GRASSY BALD (GRASS SUBTYPE)

Concept: Grassy Bald (Grass Subtype) is a natural high elevation meadow with a dense herb layer dominated by grasses, though patches of forbs and sedges are present and some examples now have extensive patches of shrubs or *Rubus*. Grassy Balds have well-developed soils that contrast with those of rock outcrop communities and glades. *Danthonia compressa* is typically the dominant grass, but pasture grasses such as *Phleum pratense* may become abundant in the more heavily grazed examples.

Distinguishing Features: Grassy Balds are distinguished from other natural communities by the natural dominance of dense herbaceous vegetation in high elevation upland sites that are not rock outcrops or glades. Small rock outcrops and shallow soil patches may be embedded but do not make up most of the area. High Elevation Rocky Summit communities, in contrast, contain substantial bare rock, though they may contain small patches of herbaceous vegetation with some of the same species. High Elevation Mafic Glades and Low Elevation Acidic or Basic Glades contain more grass but are clearly related to shallow soil.

True Grassy Balds can be difficult to distinguish from old high elevation pastures and burn scars. Some extensive grassy areas, e.g. Graveyard Fields and areas near Mount Mitchell, are known to have originated from logging and burning of spruce-fir forest in the 1900s and should not be regarded as Grassy Bald. The classification should be used only if there is reason to believe an area has been grassy from prehistoric times. Artificial grasslands may be dominated by *Danthonia compressa* but are less likely to contain rare plants and more often contain substantial weedy flora. However, heavily grazed natural Grassy Balds also may contain weedy flora, and many have been invaded by *Rubus* or various shrubs and are no longer herb-dominated. Some examples may remain ambiguous.

The Grass Subtype is distinguished from the Sedge Subtype by dominance by grasses, usually *Danthonia compressa*, rather than *Carex* spp. It is distinguished from the Alder Subtype by the absence of substantial cover of *Alnus crispa*.

Synonyms: *Danthonia compressa* - (Sibbaldiopsis tridentata) Herbaceous Vegetation (CEGL004242).

Sites: Grassy Balds occur on gentle to moderate slopes, ridgetops, and broad domes at high elevation. Examples range from around 5000 feet to over 6000 feet in elevation.

Soils: Grassy Balds occur on relatively deep soils, where tree presence apparently is not precluded by soil depth. Most are mapped as the Burton series (Typic Haplumbrept). Cain (1931) found that Grassy Bald soils in the Smokies were less acidic than other soils at similar elevations, though it is unclear that this causes the distinctive vegetation rather than resulting from it.

Hydrology: Grassy Balds generally occur on high convex slopes and are well drained, though seeps may be embedded in them. They are mesic due to high rainfall, frequent fog, and low temperatures, but are exposed to drying winds.
Vegetation: Grassly Balds are characteristically dominated by dense herbaceous vegetation, with Danthonia compressa the dominant species. Patches may be dominated by Sibbaldia retusa (Sibbaldiopsis tridentata), Packera schweinitziana, or Rumex acetosella. Other frequent herbs in CVS plot data include Carex pensylvanica, Pilosella (Deschampsia) caespitosa, Potentilla simplex, Poa compressa, Achillea borealis, Carex brunnescens var. sphaerostachya, and Athyrium asplenioides. Phleum pratense, Poa compressa, and Poa pratensis are also fairly frequent, presumably because of a history of grazing. Other species less frequent in plots but often prominent in observations include Houstonia serpyllifolia, Fragaria virginiana, Lilium grayi, Athyrium angustum, Athyrium asplenioides, Gentiana austromontana, and the moss Polytrichum commune. Balds may be purely herbaceous or may have shrubs and trees of varying density. Rubus canadensis or Rubus alleghaniensis have invaded many balds that were grazed and then removed from grazing and may be dominant over large patches where not kept in check by deliberate management. Vaccinium altomontanum, Rhododendron calendulaceum, Rhododendron catawbiense, Vaccinium simulatum, Kalmia latifolia, Menziesia pilosa, Abies fraseri, Picea rubens, Fagus grandifolia, and Quercus rubra may be present in sparse to moderate density. These species too are considered invaders and may eventually shade out the herb layer.

Range and Abundance: Ranked G1. Only a few examples are known, scattered throughout the higher mountains from the Great Smoky Mountains northward. The overall abundance and range is confused by the presence of ambiguously natural grassy areas in several places and the widespread use of the term bald for artificial grasslands. This community is nearly endemic to North Carolina, but a few examples occur in adjacent Tennessee and Virginia.

