

# Soils and Vegetation of the Snowy Range, Southeastern Wyoming Wildland Shrub Symposium Field Trip: Laramie to Woods Landing, Riverside, Libby Flats, and Centennial, Wednesday, August 14, 2002

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Laramie, Wyoming, was established as a railroad construction town in May, 1868. The transcontinental railroad (Union Pacific) came across the Rockies in the late 1860s, across the then unsettled landscape that now contains Cheyenne and Laramie, after a southern route through Colorado was rejected because of the terrain. A relic of the Tertiary Ogallala formation called the “Gangplank” west of Cheyenne provided an access ramp across the mountains; this was the first place north of Denver where it was feasible to build the railroad. It was also the first place west of Missouri that railroad ties could be cut from the surrounding forests, and railroaders timbered for ties extensively in the Laramie and Snowy Ranges (about 3,000,000 ties were cut by 1870). The “tie hacking” continued until World War II. “Tie hacks” would cut mid-sized trees of 12 to 14 inches (30 to 35 cm) diameter in the winter, cutting flats on two opposing sides of the tree with a broad axe and piling 8-ft (2.4-m) lengths into creeks all winter, behind a temporary dam. In spring, when runoff waters were high, the dams were dynamited, and they had a log run! The fishery biologists are still trying to restore fish habitat in some of the drainages in the Snowy Range where channels were extensively gouged by these log runs.

Today, you can still see standing stumps from tie-hack activity in the Laramie and Snowy Ranges—often they are 3 to 4 ft (0.9 to 1.2 m) tall because the hacks were cutting in deep snow. These forests provided ties from Laramie to Rawlins and Rock Springs, 200 miles away, at which point ties were cut from the forests to the south of the track in the Uinta Range. At the peak of the steam engine period, the

trains also used 2 million gallons of water each day from the Laramie River. Stops along the track where coal and water were available developed into towns, for example, Rawlins and Rock Springs. We left town heading southwest via Highway 230. Elevation at Laramie is 7,170 ft (2,185 m), and precipitation is 10.5 inches (26 cm), most of which falls in March through July.

**Stop 1: University of Wyoming, Monolith Ranch** by the fishing access to a Laramie River site with greasewood (*Sarcobatus vermiculatus*). This is an area that was farmed at the turn of the last century. In 1906, a grain elevator capable of loading 50,000 bushels onto railroad cars daily was built in Laramie. By 1920, failed farms were being consolidated into ranches. Greasewood, a highly salt-tolerant shrub, is increasing here between the Pioneer Canal (dug in 1890, visible along the hillside to the west and north) and the Laramie River to the southeast. The greasewood is expanding from canal seepage water that for the last hundred years has permeated the unlined canal into the underlying Niobrara formation (a Cretaceous age marine shale and sandstone). Other salt-tolerant plants include alkali sacaton (*Sporobolus airoides*) and saltbush (*Atriplex* sp.). Soils here are apparently increasing in salinity over time as a result of an accumulation of very soluble salts from the canal seepage water. The soils on this geomorphic surface are Aridisols (Calcids with frigid temperature regimes), which typically have calcic horizons and significant amounts of gypsum in the subsoil.

**Stop 2: Fox Creek Road.** Here we are on an alluvial fan extending from a canyon. The soils have a fairly thick profile; however, they are not well developed (no B horizons), but do have a mollic epipedon. Elevation at the site is 7,800 ft (2,377 m), and annual precipitation is approximately 16 inches (40 cm). There is a pronounced aspect effect here, between north- and south-facing slopes. Soils on the landscape are Mollisols (Haplustolls) on the drier south slopes; on the wetter, north-facing slopes the soils are Inceptisols (Dystrocrypts). There is also a pronounced aspect difference between north- and south-facing slopes in

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terms of the trees present: lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), Englemann spruce (*Picea engelmannii*), and Douglas-fir (*Pseudotsuga menziesii*) on north-facing slopes; ponderosa pine (*Pinus ponderosa*), limber pine (*Pinus flexilis*), and Rocky Mountain juniper (*Juniperus scopulorum*) on the south-facing slopes. Dry open sites are dominated by mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*), common rabbitbrush (*Chrysothamnus nauseosus*), and Idaho fescue (*Festuca idahoensis*). Narrowleaf cottonwood (*Populus angustifolia*), balsam poplar (*Populus balsamifera*), mountain alder (*Alnus incana*), willows (*Salix* spp.) and choke-cherry (*Prunus virginiana*) grow in the riparian area along Fox Creek. Chokecherries are an important food supplement for black bears; there are approximately 100 bears in the Snowy Range. This is an area that is used heavily by deer and elk as winter range, so you may see signs prohibiting offroad travel during the winter months.

