Pitkin County Open Space and Trails

e.m. ecological, LLC
natural resource and restoration consulting

Filoha Meadows Open Space

Vegetation Descriptions and Stewardship

2007

Preparation by:
E.M. Ecological, LLC
Natural Resource and Restoration Consulting

TABLE OF CONTENTS

Acknowledgement and Disclaimer

This document has been created thanks to the patience and assistance of Pitkin County Open Space and Trails and their dedication to seeing the beginnings of a comprehensive vegetation document for the Hot Springs Ranch and Filoha Meadows properties. Several years of experiences and investigation of the property have been compiled in this document to provide insight and guidance to assist Open Space Staff in more effectively managing and conserving the quality of the vegetation resources. Actual Open Space policies will not be identified in this document and can be found on the Pitkin County Open Space and Trails website. This document was created to help inform and guide sustainable, natural resource management decisions in regards to the Hot Springs Ranch and Filoha Meadows (HSR & FM) landscapes.

This document should not be construed as a complete or formal fire hazard assessment, flood hazard assessment or geologic hazards analysis. The mapped wetlands are only a part of the vegetation assessment and should not be considered wetland delineations. Any mention of commercial products and trade names is simply to better inform and not meant as an endorsement by E.M. Ecological, LLC or Pitkin County Open Space and Trails.

Vegetation Executive Summary

Sustaining the resources and the natural processes that maintain them is the reason for continually trying to better understand the extent and condition of the natural resources on Pitkin County Open Space properties. The information provided within this document is meant to help identify appropriate goals, guidelines and current and potential threats, as well as recommend measures to ensure current and future protections for more sensitive and exceptional OS&T vegetation resources. This document attempts to be comprehensive and provide findings and data along with pertinent useful information regarding the plant resources to better inform stewardship practices.

Significant Natural Resources (pertaining to vegetation)

From surveys and assessments conducted so far, HSR & FM have proven to include noteworthy vegetation resources. Visual representation of important attributes is shown in Figure 1. Much of the property is in good condition, however other areas reflect impacts from past land use activities such as hot spring water channelization, hay production, vegetation manipulation, irrigation, cattle grazing, a movie set and more current influences including noxious weed invasion and fire suppression.

A portion of the landscape consists of intact, native vegetation communities typical of the surrounding area as well as wetlands and plants that are very atypical and rare both in the watershed, the state, and the entire U.S. Notable **vegetation** characteristics include:

- **Shrublands**-the shrublands on the steeper hillsides of the property are in excellent condition.
    - **Oak and sagebrush shrublands** – these communities provide essential forage for deer, elk and area bighorn sheep, berries and nesting sites for songbirds and blue grouse as well as acorns and calories for bears. Winter forage in these areas can be essential for area ungulates and is critical winter range for a herd of bighorn sheep. The diverse vegetation structure provides wildlife cover and much of the upper slopes immediately rising from the Crystal River valley floor consist of these mixed mountain shrublands.
- **Wetland and Riparian Communities** – healthy riparian and wetland communities make up a good part of the western portion of the property. These productive sites provide varied habitats for numerous wildlife species as well as ideal conditions for four species of orchids, two of which are tracked by the Colorado Natural Heritage Program due to rarity. These riparian and wetland areas are also crucial for recharging groundwater that is discharged later in the season helping to maintain Crystal river base flows.
    - **Wet Meadows** – There are both fresh water and hot, mineral spring fed wetlands. A good portion of the calcareous wet meadows consist of beaked spikerush (*Eleocharis rostellata*), a rare species in the state and in most occurrences in the U.S. Approximately 15 acres are currently dominated by beaked sedge with many more also harboring the species. Other wet meadows consist predominantly of bulrushes, sedges, willows, and common reedgrass each typically mixed with at least some beaked spikerush.
    - **Riparian habitats**- Healthy stands of cottonwood dominated woodlands with especially diverse vegetation structure, line the majority of the Crystal River banks on the entire southern half of the property. In spring, elk use the right bank areas for calving in the more densely vegetated sections while songbirds nest throughout.
- **Woodlands** – Rocky Mountain juniper intermingle with Gambel oak on three south/southwest facing sloped outwash areas where soils are rockier and less developed. Upper, steep, rocky cliffs and hillsides support pockets of Douglas fir intermixed with Gambel oak and oceanspray.

- **Juniper Woodlands-** Stands of Rocky Mountain Juniper with Gambel oak provide a stark contrast to the open grassy meadows and sagebrush and pasture grass areas that abut them. The contrasts between the vegetation structure of the woodland versus the adjacent more open meadows provides a mosaic of vegetation that may very well be the key elements currently keeping the bighorn sheep so dedicated to this area as winter habitat.

The **water** resources of interest include:

- **The Crystal Rive**r a very significant feature of the property including the fishery and vegetation it supports. Currently it is important to remember this perennial river is essentially a free flowing river, one of the few remaining in the state, let alone the western U.S. Upstream inbasin diversions have some impacts, but they are still minimal at this section compared to a river system dealing with the significant ecosystem impacts caused by a dam or more extensive water diversions. The health of the intact riparian communities here reflects this.

- The **mineral laden, hot spring** waters flow year round, sustaining a good portion of the wetland plant communities. It is also used by the adjacent Johnson residence for heating and hot tubs.

- **Beaver enhanced wetlands** on the southern portion of the property, river right flanking the Crystal River, provide a critical water storage function. Not only does this dam complex maintain extensive wetlands, but like all streamside active beaver dam sites, the area also helps contribute to base flows during times of diminished instream flows later in the summer and into fall and winter. Springtime overbanking flows are essentially stored in the beaver ponds and recharge groundwater. This water is then slowly discharged later when river flows decrease, ultimately helping maintain instream, base flows long after snowmelt season has passed.

The **geologic** resources of the Hot Springs Ranch and Filoha Meadows of particular interest include:

- Mount Sopris, the dominant mountain just north and east 3.75 miles, consists of an **intrusion of igneous rock**. The rock, called quartz monzonite, also includes several dark minerals. This large Tertiary intrusion is most likely still cooling deep below the surface. This may help explain the presence of the **heated mineral springs** in the wet meadows and at the locally famous Penny Hot Springs, river-left on the northwest portion of the property.

- In the wet meadows fed by hot springs, minerals precipitate out into the topsoil causing nutrient and **mineral enrichment locally**. These conditions are unique and tend to support distinctive and/or rare plants and plant communities.

- **Cliff/Talus areas** also known as Rocky/ Tall Shrublands (Johnston 2001) on the property support a unique suite of plant species, provide dramatic scenic relief to the landscape and locally are coveted by bighorn. These habitats are intermittent along the Crystal River corridor, and relatively small percentage-wise compared to the extent of other typical communities.

