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VEGETATION STUDIES IN THE MIDDLE FORK, SALMON RIVER, JUNE
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This report presents descriptions of the grass and shrub dominated communities in the vicinity of the "Flying B" ranch and the Taylor Ranch in June 1988. The purpose of the descriptions in the Taylor Ranch area, which is operated as a research station by the College of Forestry, Wildlife, and Range Sciences, was to document vegetative conditions on the several important nonforested communities in that area for purposes of initiating a long-term monitoring program. The descriptions near the "Flying B" provide comparisons of composition inside and outside of exclosures which were established to exclude livestock and big game at least 30 years ago. Additionally a site in Cave Creek within the Big Creek drainage which had an exclosure was examined to compare vegetation conditions within the formerly exclosed area with adjacent vegetation. Finally, sites which were photographed in 1925 and 1968 in Brush Creek and across from Reservoir Creek were rephotographed for comparisons.

This report is part of an investigation which was initially designed to assemble available vegetation descriptions that had been obtained by University of Idaho graduate students and Idaho Fish & Game personnel over the years, into a description of the nonforested vegetation for this region. However, as we began examining the exclosures and the records, we realized that differences in vegetative conditions occurred inside and outside. Therefore this report also constitutes a first interpretation of causes of the observed vegetation change. This interpretation is offered here for comment and criticism. Additional work and search of records is necessary before a final interpretation is arrived at. Plant species identification is tentative in some cases.

This work was supported through the McIntire-Stennis program at the College of Forestry, Wildlife, and Range Sciences, and the Wilderness Research Center. U.S. Forest Service authorized these studies, which are in wilderness and therefore require that methodology used be appropriate with wilderness values. Idaho Fish and Game provided use of the Mormon Ranch cabin and horse pasture. Gary Power, Idaho Fish and Game, was instrumental in facilitating this work. Salmon National Forest kindly provided records on the exclosures and other reports which greatly enhanced the value of our effort. I thank Bill Guth for providing access to landing strips at the "Flying B", Bob and Cathy Gillihan

and Jerry Jeppson for hospitality and information. Jim and Holly Akenson were instrumental in facilitating our work in the Big Creek drainage. Ray Guse, Tami Lesh, Stewart Markow, and Sarah Topp, student interns at the Taylor Ranch facility, helped in the field. My wife Pat was at every site with me and served as data recorder. As is always the case, this effort was greatly enhanced by the cooperation of everyone and I thank all who helped.

METHODS

HERBACEOUS VEGETATION

We randomly established a transect of twenty, 2 X 5 dm plots on representative sites inside exclosures and on similar sites adjacent. Plots were 1 m apart. Where more than one vegetative type or topographical situation was available in an exclosure, then paired plots were established inside and outside for each type where possible. We examined vegetation to determine if the fences appeared to be influencing characteristics and avoided locations immediately adjacent to fences. At Taylor Ranch, plots were established on selected sites which were deemed appropriate for monitoring by random selection of the starting point within the stand to be sampled.

Canopy coverage of each species was estimated in each plot to be in one of six standard categories: 1, 0-5%; 2, 5-25%; 3, 26-50%; 4, 51-75%; 5, 76-95%; and 6, 96-100%. Canopy coverage is defined as the vertical projection to ground level of the maximum aerial canopy of the species within the sample plot. Data analysis used midpoints of the coverage estimation classes, and standard descriptive statistics for each species on the site was obtained using SAS-PC PROC MEANS. This report presents coverage values, but we have the frequency data available as well.

In the Big Creek drainage, we also clipped bluebunch wheatgrass (*Agropyron spicatum*) to approximately one inch above ground level in twenty, 2 X 5 dm plots located adjacent to the composition transects. Dried standing growth from previous years was separated from green growth of the current year and discarded. All clippings from one site were placed in one bag, which precluded obtaining an estimate of variation, oven dried at 70° C. for 24 hours, and weighed to the nearest 0.01 gm. Data were converted to gm/m² by dividing the weight of the vegetation by 2 (20 2 X 5 dm plots = 2 m²). This information provides an estimate of current year's above-ground production of this dominant bunchgrass.

SHRUBS

Woody plant density was measured in twenty, 4m² circular plots (1.13 m radius) adjacent to the transects established to estimate canopy coverage of herbaceous species. Counts of stems at ground level inside plots were made. Where individual plants had crowns with stems rising

just below or at ground level, and were obviously one plant, then one plant was recorded. This occurs especially with bitterbrush (Purshia tridentata), mountain mahogany (Cercocarpus ledifolius), big sagebrush (Artemesia tridentata), currants (Ribes cereum, R. viscosissimum), rabbitbrushes (Chrysothamnus nauseosus, C. viscidiflorus), and ninebark (Physocarpus malvaceus) in this area.

Height of a representative plant of each species occurring in the plot was recorded. Dead plants were recorded when present.

Twigs, representing current annual growth (CAG) over 0.5 in long were counted for each species inside each plot. The plot was envisioned as a cylinder, and twigs within that cylinder, whether originating from stems that occurred inside or not, were counted. A twig density was calculated to serve as a partial measure of productivity. Lengths of 50 or more randomly selected twigs were measured, air dried, and individually weighed. The entire collection was then weighed and oven dried at 70° C for 24 hours and reweighed. The percent that oven dried weight was of the air dried weight was multiplied for each twig weight to convert to the oven dried weight for each individual twig. Linear regressions of weight on length of twigs were calculated using PC-SAS PROC GLM.

Photographs were taken of all stands, and a description of the location of each transect was recorded.

RESULTS

TAYLOR RANCH DESCRIPTIONS

Eight transects were established in the vicinity of the Taylor Ranch (Table 1). These transects represent stands dominated by mountain mahogany, bitterbrush, big sagebrush, bluebunch wheatgrass, and Douglas fir (Pseudotsuga menziessi), all major upland plant communities in the area. Only one stand was selected to represent a vegetation condition this summer, and it is recognized that replicate stands would be appropriate to establish. Also, the high standard deviations recorded for coverage values for most species indicate that number of plot samples should be increased to ensure better detection of differences between years.

Sage Bench. This stand, on the east side of Rush Creek less than 0.5 mile from its mouth, consists of a relatively tall stand of big sagebrush over a grass union (Table 2). Junegrass (Koeleria cristata) is the most common grass, with Letterman's needlegrass (Stipa lettermani), Idaho fescue (Festuca idahoensis) and bluebunch wheatgrass all comprising over 5% canopy coverage. Production of bluebunch wheatgrass was 49 gm/m², not especially high in comparison with other stands we sampled (Table 3), but consistent with the lower

coverage values in this stand when compared with the other grasses.

