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

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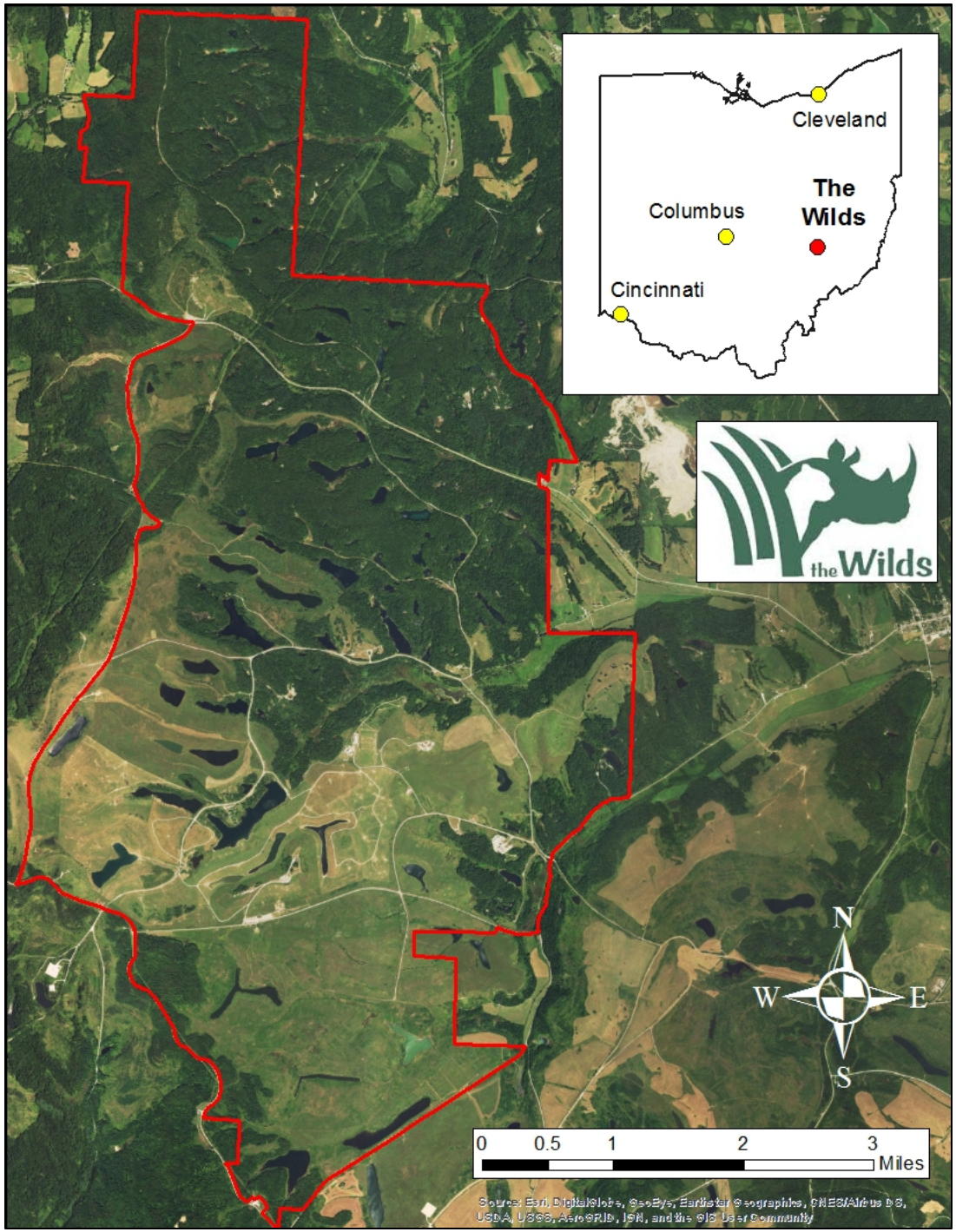
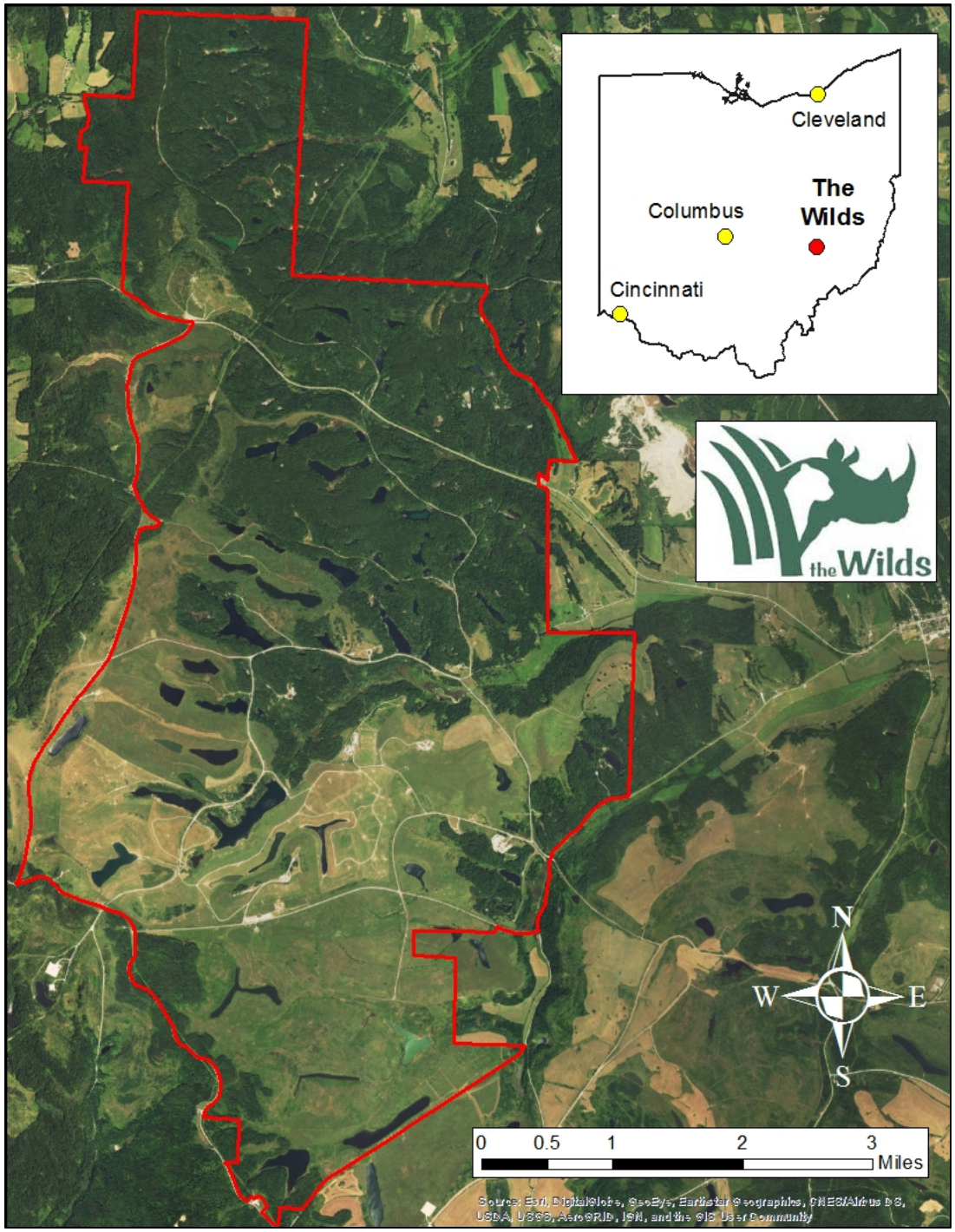
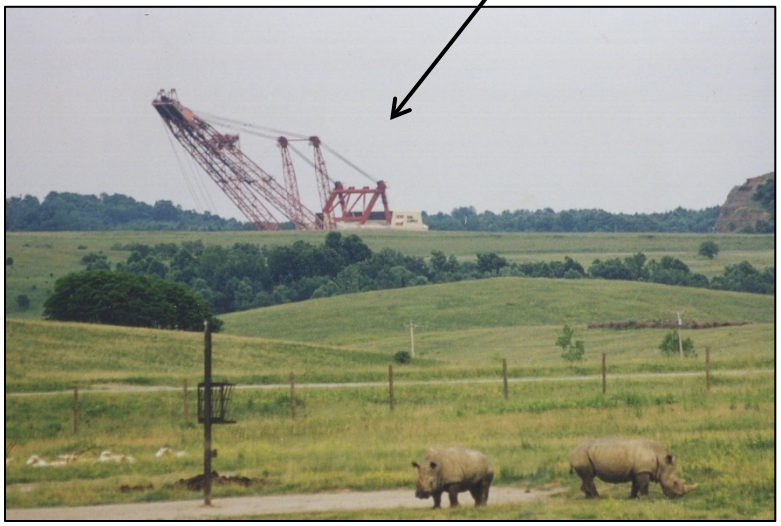



