resource Economics). Three of the respondents were previous undergraduates in the department, but could not be determined when they came through the program. One observation which was surprising was the number of biology-related undergraduate majors (five). This surprised me because my recent

experience with students (graduate and undergraduate) in the Biology Department at the University of Florida showed most had never heard of a Soil and Water Science degree. The undergraduate majors of graduate students' correlates with the statement (Collins, 2008) that they do not have the fundamental knowledge of soil science when entering the graduate program as only three of the seventeen majors listed refer to soil by name.

Question 3. Indicate initial enrollment status at the University of Florida.

The respondents were asked to report their initial enrollment status at the University of Florida; either as a freshman or transfer student in the College of Agricultural and Life Sciences (CALS), as a freshman or transfer student in another college at UF, or as a freshman or transfer student from another university. This was asked because Collins (2008) reported the majority of students in the Soil and Water Science program come in as a transfer student. The responses are shown in Figure 4.

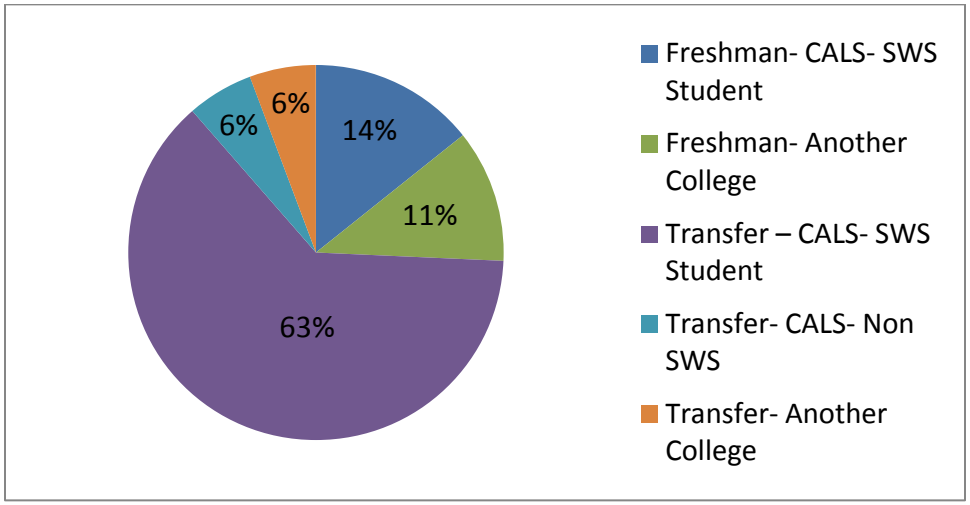


**Figure 4:** Initial Enrollment Status at the University of Florida

Nearly two-thirds of the respondents come directly into the program as a transfer student from another higher education facility. This correlates with the statements made from a previous article about the department (Collins, 2008). The results show the Soil and Water Science Department attracts more transfer students from other universities than attracting individuals from other programs at UF. An interesting result is that the Soil and Water Science Department attracts more freshman students (14%) than transfers students that are non-SWS (12%) combined. Past discussions with the Undergraduate Coordinators have stated that the department gets very few freshman into the program.

Question 4. Students decide upon a major in many ways. Please indicate how you became interested in majoring in Soil and Water Science (i.e. people who influenced you, written materials, friends, website).

The students were asked then to list the most influential reason that lead them to decide to enroll in Soil and Water Science as a major. The responses are listed in Table 5.

**Table 5:** Interest in Soil and Water Science as a Major.

| Reason for interest in Major | Number of Students (n-35) |
|---|---|
| **Faculty/Class Interaction** | 9 |
| **Introductory Soils Class/Undergrad Coordinator** | 6 |
| **Work Experience** | 4 |
| **Word of Mouth/Website** | 4 |
| **Distance Education Program** | 3 |
| **Research Interest** | 3 |
| **Life Experience** | 2 |
| **Admiration for Scientist** | 1 |
| **Outdoor Major** | 1 |
| **Guest Speaker** | 1 |
| **Funding** | 1 |

The main reason for interest in enrolling in the major was either interactions with specific professors or courses offered by the department. Most of us can probably remember a time when we enrolled in a course or section because we wanted a specific instructor for the course. I remember one such occasion, when enrolling in the course General Chemistry I, I worked in an office unit where the chemistry professors were housed and asked a certain professor when his chemistry class times were for that semester. Because I wanted that particular Chemistry instructor, I scheduled all my other classes around the time frame for the chemistry class.

The next most common response for question 4 is perhaps a very common reason we as educators believe a student enrolls in our program ---- the introductory course and/or the advisor of the department. In the Soil and Water Science Department, the instructor for the introductory course (both past and current) is also the Undergraduate Coordinator. Most of the responses named either one of the instructors as the main reason for enrolling in the department, adding that the coordinators taught the introductory course as a secondary reason.

The work experience category referred to individuals who had either taken a job in the past as, e.g. a laboratory assistant (in related disciplines,) or as a working professional in the industries (governmental or private); or the individuals have been exposed to Soil and Water Science in their life experiences. One individual wrote their interest in the science stemmed from their lifetime labor as a fruit farmer. Another individual wrote that the experience as a lab assistant in a related discipline, but was under the guidance of a graduate student, who was a soil microbiologist, greatly influence his/her decision.

The "word of mouth" or website category does not surprise the author as that was how he located the program himself (website catalog). One respondent stated that a family member suggested the major to them because they had an interest in the environmental field. Another respondent stated the combination of their friend's

influences, view of departmental website, and the reputation of the Soil and Water Science Department fueled their interest to enroll in the major. One of the respondents who went to a junior college stated the Soil and Water Science Department had a brochure of the major which led to his/her interest to enroll.

The Soil and Water Science Department distance education program may have been a factor in a student's decision to major in Soil and Water Science. The distance education program in the department has grown exponentially over the past few years (Sisk, unpublished data, 2012). The reason for this is the program attracts working professionals who attend school during their 'off-time' hours. The numbers of graduate distance education students for the last five years in the Soil and Water Science Department are shown in Figure 4. These students may not have chosen to study in the Soil and Water Science Department except for the fact the department's distance education program allows the individual to continue work in their home environment.

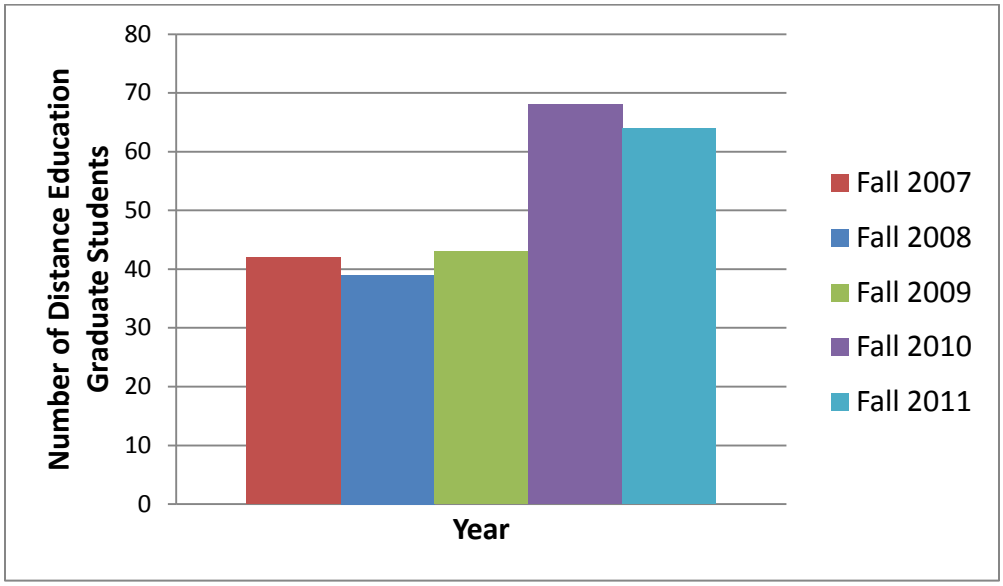


**Figure 5:** Number of Distance Education Graduate Students in Soil and Water Science Department, University of Florida.

