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The USU Tree Inventory Website: A Case Study Of An Interactive Online Woody Plant Education Resource

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THE USU TREE INVENTORY WEBSITE: A CASE STUDY OF AN INTERACTIVE
ONLINE WOODY PLANT EDUCATION RESOURCE

by

Benjamin W. Harris

A Plan B paper submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Forestry

Specializing in Urban Forestry

Approved:

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2010

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ABSTRACT

The USU Tree Inventory Website: A Case Study Of An
Interactive Online Woody Plant Education Resource

by

Benjamin W. Harris, Master of Science

Utah State University, 2010

Major Professor: Dr. Fred A. Baker
Department: Wildland Resources

The USU tree inventory website is an interactive, online tree education resource that I developed to allow students and community members to locate, identify and learn about trees on the USU campus. Students in two USU courses that teach woody plant material used the website during one semester and were surveyed about their experience. Less than half of the students accessed the website, but those that did found it useful as a supplement to traditional instruction. Most students were likely to recommend the website to another person and to use the website in the future.

ACKNOWLEDGMENTS

I would like to thank my major professor and my committee for working with me on this degree. I thank them also for their support, their ideas and their patience during this process.

I would also like to thank my employers and colleagues for being supportive and flexible with my class and research schedules. I hope that the skills and knowledge I've acquired will be beneficial to them.

The development of the USU tree inventory website would not have been possible without a generous Community Forestry Partnership grant from the USDA Forest Service, awarded through the Utah Division of Forestry, Fire and State Lands. Chris Garrard of the USU Remote Sensing / Geographic Information Systems Laboratory was instrumental in creating and maintaining the website.

Finally, I express my gratitude and appreciation to my wife and children, who have been patient and supportive during the six years that I have been engaged in this degree.

Benjamin W. Harris

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INTRODUCTION

Trees play a vital role in urban communities, providing shade, blocking wind, absorbing pollutants, reducing erosion, screening noise, retaining storm water, and sequestering carbon dioxide. They also provide economic benefits by reducing cooling and heating costs and by raising property values (Miller 1997; Harris et al. 2004; McPherson 2007). Trees make our communities more attractive, comfortable places to live. Many people feel strong emotional ties with trees and feel calm and peaceful when in the presence of trees (Dwyer et al. 1991).

The benefits of urban trees can be maximized through careful planning and tree selection. A basic tenet of urban forestry is to plant the right tree in the right place. Matching a tree to its landscape site is a critical step toward ensuring the future growth and vigor of the tree and is one of the most important steps to ensure long-term tree benefits (Harris et al. 2004). A tree that is not matched to its planting site can become a liability instead of an asset (Lilly 2001).

Matching trees to planting sites requires thorough consideration of site and tree characteristics. The conditions of each planting site should be carefully considered, then trees should be selected that fit within the site's space constraints, that tolerate the site's environmental conditions, and that offer the ornamental characteristics desired. Among the hundreds of tree species suitable for planting in urban areas are trees that are appropriate for nearly every setting.

At the community level, species diversity is the key to maintaining healthy urban forests (Guntenpergen and Stearns 1983, cited in Sun 1992). To prevent overuse of common species, researchers recommend that no tree species should constitute more than 10% of a community's total tree population (Miller 1997). Historical practice, however, has been to rely heavily on a limited number of species that are considered tolerant of a wide range of conditions (Miller 1997; Trowbridge and Bassuk 2004). In the Intermountain West, for example, only thirteen tree species were considered by urban foresters to be abundant, and five of these thirteen species were considered undesirable in most settings (Kuhns 1998). Low species diversity leaves the urban tree population vulnerable to biotic and abiotic threats and results in higher maintenance costs to care for or replace trees that were not suited for their sites (Endress 1990).

In order to maximize tree benefits in our communities, urban foresters, arborists and horticulturalists try to promote site-appropriate plantings and greater species diversity to landscape architects, landscape professionals, nurseries and homeowners. Many available tree education resources promote under-utilized species and encourage site-appropriate planting. It has been argued, though, that the best way to determine how a species will perform and look in a landscape is to visit and observe mature specimens in the area (Harris et al. 2004). However, locating and visiting trees is inconvenient at best and impractical for those who do not live near tree collections such as are found in arboreta or on college campuses. Even students desiring to learn the trees on a campus are limited by their knowledge of the tree species and locations.

Technological advances in computer and internet services made in recent decades can be used to create tree education programs accessible to a geographically broad

audience as well as to supplement or replace classroom learning. Arboriculture educators surveyed in 2002 ranked websites and computer-based training as the third-most important educational technique (Elmendorf et al. 2005). Sistrunk (1998) encouraged use of the World Wide Web to promote horticulture and enhance learning. Kjelgren and Rupp (1998) suggested that computer-assisted instruction (CAI) enhances learning in three ways: by increasing access to knowledge, by providing interactivity for students separated from on-campus settings, and through images that clarify abstract concepts. They warn, however, that learning benefits gained from CAI programs must outweigh the potentially large costs involved in program development.

The literature contains many examples of computer applications used in arboriculture and horticulture education. At Washington State University, Shaw (1993) developed a computer program to teach woody plant identification. At Alabama A&M University, Sabota et al. (1995) developed an updateable digital map of campus plants as well as a relational database of plant information. This program enables students to locate plants more easily and allows them to search for plant groups with similar characteristics or cultural needs. At Virginia Tech, Seiler et al. (1997) developed an interactive, multimedia tutorial computer program called Woody Plant ID, designed to teach woody plant identification. They have since expanded it into a more comprehensive 3-CD software program that is commercially available. Kling et al. (1996), at the University of Illinois at Urbana-Champaign, developed a database of woody campus landscape plants, called UIPLANTS, to supplement other sources of plant information, but not to replace personal interaction with plants. UIPLANTS was originally offered on CD-ROM, but is now available online at

<http://woodyplants.nres.uiuc.edu/>. Educators at Arizona State University have placed all content of a plant biology class online to be used either as a stand-alone distance education course or as a supplement to the on-campus course (Bradley et al. 2009). Wilson and Danielson (2005) created the Virtual Garden Tour of the Indian River Research and Education Center Teaching Garden, available online at <http://irrecenvhort.ifas.ufl.edu/virtualgarden/index.htm>. The Virtual Garden Tour is interactive, allowing visitors to view the garden as though they were walking through it. Visitors can also click on selected plants to see specific plant information data sheets.

