"Integrated Field Experience: Restoring Sustainable Habitat for Native Plants, Deer, and Fish in the North Bank Habitat Area" located on Bureau of Land Management (BLM) land and in Roseburg, Oregon

Sabbatical Reports September 2012

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Disclaimer: The views and opinions expressed in this document are those of the author and do not necessarily represent the views of the Bureau of Land Management

Deer with fawn at North Bank Habitat Management Area.
Photo by G. Hemsoth

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Intent of the Sabbatical

Through a field experience with an expert botanist employed by the Bureau of Land Management (BLM), Roseburg District my goals were to advance my plant identification skills, learn characteristics of Western Oregon ecosystems prior to the urban and agricultural development of the 20th century, and observe and participate in restoration techniques to improve habitat on the North Bank Habitat Management Area (NBHMA) for fish, deer, and plants. NBHMA is one of the largest pieces of publicly owned white oak habitat in Oregon. This former ranch is a 6581 acre (10 square miles) Area of Critical Environmental Concern which was acquired by the BLM in a land swap in 1994 for the purpose of securing habitat for *Odocoileus virginianus leucurus*, Columbian White-tailed Deer (CWTD), which at the time was a federally listed endangered species. The CWTD was thought to have once roamed the entire Willamette Valley, into Douglas County, and up into Washington. There are now only two populations left. One in the Wilbur, Oregon area east of Roseburg and the other along the lower Columbia River in Clatsop and Columbia Counties of Oregon and a couple of Washington counties. As a result of the federal land set-aside to enhance the CWTD, the Roseburg population has since been delisted and is considered neither endangered nor threatened; however, the Roseburg area Columbian White-tailed deer is a special status species that the BLM in conjunction with U.S. Fish and Wildlife and Oregon Department of Fish and Wildlife intentionally manage for at North Bank. The timeline of the sabbatical was early to mid-summer 2011 and early spring to mid-summer 2012 in order to provide the opportunity to study plants and management activities in different seasons; however, I extended the learning experience beyond the 11 weeks stipulated in the sabbatical plan.

While I was consistently working with the botanist, NBHMA activities are carried out by an interdisciplinary and interagency team including: hydrologist, soil scientist, fire ecologist, fishery and wildlife biologists from the BLM, as well as representatives from U.S. Fish & Wildlife and Oregon Department of Fish and Wildlife. This team works together to manage the land to augment this specific deer.

In addition to the science related goals of the sabbatical, I had personal wellness goals that this sabbatical lent itself to due to the physical nature of the outdoor work.

Scope, Timing, and Changes related to the Sabbatical

The sabbatical included the above and much more! Besides the scope included in sabbatical intent statement, the botanist I worked with was also responsible for:

1) Managing, monitoring, and devising treatment plans for noxious weeds located on BLM roads, recreational sites and timber sales areas in the Roseburg BLM Swiftwater district, and
2) Surveying for special status plants in proposed timber sale stands and/or road projects.

The incorporation of these two dimensions into the sabbatical activities added greatly to my experience and to the development of my plant identification skills. **Therefore, some of the experiences related in this report occurred outside the NBHMA yet within the BLM boundaries.**

Besides the de-listed Columbian White-tailed Deer, other special status organisms were found or relocated to this NBHMA property and are being monitored, enhanced, and protected. These include:

1) the foothill yellow-legged frog, (*Rana boylii)* (BLM sensitive species),
2) hairy popcorn flower (*Plagiobothrys hirtus*), endangered
3) Oregon coast coho salmon (federally listed as threatened),
4) red root yampah (*Perideridia erythrorhiza*) – Federal status: species of concern. This member of the carrot family was an important food source for Native Americans in the region who ate their tuberous roots.

I had the opportunity to learn about these species, as well.

Like many sabbatical awardees, I lengthened the experience beyond the 11 weeks, to include all of summer 2012 as well as summer 2011 and early spring 2012 for over 22 weeks of learning experience.

What I did in a nutshell.

I commuted to Roseburg BLM with the Swiftwater area botanist and worked four ten-hour days for most of the sabbatical. I shadowed the botanist on a daily basis. Since we spent a lot of time in the car or BLM truck, we had long conversations about botany, vegetation management, forestry, habitat ecology and the laws that regulate BLM. In addition, I attended interdisciplinary/interagency meetings, safety trainings, grass identification training, as well as interviewed fish, wildlife, fire, and soil science resource specialists. Occasionally, I accompanied a different resource specialist out in the field.

Review of specific objectives and outcomes

I. Observe North Bank Habitat and learn characteristic features and organisms found in its various ecosystems; said ecosystems are also present in the Willamette Valley: Hardwood/Conifer, Grassland, Oak Woodlands, Oak Savannah, Riparian Areas (along rivers), Bottomland Wetlands, and Rock Outcrops.

Habitats described in the North Bank Habitat Management Plan include:

A. Grasslands – primarily composed of grasses and forbs although it may contain scattered trees and brush patches
B. Oak Savannah – consisting of a grasslands understory with up to 30% of the cover as oak trees scattered or in clumps.
C. Oak Woodlands – dominated by trees (primarily oaks with scattered conifers).
D. Hardwood/Conifer – forested settings including larger numbers of Douglas fir and cedar (23)

These habitats have been compromised in various ways. For example, due to the absence of fire, the Grassland, Oak Savannah, and Oak Woodlands habitats have been and continue to be severely impacted. Historically fire eliminated competition of conifers and small oaks so that mature oaks could dominate the landscape. Absence of fire resulted in fir and small oak encroachment so that oak savannah became oak woodland and oak woodlands gravitated towards becoming early seral conifer/hardwood forests. In addition, degradation of the riparian areas due to historic ranching practices has compromised and restricted riparian area habitat adjacent to streams resulting in fewer deciduous trees to provide shade to lower stream temperatures, less leaf litter food for macro-invertebrates (an essential food source for fish), and lowered water tables which cause streams to dry out in late summer. Also, invasive species, predominantly Himalayan blackberry, where left uncontrolled, line stream banks inhibiting the re-establishment of native shrubs and trees. Thus, the landscape present at North Bank Management Habitat Area has been extensively altered from the time native peoples intentionally used fire for food production (e.g., camas) and the maintenance of open grassy and savannah areas for hunting.

I have compiled an Excel workbook of organisms (mostly plants, but also birds, amphibians, and mammals) which I either saw or learned were present at North Bank. The workbook is organized by habitat type. Plant-based notations indicate some of the following features: scientific name; common name; plant type (native, noxious, non-native, serpentine endemic, annual, perennial); federal, state, or agency status; and plant family. Distinguishing features and specific locations are sometimes noted, also. Animal-based notations include: common name, scientific name, habitat code and notes.

Here is a short sample of information on animals living at NBHMA taken from a longer Excel spreadsheet compiled by a BLM wildlife biologist for this report. The habitat code is**: R = Riparian, W = Bottomland Wetland, G = Grassland, OS = Oak Savannah, OW = Oak Woodland, F = Hardwood/Conifer Forest**

Animal	**Scientific Name**	**Habitat Code (s)**	**Notes**
American kestrel	*Falco sparverius*	R, OS, OW, F	Requires snags for nesting
Lewis' woodpecker	*Melanerpes lewis*	R, OS, OW	Winter population only
Pileated woodpecker	*Dryocopus pileatus*	R, OW, F	
Purple martin	*Progne subis*	F	needs snags in open areas
Golden eagle	*Aquila chrysaetos*	G, F	cliff or tree nester
Bobcat	*Lynx rufus*	R, W, G, OS, OW, F	
Rubber boa	*Charina bottae*	R, W, G, OS, OW, F	
Northern harrier	*Circus cyaneus*	G	observed foraging
Little brown myotis	*Myotis lucifugus*	R, OS, OW, F	
Black-tailed Jackrabbit	*Lepus californicus*	G, F	mix of shrubs, grass, & forbs

For more examples of animals at NBHMA see wildlife biologist interview Appendix I.

I collected similar information on plants found at NBHMA. Here is an abbreviated sampling by habitat type. An asterisk (*) indicates it's a native plant

Common Name	Scientific Name	Habitat Code (s)	Notes
*White alder	*Alnus rhombifolia*	R, F	
*Willows	*Salix* species	R	various species
*Vine Maple	*Acer circinatum*	R	
*Pacific Ninebark	*Physocarpus capitatus*	R	
*Mock orange	*Philadelphus lewisii*	R	
*Common rush	*Juncus effusus*	W	
*Oregon ash	*Fraxinus latifolia*	W	
*Cow parsnip	*Heracleum maximum*	W	
*California oatgrass	*Danthonia californica*	W	
*Harvest lily	*Brodiaea elegans*	OS	
*Red-root yampah	*Perideridia erythrorhiza*	OS	
*Blue dicks	*Dichelostemma capitatum*	OS	
Orchard grass	*Dactylis glomerata*	OS, OW	invasive, but not noxious
*Cat's ear	*Calochortus tolmiei*	OW	
*Wood rose	*Rosa gymnocarpa*	OW	
*Rosy checkermallow	*Sidalcea virgata*	OW	
*Pacific madrone	*Arbutus menziesii*	OW	
*Wild blue rye	*Elymus glaucus*	OW	
*Two-color lupine	*Lupinus bicolor*	OW	
*California brome	*Bromus carinatus*	OW, G	
*Sweetbriar	*Rosa eglanteria*	G, F	leaves smell good; thorns
*Self-heal	*Prunella vulgaris*	G	
*Small camas	*Camassia quamash*	G	
*Large camas	*Camassia leichtlinii*	G	
*Wild blue rye	Elymus glaucus	G	Frequent in Willamette V.
*Olney's hairy sedge	*Carex gynodynama*	G	Uncommon
*Two-toothed sedge	*Carex serratodens*	G	Uncommon
*Cascara buckthorn	*Rhamnus purshiana*	F	
*Colt's foot	*Petasites frigidus*	F	
*Pacific yew	*Taxus brevifolia*	F	

The Plant Excel spreadsheet has more vegetation listed and provides more detail. It helps me:

A. Review what I've learned: As the sabbatical progressed, I began to notice what kinds of plants were found in which type of habitat.
B. Know what to look for in what types of habitats when I return or take students out in the field in Douglas County, and to some extent in the Willamette Valley including Cottage Grove and Mt.

Pisgah/Buford Park since some of the habitats and plants found in these locations are the same. Major differences do exist, however, such as:

1) The Roseburg district is within the Klamath interior foothills eco-region while Cottage Grove and Mt. Pisgah/Buford Park are in the Willamette Valley eco-region. The Roseburg area has less average annual precipitation and higher average ambient temperature.
2) The presence of serpentine soils in some areas of Douglas County resulted in the evolution of plants which only exist in that type of soil.

