Welcome everyone! Thank you for attending this evening's presentation titled The Science of Fire: How controlled burns restore native prairies and woodlands.

Native prairies and woodlands have existed in the driftless area for thousands of years. Sometimes maintained by natural fires and sometimes maintained by fires set by native Americans.

What if I told you that all the native prairies that you know today will be gone within our lifetime and woodlands will become unrecognizable from their current state in just 25 years?

What if I told you that if we lit them on fire, we could ensure their existence for future generations?

The majority of our remaining native prairie and oak woodlands will be gone within the next 25 years without active management.

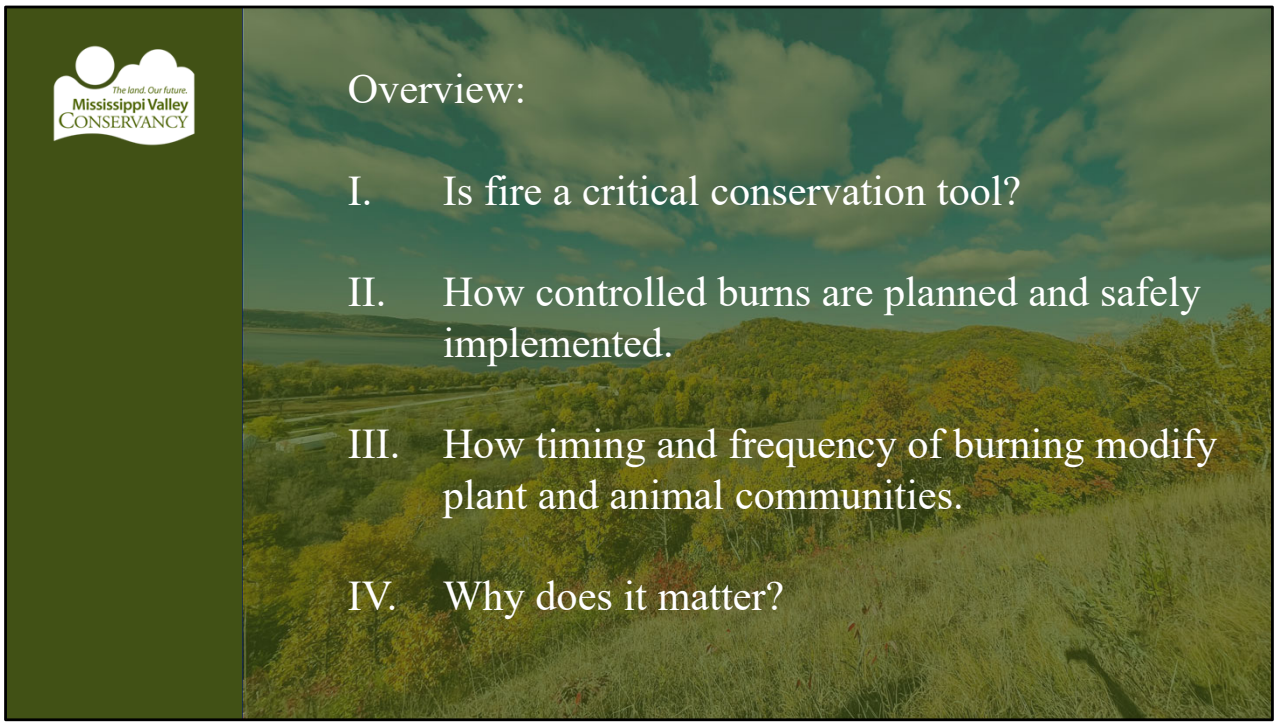
As I go through this presentation, I encourage you to consider what you can do to help save these special habitats…

With a little elbow grease and a little fire, or a lot of fire, you could take this landscape and make it look like…

This!

That’s what we do at Mississippi Valley Conservancy.

Hello everyone, I'm Levi Plath, Land Manager with Mississippi Valley Conservancy. I manage most of MVC's nature preserves in SW Wisconsin totaling more than 5,500 acres and I'm the primary burn boss and fire manager for Mississippi Valley Conservancy. Our mission is to conserve native habitats and farmlands for the current and future health and well-being of the Driftless Area.



Overview:

Is fire a critical conservation tool?

How are controlled burns planned and safely implemented?

