University grounds practitioners’ perceptions of natural areas management:
A qualitative exploration

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Abstract

As the call for nature conservation comes to urban areas, it is important to understand how organizations managing natural areas operate within real-world contexts so that conservation in urban areas is implemented effectively and efficiently. I investigated a grounds management organization to explore the practices and perceptions of natural areas management. A qualitative approach, including Grounded Theory and photovoice, allowed me to develop a rich understanding of the practice from the perspectives of practitioners.

The goals of the project were (1) to document natural areas management practices, (2) improve natural areas management operations, and (3) develop questions for future research. The research questions were: (1) What practices are currently conducted, who is involved, and what do they do? (2) Are there points of agreement and differences in practitioners’ practices, perceptions, and experiences? (3) How do practitioners perceive current practices and the barriers to, and opportunities for implementation?

Practitioners within the institution represented distinct organizations – design, construction, maintenance – and their customers. Participants described natural areas management practices as a series of independent initiatives, including stream restoration, stormwater best management practices, trash pick up, turf reduction, and design-build college courses.

There was considerable disagreement among practitioners about the financial and labor requirements needed to manage natural areas effectively. However, participants agreed that the sustainable development of the campus, the utilization of the environment as an educational tool, expanded partnerships, and staff development were significant opportunities for the management of natural areas.

I identified inadequate provision of financial resources and insufficient staffing as significant barriers to the effective implementation of natural areas management programs. Despite inadequate investment the value that the institution gives to natural areas management is significant. There is an opportunity to use the points of agreement outlined above to leverage additional investment in natural areas management programs.

I note areas for improvement, based on the findings. First, standards should be set for consistent implementation. Second, practitioners require ongoing and formal coordination for effective implementation. Third, a clear understanding of the goals and ongoing evaluation of the resources required to attain them is needed among all practitioners and stakeholders. Finally, natural areas management programs would benefit from leveraging resources needed to support the program from the significant opportunities associated with their practice, including the sustainable development of the campus, the utilization of the environment as an educational tool, expanded partnerships, and staff development.

Improving management operations requires a shift in perspective from one-off project conception that moves linearly through divisions to ongoing management involving all divisions. This will include coordination among all stakeholders throughout the lifetime of a program and consistent evaluation of program operations against clearly articulated programs goals.
Introduction

Destruction of habitat is the largest threat to biodiversity worldwide (Wilson 2010). Cronon (1996) has written extensively on how conservationists have narrowly focused on saving a pristine wilderness at the expense of seeking strategies to promote conservation amidst the human enterprise, which may be more practical. Vitousek et al. (1997) emphasized there is no corner of the globe free from human influence; leaving the conservationist to question the narrow focus. Why not preserve and enhance the ecosystem services provided in urban, albeit adulterated spaces? Leading ecologists now call for conservation strategies within human contexts: in cities and towns where people live, play, and work (Rosenzweig 2003, Miller and Hobbs 2002). Urban nature conservation is an important new chapter in conservation biology. Not only have conservationists taken notice, but also practitioners have begun to design wild spaces for nature in urban areas. However, little is known about the organizations that carry out this work. Without a clear consideration of these organizations, effective management of urban natural resources is unlikely. Researchers need a better understanding of urban nature conservation that is based in the experiences and perceptions of its practitioners to improve implementation.

Researchers have investigated the practice of urban land management and found it to be largely unsustainable. Milesi et al. (2005) estimated more than 40 million acres in the United States are covered in managed turf grass making it the largest irrigated crop in the United States. The environmental impact of these areas is significant and includes unsustainable water use, excess fertilizer run-off, and wildlife and plant habitat destruction (Bormann et al. 2001).

Researchers also know that urban nature conservation programs depend strongly upon public perceptions. Bernhardt et al. (2007) found that perceptions of stream restoration success had more to do with post-project appearance and positive public opinion than ecological realities.
Nassauer (1995) and Hitchmough and Dunnett (2004) have argued for the aesthetic presentation of natural areas to satisfy public perceptions. Kendle and Forbes (1997) and Skorulski and Foy (2011) advocated enhancing public perceptions through communication, educational outreach, and opportunities for participation. Dunnett and Hitchmough (2004) and Kühn (2006) have begun to develop landscape management operations, including extensive plantings and naturalization schemes that are compatible with the expectations of urban populations and biodiversity and sustainability objectives.

In addition to public perceptions, researchers have begun to investigate the organizations that manage natural resources. Much of the literature that identifies the methods and approaches to the management of ecosystems in undeveloped areas may be transferable to urban contexts. The ecosystem approach developed by Boyle et al. (2001) and management for resilience (e.g., Holling 1973, Holling and Meffe 1996, Folke et al. 2002) require natural resource management professionals to consider the complexities and dynamics of natural systems and the roles of human influence.

Researchers have not addressed how organizations manage natural resources in urban areas. Even though the management of natural resources in urban areas is the next frontier for conservationists and researchers worldwide. Consideration of the actual practice, including the organizations, their operations, and practitioner perspectives, could further scientific understanding and ultimately improve natural areas management implementation in urban areas.

To address the lack of research and better understand the practice of natural areas management in urban areas I conducted exploratory research of a grounds management organization at a large university in the southern United States. Engaging in participatory research, specifically Participant Action Research (PAR), I used qualitative methods, including Grounded Theory and photovoice, to develop a deep understanding of practitioners’ experience and perspectives with the management of natural areas in an urban context. The goals of the project were (1) to document natural areas management practices, (2) improve natural areas management operations, and (3) develop questions for future research. The research questions were, (1) what practices are currently conducted, who is involved, and what do they do? (2) How do practitioners perceive current practices, and are there points of agreement and differences in practitioners’ perceptions? (3) What are the barriers to and opportunities for implementation?

The purpose of the project was to further our understanding of natural areas management in context, and help practitioners, conservationists and other grounds managers learn from actual operations. Therefore, PAR was an appropriate means to better understand the organization and its practices, as well as, make program recommendations. This research could also serve scientists who wish to develop new theories regarding urban nature conservation, and articulate future research questions and hypotheses.
Methods

The methods used in this study were exploratory in nature. I employed an inductive approach, utilizing qualitative methods, including Grounded Theory and photovoice. Grounded Theory enabled me to analyze operations and make recommendations as a researcher with an outside perspective, whereas photovoice allowed me to learn about natural areas management programs and operations from the perspectives of the practitioners. Put together, these methods developed a rich understanding of the practice and situated my findings and recommendations within the experience of practitioners.

