# The Forest Health and Nutrition Study:

# An Update

Peter G. Mika IFTNC Annual Meeting April 7, 2009

#### IFTNC Forest Health / Nutrition Experimental Locations (1994-1996)



1994 1995 1996



# Design of the experiment

 Sites stratified by 4 rock types (Basalt, Granite, Metasediment, Glacial Till) and 3 vegetation types (DF, GF, WRC/WH) • A core N and K 4-treatment experiment at all sites (control, 300N, 170K, 300N+170K) Additional fertilizer treatments tailored to site conditions (N rates, N-K response surface) • Large experimental plots (1/2 a) to monitor mortality

## N Fertilizer Retreatment Scheme

	Amount of N Added (lbs/a)		
Fertilizer Regime	@Year 0	@Year 4	@Year 8
0-0-0	0	0	0
100-0-0	100	0	0
100-0-100	100	0	100
100-100-100	100	100	100
200-0-0	200	0	0
200-0-200	200	0	200
200-200-200	200	200	200
300-0-0	300	0	0
300-0-300	300	0	300
300-300-300	300	300	300

#### Diameter (in)



Height (ft)





#### N Fertilizer Regime Effects on Growth: Gross Growth/Acre



#### N Fertilizer Regime Effects on Growth: Gross Growth/Acre



#### N Fertilizer Regime Effects on Mortality

■ % Trees ■ % BA ■ % Volume



# Repeated N Application Effects on Basalt Rock Types

• Growth effects of single applications were proportional to rate • Reapplication at year 8 approximately doubles growth response. Reapplication at 4 year intervals gives inconsistent results Mortality does not appear to be affected by single applications of N fertilizer on these sites. Repeated applications may lead to increased mortality rates

#### N and K Effects on Growth and Mortality Summary of 10-Year Results

- Growth and mortality rates showed strong relationships to rate of N application. The effects were proportional to N rate at lower rates but declined at high N rates.
- N effects varied by series and rock type with rock type differences more pronounced on drier vegetation series. Growth response to N was good on all WRC/WH types.
- There was no evidence that K applications had an effect on growth rates or modified mortality rates in any consistent fashion across all sites.

# Does a K effect occur on certain types of sites?

#### • Low-K Sites (8):

- K Concentration < 0.85 %
- K/N Ratio < 0.8

#### • High-K Sites (10):

- K Concentration > 0.9 %
- K/N Ratio > 0.85

#### N and K Effects on Growth Multipliers Low K Sites (K<0.85, K/N<0.8)



## N and K Effects on Mortality Multipliers Low K Sites (K<0.85, K/N<0.8)



#### N and K Effects on Volume/a Mortality Low-K Sites



#### N and K Effects on Mortality Multipliers Low K Sites, Insect/Disease Mortality



#### N and K Effects on Low-K Sites Insect and Disease-caused Mortality



#### N and K Effects on Mortality Multipliers High K Sites (K>0.9, K/N>0.85)



## N and K Effects on Volume/a Mortality High-K Sites



#### N and K Effects on Mortality Multipliers High K Sites, Insect/Disease Mortality



## **K** Effects

- K fertilizer additions did not affect tree growth on either low and high K sites
- On sites where foliar K is low, mortality rates increase with N application but that increase is lessened when combined with moderate K application. This effect primarily relates to insect and disease mortality.
- On sites where foliar K is high, N only application does not increase mortality. However, when both high N and high K rates are applied, mortality does increase. Again, this effect primarily relates to insect and disease mortality.

**Diameter (in) by Vegetation Type** 



**BA** (ft<sup>2</sup>)



#### Volume (ft<sup>3</sup>)



#### N Fertilizer Regime Effects on Mortality

■ % Trees ■ % BA ■ % Volume



#### N and K Effects on Growth Multipliers High K Sites (K>0.9, K/N>0.85)



#### N and K Effects on High-K Sites Insect and Disease-caused Mortality

