

# Rationale for Seeding Grass on the Stanislaus Complex Burnt<sup>1</sup>

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Abstract: An emergency survey of the 147,000-acre (59,491 hectare), Stanislaus Complex Burn found that large, continuous, land areas were intensely burned, resulting in strongly hydrophobic soils, with potential to yield catastrophic volumes of flood runoff. The potential cumulative effect of greatly increased runoff efficiency on contiguous watersheds threatened serious downstream flooding, instream damages, and loss of upland site productivity. The interdisciplinary team developed a systematic method to evaluate seeding grass as an emergency watershed treatment. The evaluation used site specific data to determine where to seed or not seed grass, and concluded that seeding grass on the flood source areas could significantly decrease the potential threat to human life and property.

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The practice of the Stanislaus National Forest (U. S. Department of Agriculture, Pacific Southwest Region, Forest Service) has been to evaluate any decision of either seeding, or not seeding, burned areas, according to site specific data and the potential flood hazards of each watershed. The intent is to develop and use site criteria to describe the relative magnitude of flood hazard for each watershed. The effects of grass seeding are controversial. However, in many cases it is the only reasonable treatment that can be quickly applied to large areas in a short period of time. The teams identified 10 other possible treatments, but each was limited in scope and effectiveness for the overall burned area.

The objectives of grass seeding are to reduce the Erosion Hazard Rating

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(EHR), on the flood source areas to moderate (EHR=8), within 3 years, and to maintain the moderate EHR until all resources have been permanently restored, and the watersheds are stable.

The following discussion describes the Emergency Burned Area Rehabilitation (EBAR) survey and the evaluation of grass seeding as one of the emergency watershed treatments on the Stanislaus Complex burned area.

## THE EMERGENCY BURNED AREA REHABILITATION SURVEY

A 21-member interdisciplinary team was assembled to conduct the EBAR survey. The disciplines represented on this team included hydrologists, soil scientists, geologists, engineers, and biologists. The team objectives were to identify the magnitude of the flood emergency created by the fire, and to prescribe watershed treatments to mitigate the emergency. The two-fold definition of "emergency" is the probable threat to human life and property, and the potential loss of site productivity and deterioration of water quality. Both of these potential emergencies could result from the modified runoff condition of the post-fire watersheds.

The EBAR survey found that the wildfire created a potential catastrophic flood emergency. Many watersheds now include large, intensely burned areas (48 percent of the area within the burn), resulting in strongly hydrophobic soils, with less than 10 percent ground cover density. These watershed conditions significantly increase the runoff efficiency of the burned watersheds, over the pre-burn condition. The result can be excessive overland runoff, with severe soil erosion and excessive flooding in the channel systems.

Many channels are also intensely burned. The fire consumed much of the woody material that was formerly embedded in the channel bedloads. Some channels were previously scoured by the 1986 floods, leaving incipient erosion that will be accelerated by excessive flood flows. The 1986 floods also left some channels with dispersed, woody debris jams that can cause major bank scour and threaten instream structures during

excessive flooding. These channel conditions significantly increase potential sediment bulking of flood flows, which will increase the destructive potential of the flood. -The results can be severe channel erosion, destruction of instream structures (including road drainage, dwellings, industrial development, and other buildings), and a serious threat to human life.

The findings of the EBAR survey indicate that the fire-caused watershed conditions could produce a catastrophic flood event. Those lands that were intensely burned, with strongly hydrophobic soils, and less than 10 percent ground cover density were identified as the potential flood source areas, due to their increased runoff efficiency. The potential flood source areas make up approximately 70,000 acres (28,329 hectare), within the burned area.

#### PRESCRIPTION TO MITIGATE THE EMERGENCY

The EBAR team prescribed a total of eleven treatments to mitigate the emergency created by the fire. The treatments can be divided into two groups, based on the emergency that they are designed to mitigate, as follows:

#### Treatments To Mitigate The Effects Of Excessive Flood Runoff

Ten treatments were prescribed, as follows.

1. Contour Log Erosion Barriers, 582 Acres (236 hectare)
2. Channel Stabilization, 18 check dams.
3. Channel Clearing, 5 Miles (8 Kilometer)
4. Channel Armoring, 0.2 Mile (0.32 Kilometer)
5. Emergency Road Treatment, 300 Miles (483 Kilometer)
6. Emergency Trail Treatment, 22 Miles (35 Kilometer)
7. Debris Basins, 2 dams

8. French Drain On Unstable Soil Area, 1 each
9. Debris Deflection Wall, 1 each
10. Winter Flood Patrol On Roads, 300 Miles (483 Kilometer)

#### Treatments To Mitigate The Runoff Efficiency Of The Flood Source Areas

Only one treatment was prescribed.

1. Seed Grass as follows:

Annual Ryegrass	31,230 Acres
(12,639 hectare)	
Other Annual Grasses	9,710 Acres
( 3,930 hectare)	
Perennial Grasses	2,210 Acres
( 894 hectare)	
 Total Grass Seeding	 43,150 Acres
	(17,463 hectare)

The below discussion describes the method used by the EBAR team to evaluate the seeding of grass as an emergency watershed treatment on the Stanislaus Complex burned area. The EBAR team recognized that portions of the burned area were only lightly burned, and portions were intensely burned. Only those areas that were burned intensely were expected to yield higher than normal floods. This expectation was based on previous experience of the team, and various research studies. The purpose of seeding grass was to mitigate the increased runoff efficiency on the flood source areas.

