Interactions & Environmental Attitudes:
A Statistical Analysis of How Experiences Determine Outlook Towards Goucher's Woods

Word Count: 4,205

Introduction

'Ecosystem services' is a body of literature devoted to classifying and understanding how human communities interact with their local ecosystem. This framework for understanding human-nature relationships begun its development in the early 2000s through the Millennium Assessment, a paper that provided the basis for several revisions thereafter, notably SEEA2012 and CICES2012. In his essay espousing the benefits of this perspective, Salzman describes these services as "…purification of air and water, pest control, renewal of soil fertility, climate regulation, pollination of crops and vegetation, and waste detoxification and decomposition" noting that they are "Created by the interactions of living organisms with their environment, ecosystem services provide both the conditions and processes that sustain human life" (Salzman, 1997). The various iterations of the framework purport classification into three to four groups: cultural/aesthetic, regulating, and provisional.

In the context of Goucher College, one large part of our community's ecosystem is the surrounding woods, which occupy a large portion of the campus' 287 acres. And while the food and heating needs of the College are fulfilled through contracts with Bon Appetit and other local companies (thus negating the provisional aspect of the Woods regarding the remaining categories) the Goucher Woods are an important aspect of the Goucher community's relationship with its ecosystem. The purpose of this study is to better understand how Goucher students relate to the Woods surrounding Goucher's campus in terms of both regulatory and cultural/aesthetic services, which are measured by scales of Environmental Responsibility and Environmental Identity for the cultural/aesthetic services, and Environmental Knowledge for the regulatory services. Additionally, the analysis aims to examine the question; How do individuals' interactions with the Woods influence their environmental attitudes?

This paper hypothesizes that the interactions that students have with the Goucher Woods (as measured by the three independent variables Residence, Visit, and Class_Visit) have a

positive effect on their environmental attitudes (as measured by the three attitude subscales; Environmental Knowledge, Environmental Responsibility, and Environmental Identity).

Methodology

To evaluate Goucher students' attitudes towards the Woods, a survey instrument of 19 questions was designed using Qualtrics software, aptly titled "Attitudes Toward Goucher's Woods". Three of these questions were demographics, and 12 inquired about various aspects that influence environmental attitudes. Administered via social media website Facebook, as well as email messages to Goucher students this survey was in the field for 2 weeks during the Fall semester.

Results were analyzed using IBM's SPSS software, for both descriptive and inferential statistics. Frequency tables were obtained for the variables under examination, and crosstabulations were used as most variables were ordinal level. Chi-Squared tests were performed for significance, and then Cramer's V tests and Lambda tests were used to determine correlation and strength of relation. Additionally, one and two sample, two-tailed hypothesis tests were performed with variables indicated significant by the Chi-Squared.

Results

In total, 107 complete responses were collected. The demographic information collected revealed that the most respondents were of sophomore class rank at 34.6% (25.2 – 44.0%) of total responses, followed closely by students of senior rank at 32.7% (23.3 – 42.1%). The average respondent was female, with a mean of 1.65 and a standard deviation of 1.289. Accordingly, 64.5% (55.2 – 73.9%) of respondents identified as female, 27.1% (17.7 – 36.5%) identified as male, and 8.4% (0 – 17.8%) did not identify with the gender binary (Non-Conforming, Not Listed, or Preferred Not to Answer). Of the variables comprising the 'Interactions' group, 31.8% (22.4 – 41.2%) of respondents report visiting the Woods 'Often', 30.8% (21.4 – 40.2%) responded 'Sometimes' and 37.4% (28.0 – 46.8%) 'Rarely' which is depicted in Figure 1. Additionally, 82.2% (72.8 – 91.6%) of respondents live On Campus, and only 37.4% (28.0 – 46.7%) have visited the Woods as a part of a class activity (Figure 2).

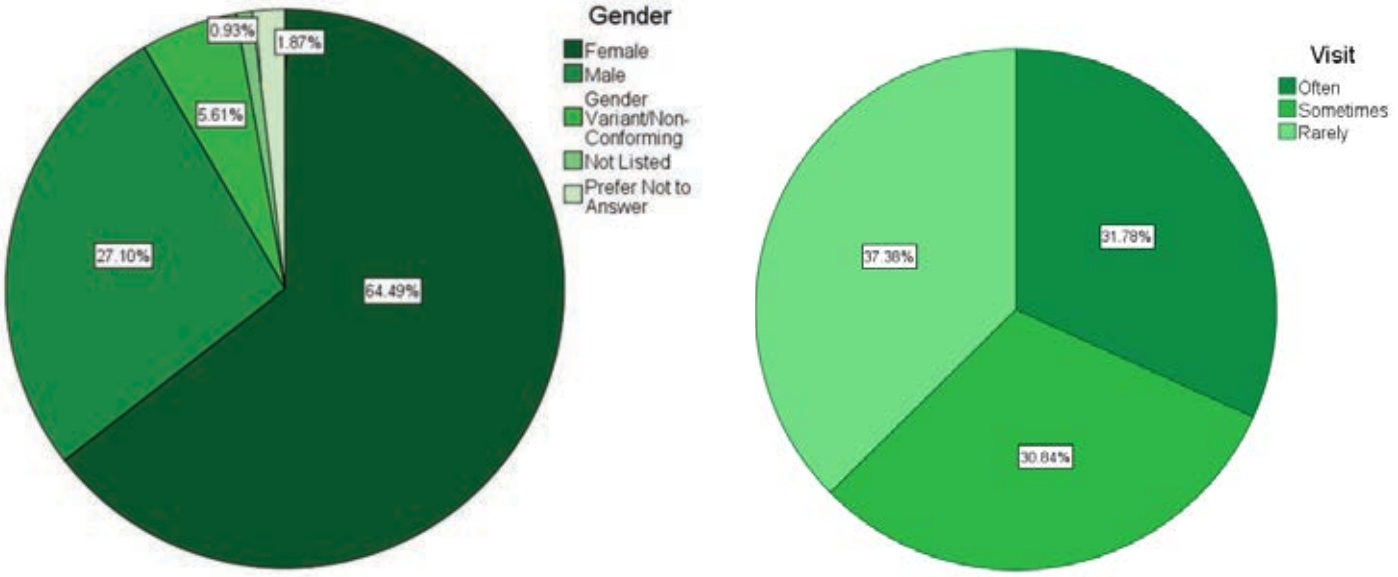


Figure 1. Displays the piecharts of the variable Gender on the right, and Visit on the left.