Several conditions on the property currently **threaten** or have potential to impact many of these resources:

- **Weed infestations**- and the introduction of exotic plant species and noxious weeds. Native vegetation is then displaced and therefore so is wildlife habitat. Some of the troublesome weeds to date are Japanese brome and downy brome or cheat grass, oxeye daisy, Canada thistle, bull thistle, plumeless thistle, tamarisk, hound's tongue, sulfur cinquefoil, common burdock, common tansy, yellow toadflax, chicory, and perennial sowthistle. Many acres within the open meadows and sagebrush sites are covered with Eurasian pasture grasses that can be every bit as aggressive as many noxious weeds and successfully displace native vegetation.

- **Juniper expansion** - The absence of fire will continue to allow the increase in the canopy covers of Rocky Mountain Juniper and other shrubs. Denser stands could eventually carry fuel loads so high that if a fire occurs, temperatures may be so hot as to impact the existing native seed bank necessary for revegetation afterwards. Further monitoring should be done to find the rate at which new recruitment and canopy covers are increasing. This information should inform future decisions regarding manipulation of tree cover densities.

- Additional trapping or **capture** of hot spring waters or increasing **surface water channelization**- would all result in loss of wetland vegetation and alteration of existing plant communities.

- Increased Crystal River **water diversion(s)** upstream from the property-resulting in the loss of either high springtime pulses or the loss of base flows. Any new water resource development should be watched closely including proposed hydroelectric dam operations and potential impacts. Seasonal peak flows are essential for the long term viability of riparian vegetation and the recruitment of genetically new cohorts. Sediments and gravels are moved and redeposited during these events. Cottonwoods and willows, for one, require wet, bare substrates such as these, in order for seeds to germinate and survive.

- **River down cutting** due to the presence of Hwy 133 having entrenched or channelized river reaches both on the property and upstream. Eventually riparian communities and streamside wetlands can be left high and dry when the river channel elevation decreases and becomes incised due to the influences of bank armoring or meander straightening. Stream channel downcutting keeps the river from accessing the historical floodplain.

Chapter 1 - Land Disturbance History

Historic Vegetation

Future land management decisions can be better informed by descriptions of past conditions and trajectories. Several factors should be investigated to piece together an accurate reconstruction of past vegetation conditions Insights into the past give a point of reference. Conditions that drive the ecological characteristics of the area, such as climate and fire history should be examined. In order to understand the development and succession of the vegetation communities, the basic ecological characteristics of dominant species should be reconstructed within the parameters of the lands historic and physical conditions. A speculation of the likely historic distribution of the vegetation communities can then be hypothesized and drive current management strategies.

Since European settlement in the Roaring Fork Valley, much of the vegetation has been altered, especially along the valley floors and on flat mesa where soils were typically deeper and yet steep

inclines were at more of a minimum. Large expanses of the mixed mountain shrub communities and sagebrush shrublands have been cleared and HSR & FM were also altered in this way. Thousands of acres of native vegetation communities in the Roaring Fork watershed were **converted for agricultural purposes** over a hundred years ago, changing montane shrublands and sagebrush expanses predominantly to hay fields planted with exotic pasture grasses.

The historic plant communities at HSR & FM were almost certainly similar to what exists today, but most likely without the open, upper, dry meadows on the property and likely with a greater expanse of riparian associated vegetation riverside on some banks. The open, upland meadows are likely an artifact of human intervention. It is impossible to accurately measure how today's vegetation resources differ from the past, but they were likely very comparable in many respects, but likely very different in distribution. In the past, it was common practice to graze cattle on properties year round. **Riparian vegetation** was typically severely impacted and mostly denuded, leaving banks highly susceptible to erosion. Fortunately, few banks on the property reflect this level of impact.

In our watershed, large areas of **oak-serviceberry and sagebrush shrublands** were typically cleared to make way for the planting of smooth brome, crested wheatgrass and other Eurasian pasture grasses. Local shrubland systems, especially sagebrush communities, having not evolved with grazers but only with browsers, saw extreme changes in understory composition with the introduction of prolonged grazing. Sagebrush seedlings and therefore sagebrush cover would increase with the degradation and elimination of understory forbs and bunch grasses. Less on-the-ground competition and disturbed areas of bare soil were perfect conditions for competition-sensitive sagebrush seedlings to become artificially successful. Impressive efforts were often used to clear areas of sagebrush and it appears much of the southeast portion of the property was treated to some form of shrub removal. Several of the open meadows on the east-central and northern portions of the property were cleared and plowed and the plant assemblages reflect this level of disturbance. A "wildflower mix" was supposedly planted on several of the upper meadows for a movie set in the 1980's and they are now rife with downy brome and Japanese brome. Historically it would have been very rare to have open, grassy meadows without some shrub component. Typically these states would have been transitional and not have lasted for many years before a recognizable influx of both shrubs and forb species.

Rocky Mountain juniper is a constant presence within the local mixed mountain shrubland systems in most areas of the Roaring Fork watershed. With prolonged periods without fire, these systems consist of ever maturing woody species, increasing in height and woody materials. Juniper appears to slowly colonize over time, ever increasing in numbers in areas of oak and serviceberry shrubs as these habitats are typically very suitable for juniper as well. Historically, with the build-up of flammable woody materials, including both trees and shrubs, these areas were ripe for fire and certainly experienced fires whenever conditions were ripe. With the influx of settlers and the ever increasing numbers of permanent residences, fire has been purposely and successfully suppressed. The difficult question to answer is at what level of fuel build-up will this area of the property become susceptible to fires that produce extremely unmanageable events with historically unprecedented high temperatures. When is this threshold crossed? And which wildlife species benefit from current conditions and which ones would benefit from a community with more of a mosaic of shrub age classes and thinner densities of juniper?

The hot springs fed wetlands have most likely been **wide-open meadows uncolonized by trees or shrubs** for a long time without any human intervention. This is in all likelihood due to the hot temperatures of the springs and the thick layers of minerals continuously being precipitated out onto soil surfaces. These conditions cannot support the areas typical riparian species, but instead select for more specialized wetland plants. Much of the hot spring water has been captured and channelized by previous property owners. Currently these channels are set to be managed similarly into the future. Any further hot spring water capture would decrease the extent of the current wetlands. It is likely wetland acreage was dewatered to a large extent following the initial capture of these waters into dugout channels. Over time a new equilibrium was set and the existing plant assemblages reflect this.

The upper irrigation lateral to the east of the beaked spikerush and other mineral spring-fed meadows, historically provided additional ditch water to these wetland sites and increased the size of the these **wetland communities**. This lateral has not been filled in several years and the wet meadow has adjusted to these drier conditions. Most likely, the upland species are increasing on the eastern edge and wetland species coverage is shrinking in extent in response to a return to historically drier conditions.

Chapter 2 – Resource Element Descriptions

This section discusses the significant plant resources on the HSR & FM properties. A description along with significant features is presented.