This stand shows evidence of alteration by grazing, considering the high coverage values of pussy-toes (Antennaria rosea), and the presence of six-week's fescue (Festuca octoflora), and the higher coverage of needlegrass. Big sagebrush is the only shrub present on this site (Table 4). Approximately 23% of the big sagebrush plants are dead.

The tentative assessment of the status of this stand is that if grazing pressure does not intercede, a reduction in big sagebrush and the forb and grasses mentioned above will occur, and Idaho fescue and bluebunch wheatgrass will increase. Tentatively, this is judged to be a successional stage of a big sagebrush dominated habitat type, possibly big sagebrush-Idaho fescue.

Pioneer Creek. This stand was selected as being representative of the Douglas fir/ninebark habitat type on a northerly exposure in Pioneer Creek. The overstory is a mature stand of Douglas fir. Twenty trees measured in the vicinity of the transect averaged 10.9 inches DBH (S.D.=5.9, range 2-24). Ninebark dominates the taller shrub union, with serviceberry (Amelanchier alnifolia) and currant present. Spirea (Spirea betulifolia) and common snowberry (Symphoricarpus albus) comprise the lower shrub complex. Sedges and club moss are the most common ground-level plants. The stand is essentially undisturbed except for some tree removal (firewood, cabin logs).

Mile High. The Mile High area immediately west of Cabin Creek is owned by Idaho Fish & Game and is an important elk wintering area. Old fields with smooth brome (Bromus inermis) are present on the more gentle terrain, and native rangeland occurs on the steeper slopes. The transect is on native vegetation, on a slope facing due south. The highest canopy coverage of bluebunch wheatgrass was recorded on this site. Cheatgrass (Bromus tectorum), junegrass, lupine (Lupinus sereceous) and the annual willow herb (Epilobium paniculatum) are common. Both rubber and green rabbitbrush (Chrysothamnus nauseosus and C. viscidiflorus) are present, the former occurring at a density of 1.65 (S.D.= 1.63) and the latter at 2.75 (S.D. = 5.34) stems/4m² (data not provided in table 4). The presence of rabbitbrush suggests big sage could occur here, and that fire may have excluded it from this immediate area, which is near the old buildings. Tentatively, this is judged to be a late seral stage of a big sagebrush dominated habitat type.

West of Airstrip. A variety of shrubs occur on this northerly exposed site, which has a sparse overstory of Douglas fir. Snowberry, ninebark, serviceberry, currant, and bitterbrush are the most common shrubs. Wood's rose (Rosa woodsii) occurs in patches. Snowberry and bitterbrush are producing the most growth at this time. A luxurious

growth of Idaho fescue is prevalent in the herbaceous union, and balsam root is also common. Bluebunch wheatgrass production is high.

I tentatively judge this to be a disturbed (fire) stage of the Douglas fir/ninebark habitat type, on the dry side. The exposure is generally north and the slope is steep. In draws along this slope, fir regeneration is prevalent. Mountain mahogany, which is distributed along this slope, is not reproducing and appears to be "off site", with plants established when a past disturbance created favorable conditions.

Ram Basin. This site is a vegetated portion of a cliffy slope which is dominated by mountain mahogany. Access requirements influenced location of the transect, but conditions encountered should be representative of similar more gently sloping terrain on this cliff, which is commonly used by bighorn sheep. Mountain mahogany plants average six feet tall, are well browsed where accessible, but produce the most current growth of woody material on this site. One big sagebrush plant, five feet tall, was located in the plots. A prostrate currant (Ribes viscosissimum) is common.

Cheatgrass dominates the understory. The site is underlain by a loose mixture of soil and rock which likely shifts extensively during the year, making a disturbed seedbed ideally suited for cheatgrass establishment. Some wheatgrass is present, but production estimates did not seem useful to obtain because of its sparse distribution. Other species are annuals or prostrates adapted to the severe growing conditions exemplified on this southerly exposed site. This is tentatively judged to be a mountain mahogany dominated habitat type.

Cliff Creek. The lower Cliff Creek site is a bluebunch wheatgrass habitat type, with a vigorous stand of that species characterizing the site. Production of bluebunch wheatgrass was 89.0 gm/m², the highest recorded. The stand is southerly exposed, on a steep slope, and has no evidence of a shrub component. Lupine and a pentstemon are prevalent.

Cliff Creek Bench. This stand is located on the second bench from Big Creek on the east side of Cliff Creek, an area now heavily used by big game. Cheatgrass dominates the site, but bluebunch wheatgrass and balsam root are common. The site reflects the grazing it receives from the big game, with wheatgrass production being low. Current vegetative composition reflects past livestock grazing pressure as well. The site is tentatively considered to be a stage of a bluebunch wheatgrass habitat type, pending evidence that shrubs may have occurred in the past.

EXCLOSURE DESCRIPTIONS

Cave Creek. This site includes a formerly exclosed area and adjacent areas which were unprotected. The site is a gentle, west-facing exposure. The major difference between the formerly exclosed portion and adjacent sites is the shrub component (Table 5). Big sagebrush density is approximately 2.5 times greater on the formerly exclosed site. Dead sagebrush stem density is much greater. The height of big sagebrush plants on the formerly exclosed site is double that on unprotected areas.

Bitterbrush heights are greater on the formerly exclosed site, but stem densities were recorded as being identical. However, twig density was higher outside than on the formerly exclosed site. Dead stem density was negligible outside and very low inside for this species.

The major difference in the herbaceous union was the high coverage of cheatgrass outside of the formerly exclosed area, and the very low coverage inside. The high standard deviation outside suggests a high variation in abundance, but the species was present in 16 of 20 plots sampled. Coverage of other species was not appreciably different, nor was dry matter production of bluebunch wheatgrass.

These differences between the formerly exclosed site and the unprotected site adjacent strongly imply that this general area is in a successional status and has been influenced by past disturbances of grazing and perhaps fire. The consistency of bitterbrush density suggests this species is a dominant, and together with the high coverage of bluebunch wheatgrass indicates a bitterbrush/bluebunch wheatgrass habitat type. The high amount of big sagebrush in the formerly exclosed area suggests grazing disturbance in past periods allowed the increase of this species which was then protected by fencing from game browsing, which in turn essentially retarded succession by allowing retention of the sagebrush. Big sage is still undergoing substantial mortality inside the formerly exclosed area, but mortality appears to have more or less stabilized at a low level outside. The greater coverage of cheatgrass outside of the enclosure may be explained by the disturbance of both past livestock and perhaps ongoing wildlife grazing, but I suspect that this species may diminish in coverage on this site through time. An old cabin occurs near the mouth of Cave Creek, and it is close to the Mile High and Cabin Creek developments, indicating that livestock grazing of days gone by was likely important in influencing vegetation trends.