During the sabbatical, the interagency, interdisciplinary team coordinating policy at NBHMA, determined goals for Blacktail Basin, an area where grazing is newly implemented and used, in conjunction with fire, to achieve specific objectives for the various habitats in that basin. The objectives are designed to attain the vegetation composition by type (grassland, oak savannah, oak woodland, and early seral hardwood/conifer forest) as described in the Habitat Management Plan. (See Appendix A: Objectives for Blacktail Basin)

II. Learn and practice restoration techniques such as best methods for restoring degraded areas including bare, eroded stream banks to productive, shaded, riparian areas providing essential functions.

IN-STREAM RESTORATION

Most creeks on the NBHMA are deeply incised due to past ranching practice of pulling wood out of creeks and cutting streamside vegetation to increase pasture. In addition, cows would trample and rub against streamside vegetation, causing compaction of the soil surrounding the plant roots. Over time these activities destroyed the floodplain and allowed water at high flows to remain in and travel rapidly down creek channels digging the streambed deeper. There was only one stream on this former ranch with large alder trees and that is now named Alder Creek. Native plants like cow parsnip, *Heracleum maximum.* which would normally occur along streams throughout the area are often smothered by blackberry vegetation except where they have been removed to improve the riparian zone.

The functions of Riparian areas include:

A. Important habitat for insects exists near streams – willows which can thrive there are a good host for insects. Willows are a valuable nectar source for bees.
B. Shade to keep stream temperatures low for fish eggs, fry, and juveniles
C. Food for insects fish feed on– E.g., leaf litter is eaten by decomposers
D. Bank stabilization via tree roots
E. Wildlife corridor - CWTD prefer riparian areas
F. Filtration of water making the stream less turbid.
G. Structure - Log structures help raise the water table which brings the stream in contact with its riparian area thus widening it. A raised water table helps keep water flowing in the stream all summer. Flowing water is more oxygenated for fish.

Restoration directed toward improving riparian habitat have benefits for coho salmon, the Columbian White-tailed Deer, and other species dependent on stream corridors, riparian areas and/or bottomland wetlands. A large percentage of species use riparian areas for water. Oregon coast coho, Columbian

White-tailed Deer, and diverse plant populations reduce when streams and their adjacent riparian areas are degraded.

A. The problems for Oregon Coast coho at NBHMA are:
    1. Lack of habitat complexity; re: riffles and pools
    2. High stream velocity/peak flows
    3. Poor winter refuge for juvenile fish which need slower moving water found in floodplains to hide out in during high flows.
    4. Seasonal intermittency – streams drying out in summer
    5. High summer stream temperatures dangerous to fry and juvenile fish
       The cooler the water, the more dissolved oxygen it can hold. Salmon eggs and fry require higher levels of dissolved oxygen to survive than adult fish.

B. The problems for the Columbian White-tailed Deer include:
    1. Reduced access to streams due to blackberry thickets
    2. Steep stream banks due to down-cutting of stream bed which reduces access to drinking water
    3. Limited access points to streams making the deer more susceptible to predator attack.
    4. Reduction of forage and plant diversity around riparian habitats the CWTD prefer.

C. Problems for plant communities are:
    1. Reduction in native, obligate wetland and riparian vegetation, including habitat for the endangered hairy popcorn flower (*Plagiobothrys hirtus*).
    2. Increase in invasive species leading to a monoculture of Himalayan blackberry, (*Rubus armeniacus*) along streams severely reducing plant diversity and making re-establishment of native species unlikely without intervention
    3. Low groundwater levels making it difficult for native plants to get re-established. The lower groundwater reduces the width of riparian vegetation found along streams.

BLM botanists, fish biologists, hydrologists and wildlife biologists take an interdisciplinary approach to addressing these problems.

Restoration activities to solve these stream and riparian habitat problems at Jackson, Chasm, and Alder Creeks include:

A. Logs and large boulders are placed to slow water velocity, create multiple complex pool habitats, and increase winter off-channel habitat through greater connectivity to the stream's historic floodplain. I observed excavators placing logs in streams at Chasm Creek. In another instance, I participated in placement of small cedar trees in Alder Creek, an incised stream channel. There I got to measure and select cedars < 12 inches in diameter, to be cut. We had a Northwest Youth Corps team remove them for placement into the creek to slow it down and raise up the streambed which was at least 5 feet deep in places.
B. Installation of larger culverts. A BLM fish ranger described the former culvert on Jackson Creek as a fire hose; that is, it was under a lot of pressure. It was cinching a larger stream into a smaller hose (culvert) which created lots of energy. This caused erosion behind and under the road and eventually the road would fail. The undercutting created too high of a distance for fish

to jump up and get through culvert when coming upstream to spawn. In fact, it was blocking salmonids from getting up stream. When a larger culvert went in, it was level with the stream bed.

C. Replacement of invasive Himalayan blackberry (*Rubus armeniacus*) and One-seed/English Hawthorne (*Crataegus monogyna)* with native willows and other riparian shrubs. I participated in several work parties involving summer youth crews and volunteers to improve riparian vegetation along Alder and Jackson Creeks. I also planted native shrubs at NBHMA to augment the cover available to the deer since blackberries had been removed. I saw the positive results of willow plantings located on the edge of the stream beds and in log jams. Willows are a valuable tool in slowing down the stream velocities and stabilizing stream banks as well as providing food and cover for animals.
D. Diversion of one-third of the flow of Jackson Creek at Soggy Bottoms created more floodplain habitat for *Plagiobothrys hirtus*, the endangered popcorn flower.

(See Appendix B: Jackson Creek Instream Restoration Interpretive Poster)

An example of these restoration techniques can be seen at Jackson Creek where the following positive effects have been noted:

1) Higher stream bed (See Appendix C: Jackson Creek Cross Section Profile)
2) Width to depth ratio improvement (See Appendix C: Jackson Creek Cross Section Profile)
3) More gradual flood plain
4) More complexity in terms of riffles and pools
5) Less energy
6) Reduced peak flows due to more water in ground and less surface flow
7) Increased groundwater
8) Deposition of gravel at log jams. Gravel is necessary for salmon to build redds (nests)
9) More shrubby vegetation in riparian area
10) More access points for deer to reach the water. There used to be only three pools of water on Jackson Creek in August making deer movement to obtain water predictable for predators. Now deer access the stream at many points.

Due to the improvements noted above the channel rebuilds and the groundwater table rises. This provides habitat for the native plantings along the stream to become more robust, diverse, and wide. Greater plant diversity helps fish by sustaining insect populations, an important food source for fish. We noticed many young alder and willow trees becoming established adjacent to streams. Revisiting areas to remove blackberries will be needed to allow native vegetation to prosper. Eventually, the leaf litter from the willow, alder, oak, and ash trees that are becoming established will provide more nutrients for the macro-invertebrates fish eat.

Effectiveness of restoration techniques designed to improve habitat for fish and improve riparian areas is monitored, in part, by:

A. Hydrology Measurements of the following changes over time (See Appendix C: Jackson Creek Cross Section):
    1. Water temperature
    2. Water table level

3. Pebble and gravel size
4. Water flow level
5. Cross-Sections of stream bed

B. Fisheries Spawning Surveys
   1. Number of redds & adult escapement (See Appendix D: Number of Coho Redds and Adult Escapement in Jackson Creek – NBHMA) Escapement is that number of adult anadromous fish that escape the commercial and recreational fisheries and reach the freshwater spawning grounds.
   2. Photo-monitoring of log jams & boulder placement as well of culvert replacement for visual comparisons pre- and post- intervention.

OAK WOODLAND AND OAK SAVANNAH HABITATS RESTORATION: thinning, increasing vegetation diversity and burning. (See Appendices E: Oak Habitat Restoration at North Bank HMA and F: Vegetation Monitoring Transect)

According to Vesely and Tucker, Oregon white oak (*Quercus garryana*) savannahs and woodlands are among the most endangered ecological communities in the Pacific Northwest (2). Due to elimination of fire, oak woodlands and conifer/hardwood forests have become overstocked and closed-canopy. This has occurred in the Willamette Valley and Douglas County among other areas in Oregon. "Oak savannas and woodlands are used by more than 200 species of native wildlife in the region "(Vesely and Tucker 5). NBHMA is one of the largest oak savanna preserves in Oregon. . Oak thinning has been used at NBHMA to bring back these habitats. The oak restoration/ thinning project at NBHMA was designed to significantly reduce the number of trees/acre Components include:

A. Arresting Douglas fir encroachment into oak habitat by thinning firs.
B. Fostering vigorous acorn production and larger canopies in oak trees by thinning selected, small diameter oaks with sparse canopies to reduce competition for water, nutrients and sunlight.
C. Retaining thinned trees to provide wildlife habitat. Piling slash to benefit small rodents, reptiles, and other wildlife.
D. Planting thinned areas with a diverse mix of native shrubs, grasses, and wildflowers to enhance plant diversity for the benefit of wildlife including native pollinators.
E. Controlling invasive vegetation.
F. Burning to maintain oak thins and to reduce invasive species; however, fire hasn't been used because the area wasn't opened up enough to carry fire at desired intensities.

I took photo-points to monitor vegetation in NBHMA areas thinned to improve upland habitats and looked at un-thinned, adjacent (conifer/hardwood forest) areas in comparison. There are a lot more grasses and wildflowers coming up in the thinned areas as demonstrated by pre- and post- photo-points. The conifer/hardwood forests had very little understory vegetation. Oak thinning and controlled burns can work hand in hand because once the acreage is dominated by big oaks, fire burns competitive species coming up under them, yet doesn't bother the oaks; thus, allowing mature oaks to grow and develop crowns for acorn production.

III. Learn to identify trees, plants (native and non-native), and shrubs common to our region by sight in summer and early spring and also how to utilize plant identification keys

In preparation for my sabbatical I took Biology of Wildflowers at LCC and learned to classify plants belonging to 50 – 60 plant families. This sabbatical built on that foundation and furthered my skills as I learned to identify some plants by their genus and species as well.

Two highlights of my sabbatical were assisting agency botanists in helping to collect, organize, and identify wildflowers for the Glide Wildflower Show and attending a two day grass identification workshop for BLM resource specialists. I utilized plant identification keys throughout the sabbatical at:

A. Glide Forestry Day where I joined the BLM botanist in giving a tree identification workshop for rotating groups of 5th graders
B. The Glide Wildflower show preparation
C. The two day Grasses Workshop by the Carex Working Group
D. A wildflower walk on the North Umpqua Trail
E. Weekly fieldwork where I encountered a wide variety of plants on a regular basis

In Lane County we use the Handbook of Northwest Plants by Gilkey & Dennis, a field guide that encompasses the floristic area from the summit of the Cascade Range to the coastlines of Washington and Oregon as far south as the Umpqua Divide. In the Roseburg BLM district, I learned to use The Jepson Manual of Higher Plants of California, edited by James C. Hickman and published in 1993. The "Jepson" is the accepted botanical field guide for this region.

