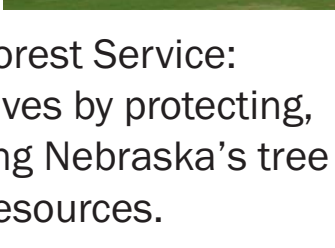
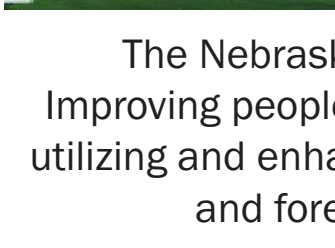
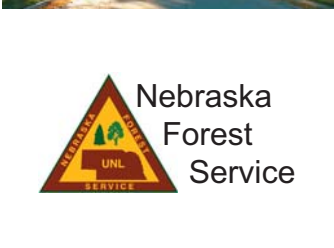
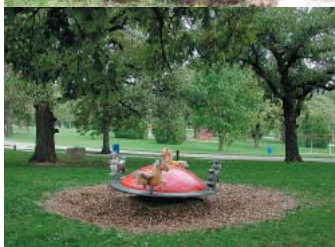


Community Forestry Resource Handbook



A guide for establishing and maintaining healthy community forests across Nebraska.



The Nebraska Forest Service:
Improving peoples' lives by protecting,
utilizing and enhancing Nebraska's tree
and forest resources.



UNIVERSITY OF
Nebraska

FOREWORD

The Nebraska Forest Service (NFS) has served the communities of Nebraska since the beginnings of the Federal Urban and Community Forestry program in 1976. Since that time, the NFS has worked actively with well over half of the state's 534 cities and villages. In addition, NFS foresters have done public tree inventories, resource assessments and management plans for 175 of those communities. The NFS endeavors to provide the best and most recent technical forestry and arboricultural information to help communities manage their tree resources. Community tree resources are assets that need to be managed and cared for just as any other part of the community infrastructure (lights, water, sanitation, etc.). Decisions concerning the management of these resources need to be based on science and sound technical information. This handbook has been developed to provide a base for these kinds of decisions and activities.

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Section I - Introduction

The Community Forestry Resource Handbook

The Community Forestry Resource Handbook has been developed to provide information and references to city clerks, park and city planners, community tree boards, beautification committees, park departments, soil conservationists, foresters, arborists, landscape designers, nursery personnel, county extension personnel and anyone whose duty is to cultivate and enhance a local urban or community forestry program.

The information included has been selected as a guide to develop and maintain community forestry programs beginning with the organization and incorporation of, and legislation related to establishing, a Community Tree Board, a key first step in developing a community forest and community forest plan. This is followed by a step-by-step guide through the processes of site selection and preparation and the careful development, selection and care of plant species. A guide for long-term care is also included. Several appendices are also attached in order to provide more detailed guidance and to address other, special concerns related to the community forest.

A complete forestry program is a tangible asset for any community and the information enclosed is of value for the development of small or large-scale forestry programs. Updated inserts and

informational sheets may be added to this handbook.

Why Develop a Community Forestry Program?

An organized plan for managing the forest resources in any community will yield significant benefits for both the community and the environment. Not only are there immediate and obvious benefits, such as the improved appearance of a city street gracefully lined with trees in bloom, but a community forest plan – with a dedicated Community Tree Board – will also address the often unforeseen legal issues associated with urban landscapes.

City trees often perform several functional duties. Trees offer privacy, emphasize an object or landscape and shield intolerable scenes. They moderate glare and reflection and guide pedestrian travel. Trees not only create backgrounds that aesthetically harmonize the rigid lines of urban structures, they also play a significant role in diminishing noise pollution by absorbing echoes from the urban environment. Trees complement urban surroundings by inspiring thoughts of relaxation and comfort. Trees often portray to visitors the first impressions of a locale.

Trees improve the environment in which we live by regulating the climate including the effects of sun, wind and rain. By catching and holding dust

fragments in their leaves or needles, trees improve air quality; trees are also oxygen factories, consuming carbon dioxide in photosynthesis and replenishing the atmosphere with oxygen for human consumption. Energy from the sun is absorbed or redirected by leaves on deciduous trees in the summer and is filtered by branches during the winter months. Trees reduce the impact of raindrops on the soil surface, resulting in less water runoff and soil erosion. Trees also improve water quality and assist in the recharging of ground water supplies. Wooded areas, such as riparian buffer forests, help to inhibit the movement of sediment and chemicals into streams. Trees are an integral part of any local ecosystem as they sustain wildlife diversity and provide a proper habitat for animals and birds that would otherwise be nonexistent in the community landscape.

Trees also have economic benefits for individuals and communities. Property values of landscaped homes are higher than those of non-landscaped homes. Trees conserve energy by cooling the home in the warmer months and by operating as a windbreak during the winter. Direct economic profits are commonly connected with energy costs, as less fossil fuel is burned for heating and cooling when plant materials are present. Air conditioning costs and needs are less in a home that is shaded by correctly planted trees. Increasing tree cover by 10% (adding about 3

trees per house) can reduce annual heating and cooling energy use by 5-10 percent (\$50-\$90 per month) per household. Trees properly placed for windbreak protection can prevent energy being consumed for heat. Homeowners benefit by an increase in property value due to a savings in energy costs.

A recent scientific study by the University of Illinois at Urbana-Champaign found that the more trees and grass in the common spaces of inner-city neighborhoods, the more those spaces are used by residents. And, use of these spaces means more opportunities for informal social interaction. In other words, relationships between neighbors are made stronger simply through the presence of vegetation. The study also found that, compared to residents living near barren spaces, those closer to green spaces enjoy more social activities, have more visitors, know more of their neighbors and have stronger feelings of belonging. Essentially, greener common areas facilitate the development and maintenance of stronger social ties – the very fabric of a healthy neighborhood.

The monetary benefits of trees are worthwhile and assist individuals and the community as a whole. Customers pay lower electricity bills when power companies are able to use less water in their cooling towers, reduce building new facilities to satisfy peak demands, use fewer amounts of fossil fuel and have less need for air pollution control.

Communities can save money if fewer facilities must be built to control storm water in the area. To the homeowner, these savings are minor; but to the community, cuts in these operating costs are in the thousands of dollars.

A national study, conducted by the University of Washington, used survey questionnaires to investigate public perceptions about the role of trees in revitalizing business districts. They compared three business districts: 1) with no trees or accessory vegetation, 2) with trees but no accessory vegetation, 3) with trees and accessory vegetation. Amenity and Comfort ratings were 80% higher for a tree-lined sidewalk compared to a non-shaded street; product quality ratings were 30% higher in districts with trees; and merchant item ratings, including customer service issues, were about 15% higher for districts with trees. Respondents claimed they would be more willing to pay more for parking in a well-landscaped business district. This suggests that greater revenues from shaded parking would offset the cost of parking space loss. Prices were on average about 11% higher in districts with trees. This was true of low-price, impulse-buy convenience goods as well as bigger ticket, comparison-shopped items.

Trees strengthen the economy by drawing and keeping businesses in an urban area. It has been reported by the National Arbor Day Foundation that people continue to shop longer along tree-lined streets. Apartments and offices rent faster and tenants stay

longer in areas encompassed by trees. Trees enhance the quality of life for all of us now and in the future by enhancing the community image, pride, and the quality of life. Investing in a community forest plan will save your community money in the long run. The following sections of this manual provide guidance on establishing a Community Tree Board and an integrative community forest plan.

Section II - Developing a Community Forestry Program

The Community Tree Board

Someone must be legally responsible for the care and management of the community's trees. This may be a professional forester or arborist, an entire forestry department or a volunteer tree board. Often, both a professional staff and advisory tree board is present, which is a good goal for most communities.

A tree board, or commission, is a group of concerned volunteer citizens charged by ordinance with developing and administering a comprehensive tree management program. Balanced, broad-based community involvement is encouraged. Boards function best if not composed entirely of tree-related professionals such as foresters, nursery professionals and arborists; individuals with a non-professional interest in trees can often provide new and interesting perspectives. Diverse representation on the board will amplify the board's integrity and improve its ability to evaluate the requests of different sectors of the community. Limited, staggered terms of service will prevent stagnation or burnout, while at the same time assuring continuity.

Community Tree Boards in well-developed cities may execute broad planning, policymaking, advisory and coordinating roles. In towns that are less expansive, a Community Tree

Board may be more concerned with generating budgets, specific forestry plans and annual work plans, and may aid in carrying out program operations. Members of a Community Tree Board can be elected or appointed. The board may be a financially self-governing, an incorporated unit or a budgeted outfit of city government.

Community Tree Boards can sponsor the local community forestry program by supplying information to public administrators and the community.

Public festivities such as Arbor Day and Tree City USA events are valuable. An effective tactic is to recognize successful projects completed by individuals and organizations. Boards can support instructive programs such as workshops for site developers, city planners and landscape designers to elevate and uphold community forests. More details on Arbor Day, Arbor Day celebrations and application materials for the Tree City USA program are included as Appendices A and B to this manual.

Principal community tree board functions may include:

- Advising the city government on the planting, care and removal of plants and trees
- Evaluating the community forestry program and addressing short- and long-range community forestry goals

and objectives

- Formulating an inclusive community forest plan
- Drafting an annual strategy of work and a yearly report to the governing organization.

Setting up Your Community Tree Board

There are many different ways to set up your Community Tree Board, but one important goal should be kept in mind. The governing body of the community must work closely and effectively with your tree board. The tree board, whether appointed or elected, should act in an advisory capacity to the community's governing body.

From that point, many other avenues can be explored. For instance, in smaller communities the tree board may also plant, water, prune, mulch and provide basic care for street and park trees in the absence of a city or park crew. The Community Tree Board must realize, however, that while they may want to plant trees, they must also provide for the future care and maintenance of the materials they plant. Thus the Community Tree Board should approve any projects.

A Community Tree Board that is set up with professional and detail-oriented standards will achieve far greater success and operate with greater efficiency than an overly casual or loosely organized body. Develop simple job descriptions for the constituent board members and officers that reflect the desired

function of the tree board within your community. Most importantly, set term limits and stagger them. After all, no one wants his or her term on the tree board to be a life sentence. Moreover, staggered term limits will ensure that fresh voices and perspectives are constantly being introduced while the continuity and integrity of the board and its mission are maintained

Make sure the voting procedures for president or chair are carried out with formal nominations and elections. Formal nomination and election procedures, along with staggered term limits, will keep your board more active and successful. While a dedicated chair may be willing to serve for several terms, another person may do an even better job. When boards are overly casual in their organization and allow for situations where the chair or president merely reappoints him- or herself, problems are likely to arise. Not the least of these problems is the likely stagnation of your board, a situation that could result in drastic problems for your community forest.

Where to Begin

Once the Community Tree Board is established, find out what you collectively know about your community's public trees. At an early stage in this process, you should investigate available grants for planting trees and especially to learn more about trees. If a public tree inventory is not on file or the clerk does not know, check with the state forestry office. List the city parks and pool areas and

possibly cemetery, golf course, library, community center, etc. These areas are only a start. Be creative and think of some new areas that your board could create in empty lots as well. If the cemetery or other public or private lands with many trees and plants have their own boards of directors, representatives from those boards could be on the Community Tree Board to facilitate communication.

Study the assessment if there is one. Was it right for the community? If a few years old, were any of the recommendations carried out? Begin with those recommendations if still needed or ask the district or community forester for help in conducting a new public tree inventory. Maybe you have ideas of your own and you need technical assistance and/or funding.

Set up an “in box” in the clerk’s office. Make sure the community is on a mailing list for tree resources such as Tree City USA, National Arbor Day Foundation and Tree City bulletins (see Appendices A and B).

Set the Community Tree Board meetings as needed either for project planning or as needed to communicate with other tree board members.

Remember to write a ‘short’ annual report each year and present it to the governing body of the community. A good time to do that will be a few months ahead of budget time and before asking for an allocated budget amount for the next year.

Tree Board Check-Up

- Are there enough members

attending meetings to help bring consensus in determining projects and to carry out projects?

- Does the tree board visit and report to a governing body?
- Is there a city council or village board representative or park or city employee?
- Are there rotating terms of office on the tree board?
- Are there job descriptions for tree board members?
- Do members of the tree board attend tree workshops and conferences?
- Are there workshops or celebrations held in your community?
- Is there a report of the trees in your community? Is it up to date?
- Does the tree board assist the city or village with an annual public tree inspection?

Communities have recognized that to defend and improve their valuable tree resources, it is practical to consider and sustain their trees as a cohesive unit, a *community forest*.

Tree Ordinances

Tree ordinances ease proper management of community tree resources. The purpose of most ordinances is to protect and care for existing trees while preparing for new ones. Tree ordinances can be used to classify heritage, historic, landmark, legacy, special interest, significant, specimen trees or variations of these expressions. Such ordinances generally specify who is accountable for managing the forestry program, how

the program functions and what enforcement measures and fixed procedures on tree planting and upkeep exist. Successful ordinances should be fashioned by a variety of people who are attentive to the needs of the community. They must stabilize the functioning requirements of the trees with what can realistically be required and enforced in that community. Ordinances supply the authorization for the community and the tree board to execute the community forestry program.

The position of the Community Tree Board can be integrated into the tree ordinance document. Once an ordinance is in effect, sustaining guidelines and procedures may be needed for performance purposes. A glossary can be included in the tree ordinance describing significant terminology in the tree ordinance document.

A tree ordinance must designate the establishment of a Community Tree Board or forestry department and give this body the responsibility for writing and implementing an annual community forest work plan. Beyond that, the ordinance should be flexible enough to fit the needs and circumstances of the particular community. A tree ordinance provides an opportunity to set good policy and back it with the force of law when necessary. Ideally, it will provide clear guidance for planting, maintaining and removing trees from streets, parks and other public places.

Tree ordinances concentrate on

developing certain standards that affect trees. A tree ordinance should specify which procedures and conditions are acceptable and which are not. Since tree ordinances should be formed to suit the community's requirements, no two ordinances will be identical. Tree ordinances regularly encompass:

- Proceedings enforcing issuance of permits
- Tree planting and removal
- Tree conservation (historic, etc.)
- Tree protection (e.g., during construction)
- Program funding
- Utility company activities
- Tree replacement
- Tree landscaping requirements (e.g., new developments and private land)
- Standards governing arborists
- Enforcement procedures (penalties, etc.)

Tree ordinances affect many individuals. Consider a list of the people whose jobs or property would be affected by a tree ordinance: arborists, realtors, developers, the mayor, homeowners, building contractors, nurserymen, horticulture teachers, utilities engineers, the city attorney, city council members, an urban forester, a public works manager and many others. Tree ordinances can be classed in three basic categories: street tree ordinances, tree protection ordinances and view ordinances.

Street tree ordinances predominantly indicate the regulations for the planting and removal of trees

within public right-of-ways. They frequently include guidelines influencing maintenance or removal of trees on public property. Incorporated into this group are ordinances with tree planting regulations, including those necessitating tree planting in parking lots.

Tree protection ordinances are chiefly aimed at supplying protection for native trees or trees that are historically important. They regularly expect that a permit be obtained prior to protected trees being removed, intruded upon, or in some cases, pruned.

View ordinances are intended to help settle disagreements between property owners that initiate when trees obstruct views or sunlight.

Efficient tree ordinances:

- Express Goals consistent with the overall mission of the community forest plan
- Assign Responsibility
- Set Basic performance standards
- Are Flexible
- Describe Enforcement procedures
- Are a component of an Inclusive Management Strategy
- Are developed with Community Cooperation

Trees and Legal Issues

Normally trees are viewed as visual assets to a community. They beautify the landscape and provide shade and shelter against the harshness of weather. However, trees can also be involved in complex legal issues.

Communities must be aware of these issues and plan accordingly. Ignoring these issues will not make them go away and, in fact, may even make a community more liable.

Communities can benefit legally by having a consistent policy that outlines how public trees are to be managed. Smaller communities need not have a paid forester on staff; but if resources allow for such a position, it is strongly recommended. The most important factor is consistency in the way in which all legal issues are handled. Being a part of the Tree City USA program and cooperating on a regular basis with the state forestry agency are positive steps to help diminish any liabilities that relate to trees or the landscape. Further details on the Tree City USA program and application materials are included as Appendix B to this manual.

Here are just some of the legal issues that may revolve around trees and other woody vegetation on public lands:

- Tree inspection and liability issues
- Damage caused by decayed or dangerous trees
- Site clearance at street intersections
- Clearance within street right-of-ways
- Street and sidewalk elevation and clearance
- Root damage to sidewalks
- Tree ownership disputes
- Leaf litter

Services provided by the Nebraska Forest Service are limited to the knowledge of the individual foresters.

In most cases, when legal issues arise, communities are well advised to seek a consultant forester or arborist who can work with legal counsel to resolve the issue.

Several books are available concerning legal issues and trees. Here are several references:

Victor D. Merullo and Michael J. Valentine, *Arboriculture and the Law*. Champaign, IL: International

Society of Arboriculture, 1992.

Cora Jordan, *Neighbor Law*. Berkley, CA: NOLO Press, 1996.

L.M. Anderson, *Legal liability for defective trees in the United States*. Athens, GA: USDA Forest Service, Southeastern Forest Experiment Station.

Section III – Planning and Designing Your Community Forest

This chapter begins with an overview on how trees grow and thrive, providing a review of tree biology. Soil factors and root growth below the ground are important dynamics to consider as well; and for this reason, an overview of soil properties is also provided.

A thorough site analysis is necessary to ensure that an integrated forestry program will be successful. This includes assessing legal and structural factors, as well as, evaluating the land and its components. The goal is to educate oneself with the area to be utilized in order to unify all elements into a natural harmony.

Included here, also, is a discussion of the planning process, providing instruction on the preparation and thought involved in developing an effective landscape for a community forestry program.

How Trees Grow and Thrive¹

Webster's dictionary defines a tree as a woody perennial plant having a single, usually elongate, main stem generally with few or no branches on

¹ Much of this section was taken from the Community Tree Planting Guide, produced by the Minnesota Tree Trust in cooperation with the USDA Forest Service, the Minnesota Department of Natural Resources and Touchstone Energy. Visit the Tree Trust web site for more information – www.treetrust.org.

its lower part. This is a simple definition for a complex living organism. Trees have specialized parts and cells that work together to perform the many tasks that need to be done to accomplish growth and reproduction. In order to manage trees effectively in a landscape or any setting, it is important to understand the basics of how trees grow and thrive.

Parts of a Tree

There are three main parts of a tree— the crown, stem and roots. Each part plays an important role in the growth, vitality and reproductive process of the tree. Trees grow in diameter and in height, and the two areas where this occurs are the buds and the cambium.

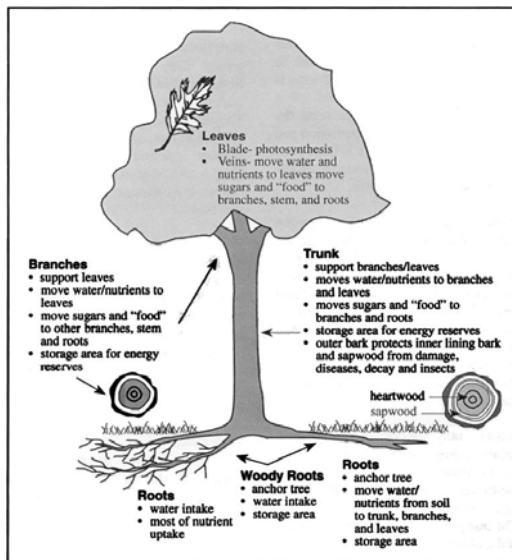
Buds – Most of the buds that grow on a tree are at the tips of the branches and the roots. From these, branches and roots grow longer each year and produce new branches and roots. Trees also have adventitious buds in the bark along branches and roots. These buds lie dormant until the tree needs them. Sprouts from adventitious buds help a tree stay alive after a catastrophe where the tree loses the end of its branches (for example, during a storm or after severe over pruning). These sprouts are weakly attached to the tree and are generally undesirable, but they do play a role in the life of many trees.

Cambium – All woody plants have an actively growing layer of cells, called the cambium, located between the bark and the wood of the trunk and branches. From the cambium, the tree puts on a new layer of wood each year. This layer or “ring” covers the old layers on the trunk, branches and woody roots of the tree.

Leaves – Trees produce all the food they need in their leaves. Through a process called photosynthesis, leaves use the green pigment chlorophyll, along with light energy from the sun, to turn carbon dioxide and water into sugar. The trees use sugar for energy and to produce wood. Through this process, trees take carbon dioxide (a pollutant) out of the air and turn it into oxygen and wood. In the process called transpiration, trees move water solutions throughout the tree. To keep themselves cool, leaves release water vapor through the pores. This keeps the area around the tree cool, too.

Trunk and Branches – These woody parts provide support for leaves and other branches. They are pathways for the movement of substances within the tree. The outer rings of wood are sapwood. Water moves up the tree through vessels in sapwood (Figure 1). Trees use wood in branches and in the trunk to store food for later use. Heartwood is the central, usually darker, less-active portion of a tree. The heartwood is important in the overall structure and support of the

tree. It is also the part of the tree from which quality wood products are made like furniture and veneer. Bark protects the cambium from harm like insulation and siding on a house protect it from rain, wind and cold. Food moves down the tree through the inner bark.



[Figure 1: Leaf and stem system]

Roots – Large woody roots anchor the tree in the ground and store starch. They are pathways for the movement of substances in the tree. From the soil, tiny absorbing roots take up water and minerals. These are carried up into the tree through woody roots. Trees shed small roots and produce new ones each year just as they do with leaves. Roots grow throughout the year, especially in the early spring and in the fall.

Roots may have a beneficial relationship with fungi called mycorrhizae (Figure 2). The fungus extends from the tiniest tree roots out into the soil to help the tree absorb

water and nutrients. The tree provides the fungus with food and a place to live.



[Figure 2: Root System]

What Trees Need to Thrive

Light – Light from the sun provides the energy trees need to manufacture food.

Water – Trees need water to prevent wilting, to produce food and move substances throughout the tree and for cooling.

Nutrients – Trees need 16 elements to grow. They get carbon and oxygen from the air, hydrogen and oxygen from water and everything else from the soil. They need lots of nitrogen, phosphorus and potassium and lesser amounts of sulfur, calcium and magnesium. They need even smaller amounts of boron, chlorine, copper, iron, manganese, molybdenum and zinc.

Room to Grow – Tree roots need plenty of room to grow so they can anchor the tree and take up water and minerals. Branches need room to

spread and capture energy from the sun. Branches need space away from buildings, roadways, utility lines and other trees so they can grow to their natural size without injury or excessive pruning.

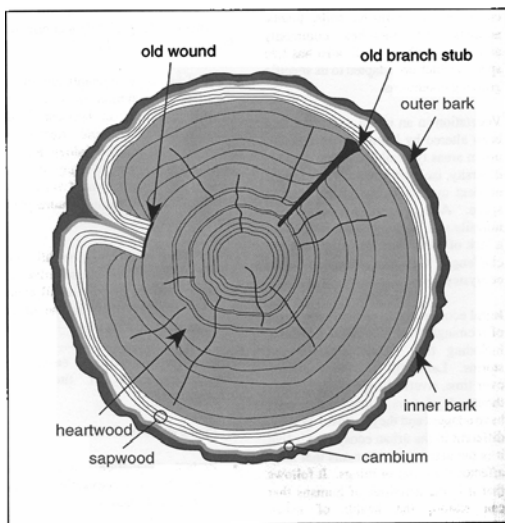
Well-Drained Soil – Trees need soil that drains and allows the free movement of oxygen, other gasses and water. When soil pore spaces are full of water or are compacted, tree roots cannot get everything they need to function properly.

The Story in Trees: What Tree Rings Tell Us

Tree trunks grow bigger each year when the cambium adds a new layer of wood over the old layers. The cambium produces large cells in the spring and smaller cells during the summer. In many trees, the early cells are light in color and later cells are dark. Since the trunk of a tree is round, the result is a pattern that appears as rings (Figure 3). We call these annual rings or tree rings. Since trees generally produce one ring for each year of growth, you can find out the age of a fallen tree by counting its rings.

Scientists often use tree rings as a record of the natural history of a given geographic region. The relative width of tree rings will tell whether or not there was plentiful water or whether there was some kind of natural catastrophe like drought or floods. The

presence of covered-over wounds provides information about previous fires, insect or disease attacks and when and where branches grew. If the tree was damaged at one time by a mower and bark was torn, there is a record of it in the tree.



[Figure 3: Growth Rings]

Leaf Drop

Trees that drop their leaves annually are termed deciduous. Trees that retain their leaves for more than one year are termed evergreen trees. Deciduous trees typically shed their leaves in the fall due to a variety of environmental conditions.

Shorter days and cool nights increase the collection of sugars. This in turn reduces the production of chlorophyll. As the chlorophyll breaks down, other colors become visible – red, purple, yellow and orange.

In the forest, leaf drop is vitally important since it is one way that trees recycle their own parts into the soil to

become organic material for future food production. In a community or urban setting, however, it is often necessary to collect and remove leaves. Additional levels of fertilization may therefore be necessary to maintain tree health.

Soils

An ideal soil is comprised of 45% minerals (sand, silt and clay), 50% pore space and 5% organic matter and soil organisms. Roots need space in which they can grow, along with organic materials and nutrients and proper oxygen and moisture. Tree root systems grow and mature in order to achieve optimum growth. For this reason, the fibrous, absorbing root hairs commonly grow in the top 12 inches of soil. Seldom do tree roots grow lower than 3-4 feet.

Soil texture describes the fineness or coarseness of soil particles, particularly, the amount of sand, silt and clay in the soil. Sand particles are moderately large and create a more textured soil. Soils that contain a large amount of clay are fine textured due to clay particles being the smallest. The texture of the soil influences the soil's capacity to retain water and to supply oxygen to the roots. Texture may influence which species of trees will thrive in a given area.

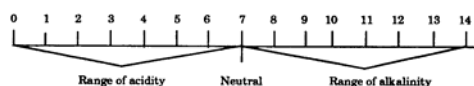
Soil aggregates and the air spaces that surround them can be distorted by physical compaction of the soil. When soil particles are crowded due to vehicles or foot traffic, oxygen-filled

pore space in the soil is minimized. Soil compaction hampers root growth, lowers water penetration and accessibility and restricts the transfer of oxygen and carbon dioxide in the soil.

Chemical Properties of Soil

Soil pH is a soil property that affects many chemical and physical activities in the soil. It is the most commonly used index of plant root zone acidity or alkalinity. Soil pH is important to plants because it influences the chemical form of many elements in the soil. It also influences the soil microbial processes. Some elements influenced by pH include the essential nutrients necessary for plant growth and health; so pH affects plant nutrition. Other elements are toxic when present in excessive amounts, and soil pH helps to determine how much is in solution at any one time.

Soil pH Range	Soil Reaction
3.0 - 4.0	Very Strongly Acid
4.0 - 5.0	Strongly Acid
6.0 - 7.0	Slightly Acid
7.0 - 8.0	Slightly Alkaline
8.0 - 9.0	Moderately Alkaline
9.0 - 10.0	Very Strongly Alkaline



Most plants grow best with a slightly acid reaction. In this range, most plant nutrients are at or near their highest solubility. Plants take up nutrients only if they are dissolved in the soil solution; thus, if the nutrients

are in the soil solution, they are available for plant uptake. The best way to find out what your soil needs is by sending a sample to a soil lab.

Biological Properties of Soil

The soil is a community comprised of a large number of organisms; most are valuable to the soil. Organisms like insects and earthworms, which occupy the soil and litter layer, foster aeration and expedite decay. Earthworms travel in pursuit of food; this constant aeration of the soil results in less evaporation and surface run-off, thus creating a more efficient use of the moisture that is introduced into the soil.

Some organisms are damaging to tree roots. Nematodes, microscopic round worms, are parasites that sap vital nutrients from tree roots and often spread disease.

Site Analysis

It is crucial towards the development of any community forest and community forest plan that the Community Tree Board make a thorough site assessment of any areas where new plantings are to occur.

Legal Restrictions – Start your assessment at city hall. Many cities have ordinances governing where you can plant. You will need to research the legal boundaries of your site and identify public easements and rights of way that may limit planting space.

Cities often govern what species may be planted and how you must plant them. The city clerk's office may be the best source for this information.

Structural Factors – Check out the planting site for structures, such as buildings, subways, roads, sidewalks, utilities, streetlights, signs, heat-producing vents and street furniture. Identify those that could physically and physiologically restrict canopy and root growth.

Soil Factors – Critical among all soil tests is determining the soil's drainage capabilities. Standing water can kill trees faster than most other stresses. Look for gray- or rust-colored soil mottling, which can indicate poor drainage. Pockets of standing water after a rain are another good sign of problems. You can do a simple percolation test by digging to where the roots will be, filling the hole with water, and timing how quickly it drains out. Anything less than 1-inch per hour warrants some remedial action. Soil type affects the soil's water and nutrient-holding capacities and, thus, influences tree maintenance.

Take a soil test to determine pH and fertility. Because soil pH determines nutrient availability, it is perhaps the most important information you need. If you suspect de-icing salts are affecting tree growth, you may want to have the lab include salinity levels in the soil test results. Take samples for this test during late fall, winter or early spring.

Determine the depth and volume of usable soil. You will want to locate underground utilities and other barriers to root growth. Be aware of grade changes and compaction arising from recent construction. Filling over the site can suffocate tree roots.

Existing vegetation – The identity and condition of existing vegetation on the site can often clue you to site conditions. Indicator species can tell you what may or may not do well there. Be aware that because of the construction process, soils around a recently constructed building will be more compacted and disturbed than those in nearby undisturbed areas.

Microclimate – Check out the sun and shade patterns on your site. Most trees need full sun, though some will tolerate partial shade. Know what USDA hardiness zone the site is in. Analyze specific site conditions to see how they might modify microclimate.

Functional considerations – Identify pedestrian traffic patterns on your site and make decisions based on what you know. For every site you study, draw up a list of its positive features and its limitations. Then you can make the appropriate horticultural and design decisions.

Planning Process

Landscape design involves much more than placing trees, shrubs and other plants on the property. It is an art

that deals with conscious arrangement or organization of outdoor space for human satisfaction and enjoyment.

Major goals include:

- Organizing and developing the site for maximum use and pleasure.
- Creating a visual relationship between the house and the site.
- Reducing landscape maintenance to a practical level.

Methods include:

- Observing and analyzing the habits of the people who will be using the space, including their needs, desires and how much space each of their activities requires.
- Studying past methods.
- Surveying available materials to solve design requirements.
- Analyzing the environment of the site including the view in and around the site. The ecology of the site should be carefully analyzed since it is an important design determinant.

General Considerations:

1. There are no absolutes in landscaping. Styles and opinions follow trends and change with time.
2. Recognize the community landscape as an ecosystem; it is much more than just trees and shrubs. Like the natural forest, it contains a wide variety of plants and animals. Also like the natural forest, the health of the community forest should be considered throughout its different layers—

canopy, understory, groundcover and soil. Unlike the natural forest, the community landscape contains many human-associated things that impact it negatively such as buildings, streets, cars, signs, utilities, pollution, dogs, cats and people.

3. Understand the planting site. The physical constraints of the planting site will help determine which plant species are appropriate and how they should be arranged.
4. Good planning and design are very important. Thinking ahead will save many aggravations. A landscape plan doesn't have to be fancy, but should reflect an understanding of the site and demonstrate knowledgeable use of plants. Don't be afraid to hire a competent professional. Good design will pay for itself over time.
5. The landscape should never be considered complete but rather a work in progress.
6. Recognize your maintenance capabilities and don't over plant. For larger projects, plant in phases. A well-maintained, small planting project is always better than a poorly-maintained, large project.
7. Defer to common sense and ideas backed by reason, research and fact. Few "experts" know it all, and those who do vary widely with their

opinion.

8. Be creative and passionate. Let the landscape reflect your personality, and don't let the fear of making mistakes stifle the imagination.
9. Remember the landscape is more than just trees and shrubs. Ground covers, vines, herbaceous perennials, wildflowers and ornamental grasses can all be used to complement tree and shrub plantings and to add a touch of refinement to the landscape.
10. Arrange plants wisely. Some design tips to consider:
 - Try to reflect a "sense of place". Remember that we live in Nebraska. Don't use plants or imitate landscape styles from other parts of the country or other parts of the world if they are not appropriate to the local condition.
 - Try to use masses of plants (three or more of the same plant) in complementary groupings. Don't plant one of everything. Use a core group of species with individual specimens of other species as accents. Try to balance diversity with repetition. The use of a core group of species in larger numbers will create a stronger feeling of design continuity from one part of the landscape to another.
 - Don't plant in straight lines unless a formal effect is appropriate. Do plant in rather informal but complementary groupings using sweeping curves.
11. Know your plants or consult with people who do.
 - Because of the vagaries of Nebraska's climate, "natural" designs are usually more effective, easier to achieve and easier to maintain than formal designs.
 - It is OK, in fact desirable, to let plants grow together, to touch and overlap, and to rely on each other for support. That's what they do in nature.
 - Limit the use of unusually shaped or colored species since they can detract from the rest of the landscape.
12. Consider the lawn as a complementary element of the landscape, not the primary element.
 - Where activity is not planned or

warranted, try to reduce lawn areas by planting appropriate trees, shrubs, ground covers and perennials.

- Try to replace high-maintenance lawns with lower maintenance alternatives. Turf grass does not grow naturally under trees, especially where shade is heavy. Don't fight it; mulch it or plant shade-tolerant perennials and ground covers.
- Don't worry about a lawn that is not perfect. If the rest of the landscape is well done, no one will notice a few weeds and bare spots. And if they do, let's help educate them to appreciate the landscape for its greater beauty.

Planting Site Requirements

The selection of planting locations is one of the most critical decisions made during the planning process. If a location is selected that will eventually cause the plant to have to be removed, then the planting was a failure. Specific items to consider are power lines, underground utilities, future construction sites and mature size of the plant. Trees that interfere with power lines must often be severely deformed or even removed to keep the lines clear.

The mature size of a plant must be considered when selecting planting locations. Trees often have to be removed because they have grown too large for the site. If the location were

selected with the potential size in mind, the plant would not have to be removed. Large landscape-sized trees should be planted a minimum of 20 feet away from any buildings or power lines. Shrubs should be planted a minimum of 5 feet away from any potential conflict. These distances are minimums and greater distances would be preferable in most cases. All underground utilities should be located in order to avoid conflicts when digging and during future utility maintenance activities.

Design Assistance

The design of landscapes requires a variety of information and skills. Requirements include a thorough knowledge of existing site conditions, an understanding of how people may use the landscape, an up-to-date perspective on the dozens of newly-developed plants available each year and an ability to visualize (and help others to visualize) the combination of these elements. In developing and working with this information, the perspective of a design professional can maximize the quality and manageability of a landscape.

Quality landscape design should be viewed as an investment rather than a cost. A well-designed landscape can enhance property values, increase the livability of the outdoor spaces within the landscape and assure that the landscape truly "fits" the citizens that will view and use the landscape.

Landscape design is often seen as a product (the completed plan). Instead, landscape design should be viewed as a service that includes the information gathering, creativity and knowledge that produce the plan. Although some nurseries and garden centers still provide a free plan if plant purchases are made, many now grant rebates for the cost of design if a certain dollar amount is spent. In other cases, some businesses now charge for landscape design services on an hourly basis. Professional design consultants such as architects and landscape architects normally charge by the hour (plus expenses) or as a percentage of the cost of project materials. By viewing landscape design as an investment and a service where you do “get what you pay for,” public agencies can begin to better understand the importance and benefits of quality design.

Even if a landscape is designed by a design professional, city personnel as well as the citizens who will ultimately use the designed landscape have an important role in the process. Quality landscape design depends on good communications between the landscape users and maintainers and the designer. If city staff and citizenry can take a more active role in the design process, better design is sure to be a result.

Benefits of Landscape Design

- Provides a logical, organized framework for creating a design solution
- Helps to insure that solution is appropriate
- Aids in determining best use of land
- Provides basis for design solution discussion
- Helps to ensure that maintenance considerations are identified

Section IV - Plant Selection

Choosing the Proper Plant Material

When choosing plant material for a landscape or community project, it is important to incorporate two concepts: 1) use of native plants and 2) use of species diversity. Appendix F includes a nearly complete list of woody plants that have proven successful across Nebraska. The woody plants are divided into categories according to their height at maturity. Each listing includes a brief description of that species' cultural conditions, what Nebraska hardiness zone the plant will grow best in and notable information on growth habit and varieties. Every woody plant has a zone to which it is hardy. If trees are selected for planting that are not hardy to the zone that they are being planted in, they will probably not survive.

Most trees and shrubs are susceptible to a variety of disease and insect pests. However, resistant varieties and cultivars are available in the plant industry. Planting these varieties will result in a stronger plant and a healthier landscape.

