United States
Department of
Agriculture

Forest Service

**Technology &
Development
Program**

2500-Watershed, Soil
and Air
5100-Fire
December 2009
0925-2828P–MTDC

Blower Clears Established Firelines in Hardwood Forests Without Disturbing Soil

Blower Clears Established Firelines in Hardwood Forests Without Disturbing Soil

Keith Windell
Project Leader, MTDC

Greg Burkhart
Fire Engine Operator, Shawnee National Forest

USDA Forest Service
Technology and Development Program
Missoula, MT

7E72F56 Low Impact Plow Line Sweeper/Blower

December 2009

Contents

Acknowledgments

The Missoula Technology and Development Center would like to thank Allen Nicholas, forest supervisor of the Shawnee National Forest, for proposing this project. Jon Teutrine, the district fire management officer on the Hidden Springs Ranger District of the Shawnee National Forest, was instrumental in coordinating the field evaluation of the Buffalo Turbine debris blower and initiating important equipment modifications during the field tests. The time and motion study and equipment modifications would not have been possible without the help of numerous Hidden Springs Ranger District personnel. MTDC also wants to thank fire engine operator Greg Burkhart for writing an excellent report that has been merged into this document.

Introduction

The Missoula Technology and Development Center (MTDC) was asked to investigate how to build fireline while still conserving the productive A-horizon soils during periodic maintenance of prescribed firelines in a hardwood forest. The project proposal envisioned an attachment that would use a sweeping and blowing action to remove leaves from the firelines. This report describes the site conditions at the Shawnee National Forest and discusses the equipment the forest has available for mounting an attachment. The results of a market search are discussed along with the equipment selected and the modifications that were made. MTDC's solution for clearing existing firelines was a high-speed, high-volume blower that could be mounted in the bed of a utility-terrain vehicle (UTV). The blower is so powerful that it does not have to use a sweeping action. This report includes the results of a time and motion study conducted by the Shawnee National Forest's Hidden Springs Ranger District fire crew. The UTV-mounted blower is an efficient alternative to the backpack leaf blowers that were being used to remove leaf litter from firelines established for prescribed fires.

Highlights...

- Established firelines may be used every few years for prescribed fires.
- Using a blade to clear the firelines every few years would remove more and more of the productive upper layers of the soil.
- When leaves are moist or wet, or when needles are dry, a powerful blower can clear leaves and needles efficiently from established firelines.
- Because the blower works even when leaves are wet, units can be prepared for prescribed burns earlier in the spring, extending the period when prescribed burns can be conducted.

Project Proposal

Allen Nicholas, forest supervisor of the Shawnee National Forest in Harrisburg, IL, submitted the following project proposal:

Maintenance and restoration of many of our oak/hickory forest communities includes repeated treatments of prescribed fire. Between establishment of the initial plow line and subsequent treatments, leaf litter accumulates. Replowing prepares the line to hold fire, but also displaces the upper portions of the A-horizon of the soil with each additional pass. This can reduce the productivity of the fireline over time.

Our idea for a solution is an attachment for a low ground pressure implement that would sweep and blow the organic litter off the fireline with minimal disturbance to the surface horizons of soil. The attachment could consist of an angled, rotating brush that would cover the width of the plow line and automatically adjust to skim the surface of the ground. A blower could also help clear debris off the line.

This design would decrease the potential for soil compaction and reduce soil displacement, which would conserve the productivity of the firelines. It would also allow operators to quickly prepare old plow lines for implementation of prescribed fire treatments.

Shawnee National Forest Site Visit

On April 26, 2007, MTDC project leader Keith Windell visited the Shawnee National Forest to better understand the forest's needs and the working environment. Forest Service employees from the Shawnee National Forest who participated included Jon Teutrine (Hidden Springs Ranger District's fire management officer, figure 1) and Tom Neal (forester).

Figure 1—Fire Management Officer Jon Teutrine in typical Illinois hardwood forest.

During the visit, Windell intended to gain a better understanding of the forest's equipment needs, examine the mobile machinery the forest already owned, walk on the prescribed firelines the proposed attachment will be used to maintain, and discuss some equipment options MTDC had been thinking about.

The forest's basic need is to remove leaf litter that collects on previously established prescribed firelines (figure 2). Leaves need to be removed from a line at least 3 feet wide and preferably 4 to 5 feet wide.

In many areas, equipment wider than 5 feet would not be able to maneuver through the fireline corridor. Obstacles include small logs and branches (figure 3), waterbars, closely spaced trees, occasional small saplings, sharp turns in the fireline, and steep, narrow gullies. The line is sometimes boggy and machines occasionally get stuck and have to be winched out. Whatever equipment is developed to maintain the firelines should not destroy the existing waterbars.

Figure 2—Tree spacing can be tight in hardwood forests.