One response stated that s/he decided on the major based solely on name of the major and the fact it was an outdoor science! The individual stated that "Soil and Water Science seemed like the dirtiest! And therefore, the most fun!"

Question 5. In 2009, the Soil and Water Science Department revised the major and added specializations for undergraduates. Please give your opinion regarding whether the change has been positive or negative, and why you have that opinion.

The next question dealt with the fact that department added specializations in Soil Science and Water Science to the undergraduate program. Students can select only one specialization for their program. The responses ranged from 10 positive to four negative responses. Some individuals were neutral and others elected not to respond on the subject (Table 6).

**Table 6:** Effect of Soil and Water Science Specializations on the Undergraduate Program

| Effect of Specialization Addition to SWS Majors | Number of Responses |
|---|---|
| **Positive** | 10 |
| **Neutral** | 7 |
| **Negative** | 4 |
| **N/A** | 7 |

This question was a free response which did not limit the students on how to respond, so there are more responses than respondents who took the survey (38 total responses, 35 respondents). One respondent felt that this change in undergraduate major was both a positive and negative change. The individual stated that the positive change came from a student could focus on or understand one topic more in depth than

before, but a negative because the student is no longer as "well-rounded" in the disciplines as perceived before the implementation of the specializations.

Most of the respondents who stated the specializations had a positive effect said it allows the student to focus more on their specific topic of interest, whether soil science or water science. One respondent stated the specializations would increase the number of alumni from the Soil and Water Science Department as they believe the degree is more marketable than before the change. Another respondent stated the change allows for more tailoring of the major to a student's specific interest.

One student who stated the specialization has a negative effect on the Soil and Water Science major said that focusing on one aspect of the science was too narrow in focus. Another respondent felt the change made the major less marketable after graduation as they viewed the coursework for either specialization redundant.

Question 6. Based on your experience in SWS, what aspects of the science are missing from the current curriculum? (both graduate and undergraduate)

The next question asked the students what they felt was missing from the curriculum in the Soil and Water Science Program. The responses ranged from revision of courses offered to the addition of new courses to the program. The responses are listed in Table 7.

**Table 7:** Responses from students on aspects missing in Soil and Water Science Curriculum

| Aspects Missing from Curriculum | Number of Responses |
|---|---|
| **Revision of Courses/Program** | |
| - Interdisciplinary approach | 5 |
| - Agriculture focus | 3 |
| - Water Science track | 2 |
| - Soil Physics | 1 |
| - Standardization | 1 |
| **Addition of Courses** | |
| - Real-World Applications | 5 |
| - Biology | 3 |
| - Field courses | 2 |
| - Wetlands | 2 |
| - Geology | 2 |
| - History of Soil Science | 1 |
| - Lab Technique | 1 |
| - Scientific Writing | 1 |
| - Oral Communications | 1 |
| **No Revisions Needed** | 5 |
| **Other** | 2 |

1

This question was an open response, so there are more responses than respondents in the survey, 37 responses to 35 respondents. The responses were grouped in broad topics from course revisions, additional courses, no revisions needed, or an 'other' category. One topic that came up in the survey results on the revision of the Soil and Water Science program was to create a more focused interdisciplinary approach in the program. One response stated that, "Soil and water are intimately involved with so many other disciplines; it would be great to have some flexibility in developing a plan of study and committee that allows for this incorporation of relevant disciplines." This echoes the advocates of an interdisciplinary approach in the development of a soil science curriculum (Baveye, 2006; Hopmans, 2007 and Lal, 2007). Field et al (2011) stated, "In recognizing that soil scientists must engage with a variety of people to provide information and solutions to increasingly complex environmental problems, the context of their education must be broad or it will lack relevance."

Some respondents felt the program is disconnected with Agronomic sciences; the focus of the department has shifted the emphasis to environmental issues rather than agricultural issues. One respondent described, "A stronger link with Agronomic Sciences, since soil science is a vital part of the good management of any crop. The department is focusing (for better or worse) to only one field of wetlands management." But within the same results, in the next group of addition of courses, respondents felt that the department did not have enough wetland courses!

Only one class offered by the Soil and Water Science Department was mentioned in need of revision, Soil Physics (SWS 4602C). The student did not state what aspect of the course needed to be changed, but simply wrote, "Soil Physics may be taken into consideration extensively."

The second group of revisions focused on what type of courses the Soil and Water Science department should add to their program. The most common response was the implementation of practical skills or real-world applications of the skills

learned in the program. One respondent felt, "Real world application of soil and water science was greatly missed in the curriculum." This respondent also stated only one class in the department had any visibility of incorporating application to real-world settings.

Other courses suggested were biology-focused, field-based, geology, and the history of soil science. An interesting result was the suggestions of the addition of courses that most educators would expect graduate students to have already taken specifically oral communications and scientific writing classes. This indicates educators should not assume just because a student is in a graduate program, does not mean that they have all course experiences to become effective scientists (verbally or written). This is echoed as one of the soil science teaching principles (Principle No. 7: Communication) developed by Field et al (2011).

The logistical problem with the additions of courses is the ability to have faculty who are qualified to teach the courses. But one respondent stated there should be no revisions to the program and commented, "… I am free to choose courses from all other departments. So I haven't really thought about what is missing. I look for that elsewhere."

Question 7. Based on your experience in SWS, what aspect of the department and program do you consider to be the best feature?

The next question is on the opposite spectrum of the previous question, instead of asking what is missing; this question pertains to ask what is the best feature of the Soil and Water Science Department. The responses are listed in Table 8.

**Table 8:** "Best" Feature of the Soil and Water Science Department/Program

| Best Feature of Program/Department | Number of Responses |
|---|---|
| Availability of Faculty/Support | 9 |
| Program Information | 6 |
| Hands-On Experience | 5 |
| Specific Courses/Research | 4 |
| Diverse Faculty | 4 |
| Department Size | 3 |
| Family Atmosphere | 1 |
| Clubs | 1 |
| Seminar | 1 |
| Funding Availability | 1 |
| Not Applicable | 2 |

**Two respondents had two responses**

The most common comment from students who stated what are the best features in the Soil and Water Science Department was the (i) availability of the faculty and (ii) support they offer students. One student response stated, "All of the professors are considerate and helpful. We are always welcome into their offices for assistance in their own class, or others."

