Understory Response to Thinning Ponderosa Pine in Northeastern Oregon

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SUMMARY: Plant understory production and composition has been monitored over a seven year period following thinning of a ponderosa pine forest in northeastern Oregon. Thinning reduced tree canopy cover by 52 percent and basal area by 59 percent. Understory vegetation did not respond during the first growing season following logging. Four growing seasons after logging, the understory vegetation increased over two-fold. However, during drought conditions, seven growing seasons following logging, understory vegetation was similar in both thinned and non-thinned stands.

Ponderosa pine (*Pinus ponderosa*) forests are widely distributed within the interior mountain ranges of the Northwest. These forests provide timber and forage for livestock and wild herbivores. Ponderosa pine forests are also an important part of watersheds that feed many salmon and steelhead streams and rivers. In the Blue Mountains of northeastern Oregon, ponderosa pine forests comprise much of the economic land base where timber and forage resources are managed for dual or multiple uses. Often these resources are managed independently, rather than simultaneously. Integration of forest and grazing management objectives has the potential to improve returns from both livestock grazing and timber yields on the same unit of land.

Understory production can be increased and species composition changed through overstory thinning, clearcutting, or other methods of harvesting. Commercial thinning of ponderosa pine allows light of greater intensity and duration to reach the forest floor, and increases soil moisture by reducing overstory competition and canopy interception of precipitation. Nutrient cycling is also changed as competition for soil nutrients from the overstory is reduced. The primary objective of this study was to evaluate long term changes in understory production and plant composition following commercial thinning of a ponderosa pine overstory. A second objective was to measure the influence of large herbivores, both domestic and wild, on plant composition within thinned and non-thinned ponderosa pine stands. This report will only discuss the effects of thinning on understory vegetation.

MATERIALS AND METHODS

The study was conducted on the Hall Ranch of the Eastern Oregon Agricultural Research Center, located approximately 12 miles southeast of Union, Oregon. The Hall Ranch is in the southern foothills of the Wallowa Mountains in the northeastern corner of the state at an elevation varying from 3,300 to 4,000 feet. The climate is continental with cold wet winters and hot dry summers, with occasional thunderstorms. Mean annual precipitation is 24 inches, most of which occurs between November and May in the form of snow.

The three study sites selected were in a ponderosa pine/snowberry (*Pinus ponderosa/Symphoricarpos albus*) community type. Ponderosa pine dominates the overstory, but can co-dominate with Douglas fir (*Pseudotsuga menziesii*). Snowberry, elk sedge (*Carex geyeri*), pinegrass (*Calamagrostis rubescens*) and heartleaf arnica (*Arnica cordifolia*) dominate the understory. Sites were selectively logged before 1936; since then there has been no logging.

The three major soil series occurring on the pine stands are Hall Ranch, Klicker and Tolo. Surface texture ranges from silt loam to silty clay loam, and depth varies from 12 to greater than 36 inches. All series originated from pumicite parent material ejected from Mt. Mazama 6,600 years ago.

Three 12 acre blocks, located within a half mile of each other, were selected for this study. Half of each block (6 acres) was commercially thinned in the winter and early spring of 1986, and the remaining half left undisturbed (control). Stands were thinned from a density of 140 to 60 trees/ac. The pine sites were relatively homogeneous in overstory species composition and stand structure, however, understory vegetation differs slightly among blocks. Tree diameters at breast height (dbh) averaged 12.5 inches with the larger trees approaching 53 inches.

