The Benefits of Prescribed Burning and Native Species

by Matthew Kocourek and Marcus Chang, Applied Ecological Services

THE yard's on fire. Orange flames leap past our office windows. Out in the field, flames reach 20 feet. The breeze hits just right, and a Fire Devil (a tornado of flame) leaps another 30 feet higher, accompanied by a roar that can be heard hundreds of yards away ...

It happens every spring at Applied Ecological Services, Inc. (AES) in Brodhead, WI, and all their branches, as well as for their clients across the country. AES started "Burn Season" at the beginning of March and burned approximately 1,500 acres of prairie, wetland and savanna by the end of the season in mid-May.

Prescribed burns are an essential part of a natural and complete ecological management plan. A perfect example took place this spring in Ladysmith, WI. The Flambeau Mining Company, a wholly owned subsidiary of Kennecott Minerals Company, operated an open-pit copper, gold and silver mine in Rusk County from 1993 to 1997. AES (utilizing the expertise of all three of its divisions: Consulting, Contracting and Nursery) joined the Flambeau team in 1997 to help guide the surface reclamation of the 181-acre site. Hydrologists, soil scientists, landscape architects, civil engineers and ecologists of the Consulting Division worked hand-in-hand with the mine's engineering firm and mine staff, shepherding a process that included grading design, topsoil application, stormwater management and planting plans. In 1998, the Contracting Division executed the land-forming and topographical plans, (including the critical compaction of layers), then the seeding and planting plans. The Nursery provided local-genotype native seed, plants, shrubs and trees. Every step of the way, meetings were held with the public, stakeholders, regulators and environmental groups.

Since late 2001, 149 acres of the former mine have been open to the public and are even contributing to Rusk County's local tourism industry. The site offers miles of hiking trails and high-quality wildlife habitat with over 250 species of native plants that attract more than 45 species of birds, 20 species of butterflies, several amphibian species, deer – even Bald Eagles and Black Bears. The site is unique because prairie ecosystem is uncommon in north-central

What the well-dressed Burn Crew is wearing this spring: protective gear, radios and backpack pumps. All photographs were taken on site at Flambeau Mine and are courtesy of Jana Murphy & Flambeau Mining Co., Ladysmith, WI.

Mineral-rich ash also helps the ground absorb sunlight better, warming it early and starting the growing season for native plants early.

Wisconsin.

The remaining area of the site – including the former mine office and water-treatment buildings – is now the Copper Park Business and Recreation Area, and includes an equestrian trailhead for trails along the Flambeau River. In fact, the local Department of Natural Resources (DNR) office is in the former mine office building, and issues the permits to conduct prescribed burns there.

Every spring, AES burns 1/3 of the restored prairie at the site (keeping a 3-year rotation and the burn sizes manageable), and it is one of the most technically challenging burns the company does. The site is in the Wisconsin Northwoods, a deeply cherished part of the state. In the very beginning, AES had to prove itself to the Wisconsin DNR to get a permit to do the first burn. The window for burning allowed by the DNR is very, very small, so each year's Burn Plan requires a substantial amount of preparation to satisfy the client, regulators, local authorities and residents. But within weeks after a burn, the prairie explodes in a riot of colors, textures and aromas.

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To understand the complexities of prescribed burning, maybe we should start at the beginning.

Why

The purpose of prescribed burning is multifold. First and foremost, it gives the native ecosystem a boost. According to Fred Faessler, Seed Production Manager of AES' Taylor Creek Restoration

Flambeau Copper Mine Reclamation

AES began surface reclamation planning and design in 1997 for Flambeau's 180-acre site near Ladysmith, Wisconsin, where copper, primarily copper sulfides, had been mined throughout the mid-90's. Because of the potential for acid mine drainage, the closure plan called for backfilling of the mine pit in the original sequence with waste rock mixed with limestone to neutralize its acidity. The neutralized waste rock was capped with a naturally occurring clay layer, followed by overlayment of the native till to approximate original contours. Salvaged topsoil was uniformly redistributed over the entire site.

A plan was developed for surface grading and reclamation planting to handle site drainage and restore ten different plant communities to the site. Communities ranging from wetlands to upland prairies and savanna were planted in phases beginning in 1998 and completed in early 1999. The site, located along the Flambeau River, primarily contained old fields and woodland patches prior to mining activities.