The next most common responses were associated with what was called "program information", meaning the (i) relevance of course material to the program, (ii) ease of access of the material, and (iii) the structure of the department courses i.e. on-campus or distance education. Relevance of course material to the program refers to students who felt that the department offered a well-rounded curriculum, which included as one student stated, "a global perspective" in the course material. Ease of access of the material refers to the students' perception that the curriculum is being

"well taught" by the instructors. The structure of the departmental courses relates to the availability of a wide variety and large quantity of distance education courses offered by the department.

Another feature students' chose as the department's best was the opportunities for hands-on experience, either in coursework or laboratory experience. One respondent stated, "Being able to touch the soil and turn that into knowledge is priceless."

Students also named specific courses offered by the Soil and Water Science Department as the best feature (SWS 3023: Soil Judging, SWS 3022: Soils in the Environment, SWS 4231C: Soil, Water and Land Use, SWS 4715C: Pedology, and SWS 4303C: Soil Microbial Ecology). The C in the course number refers to a four credit hour lecture-lab combined course. Three of these courses specifically deal with the formation of soils, soil genesis and classification.

The numbers of courses mentioned are more than the responses listed in Table 6. When counting the responses, if a respondent had listed more than one course in their response, it was only counted as one result in the table. Included in this feature are the research areas the department offers, as one student declared, "It's easy to find the right research niche."

The department size (being relatively small as compared to others in IFAS) and diversity of the faculty members were other notable features mentioned by a few student responses. One response stated that the department had a "wide range of experiences and specialties within the faculty."

One respondent stated the department felt like a family to the student. Another student felt the clubs (Agronomy-Soils or Wetlands Club) offered in conjunction with the Soil and Water Science Department was the key feature in the program.

One respondent stated the seminars given in the department were the best feature as shown in their statement, "Interaction in the research forums, and the quality of many graduate student seminars given on a weekly basis." The seminars in the Soil

and Water Science Department are given by graduate students (potentially those who are ready to graduate), and are attended by students (mostly graduate) and professors of the department.

Another student stated the best feature of the department was the readily opportunity for funding in the program. This has become a more prevalent issue though the harsh economic environment of the current decade.

Finally, two students felt that they could not comment on the best feature of the department as they were new to the program.

Question 8. On the following scale, please indicate your overall perception of the SWS program.

The next question pertains to the perception of the student respondents of the Soil and Water Science Program. The percentage of students' perception (excellent to poor) is shown in Figure 6. Note the figure does not show the complete response of what the students had to select from in the survey. The complete responses are listed in Table 9 in the Appendix.

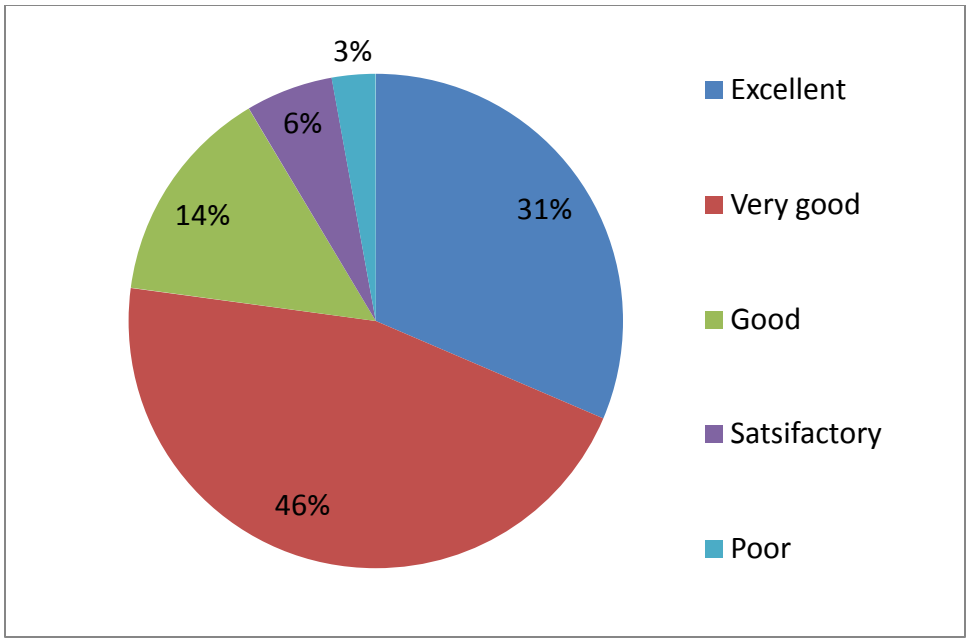


**Figure 6:** Overall Perception of Soil and Water Science Program

Most of the students (77%) feel the Soil and Water Science program is an excellent to very good program which offers what they believe to be an adequate curriculum in soil and water science. Less than a quarter of the respondents (23%) feel that there needs to be major revisions to the program in either course offerings or curriculum. Of the respondents, only three percent felt that the program is not adequate for a major to be offered by a premier university.

Question 9. A department consists of faculty, staff, and the students who are enrolled. In your opinion, how well do the various groups within SWS interact?

The next question relates back to perception of the Soil and Water Science Department as asked in the previous question. This question deals with the perception of group interactions (i.e. faculty, staff, and students) within the department; while the

previous question looked only at the department as a whole. The perception responses are listed in Table 10.

**Table 10:** Perception of Group Interaction in Soil and Water Science Department

| Perception of Group Interaction | Number of Responses |
|---|---|
| Very Well | 8 |
| Well | 10 |
| Fair | 8 |
| Poor | 6 |
| Not Applicable | 2 |

About half of the students felt that the group interaction was well/very well, while the other half thought there was definite need of improvement. One student commented, "I think they interact fairly well. As a graduate student, I have had very positive experiences interacting with faculty and staff of the department. Very helpful, resourceful, and supportive. Of course there is always room for improvement." Another stated, "The faculty and staff are always open for any questions and very helpful." Interestingly, even students who rated that the interaction was well made comments about the specific group interactions. One student commented on the student-student interaction: "I thought everyone interacted well (friendly) although there will always be a few people who forget that they aren't entitled to the same benefits an instructor/professor are and they are just students." Another student commented on the overall interactions and stated that the student is the one responsible to bring about a relationship with faculty/staff: "Very well. It's up to the student to make it happen, though."

Of the student respondents who thought the interactions were poor/fair, most had a specific type of interaction that they felt needed improvement. One student said this about the student-student interactions, "Ok. I think the students are pretty isolated, I don't feel as if I am a part of the student groups." Another student said, "As far as graduate students, there is no community with other graduate students. Several people, including myself, have tried to get people in the department together for social events, etc. with no luck.(† *next page*)" One student referred to the student-faculty interaction, "(There is a) lack interaction between the faculty and students." Another student echoed this statement, "There should be more interaction between faculty and undergrads." This same student though said about the student-student interaction, "The students had good interaction between them." A student who is new to the department stated, "I'm new but (there) doesn't seem to be much mixing. I don't even know the different groups."

