AUGMENTING TREE SPECIES IN NORTH DAKOTA: EVALUATING A 'NATURAL EXPERIMENT'

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

MASTER OF SCIENCE

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ABSTRACT

A limited number of woody species are approved by the Natural Resources Conservation Service for conservation plantings. Unapproved tree and shrub species are sometimes planted if privately funded. This study located such plantings and inventoried them. Thirty-one (31) unapproved species were inventoried on 185 sites in 27 North Dakota counties. Landowner care seemed to play a large role in success (high survival) of such plantings. Sites that were routinely maintained tended to have a higher survival than those without. Study results were shared with local Soil Conservation District personnel. Two surveys were sent out to final presentation audience members. These surveys were used to determine to evaluate how the results from this study affect planting planning strategies. Only 8 out of 27 participants the completed survey one fully completed the second survey. Five of those eight participants (63%) said that they have changed the way they plan conservation plantings.

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LITERATURE REVIEW

Conservation Organizations

There are a variety of conservation and education organizations across the United States that focus on various topics within the broad field of Natural Resources Management. Typically each conservation organization has the same core goal and that is to promote healthy soils, water, and land use (Muralikrishna & Manickam, 2017) through hands-on application. Conservation organizations are able to achieve their goals through conservation practices on private lands. Intensive farming practices can be detrimental to resource quality in the Great Plains (Quinn & Burbach, 2008). Conservation practices aim to enhance long-term land productivity and profitability (Cary & Wilkinson, 1997) and are becoming more popular as environmental awareness increases. The main conservation organizations that were involved in this study include the Natural Resources Conservation Service (NRCS) and Soil Conservation Districts (SCDs). Some education organizations focus on educating the public about the natural world around them. These organizations are more classroom oriented with occasional interactive lessons. The main education organization involved with this study was North Dakota State University (NDSU) Extension.

Organization Descriptions

The NRCS is an agency within the United States Department of Agriculture (USDA) and is part of the federal government. NRCS's main goal is to help private landowners improve the health of their agricultural operations while protecting natural resources for the future (Natural Resources Conservation Service, Mission and Vision, 2020). NRCS helps provide financial assistance through cost-share programs and some technical assistance with conservation planning (Natural Resources Conservation Service, Financial Assistance, 2020).

SCDs are part of the local/county government and are affiliated with the National Association of Conservation Districts. SCDs' main goal is to coordinate assistance from all available sources – public, private, local, state, and/or federal – to develop locally driven solutions to natural resource concerns (National Association of Conservation Districts, 2020). SCDs continuously work on achieving their goal by providing technical assistance to landowners. According to the Soil Conservation ND Century Code (1992), technical assistance covers a wide variety of tasks, including but not limited to: planning conservation projects, carrying out preventative and control measures such as growing vegetation, and providing assistance with any material or equipment to carry on operations related to soil and water conservation as a means to prevent and control soil erosion.

NDSU Extension is part of the state government and acts as the educational bridge between agriculture research and in-the-field application of new management practices. NDSU Extension emphasizes the strengthening of agriculture and empowering North Dakotans to improve their lives and their communities through science based education (North Dakota State University Extension, 2020). Through Extension, NDSU is able to bring vital, practical information that will help people make informed conservation decisions, whether those people are agricultural producers, conservation organization employees, small business owners, or the general public (United States Department of Agriculture, Extension. 2020). Extension disseminates technical information to both SCDs and NRCS and develops educational programs that are usually government funded (Prichette et al., 2012). Extension specialists are also frequently contacted by SCD and NRCS employees to answer questions that they may have experienced in the field. Specialists also provide feedback from their audience to the university

researchers by identifying issues landowners are experiencing which suggests potential research projects (United States Department of Agriculture, Extension, 2020).

The relationships among all three of these organizations are somewhat complex. Each organization is trying to fill a gap in conservation management to complement each other however, there can be some overlap between them as well (Figure 1). Government agencies, Extension, and private entities interrelate to reach the common goal of successful conservation practices. Successful partnerships result when cooperation efforts focus on the "sweet spot", otherwise as meeting the needs of the client (Pritchett et al., 2012). Achieving the "sweet spot" requires strong communication between the landowners and conservation organizations involved. If communication is lacking among organizations, planning of the proposed project is more difficult and gaps are likely to occur.

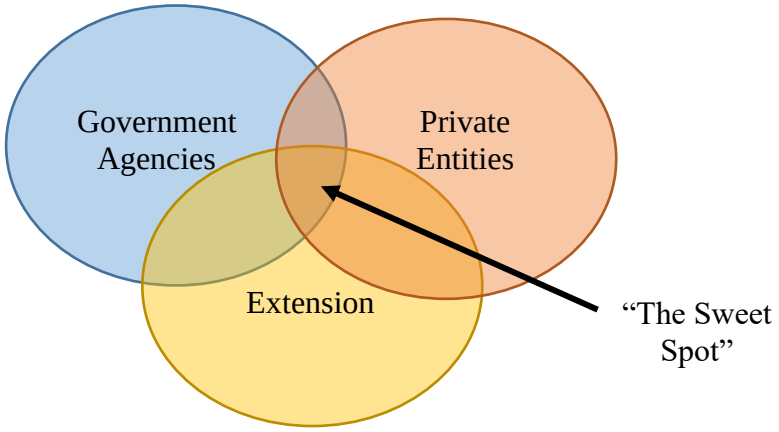

Figure 1. Venn diagram of partnering organizations (Pritchett et al., 2012).

Conservation Programs

Conservation organizations such as Soil Conservation Service, now known as NRCS, arose in 1935 (United States Department of Agriculture, Cooperative Extension History, 2020) to provide government assistance to landowners by providing better soil management practices and promote crop productivity. Other conservation organizations have been created over the years

that focus on the proper management of other natural resources as well. Programs created by these organizations guide stakeholders on how to use natural resources wisely on both public and private lands (Black et al., 2001). Extension has evolved since its creation but still has the same core goal of agriculture education to promote sustainable practices on private lands.

Technical Assistance

Two of the main reasons that landowners search for technical assistance are to address concerns they may be having or to take advantage of any potential resource opportunities in a sustainable way (Natural Resource Conservation Service, Technical Assistance, 2020). Technical assistance programs aim to promote a healthy and productive landscape. NRCS and SCDs have a variety of conservation goals in common. The ones most related to this project are: reduction of soil loss from erosion, improving long term sustainability of all lands, and to assist others in facilitating changes in land use (Natural Resource Conservation Service, Technical Assistance, 2020).

To achieve these goals NRCS and SCDs assist landowners with conservation management planning. Identifying management options and assisting with decision-making are ways that conservation organizations assist landowners. Mapping out what conservation methods the landowner wants to incorporate on their private property is one of the first steps towards better land use (Black et al., 2001). After the planning is completed, SCDs work directly with landowners to install the proposed plan on the property (National Association of Conservation Districts, 2020), because SCDs often have the machinery and the personnel that private entities do not have.

Financial Assistance

Financial assistance allows government funding to be used to assist landowners in implementing sustainable land management practices (Natural Resource Conservation Service, Financial Assistance, 2020). The purpose of these funds is to be used as monetary incentives to landowners so they are more likely to install conservation practices on their land (Song et al. 2014). The phrase 'cost-share program' is used to describe financial assistance programs. If a project is receiving federal funding as part of a 'cost-share program,' a specific amount of the total cost for the proposed project is federally funded while the remaining expenses are paid by the landowner. NRCS is one of the main organizations that provides federally funded financial assistance to landowners.

Financial assistance is only provided to projects that follow NRCS's project guidelines (M. Shappell, 2020). NRCS has a list of approved tree species in specific areas within ND which are described in the Expected 20-Year Tree Heights document. Research has shown that each species has a high likelihood of success on specific soil types, (Expected 20-Year Tree Heights, 2017), thus minimizing wasting of public funds. These regulations are followed by SCDs as guidelines for projects that receive federal funding.

A main source of revenue for most SCDs comes from installing conservation practices on private property (J. Miller, personal communication, March, 14, 2018; Richland County Soil Conservation District, 2018). Some landowners choose to incorporate conservation practices on their property and are willing to pay SCDs to assist with planning and implementation of the management strategies such as planting shelterbelts, laying protective weed barrier fabric, and or/ installing tree tubes. While SCDs do accept private payments from landowners to complete conservation projects, SCDs also try to assist landowners by connecting them with financial

assistance from federal and state programs (Kilgore et al., 2009). NRCS also assists with the planning process of these projects by working directly with SCDs to ensure that all project standards are being met if federal funding is requested Both forms of assistance (technical and financial) are important in promoting sustainable use of natural resources on private lands. Technical assistance can be provided to landowners with or without cost-share funding. Financial assistance helps alleviate expense pressures from landowners and helps promote implementation of sustainable practices (Song et al., 2014). However, not all project may apply to the requirements made by NRCS and so SCDs may provide technical assistance to privately funded projects. Occasionally SCDs go outside of the approved species list and use "off-list species" in conservation plantings. These plantings are 100% privately funded and no government funding is used.

Extension Programming

Extension education programs play an important role in agriculture. Extension personnel translate scientific research from land-grant universities into practical application methods for conservation organizations that work directly with landowners (National Institute of Food and Agriculture, 2020). Four basic steps of extension are 1) knowing the needs of the rural/urban community, 2) program planning and development, 3) implementation or execution of the program, and 4) assessment of the program (Anaeto et al., 2012). Extension personnel, whether they are Specialists or County Agents, are educators. There are a variety of extension programs; some work directly with landowners while others work closely with conservation organizations or professionals. The Specialists translate technical information to County Agents who then work directly with the landowners. Specialists also work with natural resource professionals, such as employees of Soil Conservation Districts, who then ideally implement the recommendations

made by the Specialists. Assessments give educators feedback on the success or shortfalls of the new techniques or programs implemented (Duerden & Witt, 2012). This well-established cycle of information improves agricultural, economic, and social conditions.

Extension Program Development

Extension educational programming is an intentional effort to fulfill predetermined needs of people and communities. The word program refers to the product resulting from all activities in which professional educators and learners are involved (Seevers et al., 2007). An extension program is a series of educational events that results in the audience changing their behavior to some extreme (Dromgoole et al., 2019). An array of materials and methods are used to distribute a program efficiently in various locations. Prior to delivering an extension program, educators need to determine what the desired long-term impacts or goals of their program are (Larese-Casanova, 2018). Once goals and key lessons have been determined, educators create lesson plans describing methods used to achieve those goals (Strong & Harder, 2010). Planning out how lessons will be distributed, and identifying the target audience are essential components of program planning. The relationships built with the audience members are also crucial to program success (Bairstow et al., 2002). Effective programs are focused on target audiences that have been identified using profiling techniques and directly engaging them to change their behavior (Monaghan et al., 2013).

Supplementary materials used in extension programming contributes to the success of the lesson (Stone & McConnon, 1984). When educators practice active learning techniques and incorporate educational materials participants are more likely to understand the lesson (Lecointe, 2020). Having hands on material or activities incorporated to the lesson helps the audience apply what they are learning to real life scenarios (Norton & Alwang, 2020). Lesson plans and

supplementary materials are not always created by the educator. Lessons plans and materials can be found through a variety of resources both online and in print. Project Wet and Project Learning tree are examples of printed lesson plan resources that educators can use as part of an educational program.

According to Shinn (1997), in person group discussions and hands-on demonstrations are effective teaching methods in agriculture. In the past, producers preferred attending small, locally oriented educational meetings where agency personnel could be more interactive, instead of using the internet or distance learning techniques (Boone et al., 2011). These types of interactions, while effective, are not always practical. Extension clients often have to choose which meetings to attend due to restrictions on cost of travel, increasing demands on time, and many meeting choices (Johnson, 2009).

A successful extension program depends on proper delivery of educational materials to the educators and the target audience (Pritchett et al., 2012). Presenting the lesson at a variety of locations and in different formats allows educators to increase their audience attendance (Grigoriadou & Papanikolaou, 2000). Different ways of presenting lessons include (Figure 2): audio recordings, video recordings, webinar meetings, or in-person presentations.