"Flying B" Enclosure. The outside transect was established north of the enclosure, which occurs on the ridge above the air strip owned by the "Flying B". This area receives extensive use by mule deer and is also grazed by horses. The enclosure was established in 1949. Bitterbrush was

planted inside the enclosure. The area is generally east-exposed.

The most striking aspect of the site is the dominance of balsam root, both inside and outside the enclosure (Table 6). The low coverage of bluebunch wheatgrass, club moss (Selaginella densa), Idaho fescue, and needle and thread (Stipa comata) outside of the enclosure reflects responses to grazing pressure as compared to inside the enclosure. Threetip sagebrush outside is 30% the height inside, and twig lengths are 47% as long outside as they are inside. This species is a palatable deer browse.

Bitterbrush plants inside the enclosure are tall, contain moderate amounts of dead stems, and are essentially unproductive. No CAG was measured over 0.5 inches. In contrast, bitterbrush plants outside were lower, contained high amounts of dead stems, and CAG averaged 1.9 inches long, the converse of three-tip sagebrush which was shorter and less productive outside than inside.

The site shows evidence of extensive current and past grazing. I hypothesize that this site is a threetip sagebrush/Idaho fescue habitat type, with bitterbrush being seral or existing at low density in the undisturbed state. Bitterbrush is essentially not reproducing on the site (one plant 14 inches tall had seeded on bare soil inside the enclosure). Deer use is probably responsible for the lower heights and shorter twig lengths of threetip sagebrush, and the lower heights and longer twig lengths of bitterbrush outside the enclosure when compared with plants located inside. This suggests that threetip sagebrush is more sensitive to grazing pressure than bitterbrush. An alternative explanation for the low heights and vigor of threetip sagebrush is that both deer and horses are grazing it, while only deer use the bitterbrush. Herbaceous conditions outside the enclosure are attributed to grazing by horses. Questions concerning conditions which allowed for the prevalence of bitterbrush on this site arise, and may be attributable to past grazing history. I think the bitterbrush that was planted on this site was planted in areas where that species is not especially suited to grow on, as the bitterbrush inside the enclosure is obviously not vigorous and has not been so for years, based on its form.

Sheep Creek Enclosures. The small enclosure (20 X 20 feet) located inside the major enclosure was established in 1930, while the larger enclosure was established in 1961, thereby providing comparisons of 59 and 27 years of protection with unprotected conditions. Crested wheatgrass (Agropyron desertorum) was planted inside the small enclosure and 15 plants remain (Table 7). Ten live and four dead bitterbrush plants occur in the small enclosure, and average 90.6 inches tall as compared to 66.3 inches height of seven bitterbrush plants immediately adjacent on an unexclosed site. Three

Perhaps the most striking differences in the herbaceous union inside and outside the small enclosure is the dominance of needle and thread outside, and the higher coverage of lomatium, phlox, and sweet clover inside. Just what this is attributable to is unclear, but again different grazing regimes, past and present, and the relatively small size of the enclosure which may enhance moisture retention, are likely implicated.

The larger enclosure provides similar comparisons, and includes more species (Table 8), but lomatium is less prevalent in the large enclosure than in the smaller one. Also Mentzelia dispersa is common on this site and was not observed elsewhere in the Middle Fork enclosures. Finally, if grazing is to be considered the major factor influencing comparisons between excluded and unprotected areas in this canyon, why should Eriogonum heracleoides and Phlox longifolia, both relatively unpalatable half-shrubs, be more prevalent inside the enclosures than outside? Other factors, including competition for moisture between plant species, successional patterns of vegetation following protection from different kinds of disturbances, different soil and moisture regimes among the various enclosures (this site is the highest and is located on a ridgetop), climatic change from periods of relative drought to periods of high precipitation, are likely involved.

Forty three live bitterbrush plants occur inside the large enclosure and are comparable in height to plants inside the small enclosure. Dead plants constitute 23% of the standing bitterbrush stems. Needle and thread characterizes the understory inside the enclosure, while a large variety of species constitute relatively equivalent proportions of the vegetative cover. Cheatgrass occurs primarily beneath bitterbrush plants, while needle and thread occurs in openings between shrubs, where effects of shade and perhaps moisture competition are less. The higher coverage of club moss inside this enclosure is again considered a reflection of the lack of disturbance of the soil surface. This site is considered primarily a bitterbrush/needle and thread habitat type, with some portions being bitterbrush/bluebunch wheatgrass. This may be the most severe site enclosed in the general area.

Reservoir Creek Game Enclosure. The Reservoir Creek enclosures were established in 1949. The game enclosure is located on the west and southerly exposed slopes south of Reservoir Creek, and contains a variety of sites and at least two habitat types. Outside replications on comparable adjacent sites are difficult to locate, and finally one outside replicate of the bitterbrush stand in the enclosure was located on an adjacent slope north of the enclosure.

The crest of the ridge inside the enclosure was considered a threetip sagebrush/Idaho fescue habitat type (Table 9). No replicates were available for this community adjacent to the enclosure. The aspect is northwest. The

community consists of a vigorous stand of Idaho fescue, with bluebunch wheatgrass, Sandberg bluegrass, hawkweed (Crepis atrabarba), threetip sagebrush, and bitterbrush all comprising between 3 and 10% canopy coverage.

The rest of the enclosure faces south to southwest, and likely contains bitterbrush/bluebunch wheatgrass and perhaps bitterbrush/needle and thread habitat types on the more xeric sites. The higher canopy coverage values of bluebunch wheatgrass and bitterbrush outside the enclosure are from the adjacent slope and may reflect less severe growing conditions of that slope. Bitterbrush plants in the enclosure are most decadent on sites with the highest grass coverage. The youngest and thriest plants inside this enclosure occur on the most severe sites where grass cover is lowest. There are few plants less than a foot tall which indicate seedling establishment, but more commonly bitterbrush plants are reproducing by layering. Plants outside the enclosure show 3 to 4 times the leader growth of those inside and are intensively browsed. However, the amount of dead and decadent material of this species is not much different inside or outside, with the difference being related to associated grass cover. Mule deer are the major users of this site, and a few pellet groups occur inside the enclosure.

Reservoir Creek Stock Enclosure. This enclosure is on a gentle slope below the game enclosure and further south. It appears to be a bitterbrush/bluebunch wheatgrass habitat type, and may contain some bitterbrush/needle and thread. There is abundant deer use in this enclosure and some horse use-it was apparently used as a corral by hunters at some time in the recent past. On the east side, bluebunch wheatgrass exhibits the highest coverage values, both on a representative site which is replicated outside and on an unreplicated severe site inside. Cheatgrass has similar coverage values in the protected, unprotected, and severe protected sites. Needle and thread has a much higher coverage value on the unprotected site than inside, while rubber rabbitbrush has higher coverage inside than outside. The more severe site has lower coverage values of bitterbrush, and big sage is present, suggesting a big sagebrush/bluebunch wheatgrass habitat type. I suspect that needle and thread is a high seral dominant, which ultimately would be replaced by bluebunch wheatgrass, on this site.

