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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
R-3

REPLY TO: 1410 Management Reviews
(SW)

MAY 10 1979

SUBJECT: Burned Area Rehabilitation Activity Review

TO: Forest Supervisors, Resource Staff Unit Directors & Deputy, S&PF

REPLY DUE JUNE 15

Enclosed is the Burned Area Rehabilitation Activity Review report. Comments should be sent directly to the Director of Soil and Water.

The team recommendations start on page 13. Reviewers should pay primary attention to these as they will be issued as general management direction after review.

Gary E. Cargill

GARY E. CARGILL
Acting Regional Forester

Enclosure

MAY 11 1979

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BURNED AREA REHABILITATION ACTIVITY REVIEW

USDA FOREST SERVICE SOUTHWESTERN REGION

BURNED-AREA REHABILITATION
ACTIVITY REVIEW

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SOUTHWESTERN REGION
FOREST SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

1976 - 1978

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V. Appendix

I. Introduction

This report completes the Burned-Area Rehabilitation review as outlined in the Activity Review Plan approved October 7, 1976. It contains the methods, conclusions and recommendations of the Emergency Burn Rehabilitation review team. The recommendations will be issued as general management direction after they are reviewed as per the Regional Forester's 1410 letter of February 14, 1977. The objective of this activity review was to evaluate past Regional burn rehabilitation decisions, the effectiveness of treatments applied, and to revise or supplement existing guidelines as needed. This activity review was an action agreed to as a result of the General Management Review (GMR) in December 1975 of the Prescott National Forest where the emergency reseeding of the chaparral portion of the Battle Burn was unsuccessful.

Members of a review team were selected from RMFRES, State and Private Forestry, Soil & Water, Range, and Timber Resource Staff Units in the Regional Office. In addition, Larry Allen was chosen as a permament member of the team because of his experience on most of the recent project fires; Larry also served as a Range, Soil & Water representative from the Forest level. Each Forest visited provided local people who were familiar with the fire history and rehabiliation practices. On several forests, personnel acquainted with fire control or rehabilitation were made available to the team.

The team selected several recent project fires from different vegetative zones. Emphasis was placed upon the ponderosa pine, mixed conifer, and chaparral zones.

Nine wildfires and one control burn were evaluated for degree of the success of rehabilitation treatments. A wide range of climatic, vegetative, and soil conditions under differing intensities of burn were represented. Most fires contained several different vegetative zones as shown in Table I. The review team spent nine days in the field. As each fire was visited, all available information was gathered as to burn intensity, rehabilitation, prescriptions, length of time between burn and rehabilitation, length of time between rehabilitation and the first storms and nature of the storms.

It was obvious early in the review that the information gathered was very subjective. There was no quantified data in most cases concerning the storm intensity or duration, the percent ground cover before or after rehabilitation efforts, the benefits of various rehab measures and other factors. Fires that were indicated as having been successfully revegetated occasionally had less ground cover than fires where revegetation efforts were reported to have failed.

The most common emergency burn rehab practice is the aerial reseeding of grasses and forbs immediately following the fire. Most of the effort was directed at this measure. However, some structural stabilization methods were reviewed.

TABLE 1
SUMMARY OF BURNS REVIEWED

Name of Burn	Date of Fire	Forest	Vegetative Zone	Review Team Date
Porter	June 1976	Santa Fe	ponderosa pine alligator juniper	May 10 1977
Gallinas	June 1976	Cibola	ponderosa pine pinyon-juniper	May 9, 1977
Ord	June 1976	Tonto	chaparral, heavy	Jan 26, 1978
Mingus (Prescribed Burn)	June 1975	Prescott	chaparral light	Jan 25, 1978
Bob	August 1975	Tonto	chaparral, light, moderate	Jan 27. 1978
Spring	May 1974	Lincoln	ponderosa pine mixed conifer pinyon-juniper	Nov 23, 1976
George	May 1974	Lincoln	ponderosa pine mixed conifer	Nov 22, 1976
Battle	May 1972	Prescott	ponderosa pine chaparral	Jan 24, 1978
Cebolleta	June 1971	Santa Fe	ponderosa pine	May 10, 1977
Cat & Dog	June 1971	Santa Fe	ponderosa pine	May 11, 1977
* Granite Basin	pre-1965	Prescott	chaparral	Jan 25, 1978
* Ruth	pre-1965	Prescott	chaparral	Jan 25, 1978

*Pre-1965 burns were not evaluated.

II. General Comments and Conclusions

A. Nonstructural Measures

Determining past revegetation success or failure has been difficult becuase of inadequate objective followup on seeding. Seeding success or failure is usually a subjective opinion in the minds of one or two individuals on the Ranger District or Supervisors office. The same fire may be described as a success by one person and a failure by another. The difference is even more striking between Forests. The difficulty in assessing revegetation success is also compounded by inadequate control of livestock. In one instance grazing pressure was the same inside and outside of the fire enclosure on a seeding "failure".

In all vegetative zones the success of the reseeding should be measured against the needs of the site. The amount of soil loss that can be tolerated can be compared against the predicted erosion rate using the Universal Soil Loss Equation. If the predicted rate exceeds the soil loss tolerance rate then soil productivity will be lowered. This will affect range, timber, and wildlife. This effect will have to be quantified on page 5, Form FS 2500-8. Even if the tolerence is not exceeded the sediment produced may be significant. Sediment damages should also be entered on this form.

1. Forest Formation.

The seeding of grasses and forbs on burns in the ponderosa pine zone to the Engelmann Spruce zone have a high probability of establishing a satisfactory protective cover within two years. The Porter burn was an exception as illustrated in photo 7. Later reports indicated that it too is experiencing some success. The burn rehab review team visited six burns within the ponderosa pine type that were aerially seeded. Transects were measured on four burns to gather information on the seeded and native vegetative crown cover and "total protective cover. The success in establishing a vegetative cover by the second year was considered fair or good on all of the burns reviewed except for the Porter Burn where the percent cover resulting from the seeded species was considered poor.

The Porter and the Gallinas Burns occured the same year and were seeded immediately following the fire. The number of seeds per square foot were similiar but with a different mixture of species. However, the results after one growing were very different. The Porter Burn had an average of 1.4 percent foliar cover compared to 15 percent on the Gallinas. Since the seeding methods are similiar it appears logical that the different results can be attributed to site factors.

The primary site factors here are believed to be soil, available moisture, intensity of burn and exposure to wind. These site factors on the Gallinas Burn apparently were much better than on the Porter Burn.

It is interesting to note that in Table 2 the seeded species make up from 44 to 58 percent of the total vegetative cover regardless of how much total vegetative cover exists. Therefore, the factors that produced a good cover of seeded species also produced a good cover of native species

There is no evidence that indicates seeding burns in the pine zone reduces sediment production the first year. For example on July 6, 1957, a wildfire burned over 60 acres of ponderosa pine on the Sierra Ancha Experimental Watershed (90). It was immediately seeded with grasses and forbs at the rate of nine pounds per acre which is equivalent to 44 pure live seeds per square foot. Within the next 3 1/2 years sediment measured below the burn totaled 1,133 cubic feet. Eight hundred and eighteen cubic feet or 72 percent was measured the first year following the fire. The seeding was considered successful and effectively stabilized the area. However, the first summer only seedlings had developed. By 1960 after four summer growing seasons the seeded grasses totaled 2.52 percent basal area.

On paced transects in 1960 the seeded plants accounted for 44 percent of the vegetative ground cover which is very similiar to our results shown in Table 2..

Seed mixtures for use on burns within the ponderosa pine type should be equivalent to about 60 pure live seeds per square foot. Grass or forb species seeded should have a relative rapid rate of development. Where it is planned to plant trees the seeded species should be short-lived to minimize competition. These characteristics are summarized in Table 4 appendix E for some of the more common species that have been used.

The conifer zone has the maximum conflict between protecting soil productivity and water quality versus leaving a clean site for tree plantations. This conflict can be reduced by seeding short lived bunch grasses.

Direct seeding of tree seeds in these zones as a method of reforestration has not been successful enough to justify this method of reforestation or burn rehabilitation. There is some temptation to provide the tree seeds and try reseeding while the equipment is available. This causes a drain on crucial seed supplies in view of the low success rate and the reforestation backlog.

Table 2. Seeding Burns in the Forest Formation Summary

Burn	Year	Seed Mix Seed/ft2 PLS	Seeding Results	Number of Growing Season	Percent Vegetative Foliar Cover: Seeded Species	Percent Vegetative Foliar Cover: Total Native and Seeded Species	Percent Seeded Compared To Total Veg. Cover	Better Seeded Species Percent Composition	
Porter	1976	41	poor	1	1.4	3.2	44	Orchard grass	61
								hard fescue	23
								alfalfa	16
Gallinas	1976	38	good	1	15	26	58	smoothbrome	82
								hard fescue	9
								yellow sweet clover	9
Spring	1974	60	good	3	data not gathered			orchard grass	
								timothy	
George	1974	60	good	3	data not gathered			orchard grass	
								timothy	
Cebolleta	1971	73	good	5	14	29	48	orchard grass	26
								timothy	68
Cat and Dog	1971	68	fair	5	8	17	47	orchard grass	28
								hard fescue	43
								timothy	18

2. Chaparral Zones

The chaparral zone is too broad and complex for regional or "cook-book" approaches. Precipitation ranges from 15 to 26 inches and mean temperatures vary by 10 degrees F. or more. The most commonly used rehabilitation measure is seeding with lovegrass. This grass usually take two years to become established. While in 5 to 7 years chaparral is usually reestablished to about 65 percent of its original crown cover. The major sediment reduction is between the third and fifth years.

The rehab review team visited four burns within the chaparral zone. Two burns were seeded and two were not. The two burns that were seeded were failures. The transect data is summarized in Table 3.

Based upon the information gathered in this review there is some doubt as to the utility of seeding lovegrass as a postfire emergency rehabilitation treatment measure. The results of the transects along with some previous research studies (84) (50) (59), indicate that seeding lovegrasses is not likely to be successful and even when the seeding is successful it usually will not provide adequate cover until after the second growing season. According to the studies at the Three Bar Watersheds B, C, and D summarized in Table 7 practically all the sediment production occured the first three years. Eighty-three percent of the sediment was during the first two years of which 70 percent of the sediment was during the first year. This suggests that a "good" grass cover the third year may have a beneficial effect on about 17 percent of fire accelerated sediment production. By the third year the native shrubs, forbs, and grasses have increased to about 25 to 30 percent cover. A study conducted in Southern California on the San Dimas Experimental Forest of seeding wildfires indicates that a 10 percent cover of seeded grasses was associated with a 16 percent reduction in debris even though it had no apparent effect on flood peaks (25). A lower density grass stand of five percent cover had no effect.

As stated above the critical erosion period is in the first year after the fire. Hydrophobic conditions are often present. This increases runoff and may reduce seed germination. The degree of water repellency depends on several factors including quantity of litter, fire intensity and fire duration. It can be detected by placing a drop of water on the surface, 2" and 4" zones. If it takes longer than 5 seconds for the drop to disappear the soil is hydrophobic to some degree (67).

