# Changes in Redberry Juniper Distrubtion in Northwest Texas (1948 to 1982)

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Redberry juniper is a basal-sprouting, evergreen conifer that occurs in west and northcentral Texas, southwestern Oklahoma, southeastern New Mexico, and northeastern Mexico (Adams and Zanoni 1979). A distribution map, based on a 1948 Soil Conservation Service (SCS) survey of all juniper (cedar) species in Texas was prepared by Allred (1949) (Figure 1 a). A 1982 SCS survey mapped the distribution of redberry juniper, blueberry (ashe) juniper, and eastern redcedar at three density levels in Texas (SCS 1985). While techniques used for the 1948 and 1982 surveys differed, and the 1948 survey did not separate juniper by species or density, we feel a comparison of selected portions of these two maps in northwest Texas, i.e. where redberry juniper is the only species present, is valid and provides a dependable indication of this species population trends.

## Methods

The 1948 map included all juniper species in Texas, and it is impossible to separate redberry from other junipers in some regions, such as the Edwards Plateau, where juniper species are mixed. However, Adams and Zanoni (1979) and the 1982 SCS survey (SCS 1985) indicate that junipers in northwest Texas, extending from Amarillo to San Angelo, are predominantly redberry juniper. Sixty-five counties of northwest Texas were included in our comparison of the 1948 and 1982 maps (Figure 1 b). Juniper in the northern Texas panhandle along the Canadian River breaks are one-seed instead of redberry (Adams and Zanoni 1979). We excluded one-seed juniper areas from our comparison.

Juniper distribution was quantified with a tablet planimeter and crosshair mouse (SummaSketch Professional; Summagraphics, Corp., Fairfield, Conn.) and interfaced with an IBM-compatible 80486 computer and tablet software (SigmaScan; Jandel Scientific, Inc., Corte Madera, CA). The tablet was calibrated to a known area of 6.4 million acres (100 x 100 miles), derived from the mileage scale on each map. Official area of the 65-county region in northwest Texas is 61,594 miles$^2$, or 39.4 million acres (16.0 mil-

