

Heli-Mulching on the Darby Fire: A Case Study

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Authors: Alex Janicki, Forest Soil Scientist
Sharon Grant, Hydrologic Technician

Contact: Alex Janicki
(209) 532-3671
ajanicki@fs.fed.us

Overview:

Heli-Mulching is a relatively new and unique type of straw application for erosion control following wildfires. This project as well as others from the Mendocino and Shasta-Trinity National Forests showed that the operation could be done safely and efficiently with maximum results.

Weed free rice straw was applied by heli-mulching on 70 acres of burned watersheds within the Darby fire of September 2001. The purpose of heli-mulching is to immediately replace the natural ground cover that was consumed by the fire



20 small bales (1600 lbs) released from single large net.

Operational Steps:

This report is a case study of heli-mulching on the Darby Fire. The objective is to describe operational steps needed to have a successful project, and to provide feedback on results. The following is a list of actions that will be discussed in detail.

Action	Key Skills/Tools/ Materials	Tie in With	Responsible Officer
Review BAER Report	<ul style="list-style-type: none"> BAER hydro & soil skills Noxious weed survey IR digital burn photos (if available) Burn intensity maps 	<ul style="list-style-type: none"> BAER team leader BAER survey team District Ranger 	BAER implementation team leader
Plans	<ul style="list-style-type: none"> BAER soil & hydro skills Detailed BAER Treatment Plan Aviation Safety Plan, Unit layout GPS & GIS skills Re-burn Evaluation 	<ul style="list-style-type: none"> BAER implementation team leader Helicopter mgr. District FMO 	Project mgr.
Ordering	<ul style="list-style-type: none"> Straw and trucking Helicopter and support personnel Water tender Loading crew and equip. Portable outhouses 	<ul style="list-style-type: none"> Dispatch Contracting Officer Contractors 	Project mgr.
Safety	<ul style="list-style-type: none"> Aviation Safety Plan JHA Staging area and drop zone needs Traffic Control 	<ul style="list-style-type: none"> Forest aviation officer Dispatch Helicopter mgr O&M 	Project mgr, Forest aviation officer
Staging Area Setup & Straw Delivery	<ul style="list-style-type: none"> Squeeze loader Front end loader Water tender Equipment operators Portable toilets Rain tarps 	<ul style="list-style-type: none"> Truck contractor O & M foreman Staging prep boss 	Project mgr.
Pre-Operation Meeting	<ul style="list-style-type: none"> Project overview Maps Schedule of work Expectations and adjustments Aviation Safety Plan Radio Communication 	<ul style="list-style-type: none"> District Ranger <i>Operations</i>⁽¹⁾ Weather Report 	Project mgr
Flying Straw	<ul style="list-style-type: none"> Safety review Review of Ground and Air Operations Daily closeout with helicopter mgr 	<ul style="list-style-type: none"> <i>Operations</i>⁽¹⁾ 	Helicopter mgr, Project mgr/COR
Media Coverage	<ul style="list-style-type: none"> PAO skills 	<ul style="list-style-type: none"> The Press 	Project mgr. or delegate
Closeout	<ul style="list-style-type: none"> Brief comment and review Recognize and thank personnel Release resources 	<ul style="list-style-type: none"> Pilot Operations personnel Dispatch 	Project mgr, Helicopter mgr.
Cost Analysis	<ul style="list-style-type: none"> Costs of: Straw, trucking, helicopter, salary, per diem, other; estimate acre cost(s) 	<ul style="list-style-type: none"> Contracting Officer Contractor billing 	Project mgr.

⁽¹⁾ *Operations: pilot, helicopter mgr., hook tenders, crash rescue, loading crew, field observers, COR, recorder, traffic control*

Review BAER Report

The BAER 2500-8 report is the base or starting line for implementing BAER treatments. The 2500-8 not only has valuable specialists reports but will include maps such as infra red (IR) and burn intensity. This information will help greatly to develop a final treatment. Communication with the BAER survey team and the District Ranger is essential in determining special on-the-ground needs.

In the case of the Darby Fire, the botanist identified known noxious weed sites. If we had not read the report and consulted with the botanist we might have made our first mistake. But we did consult and design the main staging area in a way that avoided a yellow star thistle problem. One item that was invaluable for unit layout was the IR digital burn imagery. This imagery was taken during the BAER survey phase and is an accurate map of the most severely burned areas. We used it at a 1/24000 scale, and a 1/10000 scale for fine resolution ([Appendix A](#)).

Plans

There are several important aspects to planning an aerial application of straw. They include the unit layout and staging, straw specifications, helicopter needs, and accurate mapping products.

The unit layout was simple enough on the Darby project because there were only four units. Unit size varied from 2 acres, to 10 acres, to 60 acres. Unit layout was first done on the IR imagery and then located by walking the units using a GPS and flagging them on the ground. Using 2-foot wide plastic flagging, we placed in an "X" pattern to mark the corners of each unit. The pilot can easily see the large "X's" from the air, especially if you can find a somewhat open area to place the marker. In addition we placed watershed flagging (1 inch black and pink stripe) on trees and bushes along the perimeter for the field observers to locate unit boundaries easily.



"X" marks the spot

The GPS information was used to create GIS maps and provide latitude and longitude coordinates to the pilot. Final acres and application rate determine the amount of straw needed for the project. We used an application rate of 2 tons per acre.

[Appendix B](#) is an example of a treatment plan for BAER heli-mulching on the Darby fire. This plan gives the following information: a general description of the treatment; specifications for straw, helicopter, nets and rigging; and estimated costs for labor and materials

Acquiring an experienced helicopter manager early on is a good idea. They will be able to help with specific helicopter/helipad needs well in advance of the project. Finding suitable staging area(s) from which straw can be flown out of will help the operation run efficiently. The areas really should be within 1.5 miles of the drop zones. The staging area(s) need to be operationally safe with no hazards present. This ultimately will add to a smooth running project.

Planning Concerns:

- The Darby fire had many areas of possible re-burn, and it was a concern of the fire/fuels people that adding straw to potential “hot spots” would spark additional burning. The District FMO sent a crew out to survey for problem areas. After checking the units with an IR probe, they were able to confirm that the units were safe to apply straw. A welcome rainstorm also helped the situation.
- Noxious weed can be a problem on the staging area(s). Early communication with the BAER botanist to help mitigate any problems with noxious weeds is essential.

