Bitterbrush Rehabilitation
Squaw Butte Fire Complex

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Idaho Bureau of Land Management
Technical Bulletin No. 94-8 August 1994

IDAHO BLM
TECHNICAL BULLETIN 94-8

BITTERBRUSH REHABILITATION:

SQUAW BUTTE FIRE COMPLEX

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August 1994

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INTRODUCTION

The Squaw Butte Fire Complex resulted from an unprecedented amount of lightning activity during a 10 day period from August 2 to August 12, 1986. During this period, more than 30 separate wildfires were ignited and burned in a rough triangle between Boise, Payette and Weiser, Idaho. The fires burned approximately 220,000 acres which included 90,000 acres of public land, 12,000 acres of State of Idaho lands and 118,000 acres of private lands.

The main concerns generated by these fires were:

1. The destruction of 107,000 acres of crucial mule deer and elk winter range. Approximately 65% of these acres were public lands. (Map 1)

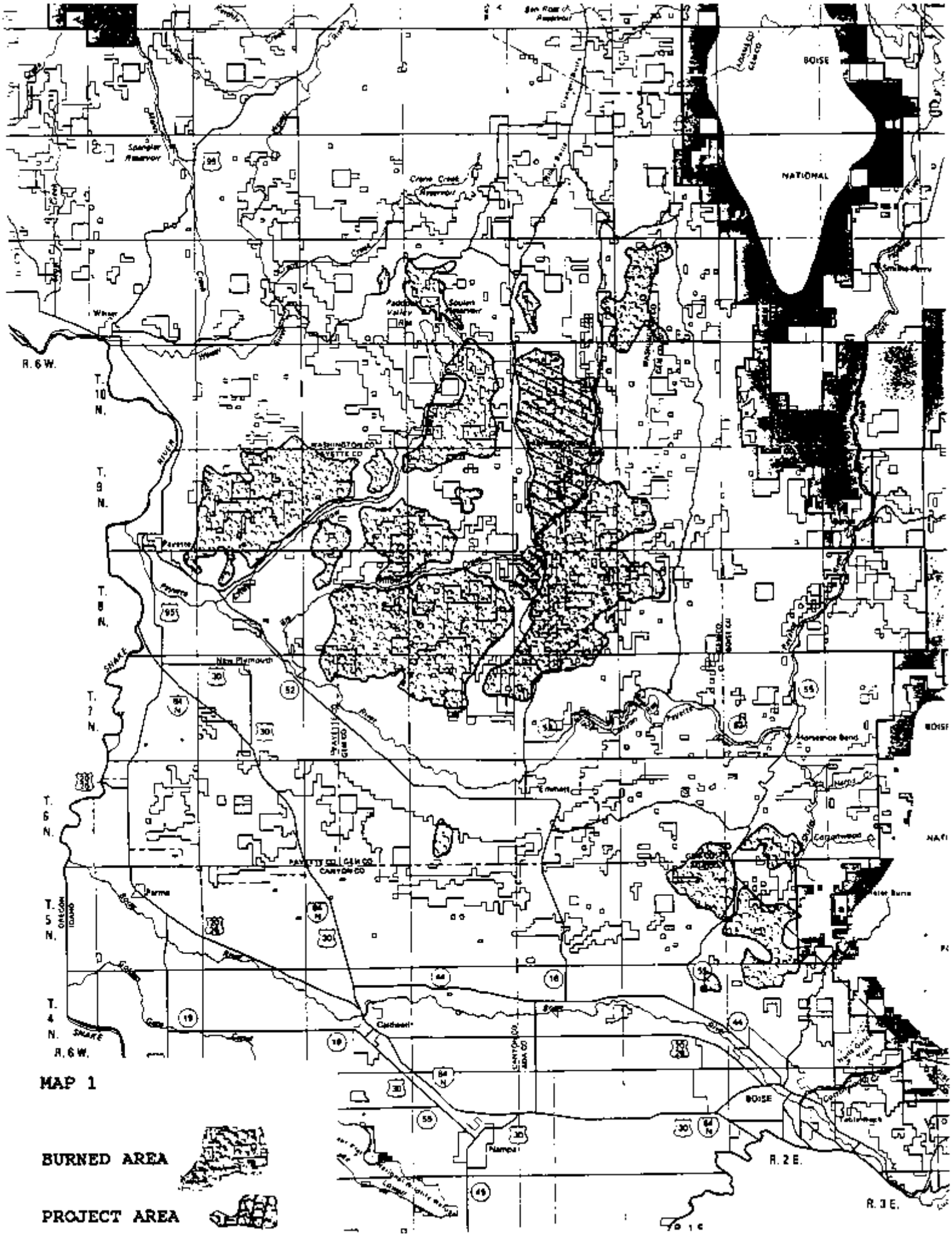
2. The loss of winter forage for 5,000 to 7,000 mule deer and 200 to 400 elk that wintered in the area.