As the sabbatical progressed my confidence in plant identification grew. The Excel workbook resource referred to under Objective I is an outcome of the sabbatical. It is a tool I will be using for years to come.

IV. Learn to use technology including: Global Positioning System (GPS), and possibly Geographic Information System (GIS) as well, to map and report weed population locations; plus (utilize) photo-monitoring to monitor weed populations;

First, I took a "Navigation with Compass and Map class" followed by a 2 hour class in GPS at Eugene's REI. Following that I attended a 6 hour REI GPS class at Stubs Stewart State Park near Buxton, OR. The second class was hands on and I learned to set waypoints and track routes

My purpose in using GPS was to obtain navigation and location reporting skills in order to collect and record the location of invasive species encountered on GED class field trips allowing us to report the information to Weed Mapper, the local watershed council, or other invasive species monitoring sites. I learned enough in these workshops to do that. An outcome of the sabbatical is that I applied for and received a grant to purchase a GPS unit with camera for the ABSE/GED classes in Cottage Grove where I teach.

The botanist I worked with used GPS, GIS and ArcMap. This system was linked to National Invasive Species Information Management Systems (NISIMS) which is where the BLM tracks invasive species populations on BLM lands. I didn't have clearance to use BLM GPS units which were loaded with the ability to input information to NISIMS, so I appreciated that REI had adequate training in GPS. I did, however, get to see how such units are used in the field.

I have been in touch with Science Department faculty about taking a GIS class designed for teachers and plan to pursue that when it becomes available.

V. **Learn and apply field botany methodology including monitoring techniques to track native and noxious plant spread or reduction.**

We used five main techniques:

A. **Transects**
B. **Photo-monitoring**
C. **Total Species lists**
D. **GPS and GIS (mapping)**
E. **Revisiting** and either counting or visually noticing the numbers of special status, native, or noxious plants.

A. **Transects** – July 12 and August 10, 2011 we completed transects on forage plots at NBHMA and during spring of 2012 we did transects at one of the oak thin sites.

The purpose of the forage plot transects was to measure vegetative changes over time and determine what's available for forage and browse especially during the dry late summer. Forage plots were envisioned as a way to increase forage for the deer. To conduct transects a tape is stretched 100 meters and photo-points are taken in the four cardinal directions. Then a transect square is place every 3 meters and a list is made of the species present. Transects can be completed annually to track changes in the plot. The plot we visited on July 12th had been seeded with a non-native elk mix after disking the plot to a fine powder. After 3 years this forage plot had become all annual grasses which die out by midsummer. Invasive plants were also present. Overall there was a net loss of forage. Lots of tall grasses were lying down resulting in a thick layer of thatch. The CWTD like grass that is freshly greening up and thatch prevents this. Rye grass, which is good for deer forage, and which had been in the mix doesn't hold for a long time. Prior to the last tilling there was no visible milk thistle (*Silybum marianum)* and today there is a lot. The botanists' prognosis for this plot is to expect the invasive medusahead rye (*Taeniatherum caput-medusae)* to increase and clover to decrease. Planting forage plots with non-natives seems after a few years to result in less clover and rye grass. Aggressive annuals expected to increase are barren brome, (*Bromus sterilus)* and soft brome-grass, (*Bromus mollis)*.

B. **Photo-monitoring** is used to provide a visual record of the landscape at the beginning and end of the 100 meters. It also verifies that the transect is repeated in the original location. Four photos are taken, one in each of the 4 cardinal directions, 360° around the beginning and ending points. I took some of the pictures of the forage plots.

In addition to using photo-monitoring in relation to transects, we also used it along with GPS/GIS/ArcMap to document Thompson's mistmaiden (*Romanzoffia thompsonii)* sites in a meadow within the BLM forestlands (not at NBHMA). The purpose there was to clearly locate the site so that in the event of a timber sale slash would not be piled in meadow containing this protected plant.

At NBHMA photo-monitoring is used to evaluate the effectiveness of the aforementioned oak thinning projects discussed in Objective II. (See Appendixes E: Oak Habitat Restoration at North Bank HMA and F: Vegetation Monitoring Transect)

The soil scientist and botanist are using photo-monitoring to monitor cattle grazing impacts. According to the soil scientist, BLM is measuring how quickly the vegetation was reduced and how well it comes back. Those points will be monitored again this fall before the burning. Photo-points are a good way to visually gauge the results of BLM management actions. Original points on the fescue unit within the grazing plot indicate that the system seems to be resilient and that the grass did recover.

There is a plan to establish photographic plots at naturally occurring populations of red root yampah (*Perideridia erythrorhiza*), a federal status species of concern; however, the timing was outside the parameters of the sabbatical so I didn't get to participate in it.

C. **Total Species Lists –** We did this a couple of times. One reason was to check a contractor's work as part of the Survey & Management requirements of the Northwest Forest Practices Act which required federal agencies including the BLM and U.S.Forest Service to check for special status species prior to ground disturbing activities. The BLM subcontracted out a botany survey and then the BLM botanist and I conducted follow-up surveys to verify locations of special status plants and to check the contractor's work. I took notes for the BLM botanist as she dictated the **to**tal plant species we found.

We used the total species list technique on July 12, 2011 at a forage plot which had been hand seeded with native mix in 2009 and then drill seeded with native mix in 2010. The purpose was to track changes in species diversity over time by listing what species were represented on the plot as a whole. There was too much competition from established weeds for the native plants to become established. Lots of tall fescue *(Schedonorus phoenix*) and common velvet grass (*Holcus lanatus*) were present on the day we made the total species list.

D. **GPS and GIS Mapping**
When I began at the BLM, they were transitioning to new units called Trimbles. As the sabbatical progressed, I observed the Trimble used more and more to map rare plants for protection and invasive plants for monitoring and treatment. Data collected out in the field via the Trimble was then loaded into ArcMap and NISIMS.

E. **Revisiting Locations** - Much of our work involved looking at vegetation as we walked or drove out in the field. A sampling of how we used this technique follows.

At NBHMA we checked on an area planted with small camas *(Camassia quamash),* and large camas *(Camassia leichtlinii* var. leichtlinii). We found camas in the areas that were planted which had been browsed by deer. I wrote a short report of our findings.

On June 22, 2011, we visited a site known for gorse (*Ulex europaeus*) and found it on private property, but not on BLM lands. The location was reported to the timber company that owned the land.

Osprey Boat Ramp – July 11, 2011 located along the Umpqua River. We checked for shining geranium (*Geranium lucidum* L.) and herb Robert (*Geranium robertianum)*; negative. Saw osprey. Invasive plants present were purple loosestrife (*Lythrum salicaria*), knapweed, Japanese knotweed (*Polygonum cuspidatum*), and Himalayan blackberry (*Rubus armeniacus*). We removed the Himalayan blackberry.

April 30, 2012 - Almost a year later, we did weed monitoring at Osprey Boat Ramp again. Saw poison hemlock (*Conium maculatum*), a knapweed, Japanese knotweed (*Polygonum cuspidatum*), shining geranium (*Geranium lucidum* L.), reed canary grass (*Phalarus arundinacea L*.), and Himalayan blackberry (*Rubus armeniacus*) invasive species. Natives were nettle and a stellaria. Himalayan blackberry had been manually removed. We hand pulled shining geranium for an hour. Next stop was up Yellow Creek to an herb Robert site. Last year Julie and a person from Douglas Soil and Water District hand pulled and filled nine bags. In an hour Julie and I hand pulled ¾ of a bag of the bigger plants. We will to return to get the small plants when they get larger.

We also monitored English ivy (*Hedera helix*), periwinkle (*Vinca minor*), Himalayan blackberry (*Rubus armeniacus*), Japanese knotweed (*Polygonum cuspidatum*), Scots broom (*Cytisus scoparius*) and Portuguese broom (*Cytisus striatus*) as well as spotted knapweed (*Centaurea maculosa*) sites.

There is an ongoing project to count the redroot yampah (*Perideridia erythrorhiza*) populations since it is a federal species of concern. The plan includes mapping and collecting site specific data from individual naturally occurring populations; however, the timing was outside the parameters of the sabbatical so I didn't participate.

VI. Participate in the development of plans to eradicate & control weed sites

A. Plan to keep herb Robert (*Geranium robertianum*) out of streams during restoration activities on Smith River.

On June 22, 2011, the BLM Swiftwater botanist, a representative from Douglas Soil & Water Conservation District (DSWCD) and I went up Smith River watershed into BLM forest. We were checking a fish restoration site that logs were going to be hauled into for the purpose of reducing the stream velocities, catching gravel, and creating pools and riffles to benefit spawning fish. Herb Robert (*Geranium robertianum)*, or stinky Bob as it is commonly called, had invaded the area and lined both sides of the road adjacent to the riparian woodland by the stream. We removed a small stretch at one of the openings a cat would traverse to get logs to the stream. In addition, DS&WCD was hired to remove a long stretch of the herb Robert so that equipment involved in the restoration project wouldn't move weed seed into the stream.

B. Plan to remove false brome *(Brachypodium sylvaticum)* along the North Umpqua Scenic River Corridor (See Appendix G: False Brome)

The Oregon Department of Agriculture (ODA) Noxious Plant program website clearly describes the threat this grass poses by describing that it can take over forest understories, tolerate substantial shade

and drought while outcompeting other vegetation for moisture. The ODA notes false brome's presence in timberlands creates an ideal situation for rodents which can lead to damaged tree seedlings. False brome can dominate oak savannah habitats and restrict native oak regeneration. Mt. Pisgah arboretum/Buford Park has an ongoing intensive effort to manually remove false brome.

In August 2011 Swiftwater BLM employees and I used three rafts to float a section of the North Umpqua River in the scenic river corridor to remove false brome. We disembarked at various points along the river's edge and bagged and packed the plants into the rafts for disposal. This effort is ongoing every summer that the river flow levels cooperate.

