Working Draft – Feedback Welcome

Animal Damage to Conifer Seedlings

Identifying and quantifying damage

Introduction

Resource managers in Minnesota have been attempting to restore conifers to the landscape ever since the end of the initial logging period at the turn of the 20th century. Civilian Conservation Corps workers planted thousands of acres in pine plantations during the Depression. Managers in the 1950s and 1960s worked diligently to grow something other than the weed tree – aspen. The 1978 BWCA Act provided timber management intensification money for softwood reforestation and timber stand improvement. The development of aspen markets in the 1980s and subsequent regeneration of hundreds of thousands of acres of aspen has greatly increased interest in conifer restoration.

The Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota (GEIS) in 1994 highlighted the need to increase forest diversity. The Sustainable Forest Resource Act (SFRA) of 1995 established the Minnesota Forest Resources Council (MFRC). The White Pine Initiative (1996) detailed efforts to increase white pine in Minnesota. The MFRC's Voluntary Site-Level Forest Management Guidelines (1999, 2005) specify leaving conifer advanced regeneration and increasing the conifer component for wildlife. MFRC Landscape Committees throughout northern Minnesota urged pine restoration in their Desired Future Forest Conditions (DFFC). New Forest Service plans (2004) for the Chippewa and Superior National Forests reflect that desire by calling for conversion of thousands of acres of aspen to conifer and mixed forests. DNR subsection plans also specify great increases in the conifer types.

However, forest managers have found it increasingly difficult to achieve these goals, as conifer seedlings are subject to many forms of damage and mortality. The public, and the DNR, have placed a large emphasis on white pine restoration, but the species suffers from blister rust, white pine weevil and other diseases. On top of that, the seedlings are highly palatable to white-tailed deer. Deer damage has been singled out as one of the largest probable causes contributing to some failed conifer plantings by most resource agencies in the state during the last decade.

Minnesota's deer herd is kept in check by four major forms of mortality – severe winter weather, hunting, car kills and predation. Harsh winter weather can do more to correct deer numbers than anything else. The last severe winter in Minnesota was in 1995-96, but deer numbers rebounded very quickly as a result of milder winters, abundant quality young forest habitats and temporary reduced deer harvests. Car kills are an undesirable by-product of deer patterns, not a solution. Predation alone cannot control deer numbers. DNR has set liberalized deer bag limits and altered the season frameworks to increase antlerless deer harvest, with good success in some areas. But despite these successes, the current (2007) deer herd is still high in some locations. Contributing factors include mild winters in conjunction with good summer habitat, forest parcelization, hunter distribution, recreational deer feeding, and the animal's adaptability to human presence.

It is important to note that the amount of deer damage to seedlings is not solely dependant upon the number of deer in the area. It can also be affected by stand shape, stand size, stand proximity

to deer concentrations, amount of edge, seedling species, seedling fertilization rate, herbicide use, site preparation technique, timber stand improvement methods and weather factors. In short, one deer can create a lot of damage under the right conditions.

This publication is intended to help forest managers identify common types of conifer seedling damage, with an emphasis on animal damage. It will also review the DNR's process for quantifying the degree of damage, and provide links to additional resources.

Seedling Damage Identification

There are a number of biotic and abiotic factors that kill conifer seedlings. Many are difficult to properly identify, requiring trained professionals in a laboratory setting. Information on many of the most common forest pests can be found in the USDA Forest Service Forest Insect and Disease leaflets at http://na.fs.fed.us/pubs/fidl_hp.shtm, at http://www.forestpests.org, or at http://www.dnr.state.mn.us/treecare/index.html.

Insects & Disease – Native and exotic fungal infections of conifers are common. Few insects affect seedlings, but several can be lethal on saplings and older trees. If you suspect you are facing an insect or disease outbreak, you should contact your agency's forest health specialist, or the DNR Regional Forest Health Specialist. Be prepared to provide the species affected, age of planting, seedling source, patterns of mortality in the stand, patterns of disease on the seedlings, and herbicide treatment history. Samples may be necessary in many cases to make an accurate diagnosis prior to treatment efforts

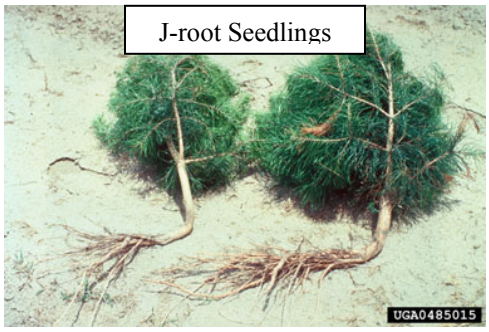
Hydration – Insufficient or excessive water can kill seedlings outright. However, it is far more common for seedlings that are water stressed to become susceptible to other pathogens, leading to mortality. Identify the problem by considering weather conditions, soils, location/pattern of affected seedlings and hydrologic regime. For example, drought and sandy soils may lead to seedling mortality on a ridge.

