

# Uneven Paths: Agricultural Pathways that Lead Students to Enroll

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## Abstract

For colleges of agriculture throughout the US, recruitment and retention of undergraduate students is a matter of existential importance. We analyzed personal statements written by applicants accepted to undergraduate degrees at North Carolina State University College of Agriculture and Life Sciences (CALs) to determine what pre-university agricultural experiences are related to first-term success and graduation within six years of first enrollment. The 491 students who submitted written materials as a part of their application to CALs described an array of agriculture pathways that we classified as categories of work and volunteer experience, clubs, coursework, personal history, and leisure. Our study found that 319 students, or 65%, described at least one pathway that played a role in their choice to apply. We found that most pathways were dominated by White students, with just 8.8% of students with at least one agriculture pathway from a minoritized group. Further, we calculated the mean First Term GPA (FTGPA) and graduation rate after six years for each pathway group. Findings include that students who discussed FFA participation had relatively high FTGPAs and graduation rates, while students intending to become veterinarians had relatively high FTGPA but low six-year graduation rates.

**Keywords:** Colleges of Agriculture, ethnicity, gender, race, undergraduate

Understanding and addressing the recruitment and retention problems that colleges of agriculture (COAs) face has been a matter of keen interest for scholars and university administrators for several decades. Many who have contributed to this body of research have argued for

the need to characterize undergraduate populations at COAs because of one seminal event in particular – the farm crisis of the late '70s and early '80s (Donnermeyer & Kreps, 1994; Dyer et al., 1999; Dyer et al., 1996). This crisis was a pivotal event that caused enrollment in COAs to plummet nationwide, thus imperiling the future of academic programs in agriculture (Donnermeyer & Kreps, 1994; Dyer et al., 1999; Dyer et al., 1996). According to Dyer et al. (2002), between 1978 and 1988, enrollment in COAs at Land Grant universities declined by 24%. Some have argued that the economic downturn in the agricultural economy around this time led to public perception that agriculture was not a tenable field to study at the post-secondary level. Donnermeyer and Kreps (1994) advanced the perspective that the crisis had created a “generally negative view of agriculture,” which caused parents, teachers, and guidance counselors to encourage “high school graduates to consider non-agricultural careers” (p.45). The persistence of this view meant that many students were discouraged from pursuing a degree in agriculture even after opportunities in the sector rebounded (Wildman & Torres, 2001).

Many have noted that despite the negative perception of the prospects associated with agriculture as a career path, there is actually a large unmet need for agriculturalists with a college degree in the US economy (Alston et al., 2019; Goecker et al., 2010; Setterbo et al., 2017). Over the past several decades, there has been a persistent and well-documented trend for a large number of jobs in the agricultural sector requiring a bachelor's degree or higher to either remain vacant or be filled by applicants with degrees from other fields (Goecker et al., 2010; Setterbo et al., 2017). Setterbo et al. (2017) state that “of the 54,000 annual job openings that were estimated to occur within agriculture, food and natural resources between 2010 - 2015, an average of 29,300 graduates from colleges of agriculture and life sciences, forestry and natural resources and veterinary medicine were expected to fill those jobs

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each year” (p.46). Authors have also noted that the sub-fields associated with agriculture have grown more complex, dynamic, and technical over recent decades compared to the public’s view of agriculture as an exclusively dirty and labor-intensive field (Jones & Larke, 2001).

The belief that perceptions of agriculture were playing a key role in enrollment outcomes caused scholars to undertake a large amount of research that was intended to characterize the opinions about agriculture held by undergraduate students at COAs (Baker et al., 2013; Donnermeyer & Kreps, 1994; Dyer et al., 1999; Dyer et al., 1996; George, 1978; Wildman & Torres, 2001). These authors used surveys to gain a better understanding of the factors that influenced COA undergraduates to apply to their programs. Student exposure to agriculture and related fields prior to enrollment in a COA has been widely studied as an important pathway to enrolling in a COA (Dyer et al., 1999; George, 1978; Smith et al., 2010; Wildman and Torres, 2001). This pathway has been considered to include various experiential factors, including prior coursework in AFNR, membership in FFA/4-H, having grown up on a farm or in a rural setting, having engaged in work on a farm or ranch, and having taken part in agriculture related hobbies (Dyer et al., 1999; George, 1978; Smith et al., 2010; Wildman & Torres, 2001). Dyer et al. (1999) found that the strongest predictor of retention in agricultural programs was previous experience with agriculture. Smith et al. (2010), meanwhile, found inconclusive results with regard to the predictive power of agricultural student group participation (FFA) and coursework at the high school level on student success in college.