Efforts are underway to eradicate the false brome at its source. Toward that end on May 14, 2012 the BLM botanist, DSWCD representative, and I went to Canton Creek near Steamboat Inn to GPS false brome locations for the private timber company on whose land the plant was growing. The company had agreed to work with DSWCD to treat the area using grant funds obtained by the agency. If the company purchased the herbicide and seed to sow after treatment, DSWCD would provide the labor. We walked along a road that is used by mountain bikers. One concern is that seeds can get in the bike tires and spread the invasive plant a long distance from where the seed was picked up. This location is the source of the false brome that has appeared in the scenic river corridor of the North Umpqua. The population was likely established due to historic logging practices. False brome has a short seed life so it can be eradicated in a couple of years with persistent treatment. This invasive grass was discovered here five years ago. False brome is hairy on both sides of blades which droop and is a bunchgrass. Last year's growth looks off-white and comes out from base

C. Plan to remove Portuguese broom (*Cytisus striatus)* in the Cox Creek area

The BLM Swiftwater botanist did a survey and found several Portuguese broom infestations. Of the 7 Portuguese broom sites the largest was developed into the Cox Creek Weed Management Area. The Weed Management Area in Cox Creek is within the six mile square township containing scattered Portuguese broom including 64 landowners, private timber companies, and BLM. A timber company knew aerial spray didn't work so invested in cut and stump treatment with herbicide. About ten years ago, Douglas County Soil and Water Conservation District was awarded a contract to implement a weed management plan whereby private land owners only had to pay for the herbicide and seed. Funding for streamside restoration projects on private property comes through other funding sources such as Title II, Conservation Reserve Enhancement Program and the Oregon Watershed Enhancement Board.

The weed projects described above are just a few of the interventions I participated in. Weed work was a large part of what we did and included lining out youth crews to tackle common St. John's wort *(Hypericum perforatum)*, English Ivy (*Hedera helix)*, and Himalayan blackberry (*Rubus armeniacus*), among others.

VII. Gain experience in invasive species weed management including: mechanical, fire, manual, biological control, and the cautious use of pesticides.

A weed survey of fire lines at NBMA showed **m**ost open habitats dominated by invasive non-native grasses that almost entirely exclude native herbaceous species. Sustained control efforts will be needed to restore native dominated plant communities.

Biological controls are already present on BLM lands. It can take twenty years to get a new bio-control approved. The risk of any given bio-control is that it may switch to harming native plants. The gall mite, which was not officially introduced, but has shown up in Douglas County and is effective against Scots broom (*Cytisus scoparius*) is also known to damage lupine. The Roseburg BLM has a federally listed lupine, *Lupinus oreganus*, on federal lands.

The following chart presents the methods used on various invasive plants which I learned about. BLM didn't do all these treatments, some involved DSWCD on public land and some were carried out by private owners. Other treatments I heard or read about but didn't see in use at BLM.

Most of the plants on the chart are noxious weeds. The legal definition of a noxious weed as found on the Douglas County Noxious Weed List is a non-native plant having one or more of the following characteristics:

Cause economic losses to agricultural and horticultural industries, and/or
Endanger native flora and fauna by encroaching in wild lands, and/or
Hamper the enjoyment and full use of recreation site and/or
Are poisonous, injurious or otherwise harmful to humans and animals

Goal 7: INVASIVE SPECIES WEED MANAGEMENT TOOLS

*** Indicates noxious weed status per Douglas County Noxious Weed List**
****Plant is not on Douglas County list, but is on Oregon State Noxious Weed List**

METHOD	COMMON NAME	SCIENTIFIC NAME
Fire/burning	medusahead rye * when seed is milky/doughy (not hard)	*Taeniatherum caput-medusae**
propane burner	English ivy*	*Hedera helix**
Manual	herb Robert	*Geranium robertianum*
	English ivy*	*Hedera helix**
	false brome**	*Brachypodium sylvaticum***
	periwinkle	*Vinca minor*
weed wrench or hand-pull	Portuguese broom*	*Cytisus striatus**
	Shining crane's bill	*Geranium lucidum L.*
	Common St. John's wort*	*Hypericum perforatum**
weed wrench or carefully hand-pull (toxic sap)	spurge laurel*	*Daphne laureola**
Pull by early July	woolly distaff thistle*	*Carthamus lanatus**
Pull when small	yellow starthistle*	*Centaurea solstitialis**
Cut/dig	Himalayan Blackberry*	*Rubus armeniacus**
Pull by late July	Canada thistle*	*Cirsium arvense**
Pull by mid-July	Milk thistle*	*Silybum marianum**

Pull/weed wrench	Scots broom*	*Cytisus scoparius**
Biological - Biological controls	Scots broom* (4 + gall mite)	*Cytisus scoparius**
	Canada thistle*	*Cirsium arvense**
	tansy ragwort*	*Senecio jacobaea**
Rust (biological)	Himalayan Blackberry*	*Rubus armeniacus**
Herbicides	Himalayan Blackberry*	*Rubus armeniacus**
	Canada thistle*	*Cirsium arvense**
Spot treat Spray(glyphosate)	One-seed hawthorn (English)*	*Crataegus monogyna**
	Japanese knotweed*	*Polygonum cuspidatum**
Cut & treat	Portuguese broom*	*Cytisus striatus**
	spurge laurel*	*Daphne laureola**
	false brome**	*Brachypodium sylvaticum***
	gorse*	*Ulex europaeus**
Mechanical/mowing		
	Canada thistle*	*Cirsium arvense**
	milk thistle*	*Silybum marianum**
Grazing	medusahead rye*	*Taeniatherum caput-medusae**

VIII. Compare the effectiveness of pulling thistles versus spraying with herbicide – this goal I expanded to include comparing various methods with a couple of plants.

A. **Thistle**: Various methods for treating thistles have been used at NBHMA. Over the past several years as forage plots have been implemented, the increase in thistle populations have been challenging. Three methods have been used on thistle at the NBHMA: herbicides, hand-pulling (often by youth crews), and mowing.

Often thistle is located where burns take place to reduce the medusahead rye (*Taeniatherum caput-medusae)* so the effect of fire on thistle has been observed as well. After the Main House controlled burn to control medusahead rye in 2011, the plan was to plant native seeds; however, that didn't happen. At the time of the burn there was milk thistle (*Silybum marianum*) and Italian thistle, (*Carduus pycnocephalus*) in the unit. Now visual observation indicates there's more thistle than there was. Fire creates a receptive seed bed for thistle and air disperses many seeds. Therefore, it is important to seed plots post-fire with desired vegetation. In another NBHMA location hand-pulling of Canadian thistle (*Cirsium arvense*) and milk thistle was done just below Blacktail Basin grazing area. At a third location, NBHMA Middle Barn, BLM treated Canadian thistle that was over five feet tall with herbicide just before it bloomed and that seems to have worked the best. Likewise, Soggy Bottoms was almost solid Canadian thistle so BLM sprayed with herbicide just before it bloomed which seems to have worked real well there, too. Mowing also works. Where the NBHMA caretaker mowed up to the road, there were no thistles, but on the berm of the road where he couldn't mow, there was Canadian thistle. Thistles are annuals and their seed doesn't last long. Thus, the plant needs to be treated or removed before going to seed. From these experiences which I either observed or heard about,

it seems that herbicides, mowing, and hand – pulling can be effective depending on the timing of the intervention.

B. **English Ivy (*Hedera helix*) Comparison:** at Stick Beach in the North Umpqua Scenic River Corridor. This past winter, a new tool, the propane burner was used to combat persistent ivy populations at Stick Beach. An adjacent plot was treated by weed whacking. In August of 2012, I participated in a work party tackling the new growth and residual ivy in these same locations. The ivy that had been propane burned was smaller and pulled out easier than the ivy that had been weed whacked. Thus, the propane burner treatment was much more effective than weed whacking.

C. **Herb Robert (*Geranium robertianum*) Comparison**: This comparison occurred in the Smith River watershed. The goal was to keep roadside herb Robert seed dropped from plants from being carried to the streamside by equipment used during the fall of 2011 in a fish restoration project. The first attempt to eradicate the herb Robert was in the spring of 2011 just before the sabbatical started. At that time, the BLM tried using herbicide contained in a crop oil base. Initially the plant responded to the herbicide by looking like it would die. When we visited the site a couple months later in June of 2011, the Herb Robert had rebounded vigorously. A possible explanation for this result was that the crop oil base was the wrong substance to use with the herbicide. However, the subsequent hand pulling by the Douglas Soil & Water Conservation District (discussed under Objective VI) had excellent results. In April and May of 2012, a year after the treatment, the BLM botanist and I re-visited the Smith River locations and found no herb Robert streamside so the stated goal of keeping it out of the area directly adjacent to the stream was accomplished. In addition, there was very little herb Robert to be found anywhere along the roads.

IX. Understand the viewpoints of various stakeholders (fisheries, sportsmen, botanists, wildlife experts, and ranchers) all of which are brought to bear in management of this ecosystem.

In addition to spending an average of ten hours a day with the Swiftwater botanist, I interviewed the fisheries biologist, wildlife biologist, soil scientist, and fire ecologist working on the NBHMA. I included the interviews in Appendices H through K. The Swiftwater District has regular meetings which I attended. In addition, I attended the NBHMA Interdisciplinary team monthly meetings which include BLM resource specialists as well as United States Fish & Wildlife and Oregon Fish and Wildlife representatives. These experiences taught me that what works best for one resource may not be viewed as the best alternative for another resource. Thus, priorities have to be set.

The last few months I was there, grazing was implemented and the ranchers who were providing the cattle attended an Interdisciplinary team meeting at Blacktail Basin in the NBHMA.
A tour of Blacktail Basin was included. Grazing is a new tool being field tested at NBHMA for increasing forage quality and duration as well as reducing weeds like medusahead rye (*Taeniatherum caput-medusae)* at a young stage. Grazing was identified in the North Bank Habitat Management Plan as a tool for achieving the goals to improve habitat for the CWTD (11). From a ranching perspective, grazing and burning go hand in hand with a fall burn often followed by cattle getting back on the pasture as soon as possible in the spring. Grazing right after a burn can facilitate cattle eating Pacific poison oak

(*Toxicodendron diversilobum*). We looked at an area which had been burned within the last couple of years. There the poison oak was less vigorous (2-3 feet tall) compared to areas that had not been burned where the poison oak was 5-6 feet tall.

Cattle are also a way to reduce thatch and to prevent grass from heading out; instead keeping it productive. This keeps the forage available for the CWTD later in the summer season. The botanist I was shadowing told me that grazing can be used as a management tool for native perennials such as bunchgrasses by grazing in the early spring, then, pulling livestock off when flowering structure is "in the boot" or just emerging. The soil scientist is monitoring soil compaction and resilience as well as noting with the botanist vegetative changes in the grazing units. Control areas within the grazing units are set up so that vegetation comparisons can be made.

X. Keep a journal of my experiences and anecdotes to draw on in teaching classes and developing learning activities.

I kept a daily journal of conversations and activities and it has been a rich source of information for this report. I am not including the journal because so much of it is conversations while driving from one location to another or meeting notes obtained without consent to publish them. This report offers a glimpse into the depth of information that was discussed.