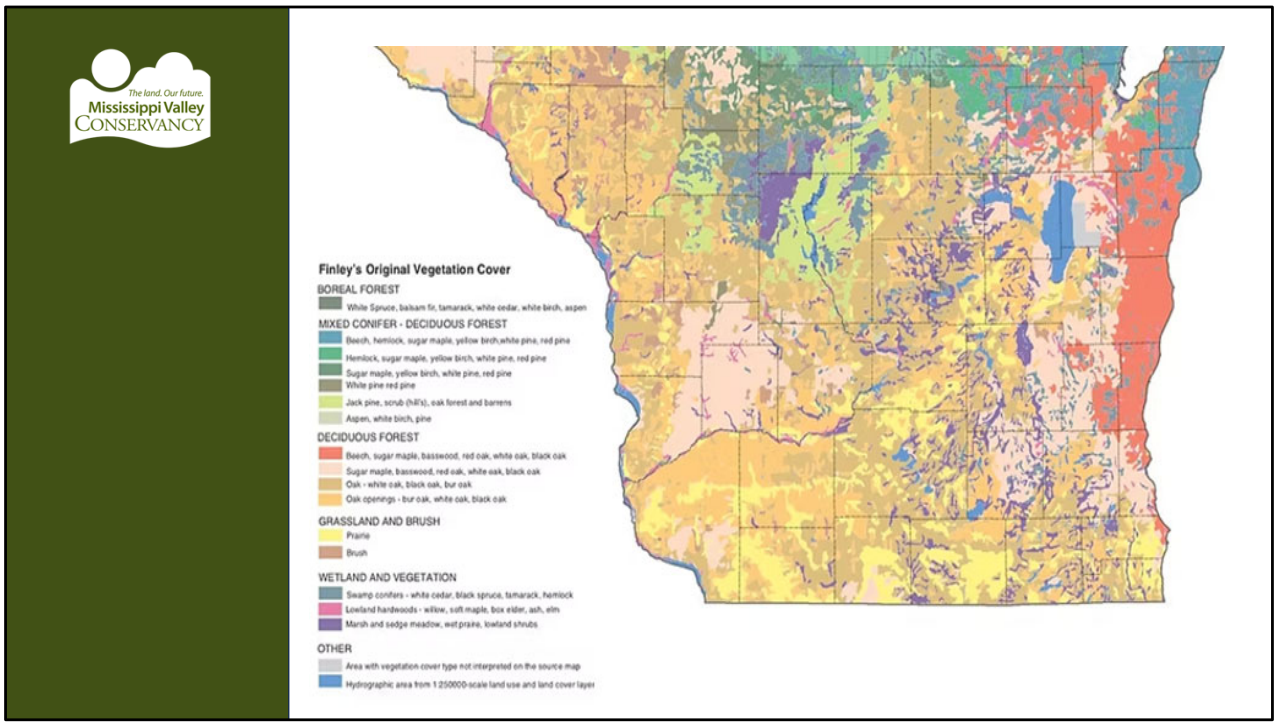
How timing and frequency of burning modify plant and animal communities?

Why does it matter?

