

Alternative Landfill Soil/Vegetation Covers at Rocky Mountain Arsenal:

Could differences in plant roots between covers contribute to differences in cover function?

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Outline

- Background
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 - Root washing
 - Root scanning
 - Root drying & weighing
 - Statistical analysis
- Results
- Discussion
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 - Report content

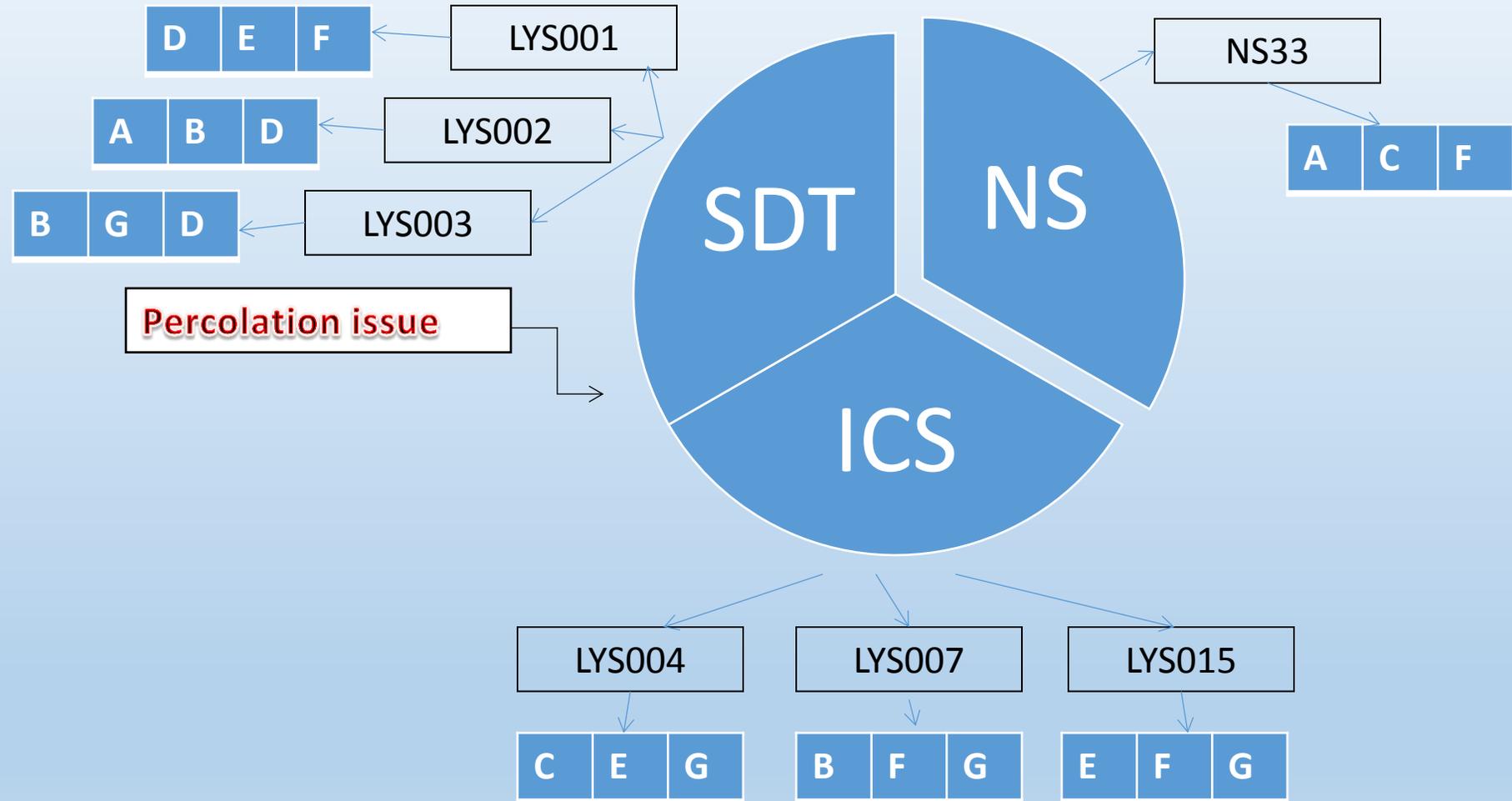
Background

- In May 2015, the Army notified Regulatory Agencies that the amount of water collected by Lys 001 and Lys 002 on the Shell Disposal Trench RCRA-equivalent cover exceeded the compliance standard of 1.3 mm/yr (Navarro report, 17 Sep 2015).

