TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE UTAH SOIL CONSERVATION SERVICE

PINYON-JUNIPER CHAINING

PLANNING

Since pinyon-juniper chaining is a controversial and expensive range treatment practice, the following information from local experience, observations and review of literature should prove helpful in reducing problems in future projects.

Only invasion pinyon and juniper sites should be considered for chaining. A recent study in Utah seems to indicate that soils on which pinyon or juniper is the ecological climax and which should not be considered for chaining have the following characteristics:

(1) Subsurface horizon of gravelly to cobbly loam within the first 28 cm (11.0 inches) of the surface (Surface texture doesn't appear to be an identifying factor.);

(2) subsurface permeability from 2.6 cm/hour (1.0 in./hour) in shallow soils to 5.4 cm/hour (2.0 in./hour) in deep soils. (Surface permeability doesn't appear to be an identifying factor.)

(3) little or no salinity (less than 2 mmhos/cm).

(4) pH that is neutral to mildly alkaline (7.4) on the surface and moderately (8.4) to strongly (8.7) alkaline in the subsurface.

(5) water-holding capacity of 0.25 cm/cm (0.25 in/inch) in the surface horizon and 0.35 cm/cm (0.35 in./inch) in the subsurface horizon.

Calcic horizons do not appear to be a good indicator of pinyon juniper sites. The highest percentage of pinyon and /or juniper sites that exhibited a calcic horizon was 53 percent.

Mature stands of invasion pinyon-juniper on deep soils with a minimum of 35 percent canopy cover are the best sites for chaining. Stands with less canopy of pinyon-juniper but with an understory of undesirable species may respond to burning or herbicides. Stands with less canopy but no understory may be suitable for chaining but should be evaluated with extra care. Seeding is necessary after chaining, since there is usually little understory of native grasses in this type of stand.

Two basic methods of chaining and seeding have proved effective in projects done in Utah.

One is to double chain, defer one year, burn the resulting slash, and drill in seed. After seeding, stand should be deferred until seed matures (for at least two years). Area can be grazed lightly during the dormant season if it doesn't damage the stand.

An alternate method is to double chain, aerial seeding between the two chainings. Two years of deferment during the growing season are also needed for this method. After two years the site can be burned or grazed. If the soils have a high erosion hazard (K values above 0.38), it is wiser to postpone burning until the roots of the grass have spread and not burn until about the fifth year. The site can be used for grazing in the interim.

A method which has not been used extensively but which looks increasingly feasible is harvesting the trees for firewood, posts or Christmas trees. This would reduce or eliminate costs of chaining and make better use of the resource. To take advantage of this method, planning should be done a year or two before the clearing is scheduled since commercial cutters usually plan well in advance.

After cutting, if some large trees remain, seed should be broadcast and the area single chained. If nothing remains but slash and small trees the area should be burned and the seed broadcast in the ash. (Stumps remaining even after burning will usually make drilling the seed difficult.)

Special care should be taken to follow our standards and specifications (314) and state policy for compliance with NEPA when planning and carrying out a pinyon-juniper chaining.

An environmental evaluation should be prepared. A narrative describing all significant effects should accompany the standard worksheet.

Archeological clearance should be obtained through the proper channels.

The plan map should include a landscape plan that will mitigate the visual and archeological impact of the chaining. Such a plan results in a more natural-looking area. Clumps of trees are left standing and edges are not straight.

IMPLEMENTING THE PLAN

Before the area is chained, a person responsible for directing the chaining should be thoroughly familiar with the landscape plan, areas flagged for archeological or historical reasons, and the landowner's objectives. Even when sites and boundaries are marked with bright colored flagging, they are difficult to locate during the chaining process unless someone on the scene is already familiar with locations.

Flags should be placed far enough from areas to be left unchained to give tractor drivers time to move over and leave a smooth, natural patch of trees. A responsible person should travel ahead, preferably on horseback to locate flagged areas and give guidance to tractor operators. Walking ahead is too slow to accomplish this, and riding a tractor doesn't allow enough advance warning to guide the tractors in a smooth pattern.

