Welcome and thank you for visiting the River to River CWMA’s 2016 WPF workshop presentations. This is one in a series of five presentations that were presented in different locations across the River to River region in the spring of 2016.

This presentation goes over best management practices, general strategies, and specific techniques by species to manage invasive plants.
These are mostly common sense ideas for best management of invasive species.

Best Management Practices

- Learn to identify invasive species
- Avoid unintentional introduction/spread
- Recognize/predict response of invasives to management
- Respond early to new invasives (EDRR)
- Minimize disturbance during management
- Maintain desirable species
- Avoid working in areas with invasive species when seeds or flowers are present if possible
- If unavoidable, conduct activities with invasive species last, after uninfested areas.
- Thoroughly remove all soil and plant material off of equipment after working in infested areas
Use of a plant phenology chart such as this one from the management guide at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3828074.pdf can help to better time treatments for the most effective treatments with the greatest impact on the target species.
The general idea here is that we should begin treatments of the outliers first, then push in on the edge of the core infestation, and finally, treat the core of the infestation. The logic is that we may not get to treat the entire population, and if we were to begin with the core, then the outliers may be allowed to set seed and spread to create a larger problem. Meanwhile, the core infestation has likely built up a seed bank that will require multiple years of treatment, so will still need to be treated in subsequent years.

On the other hand, with an outlier population, if it were to be controlled right away, the outlier population will not have had time to build up a seed bank. This will allow you to then treat from the edge of the core population towards the core and finally completely eradicate the population with follow-up treatments that would require less time and resources each year.
Integrated pest management (IPM) in natural areas is an ecosystem-based strategy that focuses on long-term prevention of invasive species or their damage through a combination of techniques such as cultural practices, mechanical controls, biological control, and minimizing the use of herbicides. Management actions are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment. Timing of management practices is often critical to an IPM strategy.
Cultural controls are preventative measures, or actions that lead to a resistance to invasion. Whole systems are more resilient and resist invasion or reinvasion. Restoring native communities following control can improve long-term results. Prescribed fire, when timed appropriately, can control some species, or be a preparatory action to improve control through another treatment, such as herbicide application.

Having a plan, even if it needs later modifications, can improve results and lead to better management. Each site can have different characteristics that could mean different management techniques fail or succeed depending on differences between those characteristics.

Monitor your results. Don’t be afraid to change your tactics or strategy if you find your original ideas do not appear to be working.
Prevention is the best option for management. It requires the least amount of time and resources in the long run when compared to controlling an infestation once it has become established.
This photo is from Cave Creek Glade Nature Preserve and is a good example of a resilient landscape that has been managed for diversity and appears to resist invasion from the surrounding disturbed areas. Some level of disturbance is necessary for maintaining most of our habitat types. Fire is a necessary disturbance that can lead to increases and decreases in different species and which species are favored will depend on the timing of the fire and the phenology of the species at the time of the fire. Generally, species that are actively growing at the time of the fire will decrease following fire at that time, while species that are dormant will likely increase following a fire at that time. Canopy gaps in the forest are also necessary for the germination of sun-loving species such as our native oak trees. However, these same canopy gaps can be a foothold for invasive plants to get a start and spread deeper into a forested habitat. Any disturbance that is introduced into a natural area should be properly timed or followed-up with additional treatments to reduce the abundance of invasive species in that area.
As mentioned in the previous slide, fire effects on vegetation depend largely on the timing of the fire, as well as the adaptations of the species to fire or lack thereof. Fire is necessary for maintaining many of our natural communities, from forests and prairies to glades and even some wetland communities. We need to take care not to spread invasive species while conducting prescribed burns or conduct this practice without the expectation of follow-up treatments where/when they may be necessary for invasive plants we know will increase following a burn. Prescribed burns can also be a way to prepare a site for herbicide treatment, and several examples of different species that may be appropriate for this practice will be examined in greater detail to follow.
Answering many of these questions will be a good place to start when considering a plan for your site. Soil types, natural communities, historic land use, corridors, species inventories, and more will direct your thinking about where potential trouble spots may be, and what the best strategy may be for managing invasive species on your site.
An adaptive management approach is a must in most cases. The first attempts at controlling and managing a site for invasive species may not be the approach that succeeds in the end. You may need to follow up treatments with plantings, change the timing of various practices, use different herbicides or rates of herbicides, try different combinations of fire, herbicides, and mechanical controls to lead to the greatest result.
Mechanical controls can be successful in managing some species, especially in reducing the population size and effects of many invasive plants. They can also be a preparatory action to minimize the use of subsequent herbicide treatments. Timing of mechanical controls like mowing or string trimming can be critical to controlling herbaceous plants.