# Western Allegheny Plateau



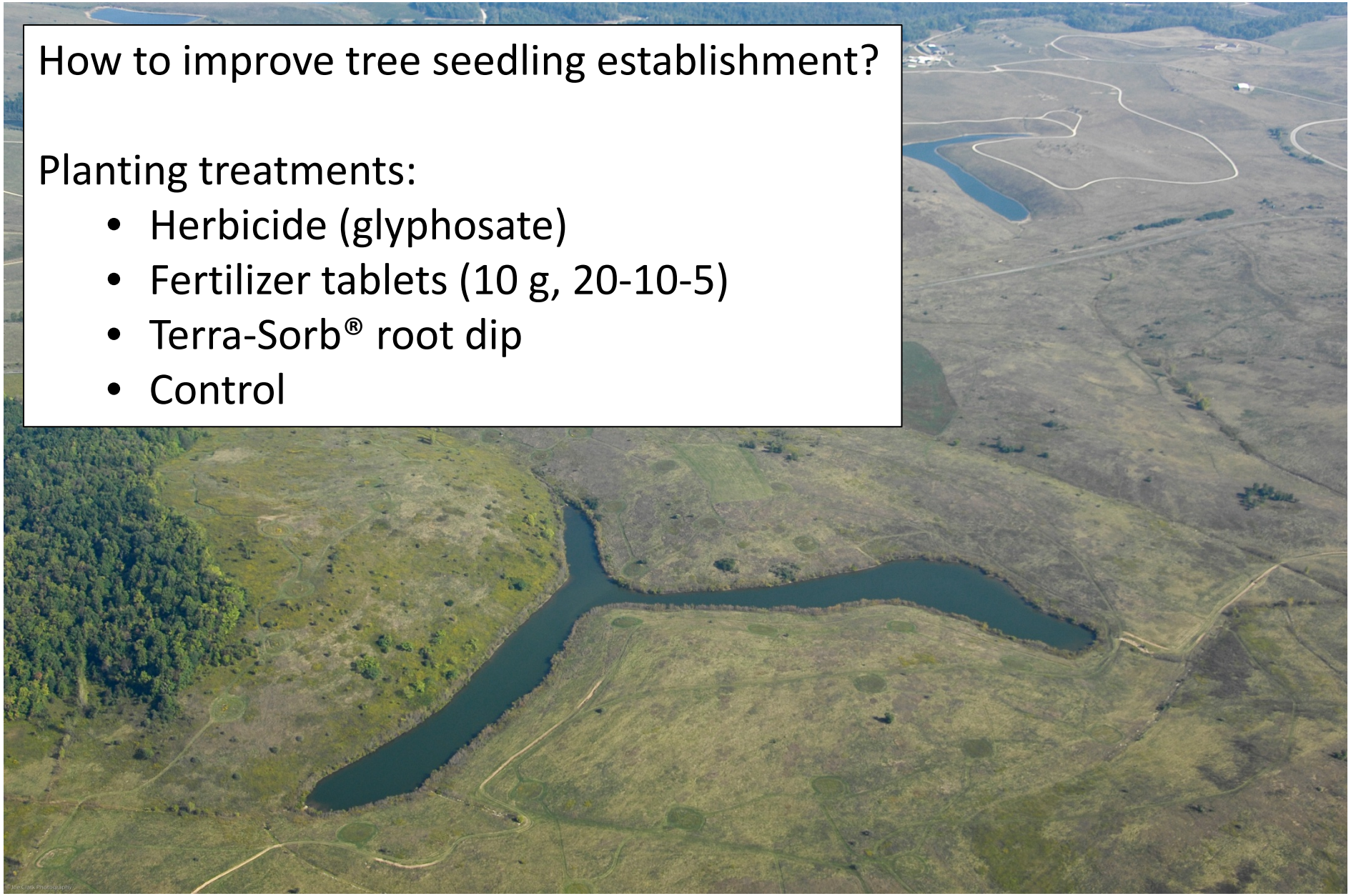

The Big Muskie



# Challenges to Reforestation

- Soil conditions
  - Compaction
  - Nutrient availability