Academic performance of students who have used CAI has been as good as or better than student performance in comparable traditional classes. Schoenfeld-Tacher et al. (2001) found that students participating in an online histology course significantly outperformed their peers in the traditional classroom setting. Riffell and Sibley (2005) found that students in a hybrid course format (part online, part traditional) section of a high-enrollment biology course reported reading the text and studying in groups more often than students in a traditional format section. The hybrid section students also reported a high quality of interaction with the instructor, and performed at least as well academically as students in the traditional section. Seiler et al. (2002) found that the use of a woody-plant identification computer tutorial improved field identification skills among students. Kahtz (2000) found that the UIPLANTS program could be successfully implemented as a partial substitute for traditional woody plant identification laboratories with no detrimental effect on student performance, regardless of student cognitive style.

Utah State University campus in Logan, Utah has more than 5,300 trees comprised of 238 species in 87 genera. This tree collection is a tremendous natural

resource that benefits the campus and the community. The campus trees provide excellent learning opportunities for students studying disciplines such as forestry, natural resources, environmental studies, horticulture and landscape architecture, as well as members of the community who wish to learn more about trees. However, only those present on campus can realize the full educational potential of the campus tree collection. To make the tree education opportunities of the USU campus more widely accessible and to enhance learning opportunities for students on campus, I created the USU tree inventory website.

METHODS

In the winter of 2005, a comprehensive inventory of trees on the USU campus was completed. Tree locations were recorded using global positioning system (GPS) equipment. The species name, diameter at breast height (DBH), and maintenance needed for each tree were also collected. The planting date and cultivar name, taken from available archived landscape planting plans, were later added to the attribute data set. The inventory's spatial and attribute data were then imported into a geographic information system (GIS) using ESRI's ArcMap software. This software allows users to create and analyze maps according to geographic and attribute data. For the USU tree inventory, this means that trees can be located according to size, species, planting date, cultivar, maintenance needs, or any combination of these attributes.

In order to make the information from the tree inventory available as an educational website, I applied for and received a generous Urban Forestry Partnership grant in 2008 from the USDA Forest Service. The USU Remote Sensing / Geographic Information Systems Laboratory (RS/GIS Lab) was then hired to create and host the website, which was completed in March 2009. The website (<http://earth.gis.usu.edu/trees/>) features an interactive map that allows viewers to search for trees on campus according to tree attributes, as well as to identify trees by their location on campus. The website also features a species description page that contains physical descriptions, cultural information, and locations of representative trees for every

species on campus. The species description page also contains digital images of the central features and seasonal variations of each species.

The USU tree inventory website required a considerable investment of resources, although much of the cost was offset by grants. The initial GIS tree inventory upon which the website is based cost \$4293 and was paid for by a Federal Work-Study grant. The USU RS/GIS Lab spent 16.5 hours creating the website at a cost of \$488. The website production cost in this case was exceptionally low, due to the technical expertise and creativity of website technician Chris Garrard. Her manual coding of the website came in far below the original estimate of \$2983.20 and was much less expensive than commercially available interactive GIS-website software packages such as ESRI's ArcIMS. Additionally, more than 3000 digital images of the trees were taken in multiple seasons, and descriptions of each species were written, taking well over 100 hours to complete. The total cost for the creation of the website was \$4781, with 280 hours of tracked time and many more unrecorded hours.

The USU tree inventory website utilizes modern technology to present an interactive tree education experience to a much wider audience than traditional methods, but the question remains how it compares with traditional methods in terms of usefulness and whether it is worth the cost and time of production. To answer this question, the website usage and experiences of the students, instructors and teaching assistants of two USU courses during the fall 2009 semester were studied.

The subject courses were Plants, Soils and Climate (PSC) 2620, Woody Plant Materials: Trees and Shrubs for the Landscape, and Wildland Resources (WILD) 5500, Dendrology: The Study of Trees. PSC 2620 emphasizes the identification, selection and

uses of trees and shrubs planted in urban landscapes. The class was comprised mostly of undergraduate students in the plant science and landscape architecture programs. WILD 5500 studies the identification, taxonomy, global distribution, and familial relationships of temperate and boreal woody species. This class was comprised of graduate and undergraduate students, mostly from the natural resources programs. Both classes had outdoor laboratories where students observed tree and shrub specimens. The laboratories occurred on and off campus; WILD 5500 students spent several lab sessions in Logan Canyon.

At the beginning of the fall 2009 semester, the USU tree inventory website was introduced to both classes as an educational resource. The website functions and some of the site's possible uses were demonstrated, and the students were provided with the website URL. The students and the instructors were encouraged to experiment with the site. At the end of the semester, separate surveys were administered to the students and instructors to learn about their experience with the website.

The student survey consisted of 15 items (see Appendix B) in multiple-choice and short answer formats. The survey was given to 50 students from the PSC 2620 course and 4 students from the WILD 5500 course for a total of 54 respondents. The instructor survey consisted of 14 items in multiple-choice and short answer format (see Appendix C). The instructor survey was given to the instructors of both courses, and three teaching assistants from PSC 2620, for a total of 5 respondents. Both surveys were administered as a paper questionnaire consisting of multiple choice and open-ended questions.

RESULTS

Visitation History

The website became available online in August 2009. Figures 1 and 2 show that visits, hits and pages were highest in the months of September, October and November 2009 and 2010. This suggests that USU students are using the website during fall semester when courses that teach woody plant material are offered. Between January and August 2010, the website received an average of 69.5 visits per month at a fairly regular rate. A website visit is a single session on the website, during which a visitor may view many pages, or files, on the website. A website hit occurs anytime information is requested from the server (AWStats [updated 2010]). For a glossary of website usage terms, see Appendix A.

