The Front Range Pine Type

A 40-Year Photographic Record of Plant Recovery on an Abused Watershed

Howard L. Gary and Pat O. Currie

1937

1977

Rocky Mountain Forest and
Range Experiment Station
Forest Service
U. S. Department of Agriculture
Fort Collins, Colorado 80521

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Abstract

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Howard L. Gary and Pat O. Currie

The Front Range of the Colorado Rockies, particularly that portion west of Colorado Springs, has a long history of use and abuse. Exploitation began about the time the United States acquired ownership of the region in 1803 as part of the Louisiana Purchase. The military expeditions of Lieutenants Zebulon M. Pike in 1806 and John C. Fremont in 1842 further opened the country to settlement. The discovery of placer gold and rich gold and silver veins in the mountains west of South Park in the 1850's marked the beginning of rapid settlement, and the large influx of people created a heavy demand for various lumber and livestock products. The discovery of gold at Cripple Creek in 1890-91 marked yet another period of rapid settlement and placed even greater demands on the timber and range resources. As the villages grew into towns, the readily accessible ponderosa pine lands were cut over repeatedly. They were also heavily grazed, and both resources were substantially diminished by 1900.

Extensive timber removal and ground cover reduction by overgrazing had an obvious impact upon the watersheds of the region. Much topsoil is gone from the most accessible portions of the ponderosa pine forests along the Front Range. Most meadows and hillsides are also lined with gullies, and exposed roots of old tree stumps are stark testimony of past erosion. By the early 1930's, demand for high quality water for irrigation and domestic use by the foothills and plains cities led to a general awareness of the importance of watershed rehabilitation and the need to reestablish vegetation cover to reduce sediment loads entering the South Platte and Arkansas river systems. Vegetation cover was also recognized for its esthetic value and maintenance of wildlife populations.

The U.S. Forest Service first assessed soil loss in the region in the mid-1930's to determine the approximate area of eroding lands and remedial actions needed for better watershed management[2]. Part of the overall study included a photographic survey of the existing plant cover on selected watersheds[3]. This paper uses one photographic record to examine the recovery and reestablishment of plant cover after 40 years of protection from domestic livestock grazing and after tree planting on a typical abused watershed in the Front Range pine type.

Study Area

The watershed selected for study was Trail Creek in the Pike-San Isabel National Forest about 3.2 km (2 miles) southwest of the community of Westcreek and about 48 km (30 miles) northwest of Colorado Springs, Colo. (fig. 1). The watershed has an average elevation of about 2,288 m (7,500 feet). The watershed has received only light recreational use during the past 40 years. Ponderosa pine (*Pinus ponderosa* Laws.) is found on the drier sites, and Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) and quaking aspen (*Populus tremuloides* Michx.) on the wetter sites. The sparse woody understory is mainly bearberry (*Arctostaphylos uva-ursi* (L.) Spreng.), true mountainmahogany (*Cercocarpus montanus* Raf.), rose (*Rosa* spp. L.,) currant (*Ribes* spp. L.), cinquefoil (*Potentilla* spp. L.), and yucca (*Yucca* spp. L.). The principal forbs are fringed sagebrush (*Artemisia frigida* Willd.), other *Artemisia* spp., Rocky Mountain pussytoes (*Antennaria parvifolia* Nutt.) and milkvetch (*Astragalus*

[2] *Connaughton, Charles A. 1939. Erosion on the National Forests of Colorado, eastern Wyoming, and western South Dakota. 68 p. [Unpublished report on file at Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.]*

[3] *Johnson, W. M. 1940. Establishment report of range recovery study Pike and Cochetopa National Forests. 13 p. [Unpublished report on file at Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.]*

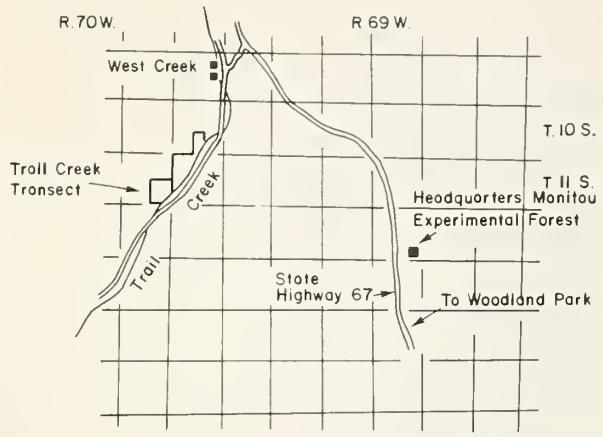

Figure 1.—Location of the Trail Creek photographic survey transect.