The purpose of this research was not only to better understand the perceptions of practitioners, but also to improve the practice. Therefore, my approach was to collaborate between researcher and participant. Participant Action Research (PAR) aims to produce knowledge and action directly useful to a group of people -- through research, adult education, and sociopolitical action. In addition, PAR seeks to empower participants through the process of constructing and using their own knowledge to communicate and change the organization they are a part of (Reason 1994). The PAR approach is particularly effective at engaging disenfranchised populations and communicating their concerns and perspectives across organizations to those who hold power. Therefore it serves a socio-political function in addition to its research purpose.

This approach is in line with an interpretivist paradigm, which many researchers adopt in organizational studies (Lindlof and Taylor 2011: 24). An interpretivist paradigm acknowledges emergent and collaborative social realities in an inductive manner between researcher and participant (Lindlof and Taylor 2011: 8-9).

Grounded Theory is a highly iterative process of data analysis that conceptualizes and re-conceptualizes theories as they inductively emerge from data (Eisenhardt and Graebner 2007). This analysis allowed me to make interpretations from participant perspectives. Ultimately these allowed me to make program recommendations that were founded in the perspectives of participants and informed by the contemporary literature of natural resource management.

Data were derived from the audio from interviews, as well as images from photovoice. Photovoice is a photo-elicitation technique used to more fully understand participants’ perspectives, assess a community’s strengths and concerns, and communicate those concerns to policy-makers (Wang and Redwood-Jones 2001). This method has been used predominately in sociology and anthropology (Harper 2002), but also in natural resource management (Chenoweth 1984). Photo-elicitation methods are useful because they address the cultural meaning of visual data and demonstrate the ways participants interpret visual data (Knoblauch et al. 2008). In this research, photovoice is meant to drive the interview process at the natural area management site in question. To be clear, participants were asked to take pictures and comment on them as they were taking them, rather than reflect on photographs already taken, as is common in other photo-elicitation methods. The result reinforces the exploratory nature of the research and creates a richer description of managers’ perceptions, practices, and experiences than verbal interviewing alone.
Sample selection followed a chain-of-referral beginning with the grounds management director. Chain-of-referral sampling allows access into complex and informal networks, as well as individuals with busy professional lives (Bernard and Ryan 2010: 367).

One-on-one semi-structured interviews were conducted with practitioners. Interviews lasted approximately one hour. They were framed as a “guided tour;” meaning they took place in the field where natural areas management was practiced. Interviews were conducted in each participant’s usual work environment: for some, the interview occurred outdoors, and other interviews occurred in an office. I developed a script to maintain a consistent line of questioning among participants (Appendix 1). All interviews began with an opportunity for the participant to describe and classify their management practices. Follow-up questions and prompts identified the meanings behind the concept of “natural areas management.”

The data collection method adhered to a participatory approach. I utilized tablet computer technology, an iPad for example, to enable simultaneous audio recording and image capture. The large screen size (9.7 inch diagonal) allowed for simultaneous observation and commentary by the participant and researcher, as well as, audio and image capture.

There were six interviews among seven participants. One interview was with two participants at the same time, as requested by those participants. There were three distinct organizations represented across three different campuses. Participants included high-level administrators as well as lower-level grounds managers. The interviews took place at the time and place of the participants’ choosing. To set up the meeting place and time, I contacted participants by telephone. The selected participants were all members of the university. Participants were not selected from the customers this organization served, such as students and housing organizations. Potentially, this bias could have influenced the findings to paint a glossy picture of the efforts the organization makes.

I manually transcribed the interviews from the audio and placed the photographs within each transcription, while highlighting key phrases and concepts in an open coding protocol (Strauss and Corbin 1998, 101-121). I categorized key phrases and concepts into themes and assembled an initial codebook.

Significant ethical risks were associated with the research approach. The photovoice method made it possible to identify participants from the images of the grounds they managed, which represented a potential breach in confidentiality. The risk was especially significant to those familiar with the participants’ duties, such as an employer or supervisor. To minimize these risks, I implemented a number of measures. First, I submitted a proposal to the Institutional Review Board for the Protection of Human Subjects in Research and gained approval. Second, I presented an informed consent form to study participants that clearly described the potential risks, including any potential breaches of confidentiality (Appendix 2). Third, I used pseudonyms for participants in the final report. Fourth, I submitted a copy of the photographs and interview transcripts back to the participants for their review. Fifth, in the instance that a human would be photographed as the subject, a photo-permission form was provided (Appendix 3). These precautions are in-line with the best minimum practices recommended by Wang and Redwood-Jones (2001) for the ethical use of photovoice methods.
Findings

The study revealed the natural areas management practices, practitioners, and their perceptions, which include points of agreement and differences of opinion, and barriers to and opportunities for implementation. I present each of these in the following section beginning with a description of practitioners. Practitioners were identified through chain-of-referral sampling beginning with the director of grounds management. Participants were asked to identify their natural areas management practices and describe their activities. Finally, practitioners were asked about the challenges and opportunities these practices represent.

Practitioners

Although they all may work on the same natural areas, practitioners belonged to three independent organizations that I identified as design, construction, and maintenance. Each of these divisions performed services for their customers. Customers used the campus for their operations, such as student housing, academic colleges, and property managers.

Participants from the design division were responsible for the planning and design of the university and its grounds. George, as I will call him to maintain confidentiality, was a representative of the design division He identified natural areas primarily as a category of space referred to in the campus master plan. The following is his description of natural areas:

Well, I think of them according to our physical master plan. That’s part of, the biggest part of what my role [is] as part of the office of the University Architect. The University Landscape Architect is to plan and evaluate all projects on campus for their adherence to the master plan. The physical master plan is this document. So if you want to take a picture of it. This is my dog-eared copy from 2007 (Image 1).
Image 1. George’s “dog-eared copy” of the campus master plan defines natural areas.

To George the categories within the master plan inform how areas should be managed. As he took the picture in Image 2 of the master plan he explained that, “Whenever we are doing work in these areas we should go back to this page in this document and be thinking about these key concepts, making sure that we are using that as a way to do work on that type of open space.”

Image 2. Natural areas are classified and standards are established within the master plan.

The design division, therefore, set the standards for how the space should be designed and, to a lesser extent, managed. Key to understanding design’s perspective was that natural areas were spaces, rather than maintenance activities. When George was asked about whether the design
division develops maintenance plans for natural areas his response was, “No, not very much”. He went on to describe that the design division became involved with maintenance by helping to set, “priority areas” with the kudzu eradication program, and “sight lines” with the turf reduction program.

The construction division builds and renovates landscape construction projects on the campus. The division is divided into two sub-organizations: Landscape Construction Services, which is responsible for the construction process, and Quality Assurance, which is responsible for the follow-up care of a project for a specified period of time. This division manages the construction of natural areas, for example wildflower meadows, rain gardens, and other stormwater best management practices (BMPs). This division has the unique role of transitioning responsibility for projects from the design division to the maintenance division through a series of formal agreements they described as, “hand-offs.”