Figure 3—Typical debris found beneath leaf litter on the hardwood forest floor.

In the past, existing firelines have been cleared with a straight blade mounted on a dozer. John Depuy, the soil scientist on the Shawnee National Forest, notes that clearing the firelines with a blade removes the productive A-horizon soil layer, which is undesirable. Now, hand crews clear existing firelines on foot, using chain saws and portable backpack blowers. One sawyer and three crew members with backpack blowers can clear leaves from about 40 chains of fireline per hour (a chain equals 66 feet). One desirable feature of the blowers is that they do not form berms of leaves on the sides of the fireline.

The Shawnee National Forest staff hoped that MTDC's solution would use equipment that the Shawnee National Forest already owned. Equipment mounted on a trailer was probably not a good solution because the trailer would have to be pulled through steep, narrow gullies. Equipment attached directly to a prime mover could be raised when crossing steep, narrow gullies. Another option would be to mount the equipment in the back of a prime mover.

The Shawnee National Forest owns a John Deere JD450 crawler tractor, a New Holland skid steer with steel tracks over rubber tires, a Sweco trail dozer, a John Deere Gator UTV, a Polaris Ranger UTV, numerous all-terrain vehicles (ATVs), and an IHI IC-30 crawler carrier.

Shawnee National Forest staff members felt that the New Holland skid steer and Sweco trail dozer are heavily used for other purposes and would not be available for maintaining prescribed firelines. The skid steer might be unstable on sidehills. The Sweco trail dozer has not held up well in some rough areas of the forest. Trail construction implements had to be reattached after the implement's attachment bolts sheared off.

The Polaris Ranger UTV (figure 4), the John Deere XUV Gator UTV, and several ATVs all had light frames that did not seem suitable for mounting an attachment in the front that could be raised easily to clear a steep, narrow gully.

Figure 4—The Polaris Ranger UTV that Shawnee National Forest staff members wanted to use for clearing prescribed firelines.

Quadivator Inc. (http://www.quadivator.com) makes a front-mounted ATV Power Broom. The Power Broom has a self-contained power unit at the back end of the ATV. A frame mounted under the ATV uses rubber belts to transmit power to the broom. The Power Broom did not seem suitable for the rough terrain on the Shawnee National Forest. The UTVs and some of the ATVs had small utility beds that could accommodate smaller slip-in units.

The JD450 (figure 5) crawler tractor was not considered available for clearing the existing firelines because it might be needed to suppress wildfires. It would be unwise to have to reconfigure the JD450 with initial attack implements after the unit receives a dispatch to a fire. Another drawback is that the JD450 requires a skilled operator, a large transport trailer, and a driver with a commercial driver's license. During some periods, weight limits are reduced and road surfaces become boggy, which could prevent the JD450 from being brought to areas where firelines needed to be maintained.

Figure 5—The JD450 crawler tractor that the Shawnee National Forest uses for fire suppression.

The IHI IC-30 (figure 6) crawler carrier was considered for the task because it has a robust machine frame and bed on back. The main drawback to using the IC-30 is that it does not have an auxiliary hydraulic circuit to power implements.

Figure 6—The IHI IC-30 crawler carrier owned by the Shawnee National Forest.

The IHI IC-30 has overheated, but this could be a correctable maintenance issue rather than an inherent design flaw. The IC-30's limited hydraulic system does not lend itself to diverting fluid to power a sweeper or blower. It might be possible to pull about 8 or 9 gallons per minute of flow without automatically locking up the IC-30's brakes, but the IC-30 would have to operate in low forward speed range. A slip-in, self-contained power attachment or an attachment that does not require power at all would be needed for the IHI IC-30.

Equipment Investigated

MTDC conducted a market search for high-volume, self-powered leaf blowers and for sweeping attachments. Basic blowers were available, but they did not have the specialized ducting and nozzles that are needed to deal with rough terrain. One portable unit that looked promising was the Cyclone KB3 debris blower, made by Buffalo Turbine (http://www.buffaloturbine.com, figure 7).

The Cyclone KB3 can put out 10,500 cubic feet per minute of air blown at 180 miles per hour. It has a wireless remote control. The suggested retail price is $6,495 (2009 dollars) for the towable unit (part No. BT-CKB) and $6,345 for the skid-mounted unit (part No. BT-CKBS). Other useful accessories for the Cyclone KB3 include a special order 22½-degree elbow section (part No. MISC 22-degree elbow section) costing $100 (2009 dollars) and a tach-hour meter (part No. 1372) costing $64.96. The Cyclone KB3 comes from the factory with a rigid polymer chute. Aluminum ducting may be substituted at no extra charge.

The Cyclone KB3 debris blower is commonly used on golf courses, but has been used by the United States military in Iraq to clear debris from streets, exposing improvised explosive devices (figure 8). The Cyclone KB3 debris blower also has been used to clear water off the field before major sporting events, including the Super Bowl.

