Relationships between ion resin capsule data and foliar nutrient analysis

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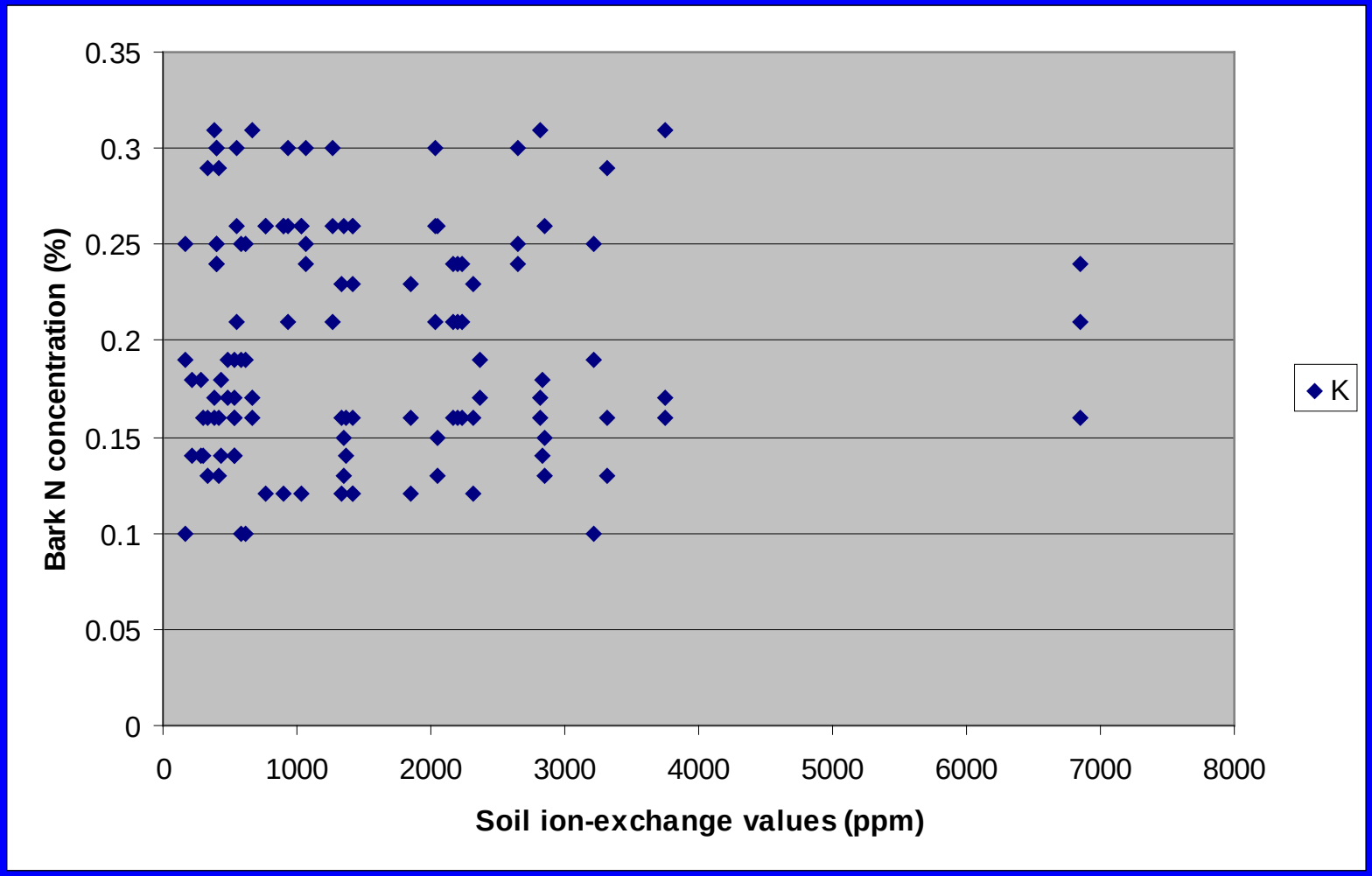
Sites with concurrent tissue and soil test data

- Forest Health/Nutrient Cycling I (bark, samples collected approx 6-8 yr after fertilization)
- Potlatch screening trials (foliage, test spanned first year following fertilization)
  - Correlation between soil and foliage nutrition
  - Predictability of fertilization response