The maintenance division is responsible for the day-to-day maintenance of the campus; including, trash removal, grass cutting, pruning, and pesticide applications, among other tasks. Many of the operational tasks associated with natural areas management were delegated to this division, which may include invasive species removal and other forms of vegetation management.

Collectively, this organization designs, develops, and maintains the university campus for their customers. Practitioners described how they performed their work for their customers, which were entities like student housing, athletics, or a particular college at the university. Customers served an important role in natural areas management. They were often the fiscal sponsors of a natural area management program. Other customers included a non-profit organization that acquired grants to fund natural area management programs; for example, a water quality organization developed a large stream restoration project that ran through the center of campus.

**Practices**

Participants were asked to describe natural areas management practices and identified the following: open space preservation, invasive species management, stream restoration, stormwater best management practices (BMPs), turf reduction, integration with college courses, wildflower meadows, a heritage tree tracking program, trash pick-up, and pasture management. Study participants described these practices as “individual initiatives,” rather than a unified effort or program. A practitioner from the maintenance division explained,

> It comes from a lot of different directions. You know sometimes it’s brought up internally here; somebody identifies that there is a problem, or that we could do something differently, or there’s a need. It can be brought to us from an outside department, maybe the landscape architect’s office, or a campus partnership, or maybe from the sustainability office. It comes from a lot of different directions. There’s not one pinpointed source. … A lot of it is brought up by students.

One example of a natural area management program is the turf reduction program. This program was implemented to mitigate increasing maintenance obligations on the campus. According to Nathan, a precinct supervisor within the maintenance division, the purpose of the turf reduction program was “to increase efficiency and provide opportunities to improve the aesthetics of the campus.” Through this program the maintenance division was able to reduce approximately ten-
acres from their regular maintenance schedule, while maintaining an acceptable presentation of the campus grounds (Image 3).

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<tr>
<th>Natural Areas Management Practices</th>
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<tr>
<td>• Open space preservation</td>
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<td>• Invasive species management</td>
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<td>• Stream restoration</td>
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<td>• Turf reduction</td>
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<td>• Integration with college courses</td>
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<td>• Wildflower meadows</td>
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<td>• Heritage tree tracking program</td>
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<tr>
<td>• Trash pick-up</td>
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<td>• Pasture management</td>
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Image 3. Turf reduction program reduced maintenance while enhancing aesthetics.

Other examples of natural areas management included, a landscape designed and built by students as a component of a college course (Image 4), and stormwater BMPs (Image 5).

Image 4. This natural area was designed, built, and maintained by students.
Practitioner’s Perceptions

Participants described a variety of perceptions regarding the practice of natural areas management. Using Grounded Theory I was able to identify common themes from participant interviews. I report points of agreement when participants presented similar information regarding each theme. I report points of disagreement where participants held certain themes in common but presented different views of those themes. Later, these common themes contribute to an understanding of the significant barriers to and opportunities for implementation. From these findings I began to identify ways the organization can improve natural areas management practices.

Points of disagreement

The points of disagreement among study participants related to a single theme: the management requirements of natural areas. Participants presented varying opinions on the amount of labor and financial resources required to manage natural areas. George, a representative of the design division, described natural areas as areas where maintenance should not occur at any significant level. Instead, George believed that maintenance levels should increase as areas became more people-centric.

I hear from [the maintenance division], ‘the level of maintenance on this area has gone from this to this’. And sometimes I make an argument and say, ‘you’re right. But this is a people area, and our master plan says in our Hearth Spaces, which is what we call places where people gather and they have their lunch, or they collaborate on their studies, that’s where we should be … putting our energy and putting our most maintenance. But other areas, and certainly natural areas, shouldn’t be one of them.

When asked whether the standard should change if natural areas occurred in people-centric areas his response was:
Some people wish it would, but it doesn’t. I had heard indirectly … that some people didn’t get it. They thought [natural areas] should be maintained differently. That they thought [they] looked ugly, they thought [they] didn’t belong on campus. But, you know that’s ok. There [are] lots of people on campus, and not everybody’s going to think the same way.

Members of the construction division also described natural areas as places that should not be intensively managed. However, the members of the construction division did describe the importance of the use of particular plants. For example, Samantha from construction described one project where, “what was spec’ed [sic] was all native plants, they wanted to use the State Wildlife program to get the plants in there just to try to re-naturalize and introduce some of the same stuff that was in there” (Image 6).

Image 6. The use of native plants determined if an area was a natural area.

It was also important to participants from the construction division to clearly delineate between areas that were controlled and areas that were left wild. Frank from the construction division described how less-managed natural areas could be integrated within the constructed environment:

It’s a wood-line! It’s naturalization. However, we got a controlled area that we’ve landscaped that’s not. That’s why [the landscape architect] wants us to bring that wood-line all the way in to the controlled area. To naturalize the whole environment of the whole area around there … We’re going in there and planting a lot of native stuff to naturalize and pull the wood line into the [built area] that’s got sod and irrigation and oak trees.

The use of the phrase, “Sod and irrigation and oak trees,” refers to the constructed landscape; where materials are brought-in and installed, which is in contrast to the wooded areas where wild plants are allowed to regenerate on their own. The management of a wildflower meadow also illustrated this concept of control versus wild. Frank from construction described the management of a wildflower meadow in the following exchange:

Frank: That’s an animal in itself, how do you control it? … When you don’t have the manpower to control it like it should be. How do you control it?  
NW: I don’t know.
Frank: We don’t. We clean up the edges. It’s like washing your car. If you can keep your tires clean your car looks pretty clean. But if your tires are dirty then your car looks nasty. It’s one of those things, you get a hard clean edge and you get contrast between your maintained turf versus your non-maintained vegetation.

Members from the maintenance division, however, held the perception that they needed to more completely manage natural areas, including all of the vegetation within them. To members of the maintenance division, the conventional management of the campus grounds was their first priority. They referred to natural areas as, “side stuff,” and, “outside our normal tasks.” John described natural areas management operations as, “kind-of relegated to things like invasive control.” The use of the word “relegated” indicates two aspects of his perceptions of natural areas management that were common among other members of the maintenance division: (1) workloads are great, and (2) the maintenance division would like to be able to do more. At times members of the maintenance division were even apologetic, “we really don’t have the staff to do anything. It’s just the way it is. Sorry. We just do not have the staff.” One grounds manager lamented as he took a photograph (Image 7):

Let’s stand back and see how many invasives can we get in one shot. Seriously. You got mulberry, you got ivy, you got privet, you got ligustrum, you got honey suckle. I mean how many can you get in one photograph!? There are only one or two natives across everything you see. So the sheer volume of time given the whole length of this and you’re going, ‘there’s no way’. Cause it’s at least both sides. ‘How much time and how much energy have you got?’

Image 7. The management of invasive species overwhelmed maintenance.