spp. L.). Scattered to locally abundant grasses are mountain muhly (*Muhlenbergia montana* (Nutt.)), Arizona fescue (*Festuca arizonica* Vasey), blue grama (*Bouteloua gracilis* (H.B.K. Lag.), little bluestem (*Andropogon scoparius* Michx.), prairie junegrass (*Koeleria cristata* (L.) Pers.), sleepy grass (*Stipa robusta* (Vasey) Scribn.), bromegrass (*Bromus* spp. L.), Kentucky bluegrass (*Poa pratensis* L.), and sedges (Carex spp. L.).

The soil, derived from the underlying Pikes Peak granite, is relatively infertile and coarse textured with little profile development. The unconsolidated soil mantle ranges up to 9.2 m (30 feet) deep. The exposure lies generally north and east with steep rolling slopes. Long-term average annual precipitation for a similar elevation at the Manitou Experimental Forest 9.7 km (6 miles) east of the study area was 404 mm (15.9 inches). About two-thirds of the annual precipitation falls during the growing season, from April through September. Winter snows generally melt within a few days on the south exposures, but may persist on protected north exposures.

Slash fires during the early logging operations were reported to have destroyed many of the seedling pines and much understory vegetation. To replace this loss, ponderosa pine and some Rocky Mountain juniper (*Juniperus scopulorum* Sarg.) seedlings were planted over much of the area in the early 1930's by the Civilian Conservation Corps. The Trail Creek watershed has also been closed to all domestic grazing since 1934. Resident deer and other big game are scarce.

Methods

In 1936, a transect about 5.6 km (3.5 miles) long was established to sample representative conditions over the lower half of the Trail Creek watershed (fig. 2.). The transect was laid out in a zigzag fashion along section and quarter-section land survey lines. At approximately 100-m (5-chain) intervals, a 1.27-cm (½-inch) iron pipe was driven into the ground and given an identification number to help locate the transect. Eleven randomly selected locations were designated as camera points in the initial watershed evaluations. Rock monuments were erected near the camera

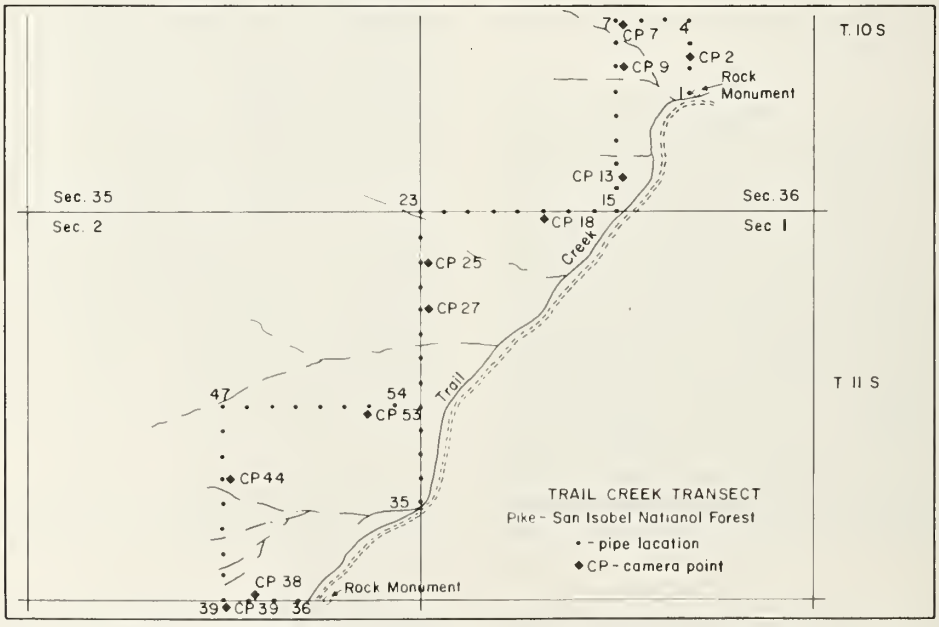

Figure 2.—Camera point locations along the Trail Creek transect.

points to help locate the points in the future. Most of the pipes were found in the 1977 survey. Barring extensive vandalism, it should be possible to relocate all camera points in the distant future.