For both responses, there were extreme comments in either direction. For the very well interaction perception, one student said, "Very well! Most of us are all on a first name basis. Many professors give out their personal phone number for when students need help and can't find the professors on campus. We are a very laid back and friendly group. Our program was voted #2 just a year ago in regards to student feedback and how much the students enjoyed the soil classes." Another student stated, "Since becoming a TA and working on an assistantship, I see a huge amount of positive interactions spurring both student and course development, and professor partnering. (As part of #8) I've traveled to national conferences and have seen the esteem for which companies and other universities hold for UF. Every corporation I've spoken with has been very impressed by the UF SWSD - it's a great feeling to know that my degrees are worth the paper they are printed on and that being associated with UF and the SWSD will open doors in the future for me." For the opposite side, one student remarked,

"Not very well, unless the student has formed a personal connection/mentorship with a faculty member. It is not uncommon for professors to express hints of impatience or disdain for his students and/or required teaching duties." Another student goes even further and isolates a specific individual, "Poorly. The department is controlled by a singular chair who highly favors a subsection of students and professors resulting in the un-equitable distribution of resources."

One of the students even commented on how to bring about better interactions through all the groups, "I think, on an overall basis, the interaction is fair, although it could be better. The department needs more social activities." This was echoed in an earlier statement (†) as an individual stated that they tried to set up these type of events but could not get the cooperation of the different groups to host the functions. This statement is what the last question of the survey asks the student to comment on how to fix the interactions. Two of the students refrained from answering the question as they felt they did not have enough knowledge about the interactions to make a comment.

Question 10. What areas of interaction between, within and among the groups need to be improved, and what suggestions do you have for making that improvement?

The last question in the survey relates back to the previous question on the group interactions, but asks the students how they suggest making improvements between the groups. This question is the solution to the problems posed between the student-faculty-staff interactions in the previous question. The suggestions are listed in Table 11.

**Table 11:** Areas needed to be improved between groups in the Soil and Water Science Department

| Suggestions for areas in need of improvement | Number of Responses |
|---|---|
| Social Events | 8 |
| Advisement | 3 |
| Distance Education Involvement | 3 |
| Interactions between Faculty, Students, and Department | 2 |
| Student Interactions with Other Students | 2 |
| Undergraduate Focus | 2 |
| Curriculum Review | 2 |
| Decrease workload of Faculty | 2 |
| Interdisciplinary Research | 1 |
| Email Streamline | 1 |
| None | 4 |
| Unsure | 5 |

The most common response from students is the need for more social events in the department. Some of the students stated that this is needed for one instance as a meet/greet type of event for students as well as faculty members, and another instance as a way of sharing ideas/intellect to help each other out. One student stated, "Maybe more outside of campus get-togethers so we can socialize in an atmosphere where the students (especially new students) can meet and chat with the faculty without feeling intimidated." Another student said, "Possibly more department wide meeting such as an informal pizza at a picnic table so that everyone can possibly talk about the research

they are working on. I think it would be a good learning experience as well as a way to brainstorm with others in the same program." This type of activity was already conducted in the undergraduate program with the previous Undergraduate Coordinator. One student felt that the department did not support these types of activities, "Student motions/ activities should receive more support from the department." One student specifically referred to the social events of the graduate students, "Graduate student social events, support groups (e.g., listening to each other's presentation before a seminar/qualifying exam/conference, etc). Consider having Gainesville grad students in a limited number of locations." One could infer the last statement refers to the location of students on campus, as mentioned earlier they are held in three different buildings on campus. Another possibility could reflect the actual residencies of the graduate students in the Gainesville area.

The next common response for an area of improvement was in the advisement of the students throughout their college career. One student remarked, "Need improved relations with student and adviser. This is most often a complaint by students." The author himself has had discussion with other undergraduates and graduate students and they voiced that they felt there was no advisement throughout their tenure in the Soil and Water Science Department. Undergraduates have felt that they did not get the advice from the Undergraduate Coordinator that they needed. Graduate students have stated they felt that the Chair of their committee did not guide/advise them in their career. Another student specifically singled out the advisement of distance education students, "Communications between advisers and distance education students need to be improved." This directly correlates to the next response, the involvement of distance education students.

Some of the students felt that distance education students are not involved in the department. One student commented on the interaction between distance education

students and on-campus students, “I think it might help if the distance education students had more ways to interact with on-campus students.” Another student commented on the availability of the distance education students to be involved with faculty research, “I wish distance education students could be more easily involved in funded faculty research.” This student also stipulated that some of this fault lies with the distance education students themselves, “However I think this is also the responsibility of the student.”

The next couple of responses deal with interactions between groups, the faculty-staff-student interaction and the student-student group. These were echoed in the previous question asking about how the interactions between the groups were perceived. One student gave an example of how an instructor in a different department conducted interactions with their students, “Not really sure, but one idea I'd suggest stems from a class I took in the LAS department. The class was relatively small (or average for a graduate level class), and the teacher set up 3 meetings with each student spaced evenly throughout the semester. These individual meetings were intended to discuss anything relevant about how the student feels the class is going, their opinions on the material, what would help them learn better, and related personal experiences. The teacher was a great listener and got to know each student.” The student also remarked that they felt this instructor truly paid attention to the students, “It really makes a huge difference in a student's learning process if they feel that their teacher truly cares about their learning.”

Another comment made by students referred to the department not having an undergraduate presence or focus on undergraduate development. One student even gave the suggestion of incorporating more undergraduates into the research aspect of faculty projects.

Two students suggested that the department was in need of a curriculum review as an area of improvement. One student stated, "I believe the most important improvement the soil and water science department could and should undergo is a serious change in curriculum to offer more real life application of soil science and improve some of the existing classes to make them more efficient."

Some students felt that the reason faculty do not have time for student interactions is due to a high workload placed on them. This is not an uncommon theme for all working members of society that they have had an increase in workload/production given the terrible economy of the past decade. As one student commented, "It seems that professors are sometimes overloaded with work, and that some e-mail or voicemail correspondence takes time before receiving a response. Suggest trying to avoid overloading professors with work to ensure they have time for their students."

Of the last two suggestions, the interdisciplinary research suggestion refers to the incorporation of a multi-faceted research program. This has been a fairly common theme throughout the article and previous articles published. The "email streamline" suggestion refers to the decrease of the amount of emails sent out by the department's student service representative. The student feels that there are too many emails to sort out what information is important for them to know.

Four of the students felt that they did not have any suggestions to offer the department. It should be noted that this is lower than the amount of students who perceived the departmental interactions were very well. Five of the students felt unsure on what suggestions they could make either because they could not figure a solution to offer or felt that they did not have enough of a knowledge base about the department to offer a suggestion.

## COMPARISON OF AUTHOR'S EXPERIENCE TO RESPONDENTS AND OTHER AUTHORS CITED

Soil science education reform has been the topic for authors (Baveye, 2006; Baveye et al., 2006; Lal, 2007; Hopmans, 2007; Hansen et al., 2007; Collins, 2008; Havlin et al., 2010) over the years. Most of the current literature has looked at the declines in enrollment and calls for curriculum revision of the soil science programs. The declines have averaged as much as 40% (Baveye et al., 2006). This statistic was calculated from enrollment data of soil science programs in the United States and Canada from the years 1992 and 2004. The Soil and Water Science undergraduate program showed an average decline of approximately 35% (Figure 7, Appendix A) for the years 1996 to 2006. Not many investigators have recorded the way student find out about soil science or obtained feedback from students on how modifications have either enhanced or detracted from the soil science programs. One example, Taskey (1994) described how his department at California Polytechnic State University at San Luis Obispo revitalized their under-enrolled program and almost tripled the enrollment in a two-year span. The Soil and Water Science Department at the University of Florida needs to follow this example and explore how the impact of the specializations has had on the undergraduate program.

