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Seeing the Forest for the Trees: Managing for Multiple Use in National Forests

by
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Part I – Timber Harvest in Our National Forests

Emily grew up in the small town of Coffman Cove on Prince of Wales Island (POW), Alaska. Her dad was a teacher at the Coffman Cove School and her mom worked with the Alaska Department of Transportation on road construction projects on the island. She spent her childhood collecting berries and mushrooms, hunting deer, and fishing for salmon in the clear streams around town. That last activity, fly-fishing for salmon in the deep pools, was her favorite, although she always had to keep an eye out for the occasional black bear fishing in the nearby riffles.

After graduating from high school, Emily enrolled in the Environmental Science Program at Western Washington University (WWU). After spending her childhood exploring the coastal rainforests on POW, she hoped an environmental science degree would mean a career outdoors. The year away from home was tough and Emily couldn't wait to get back to the island, where she had a summer job lined up working for the local fishing lodge.

On her second day home, while in the tiny grocery store, she overheard two retired loggers discussing the upcoming new jobs resulting from the recent approval of large clearcutting operations planned for the remnant old-growth forest stands between Coffman Cove and the Control Lake Junction. Emily's heart stopped! She knew those old-growth stands so well! It was there that she and her parents would hike each fall and hunt their deer by her favorite fishing hole, among the mushrooms and berries…. Thinking about the potential loss of her favorite places on the island brought back some of the lectures and readings from her "Introduction to Environmental Science" course at WWU.

Our National Forest system was created by the Forest Reserve Act legislated in 1891, which allows the President of the United States to preserve any public lands covered in trees or undergrowth for use by citizens of the United States. Within two years, Presidents Harrison and Cleveland set aside as reserves over 17 million acres of land under this new law. However, this act lacked any provisions for administration, protection, or use of these reserves and was interpreted as prohibiting any extraction of resources from these lands.

In 1897, Congress passed the Organic Administration Act, which officially defined the purpose of the reserves: "to improve and protect forests, protect beneficial water flows, and provide a permanent supply of timber for use by United States citizens." Following the passage of this act, timber harvest became an important tool for managing forests and a common activity in most of our National Forests. The passage of the Multiple Use Sustained Yield Act of 1960 and the National Forest Management Act of 1976 resulted in additional guidelines for ecosystem-level management practices of these lands, including managing for wildlife and fish.

The Tongass National Forest in Southeast Alaska (Figure 1) was designated by President Theodore Roosevelt through a series of presidential proclamations in 1902. It is the largest National Forest and includes approximately 16.8 million acres (6.8 million ha) of temperate rainforest in Alaska's Alexander Archipelago. Prince of Wales Island (POW), located in the southern part of the Tongass, has some of the most productive rainforests in the region. The dominant trees in the forests of POW are western hemlock, Sitka spruce, and yellow cedar. These *conifers* can grow large, exceeding 200 ft (65 m) in height at certain places.

Timber harvest on the island began in the 1950s and continues today (approximately 60 years). This created a mosaic *landscape* of old-growth (never harvested), young-growth (areas that experienced logging activities and are now covered primarily by even-aged, young forests), and clearcut (freshly harvested) *habitats* (Figure 2). The island landscape also includes muskegs, which are wet, bog-like areas with standing water, sparse trees, and some shrubs. Alpine habitats are found at elevations above 3,000 ft (1,000 m) and are devoid of forests.

Figure 1. Map of the Tongass National Forest located west of Canada and in Southeast Alaska. *Source:* Forest Service of the United States Department of Agriculture, <https://commons.wikimedia.org/wiki/File:Tongassmap3.gif>.

Even when the different forest habitats are adjacent to each other, the environment within the stands is very different. Old-growth stands have multiple layers of *canopy*, many downed logs, and relatively high *overstory* cover (or dense foliage). Therefore they are cool and shady, which helps retain soil moisture. The intermittent light penetrating the canopy and relatively high soil moisture lead to the development of a forest floor covered by a mosaic of mosses, ferns, some grasses and herbs, many species of *fungi*, scattered berry bushes (mainly blueberries, salmonberries and devil's club) and tree seedlings (Alaback, 1982). In winter, the dense canopy of old-growth stands intercepts much of the snow, leaving the forest floor with its lush *understory* available as forage for vertebrate and invertebrate herbivores. In contrast, although the abundant grasses and sedges that grow in muskegs provide food for animals in summer, snow accumulation limits their value in winter. Muskegs also have little value for logging because of their low quality timber and difficulties operating heavy equipment in the bog.