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[Image of mechanical controls methods]
A knapweed root weevil, a currently used biocontrol insect on spotted knapweed (left)

Verticillium albo-astrum, or Ailanthus verticillium wilt results in the near complete death of tree-of-heaven and is being researched as a potential biocontrol (top right).

A fungal leaf blight on Microstegium could be a potential biocontrol, but more research is needed. This leaf blight can also infect corn so is not likely to be an authorized biocontrol any time soon (bottom right).

Finally, prescribed grazing can be a form of control on its own when timed properly, or when coupled with other means of control, such as a follow-up herbicide treatment of resprouts.
Using Chemical Controls Wisely

- Use the least to effectively treat
- Minimize area, e.g. hand-pull outliers near desirable plants
- Minimize overspray
- Reduce drift/volatilization
- Specificity
- Timing
- Use the least toxic options
Using creative tools to minimize overspray and non-target impacts can be effective and fun!
## Herbicide Selectivity

- **Grass-specific**
- **Broadleaf specific**
- **More specific**
  - Transline (clopyralid) targets legumes and composites
  - Milestone (aminopyralid) similar targets
- The more intact we can leave the native community, the faster it will recover
Foliar Spraying

- Target individual plants or clumps
- Typically low % solution (1-5%)
- Timing – need actively growing vegetation
- Can reduce non-target impacts when timing is considered for some species
- Thoroughly wet all leaves to the point of run-off (but not beyond)
- Take care to treat most leaves on a plant
- Do not use foliar applications if rain is predicted within the next 24 hours

A larger sprayer such as this electric powered pump sprayer, or higher powered gasoline engine powered pumps attached to skid sprayers will be more efficient for larger infestations, or where accessible by UTVs or 4WD trucks.
Cut stump/basal bark

- Very little non-target effects
- Can be labor intensive
- Could miss applications to smaller stems
- Typically high % solution (15-50%)
- Timing – Anytime, but spring (during leaf-out) is less effective

Cut stump

- After cutting down stem, immediately treat cut surface with herbicide.
- For small stems (under 4” in diameter) treat entire surface heavily enough that the herbicide just starts running down the side of the stem.
- For larger stems only treat the outer 1.5” – 2”
Basal Bark

- Treat the entire circumference of the stem from ground-level to 12”-18” height with oil-based herbicide
- If plant is multi-stemmed, then you must treat all stems
- Do not use this method if the stems are coated in silt, such as after a flood event, as this will greatly reduce efficacy
Chemical:
- Foliar: Apply 1 to 3% v/v glyphosate in water or 1 to 2% v/v triclopyr in water during the growing season when plants are actively growing and before fall leaf color change.
- Basal bark: Apply a triclopyr ester formulation at a 20% v/v rate, mixed with basal oil, to the lowest 1–5 inches of the stem. For larger trees, girdle or frill the stem and apply herbicide directly into cut surface. Always read and follow the herbicide label before initiating treatment.
- Mechanical: Repeated mowing of small plants may exhaust root systems, but larger plants should not be cut without immediately applying herbicide as this will cause root suckering and increase the infestation. Small plants can be pulled; larger plants or plants that are part of a larger root system (clonal growth) cannot be removed by pulling or digging.
- Cultural: Seedlings may be killed by prescribed fire. Plants older than seedling stage should not be burned without treating with herbicide first; top killing plants will cause root suckering.