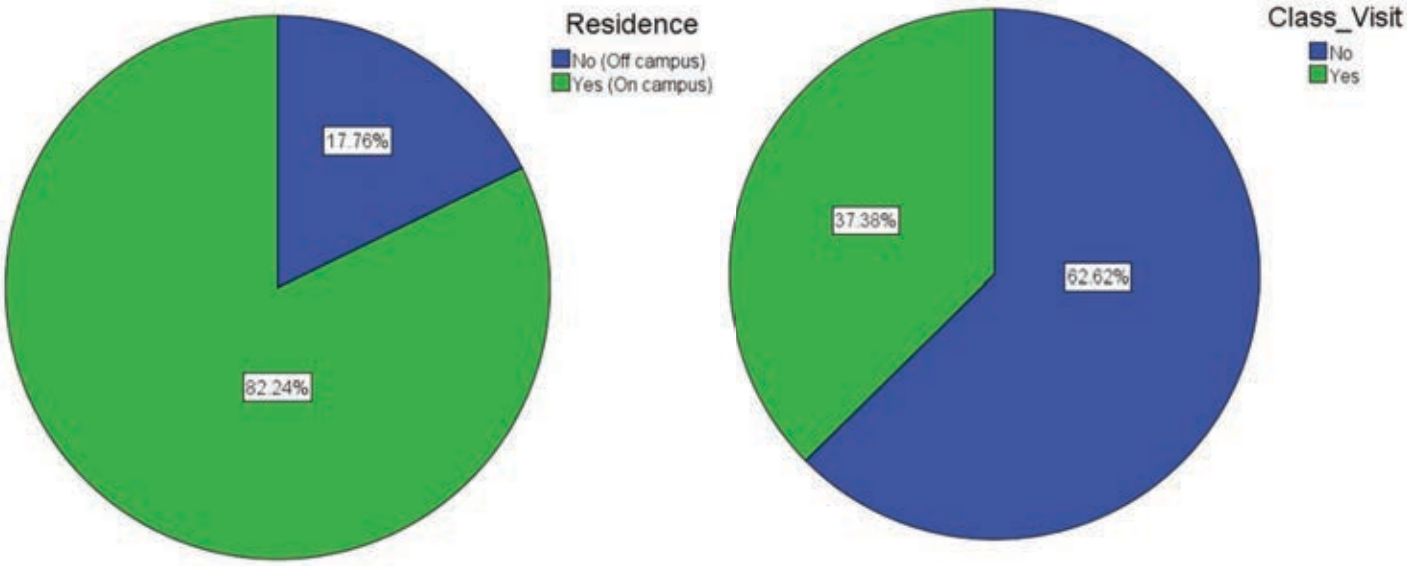


Figure 2. The X variable Residence is displayed on the left, and the X variable Class_Visit is displayed on the right

To understand how this survey sample represents the Goucher population, a one sample, 2-sided hypothesis test was conducted at the alpha level of 0.05, with a z(critical) of ±1.96. The null hypothesis states that $P_u = 0.83$ and the alternate hypothesis states that $P_u \neq 0.83$. The z(obtained) returned a value of -0.28, which falls within the z(critical) and thus we fail to reject the null hypothesis. No conclusive results can be drawn as to whether the sample accurately portrays Goucher's population.

Each subscale contains four variables regarding environmental attitudes, and each of these four dependent variables was plotted against the independent variables of 'Interactions' (Residence, Visit, Class_Visit). This paper will examine each subscale and their relationships with the X variables. Chi Square test results are listed in Table 1, Cramer's V test results can be found in Table 2, and Table 3 depicts the results of the Lambda tests.

SubScale	Variables (Y*X)	X_2	P
Environmental Knowledge	Attitude_5 * Visit	36.94	0.012
Environmental Responsibility	Attitude_11 * Visit	31.654	0.047
	Attitude_12 * Visit	37.539	0.01
	Attitude_12 * Class_Visit	10.299	0.036
Environmental Identity	Attitude_3 * Residence	10.907	0.028
	Attitude_3 * Visit	32.962	0.034
	Attitude_6 * Visit	40.096	0.005
	Attitude_10 * Residence	11.181	0.011
	Attitude_10 * Visit	58.487	0

Table 1. Displays all significant variables at the alpha level of 0.05 for the Chi Square Test.

Cramer's V Test, All Significant Variables			
SubScale	**Variables (Y*X)**	**Cramer's V**	**Strength**
Environmental Knowledge	Attitude_5 * Visit	0.588	Strong
Environmental Responsibility	Attitude_11 * Visit	0.275	Moderate
	Attitude_12 * Visit	0.601	Strong
	Attitude_12 * Class_Visit	0.315	Strong
Environmental Identity	Attitude_3 * Residence	0.319	Strong
	Attitude_3 * Visit	0.555	Strong
	Attitude_6 * Visit	0.612	Strong
	Attitude_10 * Residence	0.325	Strong
	Attitude_10 * Visit	0.743	Strong

Table 2. Displays all significant variables (as determined by the Chi Square Test at the alpha level of 0.05), their associated Cramer's V value, and the strength of the relationship between the variables.