Timber harvest (mostly clearcutting) involves the removal of large trees with their associated canopy, leaving the remaining shrubs and *herbaceous plants* on the forest floor exposed to sunlight. These clearcut stands experience much higher levels of evaporation than old growth, dry quickly and have, on *average*, lower soil moisture. During massive rainstorms and during *spring breakup*, the lack of overstory canopy results in erosion of the soil. The eroding soil flushes into streams and covers their bed with sediments. Starting about three years post-harvest, the higher availability of light and lower soil moisture allow new spruce and hemlock trees to start growing from seeds left in the soil. Shrubs such as alder, blueberries and salmonberries also expand, with some clearcuts becoming the most productive areas of berries on the landscape. This productive stage can last 20–25 years until the tree seedlings grow large enough to shade the understory layer (Alaback, 1982; McClellan, 2008).

Figure 2. The four primary habitats on Prince of Wales Island. Clockwise from the top left corner: clearcut, young-growth, muskeg, and old-growth. *Source:* E. Flaherty.

Clearcuts develop into young-growth stands where the canopy is closed. In young-growth stands, the trees are all approximately the same age and height. They grow densely creating a thick, nearly impenetrable wall (Figure 2). Because of the thick canopy, very little sunlight or water reach the forest floor. As a result, the ground is typically bare, covered in conifer needles, with few to no plants or fungi. On POW the closed-canopy stage may last up to 150–200 years because the cold winter temperatures slow tree growth. Naturally, young-growth stands revert to old-growth characteristics after some of the trees die and fall, becoming downed logs, and creating openings in the canopy, which allow more light to infiltrate to the forest floor (Alaback, 1982, 1984; Sullivan et al., 2001).

Forest succession to old-growth status can be accelerated through *commercial thinning* (selective harvest) of young-growth stands after the trees reach larger size. Similar to old-growth trees, the wood can be used to produce lumber, or milled into paper. On POW only pre-commercial thinning occurs today. In this practice, some of the trees in young-growth stands are cut within 15–25 years after logging (Sullivan et al., 2001; McClellan, 2008) and because they are small, the trunks are left on the ground as slash. The remaining trees can grow faster with less competition for water and sunlight (Sullivan et al., 2001). The accumulation of slash makes these stands less accessible to the larger species of wildlife such as deer. In pre-commercially thinned stands, canopy-closure is delayed for several years but eventually it closes again (McClellan 2008). The progression of forests from clearcuts to old-growth stands is called *succession*.

Because of the different environments that exist in each of the forest stands on POW, their value for wildlife is variable. It changes from summer to winter, as well as with the various stages of forest succession. For example, while Sitka deer and black bears may benefit from high production of stems, leaves and fruits of blueberry in clearcuts during summer, high snow depth in these stands limits their availability during winter. In that season, deer benefit from the availability of the snow-free herbaceous vegetation on the forest floor in old-growth stands (Kirchoff and Schoen, 1987).

The forests of POW are home to several species of mammals including dusky shrews, long-tailed voles, northern flying squirrels, Keen's mice, and ermine. The flying squirrel and ermine are *endemic* subspecies that are unique to Prince of Wales Island (MacDonald and Cook, 1996). These species historically occupied the nearly continuous old-growth forests on the island. Several studies have shown that landscape changes from timber harvest influence these unique animals in various ways. For example, the removal of large trees during clearcutting significantly reduces the availability of habitat for flying squirrels. These amazing gliders are inefficient runners (Flaherty et al., 2010a) and when on the ground are at risk of predation from martens, ermines and *raptors*. Also, their preferred food, truffles (fungi that fruit underground), only grow in old-growth stands (Flaherty et al., 2010b). Similarly, because clearcuts tend to have fewer large-bodied (≥ 10 mm in length) soil invertebrates than young-growth or old-growth stands, their availability as food for shrews may be lower in these stands. Thus, the amount and distribution of the various forest types on the landscape influences the *viability* of these species.