Descriptions in this chapter include the following elements related to vegetation:

- **Vegetation and Rare Plants**
- **Water Resources**
- **Geology and Soils**

Vegetation and Rare Plants-Resource Element Description

Summary Table:

Significant Elements

✓ **Wet meadows –** Support at least 3 species of orchids, two of which are tracked.

Stream orchid or giant helleborine

Epipactis gigantea CNHP ranked **S2/G3**
USFS "sensitive"species list

canyon bog orchid or Few flowered rein orchid

Plantanthera sparsiflora var. sparsiflora CNHP ranked **S3/G4G5T3?**
(syn. *Limnorchis ensifolia*)

Also: Hooded ladies' tresses (***Spiranthes romanzoffiana***)
Northern green bog orchid (***Plantanthera aquilonis***) may be in the vicinity

Hot spring fed meadows also support at least 15 acres of a rare spikerush community:
Beaked spikerush herbaceous vegetation

Eleocharis rostellata CNHP ranked **S2/G3**
(CNHP Ranks, see Appendix A)

In the wet meadows, with high bulrush cover values especially, these areas support fireflies, an uncommon occurrence in the typically dry state of Colorado.

✓ **Wetland beaver complex –** this wetland provides important groundwater recharge to both area riparian and wetland vegetation soils and to the Crystal River when high spring pulses have long subsided.

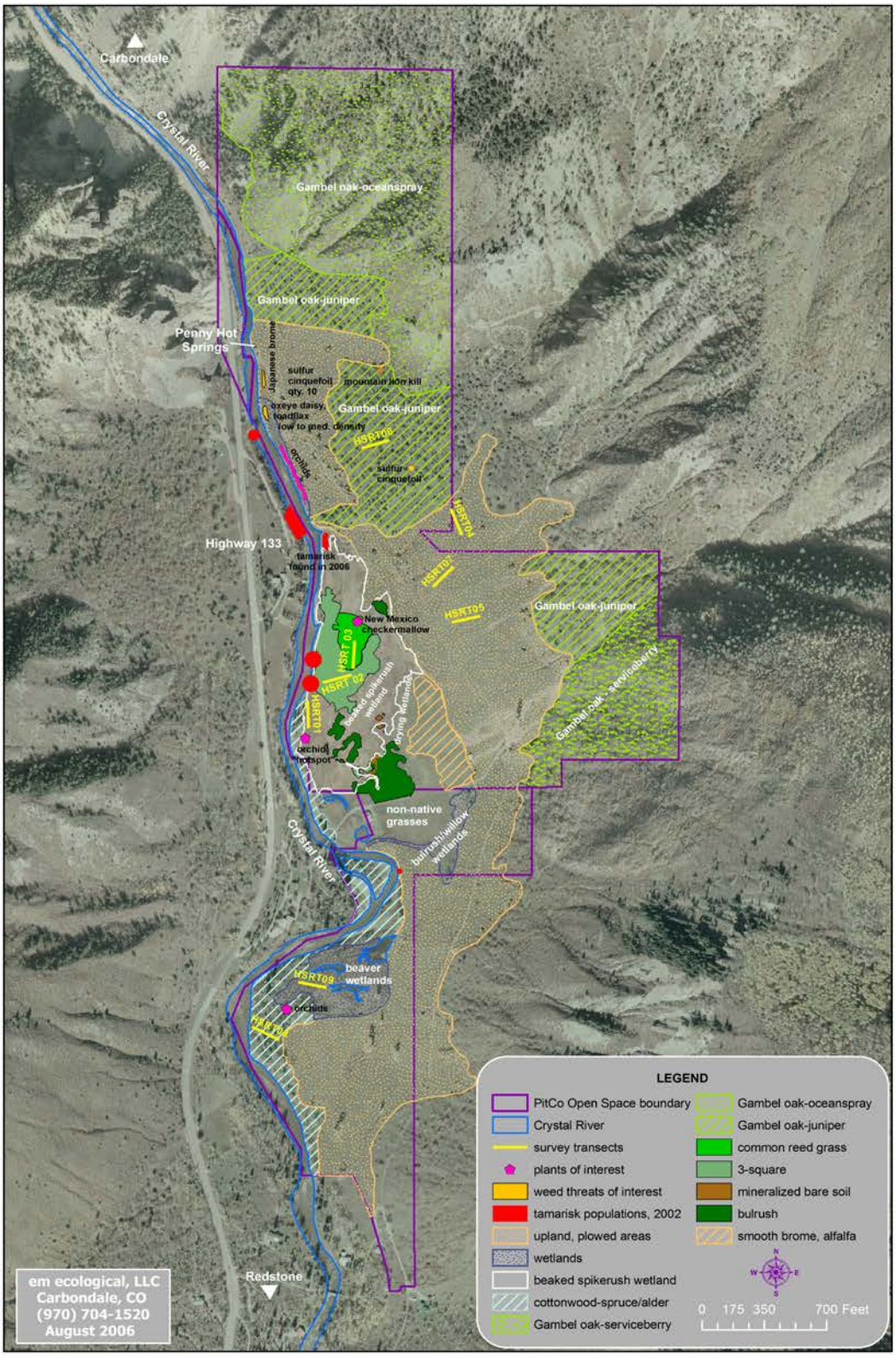
✓ **Intact riparian woodlands –** the historic hydrologic regime at this section of the river is relatively unaltered compared to many other streams of this class size in the Roaring Fork Watershed. Retaining a close resemblance to historical flows in size, timing and duration in the river system is critical to the survival and persistence of these healthy, structurally diverse and species diverse, ecologically intact plant communities.

✓ **Mixed mountain shrublands -** have very few weed species at relatively low infestation levels on the upper slopes. These Gambel oak dominated shrublands, while locally abundant, are much less common when considered on a larger landscape scale context. They make up only 3% of the Southern Rocky Mountain Ecosystem, an area covering most of the U. S. Rocky Mountain States (Rondeau 2001). In contemporary ecology, any plant communities with minimal weed infestations are now considered exemplary and therefore significant. These shrublands are one of the most productive habitats for wildlife in the west, let alone the Crystal River Valley.

Figure 1.

Hot Springs Ranch Vegetation Survey

em ecological, LLC



Summary Table (cont.):

Significant Elements (cont.)

✓ **Rocky/ Tall shrublands –** the major value of these sites is habitat for bighorn sheep. Ocean-spray is the main plant in this vegetation community that figures to a large extent in bighorn diets (Johnston 2001). Numerous droppings, trails and beds suggest this is a high use area for the local bighorn herd, with the majority of this community on adjacent forest service property to the east and north.