When asked how the maintenance division would manage natural areas differently they suggested reducing the burden on staff by establishing better funding supports, and labor assistance by utilizing subcontractors. For example, Danny in maintenance stated, “I would have started right after the installation … I would have definitely brought in somebody like [a specific sub-contractor].” And John, also in maintenance, said, “I would like to see … more
considerations made to financially support these types of things, for natural areas to thrive, be utilized and promoted.”

Participants from different divisions disagreed on the level of management a natural area should receive. Design felt it was acceptable to have unmanaged natural areas as wild spaces on the campus. The construction division was concerned about the intersection of wild areas and more controlled areas. And the maintenance division desired to manage natural areas more than they were able to, which often included the control of invasive species.

**Points of agreement**

Among participants perceptions I identified points of agreement. These common themes of natural areas management included the following: the development of the campus grounds, the utilization of natural areas for educational enrichment, the formation of partnerships, and staff development.

For all participants it was important to maintain the natural beauty of the campus and preserve the limited open-space available. For many practitioners this was a reaction to the rapid expansion and development of the campus. John described how the development of the university coincided with the need to preserve, enhance, and manage natural areas:

> With all the construction going on the natural areas are being more and more condensed. So we are trying to preserve as much as possible. For every – most every – construction project, we designate areas, like no-mow, which are designated areas that we intentionally allow to revert back to natural area, … and we also have … manufactured areas like BMPs and water retention areas that we manage.

Ultimately, this serves the university by attracting students through the enhancement of the environment and provision of educational opportunities. According to one participant, “I think the higher administration has identified the natural beauty of campus and is trying to promote that.” Study participants agreed that natural areas should be presented in a way that is aesthetically pleasing. According to George,

> Even those areas that are natural areas should have a maintained and purposeful edge to them. So even if that means you just take the mower two passes off the adjacent sidewalk you’re communicating to people, ‘we haven’t just forgotten about this area. It’s intended to be natural from here on out.’

Regulations played an important role in the implementation of natural areas management. For example, stormwater management regulations require new construction to mitigate increased stormwater runoff through stormwater BMPs, such as rain gardens and bioretention cells.

Right-of-way (ROW) management was important in natural areas management because investment into horticultural landscapes requires intensive management, which would be wasteful if the area needed to be accessed by utilities. One grounds manager reported, “…they are rights-of-way, there could be a contractor out here digging it up in two weeks.” Natural areas on the other hand represented reduced management areas, which were more compatible with ROW access.
Natural areas were commonly used as placeholders for future development. George, from design, indicated future building sites on a map were currently managed as natural areas (Image 8), “On our master plan, all of those light gray buildings are just place-holders that are not there now.” Natural areas were used by the university as flexible space that could be easily, not to mention affordably, converted to accessible area as needs arose, such as rights-of-way for utility access (Image 9), special events, and even a helicopter landing pad (Image 10).

Image 8. Gray areas represent future construction.

Image 9. Rights-of-way served as natural areas.
Another point of agreement among participants was that natural areas management represented expanded opportunities for education. John in maintenance described natural areas as, “a learning environment, and a place where research can be done. It’s not just a place for somebody to sit on a bench and eat a sandwich or read a book. It’s a place for them to do that, as well as, study the environment and learn about what’s going on.” Danny explained how courses offered by the university used natural areas for their curriculum: “Biological and Agricultural Engineering department goes through there. You know the Dendrology classes use it, and several student groups, plant identification, and those kinds of things.” Frank, from construction, took the concept further by integrating coursework into the construction of landscapes. He described how students, “engaged with real life scenarios, field changes, and equipment feel.” He went on to explain,

We had an equipment day for them. We put them on equipment and let them run some hydraulics. You know they’re in the design studios and their computers twenty-four seven, but how often does a young lady get to sit on an excavator and actually run it, to get that mentality of actually some kind of means of construction and estimation? Because a machine can do so much more. It’s just a thought process. She can read about it and see that a machine-hour takes up the amount of 5.6 man-hours, but let her experience it.

Another point of agreement among participants was that natural areas management involved the broader community. Participants generally appreciated new partners in the management of natural areas. For example, practitioners were able to use student volunteers to manage invasive species, and remove trash. John described a trash pick-up program, entitled “Rubbage-Ride,” in the following way:

We had a partnership with the sustainability office a few months back. We had volunteers come on to campus, student volunteers, and it was even open to outside people. And they came onto campus and we mapped out specific locations for them to go. They could go either on foot or on a bicycle. And they would park and walk and collect trash from naturalized areas. … It was a very
successful week. I think we collected about 550 pounds of trash, and about 250 of it recyclable material.

Samantha, in construction, described an invasive plant removal clinic they held:

We have engaged students to hold these invasive plant removal clinics. Which is great, because it works with maintenance, us, and then students and a professor come in who’ve been talking about invasives. Grounds supplied all the hand tools and everything. … And so this class was able to hear the efforts that maintenance was putting out to try to remove this stuff and reduce the amount of invasives, but the students had a ball. And it also helps the maintenance folks in the field identify more of these things.

The provision of educational opportunities with natural areas management not only benefited students in their educational pursuits, but the professional staff as well. A diversity of partners broadened ideas for management. Frank from construction described how students brought “a lot of modern knowledge to the organization.” Innovations often came from students. Danny pointed out how a student’s design for an outdoor table incorporated a power supply and became a standard for the rest of the university (Image 11):

Danny: What’s really good about it is that … this residence hall and this residence hall, mainly this one, can actually use this space now. I mean this is all WIFI out here and there are connections underneath all of them.
[Points out electrical outlets under tables]
NW: Oh cool.
Danny: This is what a student can design.
NW: That’s awesome. Let’s get a picture of that.
Danny: So, actually they designed this and now it’s a university standard.
NW: Neat.
Danny: So, completely usable space now. Built by students, used by students. And maintenance? They’ve taken ownership of it. So they help take care of it.

Image 11. Students are a source of innovation for design and construction projects.
Partnerships provided opportunities to research management techniques. Examples included; evaluation of invasive species controls, determination of species suitability for wildflower meadows, and efficacy of stormwater management devices.

Frank, in construction, also went on to talk about how expanded partnerships benefited the organization as a whole in larger intangible ways:

And it gives the employees appreciation too, because they’ve worked around students day in and day out. And you know how some students are. Some students could care less if there’s a tree there or not. But, you know when you get that … and you get engaged and you work with these kids and they show a lot of interest and they recognize the labor that you do, and why it looks the way it does, because this is what you got to do, and you get that appreciation factor. And our employees are around them every day and you can tell. They’re doing something that is meaningful on campus. It’s not just a job.