Other high-performance units considered included the BWT 180 and BWF 180 gas engine debris blowers (figures 9 and 10). These units, made by AgriMetal Co., are rated at 10,000 cubic feet of air per minute blowing at 150 to 160 miles per hour. The BWT 180 blower costs $6,285 plus freight (2009 dollars). The BWF 180 blower costs $6,535 plus freight.

Figure 7—Buffalo Turbine's Cyclone KB3 debris blower. (Photo courtesy of Buffalo Turbine)

Figure 8—Cyclone KB3 blowers used to clear debris when checking for improvised explosive devices in Iraq. (Photo courtesy of Buffalo Turbine)

Figure 9—AgriMetal's BWT 180 high-performance blower pulled as a trailer. (Photo courtesy of AgriMetal)

Figure 10—AgriMetal's BWF 180 front-mounted high-performance blower. (Photo courtesy of AgriMetal)

Many different sweeping attachments are commercially available for smaller equipment platforms (figures 11 and 12).

Figure 11—M-B Co. Model SHL sweeper, 6-foot unit, list price $5,725 (2009 dollars, photo courtesy of M-B Co.)

Figure 12—M-B Co. Model MCD-UV sweeper, 6-foot unit, list price $5,635 (2009 dollars, photo courtesy of M-B Co.)

A few companies make rotary broom attachments, including Sweepster (http://www.sweepster.com), York Modern Corp. (http://www.yorkmodern.com), and M-B Co., Inc. (http://www.m-bco.com). Some of these attachments require a machine that can provide a significant hydraulic oil flow. The Shawnee National Forest sometimes pushes over

small trees when clearing fireline. If anything is mounted on the front of the machine, the attachment must be properly guarded and not get in the way when the machine is crossing steep, narrow gullies.

Some robust towable sweepers are available. The M-B Co. offers a sweeper that has a self-contained hydraulic power system (Model 53MH, 8-foot unit, list price $28,050, 2009 dollars) and one that can be powered by a chain drive (Model 53T, figure 13) off the attachment's tires.

Figure 13—Model 53T tow-behind self-powered sweeper, 7-foot unit, list price $24,355 (2009 dollars, photo courtesy of M-B Co.).

Trailers are not likely to be suitable for the Shawnee National Forest because the equipment needs to cross steep, narrow gullies. MTDC considered modifying the sweeper's trailer so it would be attached directly to a framework in the bed of the IHI IC-30 crawler carrier. The framework would have a cylinder to raise and lower the unit as needed. The cylinder would tap into the IC-30 crawler carrier's hydraulic system. This arrangement might shorten the length of the equipment (prime mover and attachments), but probably not enough to allow the equipment to maneuver through tightly spaced trees. If a high-volume blower was needed to help finish clearing fireline, there may not be enough room to mount the blower and the hydraulic cylinder needed to raise and lower the sweeper.

MTDC considered using a trail maintenance rock rake (heavy tined York Rake) to clean the fireline. MTDC has designed and fabricated a remotely adjustable ATV rake (figure 14). The Shawnee National Forest staff present during the site visit thought the rock rake might damage waterbars. Logs under the leaf litter also would present problems for a rock rake.

Figure 14—MTDC trail rake.

Emanuel Hudson, regional soils and watershed improvement manager for the Forest Service's Southern Region, told MTDC that the Kisatchie National Forest (Frank Yerby, Winn Ranger District) has developed a prototype prescribed fireline maintenance tool called the Fire Break Rake (figure 15). The rake, which is not powered, uses two wheels of a six-wheel hay rake to cast needles and leaves to the side of a

Figure 15—The Fire Break Rake being used at the Kisatchie National Forest.

previously constructed fireline. A private fabrication shop reworked the original three-point hitch attachment's frame so the wheels are positioned directly behind a farm tractor. A video sent to MTDC appeared to show that the forward speed of the tractor has a bearing on how well the rake wheels move the material. This could be an issue on some of the hardwood prescribed firelines in Illinois. Although the Fire Break Rake is an interesting, low-cost approach, the Shawnee National Forest did not want to pursue using the Fire Break Rake.

After reviewing the prime movers available on the Shawnee National Forest, the operational constraints, and the attachments identified in the market search, MTDC purchased the Cyclone KB3 debris blower from Buffalo Turbine and adapted it for use in the bed of a Polaris Ranger UTV owned by the Shawnee National Forest.

