Silviculture Prescription for the UBC Farm

Scenario 2

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Introduction

The purpose of this exercise is to apply our knowledge of forest ecology and regeneration silviculture by selecting specific stands and determining appropriate management objectives. We used information we gained from lectures and labs in order to determine suitable strategies to conduct site and stand diagnoses. This lab provided us with the opportunity to become aware of the challenges of forests on the interface with urban disturbances. It also helps us to develop a sense of professional accountability and capabilities to defend our prescription. Finally, it exposed us to working with our crew composed of individuals with various backgrounds and knowledge in forestry. We were able to learn to communicate our ideas to form a collaborative prescription.

The UBC Farm is located in the south campus area of the University of British Columbia. It is a 24 hectare teaching, research, and community landscape, which aims to create integrated sustainable development to support the ecological, economic, social, and educational interests of the University (Centre for Sustainable Food Systems at UBC Farm 2011). The mix of crops and livestock represent the objectives of the farm to establish an agroecological framework to produce a variety of food, fibre, and fuel production (Centre for Sustainable Food Systems at UBC Farm 2011). In this prescription, the two ecological units are situated in the southwest and middle region of the farm. One site, which is referred to as Ecological Unit A (EUA), is a 0.23-ha alder stand close to the children's garden, which is a naturally regenerated stand since the developments in 2000. This stand is dominated by red alder (*Alnus rubra* Bong.). It is mixed with some conifer species in the understory, such as western hemlock (*Tsuga heterophyla* (Raf.) Sarg, grand fir (Abies grandis), and Douglas-fir (*Pseudotsuga menziesii* Mirb. Franco). The other stand which is referred to as Ecological Unit B (EUB), is a 0.99-ha site in the semi-natural forest. This stand is of high species diversity, which is mainly composed of big-leaf maple (*Acer macrophyllum* Pursh), Douglas-fir, western hemlock, and western redcedar (*Thuja plicata* Donn ex D. Don).

The main management objective of our treatments in these two stands is to achieve the success of ecological, social and economic goals of the UBC farm. We will maintain most deciduous species, thereby improving the diversity of site, as well as the diversity of wildlife habitat. Recreational and educational functions of the forest will be provided through contrasting treatment units in the stand. Finally, we will make efforts to minimize impacts on soil conditions, surrounding wildlife, and all aspects of the farm, while improving the economic, social, and ecological benefits of forest and agroforestry products.

Methods

Field Work

The UBC south campus farm provided the opportunity for our group to perform the necessary field work in developing our silvicultural plan for both EUA and EUB. We began with the mapping and initial field reconnaissance of the area. We found the existing trail networks and roads that lead to our ecological units. We then proceeded with determining the boundaries of our ecological units to distinguish them from the rest of the farm's landscape. For EUB we established a 0.01 hectare plot, which was used to determine the stems per hectare of this ecological unit, a soil diagnosis with a soil pit, and the over-story and shrub layer vegetation composition. It is assumed that the information collected in this plot is representative of the entire EU. The basal area was also measured at this location using both a prism and the thumb technique. This value was also assumed to be the average of the stand. EUA has a much smaller area. We began with mapping this area by determining where it borders the children's garden and the semi-natural stand. We then established a 0.01 hectare plot and followed the same procedure that we used for EUB. During our field reconnaissance for both EUs we noted terrain breaks, wet areas and creeks. The information gathered from the field enabled us to map both our ecological units and treatment units and to perform stand and site diagnosis for both ecological units.

Office Work

Our initial field work was followed by creating a preliminary map. This map represented the following: roads, trails, EU and TU boundaries, and specific plot locations. Assumptions that were made when creating the map were based on our field work, which provided sufficient information in regards to wet areas and creeks. We also ensured that the scale of the map was appropriate. With the site diagnosis information gathered in the field, we were able to summarize current stand conditions and determine our objectives. The solar impact graph was created in the office using information gathered from the internet. The creation of this graph assumed that the general solar angle given for the region was the true solar angle for the UBC Farm specifically.

Contacts

Many resources were contacted to establish appropriate pricing for every procedure of our silvicultural prescription and to gather information in regards to the farm. We began by contacting Mark Bomford who is the director of the farm to gather some information in regards to the history of the farm and our ecological units and to confirm the overall goals and objectives of the farm to ensure our silvicultural prescription is in align with these objectives. We then tackled the pricing portion of our prescription.

Beginning with EUB we wanted to determine how much it would cost to have a falling/tree removal crew to come in and perform our thinning and clearing procedures. The Burley Boys where contacted as they are a well-respected local certified urban arborist company and provided us with some very reasonable quotes. We assumed the price quotes were accurate, although the Burley Boys never saw the job site and had to base their quotes off of information we provided over the phone. Brushing and site prep involved accumulating tool rentals; GWG rentals and Star rentals were contacted in regards to renting brush saws and a Billy Goat heavy duty brush remover. EZE rent-it was contacted to determine the rental cost of a wood chipper. Dunbar lumber was contacted to determine the pricing for signs. These rentals provided us sufficient information to budget all of the steps of our silvicultural prescription.

For EUA we received a quote from the Burley boys for harvesting. Once again, we assumed the accuracy of this quote because the Burley Boys never saw the site. Houston Landscapes was contacted to determine the cost of trucking in mulch weigh the benefits from creating our own mulch and distributing it. Thimble Farms was contacted in regards to the cost of purchasing our berry plants and for recommendations of which species to plant and the autoecology of those species. Forstbauer Natural Food Farms was contacted to determine the pricing of our berry products such as jam and pie and the berries themselves. The information gathered from these contacts was very useful in determining the budget for our silvicultural plan to determine whether or not is was economically feasible.

Research

The primary research performed during our silvicultural prescription preparation was in regards to our red alder experiment, as it is a very new subject to us all. A paper written in 1984 by Harrington called "Factors Influencing Initial Sprouting of Red Alder" was used because it provided sufficient information to help establish the red alder coppicing experiment. We assumed that the information detailed in this paper could adequately be adapted to our plan. Supplementary research was done in regards to the tent caterpillar (*Malacosoma disstria*) to gather information in regards to protecting the regenerating red alder shoots.

Meetings

We arranged for two meetings with a silvicultural expert and registered professional forester, Dr. Steve Mitchell. These meetings were conducted to review the progress of our prescription inspire some critical thought. These meetings also provided us with an opportunity to ask an expert some questions about our prescription that aided us to clear up some difficulties. Periodic group discussions where arranged throughout the term to allow for the group to accumulate ideas and discuss the progress of the prescription.

