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Soil Losses From Utah
RANGELAND and FORESTLAND

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Introduction

The Soil Conservation Service is charged with monitoring soil losses from rangelands and forestlands as well as from croplands. Likewise, SCS policy states that technicians will aid land administrators and decision makers to establish conservation practices which will reduce or maintain soil erosion to an acceptable minimum.

The Universal Soil Loss Equation (USLE) is used to determine soil losses. By its use the gross soil movement that occurs as sheet and rill erosion can be estimated. Other methods must be used to determine gully erosion, streambank erosion and sediment delivery. By putting the two calculations together, total erosion losses and sediment delivery can be determined on a given area.

This publication will consider only the sheet and rill erosion from Utah's rangelands and forestlands by use of the Universal Soil Loss Equation. It is recognized that conditions under which this manuscript was developed are not likely to duplicate field conditions. For this reason, data presented here should be considered as the best approximations that can be derived from the equation as presently developed. As field use and testing continues, factors in the equation can be modified.
Universal Soil Loss Equation

The formula or equation is \( A = RKSCP \). The "A" is the computed soil loss (sheet and rill) in tons per acre per year.

"R" is the precipitation factor which is an erosion index number computed from the characteristics of rainfall during a normal year for a given geographical area. The intensity of rainfall and snowmelt characteristics as they effect runoff and potential erosion are considered. A map with the Average Annual Values Factor R and Rt is available from which the factor can be obtained for a given location. The Rt factor is used in place of R for localities where snowmelt is a part of soil erosion.

"K" is the soil erodibility factor which is computed from soil characteristics that cause soils to vary in their relative rate of erosion. The "K" factor is an index determined for each soil when in continuous fallow on a 9% slope 72.6 feet long. The K values have been assigned to named soils in Utah. They can be found in the publication titled, "Soil Erodibility and Soil Loss Factors for Utah Soils", SCS, July 1974. The K value can also be obtained from the SCS Soils 5 Forms in technical guides.
Slope (LS) effects are considered as a combined factor of slope length (L) and percent slope (S). The slope length factor is the ratio of soil loss from the slope length being considered to that from a 72.6 feet length on the same soil type and gradient. The slope-gradient factor is the ratio of soil loss from the percent slope of the area being studied to that of a 9 percent slope. A table has been developed from which the LS factor can be taken. Caution must be taken where slopes exceed 20 percent and slope length exceeds 400 feet since data from which the table was developed didn't include steeper or longer slopes. The table was expanded mathematically for slopes over 20 percent and over 400 feet in length.

Slope lengths included in the calculations for this publication were taken from graphic solutions developed from field data by SCS. This graph displays a common slope percentage to slope length relationship. The minimum, average, and maximum slopes for each range site and woodland ecosystem were considered and corresponding slope lengths were taken from this graph.

The "C" factor is the vegetative cover factor which is the ratio of soil loss from an area of a given vegetative cover to that from tilled fallow condition. On rangeland and woodland the vegetative cover or (C factor) is considered for different types and deviation of vegetative
cover. Three influence zones are evaluated: (1) the canopy cover, (2) cover both live vegetation and litter in contact with the soil surface, and (3) effects of cover on the surface of the soil. A Table is available to estimate the C factor. Several different vegetative cover measurements or estimates are needed. Four different canopy classes are evaluated: (1) no appreciable canopy—which would be forbs, grasses and shrubs that are less than 0.5 meter in height; (2) canopy of tall forbs--grasses and short brush more than 0.5 meter but less than 2 meters in height; (3) tall brush over 2 meters but less than 4 meters tall in height and (4) trees over 4 meters in height.

In addition to these four general types of vegetation, the C factor varies within each by percent overstory canopy wherein three overstory densities are included, 25%, 50% and 75%. Each canopy class is modified by whether the vegetation making up the ground cover is grasses or forbs. Finally the C factor is influenced by vegetative cover both live and dead (litter) which is in direct contact with the soil surface. There are six different ground cover categories in the table, 0%, 20%, 40%, 60%, 80% and 95 to 100%.

A table has been developed for "C" factors for woodland. It has three stand conditions well stocked with tree canopy on 100% to 75% of the area and forest litter over 100%-90% of the area, medium stocked
with tree canopy over 70% to 40% of the area and forest litter over 85%–75%, and poorly stocked with tree canopy over 35% to 20% of the area and forest litter over 70% to 40% of the area. These C factors are further modified from managed undergrowth where grazing and fires are controlled compared to unmanaged undergrowth where stands are overgrazed or subject to repeated burning. If tree canopy is less than 20%, or if forest litter covers less than 40% of the area or if the forest litter is less than 2 inches deep the table for rangeland should be used to determine the "C" factor. In this publication the rangeland table was used on juniper and pinyon woodlands.

Field observation can be made to make more accurate determinations of slope length and slope percent determinations. Since the equation is set up to handle only erosion caused by water moving in a thin sheet whenever a gully is encountered, the measurement of slope length should end. In other words, slope lengths should be the distance water moves in a thin sheet down slope before it enters a defined channel.

**Soil Loss Tolerance**

The prime concern of SCS with regard to soil erosion is to keep losses below the allowable soil loss tolerance. This tolerance is defined as the maximum rate of soil loss that can be sustained and still maintain a high level of crop productivity indefinitely. On rangeland
and woodland it is the maximum loss beyond which soil erosion will cause reduction of the land to produce potential native vegetation.

Soil loss tolerance is expressed in terms of tons of soil loss per acre per year. Soil loss tolerance or maximum allowable loss is shown for each soil in Utah in tons per acre per year in the publication "Soil Erodibility and Soil Loss Factors for Utah Soils," SCS, July 1974.

The maximum soil loss tolerance for even the deepest soils is 5 tons per acre per year with losses as low as 1 ton per acre per year on some of the shallow soils. There is some controversy concerning the 5 ton maximum and some indication that this may be raised to 8 or even 10 tons per acre per year for some soils.

Soil Losses by Range Sites and Woodland Ecosystems

Computations have been made for range sites and woodland ecosystems to determine potential and present soil losses. The data is presented on a graph for each range site and woodland ecosystem.

A narrative is written and occurs with the graph of each range site and woodland ecosystem. R factors were determined for each site depending on its location. A K factor was determined for each site on the basis of average soils or the most typical soils in the site. This
factor varies considerably for different soils grouped into range sites or woodland ecosystems. If the user needs more accurate data he should determine which specific soils taxonomic unit he is dealing with and use the K factor for that soil to accurately calculate soil losses.

The topographic factor was determined considering slope percent and slope length. The slope length used is taken from the graph of the common slope length found in field studies for each slope percent. Three separate calculations were made for each site: the first is the minimum slope that occurs for the site, the second is for the average slope, and the third is for the maximum slope that has been mapped for the site. Three separate slope percentages were considered: (1) minimum slope, (2) average slope, and (3) maximum slope for each site or woodland ecosystem. The LS factor was determined from the table prepared for the topographic factor or slope-effect table. There are three calculations, first for the minimum slope, second for the average slope, and third for the maximum slope mapped for each site. Next the C factor was taken from the table for the average vegetative cover found in potential or climax condition, also for good condition, fair condition and poor condition. It is recognized that cover conditions will vary considerably within each condition class for a given range site. If the user wants
accurate soil loss figures, he should determine the C value from actual field conditions. The C values used here were taken from the table for average vegetative conditions that are found in the field for each condition class.

For forestland or woodland areas (except pinyon-juniper) C value for average vegetative cover when vegetation is in potential, and medium forage value, and low forage value were taken from the table.

Using the USLE formula, soil losses were computed in tons per acre per year when the vegetation is potential or climax, in good condition, fair condition, and poor condition. Three figures were computed for each site, one for the minimum slope, second for average slopes, and third for the maximum slope mapped for each site. Soil losses in tons per acre per year were also computed for woodland ecosystems in potential, medium forage value and low forage value for the minimum slopes, average slope and maximum slope for each woodland ecosystem.

Soil loss tolerance in tons per acre per year are shown by a horizontal straight line on the graph for each site. This figure was taken from the "Soil Erodibility and Soil Loss Factors for Utah Soils"
publication. The average soils or most typical soils was used to determine the soil loss tolerance for each site or woodland ecosystem. If the user wants to be more specific he should determine soil loss tolerance for the specific soils with which he is working.

The critical slope is indicated in the narrative for each range site and woodland ecosystem. This was determined by calculating the maximum slope beyond which the climax or potential vegetation will not maintain soil loss at or below the soil tolerance point.

Soil Loss Interpretations from Individual Range Sites

Graph Descriptions

K = Soil erodibility
T = Soil loss tolerance
P = Poor condition
F = Fair condition
G = Good Condition
Po = Potential plant community

1. Alkali Bottoms

This site in good or excellent condition maintains soil loss below the 2 ton per acre per year tolerance. "Erosion on maximum slopes near 10% exceed the tolerance level when condition is depleted to fair or poor. However, average slopes have less soil loss than the tolerance level even in poor condition. Soils in this site have an extremely variable K value of from .20 to .55 but
the most common value is .43 as used in these computations.

Care must be taken to manage this site when slopes exceed 5% so that it is maintained in good or better condition. Critical slope is 10%.

2. Salt Meadow
Slopes are usually less than 6% and other factors are such that erosion does not exceed the soil loss tolerance even in poor vegetative condition. K factors of soils in this site vary from .28 to .55 but the most common value is .32. Even the soil with highest K factor maintains enough vegetation cover so that soil losses do not exceed the tolerance level. Critical slope is 40% but this site is never on slopes more than 6%.

3. Semiwet Meadow
Erosion is not a serious problem on this site except for the maximum slopes and poor range condition. Soils grouped into this site have K values varying from .24 to .49 but most common is .32. Even the soil with highest K value does not erode greater than tolerance except in poor condition on the maximum slopes. Critical slope would be 40% but site is never on slopes greater than 10%.
4. Semi-wet Streambottoms
This site maintains enough vegetation even in poor range condition to maintain soil losses lower than the 2 tons per acre per year tolerance. Most of the soils have a K value of .24. Critical slope would be 20% but slopes are less than 10%.

5. Wet Meadows
This site maintains vegetation to keep soil losses less than 1/2 ton per acre per year even in the poorest range condition. The K factors of soils in this site vary from 0.20 to .49 with the most common factor of .28. Critical slope would be 70% but slopes of the site usually don’t exceed 5%.

6. Wet Streambottoms
This site with a tolerance of 5 tons per acre per year does not exceed 1/2 tons per acre per year even when range condition is poor. The K factor for soils in this site is commonly .24. Critical slopes would be 40% but site is usually 5% or less.
11. Subalpine Slopes

Primarily because of steep slopes this site should be maintained in good or better range condition. Even in good condition, soil loss tolerance of 2 tons per acre per year is exceeded on slopes of over 40%. The K factor varies from .17 to .32 for soils grouped into this site but most common is .17. Critical slope is 70%.

12. High Mountain Clay

This site maintains erosion control except for the steeper slopes in fair and poor range condition. Soil loss tolerance of 5 tons per acre per year is exceeded in fair range condition on slopes greater than 25%. The critical slope is 50% so this site should not be utilized by livestock on slopes greater than 50%. The K values of soils in this site are fairly uniform at .24.

13. High Mountain Loam

Soil erosion is maintained below the soil tolerance of 2 tons per acre per year except for the steeper slopes (over 30%) where range condition is fair or poor. The K values of soils in
this site vary from .15 to .32 but most common is .20. Slopes over 30% should be maintained in good range condition. Critical slope is 70%.

14. High Mountain Loam (Idaho Fescue)
This site maintains enough vegetation to control erosion below the 4 ton per acre per year tolerance level except in poor condition. Management should be such that fair or better range condition is maintained. K factors for soils are pretty uniformly .20. Critical slope is 70%.

15. High Mountain Loam (summer precipitation)
Enough vegetation is produced by this site to safeguard against erosion below the 2 ton per acre per year tolerance except when the site is depleted to poor condition. In fair condition, vegetation is depleted to the extent that slopes over 30% will not keep soil erosion below the tolerance level. K values for soils in this site are primarily 0.20. The goal should be to improve and maintain this site in good or excellent condition. Critical slope is 70%.
20. High Mountain Loam (Shrub)
Vegetation is adequate to protect against erosion below the 3 ton per acre per year tolerance in excellent and good condition and in fair condition on slopes up to 30%. The best management from an erosion standpoint is to maintain this site in good or excellent condition. K factors for soils in this site vary from .17 to .24 but are mostly 0.20. Critical slope is 70%.

21. High Mountain Stony Clay
Due primarily to the fact that slopes do not exceed 15% on this site and that vegetation in all condition classes is adequate, erosion does not exceed the 2 ton per acre per year tolerance on this site. K values are .15 due to stone on the surface and throughout the soil profile. Critical slope is 70%.

31. Mountain Clay
Vegetation is adequate to protect this site from erosion below the 4 ton per acre per year tolerance in good and excellent range condition. In fair condition up to slopes of 20% and in poor condition on slopes up to 15%.
The critical slope on this site is 35% but this slope does not occur only occasionally. K values vary from .20 to .32 but most soils grouped into this site have a .24 K value. The best policy for erosion control is to improve and maintain this site in good or excellent condition.

32. Mountain Gravelly Loam
Vegetation is adequate to protect this site against erosion below the 2 ton per acre per year tolerance level when in good or excellent range condition. When in fair or poor condition the tolerance is exceeded primarily due to the fact that this site is characteristically on slopes over 30%. The goal should be to improve and maintain the range condition to good or excellent. Soils of this site have K factors that vary from .17 to .28 but the typical K is .20. Critical slope is 70%.

45. Mountain Gravelly Loam (Oak)
Vegetation is adequate to protect this site against erosion below the 3 ton per acre per year tolerance in good and excellent range condition and in fair condition up to slopes of 40%. In poor condition soil erosion exceeds soil loss
tolerance by almost 3 times. The management goal should be to maintain this site in fair or better condition. Soils of this site have K factors that vary from .17 to .32 but most typical is .20. Critical slope is 70%.

33. Mountain Loam
Vegetation is adequate to maintain soil erosion below the 3 tons per acre per year tolerance in good or excellent range condition and in fair condition up to slopes of 30%. The goal should be to improve and maintain this site in good or excellent condition. Soils in this site have K values varying from .20 to .37 but most typical is .28. Critical slope is 70%.

34. Mountain Loam (Shrub)
Vegetation is adequate in good and excellent range condition to maintain soil erosion below the 3 ton per acre per year tolerance. In fair condition the tolerance is exceeded. K values of soils in this site vary from .20 to .32 but .28 is most typical. Critical slope is 70%.
35. Mountain Loam (Oak)
Vegetation is adequate to maintain soil erosion below the 3 ton per acre per year tolerance when in good and excellent condition and in fair condition up to 35% slopes. The goal should be improvement and maintenance in good or excellent condition. K values of soils vary from 0.20 to .43 but .24 is most typical. Critical slope is 70%.

37. Mountain Loam (summer precipitation)
Vegetation is adequate to protect soils from erosion lower than the 3 tons per acre per year tolerance in fair, good or excellent range condition. This site should not be allowed to deplete to poor condition. Soil K values are primarily .24. Critical slope is 70%.

38. Mountain Shallow Loam
If soil erosion losses are to be maintained below the 1 ton per acre per year tolerance, slopes over 25% should not be grazed by livestock. Due to steepness and low potential vegetative cover soil erosion processes have exceeded soil building
on this site and thus shallow soils have resulted. If slopes over 25% are grazed, the soil erosion processes will continue to exceed the tolerance and the site will be sacrificed. This critical slope is 25%.

39. Mountain Shallow loam (Curlleaf mountain mahogany)
Soil erosion losses exceed the 1 ton per acre per year tolerance on slopes over 25% even when the climax plant cover is present. Soil erosion processes have exceeded soil building processes to create shallow soils. If this site is grazed the soil erosion will continue to exceed the soil loss tolerance on slopes over 25%. This critical slope is 25%.

40. Mountain Shallow Loam (summer precipitation)
Soil losses exceed the 2 ton per acre per year tolerance on slopes greater than 30% even when the vegetation is in climax or potential. If slopes under 30% are grazed the soil loss can be maintained below the tolerance when in good or excellent condition. Erosion exceeds tolerance levels when vegetation is in fair or poor condition. Soils typically have K values of .20. Critical slope is 30%.
42. Mountain Stony Clay
Vegetation on this site will maintain soil loss below the 1 ton per acre per year tolerance in good and excellent condition and in fair condition up to slopes of 20%. The goal should be to improve and maintain this site in good or better range condition. Soils typically have K values of .20. Critical slope is 40%.