3. Damage to many watersheds and the possibility of erosion and sediment yields due to the lack of vegetative shielding.

4. The conversion of perennial bunchgrass range to exotic annual species and loss of biological diversity.

The woody vegetation species consumed by fire in this area included sagebrush (Artemisia tridentata Nutt.), antelope bitterbrush (Purshia tridentata (Pursh) D.C.), chokecherry (Prunus virginana L.), willow(Salix spp.), quaking aspen (Populus tremuloides Michx.) and other mountain shrub species. In 1986, the Idaho Department of Fish and Game considered the loss of this winter range as the worst wildlife disaster in Idaho in the past 20 years.

In September of 1986, the Squaw Butte area experienced above normal precipitation followed by above normal temperatures in October and November. This produced an estimated 70% canopy cover of perennial and annual grasses. This reduced the threat of erosion and decreased the number of acres initially scheduled to be aerial seeded.



MAP 1

BURNED AREA

PROJECT AREA

In December of 1986, the Squaw Butte Emergency Fire Rehabilitation (EFR) Plan was completed for the Squaw Butte Complex fires. A nine member Squaw Butte Rehabilitation Committee was formed representing conservation organizations, hunting groups, the livestock industry, academia, general public, Idaho Fish and Game, Bureau of Land Management, and the Idaho Cattle Association. The committee reviewed proposed rehabilitation efforts to ensure that all resources had equal consideration in management decisions. The EFR plan provided funding for the rehabilitation efforts for 1987 and 1988. The immediate goal of this plan was to minimize short and long term soil erosion and sediment yields by enhancing vegetative cover in the area. The long term goals were to reestablish the shrub component in the crucial big game winter range and restore the habitat for other wildlife species utilizing the area.

Due to the importance of the area, an additional Squaw Butte/Willow Ridge Restoration Plan was completed in 1989. This plan identified the need for a continuous effort to reestablish the lost shrub component of the area. The goals of this plan were:

1. Maintain soil stability by restoring and improving vegetative communities in high erosion areas.

2. Reduce fire hazard/loss from future fires through greenstripping projects.

3. Reestablish the quality of big game winter habitat through shrub planting projects.

4. Restore and improve riparian zones damaged by the fires through fencing and shrub/tree planting projects.

5. Restore and improve habitat for upland and non-game species utilizing the area by addressing habitat needs for these species in all planned projects.

Purpose

The purpose of this document is to provide information on techniques for rehabilitation and restoration efforts of bitterbrush and sagebrush stands through contract seedling planting. The planting projects proceeded for five years, beginning in the fall of 1987 and ending in the spring of 1992. We used one year old bare root seedlings (except for Fall 1987) obtained from various nurseries in the region. The bitterbrush seed source was the Boise Foothills, north and adjacent to the city of Boise, Idaho. This area is comparable in soils, elevation and vegetation to the area impacted by the fires. The seed source for the sagebrush was Hobble Creek, Utah. This form of low elevation Mountain Big sagebrush, known as Hobble Creek Sage, is a selection valued for its palatability and nutritive value for wintering mule deer. Literature indicated that this selection would be adapted to the area (Welch,et.al. 1986).

Squaw Butte Rehab Profile

The most important objective of this rehabilitation effort was the protection of the watershed by maintaining soil stability. Potential problem areas were aerial seeded to reduce the possibility of erosion. The following is a compilation of all projects completed during the rehab effort. It also interprets various difficulties, obstacles and achievements encountered managing contracts, contractors, plants, equipment and other variables in a year by year narrative.

