

University of Montana Natural Areas Management Plan Includes Mt Sentinel and Fort Missoula

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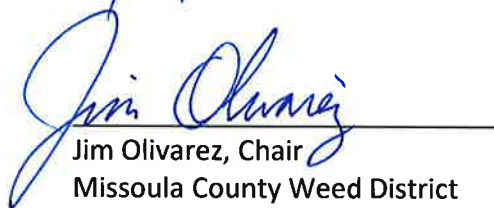
Circulated for public review on February 10, 2015

Public hearing held on February 11, 2015
Comments accepted until April 1, 2015

Per state and county laws regarding noxious weed management, this plan was cooperatively approved by UM and the Missoula Weed District on 5/21 2015



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Executive Summary

The University of Montana owns over 650 acres of undeveloped land on Mt Sentinel and Fort Missoula. Undeveloped land at both sites is not simply “vacant” but managed for specific natural area values including biodiversity of plants, preservation of wildlife habitat, availability for research and education areas, and recreational pursuits.

Components include:

- Noxious weed compliance per state and county law
- Grassland & forestry stewardship for healthy native plant communities
- Trail development/maintenance
- Education and research activities
- Social and safety concerns
- Management of the Payne Center native plant landscaping on campus
- Budgets and potential off campus funding sources

Noxious weeds will be controlled using best integrated plant management practices including judicious use of herbicides, biological control insects, and mechanical removal. Revegetation and preventing erosion are also important. A budget is included for vegetation management and for the overall management. Management of trails and forests has never been funded.

Adoption of this plan fulfills state and county laws pertaining to noxious weed management, and helps the Missoula community, user groups, and adjacent landowners understand UM’s management goals and strategies.

1.0 Introduction and overview

The University of Montana owns land on Mt Sentinel and at Fort Missoula which are managed for native plant conservation and wildlife habitat, and are heavily used for education, research and recreation. State laws require UM to have a weed management plan for its properties. Since the most recent vegetation management plan for these areas was adopted in 2006, a new management plan is due. Per state law, UM must enter into a cooperative agreement with the Missoula County Weed District. This plan will serve as that document, although it covers more than noxious weed control.

Management needs for both Mount Sentinel and Fort Missoula go beyond noxious weed compliance requirements. Past plans have addressed various aspects of vegetation management, but this plan additionally addresses forest and trail management at both sites, and reviews public safety issues.

While most of those additional activities are still unfunded, it is important for UM to know what needs exist, and has a viable plan for addressing those needs.

2.0 Mount Sentinel

Mount Sentinel is the premier icon for both UM and the city of Missoula. The M Trail and concrete M are well loved and heavily used. The trail and M are set in a beautiful native grassland community, which supports up to 100 plant species per acre as well as insects, birds and mammals. Mt Sentinel's grasslands and forests compose a special nature preserve that is often overlooked in favor of the spectacular vistas of the Missoula Valley. While the M is the most common hiking destination on the mountain (and perhaps the state of Montana), trails extend far beyond the M, onto City Parks and National Forest Service trails.

Mount Sentinel supports both grassland and evergreen forest plant communities. There are also woody draws that support thickets of deciduous shrubs but they are treated as part of the grassland.

2.1 Grassland stewardship.

2.1.1 Historic condition.

The west facing slopes of Mount Sentinel were historically dominated by blue bunch wheatgrass and rough fescue grasslands. Other common grass species include prairie June grass, Idaho fescue, and Sandberg's bluegrass. There's a high diversity of spring blooming wildflowers, including arrow leaf balsamroot, silky and silvery lupines, paintbrush, penstemons, shooting stars, yellow bells, buttercups, and many more. The grasslands were described thoroughly by W. Mitchell in his 1958 thesis at Montana State University "An ecological study of grasslands in the region of Missoula, Montana."

Deciduous shrubs chokecherry, serviceberry, mock orange and snowberry also occurred on the hillsides, but they were likely smaller and fewer, due to the frequent burn regime. The pre-European settlement fire cycle was probably more frequent than every 10 years, due to late summer lightning strikes but also indigenous people's management practices.

2.1.2 Current condition.

Invasive plants are the biggest ecological problem in the grasslands, followed by erosion due to heavy recreational use.

Due to 15 years of pro-active management, UM's grasslands on Sentinel are in mostly good condition grasslands. The exception is the area above the fire road on the south facing slope below the summit. This area was dominated by a thick stand of Dalmatian toadflax for several decades prior to 1999. Control of that infestation began in earnest in 2000, and while the toadflax is coming under control, there has been a proliferation of cheatgrass and flannel mullein.

Spotted knapweed, leafy spurge and Dalmatian toadflax occur at low levels throughout the hillside.

Two weeds of special concern are dyer's woad and houndstongue. Woad is categorized as a new invader in Montana and is therefore a high priority for eradication. UM collaborates with the Montana Dyer's Woad Task Force to ensure control and eventual eradication of this plant from the mountain. Houndstongue is not new in the state of Montana, but is relatively new on Mt Sentinel. Great attention should be taken here to prevent it from spreading. We need to work closely with adjacent property owners to sustain the emphasis on controlling these two high priority weeds.

Trees and shrubs have increased relative to their historic distributions, due to fire suppression. This is not a management concern except that it contributes to build up of fire fuels.

Erosion reduces cover by native plants in a few areas adjacent to popular hiking trails. The disturbed soil provides significant opportunity for weed establishment. Mass wasting is evident in some locations, especially around the M Trail.

2.1.3 Desired condition.

Management efforts are directed at decreasing the abundance of noxious weeds, increasing cover by native plants, and minimizing erosion. These goals are informed by state and noxious weed management goals, but also by the intended use of Mt Sentinel for preservation of biodiversity and wildlife habitat.

