

**50+ Years of Change on Abandoned Farmland in Southern Idaho**

**A Final Report submitted to the Bureau of Land Management**

**Submitted by: Erin F. Peters, Univ. of Idaho**

**Stephen C. Bunting, Univ. of Idaho**

**28 Jan. 1993**

## INTRODUCTION

Prior to Euro-American settlement of the Snake River Plains, plant communities were dominated by big sagebrush (*Artemisia tridentata*), with interspersed bunchgrasses (*Stipa* and *Festuca*) (Hironaka et al. 1983). Disturbance in this region was believed to have been fairly low, with fire having the greatest impact when it occurred (Peters and Bunting in press). Following fire, these communities may have been dominated by annual fescues (*Vulpia* spp.) and early seral perennial grasses, such as squirreltail (*Sitanion hystrix*), and replaced later by the sagebrush and late seral bunchgrasses. With the advent of farming and cattle grazing, and with the introduction of weedy annual species, the successional pattern changed. Initial dominance by annual forbs, such as Russian thistle (*Salsola kali*) and mustards (*Sisymbrium* spp. and *Descurainia* spp.) followed by long-term dominance by annual grasses, mainly cheatgrass (*Bromus tectorum*) has occurred on many disturbed sites. Piemeisel (1945, 1951) observed that this change in annual dominance generally occurred over a five year period, and would be repeated with disturbance.

In the Snake River Plains region, many farms were abandoned during the early 1900's because of low crop productivity and drought. These abandoned farmlands, and other degraded areas, supported a weedy cover that provided large host areas for the beet leafhopper (*Eutettix tenellus*) a vector of the virus that causes curly top disease in sugar beets (Piemeisel 1938). The

initial study resulting in the establishment of the exclosures was developed by Piemeisel to study the relationship between the weedy cover of the abandoned farmlands and populations of the beet leafhopper. This initial study evolved into a long-term successional study that has been continued by researchers at the University of Idaho.

#### **METHODS**

To study the relationship between the weedy cover and the beet leafhopper, five plots were originally established (Piemeisel 1938). Today, two are still intact and managed in cooperation by the Bureau of Land Management and the University of Idaho. These exclosures occur within the *Artemisia tridentata* spp. *wyomingensis*/*Stipa thurberiana* habitat type (Hironaka et al. 1983). Sandberg's bluegrass (*Poa secunda*), streambank wheatgrass (*Agropyron riparium*) and squirreltail are common species in this habitat type. The soils of these sites have been classified as coarse-silty, mixed, mesic Xerollic Camborthid, Typic Camborthid or Durixerollic Camborthid (Hironaka et al. 1983).

The Burley exclosure, located approximately 7 miles southwest of the city of Burley, was established in 1930 on a farm abandoned in 1916 (Piemeisel 1938). In June 1938, this exclosure was additionally fenced to exclude jackrabbits. The Castleford exclosure, located approximately 15 miles southeast of the town of Castleford, was established in April 1931 (Piemeisel 1938). This farm was abandoned in 1920. In 1944, the exclosure

was additionally fenced against jackrabbits.

Plots were set up on 40 acres to include 1/2 cropland and 1/2 sagebrush. However, on the Castleford exclosure, the split was slightly more than 20 acres of sagebrush. Transects were permanently established and numbered posts were set up on a 100x100' grid. Sample quadrats were established on either side of the transect posts 10m on a diagonal (Fig. 1). Sample quadrats were initially marked with small wooden stakes. In 1992, the near corner of each sample plot was re-marked with looped steel stakes. Also in 1992, permanent plots were established within the sagebrush portion of the exclosures.

Density data were collected initially only within 25x25cm quadrats, but in 1948 was expanded to include 1x1m quadrats for better representation of the perennial species, primarily sagebrush. The density of the annual species is under-estimated since actual counts of the plants in the 25x25cm plot were suspended after the first 25 plants were counted. This was done to emulate the work done by Dr. Piemeisel and also to save time. The density of streambank wheatgrass, a rhizomatous species, was also under-estimated. Analysis of the density of streambank wheatgrass was based on the number of clumps for this species. Individual stems were counted up to 25, then discontinued to save time. Frequency data were also obtained for each species. Sampling in 1992 included density and frequency in 25x25cm and 1x1m plots, and was conducted in both the "weedy" and "sagebrush" portion of each exclosure.

## CLIMATE

The climate of this area is characterized by low rainfall (mean annual precipitation = 2.5 cm) and dry, hot summers. Precipitation occurs primarily in the winter months (Figure 2). For the years that data have been collected, average growing season (April - August) temperature, average growing season precipitation, and winter (October - March) precipitation is presented in Figure 2 (US Weather Bureau Data).

## RESULTS

### BURLEY ENCLOSURE - "WEEDY" PORTION

In 1938, the vegetation on the Burley site was dominated by Russian thistle (76 plants/m<sup>2</sup>) and two mustards (118 plants/m<sup>2</sup>) (Table 1). Cheatgrass replaced Russian thistle by 1945 (Piemeisel 1951), and has maintained a density of more than 100 plants/m<sup>2</sup> since 1948 (Table 1). Perennial grasses, as a whole, have maintained densities between 50 and 90 plants/m<sup>2</sup>, with the sampling in 1954 having the highest density (Table 1). Density of species groupings have shifted from annual herbs (1937 and 1938) to annual/perennial grass (1948-1992) (Figure 3). Sagebrush density declined from approximately 8 plants/m<sup>2</sup> in 1937 to 1 plant/m<sup>2</sup> in 1992 (Figure 4). A comparison of annual vs. perennial density (Figure 5) indicated the change in life-form dominance: by 1992, perennial species occur in higher densities than annual species.

Frequency analysis (Figure 6) showed that the first

perennial species to increase on these plots was squirreltail , which by 1951 occurred in 60% of the plots sampled (Table 2) and maintained a consistent frequency until 1992. Sampling in 1992 indicated that Sandberg's bluegrass and streambank wheatgrass had a 3-fold increase in frequency (Figure 6). The dominance of sagebrush on this portion of the site is not reflected by frequency analysis.

#### BURLEY ENCLOSURE - "SAGEBRUSH" PORTION

Changes in the community composition of the sagebrush portion have occurred, but data are not available for comparison. The only record of vegetation changes are in the old photographs of Dr. Piemeisel (stored at the University of Idaho) and slides of the area taken by Dr. M. Hironaka (University of Idaho). Fires have occurred on the enclosure in the early 1960's and again in the mid 1980's. Thus, the current community composition reflects the successional changes after disturbance. Figure 7 illustrates the density of perennial species within the sagebrush portion. This portion of the site is dominated by streambank wheatgrass and Sandberg's bluegrass. Cheatgrass density, extrapolated from the 25x25cm data, was greater than 107 plants/m<sup>2</sup>.