It is important to leave a wide boundary around the flags. This prevents sharp breaks, saves time maneuvering the tractors through sharp turns, and creates a more natural looking landscape. Because the chain is some distance behind the tractors and because catching on trunks causes it to follow an irregular path, the chain will not follow the same path as the tractors when they are turning. When chaining an archeological site, it is important to project the path of the chain to make sure that it doesn't uproot a tree that the tractors have purposely avoided. This is likely to occur when the tractors make a concave bend from a smooth line of travel.

The tractors pulling the chain should travel the same direction as long as possible without turning. It is best to go in a large circle, weaving in and out for landscaping effect. Turning the tractors and chain 180° is very difficult and time consuming.

When there is moisture in the ground, trees pull out more easily and less power is needed. They are not as likely to break off leaving live parts to regrow and increase the reinvasion problems.

A chain with links weighing at least 60 pounds is recommended. The lighter chains ride over too many trees that a heavier chain would pull out. Small trees that aren't uprooted by the chain, or a live branch of a partially uprooted tree, appear to be the principal living vegetation left in chained areas. In recent observations on 15 chained areas in Utah up to 20 years of age, only one showed a significant number of seedlings.

ECONOMIC ASSESSMENT

It is assumed that the conservationist has already discussed various alternatives with the landowner and chaining was selected as the alternative to meet the landowner's objective.

An economic assessment should be completed on all alternatives before final decisions are made. Follow-up treatment should be planned at this time since it often makes the difference between economic success and failure. The following information is needed to compute the economics of pinyon-juniper chaining:

Production Per Acre

Obtain present production from the rancher's inventory (number of animal units and months of use). Then estimate production after seed establishment.

Efficiency Factor

Forage is rarely utilized at the same rate throughout a field. Topography and access to the water normally decrease the efficiency factor below 100 percent. (The efficiency factor is a percentage of the amount that can be grazed with proper use, not a percentage of the total production.)

Another problem encountered specifically on pinyon-juniper chainings is that until and unless the area is burned or otherwise cleared there is a decrease in the efficiency factor caused by the fact that livestock can't get to the forage in the slash piles. This may decrease the efficiency factor rate to 50 percent or less.

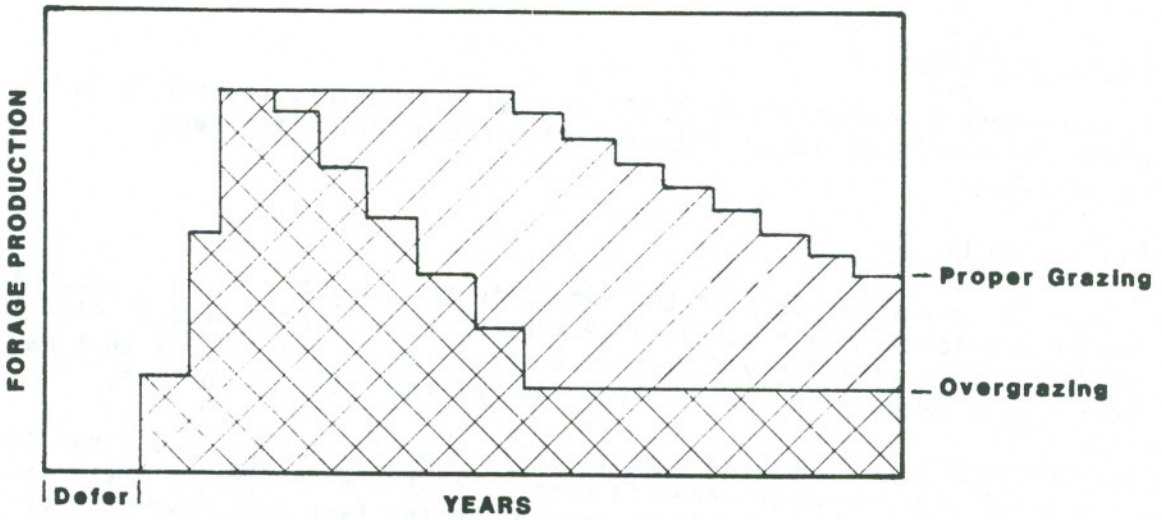
Life Span

The life span of a pinyon-juniper chaining is difficult to assess but is an essential factor in estimating the benefits that can be expected. The life span will be shortened if we "fight against nature" by chaining sites where the ecological climax is pinyon or juniper.