- Non-native species
  - Autumn olive
  - Cool season grasses
  - Lespedeza

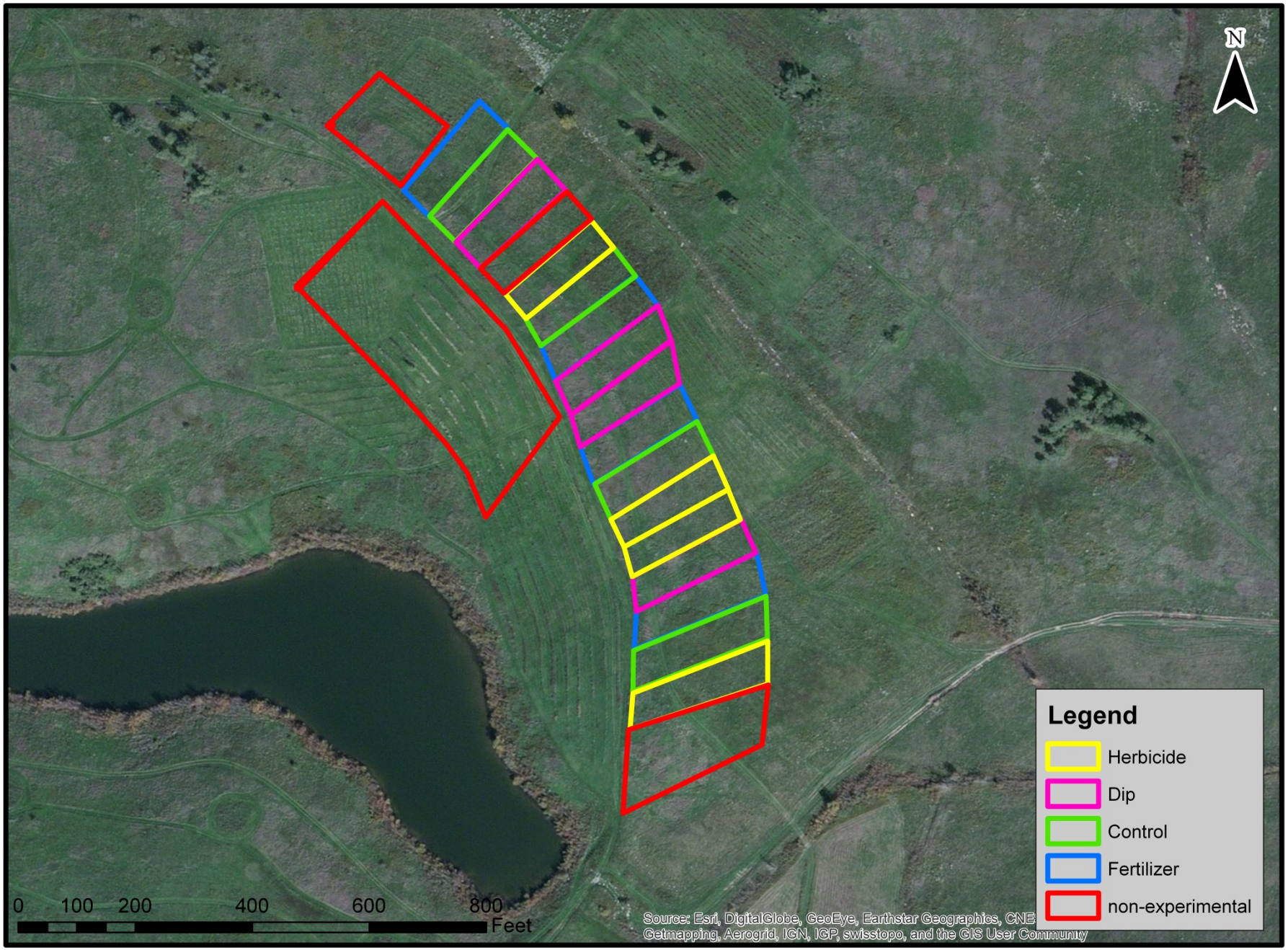


How to improve tree seedling establishment?