The higher precipitation zones in the chaparral such as the upper part of the Ord Burn usually have higher organic matter, greater standing biomass and consequently under the right conditions the potential for higher intensity fires. These conditions can lead to water repellent soils and decrease the chance of successful reseeding. The lower zones often have more openings with increased grass and forbs that recover rapidly after a fire. Because of these factors the lower chaparral zones such as the Mingus and lower Bob Burn are expected to have approximately the same successful reseeding rate as the upper zones.

The results of seeding chaparral has been quite variable. Following the seeding of the Boulder Burn (June 1959) on the Three Bar Watersheds B and D the total grass cover including seeded and native was .4 and 1.1 percent after one season and 1.9 and 1.8 percent after two seasons. (50) (Table 6). Most of this cover was native grass and forbs so the seeding was considered a failure.

On the lower area of the Mingus Burn (June 1956) at an elevation of 5,000-6,000 feet the seeded weeping lovegrass yielded 27 and 29 pounds/acre air-dry weight the second and third growing season (84). Even though this must be considered a very limited stand, the seeded species accounted for 49 percent and 34 percent of the grass and forbs as shown in Table 5, appendix E.

A 1951 wildfire in the Pinal Mountains was seeded with two pounds of weeping lovegrass per acre (87). In 1952 after the second growing season the basal area of the seeded lovegrass was .68 percent. (Table 8). The results were considered relatively good and attributed to well-spaced plentiful rains. This was a vegetation recovery study and the benefit to reduced sediment production from the seeding was not indicated. A basal area of .68 percent probably approximates a seven to ten percent foliar crown cover of lovegrass so it can be speculated that there was some benefit.

The site factors on recently burned chaparral are very harsh. The subsequent rainfall must be adequate low intensity and also be at the proper intervals. Strong winds can blow large amounts of seed from the slopes. Harvester ants, rodents, birds, and other wildlife can also destroy much of the seed. Immediately after seeding rainfall tends to cover the seed with ash and soil protecting it from such losses. However only those seeds that eventually find their way to the proper crevice or niche germinate and grow into mature plants. The amount of seed lost due to various site factors is substantial. For example. seeding weeping lovegrass at the rate of two pounds per acre is equivalent to about 60 pure live seeds per square foot with even distribution. We know that even distribution is rarely attained in the field but still provides a way to measure potential seed loss. On the June 1956 Mingus Burn study the frequency of the seeded weeping lovegreas on 9.6 square-foot cicular plots was 5.3 percent after the second year (84). This means that about

95 percent of the plots did not have any lovegrass. At 60 seeds per square foot this means that about only one out of 400 seeds made it. This indicates the severity of the site on the Mingus Burn as well as the apparent competition from the regrowth of the sprouting shrubs. Both weeping and lehmann lovegrass are aggressive seed producers. When the competition from the brush regrowth is reduced by herbicide treatment the production and density of the lovegrass is increased. For example the sprayed plots in the 1956 Mingus Burn produced 931 pounds per acre of weeping lovegrass in 1961. By comparision the unsprayed plots produced only 60 pounds per acre of weeping lovegrass in 1961 and this was the highest rate produced during the five year period 1956-1961 (84).

Similar results were observed in the Three Bar Watershed C which was treated with herbicide however the production from native grasses and forbs was also good (59). Treatment with herbicides is not considered as emergency burn rehabilitation practice.

The observations made by the burn rehab review team and the research studies quoted indicate only limited success in seeding lovegrass on chaparral burns. For a seeding to be considered effective, the crown cover resulting from the seeded species should be about 10 percent by the beginning of the third year. This could reduce the sediment production by about 15 percent (25). If this is reasonably accurate, to attain a success ratios of 50 percent or better than it appears that other species of grasses must be developed and used. A 1963 study by Lavin and Pase (67) compared 16 grasses and forbs for seeding chaparral burns near the Three Bar Watersheds. Their results indicate Lehmann lovegrass and King Ranch bluestem rated good to excellent and Turkestan bluestem and weeping lovegrass rated fair. Perhaps similiar studies should be continued.

There are some burns or portions of burns where the primary benefits of seeding grasses is to improve forage conditions and the benefits to emergency watershed protection because of the site conditions are less significant. In this case grass species that are slower developing may be used. However, in this situation the seeding would not be considered an emergency and would be handled as a range improvement project just like tree planting is a reforestration project.

Table 3. Summary of Transect Results

Chaparral Burns

Burn	Year	Seeding Results	Seed Mix Seed/Ft.[2]/	Number of Growing Seasons	Percent Vegetative Cover		Percent Seeded Cover To Total Cover
					Seeded	Total Seeded + Native	
Battle	1972	Failure	78	5	Data Not Gathered		
Mingus Watershed	1975	Not Seeded	-	2	0	32	0
Bob	1975	Failure	34	1 1/2	0	32	0
Ord	1976	Not Seeded	-	1	0	6	0

B. Evaluation of Structual Measures

1. Method

Structual stabilization methods were reviewed on the Lincoln and Santa Fe National Forests as shown in photo No. 1. Gabions, retention basins, terraces, contour tree falling, and flood control dams were reviewed. The evaulation of these practices by the review team was not done in the same detail as the reseeding. These practices have not been used extensively in the Region, mainly due to the high cost of structures.

Evaluation of the techniques were based upon our observations and the observations of the Forest personnel. No attempt was made to evaluate equations used to develop design criteria or risk factors. The primary emphasis was on visual evidence that they were functioning and on reports that the desired effect had or had not been achieved.

2. Conclusions

Structural measures may not be being used to their full potential. While we did not review them in the same detail that we reviewed nonstructural measures we did reach some conclusions. It appeared that the desired effect of some measures was not stated in as quantitative terms as it might have been. This indicates that the initial planning may not have been as precise as it should have been.

Terraces were reviewed on the Spring fire. Each terrace had caught some water and the overland flow problem was controlled. They remain very visually evident today and they will continue to be very evident long after the watershed is stabilized through vegetative ground cover.

Contour tree felling was considered ineffective. The trees have to be in contact with the soil to be effective and this is usually difficult to achieve. The amount of work involved forces the cost of this activity up to the point that more selective measures could be imployed.

Erosion control dams and debris basins were both reviewed. The dams on the Spring Burn were rendered unnecessary by the successful reseeding, contour trenching and gabion work above them. The reseeding success could not have been guaranteed before the dams were planned so the dams may have been justified. Rather than draw any conclusions from our very limited exposure to these practices we are recommending that regional guides be developed for planning these structures.

Gabions were in place and working well on the Spring Burn. They have been used extensively across the Region for watershed restoration with varing degrees of success. They have succeeded when they were planned to accomplish specific objectives. They have failed when they were used indiscrimately. Their use should be evaluated against Regional guides.

C. Forest Burn Rehabalitation Team Organization

Each Forest has the capability to organize its own rehabilitation team. The Regional Office should be involved in advisory and funding screening capacities. Exceptions to this are when one Forest has either more than one project fire, an extremely large project fire, one fire on two Forests, or when a Forest has a vacancy in a key position.

When the emergency burn rehabilitation team evaluates the burn they should consider long term uses of the land as well as short term rehabilitation. Up to date timber inventories and soil surveys are sources of information that can be used to locate high timber production potential areas. FSM 2472.3 indicates that new burns are often the most cost effective planting areas because of the low site preperation costs. These freshly burned sites also have higher available nutrients except for nitrogen than they did before the burn.

III. RECOMMENDATIONS

1. The Director of Soil and Water should maintain a Regional roster of qualified fire rehabilitation team members. Each Forest Supervisor should select his own team and submit their names, location and area of speciality by March 1 of each year to the Director of Soil and Water for inclusion on the list. If vacancies occur the Regional Forester will fill the vacancy from the roster. FSH 2509.13 Section 12.1 lists commonly needed specialists. FSH 2509.13 Section 12.2Section 12.2 requires that a roster be maintained.

2. Utilize specialists with local knowledge of soils, topography, grass species and their response to site conditions. Regional specialists should be available if local specilaists are not.

3. Delineate critical areas for seeding. Severity of burn, slope steepness, erosion hazard, needle cast from overstory, etc. should be included in analysis to reduce acreage to that actually needing treatment.

4. The Universal Soil Loss Equation should be used to estimate on-site soil loss. It should also be used to evaluate the success of the non-structural rehabilitation. Guidelines for the use of the Universal Soil Loss Equation are contained in Soil Note 2550-5 of the Soil Survey Procedure.

5. Probability of vegetative success in reducing erosion should be used to adjust rehabilitation costs and benefits. The Forest Formation has a very high success ratio. A planning rate of 80 percent chance of success can be used as a guide to adjust predicted benefits. The Woodland Formation has a lower success ratio. Sixty percent can be used as a guide. The chaparral zone is much lower with about a 10 to 20 percent success rate. These rates assume moderate to steep slopes, seeding before the first rain and following standard practices. These rates are based upon the fires observed throughout the Region. Local conditions may dictate that a higher or lower figure is more appropriate.

6. Follow up on rehabilitation work should be made in accordance with FSH 2509.13 Sec. 60. This requires that rehabilitation work be examined following major storms and runoff seasons at least annually until the watersheds are stabilized. Ground cover transects and composition transects should be made at these times also.

7. Seeding rates should be based upon pure live seed per square foot (PLS/Ft2). Rates of 60-80 seeds should be used when dealing with more common species used. In most cases each individual species should make up at least 15 percent of the seed mixture.

8. Grass and forb species selected should have fast germination, relatively rapid rate of development and good ground cover attributes. Short-lived grasses or forbs may be used where native species will provide acceptable cover after several years. Sod forming grasses should not be seeded in areas planned for forestation.

9. Mono seeding is questionable. Further studies are needed in the chaparral type to determine grass types which will be of immediate benefit rather than delayed, e.g., lovegrass. These studies should be similiar to Lavin and Pase *(7)*.

10. Livestock should be removed and removal enforced for two to three years, the time depending on vegetative recovery. If trees are planted the area should be protected for 5 years. FSM 2472 5/77 R-3. Supp. 171.

11. Drilling and other nonbroadcast methods of seeding should be considered in most vegetative types where physically possible. However, as an emergency burn rehab measure this may not be feasible due to the timing and costs.

12. Direct seeding of tree seed should not be done as emergency burn rehabilitation measure. FSM 2472 5/77 R-3 Supp. 171.

13. Salvage logging should begin as soon as possible following a wildfire. This is important to prevent timber deterioration and so that restoration practices including tree plantations can be completed in a timely manner.

14. The Region should develop guidelines for structural rehabilitation.

15. Adjustment in damage estimates should be made based upon return frequencies of storms. Rehabilitation should be based upon the risk of an unacceptable event occuring. Region Three Hydrology Note 8 "The Use of Risk in Specifying Job Quality" outlines the procedure and gives examples of the use of risk factors.

16. Organization Recommendation For Private Lands

When a fire occurs on non-Federal Forested lands, the following action should be taken to minimize on-site soil erosion and prevent flood and sediment damage to downstream property.

The Director of Cooperative Forestry and Fire Protection will contact the State Forester to offer Forest Service assistance in meeting emergency burned area rehabilitation.

The State Forester has the responsibility of contacting the land-owner or land management agency to advise them of service available and to determine if they desire assistance.