#### CASTLEFORD ENCLOSURE - "WEEDY" PORTION

In the years since the Castleford enclosure has been

exclosed to cattle and jackrabbits, the dominant species has been cheatgrass. In the earlier years of the study (1938), Russian thistle dominated (11.7 plants/m<sup>2</sup>), but in later years, it was replaced by tumbled mustard and cheatgrass (1943) (Table 3). Russian thistle has not been recorded on this site since 1945.

The results from the 1992 sampling indicated an increase in salsify (*Tragopogon*), Sandberg's bluegrass, and crested wheatgrass (*Agropyron cristatum*) (Figure 8). Combined, the perennial grasses had a density of 3.4 plants/m<sup>2</sup> (Table 3). This value may be somewhat misleading, in that the perennial species occurred in isolated dense patches and were not uniformly distributed on the plot. Prior seeding experiments of Dr. Piemeisel's account for part of the increase in crested wheatgrass, but more importantly, part has been the natural establishment of seedlings from the surrounding crested wheatgrass allotment. No sagebrush were observed within this half of the enclosure.

Analysis of frequency data (Table 4, Figure 9) also indicates the change in community composition of the "weedy" portion of this enclosure. However, it is clear that cheatgrass remains the dominant species on this site (Figure 9).

#### CASTLEFORD ENCLOSURE - "SAGEBRUSH" PORTION

Community composition change of this portion of the Castleford enclosure appears to have been slight since the early 1930's. It is unfortunate that there is very little data on the

sagebrush portion of both exclosures, and old photographs and slides are the only method of comparison. The perennial grass species are scattered in the interspaces between the dominant sagebrush, which form a fairly dense stand (approx. 3 plants/m<sup>2</sup>) (Figure 10). A portion of the sagebrush, along an old ditch or roadway, has died back. Within this area, cheatgrass and other annual species dominate. Throughout the whole "sagebrush" portion, cheatgrass had an average density of 80 plants/m<sup>2</sup> (extrapolated from 25x25cm data).

## DISCUSSION

### BURLEY EXCLOSURE

Successional changes on the abandoned farmland ("weedy") portion of this exclosure have been well documented (Piemeisel 1951, Hironaka and Tisdale 1963). The initial vegetation was dominated by annual forbs (Russian thistle and mustards) and those were replaced by annual grasses, chiefly cheatgrass, but also the native annual fescue. Squirreltail was the primary perennial grass to establish in the cheatgrass communities (Piemeisel 1945, 1951, Hironaka and Tisdale 1963). The frequency of streambank wheatgrass had increased in the years between 1948 and 1951, but had declined by 1954, and since then has increased to approximately 50%. Changes in the perennial grass component have occurred over the past 50 years, but were not unexpected. A decrease in squirreltail, and a concurrent increases in bluegrass, riparian wheatgrass and needlegrasses indicate a later



seral stage community, as evidenced by the low density of large sagebrush .

Sagebrush had established in the "weedy" portion by 1937, but since then the density has declined. This phenomenon may be due to the self-thinning of maturing sagebrush. The sagebrush present at the 1992 sampling were quite large, and very few small sagebrush were observed. It may be that sagebrush experiences population cycling, such that recruitment does not occur until the mature plants become quite decadent, or until some disturbance opens up the community.

Cheatgrass remains very prominent on both portions of this exclosure, but has been limited to slightly more than 50% of the sampled plots. Total preclusion of cheatgrass by the perennial species will likely not occur, as localized disturbances will always create openings for this species which has an ample seed source from the surrounding farmlands.

#### CASTLEFORD EXCLOSURE

Community changes on the "weedy" portion of the Castleford exclosure have been slow. This site is still dominated by cheatgrass, with widely interspersed crested wheatgrass. No sagebrush has become established in the last several decades. This lack of colonization by sagebrush, or other perennial grasses may be due to the lack of seed source from the surrounding vegetation. Examination of early photographs indicates that the vegetation surrounding the exclosure was

dominated by annual species, and then the area was converted to a crested wheatgrass allotment. The wind pattern at this site comes from a southerly direction, and thus the seed source from the sagebrush and perennial grasses, which lay to the north, are not available. It is not known if sagebrush are being established outside the north end of the exclosure in the crested wheatgrass allotment. In May 1992, there was very little vegetation surrounding the exclosure due to intense grazing of the crested wheatgrass (in June 1991, the allotment had not been grazed)

Soil disturbance, by animal species within the "sagebrush" portion, open areas for colonization by annual species. A constant seed source, from both within and outside the exclosure, guarantee the presence of annual species for many years to come.

The dominance of cheatgrass in the "weedy" portion of the exclosure, and the dominance of sagebrush in the "sagebrush" portion make this an ideal place to study differences in nutrient cycling between annual dominated communities and perennial shrub dominated communities.

## Literature Cited

Hironaka, M., M. A. Fosberg, A. H. Winward. 1983. Sagebrush-grass habitat types of southern Idaho. Univ. of Idaho, FWR Bull. No. 35.

Hironaka, M. and E. W. Tisdale. 1963. Secondary succession in annual vegetation in southern Idaho. Ecology 44:810-812.

Peters, E. F. and S. C. Bunting. (in press). Fire conditions Pre- and Postoccurrence of annual grasses on the Snake River Plain. Symposium on Ecology, Management, and Restoration of Intermountain Annual Rangelands, Boise, ID, May 18-24, 1992. USDA For. Serv. Gen. Tech. Rep. Int. Res. Station, Ogden, UT.

Piemeisel, R. L. 1938. Changes in weedy plant cover on cleared sagebrush land and their probable causes. USDA Tech. Bull. No. 654. 44pp.

----. 1945. Natural replacement of weed hosts of the beet leafhopper as affected by rodents. USDA Circular No. 739. 48pp.

----. 1951. Causes affecting change and rate of change in a vegetation of annuals in Idaho. Ecology 32:53-72.