43. Mountain Stony Loam
Vegetation of this site will maintain soil losses below the 1 ton per acre per year tolerance when in good or excellent range condition. Fair condition vegetation is not adequate to maintain erosion below the tolerance so goals should be to maintain this site in good or excellent condition. Soils have K values that vary from .15 to .32 but are typically .20. Critical slope is 40%.

44. Mountain Stony Loam (summer precipitation)
Vegetation maintains soil erosion below the 2 ton per acre per year tolerance in good and excellent and in fair range condition up to slopes of 30%. The goal from an erosion standpoint should be to maintain this site in good or excellent condition.
range condition. Soils in this site have typical $K$ values of 0.20. Critical slope is 70%.

51. Upland Clay
Vegetation and slopes are such that soil erosion is less than the 5 tons per acre per year tolerance in all condition classes but in poor condition on maximum slopes of 25% soil loss is 4.74 tons per acre per year. Soils have $K$ values varying from 0.20 to 0.32 but typically 0.24. Critical slope is 70%.

53. Upland Clay (summer precipitation)
Vegetation and slopes are such that the 3 ton per acre per year tolerance soil loss is not exceeded even though range condition may be in poor condition. Soils $K$ values vary from 0.28 to 0.37 but are typically 0.32. Critical slope is 70%.
54. Upland Gravelly Loam

Vegetation is adequate to maintain soil losses below the 2 tons per acre per year tolerance when range condition is fair or better. When vegetation is in poor range condition, soil erosion exceeds tolerance level by 2 to 5 times. Soils have K values varying from .20 to .43 but typically .28. Critical slope is 70%.

55. Upland Limy Loam

58. Upland Limy Loam (summer precipitation)

Vegetation on these two sites is adequate to hold soil losses below the 2 ton per acre per year tolerance in fair or better condition and in poor condition up to slopes of 10%. These sites should be improved and maintained in fair or better condition to adequately protect the soils from excessive erosion. Soils have K values that are typically .28. Critical slope is 45%.
59. Upland Loam
Vegetation is adequate to maintain soil losses below the 3 ton per acre per year tolerance when in fair or better range condition and in poor condition up to slopes of 15%. The goal from an erosion loss standpoint should be to improve and maintain fair or better range condition. Soils have K values that vary from .17 to .55 but typically is .32. Critical slope is 70%.

63. Upland Loam (summer precipitation)
Vegetation adequately maintains soil losses below the 5 tons per acre per year tolerance even in poor condition. Slopes do not exceed 10%. Soils have K values ranging .20 to .49 but typically is .32. Critical slope is 70%.
66. Upland Sand

68. Upland Sand (summer precipitation)
Vegetation and soil texture are such that soil loss does not exceed the 5 tons per acre per year even in poor range condition. Soils K values vary from .10 to .32 but is typically .17. Critical slope is 70%.

69. Upland Shale
Vegetation adequately maintains soil losses below the 2 ton per acre per year tolerance when range condition is good or excellent and in fair condition up to slopes of 10%. The goal should be to maintain this site in good or better condition. Soils have K values which are typically .43. Critical slope is 25%.

70. Upland Shallow Hardpan (summer precipitation)
Vegetation and slopes are such that soil losses do not exceed the 1 ton per acre per year tolerance in fair or better range condition and in poor condition up to 10% slopes.
For erosion control this site should be improved and maintained in fair or better condition. Soils have $K$ values that are typically .15. Critical slope is 30%.

72. Upland Shallow Loam

73. Upland Shallow Loam (summer precipitation)
Vegetation of these two sites will maintain soil erosion losses below the 1 ton per acre per year tolerance when range condition is good or better and slopes are less than 30%. The reason these soils are shallow is that soil erosion processes exceed soil building. Slopes of greater than 30% cannot be utilized if soil erosion is to be controlled at less than the tolerance for these soils. Soils have $K$ values varying from .15 to .43 but are typically .28. Critical slope is 30%.
79. Upland Stony Loam

82. Upland Stony Loam (summer precipitation)

Vegetation on these two sites is adequate to keep soil losses below the 2 ton per acre per year tolerance in fair or better range condition and even in poor condition up to 20% slopes. Goals from an erosion standpoint is to maintain fair or better range condition. Soils have K factors varying from .15 to .32 but typically .20. Critical slope is 70%.

62. Southern Upland Loam

Vegetation and slopes are such that soil losses are maintained below the 5 tons per acre per year tolerance even in poor range condition. Soils have K values varying from .24 to .32 but are mostly .24. Critical slope is 70%.
83. Southern Upland Loam (Shrub)
Vegetation adequately protects this site from soil losses below the 2 tons per acre per year tolerance in fair or better range condition and even in poor condition up to 30% slopes. Soils have K values of .10. Critical slope is 70%.

84. Southern Upland Stony Loam
Vegetation is adequate to maintain soil losses below the 3 tons per acre per year tolerance in fair or better range condition and even in poor condition on slopes up to 40%. Goals should be maintenance of range condition as fair or better. Soils have K values of .10. Critical slopes is 70%.

91. Semidesert Alkali Flats
Vegetation and slopes less than 10% keeps soil losses below the 1 ton per acre per year tolerance when range condition is fair or better and even in poor condition on slopes up to 5%. Fair or better range condition should be the goal to keep soil
erosion within the tolerance. Soils have K values varying from .28 to .55 but most typical is .55. Critical slope is 10%.

92. Semidesert Clay
93. Semidesert Clay (summer precipitation)
Vegetation and slopes less than 15% keep soil losses below the 5 tons per acre per year tolerance for these two sites for even poor range condition. Soils K values are .24. Critical slope is 60%.

95. Semidesert Gravelly Loam (summer precipitation)
Vegetation and slopes of less than 12% keep soil losses below the 5 tons per acre per year tolerance even for poor range condition. Soils K value is .32. Critical slope is 60%.
96. Semidesert Limy Loam

Vegetation and slopes less than 15% aid in keeping soil losses below the 2 tons per acre per year tolerance for good and excellent range condition, for fair condition up to 13% slopes and for poor condition up to 11% slopes. The goal should be to improve and maintain range condition to good. Soils K values vary from .20 to .43 but are typically .37. Critical slope is 25%.

98. Semidesert Loam

101. Semidesert Loam (summer precipitation)

Vegetation and slopes less than 10% aid in keeping soil losses below the 5 ton per acre per year tolerance even in poor condition. Soils K values vary from .20 to .49 but are typically .43. Critical slope is 35 to 40%.
105. Semidesert Shallow Hardpan
Vegetation slopes less than 20% and soils with low K values keep this site from exceeding the 2 ton per acre per year tolerance even in poor condition. Soils K values are .25. Critical slope is 50%.

106. Semidesert Shallow Hardpan (summer precipitation)
Vegetation protects this site from soil losses in excess of the 1 ton per acre per year tolerance on slopes less than 15% in good or excellent condition, on slopes less than 10% in fair range condition and on slopes less than 9% in poor range condition. The goal should be to improve and maintain this site in good or excellent range condition. Soils have K values of .28. Critical slope is 15%.

107. Semidesert Shallow Loam 8-10" precipitation
Vegetation keeps soil losses below the 1 ton per acre per year tolerance on slopes less than 20% in good or excellent condition, on slopes less 12% in fair condition and on slopes less than 10% in poor condition. Wherever possible slopes greater than 20%
should not be grazed and range condition should be maintained as good or better. Soils K values vary from .24 to .28 but typically are .24. Critical slope is 20%.

108. Semidesert Shallow Loam 10-12" precipitation
Vegetation and slopes less than 15% keep soil losses below the 1 ton per acre per year tolerance in fair or better range condition and in poor condition on slopes up to 12%. Soils K values are .24. Critical slope is 35%.

110. Semidesert Silt Loam
Vegetation and very slight slopes keep this site below the 5 ton per acre per year tolerance even in poor range condition. Soils K values vary from .37 to .49 but typically are .37. Critical slope is 40%.
111. Semidesert Stony Loam

Vegetation is adequate to keep soil losses below the 1 ton per acre per year tolerance in good or excellent range condition, on slopes less than 12% in fair condition and slopes less than 9% in poor condition. Best management is to keep this site in good or excellent condition. Soils K factors vary from .24 to .55 but are typically .28. Critical slope is 40%.

114. Semidesert Stony Hills

Vegetation adequately protects this site from soil losses in excess of the 1 ton per acre per year tolerance in good and excellent condition. When this site is depleted to fair condition, soil loss tolerance is exceeded. Range condition should be improved and maintained in good or excellent condition. Soils K values are typically .20. Critical slope is 40%.
119. Southern Semidesert Loam
Vegetation and slopes of 5% and less keep soil losses below the 5 tons per acre per year tolerance even in poor range condition. Soils K values vary from .10 to .24 but are mostly .24. Critical slope is 70%.

118. Southern Semidesert Malpai
Vegetation adequately protects this site from soil losses exceeding the 3 tons per acre per year tolerance in good and excellent range condition, in fair condition on slopes up to 30% and poor condition on slopes up to 10%. The best policy is to maintain this site in good or excellent range condition. Soils K values are .28. Critical slope is 65%.
117. Southern Semidesert Shallow Loam
Vegetation adequately keeps soil erosion below the 1 ton per acre per year tolerance when range condition is good or excellent, up to slopes of 15% in fair condition and up to slopes of 12% in poor condition. The best policy is to improve and maintain this site in good or excellent condition. Soils K values vary from .10 to .37 but typically are .24. Critical slope is 20%.

130. Desert Alkali Bench
Vegetation and slopes less than 10% aid in keeping soil losses below the 1 ton per acre per year tolerance when range condition is good or excellent, on slopes up to 7% in fair and poor condition. The safest policy is to maintain good or excellent condition. Soils K values vary from .20 to .24 but are typically .24. Critical slope is 15%.
133. Desert Alkali Flats
Primarily the flat slopes of this site keep soil losses below the 5 ton per acre per year tolerance even in poor vegetative condition. Soils K values vary from .28 to .49 but typically are .28. Critical slope is 35%.

139. Desert Alkali Sand
Slopes less than 10% and sandy texture keep soil losses below the 5 tons per acre per year tolerance even in poor range condition. Soil K values are .24. Critical slope is 40%.

121. Desert Bottoms
Slopes less than 10% and vegetation keep soil losses below the 5 tons per acre per year tolerance even in poor range condition. Soils K values are .49. Critical slope is 30%.
122. Desert Flats

Slight slopes primarily keep soil losses below the 2 tons per acre per year tolerance even in poor range condition. Soils K values vary from .24 to .55 but typically .49. Critical slope is 15%.

123. Desert Gravelly Loam

Slopes less than 10% keep soil losses below the 5 tons per acre per year tolerance even in poor range condition. Soils K values are .24. Critical slope is 35%.

124. Desert Loam

Slight slopes and vegetation keep soil losses below the 5 tons per acre per year tolerance even in poor range condition. Soils K values vary from .43 to .49 but typically .43. Critical slope is 25%.
125. Desert Loamy Shale
Slopes greater than 10% are critical and even with climax vegetation losses greater than the 2 tons per acre per year occur. Areas less than 10% in good or excellent condition will control erosion below the tolerance level. Soils K values vary from .37 to .43 but typically .43. Critical slope is 10%.

132. Desert Salt Flats
Slight slopes keep soil losses below the 5 tons per acre per year tolerance even in poor range condition. This is more of a deposition area than one where soils erode out of the area. Soils K values vary from .32 to .55 but typically are .55. Critical slope is 15%.
127. Desert Sand

Slight slopes and sandy textures maintain soil losses less than the 5 tons per acre per year tolerance even in poor range condition. Soils K values are .49. Critical slope is 20%.

138. Desert Shallow Loam

If improved to and maintained in good or excellent range condition soil losses will not exceed the 1 ton per acre per year tolerance. In fair or poor condition soil loss tolerance is exceeded on slopes greater than 7%. Soils K values are .32. Critical slope is 10%.

128. Desert Shallow Shale

Areas with slopes greater than 5% exceed the 1 ton per acre per year tolerance even where climax vegetation occurs. Soils K value is .43. Critical slope is 5%.

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131. Desert Silt Flats

Primarily due to slight slopes soil losses do not exceed the 5 ton per acre per year tolerance even where poor range conditions occur. Soils K values are .49. Critical slope is 30%.

135. Southern Desert Loam

Slopes less than 10% and vegetation keep soil losses below the 5 tons per acre per year tolerance even in poor range condition although on maximum slopes and poor range condition the tolerance is equalled. Soils K values are from .24 to .43 but typically .24. Critical slope is 40%.

137. Southern Desert Sand

With slopes less than 10% and sandy texture soil losses are less than the 3 tons per acre per year tolerance even in poor range condition. Soil K values vary from .10 to .20 but typically .20. Critical slope is 25%.
134. Southern Desert Shallow Hardpan
Slight slopes and vegetation keep the soil losses below the 1 ton per acre per year tolerance when in fair or better range condition. Soil K value is .32. Critical slope is 10%.

136. Southern Desert Stony Loam
Soil losses do not exceed the 2 tons per acre per year tolerance except in poor range condition on slopes exceeding 10%. Soils K values vary from .10 to .28 but typically are .17. Critical slope is 15%.
SOIL LOSS INTERPRETATIONS FROM INDIVIDUAL WOODLAND ECOSYSTEMS

Aspen-Grass 2o2, 3o2, 4o2, 4r1, 2f1, (16)

Aspen-Grass-Forb 3o3, 3r2, 4o4, 4r2, (17)

Vegetation is adequate on these two sites to keep soil losses below the 3 tons per acre per year tolerance even in low forage condition. Soils K values vary from .17 to .32 with the typical K of .28. Critical slope is 70%.

Aspen-Grass-Forb 3d7 (18)

Aspen-Grass-Forb 4x3, 5x3 (19)

Vegetation is adequate on these two sites to keep soil losses below the 2 tons per acre per year tolerance even in low forage value. Soils K values vary from .17 to .43 but typically are .43 for the shallow site and .28 for the stony one. Critical slope is 70%.
Vegetation adequately keeps soil losses below the 5 tons per acre per year tolerance even when vegetation is in poor condition. Soils K values are .43. Critical slope is 70%.

Vegetation adequately protects soil losses to less than the 1 ton per acre per year tolerance even when condition of understory is poor. Soils K values vary from .10 to .20 with typical .15. Critical slope is 70%.
Ponderosa Pine-Grass 5c1 (47)

Ponderosa Pine-Grass-Shrub 5f1, 6f2 (48)

Vegetation of these 2 sites is adequate to keep soil losses below the 2 tons per acre per year tolerance even when understory is in poor condition. Soils K values vary from .17 to .32 but are typically .17. Critical slope is 70%.

Juniper-Pinyon-Shrub-Grass 1c1 (52)

Vegetation adequately prevents soil losses greater than the 3 tons per acre per year tolerance except in the lowest forage condition when slopes exceed 7%. Soils K value is .28. Critical slope is 70%.
Juniper-Pinyon-Grass 2t1, 3t1 (56)
Vegetation adequately protects soil losses from exceeding the 2 tons per acre per year tolerance except when understory is in poor condition. Understory should be maintained in medium or high forage condition to keep soil losses below tolerance. Soils K value varies from .15 to .28 with typical K of .24. Critical slope is 70%.

Pinyon-Juniper-Grass-Shrub 2t2 (57)
Vegetation protects from soil losses exceeding the 2 tons per acre per year tolerance except when in poor understory condition with slopes exceeding 5%. Soils K value is .24. Critical slope is 70%.
Juniper-Pinyon-Grass 1ol, 2o3, 3ol, 3r3, 2r1 (60)

Vegetation protects from soil losses exceeding the 3 tons per acre per year tolerance when understory is in medium or better forage value. Vegetation should be managed to keep it in medium or better forage condition to prevent soil losses greater than tolerance. Soils K value varies from .20 to .43 but is typically .28. Critical slope is 70%.

Juniper-Pinyon-Grass-Shrub 2o1, 3o5, 2x3 (61)

Vegetation protects from soil losses exceeding the 3 tons per acre per year tolerance when understory is in medium or better forage value. Vegetation should be managed to keep it in medium or better forage condition to prevent soil loss tolerance. Soils K value varies from .37 to .49 with a typical .43. Critical slope is 70%.
Pinyon-Juniper-Grass 2s2, 3s2 (67)
Vegetation is adequate to keep soil losses below the 5 tons per acre per year tolerance even when understory condition is poor. Soils K value is typically .10. Critical slope is 70%.