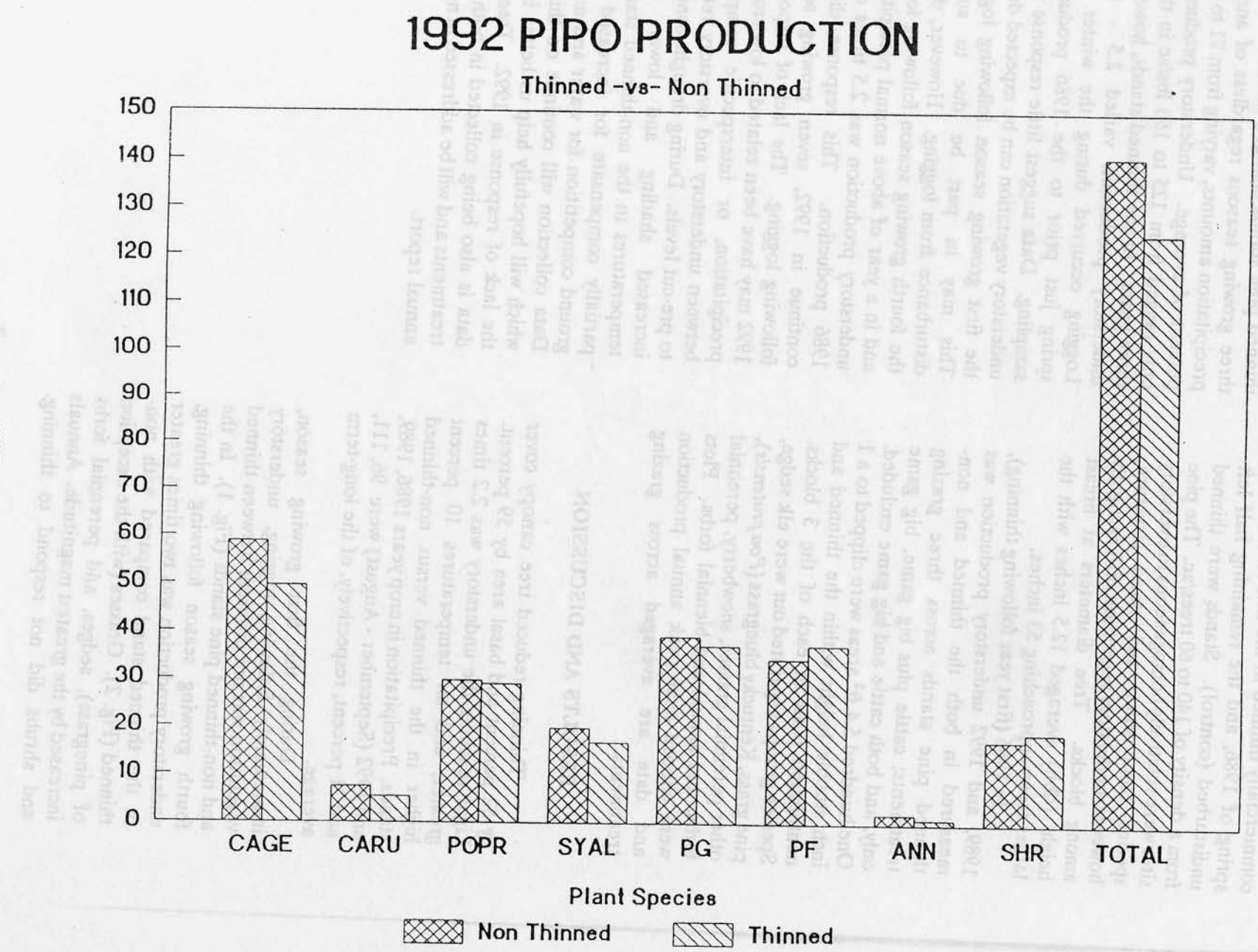
In 1986 (first year following thinning), 1989, and 1992 understory production was measured in both the thinned and non-thinned pine stands across three grazing treatments; cattle plus big game, big game only, and both cattle and big game excluded. One hundred 5.4 ft^2 areas were clipped to a 1 inch stubble height within the thinned and nonthinned plots in each of the 3 blocks. Species groups separated out were elk sedge, pine grass, Kentucky bluegrass (*Poa pratensis*), other perennial grasses, snowberry, perennial forbs, and annual and biennial forbs. Plots were clipped near peak annual production and data are averaged across grazing treatments.