#### METHOD TO EVALUATE GRASS SEEDING

Up to this point, the team had identified the potential flood source areas based only on the effects of the wildfire on the land. Each of these potential flood source areas has different magnitudes of flood hazard due to other site factors that influence the hydrology of the watersheds. These factors include such things as topography, elevation, and geology. These other site factors were used as site selection criteria to establish priorities for seeding grass on only those areas that were a source of high magnitude flooding.

Site Selection Criteria For High Priority  
Grass Seeding

The EBAR team set up eleven site selection criteria to assess the potential flood source areas and select the highest priority areas to be seeded with grass as an emergency watershed treatment. The design flood event was established by the Senior Forest Hydrologist as 300 ft<sup>3</sup>/sec/mi<sup>2</sup> (CSM), (3.28m<sup>3</sup>/sec/km<sup>2</sup>, CSK) for a watershed that had been intensely burned. The criteria for high priority seeding areas are as follows (from notes made by team 4):

1. Burn Intensity

Predominantly high, or a mixture of moderate and high if the watershed is over 50 percent burned.

2. Water Repellent Soils

Predominantly strongly water repellent, or mixture of moderate and strongly repellent if dominantly a granitic rock type.

3. Bear Clover

Less than 30 percent of area covered with bear clover.

4. Slope

Predominantly those that exceed 50 percent, or a mixture of oversteepened slopes (70 percent), and slopes greater than 35 percent.

5. Topography

High priority areas are swales, first order channels, and concave topography due to a greater tendency to produce overland flow and excessive sedimentation than convex topography. High priority areas are also those areas with in-sloped roads that artificially modify the topography by combining first order channels.

6. Rock Type

First priority for seeding is granitic rock types (more probable source of sediments). This does not preclude some Metasedimentary rock types where other site conditions would justify seeding.

7. Climatic factors

High priority is the rain-on-snowpack zone (elevations 4,000 to 6,000 feet), (1219 to 1829 meters). Long term return frequency for rain-on-snowpack events is one year in seven, but there have been three such events in the past six years.

8. Known Sensitive Areas

Identified from personal knowledge, or observed site factors, or information readily available in Forest files.

9. Threat to Human Life

High priority are watersheds with in-stream dwellings, or other structures that can be threatened by the design magnitude flood (ie, 300 CSM), (3.28 CSK). Equally high priority are those road systems that are regularly travelled by private citizens and Forest crews as normal routine.

10. Percent Watershed Burned

Over 30 percent of a watershed, greater than 200 acres (81 hectare) in size burned intensely. (Intent is to evaluate Cumulative Watershed Effects)

11. Expected Management

High priority areas are the highly productive resource management areas such as high quality commercial timber site, and highly productive range forage areas.

A potential flood source area does not have to meet all of the above criteria in order to be ranked as a high priority for grass seeding. Any one criterion, if it creates a high potential flood hazard, is justification to designate a watershed as a high priority seeding area. For

example, if a watershed, greater than 200 acres (81 hectare) in size, is 100 percent intensely burned, it would be a high priority seeding area.

#### Site Selection Criteria For Low Priority Grass Seeding

The EBAR team also developed five site selection criteria to identify areas of low priority for grass seeding. These criteria were applied to each potential flood source area.

1. Metasedimentary rock types, with known annual grass communities before the fire.

These were identified from personal knowledge, or from information readily available in the Forest files.

2. Known sensitive plant habitats.

3. Areas previously seeded for wildlife after the fire, but before watershed seeding was begun.

4. Low-intensity burn areas.

5. Proposed Grizzly Mountain Research Natural Area, (unless an emergency watershed condition is identified that threatens human life and property).

#### Issues And Concerns Of Seeding Grasses

Various issues and concerns related to seeding grasses were identified and evaluated by the EBAR teams for each individual team area. The full 21-member team then considered each of them in preparing the final prescription:

1. The aggressive species required for watershed stabilization can, and often do, conflict with recovery of other resources.

2. Exotic species may conflict with native species, especially if the native species is already sensitive and is a reduced population.

3. The cost of controlling introduced grasses can become an additional expense for reforestation.

4. Some of the areas identified as potential flood sources may already be naturally stabilized by native plants, such as annual grasses and bear clover.

However, the sites may have been burned so intensely that the native plants could not be recognized. In these cases additional grass seeding would not be necessary.

5. Aggressive grass species tend to delay the reestablishment of browse seedlings.

6. Grasses produce flashy fuels that can carry a fire at a high rate of spread.

These tend to be "cool" fires, with short residence time, and beneficial results. Grass fuels do not accumulate year to year as do woody fuels. Even with no grass seeding, the area can be invaded by cheat grass (Bromus tectorum), which is a more extreme fire hazard than seeded grasses.

7. Some research indicates that seeding grass does not significantly affect first-year sedimentation, erosion, or peak runoff.

