# Wetland Characteristics of Glacially Derived Boulder Fields in the Northeastern United States

Robert Lichvar, Jennifer Gillrich, Lindsey Dixon and Katherine Curtis

U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL)

Hanover, NH

# Introduction

- Glacial or periglacial processes
  - Remnants of the Pleistocene glacial periods (50,000-10,000 BP)
- Boulder fields can refer to block fields, glacial till, or talus slopes
  - Block fields: repeated freeze/thaw cycles
  - Glacial till: unsorted rock and sediment deposits that are eroded from the land surface
  - Talus slopes: erosional features on steep mountain slopes

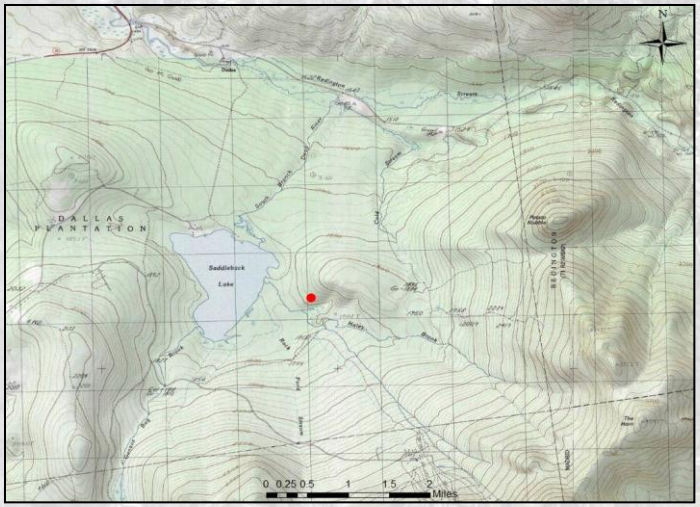
# Background

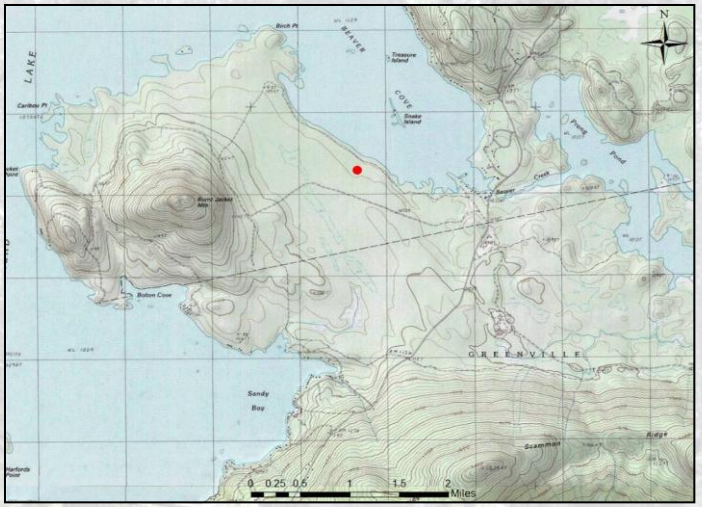
- Wet boulder fields are unique glacial deposits
  - Located in topographically low landscapes
  - Contain flowing water
  - Folist layer composed of organic material
  - Hydric soil features appear to be inconsistent with hydrologic patterns
  - Nonhydrophytic plant species
  - Potential problematic wetland types

# Objectives

1. Determine if boulder fields are wetlands or WoUS
   - What indicators are the most reliable?
2. Describe a delineation methodology

# Site Descriptions




**Saddleback**
**Rangeley, ME**

**Burnt Jacket**
**Greenville, ME**

# Field Methods

- Well installation
  - Random placement
- 2 x 2 meter plots
  - Wetland hydrology indicators, hydric soil indicators, and vegetation cover data
  - Separation between the folist layer (O layer) and the soil surface (A layer)
  - % moss cover
  - 5 random soil cores
    - Alpha, alpha-dipyridyl (AAD) liquid and AAD paper strips
  - Iris tubes

# Methods
# Statistical Analysis

**Plots that met vs. plots that failed to meet wetland hydrology criteria**

Quantitative test for differences in:

- Water table height
- Number of days within the top 12 inches
- % of moss cover

Categorical tests for differences in presence/absence of:

- Hydric soils
- Ferrous iron in soils (ADD strips and AAD liquid)
- One primary or two secondary hydrology indicators
- Hydrophytic vegetation (PI or DR)
- FACU-dominated vegetation
- Separation between the folist layer and the soil surface

# Results
# Water Table Levels

- 12 of the 19 wells (63%) met the wetland criterion of water table levels within 12 in. of the surface for at least 14 consecutive days during the growing season
  - 5 met 100% of the time
  - 2 were dry 100% of the time

# Results

**Plots that met vs. plots that failed to meet wetland hydrology criteria**

1. In wells that met the hydrology criteria:
   - Water table was higher ($p<0.001$) for a larger number of consecutive days ($p<0.001$)
2. Wetland hydrology was associated with:
   - Ferrous iron in soils- AAD paper strips and AAD liquid
   - Hydric soils
   - FACU-dominated vegetation
   - Separation between the folist layer and the soil surface
3. No association between wetland hydrology:
   - Primary or secondary hydrology indicators
   - Hydrophytic vegetation
   - Moss cover

# Results
# Boulder Field Delineation

- 3 plots – Three-factor wetlands
  - Presence of 1 primary hydrology indicator
  - Hydric soils and hydrophytic vegetation present
- 7 plots – Upland
  - All indicators absent
- 6 plots – FACU dominated wetlands
  - Primary hydrology and hydric soil indicators present
  - Nonhydrophytic vegetation
- 3 additional plots – FACU dominated wetlands with problematic soils
  - Met vegetation requirement for a FACU dominated wetland
  - No hydric soil indicators
  - Iris tube reduction and AAD paper strips reacted

# Discussion
# Reliability of NC-NE RS Indicators

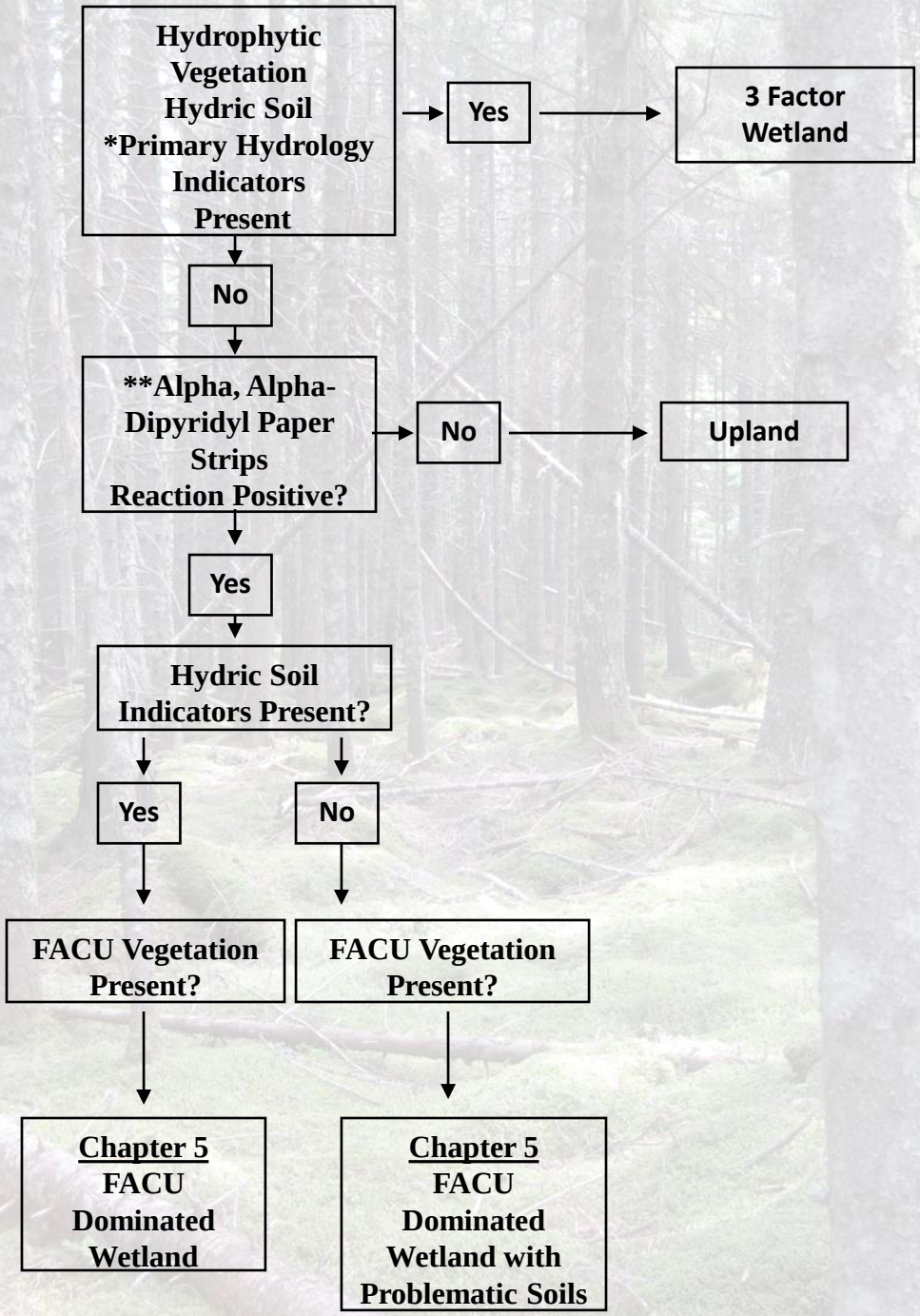
- Primary and Secondary Hydrology Indicators (p=0.042)
  - Wetland hydrology in 18 of the 19 plots
  - Secondary hydrology indicators were present in 17 of the 19 plots
  - We propose using only primary hydrology indicators
    - 14 of the 19 wells agreed
- AAD Paper Strips (p=1.00)
  - Most accurate way to determine presence of reduced iron (primary hydrology indicator)
  - Matched the well hydrology in 18 of the 19 wells