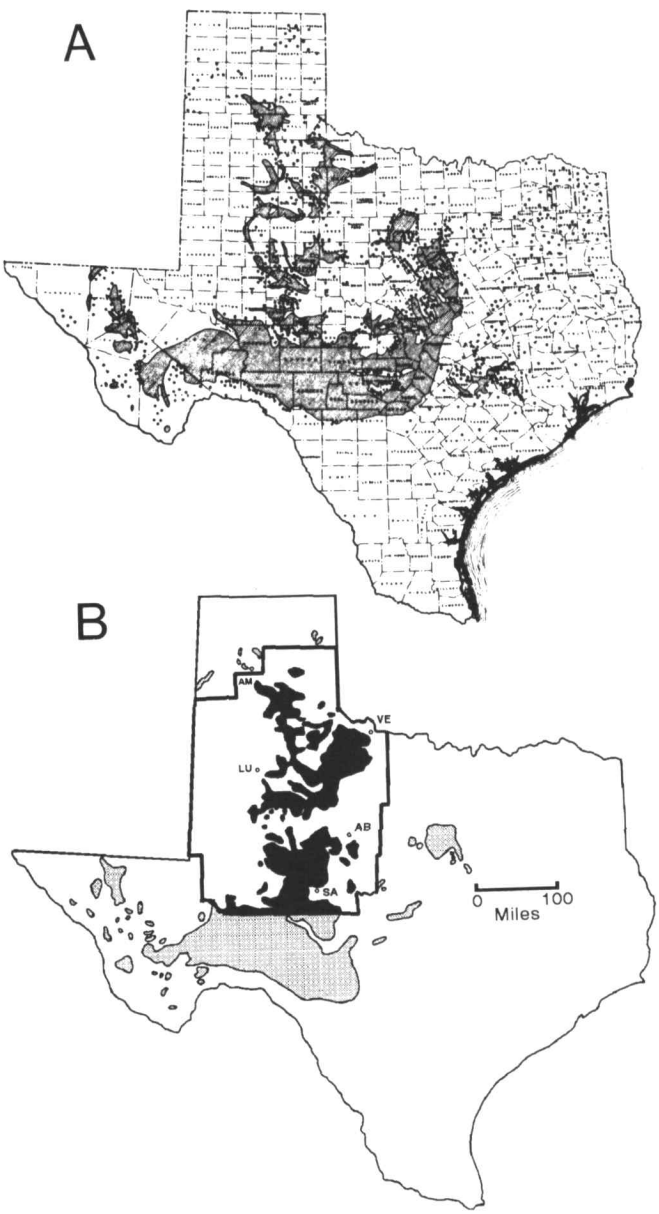


**Fig. 1.** *Distribution of (A) all juniper species in 1948 (from Allred 1949), and (B) redberry juniper in 1982 (from SCS 1985). Details for map B: All 3 original density levels are combined. Straight lines within state boundaries delineate the 65-county region used to compare the 1948 and 1982 maps. Black areas: redberry juniper within the 65-county region; gray: redberry juniper in rest of state. AM=Amarillo, LU=Lubbock, SA=San Angelo, AB=Abilene, VE=Vernon.*

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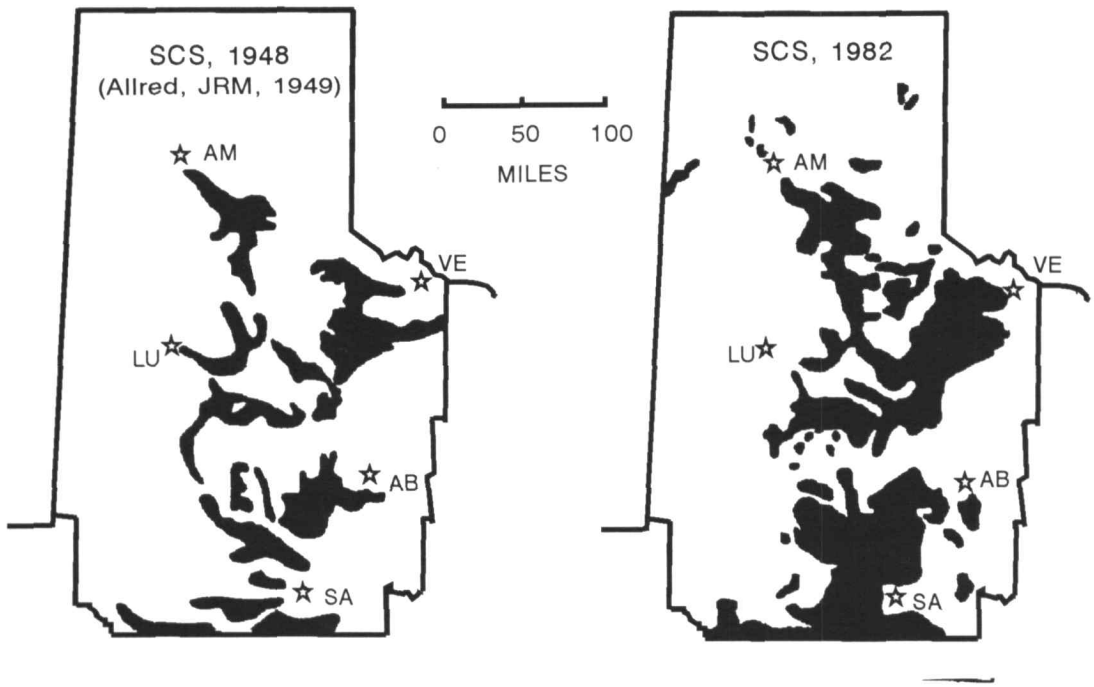


**Fig. 2.** *Redberry juniper distribution in 65 counties of northwest Texas in 1948 (left; from Allred 1949) and 1982 (right; from SCS 1985). City identification is same as Figure 1.*

lion ha) (Texas Almanac 1993). Mean of three planimeter estimates of this area was 39.3 million acres (15.9 million ha).

Area of each juniper delineation was measured twice and the values were averaged. The three redberry juniper density levels identified in the 1982 SCS map were combined and total acreage of all densities was determined. Isolated pockets of redberry juniper, identified on the 1948 map as solid circles with no area estimate, were arbitrarily assigned a value of 1,000 acres and added to the planimeter estimate of redberry juniper distribution.