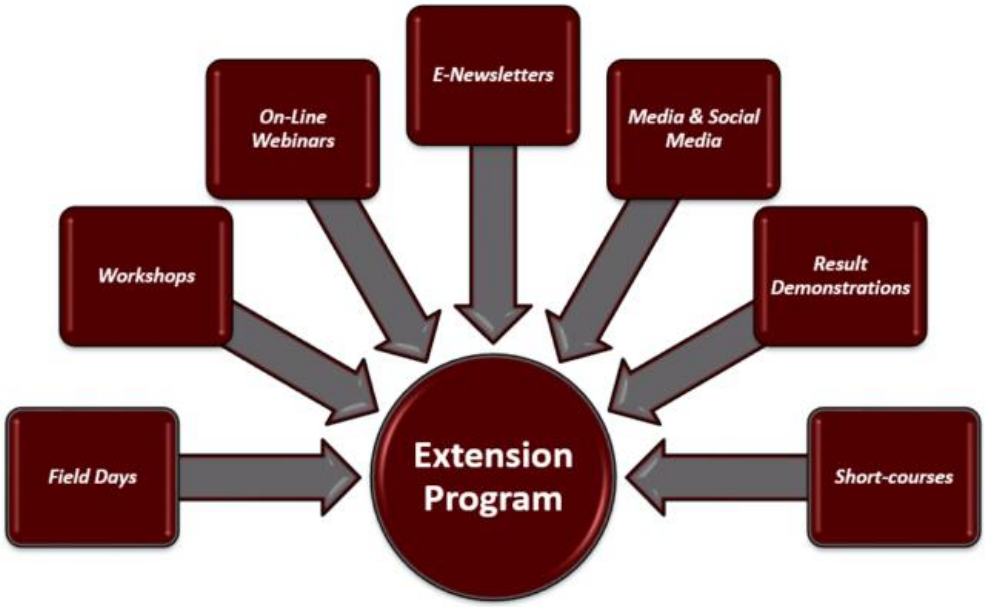

Figure 2. Concept map of Extension Education Program educational activities/events (Dromgoole et al. 2019).

Mobile technology is an essential tool that Extension educators can use to connect with their audiences in multiple ways. Online meetings/courses allow flexibility in attendance and increase participation from audience members compared to in-person meetings (Barrett, 2020). Program participants can view a short content lecture or narrated PowerPoint presentations (Schuster, 2012) instead of attending a full day workshop to learn new techniques. While in person trainings are still a preferred form of interaction, online courses allow participants to train on their own schedule without the cost of travel (Blanchard & McBride, 2020).

Extension Program Assessment

Extension educators are expected to assess the process of education delivery and measure the learner's level of achieving intended outcomes (Diaz et al., 2019). Feedback can be used to reevaluate and point out the shortfalls of the lesson to the educator as well (Roka et al., 2017). Key elements of an evaluation include: evaluation design, measurement strategies,

program monitoring, and program participation (Braverman & Engle, 2009). A clear evaluation will identify strengths and weakness within the program (Duerden & Witt, 2012). A program that lacks feedback will continue to be conducted in a way that is beneficial neither to the audience nor to other extension professionals.

The evaluation process needs to be considered with the main questions listed in Table 1 (Taylor-Powell et al., 1996). Each of these questions aims to have an answer that provides rich data to evaluate the program's success and to target any weak points in the material that can be changed for future practices. Figure 3 is a road map that lists key components involved in linking evaluation questions to the anticipated program outcomes (Radhakrishna & Relado, 2009). This flowchart provides researchers the opportunity to predict potential responses from participants to use when creating questions. The main evaluation technique involved with this study were 'Pre and post-tests.' 'Pre and post-tests' are one of the many common techniques used by extension researchers to assess participants' knowledge and understanding of instructional materials (Adedokun, 2018). These tests are given out to the audience to evaluate how much was learned and to help researchers define the strengths and weaknesses of the program (Bailey & Deen, 2002). 'Pre and post-tests' allow researchers to evaluate the change in behavior of the participant by comparing responses of the 'pre-test' to the responses of the 'post-test' (Adedokun, 2018). However, if questions are worded incorrectly some responses cannot be compared to show changes in behavior (Bailey & Deen, 2002).

Table 1. Evaluation process main questions (Taylor-Powell et al., 1996).

I. What are you going to evaluate?
II. What is the purpose of the evaluation?
III. Who will use the evaluation?
IV. How will they use it?
V. What questions will the evaluation seek to answer?
VI. What information do you need to answer the questions?
VII. When is the evaluation needed?
VIII. What resources do you need – time, money, people?

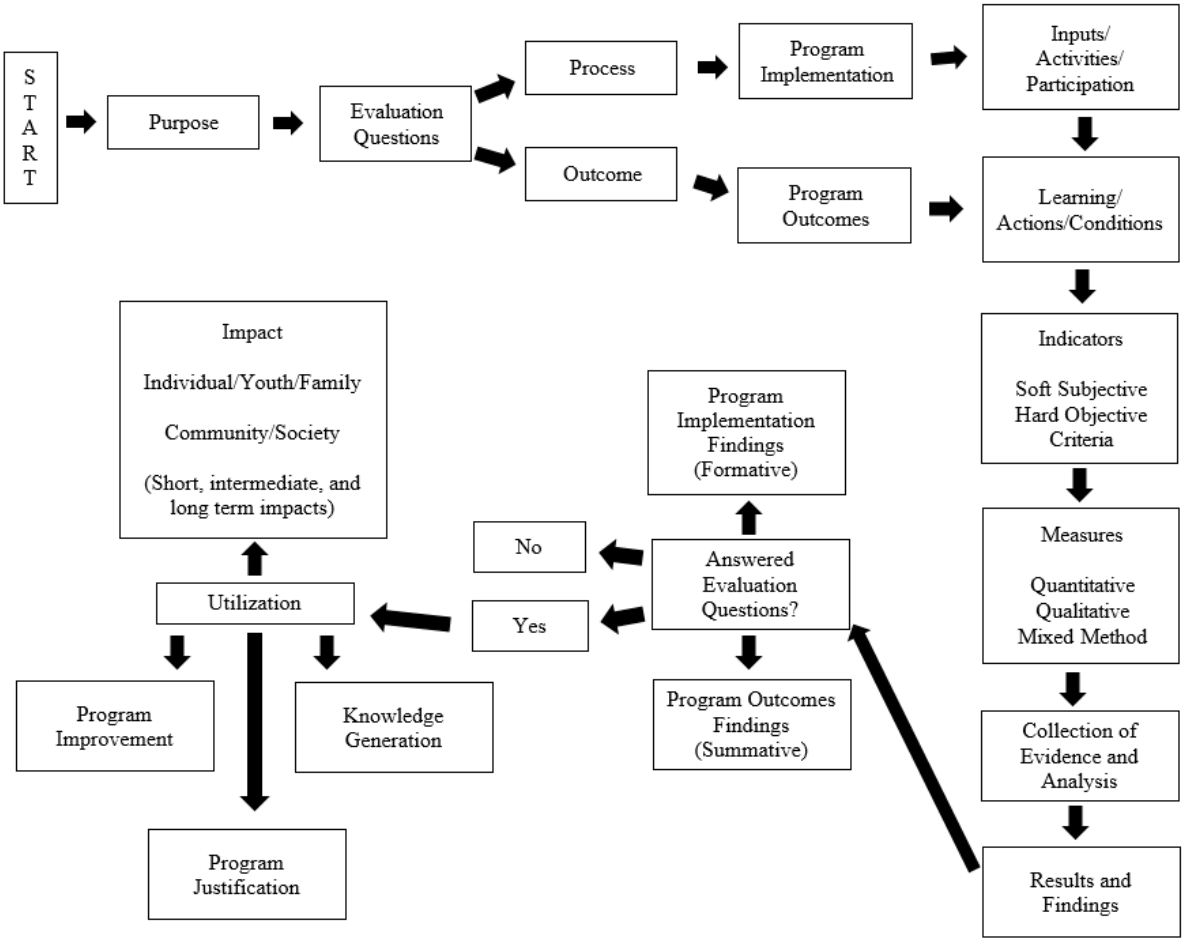

Figure 3. Schematic description of linking evaluation questions to program outcomes/impact (from Radhakrishna & Relado, 2009).

While there are many advantages to using surveys to evaluate the success of an extension program, there are some limitations as well. Surveys that are required or handed out after the

presentation and then collected once completed are more likely to have a higher number of participants compared to online surveys and the results will provide more useful feedback (Israel, 2010; Evans & Anil, 2018). However, response rates for mail in surveys has been declining as people are less engaged (Stedman et al., 2019). Telephone survey are also showing a declining trend in response rates due to the era of unlisted number, loss of land lines, and caller identification that allows potential respondents to screen calls (Connelly et al., 2003). While there are many benefits to online surveys, there are some shortfalls as well. Online surveys can be perceived as junk mail or impersonal and participants are less likely to respond due to the lack of potential consequences (Nayak & Narayan, 2019). Also, email addresses can easily become outdated for organizations that have a high employee turn-over rate (Stedman et al., 2019).

Another shortfall of surveys can be the wording of the questions. Some questions can be interpreted in a completely different way than the educator intended. This can be confusing for both the participants and for the researcher. If the question is not straight forward enough, responses could skew the results (Tobin et al., 2012). For online and printed surveys educators can use response control methods to limit the ways that participants can respond. Examples of this include: (online only) forced response applications where the participant cannot continue the survey without answering every question and multiple choice answers, or (printed and online) multiple choice answers. These are extremely useful tools that can be used to receive the most useful feedback possible without biasing the responses (Evans & Anil, 2018). Open ended questions, while also very useful because they allow participants to answer in their own words, can be difficult due to pull useful data from. This is due to the lack of control and the potential variability in responses or the misunderstanding of what the question was actually looking for (Tran et al., 2016).

INTRODUCTION

Conservation and proper management of shelterbelts in the Great Plains is an important objective for the agriculture field (Quinn & Burbach, 2008). There are a variety of conservation organizations that work with private landowners that focus on land management (Cary & Wilkinson, 1997). Each organization focuses on a specific conservation issue and some work closely with landowners (Muralikrishna & Manickam, 2017).

A variety of government assistance programs are available to landowners that provide financial or technical assistance. Specifically in North Dakota, NRCSprovides financial assistance to landowners wishing to plant shelterbelts on their property (United States Department of Agriculture, Conservation Planning, 2020). SCDs provide technical assistance to said landowners by providing the trees and assisting with planting them (National Association of Conservation Districts, 2020). In order to qualify for financial assistance, the proposed shelterbelt needs to meet specific guidelines set by NRCS. However, SCDs in some counties have attempted to utilize new and different species that do not meet guidelines. Plantings of "off-list" species do not qualify for financial assistance from NRCS and are privately funded by landowners. No follow up projects have been completed to determine the success of these plantings. However, NRCS and SCDs have shown interest in evaluating the success of these plantings in hopes to determine their potential for future plantings.

Research and education also play important roles in conservation. NDSU Extension acts as the educational bridge between agriculture research and in-the-field application of new management practices. Extension disseminates technical information to both SCDs and NRCS and develops educational programs that are usually government funded (Prichette et al., 2012). These programs are then followed up with assessments that determine changes in participants'

attitudes and especially their actions. The assessments provide feedback on the success of the program used to make improvements.

The three main objectives of this project were: 1. Identify and inventory plantings of "unapproved" tree species throughout North Dakota, 2. Present findings to SCD personnel, 3. Survey SCD personnel to see if their planting planning had changed based on inventory results.

METHODS

Study Area

The study area for this project was the entire state of North Dakota. North Dakota is known for its strong winds which are caused by a lack of natural barriers, such as mountains, to block north and south winds (National Oceanic and Atmospheric Administration, 2020). This makes it easy for large air masses to blow over the state which can cause severe soil erosion to open croplands. Movement of air masses and the associated temperature and moisture fronts cause large temperature fluctuations year round (Enz, 2003). Annual precipitation ranges from 13-20 in per year (National Oceanic and Atmospheric Administration, 2020) which makes it difficult for tree species that have high moisture requirements to survive. Harsh winters with average temperatures varying from 0°F in the northeast to 15°F in the southwest (Frankson et al., 2017), make it difficult for tree species that cannot tolerate extremely cold temperatures. Subzero temperatures have occurred as early as late October and as late as early April (National Oceanic and Atmospheric Administration, 2020). Below 0°F temperatures average about 40 to 70 days each year across the state (Enz, 2003). July is the hottest month of the year in North Dakota where daily average temperatures range from 65°F in the northeast to 72°F in the south (Frankson et al., 2017). The average number of days per year that temperatures exceed 90°F range from 10 in the northeast to 24 in the west and south (National Oceanic and Atmospheric Administration, 2020). The average growing season is about 110 days in the northeast and north-central regions and increases to about 120 days over most of the rest of the state (Enz, 2003).