Ordering

Initial planning will help greatly when ordering resources, tools, materials and equipment. These will very depending on each specific operation. Remember, the planning will continue throughout the project and everything is subject to change. The project manager must tie in with contractors, contracting officer, and Forest Dispatch. The contracting officer will be of great help for tasks such as ordering and transportation of straw to the staging area. [Appendix C](#) has information on the straw suppliers, trucking and helicopter we used for the Darby project. Dispatch will order the helicopter, the helicopter manager, helitack personnel, inmate crews for loading, water tender, crash rescue, and other support personnel. This is a good time to be in contact with the helicopter manager to make sure you have all the resources needed to run a safe operation.

There are project needs that are specific to the staging area. A staging boss is helpful for overseeing the delivery and placement of equipment and straw to the staging area(s). An O&M Forman is an excellent choice, someone who has experience with heavy equipment and trucking. We ordered both large and small straw bales for the Darby project. The large bales required the use of a mechanical loader (front end loader or backhoe), with special prongs attached to the bucket. [Appendix D](#) lists staging area personnel and special equipment needs.



Attaching Prongs

Additional material and resources needed for the project may include 2 foot wide flagging and staples to attach the flagging to the ground, regular black and pink field flagging, and portable toilets. The toilets should be secured to the ground with stakes—the portable toilet company can do this—and placed away from the helicopter flight path. Another tool that is recommended is a knife commonly known as a linoleum knife. This item works very well for grabbing and cutting bale strings, because the blade is hooked or shaped like a beak. They are available in hardware stores.

Safety

Safety must be considered throughout project planning and implementation, this will include special consideration for staging area(s) and drop zones. A project aviation safety plan and JHA are required. The helicopter manager, project manager, pilot, and Forest Dispatch work together as a team to provide a safe operational environment.

The aviation safety plan is mandatory. The plan has information on helicopter specifications and much more. In fact, the first question people ask is do you have an aviation plan? Then they tell you to start early because it requires review and approval from key people. One important feature of the plan is communication procedures and frequencies. This establishes radio communication channels to be used for the project. During the pre-operations meeting, it is good to go over radio communication to ensure that channels, usage, and responsibility are clearly understood. The aviation safety plan requires all staging personnel to wear Nomax. [Appendix E](#) is an example of an aviation plan for BAER heli-mulching projects.

Another important feature of the aviation safety plan is identification of hazards in and around the project area. These include

- Aerial hazards - power lines, towers, other aircraft
- Traffic on roads - need for closure or traffic control
- Other operations – salvage logging, etc.
- Structures – houses, etc.
- Personnel location – field observers, staging area staff, etc.

The helicopter manager plays a crucial role in all staging area operations. This person gives primary safety instructions to field crews. He/she gives approval to re-fuel at a staging area, inspects the helicopter, rigging, nets, safety equipment, etc., and assures that R5 protocol is being followed. The helicopter manager communicates often with the pilot and loading crew to provide a safe operational environment. The helicopter manager on the Darby heli-mulching project was experienced and well practiced, as was the pilot. Safety is their first and last priority!

A job hazard analysis is required for each person that is working on the project. [Appendix F](#) is an example of the one used for the Darby project.

Staging Area Setup & Straw Delivery

Setting up the staging area(s) and straw delivery is a demanding job in itself. This is an important task and may be delegated to a staging boss. There needs to be an area for helicopter landing and refueling, straw and straw operations, safety zone for equipment and personnel, and portable toilets. The layout of the staging area should be designed by the project manager and the helicopter manager to ensure a safe smooth running operation. Straw should be tarped to keep it dry.



Staging Area with Straw

Eight truck loads of straw were delivered to the project area. We met the trucks at the main highway and escorted them along a narrow winding road with traffic safety concerns. It took two days to delivery 150 tons of straw. The straw was unloaded quickly with a “squeeze” loader provided by the trucker. We smoothed the staging area with the loader so the squeeze could maneuver easily.

Logistical concerns:

We had three situations with the staging area that are worth noting:



“squeeze” loader

- One, star thistle was found on the edges of the staging area. We consulted with the BAER botanist and developed a plan to avoid spreading noxious weeds
- The second situation was an access problem. The short spur road leading up to the landing was steep (16% slope), too steep for straw trucks to drive up unassisted. The solution was to pull the loaded truck and trailers up with a 4x4 loader.
- Finally, one item I hesitate to mention but will is the correct placement of portable toilets. We put our outhouses in the takeoff path of the helicopter. The helicopter manager took one look and said move it. We did successfully with a loader. This is another reason to have communication with the helicopter manager during the planning process.

Pre-Operation Meeting

The pre-operation meeting is important, critical, and even necessary! Don't do this the day you fly straw! We had the pre-operations meeting the day before and did it with a slick Power Point presentation. I think flip charts and maps without Power Point will work just fine.

The meeting should cover the following:

- Introductions (Have everyone write their name, address, and telephone number on a sheet of paper)
- Project overview
- Maps of staging area & units
- Schedule of work
- Radio communication
- Project operations
- Safety
- Field review of the staging area and a sample unit

Good maps are essential communication tools. The pilot appreciated maps at various scales and the IR imagery of the fire was also a good visual aide.

The final half of our meeting was spent in the field looking at units and becoming familiar with the staging area. Having this meeting the day before or earlier gives people a chance to ask good questions and make last minute alterations.

We did not fly over the project area with the pilot before starting operations. I think that we were successful without this step because we had few drop zones, we prepared excellent maps at 1:24000 and 1:10000 scale, the wide flagging was highly visual from the air, and we did a field review of the staging area plus 2 of the 4 units. The pilot was also quite experienced with this work. I could see where an over flight becomes more important as more complexity is added.

Flying the Straw

Ground and Air Operations:

The day of operations has finally come. A few things to remember are SAFETY, communication, staging operations and field observations. Also, to visualize the operation from the pilot's perspective is helpful.

