Project No. TS - 5924

**Arborist Report**

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| TO: | Lori Dickenson and Bob Rossi, Vista Estates HOA |
| SITE: | Vista Estates, 16925 430th Ave S, East Gold Bar, WA |
| RE: | Forest Assessment |
| DATE: | June 23, 2017 |
| PROJECT ARBORIST: | Katherine Taylor<br>ISA Certified Arborist #PN-8022A<br>ISA Qualified Tree Risk Assessor |
| REVIEWED BY: | Michael Tomco<br>ISA Certified Arborist #PN-8432A |
| ATTACHMENTS: | Wildlife Snags Information Sheet; Wood Chip Mulch Information Sheet |

**Summary**
Vista Estates is a residential community that was built on land previously managed as a commercially harvested forest. There are 42 properties on site, each with single family homes. There are two forested green belts and trees border each property.

The forest is primarily a monoculture of Douglas-fir (*Pseudotsuga menziesii*) trees that are closely planted and evenly aged. Over the last five years or more the residents have observed a decline in the health of the forest. The majority of the trees are showing symptoms of decline and stress including thinning, dieback, and chlorosis of the canopy. Several trees have died and been removed or have failed onsite. At the time of my site visit I observed signs and symptoms of two different species of wood boring beetles.

There are a variety of factors including the tree spacing and composition, drought, and presence of wood boring beetles causing decline of the trees on site. These factors are discussed in more detail in the body of the report.

There are several management practices that can be implemented both on private properties implemented by homeowners and on the greenbelt portions of the site. These management practices include management of invasive weeds; improvement of cultural conditions to increase plant vigor along forest edges; replanting areas that have been opened up a result of tree death; and removal and/or reduction to habitat snags of dead trees that could pose risk to residents. Thinning and replanting forested areas with a mix of native deciduous and coniferous tree species as well as understory species could also be considered. If the HOA has interest in this option, we recommend that a management plan be created to guide this work.

**Assignment & Scope of Report**
This report outlines the site inspection by Katherine Taylor, of Tree Solutions Inc, on May 10, 2017. I was asked to visit the site and assess the forest condition. I was asked to produce an Arborist Report documenting my findings and management recommendations. Lori Dickenson and Bob Rossi, representatives of the Vista Estates Home Owners Association (HOA), requested these services for management purposes.

Photographs are followed by a glossary and list of references. Limits of assignment can be found in Appendix A. Methods can be found in Appendix B. Assumptions and limiting conditions can be found in Appendix C.

I conducted my assessment in the green belt areas and on the properties numbered 2, 3, 12, 15, 19, 28, and 37. I also conducted a level 1 assessment of the remaining properties from the street.

**Observations**
Vista Estates HOA is a residential community of 42 properties. The community was built on land previously managed as a forest for commercial harvesting. Residents have observed decline and dieback within the forest over the last five years or more and noticed an accelerated decline after the summer drought in 2015.

There are several native and invasive understory plant species growing on site. Native plant species found on site include salal (*Gaultheria shallon*), thimble berry (*Rubus parviflorus*), sword fern (*Polystichum munitum*), hazelnut (*Corylus cornuta* v. *californica*), vine maple (*Acer circinatum*), Indian plum (*Oemleria cerasiformis*), and ocean spray (*Holodiscus discolor*). Invasive plant species found on site include Himalayan blackberry (*Rubus bifrons,* syn *R. discolor, R. armeniacus*), invasive ivy (*Hedera* sp.), English holly (*Ilex aquifolium*). In some areas invasive plant species were the dominant vegetative cover in the understory.

The forest is predominantly a monoculture of evenly aged Douglas-fir trees. Other tree species found on site included western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), bigleaf maple (*Acer macrophyllum*), and red alder (*Alnus rubra*). There were also several ornamental tree species found within the managed gardens of many of the properties.

The trees are between 65 and 80 feet tall and range from 8 to 16 inches in diameter at standard height (DSH). They are planted approximately 5 to 20 feet apart (Photo 1).

Many of the Douglas-fir trees are exhibiting symptoms of stress and decline including tip and leader dieback of foliage, chlorosis of foliage, and thinning of foliage (Photos 2, 3, and 4). There were also several standing dead trees and trees that had previously failed throughout the community. A few of the remaining stumps of failed tree showed weak growth rings over approximately the last 10 years (Photo 5).

Trees growing in lawn areas and garden beds, appeared to be in better health condition than those growing in unmanaged areas (Photo 6). This is likely due to irrigation provided in managed areas.

I observed symptoms and signs of two different wood boring beetles while I was on site. I found larvae of the flathead fir borer (*Phaenops drummondi, syn. Melanophila d.*) under the bark of standing dead trees (Photo 7). I also found beetle galleries that appeared to be consistent with those made by Douglas-fir beetle (*Dedroctonus pseudotsugae*) (Photo 8). I also found entry and exit holes in the bark and frass in and around the holes and galleries.

**Discussion**

I was asked to identify the variety of Douglas-fir growing on site. I do not believe these trees are one of the known varieties in this area. I believe they are *Pseudotsuga menziesii*. However, it is possible and even likely that the trees were from genetically improved seed stock, which is common in the forestry industry. Genetic improvement is the collection of seed or cuttings from trees that are known to have certain genetic traits like faster growth, straightness, and wood quality. Seeds or cuttings are collected then grown in field trials to test for the desired traits. Trees from genetically improved seedlings can grow 5 to 30 percent faster over standard seedlings.