The south side of this enclosure and the adjacent unprotected site is dominated by needle and thread, with bitterbrush and big sagebrush in the overstory. Although big sage was not recorded in the plots, it occurs on the site and is taller, less decadent and exhibits longer leader growth inside the enclosure than outside. The plants outside the enclosure are extensively browsed.

Wyeth Burial Site. This burial site, excluded from grazing by a low pole fence, occurs on a flat bench across from the

Wyeth Burial Site. This burial site, excluded from grazing by a low pole fence, occurs on a flat bench across from the "Flying B" on Idaho Fish & Game Department land, and is approximately 10 by 20 feet in size. It is surrounded by a big sage dominated community, but only 1 small sagebrush plant occurs inside the fence. Needle and thread grass is dominant, with coverage estimated at over 80%. Cheatgrass is present with coverage estimated at 10%. Some bluebunch wheatgrass is present at 5% coverage. Three dead rubber rabbitbrush plants occur on this site. There were no forbs present. This obviously disturbed site, now dominated by needle and thread, may indicate that species is seral to bluebunch wheatgrass on these benches. If this is the case, then at least some of the benches along the river are likely a big sagebrush/bluebunch wheatgrass habitat type, to which this site would presumably succeed if left undisturbed.

PENCE PHOTOGRAPHIC SEQUENCE

The Pence photographic record represents a sequence of photographs taken by Thomas Pence, then of Mackay, Idaho, in October 1925, and Dan T. Pence, then working for the Salmon National Forest, in December 1968. The area covered includes Brush Creek, to Short Creek on the west side of the Middle Fork River in the vicinity of the "Flying B". These sites were relocated in June 1988 and photographed again. The original typewritten report, written by Dan Pence who was forester at Cobalt Ranger District at the time, is on file at the Supervisor's Office, Salmon National Forest. I have copies of this report, including newly taken photographs of the photographs included in the report, which are duplicates themselves of the originals. The following comments include descriptions written by Dan Pence plus my 1988 photographs with tentative interpretations.

Unfortunately, the photographs do not reproduce well on a standard copy machine. However, for the purposes of this report, figures showing the sites are included anyway.

The sequence in Figure 1 was taken from the road up Brush Creek just below the gate to the "Flying B" property. The reference is the unique rock formation in the upper right side of the photographs, which appears on the ridgeline. Dan Pence reported a decrease in bitterbrush and an increase in rubber rabbitbrush was apparent from 1925 to 1968. The 1988 photograph suggests that both species have declined on this site in the intervening 20 years.

Figure 2 is in the same area but is taken from the road between the gate and the main water line valve which regulates water flow to the ranch buildings. The photographs are of the hillside northwest of the ranch buildings. The decline in bitterbrush and rabbitbrush is evidenced in this photographic sequence also.

Figure 3 represents photographs of the west-facing slope between Brush Creek and Short Creek. The 1925 photograph was taken of a mule deer in the upper left

portion of the photograph which is not visible on the reproductions. The site was not photographed in 1968 because of difficulty in relocating it in the short time available for the task. We relocated it by using the curvature of the ridge line and assuming that the location of the photographer was along the pack trail. A considerable reduction in bitterbrush is apparent in the contrast from 1925 to 1968. Height of remaining bitterbrush is considerably greater now than 63 years ago.

Figure 4 represents a site along the old pack trail between Bernard Creek and Short Creek which is the last major draw before the trail drops into Short Creek, above the cliffs at the lower end of the "Flying B" landing strip. The 1925 photograph is of a pack string owned by the Wilson Brothers, who were traveling from Mormon Ranch to Soldier Creek at the time. The photographs suggest a decline in bitterbrush from 1925 to 1968, which continues to the present. Rubber rabbitbrush apparently increased from 1925 to 1968 and may be declining over the past 20 years. Hawthorne (Crataegus douglassi) has expanded below the cliffs along the trail. These photographs will be examined more intensively at a later time.

The 1968 Pence report states that the Wilson Brothers owned the Mormon Ranch and the "Flying B" property in 1925. The brothers wintered cattle in the area and there was substantial amounts of horse grazing also. The Wilsons were reported to have lost up to 500 head of cattle during the 1928 winter, a severe one in this area, after which they sold these properties.

Thomas Pence reported that deer were abundant in 1925, and appeared less abundant in 1968. He felt there was less bitterbrush in 1968 than in 1925, and also less grass cover.

DISCUSSION

The major conclusion to be drawn at this stage is that much of the non-forested vegetation along the Middle Fork and in Big Creek which we examined is undergoing a transition from past disturbance and should not be considered unaltered. The areas we examined have a relatively long history of use by humans and their associated livestock, so it should not be surprising that the vegetation has been modified through this use. The area around the "Flying B" was known to serve as a winter range for up to 1200 head of pack stock which supplied mining operations in the adjacent higher country. Farming was practised at these inholdings and the associated livestock were no doubt left to graze the adjacent rangelands without much thought being given to the effects on the vegetation. Conclusions drawn beyond these are tentative and will likely be modified as additional work and insights are obtained.

Parts or all of some exclosures do not appear to be within bitterbrush dominated habitat types, but rather bitterbrush stands appear as seral communities. The

essentially to demonstrate the adverse effects that game, mainly mule deer, were having on the bitterbrush and other vegetation, or were established to help judge the effect that livestock grazing was having. Some 40 years after their establishment, considerable changes within have occurred, most especially that the bitterbrush plants are quite decadent, and shifts in plant composition in the understory are also readily apparent. The exclosures were established not too long after livestock grazing was reduced in the areas and originally excluded vegetation which reflected the effects of this kind of grazing pressure, plus the grazing pressure of the high mule deer populations extant at that time. The suspicion is that these high mule deer populations were basically attributable to alterations of the shrub complex by the earlier livestock grazing. This type of grazing would likely have favored invasion of big sagebrush, rabbitbrush, and bitterbrush onto sites adjacent to the ones occupied prior to the advent of livestock in the area, and would also have favored increases of these shrubs at the expense of the more palatable grasses and forbs on sites formerly occupied as well. An alternative explanation that fire suppression may be implicated along with grazing in enhancing shrub communities, is also tenable, but here we assume that fire suppression was effective in the 1910's and 1920's. Now we see shrubs becoming decadent over thrifty stands of grass in the exclosures, and shifts in the understory composition from species like cheatgrass and needle and thread to bluebunch wheatgrass and the associated forbs. While mule deer populations remain relatively high, they are lower at some undetermined level from earlier years, and it is significant that an elk population is building. One would expect the transition from shrubs to grass that appears to be occurring to favor elk over mule deer. Current fire management policies should enhance that transition.