The helicopter manager should have a field safety meeting—including a review of the communication plan—prior to the beginning of operations. At this time he can also go over his expectations of the loading crews and equipment, and the needs (if applicable) for traffic control. At the staging area one person with a clipboard and a radio should keep track of the number of turns and tons of straw flown to a given unit. The recorder should check in with the pilot to give a running tally of how much straw is applied to the unit. The pilot will then have an idea of how many more turns is needed to finish a unit.

To find the units the pilot will need good maps. Also, each unit should be identified with a lat/long. When naming units, the pilot commented that numbers are better than names. Each unit should have corners marked that are visible from the air.

Our pilot started by laying down a contour strip of straw along one boundary of the unit. The field observer needs to give the pilot feedback on straw coverage and wind direction. It is helpful for the observer to carry a stick with a flag to indicate wind direction, because drift will carry straw for some distance. Is coverage too thin, too thick and clumpy with numerous flakes? The pilot has some control by adjusting altitude and air speed. On our project most of the flying was done at 60 knots and 150 feet above the canopy. In addition, the observer can let the pilot know where the large holes in coverage are and direct the drop using clock direction. The pilot prefers to make visual contact with the observer before making the drop. Safety is the #1 concern in the units. Be careful!

One thing that is essential on the landing is dust abatement. Dust can injure people and ruin helicopter engines. Several days of rain moistened the ground thoroughly and we were able to get by without a water tender.

Application Coverage and Production Rates:

We flew both large bales and small bales. The helicopter usually carried 1600 lbs per turn. One large net would carry 20 small bales. The other configuration would be 2 large bales with one bale per small net. For narrow strips such as roads or firelines, four small nets with 5 bales per net is the preferred setup. The two hook tenders (helitack crew), are responsible for rigging and hookups. The rigging is specialized and requires some pre-operation instruction. For example, the nets are flat-bottomed and not the more common round type net. The hook tenders lay the lines out so that all releasable lines are to the outside. The nets and hardware preformed well. Tangles were a rare problem.

We started out by applying straw in a zebra pattern, then filling in the leave strips to get the full 2 tons per acre coverage. We did this zebra pattern mostly because we were unsure of how far 2 tons of straw would spread across an acre of ground when dropped from the helicopter. It appears that we got decent broadcast coverage with this application rate. However, the contour zebra stripping method may be more critical to follow where lower application rates are prescribed?

Two factors that affect efficiency and production are the distance from staging area to drop zone and the speed of the loading crew. We had no trouble keeping up with the helicopter once the crew was practiced. If you expect turn times to be short, having two straw piles and two crews to get nets ready may alleviate helicopter downtime. Hand crews get tired especially with short turn times of less than three minutes. We utilized one 15-person hand crew and two mechanical loaders. The loaders were essential for picking up and placing the big 800 lb bales into the nets. One loader can easily keep up with the helicopter. The hand crew has to work hard and some assistance was given to them by using the second loader.

Production rates for units 1.5 miles out averaged 12 tons per hour. This example is given because it represents about 80% of our project. We thought that we were being pretty efficient but some improvement may be possible with more practice! The project pilot commented that turn times of one minute per mile are achievable. If so, the production rate for a unit 1.5 miles from the staging area would be 16 tons/hour (i.e., 1min/mile for 1.5 miles, equals 3 minute turns @ 1600 pounds per turn, or 16 tons/hour).

Media Coverage

Using straw for erosion control—applied by hand or with straw blowers—is a widely accepted practice, but Heli-Mulching is a relatively new and unique way of applying straw. The Forest felt there was need to inform the public of the application for safety and interest reasons. The media did an excellent job covering the story and the public response was very positive.

Closeout

When the straw application is finished there are a few things to remember: It is a good time for the project manager, pilot and helicopter manager to exchange brief comments. Review the operation and note any ways to improve operations next time or identify what is working the best.

The project manager should recognize and thank everyone involved in the operation. Release resources. There are forms to be completed and signed by the pilot and helicopter manager. The project manager will release resources and notify Dispatch

Cost Analysis

The total cost of this project was \$50,000. Average cost per acre was \$700. This cost includes straw, trucking, helicopter, salary, and per diem. Straw and trucking was 22 percent of the total cost (\$36 per ton for rice straw and \$37 per ton for trucking which included unloading). Salary and per diem was 33 percent. The helicopter was 45 percent of the total cost averaged across the whole project (\$120 to \$320 per ton, depending on distance flown to unit). Cost per flight hour was \$1250.

It is important to note that project costs will vary depending on application rates, trucking distance, and how close the units are from the staging area (affects helicopter turn times). Our application rate was 2 tons per acre. Trucking distance was 180 miles, one way. Our units were 1.5 miles and 3.5 miles from the staging area. Production rates for units 1.5 miles out were approximately 12 tons per flight hour. For units 3.5 miles out, the rate dropped to about 5 tons per flight hour.

Treatment cost for units 1.5 miles from the staging area was approximately \$400 per acre (straw, trucking, and helicopter costs). Salary and per diem were about \$200 dollars per acre, resulting in a total cost of about \$600 per acre

Conclusion

The objective of this project was to provide rapid, cost-effective erosion control. Were our objectives met? Yes, by applying two tons of weed-free straw per acre we were able to meet erosion control objectives.

- The project treated 70 acres in 3 days of operation and 17 hours of flight time.
- The project proved to be safe and efficient.
- The straw stayed in place and provided excellent cover.

Sites were monitored in January. Heavy sheet and rill erosion was observed on the untreated slopes. Soil loss was estimated at approximately 30 tons per acre. No erosion was observed on the treated slopes. Also impressive was the fact that very little down cutting occurred in riparian drainages within the treated unit. We feel that the heli-mulching treatment was quite effective. See [Appendix G](#) for photos of straw cover and application.

Lessons Learned

In our operation we used two bale sizes—large 800 lb bales and standard small bales. Straw was chopped to a length of 2 to 5 inches. The large bales had a definite advantage over the small ones.

1. The large bales broke apart well and covered the ground evenly. The small 80-pound bales did not break up quite as well. A portion of each small bale tended to stay in solid flakes and created a chunkier ground cover. We tried flying the bales at different altitudes and speeds with the same results. The Shasta-Trinity Forest used a lighter bale (60 pounds versus 80 pounds), with excellent results. The 60 pound bales were likely somewhat drier and less dense. Straw suppliers have said that bailing pressure, moisture content, and how fine the straw is chopped are factors that determine how well the straw breaks up and spreads.
2. Handling of the large bales was very efficient. A front-end loader equipped with special spikes was able to move and place the big bales on the nets. Where as, the small bales required a crew of 15-20 people and a crew boss. Using small bales not only complicates the staging operations and safety but increases the cost of the project somewhat.