Some residents of Vista Estates wondered if the trees had been genetically modified to die after a certain period of time, I was unable to confirm that Douglas-fir has been modified in this way. I contacted a representative of Weyerhaeuser and they said that they were not familiar with any varieties modified to die after a period of time. The representative noted that both trees planted closely together and trees purchased from a different geographic zone could be factors in the decline of trees.

There are likely a variety of factors causing the forest at Vista Estates HOA to decline including being a forest that was closely planted as a monoculture for commercial harvest, lack of ongoing management, drought conditions, pest infestation, and competition by invasive plant species.

Trees planted for commercial harvesting operations are planted for short term goals of harvest. There are differing management strategies however they often involve, suppressing understory vegetation to reduce competition, closely planting monocultures of one tree species, thinning of the crop to remove merchantable trees prior to death and to allow remaining trees to increase in size, and finally harvesting high value large logs. If the forest crop is left unmanaged, the monoculture of closely planted trees become more susceptible to decline as a result of competition for resources and pests (insect and disease).

In addition to competition for resources, it is likely that the summer droughts the Pacific Northwest has experienced in the last few years, particularly in 2015 increased the stress of the trees. Plant stress can make plants more susceptible to attack by pests like the two species of beetles that were observed on site. It can also make the trees more susceptible to disease pathogens. I did not observe any signs of disease like fungal fruiting bodies (mushrooms) or obvious infection centers while I was onsite. Some of the failed trees appeared to have a cubicle brown rot, however, it is difficult to tell if these rots occurred before or after the trees died.

It is important to note that both the flathead fir borer and Douglas-fir beetle are not invasive pests but rather a natural part of the ecosystem that proliferates when conditions are favorable. Reducing stress by improving cultural conditions and forest composition can aid in improving resistance to these insects.

Unmanaged commercially planted forests typically begin to decline and die to allow for natural regeneration. This is a slow process of forest succession where plants grow, die, and are replaced over time. Forest succession consists of a series of stages which result in a climax community. During earlier stages of succession soil building plants like grasses and herbs and shrubs grow, followed by fast growing tree species like red alder, willow, cottonwood, and birch. As more shade is provided coniferous plant species begin to establish. Humans interrupt this process with land management practices like forestry.

As part of a management plan for this site, managing invasive plant species will be extremely important. Invasive plant species thrive in areas that are opened up to sunlight and will outcompete native vegetation and prevent successful regeneration of the forest.

Management Options

The goals of management should be to reduce risk as a result of tree failures to residents and to speed regeneration of a healthy forest with diverse age and plant species over time. Several practices both on private properties and in the greenbelt areas can be implemented to achieve these goals.

To reduce potential risk to the residents of Vista Estates, trees that have died within striking distance of a target (home, structure, parked vehicles, or area that people frequent) should be considered for reduction to a habitat snag or removal. If reduction to a habitat snag is chosen, shorten the tree to a height that is out of striking distance of potential targets. Leave side branches on the tree below the topping cut to provide perches for wildlife. An information sheet with further information on wildlife habitat snags is attached.

Dead trees in striking distance of targets that are confirmed to be infested with either the Douglas-fir beetle or the flathead fir borer should be removed entirely, as close to the base as possible and be removed from the forest and managed to prevent spread of the beetles. Trees should be removed and managed between August and March to remove insects and larvae overwintering in the trees, prior to spring emergence. Below are a few ways the wood can be managed:

- Grind felled trees into wood chip mulch
- Cover stems or wood cut into fire wood with plastic sheeting to solarize and kill any larvae or beetles present
- Burn the wood in a safe manner according to local regulations regarding fires

Management of invasive plant species is both important to prevent spread and competition with native species as well as to reduce stress and impacts on remaining trees. Once invasive plants are removed bare soil should be covered with mulch and native plants should be installed to shade out the soil and prevent germination of weeds. More information about native plants can be found at the following website: King County Native Plant Guide

There are several areas on Vista Estates where invasive ivy is growing up the stem of trees. Ivy on stems adds a significant amount of load to the tree and can smother and outcompete canopy foliage reducing the tree's ability to produce energy. Invasive ivy growing up tree stems should be cut above head height and be allowed to die or be removed from the canopy by a climbing arborist. Once ivy climbs a tree, it matures to a stage where seed is produced increasing the speed and efficacy at which the plant spreads. Ivy on the ground is most effectively managed by physical removal, its roots are shallow so it can be

relatively easy to pull up by loosening the soil with a shovel. For more information on management see the following webpage: King County Noxious Weed – English Ivy

Himalayan blackberry can outcompete native vegetation especially in areas opened up to sunlight. There are many methods to managing this species, for small populations digging the majority of the root system out is sufficient. Other management strategies can be found at the following webpage: King County Noxious Weed – Himalayan Blackberry

English holly can be a serious problem for disturbed forests, plants should be managed as they germinate. Remove seedlings by digging the entire root system from the ground. Once plants have grown in size treatment using herbicides may be necessary to kill the plant. A spot application by painting a cut stump can reduce the possibility of affecting off target plants. For more information on managing English holly, see the following webpage: King County Noxious Weed – English Holly

Management of both the Douglas-fir beetle and flathead fir borer can be difficult. Both pests typically attack trees that are stressed. Improving cultural conditions to the extent feasible can make plants more resistant to beetle attack.