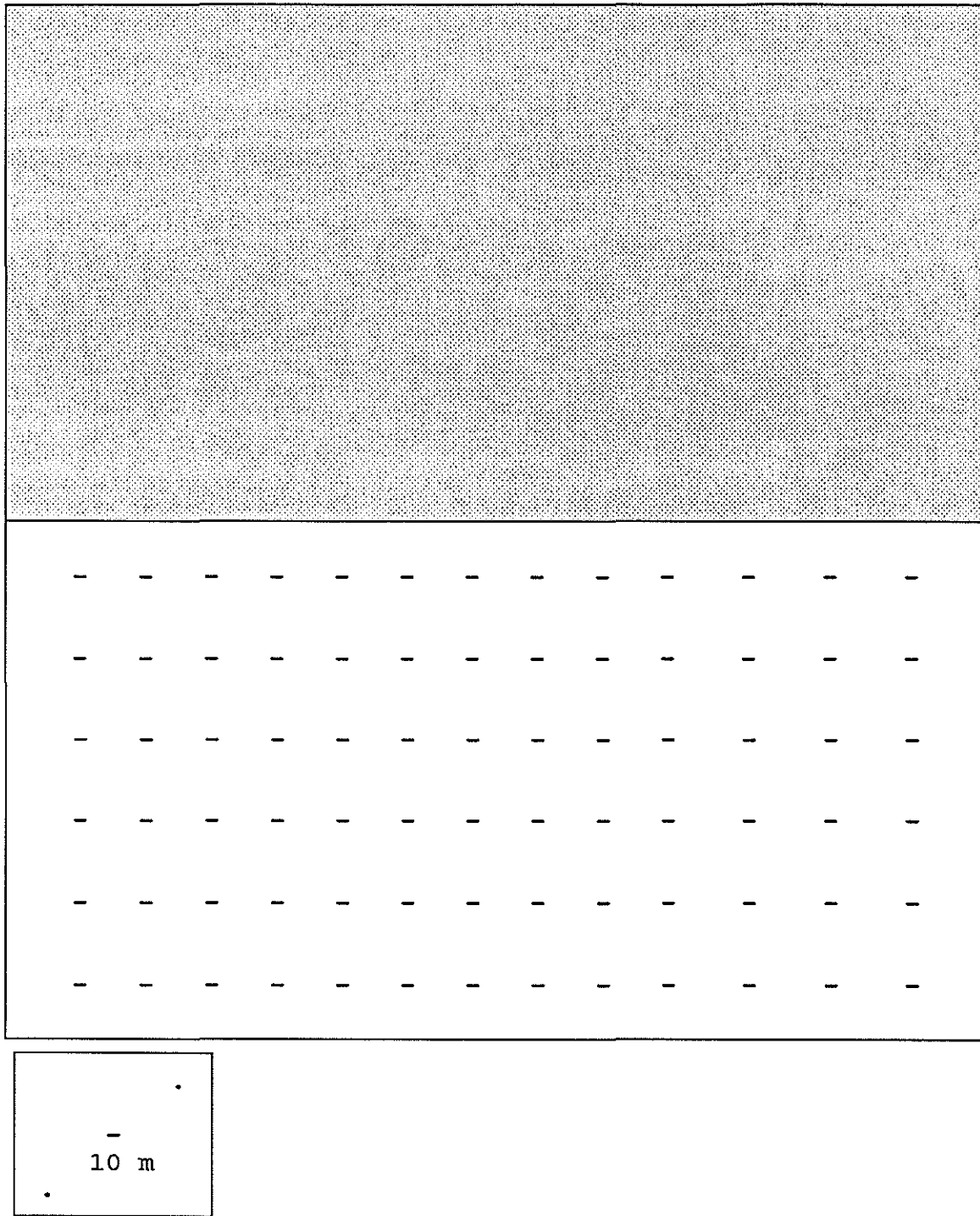


Figure 1. Schematic of the layout of the Burley and Castleford exclosures. The shaded area represents the initial sagebrush portion, the unshaded area represents the cleared portion. The exclosure was subdivided into 100 ft. sections, marked with permanently placed stakes (depicted by "-"). Sample plots are located on the diagonal 10 meters from the corner stake, depicted by "." as illustrated in lower left.

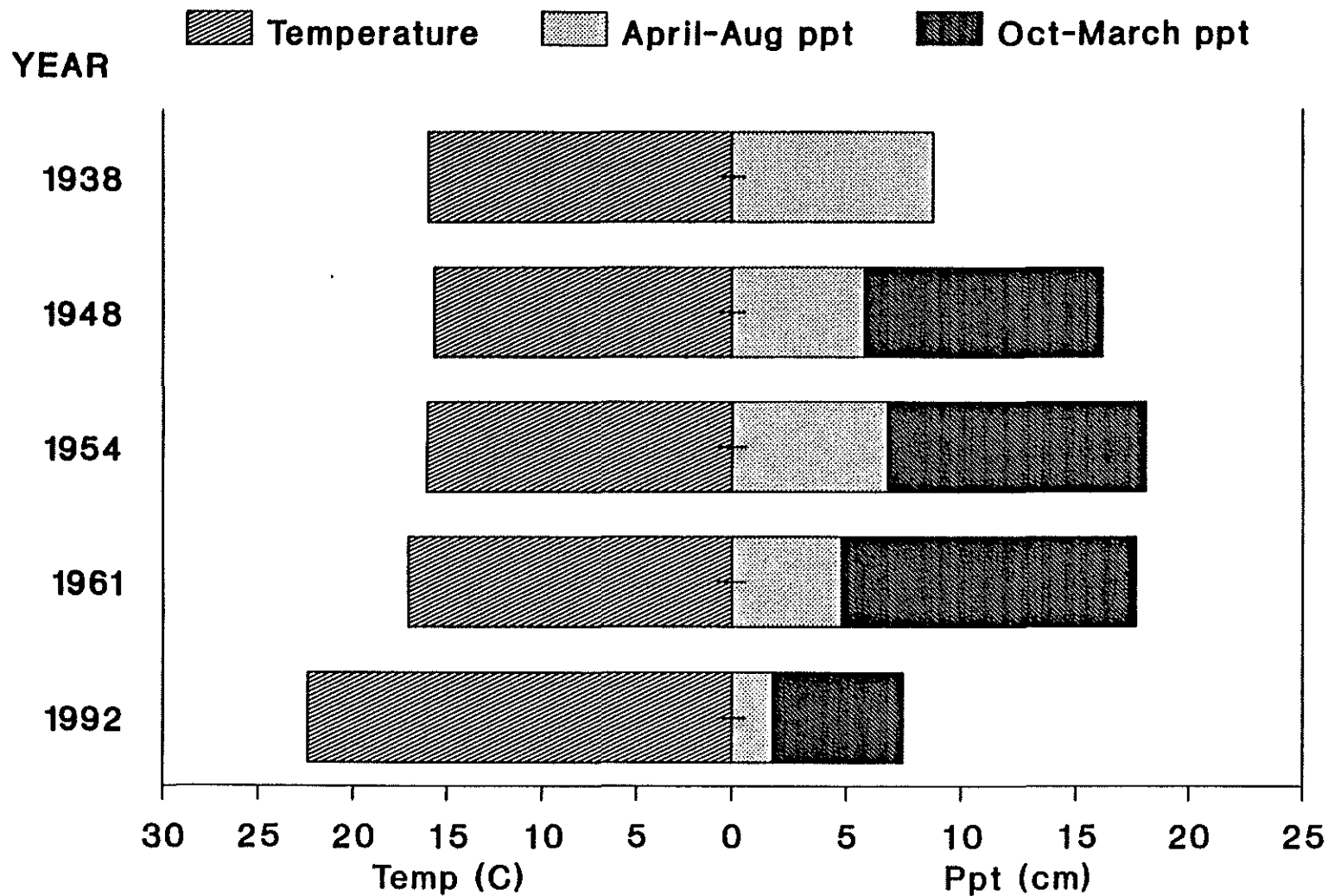


Figure 2. Weather data from Burley, ID, for the years that data were collected. Precipitation (cm) is divided into two categories: growing season (April - Aug.) and winter (Sept. - March). Temperature ( $^{\circ}\text{C}$ ) is the mean for the growing season. Precipitation data for Oct.-March 1938 was not available.