In August 1937, photographs were made with a 5x7 view camera at the 11 camera points, with 20 photo directions, to illustrate a wide range of watershed conditions. The negatives for the 1937 and 1977 photographs were deposited in the USDA, Forest Service photographic file in Washington, D.C. In the August 1977 survey, all camera points were located, and the associated views rephotographed with a similar 5x7 view camera. In some instances a few small trees and branches were removed from the camera points to obtain the same approximate view photographed in 1937. Care was taken not to destroy or unnecessarily damage the existing vegetation. Some photographs taken in 1977 appear slightly different from the 1937 photos due to camera placement, tree growth, new trees, shadows and small differences in film. Sixteen photo directions are presented in this paper. Identification numbers of the photos used in this paper correspond to the identification used in 1937 (fig. 2).

Results and Discussion

After 40 years of recovery and soil stabilization, a panoramic view of the central portion of the Trail Creek watershed as it appeared in 1937 and 1977 is best illustrated from camera point 9 west and northwest (fig. 3). Most of the stumps visible in the 1937 photographs were fire scarred. Their spacing

Figure 3.—Panoramic view from camera point No. 9. Sheep Nose is in the left background.

indicates the original pine forest was rather open. Topography is typical of the entire watershed and shows the easy accessibility for early logging and downhill skidding using teams of horses. Ground cover in 1937 was mainly bearberry, mountain muhly, and blue grama. The tree cover in 1977 masks the topography but shows the land has capacity for natural regeneration and low grade timber growth, if given sufficient time. A high density mat of bearberry dominates the lower left foreground of the 1977 photos and shows local stabilization of the site.

Widely scattered mats of bearberry were present in most of the early photographs, and most mats were still present and had expanded by 1977 (camera point 38, fig. 4). Bearberry appears to be a long-lived plant when left undisturbed, is tolerant of partial shade, and provides good local soil stabilization. True mountainmahogany, a desirable browse plant, is also now plentiful in the same area. Yucca and some of the grasses appear to have decreased because of partial shade provided by the surrounding trees.

It is of interest to note that areas of bare ground visible in 1937 were generally bare in 1977 (camera point 2, fig. 5). The lack of cover attests to the harshness and shallow soils of many sites which

Figure 4.—Bearberry cover at camera point No. 38.

1937

389305

1977

525078

Figure 5.—Confluence of two drainages at camera point No. 2.

inhibit natural plant establishment. Also, as shown in camera point 7 west (fig. 6), the steep bare slopes which today one might expect to have eroded because of lack of vegetation have changed little in 40 years. Close examination reveals that some sheet erosion has occurred, but the steep slope has not been deeply incised with new gullies. The steep slope was somewhat more rounded in 1977 but appears relatively stable for the average local climate. It appears that regeneration of trees and resultant needle drop have helped stabilize the topography.