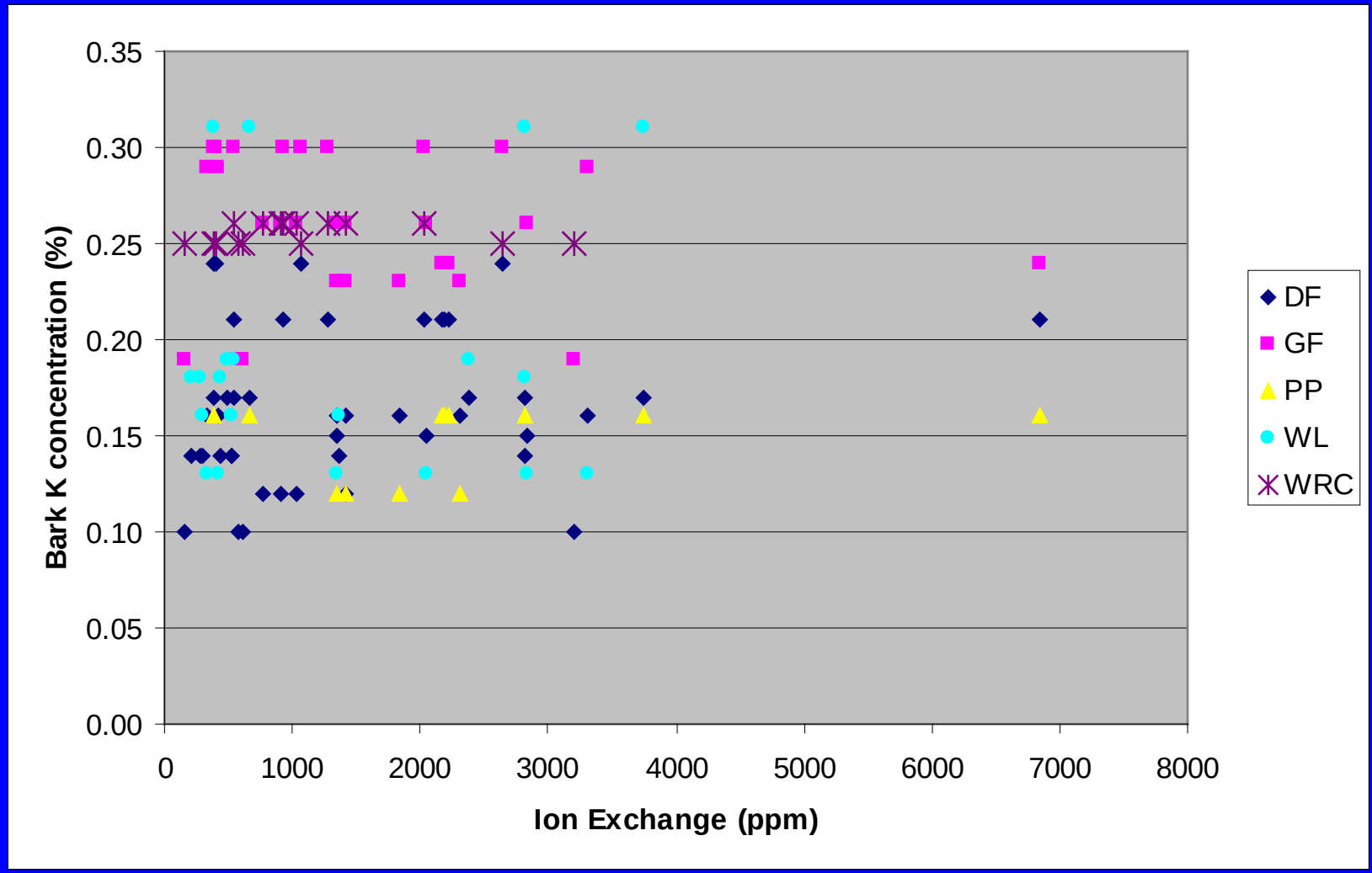
Forest Health: Nutrient Cycling

- Ion exchange data and bark were collected on six Forest Health sites in 2002
- Douglas-fir, grand fir, ponderosa pine, western larch, western red cedar