2.1.4 Required actions.

2.1.4.1 Noxious weed management.

UM will continue to use an integrated plant management approach that promotes native vegetation while killing noxious weeds. Multiple tools will be used to reduce cover by noxious weeds including targeted herbicide application, biological control agents, and hand pulling. Past efforts have shown that grazing is not a viable option for Mt Sentinel weeds (because of off leash dogs, patchiness of grazable weeds, and concerns over erosion). More detail on noxious weed management is given in Chapter 5.

2.1.4.2 Revegetation.

When noxious weeds have dominated a site long enough, or if a new disturbance creates disturbed soil, revegetation (with seeds or plugs) can help speed recovery of the native plant community. A rule of thumb commonly used by area land stewards is that if native plant cover is less than 30% on a given site, revegetation should be included as part of the management strategy.

Since the desired condition for Mt Sentinel is conservation and restoration of native prairie community, only native species should be used. When purchasing seeds, priority should be given to locally grown sources. Species that have been successful in past efforts include:

Bluebunch wheatgrass
Prairie Junegrass
Idaho fescue
Sandbergs bluegrass
Western yarrow
Wilcox penstemon
Bergamot
Fringed sage
Holboel's rockcress

It can be difficult to establish seeds following herbicide application. Some herbicides, especially picloram, stay active in the soil for several years and can suppress establishment of forbs after germination. More applied research investigating the effects of herbicide + seeded native species + seasonal timing + time since herbicide application would be very helpful.

Plug planting has been successful along the M Trail when it's necessary to get plant cover on a disturbed site right away. (Seeds can take several seasons to germinate, and then longer to establish). In past years UM has had a native plant nursery for this purpose (the Fort Missoula Conservation Nursery), but that program was halted in 2013 due to budget constraints and is unlikely to resume in the near future.

2.1.4.3 Erosion control

Because of the high volume of hikers on Mt Sentinel, erosion is a constant problem. This is addressed in Trail Management section. Closing user created trails and managing hikers is an ongoing task.

2.2 Forest stewardship

2.2.1 Historic condition.

Prior to European settlement of the Missoula Valley, the frequent fire regime of the surrounding hillsides supported fewer trees, and in different composition of species. Where forests occurred on Mount Sentinel, they were likely composed of open stands of Ponderosa pine, with more space between individual trees and a wider diversity of age classes. Aerial photos indicate the forests on Mt Sentinel historically occupied fewer acres than they do today.

2.2.2 Current.

Because fire has been suppressed for many decades, fire intolerant species, especially Douglas fir, have established at high densities. Young Ponderosa pines are less common because they cannot compete as well in the shade. Thick stands of young trees also block sunlight to the ground, resulting in lower understory plant diversity.

There are public safety and forest health consequences to this conversion. Dense stands with a lot of Douglas fir are more likely to burn at high temperatures, spread quickly, and kill more trees of all species and age classes. It is also more likely that hot, fast fires could spread to houses in Deer Creek, Pattee Canyon and even the north and west sides of Mt Sentinel.

Research has also shown that tree diseases, parasites and pest insects (pine bark beetle) are more likely to spread in thick, dense timber.

2.2.3 Desired.

It would be better for public safety, plant diversity, forest health and wildlife habitat if the forest were more similar to historic condition. This would include fewer trees, fewer diseased trees and a spacing/age structure that helps promote disease resistance, and an open canopy that allows for more plant diversity in the understory.

2.2.4 Required actions.

The existing forest needs to be thinned. As of the writing of this plan (January 2015), I am working with a student group in Restoration Ecology to develop a thinning prescription for the forest. Their faculty mentors are Cara Nelson and Chris Keyes in Forestry. This is their senior capstone project. It has been in progress for almost one year and the actual prescription is expected by May 2015, which makes it difficult to include in this proposal for public comment. However, I expect the plan to contain modern best-practices for thinning Douglas fir, and that the recommendations will be similar to thinning prescriptions already applied by the Forest Service on their adjacent property in Pattee Canyon.

This highlights the opportunities but also drawback for using student researchers to develop management strategies. Namely: it takes a very long time. We could have hired a local consulting professional to write the plan for a few thousand dollars and started implementing it years ago. (A previous student group in Restoration Ecology attempted this same project but failed to complete a plan). However, it is a tremendous opportunity for students and instructors to have Mt Sentinel (and other UM natural areas) available as outdoor classrooms.

Since the planning and implementation for forest stewardship are completely unfunded, working with students and faculty to develop a plan is the only option. For the actual thinning work, I have been cooperating with the local region of the Montana Conservation Corps to use the over grown areas of the forest for chainsaw training. This has resulted in a few acres of thinning, but with a reasonable thinning plan in hand and a few thousand dollars per year, this could go much more quickly.

In December 2014 Morgan Valliant at Missoula Parks and Recreation and I agreed to collaborate on fire mitigation (tree thinning) grant proposal to the Department of Natural Resources and Conservation. If funded it would pay for professional contract foresters to develop a prescription and implement it within a short time frame.

2.3 Trails.

Mt Sentinel is a heavily used recreation area. While the M Trail is the most popular and best known trail on the mountain, UM land includes miles of trails across Mt Sentinel, and those trails connect to larger networks on City Parks land and the Lolo National Forest. The M Trail often serves as an entry point for people who hike or run far beyond the M.