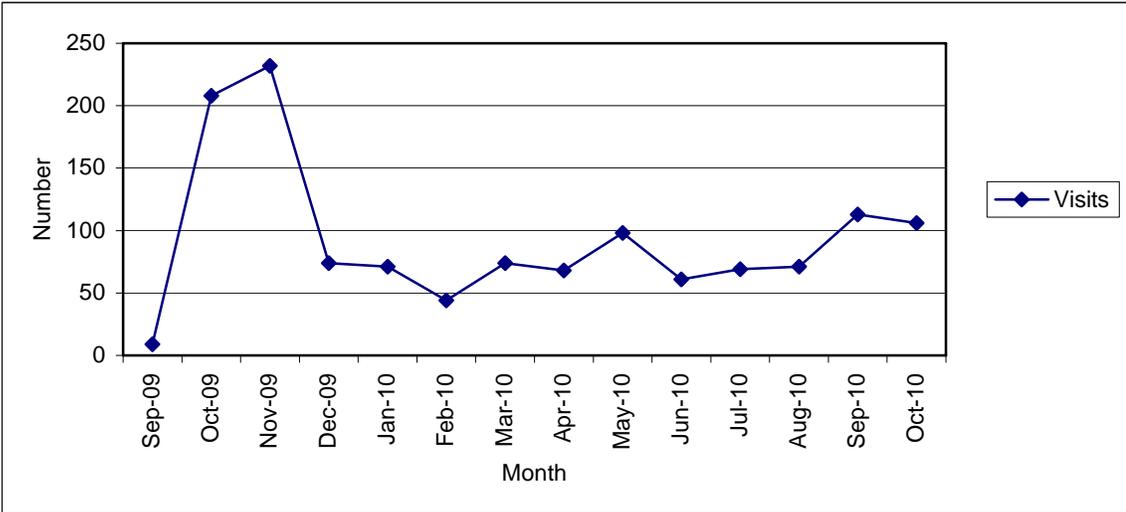


Figure 1. History of visits to website.

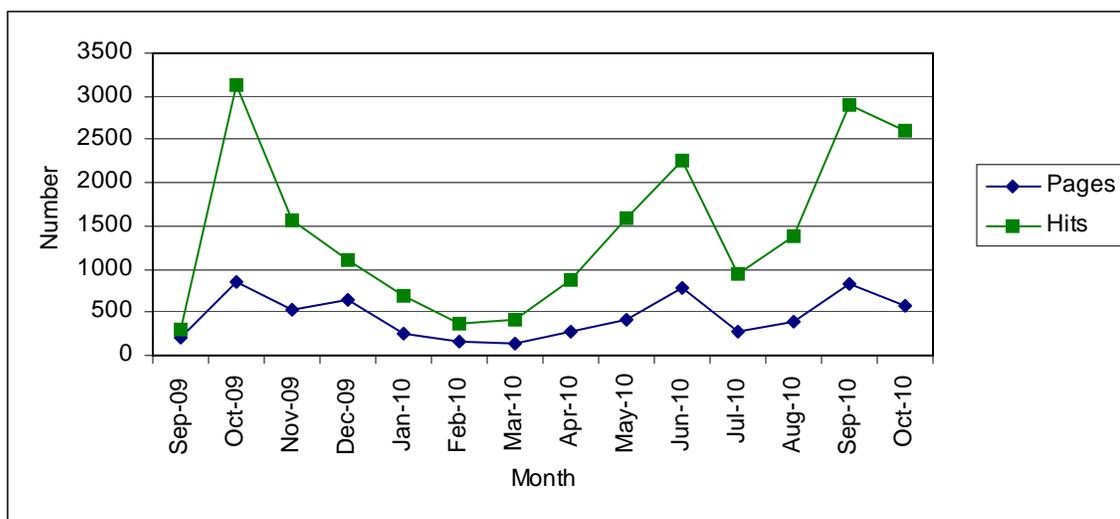


Figure 2. History of website pages viewed and website hits received.

Student Use Survey Results

Although most of the students surveyed were familiar with the USU campus tree inventory website, less than half actually visited the website. Forty out of 54 (74%) students were familiar with the website, but only 25 out of 54 (46%) visited the website during the fall 2009 semester. Among PSC 2620 students, 36 out of 50 (72%) students were familiar with the website, although only 21 (42%) visited the website. The low visitation rate could be due to limited exposure to the site. The PSC 2620 instructor later reported that he had not mentioned the website to his class at all after the initial introduction. Five PSC 2620 students commented at the end of the survey that they forgot about the website or they forgot the website URL. All four of the WILD 5500 students were familiar with the site and visited it during the semester.

Most students who accessed the website during the semester visited it on average once a month or less (Figure 3). Despite the infrequent visitation, 84% of students who

visited the website rated it as useful or very useful; no students rated it as not useful

(Figure 4).

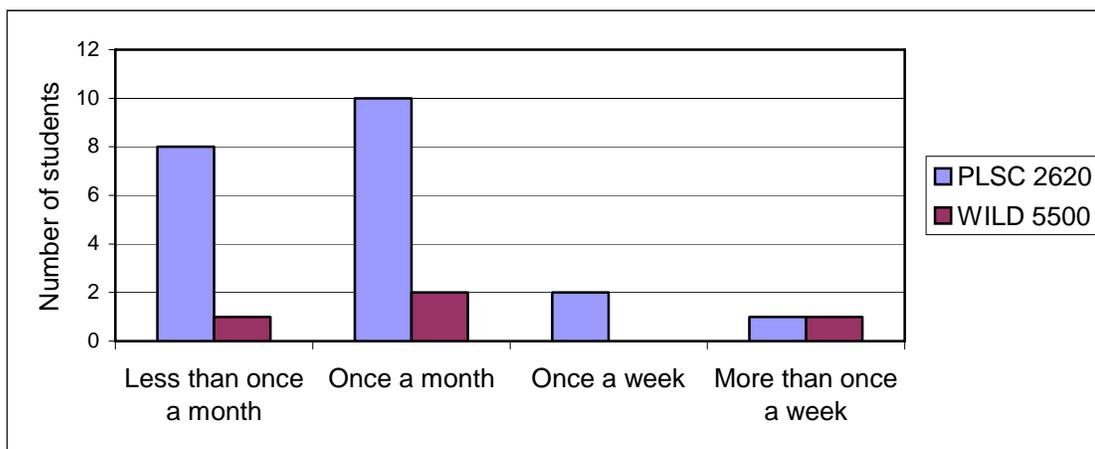


Figure 3. Reported frequency of visits by surveyed students.