Shawnee National Forest Time and Motion Study

Before the KB3 blower was purchased, a Buffalo Turbine representative demonstrated its use. The demonstration model, which was on a trailer towed behind a six-wheeled UTV, appeared to be suitable for clearing fireline, but could not access all of the fireline that needed to be cleared. A blower mounted in the back of the UTV would allow the UTV to be more mobile and to handle the terrain better. Although the factory offered a rigid air chute, it probably would have been damaged on the forest's steep, uneven terrain. The Missoula Technology and Development Center (MTDC) purchased the Buffalo Turbine Cyclone KB3 debris blower and modified it based on recommendations from the Shawnee National Forest. Modifications included developing a flexible air chute, devising a way of mounting the unit in the back of the UTV, and adding four frame attachment lugs to the blower so a fork lift could lift it into and out of the UTV.

Mounting the Blower in the UTV

Forest Service employees reinforced the bed of the UTV. Before mounting the blower, two 4- by 36- by ¼-inch pieces of flat steel were attached to the underside of the bed using two ⅜- by 3-inch stainless steel bolts per piece of steel. Holes were drilled through the crossmembers of the bed of the UTV (figures 16 and 17). The blower was secured using four ⅜- by 3½-inch stainless steel bolts running through the blower, the bed of the UTV, the crossmembers of the UTV's bed, and the flat pieces of steel.

Figure 16—One of two pieces of flat steel was installed to strengthen the bed of the UTV.

Figure 17—Bolts pass through the bed of the UTV, a crossmember, and one of the pieces of flat steel.

Lifting Bars

Forest Service employees fabricated two lifting bars to help lift the blower in and out of the UTV. The lifting bars are made of 1½-inch outside diameter, 14-gauge hollow steel tubing. Safety pins keep the lifting bars in place while the blower is being lifted into the bed of the UTV and allow the blower to be removed quickly, if necessary (figure 18).

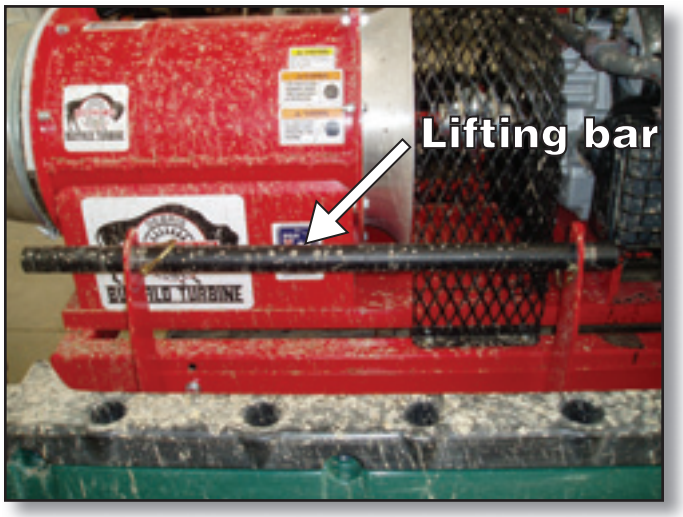


Figure 18—Locking pins keep the lifting bar in place when the blower is being lifted into the bed of the UTV.

Flexible Chute

MTDC manufactured a flexible blower chute out of heavy, nylon-coated fabric (Style 3026 OBU fabric for oil boom systems by Seaman Corp., Wooster, OH) and attached the chute to a modified aluminum air duct fitting. The chute is 34 inches long, measures 14 inches in diameter at the base, and tapers into a 14- by 6-inch rectangle at the end (figure 19). The chute needed to be flexible when being dragged through steep creek crossings or over stumps and logs. The nylon chute was bolted to an aluminum fitting that was clamped to an aluminum elbow. The clamps allowed the chute to be taken on and off easily. The chute could be set up with different angles, depending on the elbow used.

Figure 19—The flexible chute developed by MTDC.

Mud Flap

A piece of 1-inch-square tube (36 inches long) was attached to the blower's frame. The tube secured a piece of rubber conveyor belting. The flap came to within 6 to 8 inches of the ground (figure 20).

Figure 20—The mud flap developed to help keep debris from blowing under the UTV.

Figure 22—The UTV driver and an operator using a remote control to manipulate the blower work together during standard operations.

Fireline Construction

Fireline was cleared on a number of prescribed burn units in hardwood leaf litter and pine straw ground cover. Before the blower was used, chain saws were used to remove small trees and logs, allowing access for the UTV (figure 21).

Figure 21—A fireline after trees had been cut, before the line was blown clear.

