SENATE NATURAL RESOURCES
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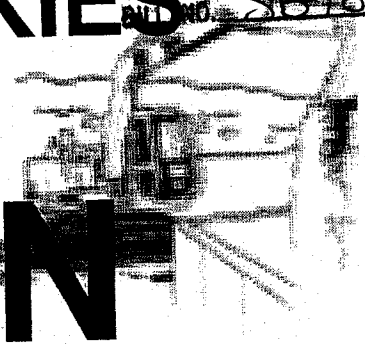
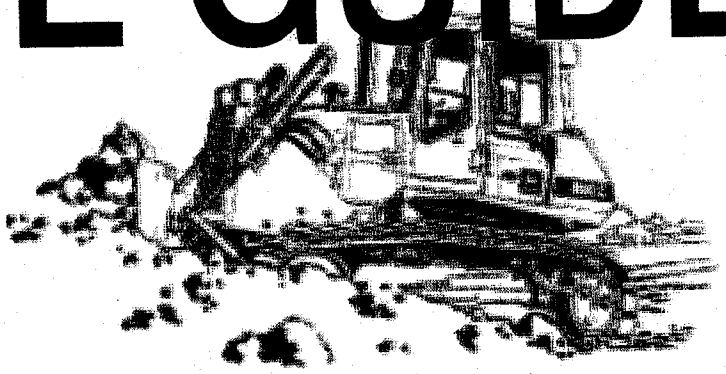
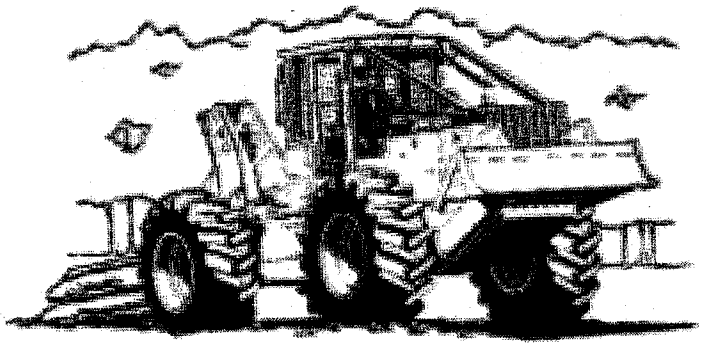
NORTHERN ROCKIES



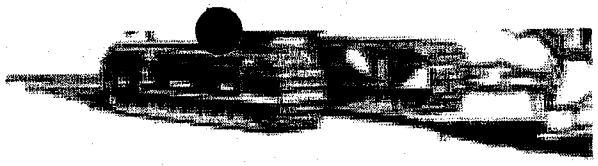
BIG IRON USE GUIDE



TACTICAL & LOGISTICAL CONSIDERATIONS FOR USING INDUSTRIAL LOGGING EQUIPMENT FOR WILDLAND FIRE SUPPRESSION



Jim Steele — Bureau of Indian Affairs
Scott Kuehn — Plum Creek Timber
Bob Rich — Montana Dept. of Natural Resources



Introduction

We have seen the evolution of large machine use on wildland fire develop quickly over the past 20 years with innovation and maturity to produce new methods for creating fuel breaks, moving earth, and hauling water. The basic job in logging and fire fighting has not changed, but our opportunities to find more efficient ways to do it have increased. Our approach to fighting wildland fire has not changed much however, and our ability to adapt to a changing industry has almost allowed a generation of firefighters to miss opportunities that are cost efficient, and more importantly a safer way to do business. As with any skilled and high risk endeavor operators and managers have to be competent and well practiced. It is the successes of these people that have initiated an interest to learn more about "Big Iron" and ask the questions to give us more availability to skilled operators and dependable machines.

On March 25, 2003 a group of about 50 professionals met to discuss opportunities based on experience when using large industrial machines for fire suppression. The group was comprised of logging contractors, who make their living in the woods with these machines, and professional fire fighters and timber sale contract administrators from federal and state fire service agencies. This brief look at Big Iron and it's use for fire suppression is a direct result of this meeting and everyone's interest to do a better job, make it safer, increase availability, and offer new opportunities to fire managers. This use guide will not discuss "dozers" as crawler tractor use is well documented with training course materials, use, safety considerations, and production rates.

Big Iron Strategy and Tactics

Big Iron strategies are: a) rapid deployment and service, b) provide skills not otherwise found, c) quick implementation of tactics, d) manageable operations, e) accomplish suppression and resource objectives, f) safety for the operators and those around the machines, g) versatility for direct and indirect attack, h) double shifting capability, and I) risk mitigation. Tandem machine operations are often the key to facilitating most of these strategic objectives. Production levels increase as machines compliment each other, and it's important to keep in mind, that Big Iron is designed by their manufacturer for high production rates as well as extended shifting. Industrial equipment is well adapted to provide rapid deployments to help with initial attack as well as extended attack and long term management on large fires. The traditional heavy-handed tactics we have been used to is now a matter of choice. Logging machines can operate with a smaller and softer footprint that allows more maneuverability, less damage to soil and residual plants, and offer better ways to reclaim damage that does occur.

We now know that careful selection of equipment prior to employing tactics is a key component of success. Misuse and lack of use is a product of not understanding what is available and capabilities of specific machines and their operators. A strategic consideration by agencies, incident management teams, geographic area teams and managers would be to use industry representatives (Logging Associations or equipment owners) or agency timber sale contract administrators to assist with machine selections, operations and support needs, as well as operator evaluations, and logistics' concerns.

This guide book will look at machine tactics that can clip, snip, prune, skid, haul, bunch, pile, yard, saw, chew, push, dig, scrape, scratch, dump, slosh, squirt, and plow. In some cases, there may be a newly designed machine that can do most of these actions. Tactically you must know what you want to occur, where that is, and for how long.

This guide makes no attempt to document which machine is better by make, model, type, or kind. It will reference what we know, and make no assumptions that cannot be documented. Table 1 represents the kinds of machines we will discuss and what they have been used for on wildland fires and fuels management projects. As with any endeavor that requires skill the operator can make or break the assignment. Operator skill levels should be considered as important as the condition and attributes of the machines. Operator performance needs to be data based and used by ordering agencies and dispatch centers to help sort for skilled operators.

Table 1. List of equipment types and fireline tasks.

Equipment / Task	Feller Bunchers (Processors)	Rubber Tired Skidder	Dozer	FMC KMC	Excavators	Slide Boom Delimber	Forwarders	Skidgines
Tree Felling	X-E	X_2-P	X_2-F	X_2-P	X_2-F			X_2-P
Brush Cutting	X-G/F				X_4-F			
Tree or Log Skidding		X-E	X-E	X-E			X-E	X_5-P w/tank X-E w/o tank
Delimbing	X-P					X-E		
Log Bunching	X-F	X-F	X-F	X-F	X_3-F			X_5-F
Log Stacking		X_3-G	X_3-G	X_3-G	X_3-G/E	X-F	X-E	X_5-G
Fireline Construction	X_1 -P	X_4-G/F	X-E	X-G/F	X-E		X_6-P	X_2-F
Water Hauling							X-E	X-E
Water Use							X-E	X-E

X_1: Can produce limited amounts of fireline; best used on spot fires, emergency response fireline only – machine dependent.

X_2: Can provide limited response, machines are not designed with this as a primary task, best used in emergencies only.

X_3: Limited decking capability.

X_4: Limited to tearing brush out of the ground versus cutting.

X_5: Limited by the water tank; may have to remove water tank to allow full range of motion.