Additional Sabbatical Outcomes:

The sabbatical continued until close to the onset of fall term 2012, so there hasn't been much time to implement changes and develop curriculum. A clear outcome is my increased energy which I attribute to breathing the outdoor forest air and increasing my level of physical activity hiking around the Roseburg BLM district. This increased energy is evident in my work. Beyond that, due to the sabbatical, I have firsthand examples of how the various pieces of an ecological system interrelate with one another and the restoration techniques for restoring habitats. I discovered new places to take students on field trips and saw scientific equipment used in the field. I applied for and received a LCC foundation grant to purchase a GPS unit with camera for reporting invasive species, a turbidimeter to measure stream turbidity, and funding to take students on field trips. This equipment will be used by students. Winter term I will take students to see Piper Creek Stream Restoration project, designed to improve fish habitat, at the base of Cottage Grove Dam.

I attended the Sustainability workshop during fall inservice and plan on participating in their meetings this winter and spring terms. I am actively encouraging two long term ABSE faculty members with science interests to apply for sabbaticals. One of them will join our class in the Salmon Watch program this year to see salmon spawning in the wild, assess water quality, catch macro-invertebrates, and study riparian vegetation. I am following the LCC Science department's application for a grant to offer a GIS class for teachers. I have taken students out in the field several times this fall to identify trees and shrubs in the riparian area along the Coast Fork of the Willamette River and at Row River Nature Park. We have also done dissolved oxygen testing in these areas. I am much more knowledgeable of the plants we encounter on field trips.

I have enriched the resources available to teach field science through the collection of photos, reports, and Powerpoint slideshows I developed. In addition, I have established relationships with resource specialists in wildlife, soil science, botany, hydrology, fisheries, and fire. The BLM fish ranger I interviewed has offered to help me identify stream locations nearby for macro-invertebrate sampling and stream reach surveys.

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Appendix A: Objectives for Blacktail Basin

Objectives for Blacktail Basin over the next five years:

To attain the vegetation composition by type as described in the Habitat Management Plan, while maintaining a mosaic of vegetation structure that provides quality cover and food for CWTD

Vegetation Type	Acres	Objective	Proposed Treatment
Oak Savannah		Maintain individual and patches of oaks and improve quality and availability of forage.	Spring burn to reduce medusa head. Thin around large oaks if needed
Grasslands		Maintain shrubs at or below current levels and improve quality and availability of forage.	Graze three out of five years. Spring burn to reduce medusa head
Oak Woodlands		Reduce competition around potential heritage oaks and reduce canopy cover to 60 percent.	Thin around large oaks. Remove conifers, except for those with unique values (e.g. large ponderosa pines)
Early Seral Hardwood Conifer		Reduce shrub cover to attain 50-50 ratio and improve forage and browse quality	Burn on three year intervals for first five years and graze on other years (if forage is ready).

- Source: Roseburg District BLM 2012

Appendix B

Jackson Creek Instream Restoration

1. Historic Stream Cleaning: Wood was removed because it was mistakenly thought to block salmon from spawning areas. Without anything to hold the gravels, high flows flushed them out of the stream channel.

2. Stream Bed Erosion: The effects of past grazing management and the 1964 floods caused Jackson Creek to erode from 6 to 20 feet vertically. As a result, natural overbank flooding was eliminated and stream energy was focused on the streambed causing further channel erosion.

3. Groundwater: As the stream level lowered in elevation, the water table also dropped. Jackson Creek historically flowed all year (perennial stream), but now dries up during the summer (intermittent stream).

4. Noxious Weeds: Past grazing practices suppressed native plants and allowed noxious weeds such as Himalayan blackberry and English hawthorne to overgrow riparian areas.

What was Done?

2008 Instream Restoration

- Placement of 95 logs and 120 boulders at 28 sites in the lower mile of Jackson Creek.
- Blackberry and Hawthorne removal by OYCC and NYCC student work crews.
- Willow and riparian shrub planting.
- 2009-2010 Restoration projects planned for Jackson and Chasm Creeks

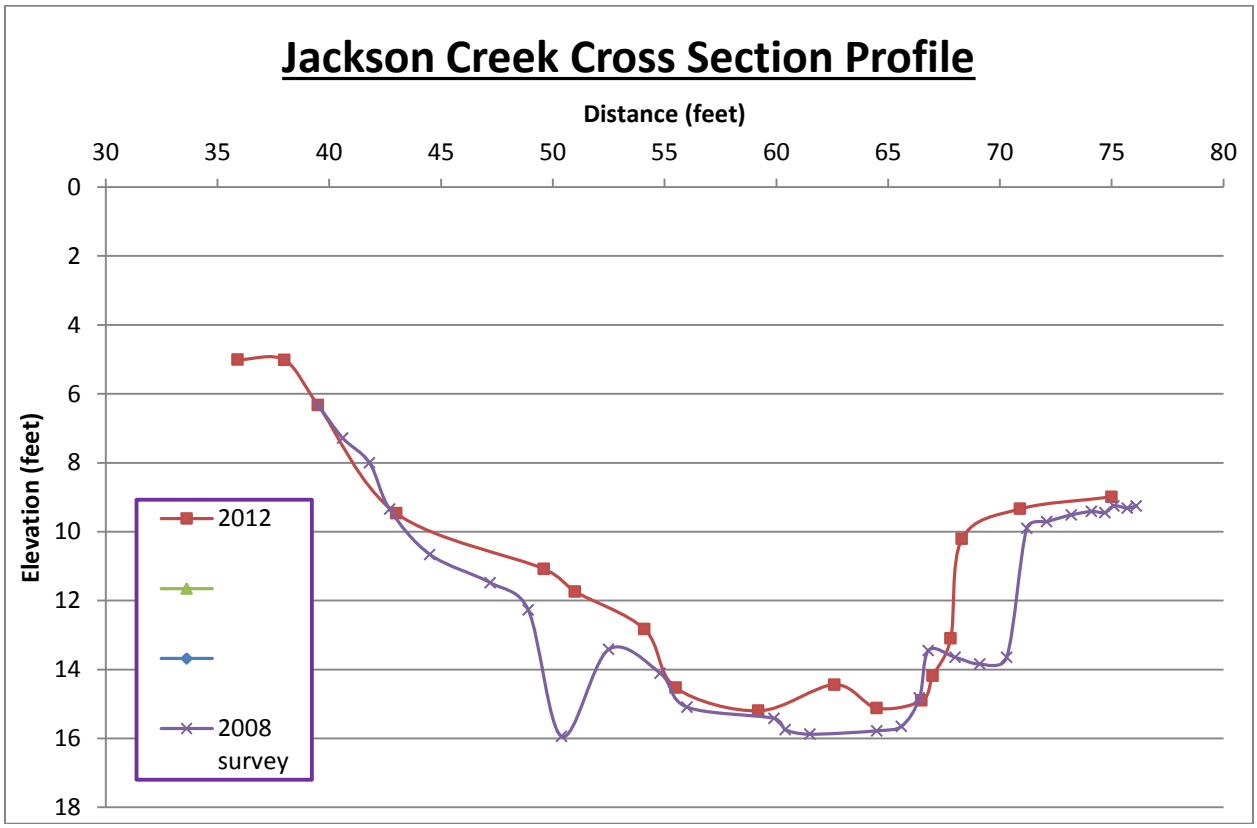
What are the Benefits?

Benefits of Logs and Boulders:

- Dissipate stream energy allowing sediment and gravel to accumulate and build the channel back up.
- Provide refuge for juvenile salmon from predators and high flows.
- Capture gravels that are used by adult salmon and steelhead for spawning.
- As the channel rebuilds, the groundwater table will rise, increasing the health of the riparian areas and allowing water to flow in Jackson Creek throughout the year.

Source: Roseburg District BLM

Appendix C

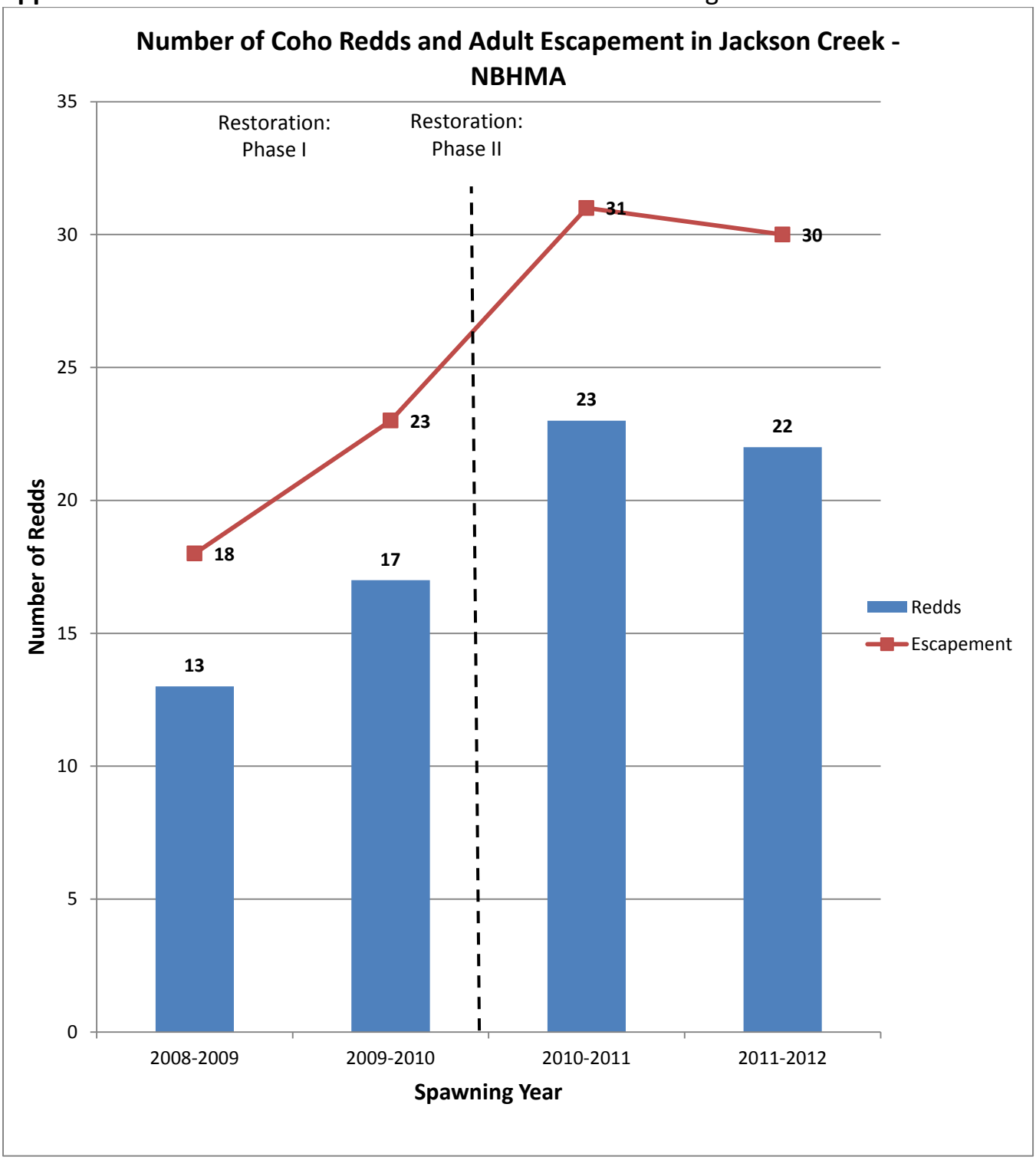


Source: Roseburg District BLM

This chart shows:

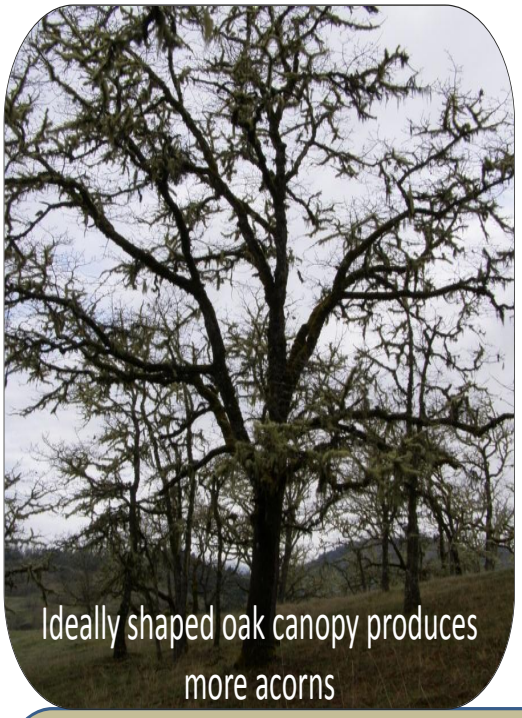
1) width to depth ratio from 2:1 to 3:1
2) floodplain is more gradual
3) energy of stream is dissipating
4) shallower compared to width

Appendix D Source: Roseburg District BLM 2012



Appendix E

Oak Habitat Restoration at North Bank HMA



Ideally shaped oak canopy produces more acorns

Oregon white oak savannas and woodlands are among the most endangered ecological communities in the Pacific Northwest.

Historic fire suppression practices have led to overstocked, closed-canopy oak woodlands and conifer/hardwood forests, resulting in a decline in many wildlife species dependent on these ecosystems, such as migratory songbirds and Western Grey squirrels.

Strategies for Restoring Oak Habitat:

- **Arrest Douglas fir encroachment into oak habitat. Thin firs and create snags for wildlife. Use thinned firs placed in incised streams to enhance fish habitat.**
- **Foster vigor, acorn production, and larger canopies in oak trees. Thin selected, small diameter oak trees with sparse canopies to reduce competition for water, nutrients and sunlight.**
- **Retain thinned trees to provide wildlife habitat. Pile slash to benefit small rodents, reptiles and other wildlife.**
- **Enhance native understory vegetation. Control invasive vegetation and plant a diverse mix of native shrubs, grasses and wildflowers. Increase plant diversity for the benefit of wildlife including native pollinators.**

Source: Roseburg District BLM

Appendix F Vegetation Monitoring Transect

Before the thin (South)

After the thin

Source: Roseburg District BLM

Appendix G: False Brome

Photo courtesy of Glenn Miller, Oregon Department of Agriculture

Appendix H: Fish Ranger Interview

(Fish ranger in bold; interviewer in plain text)

1. Which fish species are you trying to enhance at NB?
   Primarily Coho Salmon. These are ecosystem projects. Bring water table up. Improve riparian vegetation which will help other animals besides coho, such as birds, mammals, insects, steelhead and cutthroat trout

2. Any special status fish?
   a. **Oregon Coho is threatened under ESA (Evolutionarily Significant Unit)**
3. What does it mean Oregon Coast Evolutionarily Significant Unit for coho salmon? **Genetically distinct units of coho return to their home stream so have a genetic uniqueness. Alaska coho are not listed. Pacific lamprey doesn't have protection because haven't done genetic work to distinguish it.**
4. When do coho spawn? **December is peak.**

5. What are the problems for fish you are trying to correct?
   a. **High stream velocity/peak flows need to be reduced**
      Lack of large wood source near stream results in little woody debris

High flows cause down-cutting of stream so stream is not recharged by water stored in the banks and thus dries up in summer. Stream has more energy focused at bottom of channel so everything washes out instead of flooding the floodplain. What's missing for fish is spawning gravel (instead we have bedrock) and juvenile fish need deep pools with cover to hide from predators and winter high flows.

b. Lack of habitat complexity – This means diverse stream features of riffles and pools are lacking. Riffles = kitchens of stream; bugs in there; Pools are dining room and are deep with boulders and wood in them providing hiding cover. We add logs to create riffles and pools. Log jams stop water and gravel drops out. Gravel comes from erosion of stream bank. Logs kick water to edges where gravel from historic stream beds comes loose and into system. Goal: keep gravel in stream instead of ocean. There is a natural progression of how a stream recovers on its own, but that would take hundreds of years in the case of some of the North Bank streams. Meandering makes pools outside and gravel inside. Slowing down system allows for meandering.

c. Poor winter refuge for juvenile fish

d. Seasonal intermittency

Stream went dry in the summer but not in 2009 or 2010 after log jams were put in.

Goals in a 2008 NBHA restoration application goals included:

a. Attenuate stream energy.
b. Increase channel heterogeneity (roughness, sinuosity and structure)
c. Prevent and reverse channelization and incision of stream channel.
d. Expand and improve upon anadromous and resident salmonid habitat
e. Stabilize stream banks. – **this is not a result of log jams because they actually destabilize the stream by forcing water into the banks which is where the gravel comes from that we need for the redds.**
f. Maintain or raise groundwater levels.
g. Maintain or enhance populations of native, obligate wetland and riparian vegetation, including the endangered hairy popcornflower.

6. What types of interventions have you tried at NB to restore degraded areas such as bare, eroded stream banks to productive, shade-providing riparian areas.?

a. **Logs and Boulders to slow water velocity, create multiple complex pool habitats, and increase winter off-channel habitat thru greater connectivity to floodplain**.

b. Larger culverts. Culvert on Jackson Creek was like a fire hose – under a lot of pressure. It was cinching a larger stream into a smaller hose (culvert) which created lots of energy. It was eroding behind and under road and eventually the road would fail. This undercutting created too high of a distance for fish to jump up and get through culvert when coming upstream to spawn. (The fish biologist drew a picture). It was blocking salmonids from getting up stream. When culvert went in it was level with the stream bed. (Photo of culvert showed large impact)

7. What have been the effects of the interventions ?

a. Higher stream bed
b. Width to depth ratio improvement
c. More gradual flood plain
d. More complexity
e. Less energy
f. Reduced peak flows due to more water in ground and less surface flow
g. Increased groundwater
h. More shrub-like vegetation in riparian area – good picture would be culvert on Jackson Creek

8. How do you measure the effects? Are you using photo points of habitat, channel surveys and evaluation during high flow?, **We have photo-point monitoring and also redd and coho spawning surveys. Focus on restoring habitat to what fish need because it's hard to prove fish numbers change as result of one thing like log placement. Hydrology has done winter habitat surveys.**

9. Are there more fish in some of the streams where interventions occurred?
BLM has a graph of where redds are and records the number of coho; can get population trends. Anecdotally – in 2006 there were a few salmon and a couple of reds. Now 20-25 redds/yr. North Bank Rd to Comstock pavilion culvert.

10. How does your work interface with other resource specialists?
Everything needs to be hitting on all cylinders.
Botanist – what is the relationship between stream vegetation and fish**? Plant diversity helps fish. We diverted a third of the flow of Jackson Creek at Soggy Bottoms to create more floodplain habitat for *Plagiobothrys hirtus,* an endangered plant.**

Hydrologist – more technical. Keeps track of what's happening with the water table, the pebble and gravel size, water temperatures and flow.

Wildlife Biologists: Are some of the things good for fish, good for other wildlife?
There used to be only 3 pools of water on Jackson Creek in August. That's where predators will be; used to have deer highways to and from the waterways. Now deer access water at so many points there aren't any main paths. Wildlife is/was concerned about impact of disturbance on the yellow-legged frog from adding logs and boulders so are surveying each year. Once stream bed is raised it will be better habitat for this frog.

Fish biologists – bring in funding because coho is threatened. Botany/hydrology don't have the funds to do some projects

11. What works (successes) and what doesn't at NBHMA?
Doesn't work to place logs parallel to channel. Instead put in perpendicular to take energy out. 2) Doesn't' work adding just 5-6 logs. Works to add 15 logs and build a tight jam. Taller jams will fill up higher. Important to get small debris in between logs so used 10-12 foot sections of oak from oak thinning and jammed into gaps of log jams as smaller debris. Jams need to be porous so fish get around and shouldn't clog. There need to be outlets. Cedar

forms best jams; fir second best. They found fish above the large log jams. None have blocked fish.

12. What are the ways to place logs in streams?
    a) **Excavator is cheapest, but most impactful = damage to riparian area**
    b) **Pull logs into stream using a giant wench on truck. Run blocks out to trees and pull log into creek; tie onto logs by stream**
    c) **Helicopter – most expensive and dangerous; yet least impactful**

13. How do you place boulders? **Only way is with excavation.**

Appendix I: Wildlife Biologist Interview

(Wildlife biologist in bold; interviewer in plain text)

1. How did you become a wildlife biologist? **It started with desire to work outdoors. I spent 3 summers with a Youth Conservation Corps. The leaders were foresters. Then I went to OSU to major in forestry and early on took a general introductory course in the field where I was exposed to wildlife biology. I ended up getting a degree in forestry and wildlife biology. It started with a passion for the work and being outside. I like to tell students you can't write your career path in stone. One experience can lead to another. I've worked in wildlife in several states. Stay open to the possibilities.**

2. What wildlife live at NBHMA and in what habitats?
There are lots of birds. One of our wildlife biologists identified 30 species in one day.