Fall 1986:

The first effort was to rehabilitate 120 miles (180 acres) of fire suppression break lines (aerial seeded, chain drag) which occurred immediately after the fire. In a high risk area, approximately 2,100 acres were aerial seeded in late fall using a grass/forb/shrub mixture to prevent the possibility of spring erosion. Approximately 166 miles of existing fence were surveyed and some reconstruction completed. Another 13 miles of new fence was constructed to protect burned areas from livestock grazing. The fencing was a Cost/Share

project, the labor for the construction was donated by the grazing permittee, materials by the Bureau. To limit or prohibit ORV use on the burned areas, 50 signs were installed at key areas.

Spring 1987:

To prevent erosion problems, 3500 acres were aerially seeded, grass/forb/shrub mixture (Appendix B). To initiate shrub rehab efforts, 8,000 acres of sagebrush seed was aerially applied. In another project, bitterbrush seed was mechanically seeded using dribblers on 1,100 acres. Volunteers also planted bitterbrush seeds on 435 acres (4800 volunteer hours). Mountain shrub seedlings were planted on 53 acres and riparian shrub seedlings were established along one mile of drainage bottoms. A research agreement was Sestablished with the University of Idaho to examine the effectiveness of the planting techniques used during rehab efforts (Jirik and Bunting, 1989).

Fall 1987:

The first shrub planting that was described in the Squaw Butte EFR plan was originally scheduled for the spring of 1987. Seedlings could not meet minimum specifications (Appendix D) and the planting was delayed until fall. On 11/23/87 through 12/2/87, 120 acres were contract planted with 35,874 containerized bitterbrush seedlings.

The weather during this time was mostly cloudy with intermittent rain, snow, and cold temperatures. The seedlings were stored on site in a horse trailer. The contract required a 36" square planting scalp for each seedling. The contractor was experienced; crew size averaged 17.

The seedlings, used in this project, were grown in containers at Native Plants Inc. in Utah and the University of Idaho in Moscow. Both nurseries failed to meet minimum specifications for seedling stature in the spring of 1987. By fall, specifications we met and the plants were shipped to Boise and stored under tarps in the Boise District wareyard. Some seedling mortality occurred at this time due to a delay in contract initiation. The seedlings were grown

in plastic sleeves in wire baskets which made storage and transport difficult and time consuming. Pack mules were used to carry plants into some of the planting units, otherwise, plants were carried in by hand. Additional mortality was observed after planting due to frost heaving. Many of the plants were literally pushed out of the planting holes and found lying on top of the ground.

Summary:

This was our first experience planting bitterbrush and sagebrush seedlings by contract. Containerized planting stock will not be used in the future due to difficulties with disposing of the plastic sleeves and wire baskets and the fact that we experienced some container mortality. This planting project experienced high mortality due to plant quality, frost heaving and weather. All subsequent plantings were schedules and completed in the spring.

Spring 1988:

The last aerial seeding (1500 acres), designed to reduce erosion, was completed using a grass/forb/shrub mixture (Appendix B). Between 3/23/88 and 4/14/88, 72,420 bitterbrush and Hobble Creek sagebrush seedlings were planted on 284 acres by contract.

Bare-root seedlings were jelly treated by BLM personnel with Aqua Gel (hygroscopic crystals that absorb water), rolled in burlap, packed in boxes and stored in cold storage. Contract inspectors transported seedlings daily in a covered vehicle to work sites. The weather was cold with rain and snow, some warming occurred towards the end of the contract. The contract required a 36" planting scalp for each seedling.

The contractor had no planting experience, made his own planting tools, and hired his crew from the local job service. Crew size was small, had a lack of experience and supervision. There was a constant turnover in crew members and planting quality was poor.

In other project work, approximately 12 miles of electric fence were constructed by contract to protect bitterbrush plantations from livestock depredation. Volunteers planted an additional 17,000 seedlings over 102 acres (3700 volunteer hours). The 16 previously established experimental plots were monitored to collect survivability data. A two year research project with University of Idaho was initiated (Jirik and Bunting, 1989). This completed all project work funded under the emergency fire rehabilitation plan.

Summary:

Having an inexperienced contractor greatly hindered this project. There are few procurement procedures to prevent the selection of contractors with little or no experience. The selection is made by low bid and experience is not required to be awarded a government contract. The only recourse is to work closely with an inexperienced contractor and guide their work toward acceptable completion.

Spring 1989:

The Squaw Butte/Willow Ridge Restoration Plan was written to demonstrate the need and acquire the funding to continue the rehab program (Mattise,1989). This year the planting contract proceeded for 30 work days from 3/21/89 through 4/29/89. There was a shut down for 9 days at the start of the contract due to very wet conditions. Bitterbrush and Hobble Creek sagebrush seedlings (72,420) were planted by contract on 249 acres. The contract required a 36" square planting scalp for each seedling.