Trees and shrubs are rarely maintenance free. In order for plant material to survive, they may require additional watering, pruning and mulching to ensure basic tree health.

Properly planted and cared for trees and shrubs add beauty, protection, diversity and value to almost any property, whether they are

planted in a park, along a street or highway or in front of a house.

Planting is only the first step in the process of maintaining a well-kept, desirable landscape. Selecting planting locations is one of the most critical decisions made during the planting process. If the plant must eventually be removed because the site is unsuitable, then the planting was a failure.

There are a variety of features that need to be measured when choosing a tree for a particular site. These factors include:

- growth rate and size at maturity
- form
- hardiness
- insect and disease resistance
- maintenance requirements

Growth Rate and Mature Tree Size

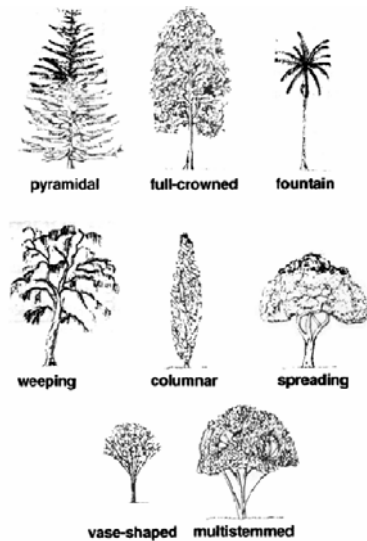
Fast growing trees, such as silver maples, willows or honeylocusts frequently adapt to inadequate soil conditions and owner neglect. They readily and quickly attain a size where they contribute practical purposes such as shade and screening. However, these trees often have fragile, delicate wood that can split easily in storms and that decomposes quickly. They typically do not survive as long as woody plants with a slower growth rate such as a red maple or oak.

Choosing a tree with a specific shape can often provide an answer to a growing space obstacle. A big tree with

an upright growth habit and narrow branching form may be placed closer to a building than a tree that has an expansive shape.

Tree Form and Shape

There are cultivars of tree types obtainable that have distinct growth forms such as columnar, pyramidal, upright or weeping (Figure 1). Trees with different growth habits also offer an assortment of architectural functions in the landscape.



[Figure 1: Tree Growth Forms]

Trees often have to be removed because they have grown too large for the site. Large landscape-sized trees should be planted a minimum of 15 to 20 feet away from buildings or other obstructions. Overhead and underground utilities must be considered in order to avoid potential conflicts. Large trees should be planted a minimum of 20 to 25 feet from overhead power lines. Shrubs should be planted a minimum of 5 feet away

from any potential conflict. These distances are minimums and greater distances would be preferable in most cases. When selecting your planting location, consider the plant's requirements for growth and survival, such as exposure to sunlight and soil drainage needs.

Plant Hardiness

Plant hardiness is genetic. That is why some plants are hardier than others, even why some cultivars are hardier than others of the same plant. They may have been bred or selected as being hardier clones.

Over time, plants slowly adapt or change genetically to accommodate their climate. That is why a species grown in southern climates may not be as hardy as the same species grown in Nebraska. Roots, stems, leaves and flower buds generally are hardy to different temperatures. This is why many perennials die to the ground in winter only to have their roots survive and produce new shoots the following spring.

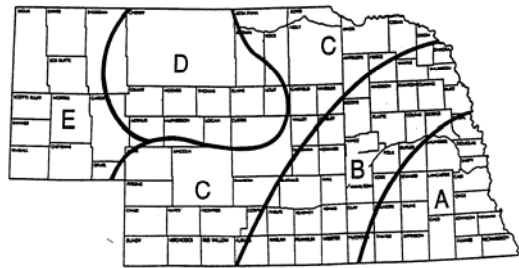
Begin by figuring out your hardiness zone. Nebraska lies in zones 4 and 5 (Figure 2). These are geographic zones shown on maps that share the same range of average annual minimum winter temperatures. A few references also will list hardiness zones for heat — the maximum temperature a plant can endure.

When using a hardiness map, remember that these zones are averages only. In colder years, plants listed as hardy in a particular zone may

not survive.



[Figure 2: U.S.D.A. Hardiness Zones Map]



[Figure 3: Nebraska Hardiness Zones Map]

In Nebraska, the climate can vary greatly from east to west. So, the state has been divided into five growing zones. These zones correlate to the plant list in Appendix F. When selecting plants, you need to consider the microclimate — conditions such as soil type, sun and wind exposure, slope and proximity to buildings. If the soil is heavy, wet and has low fertility, for instance, it may stress the plant, resulting in winter injury. On the other hand, if the soil is too fertile, the plant may grow late into the season and not harden off properly. Again, the result is winter injury.

Native plants are those species that developed naturally in the area prior to humans introducing plants from

outlying places. Before humans, native plants usually matured in areas with species that were well tailored to similar soil, moisture and weather conditions.

Landscapes with native plants require less irrigation; and native species, once established, are naturally drought resistant. Because they generally grow at a slower rate, native plants produce much less yard waste. Native plant species are also well acclimatized to local soil conditions, flourishing without artificial fertilizers.

Native plant species have changed and adapted to regional conditions over thousands of years and are typically very tolerant to the customary weather intensity at a certain location. They have adjusted to endure winter cold and summer heat, episodic drought, wild fires and intense winds.

Each native plant species is a constituent of a population that is comprised of other plants, animals and microorganisms. Native plants provide more appropriate natural forage, protection and habitat for native wildlife and are more impervious to biotic pests and diseases. Native plants supply food and shelter for birds, butterflies and other pleasing wildlife. Many aid to steady and hold the soil. Their root systems help rainfall permeate the soil, minimizing erosion and runoff and improving downstream water quality. Native plant species frequently have much deeper penetrating root systems that are more successful at keeping soil on slopes, thus lessening the likelihood of

landslide and erosion.

Native plants offer a variety of heights, shapes, colors and textures in the landscape. These traits make native plants good choices for planting beds and boundaries of landscaped areas. They can also provide brilliant color in periods of drought.

Another advantage of native plants is their historical and cultural importance. A number of species have been reported to have merit as food or medicine, while others have been employed as fiber for textiles and rope or coloring and dye for a mixture of domestic purposes. Native plants offer a physical link to our common heritage and bestow a bridge to our futures.

Landscape Sustainability

"Sustainable landscapes" are landscapes that support environmental quality and the conservation of natural resources. A well-designed, sustainable landscape reflects a high level of self-sufficiency. Once established, it should grow and mature virtually on its own — as if nature had planted it. Sustainable landscapes adhere to the general principles of landscape design: they are aesthetically pleasing, functional and environmentally beneficial.

Benefits may include enhanced landscape beauty; less environmental decline; more effective use of water, pesticides and other chemical resources; more valuable wildlife habitat; and cost savings from reduced maintenance, labor and resource use.

Although sustainable landscapes

may appear more "natural" and less manicured, they still rely on all of the standard design principles to create a visually appealing combination of plants and materials.

Aesthetic principles including accent, contrast, harmony, repetition and unity ensure the design is attractive, visually compatible and has a "sense of fit" with the surrounding landscape. Functional principles dictate that the design will be usable and will meet certain health and safety criteria. For example, drainage must be routed away from the foundation of a home, sidewalks and outdoor spaces should be sized appropriately for homeowner and visitor use and landscapes should include areas dedicated to private, public and utility needs. Environmentally beneficial design enhances the landscape microclimate, increases biodiversity and maximizes the use and re-use of resources.

Landscape microclimates can be enhanced by channeling or screening winds and shading structures and outdoor living areas from the summer sun while providing for winter sun exposure and increasing or decreasing humidity (or the perception of humidity) through adjustments in air movement. These enhancements can lead to lower energy and water use, healthier plants which are capable of resisting diseases and insects with less chemical assistance and more usable outdoor living space.

Biodiversity refers to the natural variety of plants, animals, fungi and

microorganisms found in all ecosystems. Increasing biodiversity, whether in a backyard, neighborhood park or along a regional creek, brings many benefits to landscapes.

Planting landscapes that more closely reflect native plant communities can enhance biodiversity. To achieve this, develop understory and overstory vegetation similar to the layering of plants in a natural forest. Biodiversity also assumes plants are placed in conditions and environments where they would naturally grow.

Plants that provide habitat for wildlife and year-round aesthetic interest also increase biodiversity. Likewise, alternative methods of storm drainage management – such as, detaining water on-site and allowing it to percolate through porous surfaces or implementing flood control measures along creeks – will enhance overall habitat health and appearance.

To reduce resources and minimize waste in a landscape, choose the correct plants and their locations and watering, pruning and chemical applications will be reduced. Accepting insects and diseases that are not life threatening to landscape plants (for example, some leaf feeding or leaf spot is OK) is another way to reduce chemical use and other resources. Apply mulch to the soil under plants to reduce weed growth and, in turn, reduce chemical treatments and use of gas-powered trimming equipment. In addition, mulch improves soil quality over time, minimizing water waste caused by run-off and evaporation.

Soils are typically the most misunderstood and undervalued resource in urban landscapes. Soil quality and character significantly affect the growth and health of plants and should be major considerations in landscape installation.

Whenever previously undisturbed landscape areas are slated for construction, the top 6 inches of soil should be scraped off and stockpiled. Save the soil and reuse it as the final layer of soil once construction is completed. Since a substantial amount of root growth occurs in the top 6-12 inches of soil, this reused soil can significantly enhance the establishment and growing conditions for new plants.

Woody Landscape Plants for Nebraska Communities

Species diversity is the cornerstone of a healthy community forest. In Appendix F is a nearly complete list of woody plants that can be grown in Nebraska communities. Each plant is keyed to the hardiness zone map [Figure 3, Page 23] to show where it will grow in Nebraska. Many of the plants might need extra care and protection to survive in certain zones. Conversely, many plants may do well outside their recommended zone if the proper microclimate exists.

Herbaceous Perennials and

Ornamental Grasses

Herbaceous perennials normally live for many years under local growing conditions, dying back to the ground each winter. They vary in height, leaf texture and flower color and are the backbone of the flower garden for many home gardeners.

Soil quality is probably the most important factor in determining the success of a perennial flower planting. Adequate soil moisture is needed during the growing season, but it is very important that the soil not stay excessively moist during the winter dormant season. To improve waterlogged soils, add drainage tile, raise the bed or incorporate organic matter such as compost or peat moss. Most perennials grow best in slightly acidic soils (pH 6.5 to 7.0). A soil test can be made to determine soil pH. Soil amendments should be added and worked in to a minimum depth of 6-10 inches prior to planting.

Once the foliage of herbaceous perennials (perennials that die back to the ground each year) has been killed by a hard freeze, their stems can be cut off near ground level. If the plants had disease problems this last summer, remove and destroy the plant debris; dead leaves serve as an excellent overwintering site for fungal spores that will re-infect your garden next year.

Perennials damaged or killed during the winter usually are not injured directly by cold temperatures but indirectly by frost heaving. Frost heaving occurs when the soil

alternately freezes and thaws, resulting in damage to the dormant crown and root system. This action can be reduced by winter mulch, which helps prevent rapidly fluctuating soil temperatures. Any perennials that are not reliably winter hardy should be mulched after the ground freezes, usually in late November.

Mulch about three inches thick is best. Evergreen boughs, clean straw or other loose, coarse materials are good mulches. Materials such as tree leaves or grass clippings may compact too much around the plant, inhibiting water drainage and promoting disease development. All new perennials planted in summer would also benefit from an application of mulch. Remove mulch gradually as new growth begins in the spring, usually in early March.

Ornamental grasses tolerate or even benefit from lower application rates of nitrogen and pesticides. Ornamental grasses tolerate drought, wetness and fluctuating winter temperatures. They are resistant to most diseases and insect pests and require minimum inputs of fertilizer. Because of these characteristics, they are useful to gardeners interested in a low-input or sustainable landscape. Ornamental grasses vary in size, shape, color and texture in both foliage and inflorescence (seed head). Mature plants range in height from 6 inches (blue sedge, *Carex glauca*) to 14 or more feet (hardy pampas, *Erianthus ravennae*).

Grass forms vary from low mounding to fountain shaped to tall

vertical. Foliage color includes shades of green, yellow, blue, red, brown and variegated (green and white mixed). A number of grasses change in foliage color in the fall to displays of straw yellow, orange, red or purple. Foliage texture varies from fine to coarse (blade width from 1/8 to 1/2 inch). The inflorescence also varies in size and color and may change color in the fall as well.

Ornamental grasses can serve many functions in the landscape. Ornamental grass foliage provides a surface to catch the wind. This movement adds a sense of motion to the landscape. For this reason the prairies were often visually described as an inland sea. This movement also creates a rustling sound adding another dimension to your design. Thus, ornamental grasses aren't a static landscape element. Instead, they add life, motion and sound to plantings. In a border, grasses can be either edging or background plants while larger specimens can be accent plants or screens. Rhizome (blue lymegrass, *Leymus*) or stolon (buffalograss) forming grasses will stabilize banks or serve as ground cover. Some diminutive species can be utilized in a rock garden. Combine grasses with either woody or herbaceous perennial plants, such as shrub roses or black-eyed Susan, to create a low-input or sustainable landscape.

Unlike herbaceous perennials, the foliage of most ornamental grasses don't disappear in late fall but remain throughout the winter months. Grasses

add life to a winter scene otherwise devoid of foliage.

Although a few tolerate shade, most grasses require full sun. Some grasses or grass-like plants are adapted to wet soils, but most require a well-drained soil. To become drought and pest resistant, plants require a suitable root zone. In compacted soils, even the root systems of drought-tolerant plants will not develop.

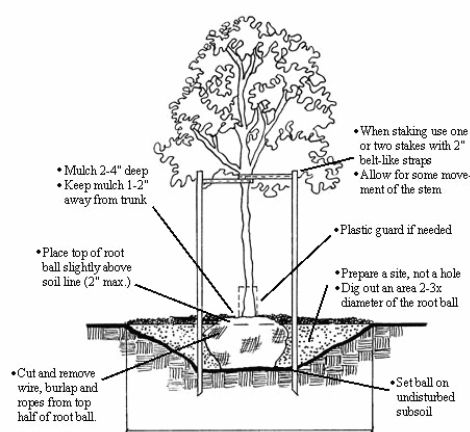
Directly seed annual grasses in the spring. If irrigation is available, you can plant container-grown ornamental grasses throughout the summer. In Nebraska, plant bare roots or divisions in the spring.

Your community forest will thrive best, and be most successful, if you take time and care with the selection of plants. Species diversity and the incorporation of native plants will aid in creating a community forest that requires minimum maintenance and provides maximum aesthetic and functional benefit. Trees and other plants should be selected with knowledge of their size and height at maturity and planted accordingly. Further details on the installation of plant materials in your community forest are provided in the next section of this manual.

Section V – Tree Planting and Care

The Complete Process

There is not much that should be done to a planting area if the site has prolific soil with good composition; however, effective site preparation is essential in preventing failure for a newly planted tree. Limits above and below the ground should be considered, as well as wind and sun exposure. This section of the Community Forestry Resource Handbook provides further guidance on the necessary steps involved in preparing a site for tree planting (Figure 1). This is followed by an overview of successful planting procedures and some specific recommendations for street and roadside plantings.



[Figure 1: Proper Planting]

To ensure successful tree and shrub planting, quality plant material and apposite planting techniques should be employed. The UNL – Nebraska Forest

Service specifications should be used as guidelines for acquiring and planting woody plant materials, as well as for immediate care of the plants once they are in the ground.

Site Preparation

Time and effort should be spent on site preparation prior to planting. Tree planting failure commonly occurs as a result of poor preparation coupled with inadequate weed and grass control the first three to five years after planting. Effective site preparation begins the year before planting. An adequately prepared planting sight has sufficient soil moisture and firm compaction. Compacted soil has fewer air pockets, which can cause tree roots to dry out and eventually die. By preparing the planting site in advance, you will reduce present and future weed and grass competition, resulting in extra soil moisture, nutrients and sunlight for trees and will, in turn, improve the effectiveness of follow-up weed and grass control practices. Site preparation conditions and mellows the soil, making it easier to plant trees by machine and/or hand. You will also have the opportunity to introduce rodent control measures that deter feeding damage on trees.

Major soil deficiencies should be identified and corrected before planting or a better planting site should be selected.

It is especially important to locate

all underground utilities before digging. In Nebraska, state law requires that you contact the "digger's hotline": (800) 331-5666 (Statewide) or (402) 344-3365 (in Omaha Metro area).

Check the area for subsurface drainage and be certain plant placement will allow for proper growth and development (do not plant large trees under power lines).

Landscape Water Use

Plants take water from the soil and use it in four ways. Understanding how this works can help you decide when and how much to water. Water inflates plant cells, which helps plants stand upright and stay healthy. Water helps deliver food and nutrients throughout the plant. It is an important component in photosynthesis, which provides food for the plant. Water also evaporates from the plant's leaves in a process called transpiration, which cools the plant during hot weather. All of these processes are critical for plant health and growth, but using too much water is unhelpful and wasteful. For example, excess moisture causes transpiration to occur even when the plant doesn't need to be cooled. For more information on how trees grow and thrive, see Section III of this manual.

While plants use some of the water, moisture also is removed directly from the soil through evaporation. Evaporation and transpiration combined create evapotranspiration. Measuring

evapotranspiration can provide estimates of how much water needs to be put back into the soil to retain good growing conditions. Research shows that in order to avoid plant stress, extra water should be applied when about 50 percent of the soil moisture reserve has been used.

Determining Need for Irrigation – General Considerations and New Plantings

Closely observing landscape plants and the soil is often the best way to determine whether watering is needed. Ornamental plants typically exhibit rolled, off-color leaves and droopy stems when soil moisture is unavailable. Turf grasses may develop a blue or gray cast, and when walked on, will not spring back quickly. Leaf and stem dieback can occur quickly under drought conditions and is of particular concern for new plants that have not developed an extensive root system. Carefully sampling soil moisture at root level with a shovel or auger, or through moisture sensors installed in the soil, also will determine how much moisture is available.

- Water early in the morning, between 4 and 10 a.m. Doing so allows the plant foliage to dry, making it less susceptible to foliar diseases. Early morning watering also ensures less distortion of sprinkler patterns and reduces evaporation due to lower winds and cooler temperatures.
- Create water zones by putting plants together that have similar water

needs. Doing so minimizes the potential of over watering and under watering neighboring plants. Where woody plants must be included in turf grass areas, consider using water-loving or water-tolerant plants that can remain healthy under relatively high amounts of irrigation.

- Irrigation for established woody landscape plants should be focused at and/or beyond the drip line to promote extensive rooting and should be applied deeply into the soil (water delivered deeper than the 2- to 3-foot range, however, will not be accessible by most of the plant roots).
- In new landscapes with automatic irrigation systems, newly installed plants may not receive the thorough watering required to promote early vigorous root establishment; supplemental hand watering, therefore, may be needed to provide the watering necessary (this is especially true for small plants which may dry out quickly or large plants with deep rootballs).

Creating Watering Zones

You can reduce water consumption by 40-80 percent by following an appropriate sequence in designing and managing your site. This includes:

- a well planned design
- use of adapted, drought-tolerant plants
- proper irrigation
- soil improvement
- mulches

- appropriate, timely maintenance

Zone watering means grouping plants with similar water requirements. Be sure your landscape plan includes this concept so you can give the rose bed sufficient water without drowning the petunias.

Irrigation systems will support your design if you carry your planning throughout the entire landscape. Remember that all the shrubs, trees, flowers and turf in a given irrigation area will receive the same amount of water. The water conserving value of buffalograss will be defeated if it is in the same irrigation area as trees.

Drip and soaker hose irrigation systems place water on the soil surface in the immediate vicinity of plants' root systems, reducing evaporation loss and irrigating only to desired plants. An added bonus of these systems is the reduction in foliar diseases that can accompany sprinklers. These systems best serve trees, shrubs and flowers.

Avoid excess watering — moisture is critical to trees, but too much moisture can cause serious damage. Established trees should receive 1 inch of water every 10 to 14 days. These amounts are in addition to the water a surrounding grass lawn would need. A new tree with a grass lawn competing with it may need 2 inches or more of water a week to thrive.

Daily watering causes a lack of soil oxygen, smothering roots. It can reduce the number of deep roots. Larger amounts of water should be applied once or twice a week.

Water with a hose or coarse-droplet sprinkler at a rate low enough to keep water from running off. Do not inject water "deep" into the soil.

Most tree roots are not very deep (within the upper 6 to 12 inches of soil), and deep roots will receive water if enough is applied to the soil surface. Tree roots extend away from the tree at least as far as the tree is tall, and in most cases much farther. Therefore, it is usually beneficial to water the entire yard to water a tree.

There is one more consideration: run-off. The conservationist wants water on the plants, not down the gutter. Careful location of emitters may not be enough to minimize run-off. You may need to reshape land to reduce slopes that encourage water to move too quickly for soil to absorb it. The slope should direct water toward the plants that are high water users and away from hard surface areas such as driveways, walks, and patios. Another way to reduce run-off is to incorporate organic matter into the soil to improve the infiltration rate and water-holding capacity of the soil.

Purchasing Specifications

Minimum specifications for all nursery grown plants will be the specifications contained in "American Standards for Nursery Stock" as adopted by the American Association of Nurserymen. All plants shall be free of noxious weeds, root rot, scales, tree borers, insects, blights, and other diseases. All plants shall be subject to the laws and regulations of the State of

Nebraska.

Packing and Shipping

All plants should be packed and shipped from the supplier in a manner, which protects the plant against drying, freezing, breaking or other injury. Bare-root plants should be packed in moist packing material and bundled to ensure against heat or mold damage. Plants should be protected against the elements while in transit and should be thoroughly inspected before acceptance. The individual(s) responsible for ordering plant material should contact the nursery supplying the order to ensure compliance with these standards.

1. Bare-root Plants

Bare-root stock that appears to be substandard, damaged, overheated, or dried during shipment should not be accepted. After delivery and acceptance, bare-root plants must be protected from drying and overheating until planting. Plants may be stored for three to seven days, depending on the weather, by placing them in a cool, shaded location, out of the wind and with the roots covered with a moist mulch material. If the plants are stored in a protected shade frame such as a lath house, they can be stored up to one month with proper care. They must be watered daily. If planting is delayed longer, bare-root stock should be placed in cold storage (cold storage areas will be maintained at a temperature between 34 and 38 degrees Fahrenheit and a relative

humidity range between 90 and 100 percent). If cold storage facilities are available, it is preferable to store the bare-root planting stock in cold storage even if the storage time is only a few days.

Bare-root plants taken from holding areas or cold storage require special care. The roots must be shaded and kept moist at all times. The roots must never be allowed to dry, even slightly, because the small hair roots will dry out and die in just a few minutes. To prevent drying, roots should be covered with moist packing material and burlap. On the planting site keep all bare-root plants in a cool, shady place out of the wind. Bare-root plants should not be planted if they show signs of drying, growth, or mold during storage.

2. Ball and Burlap and Container Grown Plants

Ball and burlap and container grown plants must be properly watered and protected from damaging winds, mechanical damage and drying until planted. The plants should be kept in a shaded area during storage to provide them with the needed protection mentioned above. Plants must be handled only by the container or soil ball. Lifting by the stem can cause shearing of the smaller roots, which often leads to mortality.

Planting Season

Bare-root plants should be planted in the spring between March 15 and May 15 when there is no frost in the

soil. The temperature should be above freezing whenever bare-root plants are planted, and the soil in workable condition. Planting operations should be suspended during exceptionally wet, dry, or windy periods. During late spring seasons, the planting period may be extended a few days if the bare-root stock is still dormant.

Ball and burlap stock may be planted in the spring between March 1 and June 15 if weather and soil conditions permit. These dates may be extended if the weather stays in spring-like condition. Fall planting should be completed between August 15 and October 30. Evergreen trees transplant very well in the fall while some extra care and maintenance may be needed for fall planted deciduous plants.

Container grown stock may be planted during most times of the year. Special care must be taken when planting during the especially hot time of mid-summer. The best time for planting container-grown stock corresponds with the planting dates for ball and burlap stock.

Variance in the dates stated above for planting could be allowed if the weather is suitable and if approved by the purchaser and the UNL-NFS.

The best time to plant tree seedlings is in the spring, before the buds begin to swell. Fall planting is usually not very successful. To minimize stress on the seedlings during planting, try to plant on a calm or cloudy day, and keep the trees moist. It is extremely important to avoid the exposure of seedlings, especially bare-

root conifers, to air any longer than absolutely necessary. Keep seedlings in the original, moist packing material, or covered with wet burlap. If practical, placing the roots in a bucket containing a slurry of soil and water will provide a coating for the roots and keep them from drying out.

Commercially prepared slurries are also available. Although dryness damages the roots, they do need some oxygen; therefore, DO NOT store the seedlings with their roots in water or in the slurry for more than several hours.

Successful Planting Procedures

Once you have selected the species that will perform the desired function in your landscape, and prepared the site for planting, visit a reliable nursery in your local area. Nursery plants usually are properly cultivated and trained, have well-developed root and crown systems, and are more likely to survive than wild trees. Nurseries also offer a large selection of sizes and species.

If the tree being planted is ball and burlap or bare-root (Figure 2), it is essential to know that the root system of the tree has been decreased by 90-95% of its initial mass during transplanting. The distress triggered by the digging process will commonly cause trees to exhibit what is referred to as transplant shock (TS). TS is denoted by delayed growth and reduced strength following transplanting.



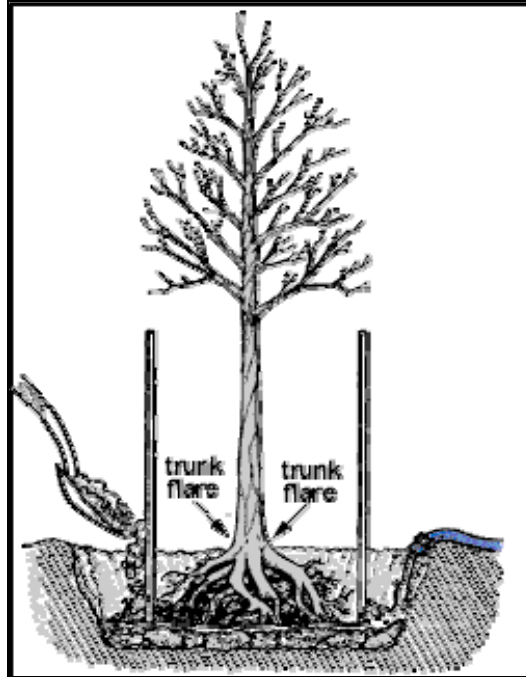
[Figure 2: Ball and Burlap and Bare-root Tree Stock]

Identify the trunk flare (Figure 3). The trunk flare is the region in which the roots extend at the bottom of the tree. This area should be partially observable once the tree is in the ground. If the trunk flare is not somewhat visible, remove the soil away from the top of the root ball.

Tree and shrub plantings are most successful when good stock and proper planting methods are used. The following are specifications and guidelines recommended by the UNL-Nebraska Forest Service for purchasing and planting trees on public lands. Both the Nebraska Nursery and Landscape Association and the Nebraska Arborists Association have endorsed these specifications.

Planting

The planting site should be dug two to three times wider than the root system of the tree or shrub to be planted. The finished hole should be narrower at the bottom than at the top and be at least two feet wider than the root mass. Hole dimensions should be



[Figure 3: Trunk Flare]

increased when planting in heavy or hard soils. With heavy or hard soils, the sides of the planting hole should be scarified (loosened) to facilitate root penetration into the adjacent soil (this will cause the plant to girdle itself and result in death of the plant).

The planting site should be dug two to three times wider than the root system of the tree or shrub to be planted.

The plant should be set slightly higher than the nursery level and soil mounded up to the top of the root ball. The root ball should be placed on solid soil.

The soil used for backfill should be well prepared. It should not be too wet or too dry and all large stones or clods should be removed. If the soil, which was removed from the planting hole, is unsuitable for backfill, it should be

mixed with a good loam soil.

Ball and burlap or container-grown stock must be lifted and carried only by the ball or container. If the plant is lifted or carried by the stem or branches, the weight of the soil ball will pull the roots and cause them to be sheared from the plant. After the ball and burlap plant is set at the proper level in the hole and sufficient backfill is placed in the hole to prevent any movement of the ball, the twine holding the burlap must be cut and the burlap loosened around the trunk of the tree. If the plant is in a wire basket, the wire should be cut and removed where possible, as long as damage to the root ball can be prevented. The burlap must then be laid back around the sides of the ball so that it will be completely covered by soil when backfilling is complete. The container on all container grown plants must be completely removed before setting the plant. If girdling roots are present the sides of the rootball should be cut with a sharp shovel or knife and roots loosened. Backfill soil should be added in layers and firmly tamped. Water should be used to help settle the soil and eliminate air pockets after backfilling is complete. Care must be taken not to tamp or otherwise work the soil after the plant has been watered or the soil structure may be damaged.

Bare-root plants require special care in backfilling. The roots should be placed in their natural position directly above a mound of soil built in the bottom of the hole. This allows the

roots to spread over the sides of the mound and form close contact with the soil. Backfill soil should be worked gradually around the roots and firmed by tamping, but care should be taken not to damage the roots in the process. The plant may be gently raised and lowered during the backfilling process to help filter the soil in between the roots. Some water may be added to help settle the soil and eliminate air pockets after backfilling is completed.

Pruning

Trees and shrubs should be pruned at planting time only to remove branches damaged during handling and transplanting. The main leader on single stemmed trees must not be pruned unless it has been damaged. Lower branches should not be removed completely because they manufacture critically needed food and help protect the lower trunk. All transplanted plants should be inspected during the fall and winter after planting and, if necessary, pruned to remove any dead branches, to improve plant structure, and to remove any branches that are rubbing each other. This pruning period is also an excellent time to inspect supports and tree wrap. More detailed information on pruning is provided in the following section of this manual: Section VI – Long-Term Tree Care.

Staking and Guying

The purpose of most staking and guying is to prevent the newly planted tree from tipping over in the wind. In

Nebraska this practice is often valid. Excessive movement will dislodge the small, fibrous roots from their new footing in the soil before they are firmly established. However many trees are lost because guying materials are not removed or are improperly installed.

Staking and guying materials should be strong enough to provide support, but flexible enough to allow some movement. Guying materials should have a broad surface at the point of contact with the tree to prevent damage from rubbing. Plastic horticultural tape or canvas webbing that is at least an inch and a half wide are examples of good guying materials. All guying materials should be removed at the end of the first growing season to prevent trunk girdling. Any trees that do not establish within a year will more than likely never establish a strong root system. The stakes may be left in the ground, if desired, to protect the trunk from equipment damage. Trees that do not need support may still need the stakes in order to protect them from damage by mowers and other equipment.

Wrapping

For many years it was recommended that tree trunks be wrapped to protect them from sunscald or freeze injury, rodent feeding, mower and weed trimmer damage, and other assorted problems. Research has shown that tree wraps may not always protect trunks from damage, and in fact, can cause, hide and increase problems. In

addition, tree wrap covers the photosynthetic tissues of the trunk, preventing the production of food that is needed by the young tree.

Some wraps are claimed to protect trees against insect damage. However, borer activity under wraps and guards is frequently reported, and research has shown that insect and disease problems can sometimes be even worse on trees that are wrapped. Often the tree wrap causes the bark to remain moist, even in dry weather. Bark and cambial tissue may be seriously damaged or killed when too much water is held against the trunk. This problem is compounded when wraps at the base of the trunk are covered with several inches of mulch.

Cracks in the bark, which wrap is supposed to prevent, frequently occur in areas where wrapping material is loose or partially degraded, allowing uncovered portions of the trunk to heat or cool more than the covered areas. Also, while wraps are often used for the purpose of moderating temperature fluctuations in young, thin bark, some studies have actually shown that certain paper wraps cause a greater fluctuation of bark temperature.

Since the problems that can occur with the use of tree wraps can be very damaging, the routine use of wraps is not recommended. Tree wraps should be used only if a nursery guarantee requires it, if the tree species is known to be susceptible to winter sun scald damage on the trunk, and during the time that the tree is being transported

and needs protection from mechanical damage. If used, wrap should be on the tree only during the first winter, and should be removed completely the following spring. Wrap left on the tree during the growing season may girdle the tree as the trunk grows in diameter.

Damage from rodents, mowers and weed trimmers can be prevented by using plastic guards. A simple, yet effective guard can be made using perforated drain tile cut in twelve-inch sections and split down the side so that it can be placed around the tree trunk. Plastic guards should be monitored regularly and removed before rubbing or girdling problems occur.

Watering

All landscape plants should be thoroughly watered to the point of soil saturation at the time of planting. Watering at planting time provides essential water for initial use by the plant and settles the soil in the planting hole for better root/soil contact.

Care should be exercised when planting in poorly drained soils. To test for poor drainage a hole should be dug and filled with water. Allow the water to stand for 24 hours. If the water has not drained completely from the hole in that period then special planting and watering procedures may be necessary.

Supplemental Watering

Supplemental watering can facilitate tree and shrub establishment.

In most cases, supplemental watering of landscape plantings will be necessary during their initial establishment phase. Native species of trees and shrubs, and adapted introduced species, can normally survive and grow without additional water after establishment.

The amount of water needed will vary with the time of year and corresponding weather conditions, the species planted, and the size of plant. In general, plants should receive the equivalent of one inch of rainfall per week from June through August. The plants should be inspected regularly during the first three growing seasons to check for excessive drying of the leaves or soil and, if necessary, have water applied. Supplemental watering should be planned for three years after planting. The volumes may be decreased with each ensuing year after planting.

Mulching

Mulching is the most important post-planting practice that you can do to improve the health and vitality of your landscape plant. Research has shown that wood chip mulch can nearly double plant growth in the first few years after planting. Mulching conserves moisture, reduces weed competition, and insulates roots from heat and cold extremes.

Mulch with a two- to four-inch layer of organic material. The minimum diameter of the mulched area should be two feet. Proper mulching provides a well-groomed

appearance and designates an area where grass or weeds are eliminated, which results in lower damage rates from mowers and weed trimmers. Mechanical damage is one of the leading causes of injury and death to landscape plants. Desirable mulching materials include woodchips, wood shavings, bark or equivalent materials. Organic mulches are preferred since they tend to aerate the soil and replenish soil nutrients as they decompose.

Caution must be used when applying mulch since a layer too thick (more than four inches) may provide an excellent habitat for small rodents and lead to considerable tree damage, primarily during the winter months. If damage from small rodents occurs, it may become necessary to use pesticides, change the mulching method, or even eliminate the practice of mulching if the problem becomes severe. Heavy mulching can also be a problem in poorly drained or wet sites where moisture can remain at high levels for extended periods and cause root dieback. In addition heavy mulch layers encourage tree roots to grow up into the mulch material that may dry and cause the roots to die during long dry periods.

Use of landscape fabric for mulch is not recommended. Research suggests that landscape fabrics often do not control weeds well and may even cause harm to trees and shrubs. In high rodent areas the use of landscape fabrics may increase the damage to tree roots by field mice. Also, some tree

roots grow up into porous fabrics. If these fabrics are lifted or adjusted as changes are made in the landscape, tree roots growing through the fabric will be damaged.

Weed Control

Weed and grass competition is a limiting factor for plant growth. It is important to keep weeds and grass out of the mulch area to maintain plant vitality. Care should be exercised so that mechanical or chemical weed control devices do not damage landscape plants. Weed and grass control are important throughout the entire life of the plant.

Fertilizing

Most base soils contain sufficient levels of available nutrients to supply the requirements of newly planted landscape plants except where construction has either altered the soil or changed its composition. Fertilizer should not be applied during the first several growing seasons while the new roots are establishing themselves. After this period, determination of additional nutrient needs will be made based upon the condition and vitality of the plants and analysis of soil samples. If it is deemed that fertilization is needed, the rates and application methods should be based on the type of fertilizer used and the size of the plant. Fertilizer can be applied on the surface or through the use of root feeders. Caution must be taken when using the root feeders to ensure that the fertilizer is not applied too deeply. The fertilizer

should be applied at an average depth of 8 to 12 inches. A side benefit from the use of root feeders is the soil aeration from the holes made when applying the fertilizer.

Surface application is acceptable and also provides some benefits for the surrounding grass.

Professional Help

It is highly recommended that professional help be used for all planting and maintenance projects. Technical assistance can be obtained through the University of Nebraska, Nebraska Forest Service at any UNL-Research and Extension Center or by calling the Community Forestry Office in Omaha at 402-444-7804. The Nebraska Arborists Association maintains lists of members in Nebraska. These lists may be obtained free of charge by contacting their office:

Nebraska Arborists Association
PO Box 81414
Lincoln, NE 68501
(402) 476-3852

Street Tree Planting Considerations

1. No single species should dominate the landscape. A general rule-of-thumb is to not let any one species achieve more than 10% of the total tree inventory. In larger towns, however, the community tree inventory should be divided into easily defined geographic sections. Appropriate diversity should then

be strived for independently in each section.