X_6: Specialized Forwarders can construct fireline and cut trees and brush (Proteus)

General Performance Rating: E: Excellent G: Good F: Fair P: Poor

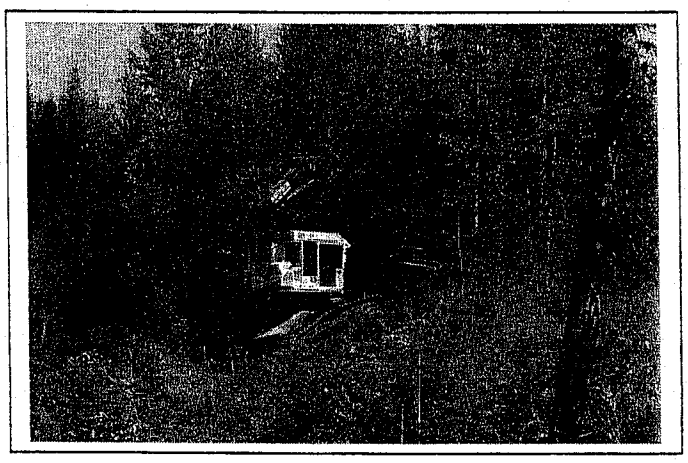
Very few of these machines were built for fire suppression, but have been adapted to provide specific needs. This makes operator skills a paramount consideration when formulating machine tactics. An additional important consideration is tandem use of machines to provide

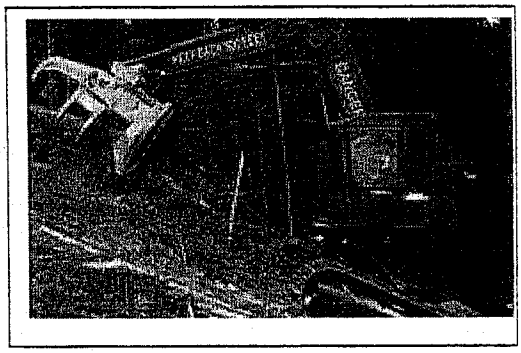
an efficient fireline that does not add risks such as log decks and slash piles, traffic flow, and conflicts with ground crews.

Fireline and fuel break locations must be ground truthed and identified for operators to follow. Tree removal specifications also have to be well thought out and administered, e.g. diameter limit tree removals.

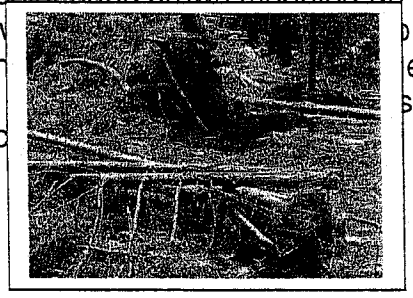
FELLER BUNCHERS

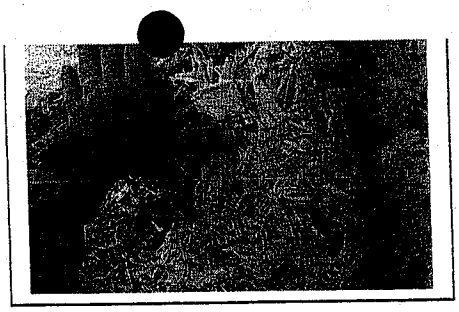
Tree falling occurs in three ways, felling, feller bunching, and harvesting. The cutting heads are different, machines are either wheel or track mounted, felling control is dissimilar, and additional tactical actions may be need to supplement the action. One of the most popular in the Northern Rockies is the track mounted feller buncher.



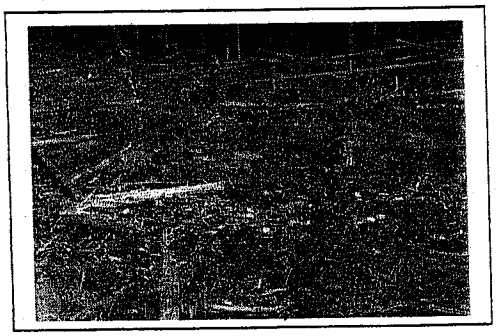


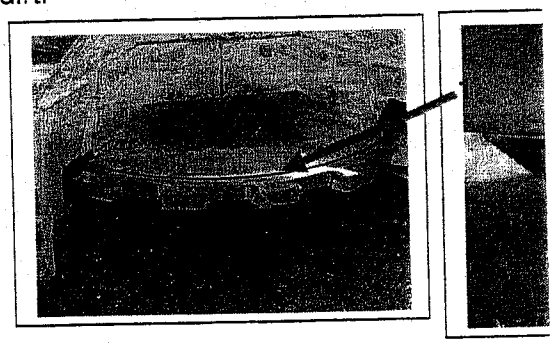
Significant features that make these machines desirable for fire suppression work are they can work on slopes up to 60%, and have a self-leveling cab to 36º. They can sit in one location and reach the knuckle boom out to trees or brush. This minimizes having to reposition the machine for each tree or clump of brush. The cutting head usually has clamping or grabbing arms that hold onto the material while its being cut, and then when the boom repositions the material to place it, or bunch it. Some cutting heads can allow the knuckle boom and cutting head to face downward so horizontal material can be grabbed and cut. This can occur with the hot saw head, and some bar saw heads. The advantage is they can be used to saw through jackpots of blow down, or to assist hand crews mopping up machin piles tha in them. Logs and , dirt sh in the fir before the cutting h e length rk. Anoth feature is they can sh in on e reduce number of cuts nec



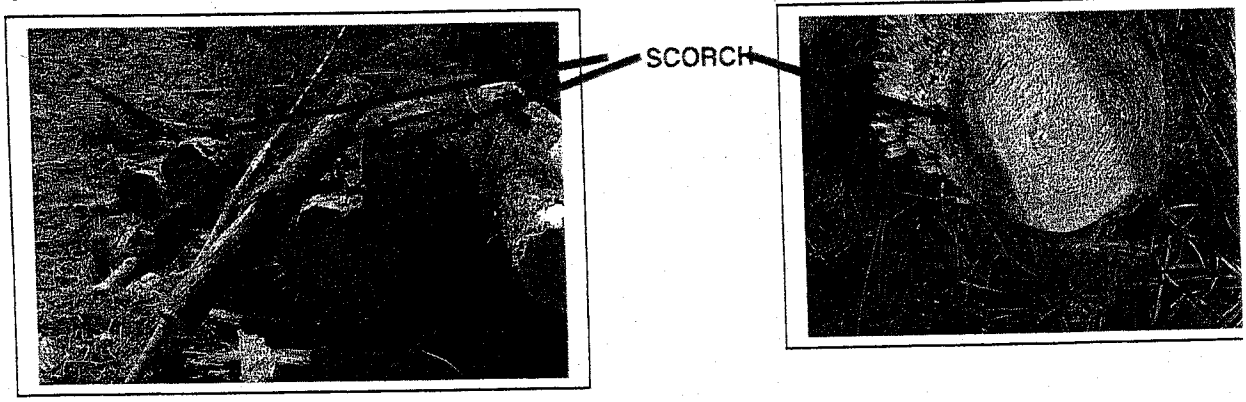


The hot saw is a continuously running circular cutting head with about 18 cutting teeth with a 2-inch kerf. It spins in one direction and discharges saw chips in that direction. It operates close to the ground, and will often include dirt, rocks, and other loose debris in the discharge. This becomes a safety item and any firefighters in the vicinity must stay at least 300 feet from all sides of the machine. If a bearing in the arbor of the hot saw head comes loose, then the saw head will wobble and it will hit the top plate causing friction and sparks (1). If the top plate above the teeth becomes worn, it can bend under the weight of a tree and rub against the spinning blade to cause spark showers and friction heat to the metal. Low cut stumps will often place the cutters into rocks and dirt and throw this material a long distance. Mitigation would be to accept higher stumps and keep the cutters out of the dirt.





