

# Tree seedling survival after planting under varying treatments on reclaimed mine land

April 12, 2017

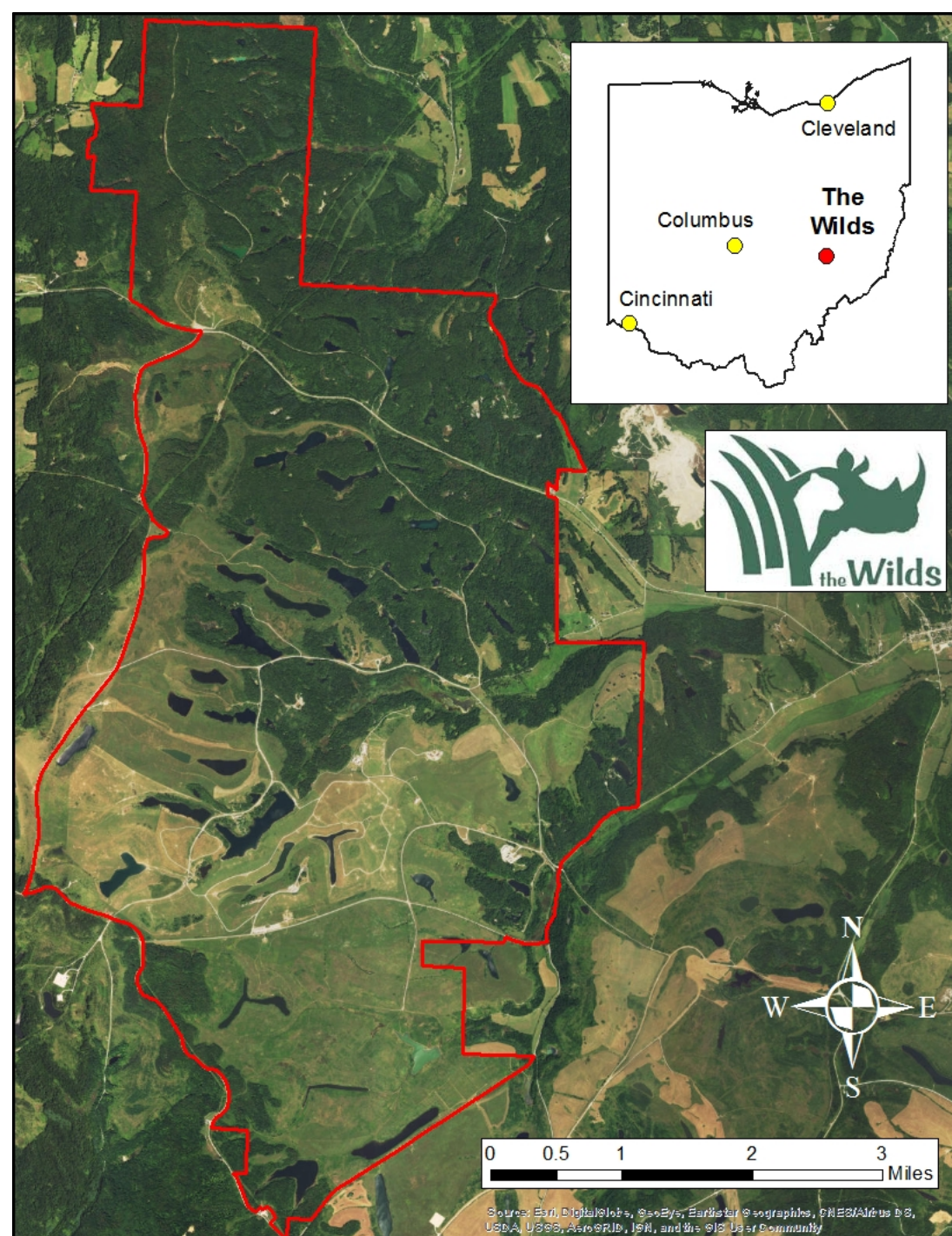
Patrick J. Boleman

Dr. Rebecca M. Swab

Restoration Ecology Associate

