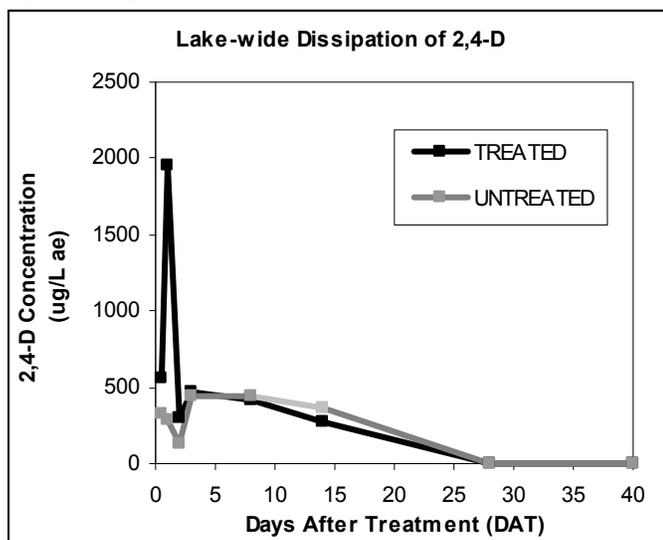


LARGE-SCALE TREATMENT RESEARCH IN WISCONSIN

Research scientists with the Wisconsin DNR and US Army Corps of Engineers ERDC have been working to evaluate large- to whole-lake scale early spring herbicide treatments for managing invasive aquatic plants. Multi-year monitoring of 2,4-D applications for Eurasian watermilfoil (EWM) and endothall for curly-leaf pondweed (CLP) are ongoing, and evaluations have been completed of fluridone for EWM¹. This page summarizes what researchers have learned so far from monitoring herbicide residuals following treatments.

Herbicides can dissipate to untreated lake areas quite rapidly.



This figure shows 2,4-D applied to a northern Wisconsin lake May 25-26th, 2010. 2,4-D was fully mixed lake-wide within three days after treatment.

The rapid dissipation of herbicide into untreated water means that the concentrations in treated areas may be lower than needed for effective control and the whole lake is exposed to a low level of herbicide. Herbicide dissipation time is affected by:

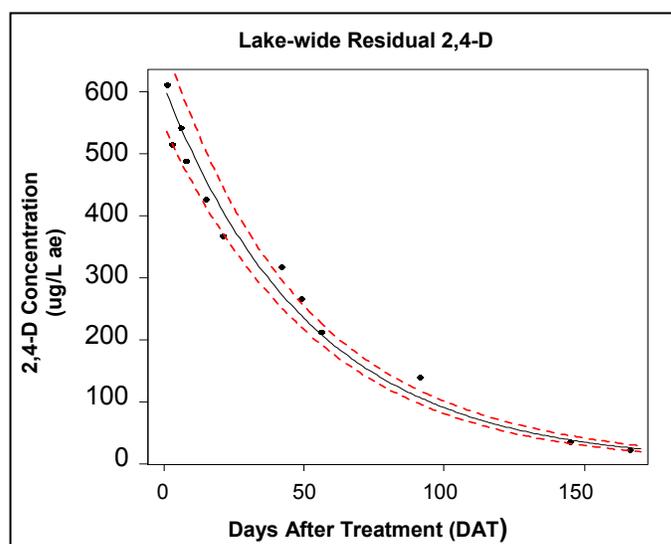
- Wind
- Water flow
- Shoreline morphometry (slower from protected bays and faster along exposed/steep littoral areas)
- Density and size of plant beds being treated

Granular formulations of 2,4-D have been observed to dissipate lake-wide similarly to liquid formulations.

Higher bottom concentrations with granular mix vertically in the water column within a day after treatment, and then dissipate off-site to untreated areas.

¹Wagner et al. 2007. Whole-lake Herbicide Treatments for Eurasian Watermilfoil in Four Wisconsin Lakes. *Lake and Reservoir Management* 23:83-94.

Degradation of 2,4-D occurs more slowly than once believed.