I. Is fire a critical conservation tool?

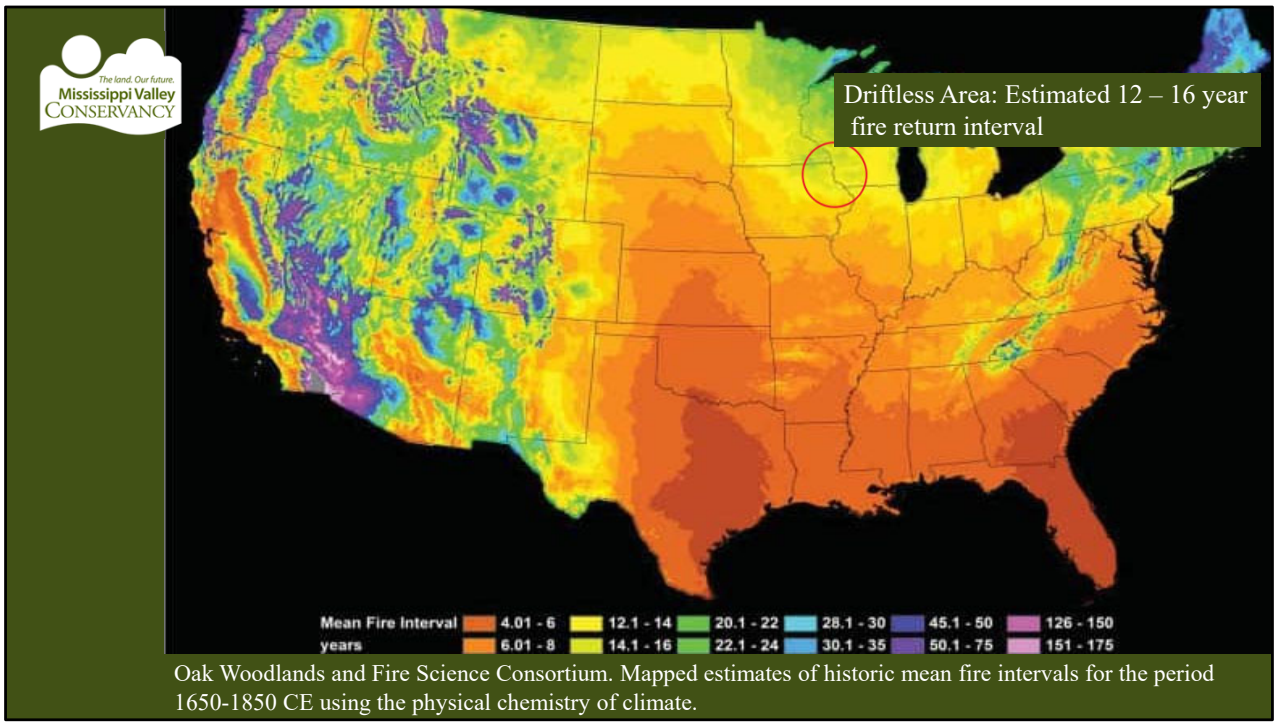
A. Historical wildfire context

We must first begin with context.



This map portrays Wisconsin's original land cover types based on the mid-1800's land surveys. Our portion of the Driftless Area was largely a combination of oak forest, oak openings/oak savanna, and prairie. Some large patches of sugar maple, basswood, red oak, white oak, and black oak also existed. Many of which are naturally maintained by wildfire.

Oaks, hickories and prairies thrive on fire. They depend on it to limit competition from other species like maples and other shade tolerant species.



Oak Woodlands and Fire Science Consortium. Mapped estimates of historic mean fire intervals for the period 1650-1850 CE using the physical chemistry of climate.

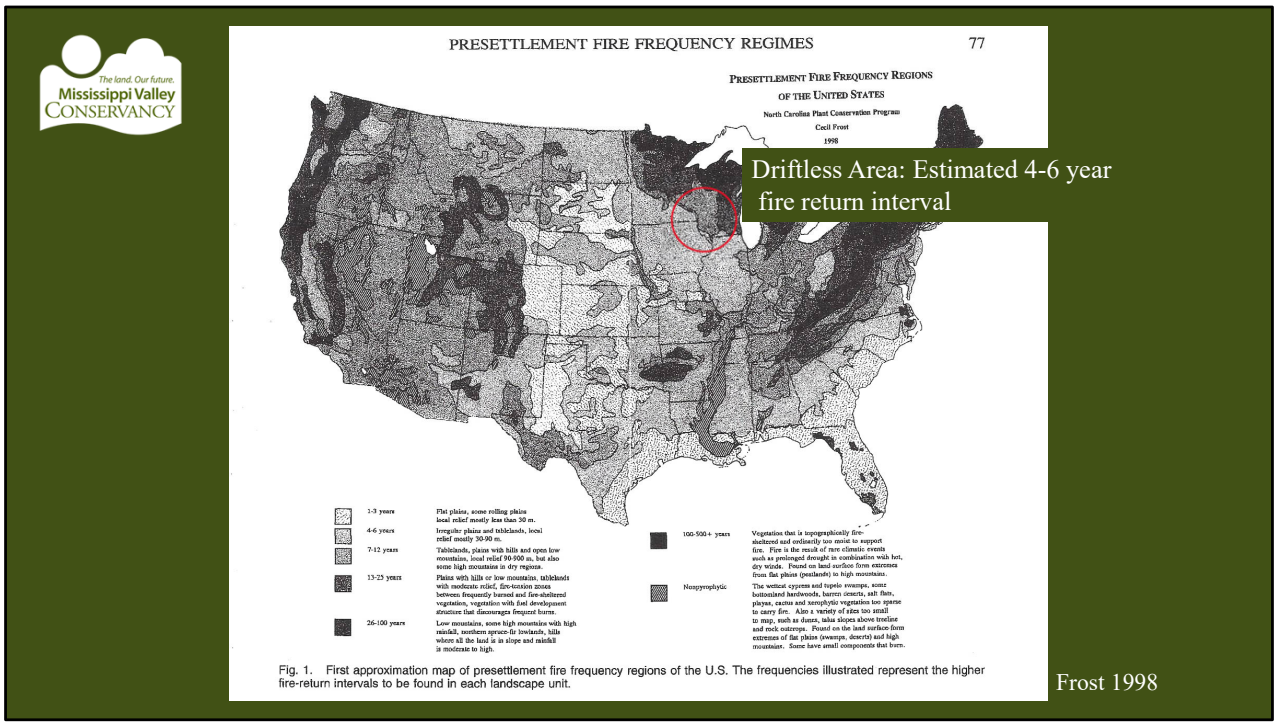
How often did the land burn in the past?