Questions

1. The Multiple Use Sustained Yield Act established policy that National Forests must be managed for a variety of uses including timber, water, recreation, livestock grazing, and fish and wildlife values. What are some challenges you might expect in managing public land for all of these uses?
2. Who are some of the potential users (human stakeholders and other organisms) you would expect for the various habitats, both natural and man-made, on POW?
3. Why do you think ecologists classified endemic animals using this specific term? What are the benefits, in general, of classifying objects in the natural word? What are the ecological, conservation, and management implications for the classification "endemic"?
4. Based on the average age of the young-growth stands (30–60 years), when do you think the young-growth stands will be ready for commercial thinning? What is the difference between pre-commercial thinning and commercial thinning that may impact how wildlife use those treated stands? What do you think would be the benefits of commercial thinning for the endemic species on POW?

Glossary

Average – also known as "mean," is a value calculated by adding numbers and dividing by their count. For example, the average of 2, 4, and 6 is 4 (2 + 4 + 6 = 12; 12/3 = 4).

Canopy – the upper layer or crown of the trees in a forest, composed of branches and leaves.

Commercial thinning – a forestry practice where some but not all trees in a re-growing stand of trees are cut. The wood is used for lumber or milled into paper.

Conifers – woody plants that produce cones. Examples include pines, spruce, cedar, and the giant redwoods in California.

Endemic – organisms (such as plants and animals) that are found in a restricted area. They are often distinct genetically, morphologically, or ecologically from other closely related species or subspecies as a result of isolation.

Forest succession – the development of mature forest through several stages following a disturbance (for example logging). In many systems, composition changes from shade-intolerant to shade-tolerant species. In the rainforests of Southeast Alaska changes to species composition are rare and succession is largely characterized by species diversity. Few of the species that survive in clearcuts and mature forests occur in the closed-canopy stage.

Fungi – a collective name for mushrooms and their relatives.

Habitat – a natural area inhabited by certain organisms (such as plants and animals) and has the conditions (moisture, light, temperature, etc.) that facilitate their existence.

Herbaceous plants – non-woody plants, usually grasses, sedges, mosses, ferns and herbs.

Landscape - the visible features (scape) of an area of land including attributes such as mountains, valleys, lakes as well as vegetation and human structures.

Overstory – the layer of branches and leaves in the tree canopy.

Raptors – birds of prey.

Spring breakup – the quick melting of snow and ice in spring.

Understory – the layer of herbaceous vegetation and shrubs growing on the forest floor.

Viability – the ability of organisms (such as plants and animals) to maintain their numbers or recover from declines in their numbers.

Part II — The Feasibility of Commercial Thinning on POW

On the first day off from work, Emily stopped by the regional Forest Service office in Thorne Bay and asked about the planned harvest. The regional forester provided her with details on the size of the proposed cut, the dates, and the expected costs and revenue. Seeing her distress, one of the staff also explained the necessity of cutting old-growth to bolster the economy on the island and to ensure the continued operations of sawmills in Craig and Ketchikan.

That explanation rolled in Emily's head as she drove on the old logging roads back to the fishing lodge. All around her were young, regenerating trees. Much of the island had already been logged and the re-growing forest turned into an inaccessible nightmare where deer could barely get through and humans, trying to hunt them, had to crawl on their bellies.

"Most of the roads are obviously still accessible," thought Emily as she turned from Forest Service Road 703 to 704. That means the timber company could bring the logging equipment to any of these stands and the logging trucks could haul the wood out without the added cost of building new roads. "Hmmm…," Emily wondered, "why don't they consider re-harvesting those young-growth stands and leave the remnant old-growth intact?"

Suddenly, Emily had an idea—the Forest Service was planning to host an open, public meeting to discuss the proposed harvest in two weeks. In her "Introduction to Environmental Science" course this past spring she had learned how to measure trees and calculate the associated timber yield. If she could provide data showing the difference in timber yield among old-growth and young-growth stands that would be considered large enough for pre-commercial thinning (~30 years), and those old enough for commercial thinning (~60 years), maybe she could convince them to harvest those regenerating managed stands! She also thought that the benefits for wildlife from commercial thinning would be another convincing argument.