Threats to Significant Elements

✓ The presence of **noxious weeds** on the property is a management concern due to their relative abundance both in the upland meadows and in the vicinity of the rare plants. Other concerns include the replacement of native vegetation, decreasing biodiversity, creating increased understory fuel loads and ultimately degrading wildlife habitat.

✓ **Juniper expansion** and **fire suppression** are creating higher fuel loads. The juniper component of the Gambel oak/ Rocky Mountain Juniper sites will most likely continue to increase. Increases in juniper densities will potentially provide extensive fuels, in addition to the Gambel oak. Subsequently if a fire was to occur, these burgeoning fuel loads could potentially create fire intensities and temperatures ultimately problematic to post-fire native species regeneration.

✓ **Changes in the Crystal River hydrograph**, alterations in the **flow and extent of the mineral hot spring waters**, and **increase in the water diversions up river** are all threats to the wetland and riparian plant communities and the bird and wildlife species that rely upon them. Changes to nutrient loading in the system would also cause alterations.

Vegetation Descriptions

The narrow Crystal River Valley is a dramatically scenic landscape with steep slopes rising up on either side of the river throughout most of the watershed. There are plant communities of both xeric and mesic origins all influenced by abiotic factors such as elevation, aspect, physiography, and geology. Not only do these natural features influence and define the establishment of the vegetation communities, but so do past land management practices. Activities such as grazing, farming, irrigating and infrastructure like the roads, railroad corridor and buildings all affect vegetation. Average annual precipitation records for Redstone, just upstream, show from 1979-1994 the average accumulation is 27.7 inches. As elevation increases while traveling up the hillsides flanking both sides of the Crystal River, so do precipitation values. The changes in plant species composition reflect these increases in available moisture.

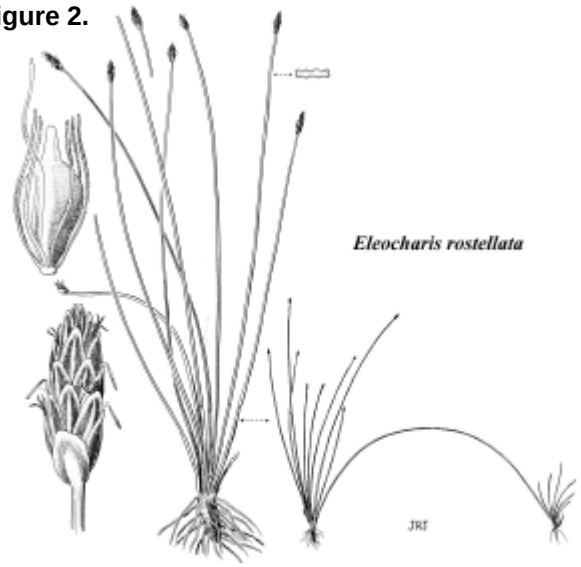
Riparian and wetland communities inhabit areas directly adjacent to the river or near springs and seeps. Oak or mixed mountain shrublands dominate the lower slopes just as they rise up from the flatter valley floor. Interspersed occasionally are sagebrush shrublands, often early seral to the mixed mountain shrublands in this area and typically highly impacted. Rocky mountain juniper can be seen interspersed within much of these shrublands at the lower elevations. Douglas fir can be found typically on steeper rocky hillsides and Aspen forests enter above the mixed mountain shrublands at higher elevations on more mesic sites. Ocean-spray or rockspirea is a common shrub also found on rock talus hillsides typically with Gambel oak and an occasional Douglas fir patch (Natureserve. 2007. Ponderosa pine, in numbers far fewer than prior to settlement, can be seen occasionally streamside and inadvertently throughout the valleys and mid-elevations.

Wet Meadows

Mineral Spring-fed Wet Meadows – A prominent feature of the property is the expansive herbaceous wet meadow devoid of typical woody, riparian vegetation all the way to the rivers edge. This

large, mineral-rich, spring-fed wetland is directly adjacent to the Crystal River just upstream and across the river from the Penny Hot Springs public use area. Most notable is the presence of **beaked spikerush** (***Eleocharis rostellata***) which occurs throughout the meadow and dominates plant cover on over 13 acres. This uncommon wetland association is typically associated with mineral springs and calcareous or alkaline sites and on the HSR & FM property, this occurrence is no exception. Analyses of the hot spring waters done in 1976 and 1980 reveal very high levels of calcium carbonates, iron, sulfates, sodium and other minerals (see Appendix B). As these flow out onto the soil surfaces, precipitates fall out of solution and can form odoriferous soil crusts locally and typically support specialized vegetation.

Figure 2.



CNHP 2003.

Beaked spikerush (*Eleocharis rostellata*) is known from Van Couver Island to Nova Scotia, Canada south to northern New Mexico and the Greater Antilles, and in the South American Andes (USDA-plants. 2007). Although seemingly widespread, it occurs only in highly scattered, very disjunct populations. This accounts for it's presence on numerous state lists of sensitive, threatened, and endangered plants. Populations are very rare on the broader landscape and very few and far between (only 2 other recorded occurrences in Colorado, CNHP 2003) most likely due to the very specific substrates it colonizes. Therefore finding it at HSR & FM is very significant and constitutes a new record for the state.

Other notable attributes of *Eleocharis rostellata* include its designation as an obligate wetland species within Region 8 meaning it occurs within wetlands with an estimated probability of 99%. The species is also most likely important in the maintenance of natural wetland functions. Additionally, waterfowl eat the achenes (fruits), stems and roots (National Plants Database). Broad zones of this spikerush along streams and rivers, like the occurrence on HSR & FM adjacent to the Crystal River, provide valuable feeding and nesting sites.

Figure 3.

Beaked spikerush sending out runners that will root at the ends. Photo L. Tasker

Larger occurrences like at HSR & FM are considered a valuable source of food and cover for the waterfowl of this area (P. Hansen, et al, 1995). Palatability is known to be very low for livestock and trampling damage occurs readily with livestock use. (National Plants Database, 2007).