Possible technical assistance includes:

-On-site assessment of potential soil loss by State Forestry and/or Forest Service personnel.

-Recommendations for treatment measures to stabalize soil by State Forestry and/or Forest Service personnel. Forest Service seeding prescriptions are available for most vegetation types in the Southwest.

Possible funding assistance for private land includes:

-ACP, Agriculture Conservation Program, administered by the Agricultural Stabilization and Conservation Service. Under this program special practices may be approved by the State ASCS committee to conduct emergency burn area rehabilitation. This is a cost share program with landowner paying 25-50% of cost.

-216, Emergency Flood Prevention Program. This program is intended to provide emergency protection for potential loss to life and property resulting from flood & sediment damage. This program is administered by the Soil Conservation Service.

If the landowner or State agency desires technical and/or funding assistance, the Director of Cooperative Forestry and Fire Protection will work with the State Forester as needed. Action will include:

-Request the services of National Forest specialist for assessment and plan development of rehabilitation work.

-Provide State Forester with Forest Service rehabilitation guideline.

-Help initiate action to obtain funding assistance.

-Serve on task force or rehabilitation team as needed.

17. Organization Recommentation For N.F.S. for Implementation of Burn Rehab Plan

a. Leadership - The Forest Supervisor should appoint a coordinator to assume responsibility for the overall job. Duties would include laison with other agencies and levels of the Forest Service, I&E publicity, budget requests, accomplishment reporting, and general supervision. This position is most logically filled by a staff officer.

b. On the Ground Supervision - The Forest Supervisor, and District Ranger (s) should select a project leader to direct daily activities and plan accomplishment. This person must have the time to give the rehabilitation job priority for the duration of the job. The project leader should be a resource specialist with knowledge of the project, he might be a hydrologist, soil scientists, range conservationist, forester, engineer, etc.

c. First Line Supervision - Each work crew will require a foreman. Contract activities must be supervised by qualified COR's. Some projects will require air service managers, air safety officers, tractor manager, etc.

18. The above recommendations and appendixed material should be used for rehabilitation guidelines after review by the resource directors and Forest Supervisors.

IV. EVALUATION OF RESEEDING BURNS AS AN EMERGENCY REHABILITATION MEASURE

A. Methods used

In order to have quantified data to base recommendations on, the team developed and used the form protective cover evaluation shown in appendix C. Using this form, each member ran several independent pace transects to estimate ground cover. The results were compiled to determine the success or failure of the effort. In some cases, the original success or failure of reseeding efforts were difficult to evaluate because of grazing in the burn.

The review team gathered ground cover information on four burns within the ponderosa pine-mixed conifer zone and three burns within the chaparral zone from the paced transects. The main purpose was to determine the following:

1. The regrowth or recovery rate of native vegetation.
2. The percent cover of seeded species compared to native species.
3. The composition of the primary seeded and native species.
4. The percent of ground cover.

A transect consisted of 20 one-foot square samples where the soil cover components and bare soil was estimated to the nearest five percent. The protective soil cover components used were:

1. Seeded grasses and forbs.
2. Native grasses and forbs.
3. Native brush and trees, understory vegetation only of sprouting regrowth and seedlings.
4. Litter
5. Rock larger than 3/4 inch. Only 1/2 of the total is considered effective ground cover.

All transects were paced with 3 to 4 paces between each sample. A one-foot square wire frame was used. The vegetative cover was based on total plant crown near the soil surface within the one-foot sample and not just plant basal area. Using only one method was believed to give more consistent results among the persons taking the transects.

Vegetative composition counts were taken on some of the transects. The information gathered from the transects is summarized for each burn. The percent of plant cover was rounded to the nearest whole number and was usually the average of several transects.

Percent distribution for each species was determined. Percent distribution is the frequency in which a component occurs in each sample. For example a distribution frequency of 60 percent for seeded species means that some seeded grass or forbs was recorded in 60 percent of the one-foot-square samples. A high distribution frequency indicates that the component was well distributed within the sample area.

With the limited field time available the transect samples are representative only of the area sampled. The team attempted to sample areas that were similiar throughout the burn. Theses areas also represent the higher intensity burn areas based on the judgement of the forest people who were with the rehab review team.

Most seed mixtures are based on bulk seed and not pure live seed (PLS). To be consistent in comparing the results of various seed mixtures, the final column is based on total pure live seed per square foot. To arrive at this figure the average germination rate shown in Table 1 of the Nonstructural Range Improvements Handbook, FSH 2209.23 was used.

B. Results and Comments For Each Burn

1. Burns Within The Ponderosa Pine Zone

The rehab review team visited six burns that occured within the ponderosa pine type. Vegetative data were gathered from transects on four of the burns.

a. Porter Burn, June 1976, Santa Fe National Forest

The Porter Fire started on June 16, 1976, and burned 5,500 acres within the pondersa pine type before being controlled on June 20, 1976. About 70 percent of the area or 4,000 acres had a high burn intensity and was aerially seeded on June 28, 1976, just prior to the summer rains with the seed mixture on page 19.

Species	Lbs/ac	Seeds/Ft 2 @ 1 Lb/ac	Total Seeds/ 2	% of Mix	No. Seeds/ Ft 2 Adjusted PLS 1/
Orchard grass	1.2	12	15	30	12
Hard fescue	1.2	13	15	30	13
Timothy	.3	30	10	20	9
Alfalfa, Ladack	2.0	5.2	10	20	7
	4.7		50	100	41

1/ This mix averages 50 seeds/ft 2, however when the mix is adjusted for average percent germination as shown in FSH 2209.23 Nonstructual Range Improvements Handbook, the number of pure live seed (PLS) is reduced to 41 per ft 2.

Two areas witnin the Porter Burn were sampled to determine the vegetative and total protective cover one year following treatment (See Map No. 1 appendix D). Both sample areas are within the ponderosa pine type on Stable Mesa. The areas were sampled first by the rehab review team on May 10, 1977. Since this was relatively early in the growing season, the areas were resampled on July 20, 1977, to determine the vegetative cover just prior to summer rains.

Area 1 is north of road 600 near the edge of the burn in the NE 1/4 Sec. T.19N., R. 2E. The area represents burning of thinning slash and was considered to be high intensity. The May 10, 1977 sample included eight transects and 160 points, the second sample on July 20, 1977, included five transects and 100 points.

Area 2 is further west on Stable Mesa on both sides of Road 611 located near the center of Sec. 5 T. 18N., R. 2E. This area is a flat ridge exposed to the wind. It consisted of a pine thicket and is believed representative of the highest intensity burn on the treated area (Photo 7). The results of the seeding in this area were not considered satisfactory Eighty-five acres were reseeded by crews using hand held broad cast seeders during the first week of July 1977. When the area was resampled on July 20, 1977, about five percent of the seed had germinated and much of the seed was still visible on the ground. The germinated seed was located against logs, depressions in the ground, and where the ash cover remained. The seedbed was not considered good. The first sample on May 10, 1977 included seven transects and 140 points, the second sample on July 20, 1977, included five transects and 100 points.. The transect results are shown on page 21 and 22.

Results of Transects — Average Percent Soil Cover

	Grasses Seeded	& Forbs Native	Brush and Trees	Litter	Rock	Total Protective Cover	Bare Ground
Area 1							
5-10-77	1.6	.5	.2	18.3	4.3	24.9	75.1
Rounded Off		2		19	4	25	75
7-20-77	.8	2.2	2.8	3.6	3.2	12.6	87.4
Rounded Off		6		4	3	13	87
Area 2							
5-10-77	.1	.1	.2	4.0	2.1	6.5	93.5
Rounded Off		1		4	2	7	93
7-20-77	3.0	.8	.1	7.3	1.4	12.6	87.4
Rounded Off		4		7	2	13	87

Percent Distribution Frequency

Area 1							
5-10-77	21	4	2	81	26	91	100
7-20-77	7	11	15	35	33	47	100
Area 2							
5-10-77	4	4	5	38	20	64	100
7-20-77	27	9	2	65	34	85	100

Percent Plant Composition :

Plant composition counts were taken on July 20, 1977. Only seeded species were tallied.

Species	Area 1 Number Hits	Area 1 %	Area 2 Number Hits	Area 2 %	Average Number Hits	Average %	% in Mix
Orchard grass	25	89	13	38	38	61	30
Hard Fescue	2	7	12	35	14	23	30
Timothy	0	0	0	0	0	0	20
Alfalfa	1	4	9	27	10	16	20
	28	100	34	100	62	100	100

Summary of Porter Burn

Even though the same areas were sampled on May 10 and July 20, 1977, there appears to be some introduced sampling error based on the difference in the distribution frequency between the first and second measurements. One explanation is that several observers during the first measurement recorded the soil protective components to the nearest 1, 2, or 3 percent while on the second survey all samples were recorded to the nearest five percent. However, the total increase in percent vegetative cover between May 10 and July 20 is believed to be reasonably accurate two times out of three or within one standard deviation.

In Area 1 the total protective soil cover probably did not change significantly between the two sample dates; however, the vegetative cover increased from 2 to 6 percent and most of this increase is from the increase in native plants.

The increase in total vegetative cover in Area 2 between the two sample dates is primarily from the seeded species as a result of the hand broadcast seeding accomplished in early July 1977.

The total soil protective cover on either May 10 or July 20, 1977, which ranged from 7 to 25 percent with a vegetative cover of 2 to 6 percent was not considered satisfactory one year after treatment. Therefore, the 4,000 acre treated area within the Porter Burn did not receive adequate watershed protection during the first or second year.

Using Area 1 as a control since it was not reseeded, the seeded species made up about five percent of the total protective ground cover. This is considered less than satisfactory, therefore, the aerial seeding proved to be unsatisfactory.

No timothy grass was recorded in the plant composition counts. This grass normally establishes very well in this vegetative and elevational zone. Perhaps this seed when used should make up a higher percentage of the seed mixture than was done on this project.

b. Cebolleta Burn, June 1971, Santa Fe National Forest

The Cebolleta Fire started on June 5, 1971, and burned over 5,000 acres within the ponderosa pine type before being controlled on June 14,1971. The burned area was aerially seeded before the summer rains in late June. The following mixture was prescribed:

Species	lbs/ac	Seeds/ft2 @ 1 lb/ac	Seeds/ft2	% Mix	Adjusted Seeds/ft2 PLS
Orchard grass	2	12	24	27	20
Hard fescue	½	13	6	7	5
Timothy	1	30	30	34	24
Perennial ryegrass	3	5.7	17	19	15
Alfalfa, ladack	1	5.2	5	6	4
Yellow sweet clover	1	6.0	6	7	5
	8½		88	100	73

Only one area was sampled on July 20, 1977, which was six years after the seeding treatment. The area includes five transects with 100 one-foot-square samples in the ponderosa pine type located north and south of road 604 in the NE 1/4 Sec. 26 T. 19N., R. 2 E. It was noted that the area adjacent to each side of the road had been reseeded with different species of grasses than indicated in the mix. According to District personnel the roadside area had been reseeded following the salvage logging operation. This roadside reseeding was not included in the burn sample transects. Plant composition counts were collected only for the seeded species.