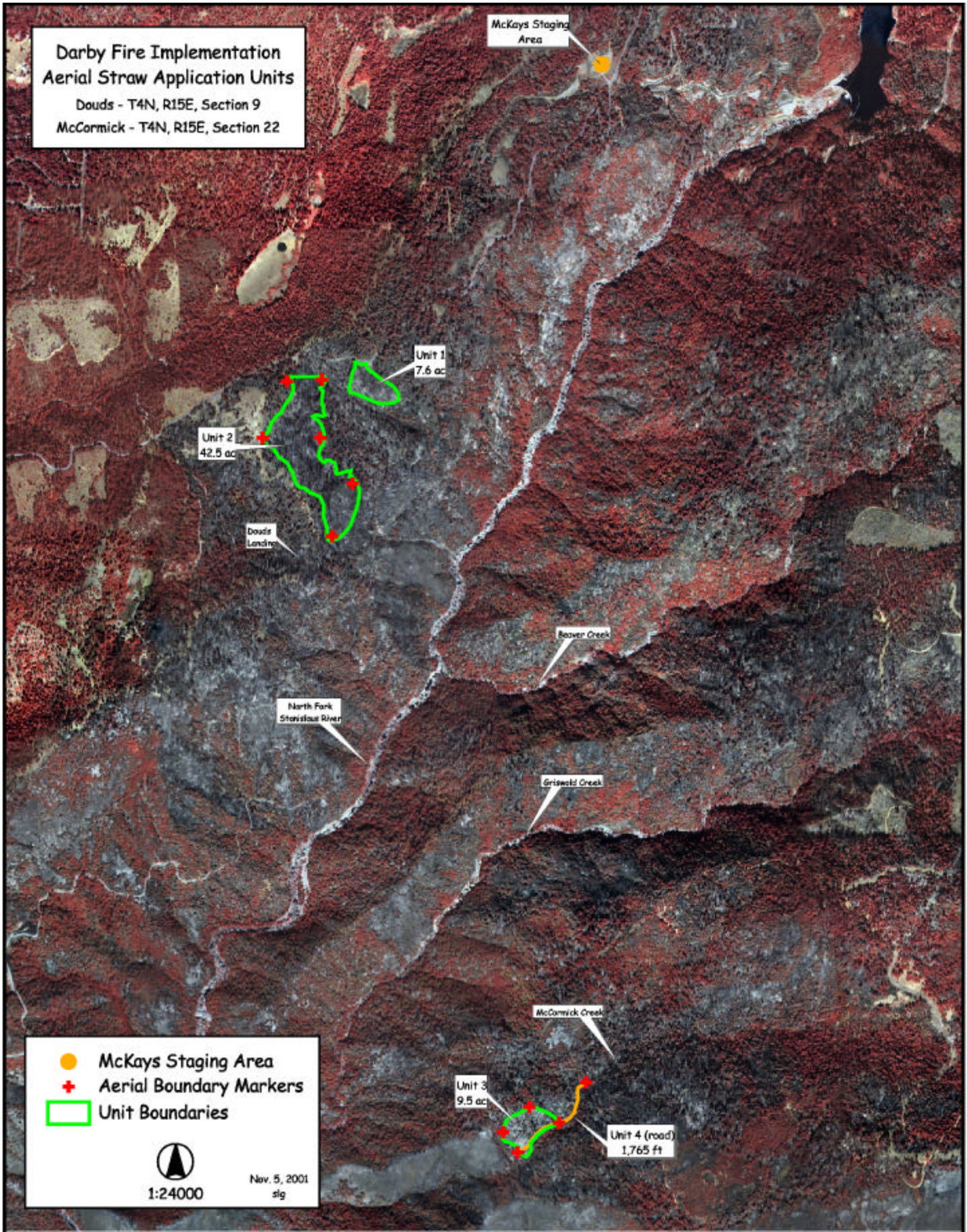
3. There was a need for a “staging area recorder”. The recorder would keep track of turns and straw dropped for each unit, and relay this information to the helicopter pilot.
4. The straw stayed in place. We applied the straw immediately after an early fall storm that moistened the ground. Wind did not blow around or remove any significant amount of straw. The straw cover was also tested and remained in place following several high intensity thunderstorms. The heli-mulching treatment provided excellent erosion control cover through the first winter.