Results and Discussion

Summary of ecological conditions of EUA

Current Stand

EUA is in the CWHdm biogeoclimatic zone. Currently EUA is composed of two distinct structural layers with a density of 2200 st/ha. The red alder overstory was naturally regenerated throughout the same time period, and is now 12 years. The average diameter at breast height (dbh) is 7.5 cm and the average height is 12 m. The understory of conifers seeded in naturally too, throughout the 12 year history of the stand. There is a diverse species composition of these including grand fir, Douglas-fir, western redcedar, and Norway spruce. The tallest of these is approximately 2.5 meters, with a dbh of approximately 4 cm. The understory also includes shrubs such as salmonberry, Himalayan blackberry (alien and invasive), and trailing blackberry.

The forest humus form is a mormoder on top of a podzol. The diagnostic horizon, Bf, was an orange silty loam. The soil coarse fragments are all subangular, and make up 15% of the soil matrix. The soil was very compacted and processed, unlike a natural forest floor. There was also some landscaping fabric. Initially the site series was classified as 03 (FdHw-Salal), but upon further diagnostics that considered the presence of plants that indicate a rich site (western redcedar, blackberries, and salmonberry), it was reclassified to be 04 (Fd-Swordfern). The 04 site is defined by a soil moisture regime (SMR) of 2-3 and a soil nutrient regime (SNR) of M-R.

Because of red alders rapid height growth, without increasing the stem diameter at the same rate, this stand is currently at risk for both wind and snow damage. Because of its proximity to the children's garden these risks need to be addressed. There is a very low risk of fire in EUA because of the high moisture content of the alder leaves.

Target Stand

TUA1

For the target stand EUA will be divided into three different treatment units. The most northwest third of the stand, TUA1, will be left in its current state, at the current density, with the alder overstory and conifer understory. This TU will serve as a control for the alder coppicing experiment. It will not be used to create any products, but will demonstrate the way a naturally regenerated stand in this region progresses through time. This is an especially unique opportunity because most forested parks within the city are not in such an early successional stage. This stand also serves as a buffer between the coppicing experiment and the semi-natural forest, so the transition between the two is not as aesthetically shocking.

TUA2

The center third of the alder stand, TUA2, is immediately adjacent to the children's garden and will become part of an alder coppicing experiment. The red alder in TUA2 will be thinned to 500 st/ha. The trees that are selected to be retained after the thinning will be those that have a consistent diameter of approximately 10 cm. It is also very important that these trees be vigorous and healthy. These trees that are left will be cut at varying heights of 1.0m, 1.5m, and 2.0m. The cut should have a southwest angle to minimize the risk of infection that increased moisture creates. They will then monitor twice a year, at the beginning of the growing season (to measure any out of season growth, or damage from the winter months) and at the end of the growing season, to quantify the coppicing that occurs.

The conifer understory and all shrubs present in the current stand will be brushed, so that they do not interfere with the coppicing experiment growing space or monitoring and because the conifers will eventually become too tall and shade out the children's garden.

As a result, once the experiment has been completed, the wood products from the coppicing experiments in TUA2 may include: wood to smoke meat on the farm (because alder is low in pitch), carving wood, basket weaving wood, indoor furniture, firewood, charcoal, and dyes from the wood and leaves (Tree Book, 2011).The reduced spacing between the coppicing branches relative to TUA3 will cause the coppiced branches to be straighter, which will increase the amount of wood for applications such as structural wooden furniture.

TUA3

TUA3, the most southeast third of the current alder stand will be thinned to 1000 st/ha. This TU will also be a part of the alder coppicing experiment, so the trees to be thinned will be selected on the same bases as TUA2. Likewise, preparation for the coppicing experiment by brushing out all conifers and shrubs will occur in the same manner. The variety of heights of the stumps in TUA3 that are cut in preparation for the coppicing experiment will be cut in the same proportion as in TUA2. The products from TUA3 will be the same as TUA2, but because the spacing between the coppicing trees is greatest in TUA3. Based on observations of other coppiced alder (See Figures 1,2, and 3 in the appendix), the shape of the branches is anticipated to have a greater bow at the bottom because there will be more growing space to take advantage of. Due to their shape, they will likely be more appropriate for non-structural uses.

Rationale

There is not a free growing standard for the coppicing experiment because the stand is not regenerating in a conventional manner. Rather, during each period of monitoring it will be verified that the coppicing is still putting on yearly incremental growth and is vigorous and structurally sound. If this standard is not met in over 50% of the trees in each TU, then there will be an additional two years before any action is taken to see if the growing improves. If the end of this two-year period is reached without improvement, then reasons for failure will be evaluated and the stand will be liquidated. One of the possible alternatives in this case is extending the garden into EUA to take advantage of the nitrogen fixed by the alder.

The UBC farm has general management objectives that are met by the creation of these three TU. In the Farm's Mission Statement it is stated that the farm is committed to sustainability by transforming the farm into a "living laboratory," which is precisely what the coppicing experiment does. The farm also hopes that the target stand will provide a source of materials as building products, food, or craft material. The coppicing experiment will adhere to this objective at the end of the experiment, by producing a volume of alder wood that can be used for a variety of purposes (see list of products in TUA2) on the farm.

More specifically the management objectives for EUA are to decrease the shade on the children's garden, while also mitigating any safety risks because of its proximity to areas with a lot of recreation. By converting EUA into the three TU of the coppicing experiment these objectives are met.

Because the red alder are already established in EUA, converting the EU into the three TU to complete a coppicing experiment seems to be a very efficient use for the site, while addressing the problem of shade over the children's garden. Additionally, the treatments for TUA2 and TUA3 address the wind and snow damage risk on the sites by reducing the turning arm of the trees. The coppicing branches will create crooks where snow might accumulate, but losing a coppiced branch is not a safety hazard like it would be in the current stand. Furthermore, because these TU are part of an experiment, some loss of coppiced branches are completely acceptable, and will just be recorded when the TUs are monitored for the experiment. TUA1 is still susceptible to this risk, but because it is not adjacent to the children's garden it has been deemed less likely to cause injury.

It makes the most sense to maintain TUA1 in its current state because a control is required to confidently determine accurate conclusions regarding mortality for the experiment. Moreover, part of the farm's objectives is to provide an opportunity to observe natural forest development, which is also achieved by maintaining TUA1 in its current state. TUA1 can remain this way and progress through natural succession because it will not shade the garden.