Lambda Test, All Significant Variables				
SubScale	**Variables (Y*X)**	**Value**	**Significance**	**Strength**
Environmental Knowledge	Attitude_5 * Visit	0.113	0.286	Moderate
Environmental Responsibility	Attitude_11 * Visit	0	Insignificant	
	Attitude_12 * Visit	0.159	0.073	Weak
	Attitude_12 * Class_Visit	0	Insignificant	
Environmental Identity	Attitude_3 * Residence	0	Insignificant	
	Attitude_3 * Visit	0.18	0.081	Weak
	Attitude_6 * Visit	0.133	0.208	Moderate
	Attitude_10 * Residence	0	Insignificant	
	Attitude_10 * Visit	0.169	0.55	Strong

Table 3. Depicts all significant variables (as determined by the Chi Square Test at the alpha level of 0.05), their associated Lambda value, the Lambda significance value, and the strength of the association.

The first subscale is "Environmental Knowledge", comprised of Attitudes 4, 5, 8, and 9. Chi Square tests were performed on each, and the results are listed in Table 2. Attitude_5 * Visit, as the only statistically significant crosstabulation, compares the frequency with which Goucher students visit the Woods and their agreement with the statement that the Woods lower the surrounding temperature. A Cramer's V test was conducted on this combination, returning a value of 0.588, as is depicted in Table 2, Attitude_5 * Visit exhibits a strong relationship between. A lambda test was then conducted on the pair, which returned a value of 0.113 and a significance value of 0.286, which indicates moderate association between the variables, as seen

in Table 3. Additionally, a two-sided, two sample hypothesis test was performed on this pair. For the purpose of comparison, the variable Attitude_5 was collapsed from five categories to three: Agree, Neutral, and Disagree. Likewise, the variable Visit was collapsed into Often, Sometimes, and Rarely. The hypothesis test compared 'Agree' with 'Often', at the alpha level of 0.05. The null hypothesis, H_0: $P_{S1} = P_{S2,}$ states that there is no correlation between the two variables, and that the variables are not dependent, while the alternate hypothesis, H_A: $P_{S1} \neq P_{S2}$ states that there is correlation between the two variables, and that the variables are dependent. The test returned a z(obtained)=5.4094, which falls outside of the z(critical)=±1.96, thus the null hypothesis of no correlation and independence is rejected; the more often Goucher students visit the Woods, the more they agree that the presence of the Woods lowers the temperature.

The second subscale is "Environmental Responsibility" comprised of Attitudes 1, 7, 11, and 12. After performing Chi Square tests on each crosstabulation, three combinations were determined to be statistically significant; Attitude_11 * Visit, Attitude_12 * Visit, and Attitude_12 * Class_Visit, as depicted in Table 1. Thus, these three pairs were then subjected to a Cramer's V test, which indicates the strength of the relationship. The relationship between Attitude_11 and Visit studies how the frequency with which Goucher students visit the Woods influences their anguish over the removal of trees for better facilities, and will be explored first. The Cramer's V test returned a value of 0.275, which indicates a moderate relationship between the two variables. However, the lambda test returned a value of 0, indicating that the association between the two variables is insignificant. A two-sided, two sample hypothesis test was performed on these two variables, which were collapsed in the same manner as the previous data. The hypothesis test compared 'Agree' with 'Often', at the alpha level of 0.05. The null hypothesis, H_0: $P_{S1} = P_{S2,}$ states that there is no correlation between the two variables, and that the variables are independent, while the alternate hypothesis, H_A: $P_{S1} \neq P_{S2}$ states that there is correlation between the two variables, and that the variables are dependent. The test returned a z(obtained)=7.9764, which falls outside of the z(critical)=±1.96, thus the null hypothesis of no correlation and independence is rejected; the more often Goucher students visit the Woods, the more they agree that they would be upset if trees were cut down, even if for better facilities.

The next pair under examination is Attitude_12 * Visit, which examines how the frequency with which Goucher students visit the Woods influences their willingness to volunteer

for a clean-up of the Woods. This pair produced a Cramer's V value of 0.601, indicating a strong relationship between the variables. The Lambda test returned a value of 0.159 and a significance value of 0.073, which demonstrates a weak association. A two-sided, two sample hypothesis test was performed on this data, and the variables were collapsed like above. The hypothesis test compared 'Agree' with 'Often', at the alpha level of 0.05. The null hypothesis, H_0: $P_{S1} = P_{S2,}$ states that there is no correlation between the two variables, and that the variables are not dependent, while the alternate hypothesis, H_A: $P_{S1} \neq P_{S2}$ states that there is correlation between the two variables, and that the variables are dependent. The test returned a z(obtained)=5.5152, which falls outside of the z(critical)=±1.96, thus the null hypothesis of no correlation and independence is rejected; the more often Goucher students visit the Woods, the more they agree that they would volunteer for a clean-up of the Woods.

The final significant pairing from the Environmental Responsibility subscale is Attitude_12 * Class_Visit, which examines how the likelihood of a class activity occurring in the Woods influences Goucher students' willingness to volunteer for a clean-up of the Woods. A Cramer's V test was conducted on these two variables, returning a value of 0.315, pointing to a strong relationship between the two. However, the following lambda test returned a value of 0, indicating that the association is statistically insignificant. A two-sided, two sample hypothesis test was performed on the data. The hypothesis test compared 'Agree' with 'Yes', at the alpha level of 0.05. The null hypothesis, H_0: $P_{S1} = P_{S2,}$ states that there is no correlation between the two variables, and that the variables are independent, while the alternate hypothesis, H_A: $P_{S1} \neq P_{S2}$ states that there is correlation between the two variables, and that the variables are dependent. The test returned a z(obtained)=4.7965, which falls outside of the z(critical)=±1.96, thus the null hypothesis of no correlation and independence is rejected; the more classes that visit the Woods, the more likely Goucher students are to volunteer for a clean-up of the Woods.