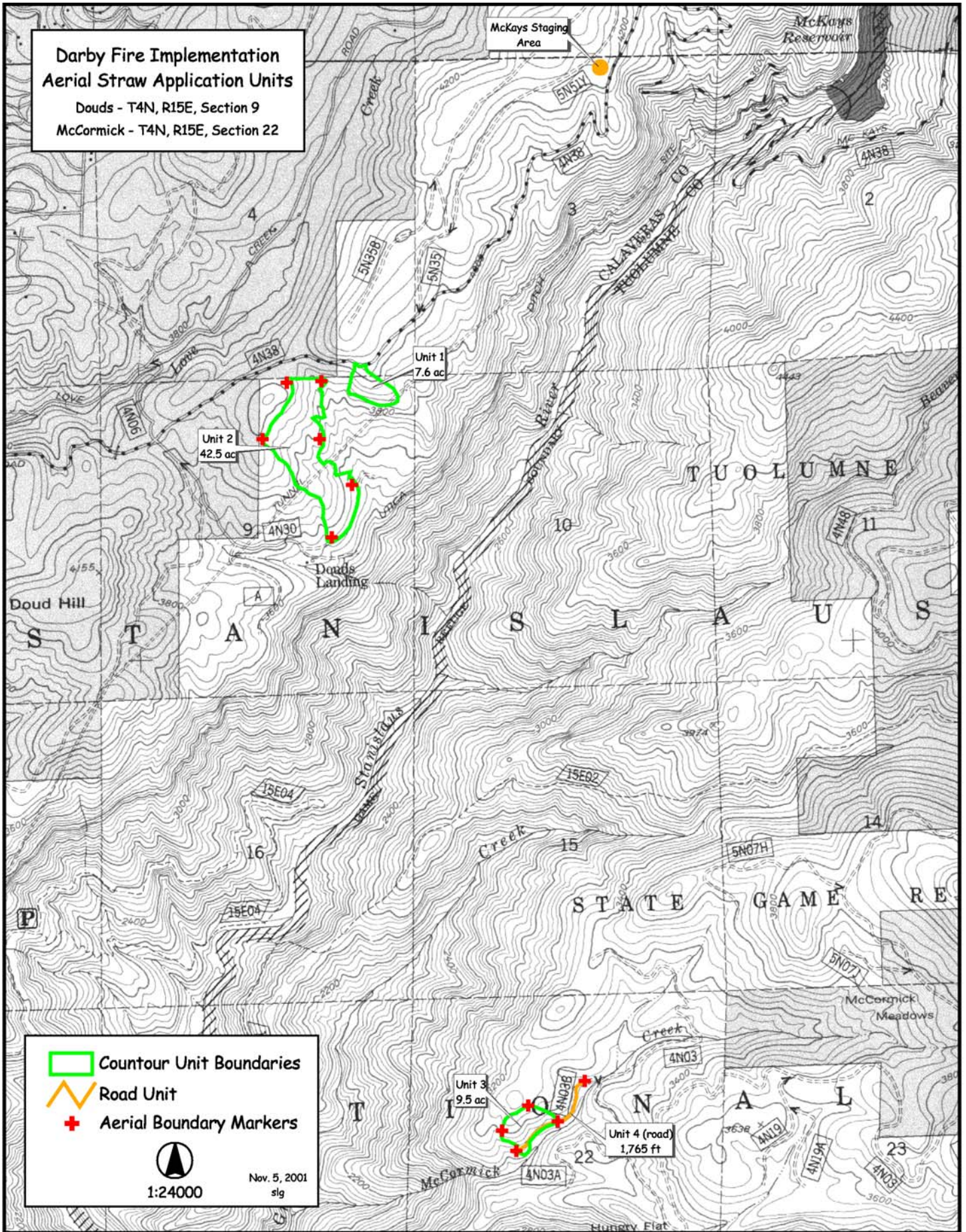
Some advantages of heli-mulching are applying straw to areas that are not easily accessible by the ground, covering a large area in a short time and reducing the amount of personnel needed to get the job done.

The helicopter time is the most expensive part of this operation. One thought on cost reduction is to apply straw at a rate of 1.5 tons per acre. This is mostly a thought—to gain more experience with the technique—than a solid recommendation.

Appendix A - Maps

IR map of units at the 1:24000 scale
Topo map of units at the 1:24000 scale





Appendix B - BAER Prescription for Heli-Mulching

INTERAGENCY BURNED AREA EMERGENCY REHABILITATION PLAN

PART F – SPECIFICATIONS

SPECIFICATION TITLE:	Aerial Straw Mulching- Darby Fire	JURISDICTIONS:	USFS
PART E: LINE ITEM:	DRAFT DRAFT DRAFT	FISCAL YEAR(S) (list each year):	FY 2001-2002

I. WORK TO BE DONE

Number and Describe Each Task:

- A. General Description:** Straw mulch is applied where ground cover was consumed by the fire and the expected soil erosion and runoff is expected to degrade soil productivity and stream channels. Aerial straw mulching will be completed with contract helicopter and pilots. Implementation monitoring will be done by the Forest Service.
- B. Location (Suitable) Sites:** There are two treatment areas, the Douds Landing site and the McCormick site. Douds Landing is 2 miles east of the community of Avery. Access is from highway 4 at Avery and east on Forest road 4N38. The staging area is also along this road and is located 1.5 miles north of the main treatment unit, Douds Landing. The staging area is referred to as McKays staging area. The second treatment area is McCormick Creek, approximately 3 air miles south of the McKays staging area.

The treatment areas are indexed on a map. The Douds Landing is a 58-acre unit. The McCormick unit is 12 acres. The unit boundary will be flagged on the ground with 2 foot wide plastic flagging and GPS data will establish latitude and longitude.

C. Design/Construction Specifications:

1. Helicopter and Nets: Helicopter shall be R5 red carded and meet all FS safety requirements. The helicopter shall be capable of carrying 2,200 lbs. of straw per load. A four-hook carousel and multiple size nets are required. The nets shall be square cargo nets (not round), with a flat bottom. Large nets are 20ft. x 20ft. and carry 20 small bales. Medium nets are 15 ft. x 15 ft. and carry 10 bales. Small nets are 12ft. x 12 ft. and carry 5 bales. The nets, rigging, and helicopter shall have a capability of spreading approximately xx tons of straw per flight hour.
2. Straw: Straw shall be rice straw. Rice straw shall be processed in a manner that releases from cargo nets and spreads evenly. Straw must be dry and baled loosely to facilitate spread once it is released. Straw moisture level shall be less than 13%. Small bails weigh 60 to 75 lbs. Straw is chopped to a 2 to 5 inch length.
3. Straw Delivery and Staging Area: Straw shall be delivered to the McKays staging area. The contractor shall supply a squeeze and operator to unload and stack straw. On site stored straw must be protected from rain. Staging area will be watered for dust abatement (Ask Sid or Joann about engine availability for both dust abatement and crash rescue?).
4. Loading Crew: Loading crew will place straw into cargo nets. Crew will load straw and remove binding string. (*Where to put loose string, don't want it flying around helipad*). An inmate crew (15 people) will carry and place bales onto cargo net. Crews will wear Nomex and leather gloves.
5. Application rate: Straw shall be applied at the rate of 2 tons per acre. Straw shall be applied in contour strips of approximately 100 ft. wide with 100 ft. wide leave strips. Test areas will be setup for calibration purposes.
6. Application Method: Straw shall be dropped by helicopter using specified nets and rigging. Pilot will utilize GPS, line of sight, and direction from forward observers during application.
7. Contract inspection: Forward observers will monitor application rate. The COR and forward observers will communicate results of test strip application and any needs related to calibration.
8. Helicopter Manager: Manager will provide safety briefing to all personnel. Helicopter manager will also provide oversight and spot check of load calculations and weight balance.