Associations and Patterns: The Grass Subtype may be associated with the Sedge Subtype and on Roan Mountain, the Alder Subtype. Grassly Balds are sometimes associated with Heath Balds, High Elevation Red Oak Forest, or Northern Hardwood Forest. High Elevation Rocky Summit or High Elevation Boggy Seep patches may be embedded. Transitions to adjacent forests sometimes seem gradual, sometimes abrupt. Because of recent management and unknown past management, it is impossible to know the nature of natural ecotones. Even examples of natural origin were grazed and may have been expanded by clearing at their edges. Encroachment of shrubs and trees into Grassly Bald often appears to progress from the edges.

Variation: Balds vary widely in dominant plants from site to site and within sites. Sites vary with grazing history, exposure, and unknown factors.

Dynamics: The factors that produced and maintained Grassly Balds have been the subject of intense scientific interest over the years, and much has been written about them, but consensus has not been reached (see Smathers 1980, summary by Peterson 1980, and views expressed in Billings and Mark 1957, Bratton and White 1980, Brown 1941, Cain 1931, Gersmehl 1973, Lindsay and Bratton 1976a, 1976b, Lindsay and Bratton 1980, Mark 1958, Smathers 1980, Stratton and White 1982, and Wells 1937, 1956). Hypotheses of origin include human action such as clearing and grazing of cattle by early settlers; clearing and burning by Native Americans; presettlement grazing and trampling by native large mammals; natural disturbances such as fire, windthrow, or insects; and changing climatic conditions. New Grassly Balds are not being created from forests at present, and existing examples do not seem to be maintaining themselves. The question of the origin of
Grassy Balds is given urgency by their ecological instability at present. All examples appear to be experiencing invasion by shrubs or trees, though trees are much slower to establish and spread than in disturbed forests. Balds that are not actively being managed to remove woody vegetation are losing their open grassy character.

The question of recent human creation is confused by the existence of grassy areas that clearly are recently created, either by logging and burning of spruce-fir forests or by clearing and grazing by early settlers. Some of these areas have place names of “bald” and are treated as grassy balds by some authors. However, there is evidence that other grassy areas were present when settlers arrived, and these are the focus of the Grassy Bald community defined here. Though Grassy Balds are not floristically similar to northern alpine tundra (Stratton and White 1982), and many of their species are present in other open natural communities, they likely developed from Pleistocene alpine tundra that is generally believed to have existed in the Southern Appalachians. The balds contain some shade-intolerant species such as Packera schweinitziana and Sibbaldia retusa which are not in surrounding forests. Such species are not observed spreading into new sites, and their presence suggests great antiquity for balds such as those on Roan Mountain. The potential for creation by Native Americans is more difficult to rule out, given their longer tenancy and the range of possible human behavior. However, the sites of Grassy Balds are not suited for agriculture or long term settlement and were not particularly close to Native American settlements. Prehistoric people hunted throughout the region and ignited fires throughout the region, but there is no reason to expect them to have focused such activities on particular ridge tops sufficiently to replace forest with grassland. More plausibly, the previous existence of grassy meadows led to a focus on such places for cattle grazing and, probably in earlier times, for hunting. Weigl and Knowles (2013) discuss several such lines of evidence against human creation of Grassy Balds.

Known natural disturbances do not seem sufficient to explain the origin or persistence of Grassy Balds. Where forests have been disturbed by wind storms, ice storms, or natural fire at high elevations, they quickly grow back in trees. With the more catastrophic disturbance caused by logging and slash fires or by introduction of the balsam woolly adelgid, spruce-fir forests developed open successional vegetation that can be distinguished from Grassy Bald. While the grassy vegetation can burn, especially outside of the growing season, fire seems unlikely to ever have occurred frequently enough to maintain balds. The moist foggy climate limits flammable periods. The spruce-fir and northern hardwood communities that surround most Grassy Balds are not very flammable, nor do they contain species favored by frequent fire. Only High Elevation Red Oak Forests, less frequent neighbors, are likely to have burned very often.

Weigl and Knowles (2013) advanced an argument for grazing by native animals as a means of creating Grassy Balds and maintaining them. A diverse fauna of large grazing mammals existed in the Pleistocene and they presumably grazed in open tundra created by the Pleistocene climate, perhaps helping to exclude trees from it. The more crucial question, however, is why any open areas created or maintained by climate or these animals would have persisted for the 13,000 years since those species became extinct. The native herd-forming grazing animals in the region since that time have been elk and bison. If these species gravitated to previously existing open grasslands, they may have contributed to excluding trees as the climate became more favorable. This needs further investigation. With their populations extirpated early by European settlers, the
behavior of these species in North Carolina landscapes is not well known. There is no reason to
expect it, or their ecological effects, to be very similar to those of domesticated cattle.