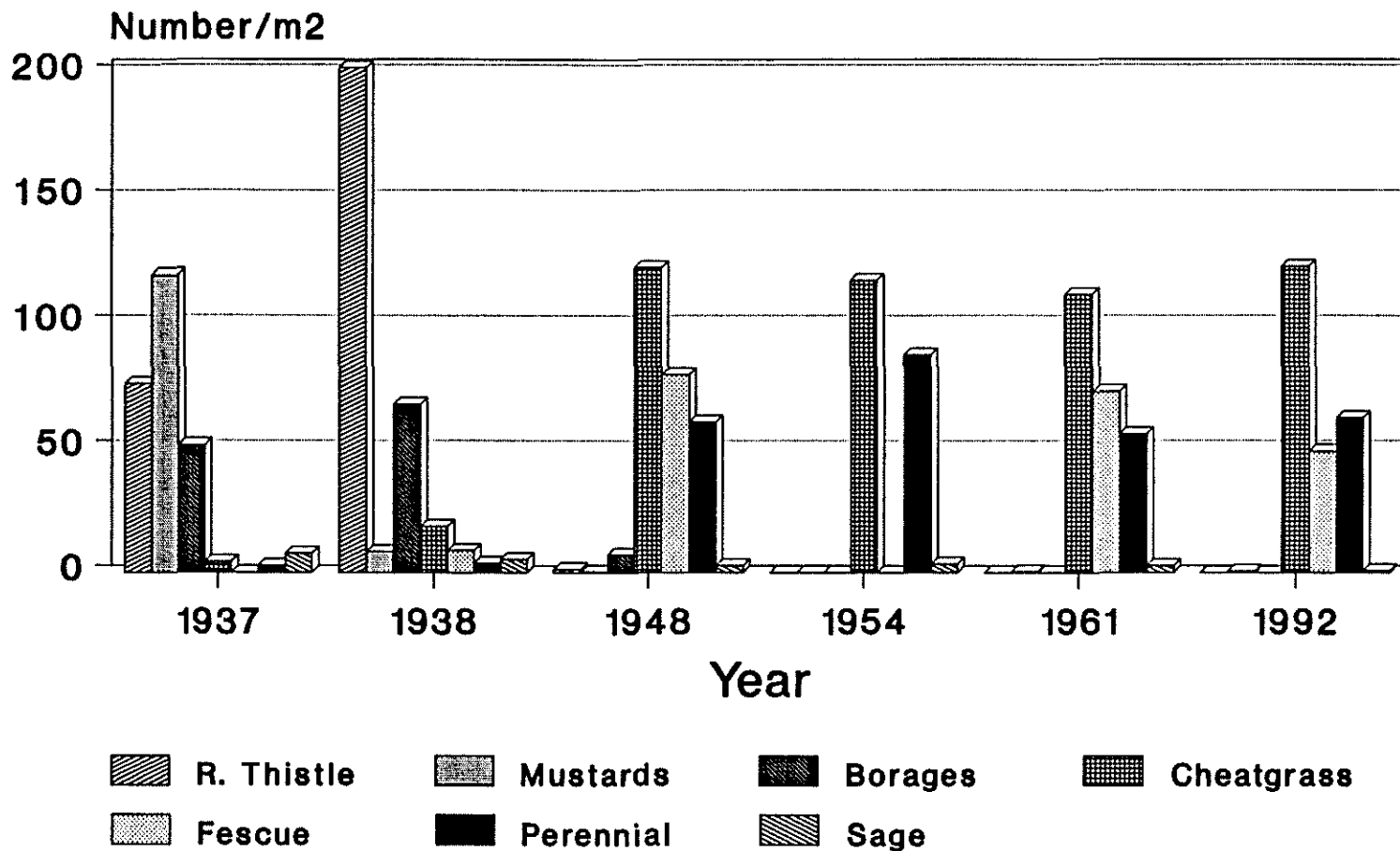


Figure 3. Density (m<sup>2</sup>) of vegetation on the "weedy" portion of the Burley Exclosure for the years 1937 through 1992. Values were extrapolated from 25x25cm quadrat data. Species of borages, fescues, mustards, and perennial grasses (perennial) were grouped to coincide with the data from 1937 and 1938 of Dr. Piemeisel.