- D. Purpose of Treatment:** The basic purpose of straw mulch is to replace only the natural ground cover that was consumed by the fire. Straw can effectively control overland runoff due to bare soil, hydrophobic soils and compacted soils.

II. LABOR, MATERIALS AND OTHER COST:

PERSONAL SERVICES (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST/ITEM
Contracting Officer Contract Development GS-11 @ \$250/day for xx days	xxx
Helicopter Manager GS-x @ xx/day for x days	xxx
15 person helicopter/loading crew @ xx/day for x days	xxx
Project coordinator GS-xx @ \$xx/day for x days	xxx
TOTAL PERSONNEL SERVICE COST	xxx
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X # Fiscal Years = Cost/Item):	COST/ITEM
140 tons of rice straw, delivered and stacked at McKays staging area	\$
TOTAL MATERIALS AND SUPPLY COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X # Hours X # Fiscal Years = Cost/Item):	COST/ITEM
1 helicopter @ \$1200 per hr. for xx hours, plus fuel truck @ \$xxx	\$
TOTAL COST	\$

Appendix C - Straw Suppliers, Trucking and Helicopters

- We ordered straw through the California Straw Supply COOP, our contact was Joe Corrancho.

California Straw Supply COOP
258 Main, # 207
Colusa, CA 95932
(530) 458-7423
e-mail: strawcoop@syix.com

Joe Corrancho – (530) 438-2518

- Straw delivery was done by Lee McLorkal (530) 934-3531. The trucking company also supplied a squeeze/forklift for unloading the straw at the staging area.
- Our helicopter was ordered through West Wind Helicopters.

West Wind Helicopters
PO Box 999
Lincoln, CA 95648
(916) 434-9007

Steven Cantrell (pilot)

Appendix D - Staging Area Personnel and Special Equipment

Per Staging Area:

<u>Personnel</u>	<u>Task</u>
1. Helicopter Manager	manage helicopter
2. Helispot Manager	manage overall site / safety
3. 2 Helitack	hook loads to hook
4. Loaders	load nets
5. 1 Helitack	Refueling

Needs for project:

1. 2- VHF FM radios	One for straw site and one for fuel site.
2. 1- VHF AM radio	Back up radio.
3. 1- 200 lb.- spring scale.	
4. 2- 20 lb. – Fire Extinguishers	One for straw site one for fuel site.
5. 2- Crash Rescue Kits.	One for straw site one for fuel site.
6. 2-Wind Indicators.	One for straw site one for fuel site.
7. Pad Marker.	Designate landing site.
8. Dust Abatement	Portatank/pump/hose and a way to fill, or water tender.
9. Radio Communications with Dispatch	

Appendix E - Aviation Safety Plan

PROJECT AVIATION SAFETY PLAN Oregon Fire BAER Rehab Shasta-Trinity National Forest

Project Aircraft Needs:

1. One Type 2 helicopter. Helicopter carded to agency standards. Must be able to lift loads in excess of 1500 lbs. out of ground effect (OGE), at an elevation between 2000-4000 feet at 20- 30 degrees Celsius with 1½ hours of fuel and a ½ hour of reserve fuel.
2. One Type 3 helicopter used for a short recon to orientate the pilot to the target sites and to recon any hazards not seen. Less than an hour of flight is all that it will be needed for. The helicopter must be capable of loads of 600lbs.OGE with 1-½ hours of fuel plus 30-minute reserve. The aircraft and pilot must be carded for the intended mission.
3. Pilot carded to agency standards for longline operations and mountain flying in the model helicopter.
4. Fuel truck capable of sustaining 8 hours of fuel and passing inspection.
5. 100-150 feet of longline with carousel hook for dispensing 1 to 4 loads of straw individually.
6. 6 cargo nets use to handle loads in excess of 1500 lbs.

Project description:

The project involves the uses of a Bell UH-1H helicopter, Longline, Carousel Hook and nets to spread straw. The straw will be spread by releasing one of the two bullrings in flight, jettisoning the straw. The net remains attached to the hook and is returned to be filled again. The hook allows us as many as four nets to be flown at one time. The use of the Carousel Hook will cut down on the amount of trips back and forth to the hay site, thus cutting back on flight time and exposures.

Approximately 2000 bales will be flown flying 5-20 bales per net. Generally the loads will be flying 100 ft. above the trees at 40 knots. The type of flying is very similar to performing bucket drops.

Two stockpiles of straw will be staged for the project. One is on top of Oregon Summit and the other by McKinzeys Gulch. The Oregon Summit site is next to Hwy 299W in a large turnout, and will require traffic control provided by Caltrans, to prevent over flight of

vehicles. The Mckinzey Gulch site is located within the burn north of the Hwy, and poses no over flights of any kind.

Fueling will be done at the Weaverville Airport. There will be an agency person at the airport to ensure that proper fueling procedures are met and provide fire and crash rescue with communications with dispatch.

Project Justification:

Straw has been traditionally flown one net at a time and then spread by hand crews. Heli-mulching lessens the exposure of the pilot and all crews around the helicopter and eliminates the hazard of hand crews walking on the steep slopes. There is also a cost savings by eliminating hand crews and reducing the amount of flight time compared with flying one net at a time.

Locations (straw staging and fueling sites)

- Oregon Summit 299w - 40.44.2 x 122.59.7
- Mckinzey Gulch - 40.45.00 x 122.59.00
- Weaverville Airport: - 40.44.74-122.55.32

Frequencies/Contacts:

- Redding Dispatch Rx 171.575 - Tx 169.100 - tone 9
- Weaverville District Rx 172.275 - Tx 172.275 - tone 7
- Air to Ground Rx 170.000 - Tx 170.000
- Crew Net Rx 168.200 - Tx 168.200

- Weaverville Unicom 122.8

Contacts:

Jeff Teal	Project Manager	530-623-2121
Jeff Ridley	Helicopter Manager	530-286-2255
Arlen Cravens	Forest Aviation Officer	530-246-5232

Project Aviation Description:

The project described earlier entails jettisoning straw while in flight using 1-4 nets attached to a Carousel Hook. There will be two straw staging sites within the fire. The helicopter will be required to fly over Hwy 299w between traffic controls. The Helicopter will not over fly the highway with loads attached to the hook. It will have to over fly the highway with a longline attached, but only within controlled traffic. The helicopter will also have to fly to Weaverville with the longline attached for fueling. The helicopter must not and will not over fly residential areas with loads attached to the hook, or with the longline itself. The helicopter will do all landings and will fuel at the Weaverville Airport. The Airport is 2-4 miles from the project sites.