The beaked spikerush habitat typically occurs on sites prone to yearly flooding. It is considered an early colonizer, but is only able to persist under continued wet conditions (National Plants Database. 2007) which currently must be the case on the HSR & FM property due to it's present dominance. Disturbance and a drop in water table levels can dramatically increase the amount of increaser and invader species and out-compete the beaked

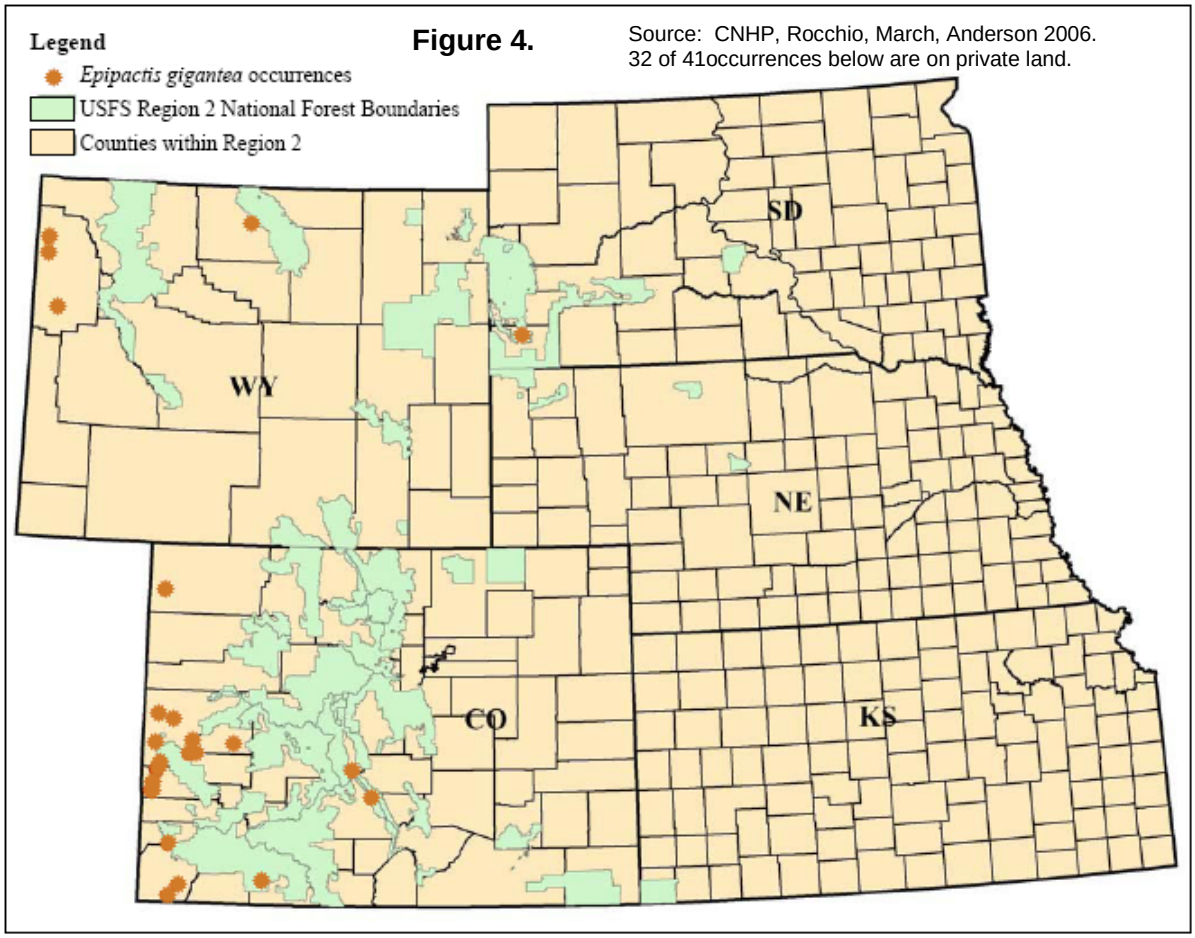
spikerush.
Beaked spike rush reproduces vegetatively and by seed. Regeneration vegetatively is by sprouting and layering from short shallow rhizomes (see **Figure 2** and **Figure 3**). Elongated layering stems arch to the ground and root in moist soil from an apical bulbil. It does not have long creeping rhizomes so is not as colonial as *Eleocharis palustris* or common spikerush, also on the property. On nutrient poor sites, more biomass is allocated to reproduction than on more fertile sites. The geothermal activity associated with the hot springs keeps the beaked spikerush dominated meadow mostly bare of snow in winter with steam visibly rising over active hot springs. This may play a role in the wet meadows attraction for area ungulates during winter months.

Orchids – Both the beaver wetlands and the calcareous wet meadows support at least three orchids. Two are tracked by the Colorado Natural Heritage Program (CNHP). **Stream orchid** or **giant helleborine** (*Epipactis gigantea*) has the highest rarity ranking with CNHP, of the three being ranked, and is listed as sensitive by the U.S. Forest Service. In Colorado it is listed as an S2 or vulnerable to extinction throughout its range due to the small number of documented occurrences or other extenuating factors (see Appendix A for CNHP Imperilment Ranks).

The range of the stream orchid is relatively wide, similar to beaked spikerush, but populations are quite disjunct and isolated (often by hundreds of miles) making it a very uncommon find. The species can be quite abundant when found, yet dense patches can represent a single genetic individual (a genet) with many hundreds of individual flowering stems (ramets) (Natureserve 2007). The less genetic diversity represented typically means the more vulnerable a species is. Populations of stream orchid are generally small but occasionally some populations are very large like the one at HSR & FM. The population estimate for HSR &FM is over 1,000 individuals found in patches all across the spring-fed wet meadow.

Figure 4.

Source: CNHP, Rocchio, March, Anderson 2006.
32 of 41occurrences below are on private land.



Stream orchid is found only in the western part of the country and is most abundant in the state of California. Eleven western states and British Columbia list it from (S1) critically imperiled to (S3)

vulnerable. This rarity is most likely due to its very specific habitat requirements. Most importantly the stream orchid needs surface water at the roots and any activity that lowers the water table will most likely extirpate it. Other described habitats, besides seeps and springs like at HSR & FM, have a common theme of having a constant, permanent source of water. These include lake margins and streambanks and like HSR & FM thermal waters are especially suitable habitats (Natureserve 2007). In Wyoming, stream orchid has only been reported to occur near hot springs (Rocchio, March, Anderson 2006).

Table 1. From NatureServe 2007 and Rocchio, March and Anderson 2006.

Nation	State/Province/District	S Rank
Canada	British Columbia	S2S3
USA	Arizona	SR
USA	California	SR
USA	**Colorado**	**S2**
USA	Idaho	S3
USA	**Kansas**	**No Rank**
USA	Montana	S2
USA	Nevada	SR
USA	**Nebraska**	**SU**
USA	New Mexico	S2?
USA	Oklahoma	S1S2
USA	Oregon	SR
USA	**South Dakota**	**S1**
USA	Texas	S3
USA	Utah	S2S3
USA	Washington	S3
USA	**Wyoming**	**S1**
Mexico		?

Known distribution of *Epipactis gigantea*.

Figure 5. Stream orchid HSR & FM. L. Tasker photo.

Figure 6. Stream Orchid close-up. L. Tasker photo.