Thus, major habitat change attributable to the varying kinds of grazing pressures that have existed in this area over the years is hypothesized to be the major precursor to changes in big game populations, rather than the big game being the major cause of vegetation change. This represents the working hypothesis which we will explore more thoroughly in subsequent work. The exclosures serve as a valuable guide to plant succession, and the task is to examine potential reasons for the observed vegetation differences.

Finally, climatic change, including the major drought of the 1930's, quite likely substantially affected these plant communities. Bitterbrush, which is seral or occurs at low density in some habitat types would be expected to proliferate during that period, and would also have increased where it is a climax dominant. During periods of high moisture, the associated bunchgrasses would be expected to be favored. There is good reason to believe that vegetation change will occur in response to natural climatic

fluctuation in the absence of human interference, especially since fire frequencies will also be affected by these climatic changes. When climate predisposes higher fire frequencies, then the combined effects will be reflected in vegetation condition. I subscribe to the concept that we are dealing with a fluctuating climate which will predispose change in the vegetation complex, and subsequently the animal complex, which will not be replicated in the future. This contrasts to the concept that change occurs as a long-term cyclic pattern with conditions repeated at an as yet undefined long term interval. Human intervention in this fluctuation by alteration of the climate through pollution will have to take this natural fluctuation into account. There is reason to believe that these nonforested communities, which appear to be sensitive to moisture changes and may demonstrate changes through relatively short time periods in comparison with other communities less sensitive, are worthy for consideration for long term monitoring. This is especially so because of the record that is already available from them, but first we should establish the causes for their current condition.

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TABLE 1. LOCATIONS OF TRANSECTS ESTABLISHED IN JUNE 1988 IN THE VICINITY OF THE TAYLOR RANCH, MIDDLE FORK SALMON RIVER, IDAHO.

all azimuths uncorrected.

RUSH CREEK: above first switchback from bottom, 185° azimuth to high spot on Rush Creek, 321° azimuth to Horse Hill. transect runs 240° up hill.

RAM BASIN: azimuths from initiation are 335° up draw to Horse Hill, 158° to high spot on Rush Creek, east of Creek, 110° to Dave Lewis Ridge. transect runs along 120° azimuth.

TAYLOR RANCH ABOVE AIRSTRIP: 38° to high point above cliff Creek, 331° to high point across Big Creek. transect runs on 260° azimuth uphill.

MILE HIGH TRANSECT: transect is above cabin, to the southeast, on native vegetation. 118° azimuth to Rush pt. Lookout, 251° to big Douglas Fir. transect runs 60° on a south aspect.

PIONEER CREEK: Along trail, 0° to high spot across Big Creek, post is behind two trees. transect runs on 240° azimuth .

SAGEBRUSH BENCH: NW of Taylor Ranch on east side of lower Rush Creek. 235° to high point above switchbacks on Rush Creek trail, 333° to high point across Big Creek. transect runs 160° from north side of bench.

CLIFF CREEK: West of creek above Big Creek Trail. 134° to Eagan Point, 158° to windsock. 60% slope, transect runs along a 192° azimuth.

CLIFF CREEK, SECOND BENCH: 1st small knob on second bench. 252° to Horse Mountain, 135° to eagan Point, 172° to highest point in head of Rush Creek. Transects is located on a 170° aspect, runs on a 75° azimuth.

Table 7. Sheep Creek, smallest enclosure, Middle Fork, June 1988

Canopy coverage of species > 5%	inside	outside
<i>Agropyron desertorum</i>	4.5 ± 19.5 (15 plants)	0
<i>Agropyron spicatum</i>	3.4 ± 9.3	0.8 ± 3.3
<i>Bromus tectorum</i>	4.0 ± 9.1	9.9 ± 20.6
<i>Lomatium foeniculatum</i>	6.3 ± 11.9	0.3 ± 0.8
<i>Phlox longifolia</i>	20.8 ± 30.2	0
<i>Purshia tridentata</i>	12.6 ± 30.7	15.8 ± 34.2
<i>Selaginella densa</i>	54.5 ± 39.9	31.6 ± 38.1
<i>Sisymbrium altissimum</i>	4.3 ± 14.1	0.1 ± 0.6
<i>Stipa comata</i>	3.8 ± 6.7	26.3 ± 28.3
 <i>Purshia tridentata</i>		
Height (in)	90.6 ± 35.3	66.3 ± 26.5
Number of live plants	10	-
Number of dead plants	4	-

Table 8. Sheep Creek, largest exclosure, Middle Fork, June 1988

Canopy coverage of species >5%	inside	outside
<i>Agropyron spicatum</i>	4.4 ± 19.6	0.8 ± 3.4
<i>Artemisia tridentata</i>	7.5 ± 23.4	0
<i>Bromus tectorum</i>	4.4 ± 9.5	1.4 ± 3.4
<i>Eriogonum heracleoides</i>	4.9 ± 21.8	0
<i>Phlox longifolia</i>	6.4 ± 9.6	0.1 ± 0.6
<i>Chrysothamnus nauseosus</i>	4.4 ± 19.6	0
<i>Purshia tridentata</i>	7.1 ± 21.9	9.8 ± 30.0
<i>Selaginella densa</i>	45.9 ± 38.3	21.1 ± 29.0
<i>Stipa comata</i>	16.6 ± 23.9	29.8 ± 27.7
<i>Mentzelia dispersa</i>	6.4 ± 13.8	4.1 ± 14.1
 <i>Purshia tridentata</i>		
Height (in)	83.9 ± 32.1	78.0 ± 34.7
Number of live plants	43	-
Number of dead plants	13	-

Table 9. Reservoir Creek Game Exclosure, Middle Fork, June 1988. Canopy coverage of species constituting >5% in at least one site, and heights, decadence ratings, and twig lengths of bitterbrush or big sagebrush.

SPECIES	INSIDE HIGH ¹	INSIDE LOW	OUTSIDE
	CANOPY COVERAGE (%)		
	$\bar{X} \pm SD$	$X \pm SD$	$X \pm SD$
<u>Agropyron spicatum</u>	10.6±16.9	7.3±20.8	23.9±26.2
<u>Artemesia tripartita</u>	2.6± 8.9	0	0
<u>Chrysothamnus nauseosus</u>	0	4.6±14.3	4.7±20.1
<u>Crepis atrabarba</u>	6.5±14.5	0	0
<u>Festuca idahoensis</u>	47.9±27.7	0	0
<u>Poa secunda</u>	6.8± 6.9	0.1± 0.6	0
<u>Purshia tridentata</u>	5.3±19.7	3.3± 9.3	10.4±30.7

<u>Purshia tridentata</u>			
height (in)		41.8 ² 49.3 ³	41.8
% decadent		16- 36	21
twig length (in)		0.5	2.3

¹Inside high is near ridge on north side of exclosure. Inside low is on the steep facing south slope in the center of the exclosure. The outside plot is comparable to the inside low plot, but on an adjacent slope north of the exclosure.