Lal (2007) offered a model of how an interdisciplinary program should function (Figure 1, Appendix A). The Soil and Water Science Department can adopt this model for a modification of the curriculum. One part of the model has been implemented in the program, such as the 'Research and Graduate Program in Soil Science.' The department has one of the strongest enrolled programs in the College of Agricultural and Life Sciences at the University of Florida (Figure 2, Appendix A). Another part of the model is the implementation of distance learning into the program. The Soil and

Water Science Department has been successful in this implementation as a majority (51%) of our Fall 2011 graduate students are distance education students (Figure 5 and Figure 2, Appendix A). The Soil and Water Science Department does not have a strong connection with the 'Industry Outreach and Advocacy' component of the model. This model can be one tool that soil science programs use to adopt an interdisciplinary curriculum.

The results from the survey distributed to alumni, undergraduate students, and graduate student show that the majority of students have felt positive (48%) about the addition of specializations, with 33% feeling neutral or indifferent with the change. Since a third felt neutral with the specializations, this could be attributed to the high volume of graduate students' responses versus undergraduate students' responses in this survey. Only three of the graduate students came through the Soil and Water Science undergraduate program, but it could not be determine when they graduated. A follow-up question should have asked the students when they graduated. This distinction would have been important in the analysis of the results to determine the level of impact of the specializations. The departmental enrollment since the implementation of the specializations in 2009 has not changed significantly (Figure 7, Appendix A). In fact enrollment increased by three students, but then dropped from 2010 to 2011 by three students. One could determine that specializations have not had a significant effect as the drastic changes that were witnessed at California Polytechnic State University at San Luis Obispo (Taskey, 1994). In Taskey though, there was a complete overhaul of the curriculum. The Soil and Water Science Department only created the specializations of 'Soil Science' and 'Water Science.'

Havlin et al. (2010) sent surveys to employers to determine if soil science departments are offering what employers have deemed necessary for graduates to become employed. The article reinforced the suggestion that there is disconnection

between what departments offer and what employers want. This indicates to faculty of the department that employers (workforce) and students should be involved in curriculum changes. Students should be involved because without our student population there is no academic department. This proved true in Taskey (1994). As result of their discussion with former students, administrators, and potential employers led to the creation of a program that tripled its enrollment in a short period of time.

Identification of how students come to find out about soil science and what clientele of students the department typically attracts (i.e. transfer students or distance education students) should be determined. The results of the survey confirmed speculations that the Soil and Water Science Department enrolls many transfer students (Collins, 2008). Also the results show that the graduate program enrolls mostly non-soils educated students into the program. Only one of the respondents is from a "soft" science (Food Resource Economics), while the others come from "hard" science backgrounds. Now the Soil and Water Science Department knows (i) the type of student they serve, (ii) they can focus their attention of student recruitment at junior or state colleges, or (iii) increase the number of freshman students through outreach programs at local high schools for undergraduate programs.

For graduate programs, discussions need to be made about whether there should be more structure or flexibility in individual programs. Some students felt that the coursework offered by the department was not adequate; others felt that they could go outside the department for other resources. Which one is correct, one could not say. I agree parts of the program could use revisions on what courses individuals should take in order to complete their program. A suggestion would be to offer courses that focus on areas such as education, curriculum development, and teaching methods in Soil Science. However, these types of courses are offered outside the department. I looked into other programs to meet these course needs and thus, was exposed to a

greater educational diversity. The greatest factor on the flexibility or rigidity of a student's program depends on the composition of his/her committee members. Students should find committee members that complement their interest and will help them succeed in any area of research they wish to pursue. A more plausible option would be to revise the definitions of the courses SWS 4941: Practical Work Experience for undergraduate students and SWS 6940: Supervised Teaching for graduate students in Soil and Water Science. The course's definitions do not clearly identify what constitutes a practical work experience in Soil and Water Science or what fulfills a supervised teaching requirement. Redefining these courses could offer students the opportunity to be exposed to teaching methods. As a biology lab teaching assistant, we were required to enroll in ZOO6927: Biology Lab Instructional Methods. This course offered guidance into different methods of teaching the biology labs.

Soil science departments should also ask students what are the strengths of the program (as shown in results as best feature) or what areas are in need of improvement. The respondents felt that the best feature was the availability and support of the faculty. I agree with the respondents because if some of the faculty members had not shown interest in my education when I was an undergraduate, I might not have continued my education in graduate school. I believe there is a need for periodical surveys of alumni and current students for all soil science departments to ensure that the curriculum offered is one of the best. One of the items discussed from respondents was the addition of real world applications to the curriculum. This was one thing I noticed after a year in the undergraduate program and still saw lacking as I entered into the graduate program. There were very few courses that offered the how, why, and what students need to know for real-life situations. One of the courses in the undergraduate program is called "Practical Work Experience" in which all students are expected to complete a 'capstone' project. This course allows students to have soil

science experience in a real-life scenario. But the expectations of this course vary depending on the choice of the faculty member. When I did my capstone project, I created a presentation on my experience in an environmental consulting firm. But I believe the department should offer more real-life opportunities such as soil mapping or storm-water treatment design.

Another factor that the survey related was the perception of the students (current and alumni) interactions had in the department. Perceptions of soil science have been discussed by soil science educators in previous articles, as most students have stated that the science is only associated with agronomy (Baveye et al., 2006; Collins, 2008). Views of how students perceive the faculty-staff, faculty-student, faculty-faculty, staff-student, staff-staff, and student-student interactions, however, have not. If the department groups (students, staff, and faculty) do not interact well how can we expect them to incorporate changes into the program? This is a plethora of unrecorded data that can be used to revitalize soil science programs at higher education facilities. Just as a person does with a first impression upon meeting a new individual, students will have an impression or perception of how the department interacts. This is not isolated to only soil science and can be applied to any discipline. But with all the calls for reform of soil science education, I feel that the department can benefit. In the Soil and Water Science Department, there is cause to address this situation because half of the students' responses expressed concern about the personal interactions.

My life experiences have been rather unique in that I have taught in academia, worked as a field technician at a consulting firm, been a manager of county farmers' market, and business owner of a soil consulting business. No student will have the same experiences that I have had, nor will I have the experiences that they have faced. Since I have had these unique experiences, I wish to discuss the topic of "what would I

expect graduates of soil science to know." As an owner of a soil consulting business there are certain skills I need: soil morphology and genesis, hydric soils in relation to seasonal high water table determinations, technical writing, effective oral communication, geology, landscape analysis (i.e. summit and toeslope), and soil mapping. In the Havlin et al. (2010) employer survey results, the top three skill sets that employers expected of graduates of soil science were in areas of soil classification/survey, soil physical properties/engineering, and wetland soils (Figure 8).