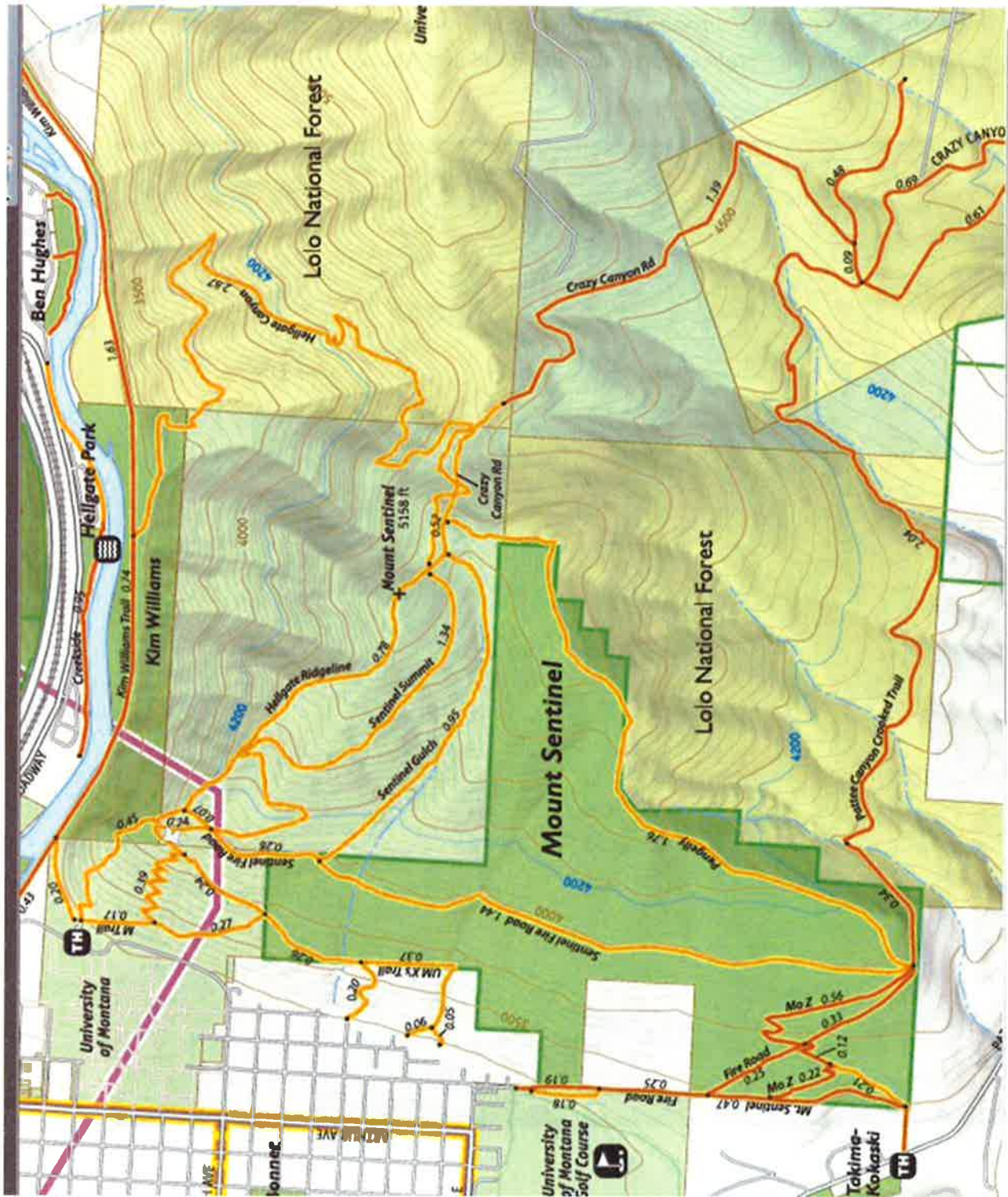
Many of the trails are “user created,” and are so steep as to cause serious erosion. The map on the next page shows on the “official” trails, not the miles of trails that should be closed or at least re-routed.

To support trail maintenance, UM will charge a \$100 fee for organized events on UM trails, beginning in 2016. The two existing events are the Mt Sentinel Hill Climb (organized through Runners Edge store) and the Pengelly Double Dip (organized through Run Wild Missoula).

There is a Friends of the M Trail account at the UM Foundation, allowing donations and payments to a 501-c-(3) charity. Run Wild Missoula has been an exceptional community partner in trail stewardship, hosting several trail work days and donating money for informational signage and for the 2014 remodel of the M Trail trailhead (over \$16,000).

Overall needs for the UM trail system on Mt Sentinel:

- Continued staff supervision of trails projects, but included as an explicit job duty from now on.
- Conduct updated trails inventory
- Increased planning/coordination efforts for sharing volunteer labor
- Conduct a Master Plan for the M Trail (signage, seating, etc)
- Establish a budget