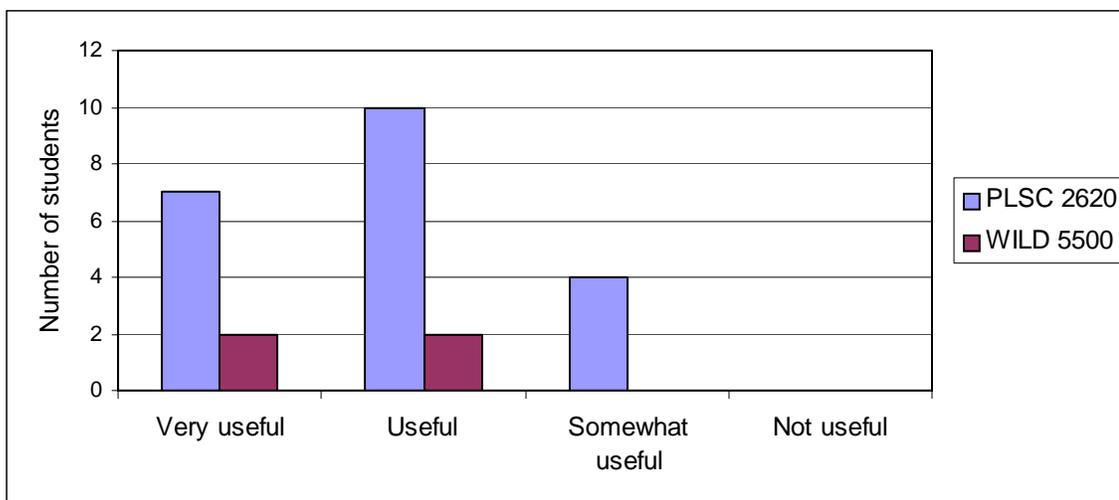


Figure 4. Reported usefulness of website.

When asked to identify which components of the website were useful, students favored the spatial functions of the website over the tree species information, although all website components were found useful to some extent (Figure 5). More specifically, the

ability to locate trees on campus was rated as the most useful component of the website by PSC 2620 students, while the ability to identify specific trees was rated most useful by WILD 5500 students.

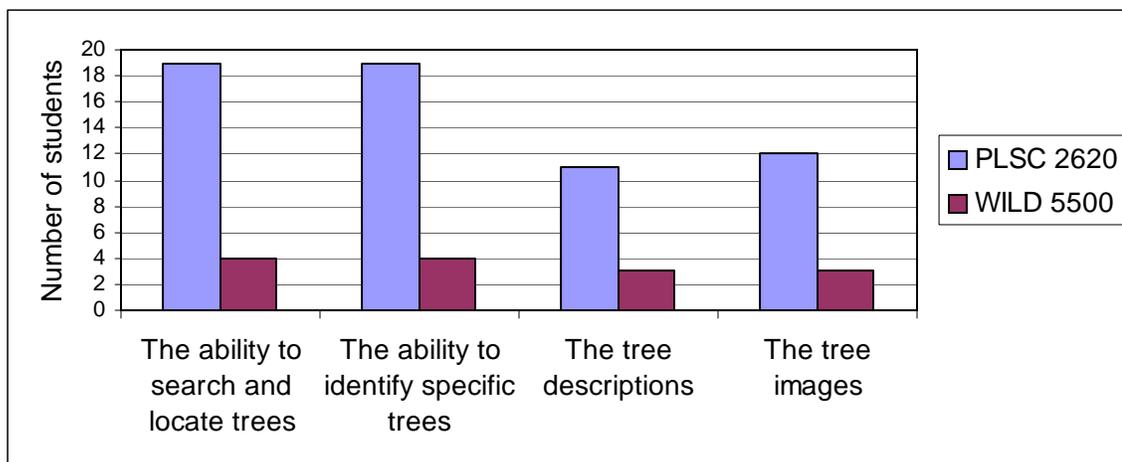


Figure 5. Components of the website reported useful by students.

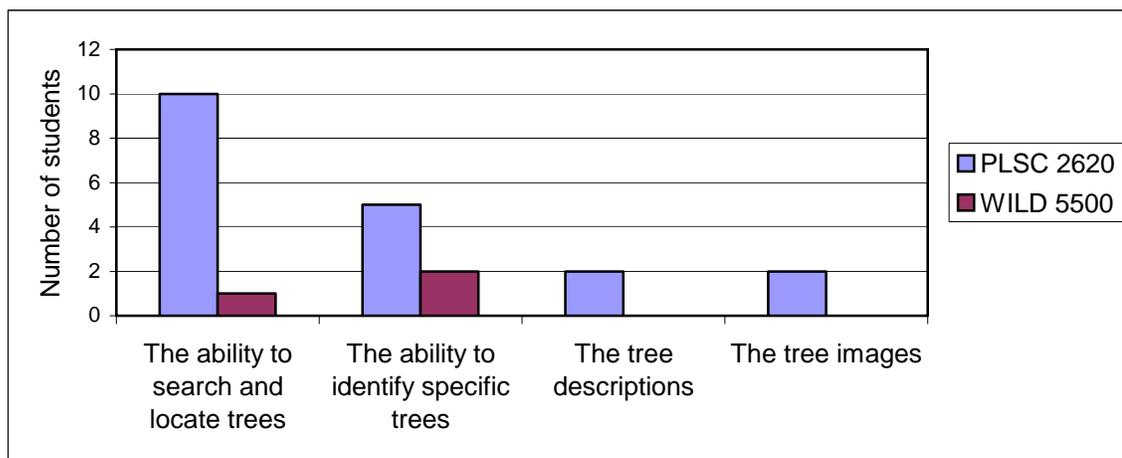


Figure 6. Components of the website reported most useful by students.

Most students used the website to search for trees on campus, and the majority of students who located a tree with the website also physically visited the tree. Of 25

students who visited the website, 20 (80%) used it to locate a specific tree on campus and of those 20, 15 (75%) physically visited the tree (Figure 7).