The purpose of the project reported here is to

- Investigate root development as possible contribution to this excessive percolation

Background

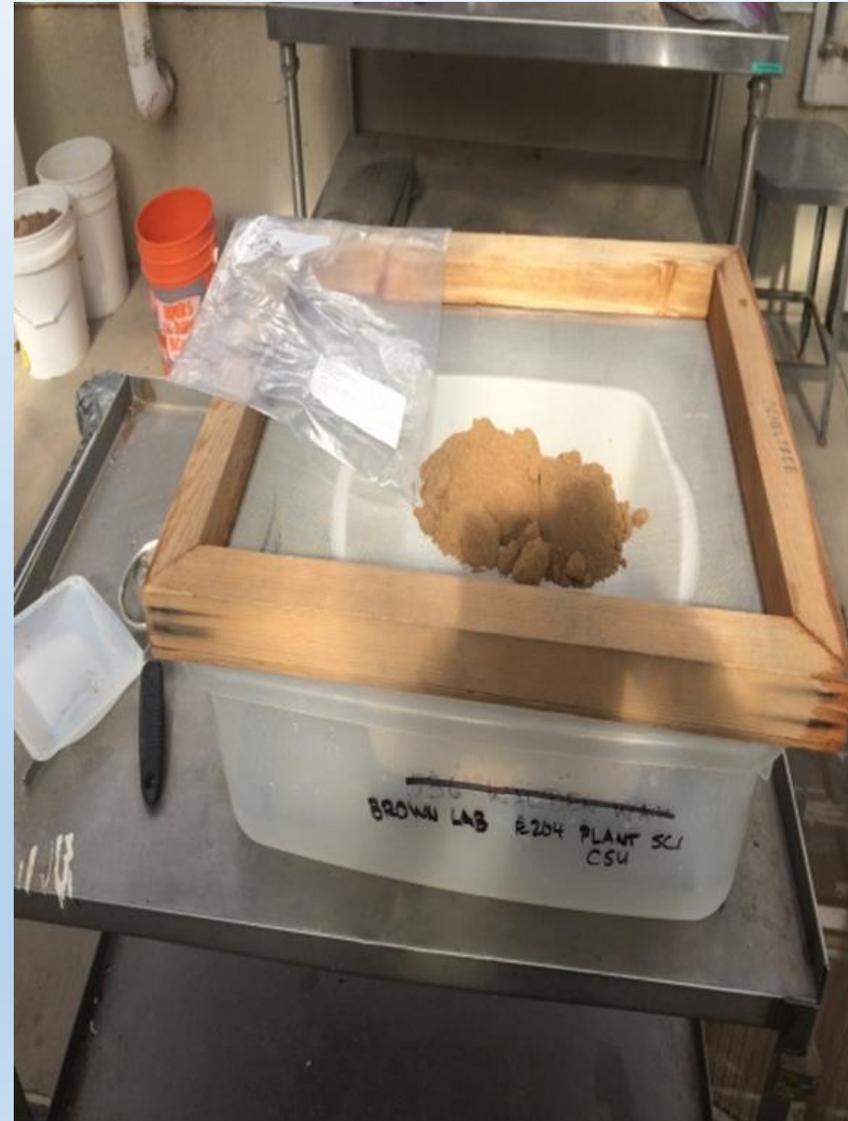


- Shell Disposal Trench (SDT)
- Integrated Cover Systems (ICS)
- Natural grassland area (NS)

Methods: Soil washing

- Took pictures: before and during the soil washing process
- Thawed soils at least 2 days before wash
- Labeled the plastic bags to put washed roots, free from soil
- Placed the roots in pre-labeled plastic bags and added water
- Stored the roots in the refrigerator until scanning (up to 7 days)