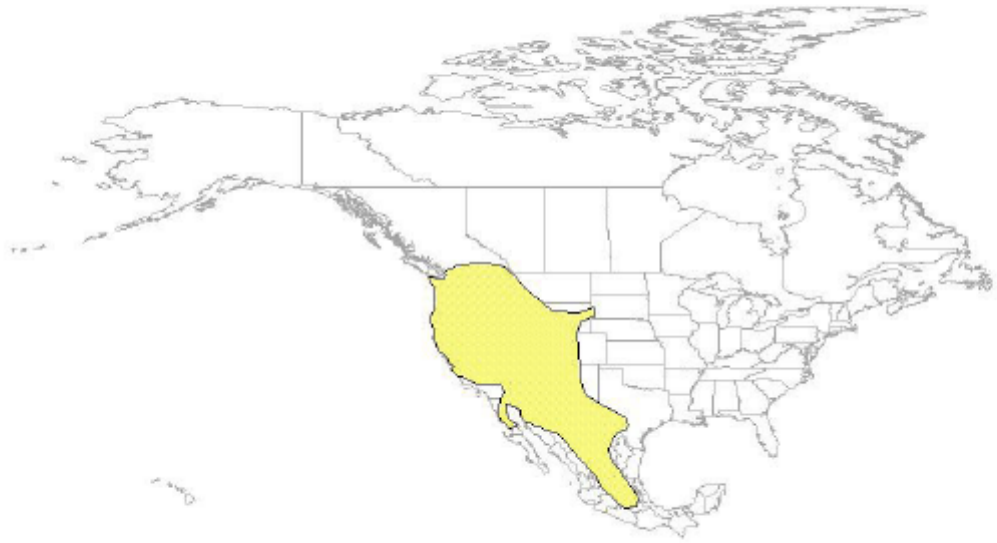
Figure 7. This area of the wetland (see Figure 1 for transect placement on the property) is where 413 stream orchids and 20 canyon bog orchids were recorded on ten 1X1 Meter square samples. Notice the noxious weed oxeye daisy is visibly prolific.

Figure 8. Lliterally hundreds, if not thousands, of stream orchids are present in large patches in the hot spring-fed meadows. This photo was taken July 1st in 2005.

The **canyon bog orchid** (*Plantanthera sparsiflora* var. *sparsiflora*, syn *Limnorchis ensifolia*) and **hooded ladies' tresses orchid** (*Spiranthes romanzoffiana*) were found in the same vicinity as the southern most section of the stream bog orchid occurrences within the mineral spring-fed wetlands. A permanent monitoring transect (HSRT01) was subjectively placed within what appeared to be a dense area of stream orchids. The hooded ladies' tresses have also been reported downstream on the lower end of Avalanche Creek, close to where the creek meets the Crystal River. Other species present included beaked spikerush (*Eleocharis rostellata*), Arctic rush (*Juncus arcticus*, syn J*uncus balticus*), Rocky mountain gentian (*Gentiana affinis*), Nuttall's sunflower (*helianthus nuttallii*), smooth aster (*Aster laevis*), and blue- eyed grass (*Sisyrinchium montanum*).

Along a **50 meter linear transect** at HSRT01 (see Figure 7), a total of ten square meters were sampled for orchids. There were 413 stream orchids and 20 canyon bog orchids along the transect. This gives some perspective on just how many individuals are potentially present in the area. The samples represent only quarter of 1% of an acre or about 108 square feet. The hooded ladies' tresses were found just outside of the transect, approximately 8 individuals. Weedy species present and of concern were Canada thistle, oxeye daisy, yellow sweet clover (unlisted weed) and chicory.

Figure 9.



The North American distribution of the stream orchid *(Epipactis gigantea)*. Rocchio, March and Anderson 2006 and Luer 1975.

Figure 10. *Spiranthes romanzoffiana* L. Tasker photo

Figure 11. *Platanthera dilatata* var. *sparsiflora*, L. Tasker photo

Beginning in the summer of 2007, a master degree student will be looking at the **pollinators** for the stream orchid on HSR & FM. In the literature, orchids are notorious for often having specialized pollinators. The stream orchid is said to potentially attract generalized pollinators, but the literature reports the plants may have a specialized relationship with syrphid flies. A recent, unpublished paper has reported that yellow jackets may be key pollinators in at least one area (Denise Wilson, personal communication 2007). Other wasps have also been suggested. Rocchio, March and Anderson (2006) report that self-pollination may also play a role, but further study is needed to assess its importance to reproduction. They also report that plants can reproduce vegetatively by means of short, fibrous rhizomes and this is a common means of increasing numbers. Very little is known about the stream orchid's seed longevity, dormant stages or seed bank dynamics.

The demonstrable competitive strategies of the stream orchid suggest it does have several competitive advantages even though other habitat requirements, like the need for water at the root zone, are restrictive. Vegetative **reproduction** is obviously one advantage. Yet stream orchids also produce numerous small seeds allowing for long distance dispersal by wind or water allowing for colonization of suitable habitat downwind or downstream. Seeds do require mycorrhizae in order to germinate but no detailed data exists in the literature on specificity of species of mycorrhizae (Rocchio, March and Anderson 2006).

<u>Mineral Spring-fed Wet Meadows-other dominant species</u> with beaked spikerush (Eleocharis rostellata):

There are approximately 1.9 acres of **hardstem bulrush** (*Schoenplectus acutus* var. *acutus*, syn. *Scirpus acutus*, Figure 12) and much of it is interspersed with the beaked spikerush. Again, maintaining the hydrology of these sites is the key to these wetland species persisting. Seeds and rhizomes of hardstem bulrush are eaten by waterfowl and stems are used for nesting. Like with many of the grass-like wetland plants, including the beaked spikerush, water velocities through hardstem bulrush are minimized and sediment movement is moderated.

Figure 12.
L. Tasker photo

Figure 13. Hardstem bulrush is the taller, darker green species in areas with standing water. The beaked spikerush is usually still the dominant species, just residing in the understory of the bulrush. Photo: L. Tasker

Common threesquare (*Schoenplectus pungens*, syn. *Scirpus pungens*) co-dominant with the beaked spikerush covers approximately 2.8 acres (Figure 14). Most notable are the stream orchids which are dispersed throughout all of wetland microsites where there is adequate moisture, regardless of what other dominant wetland species reside there. See Figure 1 for the extent of noticeably dominant common threesquare. Areas with the common threesquare co-dominant with the beaked spikerush are noticeably devoid of species diversity. Apparently these two species have a very good competitive advantage in these areas. Standing water was quite common on the transect on this site.

Figure 14. Common threesquare co-dominant with beaked spikerush. L. Tasker photo.

Common reed (*Phragmites australis*) is a species that is native to the United States and also native to Europe (Figure 16 and 17). It has been discovered that the European strains are actually different both genetically and subtly in morphological characteristics. Additionally, the non-native version has proven to be very aggressive and weedy. Fortunately, at HSR & FM the U.S. native is the species in the large mineral spring-fed wetland. It does not occupy much acreage, but is noticeable due to its height which can ranges around 6 feet or taller. It is spread across less than two acres (Figure 1.) The stream orchid is also fairly extensive in this area of the wetland. New Mexico checkermallow (*Sidalcea neomexicana*) a relatively common and attractive pink forb, a wetland indicator species, is also found on this site (Figure 15).