Juniper-Pinyon-Grass 2d1, 3d2, (71)
Vegetation protects from soil losses exceeding the 1 ton per acre per year tolerance when in high forage condition, on slopes less than 8%, on medium forage condition and on slopes less than 3% on poor forage condition. This points out the need for maintaining the understory vegetation in high condition to prevent excessive soil losses on these shallow soils. Soils K value varies from .17 to .43 with a typical .28. Critical slope is 30%.

Juniper-Pinyon-Grass 2d4 (74)
It is necessary to maintain understory vegetation in high forage condition to prevent soil losses greater than the 1 ton per acre per year tolerance.
K value of soils is .28. Critical slope is 30\%.

Pinyon-Juniper-Shrub 3d3 (75)
Pinyon-Juniper-Grass 3d5 (77)
Vegetation should be kept in high forage condition to keep within the 1 ton per acre per year tolerance. Soils K values for these two sites vary from .15 to .32 but typically are .32 and .20. Critical slope is 25\% and 10\%.

Juniper-Pinyon-Grass 2d2, 3d1 (78)
Vegetation protects from soil losses greater than the 2 tons per acre per year tolerance when in high condition, and on slopes less than 40\% in medium condition. This site should be managed to keep understory vegetation in medium or better condition. Soil K factors vary from .10 to .17 but typically .10. Critical slope is 70\%.
Juniper-Pinyon-Grass 2x1, 3x2, (80)

Vegetation of this site protects from soil losses greater than the 2 tons per acre per year tolerance when it is in high condition and on slopes less than 20% in medium condition. Vegetation should be managed in high condition to protect soils against excessive loss. Soils K values vary from .15 to .32 with a typical K of .24. Critical slope is 50%.

Juniper-Pinyon-Shrub-Grass 1x1, 3x5, 2x2, 2f1 (81)

Vegetation when in medium or high condition will protect against soil losses exceeding the 3 tons per acre per year tolerance. Soils K values are .10. Critical slope is 70%.
Juniper-Pinyon-Grass-Shrub 3d8 (85)

Due to the fact that slopes are less than 10% and with high or medium understory condition and in poor condition with slopes less than 5% soil losses are less than the 2 tons per acre per year tolerance. Soils K factors are .24. Critical slope is 50%.

Juniper-Pinyon-Grass-Shrub 3x4 (86)

Vegetation is adequate in high and medium condition to protect soils from losses exceeding the 4 tons per acre per year tolerance. Soils K factor is .10. Critical slope is 70%.
Juniper-Pinyon-Shrub-Grass 3s1 (87)

Vegetation will protect soil losses from exceeding the 5 tons per acre per year tolerance when in high or medium condition and in low condition where slopes are less than 10%. Manage vegetation to keep it in medium or better condition to avoid excessive soil losses. Soils K values vary from .10 to .32 but are typically .24. Critical slope is 70%.

Juniper-Pinyon-Grass 2f2 (88)

Vegetation is adequate to prevent soil losses greater than 3 tons per acre per year tolerance when in medium or better condition and in poor condition on slopes less than 15%. Soils K values are .10. Critical slope is 70%.
Juniper-Pinyon-Grass-Shrub 2d3 (89)

Vegetation is adequate in high and medium forage condition to prevent soil losses below the 2 tons per acre per year tolerance and in low forage condition on slopes less than 5%. The goal should be vegetative management to keep the understory in medium condition or better. Soils K values are .24. Critical slope is 50%.

Juniper-Grass 3f3 (90)

Vegetation protects the site from soil losses below the 3 tons per acre per year tolerance when in high condition and in medium forage condition when slopes are less than 20%. In low forage condition soil loss exceeds the tolerance. Soils K factors are .24. Critical slope is 70%.
Juniper-Grass-Shrub 304 (99)

Vegetation is adequate to keep soil losses below the 3 tons per acre per year tolerance when understory is in high forage condition and with medium forage condition on slopes less than 15%. Low forage condition does not maintain soil erosion losses below the tolerance. Soils K values are .28. Critical slope is 60%.

Juniper-Pinyon-Grass 3d4 (109)

Vegetation protects this site from soil losses below the 1 ton per acre per year tolerance when understory is in high forage condition and in medium forage condition on slopes less than 7%. If allowed to become depleted to low forage condition, soil losses are greater than the tolerance allowable. Soils K factors are .32. Critical slope is 25%.
Juniper-Pinyon-Grass 3x3 (120)
Vegetation is adequate for soil protection below the 4 tons per acre per year tolerance when understory is in medium and high forage condition and in low forage condition on slopes less than 30%
Soils K values are .10. Critical slope is 70%

Juniper-Pinyon-Grass-Shrub 3d6 (139)
Vegetation adequately protects this site from soil losses below the 1 ton per acre per year tolerance when understory is in high forage condition and in medium forage condition on slopes less than 7%
Management should be aimed at keeping vegetation in high forage condition to prevent excessive soil losses. Soils K values are .32. Critical slope is 25%
Juniper-Pinyon-Grass 3d7 (140)
Vegetation adequately protects this site from soil losses below the 1 ton per acre per year tolerance when understory is in high forage condition and in medium forage condition on slopes less than 8%. Vegetative management should aim at high forage condition to prevent excessive soil losses. Soils K factors are .28. Critical slope is 30%.
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Bibliography

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.01 Purpose. This Manual Section explains the Bureau's emergency fire rehabilitation (EFR) program on public land burned by wildfire.

.02 Objectives. The objective of the EFR program is to mitigate in the most cost-effective and expeditious manner possible the adverse effects of fire on the vegetation-soil complex, the inherent renewable resources of the watershed environment, and other damages.

.03 Authority. (See BLM Manual Section 7000.03.)

.04 Responsibility. (See BLM Manual Section 7000.04)

.05 Definitions.

A. Emergency Fire Rehabilitation: a combination of actions which are properly planned and initiated in the shortest time possible following destruction of vegetative cover by wildfire to minimize, to the extent practicable:

1. Loss of vegetative cover for watershed protection;
2. Loss of soil and on-site productivity;
3. Loss of water control and deterioration of water quality;
4. Damage to property on- and off-site; and
5. Invasion of burned areas by highly flammable weedy plants which produce critical reburn problems.

B. Restoration Measures: long-term treatments which should be considered with the emergency fire rehabilitation measures, but are not of an emergency nature, i.e., do not involve the quality of timeliness. Restoration implies rebuilding to an equal or superior condition or state of being, while emergency rehabilitation connotes the timely implementation of measures designed to prevent further deterioration. Restoration and rehabilitation measures must be considered simultaneously because, properly implemented, one leads into the other.

C. Treatment: rehabilitation of the damaged area through any one or a combination of the following:

1. Access management of livestock, people, wildlife, etc.,
2. Vegetation establishment (seeding, planting, etc.),
3. Watershed tillage (contour furrowing, trenching, ripping, terracing, etc.),

4. Water control (detention and retention dams, dikes, divisions, etc.).

5. Restricted use (curtailment or temporary removal of special uses), and

6. Fertilization.

D. Wilderness Area: an area of undeveloped public land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural condition and which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable, and offering outstanding opportunities for solitude or primitive and unconfined recreation.

E. Classes of Fire:

Class A Fire: A fire of 0.25 acres or less in extent.

Class B Fire: A fire of 0.26 to 9.0 acres in extent.

Class C Fire: A fire of 10 to 99 acres in extent.

Class D Fire: A fire of 100 to 299 acres in extent.

Class E Fire: A fire of 300 to 999 acres in extent.

Class F Fire: A fire of 1,000 to 4,999 acres in extent.

Class G Fire: A fire of 5,000 or more acres in extent.

.06 Policy. It is Bureau policy that emergency fire rehabilitation be accorded priority second only to protection of life, property, and fire suppression.
Preplanning Preparation Planning is done for presuppression and suppression. Attention must also be given to preplanning for rehabilitating burned areas. Preplanning for emergency fire rehabilitation and restoration assists in preventing treatment problems after a wildfire. Preparations can be partially made before fire occurs although no one can predict exactly where or when a fire will occur, what the intensity of burn will be, or what other characteristics the fire will have. If the land manager has preplanned, he/she will be prepared to meet EFR objectives.

Inventory and Planning. An emergency fire rehabilitation/restoration plan can be developed in a timely manner if some of the basic inventory and planning are done in advance. Fire year planning documents (BLM Manual Section 1605.37) identify high fire-occurrence zones, incendiary zones, zones of high resource value, zones of high erosion hazard, etc. These areas must be the focal point for pre-season emergency fire rehabilitation planning efforts. An entire District should be preplanned (by planning unit), starting with the high risk and/or high fire-occurrence zones. (See Illustration 1 for an example of preplanning narrative and overlay.)

Equipment and Supply Needs. Prior to each fire season, State Directors should review equipment inventories and compile a list by item, condition, and location of all equipment and supplies that might be necessary for EFR work. These can normally be obtained from inventory print-outs and the necessary changes made as they develop. Equipment lists are distributed to District Managers as appropriate. Rangeland drills beyond local needs are stored at Vale District. Arrangements for priority use may be made with the District Manager, Vale, Oregon, by telephone and should be confirmed in writing to ensure availability.

Pre-Designation of Treatment Areas. A number of factors need to be considered in designating treatment areas before the occurrence of fire:

A. Value-at-Risk. See BLM Manual Section 9211.22C for the methodology used to determine resource value-at-risk that is incorporated into the URA, Step 2, Physical Profile (BLM Manual Section 1605.37). The value-at-risk determination may be used by the manager for pre-determining the kinds and degree of treatment that will be necessary if a fire should occur.
B. Basic Soil Data  Completed soil inventories do not necessarily coincide with hazard, high value at risk, or high fire occurrence areas. However, these methods may be used to gather information.

1. Use Existing Soil Surveys. Determine erosion susceptibility and productive potential for those areas of public lands that have a soil survey. These parameters are interpreted in the soil inventory.

2. Expand Existing Soil Surveys. Extrapolate existing soil surveys to nearby similar areas.

3. Enlist Help of Local Soil Scientists Enlist the help of soil scientists from BLM State, District or Resource Area Offices, Soil Conservation Service, or other agencies.

4. Determine Erosion Condition Classifications See BLM Manual Section 7322.11B8a.

5. Categorize Soils. Prepare an erosion susceptibility and potential description similar to Illustration 2 in BLM Manual Section 9211. Use Roman numeral rating codes I, II, III, IV, and V rather than the numerical rating codes (1), (2), (3), (4), and (5) found in BLM Manual Section 9211, Illustration 2. Sites or areas may be categorized in different classes (codes) for erosion susceptibility and/or productive potential.

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C. Vegetation Data. To preplan for rehabilitation, it is necessary to know what vegetation is growing in an area. From existing vegetation data, an area may be coded with the following category descriptions.

<table>
<thead>
<tr>
<th>Category Code</th>
<th>Vegetation Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The area has a sufficient amount of fire-tolerant plant species, evenly distributed which, when under proper livestock grazing, will respond to provide soil protection and watershed stability within a 1- to 2-year time frame. Generally these species will make up in excess of 50 percent of the vegetation prior to the burn, based on annual dry matter production. Appendix 1 provides a guide for some vegetation species.</td>
</tr>
<tr>
<td>B</td>
<td>The area does not have a sufficient amount of fire-tolerant plant species evenly distributed to provide soil protection and watershed stability within a 1- to 2-year time frame. Generally these species will make up less than 50 percent of the vegetation prior to the burn based on annual dry matter production.</td>
</tr>
<tr>
<td>C</td>
<td>The area has a sufficient amount of fire-tolerant plant species as in Category A above, but they are undesirable from the standpoint of future fire protection. Generally, these species are annuals, such as cheatgrass, which provide quick recovery, but influence the same threat of burning year after year.</td>
</tr>
</tbody>
</table>

D. Water Quality and Quantity Data. See BLM Manual Section 9211, Illustration 2, Page 2.

E. Combined Data. The soil erosion susceptibility, soil productive potential, vegetation, water quality, and water quantity determinations are plotted on an overlay using a four-character code designation with the areas delineated. An URA base map is used for overlay preparation since all other resource values can be readily compared. These data are used to evaluate the need for emergency fire rehabilitation should a fire occur in a specific area. Decisions can be made on emergency fire rehabilitation prior to wildfire burns through this preplanning effort. (See Illustration 1.)
14 Predetermination of Treatment Practices The type of treatment after a fire depends on soil erosion susceptibility, soil productivity, capability, kind and amount of surviving vegetation, and the other resource values of the area. This information determines what treatment practices would be most suitable for each area if the area should burn. The use of existing publications, such as Restoring Big Game Range in Utah (Plummer et al., 1968) assists in the development of potential restoration practices. The treatment practice that can be most effectively pre-planned is seeding. Seeding practices can be pre-planned by selecting a seed mixture that is adaptable to the specific area pre-planned for EFR. Preselecting a seed mixture allows better planning for each area. If this selection is noted in the MFP, it provides a basis for decisions if a wildfire should occur (See Illustration 2.) URA-MFP maps are utilized for overlay preparation to review comparative MFP recommendations by the range, watershed, wildlife, etc., resources.
Burned Area Evaluation and Rehabilitation. Burned areas resulting from wildfire on public land are examined by a burned-area team as soon as suppression activities permit, but no later than 10 days after fire control. District Managers must initiate evaluation and land treatments while surface soil most conducive to plant growth is still in place. Deferment of grazing and or other treatments may be required for protection and conservation of the burned area and this must be determined and documented by the burned-area team. Deferment from grazing will be for two grazing seasons (See Appendix 2 for rationale) and deviations from this policy must be justified and approved by the Director (See 41A). District Managers must also assign resource area personnel to a fire team on ongoing fires to advise on fireline construction alternatives and to determine the EFR and restoration needs if the fire reaches Class E size. Additionally, these assigned personnel assist the fire suppression team in planning for fire operations cleanup prior to removal of crews and equipment from the burned area; e.g., as specified in BLM Manual Section 9211.31B4e.

Special Consideration for Suppression. Firelines constructed for the control and suppression of wildfires on public lands remove the protective vegetation covering and may permit accelerated wind and water erosion. In some areas gully erosion develops along the fireline and pollutes important watershed and fishery streams. Flood and silt often damage transportation facilities and private or public property. If firelines and firebreaks can lead to erosion, stream damage, flooding, etc., initial restoration is part of the final fireline mop-up operations. Bulldozers and manpower may be used for this purpose after fire control. Such use is charged to emergency fire funds (4620). Actions may include, but are not limited to, the following:

1. Recovering. Completely recovering the fireline with vegetative cover and other materials by backfilling.

2. Replacing. Partially replacing previously removed vegetative cover and other material on the fireline in the form of water bars.

3. Building. Building diversion channels through the berm if the fireline gradient is steep or runs downhill.
.22 Evaluation and Analysis. Rehabilitation of burned areas requires evaluation and analysis of potential treatment measures for protection, restoration, and maintenance of the resources. Because the emergency nature of fire rehabilitation, this evaluation and analysis must be completed promptly. Normally the EFR request or burn area report should only cover one burned area and more than one EFR request per burned area is not desirable and will slow down the review process. Two or more small burns can be included in one EFR request if the burned areas and proposed treatments are very similar. The survey team must consider information assembled in all levels of the Bureau planning system Unit Resource Analysis (URA), particularly in the preplanning overlay for the EFR, Planning Area Analysis (PAA), Management Framework Plan (MFP), Allotment Management Plan (AMP), and Habitat Management Plan (HMP), and coordinate proposed plans with other interested parties (i.e., State agencies, environmental groups, adjoining landowners and user groups). (See .3)

.23 Standards for Use of Emergency Funds. Qualification for the use of emergency funds for fire rehabilitation is subject to the following conditions:

A. Protection. Emergency rehabilitation is necessary to protect soil, water, and vegetative resources from intolerable losses or to prevent unacceptable damage (onsite or offsite).

B. Timeliness. EFR measures are effective and may be installed before anticipated damage-producing storms.

C. Compatibility. EFR measures are environmentally and socially acceptable and are compatible with land use plans (MFP and activity plans) and long-term restoration needs.

D. Implementation. In order to qualify as an emergency, accomplish work with EFR funds (4630), the following must take place after a fire is controlled:

1. Examination. An examination of the burned area must be initiated within 10 working days to determine the need for rehabilitation.

2. Work Planning. If rehabilitation efforts are required, work planning and project design must begin within 30 working days.

3. Actual Work. Actual on-the-ground rehabilitation work must begin within 90 days. The State Director may alter this time frame with justification. For example, following the prescribed time frame for an early-season or late-season wildfire could cause EFR treatments to be initiated during an improper planting season.