NRCS Classifications

North Dakota is subdivided into four main physiographic regions: the Great Plains, the Missouri Coteau, the Glaciated Plains, and the Red River Valley (National Oceanic and

Atmospheric Administration, 2020). NRCS has classified the state into Major Land Resource Areas (MLRAs) (Figure 4) based on the areas' geology, climate, soil type, precipitation, and land use. MLRAs are used by SCD offices as agricultural planning tools. NRCS has split North Dakota into two halves, Western and Eastern, as follows (Figure 4): East (MLRAs: 53A, 53BB, 54, 58C, 60B, and 63A) and West (MLRAs: 55A, 55B, 56, and 102A). Within MLRAs are Conservation Tree and Shrub Groups (CTSG) which classify tree and shrub suitability mainly based on soil type. These subunits are then used by natural resource professionals for tree and shrub management and planning. CTSGs assure satisfactory individual species performance under specific conditions of soil, climate, and physiology (Natural Resources Conservation Service, Field Office Technical Guide, 2017).

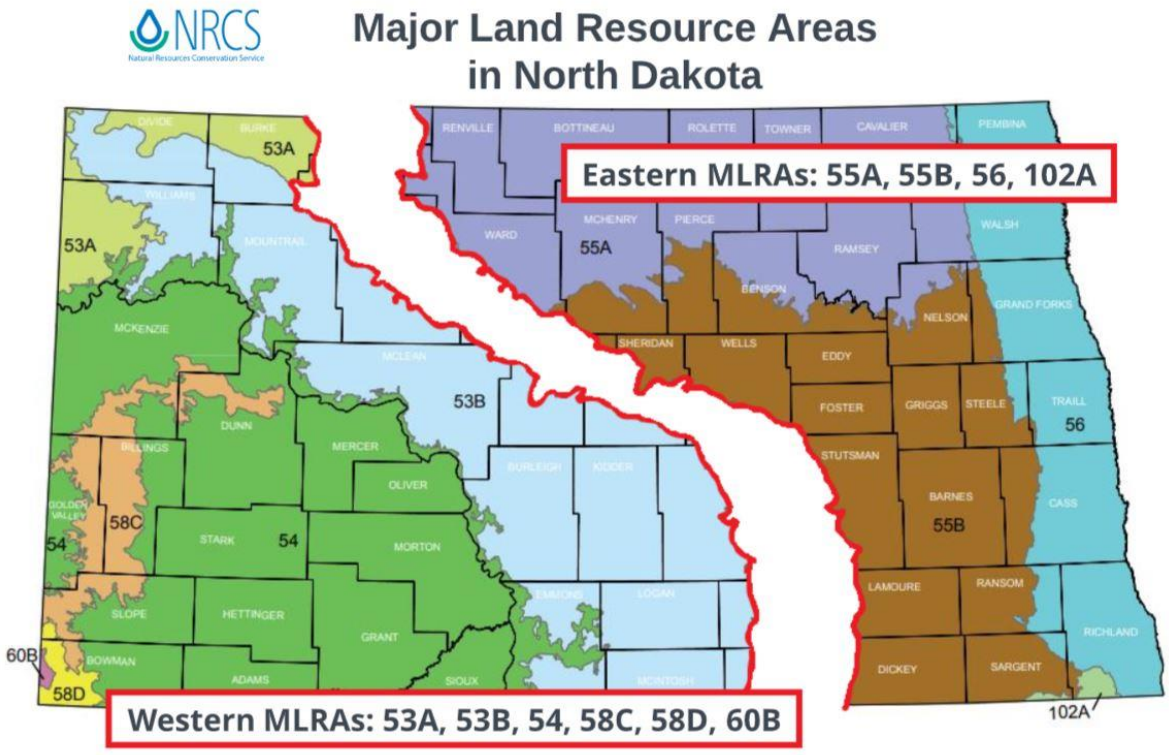

Figure 4. Adapted from Major Land Resource Area in ND Map (NRCS, 2018).

In order for NRCS to provide any financial assistance to landowners to establish shelterbelt plantings on private lands the proposed plan needs to follow CTSG guidelines. There are 56 tree and shrub species approved state wide and there are 10 species that are approved only in the Eastern half (Natural Resources Conservation Service, Field Office Technical Guide, 2017). Some species have exceptions or specific requirements to the normal conditions and are described in the Footnotes section of the CTSG guidelines. **(**United States Department of Agriculture, Natural Resource Conservation Service, 2017). NRCS's Variance Process allows SCDs to request to plant unapproved species on a given site. Proof that the tree/shrub species is already surviving on the unapproved site from a previous planting is required for the Variance request to be approved (J. Miller, personal communication, February 10, 2020). Plantings that have been approved by NRCS through the Variance process are then monitored for up to 20 years to record their level of success.

The sites that this study focused on utilized unapproved tree species that were planted by SCDs and were completely funded by the landowner. Completion of the variance procedure was not necessary on these sites because no public funds were utilized in their planting. Twenty-seven of the 53 counties of North Dakota were inventoried for this study. Twenty-six counties responded with no potential sites to inventory for this project (Figure 5). Inventory sites were identified by local SCD offices located within each county. Some counties have two SCD offices and some offices serve two counties.

NRCS personnel are aware that SCDs have planted unapproved species of trees that do not follow CTSG guidelines. However, NRCS is interested in the survival of those plantings and the results of this study. This project may provide new information about potential tree species that might be added to the approved species list.

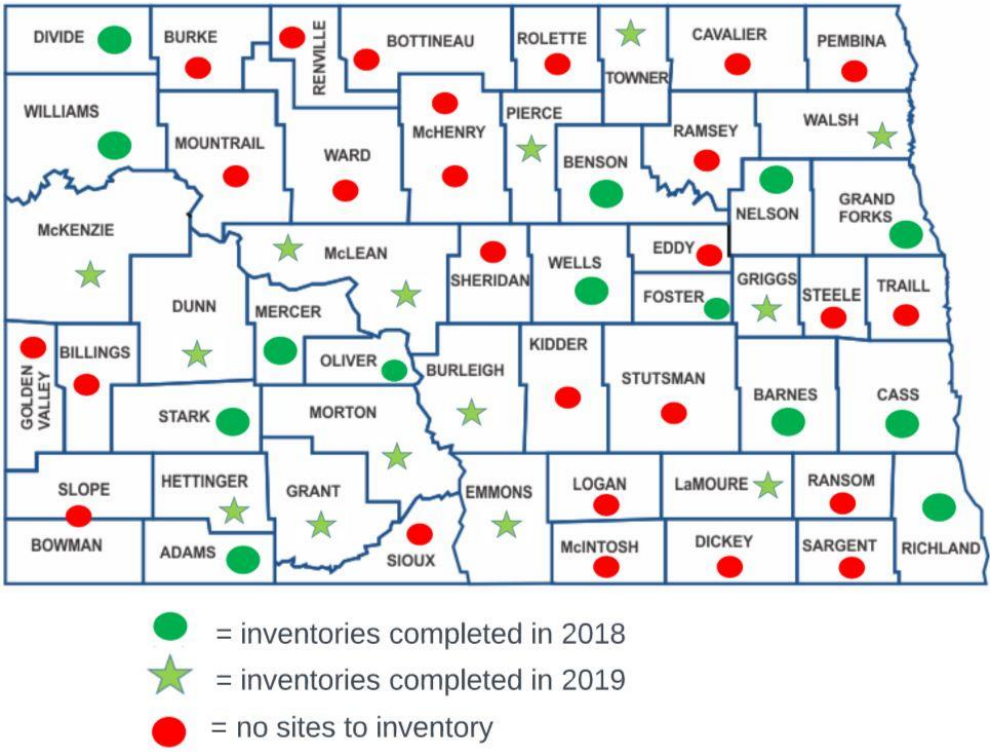

Figure 5. County inventory status map adapted from North Dakota county map (North Dakota Department of Transportation, 2018).

This project was conducted to study "unapproved" tree species that were planted across the state of North Dakota. One of the main goals for this project was to find potential tree species to increase the diversity of conservation tree plantings. The ecology of North Dakota influences the number of tree species that can grow within the state. A wide range of extreme temperatures and precipitation levels make it difficult for some species to survive while others are more tolerant of these extremes. In 2018 and 2019 there were five main steps taken in this study. They are outlined below.

1. Promote and build support for this study from stakeholders involved.
2. Locate potential sites for this study.
3. Visit and inventory sites where permission to access was received.
4. Summarize results from the field and share them with stakeholders involved.

5. Assess project result impacts on changes in SCD planting planning.

Step One: Building Support

In February of 2018 a request for potential sites to inventory was sent out to all SCD county offices in North Dakota. This was followed one month later with a presentation on the project at the annual Tree Promotion Meeting, which is attended by many SCD personnel. The email requested each SCD office to go through their planting plan records and to identify any species of trees that were planted within their county that are not on NRCS' "approved species" list, and that were 100% privately funded. Once identified, a copy of the planting record for each potential site was sent to the researcher.

Each county was emailed twice; there was a wait period of approximately one month between emails. After waiting another month, if there was no response, county SCD offices were called directly. Offices were called three times and voicemail messages were left with each call. If there was no response to messages left, offices were visited in person by the researcher.

Fourteen counties responded in 2018 with potential sites to inventory (Figure 5). Nine counties had responded positively to the email request for sites and five counties responded to phone calls. Each county that responded submitted planting records to be inventoried during the summer of 2018. Nineteen counties responded that there were no potential sites to inventory in their county and were no longer contacted for potential site information.

The email requests, the 2018 Tree Promotion Meeting, and the phone calls made to county SCD offices were all efforts to introduce and establish the researcher. These efforts towards building relationships were critical. Many SCD personnel were worried about sharing landowners' personal contact information with an outside organization. However, establishing and building those relationships seemed to alleviate the concerns of the SCD personnel. The

researcher was able to work more closely with county office while out conducting surveys as well. If there were any issues in contacting landowners or locating the property SCD personnel assisted the researcher in acquiring that information. Steps 1-3 were an iterative process, continuous efforts were put towards building support for this project, locating, and inventorying potential sites for this study.

Step Two: Locate Inventory Sites

Beginning two weeks before the summer field seasons, owners of the sites were contacted to request permission to inventory their property. Calling landowners two weeks in advance gave landowners time to prepare for their property to be inventoried. Landowners were called a total of three times with one week in between calls if there was no response. Voicemail messages were left when possible; some phone numbers were disconnected, some had no voicemail set up, and others had a busy tone and needed to be called back. Once permission was received, a time was scheduled to visit the property. If landowners were unreachable via phone calls a visit to the property to request permission in person was completed.

Step Three: Visit and Inventory Sites

Once permission was received, the target shelterbelts were inventoried and documented. Prior to arrival landowners were called to confirm the approval to access their property and the address of the property. Upon arrival the researcher introduced herself and answered any questions the landowner may have had. Then the inventory was conducted.

The inventory began with walking along the shelterbelt rows, counting live trees, and identifying any apparent influences on the trees (Table 2). Notes were recorded into a spreadsheet on a portable tablet or in a field note pad. In shelterbelts that had less than forty trees the height and new growth length were recorded for every live tree. In shelterbelts that had more

than 40 trees the height and new growth length were recorded for every fifth tree. Counties that had the highest number of sites approved for inventorying were visited first.

Table 2. List of potential influences identified during inventory surveys.

Diseases or damage to the crown and main stems of the tree	Presence/absence of weed barrier or tree tubes
Signs of general care by landowner	Presence or lack of pruning
Signs of flooding or drought	Wildlife or livestock disturbance
Signs of herbicide damage	Mowing around the planting site

Step Four: Summarize Results and Share with Stakeholders

Results were analyzed at the end of each field season. Findings from 2018 are described as preliminary results and findings from 2018 and 2019 together were considered Final Results. The dependent variable that was analyzed for each species was survival. Independent variables that were analyzed included: species, MLRA (West vs. East), soils (CTSG) within each MLRA, and management influences.