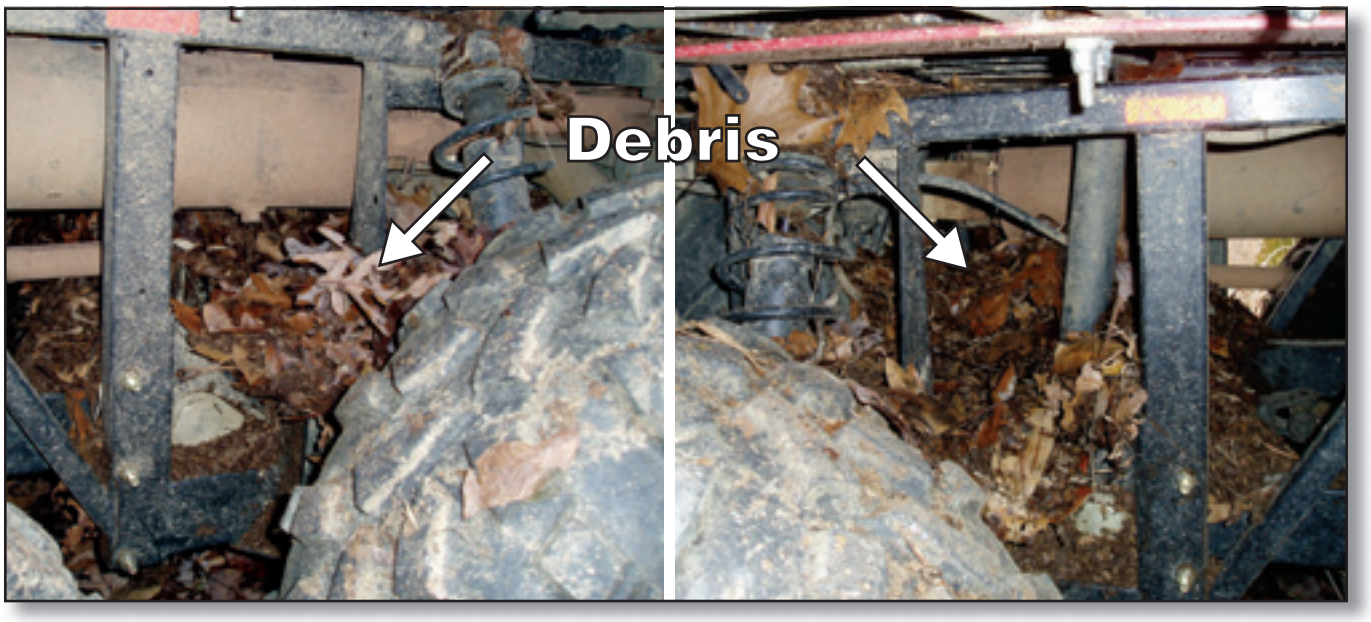
One person operated the UTV, while another person controlled the blower with a remote control while walking behind the UTV (figure 22).

The remote control was used to adjust the blower's throttle and rotate the chute. The blower operator used a radio to let the UTV operator know to go slower or faster. During fireline construction, a stopwatch was used to time blower operations. The fireline was measured to establish output in chains per hour. A chain (66 feet) is a common distance measurement in forestry project work and wildland firefighting. The fireline was cleared during a single pass. During each pass, all chute angles and the throttle speed remained constant. Employees wore personal protective equipment during operations.

Results of Blower Tests

Mounting the blower in the back of the UTV improved the UTV's mobility. The pieces of steel under the bed of the UTV kept the blower from moving when it was being transported or used.

The flexible chute helped prevent problems when the UTV was crossing creeks and traversing uneven terrain. Elbows were used to create a 90-degree angle, pointing the chute directly at the ground. Eddies blew debris under the UTV, where it collected around the muffler (figures 23 and 24).



Figures 23 and 24—Flammable debris packed around the UTV's hot muffler.

The hot muffler ignited the debris, causing a small fire. A mud flap (see figure 20) was attached to the bed of the UTV to try to decrease the amount of debris accumulating under the UTV. The flap actually caused more debris to accumulate around the hot muffler and in the UTV's engine compartment, causing another small fire threat.

Field testers believed that even if the flap reached all the way to the ground, debris would still collect under the UTV. The mud flap created another problem—the UTV could not be backed up without first lifting the flap. Otherwise, the flap got caught by the tires.

Jon Teutrine, Hidden Springs Ranger District, requested that a 22½-degree elbow section be manufactured to allow the chute to point backward slightly rather than straight at the ground (figure 25). Buffalo Turbine provided the elbow.

Less debris built up under the UTV with this arrangement. There was no recognizable difference in the amount of line construction whether the chute was pointing straight down or pointing out slightly.

Figure 25—The blower with its chute pointing slightly out rather than straight at the ground.

Fireline construction (measured in chains per hour) was completed in hardwood leaf litter and pine straw, in wet and in dry conditions. Firelines used during prescribed fires must be cleared to expose bare mineral soil for a width of at least 36 inches (figure 26).

Figure 26—Usable fireline for prescribed fire. The photo shows the same area as figure 21 after the fireline has been cleared by the blower.

Fireline construction was fastest in dry leaf litter and slowest in wet pine straw (figure 27).