The influence that parents, professionals, and other associates have on students’ decision to enroll in a COA has also been considered (Dyer et al., 1999; Dyer et al., 1996; George, 1978; Shrestha et al., 2011). In one early study, George (1978) collected survey data on 150 randomly selected agriculture students from Murray State University, which he compared and contrasted with existing data from 1862 Land Grant institutions. He found that for both Murray State students and students of the 1862 Land Grant institutions, slightly more than 60% listed influence from their parents as a factor in their decision to enroll in an agricultural major. Subsequent work has corroborated the important role that parents play in encouraging undergraduates to enroll as a student in an AFNR major (Dyer et al., 1999; Dyer et al., 1996; Rayfield et al., 2013; Rocca & Washburn, 2005; Shrestha et al., 2011).

In a more recent study, Shrestha et al. (2011) explain that “the most influential individuals as information sources for students were parents and family members, other relatives, friends, alumni, high school agriculture teachers, and college faculty members” (p.34). Studies have shown mixed results on the importance of agricultural educators and other professionals in the decision-making process, leading students to enroll in a COA (Donnermeyer & Kreps, 1994; Duncan et al., 2015; Wildman & Torres, 2001). Donnermeyer and Kreps (1994) found that teachers and extension workers were ranked as the least influential factor impacting students’ decision-making. Duncan et al. (2015) found that the importance of teachers versus parents or

other family as influencers for agriculture undergraduates depended on previous experience with agriculture-related clubs. For students with experience in 4-H, family ranked highest; for those with prior FFA experience, agriculture teachers ranked as the most influential adult (Duncan et al., 2015).

Researchers have noted that there is a tension between the need to expand the recruitment pool for COAs and the shrinking number of students from the traditional profile that these institutions have previously recruited from. Dyer et al. (1999) bemoaned the fact that an increasing number of students were enrolling in COAs with an urban background and no previous involvement with agriculture. He claimed urban students with no agriculture exposure were less committed to AFNR fields than students with more agriculture exposure and were more likely to transfer out of the college to another program (Dyer et al., 1999). According to Pepper (2010), “an increasing number of animal sciences students are urban, female, and declare career interests that are dominated by the veterinary profession” (p.25). Many COAs are now majority female and serve a population with less direct exposure to agriculture than their peers from previous decades (Dyer et al., 1999; Lancaster & Robinson, 2011; McMillan et al., 2009; Pepper, 2010; Soberon et al., 2012).

There is significant evidence that suggests that COAs will need to continue to accommodate an increasingly diverse set of students in order to stay viable (Foreman et al., 2018; Powell, 2017). The total number of graduates produced by high schools in the US has been projected to decline from 2014 until 2023 (Foreman et al., 2018). This decline is fueled by a decrease in the number of White and Black graduating students but partly offset by an increase in the number of Latinx, Asian, and Pacific Islander graduates entering the university system (Foreman et al., 2018). Many have predicted that to keep up with demographic trends, COAs will need to continue to broaden their recruitment efforts to attract students from many different backgrounds (Archibeque-Engle & Gloeckner, 2016; Foreman et al., 2018; Powell, 2017).