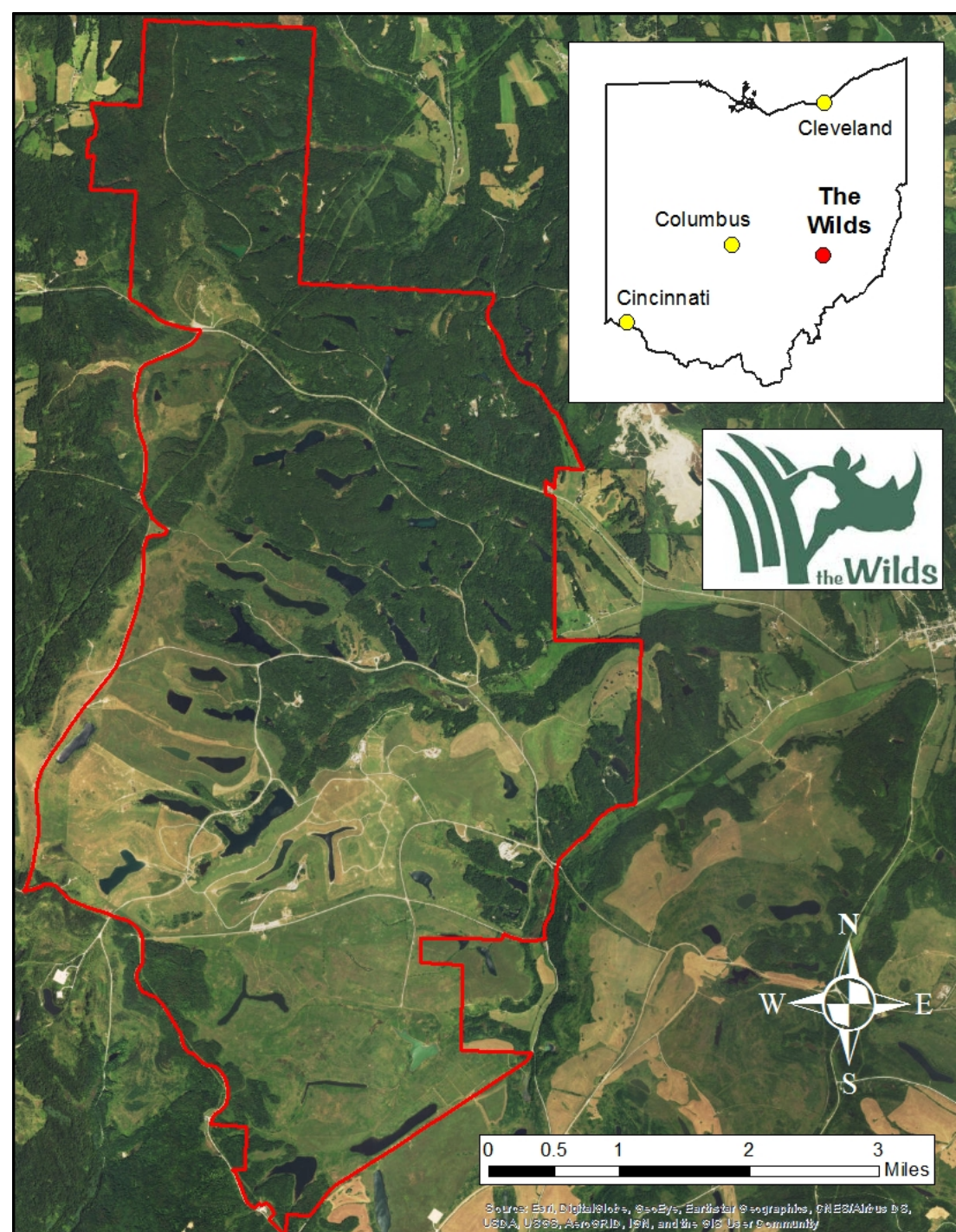
Director of Restoration Ecology





## Western Allegheny Plateau





The Big Muskie



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