In addition, approximately 63,000 seedlings (300 acres) were planted using government crews and a mechanical tree planter pulled by a four wheel drive, rubber tired tractor. Volunteers also planted 2,000 seedlings over 10 acres (900 volunteer hours).

The government stored the bare root stock seedlings at a USFS nursery cold storage; small quantities, (10,000 to 15,000) were delivered to the contractor periodically by field inspectors. The contractor then jelly treated

(hygroscopic crystals) seedling roots, rolled plants in burlap and stored them in a shed at his home. The contractor transported seedlings to the planting units in covered vehicle.

During this project, planting crews experienced moderate temperatures and rain mixed with sunny weather. The contractor had little planting experience and the crew was inexperienced and small. As in the previous contracts, the contract was bid by the acre. The contractor disagreed with contract figures for acreages and requested the planting units be resurveyed. The contractor had the crew scalp a planting unit completely, leaving the scalps exposed for a few days before they were planted. When the crew returned to plant a scalped unit, they often could not get the augers down an acceptable depth because of rocks beneath the surface soil. They would then move on to the next scalp (12 feet away) instead of trying a second hole. The contract required them to use hodads in rocky areas. The contractor was angry that time and money was spent scalping ground that couldn't be planted. The inspectors recommended that a crew member be sent ahead of the scalpers to check for rock. The contractor argued that it was the government's job to check for rock and disputed and won arguments over payment for rocky ground that was inside the flagged units vs. ground that was actually planted (we skipped over a lot of ground because of rock). The Contracting Officer came out to the work site several times to address disputes over contract language. The inspectors actually caught the contractor moving boundary markers in the planting units to reduce the size of the unit, thus reducing the acres and the amount of work to be done, but still getting credit for the full unit.

Summary:

There were problems with the contract language. The contractor had little planting experience but lots of contracting experience. Things that were assumed in earlier contracts were points of contention this contract. Unless tested, it is hard to anticipate the amount of rock beneath the surface, shallow soils, and the amount of unplantable ground in a planting unit. This prompted us to change future contract specifications completely by making the bid item by the <u>plant</u>, not by the <u>acre</u>. This allows more flexibility in

unplantable areas within designated planting units. A decision was also made to reduce our scalp size from 36" to 24" because of concerns that soils surrounding the newly planted seedlings were becoming to dry. It was also ascertained that immediate inspection (eg. looking at planting quality directly behind the contractor and immediately correcting any planting errors) gave the best planting quality and a better chance for seedling survival.

Spring 1990:

The 1990 planting contract was conducted from 3/14/90 through 3/28/90. Approximately 60,105 bitterbrush and Hobble Creek sagebrush seedlings were planted on 275 acres. The contract required 24" planting scalps for each seedling.

Volunteers also planted 10,000 seedlings over 75 acres (2700 volunteer hours). Survivability data from the experimental plot project was collected and added to the data base.

Seedlings were stored at USFS nursery cold storage to assure freshness. BLM personnel took small quantities of plants (10,000),jelly treated the roots (hygroscopic crystals), rolled the plants in planting blankets and stored them in a non-temperature controlled shed. Small quantities (5,000) were then periodically delivered to contractor in a covered vehicle.

The temperatures during this project were moderate, with sunny weather and periodic moisture. An experienced contractor with a small crew was awarded the contract. Due to the experience of the contractor, contract administration took less time than previous years. Using hodads, the crew was more efficient at planting and more experienced at handling the seedlings. On this contract, experimentation with "rangeland micro siting", was initiated. This involved planting seedlings behind rocks, logs, sticks and large bunch grass plants for protection. It was hypothesized that the benefit of the shade provided to the new seedlings by the bunch grasses would out-weigh the disadvantages of competition for available moisture. The scalp size was also reduced to 12" when "micro-siting" was used because it was observed

in earlier years that the surface soil (silt loam to very stony clay loam) dried out very quickly. It was also hypothesized that the amount of moisture saved by leaving the surface annuals covering the soil from drying would be greater than the moisture competition from the annuals themselves.