The third subscale, Environmental Identity, consisted of four variables; Attitudes 2, 3, 6, and 10. Chi Square tests were performed on all iterations of these variables with Residence, Visit, and Class_Visit, and five returned values that are statistically significant; Attitude_3 * Residence, Attitude_3 * Visit, Attitude_6 * Visit, Attitude_10 * Residence, and Attitude_10 * Visit. We will first explore the relationship between Attitude_3 and Residence, which studies how the location of Goucher students' homes influences their enjoyment of the Woods. The

crosstabulation and Cramer's V test revealed a value of 0.319, which indicates a strong relationship. However, the lambda test returned a value of 0, pointing towards a statistically insignificant association. a two-sided, two sample hypothesis test was performed on these variables. The hypothesis test compared 'Agree' with 'On Campus', at the alpha level of 0.05. The null hypothesis, H_0: $P_{S1} = P_{S2,}$ states that there is no correlation between the two variables, and that the variables are not dependent, while the alternate hypothesis, H_A: $P_{S1} \neq P_{S2}$ states that there is correlation between the two variables, and that the variables are dependent. The test returned a z(obtained)= -11.3569, which falls outside of the z(critical)=±1.96, thus the null hypothesis of no correlation and independence is rejected; the more likely Goucher students are to live on campus, the more likely they are to disagree that time in the Woods is boring.

Attitudes_3 was also statistically significant when paired with Visit, and thus was subjected to a Cramer's V test, which returned a value of 0.555, indicating a very strong relationship. Additionally, the lambda test returned a value of 0.18, with a significance value of 0.082, demonstrating a weak association between the variables. A two-sided, two sample hypothesis test was performed on the data. The hypothesis test compared 'Agree' with 'Often', at the alpha level of 0.05. The null hypothesis, H_0: $P_{S1} = P_{S2,}$ states that there is no correlation between the two variables, and that the variables are independent, while the alternate hypothesis, H_A: $P_{S1} \neq P_{S2}$, states that there is correlation between the two variables, and that the variables are dependent. The test returned a z(obtained)= -5.0848, which falls outside of the z(critical)=±1.96, thus the null hypothesis of no correlation and independence is rejected; the more often Goucher students are to visit the Woods, the less likely they are to agree that spending time in the Woods is boring.

Attitude_6 * Visit compared whether bugs, poison ivy, and other threats influenced the frequency with which Goucher students visited the Woods. Through the Cramer's V, this pair returned a value of 0.612, demonstrating a strong relationship. Furthermore, the lambda test returned a value of 0.133, with a significance value of 0.208 indicating a moderate association between the two variables. A two-sided, two sample hypothesis test was performed on the data. The hypothesis test compared 'Agree' with 'Often', at the alpha level of 0.05. The null hypothesis, H_0: $P_{S1} = P_{S2,}$ states that there is no correlation between the two variables, and that the variables are independent, while the alternate hypothesis, H_A: $P_{S1} \neq P_{S2}$ states that there is

correlation between the two variables, and that the variables are dependent. The test returned a z(obtained)= -1.3029, which falls inside of the z(critical)=±1.96, thus we fail to reject the null hypothesis of no correlation and independence.

Attitude_10 * Residence compared whether one's enjoyment of the Woods is influenced by their abode on or off Goucher's campus. Once the crosstabulation was subjected to a Cramer's V test, returning a value of 0.325, indicating a strong relationship between the two variables. However, the lambda test returned a value of 0, pointing to a statistically insignificant association. A two-sided, two sample hypothesis test was performed on the data. The hypothesis test compared 'Agree' with 'On Campus', at the alpha level of 0.05. The null hypothesis, H_0: $P_{S1} = P_{S2,}$ states that there is no correlation between the two variables, and that the variables are independent, while the alternate hypothesis, H_A: $P_{S1} \neq P_{S2}$ states that there is correlation between the two variables, and that the variables are dependent. The test returned a z(obtained)= -1.075, which falls inside of the z(critical)=±1.96, thus we fail to reject the null hypothesis of no correlation and independence.

Attitude 10 ("I am the kind of person who loves spending time in the woods") was also found to be statistically significant through the Chi Square test with the explanatory variable Visit. This compared whether Goucher students' enjoyment of the Woods is influenced by the frequency with which they visit the Woods. The Cramer's V test returned a value of 0.743, demonstrating a strong relationship. Additionally, the lambda test returned a value of 0.169, with a significance value of 0.55, which indicates a strong association between the two variables. A two-sided, two sample hypothesis test was performed on this data. The hypothesis test compared 'Agree' with 'Often, at the alpha level of 0.05. The test returned a z(obtained)=6.4328, which falls outside of the z(critical)= ±1.96, The null hypothesis, H_0: $P_{S1} = P_{S2,}$ states that there is no correlation between the two variables, and that the variables are not dependent, while the alternate hypothesis, H_A: $P_{S1} \neq P_{S2}$ states that there is correlation between the two variables, and that the variables are dependent. The test returned a z(obtained)= -5.0848, which falls outside of the z(critical)= ±1.96, thus the null hypothesis of no correlation and independence is rejected; the more that Goucher students enjoy being outdoors, the more likely they are to visit the Woods.

As a measure of validity, two questions were asked regarding the same topic in both a positive and negative phrasing, asking whether the respondent enjoys being in the woods ("I

think spending time in the woods is boring" vs "I am the kind of person who loves spending time in the woods"). The results of these two variables were analyzed using a bivariate analysis table and Spearman's test. The null hypothesis for this test states that the variables are independent and there is no correlation between them, while the alternate hypothesis states the variables are dependent and there is a correlation. The two variables, Attitude_3 and Attitude_10, returned a correlation coefficient of -0.601 and a significance value of 0.00, which is significant at both the 0.01 and 0.05 level. These results indicate that there is a significant correlation between the two variables, which is also noted by the negative coefficient, a feature that describes the inverse relationship between Attitude_3 and Attitude_10. These findings translate to respondents answering the questions in accordance with one another, for example, a Goucher student who identifies as the type of person who enjoys spending time in the woods also disagrees that spending time in the Woods is boring.