This figure shows 2,4-D degradation in a northern Wisconsin oligotrophic seepage lake treated on May 20th, 2008.

Under certain conditions, residual concentrations of 2,4-D above 100 ug/L may be present well past label irrigation restriction guidelines of 21 days.

Degradation takes longer in some lakes:

- Oligotrophic lakes
- Low alkalinity lakes
- Lakes with no history of herbicide usage
- When water temperatures are cool

Large-scale partial lake treatments have whole-lake effects due to rapid dissipation and slow degradation.

Rapid dissipation has been observed for fluridone, 2,4-D and endothall. If the volume of water treated is more than 10% of the volume of the lake, effects can be expected at a whole-lake scale.

LARGE-SCALE TREATMENT CONTROL RESULTS

Researchers with Wisconsin DNR and Army Corps of Engineers ERDC are currently evaluating target and non-target effects of multiple large-scale herbicide treatments as part of a study on management strategies. The projects involve detailed aquatic plant surveys, spring and fall mapping of the target species, residual herbicide monitoring, and water quality monitoring (Secchi, DO, temperature, and TSI parameters). The projects are ongoing to evaluate the long-term efficacy and risks of large-scale treatments.

Effects on Target Invasives

Seasonal EWM control can be accomplished with large-scale treatments, at initial concentrations below suggested label rates.

- Similar results observed with granular and liquid formulations of 2,4-D if concentration and exposure times are sufficient

Multi-year EWM control is possible.

- Length of control varies for unclear reasons; research continues
- EWM can return rapidly on a large scale

Low-dose, early-season endothall treatments repeated for 3-5 years can reduce CLP.

- Research in MN and WI suggest treatment must be conducted before turions (winter buds) form
- Endothall applications too late in spring have limited benefit to long-term CLP control

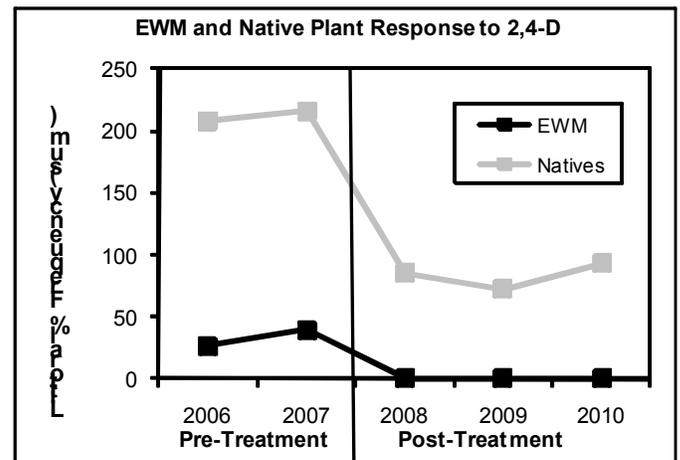
Effects on Native Plants

Large-scale treatments can result in significant damage to both monocots and dicots.

- Dicots susceptible to both 2,4-D and fluridone include native watermilfoils (particularly northern), bladderworts, water lilies and coontail
- Monocot species such as elodea, several narrow leaf pondweeds and naiads are also impacted by fluridone and some 2,4-D use.
- Fewer natives affected at lower dosages
- Endothall treatments after natives begin growing results in significant native impacts.

Effects on Native Plants, cont.

Control of EWM needs to be evaluated relative to damage to native plant populations.



This figure shows frequencies of occurrence for EWM and all native plants (summed) pre- and post-May 2008 2,4-D treatment on a northern WI lake. In this case, the frequency of EWM has remained low, but so have native plant frequencies.

Long-term success of EWM management is dependent on native plant populations recovering at least as fast as, or faster than, EWM following treatment.

Effects on Water Quality

Whole-lake scale treatments tend to result in temporary reductions in water clarity when native plants are damaged or not present, and possible long-term declines if native plants do not rebound.

Dissolved oxygen levels can decline following large-scale treatments if conducted too late in the season and water temperatures are high.



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