Tree-of-heaven (Ailanthus altissima)
Foliar: Apply 2 to 4% v/v glyphosate in water or 1 to 2% v/v triclopyr in water.
Basal bark: Plants 4 inches in diameter or less - apply a triclopyr ester formulation at a 20% v/v rate, mixed with basal oil, to the lowest 15 inches of the stem.
Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting.
Chemical:
Foliar: Plants less than 6 feet tall - apply 2 to 4% v/v glyphosate in water or 1 to 2% v/v triclopyr in water.
Basal bark: Plants 6 inches in diameter or less - apply a triclopyr ester formulation at a 20 to 30% v/v rate, mixed with basal oil, to the lowest 15 inches of the stem.
Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting.
Mechanical: Root systems are shallow so small individuals can be hand-pulled and larger plants can be pulled with weed wrench or other mechanical means.
Cultural: Prescribed fire may kill seedlings.
Autumn Olive (*Elageagnus umbellata*)

- **Chemical:**
  - Foliar
  - Cut stem
  - Basal bark
- **Mechanical**
  - Autumn olive root systems are deep.
- **Cultural**
  - Prescribed fire has little impact and is not recommended for autumn olive control
- **Biological**

**Chemical:**
Foliar: Plants less than 6 feet tall - apply 2 to 4% v/v glyphosate in water or 1 to 2% v/v triclopyr in water.
Basal bark: Plants 6 inches in diameter or less - apply a triclopyr ester formulation at a 20 to 30% v/v rate, mixed with basal oil, to the lowest 15 inches of the stem.
Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting.
Mechanical: Autumn olive root systems are deep. Heavy machinery may be required to remove large plants.
Cultural: Prescribed fire has little impact and is not recommended for autumn olive control.
**Chemical:**
- Foliar
- Basal bark
- Cut stem

**Mechanical**
- Plants can be pulled from the ground when the soil is moist

**Cultural**
- Prescribed fire may kill seedlings but generally not large plants.

Chemical:
Foliar: Apply 2 to 4% v/v glyphosate.
Basal bark: Plants 4 inches in diameter or less - apply a triclopyr ester formulation at a 20 to 30% v/v rate, mixed with a basal oil, to the lowest 15 inches of the stem.
Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting. Always read and follow the herbicide label before initiating treatment.

Mechanical: plants can be pulled from the ground when the soil is moist.
Cultural: Prescribed fire may kill seedlings but generally not large plants.
Chemical: Foliar:
Apply 2 to 4% v/v glyphosate in water or 1 to 2% v/v triclopyr in water.

Basal bark: apply a triclopyr ester formulation at a 20% v/v rate, mixed with basal oil, to the lowest 1 5 inches of the stem.

Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting. Always read and follow the herbicide label before initiating treatment.

Mechanical: Mechanical removal may be impractical due to difficulty in removing plants without breaking the roots, as well as the difficulty of dealing with thorns.

Cultural: Prescribed fire may kill seedlings, but older plants will likely resprout from roots. Prescribed fire may allow easier treatment of plants with herbicides by removing thorny overgrowth.
Chemical: Foliar:
Apply 1.5 to 2% glyphosate v/v in water to foliage. The best time to make this application to reduce non-target damage of native plants is during the fall after the first frost, when native plants have lost their leaves and Japanese honeysuckle is still green and healthy. Apply on a warm day when temperatures are close to 60°F. Alternatively, 2% triclopyr can be applied to foliage in summer through late fall. Basal bark / cut stem: The thick stems of large woody vines can be treated in the same way as other woody species, with 20 to 25% glyphosate (cut stem) or 10 to 20% triclopyr (cut stem or basal bark).

Always read and follow the herbicide label before initiating treatment.

Mechanical: Root systems may be removed by pulling or digging, but removal of the entire root system is difficult and follow up treatments may be needed.

Cultural: Spring burns can kill young plants and remove dense growth to facilitate herbicide treatment.