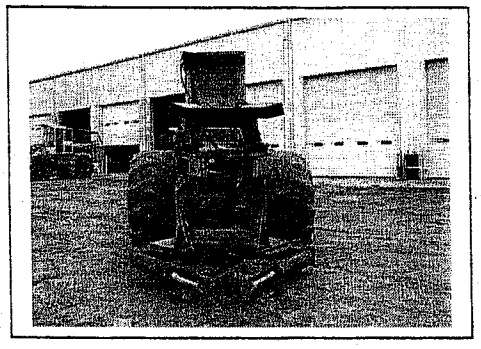
Another safety item relative to the hot saw is debris wedging into the plate (1) above the teeth. Friction created by the plate turning creates heat, and during dry conditions with low relative humidities, ignitions have occurred. This doesn't preclude the use of hot saws, but does require frequent maintenance and checks for spot ignitions. Check stumps or butt cuts for charring caused by the operator dropping the hot saw after the final cut.



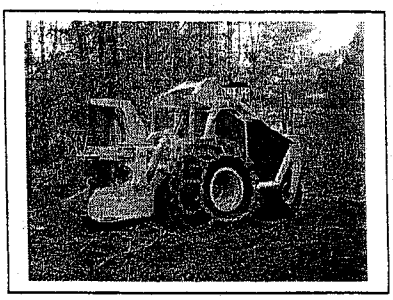
Some hot saw assemblies built for use in California might have a water-cooling system (2) to prevent these ignitions from happening.

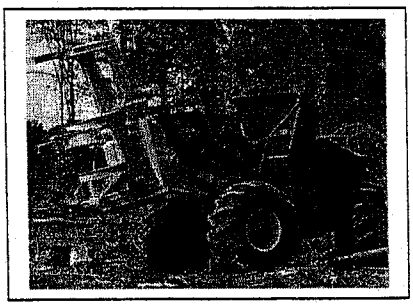
2

Another cutting head is the shears, which can be mounted on tracks or rubber tires. Shears are not as common in the Northern Rockies because they compress and shatter wood when cutting. They are used for fuels management projects where commercial products are not a primary product. They work well in small pole and sapling size trees and brush.



Wheel mounted cutting heads, not including a knuckle boom, are called drive-to-tree fellers. They can grab a bunch of material at once, but they must travel to each one. Wheel mounted clippers require gentler slopes for increased maneuverability. Three wheeled clippers require flat ground, and four wheeled clippers are restricted by side slope.

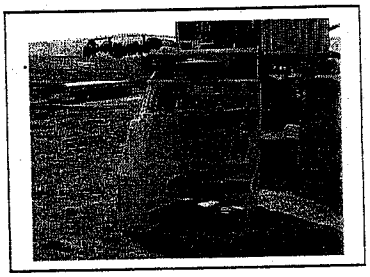




All tree felling machines can perform well with small or large diameter trees. A hot saw with a 24" diameter cutting head can fell a 34"-40" diameter tree or snag by chewing around it while the hydraulic arms hold it.

The last two cutting heads are the bar saw and dangle head. The bar saw is a chain saw on a

hydraulic cylinder. They are somewhat limited in scope due to the bar extension arm and physical restrictions to machine head tilt. They sometimes have an advantage in large timber. Expect dirt, rocks, sparks, and other debris as a byproduct because of the high speed cutting chain.



The dangle head is part of tree processing at the stump system. It includes felling, delimbing, cut to length, and placing cut products for pick up. Dangle heads are limited in that they have difficulty picking up a tree or downed log. It clamps around a standing tree, severs it at the stump using the chain saw bar, then pulls the tree butt out to directionally fell it, then runs it through the rollers to delimb it and measure product length, and finally cut the product out. This leaves limbs and debris where the tree was processed. The main disadvantages of dangle head machines for fire suppression are tree debris left on site, and their inability to grab, hold, then cut the tree, and be able to maintain control of the tree to pick it up and move it to another location.

Sometimes referred to as a cut to length system, dangle head tree fellers usually operate with a log forwarder. This equipment will be discussed later.

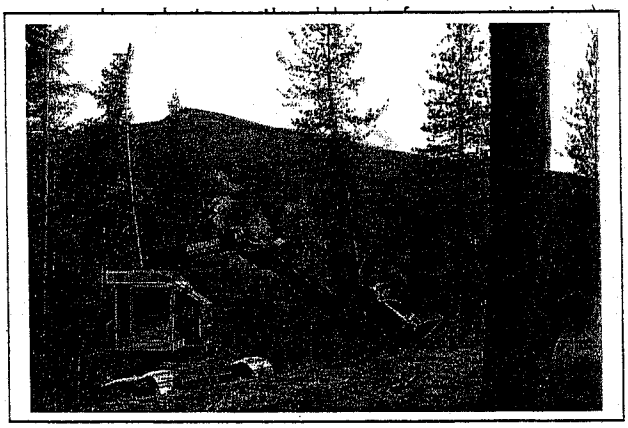
Feller bunchers are large machines and have a slow travel rate, 8.5 miles per hour at top speed on flat ground. Although this is faster than most firefighters travel, safety zones still need to be considered a standard part of the tactics if a burnover is possible. Safety zone sizes are not documented, but recent experience suggests fuel breaking should be between 200'-500' depending on the machine size, type, condition, and numbers of machines in a single safety zone. If machines are left on the fireline for extended periods, a safe zone must be considered.

Crews operating tree-felling machines that are working at night must be allowed to reconnaissance the work area during daylight. Most of these machines have integrated light

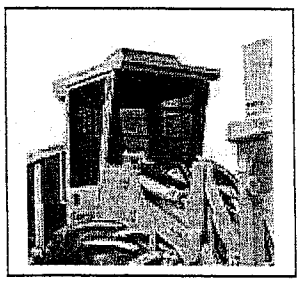
systems that provide a wide area illumination but operators need to survey the "lay of the land" before night limits their field of vision. This benefits the operators and ground forces during the day when lots of dust or smoke are present. If reflective ribbon or light sticks are available, they will facilitate night operations.

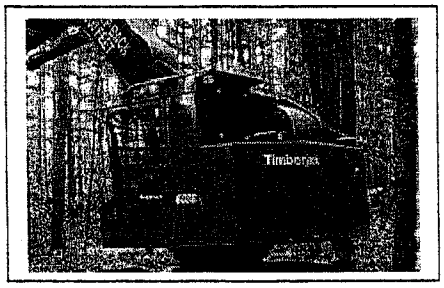
There are several safety items worth paying attention to when using feller bunchers:

1. Small woody debris and dirt accumulate wherever there are nooks to hold it. Over time this becomes a fire hazard from radiant heat, or if the machine tips over.
2. When not operating the hot saw, be certain the operator grounds the cutting head (positions fully on the



3. There is comparatively more oil leakage from a feller buncher than a dozer. This may be a factor when considering work in areas such as a riparian zone. Inspect the machine's condition to assess this aspect.
4. Feller Bunchers have a good reputation for dependable work without breakdowns.
5. When Feller Bunchers have severed a tree and is walking it to another location, treetops can break out from machine caused turbulence. All people must stay back a minimum of 300 feet from this operation.
6. Cabs should have Falling Overhead Protection Structure (FOPS). Rolling Protection Structure (ROPS) is required for machines that are capable of rotating 360º: check for FOPS or ROPS stickers. ^NOT Boom is protection.