TUA2 is the least dense and therefore will create less shade, which is why it is the TU neighboring the garden. For both TUA2 and TUA3 the cutting of the trees for coppicing reduces the windthrow and snow damage risk. The maximum height of the coppicing experiment will initially be just 2 m after the stumps are cut. Based on the Solar Angle Graph (see appendix), which determines shadows on the garden based on tree height for the longest and shortest day of the year, it is known that during the growing season only 5 m (at maximum) from the edge of the stand will be in shade as long as the trees remain below 14 m. The shadow during winter is also graphed, but because there is not any growth during this time in the garden, it not a concern that for trees that are 14 m there is a shadow length of 40 m from the edge of the stand at this time. Since this is looking at the two extremes of day length, for most days the shadow length will be between these two differences. The Solar Angle Graph is a useful tool to determine when the alder reaches a height that is too tall.

Treatment Regime and Rationale for EUA

Note: For illustration of scheduling see both timelines in the appendix.

Introduction

Red alder grows well in a variety of conditions (Harrington 1984), however it is not a shade-tolerant tree species and often establishes in a site rapidly following a disturbance and potentially shades out coniferous species (Tree Book, 2011). The current conditions in EUA are an excellent example of this natural succession of initiating alder followed by an understory of conifers including Douglas-fir, grand fir, and Norway spruce to name a few. Through a Permit Application Form from the UBC Farm and communications with Mark Bombord, the Director at the UBC Farm, the history of EUA was discovered. In 1984-85 clearing, infrastructure servicing, landscape fabric installation and other development took place (Proposal, 2009). About 15 years later, initial penetration of the landscape fabric by red alder and other successional species occurred and marked the beginning stages of the stand that is there now (Proposal, 2009). The current issue regarding EUA is the height of the alder and the shade it imposes on the children's garden to the north of the stand. It is known that red alder can reproduce through seed as well as vegetatively (Harrington 1984), which provides an excellent opportunity to utilize this stand in order to further our knowledge regarding vegetative reproduction of red alder. An example of coppicing was brought to our attention in the Totem Park Field on campus; pictures were taken of this developed stand of coppiced alders and are in the appendix section (Figures 1,2, and 3) at the end of this report.

Coppicing has been historically used as a method for maintaining a sustainable supply of small round wood (Ancient Art of Coppicing 2011). The process of coppicing allows the roots to allocate resources to new growth and can actually lengthen the life of the tree (Ancient Art of Coppicing 2011). With the development of different management systems, such as agroforestry, coppicing may begin to play bigger roles for varying objectives. It is important to understand the effects of coppicing on different tree species in order to utilize this information while developing management plans; this can be applied to either maximize or minimize the amount of sprouting in practice (Harrington 1984).

From the two studies done by Constance Harrington in 1984, many factors that influence the initial sprouting of red alder were observed. The first study consisted of planted four year old alder cut at five different heights of 0, 10, 30, 50, and 70 cm from the point of germination. The cuts were made at different times of the year as well; January, May, July, and September. The best survival was found from cuts that were 30 cm and higher in the month of January and the worst survival was 0 and 10 cm in July and September. The success of sprouting in regards to the time of the cut is related to time of dormancy of the tree. Stump height may play an important role in decay resistance; the wood of red alder is not particularly resistant to decay and because of this the height of the coppice affects the temperature and moisture. This may lead to the accumulation of decay organisms. (Harrington 1984).

The second study of Harrington observed 29 natural stands cut in February between the ages of 1 and 32 years. The results found that the young stands consisted of the most vigorous and consistent sprouts and in the oldest stands very few stumps sprouted, and of the ones that did there were fewer and shorter sprouts. The study also observed the effect of the cut surface angle and the aspect that it faces on mortality of the stump. The highest level of mortality occurred on level surfaces due to the water retained on the top of the stump. An aspect towards the south or west had the least mortality and had the highest likelihood to sprout. With the information gathered in Harrington's two studies it is clear that in order to reach specific management objectives, different coppicing treatments must be used. (Harrington 1984).

Following the lead of Harrington, and with the opportunity available to us at the UBC Farm with EUA, we want to learn more about coppicing and vegetative reproduction in red alder. The specifics of the methods will follow the results found by Harrington in order to optimize the survival of the trees. We are going to be observing different stump heights taller than those used in Harrington's, which will be 1.0, 1.5, and 2.0 m above the point of germination. The second factor we will be looking at is the density of the stand and the possible effect it will have on the angle of sprout growth. We are predicting that TUA2 is going to utilize more growing space than the trees in TUA3 because of the differences in density. We think that this is an interesting study because of the use of shelter systems, agroforestry, and other innovative silvicultural prescriptions. The main reason we have decided to manage EUA is to reduce the amount of shade that is projected onto the children's garden adjacent to the stand. Based on the Solar Angle Graph in the appendix, we know that the potential shade that is projected onto the garden is a concern that needs to be addressed.

Harvesting

The harvesting treatment in EUA will occur in the fall of year one in TUA2 and TUA3. TUA1 is being left as a control and will have no harvesting and as such will remain at 2200 st/ha. If any trees pose a threat to people in the children's garden or in any of the treatment units they will be removed to reduce the risk. TUA2 will be reduced to a density of 500 st/ha and TUA3 will be reduced to a density of 1000 st/ha. The different densities of the two TUs will assist in making observations of the effect that stand density has on the directionality of vegetative growth after coppicing. Trees that are selected for the coppicing experiment will be flagged as well as rub trees to ensure that they are not felled during harvesting. The alder that will be removed are between 2 and 20 cm dbh with varying crown sizes. The cut will be made as close to the ground as possible with a flat surface. A tractor will be used to move materials out of the stand and to the road to the east of EUA. A second entry into the stand will be made in January to apply the coppicing treatment. The selected trees will be coppiced at heights of 1.0, 1.5, and 2.0 m, which will have been previously assigned to each tree, on an angle to the south/southwest. When coppicing is taking place the rub trees that were left during the thinning treatment will be felled and removed from the stand as well.

The harvesting equipment includes a chainsaw, garden clippers, pruners, loppers and axes which are all available for use at the farm and will keep the costs of operations to a minimum. The harvesting will need to be completed by a certified chainsaw operator. Ideally, a volunteer would be available for the task; recruiting a forestry student who has experience in the field and who is interested in the project is a viable option. In the circumstance that one cannot be found, the services of the Burley Boys will be required at an estimated cost of $800 (Burley Boys 2011).