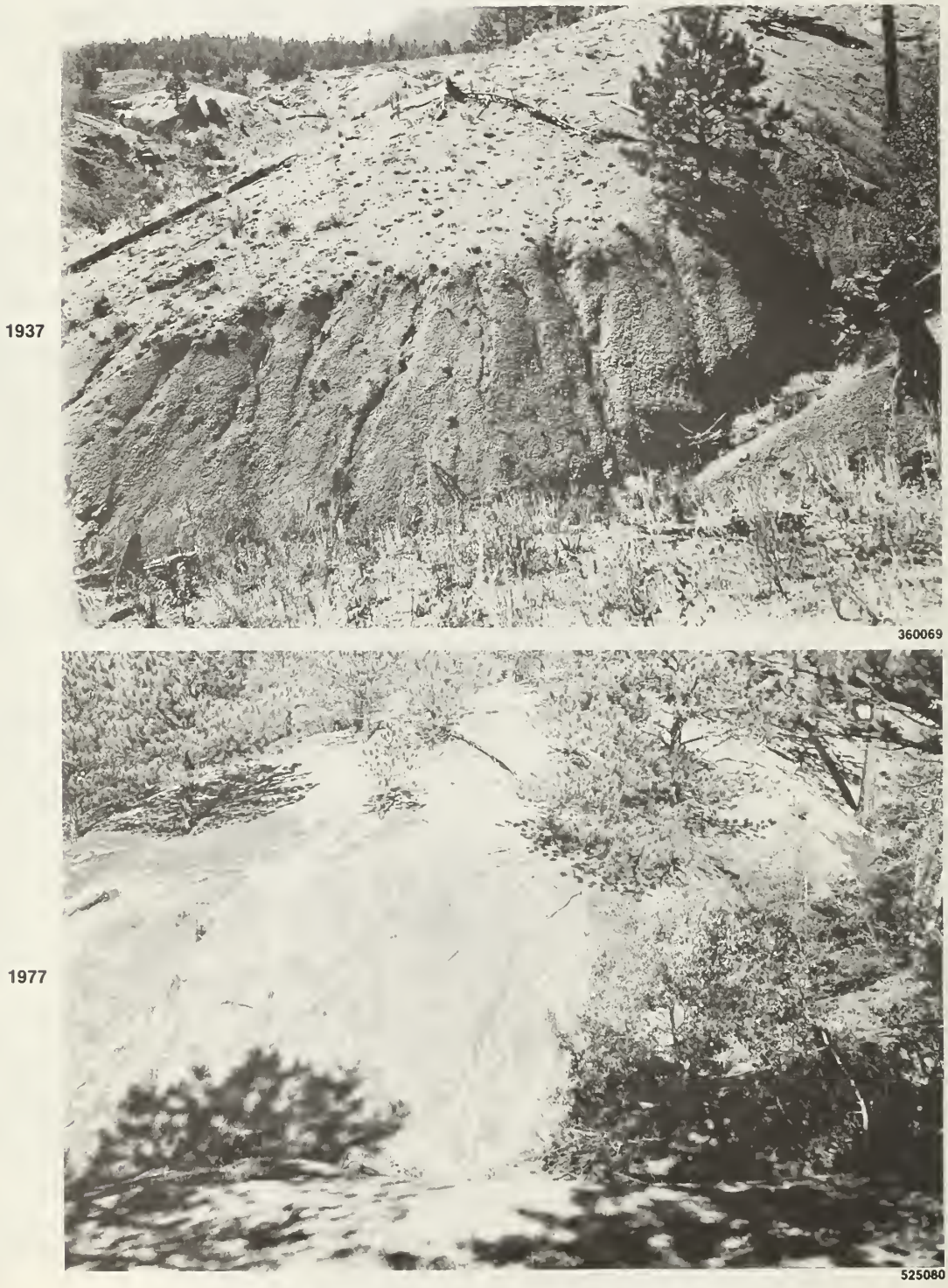

Figure 6.—Steep slope west of camera point No. 7.

In the same area, at camera point 7 north (fig. 7) tree growth was also slow on the bare south facing slope planted to ponderosa pine. Estimated tree heights averaged 4.2 m (13.8 feet), and measured diameters averaged 11.7 cm (4.6 inches). This slow growth appears to be a reflection of the harsh dry microclimate of south slopes. This harshness also limits understory plant growth, and little vegetation was present in 1977. A protective cover of pine needles was forming, however, and in time will add further protection to the site. All photos at camera point 7 (figs. 6 and 7) illustrate that without disturbance these areas are rather stable even though vegetation recovery is slow. Based on the 40-year time span, the amount of cover vegetation or dead organic matter, will be limited for many more decades and will be critical to the preservation of the soil resource.

1937

360068

1977

525079

Figure 7.—Reforested south facing slope at camera point No. 7.

Examples of artificial and natural reforestation on two north facing slopes near the center of the watershed are shown in camera points 9 south and 13 south (figs. 8 and 9). The site shown in figure 8 was planted to ponderosa pine in the early 1930's, and growth of the surviving trees was rated good for the site. The understory vegetation consisted mainly of bearberry and mountain muhly which changed little in 40 years. The apparently more moist site shown in figure 9 was not planted to trees. It may have been thought adequately stocked and that aspen would dominate and stabilize the site, or that protection from grazing alone would allow reforestation to occur. At any rate, the stage of natural reforestation with conifers on this site appears many years younger than that observed on the planted site shown in figure 8. In time, the Douglas-fir also present on the site shown in figure 9 will outgrow any trees now on the planted site.

Figure 8.—View south of camera point No. 9.