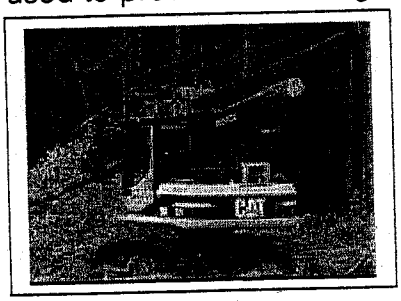




Some tactical considerations:

1. Feller bunchers can remove more material from the fireline area than in less time than if using only hand crews.
2. It requires less time and effort to remove multiple stems or brush than other methods.
3. Feller Bunchers may remove hazard trees with less risk exposure than any other means (snags, widow makers, trees on fire).
4. Hot saws can be used to cut sections out of large wood laying on the ground with or without fire in them, and help crews untangle blow down log jams.
5. A tracked Feller Buncher with hot saw and experienced operator can cut about 1500 stems per shift. Production can run 4,000 to 5,000 stems per day with 2 shifts. This may equal 8-10 acres per shift, or a 20' wide swath extending 4.1 miles in one shift.

6. A tracked feller buncher used to harvest a 66-acre block of 9" average dbh lodgepole pine on 45% slopes completed the project in 2 – 12 hr. shifts. This included two 10 hr. shifts of cutting with a 2 hr. maintenance period at the end of each shift. The harvest unit averaged about 12 MBF per acre, or about 200-250 merchantable stems per acre.
7. Using a Feller Buncher to construct a 40' wide fuel break in Grand Fire and Subalpine Fir, it took 10 minutes to clip the 40' swath for 150' in length, and reach in another 20' on both sides to remove understory trees.
8. Fuel breaking and contingency fireline construction on the Modlow Tosten Fire in CY2000 required Feller Bunchers to cut and move trees from beneath high voltage power transmission lines. They were restricted in that they could not sever the tree and lift it up before moving it out of the right of way. They held the tree, severed it, then tilted the cutting head forward without lifting it near the transmission lines, and then moved forward to discard the trees outside the power line right of way.
9. During another wildland fire, a Timbco Feller Buncher with hot saw required 2 rubber tired skidders to keep up with it's production rate of felled trees. This same ratio was successfully used on the Wedge Canyon Fire during CY 2003.
10. Whole tree skidding to remove limbs and tops from the fireline may require delimbing at the decking area. A Slideboom or Stroke Delimber may be used to provide delimbing and log bucking. Slash is handled separately from the logs.
11. Whole tree skidding can create an enormous tactical problem for log storage that may create a fire problem. Locating storage areas prior to machine operations is critical.

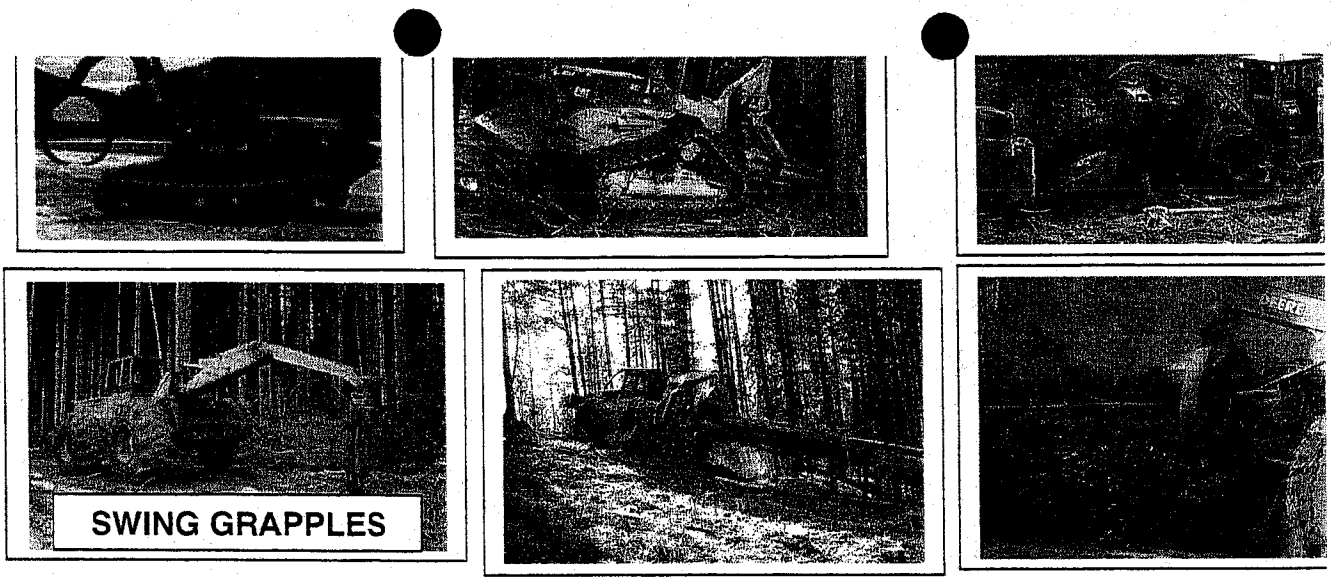


SKIDDERS

Skidders are the means to move logs, trees, and debris to locations for disposal or collection points for removal or storage. The log skidder used to operate almost exclusively with cable chokers that are stored and controlled by a rear-mounted winch. Many of these have integral arches to lift log ends off the ground. Efficient contemporary skidders today have grapples mounted on a swing boom, referred to as a swing grapple. This allows the operator to pick up several pieces at one time, or a bunch of brush by either backing up to it or reaching out to the side. It also allows the operator to pick up individual pieces and bunch them to get a full drag. Skidders with swing or parallagram grapples can also be used if following a dangle head tree harvester.

Skidders can be wheel mounted or track mounted; track mounting can be hard tracked or soft tracked. There are advantages to soft tracks when on fragile soils such as riparian areas, or steep rocky terrain. In both cases the soft tracks leave a softer footprint and affords better traction than a hard track such as a conventional dozer.

Brands like FMC or KMC are popular soft track skidders, especially when equipped with a swing grapple. They are also regularly used as Skidgines when a water tank is added.

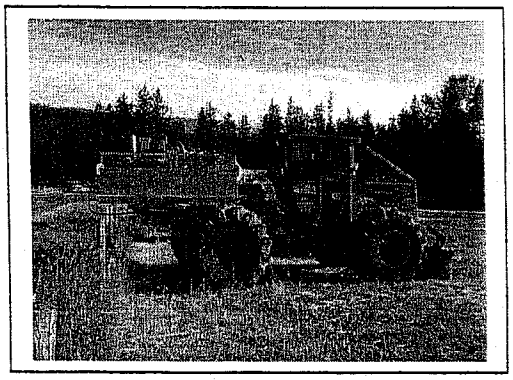


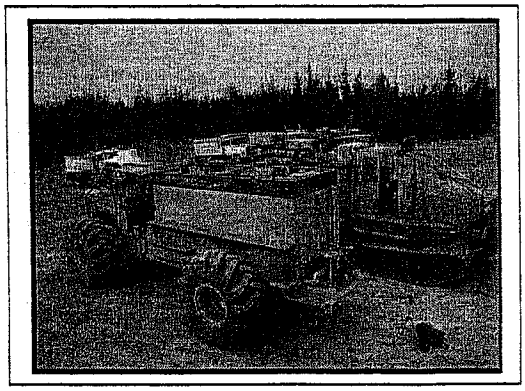
SKIDGINES

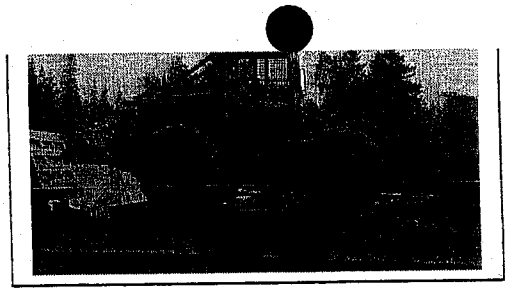
A Skidgine can be a rubber-tired skidder or hard or soft tracked tractor with baffled water tank and pump system securely fixed to the machine. A mechanical engineer must certify that the tank and pump have been mounted properly and does not impair the machines center of gravity for use as an approved Skidgine in the Northern Rockies. Tanks can be removable or integrated as a fixed component of the machine. Side hill use is the biggest safety concern for operators.