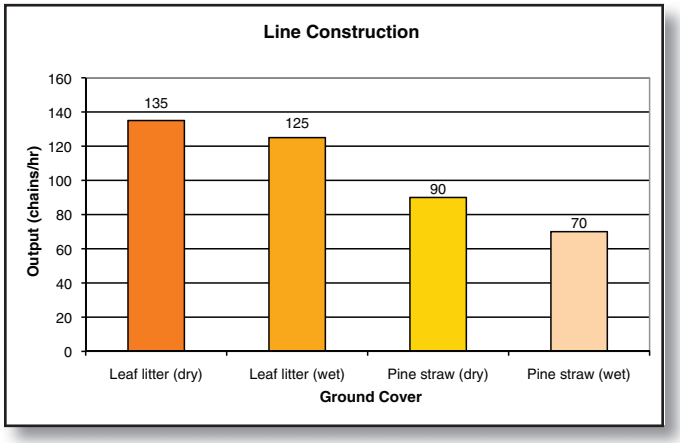


Figure 27—The length of fireline cleared by the fireline blower in different types of ground cover (a chain = 66 feet).

The width of fireline varied depending on the type of ground cover. The widest fireline (45 inches), was cleared in dry leaf litter, while the narrowest fireline was cleared in the wet pine straw (20 inches, figure 28).

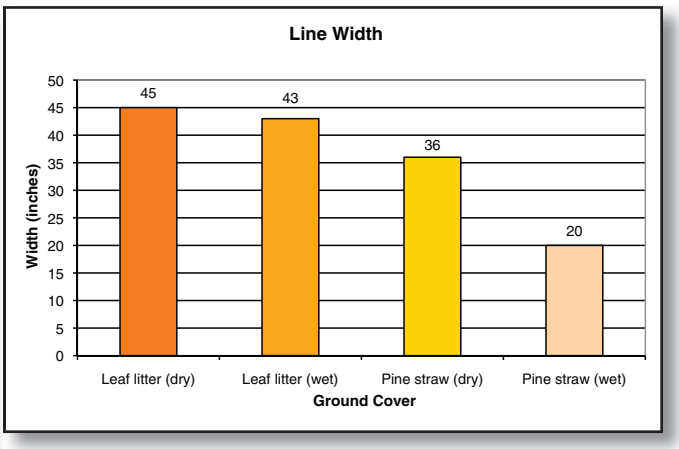


Figure 28—The width of fireline cleared by the fireline blower in different types of ground cover.

Fireline was cleared the fastest (135 chains per hour) in dry leaf litter. Flammable debris collected under the UTV, even with the best orientation of the chute. Dust produced during dry conditions was a problem both for the UTV operator and the blower operator. Leaves that collected around the blower's air intake had to be removed regularly.

On one occasion, dry leaves that collected near the muffler were sucked into the blower. The leaves could have become a fire hazard if the blower had spit embers. The blower worked well in dry leaves, but precautions were needed to ensure the safety of both operators (see the job hazard analysis, appendix A).

When the leaf litter was wet or moist, dust was not an issue. Much less debris collected under the UTV, and it did not pose a fire hazard because the leaves were wet. Moisture had little effect on the length of fireline that could be cleared in leaves (see figure 27) or on the width of the fireline (see figure 28).

Fireline could not be cleared as quickly in dry pine straw as in dry leaves, but the fireline was suitable for prescribed burns. Dust was not an issue and the pine straw did not accumulate under the UTV. Wet pine straw was too heavy for the blower to clear in one pass. Production was slow and the fireline was not wide enough.

After the fireline has been cleared, days or weeks may pass before conditions are suitable for the prescribed burn. With the blower, a quick pass could be made around the unit to ensure no leaves or pine straw had covered the line. In the past, crewmembers had to walk the whole unit with backpack blowers, taking valuable time on the morning of the burn.

Maintenance Issues

The set screw that holds the pulley to the shaft of the motor that rotates the chute came loose after extended use (figure 29). A small amount of thread-locking adhesive on the set screw remedied this problem.

Figure 29—This set screw loosened after extended use. Thread-locking adhesive solved the problem.

Shawnee National Forest's Recommendations

The blower should be used to create fireline for prescribed burn operations in wet to moist leaf litter and dry pine straw. The chute should be directed toward either tire (figure 30), not straight down.

Remove the chute before transporting the UTV to or from the job site. Otherwise, the chute could be damaged while being whipped around by the winds at highway speeds. A No. 2 Phillips screwdriver can be used to loosen or remove the adjustable rings that attach the chute to the blower.

Figure 30—Less debris collected under the ATV when the chute was directed toward either tire rather than straight down.

Davy Crockett National Forest's Experience

The Davy Crockett National Forest in Texas was experimenting with a Cyclone KB3 debris blower at the same time the Shawnee National Forest was doing so. The Davy Crockett National Forest's Cyclone KB3 debris blower was mounted in the bed of a Kubota UTV. Experimentation showed that angling the chute to one side (figure 31) worked well.