# Challenges to Reforestation

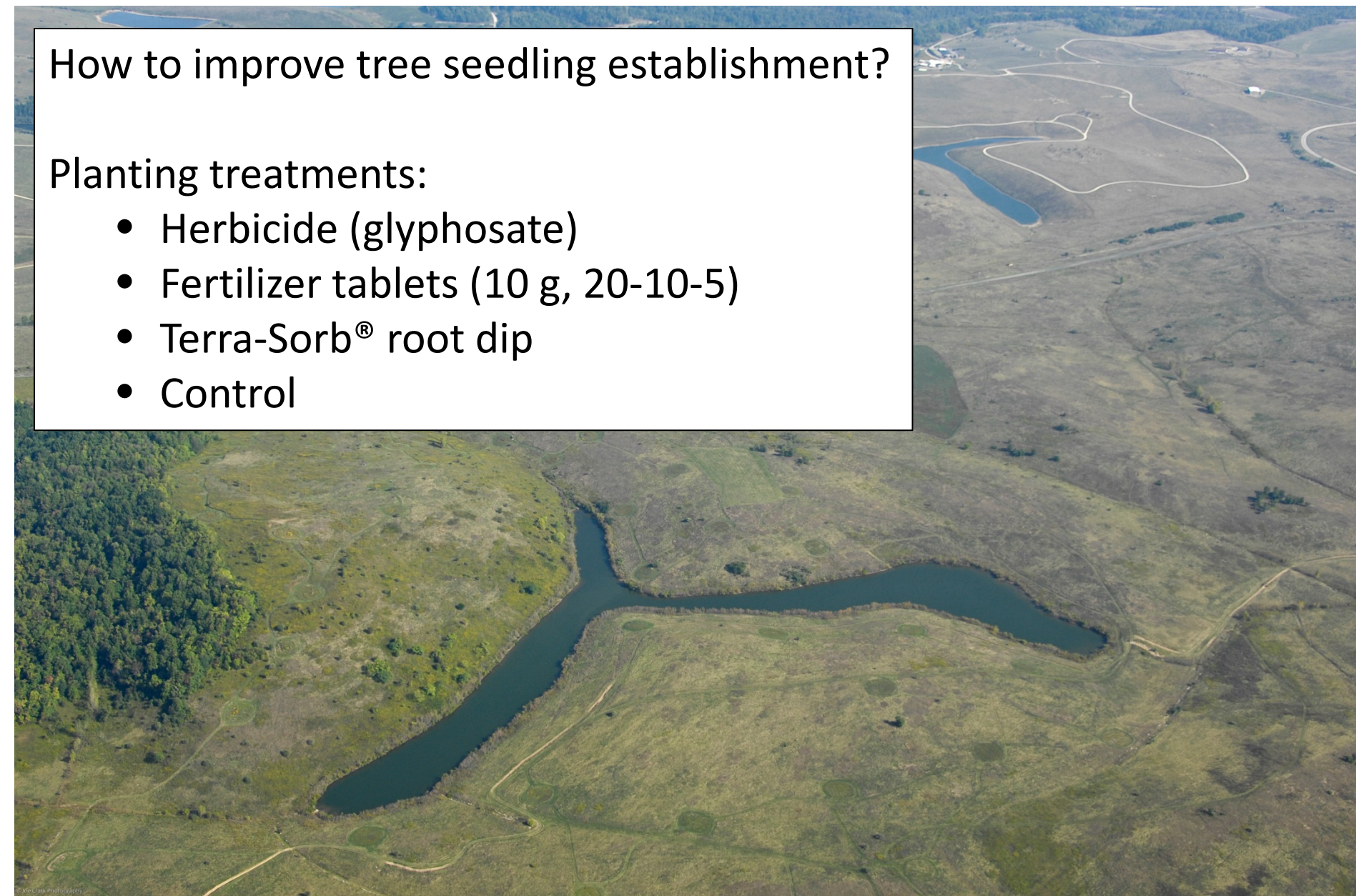
- Soil conditions
  - Compaction
  - Nutrient availability
- Non-native species
  - Autumn olive
  - Cool season grasses
  - Lespedeza