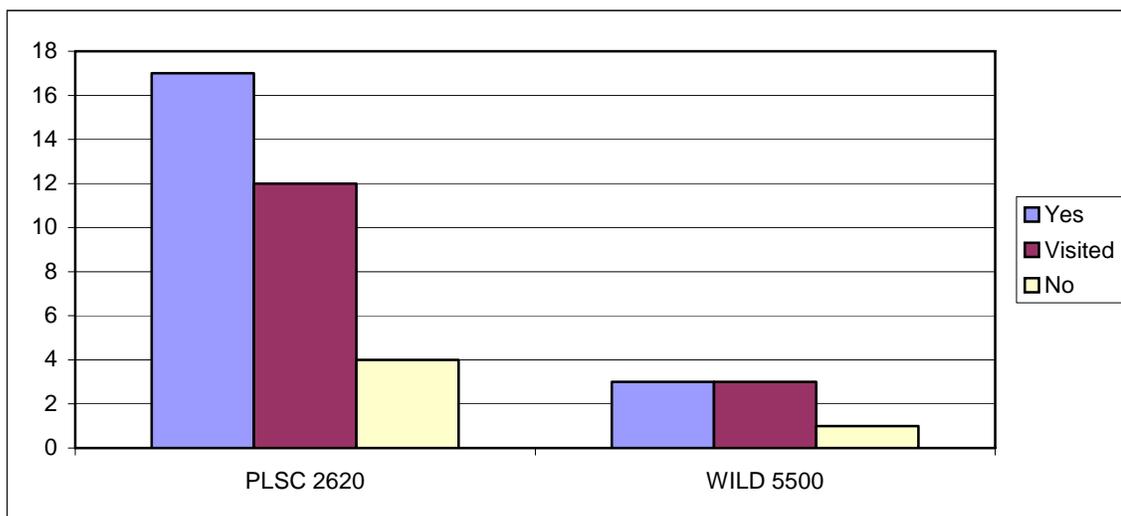


Figure 7. Number of students who located a tree using the website, and subset of those students who physically visited a tree.

Instructors of both classes were interested in whether the website would facilitate cheating during identification quizzes, especially for species that are uncommon on campus. Students could correctly identify a tree by memorizing the locations of all trees of a certain species, instead of by learning the species' attributes and characteristics. Fifty-two percent of students who visited the website and 57% of PSC 2620 students who visited the website used it to memorize the location of a specific tree on campus (Figure 8). However, these responses do not necessarily indicate that the students who memorized a tree's location did so to cheat on an exam. Some may have memorized tree locations for other purposes. This survey item was intentionally written to avoid any

reference to cheating in order not to discourage students who had cheated from answering honestly.

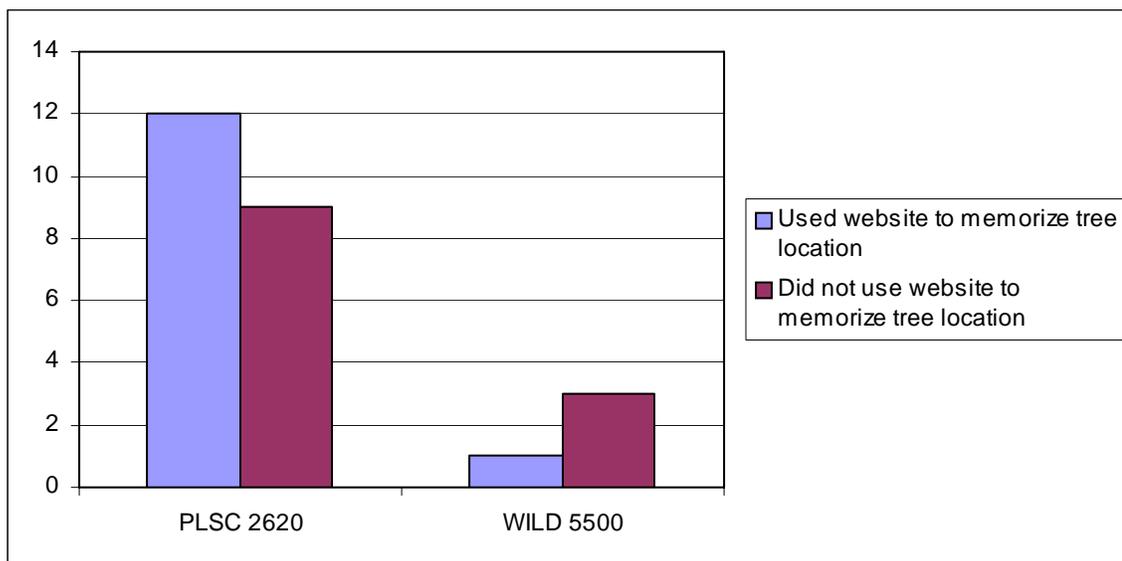


Figure 8. Number of students who reported using the website to memorize the location of a specific tree on campus.

Students found traditional learning resources more useful than the website.

Respondents most often rated the instructors, teaching assistants and textbooks as useful (Figure 9). The campus tree inventory website was comparable to the other students.

Students were also asked to rank the usefulness of these resources in order, with 1 being most useful and 6 being least useful. Among all students, the instructor was rated as the most useful resource, followed by the teaching assistants, the textbook, the other students, the USU tree inventory website, and other websites (Table 1).

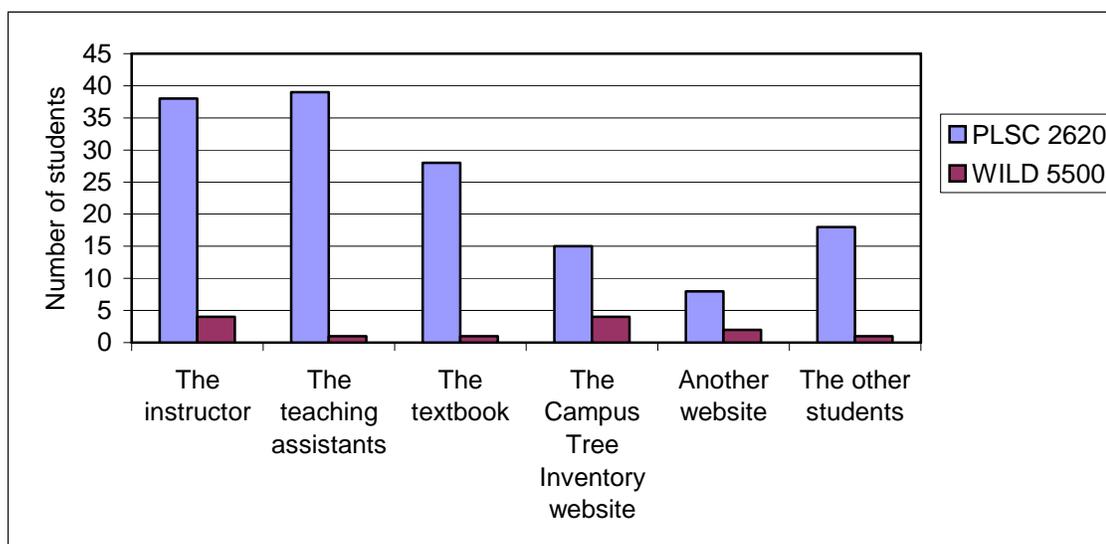


Figure 9. Resources found useful by students in learning woody plant material.