Of the 180 acres, approximately 150 were restored to natural areas, with approximately 30 acres dedicated to the development of a light industrial park utilizing part of the infrastructure developed for the mine. A wetland system and a wetland-like biofilter complex were designed to filter runoff water onsite, replace wetland habitat, and increase the biodiversity of the post-mining site. Runoff and snowmelt from the reclaimed natural area is filtered prior to discharge into the Flambeau River through a biofilter strategically located where the natural surface drainage channels converge.

The stormwater runoff and snowmelt from the light industrial or commercial area is directed through a biofilter prior to discharge offsite into a natural drainage system. By isolating the industrial park drainage, the reclamation design makes the area more amenable to prospective firms who may be required to obtain stormwater discharge permits. The biofilter will filter stormwater prior to its release, thereby assisting successor businesses in their stormwater management plans. Using ecological landscape design, AES has transformed the problems of mine site restoration into an ecological and financial asset for the local community.

Goals of the design were to:

- •Restore the mine site into a natural landscape,
- •Provide a high-quality wildlife habitat,
- •Accommodate stormwater drainage needs of future light industrial and commercial sites, and
- •Obviate subsidence over the former pit area.

Because of the diversity of species and complexity of the planting plan, AES planned and implemented a variety of live plant installation and seeding strategies, including hydro-seeding, drilling, cyclone seeding, hand seeding, transplanting, hand plugging, etc. **L&W**

Nursery, "Our prairies and savannas are fire-dependent plant communities. Without fire, the prairie would evolve into a shade-dependent system overgrown with woody vegetation."

Historically, fire has raced across the landscape since, well, since the beginning of time, usually caused by lightning. In slightly more recent times (the last six thousand years or so), the aboriginal peoples noticed that after a fire, nut and berry harvests increased, game habitat improved and traveling was easier. Since lightning touched off fires less often in the eastern woodlands and prairie, the native population intentionally set fires to achieve those same results. So it would be safe to say that Native Americans were the first practitioners of prescribed burns.

Today, fire is used as a management tool in native ecosystems because it is a natural part of their existence, and is effective and low cost, compared to other more labor-intense methods.

When prescribed fire is part of the ecological management plan, most native plants bloom earlier and longer, produce more seed, and generally thrive. The reasons are easy to see. The dead plant material is reduced to mineral-rich ash, which provides more readily available nutrients and accelerates microbial activity. Also, when blackening by the ash, the ground absorbs more of the sun's rays and warms more quickly. Without burning, the plant material and leaf litter act like an insulating blanket, keeping the soil cold. Most native plants grow best in warm soil, and the sooner the soil warms up, the sooner they begin their growth. Thus, burning extends the growing season for native plants, adding as much as four weeks at the beginning.

And don't worry about the native plants in the burn; the majority of the plant is protected beneath the soil – often boasting root systems several feet deep, as opposed to turf grass's two-inches (if that).

Fire also shortens the growing season of many Eurasian plants. Most of these are "cool-season" plants that are considered weeds in prairies. (We define a "weed" as a plant that is unwanted in its present location. For instance, a native Prairie blazing star (*Liatris pycnostachya*) popping up on a turf-grass lawn would be considered a weed, no matter how beautiful it is. On the other hand, a clump of Kentucky bluegrass (*Poa pratensis*), which is also a non-native or "invasive", in a short-grass prairie might incite a prairie enthusiast to violence.) Since cool-season grasses tend to go dormant as soil warms, a spring fire often short-circuits their growth. Further, a late spring fire can burn off three to eight inches of weeds before the native plants have even begun to grow, which gives natives a better exposure to sunlight.

ATV's have changed the face of burn crews, improving safety and efficiency.

Prescribed burning is also an excellent strategy to control woody invasive species, killing the top-growth of invading trees and shrubs and slowing their growth and spread. (Prescribed burns alone are usually not enough to prevent most woody invasives.)

An area's first prescribed burn should take place when there is sufficient fuel (dead plant material) to sustain a fire, usually two to three years after the native ecosystem was first planted. There is no hard-and-fast rule how often you should burn any area. A good rule of thumb is to burn when "a lot" of fuel has accumulated, enough so that no ground is visible. Since mesic (tall-grass) prairies tend to create more plants and, therefore, accumulate dead plant material faster than dry (short-grass) prairies, people tend to burn mesic prairies more often.

How

We do not advocate Do-It-Yourself (or "DIY") prescribed burns. In fact, some professionals wryly call it "DYI," as in "Do Yourself In." Remember, you are literally playing with fire. For every few DIY burns that go fine, one gets loose and takes out some DIYer's barn. Or worse, the neighbor's barn. So although we explain the equipment and procedure for a prescribed burn, we strongly recommend hiring trained and experienced professionals.