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4. **Timing.** When late-season fires occur, examination, project design, provision of emergency contracting procedures, and on-the-ground land treatment and seeding measures must all be implemented before the onset of adverse weather conditions. In the Mediterranean Climate Zones, all seeding should be completed prior to November 15th.

**E. Economics.** The EFR treatments to protect the site from further soil and water deterioration must employ the best cost-effective alternative except in the case of water control structures such as detention dams which must have a benefit-cost ratio over 1 to 1.

**F. Specifications.** All treatment measures must be designed to comply with existing Bureau policy standards. Bureau standard specifications are used whenever they apply.

**G. Restoration.** Restoration normally involves measures which are not immediately needed to prevent rapid decline in site productivity or a catastrophic event. However, restoration measures should be indicated in the EFR plan to provide a complete picture of the orderly process of recovery. Restoration measures cannot be funded with 4630 funds, which are restricted to EFR measures. Program funds must be used.

**.24 Planning.** The burned-area team lists specific needs to be met or obtained by EFR and restoration investments by referring to BLM Manual Sections 4112.15, 6620, 9522, and other appropriate documents (e.g., AMP, HMP, etc.). The team limits the analysis to that which is needed in accomplishing the EFR and restoration objectives. The time required to stabilize the soil and vegetation using available alternatives is an important consideration.

**.25 Economic Analysis.** The State Director must utilize cost-effectiveness analysis if individual EFR plans exceed $50,000 in project costs. (See BLM Manual Section 9522 for guidance and Illustration 3 for analysis summary.) If rehabilitation costs of individual EFR plans are less than $50,000, the use of this procedure is optional with the State Director. However, the State Director must assure, through the Burned-Area Report, that potential onsite and offsite damages are nonexistent or can be mitigated through the EFR. If offsite damages would occur, the survey team (See .3) makes a modified economic appraisal of potential damages to determine significance and/or potential liability if EFR work is not undertaken (e.g., flood control, land stabilization, etc.).
.26 **Economic Evaluation Alternatives.** The burned-area survey determines the complexities, resource values (on-site and off-site), EFR, and restoration needs. Economic effectiveness analysis, when used in the management decision process, provides the least cost and/or cost-effective alternatives for accomplishing land stabilization and documents other dollar outputs and social benefits, as well as other nondollar outputs. Any analysis must be performed in accordance with procedures contained in BLM Manual Sections 9521 and 9522. See BLM Manual Section 9522 for procedures to evaluate and formulate alternatives.

.27 **Environmental Assessment.** An environmental assessment record (EAR) or environmental impact statement (EIS) must be prepared as part of the EFR planning process. The environmental assessment will assess the impacts of the proposed action, archaeological values, wilderness values, and threatened and endangered species. The information developed in the EAR may also be utilized in the decision-making process and need not be duplicated in other justification documents (e.g., cost-effectiveness analysis, program support documents [e.g., cost-effectiveness analysis, or program decision option documents, etc.]). (See Illustration 4.)
.3 Burned-Area Survey. The initial reconnaissance phase of burned-area survey is done by the Area Manager, or his/her designate, and one individual or a group drawn from among watershed specialists, soil scientists, hydrologists, wildlife specialists, range conservationists, etc. The initial survey determines need for input from other skills through a multidisciplinary team. Other inputs may be contributed by any or all of the specialists listed in Appendix 3, Sample Multidisciplinary Emergency Fire Rehabilitation/Restoration Planning Team. If District personnel do not have these skills, assistance must be requested from the State Director. If large fires, multi-fires, or other special situations exist, the State Director may request assistance from the Service Center and from other States. Other agency participation should be included if other Federal, State, or private lands are burned. An economist should be part of the rehabilitation team. The team must document on- and off-site resource damages that have occurred or are likely to occur and prescribe EFR and restorative measures necessary to minimize potential losses. Goals should be stated in terms of resource management needs (problems and opportunities) rather than as specific levels of resource management outputs that could be performed to satisfy the needs. The value of resources damaged or destroyed by the fire are included in estimates of property and improvements subject to hazards from floods, floating debris, erosion, or sediment. Values are necessary for economic analysis (See .25).

.31 Interdisciplinary Planning. A burned area, depending on its size, presents a variety of resources and conditions, each of which must be considered when planning short-term and long-term activities. The burned area reacts differently than other land to climatic factors. Its influence on downstream lands may increase markedly. The same concepts that govern land-use planning apply to burns. A large burn in particular requires expertise from several disciplines to develop an action plan. Coordinate it with the MFP and provide the best alternatives for meeting specific objectives.

.32 Skills Needed. A multidisciplinary team of specialists working in an interdisciplinary fashion insures coordination among the various resources and activities. The number of disciplines represented on a burned area survey team and the technical expertise of its individual members varies according to the size and complexity of the burned area, much like a fire overhead team. (See Appendix 3.) Such teams may be formed at the Service Center, State and/or District Office level depending on the particular need and skills available.
.33 Team Selection. Team members and alternates with needed skills are selected by State Director or District Manager and notified of their selection several months before the fire season. One person, usually with watershed management skills, is designated leader of each team. Because of the urgency of completing the job quickly, team members should be journeyman-level specialists. People with limited experience should be assigned only as trainees. If qualified people are not available in a District, District Managers should arrange in advance to obtain necessary skills from the State Office, other Districts, the Service Center, other agencies, or private sources. The burned-area team, regardless of their regular positions, is responsible to the District Manager until Form 74411, Burned-Area Report, (Illustration 3) is accepted by the District Manager.

.34 District Manager's Responsibility. The District Manager should initiate the general mobilization procedure. From the time of mobilization, the team is financed with 4630 funds. The District Manager determines if the services of an interdisciplinary burned-area survey team are required.

A. Notifications. He/she is responsible for notifying the team leader.

B. Other Assistance. He/she is responsible for requesting assistance from the State Director.

C. Briefing. He/she is responsible for briefing the team members on pertinent management objectives and important environmental or other constraints and provides copies of applicable land management planning information expressed in site-specific terms.

D. Assignment. He/she is responsible for assigning a local District officer to work with the team full-time if its members are from outside the area.

.35 Team Leader's Responsibility. The team leader summons pre-assigned team members, makes travel arrangements, and coordinates with the District Manager. Individual members are responsible for referring materials or other aids pertaining to their own specific disciplines. The team leader may precede or accompany the team to the fire. Upon arrival he/she reports to the District Manager for briefing before proceeding with the burned-area survey.
A. Expediting Survey. Due to the urgencies generally involved, the burned-area survey team leader immediately contacts the resource advisor and plans chief of the fire suppression organization for information on problem areas. The use of helicopters, portable radios, video filming, and Polaroid cameras are usually justifiable to facilitate the survey process. The team leader must consider the time economics of using the team in various combinations for a broad-view reconnaissance phase and an on-the-ground sample-observation phase.

B. Using an Interdisciplinary Approach. The team leader should hold periodic conferences with team members to exchange observations and revise field investigation strategies.

C. Keeping Records. The team leader establishes a method of systematic filing of the field data for use after the team is released. This file is maintained in the District Office. Tabulations, notes, and photographs should identify where, when, what, and how they were prepared and by whom. Narratives should indicate what area they apply to and by whom they were prepared. All symbols on maps and photographs should be identified in suitable legends. Field data need not be typed to meet the above objectives. Documentation of all assumptions is essential.

D. Recommending Treatments. The team leader assures that team members have analyzed all methods of treatment with respect to their effectiveness in EFR.

E. Submitting the Burned-Area Report. Upon completion of its survey and draft Burned-Area Report, Form 7441-1 (see Illustration 3), the team meets with the District Manager and staff to review its findings and recommendations and make necessary changes, if needed, in recommendations. Some factors that may cause a departure from the recommendations are: non-availability of funds, multiple use or environmental constraints not recognized by the team, and trade-offs in priorities. If the District Manager approves the burned-area report, he/she submits it to the State Director for review and approval in accordance with .51B.

.36 Members' Responsibility. The burned-area survey team completes the initial Burned-Area Report so that funding authorization can be obtained to meet the emergency. Generally time constraints, even on large burns require a completed burn-area survey within 10 days. Hence, expeditious initiation of the survey is essential, and measures should be devised to speed the survey process to allow a thorough investigation.
.37 Reconnaissance Survey. The objective of reconnaissance is to obtain an overall perspective of the emergency situation. The level of survey is valuable in orienting the survey team or members and locating sub-areas for more detailed investigation. Damage intensity classifications made during pre-survey are refined into more homogeneous units during the reconnaissance phase. Aerial photographs and maps are the principal tools for recording observations during the reconnaissance phase of the burned-area survey.

A. Maps. The team selects a common mapping base for consolidation of field mapping data and observations. Mapping depends on what is available, but the ease of quickly transferring delineations from aerial photographs to base maps of the same scale should be considered.

B. Size and Number of Mapping Units. Delineation of many small mapping units must be avoided. Consolidation of field data for several team members is more difficult as detailed mapping increases. There will generally be only limited time in the office for preparing composite units for prescribed treatment and for determining acreage.

C. Methods of Making Reconnaissances. Recommended methods include special post-burn aerial infrared photography, fixed-wing and helicopter flights, high elevation observation points such as mountain peaks and fire lookouts.

D. Stratifications. Three broad conceptual stratifications are useful in making reconnaissance observations. These are:

1. Land Areas. Land areas are those areas which contribute runoff to drainage channels, including the watershed above the burned area.

2. Drainage Channels. The characteristics of drainage channels should be observed within the burned area. The main channel below the burned area, or sub-basins, should be observed to the furthest point of potential downstream damage.

1/ The reconnaissance activities described in this and following sections pertain to the broad levels of survey by the team. Another form of reconnaissance may be performed at an earlier stage by the survey team leader to determine disciplines needed and to develop a plan for surveying.
3. **Man-Made Structures and Developments.** All man-made structures and developments that may be subject to damages by landslides, erosion, sediment and debris, and floodwaters should be noted and mapped within the burned area and downstream. Hazards to life are the first concern.

E. **Potential Problems.** Examples of items within the survey area to be located on aerial photographs or maps, when vulnerable to damage, are:

1. **Hazards.** Developments subject to hazards from flooding, erosion (including wind erosion and dust pollution), or sediment as shown on Form 7441-1, Section E. (See Illustration 3.)

2. **Watershed Conditions.** Including those that threaten to increase the magnitude of flooding or sedimentation, such as,
   a. Channel capacities, constructions, obstructions, impoundments, and diversions.
   b. Areas of mass instability subject to slides, slumps, slips, and mud flows.
   c. Areas significantly disturbed by fire suppression activities.
   d. Standing burned timber that may be salvaged.
   e. Major zones of existing or potential water pollution.

3. **Areas of Critical Environmental Concern.** Areas of critical environmental concern as defined in the Federal Land Management Policy and Management Act (FLPMA) of 1976.

F. **Delineation of Homogeneous Areas.** Homogeneous areas are identified in order to predict potential erosion, runoff, and mass instability, and to prescribe and evaluate feasible EFR treatment measures. Indicators which provide information not shown on available maps and pre-burn aerial photographs are of first importance.

1. **Uniform Rock Types.** Delineate areas of apparent uniformity of rock types and topographic exposure at the soil surface not previously documented.
2. **Drainage Areas.** Delineate high-density drainage areas which indicate prefire active erosion and relatively high amounts of surface runoff, and which were not previously documented.

3. **Main Vegetation Types.** Delineate major vegetation types not previously documented.

4. **Burn Intensity.** Delineate areas of apparent uniform burn intensity classified as low, moderate, or high.

5. **Visual Resource Values.** Delineate areas of unique or sensitive visual resource values.

6. **Environmental Indicators.** Delineate other environmental indicators.

G. **Potential Treatment Measures.** Initial observations on potential emergency treatment measures should be documented as follows from the vantage point of the reconnaissance phase of the burned-area survey:

1. **Seeding Areas.** Areas suitable or not suitable for seeding or requiring different seeding prescriptions.

2. **Debris Basins.** Locations which are potentially suitable for debris basins when values downstream appear to warrant this measure.

3. **Camp Sites and Route Locations.** Possible sites for work camps and routes for work roads which may be needed.

4. **Channels.** Channels that are, or may be, clogged with debris and snags, and which require clearing and disposal of material.

5. **Maintenance.** Road maintenance requirements. (See BLM Manual Section 9110.)

6. **Timber and Rangeland.** Areas of commercial timberland or rangeland requiring different seeding prescriptions.

.38 **On-the-Ground Observations.** Time limits the details which can be observed. However, with the availability of prefire inventories and plans, data adequate for reliable evaluation and prescriptions of emergency treatments and their costs can usually be collected in a short time. The single-objective, high-priority assignment of the interdisciplinary team greatly compresses the time interval that routine plans normally require. A sample is an observation by an experienced team...
member at a point on the ground within a previously delineated homogene­
ous map unit. What types of quantitative data to collect to meet specific analytical needs must be determined in the prefire planning process.

A. Sampling Techniques. Techniques of coverage are included in BLM Manual Section 7322.1. Travel routes are closely related to rate of survey progress, particularly in steep, rugged terrain. Team members should consider the following:

1. Potential Problem Areas. Check on the ground all potential problem areas tentatively identified during the reconnaissance phase of the survey. Note questions that arise for followup interviews with local personnel.

2. Observation Points. Select observation points typical of conditions and characteristics within an homogeneous area.

B. Condition Inventory. The burned-area team indicates areas of low, moderate, or high fire intensity for the burned area. As dictated by the methods used for analysis, the team records such information as percent of bare soil, rock, unconsumed litter, and live herbaceous cover by predominant species. The team must use paced transects or observation plots to check estimates periodically.

1. Channel Dimensions and Conditions at Selected Critical Locations. Pacing and estimating dimensions at the peak storm stage usually gives sufficient accuracy. (See BLM Manual Section 7315.2.) The team notes existing and potential channel debris, such as conditions of instability. A minimum classification identifies unstable and excessive overflow reaches.

2. Roads. The team determines emergency road drainage requirements. (See BLM Manual Section 9110.)

3. Feasibility Determinations for Potential Treatment Measures. The team records observations on environmental, physical, cultural, and biological constraints that may limit or eliminate treatment measures which might otherwise be prescribed. Check areas on a sample basis to determine treatment potential. A decision not to treat is as critical as a decision to treat. (See BLM Manual Sections 7400 through 7422.)
4. Opportunities for Improved Management. The team records opportunities for improved management under post-burn conditions. Previously unknown seeps and springs may respond to reduced transpirational losses and begin flowing shortly after burning. Opportunities for new water developments through follow-up vegetation management should be noted for management consideration.

5. Potential Locations for Administrative Studies. The team notes locations which are particularly suited for photo points, permanent plots, rain gauges, and erosion and sediment monitoring stations. In some cases, natural vegetation recovery and changes in channel conditions may warrant further study and evaluation.

C. Inventory of Post-Fire Residual Soil Cover. The primary control of watershed stability is the density and type of soil cover. The soil cover consists of four basic components. (See BLM Manual Sections 7313 and 7322.11B4).

1. Surface Components. The protective soil cover consists of both inorganic and organic materials as shown in Illustration 5. These materials protect the watershed and provide surface stability in at least three ways:

   a. They break raindrop impact, thereby reducing soil particle detachment;

   b. They obstruct overland flow and thereby induce infiltration with consequent reduction in surface flow, and

   c. The plant root systems bind the soil in place. The burned-area survey team must estimate the amount and quality of the residual watershed cover.

2. Tetrazolium Chemical Test. The components normally destroyed by wildfire are the organic materials. The burned-area survey must consider the entire soil cover when evaluating the need for emergency rehabilitation measures. A wildfire may not completely destroy all of the organic materials. A team member should estimate the percentage of live plant crowns and viable seed in or on the soil by using Tetrazolium chemical. (See Appendix 4.)

3. Transects. The paced transect used in standard inventory analysis can be modified to estimate the watershed condition. (See BLM Manual Section 7322.11B3.) Each transect is located on a burned-area map for later reference and coordination in conducting follow-up studies of completed EFR jobs.
4. Burn Area Components. Any given watershed generally consists of three components: ridges, plus or minus 1 to 10 percent of the total area; sideslopes, plus or minus 70 to 95 percent of the total area; and channels, plus or minus 1 to 20 percent of the total area. As a minimum, each of the component areas should be sampled, with the largest area receiving the most transects. Reasonable estimates are acceptable. Within each watershed component, burn intensity zones should be sampled or estimated visually and recorded on the map. Other data maps may include soil series, vegetative subtypes, etc. By relating them to surface component estimates, a general map can be compiled showing the residual surface components after the fire. The surface component map is the fundamental document for evaluating the need for soil cover rehabilitation.