The final point of agreement among practitioners is that the management of natural areas was an opportunity for staff development. John described an example where team building coincided with trash pick-up:

We did an internal program recently. I was trying to do two things: I was trying to get the lake cleaned up and I was trying to do a team building exercise. So I paired up folks that normally don’t work together, as a team building exercise, and what we did is three different types of cleanup: we had folks on land, folks in waders, and folks in canoes and kayaks. We had a lot of fun. We were limited in our resources, our money, and our budget. But what I wanted to do is provide prizes for most unusual item found, things like that. Make it fun, exciting, you know. We did it voluntarily this time. We had about 35 folks that went out and we spent about three hours out there. And overall we achieved our objective and we got a lot of trash out of the lake.

There was a surprising unity among practitioners’ perceptions. I had expected practitioners to identify a particular vegetation management technique as natural area management, or even a particular area of the campus as a natural area. Instead, what unified the identification of natural areas among practitioners were the points of agreement I identified above through Grounded Theory: the development of the campus grounds, the utilization of natural areas for educational enrichment, the formation of partnerships, and staff development. Surprisingly, these points had more to do with the social aspects of managing the landscape, rather than ecological aspects, such as vegetation, soils, and water.

**Barriers to Implementation**

Barriers to implementation extended from disagreement among practitioners perceptions. Practitioners disagreed about the resources required to adequately manage natural areas, which ultimately led to a failure to establish ongoing support.

All participants reported challenges associated with natural areas management. These were consistent with all other forms of grounds management practices. John described these challenges as,

My experience is it is across the board. I mean you always have something if you were to identify an area that is now in the purview of our maintenance: you survey the area and decide what you have to do, now what are the activities associated with that and then what are the challenges: accessibility, budget constraints, lack of equipment and lack of personnel – those kinds of things.
A compilation of all the challenges participants described is presented in table 1.

Table 1. Practitioners’ stated challenges

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<tr>
<td>Soil Erosion</td>
<td>Seasonal windows, such as planting times.</td>
</tr>
<tr>
<td>Water quantity and Run-off</td>
<td>Customer demands</td>
</tr>
<tr>
<td>Access</td>
<td>Public perceptions</td>
</tr>
<tr>
<td>Size of project</td>
<td>Labor requirements</td>
</tr>
<tr>
<td>Plant species selection</td>
<td>Expertise of staff</td>
</tr>
<tr>
<td>Lack of Irrigation</td>
<td>Equipment specialization</td>
</tr>
<tr>
<td>Herbivore pressure: Deer, Beaver, Cattle, etc.</td>
<td>Rules and regulations, including DENR, Stormwater BMPs, DOT, Utilities, etc.</td>
</tr>
</tbody>
</table>

It is important to understand that the challenges associated with any grounds management operation, including, but not exclusive to natural areas management require a strategy to overcome them. However, natural areas management, unlike other forms of conventional grounds management, often lacked a sufficient and sustainable strategy of support. As John states,

Part of the problem that we are faced with is that there is no established funding source for these things. You talk about challenges for natural areas; that type of scenario … where there is no established support … is a big challenge for us. If there’s no funding source, if there is no budget in place for these types of areas to be managed, then we have to go looking for it.

Lack of established funding support ultimately threatened natural areas management initiatives:

NW: Just as an aside, is it safe to assume, that these additional programs are the first to be cut in lean times?
John: Absolutely. If there is not a traditional funding source, those types of things will be cut back. Because we have other things we have to do, regardless.
NW: Yep, you got to mow the grass.
John: Right. That’s where it gets tricky. You try not to forget about these kinds of things, but that’s the hard part. The money only goes so far.

Established support for natural area management programs was often non-existent. Practitioners agreed that natural areas management was a series of social enhancements to the landscape more so than any particular application, which allowed for misunderstandings among practitioners as to the management requirements at any one site. A complete understanding of why was beyond the scope of this research, but my research suggests it stems from disagreement among practitioners of the resources natural areas require for their management.
**Opportunities for Implementation**

Opportunities for implementation point to a strategy to overcome the barrier identified above. These opportunities extend from the points of agreement among practitioners’ perceptions that were unique to natural area management, and include the following: the sustainable and aesthetic development of the campus, utilization of the campus grounds as an educational tool, expanded partnerships and innovation, and the development of staff. Because natural areas represented unique opportunities additional resources, even from unconventional sources, could be leveraged to support their ongoing management. Granting agencies, other sources of funding, and in-kind value may provide unique areas of support for natural areas. For example, students may help manage invasive species in the context of their education. Or, the development of staff for each natural areas management program adds value to the organization.

**Discussion / Recommendations**

I note four areas for improvement based on the findings above: (1) setting standards, (2) coordination of practitioners, (3) goal-setting and evaluation, and (3) establishing support. These recommendations extend from the barriers and opportunities listed above.

**Setting Standards**

Practitioners identified many diverse practices as natural areas management: everything from trash pick-up to college course integration. Although, there was surprising unity among practitioners’ perceptions of points of agreement, which indicates practitioners value natural areas in larger less tangible ways. A set of standards for natural area management programs could help to capitalize on these points of agreement and enhance their value.

The organization already sets standards for various categories of landscape management, including natural areas, in the master plan. However, these standards do not reflect the points of agreement uncovered through this research approach. The following standards are derived from the analysis of practitioner perceptions:

- Sustainability – the project should make an attempt to achieve some measurable goal or benchmark; for example, reduce maintenance, improve water quality, etc.;
- Aesthetic presentation – the project could improve the aesthetics of the campus;
- Educational opportunities – the project could have an educational component;
- Expanded partnerships and public participation – the project could build social capital;
- And development of staff – the project could improve the organization.

These standards could be documented in the master plan and applied universally as additional natural areas management programs implemented and existing ones are revised. Simply by clarifying the quality of natural area management programs through a set of standards this recommendation could add value to the organization without additional investment.
Coordination of Practitioners
Natural areas management practitioners were from various divisions that operated independently of one another. In addition, there was significant involvement from outside partners, including students and customers. Customers could be an agency such as Housing or Athletics. They often requested natural areas management programs and sponsored them financially. The conceptual model (figure 1) depicts each of these members as part of a larger organization and how they are coordinated.

Figure 1. Coordination of divisions.

Typical landscape programs originated in the design division as a component of new construction and filtered through construction to the maintenance division. The “design review” and “maintenance agreement” described in the model enabled clear and upfront agreements for the transition of responsibility for projects. However, natural areas management programs did not engage the same formal channels as other landscape programs on the campus.
Practitioners indicated that natural areas management programs originated from many different sources. For example, the turf grass reduction program originated within the maintenance division in collaboration with the office of sustainability and proceeded to the design division and the customer, the manager of the campus, to develop the turf reduction program. Customers also initiated natural area management programs, such as wildflower meadows, and a kudzu eradication program.