Methods: soil washing



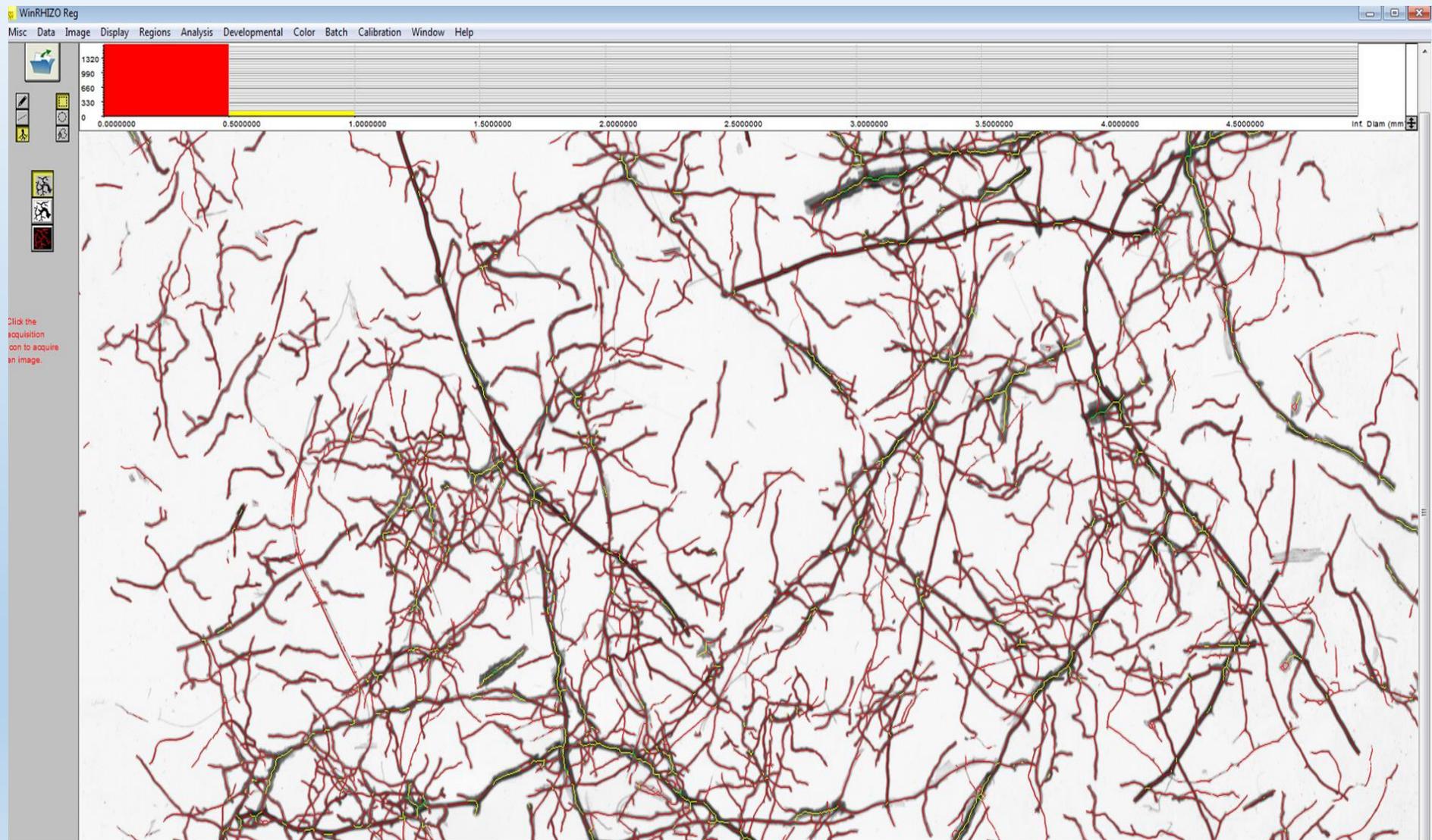
Methods: Scanning



Methods: Root scanning

- Placed sample in clear plexiglass box with water
- Arranged sample so that it is well spread out
- If we have crowded roots changed to the bigger size trays
- For bigger trays we used 2-3 repeated scanning measures and used their averages for the analysis
- Used 400 dpi for the best root imaging
- We can edit the image: erase and add roots
- Saved image with and without analysis
- Look over the data and do quality check.
- If necessary scan the roots again.