## Results

Planimeter measurement of Allred's 1948 map indicated redberry juniper distribution within the 65-county region of northwest Texas was 6.3 million acres (2.5 million ha) (Figure 2). Planimeter measurement of the 1982 SCS map indicated that redberry juniper distribution was 10.1 million acres (4.1 million ha), representing a 61 percent increase in 34 years. During this interval, the percentage of the total area within the 65-county region occupied by redberry juniper increased from 16 to 26.

Comparing 1948 and 1982 distributions on a single map indicated redberry juniper in 1982 extended from areas infested in 1948 (Figure 3). The expansion of redberry juniper infestations appears to be multidirectional with no apparent trend in direction. Areas most affected by encroachment since 1948 are Motley and Cottle Counties (between Lubbock and Vernon), and counties northwest of San Angelo. In a few areas near Lubbock, Abilene, and Vernon, the map comparison suggests that redberry juniper distribution decreased during the 1948-1982 period, but this decrease represented only 0.3 million acres (0.1 million

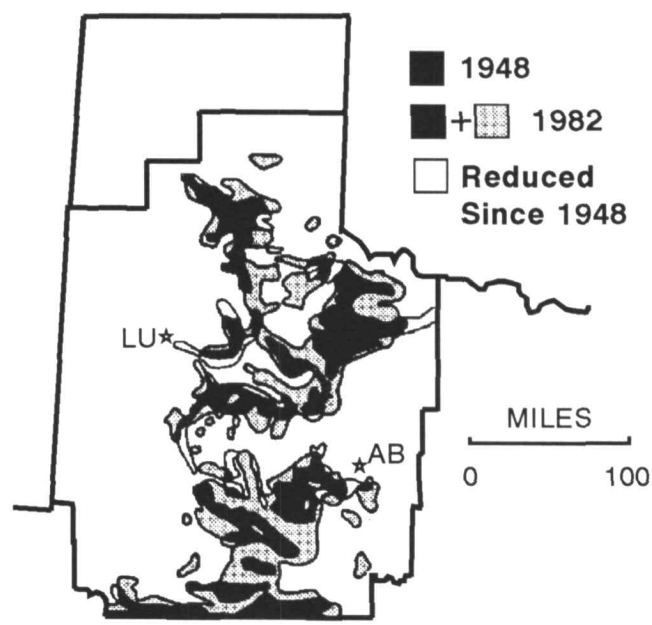


**Fig. 3.** *Overlap comparison of redberry juniper distribution in 65 counties of northwest Texas in 1948 (from Allred 1949) and 1982 (from SCS 1985).*

ha). The decrease in redberry junipers in these areas may have been due to mechanical removal (i.e., chaining, etc.) or urban development.

Comparisons in this paper represent planimeter analysis of maps with no on-site verification, however, they suggest redberry juniper distribution in northwest Texas has increased substantially since 1948. Numerous areas in northwest Texas are currently dominated by young redberry juniper on grasslands adjacent to mature juniper stands and within adjacent honey mesquite communities. This may indicate that redberry juniper is continuing to spread. Based on differences between 1948 and 1982, and assuming a linear rate of increase, we predict redberry juniper will cover over 12 million acres (4.9 million ha), or nearly a third of the 65-county region by the year 2000 (Figure 4). It was not determined what the limits of the potential distribution are, excluding cropland and urban areas, but at least half of the 65-county region (about 20 million acres) is rangeland.

## Discussion

Originally, redberry juniper populations were found on rocky outcrops, dry hills, arroyos and canyons, caprocks and shallow limestone or gypsum soils where they were protected from grass fires. Since the late 1800's, redberry juniper has encroached onto deeper-soiled clay flats, bottomlands, and valleys previously occupied by grass and honey mesquite.