2. Don't alternate species one after the other but rather work in complementary groupings.
3. Try to sequence plantings. An entire street edge or right-of-way should not be completely lined with trees. Some open areas that allow the sun to filter through are desirable.
4. Try to use species that canopy over the street as they mature (elm, bur oak, hackberry, honeylocust, etc.). Such species would be naturally more conducive to being limbed-up so as to allow for vehicular and pedestrian movement.
5. Columnar or very up-right species and cultivars are usually ineffective as street trees except where unusual site-conditions warrant their use.
6. Where room allows, try to incorporate understory species and species that provide flower interest.
7. Try to break up straight lines where possible (parks, boulevards, wider right-of-way areas, etc.).
8. Trees that bear abundant or heavy fruit should be placed carefully.
9. When planting, don't obstruct views at intersections and

driveways.

10. Be careful around utility lines -both aboveground and belowground. Don't plant directly under power lines with species that will grow into them.

Collect lists of plants and plant communities for sun, shade, wet, bird-attracting, etc. from which to make your selections. Remember:

- Suit the plants to the region, plant community, soil conditions and microclimate.
- Think in three strata -- canopy, shrub layer, and groundcover.
- Place shrubs, forbs, and grasses in groups of three, five, or more. Avoid planting in pairs -- the eye jumps back and forth between the two. The exception is trees as you may have space for only one or two.
- Avoid planting in straight lines or perfect circles.
- Do not use too many species in small areas.
- Use repetition of groups of plants and colors to allow the eye to flow through the landscape.

Be aware of each plant's ultimate height and spread at maturity. Do not over plant or plant too close to structures.

Roadside Planting Considerations

Some general rules to consider when planting along roadways include:

1. A lateral obstacle clearance, or clear zone, exists along all roadways. No woody plants or fixed objects can be located in this zone. The clear zone varies depending on the road design and speed limit. Setbacks for some common situations are:
 - Highways in town with curb, speed limit 40 mph or below - all woody plants should be at least 6' from back of curb.
 - Highways in town without curb, speed limit 40 mph or below - all woody plants should be at least 10' from edge of driving lane.
 - Rural highways without curb, any speed limit - all woody plants should be at least 30 feet from edge of driving lanes.
2. All tree and shrub plantings should allow 10' on either side of fire hydrants.
3. Allow 15' from trunk of shade trees to light poles (10' for ornamentals).
4. Trees should be located at least 20' on either side of any overhead line unless their natural habit will keep them under the line.
5. Shade trees should be at least 5' (ornamentals 10') from either side of drives.
6. Shade trees should be pruned up to at least 8' over sidewalks, more over roadways.
7. Shrubs and herbaceous perennials should be less than 30" (mature height) in medians.
8. Trees with an upright habit should be selected to reduce branching in driving and walking areas.
9. All utilities should be located and marked before planting.
10. Plants should not interfere with any signs.
11. Site triangles, in which nothing over 30" tall can be planted, exist at all street intersections. The area of the site triangle varies depending on the adjacent highway speed. The diagram on the following page shows a street intersecting a 30 mph highway. Shade trees can be planted with the trunks touching the hypotenuse. Ornamental trees must be planted so no branching extends into the site triangle.

Section VI - Long-term Tree Care

Planting Trees for the Long-term

The care provided for landscape trees during the first few years after planting is critical. This section discusses long-term cultural practices that are recommended for trees. It begins with an overview of diagnosing tree health problems. Environmental stresses and injury cause a variety of health problems for Nebraska trees. Woody plant decline and poor tree health can be inflicted by water and temperature stresses as well as from chemical or mechanical injury. Insects and disease can cause injury to trees and shrubs. Weeds are detrimental to the landscape in that they will compete with plant material for soil moisture, nutrients, sunlight, and space.

Several methods may be used to eradicate weeds, and careful attention should be given to those weeds that are noxious, or detrimental to the Nebraska landscape. This section includes a discussion of possible causes of tree decline and injury treatment recommendations. If trees show signs of extreme decay, consult a professional forester or arborist for inspection. The Nebraska Forest Service, the University of Nebraska, and county extension offices have easily obtainable information on tree care and sustainability.

This section concludes with a discussion of general tree care

principles including mulching, pruning, watering, and fertilizing. Many recommendations have changed drastically in recent years in light of new and more thorough research. Techniques used for mulching, pruning, watering, and fertilizing should be accurate and up-to-date when maintaining the woody plants in a community landscape.

Diagnosis of Tree Health Problems

The first step in the control of any plant disease is the accurate diagnosis of the problem. A wrong diagnosis, and ultimately the wrong control measure, may serve only to compound the problem. Diagnosis requires knowledge of what a normal or healthy tree looks like as well as symptoms of disease or other plant abnormality. Some problems are relatively easy to identify; others, including wilts, root diseases, diebacks and declines, are much more difficult to diagnose without experience. A series of questions and observations may help you diagnose a problem that at first glance may appear complex. Do not jump to hasty conclusions or give a rapid diagnosis! Try to obtain as much information as possible before making a diagnosis. Spend some time developing a history of the planting location as well as an assessment of the plant symptoms.

1. Determine the species and (if possible) cultivar of the affected plant. Many pathogens are host specific, and identifying the host can narrow the list of insect or disease problems. Plant cultivars can vary markedly in their susceptibility to certain diseases (e.g., flowering crabapple to apple scab).
 - Application of herbicides in the area (weed & feed, phenoxy, soil sterilants).
 - General plant vigor (wounds, poor growth, etc.).

2. Collect Information on cultural practices, weather conditions and pesticide applications before and during the development of symptoms. Remember that caretakers may not remember correctly all of the cultural practices employed. Weigh the answers against what you see in the field. Some useful information includes the following:
 - Date symptoms first appeared: Record any previous outbreaks.
 - Temperature and rainfall amounts before and during the problem; look for unusual weather patterns associated with the problem.
 - Irrigation practices (amounts, timing).
 - Fertilization (amounts, timing, formulations).
 - Edaphic factors (soil type, soil pH, drainage, compaction, etc).
 - Age of plant or crop (planting date).
 - Surrounding environment of plant or crop (proximity to sidewalks, sewers, etc.).

3. Record your overall impression of the symptoms or patterns of problems on the plant. Stand back and take a general view of the surrounding planting site best. Decide whether this is the only plant affected, or whether others are affected. The distribution of the problem is very important. At this point don't rule out the possibility of environmental (physiological), insect or chemically induced problems.
 - If the problem occurs on a number of plant species, it is most likely the result of environmental or chemical damage.
 - If the problem occurs on a single plant, and others of the same species are not affected, it is unlikely that the problem is associated with the foliage. Look for problems on the trunk, stem, or roots.
 - Look at the pattern of the problem on the plant (one-sided, top only, bottom only, etc.).

4. Record specific symptoms on individual plant parts. Symptoms are the expressions of disease on the host plant. These expressions may include abnormal plant

growth, color, taste, odor, etc.

Symptoms may be either localized (leaf spots, canker) or systemic (wilts, chlorosis, blights).

Symptoms also may be primary (direct changes in the tissue actually attacked by the pathogen) or secondary. The distinction is very important! All too often people see secondary symptoms and conclude a pathogen is associated with a certain plant part (such as scorched leaves) when the real cause of the problem actually occurs in another part of the plant (such as the root).

- Plant part affected (leaves, roots, branches, overall decline). Determine whether symptoms are primary or secondary.
- Types of symptoms:
- Localized: leaf spot, insect feeding, cankers, galls, callus, decay.
- Systemic: dwarfing, chlorosis, mosaic, wilt.
- Look for signs of the pathogen or insect. A sign is the presence of a pathogen structure or product on or in a diseased plant. They include fungal fruiting bodies, bacterial ooze, insects, and other structures. You may need a hand lens to observe these structures.

5. Once detailed information on the cultural conditions, pattern of the disease, and specific symptoms have been obtained, you are now in a position to attempt a diagnosis.

Compare your information with descriptions and photographs of problems known to occur on that species of plant. Several excellent resources are available:

- Extension publications available from county extension offices
- Reference books

6. If diagnosis is still uncertain, ask for help. It is impossible to know all plant problems. In most states, the extension service provides an insect and disease diagnostic service.
7. Control. Several control methods are available. They include these practices:
 - Exclusion (quarantines, disease-free material)
 - Eradication
 - Cultural modifications
 - Biocontrol
 - Chemical control
 - Plant resistance

Hazard Identification

A professional forester or arborist should inspect trees that have large, dead branches or show signs of interior decay. These trees can become major liabilities if left standing. In many cases accidents can be prevented through proper pruning.

Tree work can be dangerous, and many tasks should be left to professional arborists. The Nebraska Arborists Association is a professional organization that promotes proper tree

care in the state. You can contact the Nebraska Arborists Association through any District Forester to find out who your nearest arborist is, or check the yellow pages of the phone book under "Tree Services".

Professional Arborists

In all cases where larger trees are involved it is wise to consider contracting the services of a professional arborist. Lists of certified arborists can be obtained through the Nebraska Arborists Association, Box 81414, Lincoln, NE 68501-1414 (402) 476-3852 or the International Society of Arboriculture, Box 3129, Champaign, IL 61826-3129, (217) 355-9411. Many cities require licensing of arborists. Call and ask for a list of licensed arborists in your community.

Remember the following points when hiring or contracting with an arborist:

- Check your telephone directory's yellow pages under "Tree Services" for a listing of those businesses that do tree work in your area. While anyone can list himself in the phone book, a listing at least indicates some degree of permanence. Be cautious of any arborist that advertises "topping" as a service. "Topping" is not an approved tree maintenance practice.
- Ask if either the Nebraska Arborists Association or the International Society of Arboriculture certifies the arborist. Certification is not required by the State of Nebraska but it does indicate that the arborist has a high degree of knowledge.
- If the arborist you are considering is not certified, determine if he/she is a member of any professional organizations, such as the Nebraska Arborists Association, the International Society of Arboriculture or the National Arborists Association. Membership in these and other professional organizations does not guarantee quality, but does indicate professional commitment.
- Ask for certificates of insurance, including proof of liability for personal and property damage and workman's compensation. Then, contact the insurance company to make sure the policy is current. Under some circumstances, you can be held financially responsible if an uninsured worker is hurt on your property or if the worker damages a neighbor's property.
- Ask for local references. Take a look at some of the work, and if possible, talk with former clients. Experience, education and a good reputation are signs of a good arborist.
- Don't rush into a decision just because you are promised a discount if you sign an agreement now. Be sure you understand what work is to be done for what amount of money. It is not generally a good idea to pay in full until the work is completed.
- Most reputable tree care companies have all the work they can handle without going door to door. People

who aren't competent arborists may solicit tree work after storms, seeing an opportunity to earn quick money. Storm damage creates high-risk situations for both workers and property.

- If possible, get more than one estimate.
- A conscientious arborist will not use climbing spikes except when removing a tree. Climbing spikes open unnecessary wounds that could lead to decay.
- Good tree work is not inexpensive. A good arborist must carry several kinds of insurance as well as pay for expensive and specialized equipment. Beware of estimates that fall well below the average. There may be hidden costs.

Maintaining Plant Health

Basic elements that influence plant health include sufficient water, light, and a proper balance of nutrients. Too much or too little of any of these environmental conditions may cause plant stress. Environmental stress weakens plants and makes them more susceptible to insect and disease attack.

Trees deal with environmental stresses, such as shading and competition for water and nutrients in their native environment, by adjusting their growth and development patterns to reflect the availability of the resources. Although trees are adapted to living in stressful conditions in nature, many times the stresses they experience in the landscape are more

than they can handle and may make them more susceptible to insects and diseases.

Diseases

Three things are required for a disease to develop: 1) the presence of a pathogen (the disease-causing agent); 2) plant susceptibility to that particular pathogen; and 3) an environment suitable for disease development.

Plants vary in susceptibility to pathogens. Many disease-prevention programs focus on the use of pathogen-resistant plant varieties. Even if the pathogen is present and a susceptible plant host is available, the proper environmental conditions must be present over the correct period of time for the pathogen to infect the plant.

Diseases can be classified into two broad categories: those caused by infectious or living agents (diseases) and those caused by noninfectious or nonliving agents (disorders).

Examples of infectious agents include fungi, viruses, and bacteria. Noninfectious diseases, which account for 70 to 90 percent of all plant problems in urban areas, can be caused by such factors as nutrient deficiencies, temperature extremes, vandalism, pollutants, and fluctuations in moisture. Noninfectious disorders often produce symptoms similar to those caused by infectious diseases; therefore, it is essential to distinguish between the two in order to give proper treatment.

Water-Related Stresses

Scorch — Uniform yellowing or browning of the edges of leaves on broadleaf plants or the tips of evergreen needles is a symptom of a condition called scorch. This problem occurs most commonly on linden, maple, ash and cottonwood. The problem usually is more severe on the south or southwest side of the tree or on the side nearest a source of radiated heat, such as a brick wall or street. Severe scorch can result in premature leaf or needle loss.

Prolonged dry periods accompanied by warm, dry winds create an imbalance in trees in which moisture is lost through transpiration faster than the roots can supply it to the leaves. This results in the drying out and death of leaves and sometimes branch tips.

A girdling root can also cause scorch symptoms. This is usually a shallow root that has grown tightly around another major root or the base of the trunk. By pressing tightly against the other root or trunk, the girdling root restricts the upward flow of water in the tree.

Yellowing and browning symptoms in the leaves are similar to those caused by drought conditions, but the symptoms can occur even when soil moisture levels are high, and they may be more severe in one portion of the tree.

Trees with a root that girdles the lower trunk usually have little or no flare on one side of the tree at the ground line. Most girdling roots occur in the top six to eight inches of the soil

and can be discovered by removing the soil gently from around the base of the tree.

Treatment for scorch problems can be reduced by regular watering during prolonged dry periods and by replacing competing grass or other vegetation around the base of the tree with an organic mulch. If a girdling root causes scorch, careful removal of the root will sometimes reduce the problem.

Winter Injury — With symptoms that look like scorch on evergreens, winter injury causes a yellowing and browning of the tips of needles. Winter injury differs from scorch in that it usually appears during late winter, and the browning is usually greater on the side of the tree facing the wind or a source of radiated heat, such as a south or west-facing brick wall or street. In many cases the uniform browning or reddening of the foliage does not become apparent until early spring. Winter injury is common on arborvitae, spruce, yew and juniper.

The cause may result from dry conditions that occur during the winter months. Evergreens that enter the winter stressed by drought are especially susceptible. The injury occurs most often when frozen soil prevents the uptake of water by the roots needed to offset the moisture lost from needles because of dry winter winds.

Treatment – Winter injury can be reduced by watering regularly during prolonged dry periods in mid-summer through fall, by mulching, and by

protecting susceptible trees and shrubs from prevailing winter winds.

Winter desiccation is another common type of winter injury that occurs when the amount of water lost by a plant exceeds the amount picked up by the roots. Warm, sunny days increase the amount of water loss. If the soil is frozen or is low in moisture due to a previous drought, roots are unable to pick up enough water to meet the demand of the plant. Needles, twigs or in the case of turf grass, the crown of the plant, dries out and dies. Evergreen needles may hold their green color until warmer temperatures arrive in spring thus delaying the browning symptoms. Often the pattern of damage is directional, on one side of the tree more than the other. Wind accompanying dry periods can accelerate water loss from the plant and result in damage that is more extensive on the side of the tree facing the prevailing wind, or more damage to the area of a lawn that is most exposed to the prevailing winds. Other common terms for this type of injury are winter burn, winter drying or winter scorch.

The key to preventing winter desiccation is to maintain adequate soil moisture now and into the winter. One of the best ways to accomplish this is by mulching a 3-6 foot diameter area around the base of trees and shrubs with an organic material like coarse wood chips. Trees also should be kept adequately watered during dry periods in summer and fall. A tree that has

suffered from drought conditions at any time during the year will not be able to withstand dry winter conditions as well as a tree that has consistently received adequate moisture. Many people put their water hoses away for the winter, but periodic watering during the fall and winter at times when the ground is not frozen can be very beneficial. Trees and shrubs benefit from slow, deep watering with a hose that has been left to trickle for an hour or so.

Flooding

Symptoms of flooding or a highly saturated soil can cause yellowing of foliage and uniform thinning and dieback of a tree's crown. This is a common problem in landscapes with automatic sprinklers and heavy soils and in areas where large amounts of runoff water pass through. Concolor fir is very susceptible to flooding injury.

Flooding occurs during periods of heavy rains or in landscapes with heavy irrigation whenever the pore spaces between soil particles become filled with water. As these spaces fill with water, gas exchange between the soil and air is reduced. Roots require oxygen from the soil to survive, and when the oxygen is not available, roots die. As roots die they are no longer able to absorb the water and nutrients the rest of the tree needs.

Treatment – Improve the drainage around the tree if it is in an area where runoff water pools. If sprinkler irrigation is used regularly, be sure the

soil is allowed to drain well between watering.

Temperature Stresses

Freeze Injury — Symptoms of cold weather injury in broadleaf trees can be recognized in the spring by reduced leaf area in the tree crown, branch tip dieback, clumped leaf growth at branch angles inside the crown, or death of the main stem with new sprouts growing from the base of the tree. In evergreens, symptoms are the loss of terminal buds, drooping of branch shoots, lack of any new growth, or new growth originating from the middle of the branch shoot instead of the end.

This may be caused by very cold, sub-zero temperatures that can kill dormant or inactive living trees. This occurs most commonly in fruit and nut trees such as black walnut, pecan and hickory. Some trees that initiate growth early in the spring are sometimes fooled by unusually warm late winter temperatures, and after they begin to become active, the new growth (buds, leaves, branch shoots) that had broken dormancy are killed as normal winter temperatures return. These trees also are highly susceptible to late spring frosts. Freeze injury is especially common in species and varieties of trees that originate from southern sources.

Treatment is more preventative since most cold weather damage cannot be prevented except by the planting of species adapted to the area.

Sunscald — The principal symptom of sunscald is a long, vertical dead area on the south or southwest side of young, thin-bark trees. Maple, honeylocust, linden, Bradford pear, eastern white pine, all fruit trees and other trees with thin, smooth bark are most susceptible. The dead area is often somewhat reddish and sunken in appearance and may have rough edges if the dead bark has begun to dry and crack.

This may be caused during daytime hours in winter when the bark on the south or southwest side of a tree can be warmed to above freezing by the sun, even though the air temperature may be below freezing. When the sun sets or moves behind clouds, the bark temperature drops below freezing and the area of warmed, active tissue is frozen and often killed. When this occurs, a long, narrow dead area (canker) is formed. Trees are more susceptible to sunscald if their roots have recently been severely injured, such as during transplanting. The localized dead area that forms on the trunk often provides a site for disease infection and insect attack during the next growing season.

Treatment — Care should be taken to minimize root injuries during transplanting. Large roots that have been cleanly cut during transplanting contribute less to sunscald than do roots that have been crushed. The trunks of recently transplanted susceptible trees could be wrapped with a commercial tree wrap through the first winter.

Stresses from Soil and Root Problems

Decline — Symptoms of decline include trees with sparse foliage that often drops early, very slow growth, and death of some of the outer branches. This condition usually gets gradually worse over a three to ten year period.

Decline in tree health is often caused by an injured or poorly developed root system that is not able to absorb moisture and nutrients at the rate needed to meet the growth requirements of the tree. Because of the inadequate root system, the tree slowly dries out or starves to death. An injured or reduced root system can be caused by improper planting techniques, girdling roots, drought, compacted soil, soil removal and poor quality soil fill.

Treatment includes proper planting methods and regular maintenance. Mulching with wood chips or other organic material can prevent or reduce many soil and root-related problems.

Iron Chlorosis — Trees with iron chlorosis have leaves that are partly or completely yellow. The network of veins in the leaves is the last to turn yellow, so they often appear darker green against a light green or yellow background. As the condition worsens, leaves become smaller, fewer, and may have many dark brown spots or dark brown edges. In severe cases some branches fail to leaf out, although they may remain alive for several years. Ultimately the tree may die. This

condition is most common in pin oak and silver maple but can occur in many other tree and shrub species.

The cause for this is that throughout much of Nebraska the pH of the soil exceeds 7.0, and so is fairly alkaline. At these high pH levels iron, an essential tree nutrient, is tied up by the soil and is unavailable to trees. Lack of iron in the tree results in partial or complete yellowing of the leaves (chlorosis). In severe cases, browning and shedding of leaves, branch dieback, and tree death can occur.

Treatment for iron deficiency problems can be corrected with soil treatments, foliar applications, or trunk injections. See NebGuide G1218, Iron Chlorosis of Trees and Shrubs, for more information.

Herbicide Injury

Symptoms of herbicide injury is evidenced by leaves that are curled or cupped, or have turned yellow or brown along the edges, depending on the kind of herbicide that caused the injury and the amount of exposure the trees received. When exposure is severe, whole branch shoots can droop, twist, become deformed, or die.

Cause for injury is due to herbicides that can drift through the air or the soil and injure trees some distance from where they were applied. Herbicide injury in trees most often is associated with the use of 2,4-D or dicamba (Banvel) for weed control. Herbicide exposure through the soil is longer lasting and usually more

damaging than exposure through the air. Although trees can be stunted or completely defoliated by herbicide drift, they usually survive. Repeated exposure to herbicides, however, can kill trees.

Some strong herbicides, such as soil sterilants used in alleyways, around utility equipment, or along sidewalks, can be absorbed by roots and easily can kill trees. Trees that die within a short period of time that may or may not show distorted foliage may have come in contact with a soil sterilant.

Treatment is education based. Understand the possible adverse effects on trees of any herbicide you use. Avoid applying herbicides on windy days, and avoid using herbicides that volatilize or move through the soil easily. Tree roots can extend out from the trunk a distance equal to several times the height of the tree. Some strong herbicides, such as prometon (Pramitol), can be picked up by trees quite some distance away from where they are applied, and even small quantities can cause tree injury or death. Avoid using strong herbicides in areas that have valuable trees. Even if a tree is not close by, a tree's roots may be exposed.

Insects

Some insects can cause injury and damage to trees and shrubs. By defoliating trees or sucking their sap, insects can retard plant growth. By boring into the trunk and branches, they interfere with sap flow and weaken the tree structure. Insects may

also carry some plant diseases. In many cases, however, the insect problem is secondary to problems brought on by a stress disorder or pathogen.

It is important to remember that most insects are beneficial rather than destructive. They help with pollination or act as predators of more harmful species. Therefore, killing all insects without regard to their kind and function can actually be detrimental to tree health.

Insects may be divided into three categories according to their method of feeding: chewing, sucking, and boring. Insects from each group have characteristic patterns of damage that will help you determine the culprit and the proper treatment. Always consult a tree care expert if you have any doubt about the nature of the insect problem or the proper treatment.

Chewing insects eat plant tissue such as leaves, flowers, buds, and twigs. Indications of damage by these insects are often seen by uneven or broken margins on the leaves, skeletonization of the leaves, and leaf mining. Chewing insects can be beetle adults or larvae, moth larvae (caterpillars), and many other groups of insects. The damage they cause (leaf notching, leaf mining, leaf skeletonizing, etc.) will help in identifying the pest insect.

Sucking insects insert their beak (proboscis) into the tissues of leaves, twigs, branches, flowers, or fruit and then feed on the plants juices. Some examples of sucking insects are aphids, mealy bugs, thrips, and leafhoppers. Damage caused by these pests is often

indicated by discoloration, drooping, wilting, leaf spots (stippling), honeydew, or general lack of vigor in the affected plant.

Boring insects feed beneath the bark of a tree as larvae. Some borers kill twigs and leaders when adults feed, or, when eggs hatch into larvae that bore into the stem and develop into adults. Other borers, known as bark beetles, mate at or near the bark surface, and adults lay eggs in tunnels beneath the bark.

Insect Identification

The Nebraska Cooperative Extension Service offers the public a pest/plant identification service. Under this service, insects, weeds, plant diseases, and horticultural plants are identified and, if appropriate, methods for their prevention or control are recommended. Diagnoses of plant problems and control recommendations will be more precise if specimens are handled carefully.

If possible, take specimens to the local extension office. The extension agent can solve many pest problems. However, to confirm the identification and/or control recommendations, the extension staff may send the specimen to the Lincoln offices or to a specialist at the appropriate research and extension center. The extension staff will help package the sample properly, complete the specimen identification form and send the sample to the appropriate university laboratory.

One of the most critical, but often not supplied, aids in identifying pests is

written information. Always include the following information: name of collector, location (county or city), date collected, and where it was obtained (field, turf, garden, home, building, etc.). When possible, provide information such as previous cropping history, irrigation procedures and frequency, seed stock source, type and extent of injury, names and varieties of plants damaged, location of adjacent structures, and the use of pesticides or other agricultural chemicals. Any other information related to the problem should also be included.

Photographs (slides or prints) are also a good source of additional information. If possible, take them from several angles. Photographs can show trends, patterns, general appearances and the location of the plant or affected area. They are particularly helpful in diagnosing turf grass problems. Free-hand sketches of landscape plantings showing relationships to sidewalks, drains and the home and property lines may also be helpful.

For complete information, see the table on Chemical Control of Common Forest and Shade Tree Pests in Appendix C. Please keep in mind that chemical control recommendations may change. Please check with your local experts for up to date information.

Weeds

Weed control may be the most important post-planting maintenance activity that you can perform to ensure

the success of your new tree-planting project. Controlling volunteer woody vegetation, annual and perennial grasses, and broadleaf weeds may be necessary throughout the life of your plantation. However, it will be most important during the first three to five years after the seedlings are planted. Eliminating competing woody vegetation, annual and perennial grasses and broadleaf weeds can greatly improve the survival and growth of your seedlings. These elements will compete with your tree seedlings for soil moisture, nutrients, sunlight and space. Weeds also provide cover for rodents that can damage young trees.

There are several methods that can be used to control weed species within and between the tree planting rows. These include mechanical cultivation (hoeing, rototilling, etc.), mowing or shredding, mulching (straw, wood chips or other organic mulches), and chemical control (pre- and post-emergence herbicides). If herbicides are used, their selection will depend on site conditions, tree species in your plantation and the weeds to be controlled. Soil texture, soil pH and precipitation should also be taken into consideration.

Noxious Weeds

The State of Nebraska has had a noxious weed law for many years. This law has undergone numerous revisions with the most recent having been made by the 1989 Nebraska Legislature.

Noxious weeds compete with pasture and crops, reducing yields substantially. Some noxious weeds are directly poisonous or injurious to man, livestock, and wildlife. The losses resulting from noxious weed infestations can be staggering, costing residents millions of dollars due to lost production. This not only directly affects the landowner, but also erodes the tax base for all residents of the state. The business of noxious weed control is everyone's concern, and their control is to everyone's benefit. The support of all individuals within the state is needed and vital for the control of noxious weeds within Nebraska.

The Director of Agriculture determines which plants are to be deemed as "noxious" and the control measures to be used in preventing their spread. In Nebraska, the following weeds have been designated as noxious:

- Canada thistle (*Cirsium arvense* (L.) Scop.)
- Leafy spurge (*Euphorbia esula* L.)
- Musk thistle (*Carduus nutans* L.)
- Plumeless thistle (*Carduus acanthoides* L.)
- Spotted and diffuse knapweeds (*Centaurea maculosa* Lam. and *C. diffusa* Lam.)
- Purple loosestrife (*Lythrum salicaria* L. and *L. virgatum* - including any cultivars and hybrids)

Other Wounding Agents

Trees often are wounded by careless use of yard equipment like

mowers, weed whips, and other trimming equipment. These injuries cut through important vascular tissue just inside the bark, which can lead to decay and ultimately death of the tree. A bed of natural mulch around the tree eliminates the need to trim or mow close to the tree's base. Extreme care should be taken when digging up or tilling the soil under a tree. Such digging will cut many large and small roots, especially if it occurs close to the trunk. Mechanical injuries usually occur on the trunk, branches or roots. Bark may be broken off, exposing the wood of the tree; or it may be dead but still attached.

Mechanical injuries are usually wounds in the cambium, bark, or roots of trees caused by physical contact with an object. These wounds expose healthy living tissue to infection by disease organisms or attack by insects. Man causes the majority of mechanical injuries. Careless use of lawn mowers and weed whips around the base of trees destroys inner bark and girdles the stem. This reduces the flow of nutrients and moisture in the tree and can lead to death through drying or starvation. Mechanical injuries also weaken trees and make trees more susceptible to secondary insect or disease attack.

Avoid hitting trees with lawn mowers, weed whips, or other damaging objects. Mulching around the base of a tree can prevent grass and other plants from growing in that area, and can help prevent mower and weed whip damage.

Trenching next to trees cuts major roots. Where possible, tunneling should be used to leave the upper 18 inches of soil undisturbed. When tree roots must be cut they should be cut cleanly. Ripping or tearing tree roots with a backhoe or other implement leaves large open wounds or may shatter roots, preventing the formation of new roots.

Changes in soil grade can seriously injure trees. About 90 percent of the tree's root system lies within the upper 18 inches of the soil. Covering tree roots with as little as 3 inches of soil can cause damage by suffocating roots. Filled areas should be properly tilled and graveled to allow for air movement and drainage

Animals can cause wounds, especially on smaller trees. Field mice (voles), rabbits, squirrels and deer commonly feed on the young bark of trees during the winter when food sources are scarce. Excluding the animals from the area around the tree can prevent animal damage. This can be done with a simple wire fence around the tree or yard. Discourage rodents by using a plastic tree guard around the trunk.

Injury Treatment

Cavities in trees require only minimal care. Clean out any loose wood or debris. Check the cavity for carpenter ants or termites. These insects should be controlled as necessary.

Do not fill the cavity, but rather allow it to remain open. Do not scrape

the inside of a cavity to remove dead wood. This may expose live tissue and re-wound the tree, allowing decay to spread.

Drainage tubes should *not* be used in trees. Drilling holes to drain water from interior cavities opens a path for new decay.

Wound treatment should be confined to removal of loose bark or wood. Leave the wound exposed so the tree may begin the natural process of callus formation and healing or sealing over. "Scribing" a wound in an elliptical shape once was recommended to help water and nutrients flow around the wounded area. This is no longer recommended since it only makes wounds larger and does not improve sap flow.

In recent years, much has been written about the advantages and disadvantages of using a wound dressing on large cuts. Traditionally, wound dressing or pruning paint is used only on cuts larger than an inch in diameter. However, scientists have found that wound dressings are strictly cosmetic and have little to do with preventing insect or disease damage to the wound area. Pruning paint may, in fact, slow down the healing process. In general, wound dressings are not recommended or necessary. Since wound dressings have been found to increase decay, wounds should be left exposed to the open air to seal naturally.

Injections and Implants

Some insects, diseases and nutrient deficiencies can be controlled through the use of chemical injections or implants. Injections and implants, however, require holes drilled into the trunk, and should be used only after all other available treatments have been considered.

Since injection holes are wounds, they should be made in accordance with manufacturers' recommendations to minimize the damage they cause. Injection holes should be kept as small and as shallow as possible; injection should not be repeated more than once every two or three years, except in severe cases.

Injection points should not be filled or treated with wound dressing after treatment.

Cabling and Bracing

Trees that have severe structural defects or that have suffered serious damage sometimes can be saved by cable and bracing techniques. In all cases a professional arborist who is familiar with this technique should do cable and bracing. Improper cabling or bracing can result in damage to the tree, and the creation of a living hazard.

Tree Removal

Determining whether or not a tree should be removed is a difficult decision for most homeowners. Major splits or cracks in the main trunk or in one or more major limbs may render

the tree unsafe and require removal. In some cases, cable and brace work may be a viable option. Cable and bracing should only be done by a qualified arborist. If done improperly, the tree will remain in an unsafe condition.

If more than 50% of the tree's living crown has been destroyed then removal may be recommended. Be aware, however that if the root system of the tree is intact, then the crown will re-grow. Think carefully about the function that your tree performs in the landscape. If this function (screening, shade, wind protection) is still being performed, then you may want to try to salvage the tree for a few more years while you plan for and begin replanting.

Although tree removal is a last resort, there are circumstances when it is necessary. An arborist can help decide whether or not a tree should be removed. Professionally trained arborists have the skills and equipment to remove trees safely and efficiently.

The necessity for pruning can be reduced or eliminated by selecting the proper plant for the location. Plants that might grow too large for the site, are not entirely hardy, or become unsightly.

Mulching

Mulch is an organic or inorganic material applied to the soil surface during the growing season or applied over the plant during the dormant season. An important characteristic of mulch is its ability to insulate a plant and its roots from the effects of

extreme temperature fluctuations.

Ideal mulches must allow water and air to enter and exit the soil. They should be attractive, odor-free and stay in place. Also, ideal mulches should not compact or become a fire hazard. Although no single mulch material will meet all these requirements, select one that best suits the needs of your site.

The following are benefits of mulching:

- Conserves soil moisture
- Moderates soil temperature by insulating the soil surface
- Reduces soil compaction caused by equipment and people
- Reduces soil erosion from wind or water
- Slowly increases soil fertility through decomposition (organic mulches only)
- Reduces incidence of disease by protecting above-ground plant parts from splashes that carry soil-borne inoculums
- Reduces fruit rot by eliminating contact between fruit and soil
- Reduces winter injury by minimizing temperature variation, reducing water loss in plants, and decreasing heaving of plant crowns and roots
- Aids weed control

Most gardeners use organic mulches. These are derived from plant material and imitate naturally occurring forest or prairie litter. Gardeners can develop their own organic mulches by recycling yard waste such as chopped or shredded leaves, branches, wood chips or grass

clippings or they can purchase mulches from garden centers.

An important value of organic mulches is that they continuously add organic matter to the soil surface. Earthworms and other organisms will incorporate this material into the upper soil area. When the planting bed is renovated, the gardener can work this organic mulch into the soil deeply enough to actually incorporate it into the root zone.

With fine organic mulches, such as compost or shredded leaves, maintain a 3-inch layer. For coarse materials, like wood chips, maintain a 4-inch layer. Remember a 4-inch layer will compact to 3 inches (Figure 1). Mulches decompose in time; their rate of decomposition depends on particle size and composition. Plan to add more mulch occasionally, but don't exceed the recommended thickness.

Do not use reflective mulches, such as white rock, close to a building. The reflected heat warms the building in summer, increasing the cost of air conditioning and also causing winter injury to plants from unseasonable rapid warming. Be cautious about using wood mulch near the foundation area of a home. This provides an environment attractive to termites from which the pest can gain access to the home. Use a crushed, non-white rock border to keep wood two feet away from the home.

Remember: mulch like a bagel, not like a volcano! [See Figure 1, Page 28]

Pruning

Pruning can perhaps be one of the most important tree maintenance practices. Over the years, the way in which we, as foresters, have approached pruning has changed dramatically. Today pruning is a science that, if not done properly, can be very damaging to a tree.

Pruning is the removal or reduction of certain plant parts that are not required, that are no longer effective, or that are of no use to the plant. It is done to supply additional energy for the development of flowers, fruits, and limbs that remain on the plant. Pruning, which has several definitions, essentially involves removing plant parts to improve the health, landscape effect, or value of the plant. Once the objectives are determined and a few basic principles understood, pruning primarily is a matter of common sense.

Here are some tips that may be of help to you before you take the saw to the tree. First, large tree pruning can be very dangerous work. Even the most highly skilled arborists have been seriously injured or even killed while pruning a large tree. This is especially true if climbing is involved. It is best to leave major large tree pruning to professional arborists. When selecting an arborist give strong consideration to whether or not the arborist is certified by a professional organization. Certification is a good indication of knowledge and commitment to the profession.

Since the early days of utility pruning much progress has been made to change the way trees are trimmed so that there is a minimal affect on tree health. Today, a more tree-friendly system is used called “directional pruning”. It may also be referred to as “natural pruning”. The Nebraska Forest Service supports this kind of pruning and also provides one-day workshops to help train utility line clearance workers in its use. Utility companies or municipalities may contact the NFS and ask for this training. It will require a full day to do the training properly. The NFS encourages the attendees to use “directional pruning” as a part of their regular practice. There is a small fee for the training.

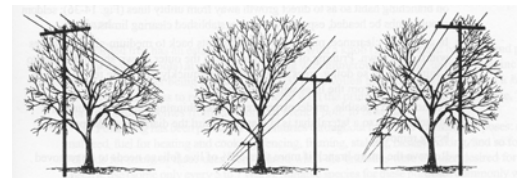
Through years of careful testing and research, international standards committees have approved more beneficial methods of pruning trees. These directional pruning techniques actually encourage vigorous growth away from power lines, cause less trauma, subject the tree to fewer problems with disease and structural difficulty, and typically reduce the number of times the tree must be pruned.