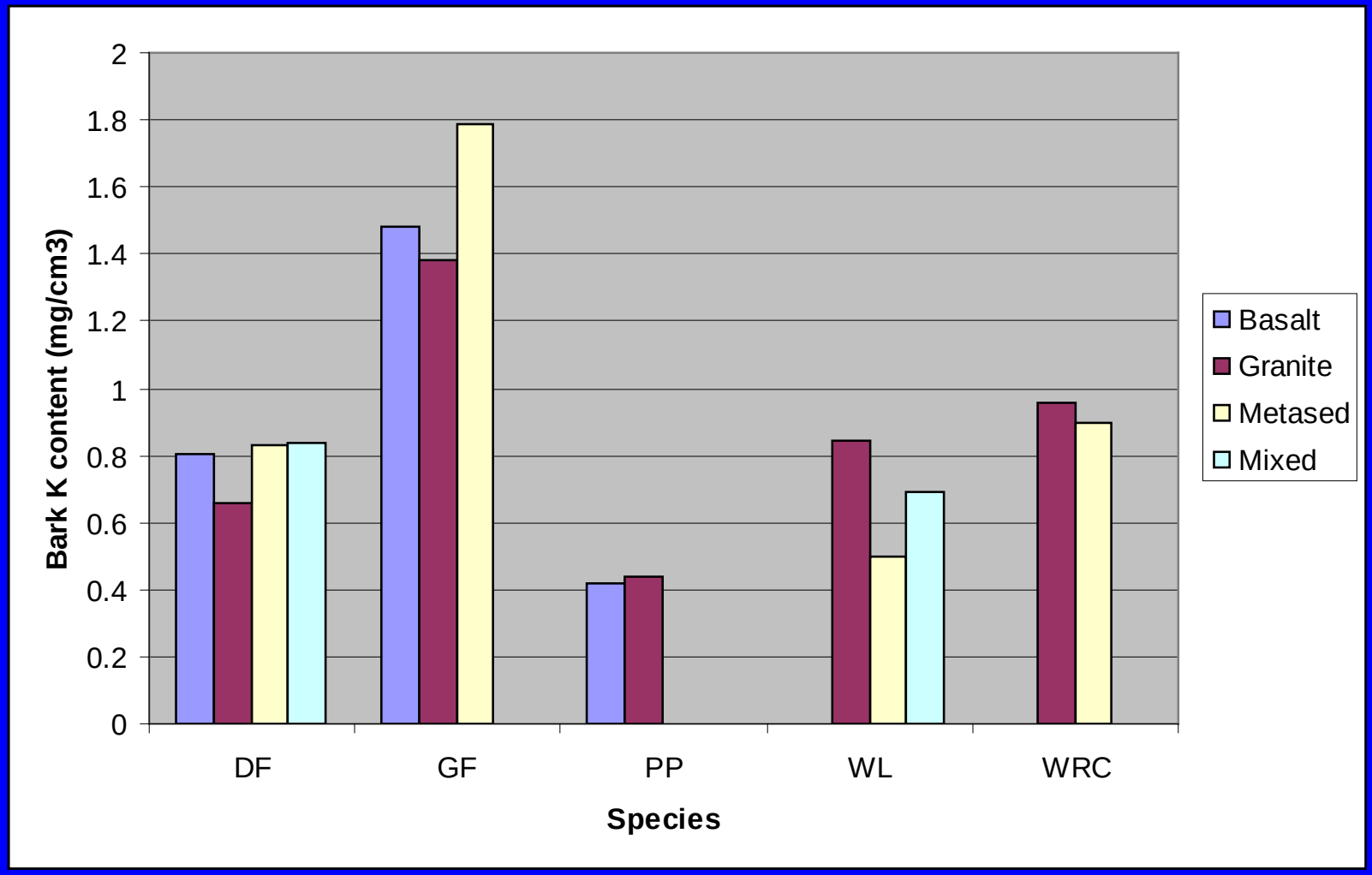
Potassium


0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Bark N concentration (%)
0
1000
2000
3000
4000
5000
6000
7000
8000
Soil ion-exchange values (ppm)
K

Potassium by species



Bark potassium contents



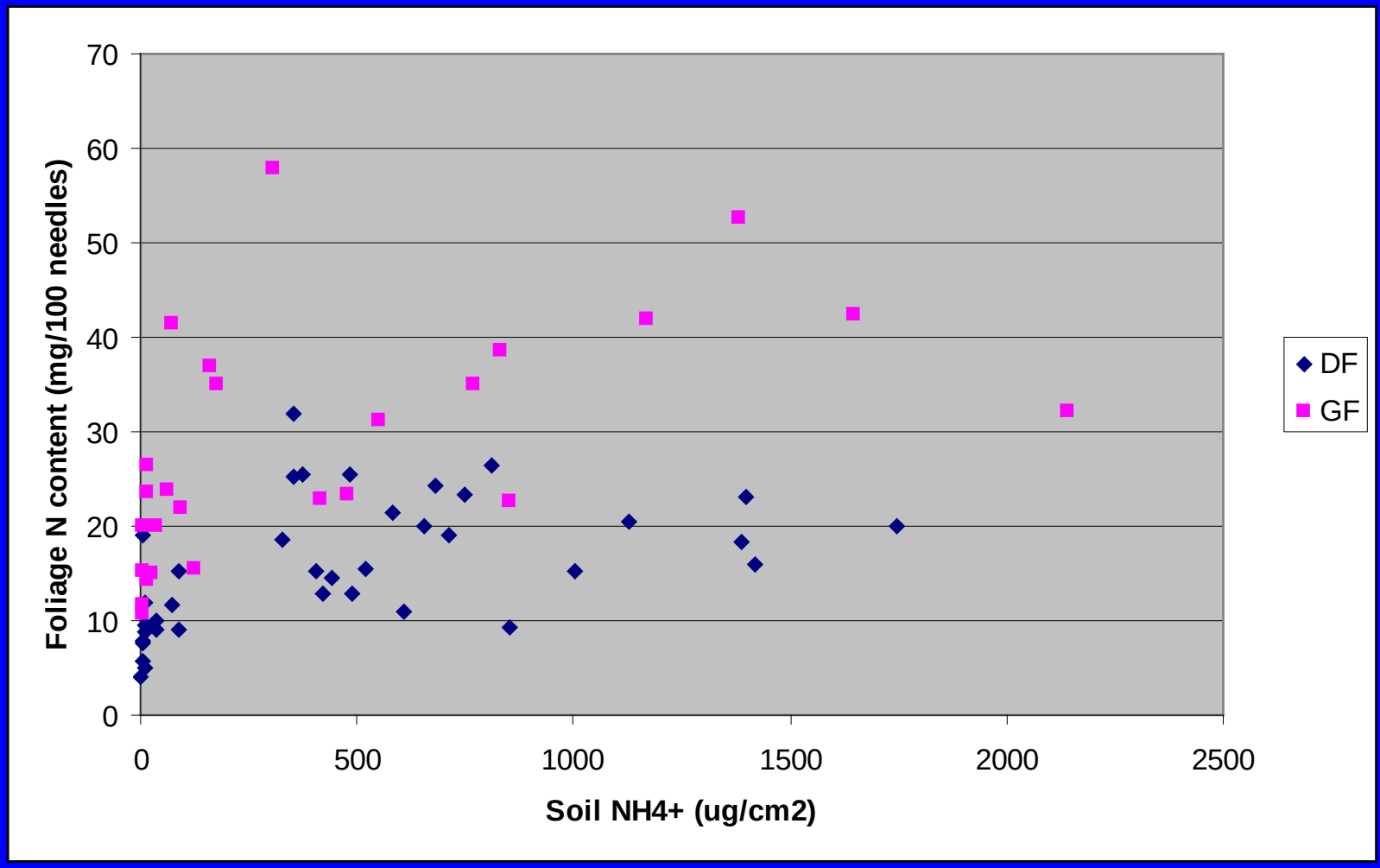
Bark/Ion-Exchange Analysis: Summary

- Direct comparison of bark nutrient concentrations to soil nutrient availability showed low correlation
- However, soil nutrient availability was a useful covariate for modeling bark nutrient concentrations and contents for N, S, K, Mg, P and Fe
- Other significant factors included species and rock type
- Past fertilization treatment was not generally detectable in either the bark nutrient concentrations or soil nutrient availably

