

Features of Carlton Ridge Research Natural Area

(900+ acres plus the 550-acre proposed addition, Section 23)

- The most extensive “forest” of alpine larch in the United States, about 250 acres
- Old-growth whitebark pine forest covering about 350 acres
- These high-elevation forests are virtually unique in occurring on a well-developed soil and supporting luxuriant undergrowth communities, thus representing a **climatic climax** of special importance in ecological studies.
- A continuous gradient of timberline, upper subalpine, & lower subalpine forest types
- A strip of rock-land (coarse talus & bedrock) extending down-slope and occupied by alpine larch, western larch, and their natural hybrids
- An ancient slump supporting an old spruce/ riparian community containing exceptionally large western larch trees

Features found only in the Proposed RNA Addition (Sec. 23)

- Numerous exceptionally old (>500 years) alpine larch and whitebark pine, and >400 year old Engelmann spruce trees
- “Ribbon forest and snow glade” formations, as described in ecological literature
- Wet meadow community with many plants not found in the existing 900-acre RNA

Current and Future Research Values:

Uniquely valuable for ecological studies comparing different forest types associated with well-developed soils, including studies of competitive interactions between the key species

Research and restoration practices to counteract the regional decline of whitebark pine, a candidate for listing as Threatened or Endangered under the ESA

Studies of climatic changes over the past 600 years, and on-going climate change--Alpine larch and whitebark pine produce growth-ring sequences highly sensitive to climatic fluctuations.

Provides a valuable ecological baseline (reference) area for understanding natural conditions in the absence of human influences

Several investigations involving scientists and graduate students from the Rocky Mountain Research Station, universities, and other institutions have been conducted in recent years (see attached list). Proximity of this RNA to major research institutions makes it a prime area for research.

Vulnerability to Impacts from Human Activities:

The exceptional ecological values of the ridgetop alpine larch forest, wet meadow, and other sensitive high-elevation plant communities found in the RNA are highly susceptible to impacts from a variety of human activities, including any large increase in recreation use on adjacent areas.

Publications and Reports on Carlton Ridge Research Natural Area

1917. The conifers of the Northern Rockies. J. E. Kirkwood. U.S. Dept. of Interior, Bureau of Education, Bulletin No. 53.
(features a large photograph of alpine larch on Carlton Ridge)
1963. Zonal great soil groups in western Montana. T. J. Nimlos. Proc. Montana Academy of Sci. 23:3-13.
(describes brown podzolic soil on Carlton Ridge)
1968. Chemotaxonomic investigation of hybridization between *Larix occidentalis* and *Larix lyallii*. A preliminary study. G. M. Knudsen. M.S. thesis, University of Montana, Missoula. (This and the following study used samples of alpine larch from Carlton Ridge.)
1969. Hybridization of western and alpine larch. C. E. Carlson and G. M. Blake. Montana Forest Conservation Experiment Sta. Bull. 37.
1970. Ecology of alpine larch (*Larix lyallii* Parl.) in the Pacific Northwest. S. F. Arno. Ph. D. disserta., Univ. of Montana.
(describes mixed alpine larch-western larch plant community on rocky outcrop, and higher-elevation alpine larch communities on Carlton Ridge in relation to those sampled throughout the species' natural range. The uniquely extensive alpine larch forest on brown podzolic soil is recognized.)
1972. (same title as above). S. F. Arno and J. R. Habeck. Ecological Monographs 42: 417-450.
(slightly condensed version of above dissertation.)
1977. Forest habitat types of Montana. R. D. Pfister and others. USDA Forest Service, Intermountain Forest and Range Exp. Sta., Gen. Tech. Rep. 34.
(Uses data from alpine larch communities on Carlton Ridge to characterize the alpine larch-subalpine fir habitat type.)
1987. Establishment record for Carlton Ridge Research Natural Area, within the Lolo National Forest, Missoula County, Montana. J. R. Habeck. (signed by Forest Service Deputy Chief George Leonard. Unpublished report on file at the Lolo National Forest, USFS Northern Region office, and Rocky Mountain Research Station, Missoula, Montana.
1988. Research natural areas in the Northern Region: A guidebook for scientists and educators. J. R. Habeck. USDA Forest Service, Northern Region/Intermountain Research Station. Review Draft. (at www.rna.nris.state.mt.us/rna)

(provides a synopsis of physical and ecological characteristics of the Carlton Ridge RNA including a map.)
1990. Hybrid larch of the Carlton Ridge Research Natural Area . . . C. E. Carlson and others. Natural Areas Journal 10(3):134-139.

Compiled by S. F. Arno, Rocky Mtn. Res. Sta., retired.

(describes the RNA as a whole, possible expansion of it, and quantifies the characteristics of alpine larch, western larch, and hybrid larch in the rocky outcrop community)

1991. Foliar terpenes of a putative hybrid swarm (*Larix occidentalis* x *Larix lyallii*) in western Montana. C. E. Carlson and others. Canadian Jour. of Forestry Research 21:876-881.
(This study used samples from alpine larch on the upper slopes in the Carlton Ridge RNA and apparent hybrids from the rocky outcrop site to assess the nature of larch hybridization. Complex introgressive hybridization is indicated by the diversity of intermediate forms and characteristics.)
1993. Cone and seed morphology of western larch (*Larix occidentalis*), alpine larch (*Larix lyallii*), and their hybrids. C. E. Carlson and L. J. Theroux. Canadian Jour. of Forestry Research 23:1264-1269.
(The Carlton Ridge RNA rocky outcrop site was used to compare and contrast cone and seed morphology among the two larch species and hybrids.)
1994. Germination and early growth of western larch (*Larix occidentalis*), alpine larch (*Larix lyallii*), and their reciprocal hybrids. C. E. Carlson. Canadian Jour. of Forestry Research 24:911-916.
(Alpine larch trees from the upper slopes of Carlton Ridge RNA were used in experimental cross-pollinations with western larch from another area. Hybrid seedlings thus produced appeared robust and may be useful in revegetating sites marginally too cold for western larch.)
1997. Botanical reconnaissance of Carlton Ridge Research Natural Area: Mid- to high-elevation subalpine habitats. C. M. Stalling. USDA Forest Service, Intermountain Research Sta., Research Note 431.
(This publication provides an ecological characterization of the area and a complete inventory of its vascular plant flora, consisting of 77 species.)
2003. Fire-climate-vegetation interactions in subalpine forests of the Selway-Bitterroot Wilderness Area, Idaho and Montana, USA. K. F. Kipfmüller. Ph.D. Dissertation, University of Arizona, Tucson, AZ.
(www.ltr.arizona.edu/%7Ekurt/research/diss_files.html.)
(Alpine larch ring-width sequences from Carlton Ridge RNA were part of this study, which developed a 748-year reconstruction of average summer temperatures. This and other studies have found alpine larch growth rings to be sensitive to climatic change, and thus potentially useful for studies of global warming.)
2011. Reconstructing annual area burned in the northern Rockies, USA: AD 1626-2008. P. A. Knapp and P. T. Soulé, Geophysical Research Letters, Vol. 38, L17402.