This map visualizes the estimated historical fire frequency from the time period of 1650 – 1850.

PC2FM is a calculation based on known climate variables like temperature, precipitation, and partial pressure of oxygen.

The PC2FM was calibrated using empirical fire history data, such as fire-scar chronologies from tree rings, from over 170 sites in North America, specifically from periods before widespread industrial human influences (prior to ~1850 CE). This calibration allows the model to:
Map Historic Regimes: Produce maps of coarse-scale historic mean fire intervals for locations that lack specific local fire history records.

This region is right on the prairie/forest border so it was not uncommon for the transition zone (oak savanna) to sway east or west 100's of miles over decades to centuries.



This map visualizes the estimated historical fire frequency from the time period of 1565 – 1890 based on known fires identified by researcher Frost in 1998.

Mapping models and site data can provide a wide range of dates. In general, fires in the driftless area were thought to be relatively frequent and very patchy.

First: Context

What can happen without burning?

1938 – Original Aerial Photos
2005 – 67 years later
2015 – 10 years later
2020 – 5 years later
2024 – 4 years later

From 150 acres of prairie and savanna in 1938 to 15 acres in 2025. That's 9.4% left compared to the national average of 1% of prairie and .01% of savanna left.

From this we can begin to see the difference fire and habitat management can make on the land.

Wisconsin Historical Society

Prairie du Chien, WI 1830

This photo is a painting of Prairie du Chien from 1830. Note the bluffs in the background are nearly all open prairie.

Present Day La Crosse, WI

Contrast with present day La Crosse, WI only 60 miles away, nearly all the bluffs are completely forested.

This speaks to how quickly the land can change. In some cases, changes like this can occur in a matter of decades, and in other cases, it can take much longer.

B.Effects of Fire Suppression

- Increases in woody species
- Less grasses and wildflowers
- Increase in invasive species
- Increase in fuel build up

Fire suppression has led to habitat degradation and decreased the number of species across the landscape.

Fire suppression leads to….

- Increases in woody species, shading out ground layer grasses and wildflowers
- Less grasses and wildflowers = less bugs/invertebrates and seeds = less birds = less overall species = less climate resilience
    - "Climate resilience" meaning how well a habitat can adapt given change or a catastrophic event.
- Increase in invasive species
- Increase in fuel build up, shading smaller stature native species which lowers biodiversity, increasing wildfire risk