**Along the Highway:** As we travel to higher elevations near the southern end of the Snowy Range, we drive past the road to the old sawmill settlement at Fox Park. At one time, the Forest Service had a small workstation there. The sawmill is closed now, and the area is largely private cabins.

The Fox Park area was extensively burned 150 to 200 years ago. It is a large area of fairly uniform lodgepole pine forest interspersed with moist shrub meadows along streams. In the coniferous forest, understory shrubs such as whortleberry (*Vaccinium scoparium*) and bearberry (*Arctostaphylos uva-ursi*) provide important forage for wildlife. Soils here are primarily Alfisols (Haplocryalfs), and in the meadows are wet Mollisols (Cryaquolls) or wet Inceptisols (Cryaquepts). This area of the Snowy Range was not glaciated, and the soils are relatively well developed (thicker Bt horizons) and contain more clay than soils on the younger, glaciated landscapes we will travel over later in the trip. Consequently, the water-holding capacity of these soils is greater, and the forests are more productive. Underlying geology here at the southern end of the Snowys is a complex of granitic, felsic, and hornblende gneiss, as well as amphibolite.

**As we continue past Mountain Home** we see several meadows with Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*). This is important habitat for wildlife that often finds limited food under the conifers. These areas also provide nesting habitat for numerous species of birds.

Next, the highway crosses briefly into northern Colorado. Here, we find larger openings of sagebrush grassland. You might notice on the surrounding hills that in the past, the Forest Service allowed rather large clearcuts. These are currently revegetated in aspen (*Populus tremuloides*) or young conifers, but are still clearly identifiable by the size of the trees. Today, logging cuts are more considerate of wildlife habitat needs, are generally smaller, and are done to create irregular contours and are thus less apparent in the early regrowth phase.

Our path has followed a former railroad track bed; the rails have now been removed. This railroad went from Laramie to North Park Colorado and was built in about 1910 to haul wood products from the Fox Park area and coal from a mine in North Park, Colorado. That coal mine has been shut down for almost 20 years now and the rails and ties were sold for scrap.

As we begin to turn north into Wyoming, on the slopes to the south of the road, remains a scar from a fairly large fire where an extensive stand of conifers burned about 10 to 15 years ago. That is a common story here in the Northern Rockies where through fire control we have allowed canopy closure in the forest on many sites that were probably more open historically. The first fire control plan was established on the Medicine Bow National Forest in 1912. These sites now are contributing to the fire problem in the West because current fires are typically hotter and extend over much larger areas than those that occurred prior to fire suppression.

On the north side of the road, there is an old copper mine. Though much more hard rock mining occurred in Colorado than in Wyoming, the Snowy Range does contain a series of gold mines and copper mines. Over in the Sierra Madres to the west of us, there was a copper mine with a smelter in Encampment, a town we will come to later in the trip.

**As we pass the North Platte River** we can see that it has fairly low flow this year, reflecting the drought we have been experiencing here in Wyoming for the past 3 to 5 years. As we drive along the Platte River Valley toward Saratoga, we see a landscape that is underlain by Tertiary age geologic materials (Upper Miocene, approximately 20 million years old). The geologic formation is the North Park Formation. There are small areas of older Eocene deposits along the southwest fringe of the basin. The small hills to the east along the highway are granite, and you may get some feeling of the filling of the basin with Tertiary valley fill materials. The geologic materials we are driving over were eroded from the top of the adjacent mountains as they were uplifted during the Tertiary. At several times during the Tertiary, the intermountain basins were largely filled with alluvium eroded off the rising mountains. Then, during periods of quiet in mountain uplift, the streams eroded much of the sediment from the basins toward the Gulf of Mexico. We are now apparently in a period when the uplift is relatively quiet and the basins are being exhumed slowly by geologic erosion. The light-colored sediments that show on hillsides along the road are exposures of the Tertiary valley fill.