Grassland – Columbian white-tailed deer (*Odocoileus virginianus leucurus)***; Oregon vesper sparrow** *(Pooecetes gramineus affinins)* **a BLM special status species; Northern harrier** (*Circus cyaneus*)**; Purple martins** *(Progne subis)* **– we put up boxes because they like large diameter snags and the cavities in them; hawks which eat insects in grasslands**

Oak Savannah – Columbian white-tailed deer, turkeys, California valley quail (*Callipepla californica*)

Oak Woodland – Columbian Black-tailed deer (*Odocoileus hemionous columbianus)***; Columbian White-tailed deer; Lewis' woodpecker (***Melanerpes lewis*) **a BLM special status species.**

Hardwood/Conifer forest – Columbian Black-tailed deer

Riparian, - Foothill yellow-legged frog (*Rana boylii)*; **Columbian White-tailed deer**

Bottomland/Wetlands – Columbian white-tailed deer, Foothill yellow-legged frog (*Rana boylii)*

Rock Outcrops – snakes and lizards

Red-tailed hawk *(Buteo jamaicensis)* **– edge of stands; grassland, conifer/hardwood**
Golden (*Aquila chrysaetos*) **and Bald eagles – all habitats**

Black bear (*Ursus americanus);* **Cougar** *(Puma concolor),* **and Bobcat** (*Lynx rufus*) **roam a wide range of habitats**

3. What wildlife species on the ranch are being monitored or their habitat enhanced? **Formal monitoring on foothill yellow-legged frog,** *Rana boylii*, **2 deer species, and coho**

4. What is the status of Columbian White-tailed Deer (CWTD) now? **BLM sensitive species; completely delisted on federal and state special status lists – not endangered or threatened on federal and state lists now.**

What makes the CWTD important?

a. **It is unknown what happened that caused the CWTD to disappear throughout so much of its range. For example, there was a tree species in Madagascar that created a big fruit. People started noticing there were no big trees. Realized that a bird that had become extinct had been eating the fruit and scarifiying the seed as it made its way through the bird's digestive tract. Since the bird had become extinct, the seed wasn't getting what it needed in order to become viable so there were no young trees sprouting up.**

b. **For the same reasons any other species is important**.

5. The ODFW spotlight surveys from 2007 to 2010 show that 2010 had the most deer per mile of 4.9. The range was 3.8 to 4.9. Looking at that alone, it appears the population isn't increasing on NB. What do you think is happening with the population and why? **This is a tough question. The spotlight surveys occur one night twice a year, so it's a very small window. Thus, there is a large margin of error. Environmental factors such as rain can effect whether the deer are there or not. We'll have a better picture of what's happening after 10 years of data collection**

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6. What other methods are used to determine deer numbers and population trends?

Twice there have been thermal imaging surveys done from planes in a fly-over. The first time most of the ranch was surveyed; the second time a portion was surveyed and then extrapolated to get an estimate for the entire ranch. The procedure is to fly over in the early a.m. and use thermal imaging and get a high contrast so an observer in a helicopter can tell if it's a CWTD or a CBTD. It gives a pretty accurate number of deer, but due to lack of funds, it can't be done very often.
The fly over is pretty accurate

7. Since acquiring NBHMA, it seems the numbers of CWTD have decreased. Why?

a. Too much disturbance which keep the deer moving. Causes of disturbance are:

1. **Recreation access of hikers and horseback riders**
2. **Hunters**
3. **Agency personnel**

b. Lack of grazing, for example, of cattle. We aren't managing the habitat like the ranchers are; we didn't start grazing cattle until 2012.

c. Perhaps when BLM acquired the ranch the deer were at an unnaturally high level.

8. Do you think the population is or has approached carrying capacity at North Bank and if so, what do you think the most effective tool for increasing carrying capacity is?

Increasing forage will increase the population. Better quality food and greater access to it will improve reproduction health of does to carry fawns to full term and also increase the health of the fawns.

The most effective tools we have are:
a. Mowing – This is done within 200 – 250 meters of creek bottoms. It's cost effective. It keeps the forage greening up and trying to release its seed.. There will be no forage quality after seeds are produced because all of the plant's nutrients will have gone into seed production and the plant will die. There is concern about mowing too early because of fawning season. Fawns are born primarily in June with some in mid-May or Mid-July. Good times to mow are as soon as dry enough in May and again in June so there is some conflict/overlap between fawning season and mowing. Sometimes we walk in front of the mower. We rely on the tractor operator.

b. Fertilizing – appropriate on flats, grasslands; not aerial . We can't change the species composition of bottomland without lots of tilling and herbicide along with burning a couple of years in a row. When managing for multiple purposes on the same landscape, it is not unusual when an activity that works best for one purpose conflicts with another. For example, at Soggy Bottoms we manage for the popcorn flower over managing for optimal forage. Therefore, we mow late in August.

9. Please share your perspective on some of the Management Objectives in the Habitat Management Plan we haven't discussed yet:

a. Maintenance of mature, oak, shrub, and herbaceous vegetation
There was a large oak thinning project several years ago. If we were to do an oak thin again, I'd like to see more heterogenic habitat created/maintained. So perhaps strips or patches that are thinned and some that are not. This would be a way to manage for multiple purposes on the same landscape.

b. Control of noxious weeds
Himalayan Blackberry is a great cover and food source for birds as well as vertical hiding cover for deer. Quail roost under their thickets. If we remove them we need to replace them with shrubs that provide the same benefits like salmonberry and native blackberry. The important consideration is: What habitat values are we going to remove and what's there when we're done.

c. Development of water sources
The amount needed is one source for every 320 acres. If water is constricted then all the deer will be concentrated down by the stream. There's not enough forage around the water sources. If we spread water around the ranch, the deer will forage across it and not trample the riparian area. There will be less stress on the deer and more forage for them. The habitat area could then carry more deer. There are five guzzlers on ridge tops and the BLM improved Grumpy's Pond which pumps water to a stock tank. In order for grazing to develop more

water sources will need to come into play because the cows can't use the natural springs or the streams.

10. Please share your perspective on some of the Management Tools we haven't discussed yet:

a. Forage Plots – These are located within 200 – 250 meters of streams in the flat bottomland. We located them where we could get to them with a mower. The goal is to keep them green longer with more palatable and nutritious plants. Tried plowing and disking and couldn't kill the grasses. Keep mowed down so it stays green.
b. Exclosures - The purpose was to have shrub patches to replace the blackberries we took out because they were invasive; however, due to poor maintenance the shrubs haven't done well. I learned we should have mulched the shrubs to counter the grass competition.
c. Hydrology - Improving riparian habitat & building up streambeds and water tables. The water table coming up will benefit all bottomland species and widen riparian areas.

11. What did you learn from the Lowell W. Whitney study entitled, Ecological Relationships Between Columbian White-tailed and Black-tailed Deer in Southwest Oregon – a thesis published by Oregon State University in 2002?

The Whitney study was done prior to active management of North Bank and prior to the forage plots BLM created there. Impact of Whitney study on North Bank management was that it revealed the sequence of food sources and how they change throughout the seasons. The study provided the scientific names of the foods eaten. I learned what the two types of deer were eating, but we didn't know if they were actively selecting for food because they preferred it or if there was just a lot of that particular food out there; that is, was it their preference or just there?

Did the research show inter-specific competition of Columbian White-Tailed Deer (CWTD) with Columbian Black-Tailed Deer (CBTD)?
No, Whitney found CBTD at higher elevations than CWTD. The deer were separated spatially with only 5 – 40% overlap. Whitney's behavioral interactions study showed they hang around with their own group. Also, CWTD and CBTD hang out in different types of terrain/habitats. The CWTD like lower elevations and more gradual slopes as well as closer proximity to streams than the CBTD.

12. What kind of health are the CWTD on NBHMA in?
Regarding deer condition work – hunters turn in body parts and the analysis has come back mixed. About three years ago the kidney indexes were low. Two years ago, deer trappers found the kidney indexes to be healthy so there are various opinions.

13. What do deer CWTD eat?
They eat forbs, shrubs, grasses, and other food sources. Whereas CBTD dominant foods are forbs & "other"

14. Is hybridization with CBTD happening? **Not a big concern.**
15. How do the in-stream restoration projects impact wildlife at NBHMA?
These projects could have impacts on the yellow legged frog so we are monitoring them. What results do you have from the monitoring?

On Jackson Creek we have no pre-intervention numbers. The surveys we've done since show that the population didn't bottom out. However, on Chasm Creek we have 3 years of survey prior to the log and boulder structures going in. This year the numbers are down. Water levels when we survey vary from year to year and that can contribute to different results from year to year. So there can be other causes for population count variations besides the in-stream restoration projects.

Appendix J: Fire Ecologist Interview

(Fire ecologist in bold; interviewer in plain text)

FIRE ECOLOGY QUESTIONS

1. What has been the role of fire historically in this area?
   Generally in valleys – grassy areas with oaks were probably burned frequently if not annually. They would have been fast moving fires with low intensity; resulting in little heat to the soil. As get to higher elevations, the pine areas would have burned every 3-30 years but the fir/hemlock areas would have burned every 75-150 years. Serpentine soils burned frequently, too.

2. What problems are there at NBMA due to no natural fire?
   There has been conifer encroachment and so there is loss of meadow and oak savannah habitat. To get meadow and oak savannah controlled burns are necessary.

   Historically, native bunchgrasses would burn in late spring and early summer due to lightning. The bunch grasses reduced the intensity and duration because there is a space between plants so the fire doesn't get as hot. Bunch grasses are generally protected during fires by having their dense core that will not burn. The ranchers brought in more rhizomatous grasses which don't do as well – fire would burn with higher intensity and destroy the grass. Thus, ranching changed the fire dynamics.

3. When bring in fire intentionally what are the benefits and problems? Is there an acreage size frame that is optimum?
   There are hot burns and light burns. Hot burns sterilize the soil which can destabilize it and cause slides. At the northwest corner of North Bank it is very steep and rocky with open grasses and shallow soil. This area was burned once (since BLM took over management) for a rare plant, *arabis koehler.* **Because the grasses have changed and we don't have the bunchgrass, there is a risk of soil damage from burning. If we did burn we'd have higher flame lengths and intensity than were achieved historically. Plus, there is more accumulation of fuels there now due to no fire for so long.**

   There are tradeoffs in terms of acreage size. It takes almost the same manpower to conduct a safe prescribed burn for 60 acres as 100 acres. The size depends in part on the terrain which influences fire line placement and plant communities present. On steep slopes, fire moves faster and burns hotter as it goes from bottom to top than if it were flat. Determining burn unit size depends on the number and type of firefighters and equipment you have available.

4. What do we know about fire and forage?
   You can plan and predict fire, but you can't control all of the variables that will determine its effects on individual plants. Fire increases forage by:
   a) **Reducing thatch load so what's under it can grow. Fertilizing has resulted in grasses getting so tall that they fall over on themselves.**
   b) **Reducing competition**
   c) **Allowing seed to reach the soil**
   d) **Stimulating new growth**

   These benefits are short lived in grassy systems due to the nature of the plants themselves.