Results of Transects

Average Percent Soil Cover

Grass & Forbs Seeded	Grass & Forbs Native	Brush & Trees	Litter	Rock	Total Protective Soil Cover	Bare Soil
14	11	4	40	1	70	30
Total Veg	29					

Distribution Frequency

80	64	11	98	9	100	71

Percent Plant Composition

Species	Number Hits	%	% In Mix
Orchard grass	20	26	20
Hard fescue	0	0	5
Timothy	53	68	24
Perennial rye	0	0	15
Alfalfa	0	0	4
Yellow sweet clover	0	0	5
(Smooth brome)	78	6	0

Summary of Cebolleta Burn

(1) Six years following treatment the total protective soil cover was 70 percent. The vegetative component made up 29 percent or about 41 percent of the total protective soil cover. The seeded species accounted for about one-half of the vegetative and about 20 percent of the total protective soil cover.

(2) Orchard grass and timothy grass acounted for almost all of the seeded species even though they made up only 44 percent of the mix. Pernnial rye, alfalfa, and yellow sweet clover are relatively shortlived species and would not expect to be in the stand six years later.

(3) Although only discussed briefly, most of this burn area has been or is in the process of being replanted with trees. The existing vegetation is believed to be competitive with the tree seedlings. Where tree planting is proposed it seems logical to use short-lived, non sod forming species in the mix.

c. Cat and Dog Burn, June 1971, Santa Fe National Forest

The Cat and Dog Fire started on June 27, 1971, and burned over 10,000 acres within the ponderosa pine and mixed conifer type before being controlled. Close to 8,000 acres were aerially seeded July 10-12 with the following prescribed mixture:

Species	lbs/ac	Seeds/ft2 @ 1 lb/Ac	Seeds/ft2	% Mix	Adjusted Seeds/ft2 PLS
Orchard grass	1½	12	18	22	15
Hard fescue	1	13	13	16	11
Timothy	3/4	30	22	27	18
Perennial rye	3	5.7	17	21	15
Yellow sweet clover	1	6	6	7	5
Alfalfa, Ladack	½	5.2	3	4	2
Alfalfa, Nomad	½	5.2	3	3	2
	8½		82	100	68

The summer rains in 1971 were described as light to moderate intensity and the moisture during the winter of 1971-1972 was considered good. The results of the grass stand established the following year were considered good.

Pace transects were measured in two areas within the ponderosa pine zone on May 11, 1977, and represent vegetative conditions six years following treatment. (Map 2 appendix D).

Both sample areas represent high intensity burning. Sample Area 1 includes seven transects and 140 samples in Sebadilla Canyon in the NE 1/4 Sec. 31 and NW 1/4 Sec. 32 to 16 N., R14 E. at about 8,400 feet elevation. Sample Area 2 includes nine transects and 175 samples in Canon de la Cueva near the road junction in the NE 1/4 Sec. 1 T. 15 N., R. 13 E. at an elevation of 8,300 feet.

Results of Transects

Average Percent Soil Cover

	Grasses & Forbs		Brush &				Bare
	Seeded	Native	Trees	Litter	Rock	Total	Ground
Area 1	6.6	8.7	.7	21.3	.9	38.2	61.8
Area 2	10.3	7.6	.2	24.8	3.8	46.7	53.3
Total	16.9	16.3	.9	46.1	4.7	84.9	115.1
Ave.	8.4	8.1	.5	23.0	2.4	42.4	57.6
Rounded Off	8	8	1	23	2	42	58

17%

Percent Distribution Frequency

	Grasses & Forbs		Brush &			Total Protective Soil	Bare
	Seeded	Native	Trees	Litter	Rock	Cover	Soil
Area 1	40.7	45.7	2.1	82.1	19.3	92.9	95.7
Area 2	56.6	33.7	1.1	80.6	45.1	97.1	89.1
Total	97.3	79.4	3.2	162.7	64.4	190.0	184.8
Average Rounded Off	49	40	2	81	32	95	92

Percent Plant Composition (Includes both seeded and native species)
Area 1 and 2

Species	Number Hits	% of Seeded species	% Mix	% Total Plant
Seeded Species				
Orchard grass	37	28	22	12
Hard fescue[1]	58	43	16	19
Timothy	24	18	27	8
Perennial rye	0		21	
Yellow sweet clover	0		7	
Alfalfa	0		7	
(Smooth brome)[2]	13	10		4
(Intermediate wheat)[2]	2	1		1
Subtotal	134	100	100	44
Native Species				
Poa, bluegrass	21			7
Pine dropseed	3			1
Sitanian	4			1
Carex	18			6
Brush and trees	10			3
Forbs	117			38
Subtotal	173			56
Total	307			100

1/ Some of these may be sheep fescue, a native grass. Identification was difficult.

2/ We assumed that smooth brome and intermediate wheat grass were included in the grass mix sown in the burn.

Six years following treatment of the Cat and Dog Burn the total protective soil cover recorded was 42 percent. The vegetative component made up 17 percent or about 41 percent of the total protective soil cover. Seeded species accounted for about one-half of the vegetative cover and about 19 percent of the total protective soil cover. Percentage wise, this is very similar to the transect results recorded on the 1971 Cebolleta Burn.

The distribution frequency of the seeded species was about 60 percent less than on the Cebolleta Burn.

Orchard grass, hard fescue, and timothy made up about 90% of the composition of the seeded species even though they accounted for 44 percent of the mix. Perennial ryegrass, yellow sweet clover, and alfalfa are short-lived species and would not expect to be in the stand six years later.

Native plants accounted for 56 percent of the stand six years following treatment.

d. Gallinas Burn, June 1976, Cibola National Forest

The Gallinas Fire was controlled on June 16, 1976, after burning over 1,500 acres in the ponderosa pine and pinyon-juniper type. The burned area was aerially seeded on July 2, 3, and 4, 1976, with the following prescribed seed mixture:

Species	lbs/ac	Seeds/ft2 @ 1 lb/ac	Seed/ft2	% Mix	Adjusted Seeds/ft2 PLS
Hard Fescue	1	13	13	29	11
Sand dropseed	.06	123	7	16	5
Smooth brome	3.2	2.9	9	20	8
Russian wildrye	2.6	3.9	10	22	8
Yellow sweetclover	.3	6	2	4	2
Black medic	.1	18	2	4	2
Weeping lovegrass	.07	34	2	5	2
	7.33		45	100	38

One area (Map 3 appendix D) was sampled on May 9, 1977, within the ponderosa pine zone in the SW 1/4, NE 1/4. Section 14 T. 1S., R. 11E. The slope was primarily a north east exposure. The sample consisted of three transects and 130 points.

The pace transects on this burn are based on the toe-point or step-point method and not the one-foot-square wire frame as was done on the other burns reported. Only one 20 point composition transect was recorded.

Results of Transects

Average Percent Soil Cover

Percent Cover Grasses & Forbs Seeded	Native	Brush & Trees	Litter	Rock	Total Protective Soil Cover	Bare Ground
15	5	6	30	6	62	38
	26					

Plant Composition

Seeded Species	No. Hits	% seeded species	% Seed mix	% Total Species
Hard fescue	1	9	29	5
Sand dropseed	0		16	
Smooth brome	9	82	20	45
Russian wildrye	0		22	
Yellow sweet clover	1	9	4	5
Black medic	0		4	
Weeping lovegrass	0		5	
sub-total	11	100	100	55
Native species				
Gambel oak	7			35
Ceanothus	1			5
Forbs	1			5
Sub-total	9			45
Total	**20**			**100**

Summary of the Gallinas Burn

(1) According to the limited transect data the total protective soil cover was 62 percent of the beginning of the summer rainy season the next year following treatment. The seeded species made up 15 percent which is about 24 percent of the total soil protective cover. The grass catch on the moderate slopes was considered excellent. On the steeper slopes just below the main ridge (40% slope+) the grass catch was sparse except in ground depressions and behind logs where there was litter cover.

(2) Smooth brome was the most common of the seeded species. Hard fescue made up 29 percent of the mix but accounted for only nine percent of seeded plant composition. Hard fescue requires several years to get good establishment so this specie will not provide adequate emergency cover in one year.

e. Spring Burn, April 1974, Lincoln National Forest

The Spring Fire started on April 6, 1974, and burned over 15,350 acres in the ponderosa pine, mixed conifer, and pinyon-juniper type. An intensive rehabilitation plan was developed and implemented. The burned area was aerially seeded during the period May 24 to June 27, 1974. A seeding rate of 60 seeds per square foot was prescribed based on pure live seed (PLS) at 8.5 pounds per acres. The following mix was prescribed for the ponderosa pine zone:

Specie	% mix
Orchard grass	24
Timothy	6
Perennial rye	29
Intermediate wheatgrass	41
	100

Using the information from Table I in the Nonstructural Range Handbook, FSH 2209.23 and the above percent mix of 60 seeds (PLS) per square foot the pounds of bulk seed per acre would be as follows for comparing with the other mixtures in this report.

Species	lbs/ac	Seeds/ft2 @ 1 lb/ac	Seeds/ft2	% Mix	Adjusted Seeds/ft2 PLS
Orchard grass	1.4	12	17	24	14
Timothy	.2	30	6	6	4
Perennial rye	3.3	5.7	19	29	27
Intermediate wheat grass	12.5	2.4	30	41	25
	17.4		72	100	60

According to the above figures, it would require 17.4 pounds seed/acre to arrive at the prescribed 60 seeds per square foot (PLS). This does not agree with the previously reported 8.5 pounds per acre.

The rehab review team visited the Spring Burn on November 23, 1976. This was the first field trip scheduled by the team and the pace transect form had not yet been developed so no transect data was gathered. However, in the areas visited, the seeded species; orchard grass, timothy, and intermediate wheatgrass were all observed in the grass stand which appeared to provide very adequate soil protective cover. The report prepared by the Forest people indicates that by the summer of 1975, one year after seeding, the total protective soil cover was 60 percent over most of the burned area. This is very similiar to that recorded on the Gallinas Burn.

Summary of the Spring Burn

f. George Burn, May 1974, Lincoln National Forest

The George Fire started on May 27, 1974, and burned over 400 acres within the ponderosa pine-mixed conifer type. The burn was aerialy seeded the first week of June 1974 using the same mix prescribed for the Spring Burn.

The rehab review team visited this burn on November 22, 1976. No transect data was collected, however, the total soil protective cover was similiar to that observed on the Spring Burn. The prescribed mixture was very effective in establishing a grass stand.

2. Burns Within the Chaparral

The rehab review team visited four burns that occurred within the chaparral vegetative zone. Vegetative transect data was gathered on three of the burns to determine the vegetative recovery with and without seeding treatment.

a. Battle Burn, May 1972, Prescott National Forest

The Battle Fire started on May 14, 1972 and burned over 28,000 acres. About 12,800 acres of chaparral had a high intensity burn. The chaparral area was aerially seeded during the period June 17 to July 3, 1972, with the following seed mixture:

Species	lbs/ac	Seeds/ft2 @ 1 lb	Seeds/Ft2	% Mix	Adjusted Seeds/Ft2 PLS
Weeping lovegrass	1.0	34	34	32	30
Sand dropseed	.5	123	62	59	43
Sideoats grama	2.0	3.3	7	7	3
Burnet	1.5	1.2	2	2	2
	5.0		105	100	78

The rehab review team visited the chaparral area within the Battle Burn on January 24, 1977, which is 4.5 years or five growing seasons after treatment. During this period the resprouting chaparral species had made their normal expected regrowth. No transect data was gathered since general observations indicated that no seeded species were present.