# How to improve tree seedling establishment?

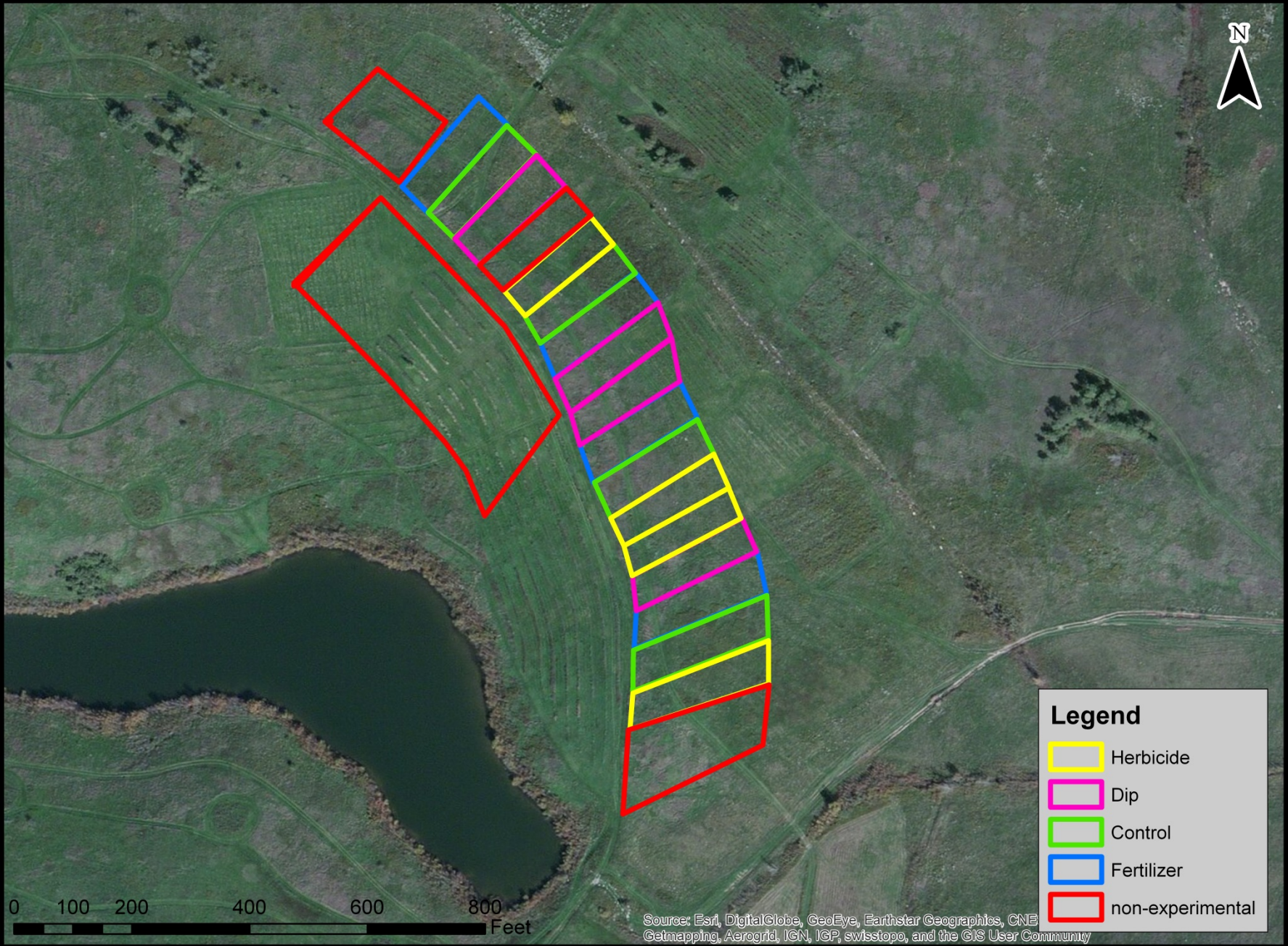
## Planting treatments:

- Herbicide (glyphosate)
- Fertilizer tablets (10 g, 20-10-5)
- Terra-Sorb<sup>®</sup> root dip
- Control





# 2016 Forest Plots





# THE FORESTRY RECLAMATION APPROACH

Jim Burger<sup>1</sup>, Don Graves<sup>2</sup>, Patrick Angel<sup>3</sup>, Vic Davis<sup>4</sup>, Carl Zipper<sup>5</sup>



## Site Prep, Fall 2015

- Broadcast herbicide
- Crosshatch rip (3' deep)





# Tree Planting, March 2016



5,000 seedlings

- White Oak (*Quercus alba*)
- Black Oak (*Quercus velutina*)
- Red Oak (*Quercus rubra*)
- Chestnut Oak (*Quercus montana*)
- Tulip Poplar (*Liriodendron tulipifera*)