Because the chute is rigid, it could be damaged when the UTV crossed streams or gullies. The Davy Crockett National Forest has expressed interest in the flexible chute developed by MTDC. Robert Manry (equipment operator for the Davy Crockett National Forest) also tried mounting the air chute so it was coming off the front of the forest's Polaris UTV. Safety staff would not sanction this arrangement because the chute obstructed visibility.

Figure 31—The Davy Crockett National Forest's Kubota UTV with the chute directed toward the rear of the UTV.

Discussion

The Shawnee National Forest already has used the UTV-mounted blower on prescribed burns. The forest's staff thinks the blower might be useful for fire suppression in open stands or to clear line constructed with a chain saw. The blower excels in quickly touching up established cleared firelines on the day of a prescribed burn.

So far, the blower's flexible chute has passed over many logs and stumps and has been through a lot of narrow creek crossings without showing any real wear and tear or getting snagged. The Shawnee National Forest plans to continue experimenting to find the best length for the chute. Existing prescribed firelines can be cleared in a single pass when leaves are wet or damp or when needles are dry. When needles are wet, a number of passes may be needed to clear the fireline. When leaves are dry, the operator may have to stop periodically to clean debris from the undercarriage. It is faster to make several passes with the KB3 blower than to have a crew using several backpack blowers do the work, based on the experience of the Shawnee National Forest.

The Shawnee National Forest's fire crew feels that the blower is well worth the investment, given the amount of quality fireline the blower can clear quickly. Even three or four crewmembers using backpack blowers could not clear fireline more quickly than two crewmembers using the KB3 blower. The KB3 blower has reduced the hours needed to clear firelines, increasing the number of acres that can be prepped for prescribed burning. Because the KB3 blower can clear fireline in wet or moist ground cover, the Shawnee National Forest can clear fireline and prep burn units during conditions that otherwise would not be suitable. When crews were using backpack blowers to clear firelines, the crews could clear fireline only when the leaves or needles were drier.

MTDC will create engineering drawings for the flexible air chute after the Shawnee National Forest has determined the optimal length.

Conclusions

The Buffalo Turbine Cyclone KB3 debris blower can blow accumulated leaf litter and pine straw off previously constructed fireline.

The KB3 blower could help create new fireline if flammable debris can be cleared with a strong gust of air.

Two operators using the KB3 blower cleared more fireline than a crew of several persons using backpack leaf blowers.

Chain saws are still needed to clear obstacles in the path of the blower.

The KB3 blower can be pulled on a trailer or mounted in the bed of a UTV, which makes the unit easier to maneuver in tight spaces.

A flexible air chute is less vulnerable to damage than a rigid air chute when the UTV crosses steep, narrow ravines and gullies.

One operator driving the UTV and another firefighter monitoring the UTV's travel speed and controlling the movement of the blower's chute appear to do a better job of clearing fireline than a UTV operator working alone.

Appendix A—Debris Blower Job Hazard Analysis

FS-6700-7 (2/98)

U.S. Department of Agriculture Forest Service	1. WORK PROJECT/ACTIVITY	2. LOCATION	3. UNIT
	Buffalo Turbine Blower Use		
JOB HAZARD ANALYSIS (JHA) References-FSH 6709.11 and -12 (Instructions on Reverse)	4. NAME OF ANALYST	5. JOB TITLE	6. DATE PREPARED

7. TASKS/PROCEDURES	8. HAZARDS	9. ABATEMENT ACTIONS Engineering Controls * Substitution * Administrative Controls * PPE
Preoperation inspection	Mechanical failure affecting controls and operation, possible injury to operator	• Conduct pretrip inspection before use. • Check fluid levels and ensure there are no leaks. • Check belts for tightness. • Ensure that the blower impeller and chute are free of debris. • Ensure that remote control operations for the throttle and chute rotation are fully operational. • Check bolts and plates that secure the machine to the UTV for tightness. Ensure that no bolts or plates are excessively worn, broken, or missing.
Loading/unloading the blower	Back strains, injuries to feet or legs	• When installing or removing the Buffalo Turbine from the UTV, ensure that an adequate number of people are available (three to four) to lift the machine. • Ensure that lift bars are installed and lift bar pins are secured. • Use proper lifting techniques and carry the machine only short distances. • Do not remove/install the blower in a UTV while it is on a trailer. First unload the UTV, then remove/install the blower from the UTV while it is on the ground level. • When lifting and moving the blower by hand, first make sure that the path is clear.
Transporting the blower	Damage to vehicles and possible injury to the drivers	• Remove the blower chute before transporting the blower to prevent the tube from being damaged. • If the blower is mounted to the UTV, follow the transporting section of the UTV JHA. • If you are transporting the blower on a trailer or in a pickup truck, make sure that the blower is securely strapped down with four points of contact.