D. Estimates of Acceptable Soil Cover. The pre-burn soil surface components can be estimated using data from range analysis transects, wildlife habitat inventories, watershed inventories, etc., including source documents that may have photographs showing the prefire condition. The natural recovery rate of the general area can be predicted by observing other recent burns in the general vicinity, and using information gathered in the burned-area survey. Team members must distinguish the difference between the acceptable soil surface cover and the potential cover. EFR is designed to provide an acceptable soil surface cover which will alleviate the emergent nature of the burn. Cover density is usually somewhat less than the potential. The maximum potential cover may require effort to achieve. This effort is part of the long-term restoration. The curve in the schematic diagram in Illustration 6 shows the relationship between soil surface cover and sediment yield for one geomorphic situation. Obviously a density of less than 15 percent is hardly more effective than bare soil. The maximum effectiveness per increment of soil cover is between 30 percent and 50 percent. This curve, developed by Meiman 2/, can be used to establish some approximate ground rules to help estimate the acceptable density of soil cover components. The following is an analysis of soil cover versus sediment yield curve:

1. Less than 30 percent. If the sum of rocks, live plant crowns, and organic litter will be less than 30 percent by the end of the second growing season after the burn, emergency revegetation is necessary.


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2. Thirty to fifty percent. Emergency rehabilitation should provide 30 percent to 50 percent soil cover by the end of the second growing season after the burn. Ground cover density greater than 50 percent does not generally provide a commensurate reduction of sediment yield or the sediment yield potential can be estimated using the field estimate of the post-burn soil surface cover as the pre-treatment cover factor. (See BLM Manual Sections 7317.33B and 7322.11B8a(4).)

3. Fifty percent Density. A 50 percent density of soil cover should relieve the emergency on most burned areas. Additional density can sometimes be achieved by using fertilizer, financed from regular program funds.


.4 Methods of Emergency Rehabilitation Treatments. The objectives of the EFR must relate to emergency treatment for water quality and quantity on- and off-site flood and sediment damage, and soil surface protection. Objective outputs are quantified into realistic time units. The do-nothing option and its effects should be described and evaluated for each potential treatment area. (See BLM Manual Section 9522.)

.41 Management. Land-use management must be given first consideration in establishing objectives for rehabilitation of a burned area.

A. Livestock. Exclusion of domestic livestock from the burn area is critically important for proper rehabilitation. A plan for grazing must be established on the area before grazing is allowed and as a minimum, the area will be closed to grazing for two growing seasons following the seeding or following the fire, in those cases where no seeding is proposed. (See Appendix 2. for rationale). Livestock operator(s) involved must be issued a notice of closure in accordance with 43 CFR 4120.3. In certain situations an exception to grazing deferment may be considered. Exception may be considered if the size of the burned area did not justify protection (40 acre burn in a 10,000 acre pasture), where the burn was a "cold" (early spring or late fall), certain annual vegetation areas where no seeding is proposed and certain burned areas where fencing or herding livestock for protection is not practical. Approval of an exception will be based upon the merits of the individual situation. Protective fencing and water control structures should be planned to meet long-term management objectives as well as EFR requirements.

B. Wild Horses and Burros. If present, wild horses and burros must be excluded in the same manner as livestock.

C. Wildlife. If the success of any EFR and/or restoration effort is threatened by either wildlife or wild horse and burro use, numbers must be regulated. The wildlife member of the team and the State wildlife agency determine the necessity for regulating wildlife numbers. Any wildlife population control is the responsibility of the State wildlife agency.

D. Recreational and Other Potential Conflicts. If off-road vehicle use, field dog trails, horseback riding, or other recreational activities are a threat to the success of the EFR restoration effort, must be restricted.
.42 Vegetation Establishment. Seeding and planting are the primary measures in EFR plans to help stabilize the soil; prevent invasion of noxious, poisonous, or undesirable plant species; and provide the best forage and cover. All seeding and planting must conform to objectives established in .02.

A. Land Treatment to Reduced Soil Erosion. The site potential indicates the upper limit that can be expected from emergency rehabilitation. Creating a greater soil cover density than the site has the potential to achieve should not be attempted. The site potential is expressed as the percent of each soil surface component that can be expected by the time of complete burn recovery. This includes both the natural recovery and emergency rehabilitation measures. (See BLM Manual Section 7410.2.) The survey team must consider management constraints such as grazing obligations, resource salvage activity, proposed restoration activity, and restriction on areas such as wilderness where short-lived species are required.

B. Seeding Rangelands. The primary consideration in determining the need for EFR seeding is the length of time required to obtain the desired cover with or without such treatment. This is influenced by composition of the original cover and the damage to it. The intensity of the fire, vegetal composition, season of the year, and amount of soil moisture are some of the important factors influencing the extent of damage. (See Appendix 1.) Soil characteristics, climatic factors, the season, availability of native plant species, and method of seeding all influence the species selection. BLM must comply with Executive Order 11987 in regard to introduction of exotic species and therefore, seed mixtures or plantings must not contain species that are not presently found in the ecosystem. Browse seed will not be purchased with 4630 funds as part of the EFR when the average annual precipitation is less than 12 inches. However, browse seed purchases with other funds may be incorporated into the mixture being seeded for EFR. (See Illustration 2.)

C. Seeding Forested Lands. Forested land burns on fragile slopes and in high intensity precipitation zones where most vegetation has been killed should be seeded with appropriate forbs and/or grasses immediately after the burn. This should be done even if tree seedlings are to be planted later.

D. Shrub Seeding and Planting. The planting of fast-growing trees and shrubs may be part of EFR if they are needed for specialized purposes, i.e., wind erosion control, soil stabilization in the vicinity of erosion control structures, streambank stabilization, etc. Shrub establishment should be considered in preplanning if any of the following conditions exist:

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1. **Forage and Cover Destroyed.** Valuable shrub forage or cover species was destroyed by wildfire in critical winter ranges, or upland gamebird nesting areas.

2. **Replacement Unlikely.** After a burn, the likelihood of natural shrub replacement is low and would take many years.

3. **Favorable Prospects.** After a burn, the site conditions are expected to remain reasonably favorable for shrub propagation.

E. **Planting A Nurse Crop.** A nurse crop annual may be planted when seeding perennial grasses. Preference should be given to native species for this purpose if they are capable of providing a micro-environment favorable to perennial grass seedling establishment.

43. **Prescribing Revegetation Treatment.** Local wildlife and range improvement handbooks and other revegetation guides provide guidelines to development of prescriptions for revegetation treatments to restore the soil cover. (See BLM Manual Section 7413.) Such prescriptions should be based upon evaluation of the site potential.

A. **Adapted Seed Mixtures.** These may include nitrogen-fixing plants in target areas where needed to help restore the site quality. Legumes must be used only selectively since establishment is sometimes short-lived, and they are more difficult to establish than grasses. A need should exist before legumes are used in a seeding mixture.

B. **Untested Species.** Many so-called ecology mixtures are based on wishful thinking rather than reality. Large scale seeding of untested species or varieties is inefficient use of rehabilitation funds. Seeding mixtures should strive for a balance of perennial forbs, grasses, and desirable shrubs meeting the rehabilitation criteria. Seed of native species of all three vegetative classes is often extremely limited in supply and of doubtful quality. Exotic species of grass are often the only alternative available to land managers. In designing seeding mixtures, the land manager must consider:

1. **Potential of the Site.**

2. **Seeding Method.** Expensive browse or legume seed must not be broadcast on the surface of a bare, ash free, seedbed.

3. **Use of the Area.** The need may exist for rehabilitation of wildlife habitat. Prime wildlife habitat may require special mixtures. However, EFR funds must not be expended for legumes or seeding nomenclatures of browse species that will not fully utilize the potential or stabilize the site.

4. **Future Management.** Species that are impossible to manage together under grazing must not be combined.
5. Seed Quality. Often the cost difference between certified and commercial seed is slight. Federal projects are subject to State seed laws, and noxious weed seeds in seed samples may result in rejection of seed lots and delays in vital rehabilitation projects.

6. Seeds that Require Special Treatment. Legumes must be inoculated if they are to fulfill the role of nitrogen fixers. Bitter-brush requires thiocarb treatments to break seed dormancy.

7. Seed Availability and Relative Cost. Seed must be available in adequate quantities on short notice at a reasonable cost.

8. Competition Factors. Consider browse and grass/legume mixture seedings in the same row or in alternate rows.

C. Seeding Rate. The objective is to achieve the amount of cover determined best in the site potential and acceptable cover analyses, expressed as pure live seed per square foot (PLS/SF). Most burn seeding is done at a rate of from 20 to 60 pure live seed per square foot, depending on the seeding objective. Road cut-and-fill prescriptions may run as high as 150 pure live seed per square foot. The pounds per acre are adjusted to yield the desired pure live seed per square foot.

D. Method of Seed Application. Methods of application may include aerial or ground broadcasting in areas having greater than 14 inches average annual precipitation, drilling (normally on flat ground or on the contour), slurry application of seed, and mulch covering of seed with harrow, hand rake, anchor chain, etc. (See BLM Manual Section 7413.24.)

1. Seedbed. Best results are obtained when the area is seeded immediately after the burn and before the first fall rains on areas of fine soils. An ash or loose surface soil should be present. Precipitation should be in excess of 14 inches annually. Where lesser amounts of moisture are expected, the seed should be covered by dragging a chain or harrow, or other tools over the site where possible.

2. Broadcast. In broadcast seeding, the seed must sprout quickly and grow well without seedbed preparation or covering. Normally, broadcast seeding is confined to rough sites where drilling would be impractical. Broadcast seeding can usually be applied most economically by aircraft.
3. **Drilling.** Best results can usually be obtained by drilling seed. The rangeland drill is recommended for this purpose. If soil surface is firm or soddy, employ deep furrow drilling.

**E. Planting.** (See BLM Manual Section 7414.) Planting should be reserved for cooperative efforts with other Government agencies such as the State fish and game departments. Trees and shrubs usually grow too slowly to provide the quick emergency cover desired for the conservation objective. Considerable research is being conducted on the use of container-grown plant material for transplanting to wildlands. Factors to consider are:

1. **Expense.** Transplants are expensive and have high labor requirements.

2. **Facilities.** Large facilities are required to produce container-grown material. Greenhouses, mistbenches, and lath houses are usually required.

3. **Time Constraints.** Most successful transplanting is done with year-old or two-year-old stock, too long a time period for start-from-scratch fire rehabilitation programs.

4. **Labor.** Unsupervised free labor must not handle expensive planting stock.

5. **Inadvisability.** Generally speaking, the use of container-grown plant material for transplanting in emergency fire rehabilitation is inadvisable.

**F. Rationale for Selecting Grasses.** The stabilization objective of quickly establishing soil cover can be achieved more quickly and efficiently in most cases by seeding annual and perennial grasses. Such grasses become established more quickly than shrubs, establish a denser root system for soil stabilization, and provide better seed availability at a lower cost.

**G. Multi-Purpose Seeding.** Where optimum land management requires the use of browse and forbs, as for wildlife habitat, grasses may be interseeded with the shrubs and forbs, thus achieving effective EFR and appropriate land management goals simultaneously. The only constraint in such multi-purpose seeding is that it must be funded with multi-program funds.
H. **Need for Fertilizer.** A soil scientist should determine the need for fertilizer. Use of fertilizer in EFR is restricted to that necessary to achieve the acceptable soil cover density.

I. **Mulching.** (See BLM Manual Section 7415.12D.) The influence of mulch is shown in Illustration 7. The rate of straw mulch reaches its maximum effectiveness at 1,000 to 2,000 pounds per acre. Use of more than 2,000 pounds per acre of mulch must be justified. The benefits of mulch must also be considered in planning for long-term restoration measures, such as salvage logging and reforestation.

J. **Alternative Seeding Prescription.** Use an alternative seeding prescription in case the first choice seed is not available, or the first treatment fails.

K. **Coordination.** Execute the post-emergency activity so as to maintain the acceptable density of soil surface components.

L. **Post-Treatment Maintenance Schedule.** Post-treatment maintenance must be promptly planned, funded, and completed.

M. **Method(s) of Post-Project Evaluation.** Post-project evaluation must be conducted on a specific date. The most obvious method is to repeat the analysis described above by reestimating the soil surface cover components (see .9).

**44 Channel Stabilization.** Channel stabilization may be necessary to prevent further streambank erosion or flooding.

A. **Clearing.** Clearing includes removal of both organic and inorganic debris located in the channel so that it does not direct floods into erodible sediments, forms debris dams, or plug culverts and bridges. In assessing the problem, the hydrology member describes the size and arrangement of the debris, the damage which could result, the magnitude of the flood necessary to cause an emergency situation, the threat to life and property, and the value of the prescribed treatment in correcting the problem. He/she should measure a cross-section of the desirable flood channel. Treatment to provide the desirable channel may include rearranging, or complete removal of the debris. A consistent water velocity must be maintained so as to prevent channel scour.

B. **Reducing Channel Damage.** The evaluation of each burn must determine whether channel damage creates an emergency, and what treatment, if any, is needed to relieve the emergency. The potential damage to the channel depends on the amount of sediment stored in the channel available for transport, and the probability of a flood with enough energy to suspend and convey the sediment. Two key factors which may flood to scour are water velocity and the amount of sediment in suspension relative to saturation capacity.
C. Water Repellent Soils. Where water repellent (hydrophobic) soils predominate, a high intensity rain falling on repellent soil tends to yield large volumes of high velocity and relatively silt-free runoff to the channels. This unsaturated flood flow tends to pick up available sediments from the channel and, in some soils, a mud flow may result or channel scour may occur. This condition frequently occurs in sandy loam to split loam soils, on steep slopes, in chaparral or other vegetative areas of high fire intensity during the first rainy season after the burn. The most obvious treatment is to alter the hydrophobic soil condition either mechanically or chemically.

D. Other Channel Scour Indicators. The following channel scour indicators should be evaluated: bedload volume and stability, vertical gully banks, debris piles in the channel, unstable meanders, and channel degradation. In each case, the volume of a design flood must be computed and an assessment must be made to evaluate the potential channel scour. The prescribed treatment must reduce a significant amount of the potential damage.

E. Stabilizing Gullies. A gully in and of itself does not create an emergency condition. To evaluate the potential for gully formation, describe the amount of erosion that can occur, specifying the emergency, if any, which would be created by subsequent precipitation. To prevent downcutting, a grade-stabilizing gully structure may be used. This should be designed to prevent downcutting, not store sediments, and create a V-notch spillway to direct the flows to the center of the channel.

.45 Watershed Tillage. (See BLM Manual Section 7412.02.) The primary functions of watershed tillage are to prevent further deterioration keep the soil in place, and aid vegetation establishment. It may also be used for reducing the potential for severe downstream damages. Such practices as ripping, furrowing, and trenching may be considered suitable.

.46 Program Facilities. Construction of necessary protective fences or replacement of related management facilities, including fences and essential water developments for off-site water needs may be needed. Construction of roads and maintenance of existing roads to provide access for such treatment may also be required (but not in areas being considered as potential wilderness areas, i.e., roadless areas).

A. Fences and Cattleguards. Fences and cattleguards may be needed to protect seedings. The facilities should be located so that they are useful after the EFR seeding is established. A grazing management system is necessary to protect the investment. A temporary protective fence may be planned as an alternative to a permanent fence.
B. Roads and Trails. It may be necessary to maintain roads and trails if they are not usable for carrying out rehabilitation work. Truck trails may be needed for access for completing rehabilitation projects. This should be planned to the minimum extent necessary to protect the wilderness character of watersheds. (See .39H.)

C. Water Facilities. Such water facilities as reservoirs, springs, and pipelines cannot be developed with emergency fire rehabilitation funds, except if such development is the only feasible means of protecting the investment of public funds.

.47 Road Drainage. Evaluating road drainage problems and recommending corrective measures is a most important function of the engineer member of the burned area survey team. Improving the ease of travel on a road or trail is not an EFR practice. Repainting and modifying road and trail drainage systems to handle increased runoff after wildfires are EFR. EFR funds should be used only as a supplement, not to replace funds scheduled for road maintenance in the burned area.

.48 Special Treatment Considerations. For the proper planning and design of rehabilitation measures, the team must consider only those special treatments that are immediately needed to prevent further damage, commensurate with long-term restoration needs and protection of investments.