Summary:

Having an experienced contractor was an advantage over past years, yet the contracting procedure still required refinement. When "rangeland micro-siting" was used, it was observed that the adult bunch grass plants used for shade competed more efficiently for available moisture than the seedlings and caused stress and increased seedling mortality. A smaller scalp size used in conjunction with micro-siting, provides more soil moisture for the seedling, but also may cause increased competition with annuals.

A better system or facility for on site temporary seedling storage is needed. Some units are up to two miles from any access road, and must be carried in by the planters. The number of seedlings that can be taken to the planting site is limited to the number that can be planted in half of a work day. The contractor will be required to periodically transport "fresh" seedlings to the worksite.

Spring 1991:

From 3/13/91 to 3/18/91, 6 working days, we contract planted 60,000 bitterbrush and Hobble Creek sagebrush seedlings (235 acres). The contract required 24" planting scalps. Seedlings were picked up from a USFS nursery and were jelly rolled (Tera Sorb hygroscopic crystals), by government personnel, bundled in planting blankets and stored in a covered shed. Large quantities, (12,000) were delivered to contractor daily. Contract inspectors transported seedlings in a covered vehicle.

The weather during planting was cold, the ground was slightly frozen, with 1-2 inches of snow on the ground. Planting conditions were excellent with some thawing and melting occurring during the final days. The contractor was

experienced and had a large crew, good supervision and primarily used hodads. Planting was started earlier than past years to take advantage of maximum ground moisture. This was accomplished because plants were lifted in the fall and stored in cold storage rather than waiting for a spring lift. The USFS nursery used to produce the seedlings is situated in a high mountain valley and planting conditions are often ready before ground thaw allows plants to be lifted in the spring. Planting seedlings early allows them to break dormancy in the ground and takes advantage of all available spring moisture.
It was much harder working with large, non-English speaking crews. More inspectors are needed to cover the progress generated by larger crews.

Summary:

The third year of planting under the Squaw Butte/Willow Ridge Shrub Restoration Plan (Mattise 1989) was contracted through the Small Business Administration (SBA) 8A Contractors and not the normal competitive bid process. SBA 8A bids are negotiated locally using area small businesses of minority or disadvantaged contractors. The quality of work of the SBA contractor was good and this contracting procedure will be used in the future. By having the field inspectors prepare the plants for the contractor the amount of time which plants are transported and handled has been reduced. The use of larger experienced crews gets more plants in the ground quicker, but it is important to have an adequate number of field inspectors on site to continually check planting quality. If the number of inspectors is inadequate, a large crew can take advantage and planting quality will suffer. Getting in and out of a project in 5 days early in the season was good for survivability. If seedlings are lifted from the nursery in the fall and planted while the ground is slightly frozen, plants come out of dormancy naturally as the ground begins to thaw. This can reduce planting stress on the seedlings and improve survivability.

Spring 1992:

During this final planting year, we again utilized the SBA process and acquired the same contractor as the previous year. Approximately, 25,000

bitterbrush & Hobble Creek sagebrush seedlings (142 acres) were planted. The contractor had a large crew, 24 people, and completed the contract in one working day. The contract required an 18" planting scalp. The scalp size was reduced because a greater percentage of native perennial grasses and smaller quantities of annual grasses were present.

The weather was warm with partly cloudy skies and the ground was moist from spring rains. Seedlings were lifted in the spring from the local USFS nursery. The nursery has discouraged fall liftings because of added stress to seedlings from possible mold growth in over-winter storage. Seedlings were jelly treated (Tera Sorb hygroscopic crystals), rolled in planting blankets by blm personnel and stored in a shed in the BLM wareyard. Plants were taken from cold storage, rolled, transported and planted in a short time reducing the stress on the seedlings.

Summary:

Due to a large planting crew and smaller scalps, we were able to plant all 25,000 plants in one day. An early ground thaw permitted the seedlings to be lifted early in the spring, and got the plants into the ground as soon as possible.

It was decided to return to a larger scalp size in future plantings. The smaller scalps were not adequately eliminating competition for available moisture. Even with good planting conditions and the best effort by the contractor, there was little available moisture left for the seedlings after the planting season.

Summer 1993:

The 16 experimental plots were monitored for survivability and the data analyzed in preparation for the final project report.