In the Northern Rockies Skidgines are required to have a 3" dump valve, 4" tank opening, a hose reel (open or enclosed), a pressure pump with minimum 30 gallon/minute at 70 pounds per square inch, 1 operator and no crew, and is paid by the size of the skidder and amount of water it hauls (per 100 gallons). Skidgines should have tanks designed for usable water. This compensates for being on slopes so that tanks designed for engines are not necessarily adequate for Skidgine use. Chains should be available to the skidder, but not necessarily installed (residential areas).

Skidgines have the versatility of bringing water over rough terrain and using it with a crew in remote areas. It can travel quickly on flat ground and moderate slopes. These features have made Skidgines excellent patrol tools and initial attack for spot fires along remote sections of fireline.



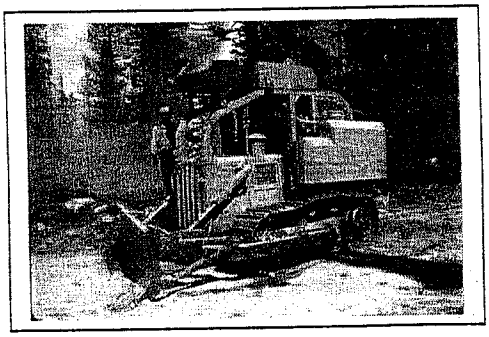




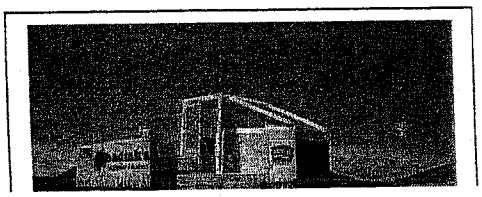
Skidgines are good tools for patrolling fireline, Hotspotting, mobile attack, hauling water to crews, and assisting crews during mop up. Although they are not allowed to haul people, they can haul equipment and supplies. These machines do offer the option of emergency extraction of firefighters during fireline abandonment. This method should never be relied upon as a primary means of emergency response.

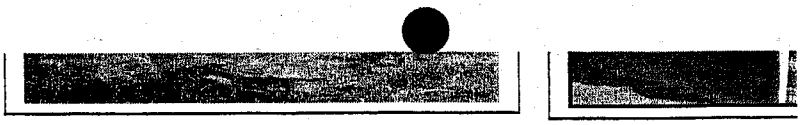
They have been used successfully during initial attack of spot fires and as a first out initial attack tool in the field. They are highly mobile and easily transported which provides versatility during initial attack as well as moving from one point to another on a large fire. This feature is desirable for spot fire containment on large fires as they can be strategically located for quick response, using water for rapid knock down and then using the blade to construct fireline before the fire has the time to build momentum. Should the fire exceed the first fireline, this machine can quickly reinstall another.

Hard track Skidgines are dozers equipped with saddle tanks in the 300-gallon range. They usually have their blade attached and can provide scraping tasks along with water support. Their contract specifications in the Northern Rockies are the same as



Hard track dozers equipped with saddle tanks are referred to as "pumper cats", and soft track skidders are referred to as "soft track pumper cats". These can distribute equipment weight more evenly, which causes less impact on the ground. They usually have a front blade and are designed to carry the tank and water weight. Tank volumes range from 500 to 1600 gallons with an integrated or attached tank. They are a little faster than a dozer, but have a high maintenance record, and are usually very loud.





Skidders with a strapped on tank and swing grapple combination offer firefighters options. The water tank can be dropped, and the skidder-grapple combination used with crews for brush piling along fuel breaks or around homes. The front blade and water are used in combination during hotline construction (spot fires or initial attack), front blade used to open roads by removing Kelly Humps, or again drop the tank and use the machine as a skidder.

Here is an example of efficient Skidgine use. A squad of firefighters had to mop up a debris pile next to the fireline, which had mixed dirt, brush, logs and fire in it. The water tank and pump was dropped into the fireline and the swing grapple was used to pick out the brush and logs from the pile, shake the dirt from them, and then place the burning material near the water tank in the fireline where the crew used water to mop it up. As the pile diminished in size, the blade was used to further open the pile for suppression.

When the Skidgine is working but stationary (water delivery), the blade should always be grounded (lowered fully to the ground). If a swing grapple is attached, it should be positioned to the opposite side of the machine from where firefighters are working and also grounded. Night-lights are necessary for use at night as well as during daylight when vision is obscured by dust and smoke. Make certain routine maintenance includes hosing out dirt and debris from all locations on the machine. This will prevent possible overheating or spot fires on the skidder later on.

Skidgine use for water delivery needs to be well planned. If a local water source is not accessible and efficient to use, be certain to order adequate water tenders or forwarders with tanks to service Skidgines. Skidgines are quick and maneuverable, but their value is having water to use on remote sites, not spending their time traveling to get it.

Skidgine operators are skilled and technically proficient with their machines. They are not necessarily skilled firefighters and may lack a thorough understanding of firefighting objectives and tactics. It is desirable to provide some management and safety oversight for them, much like the Dozer Boss position, only oriented toward Skidgine management. Anyone filling this role must be familiar with the capabilities and limitations of these machines. Contractors and other operators can provide this service if they meet NWCG basic firefighter standards. Machine operators are considered technical specialists and can operate the machine, but should not be making tactical decisions regarding actual fire suppression.

LOG FORWARDERS

Log Forwarders can be either track or rubber tired mounted. They are designed to use constructed trails or wander through a harvested stand to pick up manufactured logs, place them in their log bunks and haul to a deck for truck loading and hauling. The adaptation to wildfire suppression is to:

1. Facilitate log removal from a major fuel break by working with a cut to length felling operation.
2. Place a large volume, baffled tank in the bunks to establish a water supply in remote areas over rough terrain.

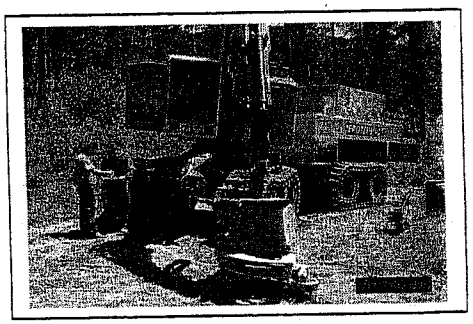
Timbco Forwarders are the only machines where the knuckle boom and log grapple can swing from the cab front to the back. This is illustrated with the last two pictures above.

Forwarders offer self-drafting pumps but are usually supported with water tenders to reduce travel and fill times. They can support multiple hose lines with gravity or pressure fed hose systems. They provide an excellent water source to refill porta tanks located away from roads. They can use rubber tires or soft tracks for improved traction and stability.

Here are some considerations to make prior to ordering forwarders:

1. The number of operational periods to be used may have a bearing of water tank size and track or wheel mount, as well as use on roads or off roads.
2. If you desire 24-hour service order machine operators double shifted.
3. These machines are large and will require adequate ware yard space, as well as support vehicles (tractor truck, lowboy, maintenance vehicle).
4. How will you communicate to the operator, will it be through a company helper with their radio system, or from fireline overhead with a fire radio?
5. Low tank profiles provide better safety performance and allow visibility over the top of the tank.