That night, Emily designed plans to collect data from trees she would randomly select within the stands along the Coffman Creek road, calculate timber yield, and then statistically analyze the data to evaluate the differences. Commercial thinning may prove beneficial to wildlife in forests because it can decrease the length of the young-growth closed-canopy stage of forest succession. However, for commercial thinning to be economically feasible, trees should be large enough to produce sufficient amounts of wood. Foresters use "board feet" as a measure of the wood content of a tree (a board foot is a one foot by one foot by one inch thick slab of wood). To calculate board feet, we commonly measure two features of tree size: tree height and diameter at breast height (DBH). Tree height is measured with a clinometer and DBH with a special tape, which directly measures DBH rather than circumference (Figure 3).

Figure 3. Examples of clinometers (top) and DBH tapes (bottom) and their uses (right panels).
Sources: Top left by Btomli2, CC BY-SA 3.0, <https://commons.wikimedia.org/wiki/File:Clinometer_commonly_used_by_foresters.JPG>; Top right by Tim McCabe, USDA Natural Resources Conservation Service, PD, <https://commons.wikimedia.org/wiki/File:NRCSIA97009_-_Iowa_%282667%29%28NRCS_Photo_Gallery%29.tif>; bottom right by VTmaddog, PD, <https://en.wikipedia.org/wiki/File:Using_a_DTApe.JPG>; bottom left: <https://www.forestrytools.com.au/index.php?id=388>.

Emily's Data and Analysis

Over the next few days, Emily used the clinometer in her compass and a DBH tape to measure 20 trees she randomly selected in the different stand-types around Coffman Cove (turning the area around her home town into her "study site"). She recorded the data in the table below.

Your task is to assist Emily with the data analysis so she can present the results at the public meeting in Coffman Cove.

Table 1 includes the raw clinometer angle values for each tree recorded by Emily who is 5 ft 9 in tall (175.26 cm) with her eye level at 5 ft 4 in (162.56 cm) above the ground (Figure 4). Emily measured each tree while standing 66 ft (or 20.12 m) away from the tree at the same ground level as the base of the trunk. The clinometer measurements are in degrees so you will need to convert them into height measurements using the trigonometry equation for tangent angles:

$$\tan(x) = \text{opposite}/\text{adjacent}$$

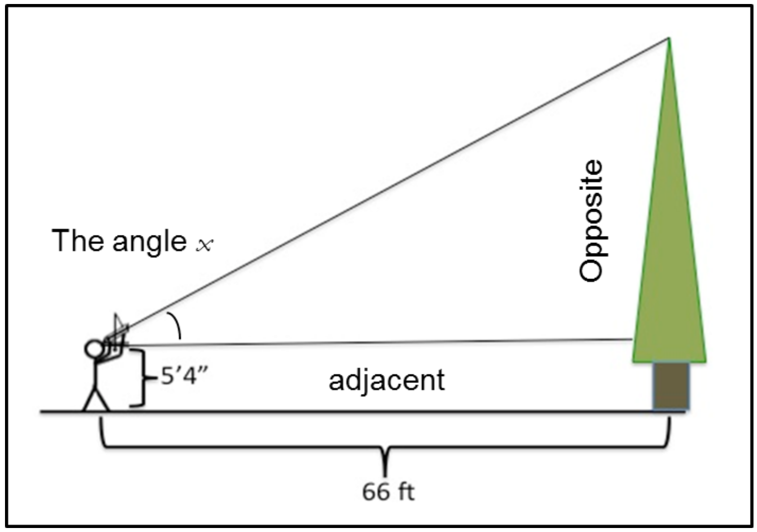

Figure 4. Diagram depicting the use of a clinometer and trigonometry to measure the height of a tree. The observer's eye level is at 5 feet and 4 inches. Feet are denoted by the symbol ′ and inches by ″. *Source:* E. Flaherty.

