

# The Rural Brain Drain and Choice of Major: Evidence from One Land Grant University

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## Abstract

Rural areas in the U.S. face the challenge of academically talented high school graduates who leave to pursue postsecondary education and often never return. This study assessed migration of 2007 and 2008 bachelor's degree graduates (N = 6,165) from a mid-south land grant university by college. Rural students enrolled in agricultural, food and life sciences (AFLS) (32.3%) at a significantly ( $p < 0.05$ ) higher percentage than the university overall (26.9%). AFLS (21.1%) and engineering (19.4%) had significantly ( $p < 0.05$ ) higher percentages of graduates currently living in rural areas than the university overall (15.3%). Rural AFLS graduates returned to rural communities at a significantly ( $p < 0.05$ ) higher percentage (56.7%) than did rural graduates overall (45.1%). Overall, only 4.3% of graduates originally from non-rural areas were living in rural areas six or seven years after graduation; there were no significant ( $p > 0.05$ ) differences by college. Rural communities experienced a net loss of 716 college-educated individuals over two academic years.

## Introduction

Rural communities in the U.S. must deal with the effects of out-migration of young people to urban and suburban areas (USDA-ERS, 2014; Whitener and McGranahan, 2003). This exodus of youth from rural communities has been dubbed the rural brain drain as the most academically-able rural youth leave for college and often never return to rural communities (Carr and Kefalas, 2009; von Reichert et al., 2011). According to Lichter and Brown (2014), land grant universities should play a key role in enhancing economic, social

and educational opportunities in rural communities. Yet, by their very natures, land grant universities are part of the mechanism whereby the most academically capable rural youth are enabled to leave rural communities, with potentially negative consequences for these communities (Artz and Yu, 2009).

Rural can be defined in a number of ways; a common USDA Economic Research Service (ERS) definition for rural is any county that is not considered metropolitan, meaning these counties contain no urban areas with populations greater than 49,999 (USDA, 2012). From virtually any perspective, Arkansas is a rural state, with 62 of the 75 counties classified as non-metropolitan in the 2010 census (University of Arkansas, 2013). From 1900 to 2010, Arkansas has consistently been home to a higher percentage of rural people than the nation as a whole, with 44% of Arkansas residents classified as rural in the 2010 census compared to 19% of the U.S. population (University of Arkansas, 2013). Arkansas, like many other rural states, deals with the effects of rural out-migration. In the 2010 census, 35 of the 36 counties in Arkansas that experienced population losses were rural counties (University of Arkansas, 2013).

Population changes occur through two mechanisms – natural increases/decreases or migration. In the case of rural communities in Arkansas, population decreases can be largely attributed to out-migration (University of Arkansas, 2013). Much of this out-migration occurs as high school graduates leave rural communities to attend college and, upon degree completion, settle in metropolitan areas where the economic returns to investments in education are greater (Marré, 2014).

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Marré (2014) used data from the U.S. Census Bureau's 2012 Current Population Survey to estimate the percentage of college graduates (Bachelor's degree or higher) in rural areas working in each of 13 industry sectors. Marré estimated more than four in 10 (41.5%) college graduates working in rural areas were employed in the education and health services sector; the next largest sector, manufacturing, employed less than one in 10 (8.9%) college graduates. The agriculture and forestry sector tied (with construction) for seventh, employed 3.4% of college graduates in rural areas; however, this very likely underestimates the percentage of rural college graduates working in what are traditionally considered agricultural occupations. For example, food and feed processing are classified as manufacturing occupations, while farm machinery dealerships and farm supply stores are classified as retail trade occupations (USDOL-BLS, 2014).

Artz and Yu (2009) studied Iowa State University graduates and found that alumni majoring in agriculture and life sciences were both more likely to have been raised in rural areas (44.8%) and to live in rural areas after graduation (26.2%) than were graduates of ISU's other five undergraduate colleges. Graduates in design (18.2%) and engineering (21.2%) were least likely to have been raised in rural areas or to live in rural areas after graduation (5.2% for each). The rural retention rate (percentage living in rural areas / percentage from rural areas) ranged from 24.3% for engineering to 58.5% for agriculture and life sciences.