Rather than just lopping off the majority of tree limbs at some arbitrary distance from the power line, a directional pruning expert will look for as few as necessary branches that once removed will produce the vast majority of clearance needed for the power line. These cuts are made where branches meet other branches or stem from the

trunk. The key is to make cuts so that the tree will be encouraged to grow vigorously—but away from the power line.

In general, each individual branch removal involves three cuts. For example, to cut a branch extending outward and slightly upward from the trunk, the specialist will make a partial cut several inches away from the trunk on the underside of the branch. The next partial cut, just outside the first, is made from above. This allows the branch to drop to the ground while protecting the trunk from splits and tears. A very important third cut removes the stub at a point just outside the bark collar, where the limb extends from the trunk. This method promotes wound repair and better protects the tree from disease and decay. Similar cuts may be made on small branches by snipping just beyond lateral branches or buds.

Below are several styles of directional pruning used today:



[Figure 1: Side, Under, and V Pruning]

Side Pruning

Sometimes called L pruning, side pruning is necessary when a large tree is growing close to one side of the power line. As few limbs as possible are cut on the side of the tree interfering with the power line (Figure 1).

Under Pruning

Sometimes it's possible to simply remove only some side branches, near the power lines, leaving some branches above the lines (Figure 1). This practice is most commonly used with lower voltage service conductors.

V Pruning

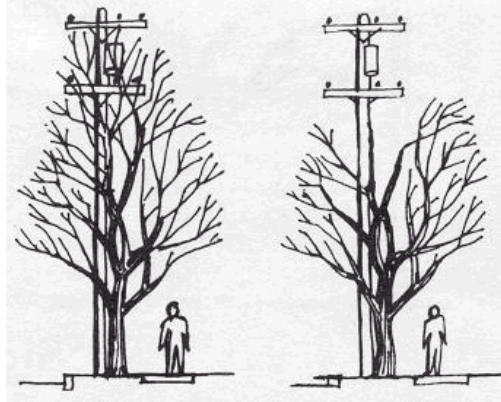
This method of pruning is often used when a tree is directly beneath a power line and is growing up on both sides of the line. In order to avoid the lines, a V-shaped gap must be cut in such a way that it encourages the tree to grow to the side (Figure 1).

Crown Reduction

This is an updated version of the old topping method. Through judicious cut selection, the height of the tree can be reduced using directional pruning methods (Figure 2). When this is not possible or practical, tree removal may be necessary.

What to Prune

Most pruning should be confined to removal of broken, rubbing, damaged or dead branches. Sometimes pruning is necessary to elevate tree branches over a sidewalk, street, roof, or other structure. It is generally not necessary to "thin" a tree out so that



[Figure 2: Crown Reduction]

more air passes through the crown. This practice is sometimes known as "lion tailing" and can leave the tree open to stress during the hot months of summer.

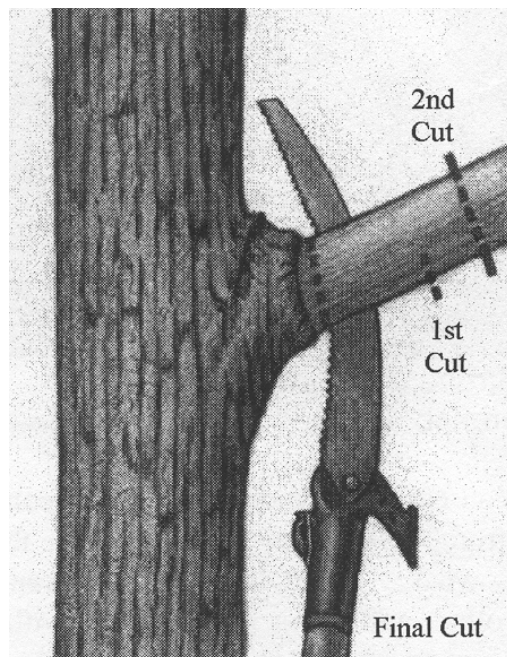
If you are cutting live branches, never remove more than about 25% of the total leaf area of the crown. If trees need to be elevated (removal of lower branches), the process can be done in stages over several years if a large amount of work needs to be done.

Making Pruning Cuts

Pruning cuts should be made so that only branch wood is removed and the trunk or supporting stem is not injured. If only branch wood is removed, the wound is smaller, the tree will be able to seal the wound more effectively, and the chance of problems with wood decay will be greatly reduced.

To locate the proper place to make a pruning cut, look for the "branch bark ridge" on the upper surface of the union of the branch with the supporting stem. This is a line of bark that has been pushed up as the branch

and supporting stem have grown. Some branch unions will not have this if they did not form properly. Instead they will have the branch simply pressing into the supporting stem, forming a sharp V-shaped union. At the base of the branch, and mostly on the underneath side, look also for the "branch collar," which is a slightly swollen area of stem tissue that wraps around the base of the branch. A proper pruning cut begins just outside the branch bark ridge and angles down and slightly away from the stem, avoiding injury to the branch collar. Do not make flush cuts that remove the branch collar. Wounds created by flush cuts cause substantially more injury to the tree than wounds left by proper pruning. Branches should be pruned using a series of three cuts as shown in Figure 3.



[Figure 3: Pruning Cut]

When to Prune

It has often been said that pruning can be done when the saw is sharp. This is not too far from the truth.

Winter pruning will provide an entire growing season after the cut for the tree to begin the sealing process. There are two times of the year when pruning should be curtailed. The first is during the active spring growing flush, usually April and May. During this period the bark is very tender and can be torn easily. This may result in a much larger wound for the tree to seal over. The second time is during the fall coloration period. It is at this time that the most virulent decay organisms are active. The chances of serious decay are increased during this period.

Pruning Evergreens

With few exceptions, evergreens (conifers) require little pruning. Different types of evergreens should be pruned according to their varied growth habits.

Spruces, firs and Douglas-firs don't grow continuously, but can be pruned any time because they have lateral (side) buds that will sprout if the terminal (tip) buds are removed. It's probably best to prune them in late winter, before growth begins. Some spring pruning, however, is not harmful.

Pines only put on a single flush of tip growth each spring and then stop growing. Prune before these "candles" of new needles become mature. Pines do not have lateral buds, so removing terminal buds will take away new

growing points for that branch. Eventually, this will leave dead stubs.

Pines seldom need pruning, but if you want to promote more dense growth, remove up to two-thirds of the length of newly expanded candles. Don't prune further back than the current year's growth.

Arborvitae, junipers, yews, and hemlocks grow continuously throughout the growing season. They can be pruned any time through the middle of summer. Even though these plants will tolerate heavy shearing, their natural form is usually most desirable, so prune only to correct growth defects.

Pruning "Don'ts"

- Never top trees. Topping creates serious hazards and dramatically shortens the life of a tree.
- All too often trees are topped ("dehorned") to reduce size or to rejuvenate growth. In either case topping is not a recommended practice. Topping is the process whereby a tree is cut back to a few large branches. After 2 to 3 months, regrowth on a topped tree is vigorous, bushy and upright. Topping seriously affects the tree's structure and appearance. The weakly attached regrowth can break off during severe wind or rainstorms. Topping may also shorten the life of a tree by making it susceptible to attack by insect and disease.
- Thinning is a better means of reducing the size of a tree or rejuvenating growth. In contrast to

topping, thinning removes unwanted branches by cutting them back to their point of origin. Thinning conforms to the tree's natural branching habit and results in a more open tree, emphasizing the branches' internal structure. Thinning also strengthens the tree by forcing diameter growth of the remaining branches.

Fertilizing

Fertilize trees only when necessary. If growth is adequate and steady, foliage appears healthy, and there has been no major disturbance around the tree, no fertilization is needed. When fertilizing is necessary, slow release, balanced, granular fertilizer or soil-applied liquids should be distributed over the tree's entire root zone. Applying fertilizer through holes augured into the soil or with fertilizer spikes is not recommended. Routine trunk injections of fertilizers into healthy trees are not recommended.

Soil and Foliar Analysis

The most precise method in determining a tree's nutrient requirements is to get a laboratory examination of the soil and leaves. A soil sample provides information about the accessibility of necessary nutrients and soil pH. The soil pH and salt content are significant for advocating tree care. Small cores should be taken from representative places of the full area being tested. The cores collected should then be mixed together and

desiccated. This will yield average results for the entire location. A soil analysis is more effective when done at the same time as a foliar analysis. Because the tree roots expand over a large area and at a range of depths, the soil analysis alone may not generate exact results for particular soil nutrients. Foliage samples from several areas of the tree, dried and evaluated, may help detect specific deficiencies or toxicities. A soil sample or foliar analysis alone can be deceptive. It is feasible for some minerals to be scarce in the foliage. They may be abundant in the soil but inaccessible due to the soil pH.

When to Fertilize

Occasionally, additional fertilizer is needed in areas where a tree's root growth is restricted by streets, curbs, or other structural features.

Plant signs indicating the need for fertilization include lack of terminal growth, pale green or yellow leaves, mottled leaves, dead branches, stunted leaves and early loss of leaves.

Fertilizer recommendations should be based on a soil and/or foliar analysis. Such analyses allow the application of fertilizers in amounts and ratios that minimize nutrient waste and the threat of pollution. In general, the best time to apply fertilizer is in the spring before growth begins.

Soil type also affects the timing of fertilizer applications. For sandy or loam soils, apply fertilizer as soil temperatures begin to rise and before growth occurs. For heavy clay soils

apply the fertilizer in late fall after leaves have fallen or the plant is completely dormant. The maximum growth response to the fertilizer is obtained if the fertilizer is available in the root zone at or slightly before the start of spring growth. In sandy soils fertilizer moves more rapidly into the root zone, whereas in heavy soils, it takes much longer for the fertilizer to penetrate.

Do not apply fertilizers from August 1 until late fall (about the time of the average date of the first killing frost). Late summer fertilizing can stimulate an excessive amount of new growth, making plants more susceptible to winter injury.

Most fertilizers are purchased according to their analysis, which is the percentage of the three major plant nutrients - nitrogen, phosphorus and potassium. The analysis is shown on the bag or container and consists of three numbers (i.e., 12-4-8). The first number indicates the percentage of nitrogen (N), the second gives the percentage of phosphorus as phosphoric acid (P_2O_5); and the third is the percentage of potassium as potash (K_2O). A 50-pound bag of a 12-4-8 fertilizer contains 6 pounds of N, 2 pounds of P_2O_5 and 4 pounds of K_2O .

Tree growth is limited by nitrogen deficiency more often than by lack of phosphorus or potassium.

For this reason, it is recommended that a fertilizer with a 2-1-1 or 3-1-1 ratio be used for trees. If soil or foliar analyses indicate a need for either phosphorus or potassium, place

fertilizer in holes rather than on the surface because these materials penetrate too slowly to reach tree roots in adequate amounts when surface applications are made.

Fertilizer applied in excess of plant needs or with improper timing often goes to waste. In the case of nitrogen, the excess material may quickly leach into the subsoil and result in pollution of underground water supplies. To reduce pollution of surface water supplies (i.e., rivers and lakes), minimize the amount of fertilizer that ends up in the storm sewer by keeping fertilizer off the pavement and

driveways. A small amount of runoff from each yard can add up to a major pollution problem for a city.

Additional Information

You can get more information about community forestry and tree care by visiting the Nebraska Forest Service web site at www.nfs.unl.edu. Your local University of Nebraska County Extension Office is another helpful resource. You may also visit the International Society of Arboriculture site (www.isa-arbor.com) following the link to Tree Care Consumer Guides.

Section VII - Special Considerations: Windbreaks, Buffers and Wildlife

Windbreaks

In many parts of the United States, the constant force of the wind exaggerates daily weather conditions and can make living in these areas seem unbearable. A well-designed windbreak around the home, ranch, or farmstead, and even a community, slows the wind and improves the overall environment. Farm and ranch windbreaks conserve energy, provide snow control, improve working and recreational environments, enhance wildlife populations, provide visual screening and dust control, and increase the production of various wood and food products. Ranch and farmstead windbreaks provide the greatest benefits in areas with high winds, large amounts of snow, extreme temperature fluctuations, or minimal natural forest cover. Windbreaks have also been used to temper the winds for rural community.

Traditionally, the most extensive use of ranch and farmstead windbreaks in the United States is in the Western, North Central, and Great Plains regions. However, windbreak use for privacy screens, dust control and noise reduction, as well as, wind protection is important throughout the country.

Designing Your Windbreak

Understanding windbreak benefits and how they are derived can help you

in designing one to meet your particular needs. The primary effect of a windbreak is the reduction in wind speed in adjacent areas. Within these areas the reduction in wind speed creates zones of protection where the microclimate is improved. For multiple-row, farmstead windbreaks the zone of maximum protection lies approximately 2 to 7H to the leeward side of the windbreak (H equals the mature height of the windbreak). Additional protection is found from 1 to 3H to the windward side. The goal in designing windbreaks is to take advantage of these zones of protection to achieve your objectives.

A ranch or farmstead windbreak needs to provide maximum protection to the major buildings and the living and working areas of your farm or ranch. Ideally, the windbreak row with the tallest tree species should be approximately 2-5H from all primary objects or areas needing wind protection. In regions needing both wind and snow protection, the most windward row needs to be 100 to 200 feet from the areas needing protection in order to provide room for snow drifts. Areas and objects more than 10H from the windbreak will receive little protection from the wind.

Include a variety of species and at least one or two tall tree species to provide maximum wind protection for

the site. By using a mixture of deciduous trees, conifers, and shrubs, the windbreak will provide better protection all year and will lessen the chance of insects or diseases damaging the entire windbreak.

A basic farmstead windbreak consists of three to eight rows of both conifers and deciduous trees. Conifers or shrubs should be located on the windward side with the tall deciduous species in the center. A row of shrubs on the interior or leeward side completes the design. Spacing between the rows is typically 12 to 16 feet but can be increased to accommodate larger tillage equipment. Spacing within the rows is typically 3 to 6 feet for shrubs, 6 to 15 feet for deciduous trees, and 6 to 20 feet for conifers. In areas with frequent heavy snows consider adding a row or two of shrubs 50 feet to the windward side to trip snow before it reaches the main windbreak. Using curved rows or adding clumps of trees or shrubs to the planting can achieve enhanced aesthetic quality and a more natural look.

Windbreak Components

The typical windbreak has several components: (1) dense conifer trees to reduce wind velocity; (2) tall broadleaf or conifer trees to extend the area of protection; (3) low shrubs to trip snow, provide wildlife habitat and/or provide aesthetic value.

Effectiveness of a windbreak is often expressed in terms of density of the windbreak. Density is defined as

the ratio of the solid area of the trees to the total area of the windbreak.

If the objective is protection from snow (e.g., a living snow fence), the windbreak should have a density of 70 - 80 percent. This can be achieved with multiple rows of dense conifer trees.

If the objective is to spread snow across cropland (e.g., field windbreak), the windbreak should have a density of 25 - 35 percent. One or two rows of mixed broadleaf or pine trees can provide this density. Most farmstead or livestock windbreaks should be designed with a density of 40 - 60 percent that can be achieved by planting multiple rows of conifer and broadleaf trees.

Windbreak Location

The most effective protection is obtained by orienting windbreaks perpendicular to the prevailing wind. Windbreaks designed for winter protection are generally located north and west of farmsteads, livestock concentration areas, working facilities or other areas to be protected. Although often overlooked, protection from northeast storms should be considered when designing a windbreak.

A windbreak with two legs protects a greater area than a single leg windbreak. A common design error is not extending the windbreak beyond the area to be protected. This creates a problem of winds circling the end of the windbreak and increasing the wind-chill or snow deposition in the

area being protected.

Field windbreaks designed to reduce soil erosion are generally single row windbreaks planted parallel to cropping patterns (north/south or east/west orientation).

The area protected by a windbreak is a function of the average height of the windbreak. Generally, a windbreak protects an area 10 - 15 times the average height of the trees. In order to allow for snow deposition the windward tree rows should be located approximately 150 - 250 feet upwind of the area or facilities to be protected. This will allow adequate area for snow deposition.

Windbreak Composition

The number of rows of trees in a windbreak depends on the objectives and available space. The following are guidelines for the number of tree rows for different types of windbreaks.

Type	# Rows	# Rows of Dense Conifer
Farmstead	4 - 10	2 - 4
Livestock	4 - 10	3 - 6
Field windbreak	1 - 2	1
Living snow fence	2 - 4	2 - 4

A general rule is the wider the initial tree spacing, the longer the effective life of the windbreak. Close spacing can be used to obtain windbreak benefits quickly, but thinning (individual or whole tree row removal) should be planned to extend the effective life of the windbreak.

Time spent in site preparation, weed control, and replanting is repaid

many times during the lifetime of the windbreak.

Each windbreak system is unique and your windbreak should be designed for your site and objectives. Your local conservation office can provide help in designing and installing your windbreak. These organizations can also help with recommendations on where to buy planting stock and how to treat your windbreak as investment.

Layout

Before planting, it is best to layout each row of the windbreak on the actual site. This will allow the design to be customized for the positions of buildings, roads or driveways, feedlots, field boundaries, utility lines, drainage ditches, and other features at your site. Lay out the dimensions of the windbreak, including the spacing within and between tree rows. This process will help assure that your design will provide the protection needed and will fit within the desired area.

Conifers should be at least 8 to 12 inches tall, with a good, healthy root system. Trees may be either container-grown or bare-root. Container-grown plants are usually larger and cost more, but may be worth the extra cost in areas where establishment is difficult. Usually, quality bare-root stock is satisfactory.

Most nurseries sell hardwoods and shrubs as bare-root seedlings. They should be 12 to 24 inches tall, with full, healthy root systems, and at least a one-quarter inch diameter just above

the root collar (the point where the roots meet the stem).

The best time to plant tree seedlings is in the spring, before the buds begin to swell. Fall planting is usually not very successful. To minimize stress on the seedlings during planting, try to plant on a calm or cloudy day, and keep the trees moist. It is extremely important to avoid the exposure of seedlings, especially bare-root conifers, to air any longer than absolutely necessary. Keep seedlings in the original, moist packing material, or covered with wet burlap. If practical, placing the roots in a bucket containing a slurry of soil and water will provide a coating for the roots and keep them from drying out. Commercially prepared slurries are also available. Although dryness damages the roots, they do need some oxygen; therefore, DO NOT store the seedlings with their roots in water or in the slurry for more than several hours.

Windbreak Design Problems

A poorly designed windbreak may cause more problems than it solves. One of the most common design problems is locating the windbreak too close to the area to be protected. This results in snow deposition where it is not wanted. For example, improperly located living snow fences may create hazards such as reduced visibility, snow drifting on roads and shading which prevents melting of ice on the roadway surface.

Another problem is gaps or holes in the windbreak for access. Gaps may

actually concentrate and accelerate wind flows through the windbreak. For maximum efficiency, the uninterrupted length of a windbreak should exceed the height of the windbreak by a ratio of at least 10:1. This ratio reduces the effect of end turbulence on the total protected area.

Riparian Buffers

The word *riparian* refers to anything connected with or immediately adjacent to the banks of a stream or other body of water. The ability of these areas to function naturally is crucial to the protection of the water resources of the United States. A *riparian forest buffer*, therefore, encompasses the area from the stream bank in the floodplain to, and including, an area of trees, shrubs, and herbaceous vegetation located upslope from the body of water.

The design of a buffer serves several important functions: it preserves the stream's natural characteristics, protects water quality, and improves habitat for plants and animals on land and in the water.

The riparian buffer traps and filters sediments, nutrients, and chemicals from surface runoff and shallow groundwater. A framework of tree roots stabilizes the stream bank.

Plant stems slow water velocity and root systems keep the soil porous, so excess water is absorbed into the ground and flooding potential is reduced. A riparian forest buffer improves the biological diversity of

surrounding areas. Birds, mammals, and other animals find the food, cover, water, and nesting sites they need as well as corridors and pathways for movement between areas.

Benefits for Aquatic Resources

Stabilize eroding banks: Plant stems absorb the erosive force of flowing water and wave action, while roots hold soil in place.

Filter sediment from agricultural land runoff: Plant stems slow and disperse flow of surface runoff, and promote settling of sediment. Roots stabilize the trapped sediment and hold riparian soil in place.

Filter nutrients, pesticides and animal waste from agricultural land runoff: Particulate wastes and sediment-attached contaminants are filtered along with the sediment. Uptake and transformation of soluble contaminants by plants and soil microbes is promoted by improved infiltration of surface runoff and vigorous growth of vegetation. Soluble contaminants may be similarly removed from shallow groundwater. No fertilizers, pesticides or animal wastes are applied to the buffer zone that could be picked up by runoff. Contaminant-rich runoff from adjacent agricultural land is diluted by rainfall within the buffer zone.

Provide shade, shelter and food for fish and other aquatic organisms: Shade reduces light intensity and water temperature. Plant litter as well as insects and other invertebrates on

plants are food for fish. Larger plant debris and roots can form stable shelter for aquatic organisms.

Benefits for Terrestrial Resources

Wildlife habitat: Perennial vegetation supplies diversity of cover and food for wildlife.

Economic products: Buffers may produce perennial crops, such as lumber and veneer, fiber, hay, nuts, fruit, and berries.

Visually diversify a cropland landscape: Strips of trees, shrubs, and perennial grasses add visual diversity to a cultivated cropland landscape. Evergreens and deciduous trees and shrubs may provide color diversity at certain times of the year.

Protect cropland from flood damage: Plant stems reduce floodwater velocity and erosive power, and block stream debris from entering cropland and pastures. Roots hold stream banks and buffer soil in place. Extensive riparian buffers in a watershed may reduce peak flood level.

Buffer Design

Four basic steps to follow when designing a riparian buffer:

1. Determine what benefits are needed.

Determine what problems are present at the site that a buffer can help solve. If you are assisting a landowner, use this information to help the landowner become aware of

all the possible benefits a buffer can provide. For example, you might see:

- unacceptable bank erosion
- cultivated crops, livestock enclosures or grazing along a waterway
- algae blooms or excessively turbid water
- lack of shade and larger debris for fish habitat
- sparse wildlife habitat
- low diversity of vegetation in the surrounding landscape
- cultivated cropland on a low floodplain

Next, determine what the landowner wants to achieve with the site. This information may be in the form of problems the landowner wants solved (e.g., "I want that bank erosion stopped") or conditions the landowner wants to see (e.g., "I want more wildlife").

Then, prioritize the landowner's needs. For example, a high priority - "I must stop bank erosion" - and a lower priority - "Getting wildlife would be nice, too." Be aware that there may be site problems a buffer can solve that the landowner has no interest in addressing. There may be other problems, such as severe stream bank erosion, that a buffer cannot solve.

2. Identify the best types of vegetation for providing the needed benefits.
3. There are three basic types of vegetation: grasses (including forbs), shrubs and trees. Each type can provide certain benefits better

than the others. Table 1 compares grass, shrubs and trees for the relative level of specific benefits they can provide in an agricultural riparian buffer.

4. Determine the minimum acceptable buffer width.

The minimum acceptable width is one that provides acceptable levels of all needed benefits at an acceptable cost. Minimum acceptable width is determined by the specific benefit needed that requires the greatest width.

5. Develop an installation and maintenance plan.

Once vegetation types and width are determined, an installation and maintenance plan is necessary to obtain successful buffer establishment and long-term benefits. A few general considerations are listed below.

Installation

- Use local knowledge to select the best plant species for each situation. Emphasize easily obtainable species yielding quick establishment and good growth on the site.
- Width may be varied to straighten tillage boundaries along meandering streams.
- Incorporate existing perennial vegetation into the buffer design, if possible, since some benefits, such as shade and bank stabilization from trees, are maximized only after

vegetation matures. Using existing vegetation also reduces installation costs and risk of total planting failure.

- The site may require tillage or herbicide application prior to planting.
- Bare soil in areas where trees and shrubs are to be planted may also need to be planted with less-competitive grasses and forbs to hold soil in place and discourage weeds until trees and shrubs become established.

Buffer Development – The Three-zone Concept

The most effective riparian buffers contain three different categories, or zones, of plantings as one moves away from the water's edge.

Zone 1 is an undisturbed forest area where logging is generally not recommended. Livestock should be excluded from this zone. Stream crossings, watering sites, and any stream bank stabilization work must be carefully planned to minimize negative impact on water quality.

Zone 2 allows the water to infiltrate or percolate into the soil so that waterborne nutrients/ pollutants are absorbed and cleansed through vegetation and other natural ecological systems. Zone 2 also provides long-term storage of nutrients in the woody biomass of trees and shrubs. Large trees dominate Zone 2, which has an understory of smaller trees and shrubs. This zone can tolerate some disturbance. Where site conditions

permit, commercially viable species can be planted for possible future logging. A wide range of forest management options can be used in Zone 2. Other nontraditional agricultural products can be grown in this area (for example, Christmas trees, nut crops, shade-loving wildflowers, and ginseng).

Select species adapted to the specific site and soil conditions. Look at adjoining areas for the types of native species that grow in that locale. Shade-tolerant shrub species such as winterberry, Virginia sweetspire, and arrowwood viburnum generally do well in this zone. Planting a variety of tree and shrub species increases diversity and improves wildlife habitat. Also, planting a mix of species prevents loss of all benefits if one species does not thrive or fails to grow completely. In areas with heavy deer browsing, spicebush and arrowwood viburnum are good choices.

Zone 3 is the transition zone between the forested areas in Zones 1 and 2 and adjacent land. When carefully designed, this zone filters sediments, increases water absorption capacity, converts nutrients into green biomass, takes in nutrients, and prevents erosion by spreading the concentrated surface water flow to a uniform sheet flow. Zone 3 also provides valuable food and cover for certain wildlife species. A dense, herbaceous cover with no trees or shrubs works best to slow and filter runoff.

Warm and/or cool season grasses are recommended in this zone.

Switchgrass is preferred because its dense, stiff stems remain upright throughout the seasons. This slows the overland flow of water, allowing the water to infiltrate the buffer, and also allows sediment carried by the water to be deposited in the buffer area. In addition, switchgrass produces an extensive and deep root system, much of which is replaced annually, providing large amounts of organic matter to the soil. Organic matter improves soil quality by increasing infiltration rates and microbial activity. Switchgrass takes approximately 3 years to become fully established.

Native forbs also may be part of the mix, especially if they are seeded in clumps with other native grasses. Cool season grasses, such as brome grass and fescue, are not appropriate for Zone 3 because they do not tend to remain upright under the flow of water and they provide limited value as wildlife habitat. They also produce up to eight times less root mass than native grasses and, therefore, do not improve soil quality as quickly or as much as the same planting of warm season grasses. However, in areas where soil erosion is a serious problem, cool season grasses are recommended to establish vegetation cover quickly. In some cases, cool and warm season grasses can be planted to provide wildlife habitat and also help prevent serious soil erosion problems.

Accelerate succession by over planting with seedlings of fast-growing, shade-intolerant species at a high enough density to provide canopy

closure relatively rapidly. Tulip poplar, box elder, and silver maple are among the fastest growing trees appropriate for the riparian zone. Seedlings of shade-tolerant canopy species, such as red oak, interplanted among these pioneer species can be selectively released after canopy closure to become the eventual dominants. That is, once the species intended to be the dominant trees are well established, the protective, fast-growing, shade-intolerant species are removed. Canopy over planting will also reduce deer browsing on the future dominant species. This strategy also provides more wildlife habitat and deadwood in the riparian zone. The decision to use this strategy is largely determined by the existing vegetation in the riparian zone.

Buffer Width

There is no ideal buffer width for all applications in all areas. Many factors including slope, soil type, adjacent land uses, floodplain, vegetation type, and watershed condition influence what can be planted. The function of the buffer, that is, the reason for installing a riparian buffer, should be the overriding criteria, with other factors (such as those listed above) influencing the final decision to a lesser degree.

The most commonly prescribed minimum buffer widths for use in water quality and habitat maintenance are approximately 35 to 100 feet. Buffers of less than 35 feet cannot sustain

long-term protection of aquatic resources.

Why Include Wildlife in Windbreaks?

Windbreaks can support wildlife: Windbreaks add beauty and pleasure to our lives. They also sustain birds that eat insect pests, improve hunting opportunities, and provide a focal point for family outdoor activities.

Insect-eaters: Many birds and predatory insects that live in windbreaks consume pest insects in the windbreak and in adjacent crop fields.

Windbreaks as an investment in recreation: Studies in the Great Plains show that hunting pheasants or quail is usually more successful in areas with woody windbreak plantings. Windbreaks also benefit other game animals including cottontails, mourning doves, squirrels and white-tailed deer.

Families and windbreaks: Windbreaks on a farm or acreage can become a focal point for outdoor family activities. They provide aesthetic beauty to enhance the home or farm; a quiet setting for walks, bird watching, or overnight camp-outs together; a route for hayrack rides with wildlife to be seen; and a place for hunting or wildlife educational activities.

How Windbreaks Benefit Wildlife

Shelterbelts provide a nesting habitat, as well as food and foraging sites for a wide variety of birds and

wildlife species. A variety of these species use windbreaks as shelter from predation and harsh weather conditions. The long, linear nature of windbreaks provides safe routes from one habitat to another.

What to Plant

For the best wildlife benefits, a shelterbelt should have a developed tree canopy, and an understory that includes shrubs and herbaceous plants that provide both food and cover. Grasses, especially sod-forming ones, compete with young trees and should be 3-4 feet away from them during the first five years after planting. However, during establishment, planting between rows, 3-4 feet from trees, a mixture of short- to mid-height bunch grasses, milo, or similar cover provides wildlife benefits and protection for soil and young trees.

Planting a variety of deciduous tree and shrub species will provide a habitat structure with a large selection of vertical and horizontal nesting and foraging sites.

Windbreaks are planted to protect farmsteads, livestock, roads or crops. The additional goal of providing wildlife benefits can be added without compromising the primary purpose. In developing a plan, select a design, plant materials and location that meet your specific windbreak needs but include factors that benefit wildlife. Overall guidelines are as follows:

- Choose trees and shrubs that have wildlife benefits, but that are

adapted to the local climate.

Generally, native species are the best bet because they are adapted and familiar to wildlife.

- Include a variety of trees and shrubs in the windbreak planting. This gives a more natural landscape appearance, improves wildlife values for more species, and reduces the chances of disease or insect pest problems.
- Where appropriate, select a site that connects to a larger habitat block such as a river corridor, woodlot, wetland, woody draw, or similar area.
- Consider planting a wildlife food plot or leaving grain fields unplowed. The cover reduces soil erosion and, on the lee side of windbreaks, wildlife has a food source in a sheltered spot.
- Consider planting or leaving herbaceous vegetation such as a mixture of grasses and legumes, grain, or stubble as a border, 20-50 feet wide, along the edges of windbreaks, but avoid competition with new plantings by keeping a clear area next to the trees. This provides nesting, loafing, and foraging cover for pheasants, quail, meadowlarks, and others. On the windward side, such cover also improves wind protection and shields newly planted trees from desiccation and abrasion caused by blowing soil. Mowing should be late in the season to avoid nesting wildlife and limited to every 3-4 years to maintain standing cover for early nesters.

- Consider adding a row of shrubs to the windward side to trap snow before it gets to the main windbreak and to improve wind protection near the ground.

Wildlife Plant Species

Sheltering evergreens, such as spruce, cedar or pine, as well as shrubby thickets of dogwood, viburnum, cotoneaster and honeysuckle, provide good nesting sites for many species of birds. Fruit-bearing shrubs and trees also attract birds and often provide fruits and berries well into the lean winter months. Hawthorns, shadbush, dogwood, viburnum and others offer a plentiful food supply. Crabapple varieties provide flowering beauty plus a fruit supply that lasts well into winter.

Plant diversity is also important. A landscape with a variety of different plants attracts more wildlife species, and is often more attractive in appearance. A variety of plants also offer a greater choice of food and cover.

Also, providing a variety of different species will alleviate many seasonal or weather-related effects. Unfavorable conditions such as very cold winters or drought may cause some plants not to bear fruit. Other plants bear fruit only in alternate years. Planting a variety of different species helps ensure a steady food supply every year.

Wildlife Considerations: Edible Landscapes¹

Nearly all of us live in an increasingly urbanized environment. Closely spaced city lots, expanding suburbs, and increasing numbers of small acreages encroach upon and divide up the countryside. Our connections to the sources of food that sustain us, the outdoors, and the wildlife that inhabit it grow ever more distant.

Yet, we can strengthen our connections to the outdoors and bring that wildness back into our lives, even if we live on a city lot! One way to do this is through “edible landscaping” - using selected varieties of trees and shrubs in our yards and acreages to produce delightful, high quality fruits and nuts. These foods would be for our own use, as well as for food and habitat for a wide variety of wildlife.

This section introduces the concept and basic principles of edible landscaping and provides a list of less commonly planted fruit and nut species.

Why Install an Edible Landscape?

Edible landscapes create opportunities to convert typical

¹ This section adopted from Edible Woody Landscapes for People and Wildlife, a publication of the National Arbor Day Foundation, University of Nebraska-Lincoln, School of Natural Resource Sciences and Cooperative Extension, and the National Agroforestry Center (2002).

landscape plantings that are of little use to wildlife or human residents into beautiful gardens of woody plants that provide food for both. This type of landscape increases opportunities for bird watching and photography by creating wildlife habitat that attracts many species of wildlife (especially birds). You can create “habitat” for *families* by surrounding your home with plants that produce delicious fruits and nuts that you and your children can together enjoy. Edible landscapes can also generate supplemental income or gifts from foods that are harvested or processed on a small scale. These striking plantings create spectacles of color throughout the year. Showy and fragrant flowers in the spring, multicolored stems, leaves and fruits during the summer, and fruits that remain on the plants during the winter please the senses year-round.

Attract Wildlife with Edibles

Even if you don’t have time to gather your fruit and nuts, the wildlife attracted to your yard will thank you for your efforts. Each wildlife species requires food, cover, water and a certain amount of space to move about, to avoid predators, and to locate a mate. These components all need to be in close proximity. Animals have specific range requirements as well. For instance, because an eastern bluebird requires about 5 acres, you probably would not expect to see this species in a small backyard lot in the city.

Habitat requirements for wildlife also change during the year. Because food and cover requirements vary with the season, select plants that bear fruit and nuts at different times of the year, or that retain fruit on the branch into the winter. Summer foods can be provided by American plum, chokecherry, sandcherry, gooseberry, currants, elderberry and riverbank grape. Good fall food producing plants are buffaloberry and most nut producing trees and shrubs. Plants that have persistent fruit through the winter might include prairie rose, chokeberry, crabapple, and highbush cranberry. Knowing which wildlife species occur in your region, when they occur, and their seasonal requirements will help you determine which species you are likely to attract with your edible landscape.

Improve Your Environment with Edible Landscapes

Strategically placed, edible landscapes not only produce valuable foods, but also improve the environment by protecting water quality, preventing soil erosion, conserving energy, enhancing wildlife habitat, controlling pests naturally, and increasing the natural diversity around your home.

Conserve Energy: Plantings on the north and west side of your property will block harsh winter winds, reducing your energy costs up to 30% while providing cover for wildlife so they can conserve energy. Planting edibles on the south side of your property can

shade your house during the summer, reducing cooling costs.

Conserve Soil: Strategically locating trees and shrubs in areas where soil is prone to washing or blowing can reduce the amount of soil lost during heavy rains or strong winds. Some woody plants that produce usable specialty products (e.g., New Jersey Tea) fix nitrogen from the air and help to replenish soil fertility.

Protect Air and Water Quality: Hate mowing the lawn every weekend? Many turf grass areas around the urban and suburban home can be converted to mulched (with wood chips) edible landscapes that require little maintenance. Using drought-tolerant plant varieties and grouping plantings according to their water needs also conserves water. Less lawn means reduced chemical and fertilizer applications, which means fewer nutrients and chemicals ending up in our surface and ground waters. And when woody plants that produce edibles are planted along watercourses or swales, they will intercept and absorb pollutants *before* they reach the water. Well-placed edible landscapes around the home also act as natural filters by removing dust and dust-born odors, and reducing noise.

Control Pests Naturally: Edible landscapes attract many species of wildlife, especially birds. Some bird and mammal species, like the downy woodpecker, yellow-shafted flicker and the little brown bat eat insects. Other species that feed on insects include the American Robin, northern cardinal,

eastern bluebird, house wren and many others. These species can help keep insect problems in check, naturally.

