# Wedgeleaf Ceanothus, Range Brush

## increase studied and control method recommended

H. H. Biswell and J. F. Street

**The useless character** of many dense brush areas on livestock and game ranges in California has become a problem of major economic concern. Studies to determine the effects of grazing and fire on the increase in wedgeleaf ceanothus and the possibility of removing it by hand are underway.

Most of the work to date has been done on the San Joaquin Experimental Range where there is a natural area ungrazed by domestic livestock for the past 14 years and unburned since July, 1929—19 years ago. It is an ideal area for such a study.

Recent detailed examinations indicate that wedgeleaf ceanothus is increasing steadily and consistently on the natural area where there is no grazing. This is borne out by the large number of young plants per acre. A few new plants appear almost every year.

Other common brush species on the natural area are bush lupine, chiefly in local areas on south exposures, redberry, coffee berry, and manzanita. Common trees on the area are digger pine, blue oak, and interior live oak.

Of the forage on the natural area, about 99% is annual plants and only 1% or less, perennial grasses. Chief among the forage plants are soft chess, foxtail fescue, slender wild-oat and broadleaf filaree. Apparently these species do not offer sufficient competition to hold the wedgeleaf ceanothus in check.

### Fire Damage

Wedgeleaf ceanothus on the natural area probably is now about as thick as before the fire of 1929—apparently recovered completely in density in 19 years.

This conclusion is based on the number of plants now alive that escaped the fire of 1929, plus dead shrubs that show fire scars or are in the same stage of decay as those with fire scars, compared with the total number of living plants at present. Apparently, none that survived the fire has since died.

Wedgeleaf ceanothus is considered one of the more important deer browse species in the state. Under proper grazing it is moderately browsed by cattle.

Observations in nearby grazed pastures indicate that the plant is not increasing as rapidly as it is in the natural area. In the grazed pastures browsing undoubtedly destroys many seedlings.

As this shrub is nonsprouting it seems that if the entire top of a one or two-inch tall seedling were bitten off, the plant would be killed.

Growth rate of shrubs in moderately grazed pastures was slower than that in the natural area. In moderately used areas, plants of wedgeleaf ceanothus were stunted to such an extent by browsing that plants eight years old were only two feet tall with a spread of one foot, whereas plants of the same age in the natural area were five feet tall with a spread of three feet.

### Increase After Fire

Effects of fire on the rate of increase of wedgeleaf ceanothus were studied in six burned-over areas in the woodland-grass type range.

Where plants were scattered in grass brush seedlings appeared slowly following the fires, as in the natural area.

In contrast, brush seedlings may appear suddenly in very great abundance following fires in areas of dense brush where the grasses have been choked out.

This happened following a fire in very dense brush on a ranch near North Fork. In one spot where wedgeleaf ceanothus seedlings came in especially thick, 125 were counted on a mil-acre plot. This is equivalent to 125,000 seedlings per acre, far more than can survive to maturity. Just how much of this great and sudden increase in number of seedlings following fires in dense brush areas is due to heating of the seeds, opening up of the brush stand, and seedbed preparation is not now known.

In artificial reseeding work it has been found by other workers that the ash of a heavy brush burn makes an ideal seedbed where rainfall is adequate to support the sown plants through dry summers. A grass burn leaves an ash that is useless as a seedbed.

This same principle may explain the difference in rate of establishment of brush seedlings following fires. If so, the sudden increase in seedlings on areas that were covered with dense brush, where the grasses were crowded out, is probably due more to seedbed preparation, such as mellowing of the soil and reduced competition than to anything else.

If further study bears out this observation, management should aim at keeping the stand of brush open in one way or another, and should not permit it to become so dense that it crowds out all grasses and becomes a hazard for fires of intense heat.

Where range improvement burning is attempted in stands of wedgeleaf ceanothus, probably it should be done while the brush is more or less open. Brush reinvasion would be expected to be very slow. On the other hand, if range improvement burning is delayed until wedgeleaf ceanothus has become very dense and has choked out the grasses, reinvasion of brush is apt to be rapid.

Tests indicate one person, working at a normal rate, could walk over three to five acres and cut about 240 plants or more per hour, provided the shrubs were

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**Single stalked wedgeleaf ceanothus such as these smaller shrubs in an open-type range can be controlled by cutting.**

# Salt Water in Wells

## intrusion into water wells limited to certain areas

C. N. Johnston

**Salt-water contamination** of wells, causing them to supply brackish water which will injure the crops they irrigate, is a probability in very limited areas only.

Moving water, either on the surface or below ground, is going downhill relatively. It is traveling to some point of escape which is at a lower elevation. Present-day streams or rivers leave the mountains at considerable elevation on the sides of the valleys and then cross many miles of valley fill that was laid down in prehistoric times by earlier streams, or the parents of present streams.