The University of Arkansas consists of six undergraduate colleges; agriculture, food and life sciences (AFLS), which includes human environmental sciences; architecture; arts and sciences; business; engineering; and education and health professions. The purpose of this study was to examine the migration patterns of 2007 and 2008 bachelor's degree graduates ( $N = 6,165$ ) from the University of Arkansas, overall and by college. Specific objectives were to determine: (1) the overall percentage of graduates from rural areas and if percentages for the six undergraduate colleges differed significantly from the university as a whole; (2) the overall percentage of graduates currently living in rural areas and if percentages for the six undergraduate colleges differed significantly from the university as a whole; (3) the overall percentage of rural graduates returning to rural areas and if percentages for the six undergraduate colleges differed significantly from the university as a whole; (4) the overall percentage of non-rural graduates living in rural areas and if percentages for the six undergraduate colleges differed significantly from the university as a whole; (5) the overall percentage of rural graduates returning to their home communities and if percentages for the six undergraduate colleges differed significantly from the university as a whole; and (6) the overall percentage of rural graduates returning to nearby (within 50 miles) rural communities and if percentages for the six undergraduate colleges differed significantly from the university as a whole.

## Methods

The data set for this study was provided by the University of Arkansas Alumni Association in March 2014 and included parents' (or guardians') zip code at the time the student first enrolled in the university, graduates' current zip code and the undergraduate college for all 2007 and 2008 bachelor's degree graduates ( $N = 6,211$ ). According to the University of Arkansas Alumni Association, alumni mailing addresses (and thus zip codes) are updated every 90 days to ensure that all alumni mailings reach the intended recipient at their current address (T. Dover, personal communication). No names or other personal identifiers were provided so as to maintain the anonymity of graduates. Graduates from 2007 and 2008 were selected for study because, at seven or six years, respectively, after graduation, these alumni were likely to have completed any post-graduate education and early career transfers and be settled into fairly stable residential environments. Parental or current zip codes were not available for 46 (0.74%) alumni; these observations were deleted from the data set, leaving 6,165 valid observations for further analyses.

Parents' zip code (at the time the student entered the university) and graduate's current zip code were used to classify each graduate's pre-college residence and current residence as either rural/small town (hereinafter referred to as rural) or non-rural based on the Rural-Urban Commuting Area (RUCA) zip code approximation database (Rural Health Research Center [RHRC], n.d.). The RUCA zip code approximation database is based on USDA RUCA codes and was last updated in 2005 (Hart et al., 2005). Primary RUCA codes range from one to 10, with codes one through three being "metropolitan" (classified as non-rural for the purpose of this research) and codes four through 10 considered "rural" (USDA, 2012). Under this classification, a zip code was considered rural if it did not contain or partially contain a city of 50,000 or more in population (USDA, 2012). Data were analyzed using descriptive and non-parametric statistics; the 0.05 *alpha* level was set a priori for all tests of statistical significance.

## Results and Discussion

The 6,165 bachelor's degree graduates from 2007 and 2008 were evenly distributed between years at 50.1% and 49.9%, respectively. Slightly over one-half (52.4%) of all graduates were female. The college of arts and sciences had the most graduates (34.5%) followed by business (24.1%), education and health professions (14.0%), AFLS (10.5%), engineering (9.8%) and architecture (3.1%). Chi square analyses revealed no significant ( $p < 0.05$ ) differences by year for number of graduates, gender, or college attended; thus, graduates from the two years were combined for all subsequent analyses.

Overall, 26.9% of 2007 and 2008 graduates were from rural areas as indicated by parents' (or guardians') zip code. At 32.3%, AFLS had a significantly higher

percentage [ $\chi^2(1) = 9.63, p = 0.0019$ ] of graduates from rural areas than did the university as a whole (26.9%). None of the other five undergraduate colleges differed significantly from the overall university in the percentage of graduates from rural areas.

Only 15.3% of 2007 and 2008 graduates lived in rural areas six or seven years after graduation (Table 1). Graduates from AFLS [21.1%;  $\chi^2(1) = 17.01, p < 0.0001$ ] and engineering [19.4%;  $\chi^2(1) = 8.20, p = 0.0042$ ] lived in rural communities in significantly higher percentages compared to all university graduates (15.3%). At 13.4%, the college of arts and sciences [ $\chi^2(1) = 6.30, p = 0.0121$ ] had a significantly lower percentage of graduates currently living in rural areas. The colleges of architecture (16.8%), education and health professions (15.5%), and business (13.5%) did not differ significantly from the university as a whole in the percentage of graduates currently living in rural areas.

**Table 1. Percentages of Graduates from Rural Areas and Currently Living in Rural Areas by College and Overall for 2007 and 2008 Graduates (N = 6,165), as Classified by ZIP Codes**

College	n	Percent from rural areas	Percent currently living in rural areas
AFLS	650	32.3**	21.1**
Architecture	190	32.1 <sup>NS</sup>	16.8 <sup>NS</sup>
Arts & Sciences	2372	26.1 <sup>NS</sup>	13.4*
Business	1485	24.8 <sup>NS</sup>	15.4 <sup>NS</sup>
Education & Health Professions	861	26.7 <sup>NS</sup>	13.5 <sup>NS</sup>
Engineering	607	28.5 <sup>NS</sup>	19.4**
University	6165	26.9	15.3

Note. Within each column one-way chi square tests were used to test for significant ( $p < .05$ ) differences between the university and each college in the percentage of graduates currently living in rural areas.