This study is grounded in Chapman’s (1981) Theory of College Choice. Chapman postulated that students choose to apply to and attend a university or college based on two types of factors which are 1) personal characteristics and 2) outside influences. Student personal characteristics that Chapman identified include socioeconomic status (SES), aptitude, and educational expectations. External influences include the influence of important people in the student’s life, including family, friends, teachers, and others; fixed college characteristics, including cost, location, and programs; and efforts from the college to reach out to students directly, including any type of recruitment or programming offered to student prospects (Chapman, 1981). The experiences and aspirations that we classify in this paper as AFNR pathways include a mix of all of the factors that Chapman identified. While previous studies have examined the connection between these pathways and enrollment in COAs, this study seeks to explain what pre-university experiences are linked to university success as measured by First Term GPA (FTGPA) and six-year graduation rate.

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Several scholars have found that variables which reflect the early academic record of undergraduates, such as first term (FTGPA) and freshman year GPA (FYGPA), are valuable indicators of subsequent success (Barkley & Forst, 2004; Gayles, 2012; Gershenfeld et al., 2016). Barkley and Forst (2004) put it as follows “the college record, once it becomes available at the end of the first semester, becomes paramount in explaining grades in subsequent semesters” (p. 440). Tracking FTGPA has the added benefit of giving an early indication of student performance at the collegiate level, meaning that faculty and staff can intervene early for students who show signs of distress.

### Methods

Elo and Kyngäs (2008) provided a checklist to improve the trustworthiness of a study that we will use as a framework to describe our research methods. In our preparation phase, we sought what Elo and Kyngäs (2008) refer to as the most suitable data to answer our research question. Thus, we received permission from our Institutional Review Board and our Enrollment Management and Services Office to access the application materials of 505 students who were accepted into CALS in the fall of 2013. This is the most recent cohort of students for whom we can examine a six-year graduation rate without the impacts of the COVID-19 pandemic that may have altered graduation timelines. These students' applications are the best available fit for determining what links exist between pre-university experiences and success as defined by First Term GPA and graduation within six years of first enrollment. We took a census, rather than sampling, approach and included all of the admitted students who enrolled and for whom we had complete application data, 491 students total. Of the 505 students who were admitted and enrolled, 14 (2.8%) did not submit written materials, and so they were excluded. We do not have access to information about students who either were not accepted or were accepted but did not enroll. This census approach supports authenticity by ensuring that the range of realities within this cohort of students was available for analysis (Polit & Beck, 2012). To determine which agricultural pathways can be linked to student success – defined as First Term GPA and graduation within six years – we began with a qualitative analysis of the students' written materials and then calculated frequencies of agricultural pathways connection to success in order to describe these students.

In our organizing phase, we analyzed the students' written materials using an inductive approach to content analysis: open coding, creating codes, and abstraction (Elo & Kyngäs, 2008). For the first round of coding, two members of the research team used In Vivo coding to develop codes using the participants' own words (Cresswell & Poth, 2018). An In Vivo approach supports authenticity as it ensures that the codes represent the range of realities present in the data and the lives of the participants (Polit & Beck, 2012; Winter, 2002). These two researchers then met to compare codes and develop categories of pre-university experiences – agricultural pathways. With their defined category list, the researchers completed a second round

of coding independently and met again to compare and refine. They then provided a list of defined categories to an undergraduate student researcher and had them analyze the data using it. This process supported confirmability as the team of researchers was able to build congruence about the meanings in the data and their relevance (Lincoln & Guba, 1985).

Throughout the analysis of the students' writing, the research team maintained an audit trail to ensure confirmability (Lincoln & Guba, 1985). Halpern (1983) established six types of information to maintain for an audit trail – raw data, reduction and analysis products, data reconstruction and synthesis products, process notes, and instrument development information – and Lincoln and Guba (1985) asserted that all six may not be suitable for all studies. As the instrument in this study was the application for admission, and its writing prompts, the researchers were not involved in its development, and it is not included in the audit trail. However, the other types of data have been maintained according to the definitions of each in Lincoln and Guba (1985) as follows:

1. Raw data – students' written responses in their original form
2. Reduction and analysis products – the code list developed through In Vivo coding and researcher memos from the coding process
3. Data reconstruction and synthesis products – category definitions and merged codes to create categories, findings from these categories, connections to the literature
4. Process notes – memos among the research team, analysis process, and procedure directions
5. Intentions and dispositions – goals and objectives of the research, intended methods, team notes, and our bibliography and works cited.