Prehistoric streams flowed into a valley much deeper than the present one and the sand and gravel they bore were carried far out into the valley to be deposited as fill. This fill accumulated for centuries until the present valley floor was formed.

The streams today cross the sloped gravel beds of the old streams where infiltration takes place. This is the chief source and locale of the present underground water supply and it is located near where the streams leave the mountains. This means that the source of our underground flow is well up in the valley.

Salt water intrusion into well waters implies a contact with the ocean somewhere.

One exception to this lies in the very deep wells such as oil wells which tap saline waters that have been left in the formations since they were part of the sea bottom or which leached their way down to these depths carrying the salts with them.

Leaching from the surface can and does produce salt concentration in the shallower irrigation type wells in a few limited areas. This effect is more often the result of surface irrigation and as such is independent of seasonal precipitation fluctuations.

There are such contacts where the earlier laid-down river fills spilled out into bays or along the coast and were laid down below the ocean floor. Atop these gravels and sands, which are relatively porous, clays and muck layers were deposited until the ends of the bays were filled above the ocean level or tongues of land were formed into the sea. The water seeping into the old stream beds near the foot of the mountains can and does find its exit or escape into the sea at such points. Sea water is heavier than fresh water so the sea water tends to hold back the fresh water flow from the buried gravels. But the source of supply for these gravels is from one to many hundreds of feet above the surface of the ocean so the fresh water is able to force its way out against the resistance of the ocean.

When pumps begin to take the water from these subsurface gravels and sands which are the supplying ducts or strata, a new place is provided for the water to escape. It is now somewhat easier for the water to move from the mountainside seepage areas and it moves a little more quickly, going downhill a little faster, or losing head a little more rapidly. More pumps drawing water from the gravel strata provide further easy escape ports for this motile supply and the process of losing head, or pressure, or elevation, increases.

### Affected Areas Limited

At some times sufficient pumps drawing upon the water-supplying gravels cause a situation where the flow from the seepage points is not able to maintain the force, or pressure, necessary to discharge into the ocean while supplying the wells. Then the ocean begins to seep back into the gravel strata.

This is the point at which those limited areas contacting ocean waters may begin to have salt water in the wells. All other areas of the state, including the main interior valleys, need have no fear of salt contamination from this source. Points a few miles inland from the sea will not be bothered.

This year, with the limited supply of rain, the streams will not have sufficient water in them to recharge the seepage areas mentioned above. As a result, as pumping is continued, providing easy outlets for the underground supply, it will continue to move toward our wells and will lose more and more elevation or head in doing so. It is apparent this is happening as the water levels go down farther than usual. Normal rainfall next year may bring back normal well levels.

In some limited inland areas, very deep wells encounter strata containing salts in undesirable amounts. Some such salt is the product of old land-trapped bodies of ocean water and others have resulted from deep leaching of salts naturally in the great mass of soil above by water percolating from the surface. Such waters are salty from the first and normally do not respond to variations in surface water supply.

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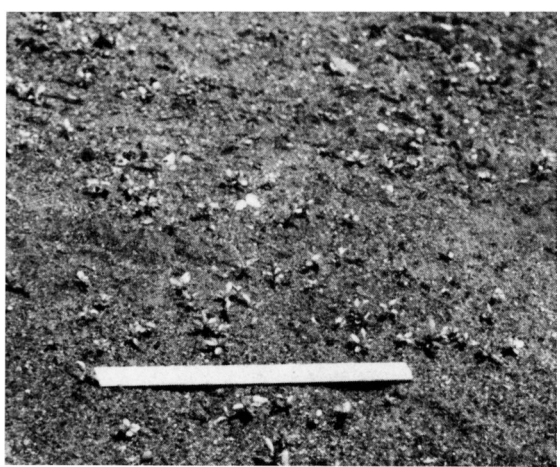
eight years or less in age. Mature wedgeleaf ceanothus plants growing in the open on the natural area had a spread of 14 feet and averaged 10 feet in height. Evenly distributed, 240 mature plants of this size will about cover an acre.

On lightly grazed or protected areas, plants of wedgeleaf ceanothus eight years or less in age can be easily cut with one stroke with an axe. But plants older than this are multiple-stemmed from the ground level, and are more difficult to remove. After the plants are mature, probably as much time would be required to cut one plant as 200 plants eight years or less in age distributed over an acre. This indicates the importance of cutting or removing the plants while they are young.

On the natural area at the San Joaquin Experimental Range where there was an abundant source of seed, about 40 new plants came in each eight or ten years following the fire of 1929. But on moderately grazed areas, and in places where old seed plants were not so numerous, they appeared much less rapidly. This number of plants per acre could be cut at very little expense.



**Young wedgeleaf ceanothus plants growing thickly in an ideal seedbed formed by the ash of a dense brush fire.**

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