Resource	Rank						Score	Mean Rank
	1	2	3	4	5	6		
The instructor	19	18	6	0	2	0	83	1.84
The teaching assistants	20	16	6	2	0	2	90	1.96
The textbook	5	4	14	10	12	1	161	3.50
The other students	2	4	10	11	10	9	188	4.09
The USU tree inventory website	0	3	7	14	10	12	205	4.46
Another website	0	0	3	9	12	22	237	5.15

Table 1. Ranking of usefulness of resources among all students. A lower rank indicates greater usefulness. Mean ranks were calculated by summing the products of each rank category and the number of votes, then dividing by the number of responses for each resource.

The PSC 2620 students rated the teaching assistants as the most useful resource in learning plant material, followed by the instructor, the textbook, the other students, the USU tree inventory website, and other websites (Table 2). PSC 2620 students who visited the website ranked it more useful than working with the other students (Table 3).

Resource	Rank						Score	Mean Rank
	1	2	3	4	5	6		
The teaching assistants	19	16	6	1	0	0	73	1.74
The instructor	16	18	6	0	2	0	80	1.90
The textbook	5	3	14	10	9	1	144	3.43
The other students	2	3	9	11	9	8	172	4.10
The USU tree inventory website	0	2	4	14	10	12	194	4.62
Another website	0	0	3	6	12	21	219	5.21

Table 2. Ranking of usefulness of resources among PSC 2620 students.

Resource	Rank						Score	Mean Rank
	1	2	3	4	5	6		
The instructor	7	11	1	0	0	0	32	1.68
The teaching assistants	9	5	4	1	0	0	35	1.84
The textbook	3	1	6	3	5	1	66	3.47
The USU tree inventory website	0	1	4	9	4	1	76	4.00
The other students	0	1	2	4	5	7	91	4.79
Another website	0	0	2	2	5	10	99	5.21

Table 3. Ranking of usefulness of resources among nineteen PSC 2620 students who visited the website.

The WILD 5500 students rated the instructor as the most useful resource in learning plant material, followed by the USU tree inventory website, the other students, the teaching assistants and the textbook, and other websites last (Table 4).

Resource	Rank						Score	Mean Rank
	1	2	3	4	5	6		
The instructor	3	0	0	0	0	0	3	1.00
The USU tree inventory website	0	1	3	0	0	0	11	2.75
The other students	0	1	1	0	1	1	16	4.00
The teaching assistants	1	0	0	1	0	2	17	4.25
The textbook	0	1	0	0	3	0	17	4.25
Another website	0	0	0	3	0	1	18	4.50

Table 4. Ranking of usefulness of resources among WILD 5500 students.

Eighteen of the 50 (36%) total respondents have recommended the USU tree inventory website to another person. Among students who visited the website, 15 out of 25 (60%) recommended it to someone. Even three students who hadn't visited the site recommended it to another person. Seventy-nine percent of total respondents were somewhat likely or very likely to recommend the website to someone in the future (Figure 10). Eighty-eight percent of students who visited the website during the semester were somewhat likely or very likely to recommend the website to another person. Seventeen students who did not visit the website were likely to recommend the website to another person.

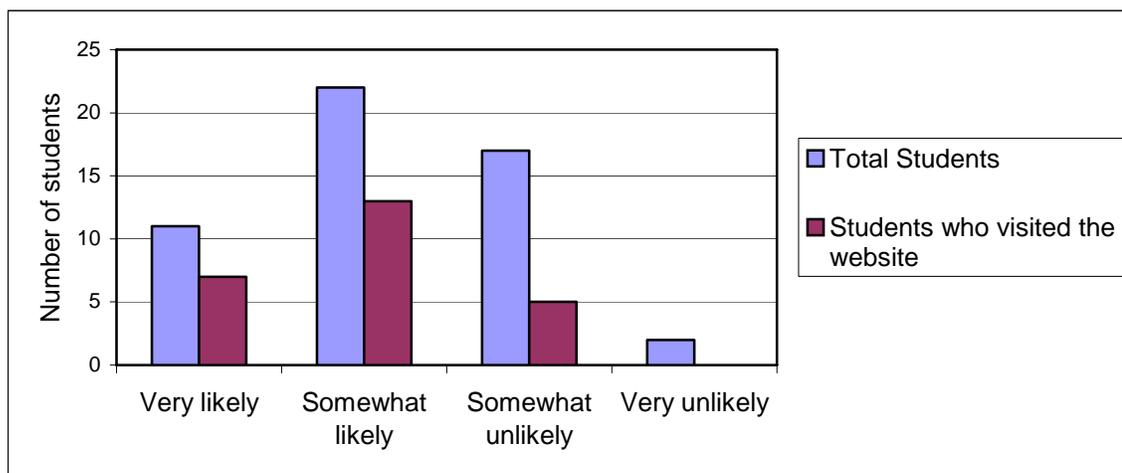


Figure 10. Students' likelihood to recommend the USU tree inventory website to another person.

Most surveyed students are likely to use the website in the future, although WILD 5500 students are more likely than PSC 2620 students to do so. Sixty-three percent of total students were use the website again, while 80% of students who visited the website

were somewhat likely or very likely to (Figure 11). Fourteen PSC 2620 students who did not visit the website planned to use it in the future.