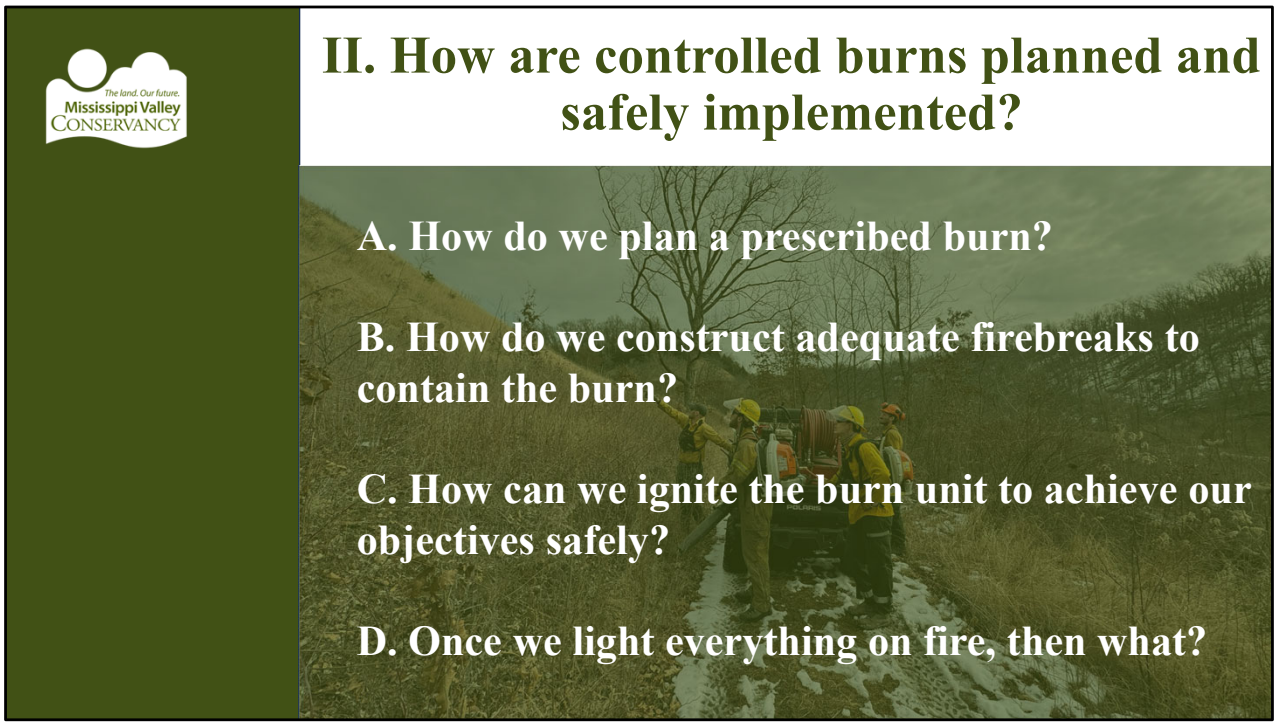
C.Re-introducing Fire

- Decrease in woody species
- More grasses and wildflowers
- Decrease in invasive species
- Decrease in fuel build up

- Decrease in woody species, providing sun for ground layer grasses and wildflowers
- More grasses and wildflowers = more bugs and seeds = more birds = more overall species = more climate resilience.
- Decrease in invasive species
- Decrease in fuel build up, giving smaller stature native species more opportunities to grow, reducing wildfire risk.

So is fire a critical conservation tool?

Yes! There's no practical substitute for controlled burning when it comes to oak woodland and prairie management.



In this section, I'll discuss the following topics…

How to plan a prescribed burn.

How to construct firebreaks.

How to ignite the burn unit to achieve objectives.

Once we light everything, then what?

A. How do we plan a prescribed burn?

Step 1: Get to know the site

Determine burn objectives

First section: How do we plan the burn.

Step 1: Get to know the site.
Does it need to be burned? Why?

Determine burn objectives: Brush kill, non-native grass/forbs, garlic mustard control, thatch/duff consumption, promoting forbs/grasses, slash/fuel consumption.

Step 2: Get Training

- Wisconsin Prescribed Fire Council https://prescribedfire.org/
- Minnesota Prescribed Fire Council https://www.mnprescribedfire.org/
- Local prescribed burn associations or contractors

Get Training!

National Wildfire Coordinating Group (NWCG)

- S-130/190 - Basic wildland firefighting
- S-212 - Wildland fire chainsaws
- S-219 - Ignitions course
- S-290 - Intermediate fire behavior

Once you know you need to burn and have been trained..

Step 3: Write a burn plan

Considerations

- Burn unit design limitations (roads, development, natural barriers to fire spread, hazardous fuels, terrain)
- What “fuel type” are we going to be burning?
- What kind and how big do our firebreaks need to be?
  - 2-3 times the fuel height is recommended
- Do we need to get a permit?

Step 3: Write a burn plan continued.