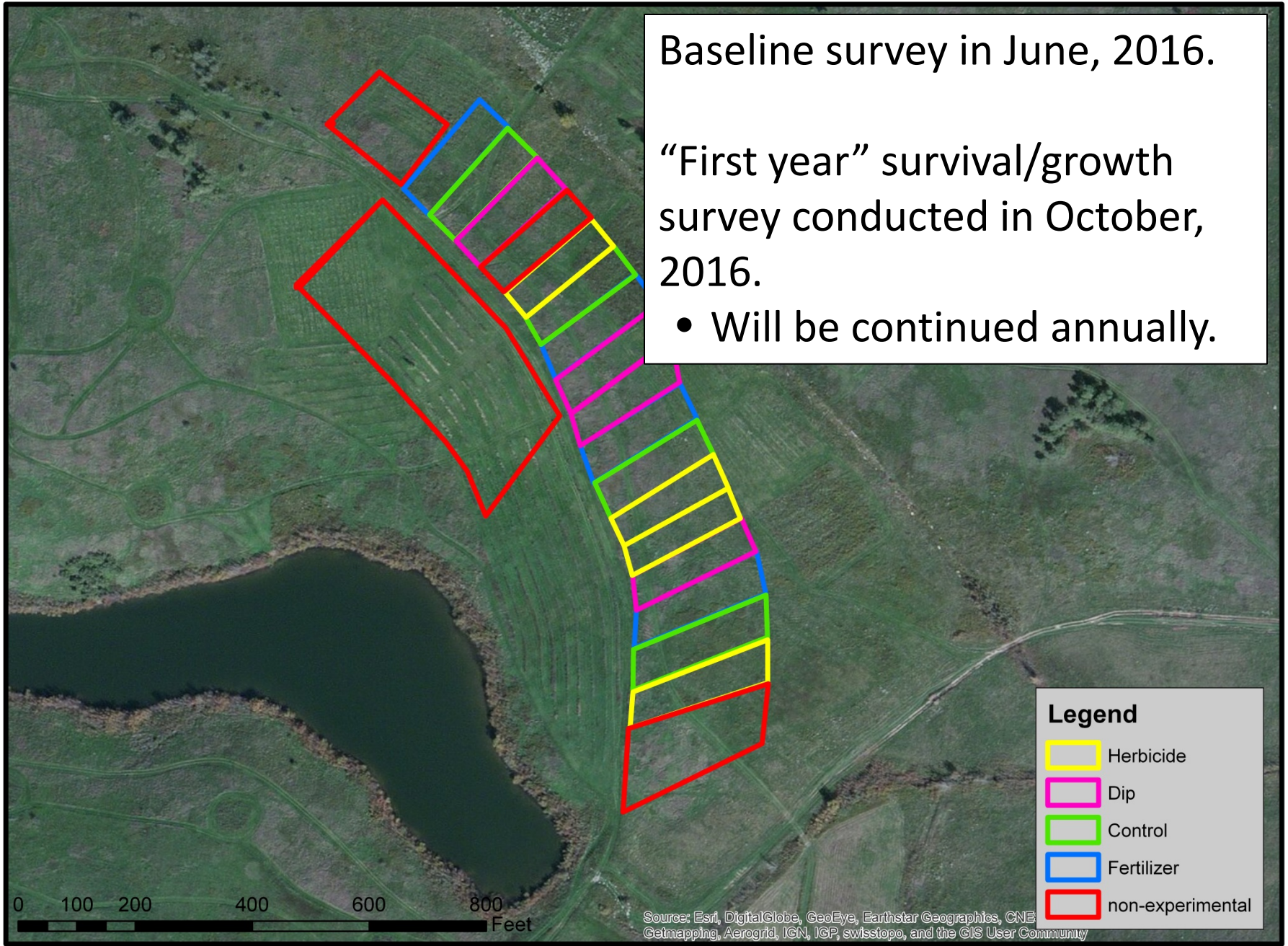


# 2016 Forest Plots

Baseline survey in June, 2016.

“First year” survival/growth survey conducted in October, 2016.

- Will be continued annually.

