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Picture the Past

Visualizing Long-Term Forest Recovery After Management and Wildfire at Miller Creek Demonstration Forest

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Located on the Flathead National Forest in northwestern Montana, Miller Creek Demonstration Forest (Miller Creek) was an early showcase of the multidisciplinary science and management that now characterizes forest management on public lands (DeByle 1981). Original research was started in the Miller Creek drainage in 1966 as a controlled operational-scale experiment on the use of prescribed fire as a site preparation technique in the ecologically and economically important moist Rocky Mountain mixed-conifer forests (*Abies lasiocarpa/Clintonia uniflora* habitat type; Pfister et al. 1977) of the northern Rockies (figure 1). After decades of research, the site was officially established as a Demonstration Forest in 1989 via an internal U.S. Forest Service Memorandum of Understanding between the Supervisor of the Flathead

Figure 1 1968 prescribed burn. Photo credit: USDA Forest Service.

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National Forest and the Director of the Intermountain Research Station (now the Rocky Mountain Research Station).

Figure 1. 10-acre experimental burning units, fifteen on each of the four cardinal aspects, were established at Miller Creek. Each unit was scheduled for clearcutting, slashing and prescribed burning (1967–1968) with burns planned for different times of year and ages of slash bed (1 or 2 years old). This 1968 image shows an experimental burn on a north-facing unit.

Figure 2. Although smoke production and the hydrological and edaphic consequences of burning were studied at Miller Creek, effects of clearcutting and prescribed fire on conifer regeneration and plant succession were central to the experiment. In these 1969 (top) and 1982 (bottom) images, Peter Stickney, USDA Forest Service plant ecologist and lead investigator on the plant succession study, collects community composition data along one of two permanent transects in this west-facing experimental burning unit. Transects were installed in twenty experimental burning units, with data and images collected annually from 1967 to 1988–2002 (depending on unit) to provide a detailed high-resolution archive of plant community responses to harvest and burning over a 30-year post-treatment timeframe (Stickney and Campbell 2000). Efforts are now underway to reestablish the plant succession transects for continued study of vegetation dynamics.

Figure 2 Vegetation transects, 1969 (top) and 1982 (bottom). Photo credit: USDA Forest Service.

Figure 3. This sequence of images shows forest development following clearcutting and prescribed fire (1968) on a south-facing experimental burning unit. An important finding from research on these units was that reestablishment of conifer cover may be slower on sites treated with low-intensity prescribed fires that leave a largely intact duff layer (Latham et al. 1998; Stickney 1990). The 1968 post-fire image (top right) illustrates these conditions, with obvious residual duff and resprouting common beargrass (*Xerophyllum tenax*), the meristematic tissues of which are typically located within the soil organic horizon. On this site, herbs dominated the vegetation community 10 years following prescribed fire (1979 image), and considerable herb cover remains 20 years postfire (1987 image). Images from 2005 and 2022 show the return of forest cover but also suggest that the gradual reestablishment of conifers, likely in combination with relatively dry site conditions, has produced a spatially complex early seral forest 37–54 years posttreatment.

Figure 4. In 1967, a high-severity wildfire burned seventeen experimental burning units, three of which had not yet been clearcut. This event provided a unique opportunity to assess the effect of wildfire on individual species and to compare the effects of clearcutting and prescribed burning with a natural high-severity disturbance. In wildfire-affected units and those treated with high-intensity prescribed fire, burning modified the germination substrate (producing a mineral seedbed) to favor post-fire conifer regeneration (Latham et al. 1998; Shearer and Stickney 1991). Fireweed (*Chamerion angustifolium*), a rapidly developing offsite colonizer, also exhibits vigorous growth on an exposed mineral soil (1973 image), but by 9 years postfire, the site is dominated by snowbrush (*Ceonothus veltunus*) and conifer regeneration (1976 image). This regeneration was largely even-aged as a result of strong initial establishment rather than a protracted phase of recruitment. Conifer reestablishment at Miller Creek was particularly strong in experimental burning units with plentiful seed supply from nearby old-growth forest or aerial seedbanks in residual live or recently dead trees, including serotinous lodgepole pine (*Pinus contorta var. latifolia* present with western larch [*Larix occidentalis*] in the 1976 image). Rapid

Figure 3 Vegetation transects, 1966 (top-left) to 2022 (bottom right) succession year (SY). Photo credit: USDA Forest Service.