Minor soil sloughing is still occurring near the toe of the slope shown in figure 9, but the bankside present 40 years ago appears to be stabilizing. Based on comparison of the two sites shown in figures 8 and 9, it is clear that early successful tree planting on depleted sites will result in earlier watershed stabilization and earlier recovery of wood production. Apparently because of higher soil moisture for the site shown in figure 9, there was a greater diversity of ground cover than at any other photo station. The principal plants were mountain muhly, little bluestem, blue grama, prairie junegrass, *Stipa* spp., *Bromus* spp., Kentucky bluegrass, *Carex* spp., fringed sagebrush, and other *Artemisia* spp.

Figure 9.—North facing slope at camera point No. 13.

The eastern boundary of the Trail Creek watershed was visible from camera point 9 east (fig. 10). The mountain range on the skyline was not heavily logged during the late 1800's because of low quality trees and steep terrain. The foreground area was successfully planted to ponderosa pine in the early 1930's. As observed in most other areas of the watershed, ground cover has changed little as a result of protection from grazing. In the immediate foreground of figure 10, it appears that density of blue grama and *Yucca* spp. has increased slightly and that bearberry has declined. Observations on the ground substantiate this photographic impression.

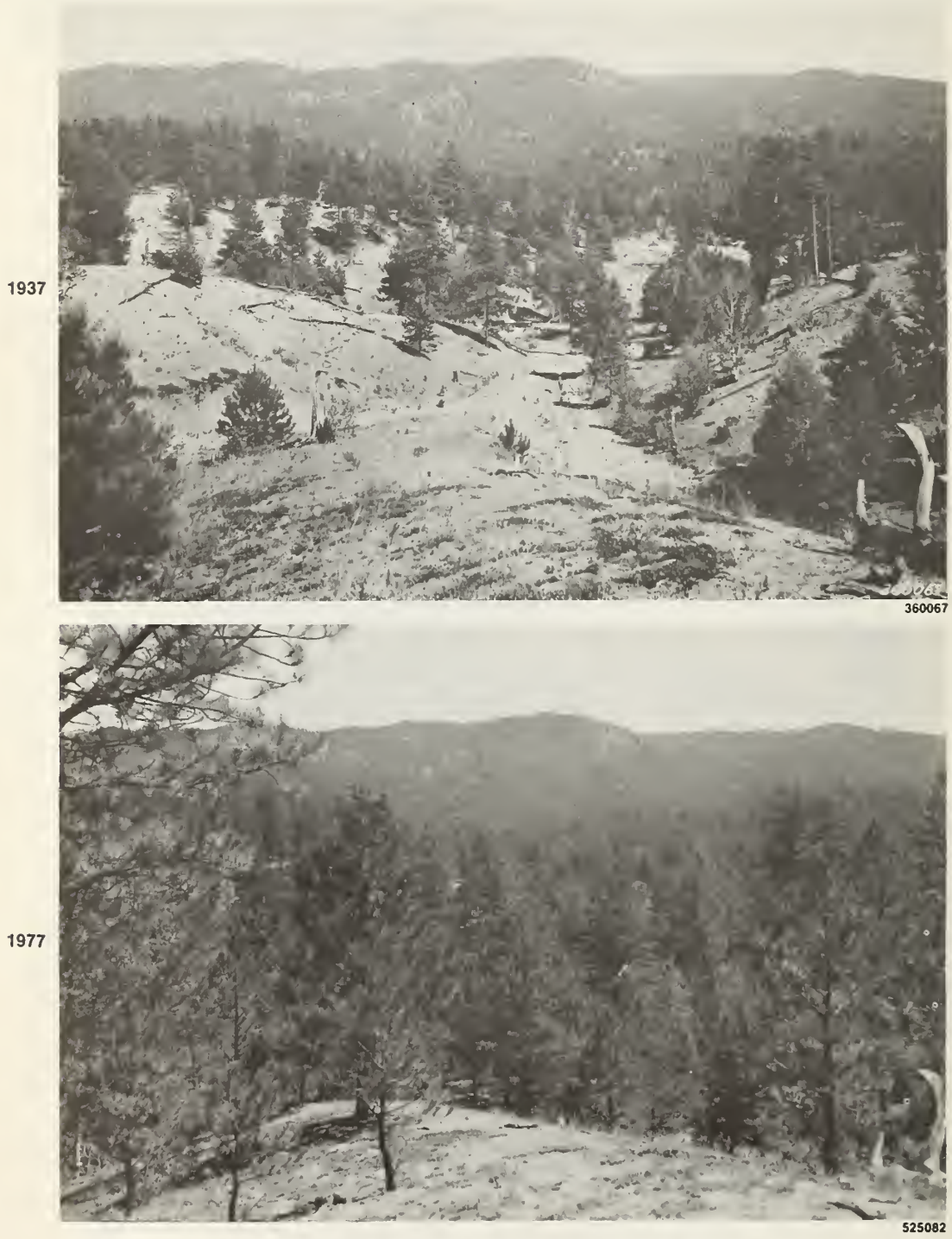

Figure 10.—View east of camera point No. 9.