Analysis

Goucher Community Comparison

Of the three explanatory variables, Visit, measuring the frequency with which Goucher students visit the Woods, was the most statistically significant across the three scales. This statistical significance is apparent with the response variables Attitude_3, Attitude_5, Attitude_6, Attitude_10 Attitude_11, and Attitude_12. The variable Residence, measuring where Goucher students live, was statistically significant twice, with Attitude_3 and Attitude_10, while the variable Class_Visit, measuring if Goucher students had visited the Woods with a class, was statistically significant once, with the variable Attitude_12. The goal of this paper is to better understand how Interactions with the Woods influences Goucher students' attitudes towards the environment, which is understood and categorized into three subscales, measuring Knowledge, Responsibility, and Identity. Of the Knowledge subscale, only one variable Attitude_5, measuring respondents' agreement with the statement "The woods lower the temperature of the campus during hot days", was shown to be statistically significant, and exhibited a strong relationship with the frequency with which Goucher students visit the Woods. This finding indicates that students exposed to nature more frequently understand the regulatory benefits that the Woods provide. This finding echoes the research of Michael Tarrant and Gary Green of the University of Georgia in their study of Outdoor Recreation and Environmental Attitudes, who found that "Indirect experiences may increase awareness and understanding of environmental

issues (thereby producing Pro-environmental attitudes) but are less likely to influence behavior because they are less personal and relevant (and thereby make attitudes less accessible) than forms of direct involvement" (Tarrant & Green, 1999). This is relevant to our research, as even though Attitude_5 * Visit exhibits a strong relationship, overall the Environmental Knowledge subscale was not very salient in relation to the overall inquiry of understanding Goucher students environmental attitudes. The analyzed results of this subscale indicate that Interactions with the Woods are positively influential on Goucher students' environmental attitudes, which supports the overall thesis of this project.

The second subscale, Environmental Responsibility, was statistically significant with two dependent variables that measured the feelings of stewardship that Goucher students experience. Interestingly enough, Attitude_1 "Being environmentally responsible is important to me" was not statistically significant across any of the independent Interaction variables, perhaps because of the vague implications of the question. However, the more often Goucher students visit the Woods, the more they agree that they would be upset if trees were cut down, even if for better facilities. The work of Jackson in 1986 captured the same sentiment, stating that outdoor recreation "…generates an aesthetic appreciation for a natural versus a developed environment, thereby further promoting an opposition to environmental degradation" (Tarrant & Green, 1999). Additionally, Attitude_12, which measured Goucher students' likelihood of volunteering for a clean-up of the woods, exhibited a strong, positive relationship with both the number of classes visiting the Woods and the frequency with which Goucher students visit the Woods of their own accord. This echoes the work of Dunlap & Hefferman in 1975, who reported that "…appreciative outdoor recreation activities may provide a potential constituency for environmental organizations" (Tarrant & Green, 1999). Sentiments such as these exhibit the importance of Interactions influencing environmental attitudes of Goucher students. The analyzed results of this subscale indicate that Interactions with the Woods are positively influential on Goucher students' environmental attitudes, which supports the overall thesis of this project.

The third subscale, "Environmental Identity", attempts to understand how Goucher students understand their own relationship with the Woods. Two of the questions, as stated above, were performed as a validity test, and therefore repeat the same sentence, once in the negative and once in the positive. Both of these questions, Attitude_3 and Attitude_10, were

found to be statistically significant with the variable Visit, indicating that contact with the Woods influences Goucher students' appreciation and enjoyment of nature. Additionally, the more likely Goucher students are to live on campus, the more likely they are to disagree that time in the Woods is boring. This leads to the possibility that being surrounded by and exposed to greenery fosters a deeper enjoyment of the Woods. This attitude matches the work of Gale in 1972, which indicates that "A strong attachment to outdoor recreation activities can manifest itself as a responsibility to preserve attributes of the environment that contribute directly to the enjoyment of that activity" (Tarrant & Green, 1999). The analyzed results of this subscale indicate that Interactions with the Woods are positively influential on Goucher students' environmental attitudes, which supports the overall thesis of this project.

However, there were two variable combinations that were deemed significant by the Chi Square test that, when tested in a two sample, two-sided hypothesis test, were inconclusive. The results pose an interesting dilemma, as they compare highly emotional attitudes. For example, Attitude_6 * Visit compared whether bugs, poison ivy, and other threats influenced the frequency with which Goucher students visited the Woods, but when testing 'Agree' and 'Often', the results were not statistically significant. This contradicts what Pooley & Connor reported in 2000, stating that "The way that people feel about the environment has to be acknowledged as a key indicator of the person/environment interaction (Lazarus, Kanner, & Folkman, 1980), and thus the role of affect (feelings) needs to be explored alongside the role of cognition". Research would suggest that the perceived threats in the Woods would deter Goucher students from visiting frequently, but this was not the case. Additionally, the results of Attitude_10, which measures the degree to which Goucher students agree that they are "the kind of person who loves spending time in the Woods" was not found to be statistically significant with the variable Residence under the hypothesis test, which is questionable considering the context of Goucher's location as a green oasis amid a very man-made area. The broader geographic categorization of urbanism would suggest that people who love spending time in the Woods would be more likely to live on campus, where they would be surrounded by the Woods. However, the overall rate of residency must be considered, as 83% of Goucher students already do live on campus. Perhaps the 17% non-residents do not live on campus partly for this reason (Goucher College, 2016).