Life span is usually determined by the length of time before brush species become a significant part of the plant community. The pinyon and juniper are not expected to significantly compete with the grass seeding within 50 years. However, brush species such as sagebrush or rabbitbrush that emerge from available seed can be expected to grow at faster rates than when the pinyon-juniper dominated the plant community.

The life span will also be affected significantly by grazing management. Proper grazing will prolong the life of the treatment.

Note in the following graph that overgrazing a newly seeded stand will result in very rapid decrease of forage production so that the range condition will be back down to its original state at the point that a properly grazed stand is just starting to decrease. This chart, of course, is only an approximation of real life. In real life, climatic factors would cause much greater variations in production.



Effects of Grazing Management

The fact that quality of management will affect the life span, and consequently frequency and type of follow-up treatment, should be discussed with the landowner.

Little data is available on how quickly brush begins to crowd out grass. On the few chained sites where we have data on both the age of the chaining and the amount of brush, it appears that at a point somewhere between 10 and 20 years after treatment the undesirable shrubs reach the fifty percent level. If you have observed regrowth of undesirable shrubs after treatment on similar sites in the area, your estimate is the best available.

A successful burn after chaining is the beginning of a new life span for an area in which sagebrush is the main increaser. In areas in which rabbitbrush is the main brush species, burning will cause a higher percentage of the undesirable rabbitbrush in stand composition.

At some point, forage production will decrease until it reaches the point at which it is no longer producing a sufficient amount of forage for the rancher's needs. Then it is necessary to treat the brush.

Cost of burning or spraying brush to return the land to optimum forage production can be considered in the original cost of treatment. The longer life span resulting from the treatment then becomes the basis for your analysis. Since the cost of retreatment is usually lower than the cost of the chaining, using this method of analysis should result in more AUM's per dollar.

Acres Treated

Acres treated should be estimated from an aerial photo and on-the-ground observations. Be sure that areas left unchained for archeological, historical, landscape or wildlife reasons are deducted from the total field acreage.

Benefits & Costs

One method of evaluating benefits of any range practice is to estimate the increase in AUM's, multiply this amount by the standard value of an AUM, and compare this to the amortized cost.

An alternate method is to determine the increased number of AUM's the rancher will be able to utilize, the length of time they will be available, and the price he will have to pay for them. This gives the rancher the information he needs to make a decision without placing a value on AUM's.

To do this for a pinyon-juniper chaining you will need the following data:

Estimating Benefits (AUM's/Acre)

Present grazing use $\frac{\text{Total AUM's}}{\text{Acres}}$ _____

Available grazing without burning:

Potential forage production/Acre _____

Efficiency Factor _____

Proper Use Factor _____

$\frac{\text{Forage x Proper use x Efficiency)}}{800}$ _____

Available grazing after burning:

Efficiency Factor _____

$\frac{\text{Forage x Proper use x Efficiency}}{800}$ _____

Years of deferment needed _____

Year optimum forage production will be reached _____

Year production will begin to decrease _____

Annual rate of decrease (pounds per acre) _____

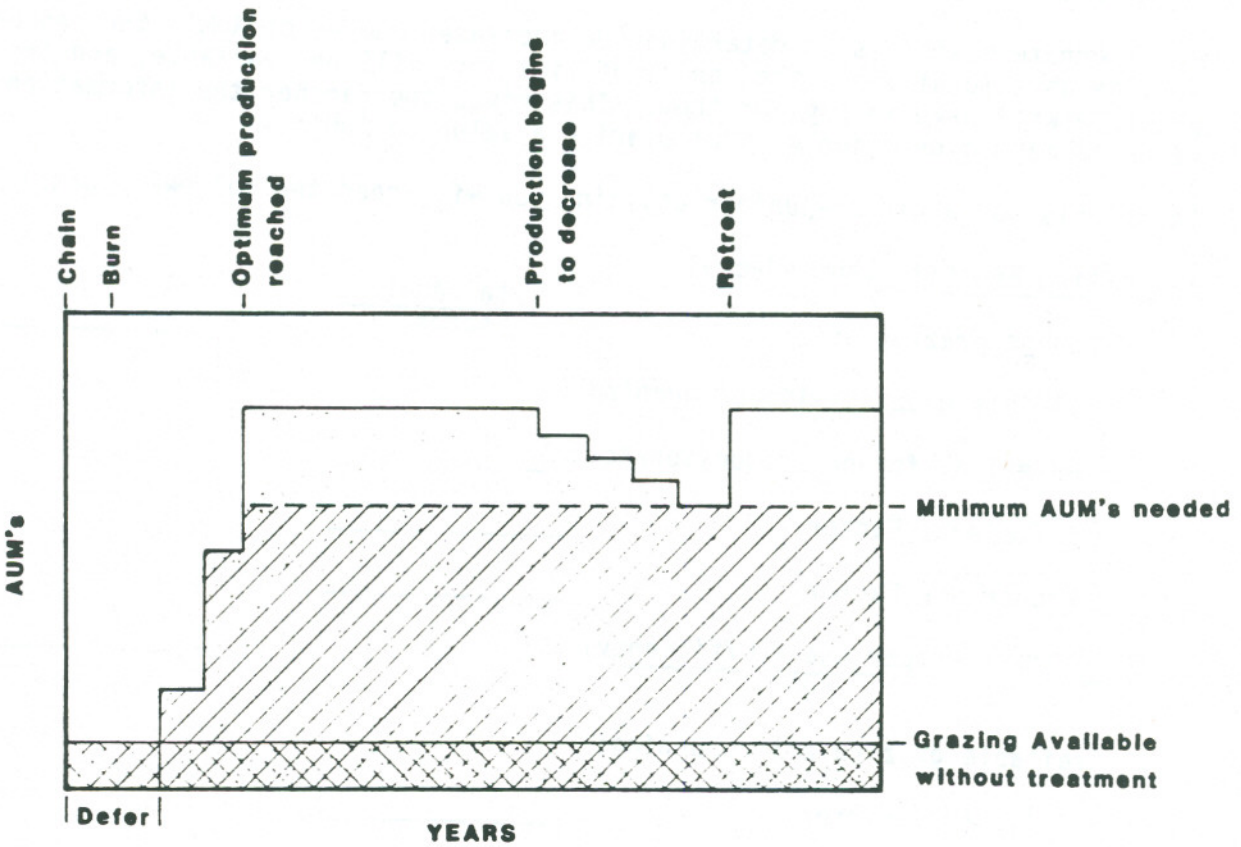
Total acres to be treated _____

$\frac{\text{(Animal units x months of grazing)}}{\text{Acres to be treated}}$ _____

Amount of forage that can be used

Non-monetary benefits _____

When this data has been gathered, it is often helpful to sketch the production in order to get a total picture (as shown below).



AUM's Produced by Range Treatment

This chart shows the average AUM's that can be expected each year when production is at the optimum.

In this example, the rancher does not need all the forage for his base herd that we estimate will be available after burning. In average and good years the rancher may consider other methods of utilizing the available forage.

It's obvious that this graph could go on indefinitely using retreatment at regular intervals. However, planning beyond 25 years will have little value to the rancher.

To compare the amount of AUM's to the total cost of the treatment, be sure to consider all of the following:

Estimating Costs:

Cost of chaining: _____

Seeding: _____

_____ pounds @ _____/lb x _____ Acres

Drilling or broadcasting _____ x _____Acres _____

Other improvements necessary to achieve increased forage _____

Deferment (Present use x value of AUM's x years) _____

Interest Rate _____

Follow-up treatment #1:

Treatment Method _____

Year _____

Cost _____

Additional Deferment _____

Present Value* _____

Follow-up treatment #2:

Treatment Method _____

Year _____

Cost _____

Additional Deferment _____

Present Value* _____

Total Cost _____

$$\text{Total Cost/Acre} \left(\frac{\text{Total Cost}}{\text{Total acres treated}}\right) \_\_\_\_\_$$

*From "Economics of Conservation Handbook" Compound Interest and Annuity Tables.