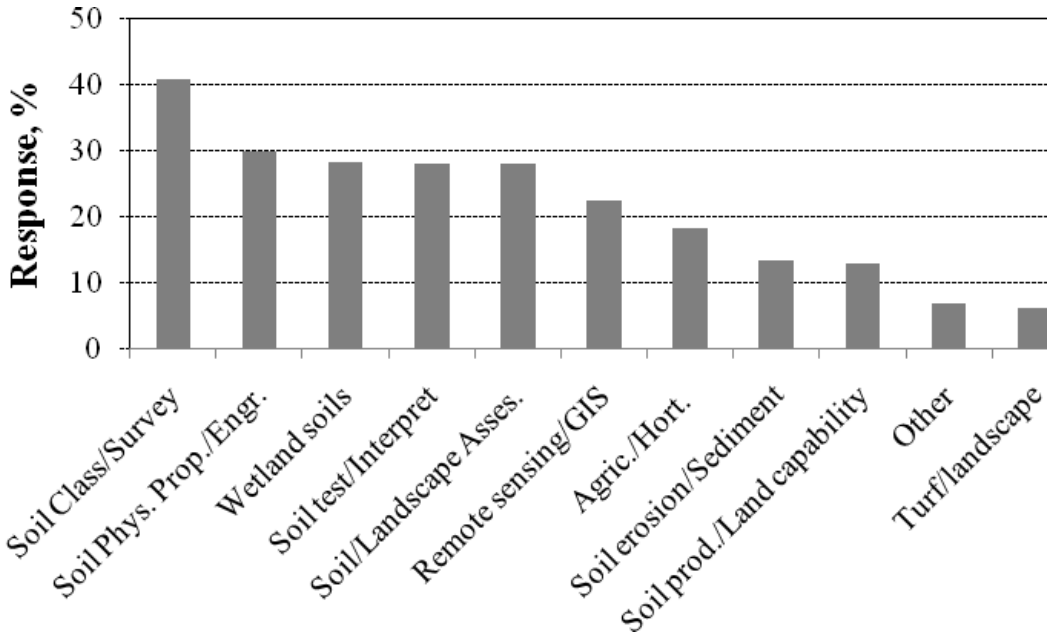


**Figure 8:** Skill sets identified by employers they expect their employees or potential hires to know. (Havlin et al., 2010)

The top two skills sets identified in Figure 8 are the skills that I use the majority of the time in my consulting business. When I worked for the environmental consulting firm, the third skill set of wetland soils was the top skill set to know as well as GIS/Arc sensing. Presently, in my own business, I hardly do any wetland delineations. Now these skill sets would be different when switching to my other job as a market

manager. Although soil science knowledge is not required, the knowledge as the market manager gives me the expertise to discuss nutrient availability in the soil for farmers' crops and discuss recommendations for fertilizer/lime use. So the skill sets required depends on the type of job employed.

Common themes arose in my experiences as a graduate student of the department as well as with other graduate students' experiences. Most of the students, including myself, felt that in their graduate program, the unity or companionship of the students was not present. Although respondents have stated that they have made attempts to rectify this problem, no clear solution has been offered by the department to help bring camaraderie with the students.

Another point is the loss of identity of soil science programs is the absence of the word 'soil' in job titles. Collins (2008) discussed the loss of the word in academic department titles and majors. Students who graduate with a soil science background cannot identify potential job opportunities due to the lack of soil in the job title/description. Many become frustrated and feel that they majored in an un-employable major. A fellow graduate of mine just recently became employed at a major environmental consulting group. When he looked for job opportunities, none of the jobs he found displayed the word 'soil' in its title. The title he gained from the environmental consulting firm was "Environmental Scientist I". This lack of identification and recognition further signifies how disconnected society is from soil science and how we as professionals have failed to promote our discipline. Academics and employers need to discuss how to successfully promote the word 'soil' back in the workforce through examples of changing job titles, for example changing the Environmental Scientist I position to Environmental Soil Scientist I.

Another factor that dealt with the loss of identity of soil science is through the certification of soil scientist. Both authors (Baveye et al., 2006; Havlin et al., 2010)

suggested that licensure will help increase the visibility of soil science to the general public. Respondents from Havlin et al (2010) survey noted that there is a lack of respect for soil science professionals amongst other professionals. The respondents also suggested that creation of certification programs will help soil scientist receive recognition among professional peers. The certification program is already existent through the Soil Science Society of America. Suggestions have been made for the Soil Science Society of America to make efforts to communicate with soil science professionals to become certified. The certification processes is on a volunteer-basis since there is no mandate for soil scientist to be certified. An example of a professional that must be certified is a Professional Engineer.

Periodically departments need to tabulate these types of data to revise their programs. It will be interesting to see how soil science programs will heed and answer the call for education reform in the immediate future.