Ten Tips for Designing Edible Landscapes

Considerations for designing a well-functioning edible landscape include:

1. **Planting Objectives:** Clarify your own objectives for your edible landscape. Will you be harvesting the fruits and nuts for your own use, or for sale? Will you process the harvest into jams, jellies or other product? Some fruits and nuts can be eaten freshly picked. Others need to be processed in some way to enjoy their full flavor.
2. **Wildlife:** What kind of animals do you want to attract to your area (e.g., songbirds, squirrels)? By knowing the requirements for the desired wildlife species, you can intentionally design your edible landscape to attract these animals.
3. **Space:** How much space do you have? Are you willing to convert your entire backyard to trees and shrubs, or just a corner? Think not only in terms of horizontal space across the yard or acreage, but also vertically, combining tall trees, short trees, shrubs, herbaceous plantings or climbing vines within the same area to create a “multistory garden”. Use this publication to help you find the plants that are the right height and width at maturity for your landscape.
4. **Time:** How soon do you want to begin producing products? Some fruit-bearing shrubs will bear beginning the second year, while grafted nut trees often take a decade or more before nut production begins. Worried that you may not have time to harvest the fruits and nuts from your edibles? No problem – just let the wildlife “harvest” them while you enjoy watching.
5. **Viewability:** When you are designing your edible landscape, be sure your design allows you to see wildlife from your favorite viewing points – a patio, terrace, window, or special place in your landscape.
6. **Diversity:** Choose a variety of trees and shrubs that provide food for both you and many species of wildlife. Intermingle plants that vary in species, size and shape. Choose species that produce foods at different times of the year.
7. **Maintenance:** Do you want to create a relatively low maintenance landscape, or one that is more intensely cultivated and cared for? Many improved selections of native shrubs and trees, and some introduced cultivars require little maintenance, spraying, etc. once established. Give your plants enough space so they can grow naturally, without pruning.
8. **Beauty:** The aesthetic characteristics of the plants you select are important to the overall “look” and beauty of your

landscape. The color of the flowers, fruits, stems and leaves, the plant's form and texture are important considerations. Selecting plants that will create a long succession of blooming and fruiting will increase the time wildlife are in your yard, and enhance your viewing pleasure. And you can always interplant flowering perennials and shade-loving ornamentals.

9. Plant Suitability: How suitable are these edibles for your particular site and climate. Are the species/cultivars you have selected cold hardy enough? Can they handle Midwest/Great Plains summer heat? Can they tolerate shade or do they require full sun? How much water will they need? How resistant are they to insects and disease? Are they normally long-lived? Are they adapted to your soil conditions?
10. Plant Availability and Price: Many of these plants are widely available from garden catalogs and stores for reasonable and competitive prices. Others are harder to find, and may

be located through specialty suppliers or the World Wide Web but at a higher price per plant.

Species for Edible Landscapes

A table in Appendix D lists many species and cultivars of fruits and nuts that produce fruit or nuts with superior qualities (larger fruit, sweeter taste, smaller seeds, thinner shells, etc.) for humans and wildlife alike. Because of their lesser quality (for human consumption), we have not listed wild varieties that may produce fruits and nuts, but which are still good for wildlife. These varieties can be obtained from many catalogues or state forestry programs that produce seedlings for conservation plantings. Most species are rated good to excellent for wildlife. Other species (ginkgo, persimmon, Corneliancherry dogwood, chokeberry, apricot, jostaberry, pawpaw, or hardy kiwi) are thought to be important to some degree to wildlife, but their use is undocumented except anecdotally.

A. Arbor Day

As Nebraskans who have studied our Nebraska history, we know that Arbor Day began here in Nebraska in 1872. Arbor Day is the one thing that Nebraska can truly call its own. It was born and raised here and has had a world wide affect on improving our environment and quality of life. Julius Sterling Morton who moved to Nebraska in 1854 from Detroit, Michigan, founded Arbor Day. He and his wife (newly wed just prior to moving to Nebraska) loved trees and when they settled in Nebraska City they immediately began to plant trees and beautify the landscape around their home.

Morton became editor of Nebraska's first newspaper and he used this opportunity to promote and support his ideas about agriculture and his love for trees. He would let no opportunity go by without encouraging tree planting and good stewardship of the land. He promoted his ideas to individuals, civic groups, businesses, and government.

Morton eventually became Secretary of the Nebraska Territory and this presented him another opportunity to advance the cause of tree planting.

In 1872 Morton was to address the Nebraska Board of Agriculture on January 4. It was not Morton's custom to ask for his wife, Caroline's approval of speeches he was to make. But this was different and he shared his comments with Caroline on January 1 of that year. Caroline heartily approved. Morton's speech was one of his best ever and it included an offer to reward the county that planted the most trees on April 10 (the day that was to become the first Arbor Day). One million trees were planted that year in Nebraska.

It is interesting to note that Morton did not realize the far-reaching affect that his January 4 speech would have on trees and tree planting in the United States and in the world. But Caroline did and she ordered 800 trees herself to be planted on the Morton ranch on April 10. The trees did not arrive on time for that first Arbor Day but several days later they did. On that day Morton himself was out of town with one of their sons (Paul). Caroline watched as Joy, Mark and Carl dug the holes and planted all 800 trees.

Caroline is not nearly as well known as J. Sterling Morton. But she was a constant presence and had as much love for trees as Morton himself and maybe even more. Caroline encouraged Morton every step of the way and there are those who feel that if it was not for Caroline, the whole concept of Arbor Day may not have been born.

Arbor Day is also a time for the celebration of a family, the J. Sterling Morton's, that worked together to provide us with a legacy of tree planting that will forever adorn our state as well as the many other states and countries that have adopted the concept of Arbor Day.

Tree planting is as significant to us now as it was to our ancestors. It may be of greater important beings many trees need to be planted just to maintain the loss of forests to land clearing, fire, and urban expansion. By reinstating the trees we can ensure there will be forests for our years to come.

Possibly the most influential aspect of Arbor Day is its stress on the future. In the words of J. Sterling Morton, "Other holidays repose on the past. Arbor Day proposes for the future." We begin to plant trees to demonstrate our optimism for the future and our interest for those who will come after us. The trees planted today will offer protection from wind and sun, create wood products, encourage wildlife habitat, serve in erosion control, enhance beauty, and give encouragement for our children and ourselves.

Why is Arbor Day so important to Nebraskans? The holiday's beginning in our state plays a part in our enthusiasm. Even more significant is the shortage of trees and forests in Nebraska. We treasure trees because we witness what existence would be like without their contributions.

Nebraskans feel pride in their tree-planting heritage and feel content in knowing we have formed our state into a more scenic place to reside and an improved home for the future.

An Arbor Day celebration can be simple and brief or an all-day or all-week observation. It can be a simple tree planting event or an award ceremony that honors leading tree planters. For children, Arbor Day may be their only exposure to the green world or a springboard to discussions about the complex issue of environmental quality. Arbor Day is a golden opportunity for publicity and to educate homeowners about proper tree care. Utility companies can join in to promote planting small trees beneath power lines or being careful when digging. Smokey Bear's fire prevention messages can be worked into the event, as can conservation education about soil erosion or the need to protect wildlife habitat. Still another way to develop Arbor Day is to link it with a tree-related festival. Some that are currently celebrated include dogwood festivals, locust blossom festivals and Macon, Georgia's Cherry Blossom Festival that annually brings more than \$4.25 million into the local economy. In meeting the four standards, help is available!

Celebrate Arbor Day

Raise the flag, strike up the band, and make Arbor Day fun. Make it memorable.

- Organize a fun run.
- Make it a real event.
- See if a local business will donate prizes.
- Have a poster contest, or a poetry contest.
- Get the local PTA to sponsor a children's pageant or play.
- Organize and train volunteers to help you carry out Arbor Day ceremonies in your schools.
- Launch a thousand helium balloons with Arbor Day greetings inside offering a free tree to anyone who finds and returns the message.
- Fill the air with music.
- Have an Arbor Day concert of songs about trees, or with tree names in their

titles.

Get people into action.

- Ask a civic or service group to promote a paper drive to gather paper to be recycled and save a tree. Use the proceeds to buy a special tree to plant in a park or other special public place.
- Ask a local radio station to sponsor a tree trivia contest and give away trees to winners.
- Conduct a tree search. Ask people to find large, unusual or historic trees in your community. Tell people to take a “tree identification hike” and have girl scouts or boy scouts act as guides.
- Dedicate a forest, or a tree, or a flowerbed in a park, and make it an occasion to talk about stewardship.
- Get a local nursery or garden center to hold an open house or field day.
- Organize an Arbor Day Fair.

Get people together.

- Ask retirement homes to invite children to plant a tree on their grounds and give the residents a chance to tell the kids about Arbor Day when they themselves were children.
- See if neighborhood organizations will hold block parties and get their members to adopt and care for street trees in front of their homes. Pass out buttons. Give away trees.

An Arbor Day ceremony, be it simple and brief or an elaborate all-day observation, can be a delight to children and adults alike. It is especially meaningful to children if they have discussed the history of Arbor Day and have learned how to plant and care for trees before the ceremony is held.

A basic Arbor Day ceremony might include:

1. Greetings by a school principal or civic leader.
2. Reading a brief Arbor Day history.
3. Singing songs and reading poems about trees and tree planting.
4. Planting a tree together. Children might add a handful of soil brought from home to cover the roots. The roots could also place a small bottle holding the planters’ handwritten names.
5. Completion of planting, along with a demonstration about how to properly water and care for the new tree. If resources allow, it is very memorable to distribute tree seedlings that can be adopted and planted at home.

B. Tree City USA

The Benefits of Being a Tree City USA

Every community, regardless of size, benefits in different ways from being a Tree City USA. Reports of these benefits have reached The National Arbor Day Foundation through the years and are summarized below in six general categories:

Framework for Action

Meeting the four standards for becoming a Tree City USA provides initial direction for an urban or community forestry program. Like the first rungs on a ladder, the standards help get a community started toward annual, systematic management of its tree resources.

Education

Education begins with discussion of the standards and getting organized to apply for Tree City USA status. It continues as the desire for Tree City USA recognition leads to contacts with the state forester's staff. In turn, this can set in motion aid from a variety of professionals in the form of technical advice, literature, films, and other assistance.

Public Image

A community's public image is a very real phenomenon and important in many ways. Being a Tree City USA helps present the kind of image that most citizens want to have for the place they live or conduct business. The Tree City USA signs at community entrances tell visitors that here is a community that cares about its environment. It is also an indication to prospective businesses that the quality of life may be better here. It has even been known to be a factor in where meetings or conferences have been held. This reason alone caused a motel owner to start action for his community to join the network!

Citizen Pride

Pride is sometimes a less tangible benefit. Gaining and retaining Tree City USA recognition is an award to the tree workers, managers, volunteers, tree board members and others who work on behalf of better care of a community's trees. Non-involved citizens, too, often share a sense of pride that theirs is a Tree City USA. This may translate to better care of trees on private property or a willingness to volunteer in the future.

Financial Assistance

Preference is sometimes given to Tree City USA communities over other communities when allocations of grant money are made for trees or forestry programs.

The reason is that there are invariably more requests than available funds when grants are available through state or federal agencies. If requests are equally worthy, some officials tend to have more confidence in communities that have demonstrated the foresight of becoming a Tree City USA.

Publicity

Presentation of the Tree City USA award and the celebration of Arbor Day offer excellent publicity opportunities. This results not only in satisfaction for the individuals involved and their families, but also provides one more way to reach large numbers of people with information about tree care. As one forester put it, "This is advertising that money can't buy -- and it is free!"

Tree City USA, sponsored by The National Arbor Day Foundation in cooperation with the USDA Forest Service and the National Association of State Foresters, provides direction, technical assistance, public attention, and national recognition for urban and community forestry programs in thousands of towns and cities.

TREE CITY USA PACKET

Participating in Tree City USA represents a strong commitment to management of your community's tree and forest resources. **If you are no longer the forestry contact for your community, PLEASE pass this packet on to the city clerk for delivery to the person who is now responsible.**

Please take time to read through the application procedures and supportive information. If you have any questions, please feel free to call any of the **Community Forestry Staff** listed below.

Community Forestry Staff

Eric Berg
Community Forestry Coord.
103 PI, UNL - East Campus
Lincoln, NE 68583-0815
(402) 472-6511
Eberg2@unl.edu

Chip Murrow
Community Forester Assistant
103 PI, UNL - East Campus
Lincoln, NE 68583-0815
(402) 472-1382
jmurrow2@unl.edu

Rachel Allison
District Forester
461 West University Dr.
North Platte, NE 69101-9495
(308) 532-3611 ext. 161
rallison1@unl.edu

Contents of this packet:

- Tree City USA Certification Application
- Tree City USA Standard 3 Financial Worksheet
- Community Forestry Program Annual Report
- Example of a Community's Calendar of Events

PLEASE NOTE: Additional Tree City USA Certification applications can be obtained by contacting the National Arbor Day Foundation at (888) 448-7337. Ask for Tina or Jeff.

MAIL your completed Tree City materials to:

Western Nebraska Communities: Communities west of Hwy 183 or residing in Keya Paha, Rock, Loup, Custer, Dawson and Harlan counties.

Rachel Allison
District Forester
461 West University Dr.
North Platte, NE 69101-9495

Eastern Nebraska Communities: Communities east of Hwy 183 or residing in Buffalo and Phelps counties.

Chip Murrow
Community Forester Assistant
103 Plant Industry
University of Nebraska-Lincoln
Lincoln, NE 68583-0815

Please type or print the following: (A complete address is necessary)

Mayor or equivalent:

City Forestry Contact*:

Name: _____

Name: _____

Title: _____

Title: _____

Address: _____

Address: _____

City, State, Zip: _____

City, State, Zip: _____

Phone #: _____

Phone #: _____

*This person can be the Parks Supervisor, Village or Town Maintenance person, Public Works Director, City Manager, volunteer, etc. **DO NOT** use the UNL-NFS District Forester or District Forester Assistant. Your contact should be a local person living in the community.

Note: Application will not be processed without Standard 3 and 4 attachments.

Certification

(To be completed by the Community Forestry Staff)

(Community)

The above named community has made a formal application to this office. I am pleased to advise you that we reviewed the application and have concluded that, based on the information contained herein, said community is eligible to be certified as a Tree City USA for the _____ calendar year, having in my opinion met the four standards of achievement in community forestry.

Signed _____
State/Community Forester or Assistant Date

Person in State Forester's Office who should receive recognition material:

Chip Murrow, Community Forester Assistant
Nebraska Forest Service
103 PI, UNL
Lincoln, NE 68583-0815

TREE CITY USA STANDARD 3 FINANCIAL WORKSHEET

Ask the city clerk to assist in breaking down expenditures. Please use the provided list of **qualifying expenditures**. You can use any community tree related expenditures from the past calendar year, fiscal year or a combination of both for this requirement.

MUNICIPAL COMMUNITY FORESTRY EXPENDITURES

Tree Planting and Initial Care

Include cost of tree purchases, labor and equipment for planting, planting materials, stakes, wrapping, watering, mulching, competition control, etc.

\$ _____

Tree Maintenance

Include pruning, insect and disease management, fertilization, watering, etc.

\$ _____

Tree Removals

Include cost of equipment, supplies, labor, etc.

\$ _____

Management

Include public education, professional training, memberships, salaries and street and park tree inventory.

\$ _____

Other

Include any other expenses not already mentioned. Briefly describe.

\$ _____

TOTAL MUNICIPAL EXPENDITURES

\$ _____

COMMUNITY POPULATION

To qualify for Tree City USA, total expenditures must be at least twice the population. Transfer these two numbers to Standard 3 on application and attach this sheet to application.

OTHER COMMUNITY FORESTRY EXPENDITURES

Utility Line Clearance

Utility trimming expenses are allowed only if the utility is a partner in the city's tree program and has implemented a tree planting program and proper pruning methods as recommended in the Tree Line USA program.

\$ _____

Volunteer Time

Value of volunteer labor and other contributions from civic organizations

\$ _____

TREE CITY USA QUALIFYING EXPENDITURES FOR FINANCIAL WORKSHEET

Here are some examples of allowable expenses for public tree care that may be counted in meeting the \$2 per capita:

- Administrative time
- Arbor Day program
- Biomass recycling
- City workers' salaries (or percentage paid for tree work)
- Computer inventory software
- Contract work
- Dead tree removal
- Donated materials, including trees
- Equipment maintenance
- Equipment purchases (equipment depreciation over life span)
- Equipment rental
- Insurance
- Leaf and brush pick-up
- Memberships in and donations to tree organizations
- Mulching
- Prizes to Arbor Day contests
- Pruning by city employees
- Public education materials – brochures, newsletters, etc.
- Stump removal
- Tree Pest control
- Tree survey or inventory expenses
- Tree care conferences and workshops attended by city workers and tree board members
- Tree pruning by utility (not to exceed 20% of total expense)
- Tree purchases and planting
- Volunteer labor/time (\$10/hour)
- Watering

NOTE – grant monies expended for any of these items may be counted

PROGRAM IDEAS YOU CAN USE FOR ANNUAL REPORT

Education

- School Arbor Day Programs
- National Arbor Day Foundation Poster Contest
- Attend State Community Forestry Conference
- Participate in UNL-NFS Tree Care Workshop
- Recycling Programs
- Proper Tree Maintenance

Awareness/Promotion

- News Media – radio, TV, public access, newspaper
- Public Meetings
- Community Organizations
- Church Meetings
- Champion Tree Program
- Youth Programs (Boy/Girl Scouts, YMCA, School)

Group/Community Activities

- Send representative to the Tree City Awards Program in Lincoln
- Dedication of Tree City community entry sign
- Memorial Tree Plantings

COMMUNITY FORESTRY PROGRAM ANNUAL REPORT

Mission Statement:

Accomplishment Report (PAST YEAR): Please answer all that apply.

- Number of educational publications: _____
- Attended educational/training program(s):

Conference	Date
_____	_____
_____	_____
_____	_____
- Other accomplishments/activities (please list):

- Helped schools with National Arbor Day Poster Contest: _____
- Number of trees planted throughout the year:
Street _____ Park _____ Other _____
- Number of trees removed: _____
- Number of trees pruned: _____

Annual Work Plan (UPCOMING YEAR): Please give an approximate date/number for each activity you plan to do.

- Arbor Day Celebration: _____
- Update community tree ordinance: _____
- Annual public tree inspection: _____
- Other accomplishments/activities (please list):

- Number of removals: _____
- Number of trees to prune: _____
- Number of trees to plant:
Street _____ Park _____ Other _____

****The accomplishment report and annual work plan should be reviewed by the tree advisory board yearly. Annual review is part of a pro-active plan.**

CALENDAR OF EVENTS

This calendar is only a sample of what a Tree Board may want to include on theirs. Each individual community should set their own dates for their activities. Workshops, seminars and conferences are announced on the Nebraska Forest Service website (www.nfs.unl.edu), announced in newsletters and sent by direct mailings.

JANUARY	FEBRUARY	MARCH
Review annual work plan	National Arbor Day Foundation 5 th Grade Poster Contest	Attend Tree Care Workshop
APRIL	MAY	JUNE
ARBOR DAY* and Tree City USA Ceremonies	Tree planting finished	Tree inventory and inspections
JULY	AUGUST	SEPTEMBER
Public education programs	Plan next year's tree planting	START Tree City USA application
OCTOBER	NOVEMBER	DECEMBER
Public school education programs	Order trees for spring planting	FINISH Tree City USA application and mail

*Arbor Day Celebrations do not have to occur on Arbor Day or take place in April.

Tree City USA Certification Checklist

(Include all of the following items in your application)

- Complete and sign Tree City USA Certification application with all required information.
- Complete Financial Worksheet - check with the municipal clerk, use the list of qualifying expenditures and give appropriate consideration to mission statement, accomplishment report and annual work plan
- Provide a copy of your community tree ordinance - signed and dated
- Provide a copy of Arbor Day proclamation - signed and dated
- Provide evidence of Arbor Day Celebration - provide original or copy of any documentation of Arbor Day celebration (news articles, photos, newsletters, meeting announcements, education programs, tree planting, tree board meetings, etc.)

NOTE: It is important that your Tree City USA Certification application be submitted by December 31 of the year of certification. If there is a delay, please call (402) 444-7804 to let us know, and if there is a problem, we will be very glad to help correct it.

TREE CITY USA RE-CERTIFICATION PACKET

Participating in Tree City USA represents a strong commitment to management of your community's tree and forest resources. **If you are no longer the forestry contact for your community, PLEASE pass this packet on to the city clerk for delivery to the person who is now responsible.**

Please take time to read through the application procedures and supportive information. If you have any questions, please feel free to call any of the **Community Forestry Staff** listed below.

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Contents of this packet:

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Tree City USA Growth Award

The Growth Award is intended for recognition of environmental improvement and to encourage higher levels of excellence in tree care. This award recognizes not only achievement, but also the ability to convey exciting new ideas and assist leaders of all Tree City USA's with opportunities to enhance awareness of the community forest resource and application of appropriate tree care techniques.

Eligibility

In order to apply for the Growth Award, the community must be a Tree City USA for at least two consecutive years and have spent as much on its community forestry program this year as it did last year.

Applications

Obtain a **Growth Award Application** by contacting either the Nebraska community forestry office or the National Arbor Day Foundation.

PLEASE NOTE: Additional Tree City USA re-certification applications can be obtained by contacting the National Arbor Day Foundation at (888) 448-7337. Ask for Tina or Jeff.

MAIL your completed Tree City materials to:

Rachel Allison (Western Nebraska Community Forester Assistant) if your community is west of Hwy 183 or resides in Keya Paha, Rock, Loup, Custer, Dawson and Harlan counties.

Chip Murrow (Eastern Nebraska Community Forester Assistant) if your community is east of Hwy 183 or resides in Buffalo and Phelps counties.

Please type or print the following: (A complete address is necessary)

Mayor or equivalent:

City Forestry Contact*:

Name: _____

Name: _____

Title: _____

Title: _____

Address: _____

Address: _____

City, State, Zip: _____

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*This person can be the Parks Supervisor, Village or Town Maintenance person, Public Works Director, City Manager, volunteer, etc. **DO NOT** use the UNL-NFS District Forester or District Forester Assistant. Your contact should be a local person living in the community.

Note: Application will not be processed without Standard 3 and 4 attachments.

Certification

(To be completed by the Community Forestry Staff)

(Community)

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Signed _____
Staff/Community Forester or Assistant Date

Person in State Forester's Office who should receive recognition material:

Chip Murrow, Community Forester Assistant
Nebraska Forest Service
101 PI, UNL
Lincoln, NE 68583-0815

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Briefly describe.

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- Public Meetings
- Community Organizations
- Church Meetings
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- Youth Programs (Boy/Girl Scouts, YMCA, School)

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- Memorial Tree Plantings

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*Arbor Day Celebrations do not have to occur on Arbor Day or take place in April.

Tree City USA Re-certification Checklist (Include all of the following items in your application)

- Complete and sign Tree City USA Re-certification application with all required information.
- Complete Financial Worksheet - check with the municipal clerk, use the list of qualifying expenditures and give appropriate consideration to mission statement, accomplishment report and annual work plan
- Provide a copy of your new/changed community tree ordinance - signed and dated
- Provide a copy of Arbor Day proclamation - signed and dated
- Complete Growth Award application (if you satisfy requirements) with documentation of activities
- Provide evidence of Arbor Day Celebration - provide original or copy of any documentation of Arbor Day celebration (news articles, photos, newsletters, meeting announcements, education programs, tree planting, tree board meetings, etc.)

NOTE: It is important that your Tree City USA Re-certification application be submitted by December 31 of the year of certification. If there is a delay, please call (402) 444-7804 to let us know, and if there is a problem, we will be very glad to help correct it.

CHEMICAL CONTROL OF COMMON FOREST & SHADE TREE PESTS

Mark Harrell, Forest Health Specialist; and Laurie Stepanek, Forest Health Management Assistant
Nebraska Forest Service / University of Nebraska–Lincoln
April 2006

This information is intended as a guide to the chemical control of common insect pests and diseases of forest and shade trees. This is not a complete list of all pesticides available. Other methods of control that do not involve the use of pesticides may be effective against certain pests and should be considered before a pesticide is used.

Trade names have been used for convenience. No endorsement is implied, and no discrimination against similar products not listed is intended. No guarantee of effectiveness is made. **Some pesticides may not be appropriate for certain trees or pests or under certain conditions. Always read and follow the instructions and precautions on the pesticide container.**

CONIFER INSECTS

Insect	Tree	Application Number and Date	Pesticide
Aphids	Pine	1	Throughout the growing season as they appear (May to September). Horticultural oil / Growing season oil Insecticidal soap brands: Safer, Concern Imidacloprid Merit 2F, 75WSP, 75WP* Acephate Orthene Bonide Systemic Insect Control Permethrin Eight Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only
		1	Soil treatment: Use prior to infestation if a serious problem is expected. Has a 60-day translocation delay. Imidacloprid Bayer "Advanced Garden" Tree and Shrub Insect Control Merit 2F, 75WSP, 75WP*
Bagworms	Juniper	1	After eggs hatch and small bags appear (late May to June). Can also hand pick bags before eggs hatch. Bt <i>Bacillus thuringiensis</i> Dipel Tebufenozide Mimic 2LV* Spinosad Ferti-lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray Monterey Garden Insect Spray Conserve* Permethrin Eight Hi-Yield 38 Plus Astro* Licensed applicators only PermethrinPro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Carbaryl Sevin Acephate Orthene Bonide Systemic Insect Control Malathion

* Pesticides marked with an asterisk (*) generally must be ordered from a chemical distributor or agricultural coop.

CONIFER INSECTS (CONT.)

Insect	Tree	Application Number and Date	Pesticide
lps bark beetles	Pine	1 Apply in April prior to earliest beetle attack or when recently cut pine logs are brought near living pines.	Carbaryl Sevin XLR Plus, SL* Carbaryl 4L* Permethrin Hi-Yield 38 Plus Astro* Licensed applicators only Perm-Up* Restricted Use Bifenthrin Onyx*
Pales weevil	Scotch & White pines	1 Apply as a drench on cut stumps and surrounding soil in spring (April).	Chlorpyrifos (Restricted Use) Chlorpyrifos Pro 2* For nurseries, industrial sites and road medians Dursban 50W* For nurseries
Pine bark adelgid	Pine	1 In dormant season just before bud break (April).	Dormant oil Horticultural oil / Growing season oil
		1+ Throughout the growing season as they appear (May to September).	Horticultural oil / Growing season oil Insecticidal soap brands: Safer, Concern Imidacloprid Merit 2F, 75WSP, 75WP* Deltamethrin DeltaGard T&O* Commercial use only
		1 Soil treatment: Use prior to infestation if a serious problem is expected. Has a 60-day translocation delay.	Imidacloprid Bayer "Advanced Garden" Tree and Shrub Insect Control Merit 2F, 75WSP, 75WP*
Pine needle scale	Pine Spruce	2-3 When eggs hatch and red crawlers appear (late May or early June). Repeat once or twice at 7 to 10-day intervals (Unless prohibited by the label, e.g. oil). Also when eggs hatch in July.	Horticultural oil / Growing season oil Oil will remove blue needle color. Insecticidal soap brands: Safer, Concern Acephate Orthene Bonide Systemic Insect Control Permethrin Eight Malathion
Pine tip moth	Pine	2-4 Third week of May and first week of July. Better control if also second week of June and third week of July.	Acephate Orthene Bonide Systemic Insect Control Dimethoate* Commercial sites only Carbaryl Sevin Permethrin Hi-Yield 38 Plus Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Tebufenozide Mimic 2LV*

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CONIFER INSECTS (CONT.)

Insect	Tree	Application Number and Date	Pesticide
Sawflies	Pine	1 When larvae appear (mid- to late April).	Permethrin Hi-Yield 38 Plus Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Carbaryl Sevin Acephate Orthene Bonide Systemic Insect Control Imidacloprid Merit 2F, 75WSP, 75WP*
Spruce needle miner	Spruce	1 When current-year damage is first observed (June).	Carbaryl Sevin
Spruce spider mite	Spruce Juniper Pine	1 In dormant season just before bud break (April).	Dormant oil Horticultural oil / Growing season oil Oil will remove blue needle color
		2 When mites are detected (April to May, and September to October). Make a second application 7 to 10 days later with a different or same product according to label directions. (A different product will reduce development of resistance.) A hard spray with water will help keep populations down.	Horticultural oil / Growing season oil Oil will remove blue needle color. Insecticidal soap brands: Safer, Concern Bifenazate Floramite* Hexythiazox Hexygon* Commercial use only Spiromesifen Forbid* Etoxazole TetraSan* Not for residential areas Abamectin Avid* Acephate+fenbutatin-oxide Ortho Systemic Insect Killer
Twospotted spider mite	Juniper Pine Spruce	2 When mites are detected (April through summer). Make a second application 7 to 10 days later with a different or same product according to label directions. (A different product will reduce development of resistance.) A hard spray with water will help keep populations down.	Horticultural oil / Growing season oil Oil will remove blue needle color. Insecticidal soap brands: Safer, Concern Bifenazate Floramite* Hexythiazox Hexygon* Commercial use only Spiromesifen Forbid* Etoxazole TetraSan* Not for residential areas Abamectin Avid* Acephate+fenbutatin-oxide Ortho Systemic Insect Killer

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CONIFER INSECTS (CONT.)

Insect	Tree	Application Number and Date	Pesticide
Zimmerman pine moths (<i>Dioryctria</i> species)	Pine	2	Second week of April and second week of August. Use rate for borers and apply to trunk and major branches.
			Permethrin Hi-Yield 38 Plus Super Eight Astro* Licensed applicators only PermethrinPro* Licensed applicators only Perm-Up* Restricted Use Chlorpyrifos (Restricted Use) Chlorpyrifos Pro 2* For nurseries, industrial sites and road medians Dursban 50W* For nurseries
		Before the end of April if too late for the April spray above.	Dimethoate* Commercial sites only

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CONIFER DISEASES

Disease	Tree	Application Number and Date	Pesticide
Brown spot	Scotch & White pines	1-2	When new needles are nearly half grown (mid-June). Repeat 3 to 4 weeks later if frequent rains occur.
			Chlorothalonil Fung-onil Daconil Weather Stik* Bravo Weather Stik* Bordeaux mixture Mancozeb Dithane 75DF, F45* Fore 80WP* Protect T/O, DF*
Cercospora blight	Juniper Redcedar	2+	Mid-June and late July. Additional sprays at monthly intervals may be necessary if frequent rains occur in August and September. Use of a spreader-sticker may increase effectiveness.
			Copper salts of fatty and rosin acids Bonide Liquid Copper Fungicide Camelot* Bordeaux mixture See note next page‡ Mancozeb Dithane 75DF* Fore 80WP* Pentathlon LF, DF* Protect T/O, DF*
Cyclaneusma needlecast	Pine (mostly Scotch)	4+	Before bud break (April). Repeat at 6 to 8-week intervals until fall or monthly during periods of frequent rainfall.
			Chlorothalonil Daconil Weather Stik* Bravo Weather Stik* Mancozeb Dithane 75DF* Fore 80WP* Protect T/O, DF*
Dothistroma needle blight	Austrian pine	2	As needles are emerging (mid-May) and after new growth has occurred (mid- to late June).
			Copper salts of fatty and rosin acids Bonide Liquid Copper Fungicide Camelot* Bordeaux mixture
Phomopsis blight	Juniper Redcedar	2+	Every 7 to 10 days during wet periods in spring and summer (usually May to June).
			Thiophanate-methyl Bonomyl 3336 F, WP* Fungo Flo, 50WSB* OHP 6672 50W* Not for homeowner use Mancozeb Dithane 75DF* Fore 80WP* Pentathlon LF, DF* Protect T/O, DF* Propiconazole Banner-MAXX*
Rhizosphaera needlecast	Spruce (mostly Colo. blue)	2+	When shoots are 1/2 to 2 inches in length (May) and 3 to 4 weeks later. If frequent rains occur, spray every 10-14 days through early July.
			Chlorothalonil Fung-onil Daconil Weather Stik* Bravo Weather Stik* Bordeaux mixture
Sirococcus shoot blight	Spruce (Colo. blue, Norway)	2	When shoots are 1/2 to 2 inches in length (May) and 3 to 4 weeks later.
			Chlorothalonil Daconil Weather Stik* Bravo Weather Stik*

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CONIFER DISEASES (CONT.)

Disease	Tree	Application Number and Date	Pesticide
Sphaeropsis (Diplodia) blight	Pine	3	First at bud break (April), second just before needles emerge, third 10 days later. Thiophanate-methyl Bonomyl 3336 F, WP* Fungo Flo, 50WSB* OHP 6672 50W* Not for homeowner use Propiconazole Banner-MAXX*
		2	During third week of April and 10 to 14 days later. Bordeaux mixture Copper salts of fatty and rosin acids Bonide Liquid Copper Fungicide Camelot*

‡ **Note:** The label for Bordeaux mixture does not state that the product will control Cercospora blight. Although research conducted in Nebraska has shown this product can be effective in controlling this disease, no guarantee of effectiveness is made.

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BROADLEAF INSECTS

Insect	Tree	Application Number and Date	Pesticide
Aphids	Many trees	1+ Throughout the growing season as they appear (May to September).	<p>Insecticidal soap brands: Safer, Concern</p> <p>Horticultural oil / Growing season oil</p> <p>Imidacloprid Merit 2F, 75WSP, 75WP*</p> <p>Acephate Orthene Bonide Systemic Insect Control</p> <p>Malathion</p> <p>Permethrin Eight Astro* Licensed applicators only</p> <p>Deltamethrin DeltaGard T&O* Commercial use only</p>
Ash leaf-curling aphid	Ash	1 Just as leaves begin to curl (May).	<p>Imidacloprid Merit 2F, 75 WSP, 75WP*</p> <p>Acephate Orthene Bonide Systemic Insect Control</p>
		1 Soil treatment: Apply in March to be effective in May. Has a 60-day translocation delay.	<p>Imidacloprid Bayer "Advanced Garden" Tree and Shrub Insect Control Merit 2F, 75WSP, 75WP*</p>
Ash sawfly	Ash	1 When larvae appear (mid- to late April).	<p>Insecticidal soap brands: Safer, Concern</p> <p>Carbaryl Sevin</p> <p>Acephate Orthene Bonide Systemic Insect Control</p> <p>Deltamethrin DeltaGard T&O* Commercial use only</p> <p>Imidacloprid Merit 2F, 75WSP, 75WP*</p>
Bronze birch borer	Birch	2 Spray trunk and branches throughout the tree in late May. Repeat in 3 weeks.	<p>Permethrin Hi-Yield 38 Plus Astro* Licensed applicators only PermethrinPro* Licensed applicators only Perm-Up* Restricted Use</p> <p>Chlorpyrifos (Restricted Use) Chlorpyrifos Pro 2* For nurseries, industrial sites and road medians Dursban 50W* For nurseries</p> <p>Bifenthrin Onyx*</p>
		1 Soil treatment: Apply in March to be effective in May. Has a 60-day translocation delay.	<p>Imidacloprid Bayer "Advanced Garden" Tree and Shrub Insect Control Merit 2F, 75WSP, 75WP*</p>
		1 Trunk inject once if too late to spray.	<p>Imidacloprid Imicide* Pointer*</p>

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BROADLEAF INSECTS (CONT.)

Insect	Tree	Application Number and Date	Pesticide
Elm leaf beetle	Elm	1	When larvae appear (May). Imidacloprid Merit 2F, 75WSP, 75WP* Spinosad Ferti-lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray Monterey Garden Insect Spray Conserve* Permethrin Eight Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Carbaryl Sevin Acephate (NOT for American elm) Orthene Bonide Systemic Insect Control
		1	Soil treatment: Apply in March or previous fall to be effective in May. Has a 60-day translocation delay. Imidacloprid Bayer "Advanced Garden" Tree and Shrub Insect Control Merit 2F, 75WSP, 75WP*
Fall webworm	Cottonwood	1	When caterpillars and their webs appear (July). Bt <i>Bacillus thuringiensis</i> Dipel Tebufenozide Mimic 2LV* Spinosad Ferti-lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray Monterey Garden Insect Spray Conserve* Permethrin Hi-Yield 38 Plus Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Carbaryl Sevin
Greenstriped mapleworm	Maple	1	When larvae appear (June). Repeat for second generation if needed. Bt <i>Bacillus thuringiensis</i> Dipel Spinosad Ferti-lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray Monterey Garden Insect Spray Conserve* Permethrin Hi-Yield 38 Plus Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Carbaryl Sevin

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BROADLEAF INSECTS (CONT.)