The climate in Grassy Bald sites is harsh. Forests that are destroyed at high elevations are slower
to recover compared to those at lower elevations, but balds are surrounded by forests that persist
in similarly harsh climates. Cogbill, et al. (1997) estimated that the elevation of the hypothetical
timberline in the Southern Appalachians in the current climate would be around 8000 feet,
considerably higher than any existing balds. Nevertheless, harsh climate may amplify the effects
of other processes and contribute to keeping balds open.

Understanding of the natural dynamics of Grassy Balds and their current instability is hampered
by the universal history of cattle grazing after European settlement. The current invasion of woody
plants into balds often is associated with the end of cattle grazing as lands were brought into
conservation status in the mid-to-late 1900s, and the removal of cattle is often blamed for the
encroachment. However, the relationship between grazing and grasslands here, as more widely, is
complex. Cases in other regions include not only maintenance by grazers but also cases of grazing
increasing woody encroachment (e.g. Briggs et al. 2002 in tallgrass prairie). Crawford and
Kennedy (2009), looking at ages of trees that had invaded Grassy and Heath Balds at Craggy
Gardens, found rapid canopy closure after cattle were removed in 1925; however, they also found
that tree patches had established in four separate episodes from 1760-1925, though cattle grazing
did not start until the late 1800s. Thus, encroachment apparently was happening both before cattle
arrived and during their presence. Stratton and White (1982) noted that most of the prominent
invading shrubs in Great Smoky Mountains Grassy Balds had been present in the 1930s while
grazing was still occurring, though they became more extensive after release from grazing. Brown
(1941) noted the disappearance of Grassy Bald on the western part of Roan Mountain by invasion
of spruce. He also noted that the upper 50 meters of spruce forest on western Roan Mountain had
few trees more than 150 years old, though trees 300-350 years old occurred farther into the forest
interior. He also noted open-grown forms of trees near the edge. He took this as evidence of
ongoing shrinkage of balds. This would suggest a slow invasion dating back to at least the late
1700s, either early in the period of grazing or perhaps predating it and extending throughout its
duration. Given the history of the Cloudland Hotel on this side of the mountain, we cannot rule out
the possibility either that older trees were cut near the edge, nor that the open area he saw
disappearing beneath spruce invasion in the 1930s had been cleared forest rather than Grassy Bald.

Cattle trample woody plants and at sufficient grazing intensity can prevent succession to forest as
long as they are present. They have numerous other effects, including soil disturbance, selective
increase or decrease of different species of plants, and if grazing is heavy, creation of conditions
favorable to ruderal plants rather than long-lived competitive plants of grasslands. Such effects
reduce the competitiveness of the native grasses, possibly making them more susceptible to
invasion than they were before cattle were introduced. The rapid spread of woody vegetation
immediately after grazing ended, compared to the slower establishment of trees and shrubs at
present, and the slower encroachment in the rare cases documenting pregrazing dynamics, suggest
this.

Most remaining Grassy Balds have some Eurasian pasture species that became established during
grazing, and some have substantial exotic plant cover. Balds that are still actively grazed often
have low plant cover and an increased component of unpalatable herbs. Some of the most prolific native plants invading Grassy Balds, such as *Rubus*, are species associated with severe disturbance and are species that can continue to spread vegetatively once established. Wegl and Knowles (2013) and others before them have argued that the cattle have replaced the role of native grazers in a natural process to maintain balds. However, given the distant taxonomic relationship of cattle to bison and elk, the alteration of their behavior by domestication, and their absence in the natural evolution of bald communities, they are better regarded as an exotic species that may be a means of artificial maintenance comparable to mowing, with its own suite of side effects. The abundance of exotic plants in remote mountaintop locations is an indication of the alteration caused by cattle grazing. Maintenance by cattle grazing can be expected to maintain the state of alteration produced by European settlement. At present, the appropriate natural means of maintaining Grassy Balds is not known, and management techniques must be selected for their ecological effects without benefit of this knowledge.

**Comments:** The previous distinction between a Northern Grass Subtype (*Danthonia compressa* - *Sibbaldiopsis tridentata* Herbaceous Vegetation [CEGL004258]) and Southern Grass Subtype has been dropped. The distinction with the Sedge Subtype has been retained but needs further investigation into whether it is justified given the uncertainties caused by grazing history.

Grassy Bald is a rare and very threatened community type. The debate about Grassy Bald origins raises questions regarding their naturalness, and some scientists regard them as an artificial vegetation type. Because of their distinctive vegetational character, however, and because their origin is not known, they are best regarded as natural communities worthy of protection. While active artificial maintenance is required, such management should be oriented toward imitating natural processes to the extent that they are understood, eliminating exotic species, allowing natural vegetation to recover, and minimizing disturbance to the site.

**Rare species:**

**References:**