Redberry juniper encroachment onto these more productive range sites is attributed to reduced frequency and intensity of grass fires, livestock overgrazing, periodic drought (Smeins 1983, Ueckert et al. 1994a) and possibly increases in atmospheric carbon dioxide (Mayeux et al. 1991). These factors increase the abundance of sites having poor grass cover which facilitate juniper seedling establishment through diminished competition from grasses and diminished frequency and intensity of fire. Redberry juniper seedlings are weak competitors and their growth and survival is reduced in the presence of competition by a good cover of grass (Smith et al. 1975).

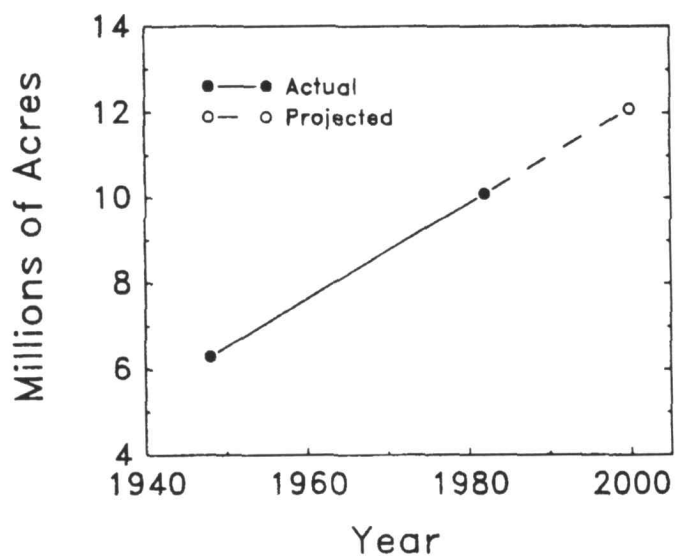


**Fig. 4**. *Acreage occupied by Redberry juniper distribution in 65 counties of northwest Texas from 1948 to 1982, and projected acreage by 2000.*

### *Pathways For Encroachment*

We hypothesize there are two primary pathways leading to the expansion of redberry juniper's range. The first is the recruitment of new plants from seed in grasslands adjacent to established mature stands. In grasslands without mesquite, redberry juniper seeds are probably disseminated by small mammals, wind and surface water flow. In some areas these processes are probably accelerated by cattle overgrazing, which reduces grass competition with juniper seedlings. Sheep and goats will consume some redberry juniper seedlings while in the cotyledon stage and have been used as a means of biological control of redberry and blueberry juniper in the Edwards Plateau region.

A second pathway is the combined effect of birds and the presence of honey mesquite trees. Chavez-Ramirez and Slack (1993) found that American robins and the cedar waxwing effectively dispersed blueberry juniper seeds in Texas, and probably the same is true for redberry juniper. Mesquite branches may act as perch or resting sites for a variety of birds that consume redberry juniper seeds and defecate or drop these seeds beneath the mesquite canopy. There are countless examples in northwest Texas of redberry juniper seedlings growing beneath mesquite canopies, as well as examples of mature redberry junipers that have grown larger than the mesquite nurse plants and appear to dominate the mesquite plant (Figure 5). We have not observed mesquite seedlings occurring beneath mature redberry juniper canopies.

It is likely that dispersal of juniper seed into grasslands that are distant from mature juniper stands would be slower if mesquite were not present. Dispersal of redberry juniper seeds by mammals may be more important in the establishment of redberry juniper in mesquite-free grasslands near mature juniper stands. Fence posts and powerlines may serve as additional perch sites and partially account for the invasion of juniper into reseeded fields and abandoned cropland. The role animals and perch sites play in the population dynamics of redberry and other junipers requires further research.

Redberry juniper seeds germinate and emerge best at 64°F (18°C) in moist soils. This suggests germination and emergence would be greatest in wet spring or autumns. Near Snyder, Texas above-average cool season (spring and autumn) precipitation in successive years, the first for seed production and the second to facilitate seedling growth, was highly correlated with redberry juniper establishment (McPherson et al. 1990a). Successive above-average precipitation years combined with avian dispersal of seeds may lead to episodic establishment of redberry