<sup>NS</sup>, \*, \*\*, \*\*\*, Nonsignificant or significant at  $p = 0.05, 0.01, \text{ or } 0.001$ .

**Table 2. Percentages of Rural and Non-rural Graduates' Currently Living in Rural Areas by College and Overall (N = 6,165)**

College	n	Graduates originally from:			
		Rural areas		Non-rural areas	
		n	Percent currently living in rural area	n	Percent currently living in rural area
AFLS	210	56.7***	440	4.1 <sup>NS</sup>	
Architecture	61	36.1 <sup>NS</sup>	129	7.8 <sup>NS</sup>	
Arts & Sciences	617	41.5 <sup>NS</sup>	1755	3.6 <sup>NS</sup>	
Business	368	41.0 <sup>NS</sup>	1117	4.5 <sup>NS</sup>	
Education & Health Professions	230	48.3 <sup>NS</sup>	631	3.8 <sup>NS</sup>	
Engineering	173	51.4 <sup>NS</sup>	434	6.7*	
University	1659	45.1	4506	4.3	

Note. Within each column one-way chi square tests were used to test for significant ( $p < .05$ ) differences between the university and each college in the percentage of graduates currently living in rural areas.

<sup>NS</sup>, \*, \*\*, \*\*\*, Nonsignificant or significant at  $p = 0.05, 0.01, \text{ or } 0.001$ .

**Table 3. Percentages of Rural Graduates (n = 1,659) Currently Living in Home Community or Rural Area within 50 Miles of Home by College and Overall**

College	n	Percent of rural graduates currently living in rural home community	Percent of rural graduates living in rural home community or in rural area near ( $\leq 50$ miles) home community
AFLS	210	41.0 <sup>NS</sup>	46.2*
Architecture	61	31.2 <sup>NS</sup>	32.8 <sup>NS</sup>
Arts & Sciences	617	33.6 <sup>NS</sup>	37.6 <sup>NS</sup>
Business	368	33.2 <sup>NS</sup>	35.6 <sup>NS</sup>
Education & Health Professions	230	34.4 <sup>NS</sup>	41.3 <sup>NS</sup>
Engineering	173	37.6 <sup>NS</sup>	44.5 <sup>NS</sup>
University	1659	34.8	39.3

Note. Within each column one-way chi square tests were used to test for significant ( $p < .05$ ) differences between the university and each college in the percentage of graduates currently living in rural areas.

<sup>NS</sup>, \*, \*\*, \*\*\*, Nonsignificant or significant at  $p = 0.05, 0.01, \text{ or } 0.001$ .

Of the 1,659 graduates originally from rural areas, less than half (45.1%) were living in rural areas six or seven years after graduation (Table 2). At 56.7%, rural AFLS graduates were significantly more likely to currently live in a rural area than were university graduates as a whole,  $\chi^2(1) = 11.37, p = 0.0007$ . No other college differed significantly ( $p > 0.05$ ) from the university in the percentage of rural graduates living in rural areas.

Of the 4,506 graduates originally from non-rural areas, only 194 (4.3%) currently lived in rural areas (Table 2). Only the college of engineering differed significantly from the university in the percentage of graduates (6.7%) from non-rural areas currently living in rural areas,  $\chi^2(1) = 6.11, p = 0.0134$ .

Overall, 577 of the 1,659 (34.8%) graduates originally from rural areas were living in the same zip code area as their parents six to seven years after graduation and were considered to have returned to their own rural home communities (Table 3). By college, the percentages of rural graduates returning to their home communities ranged from 31.2% for architecture to 41.0% for AFLS, with no significant ( $p > 0.05$ ) differences between any college and the university as a whole.

Overall, 39.3% of graduates from rural areas ( $n = 1,659$ ) were currently living either in their home community or in a rural community within 50 miles of their home community, as measured from center to center of zip code areas (Table 3). AFLS (46.2%) had a significantly higher percentage of graduates living in their own or nearby rural communities compared to the university as a whole,  $\chi^2(1) = 4.18, p = 0.0409$ . There were no other significant ( $p > 0.05$ ) differences between any college and the university overall.

To determine the relative “stickiness” of rural and non-rural areas, the percentages of graduates returning to their home and nearby (within 50 miles) areas were also compared for rural and non-rural graduates. At 34.8% and 36.1%, graduates from rural and non-rural areas, respectively, did not differ significantly in the percentages currently living in the same zip code area as their parents,  $\chi^2(1) = 0.90, p = 0.3429$ . However, a significantly lower percentage of rural graduates (39.3%) than non-rural graduates (59.3%) lived in areas within 50 miles of their parents,  $\chi^2(1) = 135.88, p < 0.0001$ .