Web Soil Survey and Result Table Layouts

Using the Web Soil Survey, soils and CTSG groups were identified for each planting site. By making the area of the shelterbelt inventoried the AOI (Area of Interest) on the website, the exact soil types, map unit symbols, CTSG ratings, number of acres within the AOI, and percent of the AOI can be displayed. This information can be found in the Conservation Tree and Shrub Groups section under the Land Classifications tab, located within the Soil Reports page that can be found on the Soil Data Explorer page of the WSSW.

It's important to note that the Soil Survey results for North Dakota are somewhat coarse. A given map unit contains two or more soil types. In turn, those soil types may be listed as having different CTSG categories from each other.

This is extremely important for this project because some shelterbelts were planted across multiple soil types, and therefore a number of CTSG categories as well (Figure 6). The percent

of map unit and the CTSG rating for each soil type within that area is listed below each map unit symbol (Table 3). Soil types within a map unit were listed from most common to least common within the map unit. For ease of interpretation, the CTSG that had the highest percentage within the map unit for the area of the shelterbelt was used in our analysis. As an example, map unit symbol G229A (Table 3) shows that Heimdal is the most common soil type within the unit is in CTSG 3. So for this example site, CTSG 3 would be listed for analysis. The information was used in an attempt to observe any potential patterns between species survival ratings on specific soil types and CTSG categories.

Figure 6. Edited map screenshot of example inventory site from the Web Soil Survey (2020). Note: that the shelterbelt is located in two different map units, each with its own soil types.

Table 3. Example table derived from the Web Soil Survey.

Map unit symbol and soil name	Percent of map unit	Conservation tree/shrub group
G229A – Heimdal-Emrick loams, 0 to 3 percent slopes		
Heimdal	43	3
Emrick	37	1
G230B – Heimdal-Esmond loams, 3 to 6 percent slopes		
Heimdal	27	3
Esmond	26	8K

Inventory results are organized in three different ways. In the first, survival summaries for all species are listed, separated by East and West, but without soil type information. The second group highlights species that were replicated five or more times, referred to as focus species, within each half of the state but again without soil information. The third displays the results of each focus species categorized by CTSG. Focus species that has six or more plantings on the same CTSG had enough replication for analysis. The remaining plantings on various CTSGs inventoried can be used in future potential studies but did not have enough replication to provide useful data. The detailed tables show the following categories for each CTSG, no personal or identifiable information was posted or made public: number of sites, original number of trees planted, survival range, and year planted ranges.

Project Result Presentations

Table 4 shows a list of all project presentations in order of attendance, from project inception to completion. The Tree Promotion Meeting of 2018 was the first official presentation of this project to stakeholders – specifically, SCD employees. This presentation provided key information on the goals of this study and how their assistance, providing potential inventory site information, was needed to complete this project. This presentation also introduced the grad

student to the audience to begin building professional relationships with them. Some county offices provided potential site information shortly after attending the presentation (Step 2).

Table 4. List of professional events attended to present project updates separated by year.

2018	2019	2020
February: First email sent to SCDs March: Tree Promotion Meeting – Project introduction	March: Tree Promotion Meeting – Preliminary results	January 13th: Webinar– Final results
November: ND Association of Soil Conservation Districts Convention – Preliminary results	November: ND Association of Soil Conservation Districts Convention – Final results	January 30th: Webinar – Final results
		March: Tree Promotion Meeting – Final results

After the field season of 2018, preliminary results for the 14 counties inventoried were presented at the ND Association of Soil Conservation Districts Convention in November 2018 as a poster, and the ND Conservation District Employees Association's Tree Promotion Meeting in March 2019 as a PowerPoint presentation. The inventory results from field season 2018 were organized into species survival summaries which included all species inventoried that season. Presenting the results of this study back to SCDs was critical; after the presentations, 13 more county offices submitted potential sites which were then inventoried in the summer of 2019. The last seven counties responded with no potential sites to inventory. Figure 5 (pg. 18) shows which counties were inventoried in each year, and which counties responded with no sites. Presenting findings to the local SCD personnel was a form of the continuous efforts made to build relationships between the researcher and the county offices (Step 1), acquiring potential sites from counties (Step2), and sharing result information (Step 4).

Once all available sites were inventoried, final summaries were presented as PowerPoint presentations at ND Association of Soil Conservation Districts Convention in November 2019,

the ND Conservation District Employees Association's Tree Promotion Meeting in 2020, and via two webinar presentations. Species inventoried that were planted on one-to-three properties lacked enough replication to provide useful information. However, those results were included in a summary of all species inventoried for both the East and the West. Individual species' summaries were created for species planted on four or more sites.

A website (https://www.ag.ndsu.edu/trees/augmenting-trees-in-nd) was created for SCDs, NRCS employees, and the general public to access information about this study (Appendix A). The website provides a brief description of the project, data tables, a recorded webinar presentation, and a link to post-webinar viewing survey.

Step Five: Assessing Project Impact on SCD Planning

Two assessment surveys for this study were created and posted on Qualtrics (Appendix B & C). Viewers of the webinars were invited to participate in the surveys. The purpose of the surveys was to evaluate the usefulness of the information and how the viewers changed their behavior over time between surveys. Survey questions were created based off of questions presented in Table 1. The survey questions focused on understanding if the participants found the information useful for future planting planning, how they plan on using the information presented, and if they shared the information with others in their county. Prior to sending out the surveys, approval from the Institutional Review Board (IRB) was received. Both surveys were preapproved by IRB as 'Exempt' (Appendix D). Adjustments were made to Survey Two after IRB approval and a Protocol Amendment form was filed accordingly (Appendix E). Advertisements for the webinars were sent out to all SCDs via the SCD employee listserv, about 110 individuals were emailed. An invitation for Survey One was sent out to 36 viewers immediately after attending a webinar. The last question of the survey asked the participant if

they would be willing to provide their contact information to participate in Survey Two. All 24 participants who provided their contact information were sent one email with a link to Survey Two in March of 2020.

Survey results were analyzed after the responses to Survey Two plateaued and no other participants responded. The results of this project are descriptive statistics. Results for Survey One were analyzed separately from Survey Two. However, responses for Survey One were compared to responses to Survey Two to view the change in behavior of the participants over time.

Both surveys were evaluated in the same way to reduce bias. The first category examined was the completion rate of the survey for each participant. Not every participant completed 100% of the survey and this was important to note when evaluating survey responses. For analysis, questions were grouped together by theme: demographics, project awareness and involvement, changes in planning strategies, usefulness of this project, and sharing project info. For Survey One, respondents were asked if/how they were planning to change their behavior (planning strategies); in Survey Two, respondents were asked how they did change their behavior.

When applicable, responses were separated based on location. Responses for a majority of the questions in survey one were separated by East and West to follow NRCS' MLRA separation and to show the differences in views throughout the state. Questions that were not separated are noted in the Results section at the beginning of each question theme. These remaining questions were often open-ended and were grouped together by common themes. Survey 2 results were not split East/West due to a low number of responses.

RESULTS

There are three major parts of this project: 1) inventorying the state of North Dakota for plantings of unapproved species of trees, 2) present field inventory results to SCD personnel, and 3) surveying the audience of final inventory result presentations to evaluate their change in planting planning behavior.

Part One: Inventory Results

North Dakota has 53 counties, 27 county SCD offices participated in this study while the remaining 26 responded with no sites to inventory. Of the 27 counties that were involved, 14 counties were inventoried in the summer of 2018 and 13 counties were inventoried in 2019 (Figure 5, p. 18). Inventory results from both summers were combined for the final results (presented below). Of the 27 counties inventoried, 12 were located in the Western half of the state and 15 were in the Eastern half, according NRCS' MLRAs. A total of 483 potential inventory sites were identified. Thirty one (31) unapproved species were inventoried on 185 sites. The remaining 298 potential sites permission was not received to access the sites, mostly due to an inability to contact the landowner.

Some species were planted on a variety of CTSGs as identified by the Web Soil Survey. CTSGs that had 1-3 sites did not provide enough information to determine if the species was successful or not on that soil type. CTSGs that had 4-5 provided some replication but depending on the number of trees planted at each site it is difficult to suggest the successfulness of the species on that soil. CTSGs that had 6 or more sites was the preferred amount of replication for this study. However, the variation in survival ranges made it difficult to demonstrate success or failure. The median and average of species that provided enough replication were calculated to provide more data on their survival. East-vs-West results are shown separately.

Western North Dakota Results

A total of 21 unique species were inventoried in the Western half of North Dakota (Table 5). Detailed results (Table 6) are presented for: 'McKenzie' black chokeberry, silver maple, black walnut, and 'Red Splendor' crabapple because they were planted on more than five sites.

Table 5. Western North Dakota summary of all species inventoried.

Species	Number Planted	Number of Sites	Number of Sites Managed by Landowner	Survival Mean (%)	Survival Range (%)
Ohio buckeye	25	1	1	96.0	NA
Highbush cranberry	117	1	1	93.2	NA
Littleleaf linden	135	2	2	91.1	91-91
Smooth sumac	188	1	1	89.4	NA
Honeylocust	40	1	1	85.0	NA
Flame willow	30	1	1	83.3	NA
Mayday cherry	30	1	1	72.3	NA
'McKenzie' black chokeberry	808	14	8	67.6	0-100
Black currant	85	2	1	65.9	29-92
Silver maple	948	12	4	59.3	8-97
American linden	56	1	0	57.1	N/A
Black walnut	253	9	3	53.4	13-100
Douglas-fir	60	2	1	51.7	48-70
'Red Splendor' crabapple	365	10	4	47.1	9-96
Pin cherry	25	1	0	28.0	NA
Jack pine	38	1	0	26.3	NA
Meyer spruce	28	1	0	25.0	NA
Engleman spruce	855	2	0	3.5	0-4
Lodgepole pine	280	2	0	2.5	0-5
'Dropmore' elm	389	1	0	1.3	NA
Princeton elm	191	1	1	0.0	NA

Table 6. Western species of focus summary.

Species	Number of Sites	Number of Counties	Survival Mean (%)	Survival Median (%)	Survival Range (%)
'McKenzie' black chokeberry	14	3	67.6	67.0	0-100
Silver maple	12	6	59.3	43.7	8-97
Black walnut	9	5	53.4	45.0	13-100
'Red Splendor' crabapple	10	3	47.1	26.2	9-96

A total of 808 'McKenzie' black chokeberry shrubs (Table 7) were planted on 14 sites in three counties. Six of the 14 sites, 442 trees, were planted on CTSG 3. These planting occurred within two years of each other from 2010-2012 and had a survival range from 0-100%. Three other sites, 163 trees, were planted in 2004-2012 on a CTSG 9n and had a survival range from 51-100%.

Table 7. 'McKenzie' black chokeberry survival summary.

Number of sites	Original Number	Survival	Year(s) Planted	CTSG
1	50	94%	2010	1
6	442	0-100%	2010-2012	3
1	35	43%	2005	4
1	50	60%	2011	6g
3	163	51-100%	2004-2012	9n
2	160	65-85%	2010-2011	10
14	**808**			

A total of 948 Silver maple trees (Table 8), were planted on 12 sites in six counties. Seven of those sites, 378 trees, were planted on CTSG 3. These trees were planted from 1994-2016 and have a survival range from 8-97%. The remaining 5 sites were all planted on five different CTSGs and lacked enough replication to determine usefulness on the specific soil types.

Table 8. Silver maple survival summary.

Number of sites	Original Number	Survival	Year(s) Planted	CTSG
1	70	53%	2004	1
7	378	8-97%	1994-2016	3
1	10	10%	1996	4
1	25	44%	2011	6d
1	330	98%	2014	8k
1	135	14%	2001	10
12	**948**			

A total of 253 Black walnut trees (Table 9) were planted on nine sites in five counties. The nine sites were planted on 7 different soil types and the survival ranged from 0%-100%. No details about the remaining sites will be discussed due to the lack of replication.

Table 9. Black walnut survival summary.

Number of sites	Original Number	Survival	Year(s) Planted	CTSG
1	51	20%	1987	1
2	116	45-54%	1992-2011	3
2	14	20-25%	1995-1996	4
1	35	100%	2004	6d
1	15	13%	1994	6g
1	30	63%	2002	7
1	22	95%	2015	10
9	**253**			

A total of 365 ‘Red Splendor’ crabapple trees (Table 10) were planted on 10 sites in three counties. Four sites, 130 trees, were planted in 2006-2015 on CTSG 3 with a survival range from 9-78%. Three sites, 210 trees, were planted in 2000-2006 on CTSG 6d with a surviving range from 12-96%. The remaining three sites were all planted on different CTSGs and lack enough replication to determine how the soil types affect their survival.