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## APPENDIX A

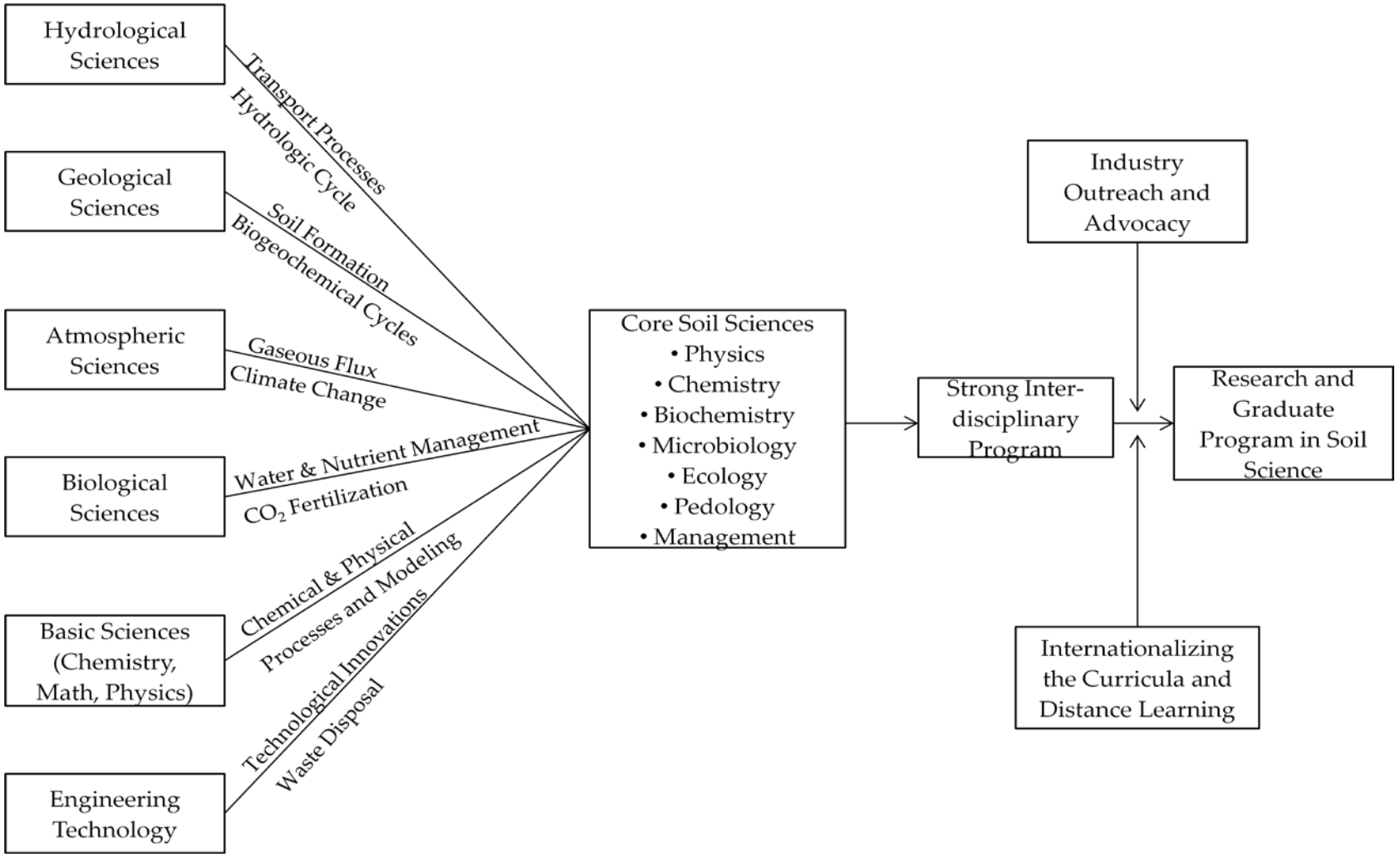



**Figure 1:** A model of a successfully interdisciplinary program in conjunction with international perspective including distance learning and a strong industry outreach and advocacy. *(Lal, 2007)*

**Table 1:** Names of academic departments that house soil and crop science undergraduate majors at 1862 Land Grant Institutions (n=61) and their frequency of occurrence. *(Hansen et al., 2007)*

| Academic departmental name † | Number of observations |
|---|---|
| **Plant Science** | 10 |
| **Soil and Crop Sciences** | 8 |
| **Agronomy** | 6 |
| **Plant and Soil Sciences** | 5 |
| **Plant, Soil and Entomological (Insect) Sciences** | 3 |
| **Natural Resources** | 3 |
| **Soil Science** | 3 |
| **Crop Sciences** | 2 |
| **Natural Resources and Environmental Sciences** | 2 |
| **Agronomy and Soils** | 1 |
| **Soil, Water, and Environmental Sciences** | 1 |
| **Crop, Soil, and Environmental Sciences** | 1 |
| **Land, Air, and Water Resources** | 1 |
| **Soil and Water Sciences** | 1 |
| **Tropical Plant and Soil Science** | 1 |
| **Plant, Soil, and Environmental Sciences** | 1 |
| **Natural Resource Sciences and Landscape Architecture** | 1 |
| **Soil, Water, and Climate** | 1 |
| **Land Resources and Environmental Science** | 1 |
| **Plant Sciences and Plant Pathology** | 1 |

| | |
|---|---|
| **Plant Biology** | 1 |
| **Environmental Sciences** | 1 |
| **Plant Biology and Pathology** | 1 |
| **Agronomy and Horticulture** | 1 |
| **Horticulture and Crop Sciences** | 1 |
| **Biosystems Engineering and Soil Science** | 1 |
| **Plant, Soils, and Biometeorology** | 1 |
| **Crop and Soil Environmental Sciences** | 1 |
| **TOTAL** | 61 |

† Close name derivatives or names with same elements in different orders were combined.

**Table 2:** Names of undergraduate majors (n=116) found in academic departments that house soil and crop science undergraduate programs at 1862 Land Grant Institutions and their frequency of occurrence

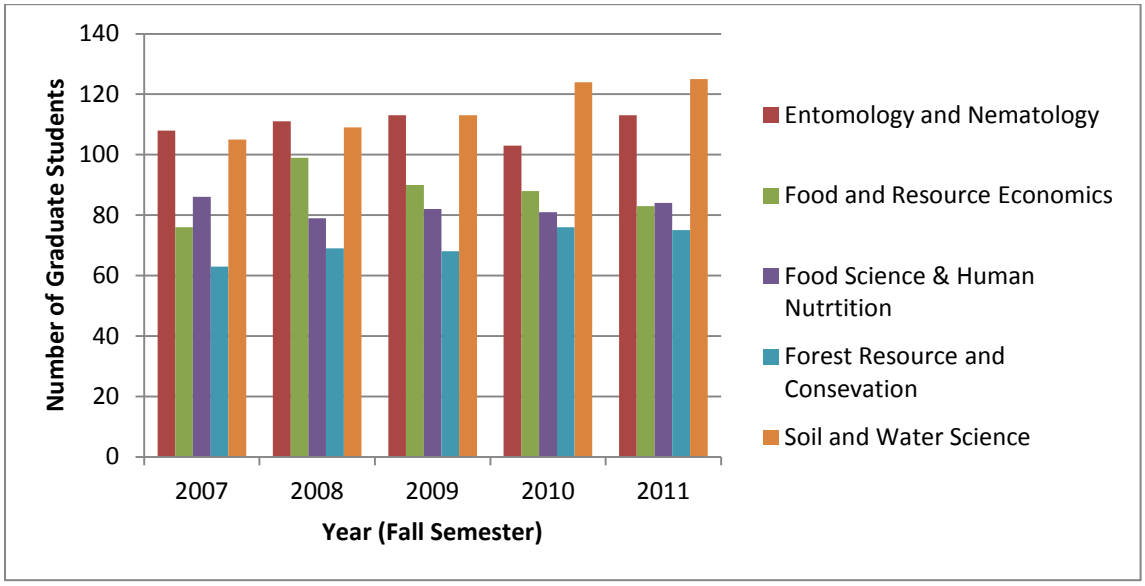
| Academic departmental name | Number of observations |
|---|---|
| **Agricultural Industries and Marketing** | 1 |
| **Agricultural Management and Rangeland Resources** | 1 |
| **Agricultural Science** | 1 |
| **Agroecology** | 2 |
| **Agronomic Business Marketing** | 1 |
| **Agronomy** | 13 |
| **Agronomy and Soils** | 1 |
| **Applied Meteorology** | 1 |
| **Applied Plant Sciences** | 1 |

| | |
|---|---|
| **Crop and Soil Environmental Sciences** | 1 |
| **Crop and Soil Sciences** | 3 |
| **Crop and Weed Sciences** | 1 |
| **Crop Management** | 1 |
| **Crop Science** | 6 |
| **Crop Science and Management** | 1 |
| **Ecological Agriculture** | 1 |
| **Environmental and Soil Sciences** | 1 |
| **Environmental Chemistry** | 1 |
| **Environmental Horticulture** | 1 |
| **Environmental Horticulture and Turfgrass Management** | 1 |
| **Environmental Horticulture and Urban Forestry** | 1 |
| **Environmental Management in Agriculture** | 1 |
| **Environmental Management Systems** | 1 |
| **Environmental Protection** | 1 |
| **Environmental Resource Science** | 1 |
| **Environmental Science** | 5 |
| **Environmental Science and Policy** | 1 |
| **Environmental Soil Science and Water Science** | 2 |
| **Environmental Soil Science** | 6 |
| **Horticulture** | 4 |
| **Horticulture and Crop Sciences** | 1 |
| **International Agricultural Development** | 1 |