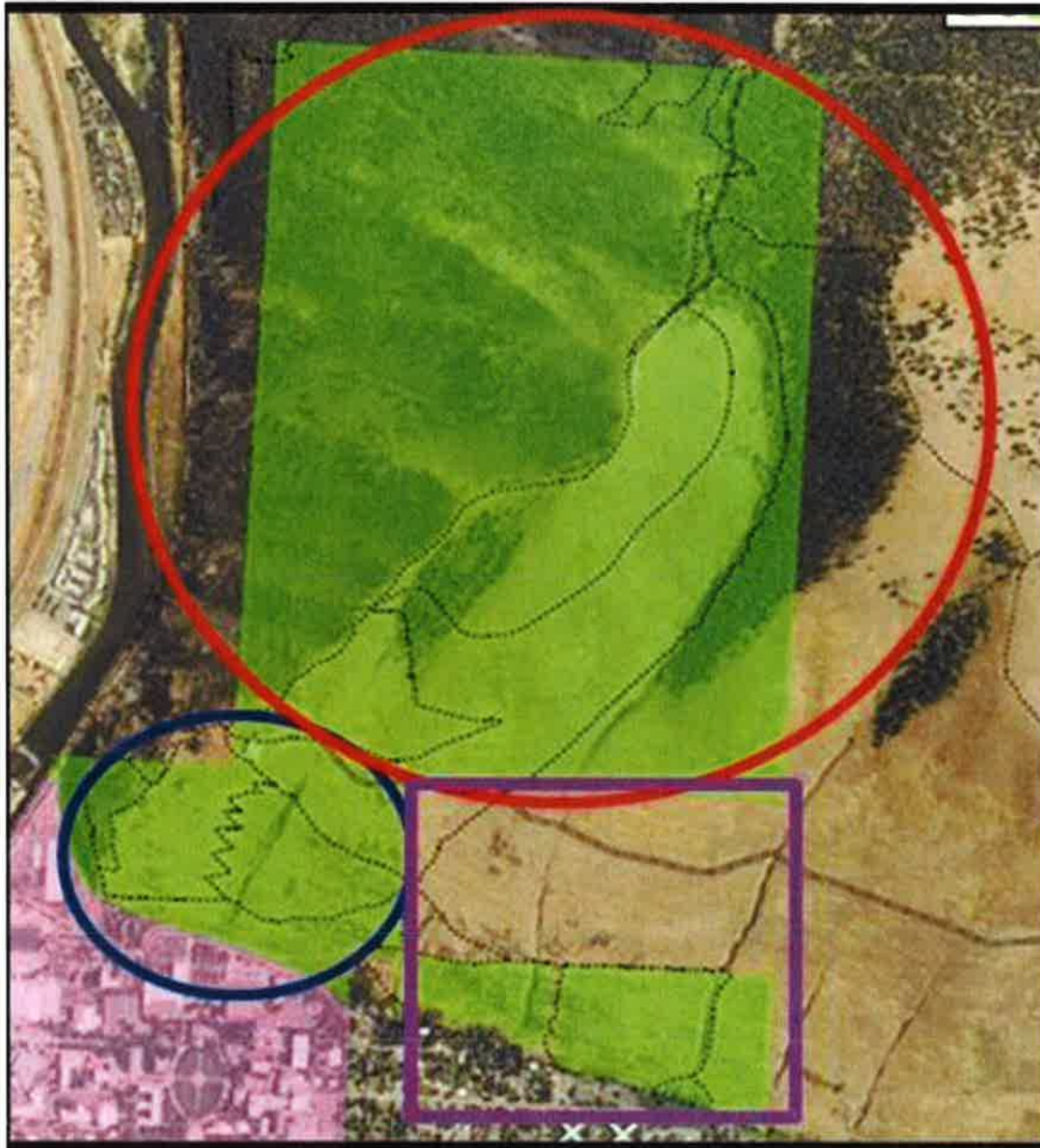


Land ownership:

Grey (near M trail) = UM, White (on the mountain between M trail and the golf course)= UM, Yellow=Lolo National Forest, Green = City of Missoula Parks and Recreation.

From Missoula Parks and Recreation Open Space Trail Map published 2012.

There are three conceptual zones for the trails: M Trail System (circled in blue), Evans Street and South (within the purple square) and Fire Road and Above (circled in red).



2.3.1 M Trail system.

The original trail to the M was established in 1908, but the current zig zag trail was built later. It was built at a grade that is so steep that there constant erosion. Modern trail design standards would have resulted in a much different trail. Switchback cutting and mass erosion at the corners of the switchbacks are apparent. If unaddressed, the hillside below and around the M would become exposed dirt, with little to no vegetation.

There has never been a budget for maintenance of the M Trail. At least 7 switchbacks have been repaired with installation of stair structures, back filling with gravel, and fence repairs. This has all depended on private donations and volunteer labor (Montana Conservation Corps, UM students, USFS Hot Shots crews) under the supervision of Marler.

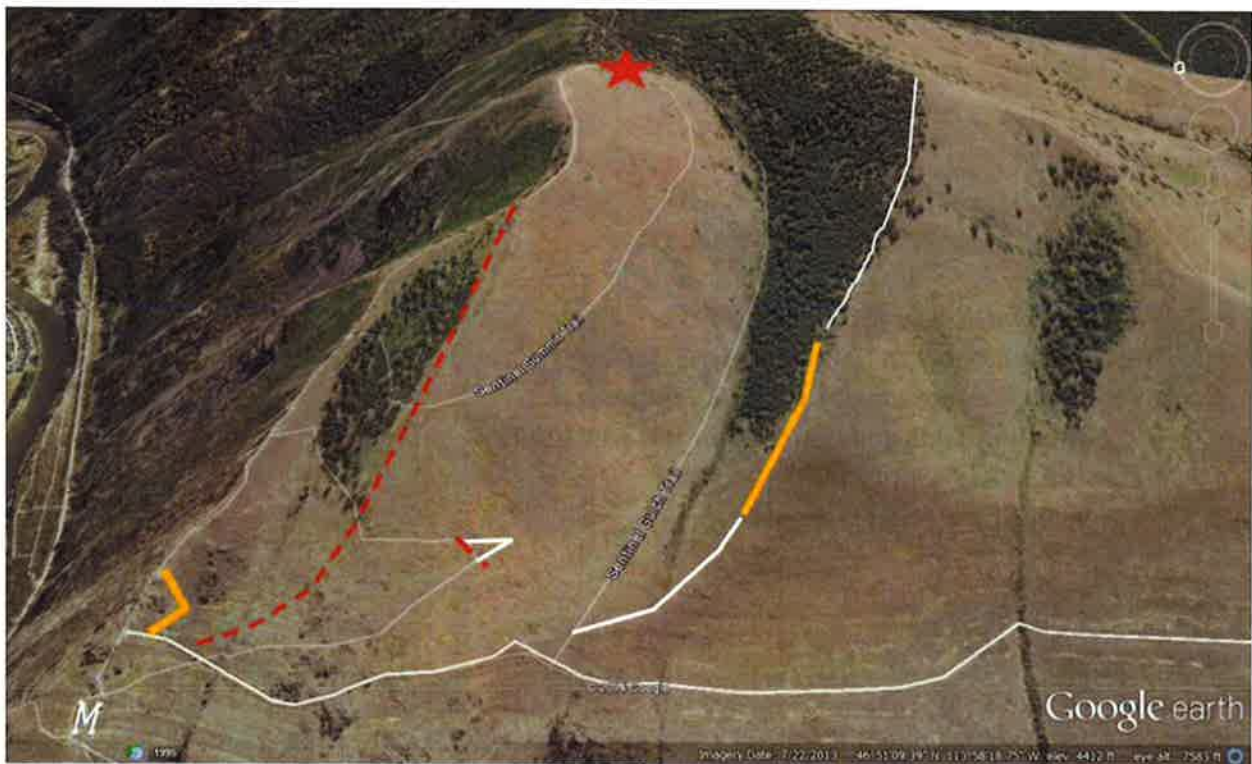
Work needs:

- At least 5 of the switchbacks still need stair structures.
- Trail cuts (vertical user trails) along the “M” and between switchbacks need to be brushed over/closed repeatedly, at about 2 year intervals.
- Stop installing signs and benches on this trail until a master plan is adopted.
- Enforce leash law and waste pick up.



2.3.2 Fire Road and above.

- The trail section from fire road to high water marker (a stone monument donated and installed by the Glacier Lake Missoula Institute) needs to be re-configured.
- The “Straight up” section (dashed red line) needs to be re-brushed and signed for closure every 1-2 years (direct hikers to the real trails)
- The final ascent from the Ridge Trail to the summit should eventually be re-designed .
- Install trailhead sign at the east edge of the UM property so trail users know they are entering UM property and that bikes are prohibited on the west face of Mt Sentinel.
- Install “No Bikes on west face of Mt Sentinel” signs near the summit.



Dashed red line = trail is closed and needs closure maintained

Solid yellow line = trail is unstable and needs to be re-routed to avoid ongoing erosion

Red star = informational signage is needed at this location

2.3.3 Evans Street trailhead and south.

- Trailhead kiosk is needed at Woodworth and possibly 1-2 locations behind student housing.
- The trails starting at Woodworth and behind Student Housing are user made and too steep. We need to have “real” trails built that tie into Evans Street Trail as well as City Parks Trail system.
- Planning and construction of these features requires collaboration with City Parks and Montana Conservation Corps.
- There are multiple, intentional gaps in the fence behind student housing. Some of these should be closed and others opened/formalized.
- Remove the Russian olive trees lining Mt Sentinel behind student housing. These were intentionally planted at some point as part of the Student Housing landscaping. However Russian Olives are now classified as noxious weeds and need to be removed per state and county law.



- Evans Street Trailhead
- Woodworth Ave Trailhead
- Undeveloped/unmarked access points behind student housing

2.4 Education and research.

Mt Sentinel is an extraordinary resource for UM. UM class field trips and labs are always welcome to use it, and off campus (K-12 and other) field trips should be hosted as staff allows. Facilitate research projects as much as possible.

Past education events have included (but are not limited to):

- UM class field trips (Environmental Studies, General Botany, General Ecology, Geography, Wilderness and Civilization)
- Field site for independent projects for students in upper division classes
- Local K-12 guided field trips
- Service learning days for 8th graders, general public (Earth Day, Public Lands Day and other work days)
- Work sites for UM interns supervising K-12 students in above-mentioned field trips
- Field trips led by local chapter of the Montana Native Plant Society
- Marler speaking at local service clubs (Lions, Kiwanis, etc) and non-profit groups

Mt Sentinel has been the site of several ecology research projects, including research on Lazuli bunting communication, spotted knapweed ecology, and using search dogs to find low density noxious weeds. Some of the research is applied, some is basic, and some is geared toward teaching students ecology research methods. It is an incredible and undervalued resource for the University.

In addition to the use of Mt Sentinel as a teaching site, it is important to “reach out” to the broader community to education Missoulians about conservation values and management activities. Local media should be engaged whenever possible. TV, radio and print articles help people to understand management goals and activities. An informed and supportive public is important for productive land stewardship.

2.5 Social/safety issues.

(In no particular order) Someone needs to be able to work with neighbors, public and the Office of Public Safety to address issues as they come up.

Off leash dogs. City ordinance requires dogs to be leashed in city limits. UM rules require dogs to be on leash on campus. There are 3 issues with off leash dogs on Mt Sentinel:

1. Nuisance/hazard to other hikers, especially on the M Trail
2. When dogs are off leash, owners are less likely to pick up their waste. There is a serious failure of dog owners to clean up after their pet on the M Trail
3. Off leash dogs can chase deer and other wildlife. Per state law it is ILLEGAL to let your dog harass wildlife. Occasionally in past years, game wardens have hiked Sentinel and ticketed owners for letting their dogs chase deer. However it is hard to change people's behavior without some kind of bigger effort . This could be undertaken in cooperation with City Parks, and or Missoula City/County Animal Control, although the level of interest from both agencies has been low on this subject.

Discharge of firearms. It is illegal to discharge a firearm (including paint ball guns, bb guns, pellet guns, compound bows, etc) within the city limits. All of the UM owned land on Mt Sentinel is within city limits. As recently as Fall 2014, there have been reports of bow hunters shooting at targets on UM property on Mt Sentinel.