Further, we preserved many of the terms used by the participants in their writing and umbrella terms that captured similar words in order to create a visible audit trail (Cutcliffe & McKenna, 2004).

We applied Elo and Kyngäs's (2008) Reporting Phase questions to the preparation of this document and tasked this document with reporting results logically, providing a description of the analysis process, and addressing trustworthiness. Transferability is the weakest claim in this research. We are not attempting to generalize our results across this group of students because we included all of them. And while we have no reason to believe that students accepted and enrolled for fall 2013 are different from other recent classes, we cannot prove that at this time. Future research will explore other cohorts and provide the ability to compare. This research was to establish a description of this cohort.

To address credibility, it is essential to identify and describe the members of the research team who worked in the qualitative analysis accurately (Lincoln & Guba, 1985). The qualitative analysis was completed by the graduate student researcher, one member of the faculty, and the undergraduate student worker. The graduate student

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completed this work as a portion of his thesis. He comes from an agricultural pathway – a multi-generation dairy farm – but did not pursue agriculture as an undergraduate student. After several years working in food systems and community foods programs, he has pursued a Master's degree in Agricultural and Extension Education. The faculty member is an assistant professor who came from multiple agricultural pathways – 4-H and horseback riding – pursued all of her degrees in agriculture, and worked as an agriculture teacher and FFA Advisor and as a 4-H Youth Development Agent prior to her faculty position. Their levels of exposure to a variety of agricultural fields allowed them to recognize references to agriculture-related experiences in the students' written submissions. The undergraduate student worker is a work-study student enrolled in a college of agriculture as well.

We used R™ to calculate frequencies to describe the pathways students indicated, demographic profiles by pathway, and academic profiles by pathway. As this data was not linearly related, ratio scale data frequencies were an appropriate measure. Other statistical measures, such as Pearson correlations, are not appropriate as the agricultural pathway data is binary – for example, you either worked on a farm or you did not. Our intention was to describe this cohort of students and their pre-university experiences that are linked to success in a COA.

### **Results**

Students discussed a wide range of pathways to enrollment in CALS that were relevant to AFNR, as detailed in Table 1. The specific experiences that students described were diverse, but they all fit under the following categories: work and volunteer experience, career intention, clubs, coursework, personal history, and leisure.

Among the work and volunteer experiences that students described, the most common was work on a farm, which ranged from multigenerational enterprises engaged in intense production agriculture employing large numbers of non-family workers to personal “hobby farms” generating limited or no income. Students were considered to have worked on a farm if they made reference to the place where they worked as a farm and described direct participation in completing chores and other tasks critical to keeping the farm functioning. Among the 491 students in the cohort whose personal statement and/or short response questions were available for study, 76 (15.5%) described participating in some form of paid or volunteer work on a farm.

The second most common form of work or volunteer experience, reported by 49 students, or 10.0% of the target cohort, was completed in a veterinarian's office, animal hospital, or pet shelter. The students in this group completed tasks that ranged from administrative functions to direct animal care. Many of them assisted in surgery, birth, and euthanization.

Participation in landscaping was listed by only seven students, or 1.4% of the cohort, which was surprisingly low considering the fact that NC State University has a well-regarded Horticultural Science Department. Additionally, 17 students or 3.5% of the cohort described participating

in various types of work that were related to AFNR but did not fit into the other work and volunteer subcategories discussed above.

In regard to career intentions that led students to apply to CALS, 151 students, or 30.8% of the cohort, described a career intention of becoming a veterinarian. This number is particularly impressive in comparison to the 32 students, or 6.5% of the cohort, who expressed similarly specific career intentions in all other fields related to AFNR. Desire to join the veterinary profession clearly plays a huge role in driving students into CALS.

The next category of AFNR pathways that students described was participation in clubs with an agricultural and/or natural resource emphasis. FFA was the most commonly discussed club, with 69 students claiming membership, accounting for 14.1% of the cohort. Students were counted as members of the FFA if they identified themselves as such in their personal statements or short response materials. Of the FFA members, 36 students, or 7.3% of the cohort, discussed being an FFA officer.