| | |
|---|---|
| **International Agronomy** | 1 |
| **Land and Water Management** | 1 |
| **Land Resource Science** | 1 |
| **Landscape Horticulture** | 1 |
| **Natural Resource and Environmental Sciences** | 1 |
| **Natural Resource Sciences** | 2 |
| **Natural Resources Conservation and Management** | 1 |
| **Plant and Soil Sciences** | 4 |
| **Plant and Soil Systems** | 1 |
| **Plant Biology** | 2 |
| **Plant Genetics and Plant Breeding** | 1 |
| **Plant Sciences** | 9 |
| **Plant, Animal, and Soil Sciences** | 1 |
| **Soil and Crop Management** | 1 |
| **Soil and Crop Science** | 2 |
| **Soil and Land Resources** | 1 |
| **Soil and Water Science** | 3 |
| **Soil Science** | 7 |
| **Sustainable Agriculture** | 1 |
| **Sustainable Landscape Horticulture** | 1 |
| **Tropical Plant and Soil Science** | 1 |
| **Turfgrass (Turfgrass Science, Turfgrass Management)** | 5 |
| **Waste Management** | 1 |

| | |
|---|---|
| **Water Science** | 1 |
| **TOTAL** | 116 |

*Modified from Hansen et al., 2007*




*(accessed from http://cals.ifas.ufl.edu/cir/)*

**Figure 2:** Enrollment for the Top Five Graduate Programs in the College of Agricultural and Life Sciences

**Table 3:** Questions from Survey Sent to Undergraduates and Alumni of Soil and Water Science Department, University of Florida

| Questions from Survey | Possible Responses to Survey Questions |
|---|---|
| **Indicate current classification. †** | Freshman, Sophomore, Junior, Senior, Master's student, Doctoral Student, Other |
| **If a Master's or Doctoral Student, please indicate undergraduate major.** | Free response |
| **Indicate initial enrollment status at the University of Florida. †** | - Entered as Freshman in College of Agriculture and Life Sciences, Soil and |

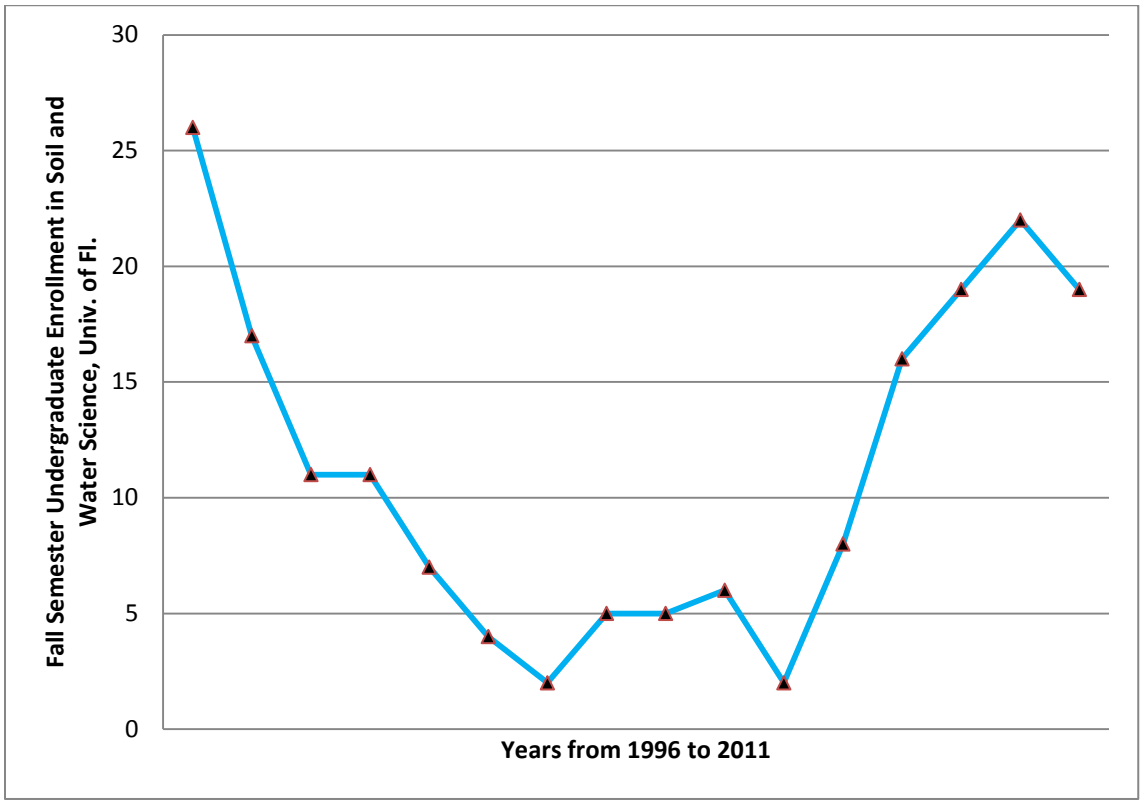
| | |
|---|---|
| | Water Science (SWS) Department<br><br>- Entered as a freshman in the College of Agriculture and Life Sciences, but not in SWS<br><br>- Entered as a freshman in another college<br><br>- Entered as a transfer student in the College of Agriculture and Life Sciences, Soil and Water Science Department<br><br>- Entered as a transfer student in the College of Agriculture and Life Sciences, but not in SWS<br><br>- Entered as a transfer student in another college |
| **Students decide upon a major in many ways. Please indicate how you became interested in majoring in Soil and Water Science (i.e. people who influenced you, written materials, friends, website)** | Free response |
| **In 2009, the Soil and Water Science Department revised the major and added specializations for undergraduates. Please give your opinion regarding whether the change has been positive or negative, and why you have that opinion** | Free Response |
| **Based on your experience in SWS, what aspects of the science are missing from the current curriculum? (both graduate** | Free Response |

| | |
|---|---|
| **and undergraduate)** | |
| **Based on your experience in SWS, what aspect of the department and program do you consider to be the best feature?** | Free Response |
| **On the following scale, please indicate your overall perception of the SWS program.†** | - Excellent, probably among the best in US<br>- Very good, but there are some areas that need to be improved<br>- Good, but there are some major changes that are needed<br>- Satisfactory, there are many areas that need to be improved<br>- Poor, the program does not meet the standards of a worthwhile major |
| **A department consists of faculty, staff, and the students who are enrolled. In your opinion, how well do the various groups within SWS interact?** | Free Response |
| **What areas of interaction between, within and among the groups need to be improved, and what suggestions do you have for making that improvement?** | Free Response |

**†** - *respondents could select only one response*

**Table 9:** Selection Answers for Overall Perception of Soil and Water Science Program

| Perception of Soil and Water Science Program |
|---|
| Excellent; probably among the best in the U.S |
| Very good; but there are some areas that need to be improved |
| Good; but there are some major changes that are needed |
| Satsifactory; there are many areas that need to be improved |
| Poor; the program does not meet the standards of a worthwile major |




*(accessed from http://cals.ifas.ufl.edu/cir/)*

**Figure 7:** Undergraduate Enrollment in Soil and Water Science from 1996 to 2011