²On severe site without significant grass understory.

³On moderate site with grass understory.

Table 10. Reservoir Creek Stock Enclosure, Middle Fork, June 1988. Canopy coverage ($x \pm$ S.D.) of species $> 5\%$ in at least 1 location.

Species	East End		West inside $x \pm$ S.D.	South End	
	inside $x \pm$ S.D.	outside $x \pm$ S.D.		inside $x \pm$ S.D.	outside $x \pm$ S.D.
<i>Agropyron spicatum</i>	23.0 \pm 31.7	15.6 \pm 22.4	18.3 \pm 30.5	-	-
<i>Arenaria congesta</i>	-	-	-	7.1 \pm 9.7	11.0 \pm 14.7
<i>Artemesia tridentata</i>	-	-	4.4 \pm 19.6	-	-
<i>Bromus tectorum</i>	4.4 \pm 9.5	5.4 \pm 6.6	6.6 \pm 19.6	-	1.0 \pm 3.4
<i>Chrysothamnus nauseosus</i>	10.0 \pm 28.5	0.8 \pm 3.4	9.4 \pm 23.8	-	-
<i>Festuca octoflora</i>	-	-	-	15.5 \pm 21.1	7.9 \pm 6.7
<i>Poa secunda</i>	3.4 \pm 6.0	0.1 \pm 0.6	-	-	-
<i>Purshia tridentata</i>	14.5 \pm 29.9	9.8 \pm 30.0	1.8 \pm 4.6	4.3 \pm 6.4	-
<i>Selaqinella densa</i>	15.0 \pm 30.9	2.6 \pm 8.9	-	1.9 \pm 8.4	-
<i>Stipa comata</i>	0.8 \pm 3.4	12.0 \pm 24.9	-	43.6 \pm 25.4	57.1 \pm 25.6
<i>Purshia tridentata</i>					
height	66.8 \pm 13.7	52.2 \pm 20.0	42.2 \pm 15.7	-	-
% decadent	22.5 \pm 12.5	28.0 \pm 19.9	24.0 \pm 20.88	-	-
twig length	<0.5	2.1 \pm 0.7	<0.5	-	-
<i>Artemesia tridentata</i>					
height	-	-	-	51.6 \pm 9.5	44.1 \pm 18.9
% decadent	-	-	-	36.0 \pm 20.4	46.5 \pm 17.2
twig length	-	-	-	5.2 \pm 2.1	37.0 \pm 1.2

canco.doc Table 2.

SUMMARY OF VEGETATION INFORMATION TAKEN IN THE BIG CREEK DRAINAGE IN THE VICINITY OF TAYLOR RANCH IN JUNE 1988, WHICH INITIATES A MONITORING PROGRAM FOR SITES INVOLVED.

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Location ¹	percent canopy coverage							
	Sage Bench	Pioneer Creek	Mile Hi	West of Airstrip	Rush Creek	Ram Basin	Cliff Creek Bench	Cliff Creek
Achillea millefolium	0.1	-	14.3	0.4	0.3	-	5.9	1.9
Agropyron spicatum	6.5	-	63.8	10.3	50.6	5.8	14.1	49.9
Antennaria rosea	8.3	-	0.9	0.3	-	-	-	-
Artemesia tridentata	6.8	-	-	-	0.9	-	-	-
Astragalus filipes	-	-	-	0.1	-	-	-	-
Astragalus purshii	0.1	-	-	-	-	-	-	-
Balsamorhiza sagittata	-	-	-	21.1	7.9	-	13.8	-
annual Brassica spp.	0.8	-	-	0.3	-	0.1	-	0.3
Brodiaea douglassii	0.1	-	-	-	-	-	-	-
Bromus tectorum	0.4	-	8.9	-	-	38.1	50.1	1.4
Castilleja spp.	-	-	-	1.0	-	-	0.4	-
Carex spp.	-	35.1	-	-	-	-	-	-
Coptis occidentalis	-	0.1	-	-	-	-	-	-
Cornus canadensis	-	0.7	-	-	-	-	-	-
Cirsium spp.	-	-	0.9	-	-	-	-	-
Collinsia parviflora	-	-	-	-	-	-	0.4	-
Collomia linearis	-	-	-	-	-	-	0.9	-
Crepis acuminata	-	-	-	1.0	-	-	-	-
Epilobium paniculatum	-	-	9.6	-	8.3	0.1	-	-
Erigeron compositus	1.5	-	-	0.9	0.8	-	-	-
Erigeron microthecum	-	-	-	3.0	-	-	-	-
Eriogonum heracleoides	-	-	1.7	-	-	-	0.8	-
Eriogonum ovalifolium	-	-	-	-	-	-	-	-
Descurainia pinnata	-	-	-	0.1	-	3.4	-	-
Festuca idahoensis	9.3	-	3.1	44.8	-	-	-	-
Festuca octoflora	2.4	-	-	-	11.5	-	-	-
Frasera albicaulis	-	-	-	1.9	2.4	-	-	-
Hieracium albertinum	-	-	-	0.1	-	-	-	-
Koeleria cristata	27.1	-	5.5	4.0	-	-	-	-
Lactuca spp.	-	-	-	-	6.8	-	-	-
Lithospermum ruderales	-	-	-	-	-	0.1	-	-
Lupinus sericeus	-	-	6.9	-	-	-	-	4.4
Myosotis spp.	2.6	-	0.1	0.8	-	-	0.1	-
Pentstemon spp.	-	-	-	-	-	-	-	1.0
Phacelia linearis	-	-	-	-	-	0.9	-	-
Phlox longifolia	-	-	0.5	-	-	0.8	-	-
Poa secunda	3.3	-	0.8	1.0	-	-	-	-
Selaginella densa	-	10.4	-	-	0.1	-	0.4	0.4
Stipa comata	0.1	-	-	3.8	-	-	-	-
Stipa lettermanni	8.8	-	-	-	-	-	-	-
Tragopogon dubius	-	-	-	0.1	-	-	-	-
Woodsia spp.	-	-	-	-	0.1	-	-	-
Unident. Composite	-	-	0.1	-	2.3	-	-	-
Amelanchier alnifolia	-	0.1	-	-	-	0.1	-	-
Berberis repens	-	0.8	-	-	-	-	-	-
Chrysothamnus nauseosus	-	-	0.1	3.3	-	-	-	-
Chrysothamnus viscidiflorus	-	-	5.1	-	-	-	-	-
Cercocarpus ledifolius	-	-	-	4.9	-	-	-	-
Physocarpus malvaceus	-	40.0	-	-	-	-	-	-
Purshia tridentata	-	-	-	0.9	-	-	-	-
Ribes velutinum	-	-	-	-	-	-	-	-
Rosa woodsii	-	-	-	-	-	1.5	-	-
Spirea betulifolia	-	7.6	-	-	1.8	-	-	-
Symphoricarpos albus	-	13.4	-	2.0	5.0	-	-	-
						6.3		

TABLE 3. SUMMARY OF PRODUCTION ESTIMATES IN THE BIG CREEK AREA FOR BLUEBUNCH WHEATGRASS, FLOWERING STAGE, TAKEN BETWEEN JUNE 15-20, 1988.