4-H participation was less commonly discussed. Only 26 students, or 5.3% of the cohort, claimed 4-H membership. This may be attributable to the fact that 4-H in this state often works with younger children, so students may have been less likely to focus on events that were potentially further in their past. Of the students reporting 4-H participation, 12 students, or 2.4% of the cohort, discussed holding a leadership role in the organization.

Just seven students discussed attending summer camps or academies with an agricultural or natural resource focus. These students accounted for only 1.4% of the cohort. Additionally, 15 students, or 3% of the cohort, made reference to membership in a number of other natural resource or agricultural clubs.

Past coursework in agriculture and related fields at the high school level was referenced by 30 students, or 6.1% of the cohort. Although participation in this type of curriculum can be inferred for all high school students in FFA as a requirement for participation, the researchers only coded students as having participated in agricultural and natural resource-focused curriculum if they made explicit reference to these experiences. There were also 14 students, or 2.9% of the cohort, who discussed having taken AFNR courses at a two or four-year institution before transferring to State University.

The students in this study discussed many details that pertain to their personal history. The most common experience which fit into this subcategory was having grown up on or lived on a farm. A total of 89 students, or 18.1% of the cohort, reported this type of personal history. Students were considered to have lived on a farm if they resided in a place that they considered a farm and identified it as such in their writing. This included not only students who had lived on a farm for their entire life but also students who may have lived on a farm for a particular period of time or who stayed with a relative during the growing season.

Having a parent or other influential adult, such as a teacher, who was involved in agriculture was reported by 56 students, or 11.4% of the cohort. Students were assigned this code if they identified a specific adult in their life

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Table 1.

*Pathways to Enrollment in the NC State College of Agriculture and Life Sciences*

	Frequency	%
Students in Cohort for Whom Data was Available	491	-
At Least Some AFNR Experience	319	65.0
<b>Volunteer or Work Experience</b>		
On Farm	76	15.5
Veterinarian, Animal Hospital, or Pet Shelter	49	10.0
Landscaping	7	1.4
Other Work Related to AFNR	17	3.5
<b>Career Intention</b>		
Veterinarian	151	30.8
AFNR Related	32	6.5
<b>Clubs</b>		
FFA Participation	69	14.1
FFA Officer	36	7.3
4-H Participation	26	5.3
4-H Leadership	12	2.4
Attended AFNR Camp or Academy	7	1.4
Other AFNR Clubs and Societies	15	3.0
<b>Coursework</b>		
Secondary ANFR Coursework	30	6.1
Post-Secondary ANFR Coursework	14	2.9
<b>Personal History</b>		
Lived on Farm	89	18.1
Influenced by an Adult Involved in Agriculture	56	11.4
Member of an Agricultural Community	22	4.5
<b>Leisure</b>		
Horseback Riding	49	10.0
Gardening	9	1.8

(parent, teacher, etc.), described that person's connection with agriculture (through a job, personal history, etc.), and explained how their connection with that adult had influenced the student in their life choices.

Another element of personal history that students described was the experience of having grown up in an agricultural community, which was reported by 22 students, or 4.5% of the cohort. In order to be counted among this group, students had to describe agriculture as a constitutive element of the economy and/or the character of their community.

The final category of experience that students described

was participation in leisure activities. Horseback riding was the most commonly reported activity; 49 students spoke about riding horses, accounting for 10% of the cohort. Gardening was reported by 9 students, or 1.8% of the cohort.

In order to get an overall impression of how many students viewed their experience with AFNR as an important element of their application to an undergraduate program in CALS, we created a composite indicator for AFNR pathways. For a student to be coded into this group, it was necessary for them to have described at least one of the experiences discussed above. Our study found that 319

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students, or 65% of the admitted cohort, discussed one of the AFNR pathways that we identified in our study as having played a role in the process that led them to apply to CALS.