Because of the resources needed, minimal costs, and the objectives in mind, this is the optimal way to harvest the stand. It is a relatively small operation and keeps tools mainly hand operated. These tools and methods have been chosen in order to reduce the impact on the soils as well as to limit the machines that are required to treat the area. In addition, trucks will not be required because all the products will stay at the farm and the transport that will be required on site can be accomplished with the farm tractor.

Site Preparation

The site preparation that will be required consists of two different brushing treatments in TUA2 and TUA3, a total area of 0.16 ha. All shrubs and the conifer understory will be removed, including salmonberry and blackberry, through the use of a brush saw in the spring following the harvest in the fall. The first brushing treatment will be conducted at the same time as the harvesting in the fall. The second brushing treatment will happen while entering the stand for the coppicing cut in January. This treatment will only take place if the vegetation is coming back in to attempt to reduce its vigor, which is not anticipated to occur because it will be winter. If there are enough people and sufficient resources, some of the salmonberry will be transplanted to TUB1 to supplement the cost of buying berries and to maintain the self-sustainability of the UBC Farm.

The cost of the first treatment is included in the price estimated for harvesting. The second treatment during the coppicing cut will be conducted by the same individuals doing the coppicing treatment. Again volunteers will hopefully be available, if not an estimated cost of $15/hr for the labour will be included for each worker. A brush saw will need to be rented for each brushing treatment; the cost is $240/week based on an estimate from Star Rental in White Rock, BC.

Due to the fact that planting is not required in this prescription, there is no need for creating suitable microsites. Brushing is a necessity for the target stand because the objectives of the experiment require there to be open space for growth of new sprouts following coppicing. The openness of the forest floor will also aid in making the stand accessible for observing and measuring the vegetative growth. Using a brush saw is the optimal choice because of the characteristics of the vegetation as well as the size of the stand; human powered tools would take a large amount of time and would be strenuous work for individuals involved, which make them an impractical option.

Regeneration

The entire silviculture prescription for EUA concerns the regeneration. There is not the typical planting procedure for this site, but rather the plan is oriented around healthy growth of the vegetative reproduction. The sprouts will be maximized, as mentioned previously, by following the findings of Harrington. Cutting on an angle, having the surface of the cut facing the south and southwest, tall stump heights, and timing of the coppicing are all methods which will be included in an aim to increase the number of sprouts per stump and to improve their vigor.

The materials do not exceed that which is needed during the coppicing application until monitoring begins. In order to reach the designated stems per hectare for each treatment unit there will be around 27 and 80 stems in TUA2 and TUA3, respectively. Collectively between TUA2 and TUA3 a total of 120 coppiced trees will have continuous measurements being taken over a time frame of 10 years. After this benchmark another coppicing experiment will take place over the following 10 years to observe how the trees react to multiple coppicing treatments. One of the multiple options for EUA at the end of these 20 years is to become a continuation of the children's garden because of the high nitrogen content in the soils. More information about measurements and timing is specified in the monitoring section.

This is an optimal plan because it maintains the goals of the farm as well as our objectives for the stand. It is an educational opportunity for university students, the farm, and the community. It also has potential to increase supplies for different purposes around the farm, such as firewood, poles, chips and so on, which is consistent with the self-sufficiency of the farm. In addition, the cost is basically zero because there is not any stock required or planting crew needed.

Vegetation Management

Vegetation management will include continuing annual brushing treatments each spring, but will not need to be as intensive as it was in the initial site preparation. These treatments will only be occurring in TUA2 and TUA3 because TUA1 is to have minimal activities occurring in it so that it represents natural succession. A brush saw may not be required as the vegetation will not be as extensive; garden sheers and loppers, available at the farm, as well as our trusty volunteers can be used. The tools will also be needed to cut back any vegetative growth that is occurring in the stand which is not part of the experiment. This brushing will keep the coppicing experiment accessible for monitoring, however preventing competition is not a major priority in the objectives and as such does not need to be extremely thorough.

Suppressing vegetation along paths, which are approximately 100 m long through TUA1 TUA2 and TUA3, will be achieved by spreading mulch that was chipped from the harvest in TUB1 and the thinning done previously in TUA2 and TUA3. This will require the farm tractor and a trailer to move the chips between EUs. This will occur immediately after the initial site preparation brushing in the fall to prevent regrowth on planned paths as well as to utilize the same crew of volunteers. Mulch may also be used on the forest floor to reduce the amount of growth of undesired species if there is a large enough supply and if more action in addition to the brushing treatments is necessary.

The alder stumps that remain after harvesting, if the objectives were met, will have as small of a stump height as possible with a flat surface. This is important to reduce their vigor and vegetative growth that is not wanted. As mentioned previously the flat surface of the stump retains water which can be detrimental to the health of the stump, and the height has an effect on temperature and moisture which can increase the amount of rot and bacteria (Harrington 1984).

The shrubs in the site are only likely to become competition to the shorter stump height coppiced trees and as such the main reason to have vegetation management is to maintain accessibility to the experiment. The primary method of obtaining this objective is through the path topped with mulch. It is unlikely that the entire forest floor of TUA2 and TUA3 will be mulched because there is no real need to manage vegetation that intensively and the costs would be too high. A light annual brushing is optimal to maintain access to the alder experiment, while still not affecting the results, both to make it easier for individuals collecting data and for the community as we encourage them to follow the experiment with us.

Protection

In order to reduce the harm inflicted on the trees selected for the coppice experiment in TUA2 and TUA3 during harvesting, rub trees are going to be left on either side of the selected trees. This will protect the individuals from trees as they are being felled as well as when they are being taken out of the stand. It is important to inform the faller that the residual trees are being used in an experiment and their protection is a priority. Another step to reduce damage during harvesting is to buck larger crowns prior to the removal from the site. The branches are fairly small and will likely only require a pair of loppers to achieve this. This will not only reduce the amount of damage to standing trees, but will also retain some of the nutrients in the stand by leaving the nitrogen rich content on the ground.

Tent caterpillars (*Malacosoma californicum pluviale* Dyar) are tree defoliators, which create tents on the tips of branches, hence how it received its name (Rhoades 55-68). Alder is among one of its many preferred hosts along with birch (*Betula*), cherry (*Prunus*) and cottonwood (*Populus*). A tree which contains only one tent can be defoliated by 20% and in the presence of multiple tents a tree can be completely defoliated (Rhoades 55-68). This will not necessarily kill the tree but its growth will be reduced and increase the susceptibility of the tree to other damage (Rhoades 55-68). The presence of these caterpillars could be detrimental to the experiment and watching for them is worthwhile. If they are seen, a non-herbicide method of simply removing them from the sprouts can eradicate them from the stand, which is consistent with the Farm's ideals.