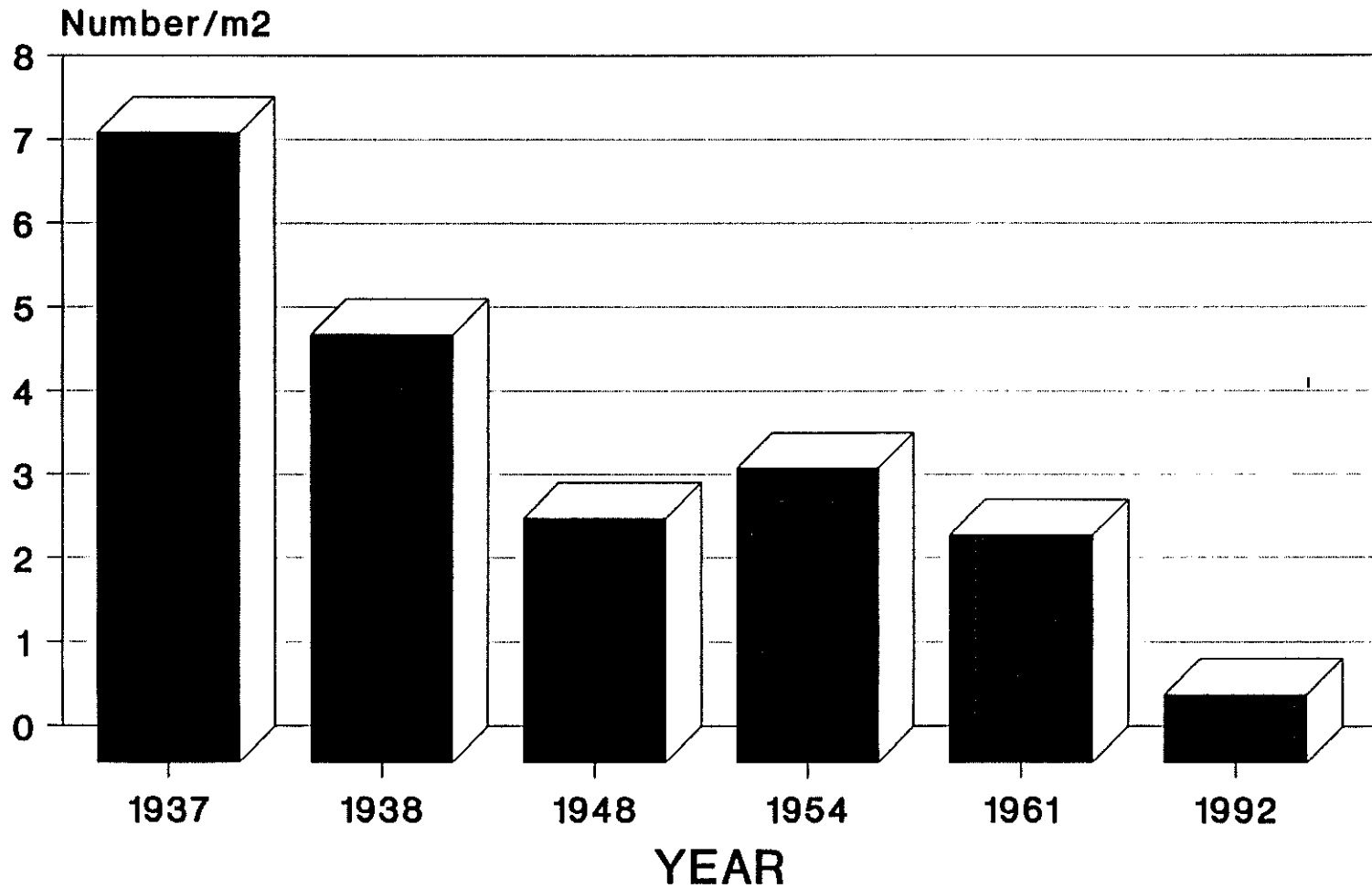


Figure 4. Density ( $m^2$ ) of sagebrush within the "weedy" portion of the Burley Exclosure for the years 1937 through 1992. Values were extrapolated from 25x25cm quadrat data.

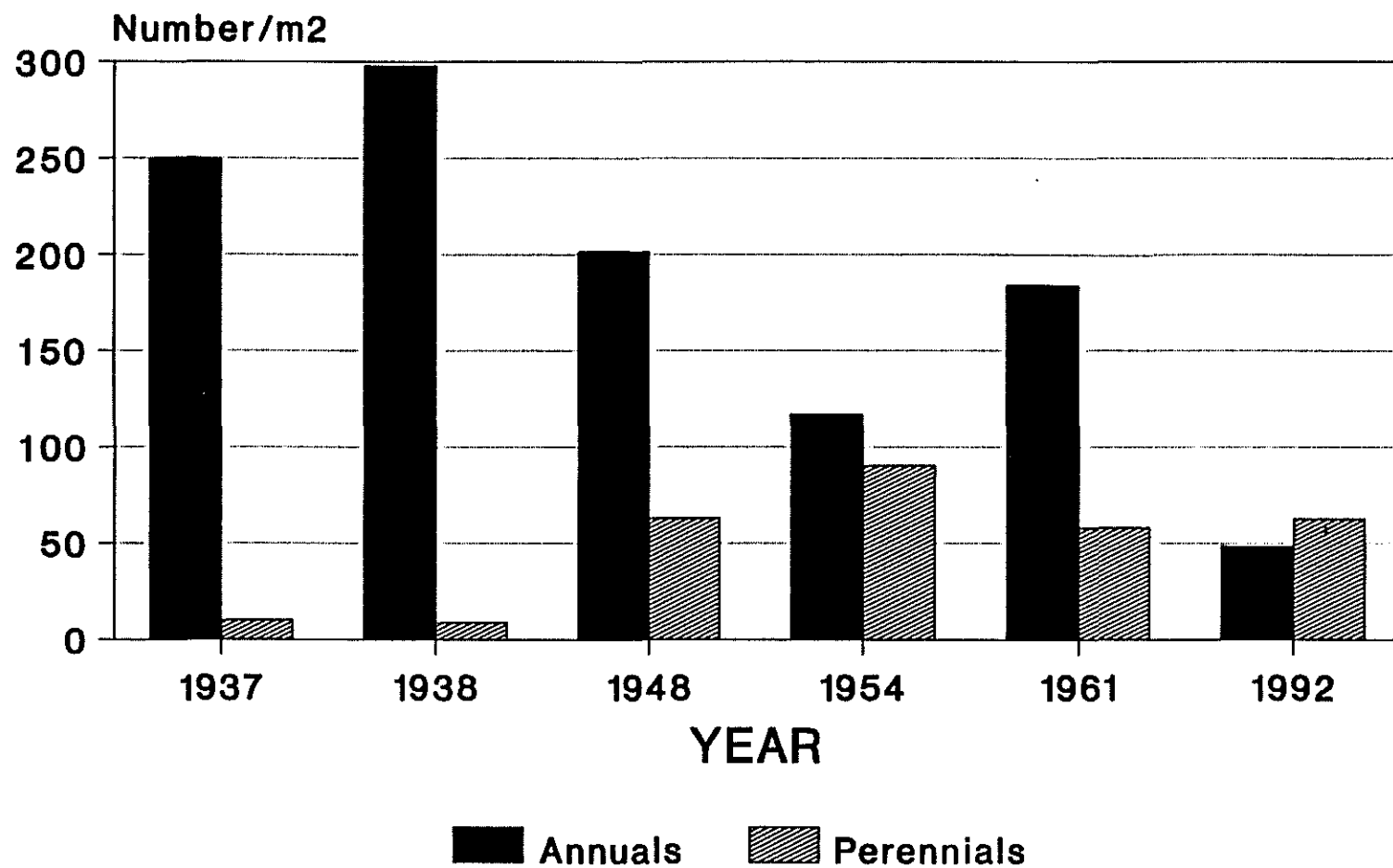


Figure 5. Annual and perennial density ( $m^2$ ) within the "weedy" portion of the Burley Exclosure for the years 1937 through 1992. Values extrapolated from 25x25cm quadrat data.