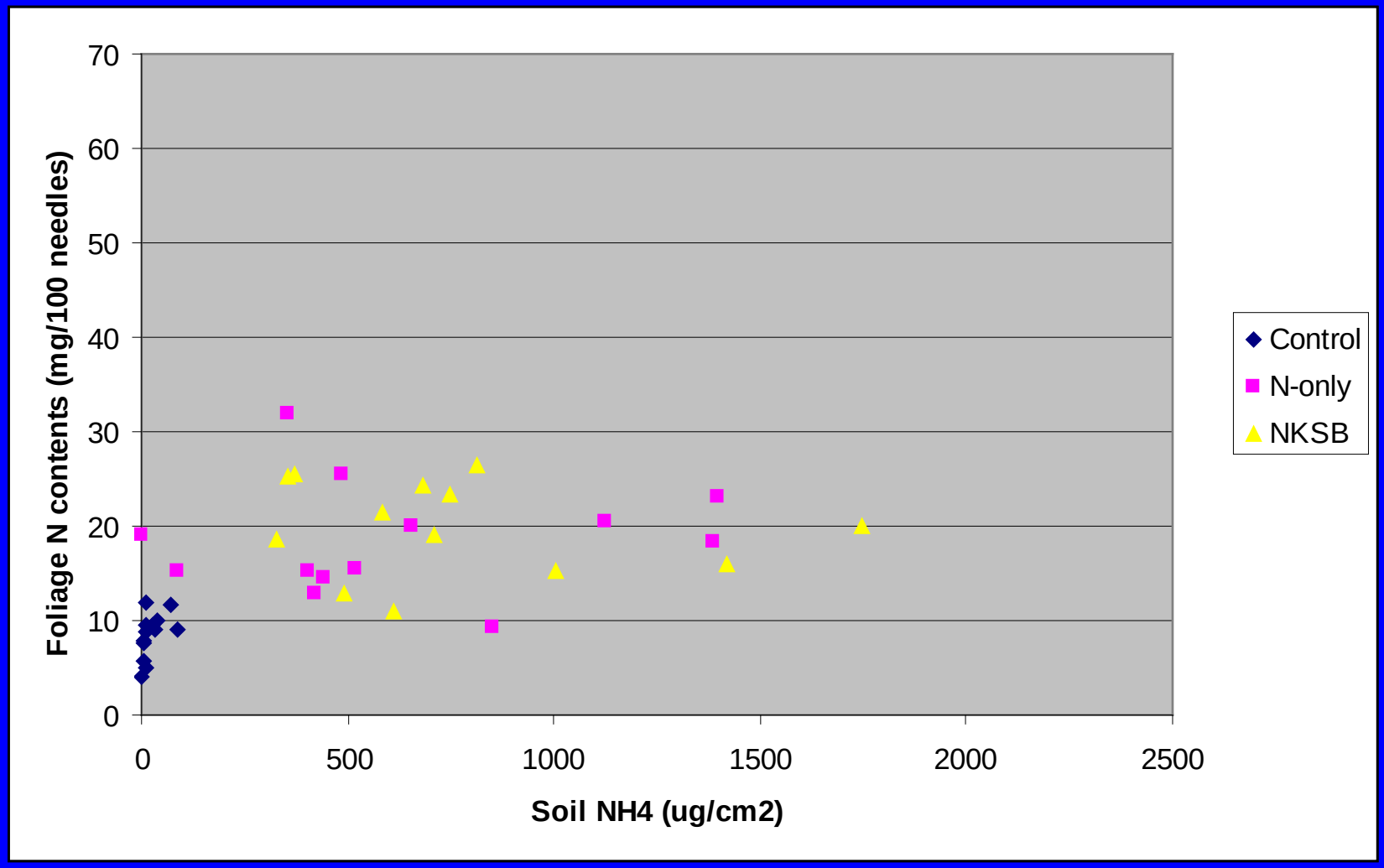
Potlatch Screening Trials

- 22 Screening Trial Transects
- Douglas-fir, grand fir
- Belt series rocks, granitics
- Ion capsules buried at establishment just prior to fertilization
- Foliage and ion capsules collected one year after fertilization
- Information presented courtesy of Potlatch Corporation