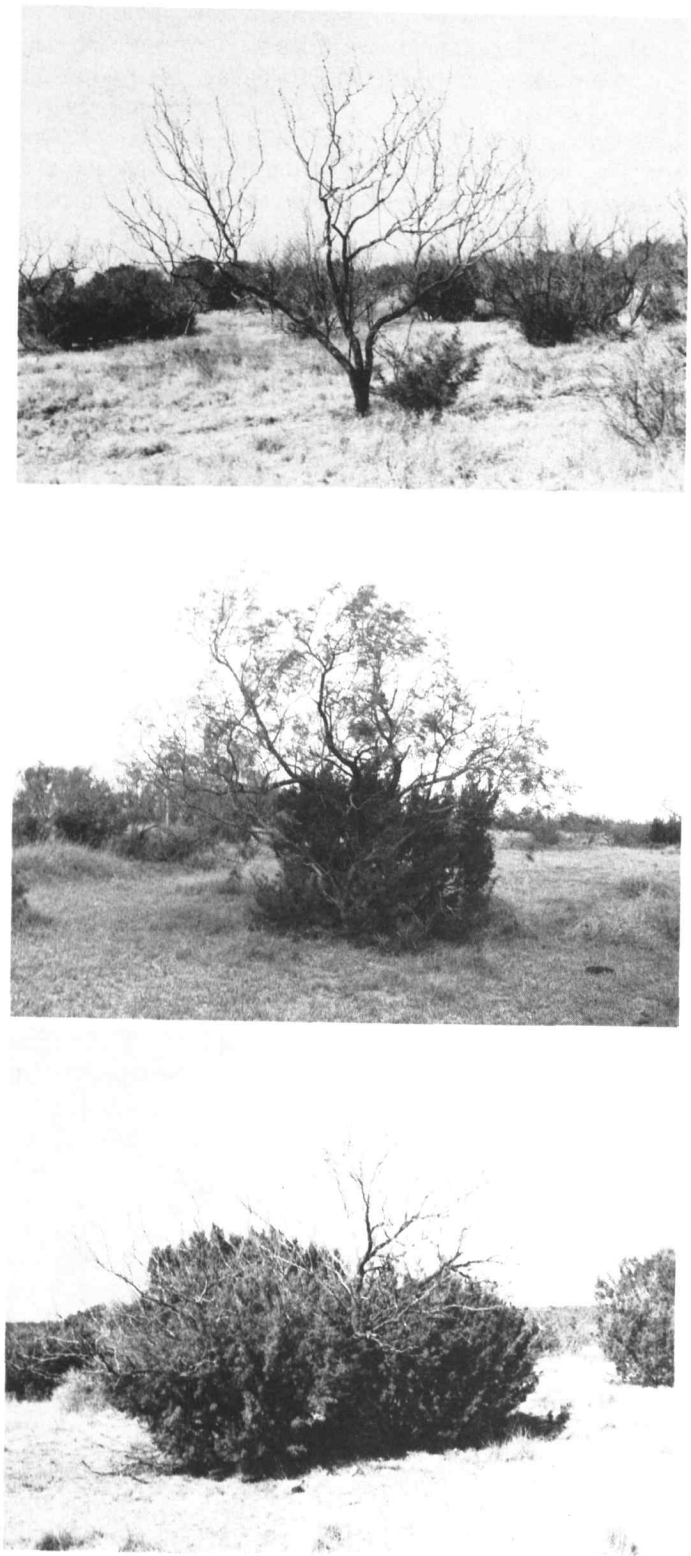

**Fig. 5.** *Young redberry juniper seedlings beneath a honey mesquite canopy (top), a larger juniper beneath mesquite (middle), and a juniper dominating the host mesquite (bottom). Photographs were taken on the Y Experimental Ranch west of Crowell, TX..*

juniper in mesquite-dominated grasslands.

*Redberry Juniper Management*

Redberry juniper reduces grass productivity, especially on shallow soils, by altering the light environment, soil moisture content, soil nutrient availability and soil temperature (McPherson and Wright 1990b, Ueckert et al. 1994a). It can increase to the exclusion of nearly all other woody and herbaceous species, thereby reducing biodiversity. Excessive woody cover interferes with movement and handling of livestock, results in inefficient on-site use of precipitation, and diminishes watershed and wildlife habitat values of rangelands (Thurow and Carlson 1994). Larvae of the cedar fly, a major problem for the livestock industry, appear to require leaf litter under redberry juniper for survival (Montandon et al. 1993). In summary, dense stands of redberry juniper represent a major threat to species biodiversity, watershed quality and quantity, and ranching and recreation industries. Scattered stands of small redberry juniper provide a forewarning of dense stands in the future.