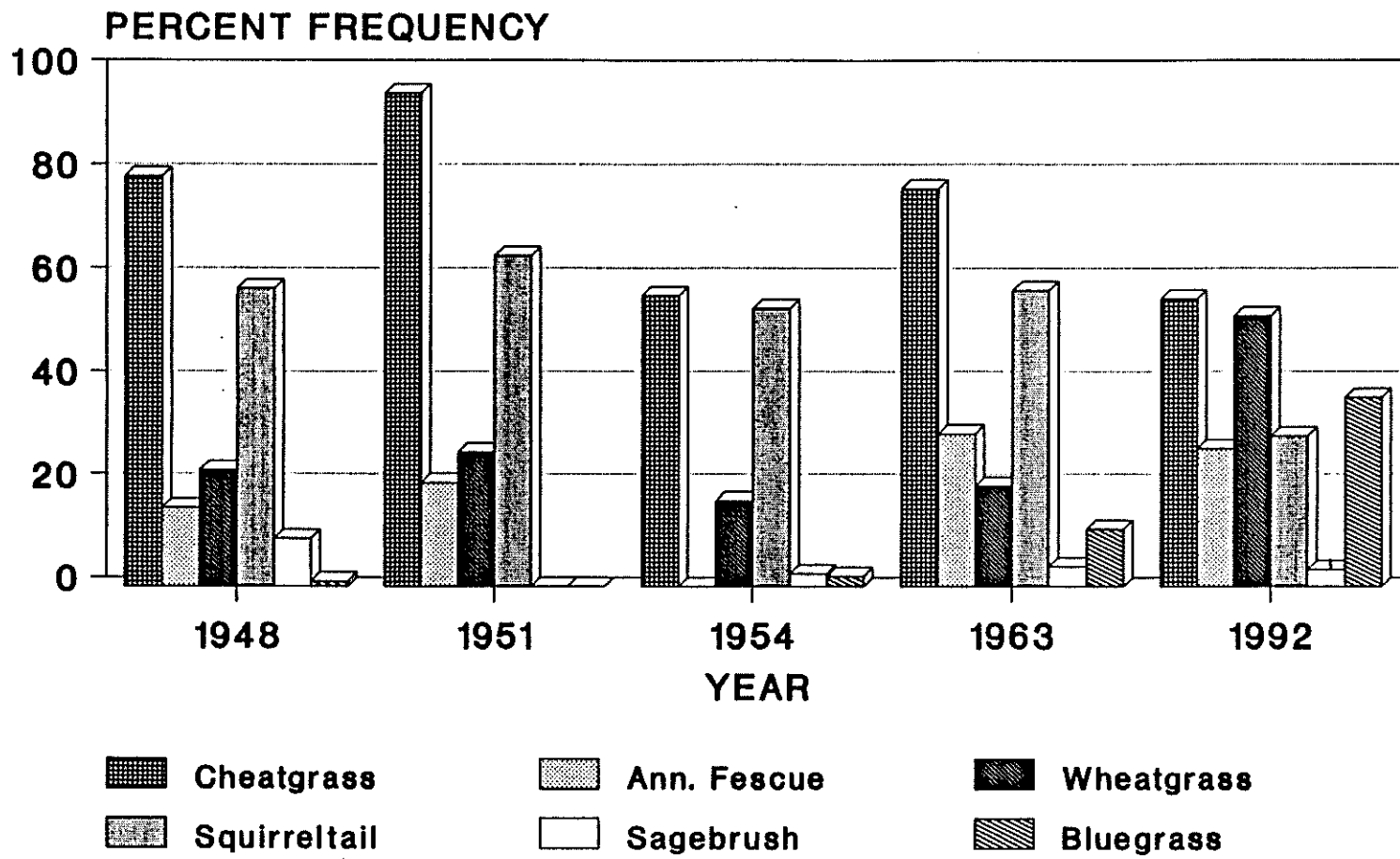


Figure 6. Percent frequency of species within the "weedy" portion of the Burley Exclosure for the years 1948 through 1992.