We are now in a rolling vista of Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*) and several species of wheatgrass (*Agropyron* spp.). We also see areas where the sagebrush was sprayed for control—as shown by the delineations across the landscape.

**Stop 3: We turn off at the Six Mile Road** access to the National Forest. After traversing an area of private land, we reach a fishing access by the Platte River that is very important winter range for elk, deer, and bighorn sheep. The Wyoming Game and Fish Department estimates that there are approximately 6,500 elk and 250 bighorn sheep in the Snowy Range at present. About 600 elk and many of the sheep winter in this area.

The elevation at the Six Mile access to the Platte River is 7,500 ft (2,286 m), and the precipitation is about 16 inches (40 cm). This area was burned about 6 years ago for wildlife habitat improvement. Most burning is done in April to catch a window when the snow has melted from the sagebrush but is still present in the trees. This timing also prevents damage to root systems of shrubs like bitterbrush (*Purshia tridentata*), which sprout from the roots if the fires are not too hot. The road was used as a firebreak. Below the road and

to the north up the slope you can see an area that was burned; the south side of the road represents the unburned condition. The burned area appears to have good regrowth of bitterbrush and shrubby cinquefoil (*Potentilla fruticosa*) and good recruitment of sagebrush seedlings. The soils here are Mollisols over the rolling topography with Inceptisols, and Entisols (Lithic Cryorthents) on the steeper slopes where the rocks are close to the surface.

**Along the highway**, driving north from the Six Mile access road, the areas without sagebrush were cleared for hay or wheat production. Much of the acreage formerly farmed with wheat in Wyoming has now been abandoned; the climate is too dry and cold, and the Conservation Reserve Program provided a good incentive for many farmers to revegetate back into rangeland.

**Stop 4: Forest Service campground at Ryan Park.** This area was the site of a Civilian Conservation Corps camp in the 1930s and was a prisoner of war camp during World War II. There was a rather short ski slope here also.

**Medicine Bow National Forest** via Highway 130. As we follow the creek you may see very telltale signs of glaciation. Ice collected on the north end of the Snowy Range on numerous occasions during the Pleistocene; and glaciers moved from the top of the range to the north, east, and west of Medicine Bow Peak. The ice carried glacial till across the landscape and down the major drainages. We are now driving along a moraine of Pinedale age (Late Wisconsin age; approximately 25,000 to 12,000 years before present). You can see the boulders imbedded in fine material jutting out of the roadcuts. Most of the soils on the moraines are Inceptisols because of their relatively young age, given the cool climate under the forest. Blocks of white rock are very distinctive in the till; they are the Medicine Peak quartzite from the highest crest of the Snowy Range. We will eventually drive beside the cliffs from which these rocks are derived; the rock was extracted by the ice and carried down the slopes in the French Creek watershed. The quartzite represents an old beach (2 billion years old!) and provides a good way to trace glacial activity from the north part of the range. The glaciers moved north, toward Elk Mountain; west, via French creek where we travel along the stream; and eastward, via Libby Creek toward the town of Centennial. French Creek was named for a family of Arcadians, the De La Sol family, who came here to prospect for gold. They did establish a productive claim, but the family eventually sold the mine and moved further north in Wyoming where they bought and leased a lot of land to create what is now the largest ranch in the State—the Sun Ranch. Another creek in the area, Pelton Creek, was named after a man who came to the area originally as a guest of the Wyoming Territorial Prison, but who later became a respected Laramie citizen and businessman (after his release).