The trees that are currently in EUA are fairly susceptible to windthrow because they are in such a small stand and are tall. For this reason, as well as the objective of decreasing the shade on the garden, there will be no residual trees other than the coppicing experiment. The stumps will not be very susceptible to snow damage because of slant of the cut, but the new shoots could be more sensitive. We are hoping that because they are deciduous and will have lost most of their leaves by the time of snowfall that snow will not accumulate on the branches and weigh it down. One concern however, regards the build-up of snow in the crooks where the new sprouts attach to the stump and may cause some damage; this will be monitored during the data collection and some mortality due to weather conditions is acceptable.

Another potential threat to the alder experiment is the public. To mitigate this risk signs will be placed at the entrance to the paths to explain the coppicing experiment to the public and to request that they do not touch or interfere. These signs will be placed after the experiment is prepared.

Monitoring

The amount of observations in TUA1 is minimal; the only condition that we are concerned with is the safety within the stand and around the path. In order to follow the success of the coppicing experiment in EUA however continuous monitoring will be required in both TUA2 and TUA3. Monitoring will occur twice a year for the whole 20 year duration of the project; once in the beginning of spring and once at the end of fall to capture both the beginning and end of the growing season. Measurements that will be taken include the number of sprouts per stump, height and diameter of sprouts, angle of sweep at the base of the sprouts, visual assessment of vigor and structural soundness, as well as notes of any mortality occurrence in the sprouts. The data will be recorded on formatted data sheets and continually filed together in a specified location. An example of how the form that will be filled out is included in the Appendices.

In order to collect this information a ladder will be required to observe the tops of the tallest coppicing applications. The pre-made form will be available along with clipboards and pens to record the information in a consistent manner. A measuring tape will be utilized to collect the height and the diameter of the sprouts; a D-tape would not be suitable in this experiment because the diameters of the sprouts will be too small in the beginning, however if growth reaches a size suitable for a D-tape then it may be utilized for more accurate readings. To ensure that diameter is measured at the same place on the sprout it will be specified on the form to measure the diameter as close to the stump surface as possible. To record the angle of the sweep, handmade weatherproof protractors will be made that are large enough to easily take the reading. Each stump will be tagged with metal pendants so that they are easily identified and the information will remain organized. This position will hopefully be able to be filled by volunteers interested in the subject, however we recognize it may not be possible to have unpaid personnel and may offer the position with a wage of $15/hr for each individual involved.

In TUA1, monitoring the mortality of the alder may give some insight about survival in the other two TUs. If there is a high level of coppiced trees dying the information collected about the alder in the control will allow us to know if the mortality is due to the coppice experiment or if it would have occurred naturally. It will be important to note the cause of death in TUA1; if it is inflicted by wind or snow damage it may not be appropriate to compare it to TUA2 and TUA3 because of the structural modifications made in these areas.

Monitoring is the most critical part of the experiment. It is how the data is collected and thus how the results will be measured. Having university and community involvement is important for the far, so by having volunteers coming in for the experiment will be highly encouraged. This also includes the necessity of having clear instructions and forms to fill out because there are many different individuals involved. Overall, if the results are to be in-depth and meaningful then intensive monitoring is key. A draft of the form which will be filled out during each monitoring event is included in the appendix of this report.

Summary of ecological conditions of EUB

Current Stand

EUB is a mixed species stand in the CWHdm subzone with a density of 4200 st/ha; predominately understory regeneration with few dominant trees. The dominant layer of this stand consists of western redcedar, western hemlock and Douglas fir, with an intermediate layer of western redcedar, western hemlock, big leaf maple, and red alder. The supressed layer is comprised of western redcedar and western hemlock, with intermittent red alder and big leaf maple. The understory vegetation is comprised of salal (*Gaultheria shallon*), sword fern (*Polystichum munitum*), spiny wood fern (*Dryopteris expansa*), trailing blackberry (*Rubus ursinus*), cut-leaf blackberry (*Rubus laciniatus*), step moss, red huckleberry (*Vaccinium parvifolium*), and snowberry (*Symphoricarpos albus*). The soil is a mull-moder Podzol with an orange-brown sandy loam Bf horizon; the coarse fragments were sub-angular and comprised roughly 15% of the soil matrix. The understory vegetation and soil properties indicate that this stand is a site series 07; with a Soil Moisture Regime (SMR) and Soil Nutrient Regime (SNR) of 5 and rich, respectively. The primary limiting factor of this site is a shallow rooting depth of roughly 90cm and a relatively high water table. Some of the risks posed to this site are windthrow, snow damage, root disease (*Phellinus sulphurascens*), and moderate fire risk; anthropogenic more so than natural.

Target Stand

TUB1

The berry patch will consist of four species: bog cranberry (*Vaccinium oxycoccos*), black huckleberry (*Vaccinium membranacium*), salmonberry (*Rubus spectabilis*), and thimbleberry (*Rubus parviflorus*). The bog cranberry prefers moister sites (Thimble Farms 2011); and will subsequently be planted in the wetter microsites. Black huckleberry prefers well-lit sites, and will be planted on the northern edge of the berry patch where the light will reach the ground for the longest time each day (Thimble Farms 2011). The thimbleberry and salmonberry will be planted in the remaining space; aiming to reach an even proportion of each species throughout the patch. Free growing conditions will be when the berry plants are well established, vigorous, and producing a harvestable amount of berries. At maturity, these berry plants will be between 3 and 6 feet tall. These berries will available for “you-pick” for visitors to the farm, and will also be collected by UBC farm workers and sold at the farmers market. In addition to selling raw berries, they can be made into jams and pies, which can also be sold at the famers market, but for a greater cost than the raw berries. Propagates of each berry species will be sold at the farmers market in one gallon pots with instructions for planting so visitors can create their own berry patch at home.