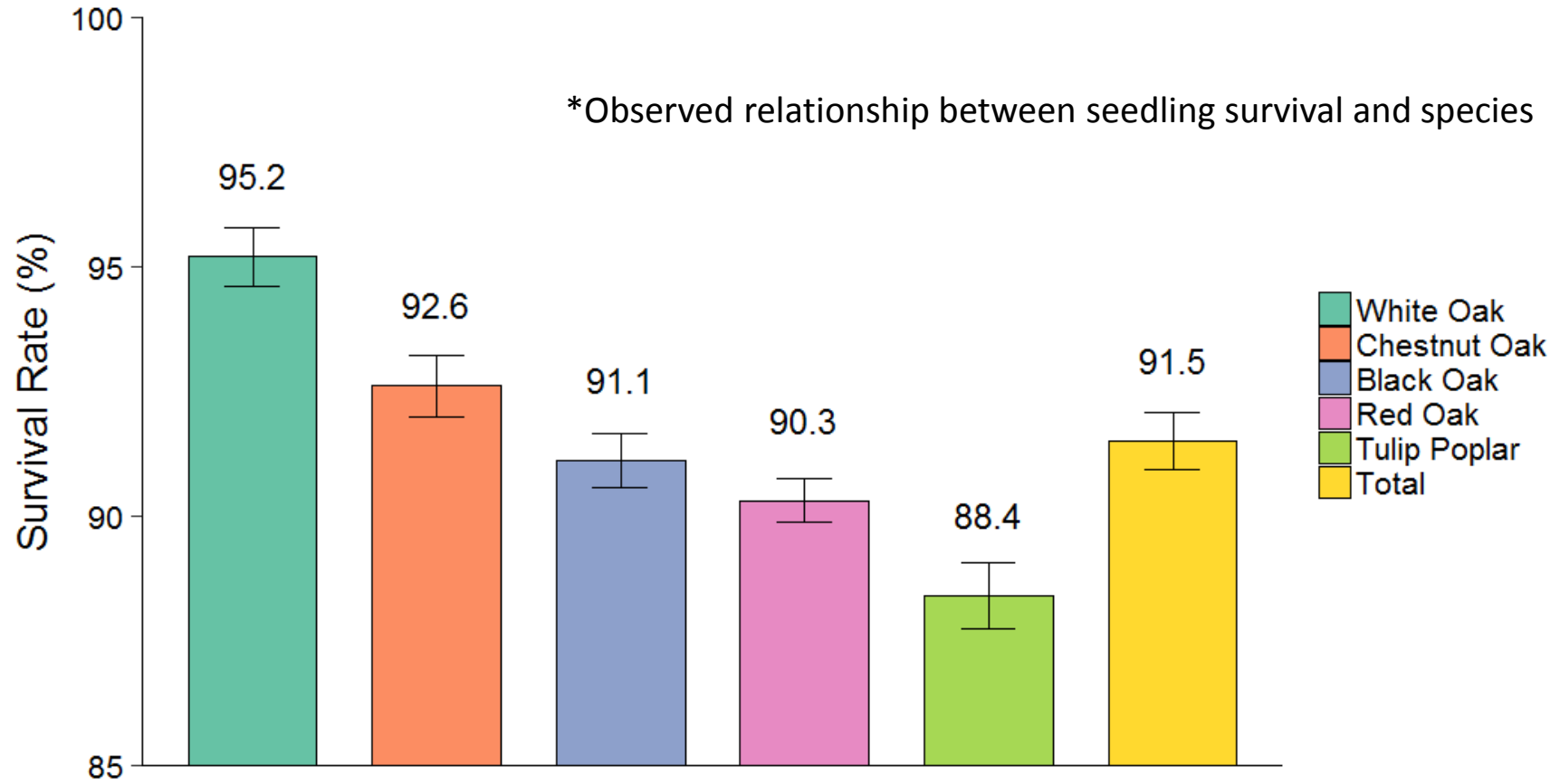


**Legend**

- Herbicide
- Dip
- Control
- Fertilizer
- non-experimental

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNR  
Getmapping, AeroGrid, IGN, IGP, swisstopo, and the GIS User Community