A. Protection of Highly Developed Areas. (See BLM Manual Section 7422.02 for criteria on structure needs.)

1. Water Control Structures. Water control structures may be of value in EFR projects to curb channel and gully erosion or to protect against flood and sediment damages. Give adequate consideration to land treatment and management practices upstream of the structures. (See BLM Manual Section 9170 for guidelines and specifications for design and construction).

   a. When potential flood and sediment damage is high, detention dams may be used independently of other practices or in conjunction with seeding or tillage practices for reducing damage potential. (See .23E for economic justification.)

   b. Dikes and diversion dams may be built with detention dams and land treatment practices to curb channel and gully erosion.

   c. Although not as effective in reducing flood flows as detention dams, the retention dam is more frequently recommended as a sediment control practice.

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2. Estimates of Flood or Debris Flows. In the assessment of this type of damage, the design criteria can be scaled to fit the magnitude of the problem. The potential damage is evaluated for a: 10-year flood, 10 percent chance; 25-year flood, 4 percent chance; 50-year flood, 2 percent chance, and 100-year flood, 1 percent chance. The line officer should use design criteria in deciding how much chance is acceptable. The type of impact and value of each property should be specified (cleanup, inundation, breakage, removal, etc.) and the duration of the emergency estimated. A flood or debris flow from a burned area may threaten human life. The assessment of the problem must be comprehensive, and treatment must be designed to provide maximum degree of protection. The maximum acceptable design probability is the 1 percent chance, or 100-year flood. Treatments to prevent such emergencies may require the assistance of other agencies to assist in evaluation and design of the treatment.

3. Emergency Prescriptions. Questions that may surface in the evaluation process are:
   a. What emergency will result from the selected flood frequency?
   b. What facilities now exist to control floods and debris?
   c. Is it best to trap and release the flow or convey the flow through the threatened area?
   d. In fire-prone areas, it is possible to design treatment that will control the effects of the existing burn and also serve the same purpose for future fires? A future fire would not then create such a fire emergency.

4. Debris Basis or Trap and Release Dams. If debris basins or trap and release dams are necessary, consider the following:
   a. The dam must be able to trap at least 50 percent, preferably 75 to 80 percent of the 1 percent design flow, and have spillway capable of passing the entire 1 percent design flow.
   b. The downstream channel must be a lined waterway to prevent channel scour. Once a flood is desilted, it must be maintained as a desilted flow until its energy is reduced to an acceptable level.
   c. The cleanout, operation, and maintenance of the structure are regular program costs, not emergency costs.
d. One alternative is an excavated pit with the following attributes:

1. Large enough to trap 50 to 90 percent of the flood flow,
2. Location in the main channel area where sediments are deep enough to permit excavation,
3. A long narrow shape to induce the desired amount of desiltation of the flood waters,
4. Overflow into a lined or scour-resistant channel similar to a debris basin, and
5. Meet the same 1 percent chance design criteria as a dam with the advantage that when the emergency passes, it is abandoned without removal costs.

B. Wilderness Areas. EFR of fire-damaged wilderness areas falls within the predetermined, agreed-upon concept outlined in a wilderness management plan. In the event that a wilderness management plan has not been developed and/or agreed upon, the EFR practices adhere to the established practices for non-wilderness EFR. In wilderness study areas, established standard EFR practices must be adhered to in the absence of a prescribed wilderness fire management plan.

C. Protecting Investments in Emergency Measures. Consider the following measures for protection of EFR investments: permanent and/or temporary fences to exclude livestock and/or wildlife for the establishment of vegetative cover; locked gates and explanatory signs to control entry to burned area; identification of land management limitations of uses until full multiple-use restoration; and rodent control.

D. Long-Term Restoration Measures. (See .23G.) Although the restoration measures are not immediately required to prevent a catastrophic event, they should be presented with the burned area treatment plan in order to give a complete picture for the orderly process of recovery. Objectives of long-term restoration can be:

1. Maintenance. EFR treatments must be maintained until they have accomplished their purpose, then removed as necessary.

2. Restoration. Site may be restored to its original productivity, or better, by continuing the recovery process.
3. **Acceleration.** Natural process of recovery may be accelerated.

4. **Salvage.** Fire-damaged products may be salvaged without further damage to the site.

5. **Establishment.** Superior tree stands may be established on suitable sites.

6. **Replacement.** Those fire-damaged facilities may be placed as needed.

7. **Utilization.** Fire-induced cover must be removed to begin building preplanned facilities which require vegetative conversion, such as:
   a. Fuel breaks.
   b. Rights-of-way for powerlines, fences, waterlines, range improvements, off-road vehicles, etc.
   c. Water-yield increase projects.
   d. Snowpack management areas, ski areas, and snow play areas.
   e. Key wildlife area improvements.
   f. Experimental areas.

8. **Enhancement of EFR.** The long-term restoration process must begin with the decisions that are made during the EFR process. If properly coordinated, the restoration process does not destroy or damage the treatment measures installed as emergency rehabilitation but enhances them. With good resource management, the emergency treatment is phased into the longer-term restoration process.
.5 Work Plans. Annual Work Plans (AWPs) for EFR programs for burned areas cannot be made in advance since the location, extent, and effects of wildfires are not predictable. If historical EFR efforts suggest a recurring minimum number of work-months are necessary, program these in the AWP. The Bureau annually requests appropriations to provide EFR of burned areas in anticipation of such emergencies. Supplemental appropriations may be requested to meet financing needs during years of unusually fire damage.

.51 Programming. All EFR and restoration plans are based upon the evaluation and analysis procedures described in this Manual Section. The AWP sets forth justification for EFR including management and other required treatment practices listed by type, estimated units, costs, work-months, total funds, etc. (See Illustration 4.) A realistic analysis of what can be accomplished, given seasonal and climatic conditions existing at the time, is critical to effective EFR/restoration work. Although restoration needs are identified in the EFR/restoration plan, they are not funded with EFR (4630) funding. All restoration needs must be referred to the appropriate program office or activity for action. Job Documentation Report, Form 4190-8, must be prepared for each job. Annual Work Plan, Form 1680-1, and Burned-Area Report, Form 7441-1, must be prepared for each proposed EFR Plan.

A. District Submission. All requirements of this Manual Section must be met prior to forwarding Form 7441-4 and Form 1680-1 for review and approval. Proposals which include treatments not authorized within the criteria of EFR work must be rejected.

B. State Office Review and Approval. The State Director may approve EFR plans submitted in accordance with this Manual Section which do not exceed a cost of $20,000 per fire and which do not involve the purchase of capitalized or major noncapitalized equipment. The State Director's recommendations must certify that all multiple-resource and environmental requirements and offsite damages have been considered and that all work falls within the scope of the definition of EFR. The State Director must inform the Director (640) of the amount of funds involved within 24 hours after each plan has been approved. The State Director also submits duplicate copies of the EFR plan to the Director (640) immediately upon its being approved. In years of unusual fire damage, State Director authority to approve EFR up to $20,000 may be temporarily withdrawn as necessary for fiscal control.
C. Washington Office Review. The Divisions of Rangeland Management (220), Budget (640), and other divisions as necessary, review, monitor all plans exceeding $20,000 in cost for compliance with OMB policy directives and for feasibility. They also review plans which require the purchase of capitalized or major noncapitalized equipment. The EFR plans approved by State Directors in accordance with the provisions of this Manual Section are spot checked and reviewed either through the regular Bureau evaluation program or by special evaluations. If plans do not meet the requirements specified herein, the $20,000 approval authority may be withdrawn.

.52 Program Execution. The emergency nature of fire rehabilitation and the seasonal restrictions imposed on many of the rehabilitation practices require close coordination between all activities, offices, and services to implement the EFR.

A. Work Schedules. The type of treatments and support service required in an EFR project influences job accomplishment. Jobs requiring favorable climatic factors (precipitation, temperature, season, etc.) or support services must be scheduled and accomplished according to the EFR plan. As an example, a proposal to seed a specific vegetative species requiring fall precipitation cannot be justified in a plan if there is inadequate time after a late season fire to issue the contract or procure the seed. Seeding should be initiated in the fall because summer seeding can cause incomplete germination and drought out of seedings due to high late summer temperatures. For best results, seedings should be completed in the fall, however, if seeding is halted because of winter weather, spring seeding should be done if possible, but seeding success rates are usually lower for spring seedings. Spring seeding normally does not qualify as EFR. Under such conditions, seeding should be programmed and financed from regular funds as a restoration project.

B. Contract Expediting. Contract services may be expedited by the requesting office if the District Manager:

1. Develops EFR and restoration plans on large fires through a burned-area team effort, thus shortening the planning time.

2. Insures the Completeness and Accuracy prior to submission. Also, see .22, Evaluation and Analysis, in relation to submission of EFR requests.

3. Consolidates similar types of work in an area into a single contract to reduce solicitation-for-bid preparation.

4. Informs the Service Center in advance of areas where an EFR is being planned in order to provide lead time to obtain necessary Service Center assistance.

BLM MANUAL
Supersedes Rel.
5. Establishes priorities on purchase requests submitted to the Service Center.
.6 Contracting Methods and Procedures.

.61 Coordination. As soon as a District Manager decides to contract an EFR project, he/she must coordinate closely with the State Office and the Service Center contracting staffs. If the emergency character and timing of the work require special processing, the contracting officer must assign top priority to the project. Certain steps may reduce processing time. For example, advertising periods may be reduced, telegraphic bids requested, etc. Negotiations in lieu of advertising may be employed if appropriate, i.e., public exigency. (41 U.S.C. 252(c)(2)).

.62 Contracting Methods. The State Director must submit a complete statement of emergency conditions with the bid request to enable the contracting officer to determine the best emergency contracting procedure. Should a public exigency exist, he/she must provide sufficient details to the contracting officer to support his/her decision to use the negotiation authority. There are basically two methods for the implementation of emergency rehabilitation measures.

A. Force Account and Cooperation. If manpower, equipment, and supplies are available, this alternative is the most expedient, particularly for small jobs.

B. Formal Contract. Because all specialized supplies, manpower, and equipment are not normally available for force account, formal contracting may be used.

1. Supply Contracts. State Offices have a $10,000 ceiling for open market purchases, depending upon redelegations from the State Director, District Offices may or may not have a $10,000 ceiling on open market purchases (see BLM Manual Section 1510.03) there is generally no dollar limit on delivery orders against Federal Supply Schedule contracts. Wage rates are not required for supply contracts.

   a. Some States have central seed storage, so contact State Office to determine if seed is available within the State before requesting contract purchases. If seed is not available, promptly process purchase requests for seed through the Service Center (D-510).

   2. Service Contracts. The service contract method is used for work other than construction, including land treatment, plowing, seeding, equipment rental, etc. (see BLM Manual Section 1512.)
3. Construction Contracts. If a structure is to be built, altered, or repaired, the work is done under a construction contract. Examples are fences, pipelines, roads, detention dams, etc. (see BLM Manual Section 1512). Wage rates for construction contracts are maintained on file at the Service Center. Wage rate requests are not required.

.63 Purchase Request. Prepare a purchase request Project Work Form 1510-5, Request for Invitation to Bid and necessary supporting documents if for service or construction. Determine availability of materials that are to be furnished by the Government.

A. Standard Specifications. Use standard specifications within constraints imposed by the fire rehabilitation plan. For the emergency rehabilitation measures, prepare specifications or supplement the standard specifications when required. Standard specifications and drawings are shown in BLM Manual Section 1512.

B. Work Location Map. Prepare an accurate work location map showing job location, size, and scope of work.

C. Bid Schedule. Prepare the proposed bid schedule.

D. Cost Estimate. Prepare an accurate cost estimate to evaluate bids.

E. Bidders' List. Assemble prospective bidders' list. This list should consist of sources who are known to be interested, normally local contractors. The bidders' list shall identify firms doing the type of work involved to insure that a maximum of these competitive bids is obtained.

F. Transmittal and Review. Obtain the District Manager's approval and transmit the request to the State Director. Clearly identify the package as EMERGENCY FIRE REHABILITATION. State office review and transmittal will consist of the following:

1. The proposal is sent first to the State Office Management Services Division, and then logged in at Program Analyst Office. It is then routed to the Division of Resources for review of Bureau policies, ES, cultural resource clearance, etc.

2. Division of Technical Services then reviews the package for clarity and accuracy. Conflicts with District Office officials on specifications and drawings are resolved in the most expedient manner.

3. After the bid is approved by the State Director, it is transmitted to DSC (D-510).

BLM MANUAL
Supersedes Rel.
4. Some EFR proposals may be within the District Manager's procurement authority. Work on these projects may begin as soon as the EFR proposal is approved by the State Director.

G. Service Center Processing. Upon receipt of the bid request from the field, the contracting officer determine methods of procurement to be used. If justifiable as a public exigency as defined in FFR 103.202, negotiations may be immediately commenced. All other work must be contracted under formally advertised procedures. The DSC contracting division (D-510) works closely with the field offices to expedite timely contract award and to abide by constraints of the regulations. Certain steps may be taken to reduce processing time in order to meet performance deadlines.
.7 Project Supervision, Inspection, and Maintenance. All EFR projects must be adequately supervised, inspected, and maintained. The EFR projects depend on proper follow-up as do other programs. Adequate District specialized manpower must be available to supervise the contract and meet responsibilities of the EFR project. Only the initial EFR project is funded to Subactivity 4630; the subsequent periodic inspections and maintenance are funded from the regularly appropriated funds of the primary benefiting program. Provisions for these activities are included in subsequent District program plans to insure that rehabilitation objectives are accomplished.

.71 Project Supervisor. The District Manager should appoint a project supervisor to oversee all facets of the rehabilitations project from its inception through completion. The project supervisor should have the following attributes:

A. Familiarity with Objectives. Supervisor should be thoroughly familiar with the management objectives of the EFR project. In order to expedite emergency procurement operations, the project supervisor should inform the State Office and Service Center Contracting Office (D-510) of the status of emergency when it is anticipated that procurement assistance will be required.

B. Competence. Supervisor should be technically competent for proper and prompt installation of the treatment measures.

C. Accountability. Supervisor should be accountable to District Manager for devoting full-time supervision to the EFR effort.

.72 Project Installation Standards. The project supervisor must utilize available reference material and technically qualified specialists to assure that rehabilitation measures function as designed.
.8 Project Completion. The District Manager implements the management prescribed by the fire rehabilitation plan. EFR accomplishments are reported on Form 4190-8, (see note at .51) Section V, and Progress Report, 1680-6 within 30 days following the completion of planned and funded work.
.9 Evaluation. Previously burned areas must be evaluated periodically. This provides a better record and basis to make future decisions on preplanning and carrying out of EFR work. Seeded areas should be evaluated annually for at least 3 years and in subsequent years as needed to provide meaningful guides to future courses of action. Study plots should be established on the treated burned areas, nontreated burned areas, and nontreated, nonburned areas. These plots are used to measure recovery of seeded vegetative species as well as nonseeded species. Paced transects, the point-toe method, should be utilized to determine the ground cover. (See Manual Section 7322.11B3.)

.91 Selecting Project Criteria. Post treatment project selection priority should be given to those areas where: major, perhaps even unique, treatment measures have been implemented; the burn was in a particularly sensitive area (e.g., municipal supply watershed, very unstable soil area, or local public concerns are expressed); land management activities may significantly affect the burn area; or a natural disaster occurs which necessitates another request for 4630 funds to replace the initial rehabilitation efforts.

.92 Monitoring the Burn Area. Burn area problems to be monitored to meet land management obligations include: the water quality and quantity leaving the burn area and sphere of influence, where the problem is, and its cause; the effectiveness of rehabilitation measures and the need for restoration measures; and the evaluation of various land management decisions on the burn area. Types of monitoring studies that should be conducted include water quality monitoring, sediment trap efficiencies, grass species composition and density, peak flows and timing measurements, and native grass and shrub recovery rates.

.93 Determining Seeding Success. Count the number of established plants per square foot. An average of 0.75 or more established plants per square foot is generally considered an excellent stand.

.94 Documenting and Submitting The Report. A written report must document the evaluation. The report should include name of team members, cooperators, when evaluations were made, areas evaluated, successes and failures of treatments and reasons, recommendations for improvement, recommendations for any additional follow-up evaluations or coordination, and references to other reports or critiques appropriate to the post treatment evaluation. Send one copy of the report to Director (220).
Soil - Vegetation - Water Preplanning Narrative

A small town is located on an alluvial fan, 1 mile from the mouth of a canyon, with 40 percent side slopes above which are undulating benches sloping generally toward the canyon. Precipitation is 10 inches; occasional summer thunderstorms occur.

The uplands may be designated II.B.5.(a), which means slight soil erosion can be expected after fire; the vegetation production potential is moderate (600 to 1,000 acres per year); the area may have to be seeded as there are not enough fire-tolerant plants. Little or no change in water quality or yield can be expected after a burn. This designation applies only to a fire confined to the benches.