To improve cultural conditions consider applying 3 to 4 inches of coarse wood chip mulch over the soil below the dripline of trees in lawn areas and around the edges of yards. Wood chip mulch will help to improve soil quality, prevent compaction, prevent evaporation in drought periods, and improve soil structure and add nutrients over the long term. More information about wood chip mulch is attached. Wood chip mulch can be obtained for free from arborists when trees are removed and chipped. In addition, infrequent irrigation during drought periods may help the trees to be less stressed from drought. Trees should be watered to a depth of 6 to 8 inches, 1 to 3 times per month. This could be achieved by using soaker hoses, drip irrigation, or using sprinklers.

There is a pheromone product called MCH that can help to repel Douglas-fir beetle. Unfortunately, this product does not repel the flathead fir borer and a similar product does not exist for the flathead fir borer. Before committing to an application of MCH I recommend confirming further that live trees are being attacked by this beetle. While I did observe symptoms and signs of the Douglas-fir beetle, I only removed the bark of dead trees at the time of my site visit.

Another approach to managing beetles is to create trap trees using freshly downed trees which beetles are attracted to. The trees should be felled just prior to beetle flight in early spring and removed by late summer.

New trees can be planted in areas where trees have been removed or have died and failed. I recommend the following species western redcedar (*Thuja plicata*) , grand fir (*Abies grandis*), noble fir (*Abies procera*), bigleaf maple (*Acer macrophyllum*) and cascara (*Rhamnus purshiana*). When choosing plants be sure to check the light requirements of the plant against the available light of the planting spot to ensure that it will be located in the right area.

Removing trees to thin or opening areas within the green belts or between properties for new plantings could be considered. This could help speed up regeneration and increase the species and age diversity of the forest, improving the long term health of the forest. This could be done in conjunction with using

pheromones or creating trap trees to control spread of beetles. This option would require additional planning to locate areas for opening and retention as well as create a planting and management plan. It may also require permitting from the city of Gold Bar. Tree Solutions would be happy to help produce a more formal management plan if the Vista Estates HOA is interested in this option.

**Recommendations**

- Remove or reduce standing dead trees that are within striking distance of targets.
- Manage invasive plant species found on site including invasive ivy and Himalayan blackberry.
- Improve cultural conditions of trees in lawn areas and at perimeter of yards by applying wood chip mulch and irrigating 1 to 3 times per month in drought periods.
- Consider further confirmation of beetle species found on site and management with MCH or creating trap trees as appropriate.
- Consider creating a management plan to remove some trees to thin and open areas for new planting to improve species and age diversity of forest.

**Photographs**

**Photo 1:** A view of a grove of trees as Vista Estates, note the close spacing and monoculture of Douglas-fir

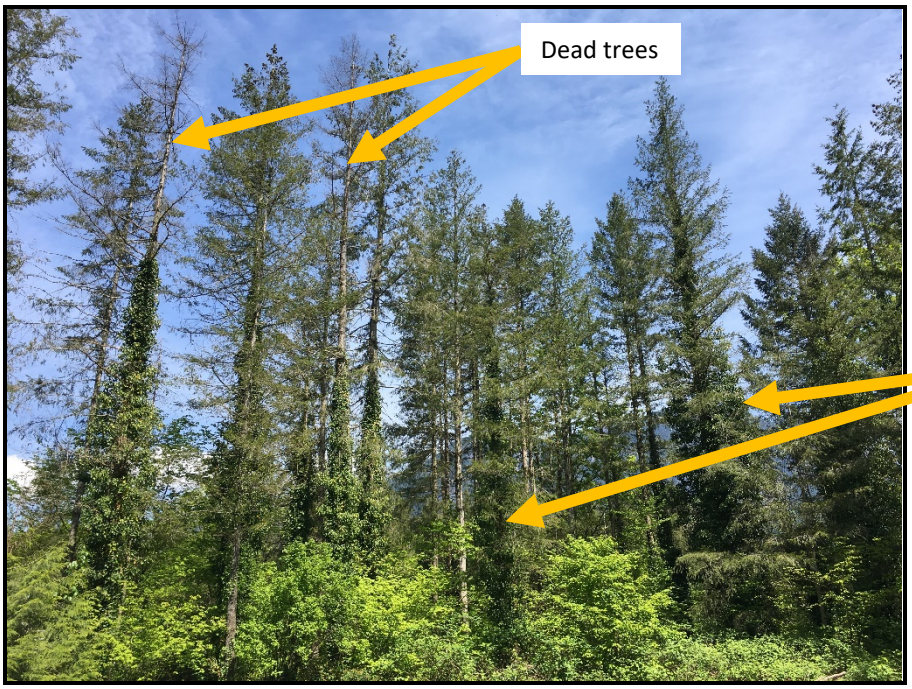


**Photo 2:** A view of a grove of trees with symptoms of thinning and dieback as well as standing dead trees. Also note the mature ivy growing up the stems of the trees.

**Photo 3:** A view of a stand of trees with extensive thinning.

**Photo 4:** A view of a stand of trees in better condition.

**Photo 5:** An example of one of the stumps observed with reduced growth rings toward the outer edge of the trunk.

**Photo 6:** Trees in lawn areas or in garden beds where they are likely getting more water during drought had healthier canopies.