Planting treatments:

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

# 2016 Forest Plots



# THE FORESTRY RECLAMATION APPROACH

Jim Burger[1], Don Graves[2], Patrick Angel[3], Vic Davis[4], Carl Zipper[5]


## 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*)

green forests work

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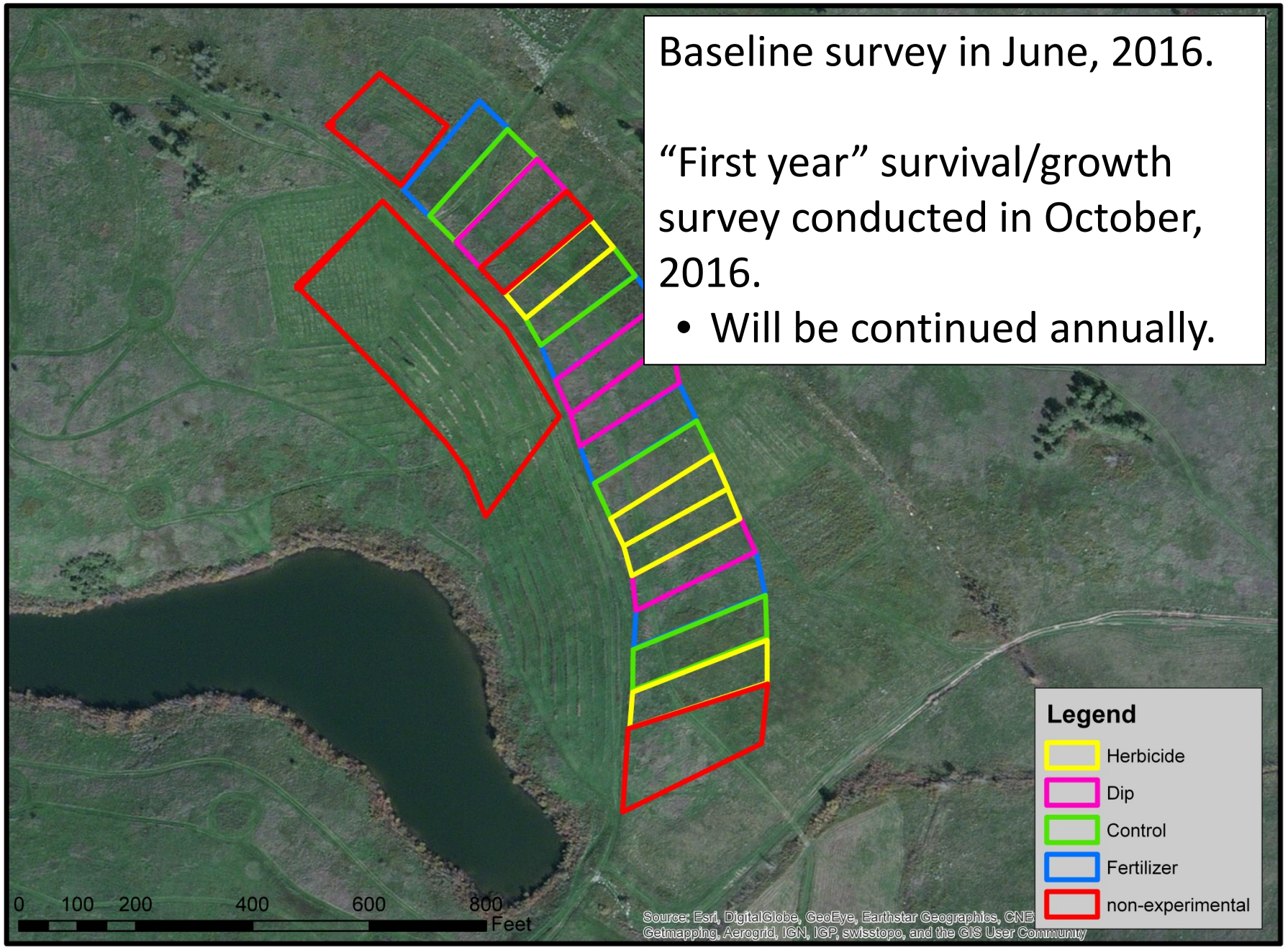
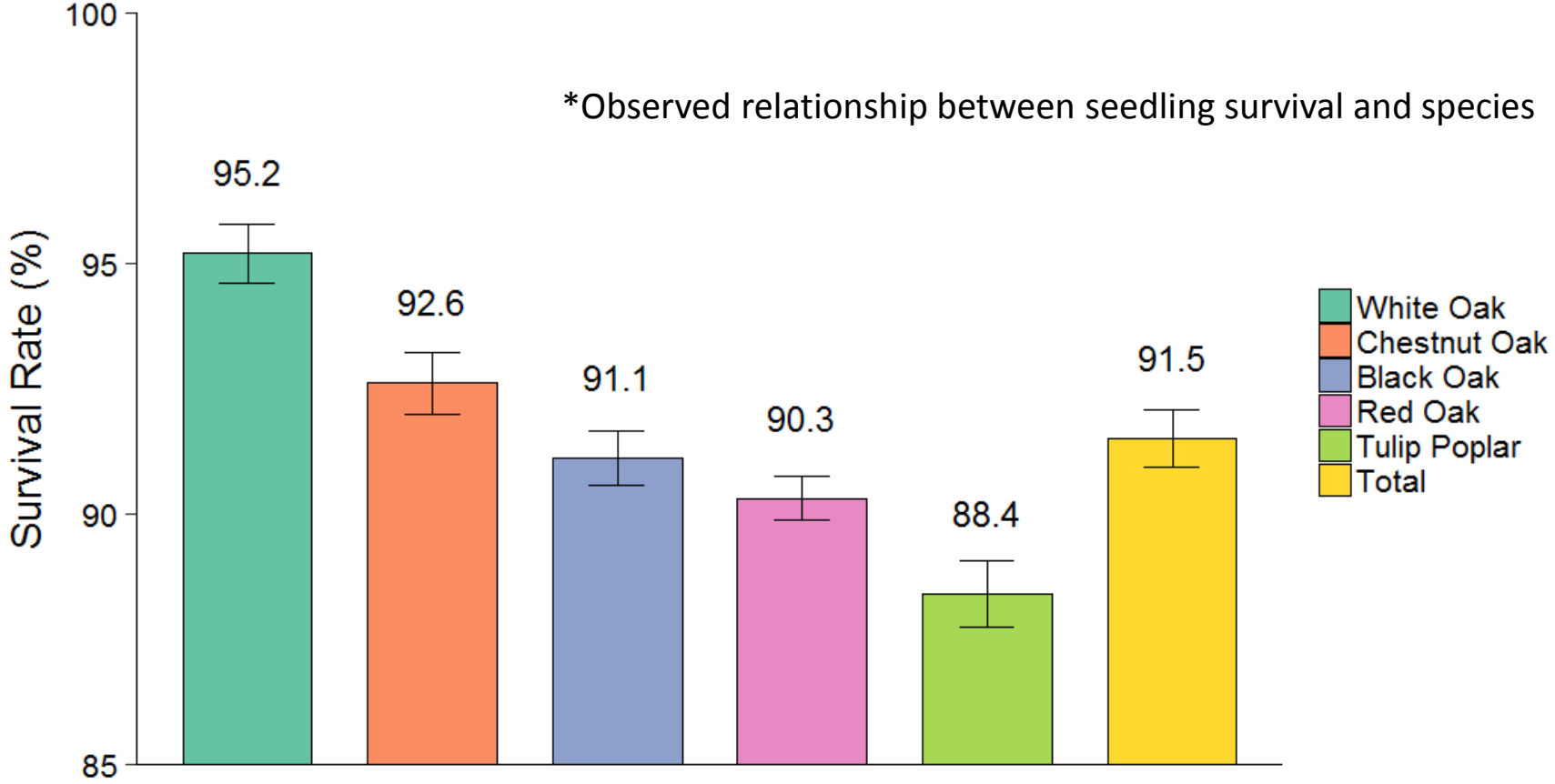
# 2016 Forest Plots