Figure 15. New Mexico checkermallow. L. Tasker photo.

Figure 16. Common reed is the tall grass, much taller than any other species in the wet meadows. There are still standing dead stems from the previous season. Much of the understory consists of beaked spikerush. L. Tasker

Figure 17. Stream orchids in the understory of the common reed near a channelized outlet for hot spring water.

Riparian Woodlands

Table 2. The numeric values below are in linear meters. The method used follows CNHP's methods used for their "Field Guide to the Wetland and Riparian Plant Associations of Colorado".

HSRT08: 50 meter line transect-Narrow leaf Cottonwood-Blue Spruce/ Thinleaf Alder Woodland on Filoha Meadows

8/21/2005

Species:	Alninc	Betocc	Padvir	Picpun	Popang	Salmon	Corsto	Roswoo	Acegla	Amealn	Crariv
	thinleaf alder	river birch	choke-cherry	blue spruce	narrowleaf cottonwood	mountain willow	red osier dogwood	Wood's rose	Rocky Mountain maple	service-berry	river haw-thorn
	3.9	**2.5**	0.3	1.7	10.5	0.1	0.15	0.2	**0.1**	**0.05**	**0.1**
	1.2		0.4	2.45	17.5	2	0.4	0.15			
	2.15		0.2	0.2	4.5	1.3	0.25	0.4			
	4.8		**0.9**	0.9	**32.5**	**3.4**	0.55	0.05			
	2.1			2.6			0.05	0.3			
	7			2.05			0.25	0.3			
	10.4			2.3			0.05	0.15			
	0.65			5.9			0.15	0.3			
	2.5			5.6			0.15	0.1			
	34.7			2.5			1.45	0.1			
				1.6			0.4	0.4			
				27.8			**3.85**	0.25			
								0.1			
								2.8			
% Cover Totals:											
	34.7	**2.5**	**0.9**	**27.8**	**32.5**	**3.4**	**3.85**	**2.8**	**0.1**	**0.05**	**0.1**
% of 50 M tape covered:											
	69.4			55.6	65		7.7				

denotes dominant species

The three dominant riparian species from the above line transect data denote **narrowleaf cottonwood** (*Populus deltoides*), **blue spruce** (*Picea pungens*) and **thinleaf alder** (*Alnus incana ssp. tenuifolia*) as the dominant species. This community is widespread in these middle and middle-upper reaches of the Crystal River. Although several other shrubs are present, they are not in big enough cover values to be considered as dominants. The Narrowleaf cottonwood-Blue spruce / Thinleaf alder Woodland is tracked by CNHP and ranked S4/G4, down from a previous rank of S3/G3 with the exploration of new occurrences in the state. Part of the criteria for a suite of species to be formally designated as an occurrence of a plant association is determined by size. An occurrence should be found on at least a mile or two of stream with the same species dominating over the majority of that entire length of stream (Renee Rondeau, personal communication 2004).

Blue spruce occurs in multiple age classes. At least two on the southern portion of the property west of the beaver ponds are over 80 centimeters in diameter. Young trees and several age classes between the 80 centimeter size can be seen throughout the riparian forest. Further monitoring of the cottonwoods to assess if recruitment of new trees is occurring should be a future goal.

The above transect HSRT08 (Figure 1) had very little no understory forbs and grasses. This was because of the large size and maturity of most of the species along the transect. At the 19 meter mark on the tape, there were four very large narrowleaf cottonwoods just out of the plot to the north about ten feet. They each had diameters at breast height of approximately 85 centimeters. As with most riparian areas in Colorado and the west, the understory did contain some aggressive non-native species. Reed canary grass (*Phalaris arundinacea*), Smooth brome (*Bromus inermis*), orchard grass (*Dactylis*

glomerata), red clover (*Trifolium pratense*), and Canada bluegrass (*Poa pratensis*) have a strong presence. However, there is still a fairly impressive native component. A few species include star Solomonplume (*Maianthemum stellatum*), pink pyrola (*Pyrola rotundifolia* subsp *asarifolia*), valerian (*Valerian edulis*), mountain lover (*Paxistima myrsinites*), Richardson's geranium (*Geranium richardsonii*), Mare's tail (*Hippuris vulgaris*), wild liquorice (*Glycyrrhiza lepidota*), Fendler's meadowrue (*Thalictrum*

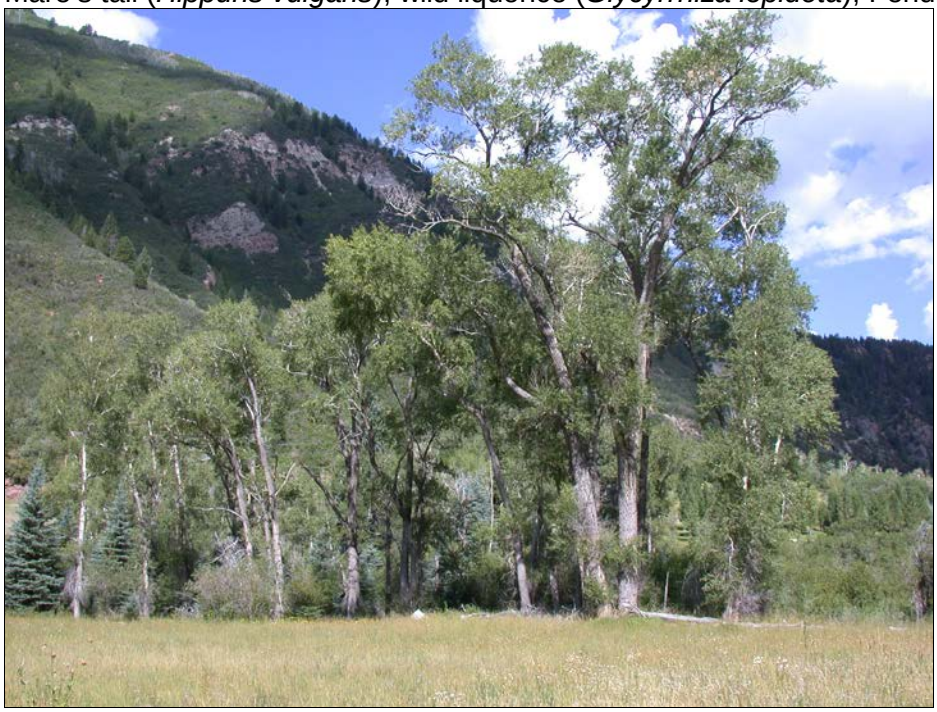


Figure 18. Different age classes of the narrowleaf cottonwoods near transect HSRT08.