**Photo 7:** Larvae of the flathead fir borer found below the bark of a standing dead tree.

**Photo 8:** A view of Douglas-fir beetle gallery found below the bark of a standing dead tree

**Glossary**

**advanced assessment:** an assessment performed to provide detailed information about specific tree parts, defects, targets, or site conditions. Specialized equipment, data collection and analysis, and/or expertise are usually required (ISA 2013)

**ANSI A300:** American National Standards Institute (ANSI) standards for tree care

**basic assessment:** detailed visual inspection of a tree and surrounding site that may include the use of simple tools. It requires that a tree risk assessor walk completely around the tree trunk looking at the site, aboveground roots, trunk, and branches (ISA 2013)

**bending moment:** a turning, bending or twisting force exerted by a lever, defined as the force (acting perpendicular to the lever) multiplied by the length of the lever (see *moment*) (ISA 2013)

**cabling:** installation of hardware in a tree to help support weak branches or crotches (Lilly 2001)

**chlorotic:** foliage with whitish or yellowish discoloration caused by lack of chlorophyll

**codominant stems:** stems or branches of nearly equal diameter, often weakly attached (Matheny *et al.* 1998)

**cracks:** defects in trees that, if severe, may pose a risk of tree or branch failure (Lilly 2001)

**crown:** the aboveground portions of a tree (Lilly 2001)

**crown cleaning:** selective pruning to remove one or more of the following parts: dead, diseased, and/or broken branches (ANSI A300)

**DBH or DSH:** diameter at breast or standard height; the diameter of the trunk measured 54 inches (4.5 feet) above grade (Matheny *et al.* 1998)

**deciduous:** tree or other plant that loses its leaves sometime during the year and stays leafless generally during the cold season (Lilly 2001)

**drive-by (assessment):** limited visual inspection from only one side of the tree, performed from a slow-moving vehicle; also may be called a windshield assessment (ISA 2013)

**epicormic:** arising from latent or adventitious buds (Lilly 2001)

**evergreen:** tree or plant that keeps its needles or leaves year round; this means for more than one growing season (Lilly 2001)

**force:** any action or influence causing an object to accelerate/decelerate. Calculated as mass multiplied by acceleration. Is a vector quantity (ISA 2013)

**increment:** the amount of new wood fiber added to a tree in a given period, normally one year. (Dunster 1996)

**ISA:** International Society of Arboriculture

**included bark:** bark that becomes embedded in a crotch between branch and trunk or between codominant stems and causes a weak structure (Lilly 2001)

**landscape function:** the environmental, aesthetic, or architectural functions that a plant can have (Lilly 2001)

**lateral:** secondary or subordinate branch (Lilly 2001)

**level(s) of assessment:** categorization of the breadth and depth of analysis used in an assessment (ISA 2013)

**lever arm:** the distance between the applied force (or center of force) and the point where the object will bend or rotate (ISA 2013)

**limited visual assessment:** a visual assessment from a specified perspective such as foot, vehicle, or aerial (airborne) patrol of an individual tree or a population of trees near specified targets to identify specified conditions or obvious defects (ISA 2013)

**mitigation:** process of reducing damages or risk (Lilly 2001)

**moment:** a turning, bending, or twisting force exerted by a lever, defined as the force (acting perpendicular to the lever) multiplied by the length of the lever (ISA 2013)

**monitoring:** keeping a close watch; performing regular checks or inspections (Lilly 2001)

**owner/manager:** the person or entity responsible for tree management or the controlling authority that regulates tree management (ISA 2013)

**pathogen:** causal agent of disease (Lilly 2001)

**phototropic growth:** growth toward light source or stimulant ( Harris *et al.*1999)

**Resistograph drill:** a drilling instrument used to determine the density of wood by measuring the amount of resistance presented to the drilling needle as it is driven into the wood. The drilling resistance profiles show clearly where compression wood, annual rings, rot in various stages and other defects have been encountered by the drilling needle

**retain and monitor:** the recommendation to keep a tree and conduct follow-up assessments after a stated inspection interval (ISA 2013)

**significant size:** a tree measuring 6" DSH or greater

**snag:** a tree left partially standing for the primary purpose of providing habitat for wildlife

**soil structure:** the arrangement of soil particles (Lilly 2001)

**sounding:** process of striking a tree with a mallet or other appropriate tool and listening for tones that indicate dead bark, a thin layer of wood outside a cavity, or cracks in wood (ISA 2013)

**structural defects:** flaws, decay, or other faults in the trunk, branches, or root collar of a tree, whichmay lead to failure (Lilly 2001)

**tomography:** a technique for obtaining 2-D cross sections or 3-D pictures of the interior of an object by passing sound waves through the object and measuring the travel times of the acoustic signals as the object absorbs or scatters them on ray paths between source and receiver.

**Visual Tree Assessment (VTA):** method of evaluating structural defects and stability in trees by noting the pattern of growth. Developed by Claus Mattheck (Harris, *et al* 1999)

**walk-by (assessment):** a limited visual inspection, usually from one side of the tree, performed as the tree risk assessor walks by the tree(s) (ISA 2013)

**References**

ANSI A300 (Part 1) – 2008 American National Standards Institute. American National Standard for Tree Care Operations: Tree, Shrub, and Other Woody Plant Maintenance: Standard Practices (Pruning). New York: Tree Care Industry Association, 2008.