# Tree Seedling Survival by Species

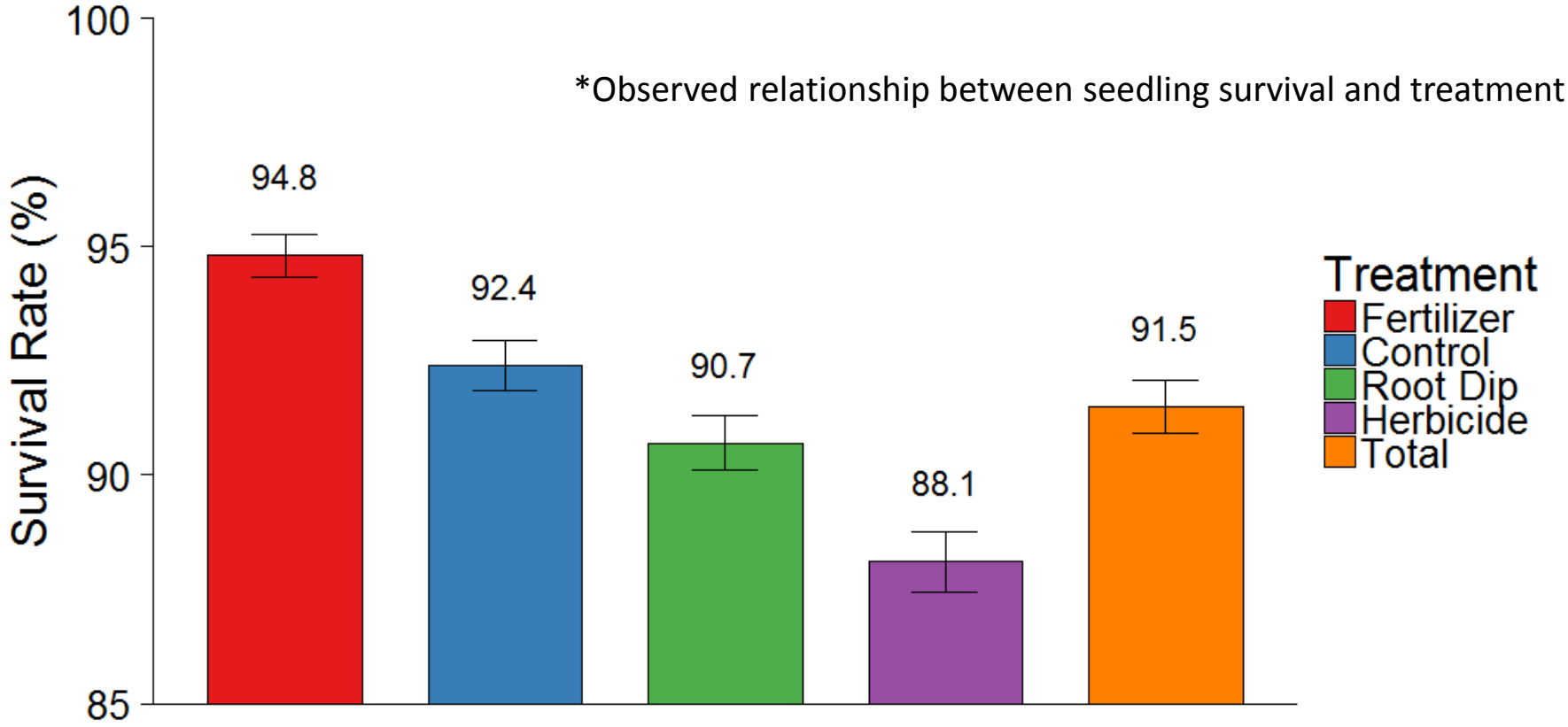



*Observed relationship between seedling survival and species

| | 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** |

| χ2 | p-value |
|---|---|
| 15.512 | 0.004 |

# Tree Seedling Survival by Treatment




*Observed relationship between seedling survival and treatment

| | Fertilizer | Control | Terra-Sorb® 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** |

| χ2 | p-value |
|---|---|
| 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.

## 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 | ($P_2O_5$) | | | |
| Potash | ($K_2O$) | | | |
| Magnesium | (MgO) | | | |
| Calcium | (CaO ) | | | |

**RECOMMENDA**

**Limestone, Calci**

Apply the followi

**Calcitic Limesto**
(0-3 % Mg)

**Magnesium:**

**Gypsum ($CaSO_4$**

**Nitrogen, Phosp**

Apply 2.5 lbs per

**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), phophate (P2O5) and potash (K2O). As an example 5-10-10 contains 5 % N, 10 % P2O5, and 10 % K2O. 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

**LABORATORY RESULTS:**

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

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]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.

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# Supplementary – Terra Sorb