LOCATION	GMS/M ²
CAVE CREEK OUTSIDE EXCLOSURE SITE	30.2
CAVE CREEK INSIDE EXCLOSURE SITE	16.3
CLIFF CREEK, NORTH SIDE NEAR TRAIL	89.0
CLIFF CREEK, SECOND BENCH	30.2
RUSH CREEK LOWER SWITCHBACK	79.9
RUSH CREEK SAGE BENCH	49.0
ABOVE AIRSTRIP, SOUTH SIDE	57.4

These are oven dried weights. Based on clips of wheatgrass occurring in 20 2X5 dm plots in vicinity of transects established to record vegetative composition.

TABLE 4. SUMMARY OF SHRUB MEASUREMENTS TAKEN IN THE VICINITY OF TAYLOR RANCH, MIDDLE FORK SALMON RIVER DRAINAGE, JUNE 1988.

	STEMS/4M ²	TWIGS/4M ²	HEIGHT (IN)
<u>RAM BASIN</u>			
Artemesia tridentata	0.05±0.22	5.90± 24.35	61.0 (1)
Cercocarpus ledifolius	0.30±0.66	53.95±130.50	73.00±22.63
Ribes velutinus	0.30±0.47	24.35± 64.96	10.77±23.44
all species	0.65±0.88	83.45±145.72	
<u>WEST OF TAYLOR RANCH AIRSTRIP</u>			
Amelanchier alnifolia	0.30±0.80	0.55± 1.88	14.0± 1.41
Artemesia tridentata	0.05±0.22	0.75± 3.35	7.0 (1)
Cercocarpus ledifolius	0.05±0.22	0	
Physocarpus malvaceus	0.20±0.89	3.60±16.10	50.0 (1)
Purshia tridentata	0.30±0.57	28.35±63.21	41.2±31.1
Rosa woodsii	0.65±2.91	4.95±22.14	26.0 (1)
Ribes cereum	0.30±0.47	11.90±25.10	39.7±32.7
Symphoricarpos albus	21.75±49.45	40.95±89.64	14.3± 6.8
all species	23.4±49.42	92.00±101.50	
<u>SAGE BENCH NW OF TAYLOR RANCH</u>			
Artemesia tridentata	0.85±0.93	214.90±333.16	46.8±15.8
ARTR dead stems	0.25±0.44		
(only Artr present)			
<u>PIONEER CREEK DOUGLAS FIR STAND</u>			
Amelanchier alnifolia	0.10± 0.45	0.25± 1.12	19.0 (1)
Physocarpus malvaceus	11.95± 8.16	176.80±103.02	48.5±13.9
Ribes cereum	0.25± 1.12	0.40± 1.79	66.0 (1)
Spirea betulifolia	17.40±19.27	59.65± 81.19	15.8±5.6
Symphoricarpos albus	6.45±7.20	61.60± 72.54	22.6±6.8
all species	37.40±24.09	302.05±171.97	
<u>RUSH CREEK SWITCHBACKS</u>			
Artemesia tridentata	0.35±0.75	99.85±208.23	46.8±15.8
Purshia tridentata	0.10±0.31	32.90± 82.48	57.4±23.9
all species	0.45±0.76	132.75±208.69	
ARTR dead stems	0.10±0.31		

FIGURES ARE MEAN ± STANDARD DEVIATION

Table 5. Summary of Vegetation Data Taken June 1988

Cave Creek enclosure site: Big Creek drainage

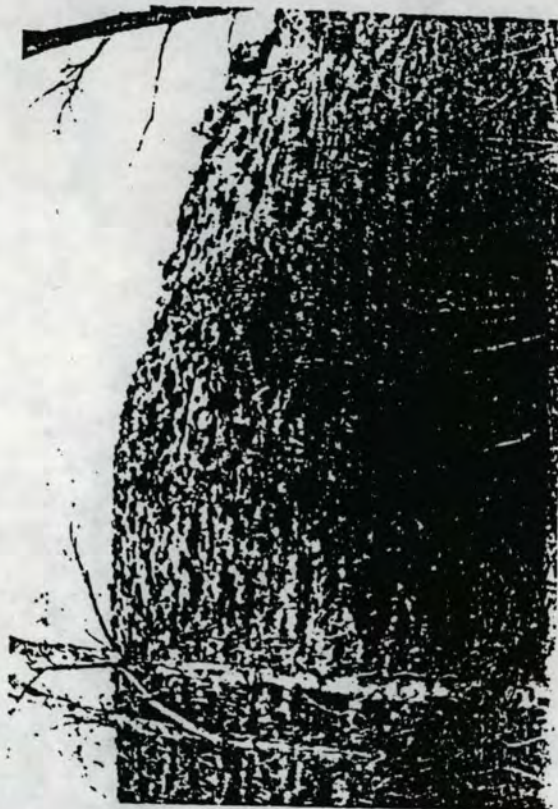
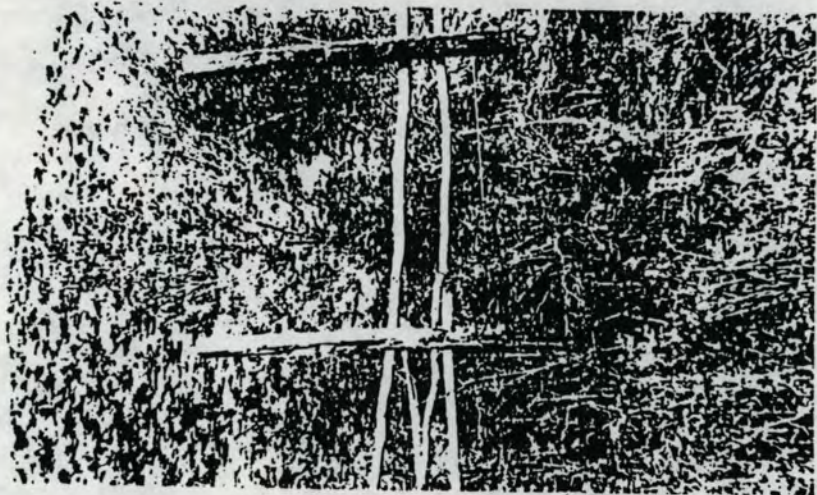
<u>Canopy coverage of species > 5%</u>	inside	outside
<i>Achillea millefolium</i>	2.1 ± 4.5	5.0 ± 6.8
<i>Agropyron spicatum</i>	19.8 ± 27.7	14.8 ± 27.9
<i>Balsamorhiza sagittata</i>	6.4 ± 14.5	4.6 ± 11.7
<i>Bromus tectorum</i>	0.3 ± 0.8	20.0 ± 23.6
<i>Stipa lettermani</i>	6.5 ± 13.8	8.8 ± 15.1
<i>Agropyron spicatum</i> dry weight/m ²	4.1 gm	7.8 gm
<u>Shrubs</u>		
<u><i>Artemisia tridentata</i></u>		
Height (in)	40.2 ± 10.2	19.5 ± 6.4
Stem density/4m ² plot	2.5 ± 1.5	1 ± 1.6
Dead stem density/4m ² plot	1.3 ± 0.9	0.05 ± 0.2
Twig density/4m ² plot	418.3 ± 339.9	86.3 ± 138.8
<u><i>Purshia tridentata</i></u>		
Height (in)	53.9 ± 14.3	34.1 ± 9.9
Stem density	0.20 ± 0.4	0.2 ± 0.4
Dead stem density	0.05 ± 0.2	0
Twig density	10.90 ± 33.1	28.7 ± 59.9