Limitations

This survey was conducted online, and was volunteer-based. The survey was distributed via email messages and Facebook posts, which certainly excludes some people of Goucher from exposure to the survey, as not all students have Facebook profiles. The distributors of the poll are mostly of the junior and senior classes, which could account for the relatively high rate of senior and sophomore respondents, and lower first-year response rate at 5.6% (0 – 15%). Additionally, the Goucher community population data were obtained from the Fall 2016 Student Profile, which is not entirely representative of the current student body that the sample was drawn from.

Conclusion & Recommendations

This survey research found that Interactions with the Woods positively influences the environmental attitudes that Goucher students report. The most salient explanatory variable is Visit, which determines the level of contact that students have with the Woods. The variable Class_Visit was not found to be statistically significant overall, perhaps because of the low level of respondents who reported having visited the Woods as part of a class activity at 37.4%. The survey was tested for validity with Attitude_3 and Attitude_10, which respondents answered non-randomly.

As a recommendation for further inquiry, perhaps a local environmental science class could be designed, and the culmination would be measuring the students' attitudes before and after the course. The class could necessitate contact with the Woods on a group and individual level, and then determine the Knowledge, Responsibility, and Identity inclinations of the students.

Appendix A: Survey Subscales

Environmental Knowledge

Attitude_4: The balance of nature is very delicate and easy to upset by human activities.

Attitude_5: The woods lower the temperature of the campus during hot days.

Attitude_8: The air that I breath on campus is healthier because of the woods.

Attitude_9: Environmental threats, such as deforestation, have been over exaggerated.

Environmental Responsibility

Attitude_1: Being environmentally responsible is important to me.

Attitude_7: More classes should take advantage of the woods.

Attitude_11: I would get upset at the idea of some of woods being cleared for better facilities on campus.

Attitude_12: I would volunteer for a clean-up of the woods.

Identity

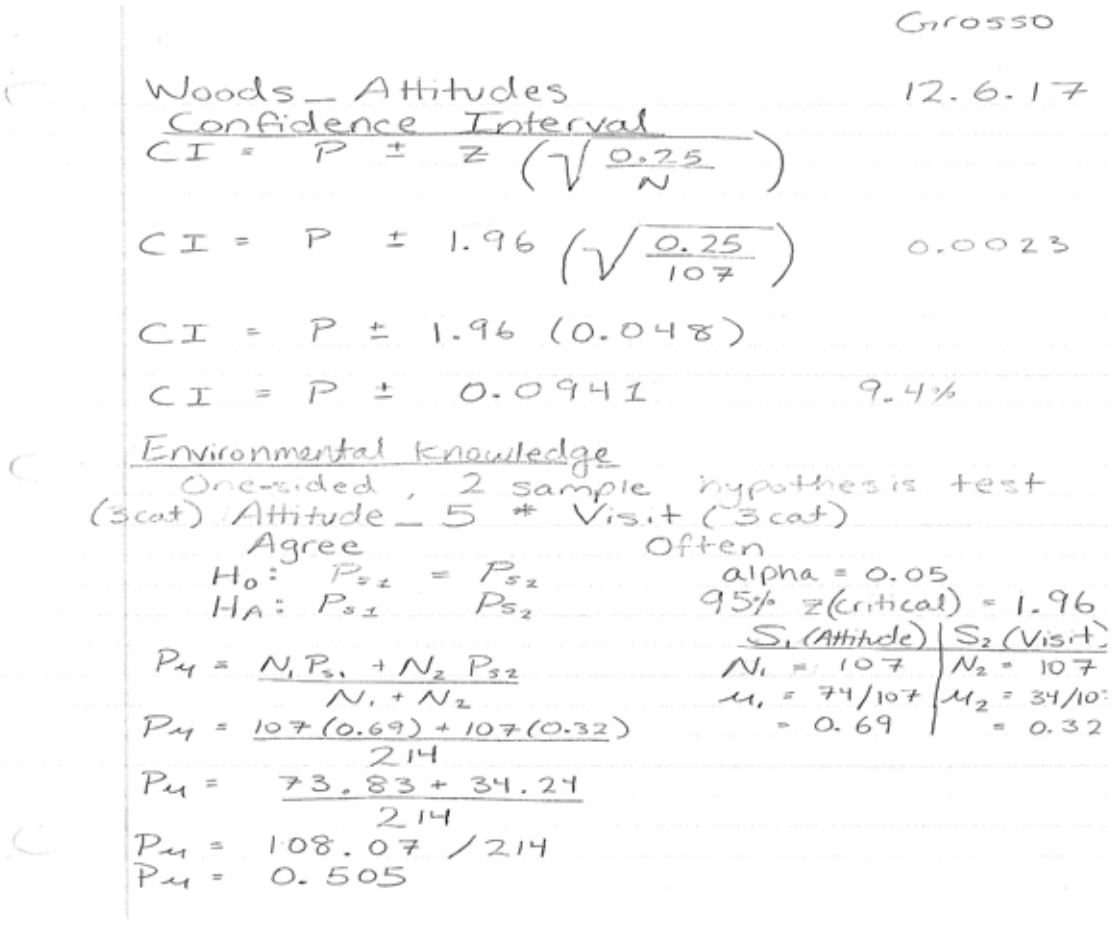
Attitude_2: I would like to visit the woods more frequently.

Attitude_3: I think spending time in the woods is boring.

Attitude_6: Bugs, poison ivy, and/or other threats make me less likely to venture into the woods.

Attitude_16: I am the kind of person who loves spending time in the woods.