Table 10. ‘Red Splendor’ crabapple survival summary.

Number of sites	Original Number	Survival	Year Planted	CTSG
4	130	9-78%	2006-2015	3
1	74	32%	2006	4c
3	210	12-96%	2000-2006	6d
1	30	7%	2005	6g
1	40	70%	2002	10
10	**365**			

Eastern North Dakota Results

Sixteen unique species were inventoried in the Eastern half of North Dakota (Table 11). Detailed results are given for: Manchurian ash, Autumn Blaze® maple, littleleaf linden, silver maple, ‘Princeton’ elm, and black walnut. These species (Table 12), were focused on because they were planted on five or more sites.

Table 11. Eastern North Dakota all species inventoried.

Species	Number Planted	Number of Sites	Number of Sites Managed by Landowner	Survival Mean (%)	Surviving Range (%)
Douglas-fir	279	2	2	78.5	69-90
Swamp white oak	164	1	0	62.8	NA
Manchurian ash	541	5	4	56.9	0-81
Black ash	28	1	0	50.0	NA
Autumn Blaze® maple	203	6	3	48.5	0-73
Littleleaf linden	1832	26	20	45.6	0-93
Silver maple	1076	23	10	34.9	0-87
Prairie Sky/Lombardy poplar	71	1	1	32.4	NA
‘Prairie Cascade’ weeping willow	28	1	1	28.6	NA
Old Flame willow	5	1	5	20.0	NA
‘Princeton’ elm	105	11	6	19.7	0-91
Paper birch	88	2	0	15.9	NA
Red oak	30	1	0	13.3	NA
‘Red Splendor’ crabapple	164	3	0	11.6	1-90
Black walnut	270	8	5	11.2	0-75
Northern Pin oak	400	1	0	0.0	NA

Table 12. Eastern species of focus summary.

Species	Number of Sites	Number of Counties	Survival Mean (%)	Survival Median (%)	Survival Range (%)
Manchurian ash	5	3	56.9	42.6	0-81
Autumn Blaze ® maple	6	2	48.5	29.9	0-73
Littleleaf linden	26	7	45.6	50.0	0-93
Silver maple	23	8	34.9	43.8	0-87
'Princeton' elm	11	1	19.7	11.1	0-91
Black walnut	8	2	11.2	26.0	0-75

A total of 541 Manchurian ash trees (Table 13), were planted on five sites in three counties and on 4 CTSGs. The range of survival was 0-81% with an average of 56.9% and a survival median of 42.6%. All five sites were all planted on four different CTSGs and lacked enough replication to determine usefulness on the specific soil types.

Table 13. Manchurian ash survival summary.

Number of Sites	Original Number	Survival	Year Planted	CTSG
1	210	81%	2000	1
2	88	0-43%	2000-2004	2
1	84	0%	2003	2kk
1	159	70%	2002	3
5	**541**			

A total of 203 Autumn Blaze® maple trees (Table 14), were planted on six sites in counties. Three sites, 120 trees, were planted in 1994-2009 on a CTSG 3 with a survival rate from 27-68%. No further details about the remaining sites will be discussed due to the lack of replication.

Table 14. Autumn Blaze® maple survival summary.

Number of Sites	Original Number	Survival	Year Planted	CTSG
2	76	0-73%	1998-2014	2kk
3	120	27-68%	1994-2009	3
1	10	0%	1981	10
6	**203**			

A total of 1,832 littleleaf linden trees (Table 15), were planted on 26 different sites in seven counties. Thirteen sites, 887 trees, were planted from 2000-2015 on a CTSG 3 with a survival rate from 0-93%. Three sites, 112 trees, were planted in 2012-2015 on a CTSG 2 and had a survival rate of 0-42%. Three sites, 123 trees, were planted in 2011-2015 on a CTSG 9w and had a survival range of 0-74%. No details about the remaining sites will be discussed due to the lack of replication on a single CTSG.

Table 15. Littleleaf linden survival summary.

Number of Sites	Original Number	Survival	Year Planted	CTSG
1	52	23%	2002	1
3	112	0-42%	2012-2015	2
2	225	22-71%	2001-2003	2kk
13	887	0-93%	2000-2015	3
1	38	61%	2012	6d
1	84	0%	2013	8k
3	123	0-74%	2011-2015	9w
2	311	50-74%	2006-2011	10
26	**1832**			

A total of 1,076 silver maple trees (Table 16) were planted on 23 sites within eight counties. Four sites, 196 trees, were planted in 2003-2016 on a CTSG 1 and had a survival range from 0-80%. Five sites, 267 trees, were planted in 2003-2017 on a CTSG 2kk and had a surviving range from 2-74%. Six sites, 231 trees, were planted from 1964-2014 on a CTSG 3 and had a survival range from 30-87%. Three sites, 134 trees, were planted in 2011-2016 on a CTSG

10 and had a survival range from 0-60%. No details about the remaining five sites will be discussed due to the lack of replication.

Table 16. Silver maple survival summary.

Number of Sites	Original Number	Survival	Year Planted	CTSG
4	196	0-80%	2003-2016	1
1	49	22%	2003	1k
1	44	82%	2013	2
5	267	2-74%	2003-2014	2kk
6	231	30-87%	1964-2014	3
1	26	65%	2014	8k
2	129	34-43%	2013-2015	9w
3	134	0-60%	2011-2016	10
23	**1076**			

A total of 360 ‘Princeton’ elm trees (Table 17), were planted on 11 sites in one county. Six sites, 231 trees, were planted in 1964-2014 on a CTSG 3 and have a survival range from 30-87%. Four sites, 133 trees, were planted in 2015-2016 on a CTSG 10 and had a survival range from 0-91%. Three sites, 135 trees, were planted in 2015-2016 on a CTSG 2kk and had a survival range from 0-58%. No details about the remaining four sites will be discussed due to the lack of replication.

Table 17. ‘Princeton’ elm survival summary.

Number of Sites	Original Number	Survival	Year Planted	CTSG
2	34	11-31%	2015-2016	1
3	135	0-58%	2015-2016	2kk
1	8	0%	2015	3
1	50	0%	2016	6g
4	133	0-91%	2015-2016	10
11	**360**			

A total of 270 black walnut trees (Table 18) were planted on 8 sites in two counties. Five sites, 186 trees, were planted in 1982-2015 on a CTSG 2kk and had a survival range of 0-75%.

The variability in survival rates for the remaining sites makes it difficult to demonstrate if a specific CTSG was successful or not.

Table 18. Black walnut survival summary.

Number of Sites	Original Number	Survival	Year Planted	CTSG
5	176	0-75%	1982-2015	2kk
2	110	12-40%	1987-2004	3
1	8	75%	2014	8k
8	**270**			

Part Two: Survey Results

Two surveys were conducted during this project; the results from each survey were kept separate for analyzation. The main purpose of the first survey was to gauge the usefulness of this project for SCD employees. The second survey was used to determine how SCDs have changed their shelterbelt planning strategies after attending a presentation of the results of this project.

Survey One Response Analysis

Thirty (27) participants began the survey; 23 participants fully completed the survey. The remaining four participants completed 0-72% of the survey and their responses have been included in the following analysis. Some questions were separated by Eastern and Western North Dakota to follow NRCS' MLRA separation and to show the differences in views throughout the state. The remaining questions that were not split by East and West were grouped together by common themes. These questions were often open-ended.

Survey questions one and two determined demographics of participants. People from 13 Western counties participated in the survey. Ten identified as District Technicians, two responded that they are District Managers, and one responded that they are a District Clerk. People from 10 Eastern counties participated in the survey. Three participants responded that they are District Technicians, five participants responded that their job title is District Manager,

one participant responded they are their Districts Watershed Coordinator, and one participant responded they work for the Natural Resource Conservation Service. Four participants did not list in which half of the state they were located or what job position they hold. These results have been analyzed separately and these four participants have been labeled group No Answer (NA).

Fourteen (14) participants from both East and West combined, first learned about this study from the first email that was sent out in February 2018 prior to the project introduction presentation in March. Twenty-one participants indicated that their county has used NRCS' variance procedure. Two participants did not know if their county uses the variance procedure and one participant responded their county has not used the variance procedure.

Responses to the question asking if their county submitted planting records to this project and their reasoning why if they did not, had some variation between the East and West. Seven Western participants responded their county submitted planting records, three did not submit records, two did not know if their county had participated or not, and one participant did not answer the question. Reasons for the lack of participation included: could not locate the information, there were on off-list plantings in their county, too new to the team didn't know about the project in time. Two Eastern participants responded that their county had submitted planting records, five did not submit records, and three did not know if their county had participated or not. Of the five that did not submit records their reasons are: two counties did not have any suitable sites, and three respondents did not have enough time.

Responses to questions about changing planning strategies varied between the East and the West. Twelve of the thirteen Western participants answered the question, "Do you plan on changing your shelterbelt planning strategies based off of the material presented?" Five participants responded that they are not going to change their planting planning strategies. Four

participants responded they were going to change their planning strategies. Two participants did not know if they were going to change their strategies. One participant did not answer this question. All ten Eastern participants answered this question. Two participants answering they do not plan on changing their strategies. Four participants plan on changing their strategies, and four participants unsure. For the NA group, one participant plans on changing planning strategies, one does not plan on changing, and two did not answer the question.

Participants were asked an open-ended question on how their shelterbelt planning process might change. Both East and West responses circled around the main theme of wanting to continue experimental plantings. Encouragement to landowners to plant new species was a popular answer with an understanding that SCDs should take more precautionary measures, such as more soil testing and more guidance to landowners on how to maintain their trees were listed.

Overall most participants found this project and its presentations to be useful (Table 19). The average rating of this presentation by Western participants was 8.08, with a median of 8. The average rating of this presentation by Eastern participants was 7.5, with a median of 8. The average rating of this presentation by NA was 6.3, with a median of 7.

Table 19. Summary of participant rating of presentation usefulness separated by location.

Presentation Rating Scale	1	2	3	4	5	6	7	8	9	10
Western Participant presentation rating						1	2	4	5	
Eastern Participant Presentation Rating		1					1	6	2	
NA Participant presentation rating				1			1	1		

Most participants plan on sharing the information with others in their counties (Table 20). In the West twelve people plan on sharing with landowners, ten people plan on sharing with SCD Supervisors, and one person plans on sharing with Extension Agents. One Western

participant did not answer this question. In the East eight people plan on sharing with landowners, nine people plan on sharing with SCD Supervisors, one person plans on sharing with Nurseries, two people plan on sharing with NRCS, one person plans on sharing with office staff, and one person does not plan on sharing this information with anyone. In the NA group two people plan on sharing information with landowners, two people plan on sharing with SCD Supervisors, one person plans on sharing with nurseries, and one person does not plan on sharing with anyone.

Table 20. Summary of community members that participants plan on sharing information with separated by location.

Will share information with:	Western	Eastern	NA
Landowners	11	8	2
SCD Supervisors	10	9	2
Nurseries	1	1	1
Other:	-	-	
Extension Agent	1		
NRCS		2	
Other office staff		1	
No one		1	1

Survey Two Response Analysis

Eleven people began the survey but only eight completed it and three participants completed only 40% of the survey. Ten participants responded that they are part of a Soil Conservation District, and one participant responded that they are from the NDASCD. Due to the low number of respondents compared to the first survey, responses have been grouped together instead of split by East and West.

SCD respondents have the following job titles: five District Technicians, two District Managers, one District Manager/Technician, one District Clerk/Technician, and one Natural Resources Coordinator. The NDASCD participant is a Farm Bill Specialist. Two of the District Technicians and the NDASCD participant did not complete the survey.

Since attending a presentation/webinar of North Dakota Shelterbelt Inventory Results, three participants responded that their county had no change, three responded some change, and two responded moderate change. These results were compared with responses to the question from Survey One asking if the participant's county was planning on changing their planning strategies after attending a presentation (Table 21).