## Discussion

These results document the reality of the brain drain for rural communities sending students to one land grant university (Carr and Kefalas, 2009; Howley, 1996). For the 2007 and 2008 graduating classes, rural communities sent 1,659 students to the university and, in return, received 748 rural and 194 non-rural graduates for a net loss of 717 (43.2%) graduates. While this may not constitute the “hemorrhage” claimed by



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Carr and Kefalas (2009, p. 1), it does represent a significant decline in both the population and intellectual capital of these rural communities.

Although Arkansas is considered a rural state with nearly one-half (40.7%) of all public school students classified as rural (Provasnik et al., 2007), only 26.9% of 2007 and 2008 graduates of the University of Arkansas were from rural areas. Thus, rural students are underrepresented among graduates of their state land grant university. This finding is consistent with previous research reporting a positive association between hometown population and the probability of students applying for admission to the University of Minnesota, a land grant university (DesJardins et al., 1999).

The overwhelming majority (84.7%) of graduates from the University of Arkansas lived in non-rural areas six or seven years after graduation. Graduates from AFSL (21.1%) and engineering (19.4%) resided in rural communities at significantly higher rates compared to all university graduates (15.3%). Yet, according to Marré (2014), agriculture and manufacturing together accounted for only 12.3% of rural jobs requiring a bachelor's degree or higher. Either AFSL and engineering graduates are working in areas not related to their majors or the percentages cited by Marré (2014) underestimate the rural career opportunities available AFSL and engineering graduates.

As might be expected, AFSL attracted a larger percentage of rural students (32.3%) compared the university as a whole (26.9%). AFSL also had more rural graduates living in rural areas (56.7%) and returned significantly more rural graduates to communities within 50 miles of their home community (46.2%). Thus, AFSL majors may be especially suitable for preparing rural students to return to rural communities, helping to ameliorate the rural brain drain. Rural AFSL majors likely include many of the students "with the firm intent of coming back despite the limitations in rural labor markets" (von Reichert et al., 2011, p. 42).

Conversely, AFSL graduates originally from non-rural areas (4.1%) were no more likely than other non-rural graduates (4.3%) to currently live in a rural area. Thus, graduation from AFSL is not associated with rural residence for graduates originally from non-rural areas. Instead, it appears that graduating with an AFSL major is associated only with rural graduates returning to rural areas. Again, this is consistent with the work of von Reichert et al. (2011).

Non-rural graduates (59.3%) were significantly more likely to live within 50 miles of their home community than were rural graduates (33.9%). This is likely due to the greater demand for educated workers in more metropolitan areas (Marré, 2014).

## Recommendations

The results of this study should be shared with rural educators, policy makers, parents and others. Rural educators and parents should be aware of and discuss with rural youth the fact that selection of a college major

influences more than what students will study; it may also influence where the graduate will later live. Rural students in this state with a desire to return to rural communities should be informed of the rural employment opportunities available to graduates.

AFSL should highlight these results in efforts to recruit students. Rural students and parents should be informed that AFSL graduates are more likely to return to rural communities, especially rural communities within 50 miles of home. This would likely be a potent recruiting message in rural communities, given the importance rural residents place on family and community (Meece et al., 2013). Conversely, since AFSL graduates originally from non-rural areas were no more likely than other university graduates to currently live in a rural area, AFSL may also be able to better recruit non-rural students by emphasizing the availability of employment opportunities in metropolitan areas.

Research should be conducted to determine the specific types of jobs secured by AFSL and engineering graduates living in rural areas. Are these graduates working in careers that make use of the specific skill sets developed in their degree programs or are students accepting out-of-field employment as the cost of living in a rural area (Reichert et al., 2011)?

Land grant universities, with their historical commitment to rural areas, must play a key role in enhancing rural economic opportunities (Lichter and Brown, 2014). If rural communities are to survive, this role must include economic development activities that will increase the demand for college educated workers in rural communities. Without availability of sufficient high-skill jobs, rural communities will most likely continue to export their most academically talented students to metropolitan areas.

This study used a limited data set, applicable only to the graduates from the University of Arkansas, and left a need to gain more detailed data about rural graduates. Research should be conducted to better understand the educational, occupational, and residential aspirations of rural youth in Arkansas. While these results for University of Arkansas AFSL graduates were consistent with those for Iowa State University agriculture graduates (Artz and Yu, 2009), this study should be replicated in other, less rural states to determine if these migration patterns are present in other land grant universities serving more urbanized states. Additionally, further research is needed to determine the status and satisfaction of rural college graduates, both those returning to rural areas and those living in non-rural areas.

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