### Demographic Profiles by Pathway Category

We sought to demonstrate how race/ethnicity and gender impacted what AFNR pathways students followed to a major in CALS, as shown in Table 2. While no racial or ethnic group is a monolith and combining groups further compounds this issue, there were so few students in some race and ethnicity categories that reporting them separately

risked identifying individual students; thus, we placed non-Hispanic Whites under the category of “White” and all other students under the category of “minoritized groups.” For the sake of comparison, the breakdown of the general population for the entire cohort is also included in this table.

Female students were represented at a rate that was higher than their representation in the general population of the cohort (65%) in pathway categories, including: at least one AFNR pathway (67.8%), volunteer or work experience with a veterinarian, animal hospital or pet shelter (89.8%), career intention to become a veterinarian (90.1%), 4-H participation (76.9%), 4-H leadership (66.7%), attending

**Table 2.**

*Representation for AFNR Pathway Categories.*

	Frequency	Female%	Male%	White%	Minoritized%
Students in Cohort for Whom Data was Available	491	65.0	35.0	86.9	13.1
At Least One AFNR Pathway	319	67.8	32.2	91.2	8.8
<b>Volunteer or Work Experience</b>					
On Farm	76	42.1	57.9	100.0	0.0
Veterinarian, Animal Hospital, or Pet Shelter	49	89.8	10.2	91.8	8.2
Landscaping	7	14.3	85.7	85.7	14.3
Other Work Related to AFNR	17	52.9	47.1	100.0	0.0
<b>Career Intention</b>					
Veterinarian	151	90.1	9.9	90.1	9.9
AFNR Related	32	40.6	59.4	87.5	12.5
<b>Clubs</b>					
FFA Participation	69	63.8	36.2	95.7	4.3
FFA Officer	36	61.1	38.9	100.0	0.0
4-H Participation	26	76.9	23.1	88.5	11.5
4-H Leadership	12	66.7	33.3	83.3	16.7
Attended AFNR Camp or Academy	7	71.4	28.6	71.4	28.6
Other AFNR Clubs and Societies	15	66.7	33.3	93.3	6.7
<b>Coursework</b>					
Secondary AFNR Coursework	30	46.7	53.3	93.3	6.7
Post-Secondary AFNR Coursework	14	50.0	50.0	85.7	14.3
<b>Personal History</b>					
Lived on Farm	89	56.2	43.8	94.4	5.6
Influenced by an Adult Involved in Agriculture	56	57.1	42.9	96.4	3.6
Member of an Agricultural Community	22	63.6	36.4	90.9	9.1
<b>Leisure</b>					
Horseback Riding	49	93.9	6.1	97.9	2.1
Gardening	9	44.4	55.6	77.8	22.2

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AFNR camp or academy (71.4%), attending other AFNR clubs and societies (66.7%), and horseback riding (93.9%).

Male students were represented at a rate that was higher than their representation in the general population in the cohort (35%) in pathway categories, including: volunteer or work experience on a farm (57.9%), landscaping, other work related to AFNR (85.7%), career intention related to AFNR (47.1%), personal history of having lived on a farm (43.8%), having been influenced by an adult involved in agriculture (42.9%), having been a member of an agricultural community (36.4%), having taken secondary coursework in AFNR (53.3%), having taken post-secondary coursework in AFNR (50%), FFA participation (36.2%), FFA officer status (38.9%), and gardening (55.6%).

White students were represented at a rate that was higher than their representation in the general population of the cohort (86.9%) in pathway categories including: at least some AFNR experience (91.2%), volunteer work or experience on a farm (100%), volunteer or work experience with a veterinarian, animal hospital or pet shelter (91.8%), other volunteer or work experience related to AFNR (100%), career intention to become a veterinarian (90.1%), personal history of having lived on a farm (94.4%), personal history of having been influenced by an adult involved in agriculture (96.4%), personal history of having been a member of an agricultural community (90.9%), having taken secondary level AFNR coursework (93.3%), having participated in 4-H (88.5%), having participated in FFA (95.7%), having been an officer in FFA (100%), having participated in other AFNR clubs or societies (93.3%), and having participated in the leisure activity of horseback riding (97.9%).