General operation of blower—driving or riding in UTV	Collisions, accidents, injuries, and fatalities	• Follow the general operations section of the UTV JHA.
Using the blower to move debris	Eye injuries, head injuries, damage to hearing, impacts to airway, possible exposure to fire	• All PPE must be worn, including hardhat, eye protection, ear protection, long pants, long sleeve shirt, boots, and seat belt. • Additionally, a 5-pound fire extinguisher and a full 5-gallon backpack pump will be carried with the blower at all times. • During dry conditions, a dust mask is required. • When starting the blower, make sure that the tube is directed away from personnel. • When starting the blower, make sure there is no loose debris close to the blower's intake. Persons operating the blower should not have loose-fitting clothing. Long hair should be tied up or tucked inside the operator's helmet. • Do not carry any items in the bed of the UTV when operating the blower. • Use caution when directing the blower chute up because the force of the blower may dislodge limbs or widowmakers above you. • When blowing debris, always have a spotter walking a safe distance behind the machine. • Ensure no other personnel are within 50 feet of the blower when it is being operated. • If a spotter controls the blower's throttle and the angle of the chute, the spotter should also watch to make sure that the blower tube does not become snagged. • The spotter should also watch for fires under the UTV caused by debris that is blown against the UTV's exhaust system.

		• The spotter should have an established method of communicating with the UTV operator, such as radio or hand signals. • After no more than 30 minutes of use, the blower should be shut down and the undercarriage and engine compartment of the UTV should be inspected for debris. All debris should be cleaned out of the UTV before operation resumes. • Allow the motor to cool and use a funnel, spout, or nozzle when fueling the UTV. • Have a working fire extinguisher nearby. • Prohibit smoking within 50 feet of the fueling area.
Emergency evacuation procedures	Illness/injury	• Activate emergency medical services by calling Shawnee Dispatch by radio or dial 9–1–1. • Refer to the **Emergency Evacuation Instructions** on the next page. • Render first aid to sick or injured persons until you are relieved by a higher level medical responder. Do not abandon the patient. • Use bloodborne pathogen precautions. • Use care when moving patients and transporting the injured. • Maintain communications. • Notify your supervisor. • Complete necessary paperwork.

10. LINE OFFICER SIGNATURE	11. TITLE	12. DATE
/s/	**District Ranger**	

Previous edition is obsolete (over)

About the Authors

Keith Windell is a project leader for reforestation, fire, and residues projects. He has a bachelor's degree in mechanical engineering from Montana State University. He has worked for the California Department of Forestry, U.S. Department of the Interior Bureau of Land Management, and the Forest Service.

Greg Burkhart is a forestry technician (fire engine operator) on the Hidden Springs Ranger District of the Shawnee National Forest in southern Illinois. He received a bachelor's degree in applied ecology and environmental sciences from Michigan Technological University. He has worked for the Forest Service for 7 years.

Library Card

Windell, Keith; Burkhart, Greg. 2009. Blower clears established firelines in hardwood forests without disturbing soil. Tech. Rep. 0925–2828P–MTDC. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Development Center. 22 p.

Established firelines may be used every few years for prescribed fires. Using a blade to clear the firelines would remove more and more of the productive upper layers of the soil. A study conducted at the Shawnee National Forest in Illinois showed that the Buffalo Turbine Cyclone KB3 debris blower mounted in the reinforced bed of a utility terrain vehicle could be used to clear established firelines. One operator drove the UTV while another walked behind the UTV using a radio to tell the driver when to slow down or speed up and adjusting the direction of the blower's chute with a remote control. The blower cleared moist or wet leaves or dry needles from the firelines. Because the blower works even when leaves are wet, units can be prepared for prescribed burns earlier in the spring, extending the period when prescribed burns can be conducted. Dry leaves present problems, because they can build up under the UTV and catch fire.

Keywords: Buffalo Turbine, Cyclone KB3, equipment development, erosion, fire fighting, firefighting, leaves, needles, prescribed fires, safety at work, soils, UTVs

---

Additional single copies of this document may be ordered from:

USDA Forest Service
Missoula Technology and Development Center
5785 Hwy. 10 West
Missoula, MT 59808–9361
Phone: 406–329–3978
Fax: 406–329–3719
Email: wo_mtdc_pubs@fs.fed.us

Electronic copies of MTDC's documents are available on the Internet at:

http://www.fs.fed.us/eng/t-d.php

For additional information about fireline blowers, contact Keith Windell at MTDC:

Phone: 406–329–3956
Fax: 406–329–3719
Email: kwindell@fs.fed.us

Forest Service and Bureau of Land Management employees can search a more complete collection of MTDC's documents, CDs, DVDs, and videos on their internal computer networks at:

http://fsweb.mtdc.wo.fs.fed.us/search/