To clear space for the berry patch, there will harvesting of roughly 40 intermediate sized Douglas-fir, western redcedar, red alder, western hemlock and big leaf maple. The fallen trees with straight stems and greater than 20cm DBH will be milled on site using a Procut Portable Sawmill to create dimensional lumber for the farm. This lumber can be used to create or maintain infrastructure on the farm such as garden beds, sheds, and fencing, pending it is properly treated for the designated purpose. The western redcedar can be used for bent wood boxes, carvings such as masks and paddles, and some medicinal uses (Tree Book, 2011). The inner bark can be used for creating rope and weaving baskets and decorative clothing (Tree book, 2011). Western hemlock and Douglas- fir will be used primarily for lumber, given its relatively poor carve-ability and less extractives compared to the big leaf maple, red alder and western redcedar. Sawn big leaf maple can be used for more specialized products such as cutting boards, which can be sold at the farmers market. These planks can also be used for smoking salmon in barbeques, which add value and will also be sold at the farm (Just Smoked Salmon, 2010). There will not be any merchantable timber from the harvested red alder, but it will be chipped to burn for smoking salmon on the farm property for the local First Nations people. Wood that cannot be used for lumber or specialty products will be chipped and used as mulch for the alder stand, the berry and patch, and any other place the farm deems requires mulch.

TUB2

This stand will not significantly deviate from current stand conditions; only minor successional changes will occur; the overall structure and composition will remain the same. Maple taping will occur during the winter months on the remnant big leaf maple trees via bucket collecting rather than a hose transport system. Since the maple sap collecting will only occur during a relatively short time of the year; there will be no need to create paths from the existing road to, and between, each big leaf maple tree. Using the buckets rather than a hose system will mitigate the overall disturbance to the understory vegetation, and will be more suitable for the scope of the maple tapping operation. (BC Forest Museum, 2010)

Rationale

TUB1

Planting native berries on the farm allows visitors to experience the local, native berry selections and to be educated on their growth, production and cultivation. The berries would provide a source of income to the farm by selling them raw, but also as valuable secondary products such as jams, pies, or cultivated berry plants in 1 gallon sized pots. Growing native berries supports a sustainable agroforestry initiative while enhancing the diversity of the stand. These berries depend on being pollinated by bees; of which the UBC farm has many (UBC Farm, 2011) (Thimble Farms 2011). The site has natural depressions and humps along the ground that will be maintained during the harvest, providing naturally wetter and drier microsites to optimize each berry species specific niche; although the general site conditions are suitable for all four species. On the site scale, the berries will be arranged by light requirements to optimize each species growth potential.

Harvesting the trees to create this area provides a wide source of materials to the farm, such as dimensional lumber, cutting boards, salmon smoking chips/planks, bentwood boxes, fire wood, and carveable wood (Tree Book, 2011). These materials can be used on the farm or sold at farmers markets. The snags within one tree length of the berry patch will be fallen, bucked, and depending on their quality, used as firewood or chipped and used as mulch. This minimizes the risk of injury to anyone in the berry patch, while retaining most of the snags in the forest for wildlife trees. Although roughly 40 trees will be harvested from the area, it will not significantly change the structure of the forest because the dimensions of the berry patch were determined by a natural opening in the forest. The Procut Portable Sawmill is a relatively cheap, effective, efficient, and easy to operate machine for the size of the logs being milled; 20cm – 90cm DBH (EZE Rent it Centre, 2011)

TUB2

The only harvesting in this treatment unit will be the snags that are one tree length away from the berry patch; allowing for natural forest development surrounding the berry patch and a potential source of firewood or mulch. The big leaf maple trees in this stand are going to be tapped for sap to be cooked into syrup and sold at the farmers markets; providing a source of revenue. In optimal conditions, one big leaf maple tree can yield up to 200L of sap in one week (BC Forest Museum, 2010). This maple tapping operation is another example of agroforestry that can be used to educate and engage the community in the diversity of forest products. The big leaf maple trees are native to the area and are well established in the stand; so their growth potential is consistent with expectations (Tree Book, 2011). Retaining virtually all of the plants in this forest conserves the biodiversity of the area and will have a negligible impact on the surrounding wildlife.

Treatment Regime and Rational for EUB

Note: For illustration of scheduling see both timelines in the appendix.

Introduction

Ecological unit B consists of two treatment units, 1 and 2. TUB1 has a total area of 0.12 ha, where we plan on altering the current state of the semi-natural stand to provide a favourable environment to plant native berry vegetation. TUB2 will remain unchanged as we plan on harvesting maple syrup from the existing big leaf maples and we only require the installation of a foot path to access the trees.

Harvesting

Harvesting in TUB1 will require two professional fallers (Burley Boys 2011). Each faller will be equipped with one chainsaw, axe, wedges, and appropriate sharpening tools and fuel to operate and maintain equipment. A chipper/mulcher will be required to chip the limbs of the felled trees and damaged limbs resulting from the felling process. The chipper/mulcher will be placed close to the Alder stand, where the mulch will ultimately end up being laid. The branches can be carried from the harvesting site to the Alder stand by farm volunteers to avoid the cost of a labourer at $15 an hour. Felling will be executed in the fall of the first year of our treatment. During the fall the farm will have less public visitors as it is past the harvest season of crops and there will no longer be the weekly farmers market, as the last farmers market is the final Saturday in October. The climate during the fall remains very operable for the fallers;

as the site remains rather dry and the deciduous trees still have their foliage which allows for less debris and hazards on the forest floor.

Felling will begin with the removal of some dangerous snags along the road side and damaged trees, this will clear the hazards from the work site. The next step will be to fall the selected western redcedar trees on the west side of the road. A small number of mature western redcedar have been selected to fall which will allow for some light exposure to the vegetation on the east side of the road. In TUB1 there will be a large area cleared of mature conifer trees, some selected mature deciduous trees, the majority of immature trees and the understory vegetation. This will be performed to create optimal sites for planting native berry plants as well as a thermal pocket that will enhance berry production and help reach our target stand quicker. The configuration of the planting site is a large semi-circle having a total area of 1260 m2, this shape will optimize the amount of light entering the berry patch and protection from surrounding stands as seen on the Final Map in the Appendices. The fallers will harvest a total of 21 trees; 5 mid-sized maples, 1 large Douglas-fir, 7 medium and 2 large western redcedar, 4 medium red alder and 2 medium snags. A tractor will be used to haul the logs from the forest to the road side where they will be loaded onto a trailer and eventually hauled by the tractor to their final destination being either the chipper for the smaller diameter poles and the larger diameter poles going to the portable sawmill (Procut portable sawmills).The structural lumber received from the mill will be put to use on the farm as they can build and maintain infrastructure.