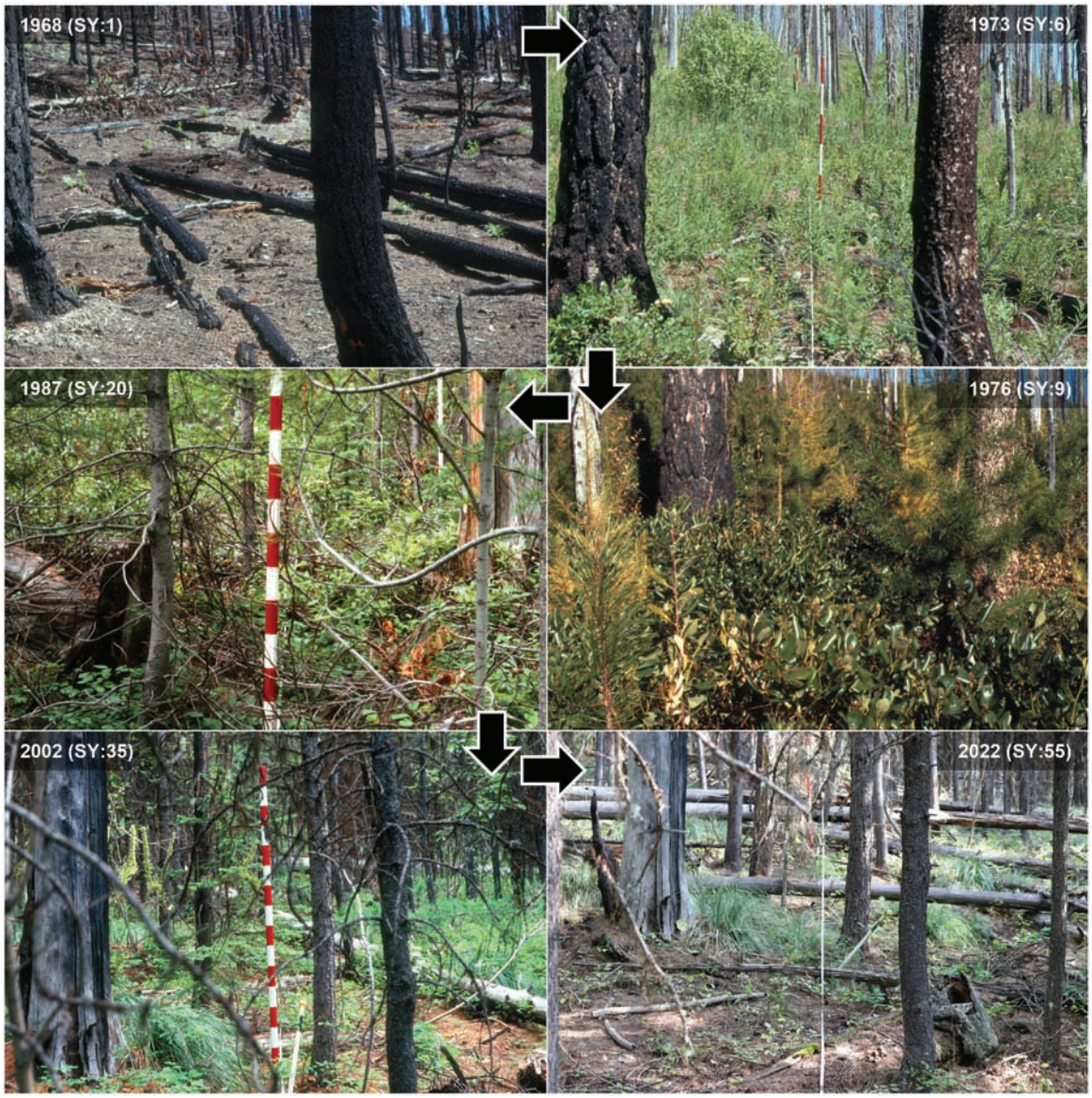

Figure 4 Vegetation transects, 1968 (top-left) to 2022 (bottom right) succession year (SY). Photo credit: USDA Forest Service.

Figure 5 Peter Stickney (left) and Dr. Raymond Shearer (right), 2002. Photo credit: USDA Forest Service.

Figure 6 Tours at Miller Creek Demonstration Forest, 2002 (left, photo credit: USDA Forest Service) and 2021 (right, photo credit: Andrew Reed, USDA Forest Service).

conifer regeneration transitioned these sites into the stem exclusion phase of stand development within three decades of stand-replacing disturbance, evident in the 2002 and 2022 images here.

Research at Miller Creek has documented the reestablishment of Rocky Mountain mixed-conifer forest following a variety of stand-replacing disturbances, and contributed to understanding the role of disturbance, site, and seedbed characteristics on successional pathways. This research continues to the present, but Miller Creek also serves an important educational function for a wide range of audiences (Figures 5 and 6).

Figure 5. Peter Stickney and Dr. Raymond Shearer (former USDA Forest Service research silviculturist and principal investigator at Miller Creek, deceased) alongside one of many interpretive signs on the forest (2002).

Figure 6. These 2002 (left) and 2021 (right) images, taken from a similar position during annual meetings of the Montana Society of American Foresters, demonstrate 20 years of forest change and the continued relevance of these long-term studies for developing local experiential knowledge in educational settings.

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