Historically, mechanical control techniques (chaining, grubbing and root plowing) have been the primary methods employed for reducing redberry juniper canopies. Chemical control of mature redberry juniper is cost-prohibitive, but seedlings and saplings can be controlled with herbicides (Ueckert et al. 1994b). Prescribed burning can be cost-effective for control of redberry juniper. Seedlings and young redberry junipers can be killed by fire, but mature plants usually sprout following fire (Steuter and Wright 1983). Basal budzone (caudex) location in relation to the soil surface is the factor which determines the susceptibility of redberry juniper to fire. Redberry junipers are fire resistant when the caudex is covered with soil. The caudex becomes covered as the plant matures, although rate of covering is site dependent and usually occurs earlier on sites with deeper soils and gentle slopes (Steuter and Britton 1983).

Dense, mature redberry juniper stands often require mechanical treatment before prescribed fire is possible, because of limited understory herbaceous production (fine fuel) necessary to carry an effective fire (Smith et al. 1975). Correct stocking levels and grazing deferment systems that allow grass to compete with redberry juniper seedlings and provide adequate fuel for planned prescription burns are recommended strategies for redberry juniper management.

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In the December 1994 issue of *Rangelands* part of Matt Ricketts article was missing starting on page 263 to 264. The following is the complete section of this article. The editorial staff apologize for any inconvenience this may have caused.

### Protein Supply and Demand of Sheep

Sheep frequently have a much higher need for protein than do cattle. This may explain why sheep have a diet that consists of a much larger percentage of shrubs and forbs than do cattle. Many forbs have a high protein content, and they are green and actively growing at various times of the summer. As earlier stated, this is when plants contain the highest amounts of category one nutrients.

For example, western yarrow and arrowleaf balsam root contain nearly 17% and 30% protein, respectively, when immature, and 13% and 10% when mature (National Research Council 1971). These forbs are an excellent source of protein that sheep select. Cattle have been known to graze considerable amounts of forbs also, but it appears that sheep have a greater need for this protein source.

Big sagebrush and black sagebrush, shrubs which are not very palatable or desirable to cattle, are utilized frequently by sheep, again most likely reflecting their need for a higher protein diet.

In addition, sheep producers often say that sheep don;t like the tall, course grass, but rather the fine short grasses. They are most likely observing a sheep's larger demand for protein. A 132 pound March lambed ewe has about a five pound daily dry matter intake in the spring and needs about 0.6 pounds of protein per day during this season. Grasses may or may not provide these needs depending on growing conditions, growth stage, and types of grasses. Sheep are then forced to utilize shrubs and forbs to meet demands.

During the summer, grasses may or may not meet sheep protein needs, but shrubs and forbs most likely will.

During the fall, sheep protein needs won't be met by grasses and may or may not be met by shrubs. Identifying the better shrubs on a ranch to assure oneself of the adequacy of the diet in meeting the seasonal sheep protein needs is important.

Winter is a season during which a 132 pound March-lambed ewe in the Northern Great Plains may not be able to meet her protein demand of .4 pounds per day. When temperatures get very cold, a sheep's dry matter intake drops, making supplements during these periods necessary in spite of the availability of shrubs. The same can be said of cattle, also, but to a much lesser extent due to a cow's larger size. An overreaction often takes place as more money than necessary is spent to provide these nutrients even though these very cold spells last a relatively short period.

Many times beneficial shrubs are not recognized for their seasonal nutritional value. The result may be that we graze these areas in the late spring or summer when the grasses are already providing the nutrients our livestock need. We may then be wintering in an area without these types of shrubs and feeding high quality alfalfa hay or other feed supplements to provide these nutrients at a much higher cost. The result may be the same. The calves or lambs or culls that we market may be the same weight or even heavier, having been fed costly supplements instead of utilizing proper grazing management planning. The question remains- How much did it cost or what was my profit?