**Stop 5: Forest Service Riparian Area Walkway.** The elevation here is 8,700 ft (2,652 m), and the precipitation is approximately 26 inches (65 cm). The riparian system here is dominated by willows (*Salix* spp.), sedges (*Carex aquatilis*, *Carex microptera*, and others), tufted hairgrass (*Deschampsia cespitosa*), and bluejoint (*Calamagrostis canadensis*). Across the road to the north you can see a good exposure of the moraine; the till contains, again, the white Medicine Peak

quartzite boulders derived from the crest of the Snowy Range. You can see the peaks in the distance by looking up the highway. Soils in the willow bottom are primarily wet Inceptisols (Histic Cryaquepts), which have a thin layer of organic material over stratified alluvium. The beaver ponds along the creek act as important sediment traps and slow the runoff of snowmelt waters through the summer months. Generally Histosols are only found in very high water table areas in the riparian zones, and in kettle holes in the Pinedale moraine.

**Stop 6: At the Forest Service observatory** on top of the summit. Elevation here is 10,845 ft (3,305 m). The ice here was perhaps 800 to 1,000 ft (244 to 305 m) thick during Bull Lake glaciation (corresponding to the Illinoian glaciation of the mid-continent 175,000 to 140,000 years ago) and again later during the Late Pinedale glaciation (25,000 to 12,000 years ago). There were smaller glaciers several thousand years ago during the Neoglaciation, which started about 4,000 years before present. Ice accumulation during the Neoglaciation was simply a major sheet of ice that covered the north and east slopes of the crest. Blocks of rock, loosened from the exposed crest by frost action, slid along the ice sheet and formed pro-talus ramparts that are now several hundred yards from the rock wall—thus indicating the dimensions of the ice sheet. The landscape contains Nash dolomite as the underlying bedrock and quartzite blocks deposited in a thin smear of till across this landscape. The inclusion of blocks of the Nash dolomite in the till serves to buffer the pH of the soils developed here, and this effect carries all the way down the valleys on either side of the Range.

Medicine Bow Peak at 12,005 ft (3,661 m) is the highest peak in the Snowy Range. The dark band that parallels the ridgeline is a mafic intrusion that is much more easily weathered than the white quartzite. On October 6, 1955, a four-engine commercial airliner crashed into the peak at about the mafic intrusion, killing all 36 people on board. Several engines and other parts of the plane are still present at the base of the cliff, and in a few more years they will be protected by the Antiquities Act; now they are just junk!

Krummholtz trees, many of which are Engelmann spruce, are common at this elevation. The Krummholtz growth form is created by blowing ice crystals shearing the needles and branches from the trees. Other vegetation in this area includes common juniper (*Juniperus communis*), cascade and arctic willows (*Salix cascadenis*, *S. arctica*), alpine fescue (*Festuca ovina*), and tufted hairgrass.

Along the ridge above French Creek, you can see 50-year-old clearcuts that have not revegetated because of the blowing snow and extremely harsh growing conditions at this elevation. This highway closes to travel each winter beginning with the first heavy snows in September or October and reopens usually by Memorial Day, although it has sometimes been closed through part of June.

**Stop 8: Fen in a Kettle Hole on the Sand Lake Road.** Elevation is 8,600 ft (2,621 m). Present on the fen are bog birch (*Betula glandulosa*) and at least four different willows, including planeleaved willow (*Salix planifolia*) and shortfruited willow (*S. brachycarpa*). On drier ground around the fen, you'll find mountain silver sagebrush (*Artemisia cana* var. *viscidula*).

The soil here is a Cryofibrist. The pH of this organic soil is controlled by Nash dolomite rocks in the moraines around the kettle hole. As that rock has weathered, it buffers the pH of the system, both for the mineral forest soils in the upland and the organic soil. These soils all have nearly neutral pH. Normally you would expect fairly acidic soils under the trees and also in a bog setting like this. But because the Nash Dolomite occurred near the point of ice collection, blocks of it were carried here, causing the neutral pH.

Organic soils occur in sites with poor drainage and high water tables in the Snowy Range. Their use here is limited by the short growing season. In warmer climates, Histosols are prized for high value crops such as vegetables because of their generally excellent properties as a growing media. Organic soils have high water-holding capacities (200 to 600 percent by weight) and do not have problems with aluminum toxicity that is common for acid mineral soils. Organic soils present special management problems if they are drained: they subside as microbes accelerate decomposition of the organic material in the newly well-aerated soil. After drainage, they also are prone to wind erosion and burning. Histosols have extremely low bearing strength and are unsuitable foundations for houses and roads. The soil has a very thin Oa horizon (approximately 5 cm) over perhaps 3 m of Oi horizons, underlain by a 2C (Pinedale till). The soil is a Fibrist at the suborder level of *Soil Taxonomy* because the fibers hold up well when rubbed; the inference is that they are only slightly decomposed.