where *x* is the angle measured with the clinometer (in degrees) from eye height to the top of the tree, *opposite* is the actual height (from eye level to the top of the tree), and *adjacent* is 66 ft. You will need to rearrange this equation to solve for opposite and remember to add the 5 ft 4 in from the ground to the observer eye (Figure 4). Table 1 also includes DBH measurements for the same trees. To convert these measurements to board feet you will need to first find the radius of the trees (Figure 5). This is calculated by dividing DBH by 2. To convert from inches to feet divide by 12 (r = DBH/2/12). Then find the cross-sectional area of the tree: $A = \pi \times r^2$. After you have calculated the area of the trees you'll estimate their volume by: V = (A × height)/4. The division by 4 is to account for the fact that most trees taper. Because some of the wood is lost as sawdust during processing, foresters usually divide the volume of the tree by a factor of 6 or 7 to calculate board feet. Biologists are less conservative and divide by 12. In summary you should calculate:

1. Height (based on tan *x*)
2. Cross-sectional area (using DBH and $A = \pi \times r^2$; remember: $\pi = 3.14$)
3. Volume (which is V = (A × height)/4)
4. Board feet (BF = V × 7)

Given that these calculations will require some effort, you should consider using spreadsheet computer software (such as Microsoft Excel) to calculate these values rather than using a calculator or doing them by hand. Please note that in Excel the default formula for tangent is specific to radians and not degrees. To use degrees, use the formula =TAN(your angle*PI)(/180).

To compare wood production for the three stand types, use the average value of board feet in each. Again, you can use spreadsheet computer software (such as Microsoft Excel) to calculate these averages (by using the formula: =average(number:number)).

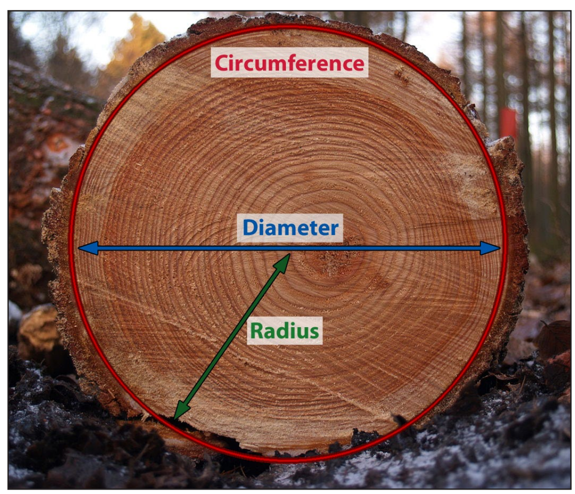

Figure 5. Diagram depicting the circumference, diameter, and radius of a cross section of a tree. *Source:* Adapted from a photo by Arnoldius, CC BY-SA 2.5, <https://commons.wikimedia.org/wiki/File:Tree_rings.jpg>.

Table 1. Clinometer measurements (in degrees) of tree heights and DBH (in inches) from 20 randomly selected trees in the different forest stands on POW.

Young growth 30 years		*Young growth 60 years*		*Old growth*	
Angle (°)	*DBH (inches)*	*Angle (°)*	*DBH (inches)*	*Angle (°)*	*DBH (inches)*
42.3	15.3	52.7	35.2	63.1	51.8
43.9	16.2	54.9	38.0	65.9	58.5
37.1	13.0	47.9	29.9	58.6	43.4
43.7	16.0	51.0	33.2	58.3	42.9
35.6	12.3	50.7	32.8	65.7	57.9
25.5	8.6	40.8	23.8	56.0	39.5
37.9	13.3	49.1	31.2	60.3	46.3
47.4	18.1	55.0	38.0	62.5	50.5
47.0	17.9	58.6	43.3	70.1	71.8
39.5	14.0	50.5	32.7	61.5	48.5
26.6	9.0	47.3	29.3	67.9	64.2
42.1	15.2	51.9	34.2	61.7	48.9
42.7	15.5	52.6	35.0	62.4	50.3
27.6	9.3	33.7	18.9	39.8	23.1
34.6	11.9	43.5	26.0	52.3	34.7
17.5	6.1	41.2	24.1	64.9	55.9
38.2	13.4	48.7	30.8	59.2	44.4
34.5	11.9	46.4	28.5	58.2	42.8
39.3	13.9	48.6	30.7	57.9	42.3
27.4	9.3	36.7	20.9	46.0	28.2

Questions

1. Based on your analysis, is there a difference in the amount of wood that will be produced by each of the three habitats?
2. Is average a sufficient metric to assess the differences among these forest types? What else do you need to know?
3. What other information would you need to know in order to determine that commercial thinning on POW is economically feasible? (*Hint:* think about expenses and revenue.)
4. Should Emily and others that are interested in this harvest only assess the economic value of the wood? What about the mandate to manage these forests based on the Multiple Use Sustained Yield Act? How can we evaluate the value of the different forest types for wildlife?