# Discussion
# Reliability of NC-NE RS Indicators

- Iris tubes (p=1.00)
  - Reduction in 2 of the 7 plots without wetland hydrology
  - 11 of the 12 plots with wetland hydrology
- Hydric soil indicators (p=0.515)
  - Observed in 1 of 7 plots without wetland hydrology
  - 8 of the 12 plots with wetland hydrology
- Separated Surface (p=0.194)
  - Absent in all plots that failed to meet wetland hydrology and in 5 plots with wetland hydrology
- Hydrophytic Vegetation- DR (p=0.020) & PI (p=0.049)
  - Not associated with the wetland hydrology criterion
  - 75% of plots were dominated by FACU vegetation

# Discussion
# Delineating the OHWM in Wet Boulder Fields

- To meet regulation under WoUS, there must be clearly defined surface features indicating recent flow and connectivity to a Traditional Navigable Water (TNW)
- Need clearly defined OHWM signature with a defined channel bed and bank


Hydrophytic Vegetation
Hydric Soil
*Primary Hydrology Indicators
Present
Yes
3 Factor Wetland
No
**Alpha, Alpha-Dipyridyl Paper Strips Reaction Positive?
No
Upland
Yes
Hydric Soil Indicators Present?
Yes
No
FACU Vegetation Present?
FACU Vegetation Present?
Chapter 5 FACU Dominated Wetland
Chapter 5 FACU Dominated Wetland with Problematic Soils

# Discussion
# Wetland Delineation of Wet Boulder Fields

- Problematic wetland type
  - Wetland/non-wetland mosaics
- Chapter 5- NC/NE RS
- Separate the project area into 3 types
  1. Continuous wetlands
  2. Continuous uplands
  3. Mosaic areas with the wetland and upland components

# Conclusions

- Reliable Indicators
  1. Water within the top 12in of the soil surface for 14 or more consecutive days during the growing season
  2. 3 out of 5 positive AAD paper strips
  3. 3 out of 5 IRIS tubes reduced
  4. Primary hydrology indicators, hydric soil indicators, presence of a separated surface, and the use of FACU dominated wetland approach
- Recommendations
  - Secondary hydrology indicators should not be used
  - Use AAD paper strips
    - To determine if a plot meets the hydrology criterion
    - To confirm that a soil lacks a hydric soil indicator

# Acknowledgements


- New England District- U.S. Army Corps of Engineers
  - Paul Minkin
  - Ruth Ladd
- David Rocque- State Soil Scientist, Maine Department of Agriculture Food and Rural Resources
- Steve Sprecher- Soil Scientist, Natural Resources Conservation Service (NRCS)
- Chris Farmer, Saddleback Mountain
- Hank McPherson and Matt Miller, McPherson Timberlands