Two of the four participants indicated in Survey One their county was going to make changes, responded to Survey Two that some changes were made. The remaining two participants responded to Survey Two that moderate changes were made. The participant that responded to Survey One that their county was not going was not going to make any changes kept their response the same for Survey Two. Two of the three participants that responded to Survey One saying they were not sure if their county was going to make any changes responded to Survey Two that no changes have been made. The remaining participant responded to Survey Two that their county has made some changes. Specific changes in planning strategies include: 3 Species selection – discontinuation of a species (Princeton elm on some sites, various), 2 Species selection – introduction of a species (Douglas-fir), 3 no answer, and one other (preference/recommendation of species).

Table 21. Comparison of how counties planning strategies have changed between Survey One and Survey Two.

Survey One Response		Survey Two Response				
		No change	Some change	Moderate change	Dramatic change	I don't know
4	Yes		2	2		
1	No	1				
3	I don't know	2	1			
8	Total	3	3	2		

Participants were asked to rank categories or study variables which were most useful to them when shelterbelt planning (Table 22). A ranking of 1 was most important and 5 was the least important). Overall, soil type (CTSG category) was ranked as the most important with a median of 1 and an average of 1.25. Location of the study sites (E/W MLRA) was the second most important with a median of 2.5 and an average of 2.75. Landowner preference was ranked as the third most important with a median of 3 and an average of 2.875. While this category was not part of this study it was important to include to determine what factors SCDs value most when planning a planting. This also gives some reasoning behind why SCDs planted approved or off-list tree species. State wide survival and number of sites inventoried both had the same median of 4. However number of sites (average: 4) was ranked slightly higher than state wide survival (average 4.125) based off of averages.

Table 22. Ranking of inventory categories based off of usefulness to participants.

	Soil type	Eastern/Western MLRA	Landowner preference	# of sites inventoried	State wide survival rate
	1	2	3	4	5
	1	3	2	4	5
	1	2	3	5	4
	2	3	1	5	4
	1	5	4	3	2
	2	1	5	3	4
	1	4	2	3	5
	1	2	3	5	4
Average	1.25	2.75	2.875	4	4.125
Median	1	2.5	3	4	4

Nine participants responded that they shared information from this project with others in their county, two participants responded that they have not shared any information. Of the nine participants that did share information, six responded with whom they have shared it (Table 23). Five participants shared with landowners, all six shared with SCD supervisors, and one shared with Tribal Lands Management.

Table 23. Summary of who SCDs have shared this project's information with.

Shared information with:	
Landowners	5
SCD Supervisors	6
Other – Tribal Lands Management	1
None	2

The last few questions of the survey were used to determine how many people would be interested in continuing to plant experimental species. Six are willing to try new species as long as it is privately funded by the landowner, and two were willing to try new species as long as it is approved by NRCS through their variance process. The last question asked if participants would be interested in participating in potential future 'experimental species' planting studies, all 8 participants responded yes.

DISCUSSION

There were three main objectives of this project: 1. Identify and inventory plantings of "unapproved" tree species throughout North Dakota, 2. Present findings to SCD personnel, 3. Survey SCD personnel to see if their planting planning had changed based on inventory results. Unofficially, we hoped to shed light on any potential tree species that could be used in future shelterbelt plantings. Identifying inventory sites provides opportunities to continue this study in the future, both on sites that were successfully inventoried and sites in which access was not yet gained. Monitoring new plantings can also potentially add new data to this study. None of the species inventoried showed consistent success. The inventory results did not provide enough information to determine usefulness of a species on a specific soil type due to lack of replication on the same soil type and/or too wide of a survival range with no distinguishable pattern.

Inventory Analysis

Potential influences of survival that were recorded for each inventory site included: presence/absence of browsing, tree tubes or weed-barrier fabric, competition from weeds, herbicide damage, and general maintenance. No patterns seemed to be present with any of these potential influences, except general maintenance. General maintenance includes routinely mowing around the trees and or pruning the trees. Sites where the landowners maintained their trees seemed to be more successful than those that were unmaintained. This did not follow the trend found in research conducted by Stange (2018). He found that sites with tree tubes and fabric had better survival rates than sites without either management practices. However, Stange (2018) did find that improper handling and care of young trees has negative effects on survival rates of the conservation plantings.

Figure 24 depicts the three main factors that were analyzed for each focus species and CTSG. A species that has been planted on a variety of sites within the same CTSG, has a high number of trees planted on those sites, and is maintained seems to have enough evidence to recommend the species to NRCS for approval. Each of these factors will be discussed for each focus species in the next section.

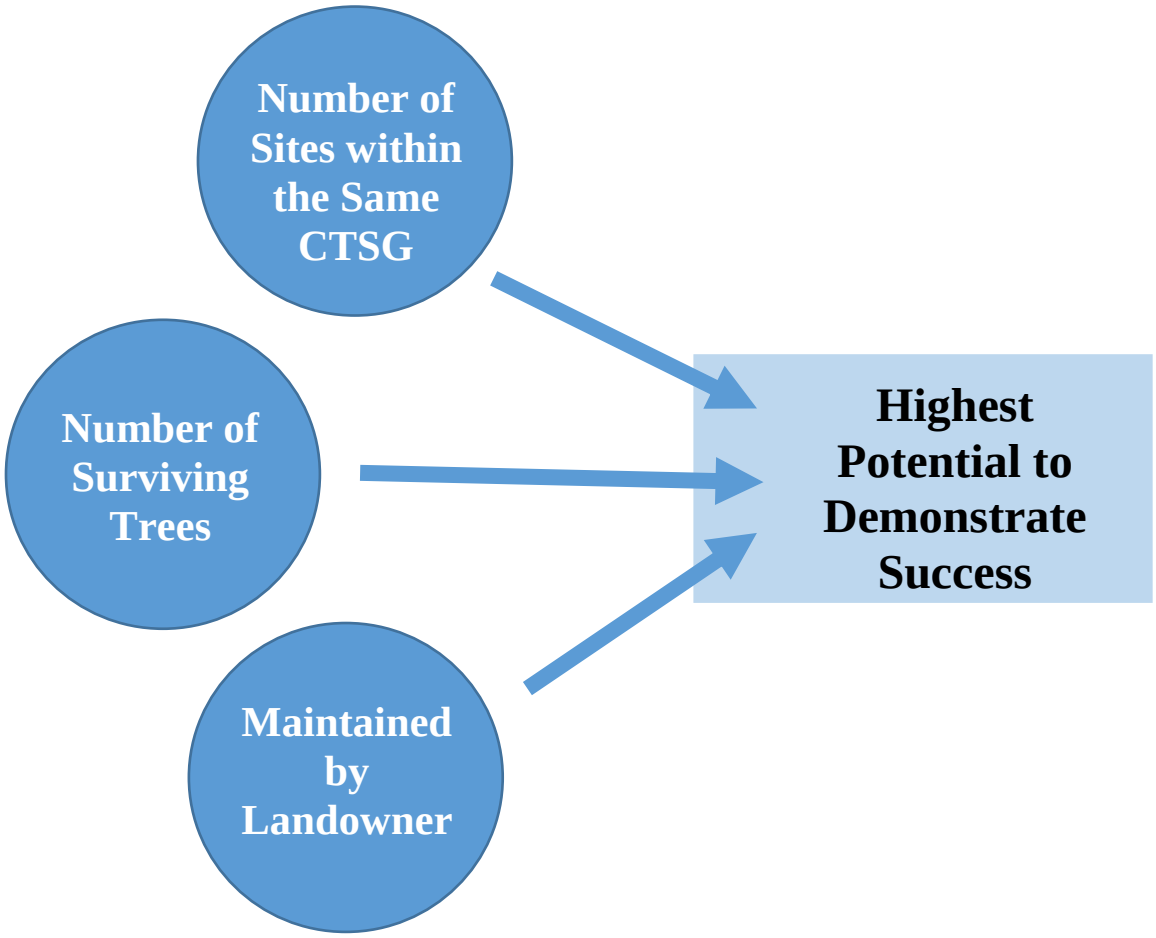

Figure 7. The three main factors analyzed for each focus species and CTSG.

Western Result Interpretation

In the West, only McKenzie black chokeberry and silver maple had six or more inventory sites on a single CTSG. These two species were focused on in this section because of the increased amount of replication on the same CTSG.

The six McKenzie black chokeberry sites, 442 trees, were planted on CTSG 3. However, with the variability in survival rates it was difficult to demonstrate overall success or not. Two of the sites were unsuccessful, due to what seems like lack of care. The remaining four sites had a success rate from 60-100% and had a range of care from occasional care, old signs of mowing and pruning, to regular maintenance. I believe this species shows potential for future studies on CTSG 3.

According to the owners of the two silver maple sites that had below 40% survival, they took care of their trees at first but eventually stopped taking care of them. Two of the three sites that were between 40% and 60% survival were either damaged by mowers or deer. The consistent injuries may have been one of the leading causes for death for the trees. The remaining two sites that were above 90% were both maintained regularly by their owners. This information shows that careful maintenance has a positive effect on this species. However, further research or monitoring of these sites should be conducted to determine a pattern of success on this CTSG with this species.

Eastern Result Interpretation

In the East, littleleaf linden and silver maple were the only two species that had six or more sites planted on a single CTSG. The remaining species had over fives individual sites but lacked enough CTSG replication.

Littleleaf linden was planted on 11 sites, 887 trees, on CTSG 3 with a survival range of 0-93%. Almost all 11 of these sites had minimum to low maintenance from the landowners which makes it difficult to show that lack of care is the cause for the results of this species. There was no pattern of heavy browsing or disease at these plantings. Two sites had 0% survival and the remaining sites had an average survival rate of 50% and a median survival rate of 49%. With no proven reason of the failure of those two sites and the middling survival of this species with minimal to no maintenance, I believe that if these plantings were cared for, as advised when planted, then the survival of this species would've been higher than what this study shows. However, more research should be done with this species with an increased amount of care to demonstrate success or failure of this species on this CTSG.

Silver maple was planted on six sites, 231 trees, within CTSG 3 and had a survival range of 30-87%, a median of 68%, and an average of 61%. The three sites that were unmaintained had survival rates of: 30%, 44%, and 65%. The three sites that were maintained had survival rates of 70%, 73%, and 87%. There were no other patterns of other potential survival influences observed. I believe the results show that this species has potential for future use on a CTSG 3 if it is well maintained, but further research needs to be conducted to provide additional support.

Project Presentations – Building Support

The three main causes for lack of response from some SCDs seemed to be: 1. lack of time, 2. this project was not a priority for certain SCD offices, and 3. lack of professional relationship between the researcher and the SCD personnel. SCD planning and planting seasons overlapped substantially with our own planning and field seasons. If the researcher ran into any issues locating potential sites or contact information for landowners during planning or planting seasons there was often little to no help from SCD offices.

Some SCD offices were very engaged with this project and eager to assist with the research. However, it seemed as though some SCD offices did not see this project as a priority and put little effort into communication. Personnel from a few SCDs were very cautious about sending out landowner contact information due to apparent lack of trust with the researcher. These SCDs followed NRCS' landowner contact release process very closely. They first contacted the landowner for approval before sending the site information to the researcher. Other SCD offices sent potential site information to the researcher without prior landowner consent once they had searched through their records. However, all potential sites were included in the inventory. For those sites where the local SCD personnel had received prior approval, this reduced the researcher's time and effort to gain access to a property for inventorying.

After summer 2018, preliminary results and county contact status were presented at two different conferences in person. SCD employees were able to interact and establish more in-person contact with the researcher than at the first preliminary conference. They asked detailed questions about our needs and how landowner contact information was being used. The building of these professional relationships proved to be beneficial. Before presenting preliminary results, the researcher was able to contact 32 of the 53 counties. After the first presentation of preliminary results, six more counties provided potential inventory sites. Seven more counties responded to the researcher stating they would go through their records. Contact with one county was still not made at this point, though the final county was contacted by the end of the 2019 field season. The final number of counties that were inventoried was 27 and the remaining 26 counties responded with no potential sites to visit.

Soil Conservation District personnel were very interested in learning the final inventory results of this study. SCD personnel were very engaged in the face-to-face and online

presentations by asking questions and making comments to the researcher. For those who completed the project surveys, almost all of the participants thanked the researcher for conducting this study and most showed interest in participating in future studies.

Survey Result Interpretation

The two surveys were both used to collect information on how SCD personnel interpreted results and how they used or plan to use the information. Analysis of these surveys followed the same process presented in Figure 3. Demographics and changing/changed planting planning strategies were the main themes for the surveys.