A specialized log forwarder is the Proteus II Fire Master has a Timber Pro single grip harvester head that can convert to a log forwarder in 10-15 minutes. It has a self-leveling cab, bar saw to 36", grapple grips, and a 3,000-gallon water tank. It is mounted on soft crawler tracks and supports hardline or 1 ½" hose lays., a 4" dump valve, and 18 hp auxiliary pump and separate trash pump that fills the tank in 13 minutes.



Experience on one fire demonstrated that one forwarder with a 2800 gallon water tank traveling 1 mile (each way) to fill two pumpkins was able to maintain a constant water supply.

EXCAVATORS

Excavators are designed for digging. They have a knuckle boom crane with a digging bucket and some kind of assist appendage to the bucket. They are usually hard track mounted and were designed for digging trenches and holes. The adaptation to fire suppression and fuels projects is multi faceted which gives us many options for use. The knuckle boom allows the working end to reach out away from the cab, and has been used to dig fireline, cup trench, pick up and move debris from large fuel jack pots, assist crews doing mop-up, prune reserve trees, slash pull back from reserve trees, slash piling, and rehabilitate fireline, safety zones, roads, camp sites, and can fix anything a dozer creates.

Tracks, machine balance, knuckle boom, dozer blade, and bucket combinations all give excavators advantages to work on steep slopes and steep side hill slopes. It is necessary to order excavators with "thumbs" to allow more precise actions, such as disassembly of piles and jackpots.

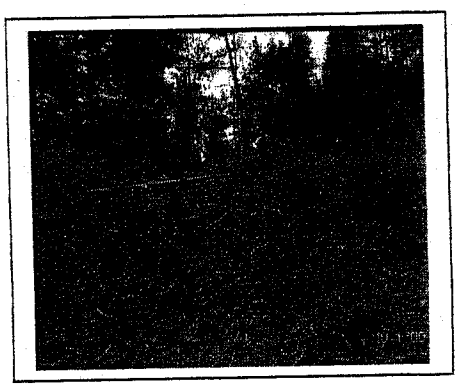
Some excavators have 6 way blades and can operate with brush rakes. Blades also provide necessary anchoring when working on steep slopes. The boom reaches out and helps pull the machine while the tracks turn, and the blade is grounded on the downhill side to provide purchase for the machine. Excavator cabs are not self-leveling and the machines are sensitive to uneven terrain because of a high center of gravity. Operators use the boom and blade to effectively work slopes up to 100% and side hills of 45º. Operator skill is in this environment is critical, and local contractors doing basement digging may not be the best choice for woods work.

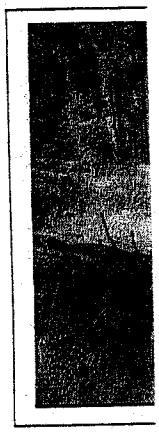
Excavators have proven to be excellent fireline diggers in rocky terrain. They provide a better service than dozers in heavy fuels because they pick material up, they can sort through green and burned debris, and build dirt free piles. These features make the excavator good for hotline construction because the boom offers separation of the operator from the fire. They can also scoop up hot spots and move them back into the fire further from the perimeter. In some instances, hose can be fashioned onto the boom and water applied to hot spots to cool them off for further work without exposing ground forces.

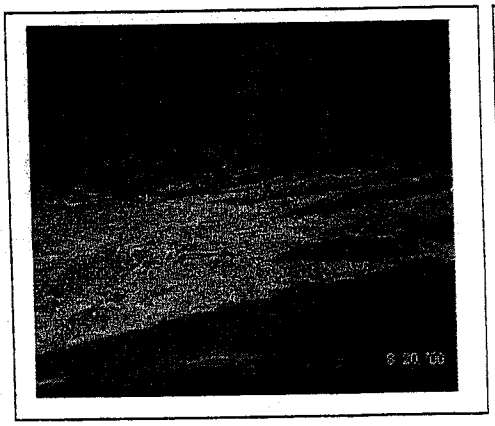
Excavators have been used successfully as initial attack tools. They are highly mobile, can off and on load most anywhere because of the boom and bucket assists. They can be used around structures because of maneuverability and have been successful leaving minimal disturbance in homeowners' yards.

Excavators do not construct fireline as quickly as dozers, however they do less heavy-handed construction that requires less rehabilitation follow-up. Their versatility with boom and bucket also makes them excellent machines for fuel break construction.

Excavators have become the machine of choice for completing site rehabilitation. Reshaping terrain contours and bucket and thumb dexterity provide grooming and debris placement that improves our chances for rehabilitation success.



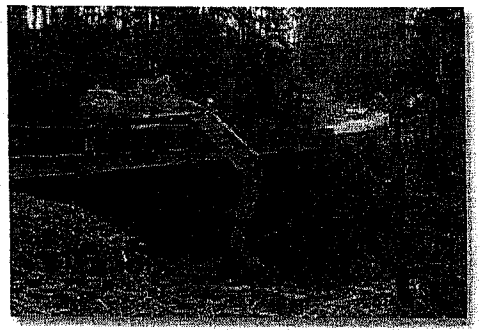


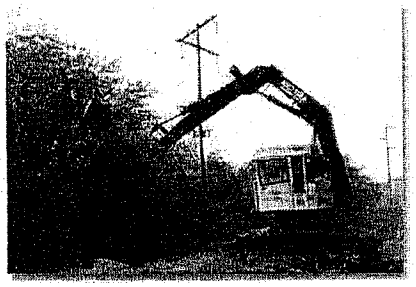


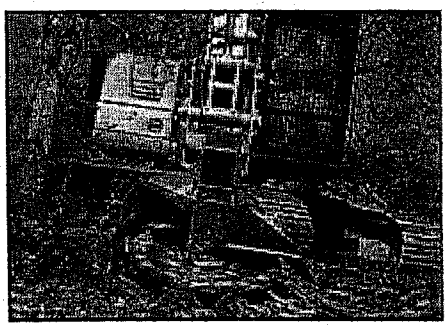
Other Equipment

Slash Bundler: The slash bundler could be described as a "trash compactor" that is mounted on an 8-wheel drive "forwarder" that is normally used for transporting logs from harvest units to log landings. The bundler picks up tree limbs and tops that are normally leftover residue from logging or other fuels reduction activities and rolls the material into compressed "logs" bound with twine. The "slash logs" created by this machine are meant to be transported by log trucks to chipping facilities that turn the slash logs into wood chips. These chips can then be burned in "cogeneration plants" to power steam turbines that create electricity.

Slash Buster: This is an excavator attachment that does several jobs and is well adapted for the fireline or in the Urban Interface. It can shred whole trees, mulch ground debris, wood, shrubs, and can be used to mulch prune large trees. It is well adapted to clean out groups of pole and sapling size trees, however the debris is left on-site.