Soils – Planting in incompatible soil types can cause seedlings to die or lack vigor. Using the Field Guides to Native Plant Communities (NPC) to identify appropriate sites for different tree species should prevent this problem. Compacted soils, or those covering rock or hard pan can also cause seedling damage. Digging below dead seedlings may reveal the source of a problem.

Frost Damage – Heavy frost can damage growing tips and small seedlings in years with little snow, or when cold air settles in low-lying areas.

Nursery Stock – Poorly handled nursery stock (too hot, dry or physically stressed) can fail to thrive. Nursery stock can sometimes arrive infected with fungus, insects or diseases.

Incorrect Planting – Seedlings planted at the wrong depth, with roots improperly trimmed, or J-rooted will suffer mortality. Frost, rocks or hardpan can affect planting depth. Often this will affect individual trees or well-defined patterns.

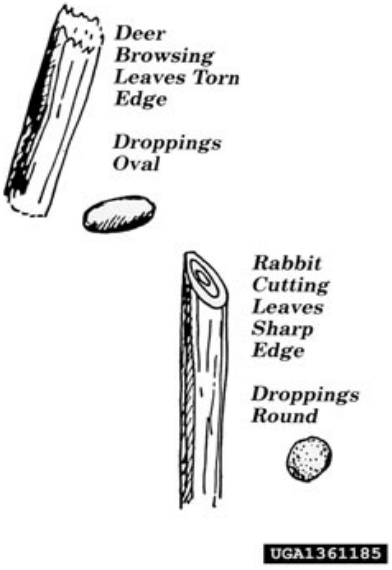


Animal Damage – Many animals scar, deform or girdle trees by chewing, scratching, rubbing, shredding the bark and cambium, and browsing buds. The type and extent of damage varies with the animal and the availability of suitable trees. In most cases of chewing or marking,

tooth or claw marks are clearly visible in the cambium or sapwood of damaged trees. The size of tooth marks on the stem may help distinguish between rodent, hare, gopher and bear damage.

- White-tailed Deer – Deer often receive a lot of blame for seedling mortality because they are large, visible and surprisingly, because damaged seedlings are often left in place where managers can easily see them. It is important for managers to distinguish between deer damage and that of other species in order to accurately report damage levels. Deer do not have upper incisors (front teeth). They browse by gripping a stem between their lower incisors and their upper hard palate and tearing it off. This leaves a characteristically ragged edge torn horizontally across the stem. They typically browse the tender tops of seedlings, particularly in winter and early spring. Browsed trees produce more stems and take on a broom-like form. They are often stunted due to repeated terminal and lateral shoot removal.

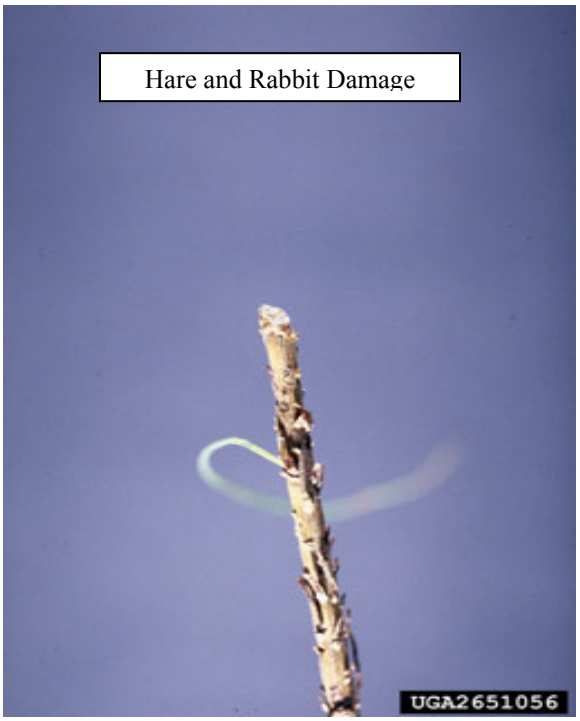
- Hares and rabbits – Snowshoe hares and rabbits damage seedlings by gnawing or biting them off at various heights. They have upper and lower incisors, so they tend to snip twigs more cleanly than deer, leaving a characteristically sharp 45-degree cut.