5. Columbian White-Tailed Deer need food throughout the year. How is fire a tool to provide forage for the deer?
   See # 4 response

6. When burned, do grasses come back in time for August/September forage?
   If an area is burned in the spring and there is some rainfall after the burn, you may have a response by fall but generally you end up increasing the fall forage the following year. Yampah Flats is looking pretty good. We have done at least 2 burns there. One was summer of 2011. The natives are looking better. There are nice bunches of tufted hairgrass and a lot less medusahead. Blue-eyed grass, a native, there likes fire. We planted a variety of seed there. It is Forage Plot 8.

7. Please comment on these reasons to burn
   a. Eradicate invasive species: medusahead rye
      Spring burns are somewhat effective on medusahead. Fall burns seem to have little effect or can actually increase the medusahead.

   b. Protect – invigorate native species such as: red root yampah? Popcorn flower? Blue-eyed grass?
      Although not as obviously fire dependent as some systems, the oak savannah is adapted to frequent fire which has influenced species composition over time. Most fire effects are anecdotal or not well documented at the species level so predictions are often based upon information from similar plants or systems. A U.S. Fish and Wildlife recovery plan says the popcorn flower is not supposed to be burned. However, we did have an accidental burn on one of the transplanted populations which seem to have a positive effect.

   c. Return oak woodlands and savannah to historical conditions – alleviate encroachment of One-seed hawthorn, Douglas fir, cedar.
      Generally fire is more damaging to firs, cedars, and hawthorn than oak. Burns can check or reduce the invasion of those less desirable species into oak savannah. Fire also helps with encroachment by too many oaks. In the oak woodlands, the surface is more shaded . Therefore, when burned it's either:
      1) **just grass so burns fast, or it's**
      2) **oak leaf litter which won't burn because the leaves are small, dense, and compacted which reduces air flow and the material holds moisture longer.**

   d. Maintain oak woodlands after thinning.

Once the area is thinned and 'restored', fire can be used to reduce encroachment, limit some oak regeneration, and keep the large fuel loading (large logs) to a minimum.

e. How does burning effect weed seeds and native seeds?
The primary influence is likely the reduction of surface fuels allows more opportunity for seed to soil contact which can increase germination rates. There is a website that tells how plants respond to fire.

f. How does the agency know if the objectives have been accomplished or not?
Botanists conduct transects to see how the vegetation is changing. In the back areas, I can see blue wild rye, a native grass, from the ridge tops now so we're getting results.

8. When you burn to thin oak woodlands, how do you do it?
The oaks cannot be thinned with fire alone because we cannot get the fire behavior needed to actually kill some of the trees. We thinned the oaks out to the drip line of big legacy trees. This included cutting down oaks that were in competition with the ones we wanted to keep. Some of the logs were used in stream restoration projects. Some chunks of logs were scattered throughout the thin. Next, we will run some burns through the area to reduce the fuel loading from accumulation over time as well as from what we generated from the thinning.

9. What factors affect the ability to burn on a certain day?
I determine what fire intensity is optimum for the treatment based on resource objectives. Determine reasonable expected weather such as wind speed, temperature, and humidity gathered from historic weather data. A fuel model is chosen based on what's carrying the fire – for example, grass. The information is then put into a computer program that predicts what the fire behavior would be under those conditions. These predictions are compared to the objectives to determine if the predicted fire behavior will accomplish the objectives. Yampah Flats factors were: wind speed 8 SW; temp 76; humidity 56.

The other main determining factor for ability to burn on any given day is how many fire resources, i.e. firefighters and fire engines, are available. Those same predictions of fire behavior are used to decide how many and of what capability are required to safely conduct the burn.

10. Has burning been used to fight thistle?
There has been thistle in some of the areas we've burned and it doesn't seem to reduce thistle. Most thistles are annuals or bi-annuals and are in the composite family. Once the thistle has bloomed and set its seed, it's accomplished its purpose. At that point, it doesn't matter if the plant is killed or not. It is even possible that the heat generated from the burn gets wind currents going which could move the seed farther than normal.

11. Fire is a form of energy. What are some energy related topics related to fire that I could explore with students?
In a forest fire energy is created and released into the atmosphere. The nutrient ash is created. You get a release of carbon load when burning. In the spring shrubs have a low level of carbon reserves in the roots due to the demand to produce new shoots, flowers, and leaves. Thus, if a fire is too intense it is more likely to kill the root. Residence time is how long heat is on an area.

12. Other comments:

Fire interacts with every other resource. The Interdisciplinary team weighs the benefits and costs to plants, soil, wildlife, etc. in making decisions about burns.

Appendix K: Soil Scientist Interview

(Soil Scientist in bold; interviewer in plain text)

The context for this interview was to learn about the soils and vegetation it supports at NBHMA. Recently grazing was implemented as a tool to attain the vegetation composition by type as described in the Habitat Management Plan (see Appendix A: Objectives for Blacktail Basin) while maintaining a mosaic of vegetation structure that provides quality cover and food for CWTD. This is a combination of a first interview and then a follow-up interview with the soil scientist.

1. What do you do as a soil scientist for the BLM**?**
   I spend most of my time on timber sales work with a little on North Bank

2. How did you get into this field?
   By accident. I took a class and thought it was interesting. I then got a job as a soils mapper for a summer.

3. A. This area has serpentine soils. What are they and where are they located in the district?
   Serpentine soils are those that have developed out of serpentine bedrock. They are located in the east part of the district. These soils are low in essential nutrients which leads them to support unusual plant communities.

   B**.** Do the nutrients serpentine soils are low in include Phosphorus, Nitrogen, and Potash?
   Yes, and all three are essential nutrients for most plants. There can also be a high concentration of heavy metals in serpentine soils.

4. Other than serpentine, what kind of soil do we have around here?
   We have soils that have developed out of different parent materials or under different conditions, but the serpentine soils are definitely unique.

5. What kind of soil is at North Bank?
   North Bank has a whole range of soils. The soil in some areas is very thin (less than 10 inches deep) to very deep (greater than 60 inches). The soil is so shallow on top of ridges and becomes deeper lower on the slope. Most of these soils are fairly similar in the fact that they come from the same parent material. They mostly have high clay content. This clay fraction is high in montmorillonite. M. clay has a high moisture shrink capacity. This shrink swell capacity helps the soil to recover from compaction well.

6. A. What would the soil be like if grazing had never occurred on this land?
   The soil at North Bank is very resilient. However, if no grazing had occurred there would be next to no compaction. I also imagine that the plant community would be different, which can have some effect on soils.

B. Why is compaction a problem?
Compaction prevents infiltration of water and exchange of air in the soil.
It can also impede the growth of root(s) and increase run off.

7. Adequate forage for the deer is a priority. How do we know what they're eating**?**
I look at the literature coming from studies on CWTD in Oregon and from studies in the mid-western states. Both of these sources require a bit of rendering. The studies in Oregon may show what the deer are eating on North Bank during different seasons, but it may not be what they would like to be eating. The deer in the mid-west deal with entirely different environmental stresses (cold winters) and aids (production grain crops).

8. What do they eat when water is plentiful**?**
During the rainy season they will consume forbs, grass, sedges and rushes, and shrubs.

9. Where do they find those types of forage?
Forbs, grasses and sedges will occur in abundance in a meadow community or an oak savanna community.

10. What do they eat in drier months of August & September?
Forbs, sedges, and shrubs. These plants tend to have a deeper root system which allows them to stay green longer into the dry season.

11. How do we increase available forage in the dry months? The botanist recommended perennials?
Very true! Perennial grasses tend to have deeper root systems that will allow them to draw water until later in the year. They also, tend to green up later than annuals out at North Bank. And they can tolerate being defoliated!

12. A. What have you noticed regarding the recent grazing impacts on the soil or vegetation**?**
I noticed some parts of the ground seemed harder hit than others (streams, near the salt feeder, etc.) In one area I noticed that the medusahead (ryegrass) seemed to have been grazed and that within the Botany plot (fenced off from grazing) the medusahead seemed more vigorous.

B. Did grazing increase the length of time forage was available to the deer by keeping down the thatch and nipping off the grass so that it would keep growing?
It appears that we were able to keep the grass from going to seed. This means that we were able to keep the forage in a higher quality state for longer.

13. A. What do you look for in comparing the photos pre-grazing and after grazing**?**
We were measuring how quickly the vegetation was reduced and how well it came back. Those points will be monitored again this fall before (hopefully) the burning. They could be a good way to continue to see the results of our management actions. What we saw from the original points on the fescue unit was that the system seemed to be resilient and that the grass did recover.

B. Why is the one unit referred to as the fescue unit?
One botany plot was put in a fescue heavy area to monitor the response of that patch to grazing. Cows will eat fescue, but I don't believe deer are partial to fescue. Fescue can contain endophytes that in high concentrations can be toxic to grazing animals.

14. What was the grazing window?
    December through June.

15. How long at each of the 3 locations? The first location was from December until April.
    The second two split the last three months.

16. A. Please talk about successes or challenges
    Successes – Saw that the system is resilient, that cattle will eat medusahead rye at an early stage; that the buffers seemed to help maintain water quality.

    B. How wide are the buffers you referred to that are there to protect water quality?
    100 feet on the main stem and portions of the east fork and 35 feet for the rest of the main stream. Other buffers will be used as necessary.

17. What are the plans for next year?
    Graze all of Blacktail Basin except for the units that will get burned.

18. What kind of soil when bed is 20' down in deeply channelized creek beds? – are there layers as the bank descends to the stream?
    Soils can be very deep. I haven't crawled down into one of these streams, but would imagine some of those are cutting through soft bedrock.

19. When logs are placed in the stream, what happens as a result?
    The logs dissipate energy allowing sediment to settle out. This sediment gradually builds up the stream bed.

20. What would creek beds be like here if grazing had never happened and natural fire had continued**?**
    The streams would not have been so incised. They probably would have adequate riparian vegetation that would protect and stabilize banks.

21. How does fire effect soil**?**
    Fire can cause detrimental impacts to soil, but the burns out at the ranch are quick moving. The speed at which grass fires moved doesn't allow the soil to heat up to a point of significance.

22. A. Perspective on forage plots, if any – **From a soils perspective the disturbance of tilling and drilling is bad.**

    B. What does tilling and drilling do to the soils that makes it bad from a soils perspective?
    Tilling can lead to increased run off and thus erosion; it disturbs the biota and breaks down aggregates.

23. Perspective on mowing, if any –
    As long as it's not wet, mowing shouldn't have too great of an effect on soils.

24. Tell me about the Blacktail Basin planning that's underway for the interdisciplinary meeting coming

up.
The ranchers are developing a proposal to graze the entire basin (Blacktail).