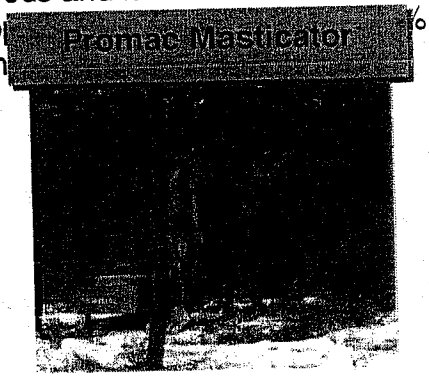




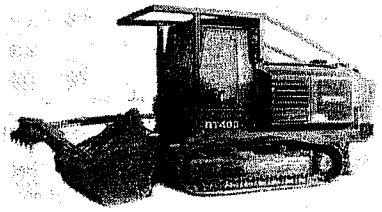


Masticator: Masticator: A masticator is a piece of heavy machinery consisting of a backhoe-type vehicle with an articulating arm or excavator with an attachment cutting

head. On the end of the [illegible]m is a device that chops or flails w[illegible]y vegetation. The machines come in various sizes for different needs and land characteristics. Masticato[illegible] can [illegible]d can o[illegible]%, exca[illegible]er groun[illegible]



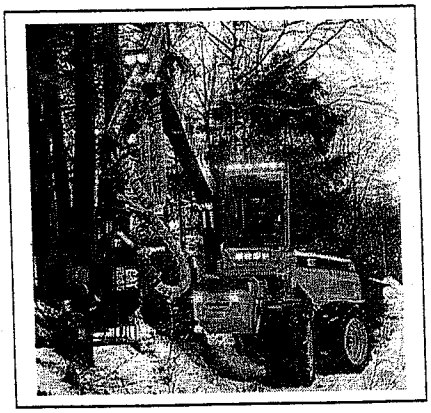
Hydrostatic Brush Cutters: These are a series of different heads that cut and mulch brush and trees ranging from 4" to 12". They usually mount on a rubber tire machine and have been designed for urban fuels treatment projects or large-scale fire breaks in the shrub fuel types likes manzanita, chaparral, and Gambel Oak.

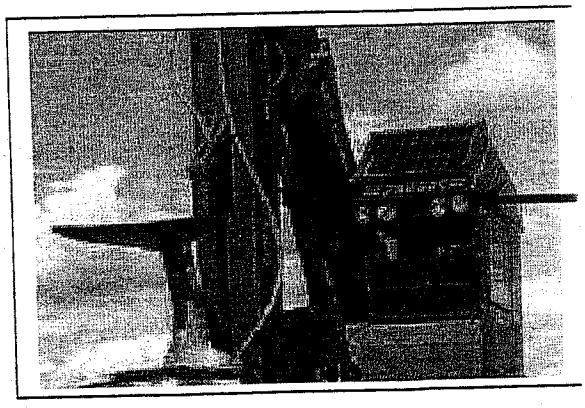


Big Iron Strategy

Night Operations

Big Iron was developed by an industry that is geared for high production. Consequently these machines are built for durability and endurance. Combustion engines require a cool environment to perform best, and night conditions provide that during the fire season. Most machines have integral lighting systems that are designed to provide wide area illumination for the operator.





Consider night operations as the time to gain productive ground, and therefore by limiting the number of firefighters operators can focus on their job and not on distractions. If the operation is large in scope, such as a long contingency fireline or primary fireline, and night operations are critical, consider using portable light plants at calculated points to assist operators and ground forces.

Initial Attack

Some of the Big Iron attributes actually provide better opportunities for success during initial attack than the conventional use of crews, engines, and helicopters:

1. Excavators as describe earlier are versatile and maneuverable, they are transported by lowboy and do not need special locations to off-load or on-load to the trailer. They travel slightly faster than a fit firefighter and offer several functions that can be used for fire suppression.
2. Skidgines also provide a very maneuverable machine that is easily transported and off loaded. They provide some fireline construction opportunities and pressurized water delivery. If accompanied with a swing grapple there are additional options that can be applied. Also used as a means to deliver supplies and equipment they offer new logistical alternatives to remote locations.
3. Forwarders can be used during initial attack although they require more consideration for transportation and use, they do offer large quantities of water to crews or to support Skidgine operations off road. These would be more of a support to initial actions, or considered as an automatic dispatch during extreme conditions. They would likely have to be supported by water tenders if there are no reasonable fill sites close to the fire.
4. Feller Bunchers can be used for initial attack but also require more thought for transport and off loading. They can be used in areas where tree or shrub densities would slow down fireline production. Depending on the machine there may have additional attributes to help firefighters as the fire suppression activities progress. Timbco feller bunchers are well known for their ability to work on steep slopes (45%-60%+).

Extended Attack

Extended attack consideration would conform to initial attack or large fire use.

Large Fire Suppression

Big Iron considerations revolve around the scope of the work. If large areas will be affected with primary fireline consider the time of day to best facilitate several machines working in tandem. Also consider the type of terrain and fuel that will be manipulated to help determine the size and kind of machines. This is also the time to consider how site rehabilitation will occur after the fire is over and which machines would do the best job.

Individual machines can compliment or provide primary services to isolated portions of a large fire and assist crews with light hand tactics or mop up. Also consider some machines as primary tools in the urban interface. Skidgines and excavators have done great work defending structures and they complete many of the tasks quicker and safer

than crews. Feller bunchers that grab and hold trees will provide the ultimate directional felling opportunities.

During extreme conditions, equipment task forces can be strategically position to respond at any level of fire management. Primary to this occurring are the logistical requirements of contracting, ware yarding, and management oversight.

Experience with these machines are highlighting opportunities to replace air tactics with ground based actions which can free up aircraft for critical assignments, reduce management risk, and increase cost efficiency.

Task Force Combinations

The purpose of an equipment task force is to produce timely results. The efficiency of large machines ultimately provides the product in a manageable time frame that reduces overall costs. The key is to assess what fuel types and terrain pose the highest risk or resistance to control.

If trees are abundant with dense understory poles and saplings and shrubs comprise a significant component as ladder fuels, then consider using 1-3 Feller Bunchers in the lead, then rubber tired skidders with swing grapples to skid and deck logs, and pile brush and sort saplings and pole size trees if they will be disposed of separately.

If shrubs comprise the majority of the tree understory, and they pose an important threat as ladder fuels and contribute significantly to fire spread, then consider using some kind of brush cutter, or mulcher ahead of a 1-2 Feller Bunchers. Follow this with a couple skidders with swing grapples.

If tree size material will accumulate in large quantities, consider processing these tree lengths either on site or at a landing. If done on site and their slash will not contribute to the fire and can be handled adequately consider using a dangle head cut to length system backed up by rubber tired skidders with swing grapples or log forwarders.

You may also consider using mulchers to follow and process slash into the soil. Fireline construction can occur in several ways that include small dozers, rubber tired skidders using their blades, excavators, or relying on the soil exposure caused from skidding tree lengths.

On steep terrain or where light hand tactics are desired, a minimal width fuel break may be constructed using a tracked Feller Buncher, a Rubber Tired Skidder to remove trees, and an Excavator to construct fireline.

Open stands or where there is abundance of old growth, disease or snags, the fireline can be constructed using an excavator followed by a Feller Buncher that removes hazard trees and snags. The Feller Buncher can also break apart log jackpots that are close to the fireline that will pose a threat to fireline security.

Fuel breaks and shaded fuel breaks can be constructed as mentioned above, and then improved for holding or major burnout operations using certain brush cutters to treat shrubs and litter as well as prune trees 20-30 feet up their boles.

Firelines can be worked with crews supported by Skidgines or Log Forwarders equipped with water tanks. They provide water support through mobile hot spotting and mop up, hose lays, refilling crew bladder bags, hauling additional hose and appliances, or mobile attack on running surface fires.

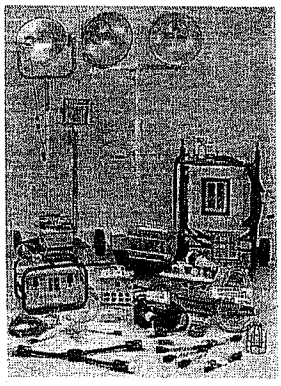
Skidgines can be supported with Excavators for holding and improving fireline. They can also be used to support crews during mop up in heavy fuels, as well as initial attack on spot fires. Both of these pieces of equipment are good for backing up burnout operations. Excavators are also good to follow dozers and improve their fireline by breaking up and sorting through the berms of dirt and slash, and removing unburned heavy downed fuels to facilitate incidental burnouts.