Demographics

The demographic questions helped shed light on where in the state participants work, and what position they hold. In general most participants for Survey One were District Technicians, fifteen participants, and the next highest participation was from District managers, eight participants. A majority of participants for Survey Two held the position District technician. District technicians handle most of the planning for their county and work directly with landowners (J. Miller, personal communication, October 29, 2020). District managers supervise District technicians and oversee budgeting for the office. For Survey Two, there was not enough participants to split East and West. Also the completion rate of the survey per participant fell compared to the completion rate per participant from Survey One. The four participants that did not complete the survey all stopped on the question that asked the participants who they shared the inventory results of this study with. While not certain, we believe that participants did not want to answer this specific forced question.

Changes in Planting Planning

There was no pattern in responses on if counties were going to change their planting planning strategies or not in Survey One. In Survey Two, five counties had changed their planning strategies since Survey One and three counties had no change in their strategies. This shows that some counties are using the presented information as intended and are changing their planting planning strategies by discontinuing to plant species that seemed to be unsuccessful in the inventory results and are introducing new species they believe can be successful in their county. Planting these species would not follow NRCS' variance procedure. This leads us to believe counties are becoming confident in assisting privately funded plantings of off-list species.

Project Challenges

A variety of different challenges arose with this project as it was being conducted. Two main challenges of this project stemmed from one issue – lack of communication.

Communication with SCD partners

The original plan for this study was to complete all inventories in summer of 2018. Contacting the correct people at SCDs turned out to be difficult, mainly due to high employee turnover rates. Contact information for new employees was not always readily available online and not all SCDs responded to voicemail messages. With such an influx of potential sites and difficulty establishing communication, the researcher was able to correspond with only 33 counties in 2018: 14 counties inventoried, and 19 responded with no sites to inventory. Over the field season six more counties provided potential site information for 2019 field inventories, but visits to the SCD offices were essential to making contact with the right personnel. It wasn't until

the preliminary results presentation that most of the remaining 20 counties established consistent contact with the researcher.

Communication with Landowners

Another project delay was caused by lack of communication with landowners. Some inventory sites lacked current contact information, specifically phone numbers and updated addresses. Some sites were planted in the 1980s and 1990s; as technology has changed over the years most landowners don't use house phones any more. A number of home phones have now been disconnected and a more current phone number had not been updated for the site. The researcher attempted to contact SCD offices when this occurred to locate updated contact information. If the office did not have an updated number or if the researcher could not reach the SCD office the researcher would cold visit the property by using the address, when applicable, provided on the planning record. Sites that were planted in the 1980s had addresses based off of railroads and were not updated to current streets and house numbers. Taking time to cold visit 289 potential sites, 60% of all sites identified, was very time consuming and caused some delay for the researcher. The researcher was able to inventory 18 cold sites and was turned down from inventorying 14 potential sites by the landowner, 9 over the phone and the remaining 5 were turned down in person. The response rates of this study follow the same trend presented in the study conducted by Hargiss & DeKeyser (2013). A majority of the time dedicated to both this study and their study were used in efforts to contact landowners.

Revisiting the remaining 271 potential sites to receive permission would add useful data to results of this study. This project can act as a beginning data set for survival rates of potential species for future shelterbelt plantings in North Dakota. This project is different than NRCS' variance process or research plantings. Both of those NRCS programs are monitored regularly.

Research sites are usually maintained properly, though not always. This study provides real world trials that shows how trees will survive when put under the stresses that landowners present.

Survey Analysis

The hope for this study overall is to continue the inventory and survey process in the future. After each survey was completed by participants errors in wording of specific questions had arose. Luckily, after survey one researchers were able to recognize that the original draft of survey two was lacking questions asking for identifying information prior to sending two survey out to participants. Identifiable information was needed in the second survey in order to correlate responses and observe changes in behavior. An IRB Protocol Amendment (Appendix E) was filed to edit survey two. However, even after survey two had been edited to what was thought of as satisfactory, some issues still arose after completion of survey two. Some questions were worded in a specific way that could not be compared to other questions. Specifically, question 18 of survey two asked if participants have changed their planting plans how much have they changed. Responses to this question could not be used because there was no question previously asked to compare results to.

Figure 3 was discovered by the researcher after distribution of both survey one and survey two. Analysis of the surveys attempted to follow the flow chart presented in Figure 3. The researchers would encourage future studies to reference Figure 3 when creating surveys for research projects.

CONCLUSION

This project has created a database of all off-list plantings that can be used in similar future studies. All North Dakota SCDs responded either with sites to inventory or no sites to inventory. The main trend in the inventory results was correlation of tree survival and level of maintenance by the landowner. Maintenance practices included routine mowing between rows and pruning of individual trees. Sites that were regularly maintained tended to have higher survival than sites that were unmaintained.

This portion of the project had experienced a few issues. The main issue faced was communication with landowners; many were uncontactable. Despite efforts such as phone calls and in-person visits, the landowner could not be reached and permission to access the site was not be obtained. This project was designed to be completed in one summer however collection on potential inventory sites from SCDs took longer than expected. Also, ability to contact landowners to receive permission took longer than initially anticipated. This follows research previously conducted by Hargiss & DeKeyser (2013).

Inventory results were presented to SCDs both in-person and online to increase distribution. After the final results were presented two surveys were sent electronically to SCDs to increase accessibility and participation. Responses from participants of survey one were compared to their responses of survey two. This was done to determine changes in behavior between surveys. Specifically have they changed their planting planning strategies, and if they have how much have they changed.

The number of participants in the second online survey decreased from the first survey by two thirds. Low participation makes it difficult to pull rich data from the surveys. Increased participation in both surveys, but specifically the second survey, would have increased data

collected and proven more useful. More efforts to increase participation in the second survey should have been done. Participants that provided contact information at the end of survey one were emailed only once about survey two. A second or third email should have been sent out as reminders or even phone calls could have been made to encourage participation.

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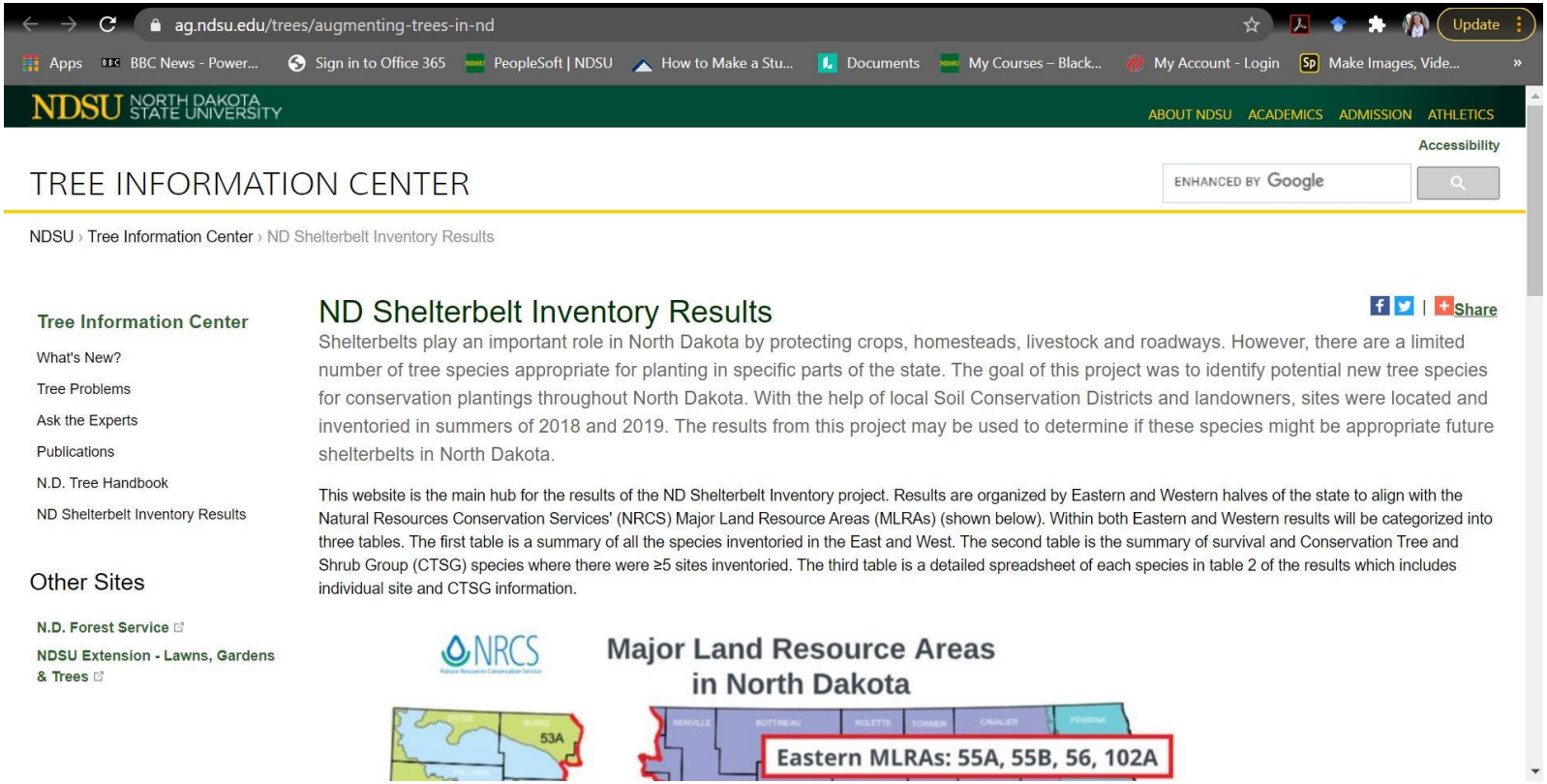
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Sign in to Office 365
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How to Make a Stu...
Documents
My Courses – Black...
My Account - Login
Make Images, Vide...
NDSU NORTH DAKOTA STATE UNIVERSITY
ABOUT NDSU
ACADEMICS
ADMISSION
ATHLETICS
Accessibility
TREE INFORMATION CENTER
ENHANCED BY Google
NDSU › Tree Information Center › ND Shelterbelt Inventory Results
Tree Information Center
What's New?
Tree Problems
Ask the Experts
Publications
N.D. Tree Handbook
ND Shelterbelt Inventory Results
Other Sites
N.D. Forest Service
NDSU Extension - Lawns, Gardens & Trees
ND Shelterbelt Inventory Results
Share
Shelterbelts play an important role in North Dakota by protecting crops, homesteads, livestock and roadways. However, there are a limited number of tree species appropriate for planting in specific parts of the state. The goal of this project was to identify potential new tree species for conservation plantings throughout North Dakota. With the help of local Soil Conservation Districts and landowners, sites were located and inventoried in summers of 2018 and 2019. The results from this project may be used to determine if these species might be appropriate future shelterbelts in North Dakota.
This website is the main hub for the results of the ND Shelterbelt Inventory project. Results are organized by Eastern and Western halves of the state to align with the Natural Resources Conservation Services' (NRCS) Major Land Resource Areas (MLRAs) (shown below). Within both Eastern and Western results will be categorized into three tables. The first table is a summary of all the species inventoried in the East and West. The second table is the summary of survival and Conservation Tree and Shrub Group (CTSG) species where there were ≥5 sites inventoried. The third table is a detailed spreadsheet of each species in table 2 of the results which includes individual site and CTSG information.
NRCS
Major Land Resource Areas in North Dakota
53A
Eastern MLRAs: 55A, 55B, 56, 102A

APPENDIX B. ASSESSMENT – SURVEY ONE

<u>Information about the study</u>: The answers you provide to this survey will be used in a study to build an understanding of how county offices are using the material in future development of planting-plans for shelterbelts in North Dakota. This study is being conducted through North Dakota State University. Your personal information (name and e-mail) will not be made public and will be used strictly for follow-up survey purposes only. Your participation is entirely voluntary you may skip any responses or stop the survey at any time.

If you have any questions about this project, please contact me (Mackenzie Alexander) at 952-905-1711 or at mackenzie.alexander@ndsu.edu, or contact my advisor, Dr. Joseph Zeleznik at 701-730-3389 or at joseph.zeleznik@ndsu.edu.

You have rights as a research participant. If you have questions about your rights or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program at 701-231-8995, toll-free at 1-855-800-6717, by email at ndsu.irb@ndsu.edu, or by mail at: NDSU HRPP Office, NDSU Dept. 4000, P.O. Box 6050, Fargo, ND 58108-6050.