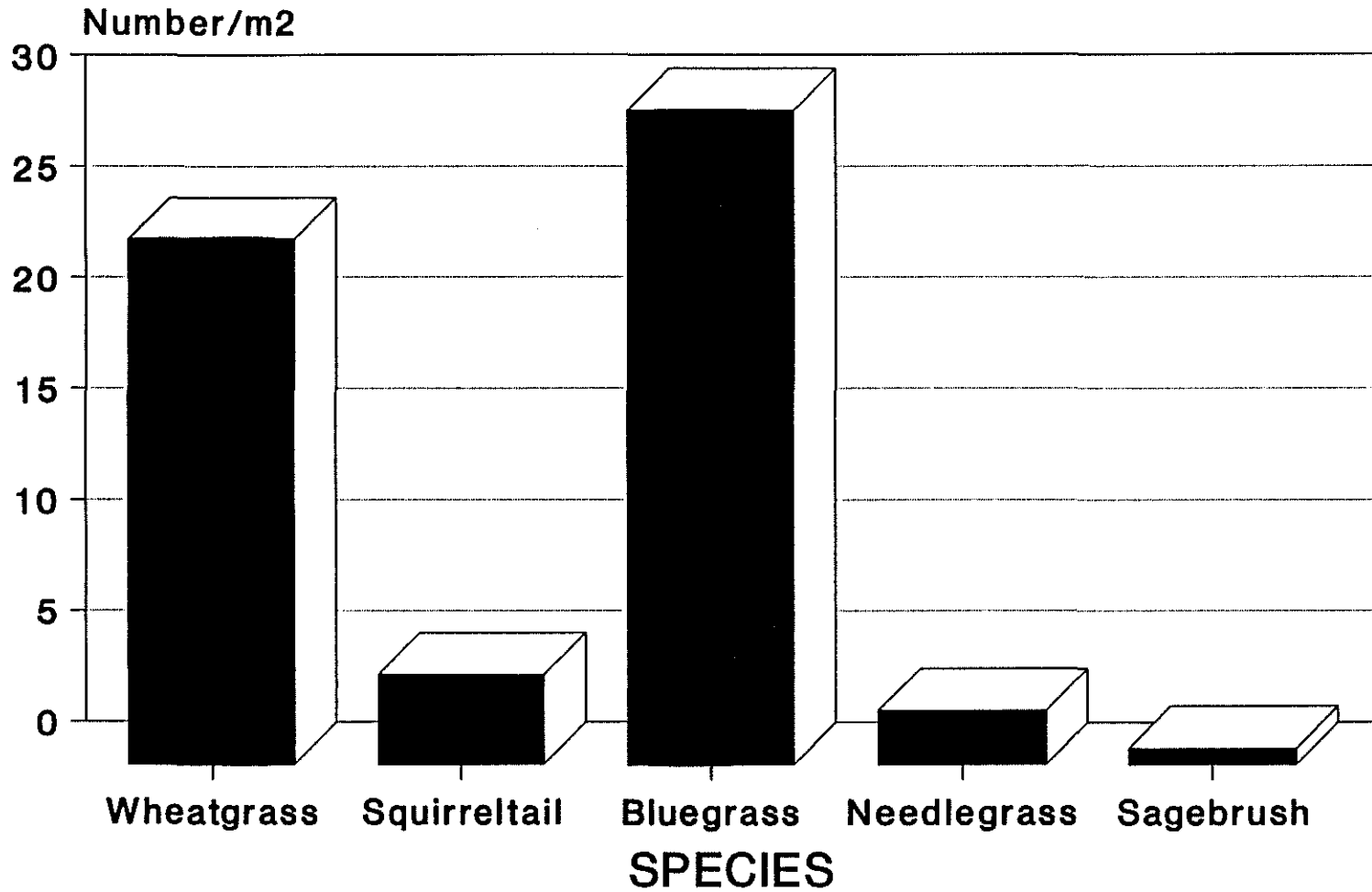


Figure 7. Density (m<sup>2</sup>) of perennial species within the "sagebrush" portion of the Burley Enclosure for the year 1992.

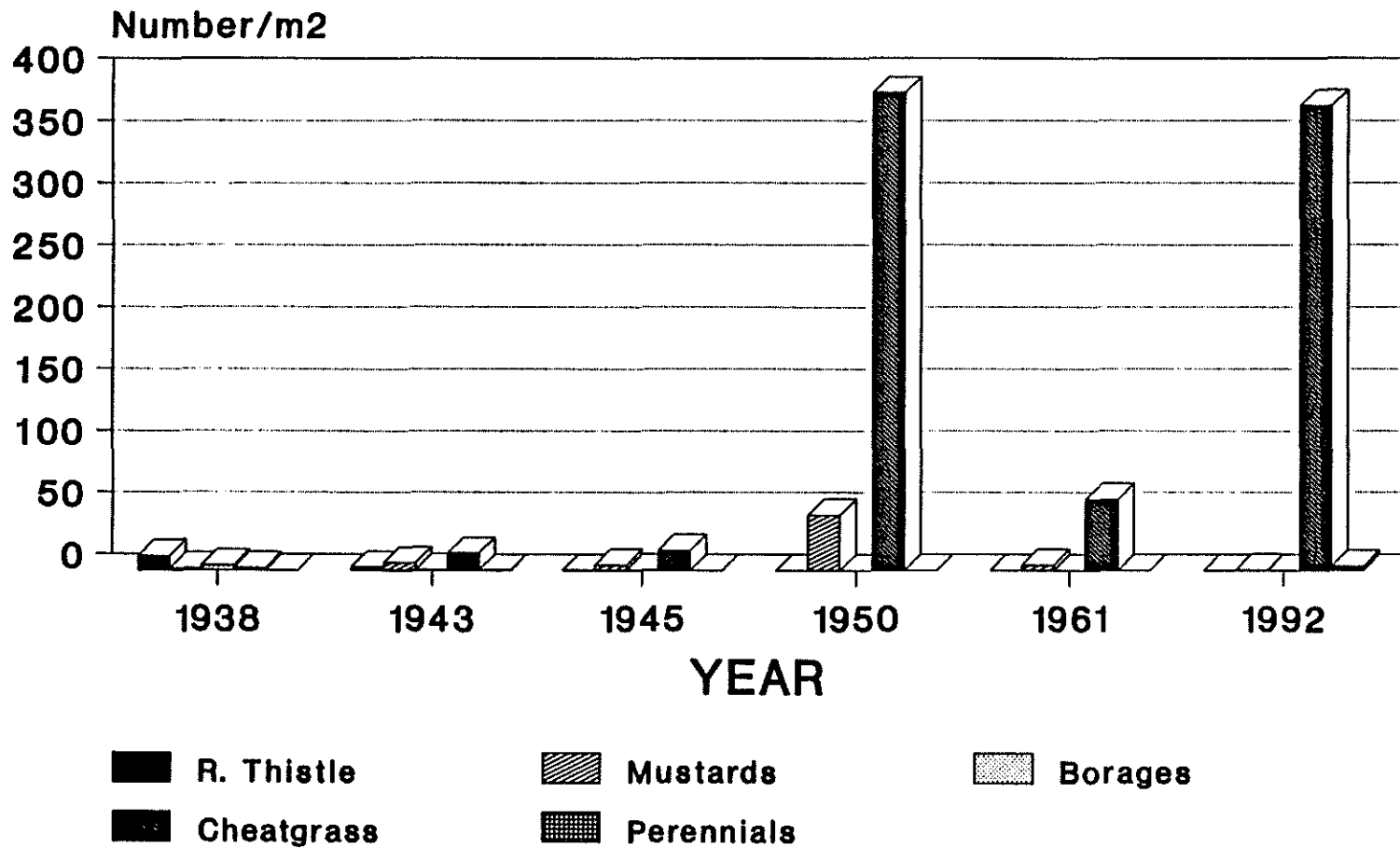


Figure 8. Density ( $m^2$ ) of species within the "weedy" portion of the Castleford Exclosure for the years 1938 through 1992. All species of mustards, borages, and perennial grasses (perennial) were grouped together to coincide with the data from 1938 of Dr. Piemeisel.