A panoramic view of plant community change in an open ponderosa pine stand is illustrated by the west-southwest views from camera point 18 (fig. 11). The density of the herbaceous ground cover shown in the foreground increased substantially in the drainage bottom, but only slightly on the slopes after 40 years of protection. The watercourse seems to have stabilized with the increased vegetation. The main grasses today are little bluestem, blue grama and mountain muhly. Bearberry density appears to have increased more than the density of the palatable grasses listed above. True mountainmahogany plants are in greater abundance today than in 1937. Some specific plants are in the same locations, suggesting long-lived plants and some capability to recover from severe overbrowsing. The new trees present in figure 11 in 1977 were the result of natural regeneration, and, in time, true mountainmahogany and ponderosa pine will likely occupy the grassy foreground.

Figure 11.—Panoramic view west from camera point No. 18.

Established ponderosa pine trees in the Front Range increase shade and litter production (needlecast) and are generally detrimental to the growth and/or reestablishment of a herbaceous understory. A dense litter cover does, however, protect the soil mantle, and will generally maintain itself for some period beyond the life of the trees. An example of a heavy litter cover was present at camera point 25 (fig. 12) where encroachment by herbaceous vegetation has changed little in 40 years. The small draw also shows little evidence of sedimentation or erosion.

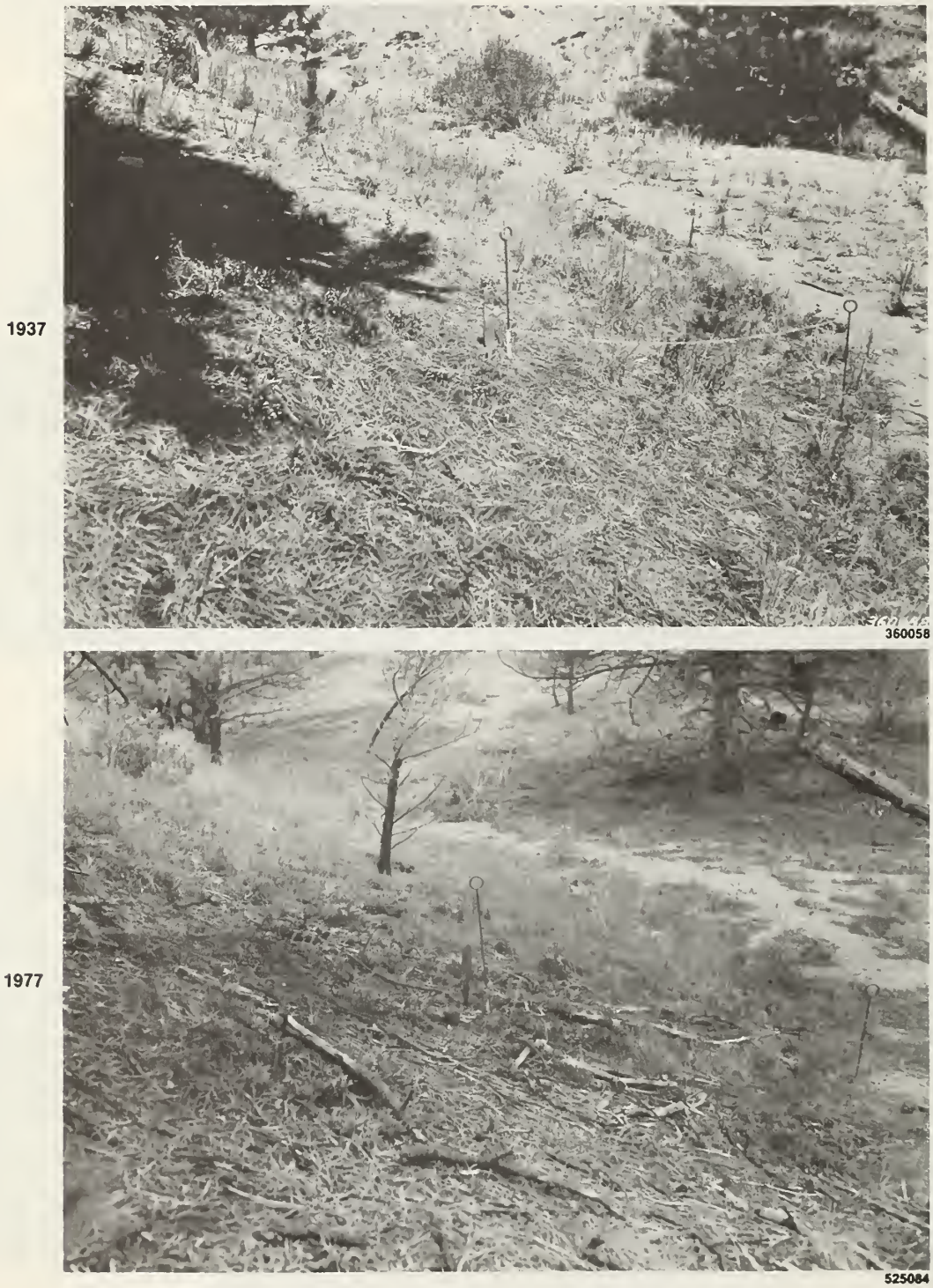

Figure 12.—Litter mat under ponderosa pine at camera point No. 25.

No widespread accelerated erosion was found in any of the arroyos within the watershed. At camera point 13 west (fig. 13), the photograph for 1937 shows a definite channel and general evidence that water periodically flowed down the channel. The channel is well defined today, but there was no apparent evidence of recent water flows. The lack of any recent flows may simply reflect storm size and frequency of occurrence. The lack of erosion may also reflect recent stability of the site. The average diameter of trees in the foreground is 20.6 cm (8.1 inches) and estimated average height is 6.6 m (21.5 feet).