# Tree Seedling Survival by Species

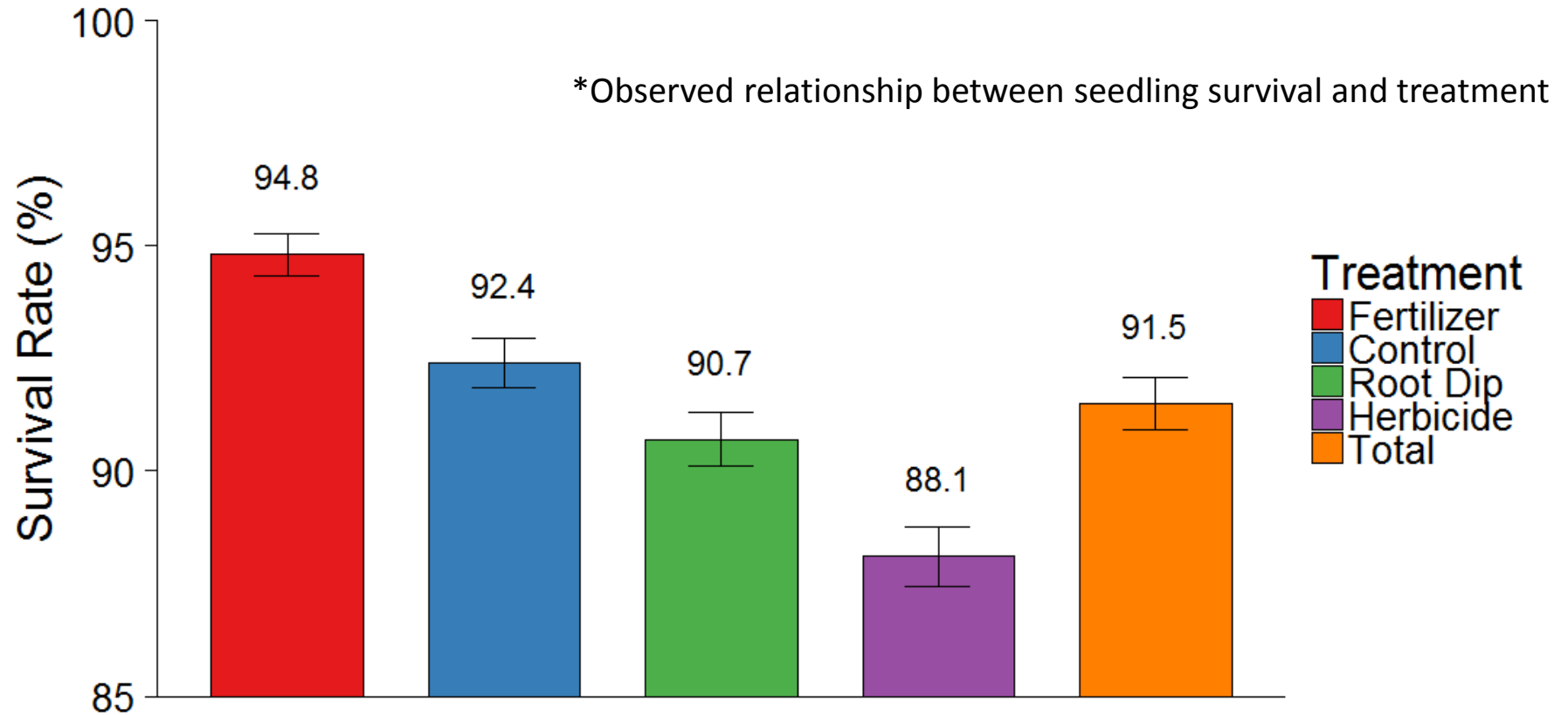


- White Oak
- Chestnut Oak
- Black Oak
- Red Oak
- Tulip Poplar
- Total

	White Oak	Chestnut Oak	Black Oak	Red Oak	Tulip Poplar	Total
Total Alive	421	449	419	428	428	2145
Total Surveyed	442	485	460	474	484	2345
Survival Rate (%)	95.2	92.6	91.1	90.3	88.4	91.5

$\chi^2$	p-value
15.512	0.004

# Tree Seedling Survival by Treatment



**Treatment**

- Fertilizer
- Control
- Root Dip
- Herbicide
- Total

	Fertilizer	Control	Terra-Sorb <sup>®</sup> Dip	Herbicide	Total
Total Alive	547	558	506	535	2146
Total Surveyed	577	604	558	607	2346
Survival Rate (%)	94.8	92.4	90.7	88.1	91.5

<b><math>\chi^2</math></b>	<b>p-value</b>
17.94	0.0005



Photo by Caitlin Mack



# Implications

- Herbicide may not be needed after planting.
  - “Competing” vegetation potentially not as harmful as we believe.
- Ripping & fertilizing may be best practice on post-SMCRA land at The Wilds.



Photo by Jess Estridge



## Further Research

- Continue monitoring
- Survey instances of herbivory
- Compare with non-experimental (tubed)?



Michael French, Green Forests Work  
Scott Eggerud, OSMRE  
Rachael Glover, OSU  
Restoration Ecology technician and apprentices  
Tree planting volunteers!