Sample pictures



Methods: Root drying & weighing

- After scanning, we dried the roots in the oven at 60 °C (24-48 hours)
- Weigh each sample on a top-loading balance. Recommended to use four significant digits after comma.
- Placed each sample in a separate coin envelope labeled with the sample identification information for long-term storage.

Methods: Statistical analysis - Roots

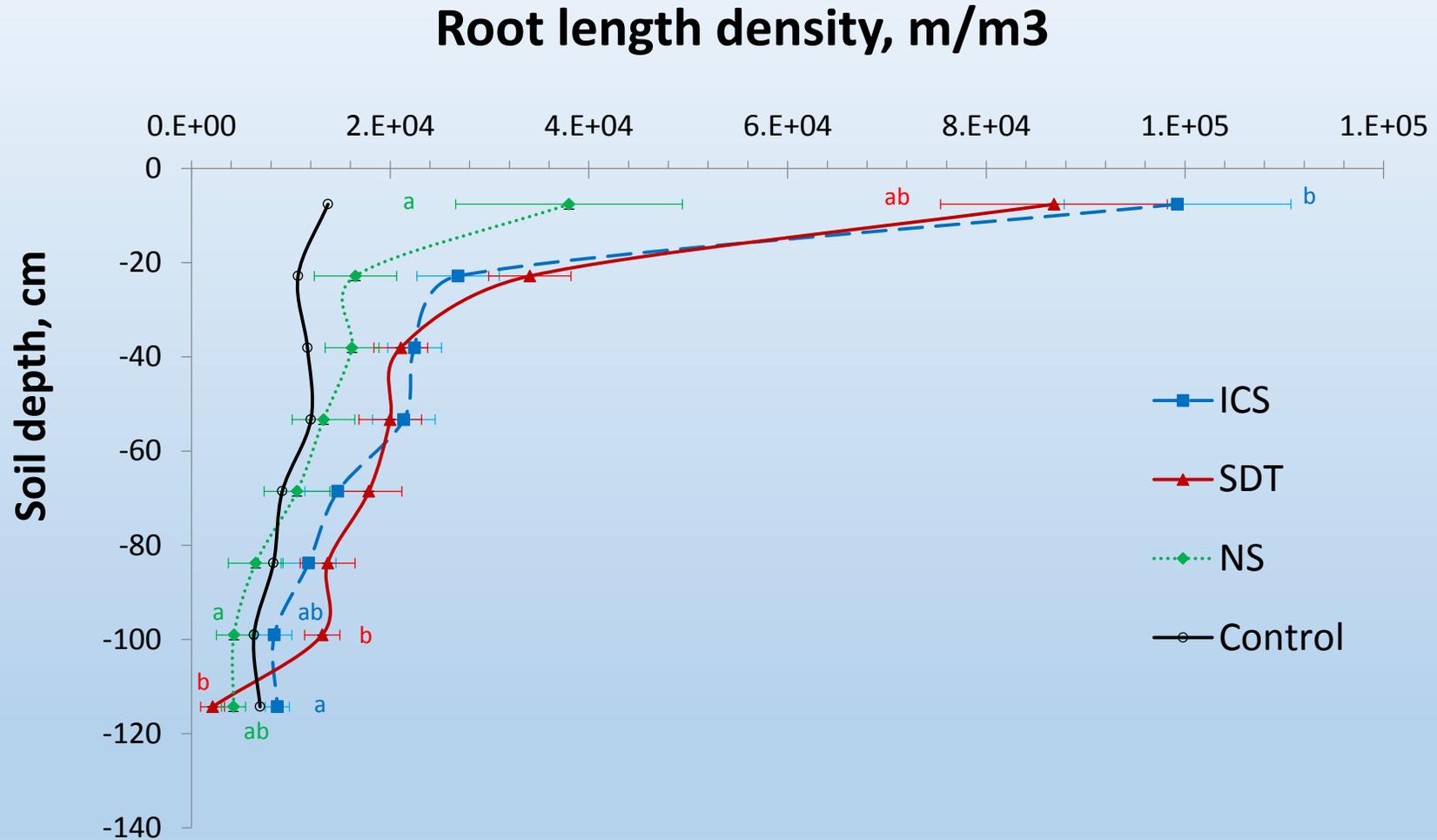
- Repeated Measures One-Way ANOVA
 - Cap Type as independent variable
 - Shell Disposal Trenches (SDT)
 - Integrated Cover System (ICS)
 - Natural Site (NS)
 - Depth as repeated measure (within factor)
 - Response variables
 - Root length density (RLD)
 - Mass per volume (MPV)
 - Average diameter (AD)
 - Coefficient of variation and residuals for each response variable
 - Significant Cap Type by Depth interaction indicates that the response variable differs by depth among the cap types
 - One-way ANOVA, Cap Type as independent variable, for each depth separately