Equipment

Here are the basic tools a professional burn crew utilizes:

Protective gear: First and foremost, you need safety clothing and equipment. Special fire-resistant boots, gloves and clothes (preferably coveralls) are an absolute necessity. So are helmets with facemasks. All crewmembers should carry portable radios, which can be lifesavers (literally) when a fire becomes established (they can be deafening).

Drip torch: A canister with a valve system and nozzle, each holds a mixture of one part gasoline and three parts diesel fuel. This thick mixture is designed to burn long and slow. When the torch is tilted forward, the fuel mixture drips out

across a lit wick, which ignites the mixture. This actually sets the fires.

Backpack pump: This is a five-gallon water tank worn like a backpack, with a short hose and side-pump or pump nozzle. The nozzle is adjustable from a wide spray for spraying close up to a stream that reaches out to 20 feet.

All-Terrain Vehicles (ATVs) and Utility Terrain Vehicles (UTVs): These have changed the face of burn crews. They are wonderfully portable, maneuverable and can get everywhere a human can and some places a human can't. They can carry larger water tanks and motorized pump systems, and can move faster than a running person. ATVs and UTVs have almost eliminated the need for most of the hand tools, like …

Fire rakes and "flappers": If your crew is small or doesn't have ATVs/UTVs, hand tools like these are very handy. A fire rake looks like a garden rake on steroids, with large triangular teeth. Fire rakes are used for dragging burning material to spread the fire, or for removing plant material and tearing up the soil to create a fire break. (These are still standard issue for fire crews of a different type, the ones putting out fires.) A flapper looks like a mudflap on a wooden rake handle, used to tamp out or smother fire and embers.

Flames leaping skyward can be the harbinger of good things to come.

Types of Controlled Fires

Yes, there are different types of controlled fire. No, the flames aren't different, but the types describe either the direction or purpose of fire. Usually, several types of fires are used in one project.

Back fire: This is the smallest, slowest and – therefore – safest fire, and produces the least smoke. But it takes longer. This fire is lit on the downwind side and slowly burns into the wind. The backfire should always be used first, to create the firebreak (an area with no fuel in it, where flames should stop). It can be the only fire used in a project. It is not unusual for a backfire to be only 8 to 12" wide with flames less than a foot high.

Flank fire (also called a Parallel fire): This fire burns hotter and faster than a backfire. It works well on square areas. It is ignited on the sides of the back burn area, parallel to the wind. It requires two

people or teams to ignite. Flank fires can also be used in curved lines to burn larger areas, but require considerable expertise.

Head fire: This is the fire lit at the top of the area, meaning up-wind, and travels with the wind. This is the largest, hottest and fastest individual fire, causes the most flames and smoke, and must be used carefully. The wind moves the fire, fans it and feeds it oxygen, too. This fire should only be ignited once adequate firebreaks have been created.

Perimeter fire (also called a Ring Fire): This is a technique of burn and not a fire, per se. It's a combination of all the types of fires previously mentioned and requires the largest crew. It's one of the fastest burn methods, and it burns hotter than previously mentioned fires. Since it's a hotter and faster fire, it must be used with caution. This method starts with a backfire to create a firebreak, is followed by lighting flank fires, then a head fire, which will move rapidly towards the flanks and backfire.

Strip head fire: For this fire, a series of strips are lit one at a time, the first closest to the downwind firebreak. This is essentially a number of wide and short head fires. No one strip head fire can burn for long or far before it hits an area already burned by a previous strip head fire. This fire takes less time than a backfire, is relatively safe, well suited for rectangular or odd shaped parcels, and smaller burn crews.

There are many other prescribed fire types – point source fires, center and circular fires, spot fires, etc. – as well as many other burn techniques, but these are the basics.

Weather Conditions

Weather is the ruling factor in prescribed burns. A proper burn plan will give the exact weather parameters for a "GO." Most professional burn crews carry sling psychrometers (to measure humidity) and digital wind meters for on-the-spot information. All weather conditions should be recorded in your burn plan.

Wind, as you might guess, is the largest concern, as a switch in direction of even a light breeze can turn a quiet little backfire into a raging head fire. Any swirling wind puts the burn into question. A steady breeze of 5-15 mph with little gusting is preferred. Relative humidity is also very important, with 25-65% being the sweet spot. Below 25%, fires can burn faster and hotter, and over 65%, fires can have a hard time catching. Temperature is also a factor; over 80° F, burning is too physically demanding on the crew. Below 32° F, the water in the pumps and tanks starts freezing, creating a safety concern. 40° F to 60° F is the sweet spot.