The canyon may be designated as I.A.1.(a) which means that severe soil erosion can be expected if a violent summer thunderstorm should occur before the residual fire-tolerant species recover within a year or two. If a sudden violent storm should occur in the interim, flooding or a reduction in community water supplies is likely. Emergency fire rehabilitation is still impractical because of steepness of slope. If precipitation exceed 14 inches annually, aerial broadcasting could be considered.

If a burn were anticipated to cover both the canyon and a portion of the uplands, a different designation might be necessary.
### Recommended Rehabilitation (Seeding Mixture)

An example of the recommended seeding mixture and seeding rate is shown below for an area where preplanning has been completed prior to fire control season.

<table>
<thead>
<tr>
<th>Area No.</th>
<th>Seeding Mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Siberian Wheatgrass 3 Pounds/Acre</td>
</tr>
<tr>
<td></td>
<td>Crested Wheatgrass 2 Pounds/Acre</td>
</tr>
<tr>
<td></td>
<td>Nomad Alfalfa 1 Pound/Acre</td>
</tr>
</tbody>
</table>

Seed above mixture including the following using regular activity funds, not 4630.

|          | Big Sagebrush 1/4 Pound/Acre |
|          | Annual Wildrye 1 Pound/Acre |
|          | Cereal Rye 5 Pounds/Acre |

Seed only with browse using regular activity funds, not 4630.

|          | 4-Wing Saltbrush 1/4 Pound/Acre |
|          | Bitterbrush 1/4 Pound/Acre |

No seeding needed as sufficient fire hardy species remain to reclothe the soil within 1 or 2 years.
<table>
<thead>
<tr>
<th>Section A - Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of acres burned</strong>: 6,321.6 acres</td>
</tr>
<tr>
<td><strong>Comprehensive Burner</strong>: Cowhee &amp; I.3.</td>
</tr>
<tr>
<td><strong>Commissioner Burner</strong>: Sub. 8 &amp; 1.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 29, 1976</td>
</tr>
<tr>
<td>July 3, 1976</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit for Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres</td>
</tr>
<tr>
<td>0.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section B - Problem Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of land affected</strong>: 8 acres</td>
</tr>
<tr>
<td><strong>Type of injury</strong>: Burned</td>
</tr>
<tr>
<td><strong>Type of tree</strong>: lodgepole pine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section C - Climatic Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual precipitation (inches)</strong>: 3.5 inches</td>
</tr>
<tr>
<td><strong>Average annual temperature</strong>: 43 degrees Fahrenheit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section D - Summary of Survey and Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimated number of acres burned</strong>: 6,321.6 acres</td>
</tr>
<tr>
<td><strong>Estimated number of acres damaged</strong>: 0 acres</td>
</tr>
<tr>
<td><strong>Estimated number of acres unaffected</strong>: 0 acres</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section E - Summary of Survey and Analysis (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimated number of acres burned</strong>: 6,321.6 acres</td>
</tr>
<tr>
<td><strong>Estimated number of acres damaged</strong>: 0 acres</td>
</tr>
<tr>
<td><strong>Estimated number of acres unaffected</strong>: 0 acres</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section F - Additional Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section A</strong>: 1. Enter number of acres burned on Form Di-1201, item 3.</td>
</tr>
<tr>
<td>2. Enter number of acres burned on Form Di-1201, item 4.</td>
</tr>
<tr>
<td>3. Enter number of acres burned on Form Di-1201, item 5.</td>
</tr>
<tr>
<td>4. Enter number of acres burned on Form Di-1201, item 6.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Note</strong>: Enter number of acres burned on Form Di-1201, item 7.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Illustrated 3. Page 24. 7422.447</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Illustration</strong>: 3. Page 24. 7422.447</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagram</th>
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</thead>
<tbody>
<tr>
<td><strong>Diagram</strong>: Illustration 3. Page 24. 7422.447</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong>: Enter number of acres burned on Form Di-1201, item 8.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference</strong>: Enter number of acres burned on Form Di-1201, item 9.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference (Continued)</strong>: Enter number of acres burned on Form Di-1201, item 10.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference (Continued) (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference (Continued) (Continued)</strong>: Enter number of acres burned on Form Di-1201, item 11.</td>
</tr>
</tbody>
</table>
### SECTION C - ELIGIBLE EMERGENCY REHABILITATION MEASURES ON TREATMENTS AND SOURCE OF FUNDS

![Image of a table showing various treatments and their associated costs for eligible emergency rehabilitation measures. The table includes columns for treatment, units, cost per unit, dollars, and total costs. For example:

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Units</th>
<th>Cost Per Unit</th>
<th>Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeding (aerial)</td>
<td>16.70</td>
<td>1450</td>
<td>24,075</td>
</tr>
<tr>
<td>Seeding (Drill)</td>
<td>6.04</td>
<td>4812</td>
<td>29878</td>
</tr>
</tbody>
</table>

**Additional District**

**Roads**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Units</th>
<th>Cost Per Unit</th>
<th>Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock (crushed)</td>
<td>1063</td>
<td>30</td>
<td>32,500</td>
</tr>
<tr>
<td>Wells each</td>
<td>25000</td>
<td>1</td>
<td>25,000</td>
</tr>
<tr>
<td>Piped valves each</td>
<td>113</td>
<td>7700</td>
<td>87,000</td>
</tr>
</tbody>
</table>

**Total** $497,623
7441 - EMERGENCY FIRE REHABILITATION

Format for Completion of Burned Area Report - Instructions

GENERAL INSTRUCTIONS

1. District Manager prepares one (1) copy for summarization of the burned area survey data for 463C subactivity if the determination has been made for an emergency fire rehabilitation (EFR) plan. Revised copy is prepared if measures are needed that differ from those already approved.

2. District Manager submits for review and approval to State Director only if EFR plan does not exceed $20,000 per fire.

3. Submits to Washington Office if (EFR) plan exceeds $20,000 per fire or if State Director's approval authority has been withdrawn. State Director submits one (1) copy each to Director (350) and Director (510).

SPECIFIC INSTRUCTIONS

(Items not listed are self-explanatory)

Section B - Problem Inventory

1. Numbered Number - If more than one watershed, enter number of others in parentheses.

2. Erosion Potential - Select the store duration from Items 2 and 4 in Section C - Climatic Data which maximizes erosion rate.

3. Snow Fall Potential - Enter in cubic feet per second per square mile to nearest .1 cu. ft. per sq. mile. Calculate in accordance with BLM Manual Section 7.138 using design storm rainfall from Section C - Climatic Data Item 2. Adoption of other than ten (10) year storm frequency may be used where appropriate. However, Item 8 of this Section and Items 2 and 4 of Section C are to have identical storm frequencies.

Section C - Climatic Data (See United States Weather Bureau technical paper 46 for Items 2 and 4)

Section D - Summary of Survey and Analysis

6. Net social welfare benefits index - (See BLM Manual Section 7.122)

7. and 7a. B C Ratio and Net Return (R - C) - (See BLM Manual Section 7.122)

Section E - On-Site and Off-Site Developments (Do not include value of resources damaged or destroyed by fire on Form DI-120)

Section F - Emergency Rehabilitation Needs

(See BLM Manual Section 1)

Section G - Eligible Emergency Rehabilitation Measures or Treatments and Source of Funds (Emergency rehabilitation is work done promptly following a wildfire and is not to solve watershed problems that existed prior to the wildfire)

Columns

1. Treatment - Enter the rehabilitation treatment recommended by the burned area survey team and their estimated cost.

2. Works - Enter the cost of maintenance scheduled for roads in burned area in the Annual Maintenance Program in Column 6 "Other Dorse." Enter the cost for other essential Drainage Activities made necessary only because of the wildfire in Column 6 "463C Dollars (Future)."

3. Major Improvements - Enter emergency structures identified in Activity Plan.

Section H - Examining Impacts of Management Alternatives for an Emergency Program

Enter interest rate in percent for current Fiscal Year (as issued manually by State Resource Council).

Section I - Qualitative Benefit Index (See BLM Manual Section 7.122)

Section J - Social, Well-Being Benefit Index (See BLM Manual Section 7.122)
Emergency Fire Rehabilitation Plan (and) Environmental Assessment Record
(Outline)

I. Background (Current Situation)

A. Fire description

1. Location
2. Date of burn
3. Acres burned
4. Major vegetation types burned (acres)
5. Intensity of burn
6. Control measures employed

B. Planning status - Major MFF decisions

II. Evaluation and Analysis

A. Description of environment prior to fire

1. Non-living
2. Living
3. Ecological interrelationship
4. Human values

B. Resource uses affected (on-site and off-site)

1. Soil
2. Water
3. Vegetation
4. Grazing
5. Wildlife
6. Air Quality
7. Recreation
8. Aesthetics
9. Other
III. Emergency Rehabilitation Objectives and Needs

A. Rehabilitation Objectives

B. Alternatives

C. Recommended action (with Burned Area and Treatment Map)

1. Vegetation establishment
2. Management
3. Wilderness areas
4. Program facilities

IV. Analysis of Proposed Actions and Alternatives

A. Environmental Impacts of Proposed Action and Alternatives

1. Anticipated impacts
2. Possible mitigating measures
3. Recommended mitigating or enhancing measures
4. Residual impacts

B. Relationship between short-term use and long-term productivity

C. Irreversible and irretrievable commitment of resources

V. AWP Summary

VI. Persons, Groups, and Governmental Agencies Consulted (Cooperation with fish and wildlife agencies, conservation districts, etc.)

VII. Intensity of Public Interest

VIII. Participating Staff

IX. Recommendations on EIS

X. Signatures

Attachment 1 - Map exhibit, showing location of:
1. Perimeter of fire outlined in black
2. Boundaries of treatment area
3. Existing and proposed treatments, jobs, and project measures.

Attachment 2 - Form 8110-1, Cultural Resource Inventory
EMERGENCY FIRE REHABILITATION PLAN (AND) 
ENVIRONMENTAL ASSESSMENT RECORD

-Instructions-

Guidelines for Preparation of EFR Plan and EAR

I. Background

A. Fire Description - Describe the fire: location, date of burn, severity of burn, control measures, fire line, backfiring, etc., and other information that would be helpful in deciding upon rehabilitation needs. Location of the fire should indicate a distance and compass direction from nearest town(s), highways, etc.

B. Planning Status. Include any information from planning system which indicate land-use priorities or restraints toward which rehabilitation should be oriented.

II. Evaluation and Analysis

A. Existing Environment. Describe the environment on the burned area and surrounding areas prior to the fire (BLM Manual Section 1791).

B. Resource Uses Affected. Clearly indicate the resource values lost or damaged by the burn. Summarize conditions recorded on the Burned Area Report Form 7441-1. Consider both on- and off-site effects. Evaluate and quantify potential threats to life and property, loss of water quality, loss of soil and on-site productivity, livestock and wildlife forage loss, etc. Evaluate natural recovery potential versus emergency rehabilitation measures. Results of a critical resource inventory are discussed here (See .21.)

III. Emergency Rehabilitation objectives and Needs

A. Rehabilitation objectives. Relate the objectives of the fire rehabilitation to emergency treatment for water quality and quantity, for on and off-site flood and sediment damage and for soil surface protection. (See .21.) Objective outputs are evaluated within a realistic time frame.

B. Alternatives. With objectives in mind, identify the alternative ways of meeting these objectives through rehabilitation practices. Remember, there is never a single method of completing an EFR project; "Identify and discuss the alternatives available, weighing the positive and negative benefits or effectiveness of each. (See .26.)
C. Recommended Action. Select most desirable alternative based on its ability to meet objectives, favorable environmental impacts, cost, feasibility, and availability. Summarize the recommended action for the recommended treatments of vegetation establishment, management, wilderness areas, program facilities, channel stabilization, tillage, road drainage, and protection of highly developed areas. (See .4.)

IV. Analysis of Proposed Action and Alternatives. Follow BLM Manual Section 1791.23. Analyze the environmental impacts using the environmental baseline established in all sections above. Consider "no action" and partial implementation of the proposed action as alternative. Correlation and evaluation of potential EFR practices by team members, resource staff, division of operations, area manager, and MFP discussions are important at this time.

V. AWP Summary. Describe units, cost per unit, work-months, pounds of seed by species, etc. Describe cost-sharing or cooperative programs, fiscal year scheduling, etc. (See succeeding Sample AWP Summary.)
Soil Cover

Watershed Surface Components 1/

- Inorganic
  - Rocky Materials
    - Gravel Pavements
    - Rocks
    - Rock Outcrops
  - Soil Materials
    - Soil Crusts
  - Peat
    - Duff Mat Mulch
  - Dead Material
    - Dead Vegetation
    - Leaf Mold
  - Organic
    - Grasses and Legumes
    - Woody Plants
    - Living Plants
      - Weeds
      - Forbs


BLM MANUAL
Illustration 4, Page 5

7441 - EMERGENCY FIRE REHABILITATION

SAMPLE AWP SUMMARY

1. Itemized Summary Project Cost Sheet. Itemize each EFR practice as outlined in Illustration 4. Include personnel costs.

Example:

<table>
<thead>
<tr>
<th>Rehabilitation Practice</th>
<th>Numbers</th>
<th>Units</th>
<th>Costs/Unit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td>60,000</td>
<td>pounds</td>
<td>.892*</td>
<td>53,520.00</td>
</tr>
<tr>
<td>Drilling Seed</td>
<td>5,000</td>
<td>acres</td>
<td>7.50</td>
<td>37,500.00</td>
</tr>
<tr>
<td>Aerial Seeding</td>
<td>1,000</td>
<td>acres</td>
<td>1.50</td>
<td>1,500.00</td>
</tr>
<tr>
<td>Chaining</td>
<td>1,000</td>
<td>acres</td>
<td>7.00</td>
<td>7,000.00</td>
</tr>
<tr>
<td>Stream Channel Clearing</td>
<td>300</td>
<td>cubic yards</td>
<td>10.00</td>
<td>3,000.00</td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>102,520.00</strong></td>
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</table>

b. Seeding Prescriptions

<table>
<thead>
<tr>
<th>Seed Species</th>
<th>Pounds per Acre</th>
<th>Cost/ Pound</th>
<th>Total/ Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blando brome (Bromus mollis)</td>
<td>4</td>
<td>$ .95</td>
<td>$3.80</td>
</tr>
<tr>
<td>Harding (Phalaris tuberosa var. stenopters)</td>
<td>2</td>
<td>1.25</td>
<td>2.50</td>
</tr>
<tr>
<td>Palistino orchard (Dactylis glomerata palistina)</td>
<td>2</td>
<td>.75</td>
<td>1.50</td>
</tr>
<tr>
<td>Luna pubescent wheat (Agrophyron trichophrum)</td>
<td>2</td>
<td>.56</td>
<td>1.12</td>
</tr>
<tr>
<td><strong>Pure Live Seed Per Square Foot</strong></td>
<td>40.8</td>
<td>($8.92)</td>
<td></td>
</tr>
</tbody>
</table>

c. Personnel Costs

<table>
<thead>
<tr>
<th>Work Months</th>
<th>Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range Conservationist (Watershed Specialist)</strong></td>
<td>1.0</td>
<td>$1,800</td>
</tr>
<tr>
<td><strong>Contract Inspector</strong></td>
<td>2.0</td>
<td>2,400</td>
</tr>
<tr>
<td><strong>Soil Scientist</strong></td>
<td>0.5</td>
<td>900</td>
</tr>
<tr>
<td><strong>Wildlife Biologist</strong></td>
<td>0.5</td>
<td>900</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4.0</td>
<td>6,000</td>
</tr>
</tbody>
</table>

d. Total Costs                                       |       | **$108,520** |

*Average cost per pound
Illustration 6

Generalized Scheme of Sediment Yield as a Function of Ground Cover Density.
Soil Loss on Two Soils With Different Rates of Infiltration As Related to Straw Mulch Rates.

△ Soil with LOW Rate of Infiltration
■ Soil with HIGH Rate of Infiltration

![Graph showing soil loss vs. straw mulch rates](image)

- **kg/ha**
- **lbs/acre**

**STRAW MULCH**

Burn Effects on Vegetal Cover Criteria

Consider EFR seeding only when fire-hardy plants cannot reasonably be expected to provide naturally necessary soil and watershed protection within 2 years. Normally wheatgrasses will recover after a burn. Most needlegrasses and bluegrasses seem to recover well. Idaho fescue usually suffers high mortality from wildlife. If a good stand of wheatgrass was present before the burn, an adequate stand can be expected to recover, except in areas of dense vegetation where the intensity of heat was excessively high and plants were killed.