Part III – Endemic Wildlife and Habitat Use on POW

After Emily evaluated the differences in timber yield, she turned to summarizing what is known about wildlife on POW. Her best friend in high school was Colleen, whose mother was the area biologist for the Alaska Department of Fish and Game. Emily called Colleen and asked to visit. Colleen's mom was more than happy to discuss the local species and their relation to old-growth forests.

Over her famous blueberry pie, Colleen's mom explained that wildlife biologists from state and federal agencies, universities, and non-governmental organizations (NGOs) collaborate on research projects designed to understand the needs of plants and animals and to maintain biodiversity in the managed rainforests of Southeast Alaska and elsewhere. These research projects yield knowledge on the natural history and habitat requirements of each species. This information is used to evaluate the responses of the wildlife species to timber harvest. After decades of study, wildlife biologists obtained a lot of data and intricate understanding of each of the endemic mammalian species, flying squirrels and ermines (MacDonald and Cook 1996), as well as one of their main predators on POW.

While Colleen's mom talked Emily fervently took notes that she intended to present at the up-coming meeting:

Dusky shrews prefer wetter habitats including areas near bodies of water and wet meadows surrounded by coniferous forests. They primarily feed on invertebrates but will also consume limited amounts of vegetation. These shrews do not hibernate and are active year-round. Predators include raptors, ermines, and martens. Dusky shrews on POW weigh about 6-7 grams (0.013-0.015 lbs; Smith and Belk, 1996; MacDonald and Cook, 2007).

Keen's mice, also called the northwestern deer mouse, have few habitat preferences and can be found in a wide variety of environments. Their diet is also diverse and may include bird eggs, invertebrates, seeds, berries, vegetation, and fungi. Predators primarily include raptors, ermines, and martens (MacDonald and Cook, 2007). On POW, in areas with high mice numbers, fewer shrews are usually found possibly because they are outcompeted. Mice are larger (19-27 grams or 0.042-0.059 lbs) and are better competitors for food.

Northern flying squirrels use gliding locomotion as their primary way of moving through their habitat. To be able to glide, they need tall launching and landing points. Their glide distance is limited by tree height; they will glide twice as far in horizontal distance as the height of the launch point. Therefore if a squirrel glides 20 meters (or 65 feet), they would lose 10 meters in altitude while gliding and must launch from a point at least 10 meter from the ground. The longest glide distances recorded are 65 meters but most glides are about 20 meters long. Their glide path needs to be free from obstruction so they prefer more open, less dense canopy for gliding. They also require cavities in trees, usually larger dead trees, for nesting. Their diet is primarily comprised of fungi (mainly truffles), lichens, seeds, and invertebrates. Predators on POW include the northern goshawk, owls, ermines and martens (Wells-Gosling and Heaney, 1984; MacDonald and Cook, 2007).

Ermines are members of the weasel family and are well known for molting twice a year and replacing their fur from white in winter to brown in the summer for camouflage. This small weasel will use a wide variety of habitats and find sufficient cover in all habitat types (Korpimäki et al., 1991; Maron et al., 2010). Ermine prey includes invertebrates, small mammals, and small birds although small mammals are preferred (Hanski et al., 1991). Predators on POW include raptors and the larger member of the weasel family, the marten (King, 1983; MacDonald and Cook, 2007). Martens are especially dangerous to ermines in old-growth forests, which is their preferred habitat.

Martens show high affinity to old-growth forests although they also use other closed-canopy forests (Buskirk, 1992; Godbout and Ouellet, 2010). They tend to avoid open-canopy forest types such as clearcuts, pre-commercial thins and muskegs. They are well adapted to life in the forest and possess special adaptations that allow them to rotate the ankle and descend trees head-first. They are therefore agile climbers and prey on a variety of birds and mammals (including Keen's mice and flying squirrels; Ben-David et al., 1997). They will also consume carrion (such as deer and salmon carcasses) when available, and in fall eat a lot of berries (including blueberries and salmonberries; Clark et al., 1987; MacDonald and Cook, 2007).