8. On the water repellent soils, the early rains may produce enough flash runoff to wash the grass seed away.

9. Some research indicates that grasses do not affect gravity erosion at all because it occurs during the fire and immediately thereafter.

10. The Forest Service has no authority to seed grasses ineffectively, for the sole purpose of relieving the fears of the general public; there must be other justification for seeding.

#### Anticipated Results Of Seeding Grass

Statements of anticipated results were developed by the area survey teams for presentation to the Forest Management Team. The nine expected effects of grass seeding on which the prescription was based are as follows:

1. Acceleration of hydrologic recovery of the burned area from 10 to 20 years, with no treatment, to 5 to 8 years with treatment.

This can mitigate the extent, and reduce the duration of the potential threat to life and property. The annual litter crop and the binding action of grass roots are expected to hold top soils in place that would otherwise erode away. This will control the velocity of overland runoff, and prevent on site scour, as well as channel scour and sediment bulking of flood flows.

2. Help maintain site productivity until the watersheds regain their stability.

This can reduce the threat to life and property. The burned watersheds will regain their normal response to climatic events, as they regain their natural infiltration capacity and ground cover. The nutrient capital in timber soils is often in the surface 6 inches. The binding capability of grass roots will keep these soils and nutrients in place.

3. Mitigate potential cumulative watershed effects from resource recovery efforts, such as fuel disposal, reforestation, and road construction.

Resource recovery efforts often disturb the soils, which can destroy the ground cover and increase the runoff efficiency. The grass will be a natural source of seed for disturbed areas, as well as provide litter. This will prevent the many small project areas from creating cumulative watershed effects which can threaten life and property.

4. Reduce the adverse impacts of storm events (accelerated runoff, sedimentation, raindrop compaction), in years 2 to 5.

This in turn reduces the threat to life and property. The probability of a catastrophic flood event is greatest in the first year following the fire. Without seeding, the second and third years also have the potential of a flood disaster. With seeding of aggressive grass species, the probability can be reduced to a reasonable level in the second and later years, and in some cases the first winter.

5. Establish at least some stable soil cover in the first year, and an adequate cover in years 2 to 5.

Both the foliage and root systems of annual grasses can help mitigate the potential flood emergency. The annual ryegrass can sprout and protect the soils within 3 weeks after planting. The native plants that have gone drought-dormant before the fire probably will not emerge until Spring, even with early Fall rains. The only effective stabilizing agent during the first winter will be the introduced annual grasses, and the residual ground cover. Annual grass roots penetrate 3 or more inches deep, and bind the surface soils. The grass foliage is enough to protect the soil from raindrop detachment and raindrop compaction.

6. Provide an on-site seed source to moderate the impacts of future land disturbance such as range use, off-highway vehicle use, logging, reforestation, and road construction and maintenance.

This point is drawn from experience on the Granite Burn (1973), where the grasses reseeded disturbed soils. This eliminates the need to reseed after soil disturbance, which is a cost savings on every resource restoration project. The potential emergency flood hazard in future years is thereby mitigated.

7. Replace the existing stabilizing agents that are now deteriorating.

The tree roots, brush roots, and residual surface litter deteriorate at an accelerated rate after a fire. The grasses serve as an immediate replacement that persists until the previous stabilizers are replaced by natural stabilizing agents. The potential future threat to life and property can thus be mitigated.

8. The grass will help to mitigate secondary adverse effects of the burned areas.

By controlling effects of on-site rainfall, the grass litter and grass roots will effectively control the volume of floatable debris, road damage, cumulative watershed effects, siltation, loss of fish habitat, and a multitude of intangible values.

9. If an acceptable density of grass is established in year one, then the people and property in the path of the potential flood will be protected.

This does not mean seeding is justified because it relieves public concerns. There are a very limited number of emergency treatments that can be quickly applied over large areas, and are effective the first five years after a fire. In many identified flood source areas, the options were either seed grass, or do nothing. For example, the total area stabilized by other emergency treatments covered less than 1,000 acres (405 hectare), and grass seeding covered 43,150 acres (17,463 hectare).

A public land management agency has an obligation to do all within its authority to prevent and moderate the potential flood disaster due to wildfire. If we as managers do nothing, and an emergency develops in the next five years, then the Forest could be held liable (or at least feel liable), for the consequences. On the other hand, if we establish grass it will provide a rapidly decreasing probability of disaster each year for the next five years.

#### SUMMARY AND CONCLUSIONS

The EBAR team considered the pros and cons of all of the above factors, and presented their findings to the Forest Management Team. The emergency was the threat to human life and property from the potential flood disaster. The conclusion of the EBAR team was that the first priority was to protect human life, instream values, and downstream values that were within the design flood zone.

The Forest Supervisors' decision to proceed with grass seeding considered all of these factors. Because of the massive size of the burned area, and the potential for very severe flood occurrences and effects on water quality, with high

potential damage to property and investments, and damage to resources, it was decided that the tradeoffs favored proceeding with grass seeding. The Management Team supported the decision and initiated resource recovery efforts to harmonize with flood protection treatments.

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\* Served on two teams