Communication Procedures:

The helicopter will be staging and fueling at the Weaverville airport, there will be a helitack person at the airport that will have communications with dispatch on forest net and the helicopter on Air to Ground. The helispot managers at both straw sites will also maintain the same communications. The project manager will also have communications with the pilot using air to ground to give instructions to pilot if needed. The helicopter must monitor the Weaverville Unicom 122.8 for air traffic in the Weaverville Basin.

Personnel Needs on site:

- 1 Project Manager.
- 2 Helicopter Managers.
- 1 Qualified Helitack at the airport.
- 2 Helispot Managers at each straw site.
- 2 Qualified Helitack at each straw site.

Flight Following & Emergency Procedures:

Pre and Post operation briefings will be held with the pilot, helicopter manager and related participants. The helicopter manager will report when the project is in service and out of service with Redding Dispatch. Flight following will be conducted locally with the helicopter manager.

In the event of a mishap, Redding Dispatch will be notified on Forest Repeater. Tx 169.100 - Rx 171.575 tone 9. Redding Dispatch will coordinate rescue operations and implement the Shasta-Trinity Accident/Incident Guide.

Helitack Ground Personnel Hazards & And Aerial Hazard Analysis:

All personnel involved with the project will be required to wear full PPE; eye protection, ear protection, nomex shirt and pants, gloves, and helmet with chinstrap, and 8 inch leather boots.

Helitack personnel and loaders will need to be very aware of the hazards while working around the longline and remote hook. Keep eyes on the hook and load at all times. Do not allow a load to over fly you.

Because of the quick turn around times, to stay ahead of the curve nets will be hooked by the helitack while the loaders are loading nets waiting for delivery. This would mean the exposure of 7-10 personnel under the helicopter. The helispot manager will manage the safety of the personnel on the deck.

Aerial Hazard: Trees have been identified as the hazard. No power lines have been observed in the work areas. Other aircraft in the Weaverville basin may be a threat. By monitoring the Weaverville Unicom 122.8 this will mitigate the hazard.

Load calculations and Manifesting:

The pilot is responsible for accurate load calculations. The loads will be manifested to ensure loads are within limits. The helicopter manager will ensure that this is done prior to starting operation.

On site Safety Equipment:

- 3-20lb Fire Extinguishers
- 3-Crash Rescue Kits
- 3-Wind Indicators
- 3-VHF FM Radios
- 1-VHF AM Radio

Project Cost Aviations Resources: \$20,000

The project is scheduled to begin November 5th at 0:900 and finish before shutdown on November 6th. The operation will finish both days at 16:30 roughly one hour before shut down.

Approval Signatures

Reviewed by _____ Project Manager

Reviewed by _____ Helicopter Manager

Reviewed by _____ Forest Aviation Officer

Reviewed by _____ Forest Supervisor

Appendix F - Job Hazard Analysis (JHA)

FS-6700-7 (3/98)

U.S. Department of Agriculture Forest Service	1. WORK PROJECT/ACTIVITY Burned Area Emergency Rehabilitation	2. LOCATION Forest-wide	3. UNIT Stanislaus NF Headquarters
JOB HAZARD ANALYSIS (JHA) References-FSH 6709.11 and -12 (Instructions on Reverse)	4. NAME OF ANALYST Greg Miller	5. JOB TITLE BAER REHAB	6. DATE PREPARED 8/31/00
7. TASKS/PROCEDURES	8. HAZARDS	9. ABATEMENT ACTIONS Engineering Controls * Substitution * Administrative Controls * PPE	
General Field work, monitoring	General personal safety	Bring your radio with charged battery Sign out at back door; If going to a remote area alone let someone know specifically where you will be; Be sure someone knows you have returned.	
		Carry sunglasses to wear on bright days and in snow to prevent eye sunburn (snow blindness). Use sunscreen to prevent sunburn.	
	Sun and hyperthermia	Drink enough water to keep hydrated and prevent heat exhaustion or heat stroke (at least 2 quarts in summer). Pace yourself when climbing steep, open slopes.	
		Carry extra clothes; wear layers to prevent sweating and subsequent cooling. Bring rain gear, hat, warm gloves with you everyday.	
		Use extra caution in stream bottoms to prevent falling in water and hypothermia.	
	Hypothermia and cold	Don't drink unfiltered or untreated water from creeks. Check yourself daily for ticks, especially hair. Tuck pants into boots, shirt into pants, wear long sleeves.	
		Fatigue, carelessness Get plenty of sleep at night; Be careful and do job right the first time, safely.	
		Trip and fall, eye poking Watch for down trees and debris on forest floor. Wear goggles when walking in thick, shrubby areas.	
	Crossing creeks	Watch where you walk in stream, expect rocks to be slippery, don't cross if you feel unsafe. Cross facing upstream so knees don't buckle, use a stick for extra balance.	
		Field surveys, monitoring	
Field surveys, monitoring	Steep slopes, Remote worksites	Wear vibram soled shoes, with good ankle support. Carry a radio, leave itinerary.	