Unlike the hemisphere on the right in the conceptual model, there was a lack of formal channels to allow maintenance to re-inform the design and ultimately management of the landscape. This is important, because, to be consistent with the literature on adaptive management and management for resilience, feedback from on the ground observation is necessary to manage dynamic ecosystems. In other words, there was no formalized management of natural areas for practitioners.

Although there were no formalized feedback channels between maintenance and other divisions, there were plenty of informal interactions. For example, in the event of unexpected change, such as a disease outbreak or climactic events practitioners reported a strategy of improvisation. A member of the construction division explained,

> It almost kind of never stops. That sounds sad, but it’s really true. Because if something major happens, like say something gets wiped out, there’s a blight or we lose a bunch of things. Then we are going to have sit down, talk amongst ourselves, or engage Project Managers in the University Design and Construction or Capital Projects, depending upon what it is. And then just try to come up with something. And usually work with the University Landscape Architect and his group to try to solve problems and get funding and this kind of stuff.

It is clear that continuous coordination among all divisions is necessary to manage natural areas. Our findings indicate informal processes are implemented when management practices need to be reevaluated, as in the result of a disaster. However, this is not an adequate strategy for sustained coordination and results in one of the central barriers to implementation: an inadequate strategy to support natural areas management programs.

Our recommendation is to establish a natural resource council among representatives of each of the divisions and other stakeholders, including customers and outside organizations, to coordinate the ongoing management of natural areas on campus. Functions of this council could include the following: customer outreach to inform and establish support for natural area management programs; unify expectations of management requirements among practitioners; and conduct natural area management program evaluations.

**Goal-Setting and Program Evaluation**

The purpose of program evaluation is to weigh whether program operations fulfill program goals. However, the findings indicate that there was no clear understanding of the level of management natural areas required to be maintained. For example, recall the perspective of George, a representative of the design division, who claimed that Hearth Spaces are “where we should be … putting our energy and putting our most maintenance, but other areas, and certainly natural areas, shouldn’t be one of them.” Danny joked about this point of view from maintenance’s perspective, “…there is no such thing as ‘no maintenance’. Around here even a
rock is gonna [sic] get maintenance every once and a while, cause somebody’s gonna [sic] paint it.” Essentially, according to the maintenance division, the adoption of natural areas represented an expansion of management responsibility; regardless of other divisions’ expectations of how much management they should receive.

Management operations for natural areas were often undefined for maintenance staff. When a grounds manager was asked if he had been charged with the removal of invasive species he responded, “I guess you could actually be held to that if somebody really wanted to push the technical issue, but in general, it’s mainly what’s most visible, and what most people know is kudzu.” The implicit nature of management tasks was not unique to invasive species control. When discussing the management tasks of a wildflower meadow with a grounds manager, I asked him if there was an explicit management plan associated with the site. He responded, “Well there’s expectations of what needs to be done. No, it would be to my discretion because it’s in my area, I maintain it, so it’s usually my discretion, or my hort [sic] tech’s discretion.” The lack of explicit management led grounds managers in maintenance to develop their own operations regardless of program goals related to natural areas management.

Since tasks were not explicitly programmed as a part of management strategy I observed the following: (1) staff were free to develop their own management strategy regardless of program goals/purposes; (2) when an effective strategy to fulfill program goals/purposes is not developed staff are left under-resourced; and (3) management resources may be wasted because they are not tied to any effective strategy to accomplish the project’s purpose.

An effective management program would utilize on the ground operations to achieve a program’s purpose. Therefore, I identified a break in the chain of communication where operations did not necessarily support program purposes, and operations were not necessarily supported by program purposes. In fact, I identified an inadequate strategy, including, funding, staffing, efficiencies, etc. to support program operations as a central barrier to implementation.

An effective and efficient natural area management program should identify the goals of particular practices and evaluate how operations support them. The recommended natural resource council could conduct an audit of existing natural areas management practices and evaluate whether current operations support program goals. To improve management practices, it is necessary to ask the following questions of any natural areas management program:

1. Are there clear program goals?
2. Do management tasks reflect program goals?
3. Is there an adequate strategy to support management tasks?

The audit could occur continually at regular intervals over the life of the program to focus efforts and make adjustments as necessary. The act of reviewing existing practices and evaluating them represents an important approach to natural resource management that resembles ongoing adaptive management of the sort that Boyle et al. (2001) envision. This approach changes the fundamental architecture of the management program and enhances its capacity to be dynamic and long term, which is necessary to manage complex ecosystems.
Establishing Support

Our findings indicate natural areas management programs generally do not enjoy the established funding mechanisms to support them that typical grounds management does. However, I indicate several opportunities unique to natural areas that could be leveraged for natural area management programs including: sustainable development of the campus, utilization of the grounds as an educational tool, expanded partnerships and innovation, and staff development. The natural resource council I recommend could explore and acquire resources to support natural area management programs from unconventional, and, perhaps, underutilized sources. Resources could include grants and other partnerships for financial and material support, and volunteer coordination for labor support. Ultimately, the council should establish a long-term strategy to support natural area management programs, which are also long-term in nature.

Finally, the organization as a whole is positioned to benefit from the development of a natural areas management program. I found these programs represented significant opportunities for enhanced education, expanded partnerships, staff development, and ultimately the sustainable development of the campus. However, I did not find how the organization as a whole capitalized from these benefits, which are highly valuable, not only to the organization, but to its customers and university governance as well.

Limitations and Future research

This research was limited to the analysis of a single organization, which provides a point of reference for further study. Specifically it would be interesting to understand how unique the research results are to this particular organization. Future research would add additional case studies to identify commonalities and contrasts among institutions conducting natural area management programs. However, to expand this research it is necessary to address some of the more significant limitations of this study.

Also, the research approach intentionally allowed participants to define natural areas management. The open-ended discussion of natural areas management led to broad discussions leaving many unanswered questions about particular applications. Therefore, it was impossible to develop a working definition of natural area management, which makes it difficult to identify natural areas management for future research. From this point in the research it would be useful to explore specific applications, especially across institutions, such as stormwater BMPs or wildflower meadows management to understand if these findings are consistent.

It was not possible to protect confidentiality through the use of photovoice. Although participants were informed through the informed consent form (Appendix 2) and efforts were made to protect participants’ identity, participants could still be identified from the sites that they managed, especially by their supervisors and coworkers familiar with them and their work. This presented a significant risk between employees and employers, which may have influenced participants’ answers to questions and their willingness to participate; limiting the sample I had access to, or, worse, left some perspectives unheard within the organization.
Also the participant selection failed to capture the perspectives of members of natural area management that fell outside the organization, for example customers and contractors were not consulted. A better understanding of natural areas management could be derived from an investigation of outside practitioners. One would expect these perspectives would not be as optimistic as the inter-organizational perspectives I documented. Going outside the organization for additional data collection, however, was beyond the scope of this study.