By answering the questions below you understand and agree to the terms listed above.

1. With which agency are you currently employed?

    - ☐ Soil Conservation District – County? _____
    - ☐ Natural Resources Conservation Service – County? _____
    - ☐ ND Forest Service
    - ☐ Other: _____

2. What is your position title?

    a. _____

3. Did you attend a ND Shelterbelt Inventory Results presentation or webinar?
    a. Yes
        i. If yes, check all that you attended:

            - ☐ Tree Promotion Meeting 2018 – Project introduction
            - ☐ ND Association of Soil Conservation Districts Convention 2018 – Preliminary results
            - ☐ Tree Promotion Meeting 2019 – Preliminary results
            - ☐ ND Association of Soil Conservation Districts Convention 2019 – Final results

- ☐ Webinar (Date) – Final results
- ☐ Webinar (Date) – Final results
- ☐ Tree Promotion Meeting (2020) – Final results
- ☐ Other _____

b. No

4. Do you plan on changing your shelterbelt planning strategies based off of the material presented?
    a. Yes
    b. No
    c. I don't know
5. How do you plan on changing your shelterbelt planning processes after attending the presentation?
    a. _____

    _____

    b. N/A
6. On a scale from 1-10 how helpful was the information presented? (1 being not helpful at all and a waste of my time, 10 being extremely helpful and you would recommend this presentation to all SCDs)

    1 2 3 4 5 6 7 8 9 10
7. Do you plan on sharing the information you observed at the presentation to others in your county?
    a. Yes (check all that apply)

    ☐ Landowners ☐ SCD Supervisors ☐ Nurseries ☐ Other:

    _____

    b. No
8. When did you first become aware of this project?
    - ☐ Email request for sites from Mackenzie (Feb. 2018)
    - ☐ Tree Promotion Meeting 2018 – Project introduction

- ND Association of Soil Conservation Districts Convention 2018 – Preliminary results
- Tree Promotion Meeting 2019 – Preliminary results
- ND Association of Soil Conservation Districts Convention 2019 – Final results
- Webinar (Date) – Final results
- Webinar (Date) – Final results
- Other _____

9. Has your county used NRCS' Variance procedure?
    a. Yes
    b. No
    c. I don't know
10. Did your county submit planting records to Mackenzie or Joe for this project?
    1. Yes
        a. If yes, thank you for your participation in this project.
    2. No
        a. If no, please explain why: _____
    3. I don't know

11. Does your county buy planting stock from local retail nurseries?
    a. Yes
    b. No
    c. I don't know
12. Comments about the presentation or the material are welcomed and appreciated.

Thank you for your participation in this study. If you would like to participate in a follow up survey please provide your name and email address and we will contact you in one month. Your information will be kept confidential and will not be made public.

Name:_____ Email:_____

APPENDIX C. ASSESSMENT – SURVEY TWO

Information about the study: The answers you provide to this survey will be used in a study to build an understanding of how county offices are using the material in future development of planting-plans for shelterbelts in North Dakota. This study is being conducted through North Dakota State University. Your participation is entirely voluntary you may skip any responses or stop the survey at any time.

If you have any questions about this project, please contact me (Mackenzie Alexander) at 952-905-1711 or at mackenzie.alexander@ndsu.edu, or contact my advisor, Dr. Joseph Zeleznik at 701-730-3389 or at joseph.zeleznik@ndsu.edu.

You have rights as a research participant. If you have questions about your rights or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program at 701-231-8995, toll-free at 1-855-800-6717, by email at ndsu.irb@ndsu.edu, or by mail at: NDSU HRPP Office, NDSU Dept. 4000, P.O. Box 6050, Fargo, ND 58108-6050.

By answering the questions below you understand and agree to the terms listed above.

13. With which agency are you currently employed?

    - ☐ Soil Conservation District – County? _____
    - ☐ Natural Resources Conservation Service – County? _____
    - ☐ ND Forest Service
    - ☐ Other: _____

14. What is your position title?

    a. _____

15. Did you attend a ND Shelterbelt Inventory Results presentation or webinar?
    a. Yes
        i. If yes, check all that you attended:
            - ☐ Tree Promotion Meeting 2018 – Project introduction
            - ☐ ND Association of Soil Conservation Districts Convention 2018 – Preliminary results
            - ☐ Tree Promotion Meeting 2019 – Preliminary results
            - ☐ ND Association of Soil Conservation Districts Convention 2019 – Final results

□ Webinar (Date) – Final results

□ Webinar (Date) – Final results

□ Tree Promotion Meeting (2020) – Final results

□ Other _____

b. No

16. Have you shared information from the presentation/webinar with others in your county?

a. Yes (check all that apply)

□ Landowners □ SCD Supervisors □ Nurseries □ Other: _____

b. No

c. N/A

17. Since attending a presentation/webinar of ND Shelterbelt Inventory Results has your county changed their shelterbelt planning strategies? Please check one of the following that best fits how much of your
shelterbelt planning has changed:

□ No change □ Some change □ Moderate change □ Dramatic change

□ I don't know □ N/A

18. If your county's planting plans for 2020 have already been made prior to your viewing of this presentation, how much is your county planning on changing their strategies by 2021? Please check one of the following that best fits how much of your shelterbelt planning will change:

□ No change □ Some change □ Moderate change □ Dramatic change

□ I don't know □ N/A

19. Which of the following have changed or will change in your shelterbelt planning strategies since you
attended the presentation/webinar? Check all that apply.

a. Species selection – discontinuation of a species: _____

b. Species selection – introduction of a species: _____

c. Other

_____

d. N/A

20. Based on the project results presented, please rank the following categories in order 1-5 based on their importance level when **you** are planning a shelterbelt planting. (1 being the most important and 5 being least important)

__ State wide survival rate

__ Eastern/Western MLRA

__ Soil Type

__ Number of sites inventoried

__ Landowner preference

21. Which of the following best describes your county's shelterbelt planning process?

a. Strictly follow NRCS's approved species list and do not deviate from the list.

b. Follows NRCS's approved species list as closely as possible but willing to try new species as
long as it is approved by NRCS through their variance process.

c. Follows NRCS's approved species list as closely as possible but is willing to try new species
as long as it is privately funded by the landowner.

22. Hypothetically, would you be interested in participating in an experiment by planting 'experimental species' in your county? ***Note: we are not providing funds to plant experimental plantings, we are gauging to see the interest level for participation of this project***.

a. Yes

b. No

APPENDIX D. LETTER OF IRB EXEMPT APPROVAL

NDSU NORTH DAKOTA STATE UNIVERSITY

December 13, 2019

Dr. Joseph Zeleznik
Natural Resources Management

Re: IRB Determination of Exempt Human Subjects Research:
Protocol #AG20142, "Augmenting Trees of North Dakota Audience Survey"

Co-investigator(s) and research team: Mackenzie Alexander, Chris Whitsel, Christina Hargiss
Date of Exempt Determination: 12/13/2019 Expiration Date: 12/12/2022
Study site(s): online Sponsor: n/a

The above referenced human subjects research project has been determined exempt (category #1) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, Protection of Human Subjects). This determination is based on the original protocol submission (received 12/11/2019).

Please also note the following:
• If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
• The study must be conducted as described in the approved protocol. Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
• Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
• Report any significant new findings that may affect the risks and benefits to the participants and the IRB.

Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.
Sincerely,

Kristy Shirley

Kristy Shirley, CIP, Research Compliance Administrator

For more information regarding IRB Office submissions and guidelines, please consult https://www.ndsu.edu/research/for_researchers/research_integrity_and_compliance/institutional_review_board_irb/. This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

INSTITUTIONAL REVIEW BOARD
NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | 701.231.8995 | Fax 701.231.8098 | ndsu.edu/irb
Shipping address: Research 1, 1735 NDSU Research Park Drive, Fargo ND 58102

APPENDIX E. IRB PROTOCOL AMENDMENT

Date Received

IRB Protocol #: AG20142

NDSU NORTH DAKOTA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
office: Research 1, 1735 NDSU Research Park Drive, Fargo, ND 58102
mail: NDSU Dept. #4000, PO Box 6050, Fargo, ND 58108-6050
p: 701.231.8995 **f:** 701.231.8098 **e:** ndsu.irb@ndsu.edu **w:** www.ndsu.edu/irb

Protocol Amendment Request Form

Changes to approved research may not be initiated without prior IRB review and approval, except where necessary to eliminate apparent immediate hazards to participants. Reference: *SOP 7.5 Protocol Amendments*.

Examples of changes requiring IRB review include, but are not limited to changes in: investigators or research team members, purpose/scope of research, recruitment procedures, compensation strategy, participant population, research setting, interventions involving participants, data collection procedures, or surveys, measures or other data forms.

Protocol Information:

Protocol #: **7.5** Title: **Augmenting Trees of North Dakota Audience Survey**

Review category: ☒ Exempt ☐ Expedited ☐ Full board

Principal investigator: **Joseph Zeleznik** Email address: **joseph.zeleznik@ndsu.edu**
Dept: **Natural Resources Manamgement**

Co-investigator: **Mackenzie Alexander** Email address: **mackenzie.alexander@ndsu.edu**
Dept: **Natural Resiources Management**

Principal investigator signature, Date: Joseph Zeleznik via email

In lieu of a written signature, submission via the Principal Investigator's NDSU email constitutes an acceptable electronic signature.

Description of proposed changes:

1. Date of proposed implementation of change(s)*: **As soon as possible.**
   ** Cannot be implemented prior to IRB approval unless the IRB Chair has determined that the change is necessary to eliminate apparent immediate hazards to participants.*

2. Describe proposed change(s), including justification:
   Change in follow up survey by adding a line for survey participants to enter their name at the end of the survey. This information will be used to compare responses of second survey with responses from the first survey that was distributed. A change in the "information about the study" section will be made accordingly to notify participants that their personal information will not be made public and how their name will be used. Without making this addition to the second survey responses can not be compared between surveys and changes in behavior will be less useful. Final results will be

reported in the aggregate; no individual results will be reported.

3. Will the change(s) increase any risks, or present new risks *(physical, economic, psychological, or sociological)* to participants?
   ☒ No
   ☐ Yes: *In the appropriate section of the protocol form, describe new or altered risks and how they will be minimized.*

4. Does the proposed change involve the addition of a vulnerable group of participants?
   Children: ☒ no ☐ yes – include the *Children in Research* attachment form
   Prisoners: ☒ no ☐ yes – include the *Prisoners in Research* attachment form
   Cognitively impaired individuals: ☒ no ☐ yes*
   Economically or educationally disadvantaged individuals: ☒ no ☐ yes*

   **Provide additional information where applicable in the revised protocol form.*

5. Does the proposed change involve a request to waive some or all the elements of informed consent or documentation of consent?
   ☐ no
   ☒ yes – Attach the *Informed Consent Waiver or Alteration Request.*

6. Does the proposed change involve a new research site?
   ☒ no
   ☐ yes

If information in your previously approved protocol has changed, or additional information is being added, incorporate the changes into relevant section(s) of the protocol. Draw attention to changes by using all caps, asterisks, etc. to the revised section(s) and attach a copy of the revised protocol with your submission. *(If the changes are limited to addition/change in research team members, research sites, etc. a revised protocol form is not needed.)*

Impact for Participants (future, current, or prior):

1. Will the change(s) alter information on previously approved versions of the recruitment materials, informed consent, or other documents, or require new documents?
   ☐ No
   ☒ Yes - attach revised/new document(s)

2. Could the change(s) affect the willingness of *currently* enrolled participants to continue in the research?
   ☐ No
   ☒ Yes - describe procedures that will be used to inform current participants, and re-consent, if necessary:A notification that their participation is voluntary has been added to the document at the end

of the survey.

3. Will the change(s) have any impact to *previously* enrolled participants?
   ☒ No
   ☐ Yes - describe impact, and any procedures that will be taken to protect the rights and welfare of participants:

----------FOR IRB OFFICE USE ONLY---------

Request is: ☒ **Approved** ☐ **Not Approved**	
Review: ☒**Exempt, category#:** 2(ii) ☐**Expedited method, category #** ____ ☐**Convened meeting, date:** _____ ☐**Expedited review of minor change**	
IRB Signature: Kristy Shirley	**Date:** 4/1/2020
Comments:	