- Notifications
- Seasonality
- Weather conditions
- Expected fire behavior

- Do we have to notify our neighbors?
- What season should we burn in?
  - Are there fire sensitive species in the area to be burned? Or other species to account for?
- Weather conditions (temp, rh, wind speed, wind direction, smoke disbursal, local fire indices, long term trends)
- What is our expected fire behavior based on the weather and fuel conditions?

Step 3: Write a burn plan continued.

- People
- equipment/water
- What if the fire escapes?
- Medical Emergency

- How many people do we need?
  - What is the leadership structure for the burn?
  - What are the specific assignments for crewmembers?
- How much equipment/water do we need?
- What if the fire escapes?
  - Identify contingencies
  - What will we do incase of a medical emergency during the burn?

Step 3: Write a burn plan continued.

- LCES – Lookouts, Communications, Escape Routes, Safety Zones
- Requirements to extinguish

- LCES – Lookouts, Communications, Escape Routes, Safety Zones
- Are there requirements to extinguish the fire?
  - Wisconsin Law – you must not leave the fire until it is extinguished.

B. How do we construct firebreaks?

- Use natural or man-made barriers
  - Roads
  - Rivers
  - Plowed ag fields
- Removing Fuel
  - Mowing
  - Brush cutting
    - Leaf blowing
  - Rotovating or tilling

Firebreaks can have many different forms. Anything that will provide safe access while limiting fire spread will do.

Low maintenance options:

Roads
Rivers
Plowed Ag Fields

More labor-intensive options:

Mowed firebreaks
Brush cutting where access is restricted
Leaf blowing thatch to reduce fuel within firebreak.
Rotovating or tilling

Removing hazardous fuels

Additionally, you may need to remove hazardous fuel loads adjacent to firebreaks to reduce chances of spots or escapes.

This involves cutting/piling/burning fuel loads, chipping, or removing fuel from the site.

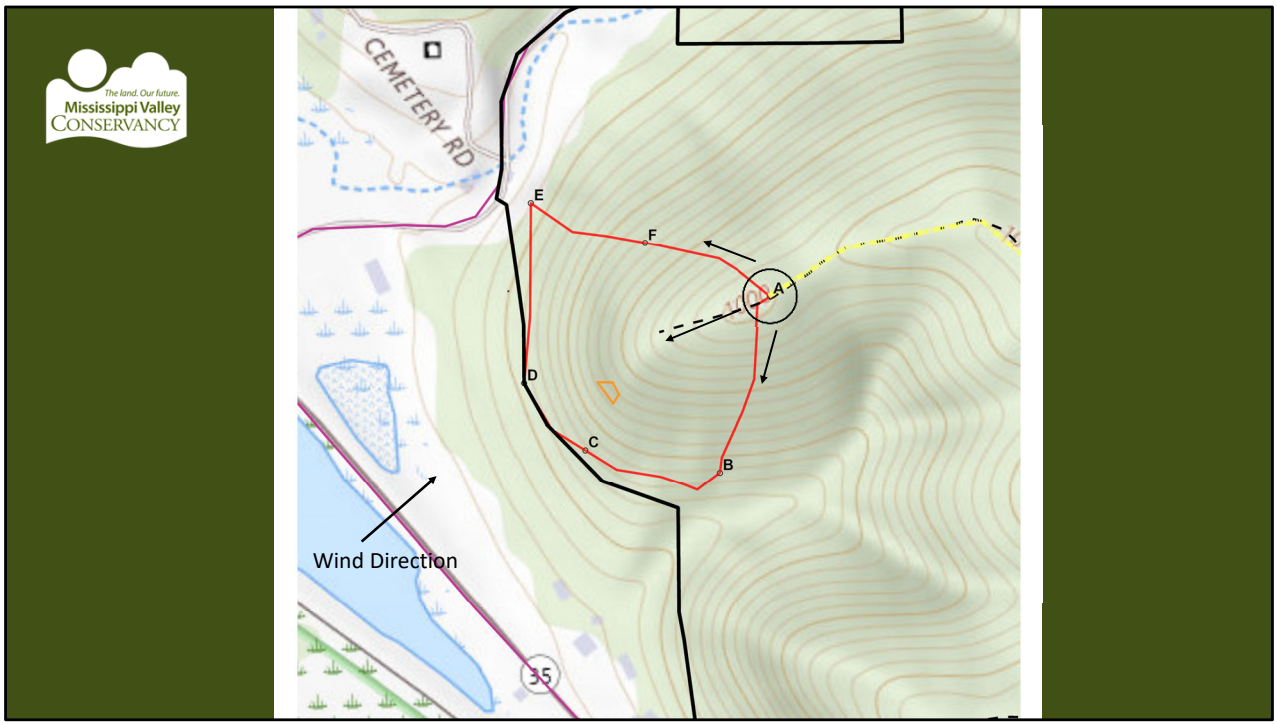
C. How do we ignite the burn?