RESULTS AND DISCUSSION

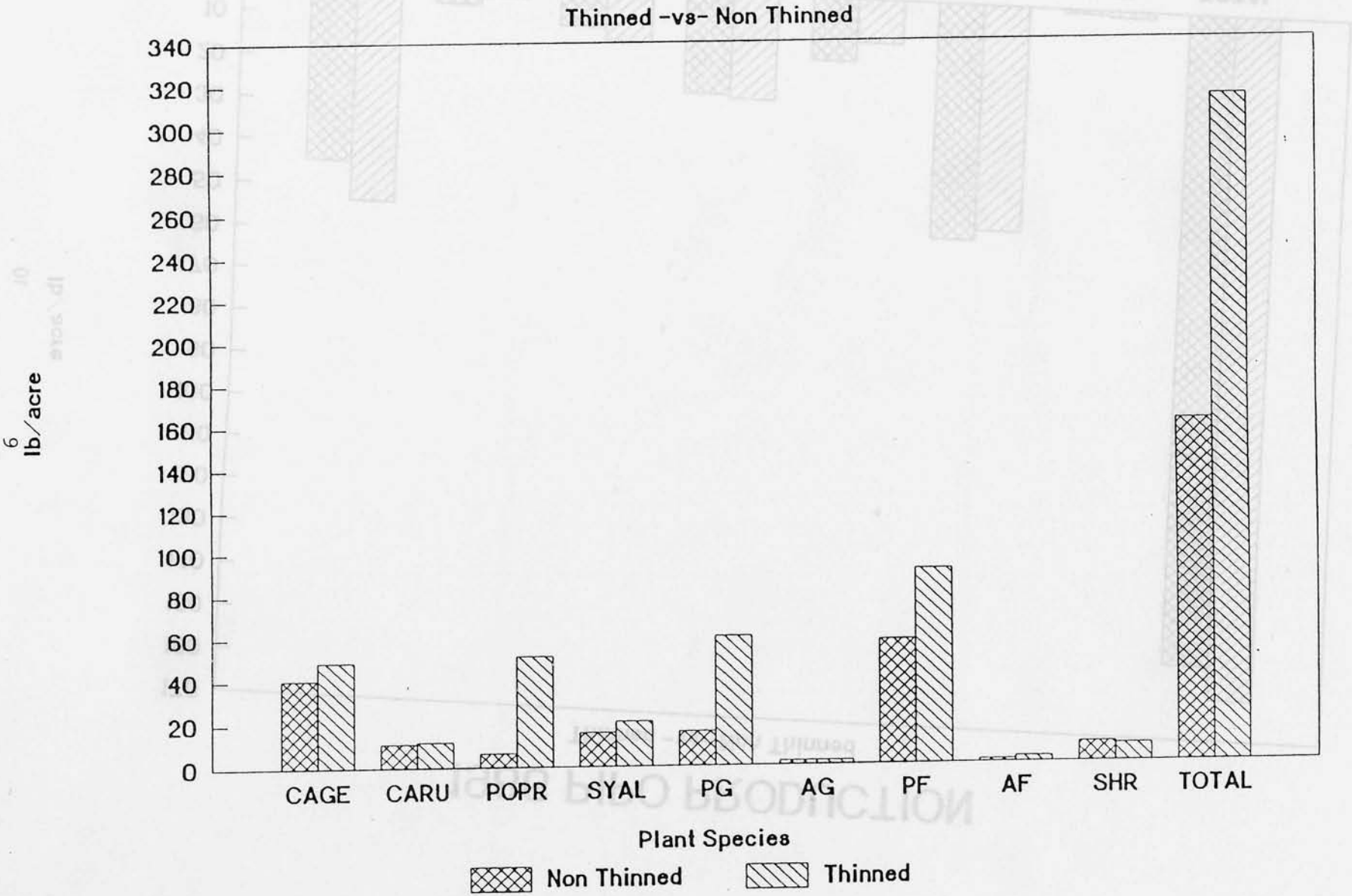
Thinning reduced tree canopy cover by 52 percent and basal area by 59 percent. Light reaching the understory was 2.2 times greater, and air temperatures 10 percent higher in the thinned versus non-thinned stands. Precipitation in crop years 1986, 1989, and 1992 (September - August) were 96, 111, and 71 percent, respectively, of the long-term average.