Trespassing on private property. There have been past occasions when trespassing has become a big problem (when a trail was re-routed above Madeline/Evans, and hikers cut straight through backyards). This seems to have been resolved with improved signage.

Trail cutting. The best approach to avoiding trail cutting is ongoing brushing over of user created trails, and public education about the damage caused by trail cutting.

Camping, Drug operations, Underage drinking. There are rumors and evidence of these activities happening on Mt Sentinel, but the Natural Areas Manager has not been included in the conversations. It would be helpful to get land managers and law enforcement agencies working together as needed.

3.0 Fort Missoula

Fort Missoula has a rich human history in addition to its wonderful natural history. The site was an actual US Army Fort, and was the site of the World War II internment camp for Japanese and Italian community members. It's important to honor the historical artifacts and history of the site while taking action to maintain healthy natural plant and animal communities.

Existing uses at UM land at Fort Missoula include:

- Research at the Biological Station at Fort Missoula
- Educational activities at the Fort Missoula Native Plant Gardens and Classroom (used and maintained by the Montana Natural History Center),
- Walking, bird watching and fishing
- Native American Studies Department Sweat Lodges
- Honey Bee Research Group (PI Jerry Bromenshenk)
- Plant ecology research projects (PIs Ray Callaway, John Maron, Dean Pearson)

There needs to be better communication among all parties involved at the Fort; my recommendation is for Bret Tobalske to take on a more central role and I have discussed this with him.

UM land at Fort Missoula contains important historical features:

- Quarter master stable (now the research station)
- Foundations of barracks that housed Japanese and Italian prisoners during WWII.
- 2 houses (in state of disrepair)
- "Four stall garage" which has been renovated into the Garden Classroom and received a historic preservation award (cooperative project between Montana Natural History Center, UM Natural Areas Program, and Loken Builders)

UM land at Fort Missoula includes grasslands (mostly degraded) and cottonwood forest. Both areas are used by dog walkers and bird watchers. Recreational use is expected to increase as the Fort Missoula Regional Park is developed over the next several years.

3.1 Grassland stewardship.

3.1.1 Historic condition. Bluebunch wheatgrass and rough fescue grassland; many forbs; frequent burn regime due to lightning but also indigenous people's management practices. The community composition was probably very similar to Mt Sentinel's historic grasslands.

3.1.2 Current condition. Many non-native grasses, and some weedy species exist due to impacts of the Army era. Invasive plants are the biggest ecological problem in the grasslands. These include spotted knapweed, leafy spurge, and Russian olive, and are addressed in the noxious weed chapter of this plan.

3.1.3 Desired condition. At a minimum, UM needs to comply with noxious weed laws, and increase cover by native plants. Unlike Mt Sentinel, these grasslands have been so thoroughly converted to non-native rhizomatous grasses in some areas that a return to the historic (pre-Army) condition may not be feasible.

It's important that management activities do not impact human history artifacts on the site. Tilling and digging are discouraged outside of established garden areas.

3.1.4 Required actions.

Continue noxious weed management (Chapter 5) and trail management (section 3.2)

Noxious weed management.

UM will use an integrated plant management approach that promotes native vegetation while killing noxious weeds. Multiple tools will be used to reduce cover by noxious weeds including targeted herbicide application, biological control agents, and hand pulling. Past efforts have shown that grazing is not a viable option for UM land at Fort Missoula (because of off leash dogs, patchiness of grazable weeds, and concerns over damage to historical features). See Chapter 5 for a discussion of tools for each weed species.

Revegetation should be implemented when needed and native species should always be used.

3.2 Forest stewardship

3.2.1 Historic condition. Riparian areas along the Bitterroot River support open cottonwood forests. The historic condition can be observed from aerial photos from the mid-1900s. There would have been a sparse mid-story of shrubs, understory of native graminoids and forbs. Mature and regenerating cottonwood galleries are increasingly rare in Montana and throughout North America because they rely on flooding for seedling recruitment. Most rivers are not permitted to flood because of adjacent land use practices.

3.2.2 Current. There is still a mature cottonwood gallery. However the extent of regeneration that is happening isn't known. Seasonal flooding does occur, but there hasn't been a survey for seedlings. Many noxious weeds and non-native trees and shrubs crowd the mid- and understory relative to historic conditions.

3.2.3 Desired. More similar to historic condition, specifically, fewer non-native species and less crowding of the understory.

3.2.4 Required actions.

Weed control, including removal of non-native woody species. Weed control information is included in Chapter 5.

3.3 Trails.

This is a well-used recreation area. Since it is flat, the trails are not causing erosion.

3.3.1 Upland trails.

This area is heavily used for dog walking, and general use of the site is expected to increase as the Fort Missoula Regional Park and the Missoula-Lolo Trail are completed in the near future. UM needs to anticipate this increase of activity and plan accordingly.

There are established trails throughout the grasslands, and since the area is flat, they do not pose a threat of erosion. Some of the roads could be closed to public vehicle traffic, and way finding and interpretive signs could enhance user's experience.

There have been informal suggestions over the years (from staff at the Montana Natural History Center, UM's Division of Biological Sciences (DBS), and the Historical Museum at Fort Missoula) that UM close a section of road to motorized vehicles. Proponents have suggested that this would help preserve certain historic features and wildlife habitat, but this suggestion is not proposed as part of the current plan.,

3.3.2 Slevens Island trails.

Erosion and excessive user created trails are not an apparent problem in the riparian area. Signage at trailheads (there are 2 main access points) should be maintained or improved.