Biological:
Chemical:
- Foliar: Apply 2% v/v glyphosate in water or 1 to 3 % v/v triclopyr in water to healthy foliage.
- Basal bark: Apply 20 to 30% v/v solution of triclopyr ester in a basal oil.
- Cut stem: Cutting the stem will stimulate root suckering (sprouting), increasing stem density. Cutting should not be done without applying herbicide, but herbicide may not translocate to the end of the root system. A 10 to 20% solution of triclopyr or a 20 to 25% solution of glyphosate can be used with follow up monitoring to ensure herbicide translocation. Always read and follow the herbicide label before initiating treatment.

Mechanical: Seedlings may be pulled by hand, but the root is difficult to remove completely, which will lead to resprouting.

Cultural: Prescribed fire may kill seedlings but will top-kill larger plants, which will stimulate root suckering. Fire without integrated treatment with herbicides may increase stem density 2 to 3 times.
### Garlic mustard (Alliaria petiolata)

- **Chemical**
  - Foliar
  - Mechanical
    - Bolting plants easily removed by hand pulling
    - Pulled plants that have begun to flower must be bagged and taken off site, since seeds may still form after pulling
    - Cutting flowering plants at ground level will reduce seed production
  - Cultural
    - Prescribed fire in late spring kills seedlings and reduces rosettes.
    - Once leaf litter is removed by fire, there may be a flush of new seedling emergence
    - Following up with herbicide treatment may exhaust the seedbank faster
  - Biological

**Chemical:**
Foliar: Apply 1 to 3% glyphosate v/v mixed with water to plants in rosette or bolting stage. Glyphosate may not prevent seed production once seeds have begun to form. Alternatively, a 1.5% solution of triclopyr may be used in the fall or spring on rosettes or during bolting or flowering stage. Treating flowering plants with triclopyr amine (Garlon 3A) may prevent viable seeds from forming. Once seeds are mature, they are easily spread, and entering patches of garlic mustard is not recommended. Always read and follow the herbicide label before initiating treatment.

**Mechanical:** Once plants have started to bolt, they are easily removed by hand pulling. Pulled plants that have begun to flower must be bagged and taken off site, since seeds may still form after pulling. Cutting flowering plants at ground level will reduce the amount of seed produced.

**Cultural:** Prescribed fire in late spring may kill seedlings and reduce the number of rosettes. However, once leaf litter is removed by fire, there may be a flush of new seedling emergence. Following up with herbicide treatment may exhaust the seedbank faster.
Chemical:
Foliar: Apply a grass-specific herbicide, such as sethoxydim, at a 1.5% rate in mid- to late summer until the time that seeds begin to mature on the plant. Once seed have begun to mature, entry into infestations is not recommended. Alternatively, apply glyphosate at a 1 to 1.5% v/v in water. Glyphosate is non-selective and will kill all plants contacted but is available in aquatic safe formulations, Always read and follow the herbicide label before initiating treatment.

Mechanical:
Stiltgrass roots are very shallow, and plants are easy to pull. Mowing or weed whipping is effective if done late in the season but before plants flower.

Cultural:
Following prescribed fire, there will be a flush of germination from the seedbank. Follow up treatment with herbicides or mechanical methods are necessary to prevent the development of a more dense infestation. Integrated methods, using prescribed fire and herbicides, may lessen the duration of the infestation.

Biological:

Japanese stiltgrass (*Microstegium vimineum*)
Thanks for checking out this presentation of the River to River Cooperative Weed Management Area! Be sure to check out the other four presentations in this series and see our website at www.rtrcwma.org for more resources and information such as these guides to the identification and management of invasive plants in Southern Illinois.

More Information

  [http://bugwoodcloud.org/mura/rtrcwma/assets/File/Management_SIInvasiveplants.pdf](http://bugwoodcloud.org/mura/rtrcwma/assets/File/Management_SIInvasiveplants.pdf)
  [http://bugwoodcloud.org/mura/rtrcwma/assets/File/ILIInvasiveplants.pdf](http://bugwoodcloud.org/mura/rtrcwma/assets/File/ILIInvasiveplants.pdf)

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