# Thank you!

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# Supplementary – Soil sampling

DATE	LAB #	SERIAL #	COUNTY	ACRES	FIELD ID	SOIL
09/28/2015	S15-34834	82856	OH-Guernsey		Pit 3 Tree P	

SOIL NUTRIENT LEVELS		Below Optimum	Optimum	Above Optimum
Soil pH				
Phosphate	(P <sub>2</sub> O <sub>5</sub> )			
Potash	(K <sub>2</sub> O)			
Magnesium	(MgO)			
Calcium	(CaO)			

## MESSAGES

The above lime and fertilizer recommendations are for this soil sample and this season only. Nitrogen, phosphate and potash recommendations are for fertilizers containing specific ratios of nitrogen (N), phosphate (P<sub>2</sub>O<sub>5</sub>) and potash (K<sub>2</sub>O). As an example 5-10-10 contains 5 % N, 10 % P<sub>2</sub>O<sub>5</sub>, and 10 % K<sub>2</sub>O. If fertilizers with the ratio(s) shown are not available, contact your local garden center or fertilizer supplier for the appropriate substitution.

pH is high. Use sulfur (see Table on back of report) to lower pH to optimum level of 6.0

## RECOMMENDATIONS

### Limestone, Calcium

Apply the following

Calcitic Limestone  
(0-3 % Mg)

Magnesium:

Gypsum (CaSO<sub>4</sub>)

### Nitrogen, Phosphorus

Apply 2.5 lbs per

LABORATORY RESULTS:										Optional Tests:		
<sup>1</sup> pH	<sup>2</sup> P lb/A	Exchangeable Cations (meq/100g)					% Saturation of the CEC			Organic Matter %	Nitrate-N ppm	Soluble salts mmhos/cm
		<sup>3</sup> Acidity	<sup>2</sup> K	<sup>2</sup> Mg	<sup>2</sup> Ca	<sup>4</sup> CEC	K	Mg	Ca			
8.0	6	0.0	0.3	4.9	25.7	20.3	1.6	24.4	74.0	1.3		

Test Methods: <sup>1</sup>1:1 soil:water pH, <sup>2</sup>Mehlich 3 (ICP), <sup>3</sup>Mehlich Buffer pH, <sup>4</sup>Summation of Cations

The high calcium level in this sample indicates the probable presence of soluble calcium. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable calcium level of 15 meq/100 g.

# Supplementary – Terra Sorb

EASY-TO-USE HYDROGEL FOR TREES

# Terra-Sorb®

## FINE GRADE

Terra-Sorb® Fine Hydrogel is a super-absorbent hydrogel that absorbs up to 200 times its weight in water. The fine grade is machined into small particles for use as a pre-planting root dip, for preventing desiccation of roots during shipment of seedlings, or in hydroseeding. Terra-Sorb® will repeatedly absorb and release water in the soil, and lasts for several years until it biodegrades. Terra-Sorb® does not contain sodium.

### DIRECTIONS FOR USE

**Dipping Bare Root Plants:** Mix Terra-Sorb® Fine with water at a rate of 1 pound per 22 gallons of water. Water absorption will vary with each local tap water, so use more or less water as needed to achieve the desired consistency that allows the maximum amount of gel to adhere to the roots. Stir gently and allow about 15 minutes to gel. Gel will appear as a collection of individual globules. Dip seedling roots into the gel and remove. Then plant immediately. Apply water to the new plant as usual.

**Tree Seedling Packing, Shipping or Planting:** Mix Terra-Sorb® Fine with water at a rate of 1 pound per 22 gallons of water. Let stand about 15 minutes to gel. Add more water or more product to achieve the desired consistency that permits the maximum amount of gel to adhere to the roots. Squirt or dip the roots of the seedlings prior to storage or shipping to prevent desiccation.

**Hydromulching or Hydroseeding:** Add Terra-Sorb® Fine to the tank mix at a rate of 50 pounds per acre before adding fertilizer. At a normal rate of 3,000 gallons of water per acre, 50 pounds of Terra-Sorb® Fine will hold an additional 1200 gallons of water in the seed area.

**Compatibility:** Terra-Sorb® Fine can be used on all tree and grass species. Terra-Sorb® is most effective over a range of soil pH from 6 to 8. At pH extremes, its ability to absorb water is reduced.

APPLICATION RATES			
Application	Terra-Sorb Fine	Water*	Coverage
Bare root dip	1 pound	About 22 gallons	Dip roots in gel
Bare root shipping	1 pound	About 22 gallons	Squirt gel on roots
Hydro-mulching	50 pounds	3000 gallons	1 acre
Hydro-seeding	50 pounds	1200 to 3000 gallons	1 acre

\*Rates are suggested. Use more or less water to suit your needs.

For planting or potting Terra-Sorb® Fine can be used at the same rates as other grades of Terra-Sorb®. See Terra-Sorb® Medium literature for planting and potting rates.

ANALYSIS

03/22/2012