3.4 Education and research.

As the site of both the UM Field Research Station at Fort Missoula (operated a part of the UM Division of Biological Sciences) and the Native Plant Gardens at Fort Missoula (operated by UM in collaboration with the Montana Natural History Center.

Sleven's Island is commonly used by teachers at nearby Big Sky High School for science (and possibly other) class field trips. Because the area is open and public, these outings are not coordinated with UM, but we should be aware that they happen, and be open for collaboration if requested.

There is a 2 acre field near the water tower that has been used for plant ecology research. This needs to be managed so it is available for researchers to use, but not proliferating weeds to the rest of the Fort.

The productive and fascinating UM Honeybee Research Unit maintains a "Bee yard" near the Water Tower. They frequently use the surrounding grasslands for various research of honey bee behavior.

There is a consistently used osprey nest in the upland area (near the Bee Yard). This nest is monitored as part of Erick Greene's research program.

The entire site is a valuable asset for UM classes and researchers.

3.5 Social/safety issues.

- Staff and hikers have commonly encountered camping in the riparian area on Slevens' Island; this is always referred immediately to UM's Office of Public Safety
- Discharge of firearms in the riparian area has been an ongoing issue in two ways.

* First, because people have hunted ducks at Slevén's Island in recent memory (prior to annexation into the city limits), duck hunting has been occasionally observed over the years. Also until very recently (within 5 years) Fish Wildlife and Parks staff have sometimes recommended the area as a duck hunting site (Marilyn Marler with Dan Curtin, personal communication). This speaks to the need for good communication among agencies; there have not been any unsafe situations reported to my knowledge related to duck hunting.

*Second, there have been periods when paint ball groups have heavily used the area, leaving trash, paint, and plywood structures on site for others to remove. I posted signs and reached out to various clubs, and this appears to have stopped. However ongoing monitoring and communication are needed in this as in all areas.

- Researchers and educators have reported constant break ins and vandalism. We need some strategies for this expensive and discouraging problem.
- Discarded cans and bottles, suggesting underage drinking, are sometimes found around buildings and at Slevén's Island.

Chapter 4 .Payne Center Landscaping

4.1 History

The Payne Center for Native American Studies was built on campus in 2001, and landscaped with plants native to Montana. The plantings were designed with low-input management methods in mind; however it was never successfully incorporated into the work plan for Campus Grounds Crew. In summer 2014 its maintenance was assigned to the Natural Areas Program since the management tools and plants involved are more closely aligned (at this point) with natural areas methods. It also provides a convenient teaching space in the center of campus for plant identification and native plant conservation.

4.2 Goals

Goals of the landscaping include

- promote appreciation of native species
- promote use of native plants in campus landscaping
- water & pollinator conservation
- reflect Montana's natural heritage and human history

Assessment

This project looks very different than traditional campus landscaping. Some people describe it as messy, and to some eyes it may appear that plants are being left to grow at random and unchecked.

If maintained properly, the gardens should appear intentional and well kept. Unfortunately, by summer of 2014, some of the originally recommended species had died out, and some unwelcome weeds had moved in. Summer and fall of 2014 were spent removing unwanted plants, trimming overgrown plants, and removing or relocating some features that were unsuccessful.

Assessment of the landscaping should be ongoing, as with other aspects of campus grounds maintenance.

Management Tools.

- Proper irrigation (only water in late July-mid-September, and only targeted application)
- Maintain heavy mulch. Fine mulch can be used near the Oval for a more clean and formal look; shredded bark and leaves in other parts. Eventually the plantings will be making their own mulch and fewer inputs will be required.
- Spot application of herbicides for weed control, timed with target weed's biology and in concert with other control methods listed here
- Manual removal of weeds, ongoing from April-November
- Interpretive signs are needed- this will help with appreciation and understanding of the site.

Chaptepter 5. Noxious weed management

State and county laws require all landowners to control noxious weeds on their property. State agencies must specifically enter into a cooperative weed management plan with their appropriate county weed district, and make progress on that plan. State agencies must report progress every two years to the Montana Department of Agriculture, and update their plan with the county weed district every 6 years.

A successful noxious weed program is focused on maintaining desirable plants, and not focused on simply killing weeds. When killing weeds is necessary, control methods are selected and applied in consideration of the target species' biology and in consideration of the physical and social context of the land being managed.

Integrated noxious weed management operates in an adaptive manner. Goals are set, existing conditions assessed, management tools applied, efficacy assessed, and the goals and tools are reconsidered. Ideally formal monitoring is a central part of this adaptive management strategy. Since monitoring has not been funding in the 15 year history of this project, we rely more on observation and experience, and communication with peers.

Monitoring efforts have occurred in the past. Weeds have been GIS mapped by Missoula County Weed District, and plot data has been collected at various points over the years. In the future, more attention and funding should be paid to monitoring data.

UM has proactively controlled noxious weeds since 1999, and tremendous progress has been made in restoring healthy native plant communities. It is important that UM stays committed to this course of action. Skipping management for one year can result in loss of several years' progress. The adage 'one year's weeds makes seven years' seeds' does apply here.

Noxious weed management matrix for Mount Sentinel. Note that education is used for all species, and grazing is not used for any species (because of the steepness and high recreational use of the site).