Finally, there were difficulties with the technology used for data capture. The tablet technology was awkward for participants to operate, often leading to sloppy photography. For example, the fingers of a participant are visible in image 4. Also, participants were often driving, which prohibited their use of the technology. More importantly, participants often lacked the willingness to use the tablet. Participants tended to hand the tablet back after taking a picture. I had to consistently encourage participants to take pictures. Instead, participants were more comfortable telling me to take pictures of certain things for them. This represents an important departure from the methodology and mode of data capture I intended. If participants used the technology more fully data may have been richer leading to better understandings of the perspectives of practitioners. Future research would seek ways to for participants to more fully engage with the technology.

This study suggests several avenues for future research. It is of interest to explore other institutional contexts, such as cities and counties, military bases, etc. to determine if the significant factors and implications discovered in this research are unique to natural areas management or the institutional contexts in which the practice occurred.

A complete comparison of natural areas management programs and conventional grounds management programs could help to understand why an adequate strategy to support natural areas management was not readily available. This analysis could evaluate program goals against management operations and how program goals are communicated to operations staff. Further research is needed into the establishment of funding structures for natural areas management programs. Results would improve the sustainability of natural areas management programs.

Finally, there is not a clear picture of how the values expressed as program purposes could be integrated in the management of natural areas where there are conflicts, for example rights-of-way within natural areas. Follow up research is needed to better understand how conflicts within natural areas management are mitigated.

**Conclusions**

My understanding of the practice of natural area management is less clear as a result of this research. For example, there was not one practice, or even category of practices that defined natural area management. Instead, practitioners presented a surprising perspective of what constituted the practice, which was more value-laden than I originally imagined. These values describe the culture of the organization I investigated, and hopefully foreshadow future accomplishments they will make.
The recommendations I described were based on practitioners’ perceptions and comparisons among them. These serve to provide a basis from which improvements of natural areas management programs can be made. Ultimately these recommendations could make natural areas management programs more sustainable by becoming more efficient and more effective at achieving program goals, and more capable of dealing with uncertainty through incorporating processes that make the organization more flexible.

Opportunities were unique aspects of natural areas management that created advantages for implementation that other forms of grounds management did not. Barriers stemmed from practitioners having varying expectations of the management requirements for each natural area, which led to inadequate financial and labor support. This research also suggests that inadequate resources are assigned to natural areas management programs because they are often implemented unconventionally and through informal channels that lack strategic planning and established support.

The qualitative analysis of management organizations was a useful method to identify practitioner perceptions and improve natural area management operations. Grounded Theory was especially useful at identifying similarities and contrasts among practitioners’ perceptions. The photovoice method gave practitioners an opportunity to express their concerns and ideas regarding their practices, which could then be used to communicate across organizational divisions and up and down organizational hierarchies.

A better understanding of the organizations that conduct natural areas management exposes some of the motivations for conducting the practice. It does raise questions regarding the organization’s approach to the conservation of nature. In some ways, these practices were meant to increase efficiencies and not necessarily conserve nature or achieve ecological goals. Recall that natural areas were often in rights-of way or “placeholders” for future development. This suggests contradictions regarding the motivations of natural areas management at the institution. As ecologists continue to call for conservation within urban areas, consideration should be given to compatibilities and conflicts among natural areas management practices. For example, perhaps natural areas are compatible with rights-of-way, however the explicit description of ecological goals may be needed to make the practice more legitimate.

Another important observation from the practices and perceptions of natural areas management practitioners was the extent to which the achievement of certain societal goals was important to the practice, such as the sustainable development of the campus, enhanced opportunities for education, innovative partnership building, and staff development. These served to unify diverse practices all considered natural areas management by practitioners suggesting that natural areas management appealed to social goals as much as, if not more than, ecological goals.

I developed several recommendations to improve natural areas management implementation based on the idea that natural areas management requires the same planning and strategic approaches as conventional land management programs. First, coordination among practitioners is necessary to unify the management expectations of diverse actors and their stakeholders, including, customers and other fiscal sponsors. Practitioners should also formalize processes to
evaluate natural area management programs as they relate to program goals. This would increase efficiencies and effectiveness of current operations, and bolster future operations with operational strategies to support programs through time. Finally, practitioners should establish clear and sustainable strategies to support natural areas management programs by leveraging the unique opportunities that they present; including, the sustainable development of the campus, enhanced opportunities for education, innovative partnership building, and staff development. I believe a natural resource council made up of practitioners from each division identified, and customers and other stakeholders could carry out the above recommendations.

Natural areas management represents a valuable enterprise that benefits not only the physical campus and many of its environmental components, but also its practitioners and their organizations. The development of a sufficient natural area management program requires an adequate strategy to support these operations, which ultimately positions the organization to fully realize the benefits it provides.
References


Appendix 1

Interview protocol

Research Questions
(1) What are the natural areas management practices currently conducted at the university and who is involved and what do they do?
(2) How do practitioners perceive natural areas management practices, including identifying barriers to and opportunities for implementation?
(3) Are there points of agreement and differences among all practitioners of the practices, perceptions and experiences of natural areas management?

Initial contact is made with the director of grounds management and a chain of referral sampling is employed to identify the management organization surrounding particular sites that are managed as alternatives to turf. All participants in the study will be investigated using the same interview protocol below. The interview will be semi-structured, which allows for adjustments in the interview process to follow particularly interesting lines of information. A “guided tour” demonstrating how they conduct natural areas management will be requested of each participant.

An informed consent form will be provided at the beginning of the interview. This form informs participants of the risks and benefits of participating in this study, that their participation is voluntary, and confidentiality cannot be guaranteed. However, efforts will be made to keep confidentiality including the use of pseudonyms, a secure master list of participants will be kept in a separate location, and respondents will have the opportunity to review their interview responses before publication.

Interviews are one-on-one and take place in the “field” for approximately one and a half hours and employ participant led photography and audio recording (photovoice) using a tablet computer. The tablet computer will be introduced at the beginning of the interview. At this time I will discuss how to use it, the participant will have the opportunity to review the photos and grant permission to use them, and the rationale for using the camera as a new research approach to better understand their perspective.

The “field” is where the particular participant conducts the business of managing the site, for example a precinct supervisor may have a different location where they conduct their practice than a grounds supervisor.

At the end of the interview a review of the photos will take place and permission to use them will be requested. A copy of the photos and transcription of the interview will be provided via online file transfer. Participants will have the opportunity to review and comment on all interview materials.

Interview Script

A preliminary questionnaire will be sent to potential participants to arrange the interview. This email/phone call describes my expectations for the interview:

“I am interested in the management of natural areas on campus. Would you be available for a 1.5 hour guided tour of some of these sites?”