Table 6. Flying B exclosure site, Middle Fork, June 1988

Canopy coverage of species + 5%	inside		outside
	southside	northside	
<i>Agropyron spicatum</i>	12.5 ± 23.2	12.9 ± 22.4	0.4 ± 0.9
<i>Artemisia tripartita</i>	3.8 ± 9.2	10.3 ± 26.8	0
<i>Balsamorhiza sagittata</i>	12.6 ± 26.8	34.8 ± 39.3	21.6 ± 20.3
<i>Bromus tectorum</i>	32.4 ± 31.1	16.0 ± 26.4	4.5 ± 9.2
<i>Festuca idahoensis</i>	14.0 ± 26.6	7.1 ± 13.8	0.3 ± 0.8
<i>Phlox longifolia</i>	3.4 ± 6.0	1.3 ± 3.4	0.5 ± 1.1
<i>Pushia tridentata</i>	3.1 ± 13.9	2.3 ± 5.5	0
<i>Selaginella densa</i>	26.3 ± 39.2	22.6 ± 38.6	0
<i>Stipa comata</i>	2.3 ± 8.4	10.8 ± 22.7	0
<i>Cerastium arvense</i>	0	10.1 ± 21.6	4.7 ± 6.4
<i>Poa secunda</i>	0.1 ± 0.6	3.0 ± 8.8	0
 <i>Purshia tridentata</i>			
Height (in)	-	67.5 ± 12.8 ¹	47.6 ± 21.5
% Decadence	-	24.5 ± 16.4	59.5 ± 15.4
Twig lengths	-	<.5 in	1.9 ± 0.84
 <i>Artemisia tripartita</i>			
Height (in)	-	25.7 ± 5.9	7.8 ± 3.1
% Decadence	-	20.7 ± 16.2	20.0 ± 16.9
Twig length (in)	-	6.8 ± 2.0	3.2 ± 1.4

¹One plant, 14" high with a 4.5" leader, was established in a bare soil site inside the exclosure.

Figure 1. Photographs taken in 1925 (top), 1968 (middle), and 1988 (bottom) of the hill west-northwest of the "Flying B" ranch buildings, from the road up Brush Creek just below the gate to this property. The shrubs are bitterbrush and rabbitbrush with a substantial grass cover evident in the 1925 photograph.



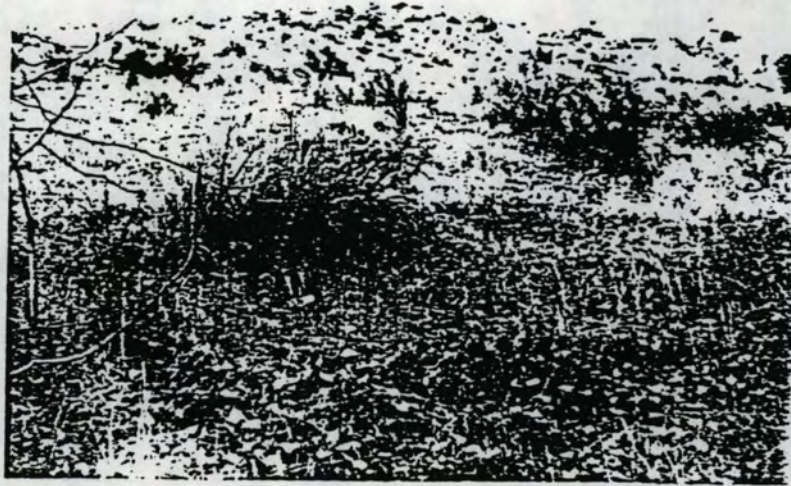


Figure 2. Photographs taken in 1968 (top) and 1988 (bottom) from the mouth of the water valve in Brush Creek which supplies the "Flying B" ranch. The slope is the same one as in Figure 1.

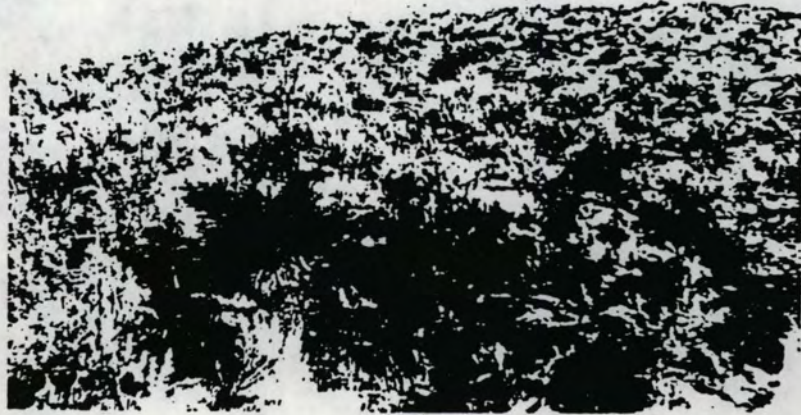


Figure 3. Photographs taken in 1925 (top) and 1988 (bottom) of the hillside between Brush Creek and Short Creek.

Figure 4. Photographs taken in 1925 (top), 1968 (middle) and 1988 (bottom) from the old trail between Short Creek and Bernard Creek, above the cliffs at the lower end of the "Flying B" landing field.