Insect	Tree	Application Number and Date	Pesticide
Honeylocust plant bug	Honeylocust	1	When leaves fail to appear after budbreak (May) and small green bugs are present.
			Insecticidal soap brands: Safer, Concern Horticultural oil / Growing season oil
Lace bugs	Sycamore Hackberry Oak Linden	1	When feeding damage (small yellow spots) and insects appear (June).
			Insecticidal soap brands: Safer, Concern Horticultural oil / Growing season oil Permethrin Hi-Yield 38 Plus Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Imidacloprid Merit 2F, 75WSP, 75WP* Acephate Orthene Bonide Systemic Insect Control Malathion
		1	Soil treatment: Apply in April to be effective in June. Has a 60-day translocation delay.
			Imidacloprid Bayer "Advanced Garden" Tree and Shrub Insect Control Merit 2F, 75WSP, 75WP*
Lilac (ash) borer	Ash	2	Spray trunk and large branches around May 10. Repeat in 3 weeks.
			Permethrin Hi-Yield 38 Plus Super Eight Astro* Licensed applicators only PermethrinPro* Licensed applicators only Perm-Up* Restricted Use Chlorpyrifos (Restricted Use) Chlorpyrifos Pro 2* For nurseries, industrial sites and road medians Dursban 50W* For nurseries Bifenthrin Onyx*
Mimosa webworm	Honeylocust	1	When webs first appear (early June). Repeat for second generation in August if needed.
			Bt <i>Bacillus thuringiensis</i> Dipel Spinosad Ferti-lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray Monterey Garden Insect Spray Conserve* Permethrin Hi-Yield 38 Plus Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Acephate Orthene Bonide Systemic Insect Control

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BROADLEAF INSECTS (CONT.)

Insect	Tree	Application Number and Date	Pesticide
Oystershell scale	Ash Maple	2 When eggs hatch and light-yellow crawlers appear (late May). Repeat in 7 to 10 days (Unless prohibited by the label, e.g. oil). Repeat at August egg hatch if needed.	Horticultural oil / Growing season oil Oil may damage some maples Insecticidal soap (NOT for some maples) brands: Safer, Concern Acephate (NOT for some maples) Orthene Bonide Systemic Insect Control Malathion
Peach tree borer	Peach Cherry Plum	3 Apply to lower trunk and soil around July 1, July 25, and August 15. Some chemicals cannot be used on trees grown for fruit production/consumption.	Permethrin Super Eight Eight Astro* Licensed applicators only Perm-Up* Restricted Use
Spider mites	Many trees	2 When mites are present (as early as April, but mostly June through August). Make a second application 7 to 10 days later with a different or same product according to label directions. (A different product will reduce development of resistance.)	Horticultural oil / Growing season oil Insecticidal soap brands: Safer, Concern Bifentazate Floramite* Hexythiazox Hexygon* Commercial use only Spiromesifen Forbid* Etoxazole TetraSan* Not for residential areas Abamectin Avid* Acephate+fenbutatin-oxide Ortho Systemic Insect Killer
Tent caterpillars	Plum Cherry Apple Crabapple	1 When caterpillars and their webs appear (April). Some chemicals cannot be used on trees grown for fruit production/consumption.	Bt <i>Bacillus thuringiensis</i> Dipel Tebufenozide Mimic 2LV* Spinosad Ferti-lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray Monterey Garden Insect Spray Conserve* Permethrin Eight Hi-Yield 38 Plus Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Carbaryl Sevin Acephate (NOT for crabapple) Orthene Bonide Systemic Insect Control Malathion

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BROADLEAF INSECTS (CONT.)

Insect	Tree	Application Number and Date	Pesticide
Walnut caterpillar	Walnut	1 When caterpillars appear (June).	Bt <i>Bacillus thuringiensis</i> Dipel Spinosad Ferti-lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray Monterey Garden Insect Spray Conserve* Permethrin Hi-Yield 38 Plus Astro* Licensed applicators only Deltamethrin DeltaGard T&O* Commercial use only Carbaryl Sevin

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BROADLEAF DISEASES

Disease	Tree	Application Number and Date	Pesticide
Anthracnose	Sycamore	3-4 At budbreak (mid-April) and repeat 2 or 3 times at 7 to 14-day intervals.	<p>Chlorothalonil Fung-onil Daconil Weather Stik*</p> <p>Thiophanate-methyl Bonomyl 3336 F, WP* Fungo Flo, 50WSB* OHP 6672 50W* Not for homeowner use</p> <p>Copper salts of fatty and rosin acids Bonide Liquid Copper Fungicide Camelot*</p> <p>Bordeaux mixture</p>
	Ash Maple Oak Walnut	3-4 At budbreak (mid-April) and repeat 2 or 3 times at 7 to 14-day intervals. Damage is seldom serious enough to justify a treatment.	<p>Thiophanate-methyl ash, maple, oak, walnut Bonomyl 3336 F, WP* Fungo Flo, 50WSB* OHP 6672 50W* Not for homeowner use</p> <p>Chlorothalonil ash, maple, walnut Daconil Weather Stik*</p> <p>Copper salts of fatty and rosin acids maple, oak Bonide Liquid Copper Fungicide Camelot*</p> <p>Bordeaux mixture ash, maple, oak, walnut</p> <p>Propiconazole walnut Infuse Ferti-lome Liquid Systemic Fungicide Banner-MAXX*</p> <p>Mancozeb Dithane 75DF* white ash, walnut Fore 80WP* white ash, walnut Pentathlon LF, DF* ash, oak, walnut Protect T/O, DF* ash, maple, oak, walnut</p>
Apple scab	Crabapple	5+ At 7 to 14-day intervals from prebloom (April) through rainy periods of growing season. Some chemicals cannot be used on trees grown for fruit production/consumption.	<p>Chlorothalonil Fung-onil Daconil Weather Stik*</p> <p>Thiophanate-methyl Bonomyl 3336 F, WP* Fungo Flo, 50WSB* OHP 6672 50W* Not for homeowner use</p> <p>Myclobutanil Immunox Systhane WSP* Eagle 20EW, 40WP*</p> <p>Mancozeb Dithane 75DF, F45* Fore 80WP* Pentathlon LF, DF* Protect T/O, DF*</p> <p>Propiconazole Infuse Ferti-lome Liquid Systemic Fungicide Banner-MAXX*</p>

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BROADLEAF DISEASES (CONT.)

Disease	Tree	Application Number and Date	Pesticide
Ash rust	Ash	3-4 At budbreak (mid-April) and repeat 2 or 3 times at 10 to 14 day intervals.	Myclobutanil Immunox Systhane WSP* Eagle 20EW, 40WP*
Cedar-apple rust	Crabapple Hawthorn	5+ As flower buds break (mid-April), at petal drop, and 3 or 4 additional sprays at 7 to 10-day intervals. Some chemicals cannot be used on trees grown for fruit production/consumption.	Chlorothalonil Fung-onil Daconil Weather Stik* Thiophanate-methyl Bonomyl 3336 F, WP* Fungo Flo, 50WSB* OHP 6672 50W* Not for homeowner use Propiconazole Infuse (crab only) Ferti-lome Liquid Systemic Fungicide (crab only) Banner-MAXX* Myclobutanil Immunox Systhane WSP* Eagle 20EW, 40WP* Mancozeb Dithane 75DF, F45* Fore 80WP* Pentathlon LF, DF* Protect T/O, DF*
Cherry leaf spot	Cherry	4+ At petal fall (May) and every 10 to 14 days as fruit matures. Some chemicals cannot be used on trees grown for fruit production/consumption.	Chlorothalonil Fung-onil Daconil Weather Stik* Bravo Weather Stik* Myclobutanil Immunox Systhane WSP* Eagle 20EW, 40WP* Propiconazole Infuse Ferti-lome Liquid Systemic Fungicide
Dutch elm disease	American elm	1 Preventive treatment: Trunk inject when leaves approach full size (late May). Therapeutic treatment: Trunk inject as soon as current year infections are seen (5% or less of crown infected; late June through August).	Thiabendazole Arbotect 20S*
		1 Trunk inject as soon as symptoms begin appearing or before. High volume injection (macro-injection) more effective than small volume injection (micro-injection).	Propiconazole Alamo*

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BROADLEAF DISEASES (CONT.)

Disease	Tree	Application Number and Date	Pesticide
Fire blight	Apple Pear	3-4	At pink stage (3 to 4 days before blossoms open, mid-April) and every 5 to 7 days until petal drop.
Oak wilt	Oak	1	Trunk inject as soon as symptoms begin appearing or before. High volume injection (macro-injection) more effective than small volume injection (micro-injection).
Tubakia leaf spot	Bur oak	3	At budbreak (April) and repeat 2 times at 10 to 14-day intervals.

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D. Edible Woody Landscapes for People and Wildlife

Why Install an Edible Woody Landscape?

Edible landscapes are an opportunity to convert typical landscape plantings that are of little use to wildlife or people into beautiful gardens that provide food for both. They increase opportunities for wildlife feeding, watching and photography by creating habitat that attracts many species of animals (especially birds).

These plantings also create “habitat” for your family by surrounding your home with plants that produce delicious fruits and nuts that you and your children can enjoy together. The “fruits” of edible landscapes also can generate supplemental income or gifts. And the showy and fragrant flowers, multicolored stems, leaves and fruit please the senses year-round.

Ten Tips for Designing Edible Woody Landscapes

1. **Planting Objectives:** Will you be harvesting and/or processing the fruits and nuts for your own use, for sale, or will you be leaving them for wildlife?
2. **Wildlife:** What kind of animals do you want to attract to your area (e.g., songbirds, squirrels)? By knowing the requirements for the desired wildlife species, you can intentionally design your edible landscape to attract these animals.
3. **Space:** How much available space do you have? Think not only in terms of horizontal space across the yard or acreage, but also vertically, combining tall trees, short trees, shrubs, herbaceous plantings or climbing vines within the same area to create a “multistory garden.”
4. **Time:** How soon do you want to begin producing products? Some fruit-bearing shrubs will begin to bear the second year, while grafted nut trees often take a decade or more before nut production begins.
5. **Viewability:** Be sure your design allows you to see wildlife from your favorite viewing points – a patio, terrace, window, or special place in your landscape.
6. **Diversity:** Choose a variety of trees and shrubs that provide food for both you and many species of wildlife. Intermingle plants that vary in species, size and shape. Choose species that produce foods at different times of the year.
7. **Maintenance:** Do you want to create a relatively low maintenance landscape, or one that is more intensely cultivated and cared for? Many improved selections require little maintenance once established.
8. **Beauty:** The color of flowers, fruits, stems and leaves, and the plant’s form and texture are important to the overall “look” and beauty of your landscape. Selecting plants that will create a long succession of blooming and fruiting will increase the time wildlife are in your yard, and ease harvesting.
9. **Plant Suitability:** How suitable are these edibles for your particular site, soils and climate? Are the species/cultivars you have selected cold hardy and disease and

insect resistant? Can they handle the Midwest/Great Plains summer heat? How much sunlight and water will they need? Are they normally long-lived?

10. **Availability and Price:** Many of these plants are widely available from garden catalogs and stores. Others are harder to find, and may be located through specialty suppliers or the Internet.

Species for Edible Landscapes

The following table lists woody plants that produce fruits and nuts with superior qualities (larger fruit, sweeter taste, smaller seeds, thinner shells, etc.) for humans and wildlife alike. Most of the fruits listed can be eaten fresh, or processed for jellies, jams, syrups, juices or wine. Nuts can also be eaten fresh or used in cooked dishes and baked goods.

Because of their lesser quality (for human consumption), we have not listed wild varieties that may produce fruits and nuts, but which are still good for wildlife. These varieties can be obtained from many catalogues or state forestry programs.

Species	Cultivars	Form	Mature Width & Height	Wildlife Use	Other Characteristics
				C=Cover F=Food B=Browse U=Unknown	
NUTS					
Butternut	'Kenworthy', 'Mitchell'	Tree	40' x 40'-70'	F,C	Susceptible to canker disease
Chestnut, Chinese	Many	Tree	50' x 40'-60'	F,C	Prickly husk
Ginkgo	'Salem Dandy', 'Salem Lady'	Tree	40' x 60'	U	Fruit has offensive odor; male/ female req.
Hazelnut, Hybrid	'Farris 88-BS', 'G-17', 'Gellatly #502', 'Grimo 188P', 'Skinner', 'Grand Traverse' 'Badgersett' Hybrids	Shrub	10' x 15'	F,C,B	May spread by suckers
Hickory, Shagbark	'Felger', 'Grainger/Heisey', 'Porter', 'Sinerling', 'Silvis 303', 'J. Yoder No. 1'	Tree	25' x 60'-80'	F,C	Unique mellow flavor
Hickory, Shellbark	'Eureka', 'Keystone', 'Nieman'	Tree	40' x 60'-80'	F,C	Unique mellow flavor
Pecan, Northern	Many	Tree	55' x 70'-100'	F	Smaller than southern pecans, but sweeter
Walnut, Black	Many	Tree	60'-120' x 100'-150'	F,C	Inhibits growth of some plants
FRUIT					
Apricot	'Moongold', 'Sungold', 'Manchu'	Shrub	20'-25' x 20'-35'	F	Male and female plants required
Buffaloberry	'Gold-eye', 'Sakakawea'	Shrub	16' x 12'-18'	F,C	Grows along prairies, pastures
Cherry, Nanking	'White', standard red variety	Shrub	10'-15' x 6'-10'	F	Prone to rabbit damage
Cherry, Sand	'Hansen', 'Sioux'	Shrub	4'-6' x 4' -6'	F,C	Needs to be stressed to fruit well
Cherry, Black	None	Small Tree	60' x 15'	F,C	Also known as Rum Cherry
Chokeberry	'Nero', 'Viking'	Shrub	5'-8' x 4'-10'	F,C	Persistent winter fruit

Species	Cultivars	Form	Mature Width & Height	Wildlife Use C=Cover F=Food B=Browse U=Unknown	Other Characteristics
Chokecherry	'Boughens Chokeless', 'Robert', 'Goertz', 'Pickup's Pride', 'Garrington', 'Schubert', 'Canada Red'	Small Tree	15'-18' x 20'-30'	F,C,B	Wild variety widely distributed Most cultivars only available in Canada
Cranberry, Highbush	'Wentworth', 'Hahs'	Small Tree	15'-35' x 20'	F,C,B	
Currant, Black	Many	Shrub	12' x 12'	F	Offensive odor when first processed
Currant, Red	Many	Shrub	2' - 4' x 4' -7'	F,C	Buffalo currant sweeter than black currant
Currant, White	Many	Shrub	5' x 5'	F,C	
Dogwood, Corneliancherry	'Elegant', 'Redstar', 'Yellow', 'Redstone'	Shrub	5' x 5'	F	
Elderberry	'York', 'Adams'	Small Tree	15'-25' x 20'-25'	F	Makes excellent jam
Gooseberry	'Pixwell', 'Welcome', 'Clark'	Shrub	6'-12' x 6'-10'	F,C	Spreads by suckers; flowers used for tea
Grape, Riverbank (Wild)	None	Shrub	3' x 5'	F,C,B	Some varieties of gooseberry have spiny stems
Jostaberry	'Jostagranda', 'Jostina', 'Red Josta'	Vine	30' x NA	F,C	Easily started from seed
Kiwi, Hardy	Many	Shrub	6' x 6'	F	Cross between gooseberry and currant
Mulberry	'Johnson', 'Weisman'	Vine	20-25' x 15-20'	F	Male and female plants required
New Jersey Tea	None	Tree	35'-50' x 35'-50'	F,C	Invasive seedlings; M/F plants required
Pawpaw	Many	Shrub	3.5' x 3'	F	Fixes nitrogen, used for tea
Persimmon	'Hicks', 'Meader', 'Pieper', 'Runkwitz'	Small Tree	15'-20' x 15'-20'	F	Fruits having yellow flesh more rounded
Plum, American (Wild)	None	Small Tree	20'-35' x 35'-60'	F	Fruits ripen from September to November
Raspberry, Black or Red	Many	Small Tree	20'-35' x 15'-25'	F,C	Invasive, suckers
Rose, Wild	Some	Shrub	4-6' x 1.5-8'	F,C	Fruit from early to midsummer
Saskatoon (Juneberry)	'Smoky', 'Northline', 'Pembina', 'Nelson'	Shrub	4' x 7'	F	Winter persistent fruit
		Shrub	8-10' x 5'-15'	F,B	

Improve Your Environment

Strategically placed, edible landscapes not only produce valuable foods, but also improve the environment by protecting water quality, preventing soil erosion, conserving energy, enhancing wildlife habitat, controlling pests naturally, and increasing the natural diversity around your home.

Attract Wildlife: Animals require food, cover, water and space in close proximity to live and reproduce. Some wildlife species only need a backyard to thrive, others require many acres. Habitat requirements for wildlife also change during the year. Winter food and cover requirements may be completely different than summer food and cover, so select plants that bear fruit and nuts at different times of the year. Summer foods are provided by American plum, chokecherry, sandcherry, gooseberry, currants, elderberry and riverbank grape. Good fall food-producing plants are buffaloberry and most nut producing trees and shrubs. Plants that have persistent fruit through the winter include prairie rose, chokeberry, crab apple, and highbush cranberry. Knowing which wildlife species occur in your region, and their life requirements, will help you determine which species you are likely to attract with your edible landscape.

Conserve Energy: Plantings on the north and west side of your property will block harsh winter winds, reducing your heating energy costs up to 30% while providing cover for wildlife so they can conserve energy. Planting taller nut trees on the south, west, and east sides of your property can shade your house during the summer, considerably reducing cooling costs.

Conserve Soil: Trees and shrubs can reduce the amount of soil lost during heavy rains, especially on erosion-prone areas.

Protect Air and Water Quality: Hate mowing the lawn? Convert some of that turfgrass around your home to mulched edible landscapes that require little maintenance. Less lawn means reduced chemical and fertilizer applications, which means fewer nutrients and chemicals ending up in our surface and ground waters. And edibles planted along watercourses or swales intercept and absorb pollutants before they reach the water. Well-placed edible landscapes around the home also reduce dust, odors, and noise.

Control Pests Naturally: Edible landscapes attract many species of wildlife, especially birds. For many bird species, such as the downy woodpecker, northern cardinal, American robin and eastern bluebird, insects make up a large portion of their diet. These species can help keep insect problems in check, naturally.

Sources of Further Information on Edible Landscapes

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E. Plant Classification and Binomial Nomenclature

Common knowledge of how plants are classified can help discover how to recognize trees and shrubs. Plants that are directly connected have similar traits. This knowledge can be useful in the diagnosis of plant health. Plants that are in the same family are usually vulnerable to the same diseases and insect pests.

Binomial nomenclature is a system for the naming of plants. People are often familiar with common names of trees through experience, but it is imperative to know that the restricted use of these names can stem complication and doubt.

One plant may have several common names. *Calycanthus floridus* is known as Common sweetshrub, Carolina allspice and strawberry-shrub. Two separate plant species may have the same common name. For example, *Magnolia x soulangiana* and *Liriodendron tulipifera* are each referred to as a tuliptree in different regions of the world. Common names can be deceptive. For instance, the Russian-olive is not an olive, and the mountainash is not a true ash.

Every kind of plant has a distinctive scientific name that is universal; thus the same throughout the world. The scientific name of a plant is binomial, having two parts, and originates from the plant classification system developed by Linnaeus, a Swedish botanist. The name consists of at least two Latin words. The first word of the name is the genus, which is capitalized. Plants that are grouped into the same genus are strongly connected and display comparable features, predominantly in their flowers and fruit. The second word is more specific and classifies the species. It is not capitalized.

A variety of plants are then separated into varieties or cultivars. A variety is a subdivision of a species that differs from the distinctive element of the species and breeds true to that difference. Varieties are not capitalized.

Cultivars are varieties that are cultivated by man and are derived by a variety of methods. New plants can be originated through hybridization, genetic alterations, and a series of other man-induced alterations. The names of cultivars are written with single quotes and the first letter is capitalized.

Examples of accurately written scientific names are:

Quercus robur – English oak

Acer rubrum ‘October Glory’ – October Glory maple

Picea glauca var. *densata* – Black Hills spruce

The amount of names to learn and understand may appear to be monumental, however, it is essential that foresters, arborists, county extension personnel, city clerks and whomever is to monitor and maintain a community forestry program understand the process and logistics of binomial nomenclature in order to effectively communicate plant knowledge without confusion. The nomenclature process is also particularly valuable when consulting reference materials for plant material growth habit, height, leaf color, and other identifying characteristics.

Appendix F. Guide to Woody Plants

GUIDE TO WOODY PLANTS OF NEBRASKA

Justin Evertson, Nebraska Statewide Arboretum

Kim Todd, UNL – Horticulture

David Mooter, Nebraska Forest Service

Kate Schumacher, Nebraska Statewide Arboretum

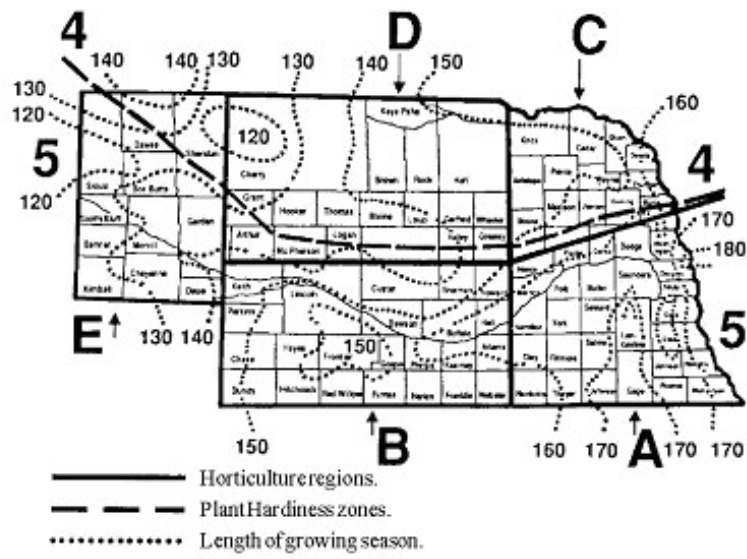
Species diversity is the cornerstone of a healthy community forest. In an effort to increase species diversity, this publication provides a nearly complete list of woody plants that can be grown in Nebraska communities. Each plant is keyed to the hardiness zone map on this page to show where it will grow best in Nebraska. It should be noted, however, that many plants need extra care and protection to survive certain climates. Conversely, many plants may do well outside of their recommended zone if the proper microclimate exists.

This guide describes 11 categories of plants. The height/spread information lists the approximate size, in feet, of the mature plants. These numbers are averages of actual plants measured in Nebraska, or, in the case of some less common or new plants, reasonable estimates of mature size under Nebraska growing conditions.

Cultural conditions are also identified according to the following key:

1. Indicates plants that tolerate wet conditions.
2. Indicates plants that, once established, require some supplemental watering during prolonged dry periods.
3. Indicates plants that require little or no supplemental water once established and are tolerant of moderate drought conditions.
4. Indicates plants that will perform well in the shade.
5. Indicates plants that will perform well in partial shade.
6. Indicates plants that will perform best in full sun.

Plants that will do well in a range of cultural conditions may have several symbols.



Hardiness Zone Map of Nebraska

LARGE DECIDUOUS TREES: OVER 45 FEET AT MATURITY

Scientific Name Common Name	Cultural Conditions	Zone	Remarks
<i>Acer nigrum</i> black maple	3 6	All	Very similar to sugar maple with greater heat and drought tolerance; possibly adaptable to western Neb.; >Greencolumn= is a common cultivar; native to western Iowa; 40= spread.
<i>Acer platanoides</i> Norway maple	2 6	A,B,C	Traditional shade tree; often suffers from scorching and frost cracks; limited success with cultivars in zones D and E; suggested cultivars include: >Deborah= >EmeraldLuster= >Emerald Queen= >Erectum= >Schwedleri=
<i>Acer pseudoplatanus</i> planetree maple	2 6	A,B,C	Uncommon in the landscape; 35= spread.
<i>Acer rubrum</i> red maple	2 6	A,B,C	Nice landscape/specimen tree with good fall color; does not tolerate dry soils; 35= spread; choose from hardy cultivars including: >Armstrong= >Northwood= >Red Sunset=
<i>Acer saccharinum</i> silver maple	2 6	All	Native to eastern Neb. waterways; overplanted in eastern Neb.; limited use only; breaks up easily in storms; 70= spread.
<i>Acer saccharum</i> sugar maple	2 6	A,B,C	A beautiful tree when properly sited; some cultivars show promise for the western part of the state; nice fall color; does not tolerate dry soils; 40= spread. Cultivars include: >Bonfire= >Green Mountain= >Legacy=
<i>Acer x freemanii</i> freemanii maple	2,3 6	A,B,C	Red-silver maple cross; may be adaptable to western Neb.; cultivars include: >Celebration= >Autumn Blaze=
<i>Carya cordiformis</i> bitternut hickory	2 5,6	A,B	Needs some protection; fastest growing hickory; good tree for attracting wildlife; native to southeast Neb.; 40= spread.
<i>Carya glabra</i> pignut hickory	2 4,5	A,B	Good nut tree; plant in protected area; tolerates shade; 40= spread.

<i>Carya illinoensis</i> pecan	2	5,6	A,B,C	Under utilized in the landscape; makes a nice yard or street tree; use tested cultivars; >Hican= is a cross with hickory; 30= spread.
<i>Carya laciniosa</i> shellbark hickory	2	5	A	May need protection; prefers bottomland soils; 40= spread.
<i>Carya ovata</i> shagbark hickory	2	5,6	A,B	Edible nut; needs protection; distinguishing exfoliating bark; tolerates shade; native to southeastern Neb.; 60= spread.
<i>Castanea dentata</i> American chestnut	2	6	A,B,C	Nearly extinct in eastern U.S., still a good tree for eastern Neb.; site carefully, spiny fruit; 40= spread.
<i>Castanea mollissima</i> Chinese chestnut	2	6	A,B	Similar to <i>C. dentata</i> , but lower growing, produces large, edible nuts; messy; site carefully - spiny fruit.
<i>Catalpa speciosa</i> northern catalpa	3	5,6	All	Not for formal landscapes; profuse white flowers in late spring; large seed pods; naturalized in eastern Neb.; grows tall and narrow; 35= spread.
<i>Celtis laevigata</i> sugar hackberry	1	6	A	Southern relative to common hackberry; less hardy; prefers floodplains and wet areas; 45= spread.
<i>Celtis occidentalis</i> common hackberry	3	6	All	Excellent tree for urban use and difficult sites; interesting warty bark; native to much of Neb.; sensitive to herbicides; 55= spread.
<i>Fagus grandifolia</i> American beech	2	5,6	A	Very few in Neb. but can be a beautiful landscape tree; provide some protection; 50= spread.
<i>Fagus sylvatica</i> European beech	2	5,6	A	Similar to American beech; difficult to grow in Neb.; 40= spread.
<i>Fraxinus Americana*</i> white ash	2	6	All	More ornamental than green ash; all ashes are susceptible to insect and disease problems; >Autumn Purple= is a very nice cultivar with purple fall foliage; 40= spread.
<i>Fraxinus excelsior*</i> European ash	2	5	A,B,C	Very uncommon tree with fine foliage; dark green; clean; >Kimberly= is the most common cultivar; 40= spread.
<i>Fraxinus mandshurica*</i> Manchurian ash	3	6	All	Uncommon ash worth trying across Neb.; proven hardy in Colorado; 40= spread. >Mancana= is a common cultivar.
<i>Fraxinus pennsylvanica*</i> green ash >Marshall=s Seedless= >Patmore=	1,3	5,6	All	Native ; avoid heavy clay soils; 40= spread; suitable cultivars include: Vigorous with fewer insect problems than the species; seedless variety. More upright, uniform and symmetrical than >Marshall=s Seedless=.
<i>Fraxinus quadrangulata*</i> blue ash	2	6	All	Interesting tree with square twigs and scaly bark; >True Blue= is a common cultivar.
<i>Gleditsia triacanthos</i> var. <i>inermis</i> thornless honeylocust >Green Glory= >Imperial= >Shademaster= >Skyline=	3	6	All	Fast growing; insect resistant; thornless; native ; 55= spread; many nice cultivars including: Seedless; retains leaves into the fall; good selection; 55= spread. Neb. selection; very adaptable; shortest variety; 60= spread. Very common; seedless; dark green foliage; 55= spread. More compact; good selection; dark green foliage; 55= spread.
<i>Gymnocladus dioica</i> Kentucky coffeetree	3	6	All	Nice native tree; large seed pods; pest free; good fall color and coarse winter habit; 55= spread.

<i>Juglans nigra</i> black walnut	3	6	All	Good native tree for parks and wildlife; site carefully, juglone from roots may inhibit growth of other plants; prefers rich, loamy soil; 55= spread.
<i>Larix decidua</i> common larch	1,2	6	All	Deciduous conifer; unique foliage; prefers consistent moisture and protected site; 30= spread.
<i>Larix kaempferi</i> Japanese larch	2	6	A,B,C	Deciduous conifer; excellent fall color; unique spring flowers; needs early spring protection; 35= spread.
<i>Liquidambar styraciflua</i> sweetgum	2	6	A	Nice tree with good fall color; unusual spiny fruit; may have die back in severe winters; >Moraine= is a hardier, northern selection; 40= spread.
<i>Liriodendron tulipifera</i> tuliptree (yellow poplar)	2	6	A,B	Unusual tree with tulip-like spring flowers; good in groups; 40= spread.
<i>Platanus occidentalis</i> American sycamore	1,2	6	A,B,C	Majestic native planetree; unusual mottled bark; anthracnose a minor problem in wet springs; grows very tall when sited properly; 75=+ tall by 50= wide.
<i>Platanus x acerifolia</i> London planetree	2	6	A,B,C	Large spreading tree; nice bark; similar to the American sycamore; 70=+ tall by 45= wide.
<i>Populus alba</i> silver poplar	3	6	All	Very hardy, wide spreading tree; dark green leaves with a fuzzy white underside; disease prone with weak wood; use carefully; 50= spread.
<i>Populus balsamifera</i> balsam poplar	2	6	All	Fragrant, resinous buds with strong balsam odor; short lived; 30= spread.
<i>Populus deltoides</i> eastern cottonwood	1,3	6	All	Can grow very large; state tree of Neb.; seedless varieties available including: >Mighty Mo=, >Ohio Red= & >Platte=, avoid >Siouxland=; 70=+ tall by 60= wide.
<i>Quercus acutissima</i> sawtooth oak	2	6	A,B,C	Eurasian oak with unique, sawtooth leaves; 45= spread.
<i>Quercus alba</i> white oak	2	6	A,B	Slow growing, long-lived tree; good fall color; nearly native to southeastern Neb.; 50= spread.
<i>Quercus bicolor</i> swamp white oak	1,3	6	All	An excellent selection; good on poorly drained or compacted sites; shows chlorosis on high pH soils; 50= spread.
<i>Quercus coccinea</i> scarlet oak	2	6	A,B	Nice fall color; avoid alkaline soils; needs protection; 40= spread.
<i>Quercus imbricaria</i> shingle oak	2	6	A,B,C	One of the nicest oaks; interesting narrow leaves persist into winter; nearly native to southeastern Neb.; 40= spread.
<i>Quercus macrocarpa</i> bur oak	3	6	All	One of finest native trees; majestic; good winter form; very large; good strong branch structure; 55= spread.
<i>Quercus muehlenbergii</i> chinkapin oak	2	6	All	Nice tree that should be planted more; native to southeast Neb.; 45= spread.
<i>Quercus palustris</i> pin oak	2	6	A,B,C	Should be limited to undisturbed acid soils or severe chlorosis may be a problem; 40= spread.
<i>Quercus prinus</i> chestnut oak	2	6	A,B,C	Nice oak for southeast Neb.; fairly fast growing; 45= spread.

<i>Quercus robur</i> English oak	3	6	All	Nice oak with smaller leaves; reasonably fast growing; 45= spread; many cultivars; >Fastigiata= is an upright selection (to 15= wide) with unusual acorn coloration.
<i>Quercus rubra</i> red oak	3	6	All	Excellent fall color; pest resistant; one of the best native oaks; 50= spread.
<i>Quercus shumardii</i> shumard oak	2	6	A,B	Similar to red oak; nice fall color; avoid alkaline soils; 45= spread.
<i>Quercus velutina</i> black oak	2	5,6	A,B	Nice native oak ; lustrous green leaves; prefers rich, well-drained soils; may need protection; 50= spread.
<i>Salix alba</i> white willow	1,2	6	All	Good for wet sites where little else will grow; >Cardinal Red= is a common cultivar; 45= spread.
<i>Salix</i> x > <i>Tristis</i> = Tristis weeping willow	1,2	6	All	The standard weeping willow; good on wet sites; willows are short-lived trees; 45= spread.
<i>Taxodium distichum</i> Baldcypress	1,3	6	A,B,C	Deciduous conifer; good on both wet and dry sites when established; may be more adaptable than previously thought; 30= spread.
<i>Tilia americana</i> American linden	2	6	All	Fragrant flowers in the spring; nice native shade tree; 45= spread. The cultivar >Redmond= is a Nebraska selection of unclear origin; very similar in habit to <i>T. americana</i> .
<i>Tilia cordata</i> littleleaf linden	2	6	All	Small leaves, formal shape; pest resistant; common cultivars include >Chancellor=, >Glenhaven= and >Greenspire=; 35= spread.
<i>Tilia platyphyllos</i> bigleaf linden	2	6	A,B,C	Beautiful formal tree; very dense canopy; 45= spread.
<i>Tilia tomentosa</i> silver linden	2	6	A,B,C	Beautiful silver underside to the leaves; 40= spread.
<i>Tilia</i> x <i>euchlora</i> crimean linden	2	6	All	Similar to littleleaf linden; 30= spread.
<i>Ulmus americana</i> American elm	3	6	All	Native tree that was the pride of most Neb. communities until Dutch elm disease nearly wiped it out. New cultivars such as >Liberty= show promise of disease resistance.
<i>Ulmus</i> x > <i>Homestead</i> = homestead elm	3	6	All	Cross between smoothleaf elm and Siberian elm; Dutch elm disease resistant; 45= spread.
<i>Ulmus</i> x > <i>Pioneer</i> = pioneer elm	3	6	A,B,C	Cross between scotch elm and smoothleaf elm; resistant to Dutch elm disease; growing well in some locations; 50= spread.
<i>Ulmus pumila</i> Siberian elm	3	6	All	Fast growing but messy; short lived without extra attention; over-planted in the past; use only on difficult sites; 50= spread.

MEDIUM DECIDUOUS TREES: 25 - 45 FEET AT MATURITY

Scientific Name Common Name	Cultural Conditions	Zone	Remarks
<i>Acer campestre</i> hedge maple	3 6	A,B,C	Good on dry sites; dark green summer color; look for a northern seed source; good for screening; 25= spread.
<i>Acer grandidentatum</i> bigtooth maple	3 6	All	Small to medium landscape tree with beautiful orange to orange-red fall color; native to the Rocky Mountain region; needs more testing in Neb.; 25= spread.
<i>Acer negundo</i> boxelder maple	3 5	All	Decent park tree; native along creeks; susceptible to storm damage; limited use; >Flamingo= is a variegated cultivar; 60= spread.
<i>Aesculus flava (octandra)</i> yellow buckeye	2 6	All	Similar to Ohio buckeye; yellow flowers; smooth fruit; nice pumpkin color in the fall; 35= spread.
<i>Aesculus glabra</i> Ohio buckeye	2 6	All	Nice white flowers in the spring; large prickly fruit; native to S.E. Neb.; 35= spread.
<i>Aesculus hippocastanum</i> horsechestnut	2 6	All	Dark green summer foliage; large, spiny fruit; nice pyramidal form; ABAumannii= is a fruitless cultivar with double white flowers; 40= spread.
<i>Alnus glutinosa</i> common alder	1 5	All	Adaptable to wet sites; cone-like fruit; may winterkill on exposed sites; 35= spread.
<i>Alnus incana</i> white alder	2 5	All	Similar to common alder; short-lived; 30= spread.
<i>Betula nigra</i> river birch	1 6	A,B,C	Excellent tree for multiple purposes; beautiful peeling bark; often chlorotic on disturbed sites; 30= spread.
<i>Betula papyrifera</i> paper birch	2 6	All	White bark; borers a serious problem; can be useful in sheltered areas; >Niobrara= is a native Neb. selection; 40= spread.
<i>Betula pendula</i> European white birch	2 6	All	Lovely weeping habit; white bark; chlorosis and borers are serious problems; short-lived; spread 30=; >Gracilis= is a cutleaf form that grows 20= tall.
<i>Betula platyphylla</i> Asian white birch	2 6	A,B,C	Similar to other white-barked birches; >Whitespire= is a cultivar that has shown good resistance to bronze birch borer; 30= spread.
<i>Carpinus betulus</i> European hornbeam	2 5,6	A,B	Wide variety of cultivated forms; usually an upright formal tree; 30= spread.
<i>Catalpa bignonioides</i> southern catalpa	2 6	A,B	Smaller, less hardy relative of northern catalpa; 30= spread.
<i>Cercidiphyllum japonicum</i> katsuratree	2 5,6	A,B	Lovely spreading tree; has some difficulty in our climate; 40= spread.
<i>Cladrastis kentukea (lutea)</i> American yellowwood	2 5,6	A,B,C	Nice informal tree; profuse white, fragrant flowers in June; 25= spread.