Squaw Butte Rehabilitation/Restoration Synopsis:

After the fire in 1986, before any shrub rehabilitation was initiated, 100 soil samples were collected from burned shrub sites. These samples were analyzed to determine if any bitterbrush or sagebrush seed survived the heat of the fire. Since no viable seed was found in any of the samples, this major shrub rehabilitation effort was launched. In 1992, after six years of project work, over 398,000 seedlings have been planted. Extensive coordination, cooperation and consultation was conducted with grazing permitees and other interested parties to provide information and receive input on planting projects.

Survivability of the plants was influenced by pressures beyond our control. The affect of some impacts on plants differed with various plantations. For instance, browsing and trampling by deer, elk and livestock did not seem to have a major impact on survivability in most plantations, but it was documented and noted in some. The most severe, uncontrollable impact on survivability appeared to be girdling and defoliation of the plants by insects and rodents. In some plantations, tunneling by pocket gophers also escalated the mortality of the seedlings.

A major factor that enhanced seedling mortality was the lack of normal precipitation in the area. Weather data was collected by the National Weather Bureau at a weather station in Emmett,Idaho. Data was analyzed from March through September, 1987 to 1992 (Table 1). During this period of time, five of six years were below normal with an average of -2.16 in. of normal per year. Precipitation levels for 1990 were above normal by .64 in.

Inconclusive monitoring was done on the contract plantations. The conclusions we have stated above have been derived from monitoring and survivability data of the 8 bitterbrush experimental plots. The experimental plots were initiated in the spring of 1987 from the same stock planted as the 1987 fall contract plantings. With very little data available about planting bitterbrush seedlings and our inexperience in contract planting, errors were

made in negotiations,planning,logistics and plant handling, but valuable lessons were learned.

Table 1.

Total precipitation and departures from normal

from the Emmett, Idaho weather station.

1987

November	1.01/-0.48
December	1.54/-0.08
Annual	8.60/-4.50

	1988	1989	1990	1991	1992
March	.93/-.14	3.19/2.12	1.08/.01	1.41/.34	.22/-.85
April	1.66/.53	.83/-.30	2.42/1.29	1.55/.42	.78/-.35
May	.98/-.25	.38/-.85	3.56/2.33	1.91/.68	.12/-1.11
June	.70/-.34	.14/-.90	.39/-.65	.57/-.47	1.89/.85
July	.12/-.03	.08/-.07	.23/.08	.02/-.13	.56/.41
August	.02/-.36	1.66/1.28	.97/.59	.02/-.36	.10/-.28
Sept	.51/-.28	.72/-.07	.02/-.77	.29/-.50	.24/-.57
Annual	11.66/ -1.44	12.11/-.99	13.74/.64	11.74/ -1.36	10.57/ -2.53

In the spring of 1987, sixteen experimental plots were designed and established within the crucial winter range area. Eight bitterbrush plots with 20 plants each of six selections and eight sagebrush plots with 20 plants each of three selections. All six selections came from areas in both

sedimentary and basaltic soils located from Boise,ID. west to the Snake River. Two of the sagebrush selections came from Utah and the third from the Boise Foothills. Two plots were planted on each of the four aspects for each species. The purpose of the study was to derive whether any of the selections were more adapted to the area than the others and which aspect was most productive. Four of the bitterbrush plots were also fenced to establish if livestock browsing and trampling contributed to plant mortality. The overall survivability ratings of the plots provides an indication of the overall survivability of the contract bitterbrush plantations (Table 2). It also furnishes an insight to the aspect, at least in this area, which bitterbrush seedlings have the best chance of survival.

Table 2.

Survivability Based on Plot Aspect*

Aspect	Percent Survivability		
	1988	1990	1993
North	68	55	36
East	63	27	0.5
South	67	53	46
West	86	49	5

Mattise and Olson, 1994.

All plants used in the bitterbrush plots were containerized stock. Due to a difference in the hydrostatic pressure between the medium in which the plants were grown and the soils of the area, frost heaving was very prevalent and was a major cause of seedling mortality. Plants on the north and south slopes had a higher survival rate and significantly more growth than the east and west slopes. In summary, many variables impacted the survival of seedlings in the plots. Frost heaving had a major impact and together with annual grass

competition and summer drought, resulted in high seedling mortality. (Jirik and Bunting 1989)

Summary:

The following details should be considered when contract or agency shrub rehabilitation projects are being considered.