Dunster & Associates Environmental Consultants Ltd. Assessing Trees in Urban Areas and the Urban-Rural Interface, US Release 1.0. Silverton: Pacific Northwest Chapter ISA, 2006

Dunster, Julian A., E. Thomas Smiley, Nelda Matheny, and Sharon Lilly. Tree Risk Assessment Manual. Champaign, Illinois: International Society of Arboriculture, 2013

E. Smiley, N. Matheny, S. Lilly. Best Management Practices: TREE RISK ASSESSMENT. ISA 2011.

Lilly, Sharon. Arborists' Certification Study Guide. Champaign, IL: The International Society of Arboriculture, 2001.

Matheny, Nelda and James R. Clark. Trees and Development: A Technical Guide to Preservation of Trees During Land Development. Champaign, IL: International Society of Arboriculture, 1998.

Mattheck, Claus and Helge Breloer, The Body Language of Trees.: A Handbook for Failure Analysis. London: HMSO, 1994.

## Appendix A - Limits of Assignment

Unless stated otherwise: 1) information contained in this report covers only those trees that were examined and reflects the condition of those trees at the time of inspection; and 2) the inspection is limited to visual examination of the subject trees without dissection, excavation, probing, climbing, or coring unless explicitly specified. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject trees may not arise in the future.

Tree Solutions did not review any reports or perform any tests related to the soil located on the subject property unless outlined in the scope of services. Tree Solutions staff are not and do not claim to be soils experts. An independent inventory and evaluation of the site's soil should be obtained by a qualified professional if an additional understanding of the site's characteristics is needed to make an informed decision.

A **Hazard Tree** is defined as a tree that has been assessed and determined to have characteristics that make it an unacceptable risk for continued retention. A hazard tree, or a hazardous component, exist when the sum of the risk factors equals or exceeds a predetermined threshold of risk. The predetermined threshold for risk and the actions required to reduce the risk below that threshold is established by the risk manager.

As a Qualified Tree Risk Assessor, my job is to provide the risk manager, in most cases the property owner, with technical information required to make informed decisions. The risk manager must make the decision about how to implement the actions required to reduce risk to acceptable levels.

## Appendix B - Methods

I evaluated tree health and structure utilizing visual tree assessment (VTA) methods. The basis behind VTA is the identification of symptoms, which the tree produces in reaction to a weak spot or area of mechanical stress. A tree reacts to mechanical and physiological stresses by growing more vigorously to reinforce weak areas, while depriving less stressed parts (Mattheck & Breloer 1994). An understanding of the uniform stress allows me to make informed judgments about the condition of a tree.

I measured the diameter at standard height (DSH) of each tree, typically at 54 inches above grade. If a tree had multiple stems, I measured each stem individually at standard height and determined a single-stem equivalent diameter by taking the average of the stem diameters, as established by the RZC.

I used a steel soil probe to test soil depths.

I used binoculars to inspect the upper parts of the trees.

**Tree health** considers crown indicators including foliar density, size, color, stem shoot extensions, decay, and damage. We have adapted our ratings based on the Purdue University Extension Formula Values for health condition. These values are a general representation used to assist in arborists in assigning ratings. Tree health needs to be evaluated on an individual basis and may not always fall entirely into a single category, however, I assigned a single condition rating for ease of clarity.

Excellent
Perfect specimen with excellent form and vigor, well-balanced crown. Normal to exceeding shoot length on new growth. Leaf size and color normal. Trunk is sound and solid. Root zone undisturbed. No apparent pest problems. Long safe useful life expectancy for the species.

Good
Imperfect canopy density in few parts of the tree, up to 10 percent of the canopy. Normal to less than ¾ of typical growth rate of shoots and minor deficiency in typical leaf development. Few pest issues or damage, and if they exist they are controllable or tree is reacting appropriately. Normal branch and stem development with healthy growth. Safe useful life expectancy typical for the species.

Fair
Crown decline and dieback up to 30 percent of the canopy. Leaf color is somewhat chlorotic/necrotic with smaller leaves and "off" coloration. Shoot extensions indicate some stunting and stressed growing conditions. Stress cone crop is clearly visible. Obvious signs of pest problems contributing to a lesser condition. Control might be possible. I found some decay areas in the main stem and branches. Below average safe useful life expectancy

Poor
Lacking full crown, more than 50 percent decline and dieback, especially affecting larger branches. Stunting of shoots is obvious with little evidence of growth on smaller stems. Leaf size and color reveals overall stress in the plant. Insect or disease infestation may be severe and uncontrollable. Extensive decay or hollows in branches and trunk. Short safe useful life expectancy.

*Tree health condition ratings have been adapted from the Purdue University Extension bulletin FNR-473-W - Tree Appraisal*

**Appendix C - Assumptions & Limiting Conditions**

1. Consultant assumes that any legal description provided to Consultant is correct and that title to property is good and marketable. Consultant assumes no responsibility for legal matters. Consultant assumes all property appraised or evaluated is free and clear, and is under responsible ownership and competent management.

2. Consultant assumes that the property and its use do not violate applicable codes, ordinances, statutes or regulations.

3. Although Consultant has taken care to obtain all information from reliable sources and to verify the data insofar as possible, Consultant does not guarantee and is not responsible for the accuracy of information provided by others.