Methods: Statistical analysis - Vegetation Cover

- One-Way ANOVA
 - Cap Type as independent variable
 - Response variable: Vegetation Cover in 2015
- Used JMP 12pro (SAS Institute) for all analyses

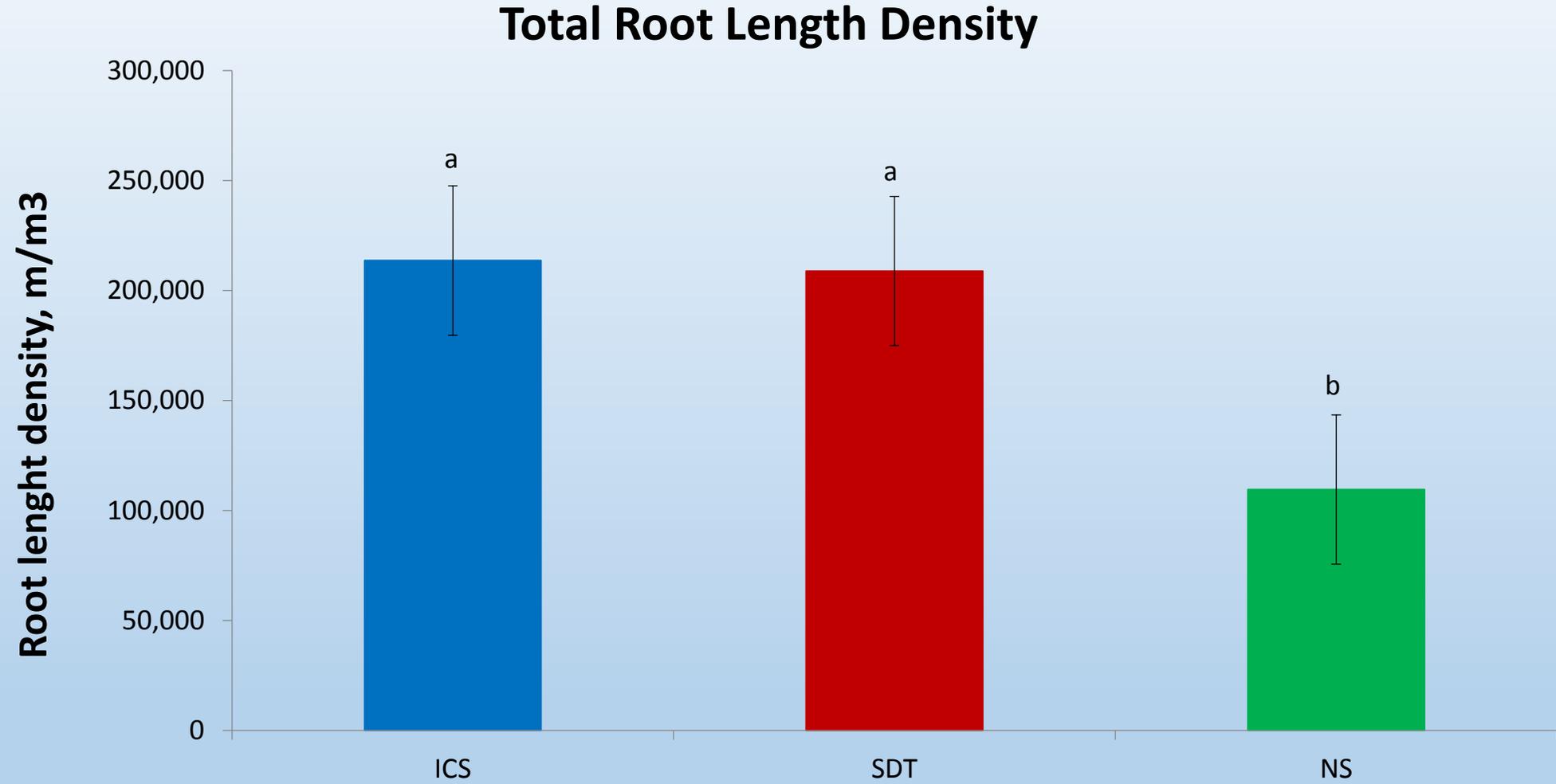


Results: RLD