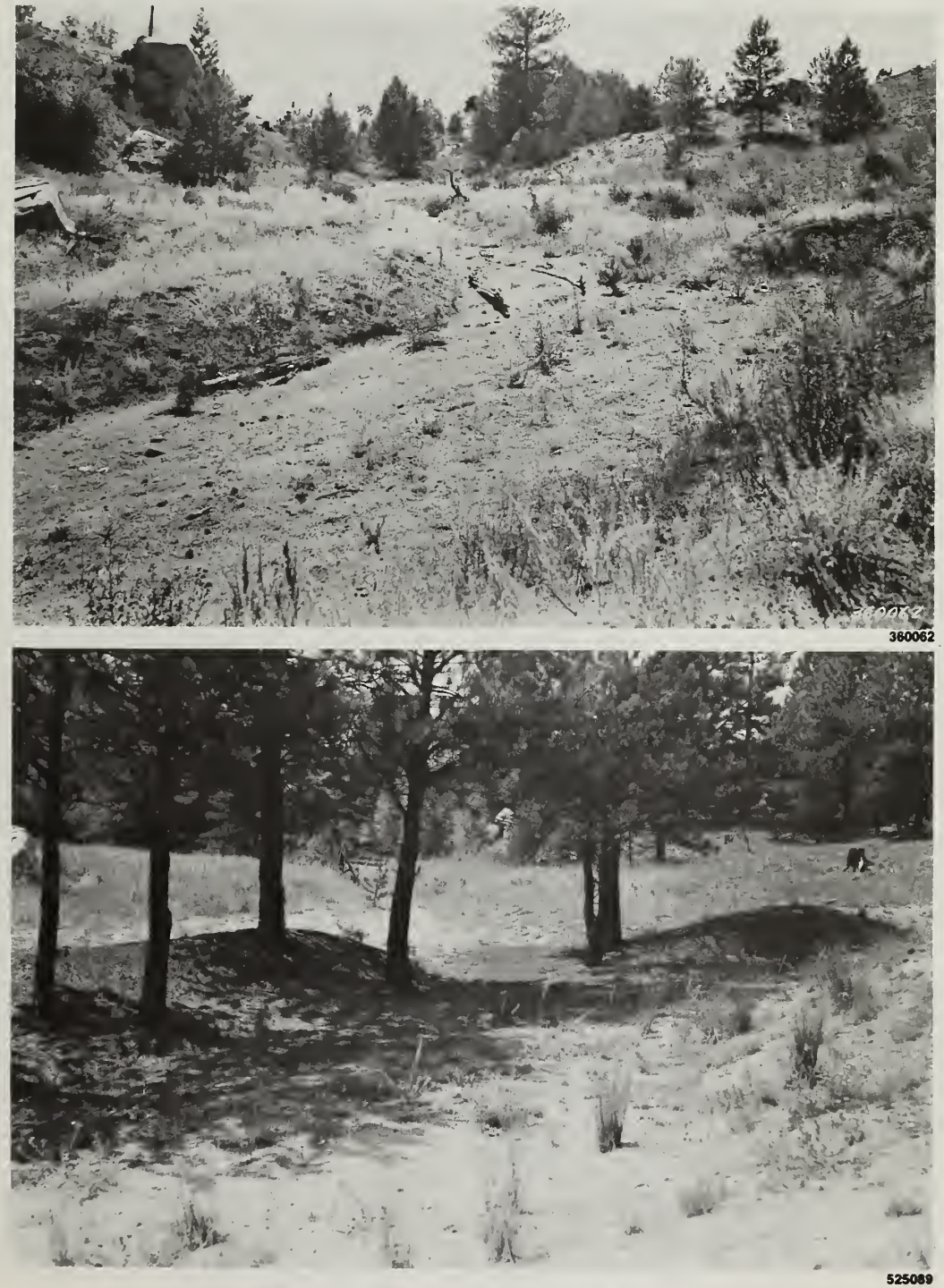

Figure 13.—Drainage west of camera point No. 13.

Two views at the upper reaches of the watershed are shown from camera point 39 north and west (figs. 14 and 15). Most of this area was replanted to ponderosa pine in the early 1930's. The area shown in fig. 15 was also planted at the same time. The presence of aspen on both sites in 1937 provided evidence of good sites for the reforestation efforts. Estimated average tree height in both areas is 3.6 m (11.9 feet) and measured diameter averages 8.7 cm (3.4 inches). The herbaceous ground cover that was present in 1937 appears to be on the decline.

1937

360051

1977

525087

Figure 14.—View north of camera point No. 39. Sheep Nose is in the left background.

1937

360052

1977

525086

Figure 15.—View west of camera point No. 39.

A south facing aspect (camera point 44 south) in the same general area as shown in figures 14 and 15 was also planted to both ponderosa pine and Rocky Mountain juniper (fig. 16). Stumps present over the general region shown in figures 14, 15, and 16 further illustrate that usable timber was produced in the past. Successful reestablishment of ponderosa pine and juniper over the area gives some assurance the area will again produce usable wood products and shrubby ground cover.

1937

1977

Figure 16.—View south of camera point No. 44. Signal Butte is in right background and near upper reaches of the watershed.

Summary and Conclusions

During a 40-year period since livestock grazing was removed from the Trail Creek watershed, there has been little further deterioration of the soil mantle, fair establishment of tree and shrubby ground cover on most sites, and some improvement of litter cover. The success of the vegetative recovery was mainly from tree planting efforts in the early 1930's by the Civilian Conservation Corps. Natural restocking of ponderosa pine