Minoritized students were represented at a rate that was higher than their representation in the general population of the cohort (13.1%) in pathway categories including: work or volunteer experience with landscaping (14.3%), having taken post-secondary coursework related to AFNR (14.3%), having participated in 4-H in a leadership position (16.7%), having attended an AFNR camp or academy (28.6%), and having participated in the leisure activity of gardening (22.2%).

### **Academic Profiles by Pathway Category**

We have assembled student academic profiles, which include indicators for the AFNR pathway groups, in Table 3. The data is provided as a cross tabulation to provide an easy comparison between groups. It should be noted that these groups inevitably overlap and intersect with one another. We do not intend to imply a causal link between membership in any one of these groups and outcomes such as graduation. Rather, our intention is to give a basis for comparison between groups to give an insight into how students perform on average when they enter the college through their mean first academic term NC State GPA (FTGPA) and their prospects for graduation through the six-year graduation rate.

The student groups with the highest mean FTGPA were those who attended an AFNR camp or academy (3.37), those who participated in 4-H (3.32), and those who participated in gardening (3.30). Additionally, the groups with the highest

six-year graduation rate were those who attended an AFNR camp or academy (100%), those who participated in gardening (100%), and those who participated in FFA as an officer (94.3%). While these numbers appear promising, it should be noted that the students who participated in an AFNR camp or academy and those who participated in gardening were both small groups, consisting of just 7 and 9 students, respectively. FFA officers and 4-H participants represented larger groups representing 36 and 24 students, respectively.

Students with the lowest FTGPA included students who entered the college after having taken post-secondary coursework in AFNR (2.70), students who had an AFNR career intention (2.88), and students who had AFNR work experience in the “other” category (2.89). The student groups with the lowest graduation rate after six years were those who took post-secondary coursework in AFNR (64.3%), students who took secondary coursework in AFNR (73.3), and students who participated in AFNR clubs in the “other category” (73.3).

Interestingly, students who reported having work or volunteer experience with a veterinarian, animal hospital, or pet shelter or who had a career intention to become a veterinarian had relatively high mean FTGPAs (3.11 and 3.10, respectively) but surprisingly low graduation rates (73.5% and 77.5%, respectively). There is likely a considerable amount of overlap between these groups since many of the students reported pursuing volunteer and work experience in animal care settings in order to improve their chances of being admitted to veterinary school.

## **Discussion**

Our analysis demonstrates that AFNR pathways continue to play an important role in attracting students to enroll in undergraduate programs at COAs. Of the students in our target cohort, 65% described an AFNR pathway that was relevant to their decision to apply to CALS. We found that some of the traditional pathways to COA enrollment that other researchers (Donnermeyer & Kreps, 1994; Dyer et al., 1996; Dyer et al., 1999; George, 1978; Wildman & Torres, 2001) have identified, such as work experience on a farm, having lived on a farm, FFA participation, and having been influenced by an adult involved in agriculture, continue to be crucial in attracting students to CALS.

We found evidence to corroborate the research that indicates that interest in animal science and career intention of becoming a veterinarian are major pathways attracting female students (Buchanan, 2008; Dyer et al., 1999; Geocker, 1982; Pepper, 2010). Our data highlights major disparities in the AFNR pathways that are followed by White students as compared with students from minoritized groups. Just 8.8% of the students who described at least one AFNR pathway in their personal statement were from minoritized groups. This was even lower than the overall rate of representation for minoritized student groups in the cohort’s general population which was 13.1%. For pathway categories, including having work or volunteer experience on a farm and FFA officer status, the number of minoritized students who described participating was zero.

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Table 3.