Anatomy of a flame

How do we practically ignite our burn unit to achieve our objectives once our firebreaks have been completed?

First let's discuss the anatomy of a flame…

Headfire – largest flame lengths
Backing fire – smallest flame lengths
Flanking fire – fire burning parallel to the wind direction or slope.



We always begin a test fire on the downwind or upslope side of the unit. This is the direction the fire wants to go. It will burn slower into the unit.

We do NOT want to ignite a test fire on the upwind side or downslope side of the unit. This will cause a headfire to enter the unit potentially jumping adjacent firebreaks and causing increased risk for containment and firefighter safety.

When possible, we always like to have interior igniters to reduce fire intensity when needed. This reduces fire severity and reduces the risk of spotting and escapes.

We also regularly burn around refugia (unburned areas) left for invertebrates or reptiles to minimize negative impacts to sensitive species. This provides an added layer of complexity during burn operations.

This technique is generally referred to as a “ring fire” technique.

Regulating fire intensity along firebreaks and within the burn unit is done by modifying the ignition pattern.

Dots lower fire intensity
Strips increase fire intensity depending on their orientation.

C. Once we ignite everything, then what?

We walk away?
- No!

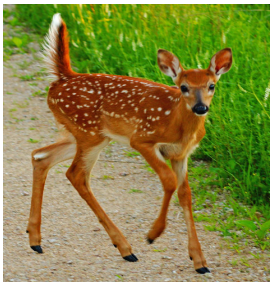
We “mop up”

Once our fire is rung, then what?

Can we walk away? No!

We “mop up” by combing through the unit, extinguishing every last ember until no hot spots remain and we can deem the fire extinguished.

III. How does timing and frequency modify plant and animal communities?


How does timing and frequency modify plant and animal communities?

Let's answer a few questions before we continue..

When can we burn?

Spring, Summer, Fall, Winter

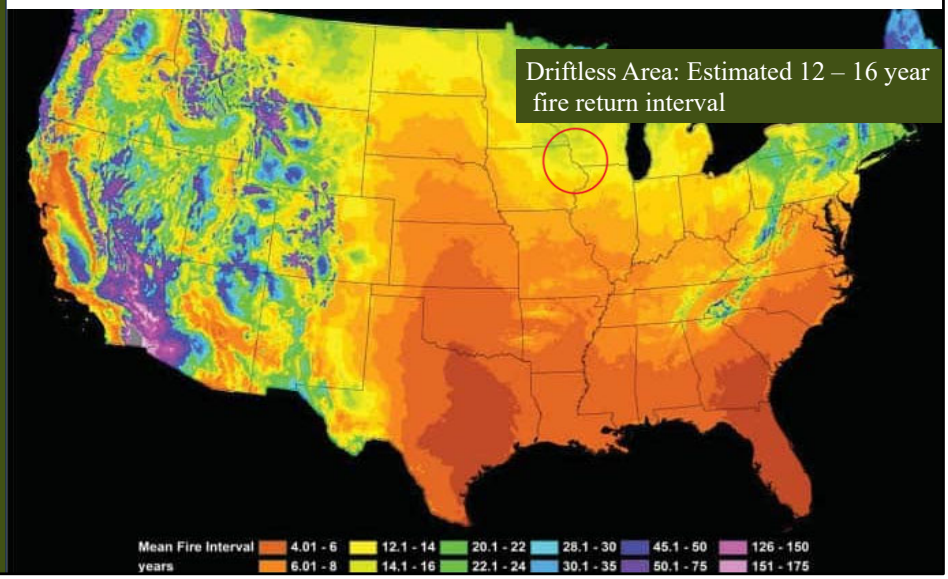
How often can we burn given environmental conditions?

As often as we have the resources available.

How often should we burn?

Depends on your objectives.

A. Historical fire timing and frequency



Should we be burning at the presumed historical frequency of every 4-16 years? Depending on your specific area.