Appendix B: Calculations



Grosso

Woods_Attitudes 12.6.17

Confidence Interval

$CI = P \pm z\left(\sqrt{\frac{0.25}{N}}\right)$

$CI = P \pm 1.96\left(\sqrt{\frac{0.25}{107}}\right)$ 0.0023

$CI = P \pm 1.96\ (0.048)$

$CI = P \pm 0.0941$ 9.4%

Environmental knowledge

One-sided, 2 sample hypothesis test

(3cat) Attitude_5 * Visit (3cat)

Agree Often

$H_0: P_{s1} = P_{s2}$

$H_A: P_{s1} > P_{s2}$

alpha = 0.05

95% z(critical) = 1.96

S_1 (Attitude)	S_2 (Visit)
$N_1 = 107$	$N_2 = 107$
$n_1 = 74/107$	$n_2 = 34/107$
$= 0.69$	$= 0.32$

$P_4 = \frac{N_1 P_{s1} + N_2 P_{s2}}{N_1 + N_2}$

$P_4 = \frac{107(0.69) + 107(0.32)}{214}$

$P_4 = \frac{73.83 + 34.24}{214}$

$P_4 = 108.07 / 214$

$P_4 = 0.505$

$$\sigma_{p_1 - p_2} = \sqrt{P_M(1 - P_M)}\left(\sqrt{\frac{N_1 + N_2}{N_1 N_2}}\right)$$

$$\sigma_{p_1 - p_2} = \sqrt{0.505(1 - 0.505)}\left(\sqrt{\frac{214}{11{,}449}}\right)$$

$$\sigma_{p_1 - p_2} = (\sqrt{0.25})\ (\sqrt{0.0187})$$

$$\sigma_{p_1 - p_2} = (0.5)(0.1368)$$

$$\sigma_{p_1 - p_2} = 0.0684$$

$$z\,(\text{obtained}) = \frac{(P_{s_1} - P_{s_2})}{\sigma_{p_1 - p_2}}$$

$$z\,(\text{obtained}) = \frac{0.69 - 0.32}{0.0684}$$

$$z\,(\text{obtained}) = 5.4094$$

$5.4094 > 1.96$

Reject the null

Environmental Responsibility

Attitude_11 (3 cat) * Visit (3 cat)

Two-sided, 2 sample hypothesis test testing 'Agree' vs 'Often'

$H_0: P_{s_1} = P_{s_2}$ $H_A: P_{s_1} \neq P_{s_2}$

alpha = 0.05 95% z(critical) = 1.96

S_1 (Attitude)	S_2 (Visit)
$N_1 = 105$	$N_2 = 107$
$u = 90/105 = 0.86$	$u = 34/107 = 0.32$

$$P_M = \frac{105(0.86) + 107(0.32)}{212}$$

$$P_M = (90.3 + 34.24)/212$$

$$P_M = 0.5863$$

$$\sigma_{p_1 - p_2} = \sqrt{0.5863(1 - 0.5863)}\left(\sqrt{\frac{212}{11{,}235}}\right)$$

$$\sigma_{p_1 - p_2} = (\sqrt{0.2426})(\sqrt{0.0189})$$

$$\sigma_{p_1 - p_2} = (0.4925)(0.1375)$$

$$\sigma_{p_1 - p_2} = 0.0677$$

$$z\,(\text{obtained}) = \frac{(0.86 - 0.32)}{0.0677} = 7.9764$$

$7.9764 > 1.96$ Reject the null

Attitude_12 (3cat) * Visit (3cat)
Two sided, 2 sample hypothesis test
Testing 'Agree' vs 'Often'
$H_0: P_{s1} = P_{s2}$ $H_A: P_{s1} \neq P_{s2}$
alpha = 0.05 95% z(critical) = 1.96

S_1 (Attitude)	S_2 (Visit)
$N_1 = 104$	$N_2 = 107$
$\mu_1 = 73/104 = 0.7$	$\mu_2 = 34/107 = 0.32$

$P_M = 104(0.7) + 107(0.32) / 211$
$P_M = (72.8 + 34.24) / 211$
$P_M = 0.5073$

$\sigma p_1 - p_2 = \sqrt{0.5073(1 - 0.5073)} \left(\sqrt{(211/11,128)}\right)$
$\sigma p_1 - p_2 = (\sqrt{0.25})(\sqrt{0.019})$
$\sigma p_1 - p_2 = (0.5)(0.1378)$
$\sigma p_1 - p_2 = 0.0689$

$z(\text{obtained}) = \dfrac{0.7 - 0.32}{0.0689}$
$z(\text{obtained}) = 0.38 / 0.0689$
$z(\text{obtained}) = 5.5152$

$5.5152 > 1.96$
Reject the null

Attitude_12(3cat) * Class_Visit
Two sided, 2 sample hypothesis test
Testing 'Agree' vs 'Yes'
$H_0: P_{s1} = P_{s2}$ $H_A: P_{s1} \neq P_{s2}$
alpha = 0.05 95% z(critical) = 1.96

S_1 (Attitude)	S_2 (Class_Visit)
$N_1 = 104$	$N_2 = 107$
$u_1 = 73/104 = 0.7$	$u_2 = 40/107 = 0.37$

$P_u = (104(0.7) + 107(0.37))/211$
$P_u = (72.8 + 39.59)/211$
$P_u = 0.5327$

$\sigma_{P_1 - P_2} = (\sqrt{0.5327(0.4673)})(0.1378)$
$\sigma_{P_1 - P_2} = (\sqrt{0.2489})(0.1378)$
$\sigma_{P_1 - P_2} = (0.4989)(0.1378)$
$\sigma_{P_1 - P_2} = 0.0688$

$z(\text{obtained}) = \frac{0.7 - 0.37}{0.0688}$
$z(\text{obtained}) = 4.7965$

$4.7965 > 1.96$
Reject the null

Environmental Identity

Attitude_3 (3cat) * Residence

One-sided, 2 sample hypothesis test

Testing 'Agree' vs 'On campus'

$H_0: P_{s1} = P_{s2}$ $H_A: P_{s1} \neq P_{s2}$

alpha = 0.05 95% z(critical) = 1.96

S_1 (Attitude)	S_2 (Residence)
$N_1 = 107$	$N_2 = 107$
$\mu_1 = 5/107 = 0.05$	$\mu_2 = 88/107 = 0.82$