4. Client may not require Consultant to testify or attend court by reason of any report unless mutually satisfactory contractual arrangements are made, including payment of an additional fee for such Services as described in the Consulting Arborist Agreement.

5. Unless otherwise required by law, possession of this report does not imply right of publication or use for any purpose by any person other than the person to whom it is addressed, without the prior express written consent of the Consultant.

6. Unless otherwise required by law, no part of this report shall be conveyed by any person, including the Client, the public through advertising, public relations, news, sales or other media without the Consultant's prior express written consent.

7. This report and any values expressed herein represent the opinion of the Consultant, and the Consultant's fee is in no way contingent upon the reporting of a specific value, a stipulated result, the occurrence of a subsequent event or upon any finding to be reported.

8. All photographs included in this report were taken by Tree Solutions Inc. during the documented site visit, unless otherwise noted.

9. Sketches, drawings and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys. The reproduction of any information generated by architects, engineers or other consultants and any sketches, drawings or photographs is for the express purpose of coordination and ease of reference only. Inclusion of such information on any drawings or other documents does not constitute a representation by Consultant as to the sufficiency or accuracy of the information.

10. Unless otherwise agreed, (1) information contained in this report covers only the items examined and reflects the condition of the those items at the time of inspection; and (2) the inspection is limited to visual examination of accessible items without dissection, excavation, probing, climbing, or coring. Consultant makes no warranty or guarantee, express or implied, that the problems or deficiencies of the plans or property in question may not arise in the future.

11. Loss or alteration of any part of this Agreement invalidates the entire report.

Tree Solutions Inc
Consulting Arborists

# Wildlife Snags

An Alternative to Tree Removal

*The object of creating a snag is to preserve as large a portion of a defective tree, location permitting. The tree is meant to serve as habitat for birds and insects and to blend in with the landscape. In order for the tree to blend in, the cuts made by chainsaw should be disguised to look like a natural break rather than a saw cut.*

**Figure 1.** A naturally occurring snag in the wild takes years to reach this stage

## Species Selection

**Long-lasting snags (15 years or more)**

Douglas fir (*Pseudotsuga menziesii*),
Western red cedar (*Thuja plicata*)
Bigleaf maples (*Acer macrophyllum*)
Other maple species (*Acer*)
Oak species (*Quercus*)

**Short-lived snags (Less than 15 years)**

Western hemlock (*Tsuga heterophylla*)
Red Alder (*Alnus rubra*)
Bitter cherry (*Prunus emarginata*)
Black cottonwood (*Populus trichocarpa*)

## Snag Height

The height of a snag is dependent on the site. It is important to remember the tree will slowly decay and fall apart. In busy locations, it is best to choose a height that will not put anything at risk as the tree slowly decays and falls apart. Based on management concerns and budget, long-lived snag species may be monitored and reduce in height again as they break down.

## Snag Techniques

Birds love a perch. So, it is important not to strip a snag tree of the lower branches. Branches can be cut back, but stubs should be left to serve as perches and to mimic nature. The cut at the top is important to the look of the final project.

- Try to mimic the way trees look when they break naturally
- Many small slits in the edge of the trunk works well
- Use a small sledgehammer to break and bend the smaller pieces created with saw cuts

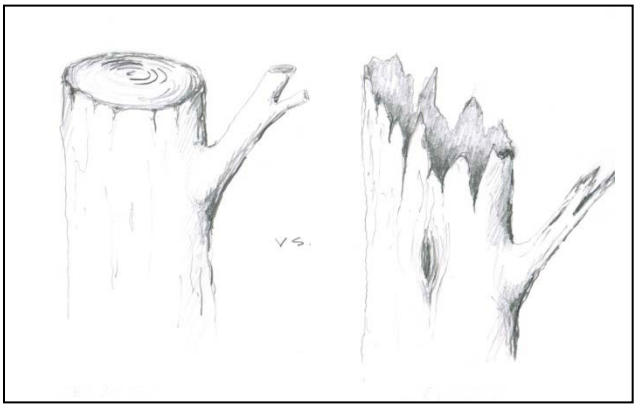

**Figure 2.** Ragged cuts at the end of branches and the top of the tree will look best when the tree is finished.

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**Snag Techniques**

Bird holes form as stumps decay and woodpeckers begin to work on the decayed wood. Bats often use narrow cracks or loose pieces of bark that occur as a snag deteriorates to roost in. This process can be speeded up by cutting in a birdhouse or bat slit in the created snag. **CAUTION: these techniques require advanced chainsaw skills**. Use a small, sharp saw and extreme care.

***Bird hole***

- Bore a triangular "pie' shaped piece from the trunk. Use a crowbar to pop the piece loose.
- Send the piece to the ground and cut the back off, leaving a 1-2" thick slab of wood with the bark.
- Drill an appropriately sized hole. Two northwest species that use trees are chickadee ( 1") and Flicker (2.5")
- Deepen and enlarge the hole using the tip of the saw bar
- Send the piece back up into the snag and screw or nail it back in place.

***Bat slit***

- Make a shallow cut upwards into the trunk of the tree.
- Use the saw to widen the cut to about ½"

**Figure 3.** Climber cutting in a bird hole. Note the limbs have been partially left and the top of the tree has jagged cuts.