Questions

1. Which wildlife species do you think would be most dependent upon tree size? Why?
2. Create a flowchart of boxes and arrows describing the relationships between these mammals that Emily could use as a visual aid during the public meeting. Organize your chart as a food web and also refer to habitat requirements (i.e., if two species have different habitat requirements they are less likely to interact).
3. Based on the ecological requirements for each species and based on what you have learned in Parts I and II, create a list of management suggestions for each endemic species. Consider which habitats would be of most value to each, management strategies that might improve value of certain habitats for these species, and how improving habitat for one species might have indirect effects on another.
4. In addition to tree height and DBH, what other vegetation or tree data would be helpful for development of management plans (see next page for Management Plan Examples for Wildlife Species) for each species? If Emily were to work as an intern with the Forest Service, what data might she be interested in collecting to answer this question?
5. How would management decisions based on wildlife requirements impact those made for timber harvest?
6. Provide a few sentences that summarize the points related to wildlife impacts that Emily should present at the public meeting in Coffman Cove about the planned timber harvest.

Management Plan Examples for Wildlife Species

The Florida Fish and Wildlife Conservation Commission (FWC) provides a template for developing Management Plans for imperiled species. It can be found at: http://myfwc.com/wildlifehabitats/imperiled/management-plans/template/

The FWC requires that plans "must address all levels of action needed for recovery or maintaining recovered status of species by all partners…Plans must be able to be implemented." Their management plans require that the following information is included:

I. Introduction (short narrative, summarized from Biological Assessment)
   a. Includes taxonomy, life history and habitat, distribution and population status, and historic and ongoing conservation efforts

II. Threat Assessment (from Biological Assessment)
   a. Reason for listing/delisting
   b. Present and anticipated threats

III. Conservation Goals and Objectives

IV. Recommended Conservation Actions
   a. Strategies to achieve the conservation objectives
   b. Proposed regulations
   c. Permitting framework
   d. Management actions
   e. Incentives
   f. Monitoring Plan
   g. Education and outreach
   h. Future research

V. Implementation Strategy
   a. Priority actions
   b. Required resources and other costs
   c. Proposed implementation schedule
   d. Management plan review and revision

VI. Anticipated Economic, Social, and Ecological Impacts

VII. Literature Cited

VIII. Appendices (include at least 1 with definitions, key words, and acronyms)

Websites

Oregon's wildlife management plans developed by the Oregon Department of Fish and Wildlife:
http://www.dfw.state.or.us/wildlife/management_plans/

Management plans for species in the Yukon developed by Environment Yukon:
http://www.env.gov.yk.ca/animals-habitat/Species-Management-Plans.php

The Tongass Land Management Plan, which includes a management framework for all of the natural resources including wildlife within the forest:
http://www.fs.usda.gov/detail/tongass/landmanagement/planning/?cid=stelprdb5402695

Scientific Names

All living organism are classified into species and described by a scientific name. The name is composed of two parts: the name of a genus which is shared with close relatives as well as a unique name describing the particular species. The genus name is capitalized the species name is not. Both are italicized. If subspecies are identified, a third italicized name is added.