The following summary is compiled from various research done on the recovery of plant species following fire. Additions to this summary may be developed at the District level from experience or on designations of areas requiring rehabilitation or restoration following wildfire.

### After Fire Recovery Time for Range Grasses

<table>
<thead>
<tr>
<th>Grass Species</th>
<th>Recovery Time Following Fire (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluebunch</td>
<td>1 - 3</td>
</tr>
<tr>
<td>Crested wheatgrass</td>
<td>1 - 3</td>
</tr>
<tr>
<td>Needle-and-thread</td>
<td>3 - 8</td>
</tr>
<tr>
<td>Prairie junegrass</td>
<td>3 - 8</td>
</tr>
<tr>
<td>Idaho fescue</td>
<td>12 - 30</td>
</tr>
<tr>
<td>Sandberg bluegrass</td>
<td>1 - 2</td>
</tr>
<tr>
<td>Bottlebrush squirreltail</td>
<td>1 - 2</td>
</tr>
<tr>
<td>Thickspike wheatgrass</td>
<td>1 - 2</td>
</tr>
<tr>
<td>Plains reedgrass</td>
<td>1 - 3</td>
</tr>
<tr>
<td>Other wheatgrasses</td>
<td>1 - 3</td>
</tr>
</tbody>
</table>
## Susceptibility of Range Forbs to Fire

<table>
<thead>
<tr>
<th>Severely Damaged</th>
<th>Slightly Damaged</th>
<th>Undamaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antennaria dimorpha</td>
<td>Astragalus sup.</td>
<td>Achillea lanulosa</td>
</tr>
<tr>
<td>Antennaria microphylllo</td>
<td>Castilleja angustifolia</td>
<td>Allium sp.</td>
</tr>
<tr>
<td>Arenaria unintahensis</td>
<td>Crepis acuminata</td>
<td>Balsamorhiza sagittata</td>
</tr>
<tr>
<td>Erigeron concinnus</td>
<td>Geranium viscosissimum</td>
<td>Erigeron corymbosus</td>
</tr>
<tr>
<td>Erigeron heracleoides</td>
<td>Lupinus candatus</td>
<td>Lupinus leucophyllus</td>
</tr>
<tr>
<td>Erigeron caespitosum</td>
<td>Penstemon radicosus</td>
<td>Phlox longifolia</td>
</tr>
<tr>
<td>Phlox canescens</td>
<td>Sphaeralcae monroana</td>
<td>Sisymbrium linifolium</td>
</tr>
</tbody>
</table>

## Extent of Fire Damage and After-Fire Recovery Time for Range Shrubs

<table>
<thead>
<tr>
<th>Shrub Species</th>
<th>Extent of Damage</th>
<th>Recovery Time Following Fire (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbitbrush</td>
<td>Slight</td>
<td>1 - 3</td>
</tr>
<tr>
<td>Horsebrush</td>
<td></td>
<td>1 - 3</td>
</tr>
<tr>
<td>Big sagebrush</td>
<td>Severe</td>
<td>12 - 30</td>
</tr>
<tr>
<td>Antelope Bitterbrush</td>
<td></td>
<td>12 - 15</td>
</tr>
<tr>
<td>Service berry</td>
<td></td>
<td>15+</td>
</tr>
<tr>
<td>Granite gilia</td>
<td></td>
<td>15+</td>
</tr>
<tr>
<td>Broom snakeweeds</td>
<td></td>
<td>15+</td>
</tr>
<tr>
<td>Mountain snowberry</td>
<td></td>
<td>15+</td>
</tr>
</tbody>
</table>
Rationale for Deferment of Land Uses Required for Protection and Conservation of Burned Area

The deferment or restrictions of land uses after a wildfire depends on soil erosion susceptibility, soil productive capability, kind and amount of surviving vegetation, and other resource values of the area.

1. Management for Natural Plant Recovery and Seeding Establishment

On those predesignated areas where sufficient amounts of fire-resistant plant species can reasonably be expected to provide soil, and watershed protection within a year or two following a burn, livestock grazing is banned for a minimum of two growing seasons.

This is necessary because wildfire is a very destructive natural force. When it besets an ecosystem, damage occurs that is far greater than the worst overgrazing. Not only is vegetative cover lost, but also soil nutrients and soil organic materials. Fortunately, some plant species are resistant to fire and survive all but the most intense fire with only minor damage. These species grow new leaves and shoots from existing crowns and/or rootstalks. However, rest is needed for the following reasons:

A. Livestock tend to concentrate on areas with lush new green herbage. The root reserves of surviving vegetation must be allowed to develop into shoots and leaves that actively photosynthesize new plant foods. If new growth is harvested, remaining plants, already in a weakened condition, are easily killed.

B. Litter, an important segment of erosion control, usually does not accumulate in any significant amount until the second year after a burn, or later.

C. Standing vegetation retains precipitation and soil moisture on any area by increasing snow accumulation. Greater effective moisture and improve micro-climate hasten gains in plant vigor and size. A 12-inch high stand of wheatgrass can store 3.6 inches of additional moisture. This additional moisture can normally ensure the success of a rehabilitation seeding the first 2 years.

2. Other Management Considerations After Seeding

Seedings are protected from livestock grazing for a minimum of two growing seasons following the fire for the following reasons:

A. Not all seed germinates the first year. Frequently 20 percent or more of the seed does not germinate until the second or third year.
B. Root growth the first year is not generally sufficient to prevent uprooting by grazing animals, especially in the light sandy soils where most burns and rehabilitation efforts occur.

C. Wheatgrass seedlings develop slowly in arid and semiarid conditions (less than 12 inches precipitation), requiring 2 to 4 years to develop good vigor and maximum production.

D. Livestock tend to concentrate on newly seeded areas and immature plants may be seriously damaged by trampling.

E. Plants do not usually produce viable seed within the first year.
Multidisciplinary Emergency Fire Rehabilitation/Restoration Team

**District Manager**

**Team Leader**

(Area Resource Specialist or District Resource Specialist)

<table>
<thead>
<tr>
<th>Team Leader</th>
<th>(Area Resource Specialist or District Resource Specialist)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Specialists</td>
<td>BLM Specialists</td>
</tr>
<tr>
<td>Soil Conservation Service</td>
<td>- Watershed Specialist</td>
</tr>
<tr>
<td>State Agencies</td>
<td>- Soil Scientist</td>
</tr>
<tr>
<td>Fish and Game</td>
<td>- Hydrologist (or Hydrogeologist)</td>
</tr>
<tr>
<td>Water Resources</td>
<td>- Engineer</td>
</tr>
<tr>
<td>Lands Department</td>
<td>- Environmental Coordinator</td>
</tr>
<tr>
<td>Forestry</td>
<td>- Forester (when forest/woodland products are involved)</td>
</tr>
<tr>
<td>Other</td>
<td>- District Fire Management Officer</td>
</tr>
<tr>
<td>Forest Service (when appropriate)</td>
<td>- Resource Advisor to the Fire Overhead Team</td>
</tr>
<tr>
<td>Soil Scientist</td>
<td>- Wildlife Biologist</td>
</tr>
<tr>
<td>Hydrologist (or Hydrogeologist)</td>
<td>- Recreation Specialist</td>
</tr>
<tr>
<td>Engineer</td>
<td>- Economist/Planner</td>
</tr>
<tr>
<td>Environmental Coordinator</td>
<td>- Planning Coordinator</td>
</tr>
<tr>
<td>Forester (when forest/woodland products are involved)</td>
<td>- Archaeologist (when needed)</td>
</tr>
<tr>
<td>District Fire Management Officer</td>
<td>- Contract Specialist</td>
</tr>
<tr>
<td>Resource Advisor to the Fire Overhead Team</td>
<td>- Physical Scientist (Air Resource)</td>
</tr>
<tr>
<td>Wildlife Biologist</td>
<td>- Draftsman</td>
</tr>
<tr>
<td>Recreation Specialist</td>
<td>- Typists</td>
</tr>
<tr>
<td>Economist/Planner</td>
<td>- Other Support Personnel</td>
</tr>
</tbody>
</table>

**NOTE:** The makeup of each team depends on the complexity of the Emergency Fire Rehabilitation Plan.
Determining Recovery Potential
of Burned Plants Following
Range Fire

A need is recognized for guidance to evaluate more objectively range recovery potential following wildfires. Specifically, a technique for quickly determining whether the plants of a burned area are dead or alive is available. The emergency nature of needed treatment often requires completion of the evaluation and analysis within a short time. The technique described is one additional tool for making such decisions.

The material used is tetrazolium (2,3,5-triphenyl tetrazolium chloride), usually abbreviated as TZ. It is largely used as a rapid method of testing the potential viability and vigor of seeds. Seeding testing laboratories find the TZ test especially useful in evaluating seeds that otherwise require long or undetermined testing periods, such as those of many woody plants. Prepared seeds are soaked in a 1 percent solution of white powder. Testing is based on the principle that respiration processes within living tissues release hydrogen, which combines with the colorless tetrazolium solution and produces a red pigment. Depth of color normally is an indicator of the vigor of the tested tissue. Dead tissues remain unstained. TZ is available from biochemical supply firms. Both the power and the solution keep indefinitely. Re-use of the solution is not recommended.

TZ can be used to detect live tissue in badly burned plants following rangeland fire. Steam based of perennial grasses, for example, can easily be field tested with results becoming evident within a few hours. A simple procedure that has worked satisfactorily is as follows:

Collect the sample. A 1-inch section taken from the basal (growing point) area is sufficient.

Clean away excess chaff. Coarse stems may be slit. The TZ must contact living material to produce the reaction.

Place sample in suitable container (15 to 20 cc. glass or plastic vials are satisfactory for field use). Cover sample with TZ solution (1 percent).

Affix stopper and label. Place in dark.
Color changes of vigorous, live tissue may become apparent within a few hours. There is no need to wait longer than overnight before examining samples of woody tissue exposed to TZ. Warm temperatures (e.g., 100°F) speed action. Remove tissue from solution and examine under a low-power lens. Any pink color indicates some life. Much active respiration produces deeper red color. Further experience is needed with various species to improve accuracy of recovery predictions in local situations.

Seeds found on or in the soil can be tested for viability, whether following fire, or in seedings where germination failures occur, as well as in the usual sampling of bulk seed. Seed procedural details vary with species. In general, the seed sample is presoaked in water to soften for approximately 5 or 6 hours, then drained, and the seed coats removed or the seed cut transversely, avoiding the embryo. The prepared seeds are then placed in a 1 percent solution of TZ sufficient to cover. Simple field tests using the chemical tetrazolium to determine living plant tissue, both vegetative and seed, can reduce time of decisionmaking.
BIBLIOGRAPHY


Cook, Wayne C., Range Seeding in Utah. USU Cir. 307, p. 15

Hull, A.C., Seeding Southern Idaho Rangelands. USFS Research Paper INT-10


USDA Handbook No. 339, Grasses and Legumes for Soil Conservation in the Pacific Northwest and Great Basin States

U.S. Forest Service Research Note, Phenology of Grasses, May 1965

### SECTION E - ON-SITE AND OFF-SITE DEVELOPMENTS

<table>
<thead>
<tr>
<th>DEVELOPMENTS</th>
<th>UNITS (Number)</th>
<th>ESTIMATED VALUE (Dollars)</th>
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</thead>
<tbody>
<tr>
<td>Community and urban development (people)</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>Municipal and domestic water supplies (people served)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation systems (miles)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water distribution systems (miles)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural development (crops, facilities, acres)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial development (dams, power, manufacturing) (number)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power and communication lines (miles)</td>
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<td></td>
</tr>
<tr>
<td>Recreation development (PACT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish habitat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL HAZARD POTENTIAL** $  

### SECTION F - EMERGENCY REHABILITATION NEEDS

<table>
<thead>
<tr>
<th>LAND OWNERSHIP</th>
<th>ACRES BURNED</th>
<th>LAND (acres)</th>
<th>CHANNEL (miles)</th>
<th>ROAD</th>
<th>OTHER (Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEDERAL</td>
<td>103,046</td>
<td>52,120</td>
<td>Fence - 5 mi.</td>
<td>Line - 15 mi.</td>
<td>Well - 100</td>
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<td>Public lands</td>
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<td>Other/Federal</td>
<td>Military (Eng.)</td>
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<td>Army/Reserve</td>
<td>Military (Res.)</td>
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<td>SUBTOTAL</td>
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<td>NON-FEDERAL</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>State and County</td>
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<td>Private</td>
<td>3,720</td>
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<td>Indian</td>
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<tr>
<td>Other</td>
<td></td>
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<td>SUBTOTAL</td>
<td>10,320</td>
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<td>TOTAL</td>
<td>143,178</td>
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### SECTION H - EXAMINING IMPACTS OF MANAGEMENT ALTERNATIVES

#### FOR AN EMERGENCY PROGRAM

<table>
<thead>
<tr>
<th>Economic benefits summary with interest rate (percent)</th>
<th><strong>ECONOMIC CRITERIA</strong></th>
<th><strong>UNIT OF MEASURE</strong></th>
<th>NO TREATMENT</th>
<th>WITH TREATMENT</th>
<th>DIFFERENCE IN PRESENT VALUE</th>
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<tr>
<td><strong>Sedimentation Impacts</strong></td>
<td><strong>Dollars</strong></td>
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<td>Downstream storage</td>
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<td>Sediment removal</td>
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<td>$</td>
<td></td>
<td></td>
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<tr>
<td>Water quality</td>
<td></td>
<td>$</td>
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<tr>
<td>Flood water damage</td>
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<td></td>
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</tr>
<tr>
<td>Land</td>
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<td>Property</td>
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<tr>
<td>Other</td>
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<td>$</td>
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#### SECTION I - QUALITATIVE BENEFIT INDEX

<table>
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<tr>
<th>NON-MARKET VALUE CRITERIA</th>
<th>WEIGHT FACTOR</th>
<th><strong>ACTUAL</strong></th>
<th><strong>WEIGHTED</strong></th>
<th>WITH TREATMENT</th>
<th><strong>ACTUAL</strong></th>
<th><strong>WEIGHTED</strong></th>
<th>DIFFERENCE</th>
<th><strong>WEIGHTED</strong></th>
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</thead>
<tbody>
<tr>
<td>Erosion and sediment</td>
<td>20</td>
<td>2</td>
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<td>5</td>
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<td>1</td>
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**TOTAL** 20 29 11 - 18

#### SECTION J - SOCIAL WELL BEING BENEFIT INDEX

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**TOTAL** 28 42 10 - 32

#### ADDITIONAL INSTRUCTIONS

**SECTION H - EXAMINING IMPACTS OF MANAGEMENT ALTERNATIVES FOR AN EMERGENCY PROGRAM**

(See Illustration 3, Page 3 and BLM Manual Section 9522.46.)

**SECTION I - QUALITATIVE BENEFIT INDEX**

Non-Market Value Criteria - Enter Field Assessment of Environmental Indicators.

Weight Factor - (See BLM Manual Section 9522.46, Illustration 13.)

**SECTION J - SOCIAL WELL BEING BENEFIT INDEX**

Social Criteria - Enter Field Assessment of Beneficial Social Effects. (See BLM Manual Section 9522.47A.)

Weight Factor - (See BLM Manual Section 9522.47B, Illustration 14.)

_Date:_

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<th>District Manager Signature</th>
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<th>State Director Signature</th>
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<td>J. W. B. Matthews</td>
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_ILLUSTRATION 3, PAGE 4_
2. **EFR Plan AWP Submission.** (See .51 for necessary documents and procedures.)

VI. Persons, Groups, and Governmental Agencies Consulted. Show input received from State wildlife and fishery agency, conservation districts, special interest groups, etc. (See BLM Manual Section 1791.23C.)

VII. Intensity of Public Interest. List names of individuals, groups, or organizations that have expressed an interest in this action or management area. (See BLM Manual Section 1791.24D.)

VIII. Participating Staff. List Burned Area team members (with titles) who assisted in preparation of this document.

IX. Recommendation on EIS. Following BLM Manual Section 1792, recommend whether or not an EIS is required.

X. Signatures. As a minimum, the burned area team leader, the area manager, environmental coordinator, and District manager should sign.

**Attachment 1.** Display perimeter of fire, treatment areas (by type of treatment) and existing and proposed jobs on 7 1/2 minute USGS Quad(s) map for clarity

**Attachment 2.** Attach a copy of the Cultural Resource Inventory, Form 8110-1, to the EFR plan upon completion of a cultural resource inventory in accordance with BLM Manual Section 8110.