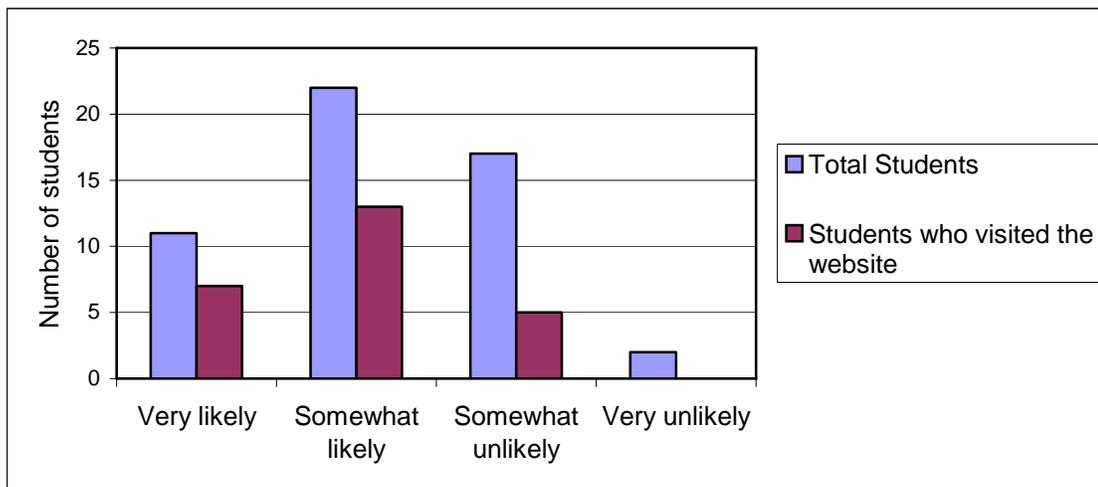


Figure 11. Students' likelihood to use the USU tree inventory website in the future.

Thirty-four students commented on their experience with the USU campus tree inventory website. Among students who visited the website, three reported technical problems, twelve provided positive feedback, and ten offered suggestions for improvement or further development, such as including shrubs on the site. Among students who did not visit the website, two reported technical problems, seven gave positive feedback, and five admitted that they forgot about the website or forgot the URL. Six students in this group indicated that they wished they could have or would have used the website.

Instructor Use Survey Results

The instructors of each class and three teaching assistants of PSC 2620 were surveyed. One teaching assistant was not familiar with the website and did not access it, giving four respondents. All four respondents visited it once a week on average. All instructors rated the website either very useful or useful in teaching woody plant material. Like the students, the instructors thought the spatial features were the most useful components of the website. The instructors found the ability to search and locate trees and the ability to identify specific trees useful; one instructor found the tree images useful. Two instructors rated the ability to search and locate trees most useful, and two rated the ability to identify specific trees most useful. One instructor reported using the website to prepare for lectures, and all instructors reported using the website to prepare for labs. All instructors were very likely to use the website in the future to prepare for their classes.

Two instructors felt that the website was very useful for their students, and two felt that the website was useful. Three instructors reported referring a student with a question to the website. Three instructors thought the website contributed to a slight improvement on student quiz or test scores compared with previous years, and one thought there was moderate improvement. Finally, the instructors were asked for comments about their experience with the website. One replied with positive comments, adding that he/she used the website to plan quizzes and answer questions he/she had about campus trees. Another replied that he/she will probably incorporate the use of the website into the course in the future, and that a shrub version would be helpful. Another

instructor offered a design suggestion to improve the website, and stated that, overall, the website is a tremendous resource for instructors and students.

DISCUSSION

The small number of surveyed students, and the small number of students who visited the website in particular, make it difficult to draw any conclusions from this study. Even in the relatively large PSC 2620 class, only 21 out of 50 students accessed the website during the semester. These students, combined with the four WILD 5500 students, provided only 25 respondents who had some experience with the website. More students may have accessed the website if they had been encouraged periodically through the semester, based on some of the comments from students who had forgotten about the website or forgotten the website URL.

Website visits were highest in the fall semester months when PSC 2620 and WILD 5500 were taught, yet the students of these classes who visited the site reported doing so on average once a month or less. Twenty-five students visits each month account for only 12% of the total visits in October 2009 and 11% of the visits in November 2009. Either the students underreported their visit frequencies or the higher number of visits during October and November 2009 was due to other factors.

The PSC 2620 students who did visit the website found it beneficial. They found the website more useful, recommended the website more to others, were more likely to continue to recommend the website to others, and were more likely to use the website in the future themselves than the students who did not visit the website.

The WILD 5500 students found the website very useful, ranking it as the second-most useful resource behind their instructor. They showed more preference for and usage of the website than the PSC 2620 students, even those that visited the site. This preference could have been caused by a few factors. One may be that their instructor likely encouraged students to use the website more than the PSC 2620 instructor. Another could be that the website was more useful to the WILD 5500 class, since they learned a set of woody plants that consisted of many species that are sparsely represented on campus, whereas the woody plant set learned by the PSC 2620 class consists of much more common species. The search function of the website may have been particularly useful to the WILD 5500 students as they tried to locate rare and hard-to-find species on campus.

Although the website received a fairly high usefulness rating, the visitation frequency seemed relatively low. However, students may have only needed the website occasionally to find trees they could not locate, or to locate trees described but not presented by the instructors. Other survey results indicate that the website was helpful to the students. Among these are the fact that no students rated the website as not useful, the fairly high referral rate and referral likelihood among students who used the website, and the likelihood of the majority of students to use the website in the future. Also, many students made positive comments about the website, while the only negative comments were suggestions for improvement. Alternatively, the usefulness rating, the likelihood of recommendation and the likelihood of future use indicated by students could have been skewed by my presence at the introduction of the website and when the survey was given. The results might have been different had I remained anonymous to the classes.

Among website components, the interactive geographic features, specifically the ability to search for trees by attribute and the ability to identify trees by location, were rated the most useful and were used most by students. The high percentage of students who physically visited a tree after locating it with the website supports the claim of Harris et al. (2004) that the best way to learn about trees is to visit and observe them. The tree information and images may not have been especially useful to the students since they likely received similar information from their assigned readings or directly from their instructors. However, the tree information and images section may be more useful than the spatial features to non-local users who aren't familiar with or cannot visit the campus. Users throughout the Intermountain West may particularly benefit from the tree descriptions page as a free, available resource to select trees that have performed well on the USU campus.

The response from the instructors indicates that they find the website useful preparing for their laboratory sessions. Both head instructors related verbally how excited they are about the website and how useful it will be to them in the future.

Another benefit to the tree inventory website is the utility of the GIS tree inventory that it is based on. USU Facilities uses the tree inventory on a regular basis to manage the campus tree community. The inventory provides information on species composition, tree sizes, cultivar information, maintenance needs, and tree-related hazards. We also use the inventory to record the date work is performed on each tree. These functions greatly improve the accuracy and effectiveness of our records and help us to keep the USU urban forest healthier and more attractive than we could without the inventory.