Is the historical fire frequency working in today's landscape?

No! The overall context of the landscape has changed, so the frequency must also change from historic conditions if we're going to modify the land to increase fire dependent habitats on the landscape and increase biodiversity. To achieve most prairie, savanna or oak woodland characteristics, burning should be done as frequently as possible.

We're currently in the era of designer landscapes where we can modify the land as we see fit given enough resources.

B. Current/Future Fire Frequency

Annual

Biennial

Every 3 years

Every 4+ years

Annually: Reduces small diameter woody vegetation, increasing herbaceous vegetation

Biennial: Maintains current live woody stems

Every 3 years: No control of woodies, borderline encouraging woody growth.

Every 4+ years: Increasing woody brush and trees

Most woody species resprout quicker after a fire and can grow too large to be top-killed by a fire after 3-4 years without burning.

In this case, you may need to cut/treat woodies again if you wish to control them.

C. Timing

Growing Season

Dormant Season

Timing

Spring, Summer, Fall Winter can be lumped into the following two categories depending on the growth stage of the year.

Growing season:

- lower intensity (more smoke)
- negatively impacts brush
- Higher potential for collateral damage to non target species
- Spring burning favors late season grasses and can put a damper on some of the early flowering wildflowers.

Dormant season:

- Promotes more short stature native plants.
- Fall burning favors early and mid summer wildflowers.
- Negatively impacts brush

D. Specific Species Considerations

Invertebrates

Reptiles

Birds

Mammals

Plants





- Animal species can be complicated.
    - Invertebrate communities: some inverts are fire sensitive, and some don't seem to mind. Impacts largely depend on burn timing.
    - Reptiles: are dry adapted so they like burning but impacts also depend on burn timing.
    - Birds – Depends on the species – some species prefer old growth forests, and some prefer mixed grassland and prairie, some prefer open grasslands. The more you burn, the more you'll favor the more open structure adapted species.
    - Mammals: Most mammals are generalists. They'll utilize burned areas for forage and cover depending on burn timing.
    - Burning in the early growing season promotes habitat for deer browse and turkey foraging because new growth is lush and high in nutrients.
    - Burning in the late growing season promotes habitat for deer bedding,

fawn cover and turkey polt rearing because woody brush has more time to resprout, creating more
woody structure to serve as cover during the growing season.

- Plants: Overall shift from more mesic species like maple and basswood to more fire tolerant species including oak and hickory in the overstory with open structured understory with some shrubs but primarily herbaceous vegetation.
    - Some clonal species are less impacted by fire.
        - Sumac, and black locust seem to be encrouaged by fire due to vigorous resprouting after top killing.
            - There is some research from Konza Prairie Biological Research Station in Kansas that suggests that annualy burning each fall can have an impact on decreasing sumac over a long period of time (10+ years) as opposed to burning in spring or summer. When clonal species cant grow up (by continually being topkilled) they grow out.

Burning isn’t the only tool in the toolbox.

Often burning is complemented by seed collection, brush removal, selective tree thinning, and herbicide application to restore native habitats and provide wildlife habitat.

IV. Why does it matter?

Why does any of this matter?

It matters to them! The plants and animals that live on the land depend on their habitats like we depend on our homes. They need them as much as you or I need a roof over our heads.

They can't provide their own habitats! So, we must save these habitats for them.

It matters for you!

We also depend on them! The wildlife that controlled burning maintains habitat for, are the same wildlife that we depend on to pollinate our crops and fill our freezers come hunting season.

The plants filter our water and clean our air.

As much as we like to think that we're not, we ARE dependent on the land and wildlife provided by fire dependent habitats here in the Driftless Area.

And finally, they are depending on US to make sure they have quality places to explore which provide the same natural benefits (clean water, clean air) that we enjoy.

Join me in caring for the land for us, and for them if you enjoy clean water, clean air and places like this one!

Sugar Creek Bluff SNA

Join us as a volunteer in the office or the field.

Join us to learn more at our Linked to the Land events throughout the year.

Join us by donating to support our educational programs or restoration efforts.

Join us by hiking, birding, canoeing, or exploring at more than 30 nature preserves across 9 counties. Bring a friend and help others begin to understand the importance of protecting wild places close to home.


The land. Our future.
Mississippi Valley
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