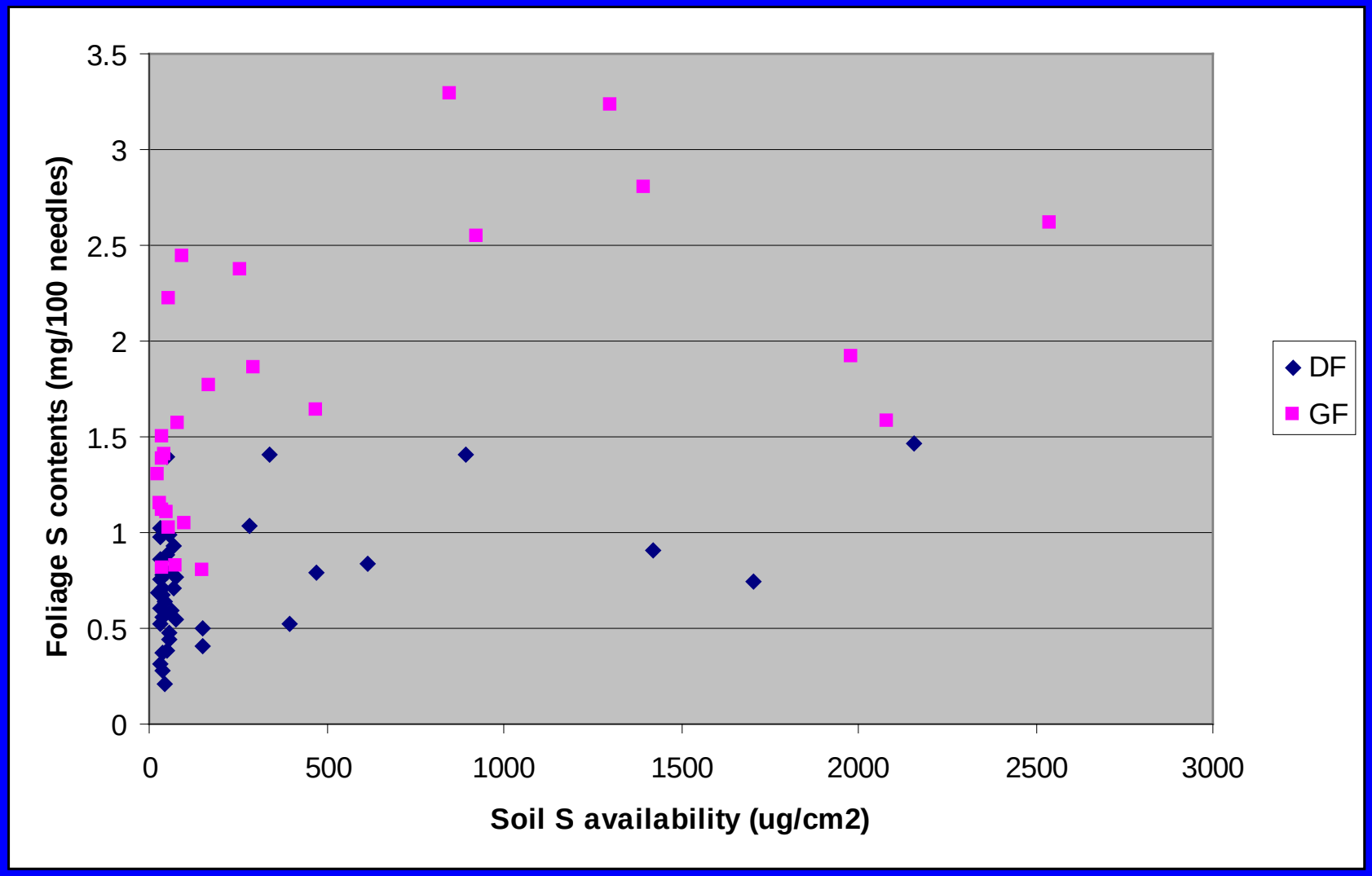
Nitrogen: Douglas-fir and grand fir



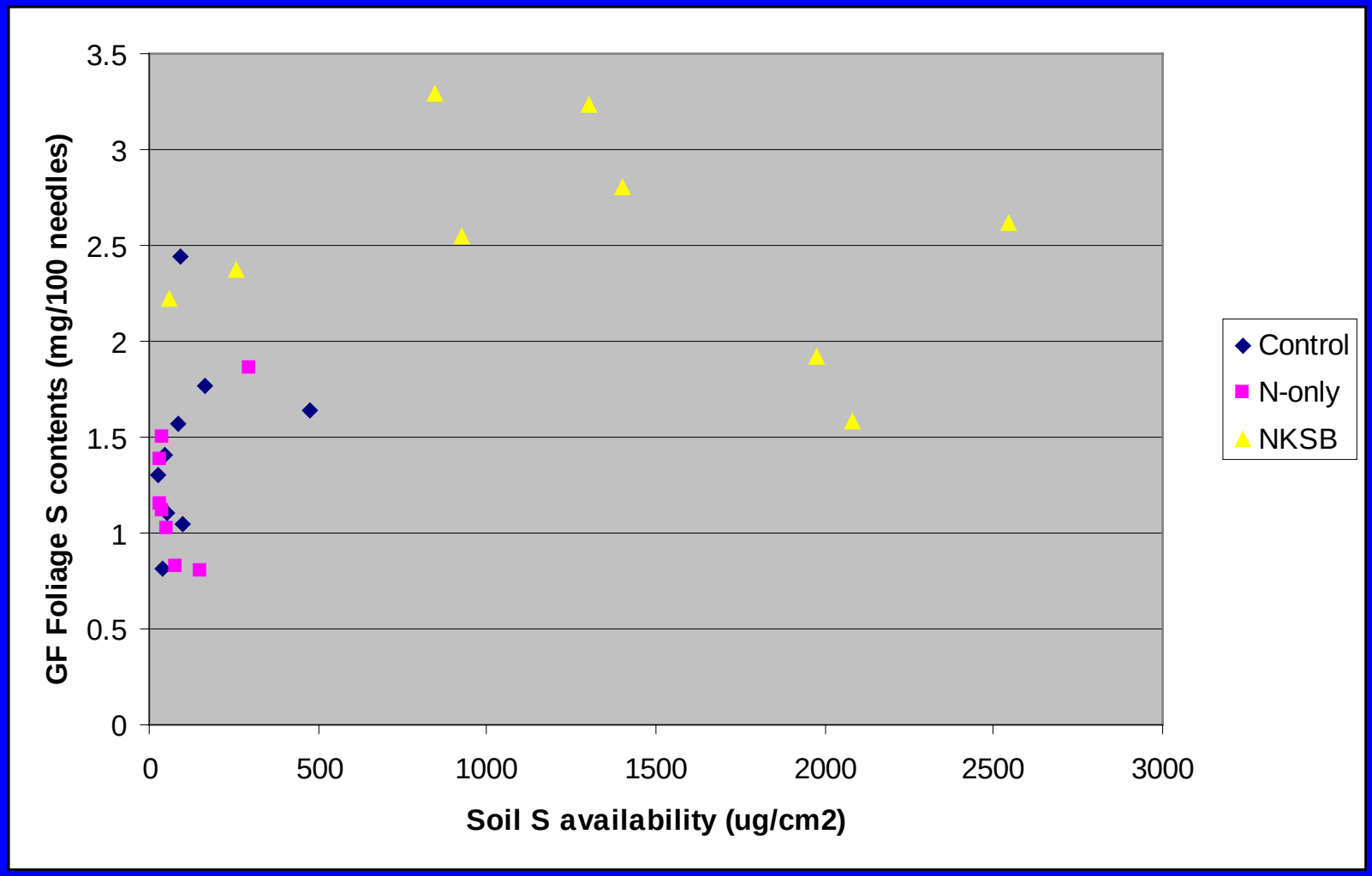
Douglas-fir by treatment



Sulfur: Douglas-fir and grand fir



Grand fir by Treatment



Correlation between soil and foliar nutrient levels

- Significant correlations between foliage nutrient level and soil nutrient availability were found for N, K, S, B, Zn and Cu.
- Correlations most often occurred for the surface and 0-12” burial depths, and occasionally the 12-24” burial depth.
- Generally, as soil levels increased, so did foliage levels.