In a report Preliminary Battle Fire Erosion Survey prepared in April 1973 by James Williams, Watershed Scientist and Sherman Radtke, Soil Scientist, they indicate that due to various conditions, the resulting germination of the grass seed was very low. A thick layer of ash was created by the fire but light rain fell before the seeding was started, forming a hard crust over the ash. In the middle of August, heavy rains occured, washing a considerable amount of soil and grass seed into drainages. Most of the grass that did germinate was either on level ground, or trapped by obstacles on slopes. Their report also states there were problems in dispersing large seed such as sideoats grama by the helicopter.

Summary of Battle Burn

In the above quoted report they estimated that 1,577 acre-feet of sediment was displaced the first year from the total burn area. Even if the seeding had been relatively successful the amount of production from both seeded and native species during the first growing season would be only a trace based on a study of the 1956 Mingus Burn which was seeded with weeping lovegrass (85).

According to this study by the second growing season the production of grasses and forbs was 55 pounds per acre air-dry weight. It is interesting to note that 27 pounds or 49 percent was weeping lovegrass, the only seeded specie. By the third growing season it accounted for 32 percent of the production of grasses and forbs. Also by the third growing season the shrub canopy cover was close to 30 percent which probably represents about 50 percent of the preburn shrub cover. When you combine the grasses and forbs with the pounds of shrub regrowth the seeded weeping lovegrass accounts for less than five percent of the production during the second growing season.

b. Mingus Burn, June 1975, Prescott National Forest

This is a prescribed burn within the Mingus Research Watershed. The area is representative of the lower elevation chaparral in which the shrub canopy cover is usually about 30 percent and described as light. Because there was a fair stand of residual native grasses and forbs the burn was not reseeded. The rehab review team visited the watershed on January 25, 1977, which is 1.5 years after the fire or two full growing seasons. Three transects with 60 frame samples, were made with the following results:

Results of Transects

Average Percent Cover

Grasses and Forbs		Brush and Trees	Litter	Rock	Total Protective Soil Cover	Bare Ground
Seeded	Native					
0	14	18	6	16	54	46
Total veg.	32					

Percent Distribution Frequency

0	62	36	66	88	100	76

Summary of Mingus Burn

After two growing seasons the total protective soil cover of 54 percent was considered satisfactory. This suggests that the amount of residual grass and forb species in the light density chaparral stands provide adequate protection the second year. However, on most wildfires the amount of grass and forb that existed prior to the burn may not be known.

c. Bob Burn, August, 1975, Tonto National Forest

The Bob Fire started on August 6, 1975 and burned over 13,700 acres before being controlled on August 11, 1975. The crown cover of the chaparral varied but much of the burn area was light to medium density. Based on the burn rehab survey following the fire it was determined that approximately 7,000 acres needed seeding with weeping lovegrass. It was also determined that about one-half of the area needing treatment was critical so about 3,500 acres was also seeded with annual rye to serve as a quick cover and nurse crop for the weeping lovegrass. The aerial seeding was started on August 13, only two days after the fire was controlled, and completed on August 16, 1975. Two fixed wing aircraft were used one to apply the annual rye and the other to apply the weeping lovegrass seed.

The following seed mixture was used:

3500 Acres Critical Area, Boulder Creek Drainage

Species	lbs/ac	Seeds/Ft² @ 1 lb/ac	Total Seed/Ft²	% Mix	Adjusted Seeds/Ft² PLS
Weeping Lovegrass	1	34	34	87	30
Annual ryegrass	1	5	5	13	4
	2		39	100	34
3500 Acre Tonto Basin Drainage					
Weeping lovegrass	1	34	34	100	30

The rehab review team visited the Bob Burn on January 27, 1977, which is about 1 1/2 years after treatment or two growing seasons. Because of the size of the burn and very limited access only a small part of the burn was observed. The area sampled is located in the S 1/2, SW 1/4 Sec. 27 T. 6 N., R9E at about 3,800 feet elevation. It is representative of the light chaparral cover and generally on a north slope. No seeded species were observed within the sample area nor were any seen by the team during the one mile hike into the area. No plant composition counts were taken.

The sample consisted of five transects or 100 frame points with the following results:

Results of Transects

Average Percent Soil Coverage						
Grasses and Forbs		Brush and Trees	Litter	Rock	Total Protective Soil Cover	Bare Ground--
Seeded	Native					
0	15	17	9	10	51	49
Total Veg.	32					
Percent Distribution Frequency						
0	87	35	64	81	100	86

Summary of the Bob Burn

Based on the observations made by the rehab review team the seeding was a failure. This was confirmed by the Forest and District representatives who had observed other areas within the burn.

The reasons for the very poor seeding success are not known. However, one can speculate that seeding midway through the summer rain season was too late and the number of pure live seed per square foot particular annual rye was too light. The results also suggest that there are many unknown environmental factors such as rodents and seedbed conditions that may not be adequately considered when seeding prescriptions are being determined. According to the Burn Rehab Report prepared by the Forest people, it was recommended that the critical seeding area of 3,500 acres be fenced to control livestock use. However, it is not known to what extent livestock use was controlled.

The results on the percent cover from the transects on the Bob Burn are very similiar to the prescribed burn on the Mingus Research Watershed which was not seeded because it was determined that a residual grass stand existed before burning. The transect area within the Bob Burn was in light chaparral very similiar to the Mingus Burn. Perhaps there was a residual grass stand within the light density chaparral representative of the area sampled. Although this is questionable because much of the burn area was heavily utilized by livestock.

d. Ord Burn, June 1976, Tonto National Forest

The Ord Fire started on June 16, 1976, and burned over 4,000 acres in the chaparral type that was considered medium to heavy density. Most of the burn area was high intensity by north and northeast aspect and up to 50 percent slopes. Based on previous results of seeding chaparral burns the Forest Supervisor decided that seeding the Ord Burn would not be cost-effective.

The rehab review team visited the Ord Burn on January 26, 1977 which was seven months or one growing season following the burn. The access road above the Ord Mine was assessible only at the lower part of the burn. Therefore, the burn area samples are located approximately in the NW 1/4 Sec. 14 T.7N. R. 9E. at an elevation of about 3,800 feet on a northeast slope. See Map No. 5 appendix D. The sample consisted of 11 transects and 220 frame points, which gave the following results:

Results of Transects

Average Percent Soil Cover

Grasses and Forbs Seeded	Forbs Native	Brush and Trees	Litter	Rock	Total Protective Cover	Bare Ground
0	2	4	3	12	21	79
TOTal Veg	6					

Percent Distribution Frequency

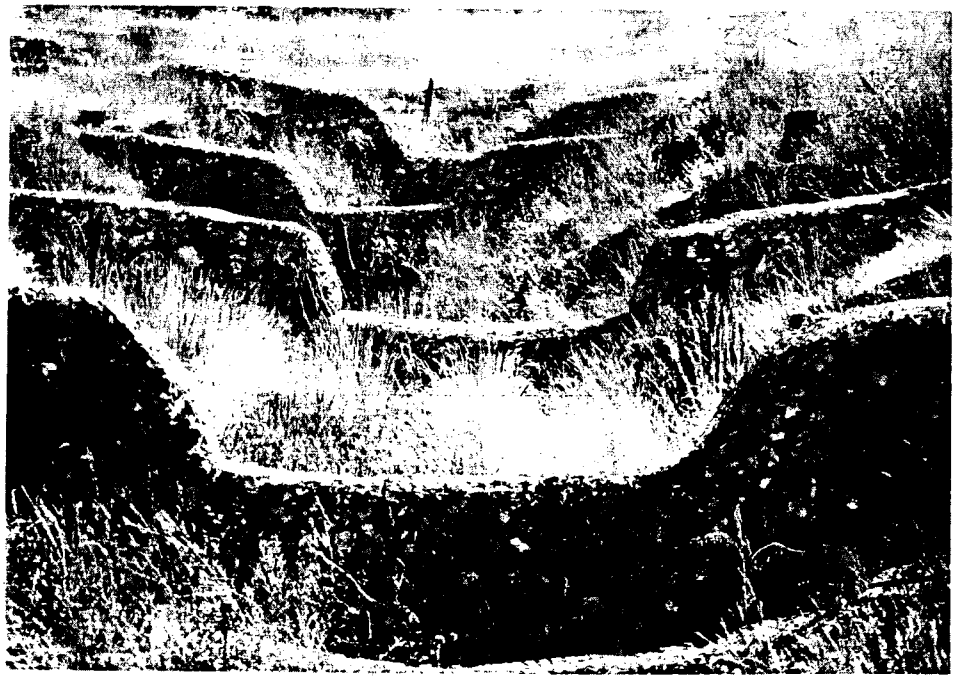
0	32	19	40	96	100	100

No plant composition counts were made but native forbs were most prominent and the resprouting shrub live oak (Q. turbinella) was the most prominent shrub cover.

Summary of Ord Burn

The transect results indicate a total protective soil cover of 21 percent with the vegetative component of six percent. This was not considered adequate protective cover for the area sampled. However, if the burned area had been seeded presumably with weeping lovegrass, it is speculated that the seeded grass would be close to one or two percent ground cover based on the 1964 study by Pase and POnd on the 1956 Mingus Burn (84). This would increase the total protective soil cover to about 23 percent after one growing season. This increase would not be significant.