I will then meet the participant at the arranged time/place of their choosing.
“I am interested in your perspective regarding the challenges and opportunities of natural areas. I would like to ask you to show me how you manage these areas on a day-to-day basis and for you to take photographs of this process using an iPad. Admittedly this is a new and maybe unusual research approach, but I am very much interested in your perspective of these projects. I think you will find that the combination of the visual images combined with the discussion makes for a powerful result. I will record our conversation using audio recording software on the iPad so that you may essentially narrate the photographs as you take them. Afterwards, I can review the photographs you took and I will ask your permission to use them.”

I will present and discuss the informed consent form at this point.

Semi-structured interview questions

1. What is your role in the grounds management organization?

2. Can you describe the variety of vegetation management practices on campus? Can you begin to categorize these practices?
   a) Where are they and how big are they?
   b) Who is involved with their management?
   c) What motivated these particular projects?
   d) Are there any specific goals or objectives associated with the project?

Site-specific questions:

3. Are there any particular objectives with the management of this site?

4. Can you discuss the role of the managing team for this site?
   a) How does it operate?
   b) Who is involved?

5. What management tasks occur at this site throughout the season?
   a) Does this site require any particular expertise or skill-set to manage?

6. Can you describe for me how you conduct weed management at this site?
   a) How do you identify weeds?
   b) How do you decide which plants you use here? Have you selected any particular species or cultivars and why?
   c) How do you arrange the plants?

7. Is there a management plan for this site?
   a) If yes, then how do you use it? And follow up with “Why?”
   b) Who developed the plan?
   c) Can you tell me about your process, for example if you need to make changes to the plan how do you do that?

8. How do you address public perceptions?
   a) Have you received any commentary on this site, whether positive or negative, from its users?
   b) How have you addressed these commentaries?
c) Do you make any efforts to inform the public about what you are doing here, such as signage and/or tours? Could you describe them for me?

9. Are there any particular challenges to managing this site?
   a) Do you feel like what you are doing with this site is working well?
   b) Could it be improved?
   c) What would you do differently?

10. Can you describe the advantages to managing the site in this way?

11. Do you think it would be advantageous to expand this type of management on campus?
    a) Why or why not?
    b) How would you go about doing that?
Appendix 2

North Carolina State University
INFORMED CONSENT FORM for RESEARCH

Title of Study
Learning landscapes: A qualitative investigation of naturalistic vegetation management on the campus of North Carolina State University

Principal Investigator  Neal Wisenbaker, 919-533-9369  Faculty Sponsor (if applicable)  Dr. George Hess, 919-515-7437

What are some general things you should know about research studies?
You are being asked to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time without penalty. The purpose of this research study is to gain a better understanding how land managers manage natural areas on North Carolina State campus. You are not guaranteed any personal benefits from being in this study. Research studies also may pose risks to those that participate. In this consent form you will find specific details about the research in which you are being asked to participate. If you do not understand something in this form it is your right to ask the researcher for clarification or more information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher(s) named above.

What is the purpose of this study?
The purpose of this study is to better understand how land managers manage natural areas on North Carolina State University campus.

What will happen if you take part in the study?
If you agree to participate in this study, you will be asked to explain your perspective on the management of natural areas during a site tour of the managed area, which will serve as a walking interview guided by you. The investigator will ask you to take photographs of the sites visited while explaining their significance. The interview will be audio-recorded for later analysis. The walking interview will last approximately one and a half hours.

Risks
This research study seeks your feedback regarding the management of natural areas on the NCSU campus. This may be uncomfortable because it will inquire about the difficulties and challenges you face as you carry out your professional work. I will use pseudonyms and take precautions to maintain your confidentiality. However, a reader, including your co-workers, superiors, and others because of your association with the sites you manage, could still discover your identity and the photographs you take. This study is not about your job performance or your opinion of co-workers and supervisors. It focuses on the ability of an organization to manage landscapes that are dynamic and complex. For your protection, all comments and photographs you provide during the interview will be submitted to you afterwards for your review before publication. This will give you an opportunity to delete or withdraw comments and photographs. Interview recordings and transcripts will be stored in a secure location that is separate from any identifying information of participants of the study.
Benefits
There are no direct benefits to participation in this study. However, this research will provide grounds managers at NCSU and the broader grounds-management community an assessment of the land management practices on one university campus, which could be used to improve land management in the future.

Confidentiality
There is no implication that your responses, including recordings and written transcriptions of your interview responses will be confidential. Quotations and other information derived from your interview may be attributed to you. All communications with you (for example, email messages to arrange an interview) will be deleted upon completion of the study. If the investigator wishes to publish the research results, you will first have an opportunity to correct or delete any information or quotations that you provided. Published results will not include your real name or any other information that could link you to quotes or other information unless you provide express permission.

Compensation
You will not receive any compensation for participating.

What if you are a NCSU employee?
Participation in this study is not a requirement of your employment at NCSU, and your participation or lack thereof, will not affect your job. Your co-workers, supervisor(s), and other NCSU personnel will not know whether you participated.

What if you have questions about this study?
If you have questions at any time about the study or the procedures, you may contact the researcher, Neal Wisenbaker Neal Wisenbaker (ndwisenb@ncsu.edu, or 919-533-9369). You may also contact the supervising faculty member, Dr. George Hess (george_hess@ncsu.edu, or 919-515-7437).

What if you have questions about your rights as a research participant?
If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Deb Paxton, Regulatory Compliance Administrator, Box 7514, NCSU Campus (919/515-4514).

Consent To Participate
“I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may choose not to participate or to stop participating at any time without penalty or loss of benefits to which I am otherwise entitled. I agree to allow you to use the photographs I have taken and comments I have given after I have reviewed them.”

Subject’s signature ___________________________ Date ___________________________
Investigator’s signature ___________________________ Date ___________________________
Appendix 3

Photo Permission Form

I give permission to take my photograph. I understand this photograph is for research conducted by Neal Wisenbaker, a graduate student at North Carolina State University. The photograph(s) may be used in publications and other presentations associated with this research.

Print Name ____________________ Signature ____________________ Date ________________
Appendix 4

List of Illustrations

Table

1 Participants’ stated challenges.  

Images

1 George’s “dog-eared copy” of the campus master plan defines natural areas.  
2 Natural areas are classified and standards are established within the master plan.  
3 Turf reduction program reduced maintenance while enhancing aesthetics.  
4 This natural area was designed, built, and maintained by students.  
5 Stormwater BMP’s were described as manufactured natural areas.  
6 The use of native plants determined if an area was a natural area.  
7 Maintenance was overwhelmed by invasive species management.  
8 Gray areas represent future construction.  
9 Rights-of-way served as natural areas.  
10 The helicopter-landing pad was managed as natural area.  
11 Students were a source of innovation for design and construction.  

Figure

1 Coordination of divisions.