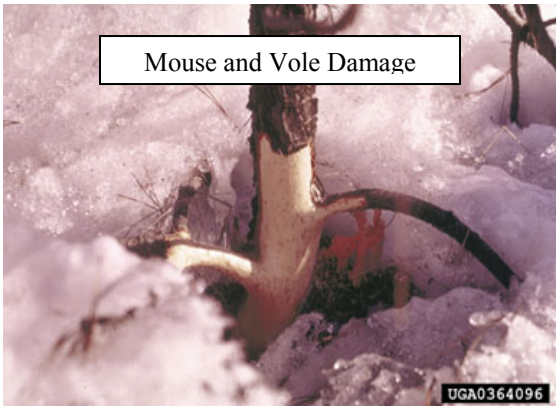
There are two signs in the field that will help foresters determine whether the seedlings were damaged by deer or rabbits: Deer clip the seedlings straight across and leave a ragged edge; rabbits clip them off at an angle. Droppings will also usually be present. Rabbit pellets are usually deposited at the base or near the base of damaged seedlings. Deer droppings are deposited at random

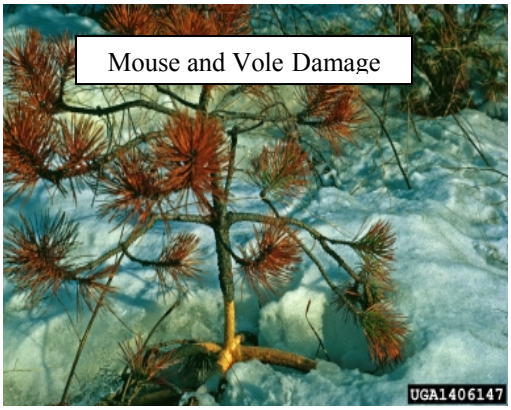
throughout the area. It is not uncommon to find droppings from both animals in the same area. Rabbit droppings are round, whereas deer droppings are oval.

Hares and rabbits also gnaw bark to the cambium more readily than deer. Look for medium-sized paired tooth marks indicative of the rodent-like front teeth.

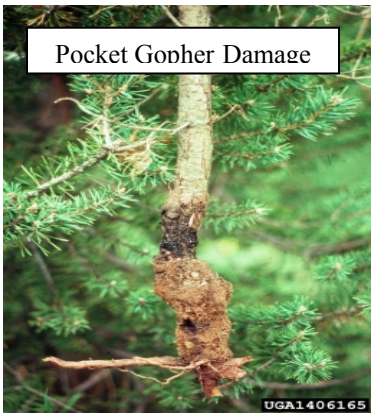


- Mice and voles – Mice and meadow voles periodically damage young pines by gnawing at the base of trees, feeding on the cambium near the ground. This commonly scars or girdles trees. Look for small, paired tooth marks. Snow cover or tall grass provide cover from predators, allowing these animals to browse uncontrolled. Trimming lower branches may help reduce protective cover.





- Pocket gophers - Pocket gopher damage can be confused with mouse and vole damage, but pocket gophers commonly prune roots of seedlings and girdle or clip seedling stems at or near ground level. Small seedlings are the most vulnerable. Gophers may pull seedlings underground and stockpile them in their burrows. Young trees with most of their root connections severed by pocket gophers may be found tipped over or are easily pulled out of the ground by hand.



- Moose - Moose damage trees by browsing seedlings, suckers, saplings, and foliage, and by rubbing antlers on saplings and larger trees. Moose have been known to pull down trees (especially aspen) and brush 9 ft or higher and snap the top off while browsing. Preferred species include aspen, white cedar and fir.

- Black bear - Bears will strip the bark off saplings and small trees to feed on the cambium, sometimes girdling large groups of trees in an area. They tend to select vigorously growing trees. Look for large, unpaired tooth marks perpendicular to the stem.

Quantifying Damage

DNR Division of Forestry quantifies deer damage to seedlings during regeneration surveys. Other agencies and private individuals are welcome to use this protocol if they don't have one established. Contact your local Division of Forestry office for more information. The following regeneration survey protocol is a revised version of process in the Division of Forestry's Forest Development Manual (1994). The Regeneration Survey Form can be found at http://files-intranet.dnr.state.mn.us/user_files/1980/regeneration_survey.pdf.

Recommended survey schedule:

- Plantings - Survey at 1, 3, 5, and 10 (recommended) years after establishment. Spring plantings may be checked in the fall of the first year, in order to facilitate release or replanting the following year.
- Seedings (artificial and natural) - Survey conifer seedings at 3, 5, and 10 (recommended) years on upland sites and 5 years on lowland sites. Hardwood direct-seedings should be surveyed annually for the first 3-5 years.