In just weeks, a riot of colors, textures and aromas bursts forth.

Smoke Management

Where there's fire, there's smoke, and if there are any neighbors in the area, smoke management is necessary. Schools, hospitals, nursing homes and roads are considered smoke-sensitive areas. Near any of these, burners could be held liable for damages caused by their smoke. Obviously, monitoring weather conditions is a large portion of smoke management, and those conditions are components of the following factors:

- Dispersion Index: A measurement of how quickly smoke disperses
- Mixing Height: The top of the available volume of atmosphere (or maximum height at which smoke will begin to travel horizontally)
- Transport Wind Speed: The average wind speed within the mixing height (not at ground level)
- Turner Stability Index: Atmospheric stability
- Wind: Wind is required to move smoke and the fire, but too much is never good

The Burn Plan

The first step to a successful burn is a good written plan. The plan is the prescription for your project. It outlines your objectives, includes responsible parties and local authorities, contains any insurance, certifications and permits necessary.

The plan should also include, well, your plan; first, it should contain your evaluation of the burn site, in text and map, identifying the location of firebreaks (natural or man-made), structures, terrain, obstacles, etc. Another map should identify the location of crews and their planned movements, placement of safety equipment, etc. Also listed should be smoke management, special considerations, local residents, traffic, public relations, and any other variables.

Public Relations and Education

One aspect of prescribed burns that articles tend to omit is public relations.

There are people who believe any fire is dangerous, harmful and must be avoided at all costs. This is where public relations and public education are absolutely necessary beforehand. Start as early as possible, preferably before the installation of the ecosystem (whether prairie, savanna, wetland, etc.), explaining prescribed burning within the context of ecosystem maintenance. Prior to the burn, involve local schools and groups in it, educating them about prescribed burns and inviting them to watch safely (everyone will want to watch). Turn a project into a living, breathing outdoor classroom. It is our experience that getting school children and classes involved in a native ecosystem results in new, young stewards of the project and passionate devotees. And as probably the most exciting single incident of a native ecosystem, a prescribed burn is the perfect opportunity to recruit new disciples.

"If you build it, they will come." Certain plants and animals are dependable indicators of a high-quality ecosystem.

Results

Homeowners and public-land managers are realizing the benefits of native plants. Naturally adapted to the local soils and climates, they require almost no water, chemicals, care and expense, they cause fewer problems, add natural beauty and once established, require no mowing. Because they are native species, they can withstand anything Mother Nature throws at them. That's what they're used to. In contrast, most non-native plants cannot

support themselves and require expensive chemicals, irrigation and labor. Natives' deep root systems are able to take more water and take it deeper into the ground than garden-variety non-native plants, which is helpful in controlling runoff and also the reason native ecosystems are being used by municipalities and developers to combat stormwater issues.

It has to be understood that fire is as much a part of maintaining healthy native ecosystems as earth and water. With the proper education and communications, prescribed burns can become an event and create positive publicity, adding to the already multifold benefits of a native ecosystem.

And the end result at the reclaimed Flambeau Mine? The site received the 2007 Green Award from the Ladysmith Area Chamber of Commerce. And most significant, it received a Certificate of Completion from the State of Wisconsin for the 149-acre site that is now wildlife habitat and a passive recreation area. The reclamation design and implementation by AES, followed by their ecological maintenance and management (which includes prescribed burning) resulted in meeting the vegetative performance standards for surface reclamation, culminating in the Certificate of Completion. It is a significant milestone in the history of mine site reclamation in the State of Wisconsin. **L&W**

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For more information call 608-897-8641 or visit www.appliedeco.com.

Applied Ecological Services, Inc. (AES) is a broad-based ecological consulting, contracting, and restoration firm providing services to foundations, governmental units, corporations, and commercial/residential developers nationwide. They have been the principal firm in many diverse, large-scale restoration and site-remediation projects, including residential developments and reuse projects. Established in 1978, AES has over 100 full-time employees, at offices in Illinois, Wisconsin, Minnesota, Kansas, New Jersey, Pennsylvania and Eastern Europe. They own and operate Taylor Creek, Spring Lake and Kaw River Restoration Nurseries, providers of native seed, plants, shrubs and trees of proper local genotypes.