Latin name	Common name	Spraying (product/rate/season)	Pulling	Biocontrol
<i>Centaurea maculosa</i>	Spotted knapweed	Picloram /1 pint per acre/spring or fall	Yes, on the M Trail, with service learning volunteers	All known agents are established.
<i>Cynoglossum officinale</i>	Hounds tongue	Metasulfuron/1 oz per acre/spring or fall	Yes, all zones, with volunteers or staff, whenever encountered	None available.
<i>Euphorbia esula</i>	Leafy spurge	Picloram/ 3 pints per acre/spring or fall OR Imazipic/ 8 oz per acre/ fall only	No, roots are too long for this to be effective	All known agents are established
<i>Hypericum perforatum</i>	St. Johnswort	Picloram / 3 pints per acre/spring or fall	Yes, small patches or isolated plants	Chrysolinid beetle is established
<i>Isatis tinctoria</i>	Dyer's woad	Metasulfuron/ 1 oz per acre/any time plant is actively growing	Yes, and follow up with spraying	None available
<i>Linaria dalmatica</i>	Dalmatian toadflax	Picloram / 3 pints per acre/spring or fall OR Imazipic/ 8 ounces per acre/fall only	Individual plants, but not as a general management tool	All known agents are established
<i>Potentilla recta</i>	Sulfur cinquefoil	Picloram / 1 pint per acre/spring or fall	No	None available
Latin name	Common name	Spraying (product/rate/season)	Pulling	Biocontrol
<i>Tanacetum vulgare</i>	Common tansy	Picloram product, 3 pints/acre, spring or fall	Yes, if found	None available
<i>Eleaegnus angustifolia</i>	Russian olive	Treat freshly cut stumps with herbicide	Not applicable	None available

<i>Hesperis matronalis</i>	Dame's rocket	Metasulfuron/ 1 oz per acre/when actively growing	Yes	None available
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Fort Missoula noxious weeds and treatment matrix.

Latin name	Common name	Spraying (product/rate/season)	Pulling	Biocontrol
<i>Centaurea maculosa</i>	Spotted knapweed	Picloram /1 pint per acre/spring or fall	Yes, with service learning volunteers	All known agents are established.
<i>Cynoglossum officinale</i>	Hounds tongue	Metasulfuron/1 oz per acre/spring or fall	Yes, with volunteers or staff,	None available.
<i>Euphorbia esula</i>	Leafy spurge	Upland: Picloram/ 3 pints per acre/spring or fall OR Imazipic/ 8 oz per acre/ fall only Riparian areas: Only use glyphosate that is labeled for use near water. Or Krenite (find rates/season)	No, roots are too long for this to be effective	All known agents are established
<i>Hypericum perforatum</i>	St. Johnswort	Picloram / 3 pints per acre/spring or fall	Yes, small patches or isolated plants	Chrysolinid beetle is established
<i>Isatis tinctoria</i>	Dyer's woad	Metasulfuron/ 1 oz per acre/any time plant is actively growing	Yes, and follow up with spraying	None available
<i>Linaria dalmatica</i>	Dalmatian toadflax	Picloram / 3 pints per acre/spring or fall OR Imazipic/ 8 ounces per acre/fall only	Individual plants, but not as a general management tool	All known agents are established

Latin name	Common name	Spraying (product/rate/season)	Pulling	Biocontrol
<i>Potentilla recta</i>	Sulfur cinquefoil	Picloram / 1 pint per acre/spring or fall	No	None available
<i>Tanacetum vulgare</i>	Common tansy		No.	None available
<i>Eleagnus angustifolia</i>	Russian olive	Treat freshly cut stumps with herbicide	Not applicable	None available
<i>Gysophila</i>	Baby's breath	Check	Yes	None available

Thematic work plan for weed/vegetation management. Excludes trails, forestry, native plant propagation

- Jan/Feb/Mar Planning, scheduling, reporting.
 Attend conferences & meetings, continuing education.
 Apply for grants and other fundraising activities
 Recruit student staff , interns and volunteers, scheduling, use vacation time
- April/May. Volunteers and UM students engage in weed pulls (knapweed on the M Trail, hounds tongue elsewhere), supervision of staff . Recruit and train field staff. Post signs and press releases regarding weed management and other activities.
 Search dogs begin seeking dyer's woad; human handlers remove plants. Continues through late October.
- June. UM staff back pack spray spurge/toadflax/knapweed below the Fire Road.
 Houndstongue is pulled as encountered. Work continues to July 4. Plan 1-2 days for spraying metasulfuron on houndstongue
- July/Aug/Sep Shift to Fort Missoula & Payne Center; Work on fencing/seed collecting as time allows.
- Oct UM staff backpack spray above the fire road.
- Nov Seeding (use volunteers); clerical and budget; equipment maintenance
- Dec reporting, grants/fundraising, scheduling

Could show additional timeline for fencing/forestry/trails... reveg

Chapter 6. Budget & Staffing

Description	Current	Optimum
Classified staff (director)	32,214	47,840
Hourly staff:	7,000	9,360
Fringe Benefits	9,342	13,874
Health insurance	10,644	10,644
Communication Allowance	600	600
Contracted Services	1,000	10,000
Supplies	3,150	3,500
Travel	500	750
Repair & Maintenance	250	500
Total Expenditures	64,700*	97,068**

Assumptions:

Current year: director position at 3/4 time, \$20.65/hour,
538 hours for season help (= 2 people, \$13/hour for 9 weeks)

Optimum: director position at full time, \$23/hour,
720 hours for season help (= 2 people, \$13/hour for 12 weeks)

* The University of Montana will commit to maintain current funding of \$64,700, plus state-approved pay increases, from Facilities each year.

** Support external to Facilities will be needed to reach an optimum budget of \$97,068 for the program.

Potential sources of external support include:

- Division of Biological Sciences
- Private donors and foundations
- Montana Noxious Weed Trust Fund
- Missoula County Weed District
- Labor: community groups, student groups, etc., though this requires staff supervision in addition to recruiting partners, maintaining relationships and making the volunteers experiences meaningful for participants.

University of Montana & Mount Sentinel Ownership