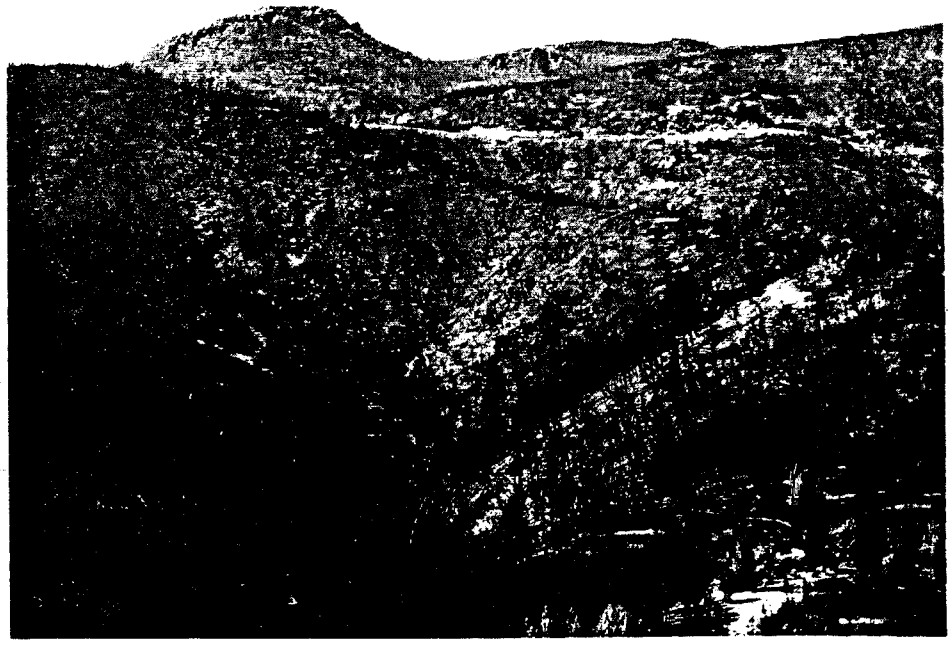
Appendix A



1. Successful gabion work and reseeding on the Spring Fire. Lincoln N.F.

2. Fuel break seeding to weeping lovegrass. Prescott N.F.

Appendix A



3. Ord fire one growing season after burn. This fire was not reseeded. Tonto N.F.

4. Roots exposed on the surface from severe sheet erosion. Ord fire Tonto N.F.

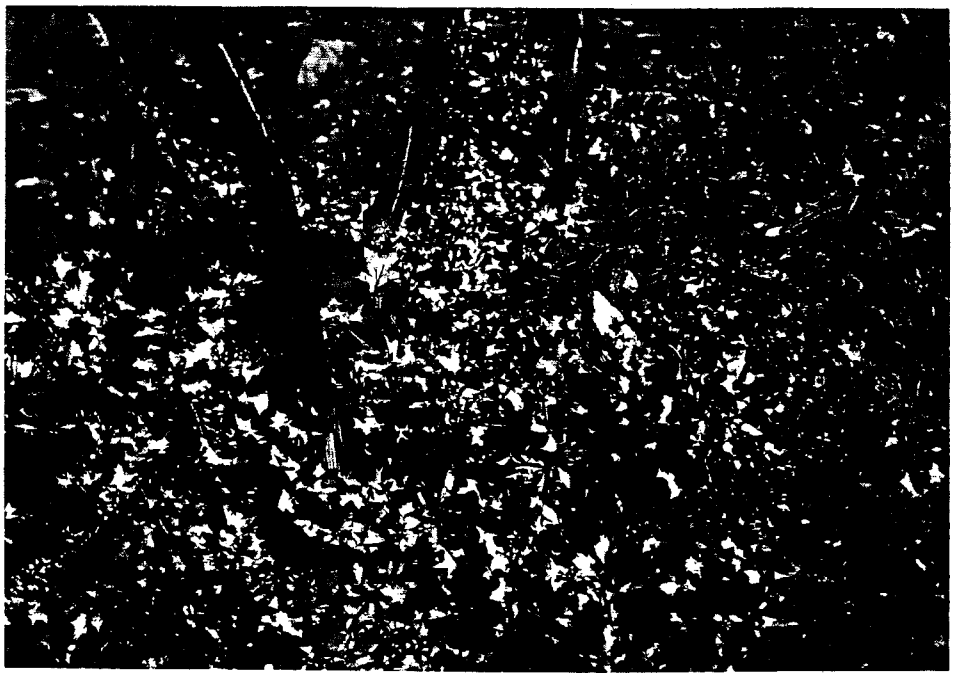
5. Research control burn near Battle Flat, Prescott N.F. Stakes mark boundary of seeding trials.

6. Rill erosion that occured on the above control burn.

7. Early seeding failure on the Porter Fire, Santa Fe N.F Later transects showed more seeded plants.

8. Good revegetation of both native and seeded species on the George Fire, Lincoln N.F.

Appendix A



9. Turbinella oak sprouts after two growing seasons. Prescott N.F.

10. Chaparrel sprouting after 7 growing seasons. Battle Fire Prescott N.F.

Appendix B

EMERGENCY BURN AREA REHABILITATION PRACTICES

IS	IS NOT
Developing seed mixtures which will stabilize soil.	Including seed species for reforestation, range and wildlife habitat plantings. If it is desirable to include these, they must be paid for from appropriate P & M funds.
Seeding appropriate burned areas to stablize soils.	Seeding areas where soil stabilization is not needed; i.e., flat areas with high infiltration rates and low run-off potentials. To restore range and wildlife productivity.
Temporary fencing of burned area to exclude livestock during the stabilization period.	Replacing allotment division or pasture fences.
Fertilizing to increase ground cover to 30 - 50% by the second growing season.	Fertilizing to increase land productivity
Mulching to improve seeding success on harsh sites.	
Chemical or mechanical treatment of hydrophobic soils.	
Contour ripping to control runoff.	Erosion control, seeding, or other measures applied to correct damage caused by fire suppression activities; i.e., repairing damaged roads closing temporary roads, draining and seeding firelines, etc. These will be paid for from FFF 102 funds.
Contour plowing to control runoff.	
Pitting to control runoff.	
Channel treatment to prevent headcut or lateral movement, degradation, control sediments, etc.	Channel treatment to improve fish habitat.
Channel alignment to facilitate water transport.	
Channel bank stabilization to control headcutting, lateral movement, and sediments.	