With only one year of experience using containerized seedlings, it is difficult to make a final conclusion about this technique. The soil medium of containerized stock may not be compatible with certain soils, particularly those of the Idaho Batholith, and this may cause additional mortality. The spongy plant medium tends to dry out faster than native soils. The roots also tend to remain in the potting medium and as this medium dries out, the seedlings die.

Efficient contract operations depend on experience of contract managers and project inspectors. It is most important to have the same team members work the entire contract to insure consistency during a contract.

The contracting officer can only enforce the content of the contract specifications, it is most important to have all specifications explained and documented. All specifications necessary to the project, no matter how trivial, should be written into the contract. Once they are in the contract, they can be enforced. Contract changes during the planting phase can be very expensive. Obtain examples of contracts from other agencies doing similar projects and modify them to fit your situation. In the contract, explain clearly WHAT YOU WANT,WHERE and the TIME FRAME.

Project costs will vary depending on agency goals,number of inspection personnel, availability of plant materials, logistics and the experience of those involved in the project. An overall view of the project costs can be found in Appendix C.

According to nursery personnel, the use of a cold storage facility is very important for the health of bareroot seedlings. Ideally, a trailer with

cooling capacity could be used to store seedlings at the worksite for the duration of the contract. Seedlings should be kept at the same temperature and environment of the nursery storage coolers. If the worksite is cold, even with snow on the ground, the seedlings could go from the cold storage trailer to the planting bags (possibly wet down and rolled in towels to protect from the wind and sun and their drying effects) and then planted. If the planting site soil is warming up, it would help to slowly acclimate the seedlings to the planting site soil temperature. The seedlings should be kept moist and protected from the wind and sun during this time. There should be a maximum of 24 hours from the time the seedlings leave cold storage, are moistened and brought up to soil temperature, to the period when they are planted. It is imperative to pay extra attention to worksite conditions and climatize your seedlings before the are planted.

Plants lifted from the nursery in the fall and held in cold storage over the winter are still respiring. This may cause mold to form on the seedlings root systems and cause additional stress. If the nursery ,however, will lift your seedlings in the fall and store them throughout the winter, seedlings will be available as soon as your planting site is ready. If you incorporate a spring lift, your planting site could be ready before the nursery is able to lift your planting stock.

Start your planting project as early in the spring as possible. This gives the seedlings the best chance to overcome the stress of planting with the higher precipitation rates of the spring season.

Start your planting as soon as the sites are accessible and the planting stock is available. Optimum planting conditions include two inches of snow on the ground, one inch maximum of frozen ground, and moisture in the upper 10 inches of soil. It is most desirable to have the seedlings break dormancy after planting and at the same time as the other vegetation on site.

We experimented with 'micro-siting planting' which is planting seedlings behind an object to give it added protection from the wind,sun and trampling. Micro-siting behind objects such as rocks and logs is an effective technique.

We found, however, that the benefits of protection to seedlings provided by bunchgrass plants does not out weigh the competition for moisture from the established root systems of these mature plants.

An average of 24 inch square scalps is needed to reduce competition for moisture from other adjacent vegetation. Do not allow the contractor to completely scalp and auger an area and return later for planting. This practice reduces the soil moisture in the augured planting hole and increases planting stress on seedlings. We found that the greater the density of annual grasses on your planting site, the larger the scalp you will need. If you are planting in higher elevations with lower densities of annuals you can reduce you scalp size according to the competition on site. A variety of scalps sizes were tried through the years, 18 inch, 24 inch to 36 inch and 12 inch during micro-siting. A 24" scalp gives enough protection from invading annuals to help the seedling past planting stress.

Various techniques were used to protect seedling roots from the effects of wind, sun and drying during storage and transportation. Different types of hygroscopic crystals (crystals that absorb and store water) were used to treat seedling root systems. Seedlings were first wrapped in burlap and then Kemtex towels to retain moisture and stored upright in open containers. Seedlings were transported to the planting unit in covered vehicles. There is a possibility that the hygroscopic crystals used to protect seedling root systems may restrict the movement of soil moisture into these same systems. The amount of crystals used,however, is minimal and the competition is probably insignificant. A better medium to protect the seedlings during transportation and acclimation to the planting site has not been found. It is essential to reduce the time the plants are exposed to fluctuating temperatures, drying, sun, wind and other components. Seedling survivability will increase as exposure to elements and temperature fluctuations decrease. It is suggested that seedlings be treated with the hygroscopic crystals and kept in a temperature controlled environment.