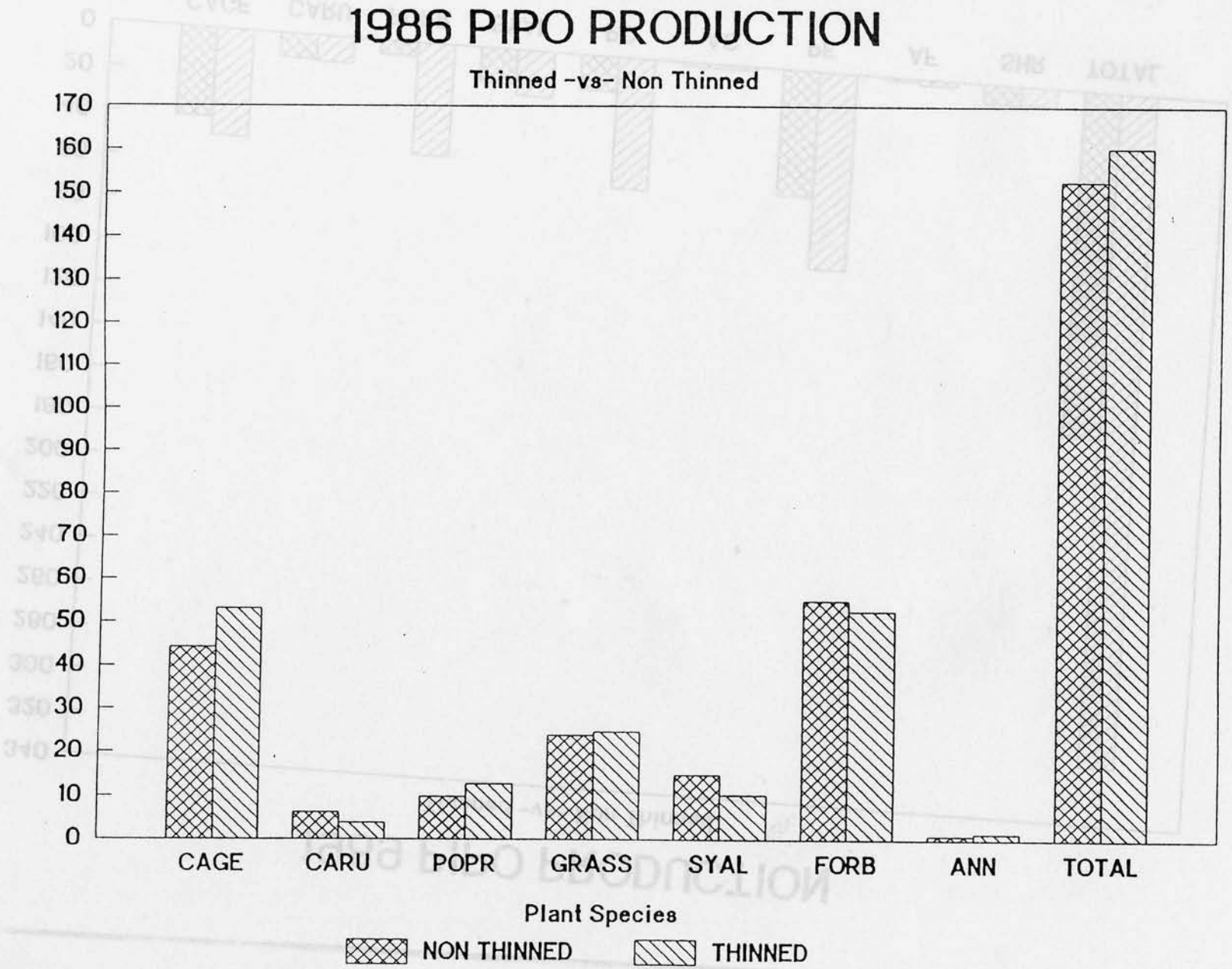
During the first growing season, immediately following logging, understory vegetation was not different between thinned and non-thinned pine stands (Fig. 1). In the fourth growing season following thinning, understory production was two times greater in the thinned stand compared with non-thinned (Fig. 2). Grasses (with the exception of pinegrass), sedges, and perennial forbs increased by the greatest magnitude. Annuals and shrubs did not respond to thinning. During the 1992 growing season no difference occurred in understory production between logging treatments.

Understory production in the non-thinned pine stands changed little across the three growing seasons regardless of annual precipitation amounts, varying from 71 to 111 percent of average. Understory production only ranged from 125 to 150 lbs/ac in these three years. In the thinned stands, however, understory production varied 2.5 - fold. Logging occurred during the winter and spring just prior to the 1986 production sampling. Data suggest little response from understory vegetation can be expected during the first growing season following logging. This may in part be due to surface disturbance from logging. However, during the fourth growing season following logging and in a year of above normal precipitation, understory production was 2.5 times of the 1986 production. This response did not continue in 1992, seven growing seasons following logging. The lack of response in 1992 may have been related to low crop year precipitation, or interspecific competition between understory and overstory returning to pre-cut levels. During drought conditions, increased shading and lower midday temperatures in the non-thinned stand may partially compensate for increased below-ground competition for water and nutrients. Data collection will continue on this study, which will hopefully help us better interpret the lack of response in 1992. Tree growth data is also being collected in both logging treatments and will be addressed in next years annual report.


1992 PIPO PRODUCTION
Thinned -vs- Non Thinned
lb/acre
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
CAGE
CARU
POPR
SYAL
PG
PF
ANN
SHR
TOTAL
Plant Species
Non Thinned
Thinned

1989 PIPO PRODUCTION




1986 PIPO PRODUCTION
Thinned -vs- Non Thinned
lb/acre
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
CAGE
CARU
POPR
GRASS
SYAL
FORB
ANN
TOTAL
Plant Species
NON THINNED
THINNED