**In the bottom of the Libbey Creek drainage** we are driving through very classic Pinedale moraines, short steep slopes with a lot of stone showing in the road cuts. The ridges above us to the south have Bull Lake till on them. During the Pinedale, glaciers cut the deep canyons. The Bull Lake glacier carried till further out into the basin, and as we pass through the terminal Pinedale moraine we come to a more smooth and rounded topography that is the terminal moraine of the Bull Lake glacier. The landscape on the terminal moraine of the Bull Lake glacier has a more rounded form and is still studded with boulders of quartzite. Wyoming big sagebrush grows here on the terminal moraine and around the slopes on the igneous rock. Once you get out into the alluvium in the center of the valley, you lose the sagebrush.

**Along the road** in the Centennial area at 8,000 ft (2,440 m) elevation, we again see sedimentary rock exposed in hog-back ridges. The ridge above Centennial was the terminal moraine for the Bull Lake glaciation. There is a veneer of Bull Lake till above Centennial and a large outwash plain below the town. Sedimentary rock exposed south and west of the town includes some very red rocks of Jurassic and Triassic age. These have a very distinctively bright red chroma. The exposed sedimentary rocks support mountain mahogany stands (*Cercocarpus montanus*), along with bitterbrush, willows, and chokecherry. On the east side of the Centennial Valley there is a similar uplifted banding of sedimentary rock against the flank of Sheep Mountain.

**Stop 9: Petrocalcic horizon (caliche) on high alluvial surface above the Big Hollow.** This stop shows the maximum expression of carbonate accumulation in Wyoming. The soil is Typic Petrocalcic, loamy-skeletal, carbonatic, frigid. Horizons are Ak, Bk, Bkm, Bk', and 2C. The surfaces

where this soil occurs are all on the order of 1,600,000 years plus. This Bkm horizon material is what the locals refer to as "caliche" in the Southwest. The laminar layer at the top of the Bkm indicates that water no longer penetrates it at all. The original parent material here was quartzite-rich alluvium from the Little Laramie River, and the carbonate accumulation represents a tremendous accumulation of dust over time. These petrocalcic horizons are a very effective "armor" against erosion for the old valley floors. The high surfaces in the southern Laramie Basin are old alluvial valley floors, which are still extant because of the protection afforded them by the petrocalcic horizons and alluvial cobble channel deposits which occur on them. Plants here include winter fat (*Krascheninnikovia lanata*), ricegrass (*Oryzopsis hymenoides*), and wheatgrasses.

**Along the Highway to Laramie: The Big Hollow** is the largest deflation feature in North America, and you can see the entire rim around the Hollow. Apparently wind was channeled between Sheep and Jelm Mountains, and scoured out the hollow during Late Pleistocene time. The rims on either side are actually old alluvial valley floors, and the cobbles from the alluvium protected those surfaces on the north and south from erosion. The area where the basin lies would have been a small shale hill complex prior to the deflation. The shale hill in the distance is an example of the landscape before the topographic reversal. The shale hill was in place when the alluvial valleys were deposited on either side, but was much softer and eroded away, and so you now have a depression. Where the alluvial valley floors ran from the mountains toward Laramie on either side of that shale hill, the alluvium protected those surfaces from erosion. Today, they are still intact and stand high above the Hollow. The small pumping station is the southern end of the Quealy Dome oilfield. The pumping station reflects current oil prices; when prices are high (above \$24 per barrel), the well is active, and when prices fall below that mark, the field is closed down.

The white rock that you can see in the distance is cretaceous Niobrara chalk formation. The Niobrara formation underlies the alluvial valley floor that we follow all the way into Laramie. Between here and town, ground water availability is poor, and livestock owners have dug stock ponds. By placing snow fence around the pond, they can successfully trap blowing snow in wet winters to collect stock water on these high surfaces for use in the summer.

**Return to the University of Wyoming Campus.**

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