Academic Profiles of AFNR Pathways

	Frequency	FTGPA		6-yr Grad
		Mean	SD.	%
Students in Cohort for Whom Data was Available	491	2.99	0.80	81.8
At Least One AFNR Pathway	319	3.03	0.78	81.8
<b>Volunteer or Work Experience</b>				
On Farm	76	2.92	0.85	81.6
Veterinarian, Animal Hospital, or Shelter	49	3.11	0.83	73.5
Landscaping	7	3.14	0.51	85.7
Other Work Related to ANFR	17	2.89	0.78	82.4
<b>Career Intention</b>				
AFNR Related	151	2.88	1.01	84.4
Veterinarian	32	3.10	0.76	77.5
<b>Clubs</b>				
FFA Participation	69	3.07	0.63	89.9
FFA Officer	36	3.01	0.58	94.4
4-H Participation	26	3.32	0.49	92.3
4-H Leadership	12	3.16	0.61	83.3
Attended AFNR Camp or Academy	7	3.37	0.41	100.0
Other AFNR Clubs and Societies	15	2.84	0.71	73.3
<b>Coursework</b>				
Secondary ANFR Coursework	30	2.99	0.79	73.3
Post-Secondary ANFR Coursework	14	2.70	0.80	64.3
<b>Personal History</b>				
Lived on Farm	89	2.99	0.73	86.5
Influenced by an Adult Involved in Agriculture	56	3.06	0.56	89.3
Member of an Agricultural Community	22	2.93	0.88	90.9
<b>Leisure</b>				
Horseback Riding	49	3.23	0.80	93.9
Gardening	9	3.30	0.59	100.0

However, we found that some AFNR pathways seemed to attract minoritized student groups at higher rates. Our results show that students who participated in agricultural academies or camps and those who participated in gardening were both more diverse than other pathway groups and had very high FTGPAs and six-year graduation rates. It should be noted that the number of students in these two groups was small, and therefore random chance may have impacted the apparent makeup and performance of these groups.

Results pertaining to academic performance for students from the pathway groups were mixed and provide material for further study. While students who described being FFA participants and officers had one of the highest six-year graduation rates of all the AFNR groups, students who described having taken AFNR coursework in high school had a six-year graduation rate that was lower than the cohort average. This is surprising because students can only participate in FFA if they have taken high school coursework in AFNR. This discrepancy should be explored

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further.

Another question that the data presents is why students who accumulate animal care experience and/or have a career intention to become a veterinarian have relatively high FTGPAs but relatively low rates of graduation from CALS. More work should be done to investigate whether these students transfer or drop out of college at elevated rates upon being confronted with the rigor and selectivity of the path to veterinary school.

### Summary

Our study shows that AFNR pathways remain an important route for driving students to enroll in CALS and that some are linked to success as defined by FTGPA and the six-year graduation rate. A total of 65% of the students for whom written application materials were available described an AFNR pathway that was an important factor in their decision to apply to the college. However, the students who identified themselves with at least one pathway were less diverse than the college overall. Only 8.8% of these students were from a minoritized racial or ethnic group. Our comparison of academic outcomes for students in these groups was mixed and provided material for further study on the relevance of FFA participation and AFNR coursework to performance at the college level.

### Recommendations

While many of the traditional AFNR pathways continue to play an important role in recruitment and retention for COAs, it is crucial these institutions find ways to broaden their appeal as well. Interest in animal science and a career intention to become a veterinarian has attracted more female students to enroll in CALS. Yet there is a continued need to broaden the presence of female students in CALS programs other than veterinary science. In light of the evidence that we found, which suggests that students with a career intention to become a veterinarian are high performing but have a relatively low six-year graduation rate, more effort could be taken to find another academic track for students who are ultimately not successful in their aspiration to become a veterinarian. Perhaps incentivizing transfer into another CALS program or a different field in Animal Science would be appropriate for these students.

Additionally, our study shows that CALS has an urgent need to create more pathways for racially and ethnically diverse applicants and enrollees. Further research should be conducted to identify and develop AFNR pathways that attract diverse students and spark interest in pursuing a degree at CALS or another COA. Faculty, staff, and alumni should also work to broaden access to traditional pathways, which are disproportionately dominated by White students. Leadership of traditional AFNR youth organizations such as FFA and 4-H should continue to work to broaden their appeal outside of the traditional core of students that these programs serve. CALS should devote resources to support programming that allows minoritized students to gain direct volunteer or work experience in AFNR. Expanding access to these pathways for high school students of all backgrounds

will help ensure a more secure future for CALS in regard to enrollment and retention.

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