appeared slower than planting and was more dependent upon interacting factors such as abundance of seed trees, slope exposure, existing ground cover, soil conditions, appropriate seed bed, and weather. Shrubby and herbaceous plant cover changes were generally less pronounced except for bearberry which increased considerably throughout the watershed during the last 40 years. Today, many individual bearberry plants range up to 3 feet in diameter. Some localized stands have formed a dense ground mat that prevents further erosion and contributes to wildlife habitat.

In general, the photos showed some reestablishment of the more palatable bunchgrasses, such as mountain muhly and Arizona fescue. There was also a decline of grasses in some areas due to litter accumulation and increased shading by the young trees. Most of the areas were originally open forests which would have allowed some grass establishment, but reestablishment of grass may take considerably longer than 40 years with the existing site conditions.

Watershed rehabilitation is a slow process in the Front Range pine type, particularly because of low annual rainfall, low soil fertility and highly erosive soils, especially those derived from granites. In abused watershed areas such as Trail Creek, it appears that we must help nature through planting efforts in order to more rapidly regain the potential productivity of forests and rangelands. Today, abused watersheds such as Trail Creek, remind us that good land use planning and wise use of forest lands are necessary to protect the soil, vegetation, and water resources. Good stewardship of the land will also help maintain downstream reservoir storage and reduce sedimentation of flood control structures.

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Keywords: Watershed management, gully erosion, livestock grazing.

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