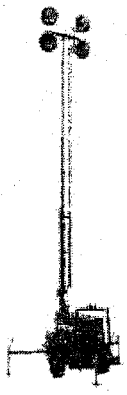
Communications

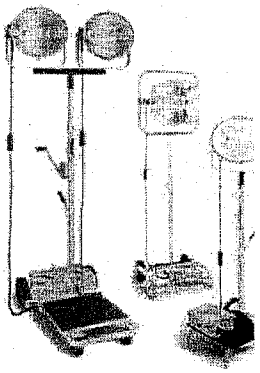
Our approach to equipment use on fires has been to provide a Dozerboss that communicates directly to the operator using hand signals or a radio. Dozers will often be lead or follow ribbon lines during hotline construction. It is important to allow the operators conditions where they can focus on their tasks without being disturbed with a backdrop of radio noise. It is also imperative they not be constantly watching out for ground personnel for directions or distractions. It may be desirable to provide an industry person to work and communicate with each piece of equipment and allow fire overhead to then manage equipment tasking while industry manages doing the tasks. This would require 2 separate radio systems where the contractor would provide one of them.

Lighting

It may become necessary, particularly at decking areas, to provide a wide area of illumination because of the traffic and multi-tasking that's going on. This kind of lighting is available commercially and can be rented. The advantages are extending work periods and production when timing is critical.







Risk Management

By introducing large scale heavy equipment use is to modify, eliminate, and introduce new risk to firefighters. Although we have used many of these machines in the past, our experience and prejudice lies with dozer use because we are the most experienced with them. It becomes necessary to look at the products other Iron offers and what the

benefits are with their use.

1. Hard shell protection to the operators from overhead and rolling hazards.
2. High quality integrated lighting for day or night use.
3. Controlled environment in the operator compartments that provide better working conditions.
4. Higher production than compared to ground crews, with less work exposure to firefighters.
5. Higher sustained production so that diminishing production rates are not considered.
6. They can provide light or heavy-handed tactics as directed.
7. Machines can provide more fire fighting opportunity to remote areas and reduce the reliance on retaining aircraft through mop up and holding actions.
8. Machines provide additional resources such as multi tasking of an individual apparatus.
9. Every cutting machine is better than a "C" Faller because of solid directional felling, some machines can pick up the tree and place it, some can carry it to a different location, industrial overhead protection for the operator, increased heat load resistance, controlled environment for the operator, and double shifting endurance.

Future Needs

As identified in the Northern Rockies White Paper for Big Iron use these are the future needs:

1. Publicize Equipment Capabilities

    a. Knowledge of current capabilities of equipment is necessary to understanding what our opportunities are, and where we can be successful. Building an understanding of successes is key to dispelling our traditional view of equipment use.

2. Education of capabilities and functional use.

    a. Education of specific equipment use tactically, on-site equipment management, and strategic management (MAC, Area command, Incident Management Team, ICT4, ICT3, TFLD, DIVS).
    b. Identify how to assemble, dispatch, and use equipment as either single resources or modules. Realizing some machines work best in concert with others, does this become a modular approach (slash buster, tree harvester: based on slope and fuel type conditions).
    c. Specific management information designed for specific ICS positions, e.g., Resource Advisor, General Staff (IMT), Management Team Leaders (Resource Management Plan development as it affects fire and fuels management).
    d. Realizing an expanded use of various heavy equipment will require revision of tactical publications, ICS position requirements (DOZB ..... ?), and possibly identify additional positions.
    e. Understand support management needs for planning equipment use e.g. GIS mapping of soils, fuel types, and slopes for planning machine specific assignments, contingency planning, and equipment staging areas.

3. Equipment Agreement Data Basing

   a. Improvements are needed to increase access to available equipment. Current restrictions inhibit use of available equipment outside of where the equipment was signed up within the geographic area and nationally.
   b. Dispatching of local equipment must improve to provide consistency and timely resource allocations.

4. ICS Typing of Equipment and Standardization

   a. There is a need to type equipment more specifically to function and performance. Feller/bunchers come in different sizes and configurations and have different requirements for use, maintenance, transport, and ultimately payment. Log forwarders, excavators, and Skidgeons also present the same array of differences. The additional consideration involves a standard piece of equipment as already mentioned that is redesigned and offers additional features. This affects typing and contracting specifications.
   b. Develop a national database of equipment including pictures and documented performance and production rates.

5. Operator Standards

   a. A need to define minimum fire qualifications standards for equipment operators involved with fireline tactics, and others for those involved with logistical support, burned area rehabilitation, and fuels management projects.

6. Strategic Management

   a. There is a need to develop strategic management criteria for equipment that carries the same implications as current national resources, e.g. aircraft, type 1 crews, and dozers. Pre-positioning equipment at the geographic area and national levels will affect contracting and dispatch requirements along with oversight positions and logistical considerations.

7. Safety

   a. Recent experience demonstrates clearly that effective use of heavy equipment can be done safely while providing cost efficient production, and eliminating or drastically reducing risk to additional fireline personnel.
      i. We need to specifically identify risk reduction.
      ii. Identify new risks and mitigations created by equipment use.
      iii. Identify new use options created by using equipment, which mitigates unacceptable risk, e.g. night operations, crew availability to other parts of the same fire or other fires, different shifts and shift lengths for equipment versus personnel.
      iv. Review how equipment use meets the 30 Mile Abatement Standards.

8. Review Existing Policies

a. Acceptance of organized equipment use may necessitate review of land management policies that un-necessarily restrict equipment. Examples of this would be slope, and riparian zone restrictions.
b. A review of policies that fit equipment use, e.g. safety requirements from OSHA, NIOSH recommendations, or agency specific direction.

9. Identify Use Areas Other Than Fire Suppression

a. There exists a need to define where and how heavy equipment can be used for fuels management projects, rehabilitation work involving watershed restoration, and other resource areas.

10. Tactics and Equipment Use

a. Mechanized equipment has been used in recent years to meet a number of different needs. Operators and fireline managers have adapted and innovated different and new ways to construct fireline, contingency lines, patrol firelines, deliver water, construct fuel breaks, and the list continues. All of this creates different methods to facilitate tactics, which has to be captured, documented, and instructed.
b. There is a need to reflect these additions and changes within existing materials, e.g. Wildland Fire Suppression Tactics Guide.
c. There is a need to examine strategic planning elements of equipment use and support at the MAC and Area Command levels.

11. Incident Command Structure.

a. There is a perceived need to identify a specialist position that advises IMTs on heavy equipment use and support. Designed much like the Chainsaw Coordinator, this position would facilitate team planning for equipment, on-going equipment evaluations of performance and condition, and liaison with contractors regarding issues involving performance, contract use, and payment.
b. There is a perceived need to identify an equipment trained fireline oversight position to replace the contemporary Dozer Boss. This person would be more versatile for site management for a variety of heavy equipment.

12. Communications

a. Heavy equipment has different communications needs based on operator preferences, job requirements, environmental conditions, and nearby workforce and overhead oversight. These have to be identified, and developed to meet fireline communications needs.

13. Future Needs

a. We (the geographic area) have to be forward thinking and provide industry with our needs; specifically what we want, defined by what we have, the expected results, and the limitations we impose. We have to key industry to develop what we need and not expect them to figure it out.