- Suggests that for fertilizer-applied elements, the applied fertilizer entered the soil solution and was taken up by trees.

Predictability of Fertilization Response

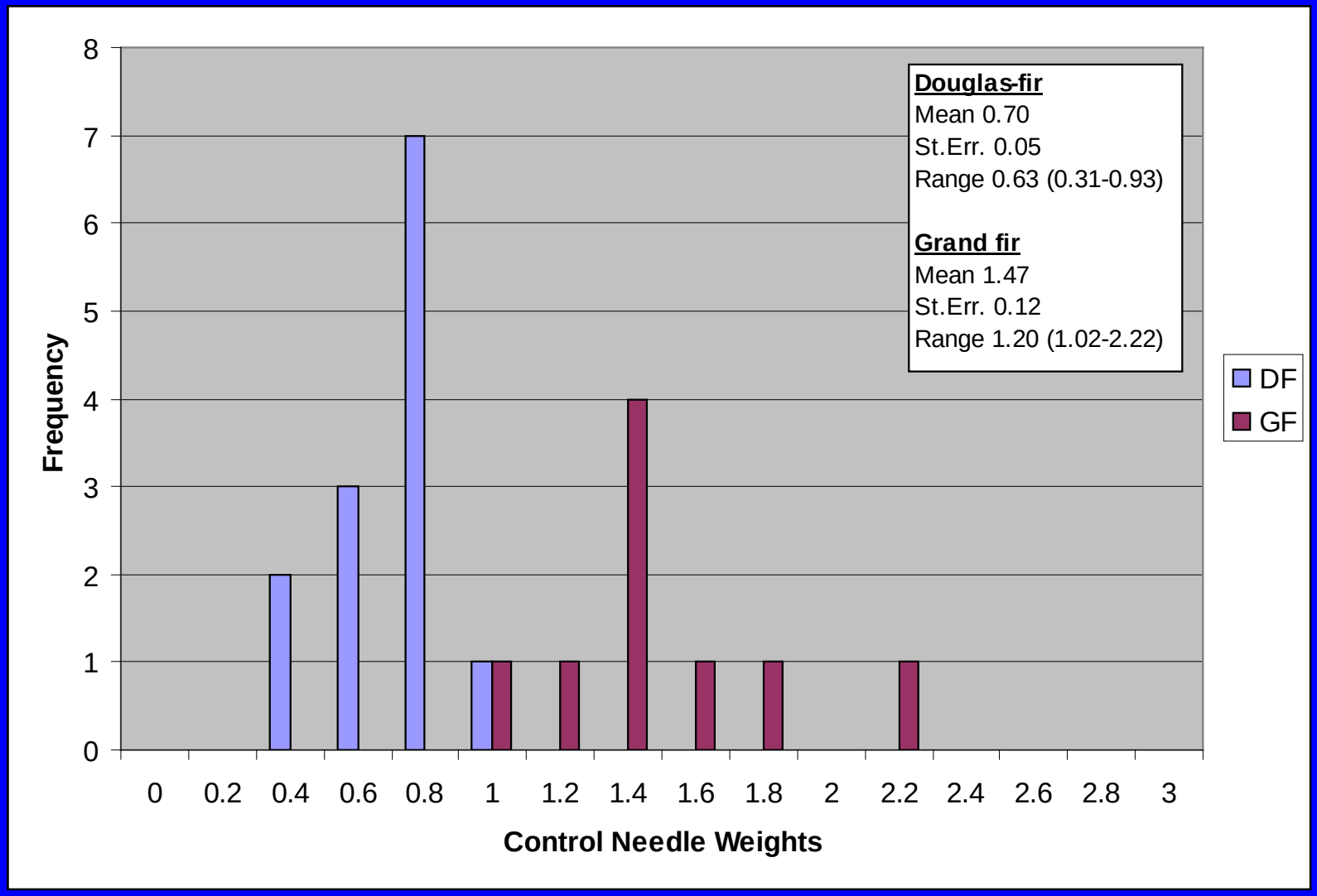
- We would like to be able to use ion-exchange resin capsules to assess sites for potential response to fertilization
- This requires development of a database which includes both ion-exchange capsule placement and growth monitoring
- Growth data not yet available
- Needle growth response was examined as a proxy for future volume growth response
- Information presented courtesy of Potlatch Corporation, from whose screening trials these results were developed.