Surveys required for regeneration standards reporting are as follows:

- Plantings—Survey the first year after planting (to be completed before the second growing season) and the fifth year after planting (to be completed before the sixth growing season).
- Seedings—Survey the fifth year after seeding (to be completed before the sixth growing season)
- Natural Regeneration—Survey stands no later than the fifth year after harvest (to be completed before the sixth growing season).

Survey Method:
The method of a regeneration check should match management objectives and the need for the data. Regardless of the method chosen, it is important that the survey provide adequate coverage of the site. The forester is responsible to ensure that the information collected is sufficient to meet management needs. Plot surveys are most common.

Plot Surveys:
Plot surveys require one plot for every two acres (with a minimum of 10 plots for sites > 20 acres). Plots should be distributed evenly across the site, and plot centers should be selected randomly. Plots should be numbered and mapped on the Inventory of Regeneration Site survey form. Be sure to record the plot size used on the survey form.

Plot size may vary from site to site depending on anticipated management activities and data needs. Plot size recommendations are as follows:
1/1000 acre - 3.7 ft. radius - Seeding sites
1/500 acre - 5.3 ft. radius - Planting sites with more than 500 trees per acre
1/250 acre - 7.4 ft. radius - Planting sites with more than 250 trees per acre
1/100 acre - 11.8 ft. radius - Sites with less uniform stocking and/or low stocking levels

Use a larger plot size (1/250 or 1/100 acre) for planting sites whenever practical.

Field Tips:
A simple technique for measuring plot radius is to cut a short stick to a length equal to the desired plot diameter. Or, carry a high-pile stick marked at the plot diameter. For 1/100-acre plots, use a logger's tape to establish plot diameter, and carry a shovel with a screw in the top of the handle to serve as plot center.

Data Collection:
For deer browse damage, enter the number of browsed stems within the plot in the 'deer damage' column. Count stems that have significant damage; defined as: the terminal leader is browsed, or at least ⅓ of the lateral stems are browsed, or both. For other damage (ex; mice, rabbits, insects, diseases), enter the number of damaged stems in the 'other damage' column. If the other damage is common or prevalent, record the type of damage in the Remarks block.

Survey Summary:
Summarize the survey plot data in the table on the bottom of the back side of the regeneration survey form. Transfer that data to the appropriate summary block on the front of the survey form, and complete all indicated calculations. Note that for the Damage Summary block, the required calculation is to divide the number of stems damaged by the total number of stems tallied. This is the damage percentage that should subsequently be entered in Cruiser.

Reporting Poor Regeneration Survival:
Planting sites where crop tree survival is 50% or less should be reported to the Region Forest Health Specialist, the Region Silviculturist, and the Area Silviculture Program Leader. This is to make the Area and the Region aware of problems that may potentially be wide spread, such as the recent Diplodia outbreak in red pine bare-root stock. In such cases, it is important that the search for causes, and possible solutions, begin as soon as possible.

Specific reporting protocols may vary from Region to Region. The following procedure may be used as a "default" - The initial report should be made as soon as possible after the survey is completed, and can be done via email or phone call. The Area should fax a copy of the survey data to Region staff. The Region Forest Health Specialist and the Region Silviculturist will follow up with the reporting forester, and will notify the Area of any further action needed.

<u>Replanting/seeding</u>

Many factors are considered when deciding if additional planting or seeding is necessary, so those decisions are left to the forester's discretion. In general, an even-aged conifer stand with less than 400 trees per acre should be considered for supplemental planting. However, lower levels can be acceptable if the stand objective is to produce mixed stands, or if natural regeneration is present/potential.

Within the DNR, it needs to be understood that stand objectives defined during subsection planning take precedence over meeting the regeneration standards. Therefore, standards should always be viewed in light of the objectives for the stand. When standards conflict with stand objectives, that fact should be documented. For example, if stand objectives include areas of the stand to be carried as non-stocked or understocked, then the stocking standard may not be attained. In this example, the reason for not attaining the standard is legitimate. The reason should be recorded and become part of the site documentation.

For Additional Information:

http://icwdm.org/handbook/damage/damid.asp

http://lib.colostate.edu/research/agnic/damageprobs/econimpact.html

http://ext.nrs.wsu.edu/forestryext/foresthealth/notes/animalmechdamage.htm

http://www.extension.org/pages/Black_Bear_Damage_Assessment

http://www.extension.org/pages/Deer_Damage_Assessment

http://www.extension.org/pages/Pocket_Gopher_Damage_Assessment

http://www.extension.org/pages/Cottontail_Rabbit_Damage_Assessment

http://www.extension.org/pages/White-footed_and_Deer_Mice_Damage_Assessment