Figure 19. Riparian woodland transect, river right west of the beaver pond wetlands. L. Tasker photos.

Gambel Oak Communities

There are three areas of **Gambel oak mixed with Rocky Mountain juniper** that are fairly sizable on the property. Each is adjacent to open meadows that are dominated by non-native grasses and forbs which provide a stark contrast to the shrubs and trees on the oak-juniper dominated areas. The understory and overstory were sampled in this community. Within a 625 square meter area (25meter X 25 meter plot):

12 trees	taller than breast height
8 trees	2 feet tall up to breast height
60 saplings	less than 2 feet tall
15 seedlings	2-3" in height
95 trees	Total

Figure 20. Gamble oak-Rocky mountain juniper. L. Tasker photo.

The understory consisted of primarily of Gambel oak (Quercus gambelii), golden aster (*Heterotheca villosa*), elk sedge, snowberry, Agassi's bluegrass (Poa agassizensis), and Oregon grape holly (*Mahonia repens*). Many other species were present in very low cover values.

This plot should be revisited every 2-3 years to see if young tree numbers continue to increase and to see if the numerous small trees are surviving (Figure 1). Both Gambel oak and Rocky Mountain juniper are considered highly flammable species and as the canopy closes, these areas will become highly susceptible to very hot crown fires. After analyzing monitoring data trends, eventually selective thinning will most likely be the management action of choice.

The understory consisted of primarily of big sagebrush (*Artemisia tridentata* var. *pauciflora*, syn. *Artemisia tridentata* subsp. *vaseyana*), golden aster (*Heterotheca villosa*), needle-and-thread grass (*Hesperostipa comata*) and Agassi's bluegrass (*Poa agassizensis*) with many other species with very low cover values.

The **Gambel oak dominated sites with serviceberry** (*Amelanchier utahensis*) as the next dominant cover value, cover a northwest facing section of the property on the eastern portion as it goes up the hillsides. These are typical examples of this community type and the understory is in excellent condition as very few weeds exist moving up the slopes.

Of interest ,because of the **oceanspray** or rockspirea (*Holodiscus dumosus*) component, are the talus covered hillsides to the north and off the property to the northeast. These areas have been described in the literature as Rocky/Tall Shrublands (Johnston 2001). On the sites at HSR & FM, **Gambel oak is dominant** with areas of oceanspray, three-leaf sumac (*Rhus aromatica* subsp. *trilobata*), Douglas fir (*Pseudotsuga menziesii*) pockets and even an occasional box elder (*Acer negundo*). These sites are easily accessible by agile bighorn sheep and are used extensively according to the number of droppings in the area. Oceanspray is the main plant in this community that figures into the bighorn diet (Johnston, 2001).

Figure 21. Gambel oak-oceanspray shrublands on the north and northeast sides of the property.

There are open meadows in the middle portions of the property that are dominated by **Japanese brome**. These sites were disturbed during the establishment of a movie set on the property in the 1980's and then supposedly planted with "wildflowers". Below this area is the eastern edge of the spring-fed wet meadow, an area that has been plowed and planted in alfalfa and **Eurasion pasture grasses** (Figure 1). Several upland meadows on the property have experienced severe clearing of native shrubs and vegetation or have actually been plowed and planted in exotic grasses (see plowed or cleared areas, Figure 1). These sites are some of the more problematic as they have been heavily disturbed and are areas ripe for continual weed invasions. Diligent efforts are needed to keep them from being colonized by noxious weed species. They are also prime areas for restoration efforts.

Figure 22. Areas dominated by Japanese brome and downy brome

Figure 23. Japanese brome (Bromus japonicus). Photos L. Tasker

References:

Brown, Paul Martin. 2003. The Wild Orchids of North America, North of Mexico. University Press of Florida. Gainsville, FL.

CalFlora Database. 2007. Http: //www.calflora.org/

Carsey, K., G. Kittel, K. Decker, D.J. Cooper, and D. Culver. 2003. Field Guide to the Wetland and Riparian Plant Associations of Colorado. Colorado Natural Heritage Program, Fort Collins, CO.

Chronic, John and Halka. 1972. Pairie, Peak and Plateau: A Guide to the Geology of Colorado. Colorado Geological Survey Bulletin 32, 1972. Colorado Geologic Society.

Cronquist, Arthur, A.H. Holmgren, N.H. Homgren, J. Reveal, and P.K. Holmgren. 1994. Intermountain Flora: Vascular Plants of the Intermountain West, USA, Volume Six. The New York Botanical Garden, New York City, NY.

Hansen, Paul L. et al. 1995. Classification and and Management of Montana's Riparian and Wetland Sites. Montana Forest and Conservation Experiment Station. University of Montana, Missoula.

Harrington, H.D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.

Johnston, B. 2001. Ecological Types of the Upper Gunnison Basin, Colorado. Vegetation-soil-landform-geology-climate-water land classes for natural resource management. Renewable Technical Resources Report R1-RR-2001-01 USDA-USFS Rocky Mountain Region, Denver, CO.

Johnston, B. 1987. Plant Associations of Region Two. Edition 4. R2-ECOL-87-2. U.S.D.A. Forest Service, Rocky Mountain Forest and Experiment Station, Fort Collins, CO.

Lyon, Peggy, J. Sovell, and J. Rocchio. 2001. Survey of Critical Biological Resources Garfield County, Colorado, Volume I. Colorado Natural Heritage Program, Fort Collins, CO.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Northern Prairie Wildlife Research Center. 2002. Western Wetland Flora: Field Office Guide to Plant Species. USGS http://www.npwrc.usgs.gov

Ramsey, R. Douglas. 2002. Digital Atlas of the Vascular Plants of Utah. Department of Geography and Earth Resources, Utah State University, Logan, UT 84322-9635.

Rocchi, J., M. March and D. Anderson. 2006. Epipactis gigantea Dougl. Ex Hook. (stream orchid): A Technical Conservation Assessment. Colorado Natural Heritage Program. Fort Collins, CO.

Spackman, Susan, K. Fayette, F. Siemers, K. Murrell, and M. Sherman. 1999. Roaring Fork Watershed and Biological Inventory 1997-1999. Colorado Natural Heritage Program, Fort Collins, CO.

Tweto, O., R.H. Moench, and J. C. Reed, Jr. 1978. Geologic Map of the Leadville 1X2 Minute Quadrangle, NW Colorado. U. S. Geologic Survey.

USDA, NRCS 2007. The Plants Database, Version 3.1. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Washington Natural Heritage Program and the Spokane District of USDI Bureau of Land Management, 2002. Field Guide to Selected Rare Vascular Plants of Washington. http://www.wa.gov/dnr/htdocs/fr/nhp/refdesk

Weber, W.A. and R.C. Whitman. 1996. Colorado Flora: Western Slope. Revised edition. University Press of Colorado, Niwot, CO.