<i>Corylus colurna</i> Turkish filbert or hazel	3	6	All	Good but uncommon landscape tree; prefers well-drained, loamy soil; can withstand hot sites; drought tolerant; 35= spread.
<i>Diospyros virginiana</i> common persimmon	2	5	A,B,C	Nice informal shape; edible fruit; needs protection; 25= spread.
<i>Elaeagnus angustifolia</i> Russian olive	3	6	All	Silver summer leaf color; short-lived; good for difficult sites where little else grows; has invaded Neb. waterways; 25= spread.
<i>Evodia daniellii</i> Korean evodia	2	5,6	A,B,C	Unusual and uncommon tree; compound leaves similar to ash; nice specimens at Arbor Lodge; 25= spread.
<i>Fraxinus nigra*</i> black ash	2	6	All	Extremely hardy ash. >Fallgold= is a seedless, clean and disease free form with good golden fall color.
<i>Ginkgo biloba</i> ginkgo (maidenhair tree)	3	6	A,B,C	Very resistant to pests; unusual leaves; male preferred (female seed malodorous); 30= spread; >Sentry= is a columnar variety (10=-15= wide).
<i>Juglans cinerea</i> butternut	2	6	A,B,C	Plant in well-drained, bottomland soil; needs protection in western Neb.; 30= spread.
<i>Juglans regia</i> English walnut	2	6	A,B	Good nut tree for home use; can winterkill in extreme winters; 30= spread.
<i>Koelreuteria paniculata</i> goldenraintree	2	6	A,B	Unusual tree with yellow flowers in late May; prolific raindrop-like yellow fruit in late summer; makes a nice specimen tree; 30= spread.
<i>Larix laricina</i> American larch (tamarack)	2	6	A	Deciduous conifer; excellent fall color; needs protection; 20= spread.
<i>Maclura pomifera</i> Osage-orange (hedge tree)	3	6	A,B,C	Spurs and large fruit; good for wildlife but not an ideal landscape tree; >Park= is a thornless variety more suited to the landscape; 35= spread.
<i>Magnolia acuminata</i> cucumbertree magnolia	2	6	A,B	Unusual tree for Neb.; pale green flowers in the spring; 35= spread.
<i>Morus alba</i> white mulberry	2	5	All	Birds love the fruit; should be limited to wildlife and natural plantings; 45= spread.
<i>Morus rubra</i> red mulberry	2,3	5	All	Native Neb. mulberry; better than white mulberry; limited use recommended; can be invasive and weedy; 45= spread.
<i>Nyssa sylvatica</i> black gum	2	5,6	A	Beautiful fall color; does not tolerate alkaline soils; hard to transplant; 45= spread.
<i>Paulownia tomentosa</i> royal paulownia	2	6	A	Very large simple leaves similar to catalpa; needs protection; more of an oddity than a useful tree; 30= spread.
<i>Phellodendron amurense</i> amur corktree	2,3	5,6	All	A good specimen tree with unusual bark and attractive leaves; 30= spread.
<i>Populus tremuloides</i> quaking aspen	2	6	All	Native to the Pine Ridge area; nice yellow fall color; good as multi-stemmed form; some insect problems common; short-lived; 25= spread.
<i>Prunus sargentii</i> sargent cherry	2	6	All	One of the best large cherry trees for general landscape use; 30= spread.
<i>Prunus serotina</i> black cherry	2	5,6	A,B,C	Good for birds; native to southeastern Neb.; mid-spring flowers and fruit; 25= spread.
<i>Pyrus calleryana</i> callery pear	2	6	A,B,C	Very formal; lustrous dark green leaves; white flowers; good fall color; overplanted. Suitable cultivars include: >Aristocrat=, >Chaniclear= and >Redspire=; avoid >Bradford=; 25= spread.

<i>Quercus marilandica</i> blackjack oak	2	6	A,B	Native to southeast Neb.; interesting habit with stout branches; good choice for sandy soils; 25= spread.
<i>Robinia pseudoacacia</i> black locust	3	6	All	Very informal tree; small thorns; fragrant flowers; use on tough sites and for naturalizing; 30= spread.
<i>Salix pentandra</i> laurel willow	1	6	All	Shiny green foliage; good for wet sites; short-lived; 30= spread.
<i>Sophora japonica</i> Japanese pagodatree	2	6	A,B,C	Good summer flowering habit; can die back in severe winters; canker can be a problem; 30= spread.
<i>Sorbus aucuparia</i> European mountainash	2	6	All	Bright orange berries in fall; fireblight can be a severe problem; short-lived; 25= spread.
<i>Sorbus thuringiaca</i> oakleaf mountainash	2	6	All	A nice mountainash with oak-like leaves; seems to be less susceptible to fireblight; 30= spread.
<i>Ulmus parvifolia</i> Chinese elm	3	6	A,B	Unusual mottled bark; can winterkill in Neb.; very nice tree when established; 45= spread.
<i>Ulmus rubra</i> red elm (slippery elm)	2	6	All	Close relative of the American elm; native to eastern Neb.; not readily available; susceptible to Dutch elm disease; 50= spread.
<i>Ulmus thomasii</i> rock elm	2	5	A,B,C	Native to eastern Neb.; very tough wood; not readily available; susceptible to Dutch elm disease; 50= spread.
<i>Zelkova serrata</i> Japanese zelkova	2	5	A,B	Interesting bark; can be susceptible to frost damage and winterkill; closely related to the elm family; 40= spread.

* All ash species (*Fraxinus* species) are predisposed to attack from emerald ash borer. This invasive pest has killed millions of ash trees in the Great Lakes Region and is spreading across the United States. It is anticipated that this pest will soon be in Nebraska and as such the selection and planting of ash trees is discouraged.

SMALL DECIDUOUS TREES: LESS THAN 25 FEET AT MATURITY

Scientific Name Common Name	Cultural Conditions		Zone	Remarks
<i>Acer glabrum</i> Rocky Mountain maple	3	6	C,D,E	Native to the Pine Ridge area; tolerates alkaline, rocky soils; prefers higher elevations; 25= spread.
<i>Acer griseum</i> paperbark maple	2	5	A,B	Exfoliating bark reveals a trunk of beautiful cinnamon color; 25= spread.
<i>Acer palmatum</i> Japanese maple	2	5	A	Lovely smaller tree; needs protection; 15= spread.
<i>Acer tataricum</i> tatarian maple	3	6	All	Very similar to Amur maple; may be better for western Neb.; 15= spread.
<i>Acer truncatum</i> shantung maple	2	6	All	Lovely spring and fall color; needs protection in western Neb.; 25= spread.
<i>Amelanchier arborea</i> downy serviceberry	2	5,6	All	Large shrub or small tree; showy flowers; seldom seen in Neb.; 15= spread.
<i>Amelanchier</i> × <i>grandiflora</i> apple serviceberry	2	6	All	Nice small tree with edible fruit and good fall color. >Autumn Brilliance= and >Robin Hill= are nice cultivars with good fall color; 15= spread. 1998 Nebraska Tree of the Year.
<i>Asimina triloba</i> common pawpaw	2	4,5	A,B,C	Interesting tree with unusual banana-like fruit and brown-red flowers; cultivar >Sunflower= has better fruit production; 15= spread.
<i>Betula occidentalis</i> water birch	2	5	All	Handsome, reddish brown bark; nice tree; especially good for western Neb.; native to the Pine Ridge area; 25= spread.
<i>Carpinus caroliniana</i> American hornbeam	2	4,5	All	Shade tolerant; understory tree; very interesting, sinewy bark; 20= spread.
<i>Cercis canadensis</i> eastern redbud	2	5	All	Eastern Neb. native with beautiful rosy-pink flowers in early spring; lovely natural habit; prefers some shade; 25= spread.
<i>Chionanthus retusus</i> Chinese fringetree	2	6	A	Small tree or large shrub; showy flowers; seldom seen in Neb.; 15= spread.
<i>Chionanthus virginicus</i> white fringetree	2	6	A,B,C	Similar to <i>C. reusus</i> but hardier; very refined with beautiful, fragrant flowers; needs protection from desiccating winter winds; 15= spread.
<i>Cornus alternifolia</i> pagoda dogwood	2	5	A,B,C	Large shrub or small tree; nice layered habit; prefers some shade; 20= spread.
<i>Cornus florida</i> flowering dogwood	2	5	A	Common in eastern U.S.; limited use in Neb.; must have protection; shade tolerant; 10= spread.
<i>Cornus kousa</i> Kousa dogwood	2	5	A,B	Large shrub or small tree; beautiful when in flower but needs protection in Neb.; hardier than <i>C. florida</i> ; 15= spread.

<i>Cornus mas</i> corneliancherry dogwood	3	6	All	Large shrub or small tree; one of the earliest to flower (yellow); good for foundation plantings; attractive bark; 15= spread.
<i>Cotinus coggygia</i> common smoketree	2	6	A,B,C	Large shrub/tree; showy, smoke-like flowers June through August; limited use; several cultivars with purple leaves and purple-red flowers; 15= spread.
<i>Cotinus obovatus</i> American smoketree	2	6	A,B,C	Similar to <i>C. coggygia</i> ; very ornamental leaves; 15= spread.
<i>Crataegus crusgalli</i> cockspur hawthorn	3	6	All	Very thorny; avoid in areas where children may play; nice flowers and shiny foliage; 20= spread.
<i>Crataegus crusgalli</i> var. <i>inermis</i> thornless cockspur hawthorn	3	6	All	Thornless variety of the species; good throughout the state; 20= spread.
<i>Crataegus laevigata</i> English hawthorn	2	6	A,B,C	Flowers in spring; persistent fruit; >Crimson Cloud= and >Paul=s Scarlet= are good cultivars; 20= spread.
<i>Crataegus laevigata</i> var. <i>superba</i> crimson glory hawthorn	2	6	A,B,C	Brilliant crimson flowers; fine texture; unusual upright habit; 20= spread.
<i>Crataegus x lavalleyi</i> Lavalley hawthorn	2	6	All	Dense crown with orange to red fall color; good screen/border plant; 20= spread.
<i>Crataegus x mordenensis</i> >Snowbird= snowbird hawthorn	2	6	All	>Snowbird= is a selection with double white fragrant flowers in spring; good screen/border plant; 20= spread.
<i>Crataegus phaenopyrum</i> Washington hawthorn	2	6	All	Very thorny; dense crown; nice flowers and showy fruit; good tree for screening and fall color; 25= spread.
<i>Crataegus viridis</i> green hawthorn	2	6	All	>Winterking= is a selection with good fall color and fruit; may need protection in western Neb.; 25= spread.
<i>Euonymus bungeanus</i> winterberry euonymus	3	6	All	Rich pink fruit; very hardy small tree; scale can be a problem; 15= spread.
<i>Hamamelis virginiana</i> common witchhazel	2	56	A,B	Large shrub or small tree; interesting yellow flowers in late fall; needs consistent moisture; 15= spread.
<i>Maackia amurensis</i> Amur maackia	3	6	All	Nice small tree; flowers in late summer; attractive bronze colored bark; 20= spread.
<i>Magnolia x soulangiana</i> saucer magnolia	2	6	A,B,C	One of the best large magnolias for Neb.; large, early white flowers; 25= spread.
<i>Magnolia x loebneri</i> Loebner magnolia	2	6	A,B,C	Finer texture than saucer magnolia; early white flowers; can die back in severe winter; 20= spread. >Dr. Merrill= is a common cultivar.
<i>Malus spp.</i> flowering crabapple	3	6	All	Many crabapple cultivars are available for the landscape. Select from disease resistant varieties that include: >Adams= >Donald Wyman= >Indian Magic= >Indian Summer= >Liset= >Mary Potter= >Pinkspires= >Prairifire= >Red Jade=

White flowers; red persistent fruit; 15= spread.
Clean, green foliage; white flowers; 20= spread.
Pink flowers; small persisting orange fruit; 15= spread.
Red flowers; good selection; 15= spread.
Red flowers; persistent red fruit; purple-green leaves; 15= spread.
White flowers; dense crown to 15= tall; 15= spread.
Pink flowers with and upright growth habit; 15= spread.
Dark pink flowers; upright habit; very disease resistant; 15-20= spread.
White flowers; unique weeping habit; to 15= tall; 15= spread.

>Red Snow=				Pink flowers; red persistent fruit; only 10= tall; 15= spread.
>Sargent=				White flowers; shorter variety; small fruit; good for wildlife; 10= spread.
>Snowdrift=				Profuse white flowers; dense crown; small fruit; 20= spread.
>Sugartyme=				Wine-colored leaves in summer; 20= spread.
>Tina=				White flowers; very small tree - only 5= tall.
>Velvet Pillar=				Columnar variety with red foliage; disease resistant; 10= spread.
>White Candle=				White flowers; columnar; makes a nice screen; to 15= tall; 10= spread.
>Zumi Calocarpa=				Nice white flowers; 20= spread.
<i>Metasequoia glyptostroboides</i> dawn redwood	2	6	A	Soft foliage; nice fall color; deciduous conifer; needs consistent moisture; 25= spread.
<i>Ostrya virginiana</i> hophornbeam	3	5	All	Good native for tough sites; does well in narrow spaces; shade tolerant; 15= spread.
<i>Parrotia persica</i> Persian parrotia	2	56	A,B,C	Nice tree with good fall color and exfoliating bark; similar to witchhazel; 20= spread.
<i>Prunus cerasifera</i> Newport purple leaf plum	2	6	All	Purple foliage in the summer; short-lived tree but good while it lasts; 25= spread. >Newport= is a common cultivar.
<i>Prunus maackii</i> Amur chokecherry	3	6	All	Pyramidal in youth; very nice, shiny, exfoliating bark; 25= spread.
<i>Prunus padus</i> European birdcherry	2	6	All	One of the earliest to leaf out; good for wildlife; can sucker profusely; >Summer Glow= is a non-suckering cultivar with red-purple leaves; 20= spread.
<i>Prunus virginiana</i> chokecherry	3	6	All	Nice small native tree; good for wildlife; foliage turns from green to purple; suckering; plant in masses; good for tough sites; 10-15=h x 10-15=w. >Shubert= and >Canada Red Cherry= are common cultivars with wine colored leaves.
<i>Ptelea trifoliata</i> wafer-ash	2	5	All	Small native tree; tolerates shade; 15= spread.
<i>Quercus gambelii</i> Gambel=s oak	3	6	B,D,E	Large shrub or small tree; thicket forming; good for wildlife; drought tolerant; especially good for western Neb.; 15= spread.
<i>Robinia neomexicana</i> New Mexico locust	3	6	B,D,E	Large shrub or small tree; thicket forming; nice purple flowers; drought tolerant; similar to black locust but smaller in stature; 15= spread.
<i>Sassafras albidum</i> common sassafras	2	5	A	Nice fall color; can die back in severe winters; needs protection; 25= spread.
<i>Syringa pekinensis</i> pekin lilac	3	6	All	Similar to Japanese tree lilac but slightly smaller and more informal; 20= spread.
<i>Syringa reticulata</i> Japanese tree lilac	3	6	All	Nice, small tree; good in mass or as a screen; white flowers in June; 15= spread.
<i>Viburnum lentago</i> nannyberry	3	56	All	Nice native plant; usually planted as a large shrub; good fall color; 15= spread.
<i>Viburnum prunifolium</i> blackhaw viburnum	2	56	All	Similar to <i>V. lentago</i> with smaller leaves and slightly more refined appearance; 15= spread.
<i>Viburnum rufidulum</i> rusty blackhaw viburnum	2	56	A,B,C	Handsome plant similar to <i>V. prunifolium</i> but with more leathery foliage; 15= spread.

Xanthoceras sorbifolium
shineyleaf yellowhorn

2

5

A,B,C

Tolerant of alkaline soils and cold winters; yellow flowers in May; 25=
spread.

LARGE EVERGREEN TREES: MORE THAN 25 FEET AT MATURITY

Scientific Name Common Name	Cultural Conditions	Zone	Remarks
<i>Abies balsamea</i> balsam fir	2 6	A,B,C	Lovely color; plant in groups; very narrow, to 50= tall; 20= spread.
<i>Abies concolor</i> concolor fir (white fir)	3 6	All	Nice alternative to blue spruce; silver green color; avoid windy sites; to 50= tall; 30= spread.
<i>Picea abies</i> Norway spruce	2 6	All	Stately evergreen with pendulous branches; fairly fast growing; to 50= tall; 35= spread.
<i>Picea engelmannii</i> Engelmann spruce	2 6	All	Not as adaptable as other spruces; 25= spread.
<i>Picea glauca</i> white spruce	2 6	All	More upright than Norway spruce; to 50= tall; 25= spread.
<i>Picea glauca</i> var. <i>densata</i> Black Hills spruce	3 6	All	Native to Black Hills; more compact than the species; slow grower to 40= tall; 25= spread.
<i>Picea omorika</i> Siberian spruce	2 6	All	Graceful tree with drooping branches; needs testing in Neb.; to 50= tall; 25= spread.
<i>Picea pungens</i> Colorado spruce	3 6	All	Variable in color; slow growing; grows quite tall to 60=; does very well across Neb.; 30= spread.
<i>Picea pungens</i> var. <i>glauca</i> Colorado blue spruce	3 6	All	Variety of the species with blue/silver-green foliage; 30= spread. Many nice cultivars including: <ul style="list-style-type: none"> >Fat Albert= Compact, broad-based form; good blue-green color; 30= spread. >Hoopsii= Dense, compact form; very blue-white (glaucus) foliage; 20= spread. >Iseli Foxtail= Bushy blue twisted new growth; may be more heat tolerant; 20= spread. >Moerheimii= Dense, compact, irregular form; nice blue-white foliage; 20= spread. >Thompsenii= Symmetrical & compact; nice silver-blue foliage; 20= spread.
<i>Pinus banksiana</i> jack pine	3 6	All	Very unrefined, often shrubby; good on tough, dry, sandy sites; 25= spread.
<i>Pinus bungeana</i> lacebark pine	2 6	A,B,C	Unusual mottled bark; ice and snow can cause breakage; prefers protected sites; 25= spread.
<i>Pinus cembra</i> Swiss stone pine	2 6	All	Picturesque and hardy pine; seldom seen in the landscape; avoid highly alkaline soils; 20= spread.
<i>Pinus flexilis</i> limber pine	3 6	All	Native to Kimball county; soft foliage with flexible branches; nice specimen tree; >Vanderwolf= is a common cultivar with blue coloring; 25= spread.
<i>Pinus koraiensis</i> Korean pine	3 6	All	Seldom seen evergreen; plant as a specimen or in groups; very cold hardy; 20= spread.

<i>Pinus monticola</i> western white pine	3	6	All	Similar to <i>P. strobus</i> ; not a common landscape plant, hard to find; 25= spread.
<i>Pinus nigra</i> Austrian pine	3	6	All	Multiple-use evergreen; susceptible to leaf and tip blight; becoming overplanted; 45= spread.
<i>Pinus ponderosa</i> ponderosa pine	3	6	All	Long needles; more disease resistant than Austrian pine; native to western Neb.; 35= spread.
<i>Pinus resinosa</i> red pine	2	6	A,B,C	Good on north slopes; low survival rate; 30= spread.
<i>Pinus strobiformis</i> southwestern white pine	3	6	A,B,C	Similar to white pine but not as hardy; needs testing in Neb.; 35= spread.
<i>Pinus strobus</i> eastern white pine	2	6	All	A beautiful pine with soft foliage; adaptable to most Neb. communities; avoid windy and open sites; spread 45=. >Fastigiata= is an upright cultivar (about 20= wide).
<i>Pinus sylvestris</i> Scotch pine	3	6	All	Very common landscape tree and Christmas tree; mature tree has nice orange bark; small cones; picturesque crown; avoid sheared >leftover= Christmas trees; 45= spread.
<i>Pseudotsuga menziesii</i> Douglas fir	2	6	All	Very adaptable tree; nice blue color; unusual cones; graceful tree; not a true fir; 35= spread.

MEDIUM AND SMALL EVERGREEN TREES: LESS THAN 25 FEET AT MATURITY

Scientific Name Common Name	Cultural Conditions	Zone	Remarks
<i>Ilex opaca</i> American holly	2 4,6	A	Nice tree-form holly; should only be planted in urban areas with suitable micro-climates; spread 15=.
<i>Juniperus chinensis</i> Chinese juniper	3 6	All	Other cultivars of <i>J. chinensis</i> worth planting include: >Keteleerii= >Robusta Green= >Spartan= >Spearmint= Makes a nice informal screen; spread of 10-15=. Brilliant green foliage; handsome, irregular form; 10= spread. Fast, dense grower; rich green color; 10 - 15= spread. Dense, upright habit to 15= tall; bright green; 5= spread.
<i>Juniperus scopulorum</i> Rocky Mountain juniper	3 6	All	Drought tolerant native to western Neb.; 10-15= spread; better adapted to western Neb.; many nice cultivars including: >Cologreen= >Gray Gleam= >Greenspire= >Pathfinder= >Skyrocket= >Sutherland= >Wichita Blue= Blue-green foliage; very formal shape; nice tree; 15= spread. Blue-gray foliage holds color well in the winter; 5 -10= spread. Dense, dark green foliage; tall; very hardy; 5 - 10= spread. Blue-silver foliage; extremely hardy and drought tolerant; 10= spread. Very narrow, upright form; silvery-blue foliage; 5= spread. Very attractive silver-green foliage; 10= spread. Blue foliage; upright; does better in western Neb.; 10= spread.
<i>Juniperus virginiana</i> eastern redcedar	3 6	All	Native cedar; good selection for wildlife; susceptible to rust; 10-20= spread; cultivars include:. >Canaertii= >Hillspire= >Manhattan Blue= >Taylor= Irregular form; very picturesque; susceptible to rust; 20= spread. Dark green foliage on a narrow, pyramidal form; 10= spread. Compact; nice blue-green foliage; 15= spread. Very narrow; native Neb. selection; obtain through NSA; 5= spread.
<i>Pinus aristata</i> bristlecone pine	3 6	All	Picturesque; slow growing; very drought tolerant; excellent in western Neb.; 15= spread.
<i>Pinus cembroides</i> var. <i>edulis</i> pinyon pine	3 6	All	Edible seeds; very good on dry sites; 20= spread.
<i>Taxus cuspidata</i> Japanese yew	2 5	All	>Capitata= is an upright form; can be pruned for formal appearance; shade tolerant; avoid hot sites; not adaptable to western Neb.; 10= spread.
<i>Taxus x media</i> Anglojap yew	2 5	All	AHicksii= is an upright form; good for formal landscape; shade tolerant; needs more protection in western Neb.; max. ht. 15= and up to a 10= spread.
<i>Thuja occidentalis</i> American arborvitae	2 5	All	Nice evergreen with feathery foliage; susceptible to wind, snow and ice damage; >Mission Hills= (Techy) nice, broad-based cultivar; 10= spread.
<i>Thuja orientalis</i> Oriental arborvitae	2 5	A,B	Needs protection; good for foundation plantings; 10= spread.

Tsuga canadensis 2 6 A,B Graceful evergreen; needs protection; moist, well drained sites; 25= spread.
Canadian (eastern) hemlock

EVERGREEN SHRUBS

Scientific Name Common Name	Cultural Conditions	Zone	Remarks	
<i>Buxus microphylla</i> var. <i>koreana</i> Korean boxwood	2	4,5	A,B	Formal, low, fine-textured broadleaf evergreen. >Wintergreen= is a good cultivar; 2-3=h x 2-3=w.
<i>Buxus sempervirens</i> common boxwood	2	4,5	A,B	Similar to <i>B. microphylla</i> but not as hardy; needs protection; 4-6= h x 3-5= w.
<i>Euonymus fortunei</i> wintercreeper euonymus	2	5	All	Usually a spreading broadleaf evergreen but >Sarcoxie= is a more upright variety; can withstand renewal pruning; 3-4=h x 4-8=w.
<i>Ilex</i> spp. evergreen holly	2	4,5	A,B	There are several hardy evergreen hollies worth considering for protected areas; the Merserve series including >Blue Boy=, >Blue Girl=, China Boy, China Girl and Blue Stallion are most commonly planted; include a male cultivar to ensure fruit production.
<i>Juniperus chinensis</i> Chinese juniper	3	6	All	Common evergreen landscape shrub; many cultivars available including: >Armstrong= >Mint Julep= >Nick=s Compact= >Pfitzeriana= - Pfitzer >Sargent= >Seagreen=
<i>Juniperus communis</i> common juniper	3	5,6	All	Common spreading type. Brilliant mint-green foliage; fountain-like appearance; 4=h x 5=w. Compact variety of Pfitzer; 3=h x 6w. Can grow quite large - typically reaches 6=h x 12=w. Low, spreading habit; blue-green foliage; 2=h 8=w. Cultivated from <i>J. chinensis</i> var. <i>sargentii</i> . Dark green foliage; fountain-like appearance; up to 6=h x 7=w.
<i>Mahonia aquifolium</i> Oregon grapeholly	2	5	A,B	Very hardy; native to northwest Neb.; tolerates some shade; good on sandy soils and difficult sites; 3-5=h x 8-12=w.
<i>Mahonia repens</i> creeping mahonia	2	5	All	Holly-like leaves that turn purple-red in the fall; needs protection from winter winds; prefers partial shade; 6=h x 3-5=w; >Compactum= grows to 3= high.
<i>Mahonia repens</i> creeping mahonia	2	5	All	Native evergreen to semi-evergreen; grows to about 1=h; spreads by underground stems; purple leaves in winter.
<i>Picea pungens</i> x >Montgomery= Montgomery Colorado spruce	3	6	All	>Montgomery= is a dwarf form of Colorado spruce; nice blue color; 5-6=h x 6-7=w. >Glauca Globosa= is a similar dwarf variety growing to about 3=h x 4=w.
<i>Pinus mugo</i> mugo pine	3	6	All	Nice landscape specimen; good alternative to junipers; can get quite large; 12- 20=h x 20=w. Variety >Compacta= will grow up to 4=h x 7=w.
<i>Pyracantha coccinea</i> firethorn	2	5	A,B	Broadleaf evergreen with bright red-orange fruit in the fall; choose a hardy variety; 6-12=h x 6-12=w.
<i>Rhododendron</i> spp. rhododendron cultivars	2	5	A,B,C	Broadleaf evergreen with showy flowers; prefers acid soils; choose from hardy cultivars including the >P.J.M.= series, 3-6=h.
<i>Taxus</i> x <i>media</i> Anglojap yew	2	5	A,B,C	Dense, shrub-like form; 3-4=h x 4-5=w; does well in the shade; needs protection to survive in zones D and E. Hardier cultivars include: >Everlow= (2=x4=), >Runyon= (3=x5=), >Sebian= (4=x8=), >Wardi= (4=x10=) and >Densiformis= (3=x5=).

<i>Thuja occidentalis</i> arborvitae	2	5	All	Several dense, globe shaped cultivars with dark green foliage; plant in protected location; including >Hetz=, >Aurea= and >Canadian Green=; reaches 2-3=h x 2-3=w.
<i>Yucca filamentosa</i> Adam=s needle yucca	2	5	All	Long sword-like evergreen leaves; tall stalk with showy, yellowish-white flowers in the summer.
<i>Yucca glauca</i> soapweed	3	5	All	Long, glaucous green leaves radiate from the center; tall flower spike from July - August; 2-3=h x 3-4=w.

LARGE DECIDUOUS SHRUBS: OVER 10 FEET TALL

Scientific Name Common Name	Cultural Conditions	Zone	Remarks
<i>Acer ginnala</i> Amur maple	3 6	All	One of the best small trees for Neb.; good fall color and drought tolerant; often multi-stemmed; can show chlorosis on high pH soils; 20= spread; >Flame= is a more compact cultivar with outstanding fall color; >Red Wing= has nice red fruit; >Bailey=s Compact= is slightly smaller growing 8-12=h x 8-12=w.
<i>Amelanchier alnifolia</i> Saskatoon serviceberry	2 5,6	All	Native to Neb.; tolerates alkaline soils; good for natural landscapes and attracting wildlife; 8-12=h x 8-10=w.
<i>Amelanchier arborea</i> downy serviceberry	2 5,6	All	Very large shrub or small tree; good in groups and for wildlife; good fall color; 18= spread.
<i>Amelanchier canadensis</i> shadblow serviceberry	1 5,6	A,B,C	Naturalistic planting; spring bloom; good fall color; edible fruit; moist sites; 10-20=h x 10-20=w.
<i>Amorpha frutcosa</i> indigobush amorpha	1,3 6	All	Native Neb. plant; good for tough sites where little else grows; 10-12=h x 8-10=w.
<i>Buddleia alternifolia</i> alternate-leaf butterflybush	2 6	A,B,C	Leggy shrub that is herbaceous in Neb.; showy purple flowers in August are very attractive to butterflies; 6-10= h x 8-10=w.
<i>Caragana arborescens</i> Siberian peashrub	3 6	All	Good on difficult sites; many cultivars including smaller ones; 15-20=h x 12-18=w.
<i>Cercocarpus ledifolius</i> curl-leaf mountain mahogany	3 6	C,D,E	Semi-evergreen; very cold hardy; better suited to western Neb.; 10-12=h x 6-10=w.
<i>Chionanthus retusus</i> Chinese fringetree	2 6	A	Small tree or large shrub; showy flowers; seldom seen in Neb.; 15= spread.
<i>Chionanthus virginicus</i> white fringetree	2 6	A,B,C	Similar to <i>C. reusus</i> but hardier; very refined with beautiful, fragrant flowers; needs protection from desiccating winter winds; 15= spread.
<i>Cornus kousa</i> Kousa dogwood	2 5	A,B	Large shrub or small tree; beautiful when in flower but needs protection in Neb.; hardier than <i>C. florida</i> ; 15= spread.
<i>Cornus mas</i> corneliancherry dogwood	3 6	All	Large shrub or small tree; early yellow flowers; good for foundation plantings; attractive bark; 12-18=h x 10-15=w.
<i>Cornus racemosa</i> gray dogwood	3 5,6	All	Native ; sprouts from the roots; good for wildlife; purple fall color; 8-12=h x 10-12=w.
<i>Corylus americana</i> American hazelnut	2 5,6	All	Edible nut; unusual flower; good for natural appearance; 10-12=h x 8-10=w.
<i>Cotinus coggygria</i> common smoketree	2 6	A,B,C	Large shrub/small tree; showy, smoke-like flowers from June to August; limited use; 10-15=h x 10-15=w.
<i>Cotinus obovatus</i> American smoketree	2 6	A,B,C	Large shrub or small tree; very ornamental leaves, bark and smoke-like flowers; 15-25=h x 10-20=w.

<i>Euonymus alatus</i> winged euonymus	2	4,6	All	Good in hedges or groups; nice red fall color and winter form; 8-12=h x 7-10= w; >Compactus= is a slightly smaller form.
<i>Euonymus atropurpureus</i> eastern wahoo	2	6	All	Nice native small tree or shrub; unusual red fruit and fall color; 10-15= h by 8-12= w.
<i>Euonymus bungeanus</i> winterberry euonymus	3	6	All	Large shrub or small tree; scale can be a problem; good on difficult sites; 10-18=h x 12-20=w.
<i>Exochorda spp.</i> pearlbush	2	5,6	All	Plants are covered with showy flowers in the spring; >The Bride= is a cultivar with blue-green foliage and pearl-like buds; 10-12=h x 10-12= w.
<i>Hamamelis virginiana</i> common witchhazel	2	5,6	A,B,C	Unique large shrub or small tree that flowers in late fall (November and December); needs consistent moisture; 10-14=h x 12-15=w.
<i>Hippophae rhamnoides</i> sea buckthorn	2	6	All	A hardy shrub; tolerant of poor soil and sea spray; silver foliage; 8-12=h x 10-15=w.
<i>Hydrangea paniculata</i> panicle hydrangea	2	5,6	All	Large shrub or small tree; very coarse with large white flowers; use with discretion; 10-15=h x 10-12=w; >Grandiflora= or >PeeGee= are common cultivars with very full blooms.
<i>Ligustrum amurense</i> Amur privet	3	6	All	Common hedge plant; withstands frequent and severe pruning; good for screens; 10-15=h x 8-12=w.
<i>Ligustrum obtusifolium</i> border privet	3	5	A,B	Commonly used border shrub; good for screens and hedges; 10-12=h x 8-10=w.
<i>Lonicera maackii</i> Amur honeysuckle	2	5,6	All	White flowers; very large; 10-12=h x 8-10=w.
<i>Lonicera tatarica</i> tatarian honeysuckle	2	6	All	Pink white flowers; aphids can be a problem making it inferior to most shrubs; 8-12=h x 10-15=w.
<i>Prunus americana</i> American plum	3	6	All	Large shrub or small tree; suckering; plant in masses; good for difficult sites and attracting wildlife; 10-15=h x 10-20=w.
<i>Prunus tomentosa</i> nanking cherry	2	6	All	Early white, fragrant flowers (mid-April); shiny, exfoliating bark; good in groups; makes a good windbreak; 8-12=h x 10-15=w.
<i>Prunus virginiana</i> chokecherry	3	6	All	Large shrub or small tree; suckering; plant in masses; good for tough sites; 10-15=h x 10-15=w. >Canada Red Cherry= is a common cultivar with wine colored leaves.
<i>Quercus gambelii</i> Gambel=s oak	3	6	B,D,E	Large shrub or small tree; thicket forming; good for wildlife; drought tolerant; 8-15=h x 10-15=w.
<i>Rhamnus cathartica</i> common buckthorn	3	5,6	All	Good as a screen/border; good in difficult sites; 12-18=h x 12-18=w.
<i>Rhamnus frangula</i> glossy buckthorn	3	5,6	All	Large gangly shrub with lustrous, dark green leaves; 8-12=h x 4-12=w. >Asplenifolia= is a narrow cultivar with very narrow and irregular leaves - much better than the species. >Columnaris= is a very narrow type that makes a nice, dense screen (10-12=h x 4-6=w), often referred to as tallhedge buckthorn.
<i>Rhus copallina</i> flameleaf (shining) sumac	3	6	A,B,C	Picturesque plant with good red fall color; least hardy of the sumacs for Neb.; reaches 10-15=h x 10-15=w.
<i>Rhus glabra</i> smooth sumac	3	6	All	Spreads from the roots; hardy; good fall color; 8-12=h x 6-12=w.

<i>Rhus typhina</i> staghorn sumac	3	6	All	Prominent seed heads; good fall color; suckers profusely; >Laciniata= is an ornamental variety with cut-leaf foliage; 12-18=h x 10-20=w.
<i>Robinia neomexicana</i> New Mexico locust	3	6	B,D,E	Large shrub or small tree; thicket forming; nice purple flowers; drought tolerant; 10-12=h x 10-12=w.
<i>Syringa vulgaris</i> common lilac	3	6	All	Fragrant flowers; many nice cultivars to choose from; 8-12=h x 8-12=w.
<i>Viburnum lantana</i> wayfaringtree	3	5	All	Good on hot sites; excellent fruit; >Mohican= is a compact cultivar (8= by 8=) with thick, dark green leaves and showy orange-red fruit; 10-15=h x 10-15=w.
<i>Viburnum lentago</i> nannyberry	3	5,6	All	Nice, native Neb. plant; fast growing and spreading; nice fall color; good in mass; 12-16=h x 6-10=w.
<i>Viburnum opulus</i> European cranberrybush viburnum	3	5,6	All	Vary adaptable viburnum; coarse texture; nice white flowers in May. Variety >Roseum= is the common snowball viburnum with large, showy flowers in May; aphids can be a problem; 8-14=h x 10-15=w.
<i>Viburnum plicatum</i> var. <i>tomentosum</i> doublefile viburnum	2	5,6	All	Lovely flowering viburnum; can be a very large plant; >Mariesii= is a common cultivar with magnificent flowers; some dieback in severe winters 8-12=h x 10-12=w.
<i>Viburnum prunifolium</i> blackhaw viburnum	3	5,6	All	Somewhat irregular in form; nice fall color; good when single stemmed; 12-15=h x 8-12=w.
<i>Viburnum rufidulum</i> rusty blackhaw viburnum	2	5,6	A,B,C	Handsome plant similar to <i>V. prunifolium</i> but with more leathery foliage; 15= spread.
<i>Viburnum sargentii</i> sargent viburnum	2	5,6	All	Similar to <i>V. opulus</i> but more open; resistant to aphids; very coarse texture; 12-15=h x 12-15=w. >Onondaga= is a very nice 6-8= selection with good flowers and fall color.
<i>Viburnum sieboldii</i> siebold viburnum	2	5,6	All	Nice specimen; almost tree-like; very coarse; 12-18=h x 10-15=w.
<i>Viburnum trilobum</i> American cranberrybush viburnum	2	5,6	All	Better fall color and fewer aphid problems than <i>V. opulus</i> ; very coarse; nice white flowers in May. Variety >Wentworth= was selected for its excellent fruit and fall color; 8-12=h x 8-12=w.