Appendix C

FIELD FORM - PROTECTIVE COVER EVALUATION

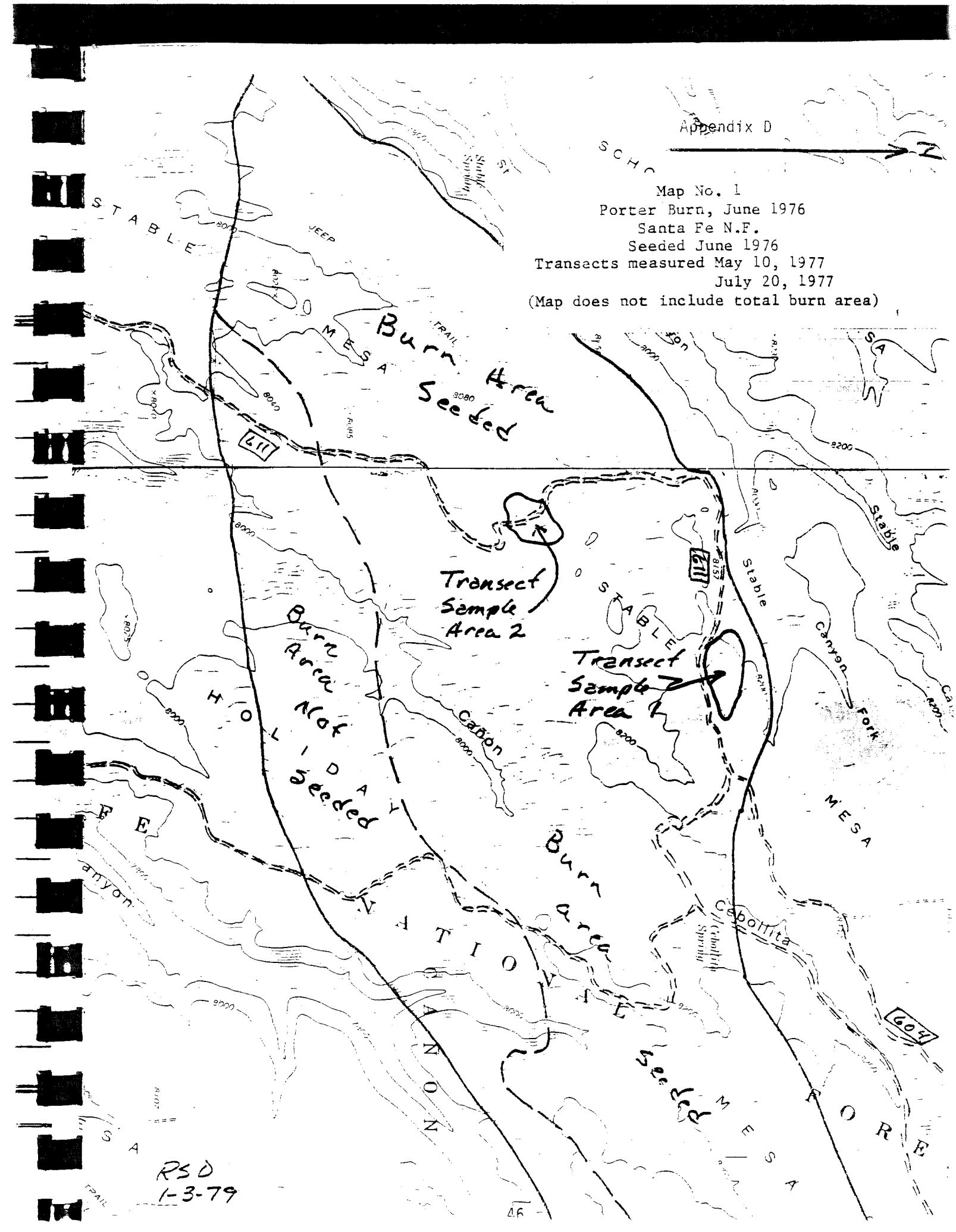
PROJECT _____ TRANSECT NO. _____

*Estimate to nearest 5 percent for all categories

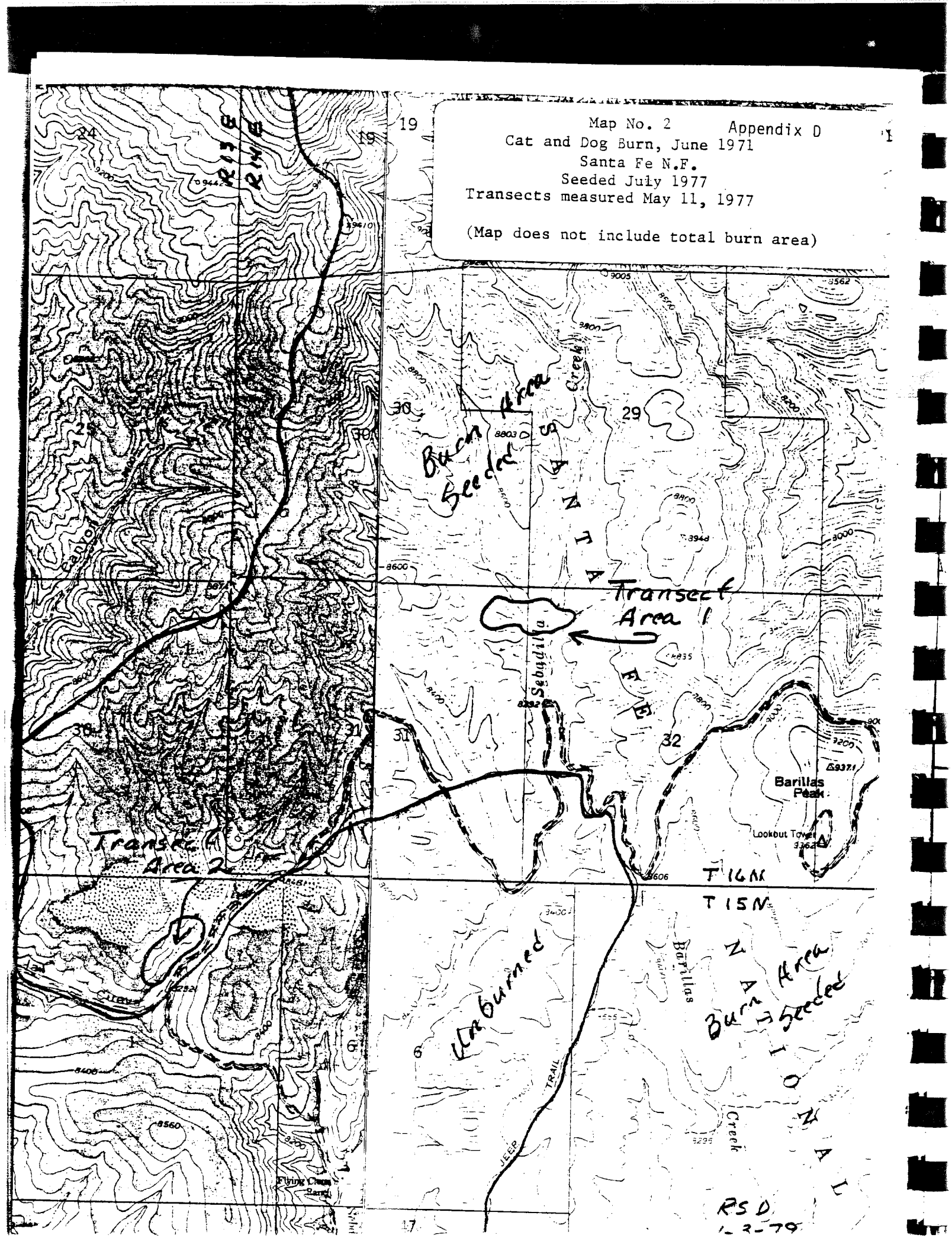
Sampled by _____

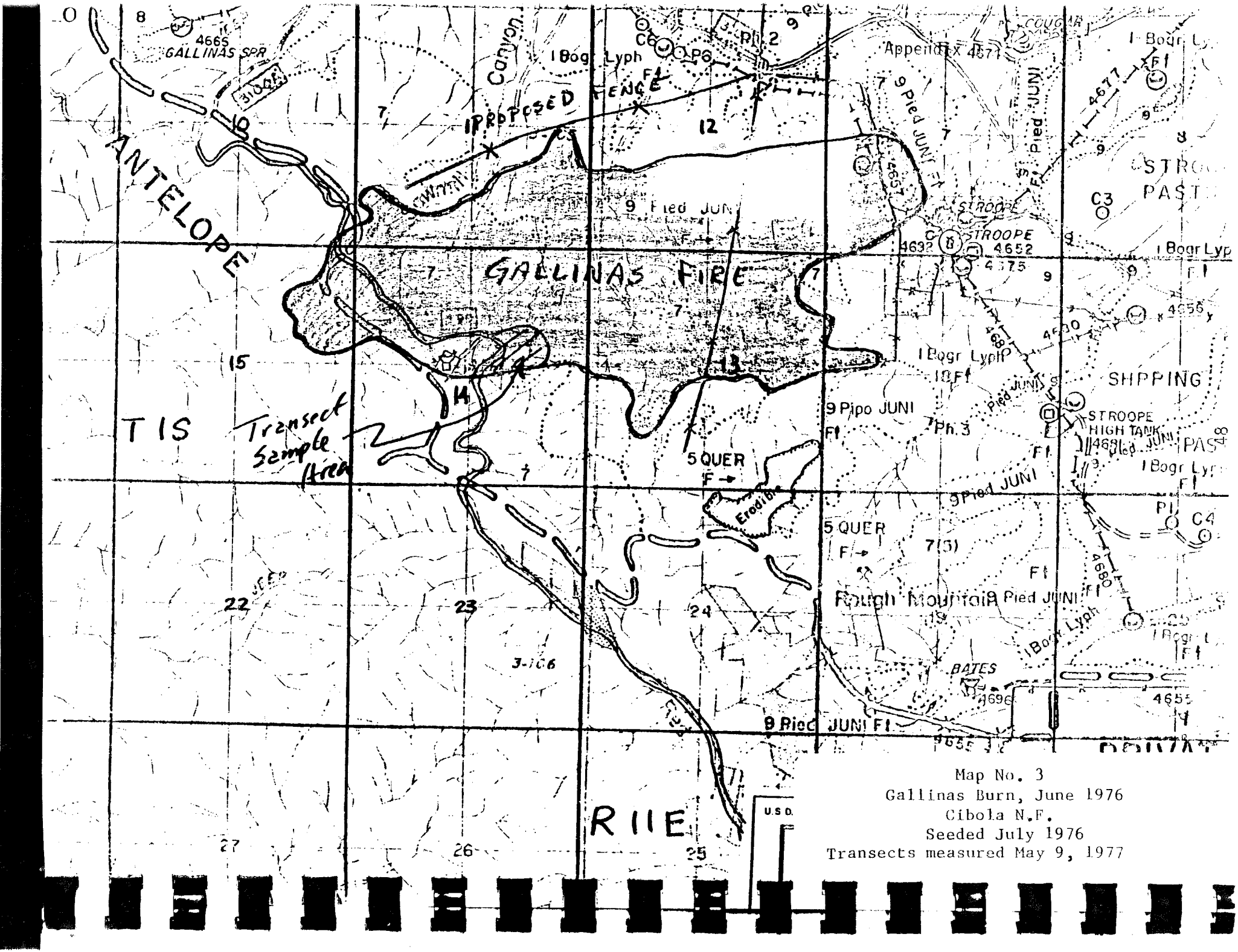
POINTS	PROTECTIVE COVER* Grasses & Forbs Seeded	Grasses & Forbs Native	Brush & Trees Sprouts or Seedlings	Litter	Rock >3/4"	TOTAL	BARREN* Bare Ground
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
SUM.							
AVG.							

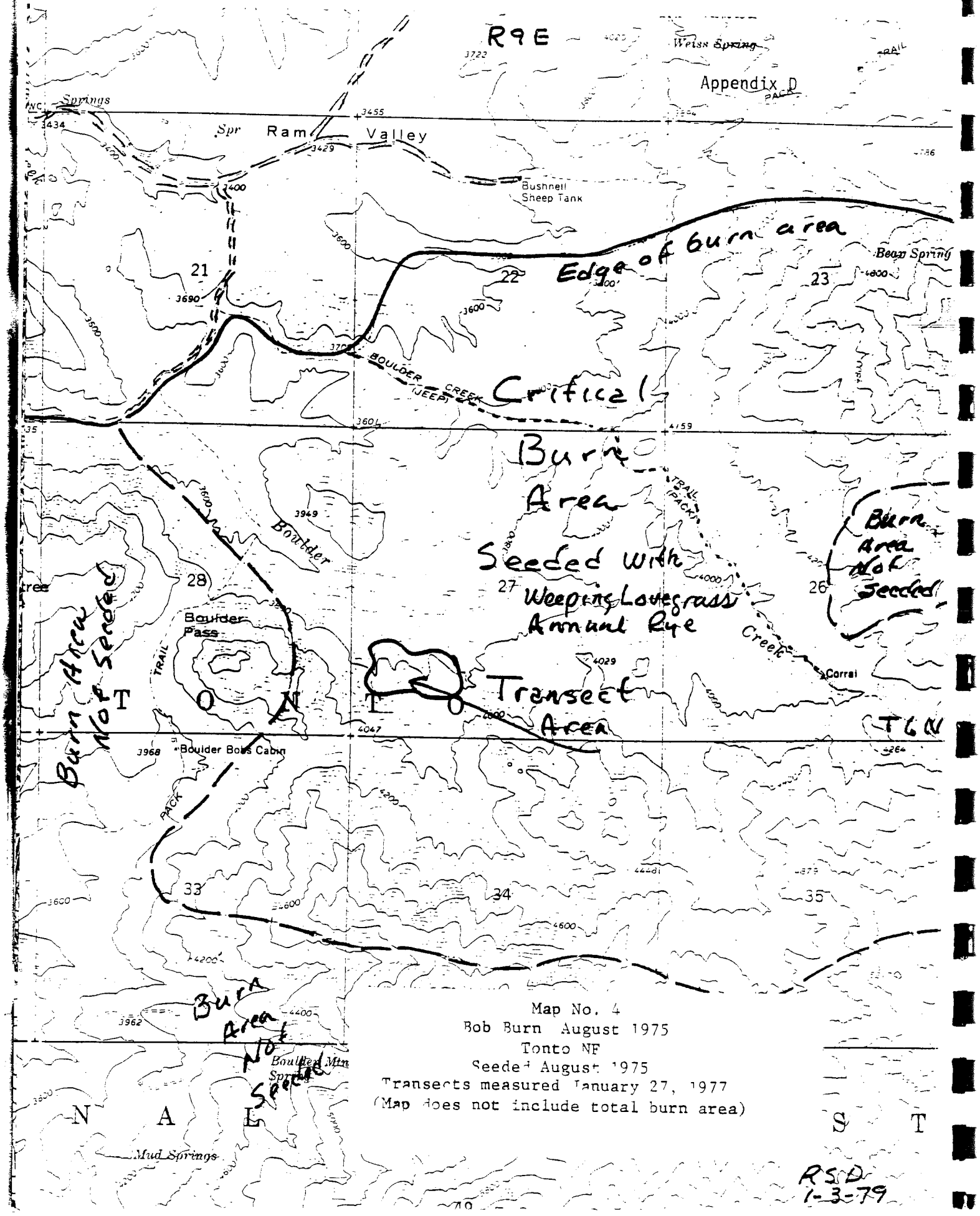
Appendix D



Map No. 1
Porter Burn, June 1976
Santa Fe N.F.
Seeded June 1976
Transects measured May 10, 1977
July 20, 1977
(Map does not include total burn area)