Predicting needle growth by ion-exchange measurement

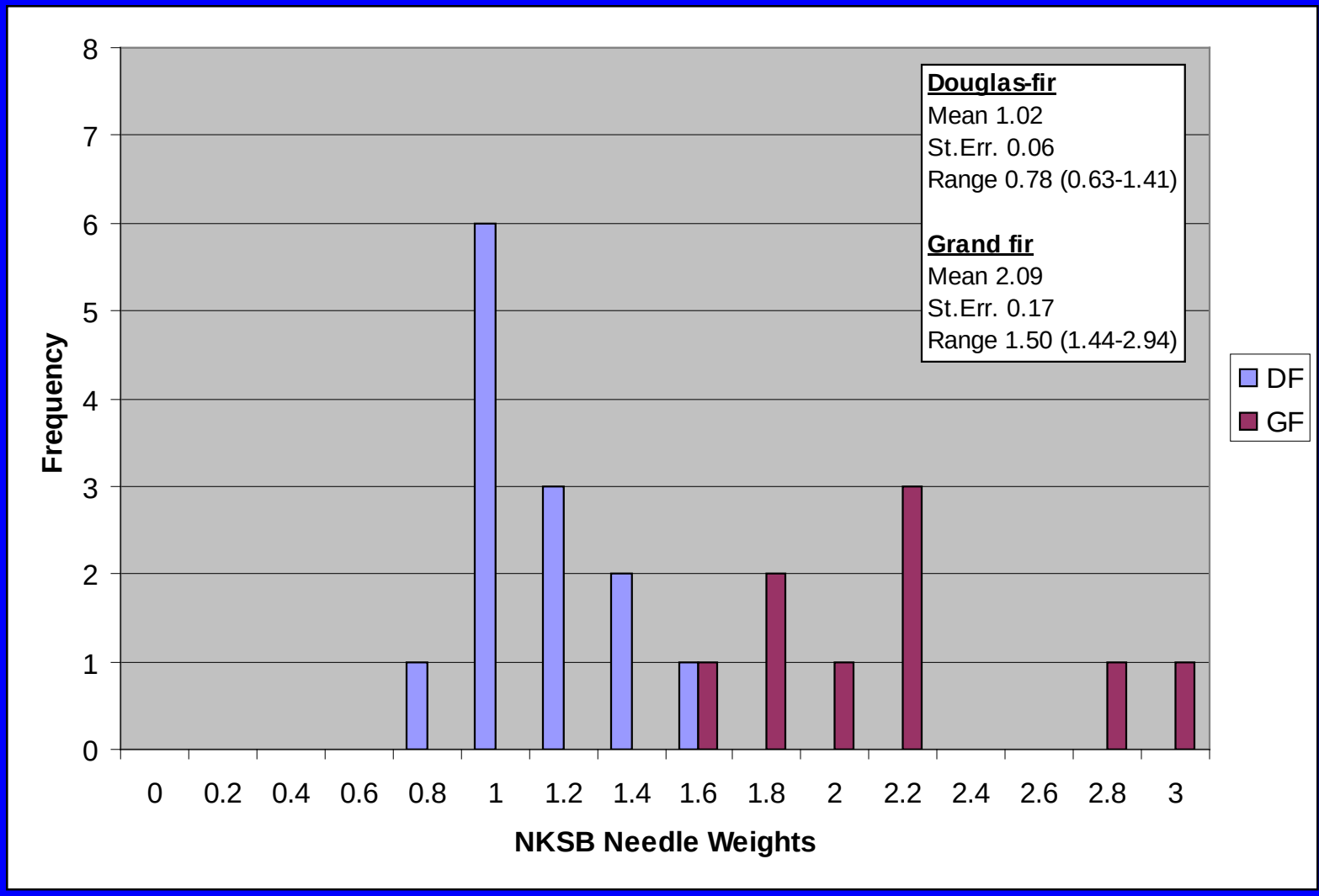
- Needle weight response one year after fertilization is often a reasonable predictor of future volume growth response.
- Needle weight responses of fertilized trees were defined as follows:

  (Treated Need.Wt.-Cont. Need.Wt.)/Cont. Need.Wt.
- Needle weights and needle weight responses were examined for effects of control ion-exchange levels, rock type and species.