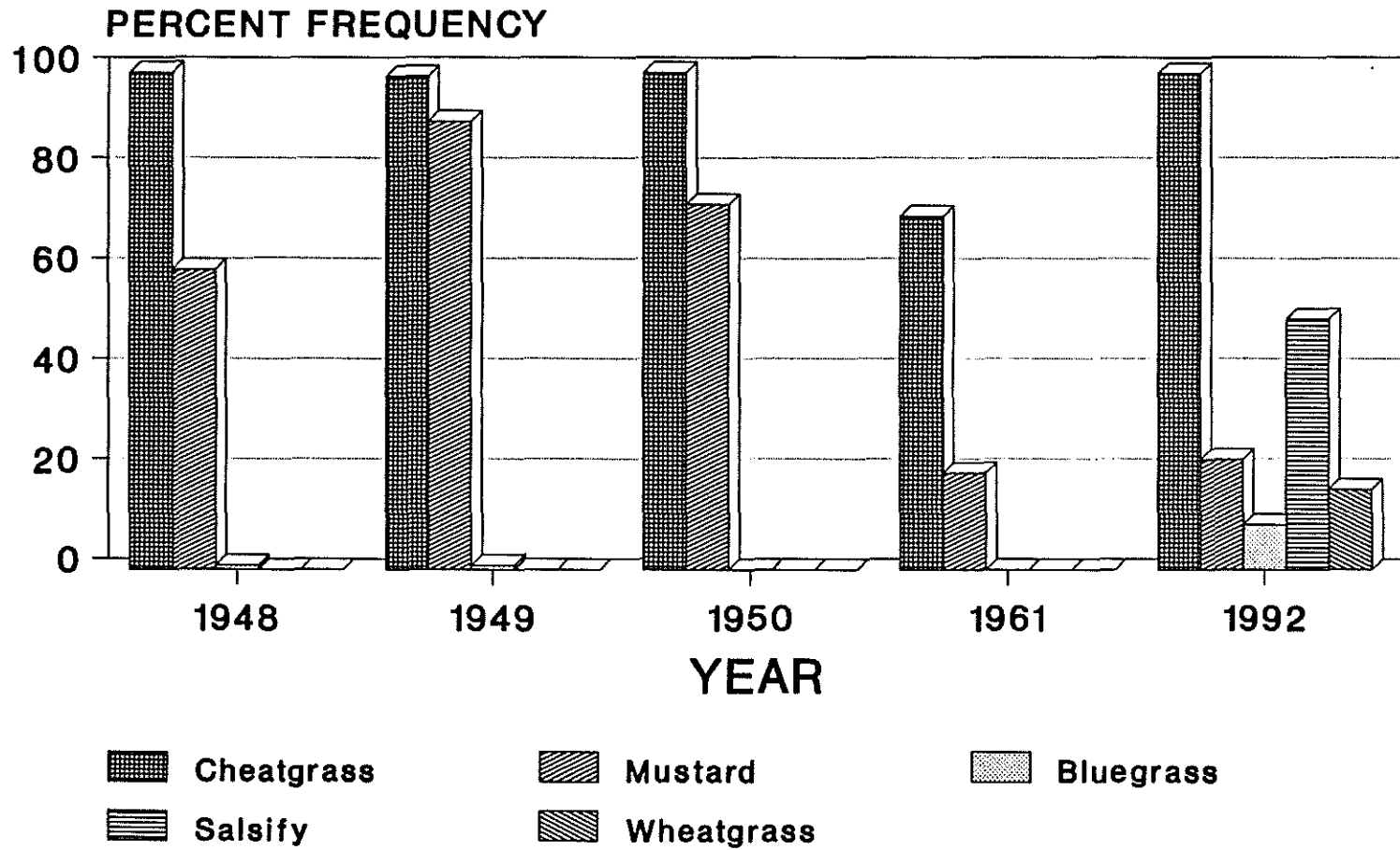


Figure 9. Percent frequency of species within the "weedy" portion of the Castleford Exclosure for the years 1948 through 1992.

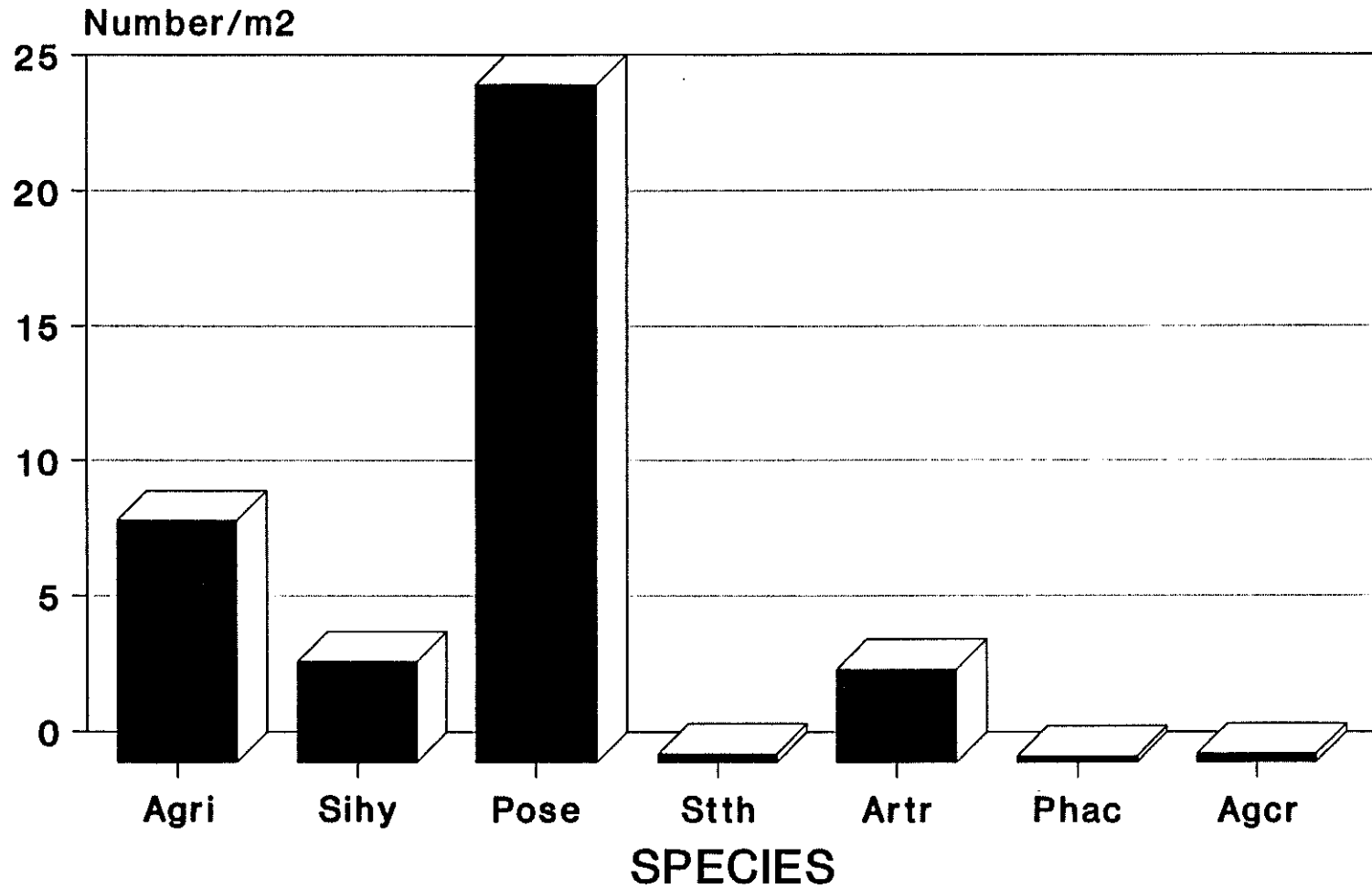


Figure 10. Density ( $m^2$ ) of perennial species within the "sagebrush" portion of the Castleford Exclosure for 1992. Agri = streambank wheatgrass; Sihy = Squirreltail; Pose = Sandberg's bluegrass; Stth = Thurber's needlegrass; Artr = sagebrush; Phac = phlox; Agcr = crested wheatgrass.