We suggest working very closely with the planting contractor to insure the best quality product. We spot inspect the plantings directly with the

contractor. With this method, if mistakes are found, they can be corrected immediately. We also have an inspector running transects behind us to calculate the quality of the planting. The contractor is paid for the quality of the work by the percentage of correctly planted seedlings. If 98% or more are planted correctly, full contract payment; 97% - 85%, the percentage of correctly planted seedlings; below 85%, the incorrectly planted seedlings must be replanted. By working directly with the contractor during the planting process and immediately correcting any planting errors, both the government and the contractor have a successful project.

An Optimum Planting Situation

1. Inquire with your Contract Specialist and the Small Business Administration in your area to find experienced planting crews within your state. Contact them regarding your project and their interest in submitting a contract bid. We have found this to be an advantage over the low bid contracting process.

2. Make sure your contract is well written. Get examples from other agencies that have experience with contract planting (Appendix A). Make sure that all specifications addressed in your contract are explained thoroughly. All details, no matter how trivial, involved in the project, should be stated in the initial contract before contract negotiations begin. If changes are made to the contract after the project is started, they are costly and disrupt already strained budgets. Acquire a list of planting contractors from other agencies and send out project announcements.

3. Store all seedlings in a cold storage trailer that can be moved to the planting site. Keep seedlings stored until planting begins unless acclimation to planting site soil temperature is necessary. If plants need to be acclimated, remove from storage at least 24 hours before planting, treat with hygroscopic crystals, wrap roots in planting towels and store in open containers, leaf side up.

4. Have enough qualified project inspectors to work with and inspect crew performance. Finding inspectors with experience may be difficult. Contact other agencies with planting experience. You can ask them to give a short training session on the inspection techniques they use for their planting contracts. You can then modify these techniques to fit your present situation.

5. Work closely and directly with the crew supervisors, not against them. You will have less trouble and ultimately better seedling survival if you establish a rapport with these people. You must be strict, but fair. Establish the ground rules for planting inspections and the consequences for unacceptable performance. Usually the contractors will test you and your system continually throughout the contract, so being familiar with the contract and being consistent with inspections is a necessity.

6. Coordinate closely with grazing permittees, recreationists and special interest groups to provide information and receive input on proposed planting projects.

7. It is necessary to plant early and have spring rains for your newly planted seedlings to survive. Good luck!

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APPENDIX

Appendix A - Planting Contract (Example)

Appendix B - Aerial Seeding Species List

Appendix C - Inspection personnel, plant materials and contract preparation costs.

Appendix D - Minimum Plant Standards

Appendix A

Foothill Bitterbrush Planting Contract

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SECTION B

SUPPLIES OR SERVICES AND PRICE/COSTS

Contract No.

Foothill Bitterbrush '94

1. BASIS FOR AWARD: Quotes will be received on the following Schedule on an all or none basis; no quotes will be considered for only part of the Schedule. Award will be made to the responsible quoter submitting the lowest priced, responsive quote, based upon the unit prices quoted. Quoters are cautioned, therefore, to be sure that a unit price is shown for each item. Failure to show a unit price for each item may result in rejection of the quote as non-responsive.

2. PRICING SCHEDULE

Item No.	Description	Quantity	Unit	Unit Price	Amount
1.	Planting bitterbrush seedlings	est. 50,000	seed-lings	$_____	$_____

APPROXIMATE START DATE: March 1, 1994

PERFORMANCE TIME: Ten calendar days

WORK DATA SHEET

Estimated Acres:	200
Shrub Species:	Bitterbrush
Shrub Age:	1-0 bare root stock
Type of Treatment:	Initial planting
Spacing:	12' x 12'
Approx # Of Shrubs per Acre:	255
Inspection Plot Size:	1/50 th

The units are expected to be accessible to within 1 mile (horizontal miles measured on a map) of a road. The units are accessible by jeep trail in good weather. Four wheel drive vehicles are highly recommended.

The sites contain approx 1110 acres. The project consists of planting an estimated 50,000 bitterbrush seedlings. At an approximate 255 bitterbrush seedlings per acre, approximately 200 acres will be planted. The sites contain more acres than necessary because of differing ground conditions (eg. under ground rocky conditions) and differing weather conditions may be encountered. The seedlings will be planted in the best possible ground on the sites. This will require omitting rocky and other undesirable ground on the sites.