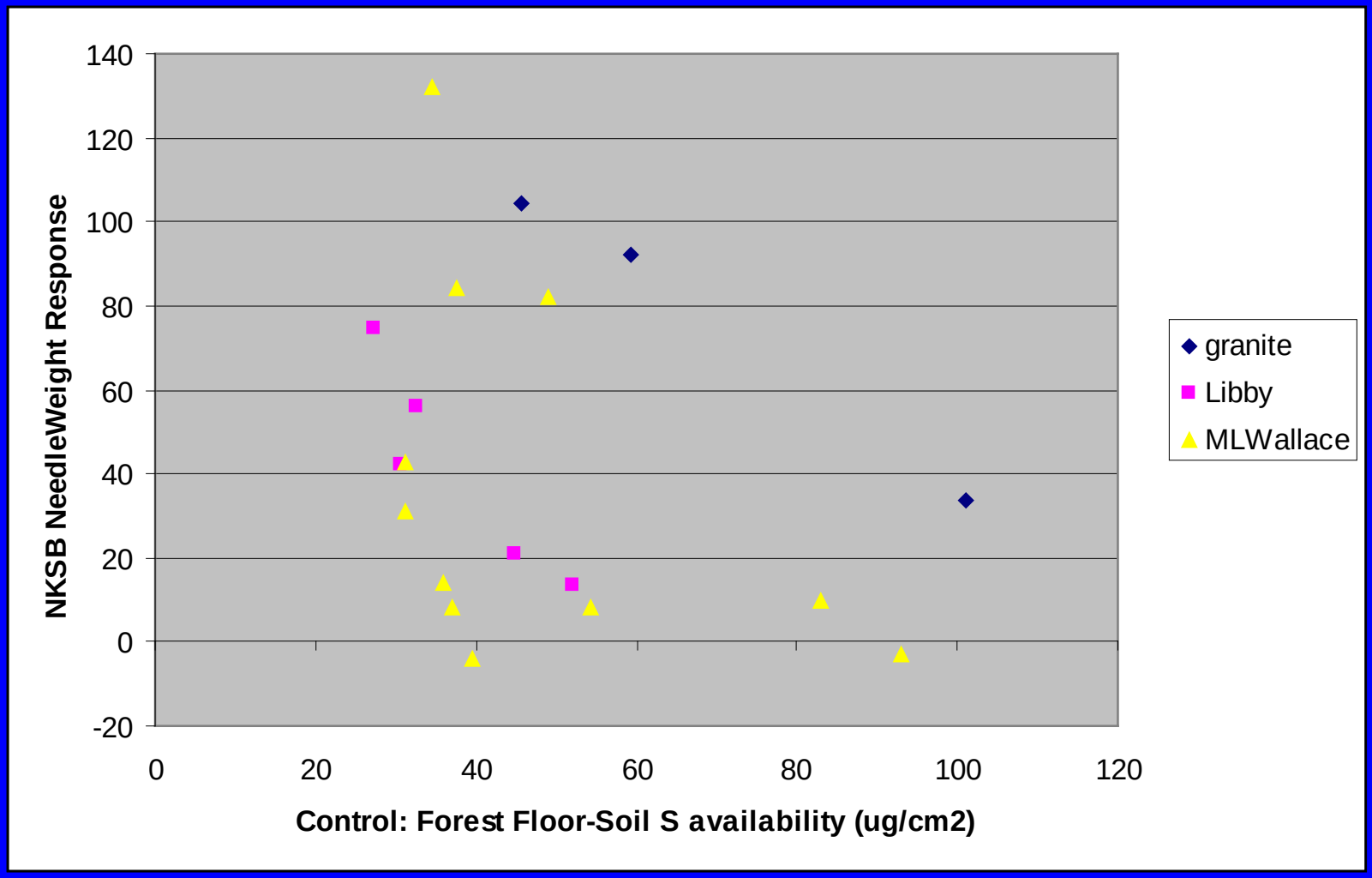
Control Needle Weights



NKSB Needle Weights



NKSB Needle Growth Response



Foliage Growth Response: Summary

- Species was the single best predictor of needle weight, regardless of treatment or soil nutrient availability
- Rock type also became a significant factor for predicting needle weight following NKSB fertilization, with trees on metasedimentary rocks showing higher needle weights than trees on granitic rocks
- Soil S and NH4 availability at the forest floor/mineral soil interface were significant predictors of needle growth response to NKSB fertilization
- Sites with the lowest S and NH4 availability showed the highest needle growth responses to NKSB fertilization

Use of ion-exchange resins as a tool for predicting fertilization response

- Additional research needs:
  - Monitoring of actual volume growth response to fertilization (N and NKSB)
  - Additional observations would be useful, perhaps incorporating other species and rock types
  - Results thus far restricted to young stands
- Concerns
  - High variation in ion-exchange data
  - Multiple capsule burials per site would be better
- Positive aspects
  - Simple model predicts growth response by rock type and soil S and NH4 availability (as measured by ion-exchange resins)
  - Capsules are easy to use, especially the forest floor burials
  - One-year burials should be easy to work into a site assessment/fertilization program

NKSB Needle Weights