Harvesting in this way will reduce the time required to reach the target stand, and increase the productivity of harvesting. A target stand of a free growing, well established berry plants community will be reached by spring of year two of the silvicultural plan (Thimble Farms). Harvesting with hand fallers is optimal because disturbances will be minimized. Impacts on soil will be slight and humics will be maintained, which is especially important on this site because it is in a low-slope position and can be wet during different seasons. This will reduce the cost of site preparation that would have been required to create good microsites. Stand structure and species composition of crop and non-crop vegetation will be maintained because openings of standing trees and coarse woody debris will not need to be created for the use of heavy machinery. There will be no harvesting of trees in TUB2. The only activity will be the annual sap harvest from the big leaf maples occurring during winter, which is the optimal time to harvest sap of big leaf maples (USfed).

Harvesting the berries will begin in the second summer of our prescription. This will allow for the berries to have enough time to establish themselves and produce sufficient amounts of berries to be harvested (Thimble Farms). Volunteers of the farm will pick the berries and sell them for $3 a pound, where if you pick your own berries it will cost $2.50 a pound (Forstbauer Natural Food Farm). By having farm volunteers pick berries and a U-pick berry system we avoid the $15/hr charge for general labour. All the berry species will be sold at the same rate. The berries can also be made into pies and sold at the farmers market for $10 each and jam will be made and jarred into 500ml jars and also sold at the market for $5 a jar (Forstbauer Natural Food Farm).

Site Preparation

To clear TUB1 of initial vegetative competition see the vegetation management section. There will be no site preparation in TUB2 as this unit is remaining unchanged.

Large scale site preparation is not required because natural microsites will have been maintained through the harvesting. Any modifications of microsites will be done on an individual site basis, if needed. Because these changes will be minor, only a shovel will be required for modifying the site. This will occur in the spring after the harvest at the same time the berries are planted.

This is the optimum site preparation method to reach the target stand because it can be done on a per plant basis. There is no need to use heavy machinery to prepare the site because the natural microsites were maintained. This saves money and reduces the impact of forest operations in EUB. Also, because site prep is not overly complicated, untrained individuals will be able to do the work on a volunteer basis. This will eliminate the $15/hr wage for their labour. This is the most sensible option, not only because of the reduced cost but it is also consistent with the farm objectives: striving to be self-sustainable and involve its community. Also, human power is carbon neutral, which makes it a better option than machinery. At the site preparation stage the labour involves removal of all the brushed and chopped shrub layer debris, as well the use of shovels and rakes to finally clear the site to expose the forest floor to make choosing microsites easier. Injuries are unlikely due to the ease of this work. The debris removed from the site will be transported in wheelbarrows to the composter.

Regeneration

Our target stand conditions for TUB1 are to have a free growing plantation of native berry plants such as: Rubus parviflorus, Rubus spectabilis, Vaccinium membranaceum and Vaccinium oxycoccos. This will involve volunteers planting an assortment of beery producing vegetation; again the use of volunteers will eliminate any planting labour at $15 an hour. Materials will involve hand spades and proper safety equipment for the planters. The hand spades will be used to remove some forest floor and dig into the mineral soil so that the vegetation will be properly installed. The planting spacing of the regeneration will be roughly a meter apart; planted in rows of 5 to 15 (Thimble farms).The total plants per hectare for the berry patch will be approximately 2350 depending on microsite availability. The aim of planting is to have an equal distribution of each berry species; this will be dependent upon the distribution of suitable microsites for each species. Planting will be accomplished during the spring of the first year of the silvicultural plan. The regeneration of the berry species will begin post planting where the ideal growing conditions of spring and summer will allow for optimal regeneration. There will be no regeneration in TUB2 as this unit remains unchanged.

We will be planting one gallon pot sized berry vegetation, where each plant has a cost of roughly $10 (Thimble farms). Calculating the plants per hectare results in a total cost of approximately $2819.88 to plant 282 plants. Planting labour will be done by volunteers and will have no cost as we will be mitigating the $15 an hour labour rate. Regenerating in the spring will allow for the best development of our planted berry vegetation; where they will be planted with sufficient spacing of 1 m apart so to reduce the competition among the plants and allowing for maximum berry production (Thimble farms).

Planting native berry plants it will provide a unique experience to farm visitors as they will have an opportunity to pick and taste a large variety of native berries. The first berries will be available to harvest the following spring. In the first year on the site the berry plants will not produce sufficient amounts of berries to be harvested and sold (Thimble Farms). There will be some berries produced the first summer upon planting however not in sufficient supply to be sold so they will be enjoyed by the farm volunteers.

Vegetation Management

Upon successful harvesting in TUB1, where mature conifer and deciduous trees where hand fallen; there will need to be considerable vegetation management. Volunteers will begin to clear the non-crop vegetation in the spring of the year 1 of the treatment regime; this is the prevention strategy of vegetation management. By clearing the non-crop vegetation in the spring, there will less sprouting and suckering from vegetative reproducing species on the site such as red alder and big leaf maple. This is due to the vegetation having low nutrient reserves to feed the vegetative reproducing saplings. Clearing the non-crop vegetation just prior to the planting of the crop species of local berry plants will allow for a very fresh site with ample soil nutrients, especially nitrogen supplied from the non-crop red alder.

The volunteers will be equipped with the proper safety gear for clearing thick brush, such as: gloves, appropriate hard hats, ear and eye protection and proper rain gear and footwear. Preliminary brushing will be executed with a brush saw, where the vegetation of larger diameter will be felled and removed from the site. This will eliminate any well-established competitive non crop vegetation as well as prepare the site for the next piece of equipment to be used to clear non crop vegetation. A Billy Goat Outback Brush-cutter will precede the brush saw work. This machine is designed to completely remove all vegetation up to 2 inches in diameter, exposing the forest floor. An efficient operator can clear up to two thirds of an acre every hour using the billy goat, and will effectively completely remove all non-crop vegetation (BillyGoat). Applying the billy goat will allow for an open site with exposed forest floor, which will ease site preparation for planting. Uneven ground is no issue for the billy goat as it is very maneuverable and the wheels are motorized with both forward and reverse direction reducing the effort needed by the operator (BillyGoat).

The goal of our vegetative management is to eliminate all non-crop vegetation prior to planting and post planting. Both prevention and suppression strategies of vegetation management will be employed. The intensity of the prevention management is to remove 90-100% of the non-crop vegetation in the 0.12 ha berry patch. During the growth of the crop vegetation, volunteers will be active in using hand tools such as loppers and garden sheers to remove any regenerating non crop vegetation. Once the crop vegetation has reached a free growing stage, the volunteers will continue to be active in clearing any non-crop vegetation on an annual basis. We will use some of the wood chips as mulch trails among the berries to ease berry picking and as a form of non-crop vegetation prevention. TUB2 will not involve any vegetation management as the non-crop vegetation does not impede the big leaf maples ability to produce sap.