Mapping/Inventory Within Fire Perimeter	Working within fire perimeter.	Wear PPE (Hard Hat, leather boots, NOMEX, fire shelter, goggles, and gloves) at all times. Recognize fires are not controlled. Know your 10 standard fire orders and "watch out" situations.
Mapping/Inventory Within Fire Perimeter, cont.	Stump/root holes	Keep your eyes on path of travel. Stop your travel and complete task if your attention is diverted.
	Snags/Hazard trees	Size up your surroundings. Avoid work in areas where hazards exist. Be aware of expected conditions.
	Slippery footings	Be aware in areas of wet ash, loose rocks, and unstable slopes.
	Rattle snakes	Be aware at all times especially when working in: Upper Sula, Rye Creek, Division N of Skalaklho Complex (Sleeping Child Creek).
Communication/Coordination with Team Leaders and Suppression Personnel	Personal Health and Safety	Take care of cuts, bruises, and blisters immediately. Report accident to Team Leader and complete accident report.
	Lightning	Check weather report, stay off ridge tops and open slopes during lightning storms
		If stuck in open keep radio and metallic objects away from you, squat down with only feet on ground using insulate pad if possible, keep as much of your body off the ground as possible.
	Falling rocks	Wear hardhat if in area with loose rocks; don't work directly above another person; be wary of rocks.
	Heavy brush	Wear long sleeve shirt; goggles
	Insect bites	Wear long sleeve shirt and hat; use repellent at your discretion.
		Carry anti-histamine and asthma-inhaler for bee stings. If known allergic carry proper medication and instruct coworkers in administration.
Report your next day's work area to Team Leader by 1800 the previous day In order to be included in next day's shift plan). Be Sure to check in with Division Sup.Group before entering and leaving fire perimeter.		
Driving	Vehicle accidents and associated injury	Always wear safety belts and make sure everyone else is! Keep windows clean and garbage from cab of truck. Drive extremely carefully in parking lot.
		Drive carefully in snow and mud, chain up BEFORE you get stuck. Don't attempt accessing remote areas if conditions are bad
		Forest roads are narrow, drive defensively, giving yourself enough time and space to react to other drivers.
		Stop and take a break if you feel sleepy while driving, or let someone else drive.
		If possible, remove hazards from roadbed rather than try to drive over or around them.

Helicopter Operations:		
1. Approach Departure	<p>Rotor and engine exhaust location on different helicopter types pose danger of serious injury.</p>	<p>Approach operating helicopter only when instructed to do so by pilot, manager, or helitack personnel. All personnel must receive a briefing on the specific type/model of helicopter before working around that helicopter. Each type/model may have different procedures for approach and departure.</p> <p>Standard Procedure is as follows: 1) Approach from the front or front side of helicopter, in a slight crouch and in clear view of the pilot. 2) Never go near the rear of the helicopter unless instructed to do so (for models without a tail rotor hazard). 3) Allow helitack personnel to carry long objects, or carry them horizontally, low to the ground if authorized to do so. 4) Approach/depart helicopters to/from the downhill side (never uphill).</p>
2. Loading/Unloading Sling Loads	<p>Improper hookups Tangled nets</p> <p>Dust in eyes Malfunction of cargo hook Shocks from hooking</p>	<p>Double check locking mechanism. Stay alert for problems. Parking tender signals pilot.</p> <p>Wear eye protection (goggles). Pre-flight checks. Check manual and electronic release. Make sure hook is re-armed. Wear gloves. Long line remote hook touches ground before you grab.</p>
3. PPE	<p>Potential for flash fire and Potential for serious head trauma in the event of an accident.</p>	<p>For all helicopter flights, PPE must include: Nomex or fire resistant cotton shirt and trousers, Leather or Nomex gloves, Leather boots, *Aviator Flight Helmet*, 2" overlap of all PPE. *NOTE: Firefighters being transported to a managed helispot may substitute a hardhat with chinstrap and earplugs for the aviator flight helmet.</p>
10. LINE OFFICER SIGNATURE	11. TITLE	12. DATE

Instructions (References-FSH 6709.11 and .12)

The JHA shall identify the location of the work project or activity, the name of employee(s) involved in the process, the date(s) of acknowledgment, and the name of the appropriate line officer approving the JHA. The line officer acknowledges that employees have read and understand the contents, have received the required training, and are qualified to perform the work project or activity.

Blocks 1, 2, 3, 4, 5, and 6: Self-explanatory.

Block 7: Identify all tasks and procedures associated with the work project or activity that have potential to cause injury or illness to personnel and damage to property or material. Include emergency evacuation procedures (EEP).

Block 8: Identify all known or suspect hazards associated with each respective task/procedure listed in block 7. For example:

- a. Research past accidents/incidents.
- b. Research the Health and Safety Code, FSH 6709.11 or other appropriate literature.
- c. Discuss the work project/activity with participants.
- d. Observe the work project/activity.
- e. A combination of the above.

Block 9: Identify appropriate actions to reduce or eliminate the hazards identified in block 8. Abatement measures listed below are in the order of the preferred abatement method:

- a. Engineering Controls (the most desirable method of abatement). For example, ergonomically designed tools, equipment, and furniture.
- b. Substitution. For example, switching to high flash point, non-toxic solvents.
- c. Administrative Controls. For example, limiting exposure by reducing the work schedule; establishing appropriate procedures and practices.
- d. PPE (least desirable method of abatement). For example, using hearing protection when working with or close to portable machines (chain saws, rock drills, and portable water pumps).
- e. A combination of the above.

Block 10: The JHA must be reviewed and approved by a line officer. Attach a copy of the JHA as justification for purchase orders when procuring PPE.

Blocks 11 and 12: Self-explanatory.

Emergency Evacuation Instructions (Reference FSH 6709.11)

Work supervisors and crew members are responsible for developing and discussing field emergency evacuation procedures (EEP) and alternatives in the event a person(s) becomes seriously ill or injured at the worksite.

Be prepared to provide the following information:

- a. Nature of the accident or injury (avoid using victim's name).
- b. Type of assistance needed, if any (ground, air, or water evacuation).
- c. Location of accident or injury, best access route into the worksite (road name/number), identifiable ground/air landmarks.
- d. Radio frequencies.
- e. Contact person.
- f. Local hazards to ground vehicles or aviation.
- g. Weather conditions (wind speed & direction, visibility, temperature).
- h. Topography.
- i. Number of individuals to be transported.
- j. Estimated weight of individuals for air/water evacuation.

The items listed above serve only as guidelines for the development of emergency evacuation procedures.

JHA and Emergency Evacuation Procedures Acknowledgment

We, the undersigned work leader and crew members, acknowledge participation in the development of this JHA (as applicable) and accompanying emergency evacuation procedures. We have thoroughly discussed and understand the provisions of each of these documents:

SIGNATURE	DATE	SIGNATURE	DATE
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_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Appendix G - Photos of Straw Application

Straw/Helicopter Staging Area



Straw Application



Straw Coverage



Heli-Mulching after Winter (April 2002) Douds Landing Area