$P_M = (107(0.05) + 107(0.82))/214$

$P_M = (5.35 + 87.74)/214$

$P_M = 0.435$

$\sigma_{P_1 - P_2} = (\sqrt{0.435(0.565)})(\sqrt{(214/11{,}449)})$

$\sigma_{P_1 - P_2} = (\sqrt{0.2458})(\sqrt{0.0187})$

$\sigma_{P_1 - P_2} = (0.4958)(0.1368)$

$\sigma_{P_1 - P_2} = 0.0678$

$$z\,(\text{obtained}) = \frac{0.05 - 0.82}{0.0678}$$

$z\,(\text{obtained}) = -11.3569$

$-11.3569 < -1.96$

Reject the null

Attitude_3 (3 cat) * Visit (3 cat)
One-sided, 2 sample hypothesis test
Testing 'Agree' vs 'Often'
$H_0: P_{S_1} = P_{S_2}$ $H_A: P_{S_1} \neq P_{S_2}$
alpha = 0.05 95% z(critical) = 1.96

S_1 (Attitude)	S_2 (Visit)
$N_1 = 107$	$N_2 = 107$
$\mu_1 = 5/107 = 0.05$	$\mu_2 = 34/107 = 0.32$

$P_M = (107(0.05) + 107(0.32)) / 214$
$P_M = (5.35 + 34.24) / 214$
$P_M = 0.185$

$\sigma_{P_1 - P_2} = (\sqrt{0.1508})(\sqrt{0.0187})$
$\sigma_{P_1 - P_2} = (0.3883)(0.1368)$
$\sigma_{P_1 - P_2} = 0.0531$

$z(\text{obtained}) = \frac{0.05 - 0.32}{0.0531}$

$z(\text{obtained}) = -5.0848$

$-5.0848 < -1.96$
Reject the null

Attitude_6 (3 cat) * Visit
One-sided, 2 sample hypothesis test
Testing 'Agree' vs 'Often'
$H_0: P_{s1} = P_{s2}$ $H_A: P_{s1} \neq P_{s2}$
alpha = 0.05 95% z(critical) = 1.96

S_1 (Attitude)	S_2 (Visit)
$N_1 = 107$	$N_2 = 107$
$u_1 = 26/107 = 0.24$	$u_2 = 34/107 = 0.32$

$P_u = (107(0.24) + 107(0.32))/214$
$P_u = (25.68 + 34.24)/214$
$P_u = 0.28$

$\sigma p_1 - p_2 = (\sqrt{0.2016})(\sqrt{0.0187})$
$\sigma p_1 - p_2 = (0.449)(0.1368)$
$\sigma p_1 - p_2 = 0.0614$

$z(\text{obtained}) = \frac{0.24 - 0.32}{0.0614}$
$z(\text{obtained}) = -1.3029$

$1.96 > -1.3029 > -1.96$
Fail to reject the null

Attitude_10 * Residence

Two-sided, 2 sample hypothesis test

Testing 'Agree' vs 'On-campus'

$H_0: P_{s1} = P_{s2}$ $H_A: P_{s1} \neq P_{s2}$

alpha = 0.05 95% $z_{(critical)} = 1.96$

S_1 (Attitude)	S_2 (Residence)
$N_1 = 106$	$N_2 = 107$
$\mu_1 = 81/106 = 0.76$	$\mu_2 = 88/107 = 0.82$

$P_\mu = (106(0.76) + 107(0.82)) / 213$

$P_\mu = (80.56 + 87.74) / 213$

$P_\mu = 0.79$

$\sigma p_1 - p_2 = (\sqrt{0.1659})(\sqrt{(213/11,342)})$

$\sigma p_1 - p_2 = (0.4073)(\sqrt{0.0188})$

$\sigma p_1 - p_2 = (0.4073)(0.1371)$

$\sigma p_1 - p_2 = 0.0558$

$$z_{(obtained)} = \frac{0.76 - 0.82}{0.0558}$$

$z_{(obtained)} = -1.075$

$-1.96 < -1.075 < 1.96$

Fail to reject the null

Attitude _ 10 * Visit (3 cat)
Two-sided, 2 sample hypothesis test
Testing 'Agree' vs 'Often'
$H_0: P_{S_1} = P_{S_2}$ $H_A: P_{S_1} \neq P_{S_2}$
alpha = 0.05 95% z (critical) = 1.96

S_1 (Attitude)	S_2 (Visit)
$N_1 = 106$	$N_2 = 107$
$u_1 = 81/106 = 0.76$	$u_2 = 34/107 = 0.32$

$P_u = (106(0.76) + 107(0.32))/213$
$P_u = (80.56 + 34.24)/213$
$P_u = 0.539$

$\sigma_{P_1 - P_2} = (\sqrt{0.249})(\sqrt{0.0188})$
$\sigma_{P_1 - P_2} = (0.4989)(0.1371)$
$\sigma_{P_1 - P_2} = 0.0684$

$z\text{ (obtained)} = \frac{0.76 - 0.32}{0.0684}$
$z\text{ (obtained)} = 6.4328$

$6.4328 > 1.96$
Reject the null

Residence

One sample, 2 sided hypothesis test

alpha = 0.05 95% z^* (critical) = ± 1.96

$H_0: P_H = 0.83$ $H_A: P_H \neq 0.83$

Sample	Population
$P_S = 0.82$	$P_H = 0.83$
$N = 107$	

$$z(\text{obtained}) = \frac{P_S - P_H}{\sqrt{P_H(1-P_H)/N}}$$

$$= \frac{0.82 - 0.83}{\sqrt{(0.83(0.17))/107}}$$

$$= \frac{-0.01}{\sqrt{0.0013}}$$

$$= -0.01 / 0.0361$$

$$= -0.28$$

$-1.96 < -0.28 < 1.96$

Fail to reject the null

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