Protection

By restricting the harvest of timber on this site to the fall the amount of damage to the trees selected to stay on the site is lower. During the fall the sap is not flowing in the big leaf maples, therefore they are more stress resistant to mechanical damage from sloppy operating from the hand fallers. The trees selected to remain in the over story of the berry patch, being a choice few big leaf maples, will be clearly marked so that they will not be felled or damaged. By leaving the majority of the trees on the west side of the road there will be a natural wind buffer that will protect the berry plants. As well the western redcedars neighboring the berry patch on the west side of the road will create a warmer thermal pocket for the berry's; as it will shield the berry patch from the cold marine breezes in the summer and western redcedar itself has thick branches allowing less cool air to enter the berry patch. This thermal pocket is an ideal micro climate for the berries which will see the most optimal berry production. To prevent damage to the berry patch during harvest we will have established mulch trails to reduce trampling and to ease picking. The optimal condition for this patch is to maintain the health and vigour of the vegetation during the harvest season.

Post-harvest, the felled trees will be skidded from the site with the farm tractor onto the road where they will be loaded into a trailer to be transported to the wood chipper. The hand fallers will buck all the felled trees on the site where they felled them into manageable lengths that the tractor can skid to the road side. Bucking length of the large fallen coniferous and deciduous trees will be 10 feet; this will be a sufficient length to potentially salvage some dimensional lumber while still be an appropriate weight to be hauled out. The John Deere tractor that is operated and owned by the UBC farm will be used to haul the bucked stems out from the site and transported to the wood chipper or portable sawmill. The felled trees will be limbed and the resulting debris will be carried of the site by hand and transported to the chipper by the tractor. Protecting the big leaf maples that have been selected on site from the removal and transportation of woody debris and bucked stems will involve using some culled logs and bump trees. We will have acceptable damage to the big leaf maple during falling as some branches may be broken and wounds to the stem; allowing this damage to occur in the fall will lower the potential of disease and pathogen infestations.

As far as protecting the ripened berries during the harvest season, we will have an open policy where the public and farm staff can pick at will and the amount of berries harvested by an individual will be weighed and priced, as well we will be selling pre-picked berries. There is very little omnivore grazing in this area, and as such fencing to protect the berries themselves will not be necessary. The rationale behind focusing much of our protection on the big leaf maples is because the big leaf maple will be vulnerable to damage during every stage of the treatment plan. Conversely the berries will be planted post site prep and vegetation and will be clear of most hazardous work conditions that could have resulted in damage. There are few local forest pathogens and diseases in EUB; however, we've been told there is some root disease affecting the Douglas-fir in parts of the semi-natural stand that is beyond our EUs. However we are not concerned with a root disease outbreak in our berry patch.

Monitoring

Brushing will be closely monitored in the spring as the big leaf maple is most susceptible to mechanical damage. Volunteers running both the brush saw and billy goat brush cutter during the prevention vegetation management will be closely monitored for damaging the marked big leaf maple trees so that there is no damage to them. During the annual suppression vegetation management composing of using hand tools to chop and remove non-crop vegetation there is a risk to damage of our berries. We will inform the volunteers which plants to chop and snip to reduce the damage to the berries; the crop vegetation being the berries will be marked to be easily identified so that they are not damaged or brushed. Monthly check ups on the health of berries will be executed by farm volunteers, where they will check for drought and cold stress. During the harvest season which composes of late spring to early fall we will monitor the intensity of harvesting of the berries, as well monitor damage to the berries resulting from high foot traffic in the patch. To mitigate damage to the berries during all monitoring the use of the mulch paths will be implicated to all volunteers.

Harvesting of maple sap will be closely monitored during tapping season, which is mid-winter. We will ensure the previous year's tap holes are in good health and have not started to decay or host any harm full fungi. During harvest season daily monitoring of maple sap accumulation will be executed, where a maple tree under ideal conditions can produce up to 200 liters of sap in a weeks' time (BLMapleNet). When the buckets are removed from the site we will ensure there is no damage to the berry patch as the buckets are transported to the road. A trail will be established entering TUB2 to help efficiently move the sap from TUB2 to the road.

Periodic monitoring of the health of our berry patch and big leaf maple community will ensure the sustained harvest of their goods for a long length of time. Monitoring for heavy foot traffic in the berry patch and ensuring people are using the mulch paths during harvest season will allow us to control the amount of physical damage to the berries. When tapping the big leaf maples, we will annually check to see if there are any signs or symptoms of tissue damage to the stems, reason being we do not want to promote an infection to our big leaf maples by continuously exposing the stem to biotic disturbances.

Conclusion

This is the most suitable site plan for the farm because it addresses the farm's mission and specific objectives. Each prescription provides opportunities for the community to observe natural forest development and the outcomes of silvicultural practices; conserves or enhances the present biological diversity within the UBC Farm; and provides a source of materials from the forest as building products, food, or craft materials. In a variety of ways the prescriptions "engage the UBC community; integrate academically rigorous and globally significant activities that [transform] the campus into a living laboratory; and regenerates healthy soils, foods, individuals, communities, forests and ecosystems" (UBC Farm Mission). In addition, many products are made, other than just raw wood, that increase the value of products made at the farm. These prescriptions are self-sufficient and sustainable. Few materials from outside of the farm are required to complete the treatments, and the products from the treatments do not leave the farm without additional value added. The prescriptions are all built around the existing conditions of the stand, so they take advantage of what is there, rather than trying to change the stand to meet objectives. This is the most efficient, cost-effective, and least invasive method of management, while still achieving farm objectives.

This exercise helped us proficiently identify and measure ecological attributes of the sites in a more professional setting. We have also learned that in some situations it is easier to start at a smaller scale before determining the bigger picture. We found the brainstorming process to be tricky because we had so many big ideas that logistically would not work on a smaller scale. After this realization the planning process became much clearer. This exercise exposed us to a variety of forest products that are not conventional in industrial forestry. Many of these products are much more appropriate for a small-scale operation, and because of that provide the opportunity to work up the value chain and create unique, high value products. For the most part, this is not emphasized in many of our typical forestry classes. This exercise also made it very clear that timing is crucial for a planning process, for both scheduling for group work and anticipated silviculture activity timing. Finally, this exercise made it very apparent that the creation of a silviculture prescription is quite complex, but with this experience and knowledge from a variety of courses, it is doable.