Common name	*Scientific name*	*Description*
Red alder	*Alnus rubra*	A woody deciduous plant common in early stages of forest succession in Southeast Alaska. It also grows on disturbed sites (for example edges of forest). It has the ability to fix atmospheric nitrogen and is important for establishment and growth of other plants.
American marten	*Martes americana*	A small carnivore from the weasel family (mustelids) that is well adapted to climbing and relies heavily on mature forests. Two species of martens occur on the Tongass National Forest: the American marten and the Pacific marten (*Martes caurina*). American martens are not native to POW. They were introduced from the nearby mainland in the 1930s.
Black bear	*Ursus americanus*	A large carnivore from the bear family (ursids). Its diet includes a lot of vegetation (largely grasses and berries) and during summer and fall it also eats salmon. It spends the winter in hibernation.
Blueberry	*Vaccinium* sp.	There are several species of blueberries in Southeast Alaska including Vaccinium alaskaense, *Vaccinium ovalifolium, Vaccinium uliginosum (bog blueberry), and Vaccinium parvifolium* (red h*uckleberry). The first two are hard to distinguish except that* V. ovalifolium tastes much better!
Devil's club	*Oplopanax horridus*	A large and pretty shrub with hand-like leaves and clusters of red berries (edible only to bears). BUT as its name suggests it is a horrible plant covered in thorns that fester when embedded in the skin. It can get taller than a person on wet soils.
Dusky shrew	*Sorex monticolus*	A small mammal that primarily feeds on invertebrates.
Ermine	*Mustela erminea*	Another member of the weasel family but smaller than martens (about a tenth of the weight). The ermines on POW are unique from all other ermines (endemic) and belong to the subspecies *M. e. celenda*.
Keen's mouse	*Peromyscus keeni*	A small deer mouse with white paws and belly found on most islands of the Alexander Archipelago. The island animals are different and distinct from those living on the mainland (endemic). Their numbers fluctuate widely such that in some years they are rarely caught. These population crashes most likely occur because of predation by martens and ermines.
Long-tailed vole	*Microtus longicaudas*	A fairly "large" small mammal (37-57 grams) which mainly feeds on grasses. It was common on POW until the 1980s. Since then very few individuals have been caught on the island.
Northern flying squirrel	*Glaucomys sabrinus griseifrons*	An endemic subspecies of this gliding squirrel is found on POW. It is dependent on large trees for launch and landing points. It is also dependent on old-growth forests to find its preferred food, truffles.

Salmonberry	*Rubus spectabilis*	A thorny shrub with large and tasty berries the color of salmon. Grows on wetter sites and is fairly shade-tolerant.
Sitka deer	*Odocoileus hemionus sitkensis*	A small mule deer (subspecies) native to Southeast Alaska.
Sitka spruce	*Picea sitkensis*	An impressive tall conifer with elongated cones and sharp needles that spiral around the stem. Usually grows in lower elevations on wetter sites. Associated understory usually includes devil's club and salmonberries. Some individuals are so large it takes several people to measure their DBH.
Western hemlock	*Tsuga heterophylla*	This tree usually grows in upland sites in association with blueberries. The needles are short and soft and grow on one plane along the stem. The cones and seeds are very small and offer little nutrition to squirrels and mice.
(Alaska) Yellow cedar	*Cupressus nootkatensis*	This conifer grows in higher elevations. The needles resemble scales and are flat. Large recent die-offs have been attributed to climate change. On POW western red cedar *(Thuja plicata)* also occurs although this tree belongs to a different genus and rarely grows north of POW in the Alexander Archipelago.

English and Metric Measurement Systems

Two measurement systems are used around the world today (there were others in the past developed by the early Egyptians and Native Americans but they are no longer in use). The English system was developed in the British Empire and is the basis for the United States customary units. Length measurements are in inches (including 16 fractions), feet (=12 inches), yards (=3 feet) and miles (=1,760 yards). Areas are measured in acres (=43,560 square feet), sections (1 square mile), and townships (36 sections). Weight measurements are in ounces (with 16 fractions), pounds (lbs; 16 ounces), and tons (2000 lbs). In this system there is no clear relation between length and weight measurements. In contrast, in the metric system which was invented by the French government, all units relate to each other by a factor of 10. Length measurements are in millimeters (mm), centimeters (cm; 10 mm), meters (m; 1000 mm or 100 cm), and kilometers (km; 1,000 m). Areas are in hectares (1 ha = 100 x 100 m = 10,000 square m), such that 100 hectares are 1 square km. A liter is the volume of 10 x 10 x 10 cm, which when filled by water weighs 1 kilogram (kg; =1,000 grams or g). The metric system is consistent and therefore much easier to use. It was adopted by all countries in the world (including Britain) except the United States. *It is the official measurement system of science.*

As an exercise try and calculate the volume of wood in 60 year old young-growth stands on POW after converting all the measurements to the metric system (i.e., DBH from inches to cm and height from feet to m). To help you there are numerous online calculators that are designed to convert between the English the Metric systems.

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