MEDIUM DECIDUOUS SHRUBS: 5 TO 10 FEET TALL

Scientific Name Common Name	Cultural Conditions	Zone	Remarks
<i>Acanthopana x sieboldianus</i> fiveleaf aralia	3 5,6	All	Good on dry sites; thorny barrier; 5-10=h x 8-10=w.
<i>Aesculus parviflora</i> bottlebrush buckeye	2 5,6	A,B,C	Beautiful multi-stemmed flowering shrub with foliage like Ohio buckeye; 8-10=h x 8-10=w.
<i>Amelanchier alnifolia</i> >Regent= regent serviceberry	2 5,6	All	Excellent foliage and fruit; good for wildlife; 6-8=h x 6-8=w.
<i>Aronia arbutifolia</i> red chokeberry	2 5,6	A,B,C	Dark green leaves turning to red in the fall. >Brilliantissima= is a variety with lustrous green leaves, good fall color and better fruit; 6-8=h x 3-5=w.
<i>Aronia melanocarpa</i> black chokeberry	3 5,6	All	Very nice shrub; adaptable from dry to wet sites; red fall color and showy black berries; 4-6=h x 3-5=w. 1998 Nebraska Shrub of the Year.
<i>Berberis x mentorensis</i> mentor barberry	3 5,6	All	A nice hedge shrub; has sharp thorns; can winter kill; 4-6=h x 5-6=w.
<i>Calycanthus floridus</i> Carolina allspice	2 4,6	A,B	Nice shrub with interesting, fragrant flowers; needs protection in Neb.; 5-7=h x 5-8= w.
<i>Cephalanthus occidentalis</i> buttonbush	2 5,6	A,B	Unusual plant with coarse winter texture, globular flowers and interesting nutlet fruit from which it derives its name; 4-8=h x 4-8= w.
<i>Cercocarpus montanus</i> mountain mahogany	3 6	All	Native to western Neb.; semi-evergreen; very thick, interesting leaves; 5-7=h x 4-6=w.
<i>Chaenomeles speciosa</i> flowering quince	3 5,6	A,B,C	Thorny plant with red or white flowers in April; trash collector; 5-7=h x 4-6=w.
<i>Chrysothamnus nauseosus</i> rabbit brush	3 6	All	A dense native to western Neb. shrub; drought tolerant; good for difficult sites and native plantings; 5-6=h x 4-5=w.
<i>Clethra alnifolia</i> summersweet clethra	2 5,6	All	Nice plant for summer flower; underutilized in the landscape; 4-6=h x 4-6=w.
<i>Cornus alba</i> tatarian dogwood	2 5	All	Red stem in the winter; similar to redosier dogwood. >Variegata= is a common cultivar with variegated leaves - use with discretion; 7-10=h x 8-12=w.
<i>Cornus sericea</i> redosier (redtwig) dogwood	3 6	All	Red stems add winter color; good for wildlife; 7-9=h x 8-10=w. >Isanti= is a compact form; bright red stems for winter color; 4-6=h x 5-7=w.
<i>Cotoneaster acutifolia</i> Peking cotoneaster	3 5,6	All	Good for windbreaks and wildlife plantings; red fall color; 7-10=h x 8-10=w.
<i>Cotoneaster divaricatus</i> spreading cotoneaster	3 5,6	All	One of the best shrubs for Neb.; good foundation plant; fine texture; good for wildlife; 4-6=h x 5-8=w.
<i>Cotoneaster lucidus</i> hedge cotoneaster	3 5,6	All	Upright habit makes it useful as a hedge; 7-10=h x 5-7=w.

<i>Forsythia x intermedia</i> showy border forsythia	3	6	All	Yellow flowers in early spring ; use hardy northern selections; 7-10h x 8-12=w. >Meadowlark= >Northern Sun=
<i>Hamamelis vernalis</i> vernal witchhazel	2	5	A,B,C	Interesting plant with yellow-red flowers that bloom in late winter (February to March); 5-8=h x 6-10=w.
<i>Hibiscus syriacus</i> Rose-of-Sharon	2	6	A,B,C	Nice, late season flowers on an upright plant; choose a hardy cultivar. 4-8=h x 3-5=w.
<i>Ilex verticillata</i> winterberry	2	5	A,B,C	Good plant for wet areas; excellent in mass; prefers acid soils; need male and female plants to set fruit; reaches 6-10=h x 6-10=w; choose hardy cultivars like >Apollo=, >Sparkleberry=, and >Winter Red=.
<i>Ligustrum vulgare</i> privet	3	5	All	Large hedge; showy flowers and fruit; reaches 8-10=h x 8-10=w; >Cheyenne= is a common cultivar.
<i>Magnolia stellata</i> star magnolia	2	5,6	A,B	Fragrant white flowers; excellent spring color; beautiful plant for southeast Neb.; 5-8=h x 5-8=w.
<i>Philadelphus spp.</i> mockorange	2	6	All	Old fashioned shrubs planted for fragrance; wide size range from 3-10=h x 3-10=w; choose from improved cultivars including >Minnesota Snowflake= and >Miniature Snowflake=.
<i>Physocarpus opulifolius</i> common ninebark	3	5,6	All	Upright spreading shrub with exfoliating bark; 6-8=h x 6-8=w. >Dart=s Golden= is a compact cultivar with yellow-green foliage; 6=h x 6=w. Var. <i>intermedius</i> is a low growing, fine textured form (4=x4=); native to the Black Hills.
<i>Prunus besseyi</i> sand cherry	3	6	All	Native to the Sandhills and western Neb.; profuse white flowers; suckering; good fruiting shrub for tough sites; 4-6=h x 6-8=w.
<i>Rhus aromatica</i> fragrant sumac	3	6	All	Good for stabilizing banks; good fall color and wildlife habitat; native ; 4-6=h x 5-8=w.
<i>Rhus trilobata</i> skunkbush sumac	2	6	All	Closely related to fragrant sumac; good on calcareous soils and for screening; native to western Neb.; 3-6=h x 5-8=w.
<i>Ribes aureum</i> golden currant	3	5,6	All	Hardy native shrub with fragrant yellow flowers in spring; 5-6=w x 5-6=h.
<i>Ribes odoratum</i> clove currant	3	5,6	All	Very fragrant, yellow flowers in early April; takes on a ragged appearance with age; native to Neb.; 5-6=h x 5-6=w.
<i>Rosa foetida</i> brier rose	2	6	All	>Bicolor= (Austrian Copper) is a very old, hardy rose; brilliant copper-red flowers in May-June; 5-6=h x 4-5=w; >Persiana= is a cultivar with double yellow flowers.
<i>Rosa virginiana</i> Virginia rose	2	6	All	One of the best shrub roses for year-around interest; 4-6=h x 5-7=w.
<i>Rosa woodsii</i> wild rose	3	6	All	Native rose; good for naturalized plantings and erosion control; 5-6=h x 5-8=w.
<i>Sambucus canadensis</i> American elder (elderberry)	2	6	All	Good plant for naturalized areas; fruit is good for jellies and attracting birds; 5-12=h x 8-15=w.

<i>Shepherdia argentea</i> silver buffaloberry	3	6	All	Good on poor sites and rough areas; ornamental silver foliage; 6-10=h x 6-10=w.
<i>Shepherdia canadensis</i> russet buffaloberry	3	6	All	Silver foliage; very cold tolerant; 5-8=h x 5-8=w.
<i>Spiraea x vanhouttei</i> Vanhoutte spirea	2	6	All	Nice white flowers; can spread to 12=; good for parking lot screen; 6-8=h x 6-8=w.
<i>Syringa meyeri</i> meyer lilac	3	6	All	Dense, neat and good for uniform outline in summer and winter; spectacular flowers; often referred to as Dwarf Korean Lilac; 5-6=h x 5-6=w.
<i>Syringa microphylla</i> littleleaf lilac	2	6	All	Fragrant flowers; fine texture; similar to Meyer lilac; 6-8=h x 6-10=w.
<i>Syringa patula</i> manchurian lilac	3	6	All	Lilac-purple flowers; a very good small lilac for Neb.; 5-7=h x 5-6=w; >Miss Kim= is a common cultivar (3=x3=) with icy blue flowers.
<i>Syringa persica</i> Persian lilac	3	6	All	Purple flowers; nice small lilac; 6-8=h x 6-10=w.
<i>Syringa villosa</i> late lilac	3	6	All	Flowers later than other lilacs, usually around late May or early June; 6-8=h x 6-8=w.
<i>Viburnum x burkwoodii</i> burkwood viburnum	2	5,6	A,B,C	White aromatic flowers; glossy green leaves; >Mohawk= is a nice cultivar with heavy fragrance and ornamental flower heads; 8-10=h x 5-8=w.
<i>Viburnum x carlcephalum</i> fragrant viburnum	2	5,6	A,B,C	One of the most fragrant viburnums; not as refined as <i>V. carlesii</i> or <i>V. juddii</i> ; 6-10=h x 6-10=w.
<i>Viburnum carlesii</i> koreanspice viburnum	2	4,6	All	Very fragrant flowers; smaller viburnum; shade tolerant; needs protection in western Neb.; 4-6=h x 4-6=w.
<i>Viburnum dentatum</i> arrowwood viburnum	3	5	All	Beautiful dense form; tall and wide; >Chicago Lustre= is a good cultivar; 8-10=h x 8-12=w.
<i>Viburnum x juddii</i> judd viburnum	2	5	All	Very fragrant selection; may be superior to <i>V. carlesii</i> in Neb.; may need protection in western Neb.; 6-8=h x 6-10=w.
<i>Viburnum opulus</i> >Compactum= compact European cranberrybush viburnum	2	5	All	Dense, compact form that is superior to the species; course texture; 5-7=h x 5-7=w.
<i>Viburnum x rhytidophylloides</i> lantaphyllum viburnum	2	5	All	Outstanding selection with very dark green, leather-like and semi-evergreen leaves; showy fruit/flowers; 4-6=h x 4-6=w. >Alleghany= and >Willowood= are common cultivars.
<i>Viburnum setigerum</i> tea viburnum	2	4,6	A,B	Leggy viburnum with good fruit; once used for making tea; 6-10=h x 5-8=w.
<i>Viburnum trilobum</i> >Compactum= American cranberrybush	2	5	All	Excellent compact form of the species with good flower and fruit characteristics; very course. >Alfredo= is similar but with a denser, broader habit and nice red fall color. Both selections are superior to <i>V. opulus</i> types; 4-6=h x 4-6=w.
<i>Weigela florida</i> var. <i>venusta</i> old-fashioned weigela	2	5	All	Good foundation plant with nice lavender flowers that bloom all summer; poor winter form; choose a hardy cultivar; 5-8=h x 6-10=w; many dwarf cultivars available.

SMALL DECIDUOUS SHRUBS: LESS THAN 5 FEET TALL

Scientific Name Common Name	Cultural Conditions	Zone	Remarks
<i>Amorpha canescens</i> lead plant	3 6	All	Beautiful silver-gray foliage; good in combination with <i>Cercocarpus</i> species; excellent in the perennial garden; 3-4=h x 3-4=w.
<i>Amorpha nana</i> fragrant false indigo	3 5	All	Blue-green foliage; drought tolerant; most restrained <i>Amorpha</i> ; 3-4=h x 3-4=w.
<i>Berberis koreana</i> Korean barberry	3 5	All	Dark green foliage changing to reddish purple in fall; spiny; good barrier plant; 3-4=h x 3-4=w.
<i>Berberis thunbergii</i> Japanese barberry	3 4,6	All	Multiple use shrub; very thorny; >Kobold= is a good cultivar; var. <i>atropurpurea</i> >Redleaf= has red leaves through the summer and >Crimson Pygmy= is a nice, compact form with purple foliage; 2-3=h x 2-3=w.
<i>Cornus sericea</i> >Kelsey= redtwig dogwood	3 6	All	Low growing, compact form of the species; tolerates some shade; 1-2=h x 2-3=w.
<i>Cotoneaster apiculatus</i> cranberry cotoneaster	3 6	All	Low and wide spreading; often good fruit display; fire blight can be a problem; 2-3=h x 4-6=w.
<i>Forsythia viridissima</i> >Bronxensis= Bronx forsythia	3 6	All	Compact form; flowering is unreliable; 1-2=h x 2-4=w.
<i>Hydrangea arborescens</i> smooth hydrangea	2 5,6	All	Interesting shrub with large, showy flowers on long stems; should be treated as a perennial in Neb.; 3-4=h x 3-4=w. >Annabelle= is a cultivar with very large flowers (up to 1= across).
<i>Hydrangea quercifolia</i> oakleaf hydrangea	2 4,6	A,B	Very coarse shrub that often acts herbaceous in Neb.; interesting flaky bark; nice flower effect; 4-6=h x 4-6=w.
<i>Hypericum frondosum</i> golden St. Johnswort	2 6	A,B	Beautiful yellow flowers June through August; treat as a herbaceous plant; does well in protected locations with afternoon and evening sun; >Sunburst= is a proven cultivar; 2-3=h x 2-3= w.
<i>Hypericum kalmianum</i> kalm St. Johnswort	2 5	All	Yellow flowers on blue-green foliage; dense, uniform habit with fine twigs 2-3=h and 3-4=w.
<i>Hypericum prolificum</i> shrubby St. Johnswort	2 5,6	All	Good summer color from yellow flowers; good substitute for potentilla in eastern Neb.; 3-4=h x 3-4=w.
<i>Lonicera xylosteum</i> >Emerald Mound= emerald mound honeysuckle	3 5	All	Fine low growing shrub; 2-4=h x 3-5=w.
<i>Physocarpus opulifolius</i> >Nanus= dwarf ninebark	3 6	All	Dwarf form of the species; white or pink; 3-4=h x 3-5=w.
<i>Potentilla fruticosa</i> bush cinquefoil (potentilla)	3 6	All	Small shrub with yellow flowers that bloom all summer; performs better in western Neb.; 2-4=h x 3-4=w. Cultivars include >Abbottswood= and >McKay=s White, (white flowers); >Gold Drop=, >Jackman= and >Katherine Dykes=, (yellow flowers).

<i>Rhododendron spp.</i> azalea and rhododendron	2	4	A,B	Several varieties of azaleas and rhododendrons can be grown in eastern Neb. These plants are grown for their spectacular spring blooms and are either evergreen (rhododendrons) or deciduous (azaleas). Both need a shady, protected location with acid soils. The soil and care requirements make these a poor choice for low maintenance landscapes. Select hardy varieties such as the >P.J.M= and >Northern Lights= series.
<i>Rhus aromatica</i> >Gro-Low= fragrant sumac	3	6	All	Nice, low-spreading cultivar; good as a ground cover; 2-3=h x 8-12=w.
<i>Ribes alpinum</i> alpine currant	3	4	All	Very cold tolerant; shade tolerant; dwarf cultivars available; 2-4=h x 3-5=w.
<i>Rosa blanda</i> meadow rose	3	6	All	Light pink flowers; bright, showy fruit adds winter interest; suckering; very hardy; 3-4=h x 3-4=w.
<i>Rosa x >Nearly Wild</i> = nearly wild rose	3	6	All	Pink flowers; good in mass plantings; 2-4=h x 3-5=w.
<i>Rosa rugosa</i> rugosa rose	3	6		Beautiful flowers; nice red fruit; may be the best shrub species for landscape use; many nice cultivars including:
>Albo-plena=				White flowers; no fruit; 3-4=h x 3-4=w.
>Blanc Double de				Double white flowers; very fragrant; 4-5=h x 3-5=w.
>Frau Dagmar Hastrup=				Prolific bloomer; light pink flowers; very large, red fruit; 2-4=h x 3-5=w.
>Topaz Jewel=				Double yellow flowers that bloom all summer; 3-5=h x 5-6=w.
<i>Rosa setigera</i> prairie rose	3	6	All	Good flowers; spreading natural rose with good fruit and fall color; best in naturalized settings, along roadways; 3-4=h x 6-10=w.
<i>Sorbaria sorbifolia</i> Ural falsespirea	2	6	All	Foliage similar to mountainash; good in groups for bank stabilization; 3-5=h x 5-10=w.
<i>Spiraea x arguta</i> garland spirea	2	6	All	Profuse white flowers in May; fine texture; 4-5=h x 4-5=w.
<i>Spiraea xbumalda</i> Bumald spirea	2	6	All	One of the most popular shrubs for general landscape use; formal appearance; flowers in late May to June; 2-4=h x 3-5=w; many cultivars available including: >Froebelii=, >Crispa= and >Anthony Waterer=.
<i>Spiraea x cinerea</i> >Grefsheim= Grefsheim spirea	2	6	All	Profuse white flowers in April; superior to <i>S. x arguta</i> ; nice plant but little known; 3-5=h x 4-6=w.
<i>Spiraea x fritschiana</i> fritschiana spirea	3	6	All	White flowers in May-June; compact; very hardy; good for tough sites, 2-3=h x 3-4=w.
<i>Spiraea japonica</i> Japanese spirea	2	6	All	Quite variable with many suitable cultivars; >Little Princess= is a dwarf mound with pink flowers; good as groundcover or small hedge; 1-2=h x 2-3=w.
<i>Spiraea nipponica</i> >Snowmound= snowmound spirea	2	6	All	Profuse white flowers; blue-green foliage; better form and habit than <i>S. x vanhouttei</i> ; 3-4=h x 3-4=w.
<i>Spiraea x >Snow White</i> = snow white spirea	2	6	All	Nice white flowers in May; 3-4=h and 4-5=w.
<i>Spiraea trilobata</i> three-lobed spirea	3	6	All	Similar to <i>S. x vanhouttei</i> but slightly smaller; profuse white flowers in May; 4-5=h x 5-6=w.

<i>Symphoricarpos albus</i> snowberry	3	4,6	All	Good for a mass planting effect and white fruit; shade tolerant; native to western Neb.; 2-4=h x 3-6=w.
<i>Symphoricarpos occidentalis</i> western snowberry	3	4,6	All	Very similar to <i>S. alba</i> but slightly larger; fruit set not quite as reliable; native ; 3-4=h x 3-6=w.
<i>Symphoricarpos orbiculatus</i> indiancurrent coralberry	3	4,6	All	Purple-red coralberries along stems; yellow-white flowers; shade tolerant; 2-4=h x 3-8=w.
<i>Symphoricarpos x chenaultii</i> chenault coralberry	3	4,6	All	Good natural appearing spreader; pink fruit and flowers; shade tolerant; 2-4=h x 3-8=w. >Hancock= is a beautiful, low growing cultivar (2=h x 2=w).
<i>Viburnum opulus</i> >Nanum= dwarf European cranberrybush viburnum	2	5	All	Dwarf form of the species; seldom flowers; good filler plant; 2-3=h x 2-3=w.

GROUND COVERS

Scientific Name Common Name	Cultural Conditions	Zone	Remarks
<i>Cotoneaster adpressus</i> creeping cotoneaster	3 6	All	Similar to <i>C. horizontalis</i> ; showy dark fruit in late summer; 12 - 18@h x 4-6=w.
<i>Cotoneaster dammeri</i> bearberry cotoneaster	3 6	A,B,C	Nice semi-evergreen cover; 1=h x up to 10= w; >Coral Beauty= and >Skogholm= are popular cultivars.
<i>Cotoneaster horizontalis</i> rockspray cotoneaster	3 6	All	Excellent glossy dark green foliage; leaves hold until late fall; 2 - 3=h x 8 - 10=w.
<i>Euonymus fortunei</i> wintercreeper euonymus	2 4,6	All	Broadleaf evergreen; will need winter protection in west Neb.; 6@- 12@h and spreads widely; many cultivars available.
<i>Forsythia viridissima</i> >Bronxensis= Bronx forsythia	3 6	A,B,C	Shrub-like ground cover; flower buds often killed during winter; poor winter appearance; 1 - 2=h x 2 - 4=w.
<i>Juniperus chinensis</i> var. <i>sargentii</i> sargent juniper	3 6	All	One of the best spreading junipers; gray-green foliage; 18@ - 2=h x up to 8=w.
<i>Juniperus horizontalis</i> creeping juniper	3 6	All	Low spreading evergreen;; good for difficult sites; 6@ - 2=h x up to 10=w; many nice cultivars including: >Bar Harbor= >Blue Chip= >Wilton Carpet= >Andorra= >Prince of Wales=
<i>Juniperus procumbens</i> japgarden juniper	3 6	All	Nice ground cover; blue-green; very slow growing; may be difficult to establish; 6@- 2=h x up to 10=w.
<i>Juniperus sabina</i> savin juniper	3 6	All	Bright green; 18 - 24@h x 10=w or more; good cultivars include >Broadmoor= and >Buffalo=.
<i>Juniperus sabina</i> var. <i>tamariscifolia</i> tam juniper	3 6	All	Similar to >Broadmoor=; bluish green 2=h x 10=w.
<i>Mahonia repens</i> creeping mahonia	2 5	All	Native evergreen to semi-evergreen; spreads by underground stems; purple leaves in winter; about 1=h.
<i>Potentilla tabernaemontani</i> dwarf potentilla	3 6	All	Deciduous ground cover that forms low growing mats; prefers partial shade; may be better suited to western Neb; 3 - 6@h.
<i>Rosa wichuraiana</i> memorial rose	3 6	A,B,C	Low, sprawling rose; covered with white flowers in June; 12@h.
<i>Rosa</i> >Red Cascade= red cascade rose	3 6	All	Produces red flowers from June to October; 12@h.
<i>Vinca minor</i>	2 4	All	Excellent ground cover; handsome flowers and foliage; does best in shade

common periwinkle

but will perform well in sunny areas; 6' h x 2' w.

VINES

Scientific Name Common Name	Cultural Conditions		Zone	Remarks
<i>Akebia quinata</i> fiveleaf akebia	3	5	A,B	Fast growing; twining; new leaves have purplish tinge; purplish flowers in spring but somewhat obscured; will reach about 40= at maturity.
<i>Ampelopsis brevipedunculata</i> porcelain ampelopsis	2	5	A,B,C	Aggressive, fast growing vine; climbs by tendrils; 1/4 inch berries mature to a bright blue in the fall; adaptable to most soils; in one year may grow 15-20=.
<i>Aristolochia durior</i> Dutchman=s pipe	2	5	A,B,C	Unusual, pipe-shaped, yellow-green flowers appear in the second year; needs sufficient moisture and drainage; may grow to 30= in a year.
<i>Campsis radicans</i> trumpet vine	2	5	A,B,C	15-inch-long, lustrous green leaves; clusters of orange, trumpet shaped flowers; may grow 10= in a year.
<i>Celastrus scandens</i> American bittersweet	3	5	All	Bright crimson berries with yellow-orange capsules, male and female plants must be planted for fruit production; rapidly spreading; twining vine; may grow up to 10= in a year.
<i>Clematis x jackmanii</i> Jackman clematis	2	5	All	Most popular garden clematis; a hybrid with wide-ranging flower color selections; blooms June to September; grows up to 12= in a year.
<i>Clematis macropetala</i> downy clematis	2	5	A,B	Large azure-blue flowers with interesting petal-like centers; grows up to 10= in a year.
<i>Clematis maximowicziana</i> sweetautumn clematis	2	5	A,B	Easy to grow; vigorous, twining vine; masses of fragrant, small, white flowers in late summer and early fall.
<i>Clematis montana</i> anemone clematis	2	5		Pinkish-red, star shaped flowers; needs periodic thinning; grows to 18= in a year.
<i>Clematis tangutica</i> golden clematis	2	5	A,B	Nice yellow flowered clematis; 4-inch-flowers; twining vine; grows 3 to 4= in a year.
<i>Hydrangea anomala petiolaris</i> climbing hydrangea	2	5	A,B,C	Attractive dark brown, papery bark; large flower clusters in June; root-like holdfasts; grows 5-7= in a year and reaches a total length of 40=.
<i>Lonicera x heckrottii</i> goldflame honeysuckle	2	5	A,B	Glossy bluish-green leaves; blooms in June and July; reddish-purple tubular petals with yellow insides; grows 3-4= in a year and reaches a total length of 7=.
<i>Lonicera sempervirens</i> trumpet honeysuckle	2	5	All	Fast growing; twining vine; flowers are orange-red to red outside and yellow on the inside; will reach 10-15= at maturity.
<i>Parthenocissus quinquefolia</i> Virginia creeper	2	5	All	Vigorous growing; scarlet fall color; climbs with tendrils ending in sticky tips; grows 6-10= in a season; native .
<i>Parthenocissus tricuspidata</i> Boston ivy	2	5	A,B,C	Glossy dark green leaves, turns brilliant red in fall; will reach a total of length of 40=.
<i>Polygonum aubertii</i>	3	5	A,B	Twining vine; rapid grower; reaches a total length of 25=.

silver lace vine

Wisteria floribunda
Japanese wisteria

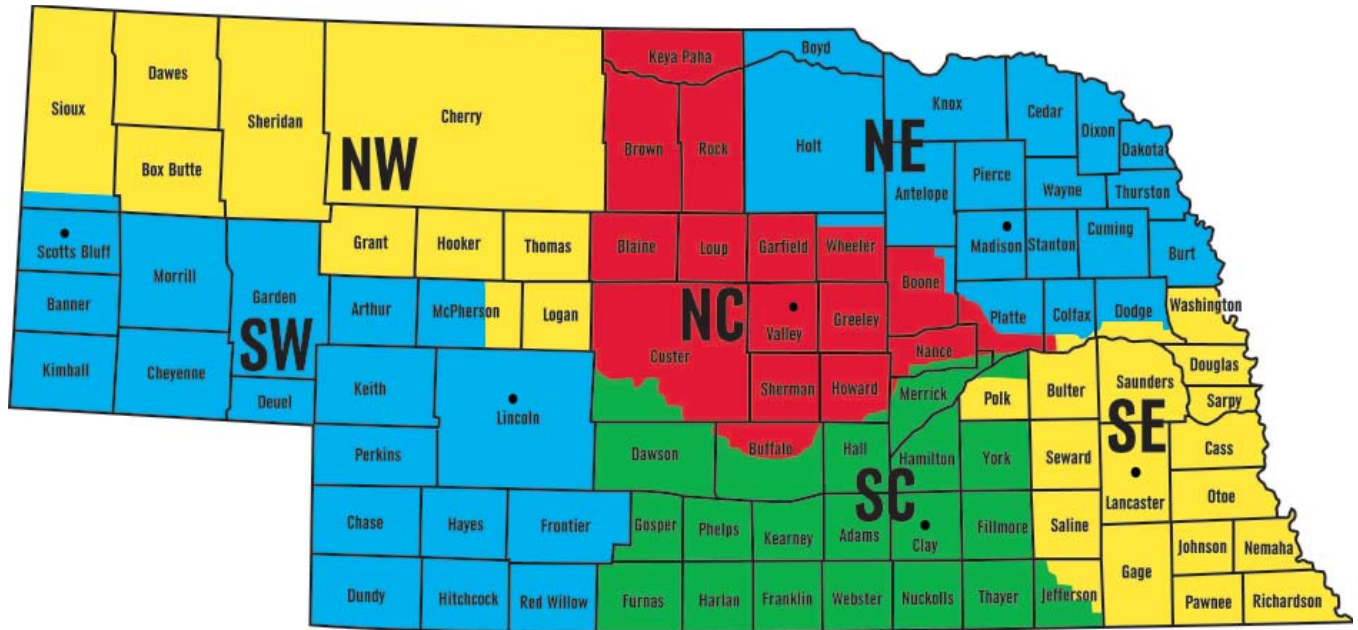
2

5

A,B,C

Very showy; blue, violet or white flowers appear on long racemes which make a graceful shower in May; use a grafted variety and heavy pruning for good flowering; twining stems require a sturdy support.

G. Nebraska Forest Service Districts



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103 Plant Industry Building
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Clay Center

Scott DeWald
 district forester
 south central South Central Agricultural Lab
 P.O. Box 66
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 sdewald1@unl.edu

H. UNL-Nebraska Forest Service - Community Forestry Resources

Here is a listing of various resources available for tree boards, arborists, nursery professionals, and others interested in community forestry.

Books & Pamphlets:

- Manual of Woody Landscape Plants - Michael A. Dirr. 3rd Edition, Stripes Publishing Co., 10-12 Chester St., Champaign, IL, 61820
- Know it and Grow it - Carl E. Whitcomb. Revised 1985, Lacebark Publications, Rt. 5 Box 174, Stillwater, OK, 74074.
- Street Tree Fact Sheets, Gerhold, Wandell, Lacasse, Schein. Short Courses in Agriculture, the Pennsylvania State University, 306 Ag Administration Building, University Park, Pennsylvania, 16802.
- Handbook of Landscape Tree Cultivars, W.N.Wandel. East Prairie Publishing Co., Box 174, Gladstone, Il, 61437.
- American Standards for Nursery Stock, American Association of Nurserymen, 1250 I Street NW, Suite 500, Washington D.C., 2005.
- Shading Our Cities, A resource guide for Urban and Community Forests. American Forestry Association, Island Press, Suite 300, 1718 Connecticut Ave. NW, Washington D.C., 20009.
- Urban Forestry, Planning and Managing Urban Greenspaces, Robert W. Miller. Prentice-Hall, Inc., Englewood Cliffs, NJ, 07632.
- Tree Maintenance, Pirone. 6th Edition, Oxford University Press, Inc., New York.
- Establishment and Maintenance of Landscape Plants, Carl E. Whitcomb. Lacebark Publications, Rt 5, Box 174, Stillwater, OK 74074.
- Arboriculture, Richard W. Harris. Prentice-Hall Inc., Englewood Cliffs, NJ 07632.
- Common Insect Pests of Trees in the Great Plains, G.P.A.C. publication No. 119, Distribution Center, Umberger Hall, Kansas State University, Manhattan, KS 66506.
- Sources of Shade Trees in the United States, Sydnor and Holman. Special Circular 105 Revised, The Ohio State University, Ohio Agricultural Research and Development Center, Wooster, OH.
- National Arborist Association Standards for Tree Care, NAA, National Arborist Association, P.O. Box 1094, Amherst, NH, 03031-1094.
- Guide for Plant Appraisal, Council of Tree and Landscape Appraisers and International Society of Arboriculture, Box 3129, Champaign, IL 61826
- Arboriculture and the Law, Victor Merullo and Michael Valentine, International Society of Arboriculture, Box 3129, Champaign, IL 61826
- Neighbor Law, Cora Jordan, Nolo Press, 950 Parker St., Berkeley, CA 94710

Periodicals:

Tree City USA Bulletin, National Arbor Day Foundation. National Arbor Day Foundation, 211 N. 12th St., Suite 501, Lincoln, NE, 68508

American Forests, American Forests. American Forests, P.O. Box 2000, Washington, D.C., 20077-4244. Included in AF membership

Journal of Arboriculture, International Society of Arboriculture. Box 3129, Champaign, IL 61826-3129. Included with membership in ISA

Listservers:

The UNL-Nebraska Forest Service offers two listservers that may be of interest to you. The first is the **Shady Lane** listserver that deals with community forestry information as well as other items of interest about Nebraska forestry. To subscribe just send an email to Dave Mooter (dmooter2@unl.edu).

The second is the **Tree Care Communicator** that is geared more toward the commercial arborist or those who are involved directly in landscape management. The server allows sharing of information among green industry professionals about pests and other aspects of tree health. To subscribe send an email to either Dave Mooter (dmooter2@unl.edu) or Mark Harrell (mharrell2@unl.edu). There is no cost for either server.

Web Sites:

Web sites are a valuable source of information. Please realize that just about anybody can put information on the web so reliability and credibility are critical issues so be sure to always check sources. This list contains some popular tree related sites to visit:

<http://www.nfs.unl.edu/>

This is the home page for the UNL Nebraska Forest Service. There are links to community forestry, Nebraska's conservation tree sales program and other Nebraska resources.

<http://www.treelink.org/>

TreeLink, a very comprehensive collection of web links for trees and forestry, one of the best.

<http://www.arborday.org>

The National Arbor Day Foundation, headquartered in Lincoln, lists programs and resources available.

<http://www.amfor.org>

American Forests is a national conservation organization and, like the National Arbor Day Foundation, has some excellent information and links to other sites.

<http://www.isa-arbor.com/>

This is the International Society of Arboriculture home page. The ISA is one of two professional organizations for arborists. There are some very good educational links as well as information about the ISA=s certified arborist program.

<http://hortwww-2.ag.ohio-state.edu/ODNR/Forestry.htm>

<http://www.kansasforests.org/>

These are good examples of state community forestry sites. They have good links and excellent educational resources.

<http://webgarden.osu.edu/>

<http://www.ag.uiuc.edu/~robsond/solutions/horticulture/trees.html>

These are searchable databases full of information about a wide variety of horticultural topics, including trees and shrubs.

<http://arboretum.unl.edu/>

Nebraska Statewide Arboretum

<http://www.forestry.uga.edu/>

<http://www.cnr.vt.edu/dendro/>

<http://hort.ifas.ufl.edu/woody/index.htm>

Universities of Florida, Georgia and Virginia Tech, some excellent technical and visual information

<http://www.fs.fed.us/>

The USDA Forest Service

<http://www.fs.fed.us/r2/nebraska/>

The Nebraska National Forest

<http://www.forestryindex.net/>

All you wanted to know about forestry and more, a searchable database

<http://plants.usda.gov/>

A great searchable database with plants of all kinds

<http://www.smokeybear.com/>

Smokey Bear online, some good educational resources

Organizations:

This is a listing of national and statewide organizations that provide tree related information.

The National Arbor Day Foundation
100 Arbor Avenue
Nebraska City, NE 68410
(402) 474-5655

International Society of Arboriculture
Box 3129
Champaign, IL 61826-3129
(217) 355-9411

The Nebraska Arborists Association
Box 81414
Lincoln, NE 68501-1414
(402) 476-3852

American Forests
Box 2000
Washington, DC 20013
(202) 955-4500

Nebraska Nursery and Landscape Association
Rt 1, Box 275
Clarksdale, MO 64430
(816) 233-1481

I. Terms

Abscission zone - A layer of cells at the end of the petiole that serve to seal off the vascular tissue, thus preventing desiccation and injury

Anthocyanins - A group of pigments that is responsible for red, blue and purple colors in plants

Apical bud - A bud at the tip of a branch or stem

Axillary bud - A bud that occurs at the axil of a leaf

Bark - The dead outer covering of woody stems, branches and roots of plants

Blade - The broad part of the leaf

Carbohydrates - A compound in the form of sugar or starch; plants store or use it for energy

Carotenoids- A group of pigments found in chloroplasts and are responsible for yellow, orange and red colors in plants

Cells - The basic structural and functional unit of life

Chlorophyll - The pigment that is responsible for the green color in plants; traps light for photosynthesis

Chloroplasts - Chlorophyll-containing organelle that is the site of photosynthesis

Cork cambium - A meristem in plants that produces cork and secondary tissues

Cuticle - A layer covering leaves that is almost impermeable to water

Deciduous - Plants that shed leaves during a certain season

Evergreen - Plants that retain their leaves all year round

Growth rings - Seasonal activity of vascular cambium that produces growth increments viewed as rings

Guard cells - Cells that change in shape to control the opening of the stomata affecting transpiration

Hardiness - The ability of a plant to withstand low temperature

Internodes - The part of a stem in between the nodes

Leaves - Green part of the plant that grows on stems or branches; the site of photosynthesis

Lenticels - A group of cells on the outside of the stem that aid in gas exchange

Meristems - Region of cell division in plants that occur at the end of stems and roots, in the vascular cambium, and in young leaves

Nodes - Place on the plant stem where a leaf or many leaves grow

Organs - Two or more tissue types integrated to be functional; roots, stems, leaves

Oxidation - Process where sugars and starches are converted to energy

Petiole - The stalk that attaches the leaf blade to the stem and supports the leaf

Phloem - Food conducting tissue in vascular plants

Photosynthesis - A chemical reaction where plants use light to form oxygen and carbohydrates from carbon dioxide and water

Respiration - The process of changing stored food into energy

Roots - Plant parts that grow down into the soil to anchor the plant and absorb nutrients

Root hairs - Fibrous extensions of the root that serve to absorb water and minerals from the soil

Soil pH - The measurement of acidity or alkalinity in the soil

Stomata - Small opening in the leaf where gas exchange occurs

Tissues - A group of cells with a common origin and similar function; group to form organs

Transpiration - Loss of water vapor from plant surfaces, thus moving water up through the plant from the roots

Vascular bundles - Conducting tissue that contains the xylem and the phloem

Xylem - Water and mineral conducting tissues in vascular plants