**Figure 4.** Finished, artificially created bird hole.

*Tree Solutions Inc. is a Seattle-based environmental consulting firm, with offices in Portland and Bend, OR. We provide a science-based, objective approach to tree evaluation and management grounded in years of experience with tree pruning and removal, land development, treehouse construction and challenge course installations. We have six highly-skilled arborists on staff and are capable of inspecting trees along courses across the United States.*

# Wood chip mulch:
## Landscape boon or bane?

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Landscape mulches are increasingly recognized as pivotal components of environmentally sustainable gardens and green spaces. Select the right mulch and you reap the benefits of healthier soils and plants. Choose the wrong mulch and the only plants that thrive are the weeds.

Before selecting a landscape mulch material, it's important to reflect on the purpose of the landscape in question. For instance, production agriculture generally requires short term, intensive management of a crop, while the philosophy behind landscape horticulture is the long term, sustainable management of a system. Therefore, those mulches that work best for crop production (including vegetable gardens) are often not the best choices for woody ornamental landscapes, and vice versa.

### Direct benefits

The potential, *direct* benefits of any landscape mulch material can be grouped into four general categories:

**Soil benefits**
- improve structure
- enhance gas transfer
- enhance water infiltration and retention
- prevent erosion and compaction
- moderate temperature

**Plant benefits**
- provide nutrients

**System benefits**
- suppress pathogens and pests
- enhance beneficial organisms
- increase biodiversity
- neutralize pollutants

**Human benefits**
- economic
- aesthetic
- ease of application

An exhaustive review of the science behind landscape mulches is beyond the scope of this column (though I have just completed such a review for upcoming publication in a scientific journal). Instead, I'm going to address the documented benefits and drawbacks behind the use of arborist wood chips as a landscape mulch.

### Perfect choice

In areas where trees are a dominant feature of the landscape, arborist wood chips represent one of the best mulch choices for trees and shrubs. A 1990 study evaluated the landscape mulch potential of 15 organic materials, including grass clippings, leaves, composts, yard wastes, bark, and wood chips. Wood chips were one of the best performers in terms of moisture retention, temperature moderation, weed control, and sustainability. In many urban areas, arborist wood chips are available for free, representing one of the most economically practical choices.

Unlike the uniform nature of sawdust and bark mulches, wood chips include bark, wood, and often leaves. The chemical and physical diversity of these materials resists the tendency towards compaction seen in sawdust and bark. Additionally, the materials vary in their size and decomposition rate, creating a more diverse environment that is subsequently colonized by a diverse soil biota. A biologically diverse soil biota is more resistant to environmental disturbance and will in turn support a diverse and healthy plant population.

Wood chips are considered to be slow decomposers, as their tissues are rich in lignin, suberin, tannins, and

### Interested in field trial research?

*Is your local Master Gardener program interested in conducting field trials on gardening products? Occasionally, companies will contact Dr. Chalker-Scott with requests for product testing. Interested groups will receive basic training in designing and conducting experimental field trials; local programs will need to provide all materials and field space. If interested, please email Dr. Chalker-Scott at* lindacs@wsu.edu..

**MORE INFORMATION**

Dr. Chalker-Scott's extensive reference information is located at the following Web site:

*www.puyallup.wsu.edu/~Linda%20Chalker-Scott/Wood%20chip%20references.html*

other decomposition-resistant, natural compounds. Thus, wood chips supply nutrients slowly to the system; at the same time they absorb significant amounts of water that is slowly released to the soil. It is not surprising that wood chips have been cited as superior mulches for *enhanced plant productivity*. Wood chips have been especially effective in helping establish trees and native plants in urban and disturbed environments.

Arborist wood chips provide incredible weed control in ornamental landscapes. The mechanism(s) by which wood chips prevent weed growth are not fully understood, but probably include light reduction (preventing germination of some seeds and reducing photosynthetic ability of buried leaves), allelopathy (inhibiting seed germination), and reduced nitrogen levels at the soil-mulch interface (reducing seedling survival).

While there are imported wood mulches available for purchase at nurseries and home improvement centers, they are not as cost-effective as locally produced wood chips, which are often free. In a society where using locally produced materials is increasingly popular as a measure of sustainability, arborist wood chips are a natural choice. Finally, the reuse of plant materials as mulches keeps them out of the landfill—a benefit with both economic and environmental attributes.

## Drawbacks of wood chips—mulch ado about nothing

There are a number of concerns surrounding the use of arborist wood chips as a landscape mulch. I have constructed a quick summary here. Relevant references can be found on the Web site listed in "More Information." Overall, the commonly expressed concerns about woody mulches are not borne out in research trials.

***Concern***: Woody mulches will acidify soils.

***Evidence***: None. In field situations it is difficult to significantly alter soil pH without addition of chemicals. Transient changes in pH may be found in the decomposing mulch layer itself, but these have little effect on underlying soils.

***Concern***: Woody mulches, such as cedar, leach allelopathic chemicals that kill other plants.

***Evidence***: Many plant materials contain allelopathic chemicals, which can prevent seeds from germinating or kill young seedlings. Most compounds have no effect upon established plants. Only a few woody materials have been found to contain allelopathic chemicals (e.g. *Juglans nigra*, black walnut). Cedars (*Thuja* spp.) have not been found to have this ability.