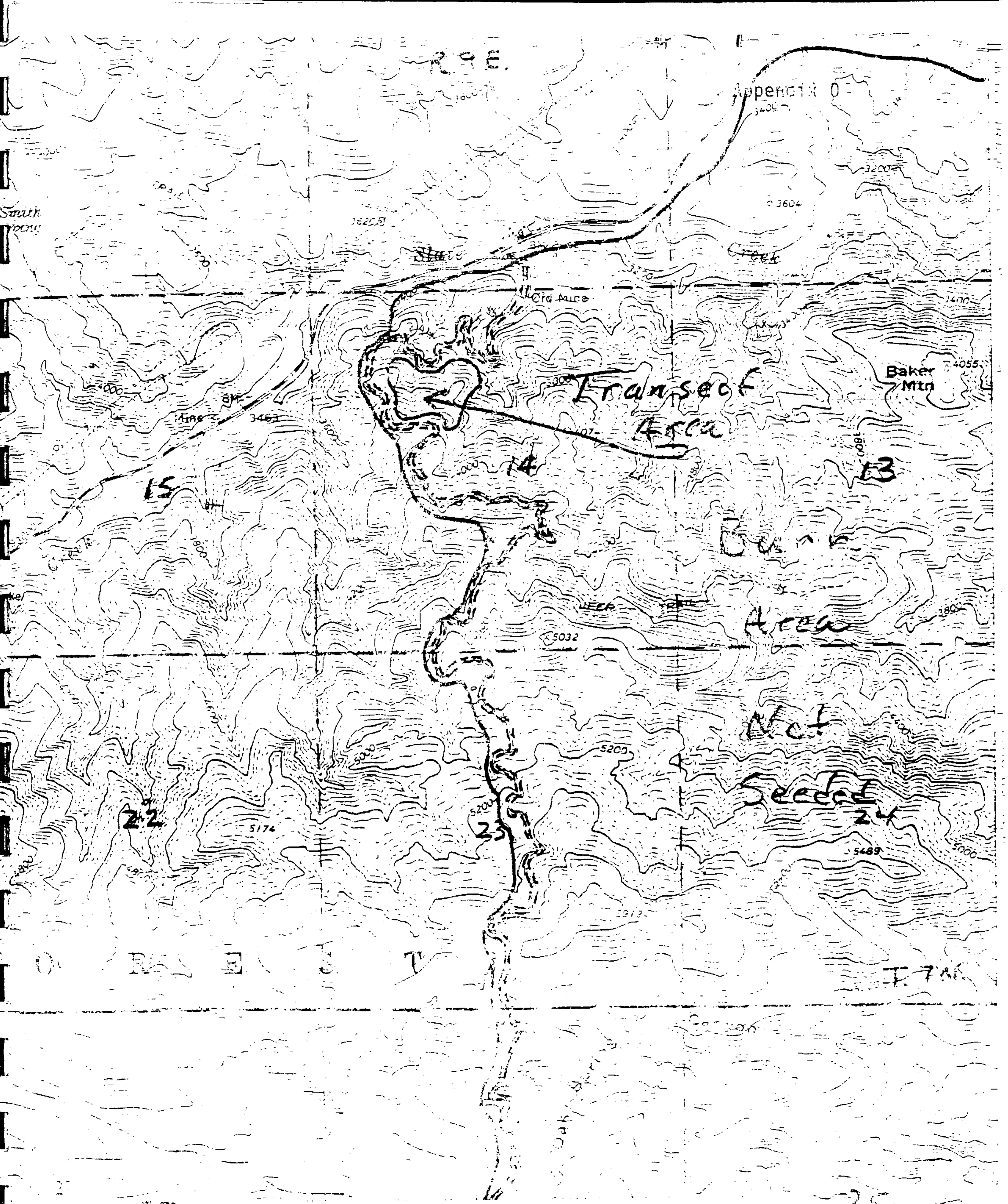

Map No. 2 Appendix D
Cat and Dog Burn, June 1971
Santa Fe N.F.
Seeded July 1977
Transects measured May 11, 1977
(Map does not include total burn area)
Burn Seeded Area
Transect Area 1
Transect Area 2
Unburned
Burn Area Seeded
Barillas Peak
Lookout Tower
T16N
T15N
SANTA FE
NATIONAL
Sebadillo Creek
Barillas Creek
JEEP TRAIL
RSD
1-3-79


GALLINAS FIRE
ANTELOPE
PROPOSED FENCE
Canyon
TIS Transect Sample Area
Rough Mountain
STROOPE
SHIPPING
BATES
Map No. 3
Gallinas Burn, June 1976
Cibola N.F.
Seeded July 1976
Transects measured May 9, 1977



Map No. 4
Bob Burn August 1975
Tonto NF
Seeded August 1975
Transects measured January 27, 1977
(Map does not include total burn area)

RSD
1-3-79



Map No. 5
...d Burn, June 1976
Tonto N.F.
Not Seeded
...nsect measured January 2..., 1977

Appendix E

Table 4. Summary Seeded Species- Forest Formation

Species	Relative Seed Size PLS No/Ft2 @ 1 lb/ac	Relative Rate Development	Relative life	Type
Orchard grass	10	rapid	long-lived	bunch grass
Timothy	24	moderate	short-lived	bunch grass
Smooth brome	2.4	rapid	long-lived	bunch grass
Perennial rye	5	rapid	short-lived	bunch grass
Hard fescue	11	slow	long-lived	bunch grass
Yellow sweet colver	5	rapid	short-lived	perennial forb

Appendix E

Table 5.

Mingus Burn, June 1956, Lower Area 5,000-6,000 Ft. Elevation
Seeded July 1956 With Weeping Lovegrass

	Number of Growing Season lbs/ac air dry weight					
	1		2		3	
	1956		1957		1958	
	Lbs.	%	Lbs.	%	Lbs.	%
Seeded grass	T		27	49	29	34
Native Grass	T		13	24	28	33
Native Forbs	—		15	27	28	33
Total Lbs.	T		55	100	85	100
% seeded species			49		34	
Total Shrub Canopy Cover						
Approx, Percent	5		14		30	

Source: Pase, C.P., and F.W. Pond. 1964. Vegetation Changes Following the Mingus Mountain Burn. Research Note RM-18.

Appendix E

Table 6.

Three Bar Watersheds Following Boulder Fire June 1959

Vegetation Recovery Percent Cover by Watershed

	B (Seeded)			C (Not Seeded)			D (Seeded)		
	Shrubs	Forbs	Grasses	Shrubs	Forbs	Grasses	Shrubs	Forbs	Grasses
1958 Prefire	62.7	.5	.2	72.9	.4	.4	70.2	.8	1.5
Nov. 1959 1-Season	7.7	6.2	.4	7.0	13.4	.1	7.4	15.7	1.1
Fall 1960 2-Seasons	21.7	4.2	1.9	8.5	6.3	1.0	20.0	8.8	1.8

Source: Glendening, G.E., Pase, and P. Ingebo. 1961
Preliminary Hydrologic Effects of Wildfire in Chaparral.

Table 7. Three Bar Watersheds - Following the Boulder Wild Fire June 1959
Watershed - Area - Treatment

Date Treatment	B. 46.5Ac	C. 95.3Ac	D. 80.5Ac
June 1959	Seeded, weeping, Lehmann lovegrass	not seeded	Seeded same as B.
Results	Failure		Failure
May 1960	Reseeded	Seeded, weeping Lehmann, Boer lovegrass	None
May 1960		Herbicide treatment	

Sediment Production $Ft^3/ac/yr$ and Precent/yr

	Total B-C-D $Ft^3/ac/yr$	%	B $Ft^3/ac/yr$	%	C $Ft^3/ac/yr$	%	D $Ft^3/ac/yr$	%
Year 1 1959-60	2577	70	1238	68	406	76	933	71
Year 2 1960-61	487	13	321	18	64	12	102	08
Year 3 1961-62	597	17	259	14	64	12	274	21
Total	3661	100	1818	100	534	100	1309	100

Source: Hibbert, A.R., E.D. Davis, and D.G. Scholl. 1974. Chaparral Conversion Potential in Arizona: Part I Wateryield Response and Effects On Other Resources. USDA FS Research Paper RM-126.

Appendix E

Table 8.

Wildfire, Pinal Mountain, June 1951

Seeded With Weeping Lovegrass at Two lbs/ac

Vegetation Recovery - Ungrazed

	1952	1956
	Two-Growing Seasons	Six-Growing Seasons
Lovegrass, Basal Area, Percent	.68	1.25
Shrub Crowncover Percent	22.0	37.0

Source: Pond, F.W. and D.R. Cable, June 1962, Recovery of Vegetation Following Wildfire on a Chaparral Area in Arizona. RMS, Research Note.

ACTIVITY REVIEW PLAN

Burned-Area Rehabilitation

Region 3

1976-1977

Approved By:

for Regional Forester

10/7/76
Date

ACTIVITY REVIEW PLAN

Burned-Area Rehabilitation

Type of Review

This will be a review of activities related to burned-area rehabilitation in Region 3. The review will be conducted to determine the Region's capabilities and needs to perform under the objectives and guidelines of FSM 2523 and FSH 2509.13.

Scope

The review will focus on the following evaluations:

1. Past decisions to rehabilitate or not to rehabilitate.
2. The technical adequacy of prescriptions prepared.
3. The effectiveness of methods' of application and how the rehabilitation job was organized.

Major emphasis will be placed on field evaluation of recent burns. The FSM has been altered and supplemented too greatly during the past year for a meaningful assessment of field responses to policy and direction for emergency actions for burned-area rehabilitation.

Need For Review

The Region has not made a systematic evaluation of burn rehabilitation recently enough to be of value. The 1975 Prescott GMR found that emergency reseeding of the chaparral portion of the Battle Fire was unsuccessful. The Tonto National Forest, in a recent report on the 1976 season, evaluated 15,700 burned acres on three fires without finding need to apply rehabilitation measures.

Burn rehabilitation is a significant land treatment in the Southwestern Region. Class D and above wildfires occur relatively frequently. Percent of burned area requiring revegetation often exceeds 50 percent of the burned area. Rehabilitation costs range from $2.00 per acre in the chaparral to $10.00 and above in the ponderosa pine type. Major wildfires typically occur just before seasonal convective storms of high intensity begin. Rapid analysis of emergency rehabilitation needs, purchase of seed and contracting for equipment must often compete with the Region's manpower and equipment resources engaged in ongoing multiple fire suppression activities.

Objectives of Review

The objective of this activity review is to evaluate past Regional burn rehabilitation decisions, the effectiveness of treatments applied, and revise or supplement existing guidelines as needed.

Some specific objectives are:

- Determine administrative study needs.
- Determine research needs.
- Develop Regional FSM and FSH supplement needs and revisions.
- Obtain field personnel's viewpoints and experiences on the W.O. Emergency Directive in FSH 2509.13 which will be finalized in one year.
- Prepare organizational plan for coordination with and to assist State Foresters in meeting emergency burn rehabilitation needs on State and private lands.

Items of Interest

The following items indicate the areas of interest that the review team will engage itself in:

- The documentation of methods of analyses used to determine burn rehabilitation needs, both through emergency actions and program planning.
- The use and adequacy of field data and special surveys from which burn rehabilitation decisions are made.
- The use of research findings for developing burn rehabilitation treatment prescriptions.
- The use of followup administrative evaluations and studies as a basis for determining the correctness of decisions and the occurrences of "acts-of-God."
- The extent of Regional Forester's staff assistance and support to the Forest Supervisor.
- The disciplines used in determining burn rehabilitation needs.
- The handling of public relations.

- Determining if burn rehabilitation decisions reflect long-term management goals such as those that would be included in a land use plan.

- To determine if on-the-ground conditions show that past rehabilitation was effective, failed, or was not needed.

Review Approach

The review team will develop its own approach and time schedule within the direction of this Review Plan. The core team for the review will consist of the following members:

Bob Ettner (Chairman)	-	Soil & Water Management - R.O.
Ray Dalen	-	Range Management - R.O.
Harry Little	-	Area Planning & Development - S&PF
Larry Allen	-	Staff - Lincoln National Forest
Carl Taylor	-	Soil & Water Management - R.O.
F.S. Research Contact	-	RMS (Duane Knipe)
Wes Bates	-	Timber Management - R.O.

The Forest Supervisor for each Forest visited will supplement the core team with a Forest coordinator, who would serve as primary contact to the team until the review is completed. Forest coordinators should be available for short detail assignments to assist the core team during the preparation of Regional guidelines next spring, if needed.

The review team will balance its time in relation to an anticipated and observed problems confronting effective burn rehabilitation. For example, it is anticipated that the chaparral vegetation type in its major variants will be dealt with in greatest detail.

Major Components of the Review & Schedule	Target Dates
1. Core Team Meet and Develop Details of Approach, Schedules, and Notify Forests to be Visited.	10/27 & 28/76
2. Assemble Existing Information and Interview Regional Office Staff Units	Set by Team
3. Field Review & Interviews - Selected Forests - State Foresters	Set by Team
4. Complete Activity Review Report	3/30/77
5. Complete Guidelines	6/30/77

Appendix G

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