CONCLUSIONS

Although the small number of students surveyed in this study prevents us from drawing any reliable conclusions about the usefulness of the USU tree inventory website to students learning woody plant material, the study suggests that it was useful to students and instructors as a supplement to traditional learning resources. Considering also that the website has a steady visitation rate, I feel that it meets its objectives and is worthwhile, especially given the relatively low production cost.

The major findings of this study are that for unknown reasons the majority of students did not visit the website; that students and instructors who visited the website found it useful; that students used it infrequently and usually to locate a tree; that the spatial functions of the website were more useful than the tree information; that students are likely to recommend the website and to use it in the future; and that WILD 5500 students found the website more useful than PLS 2620 students. Additional research among more classes over a longer time period would be necessary to verify these indications.

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APPENDICES

Appendix A. Glossary of Website Usage Terms

Unique Visitor: A unique visitor is a person or computer (host) that has made at least 1 hit on 1 page of your web site during the current period shown by the report. If this user makes several visits during this period, it is counted only once. Visitors are tracked by IP address, so if multiple users are accessing your site from the same IP (such as a home or office network), they will be counted as a single unique visitor.

Visits: Number of visits made by all visitors. Think "session" here, say a unique IP accesses a page, and then requests three other pages within an hour. All of the "pages" are included in the visit, therefore you should expect multiple pages per visit and multiple visits per unique visitor (assuming that some of the unique IPs are logged with more than an hour between requests).

Pages: The number of "pages" viewed by visitors. Pages are usually HTML, PHP or ASP files, not images or other files requested as a result of loading a "Page" (like js,css... files).

Hits: Any files requested from the server (including files that are "Pages") except those that match the SkipFiles config parameter.

Taken from http://awstats.sourceforge.net/docs/awstats_glossary.html, last accessed on 10/11/10.

Appendix B. Student Website Use Survey

USU Campus Tree Inventory Website Student Use Survey

Earlier in the semester I introduced the USU Campus Tree Inventory website and the Tree Descriptions Page to your class. Through this survey, I'd like to find out about your experience with the website in learning woody plant material. Participation in this survey is completely voluntary and your answers will be anonymous. Thank you for your cooperation.

- 1. Are you familiar with the USU Campus Tree Inventory website?**
 - Yes
 - No

- 2. Have you accessed the website during the last semester?**
 - Yes
 - No

- 3. If yes, how often would you say you accessed the website on average?**
 - Less than once a month
 - Once a month
 - Once a week
 - More than once a week

- 4. How useful did you find the website to be in learning woody plant material?**
 - Very useful
 - Useful
 - Somewhat useful
 - Not useful

- 5. Please indicate which components of the website you found to be useful:
(check all that apply)**
 - The ability to search and locate trees
 - The ability to identify specific trees
 - The tree descriptions
 - The tree images

6. **Which component of the website did you find to be the most useful?**
(select one)
- The ability to search and locate trees
 - The ability to identify specific trees
 - The tree descriptions
 - The tree images
7. **Have you ever used the website to locate a specific tree on campus?**
- Yes
 - No
8. **If yes, have you ever physically visited a tree you located using the website?**
- Yes
 - No
9. **Have you ever used the website to memorize the location of a specific tree on campus?**
- Yes
 - No
10. **What resources did you find to be useful in learning woody plant material?**
(check all that apply)
- The instructor
 - The teaching assistants
 - The textbook
 - The Campus Tree Inventory website
 - Another website
 - The other students
 - Other _____

- 11. Please rank the following resources in order of usefulness, with 1 being most useful and 6 being least useful.**
- The instructor
 - The teaching assistants
 - The textbook
 - The Campus Tree Inventory website
 - Another website
 - The other students
- 12. Have you ever recommended the USU Campus Tree Inventory website to a friend or acquaintance?**
- Yes
 - No
- 13. How likely are you to recommend the USU Campus Tree Inventory website to a friend or acquaintance in the future?**
- Very unlikely
 - Somewhat unlikely
 - Somewhat likely
 - Very likely
- 14. How likely are you to use the USU Campus Tree Inventory website after you have completed this class?**
- Very unlikely
 - Somewhat unlikely
 - Somewhat likely
 - Very likely
- 15. Please include any additional comments you have about your experience with the USU Campus Tree Inventory website.**

Appendix C. Instructor Website Use Survey

USU Campus Tree Inventory Website Instructor Use Survey

Earlier in the semester I introduced the USU Campus Tree Inventory website and the Tree Descriptions Page to your class. Through this survey, I'd like to find out about your experience with the website in teaching woody plant material during the last semester. Thank you for your cooperation.

- 1. Are you familiar with the USU Campus Tree Inventory website?**
 - Yes
 - No

- 2. Have you accessed the website during the last semester?**
 - Yes
 - No

- 3. If yes, how often would you say you accessed the website on average?**
 - Less than once a month
 - Once a month
 - Once a week
 - More than once a week

- 4. How useful did you find the website to be in teaching woody plant material?**
 - Very useful
 - Useful
 - Somewhat useful
 - Not useful

- 5. Please indicate which components of the website you found to be useful:
(check all that apply)**
 - The ability to search and locate trees
 - The ability to identify specific trees
 - The tree descriptions
 - The tree images

6. **Which component of the website did you find to be the most useful? (select one)**
- The ability to search and locate trees
 - The ability to identify specific trees
 - The tree descriptions
 - The tree images
7. **Did you use the website in preparation for your lectures?**
- Yes
 - No
 - Not applicable
8. **Did you use the website in preparation for your labs?**
- Yes
 - No
 - Not applicable
9. **How useful do you think the website was for your students?**
- Very useful
 - Useful
 - Somewhat useful
 - Not useful
10. **Have you ever referred a student with a question to the website?**
- Yes
 - No
11. **What do you think is the effect of the website on student quiz or test scores compared to previous years/semesters?**
- No improvement
 - Slight improvement
 - Moderate improvement
 - Considerable improvement

13. How likely are you to use the USU Campus Tree Inventory website in the future in preparation for your classes?

- Very unlikely
- Somewhat unlikely
- Somewhat likely
- Very likely
- Not applicable

14. Please include any additional comments you have about your experience with the USU Campus Tree Inventory website.