***Concern***: Mulches made from chipping diseased trees can infect healthy trees.

***Evidence***: Most studies indicate that diseased mulch cannot transmit pathogens to the roots of healthy trees. Under no circumstances should wood mulch be used as backfill. Not only is this a poor installation practice, but a potential mechanism for disease transfer as well. Fungal communities found in wood chip mulches are generally decomposers, not pathogens. Under healthy soil conditions, beneficial and harmless fungi can out-compete pathogens for space on plant roots. Furthermore, healthy plants are not susceptible to opportunistic pathogens such as *Armillaria* and *Phytophthora,* which are often ubiquitous but inactive in well-managed soils.

***Concern:*** Wood chips could be a fire hazard, particularly when they are used on landscapes around structures.

***Evidence:*** Coarse textured organic mulches, like wood chips, are the least flammable of the organic mulches. Fine textured mulches are more likely to combust, and rubber mulch is the most hazardous of all tested landscape mulches.

Jim Black

## *A bargain for gardeners*

**Arborist wood chips are available locally in many communities. Most sources are free or inexpensive for wood chips made from recycled pallets and other discarded wood products. That this mulch is both cheap and scientifically proven to be superior makes it an ideal Master Gardener-recommended product.**

**At left, Yakima County recyling and compost education program coordinator Mikal Heintz is shown with her wood chip operation located at the county landfill. Former head of the Yakima Area Arboretum, Mikal works with the community to promote composting and wood chip mulches.**

***Concern:*** Wood chip mulches will tie up nitrogen and cause deficiencies in plants.

***Evidence***: Actually, many studies have demonstrated that woody mulch materials increase nutrient levels in soils and/or associated plant foliage. My hypothesis is that a zone of nitrogen deficiency exists at the mulch/soil interface, inhibiting weed seed germination while having no influence upon established plant roots below the soil surface. For this reason, it is inadvisable to use high C:N mulches in annual beds or vegetable gardens where the plants of interest do not have deep, extensive root systems.

***Concern:*** Woody mulches will attract termites, carpenter ants, and other pests.
***Evidence:*** Many wood-based mulches are not attractive to pest insects but are actually insect repellent. For instance, cedar (*Thuja*) species produce thujone, which repels clothes moths, cockroaches, termites, carpet beetles, Argentine ants, and odorous house ants. In general, termites prefer higher nutrient woody materials, such as cardboard, rather than wood chips.

## Application

***Let wood chips age before using them if there are concerns about disease.*** Personally, I have never done this; I happen to love the smell of fresh wood chips and enjoy spreading them out over the landscape. Additionally, some of the nutrient value (particularly nitrogen if the chips contain leaves or needles) will be lost in the composting process. Using fresh chips ensures that some of the foliar nitrogen will feed the landscape rather than the compost pile.

***Before installing wood chips, create a thin underlying layer of a more nutrient-rich mulch (like compost) if there are concerns about nutrient deficiencies.*** This "mulch sandwich" approach is a logical one that mimics what you would see in the mulch layer of a forest ecosystem. It's not required, though, and over time a wood chip mulch will develop this same structure as the lower layers break down.

***Begin mulch application before annual weeds are established.*** Mulch is most effective in suppressing weeds when weeds are not yet present on site. Therefore, bare soil should be mulched as soon as practical, especially in the spring and fall when weed seed germination is at its peak. If this is not possible, the most effective, non-chemical way to remove weeds prior to mulching is to mow them as close to the ground as possible, followed immediately by mulching.

***Prune or mow perennial weeds at the root crown in early spring when root resources are lowest (generally just as leaf growth begins).*** Extensive pulling of perennial weeds from unprotected soil is not recommended, as this disturbance will increase erosion, especially in sandy soils or in sloped areas. It is better to keep unprotected soil undisturbed. However, you can pull resprouting perennial weeds covered in mulch; the mulch layer prevents erosion and facilitates pulling.

***Remove all noxious weed materials from site to prevent rerooting or seeding.*** Self explanatory!

***Install chips to the desired depth.*** A successful wood chip mulch must be deep enough to suppress weeds and promote healthy soils and plants: research has demonstrated that weed control is directly linked to mulch depth, as is enhanced plant performance. A review of the research on coarse organic mulches and weed control reveals that shallow mulch layers will promote weed growth and/or require additional weed control measures. I recommend 4-6 inches for ornamental sites and 8-12 inches for restoration sites and/or perennial weed problems.

***Keep mulch away from trunks of trees and shrubs.*** Piling mulch against the trunks of shrubs and trees creates a dark, moist, low oxygen environment to which above-ground tissues are not adapted. Fungal diseases require a moist environment to grow and reproduce; piling mulch on the trunk provides exactly the right conditions for fungi to enter the plant. Likewise, opportunistic borers are more likely to invade a plant whose bark is wet due to excessive mulching. Rather than creating mulch volcanoes, instead taper the mulch down to nearly nothing as you approach the trunk. This donut-shaped application will protect the soil environment as well as the above-ground plant tissues.

**Arborist wood mulch, when used with contrasting landscape textures, such as the gravel, rock, and grass shown at right, produces a low-maintenance but beautiful garden setting.**

***Replace mulch as needed to maintain desired depth; replacement rate will depend on decomposition rate.*** Once mulch is applied, little management needs to be done other than reapplication to maintain minimum depth. High traffic areas are most likely to need replacement.