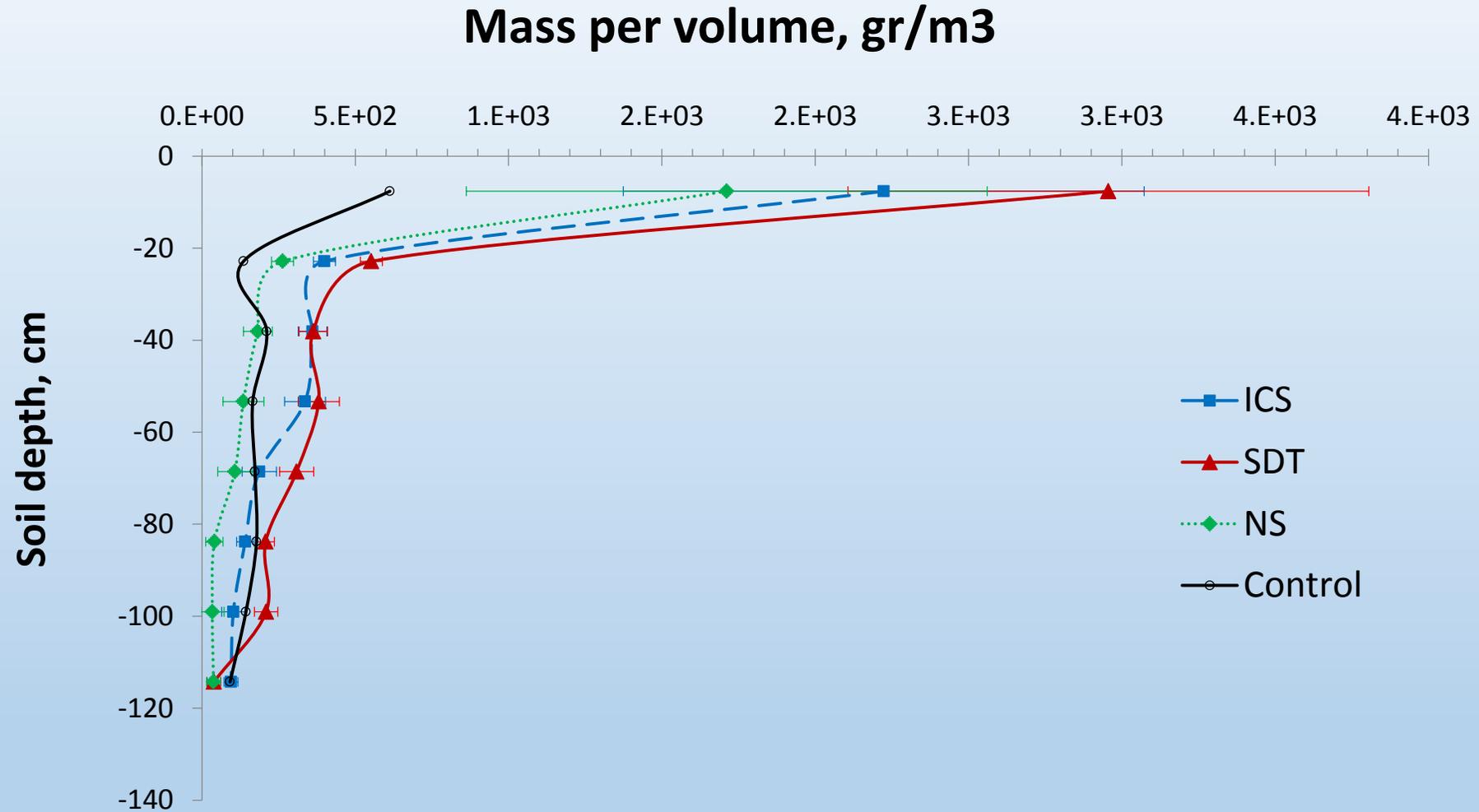


RLD differed among cap types at some depths

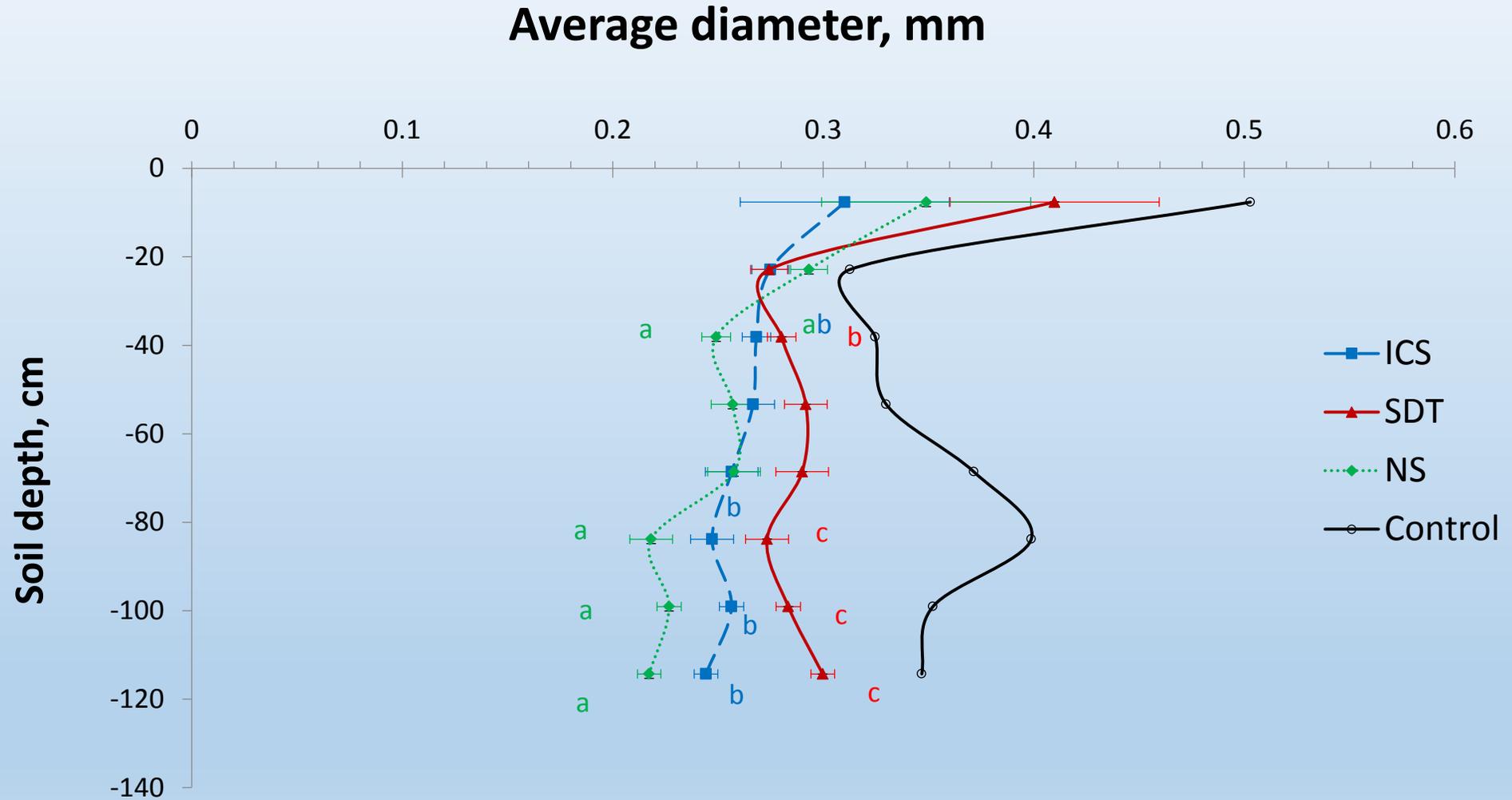
Results: RLD



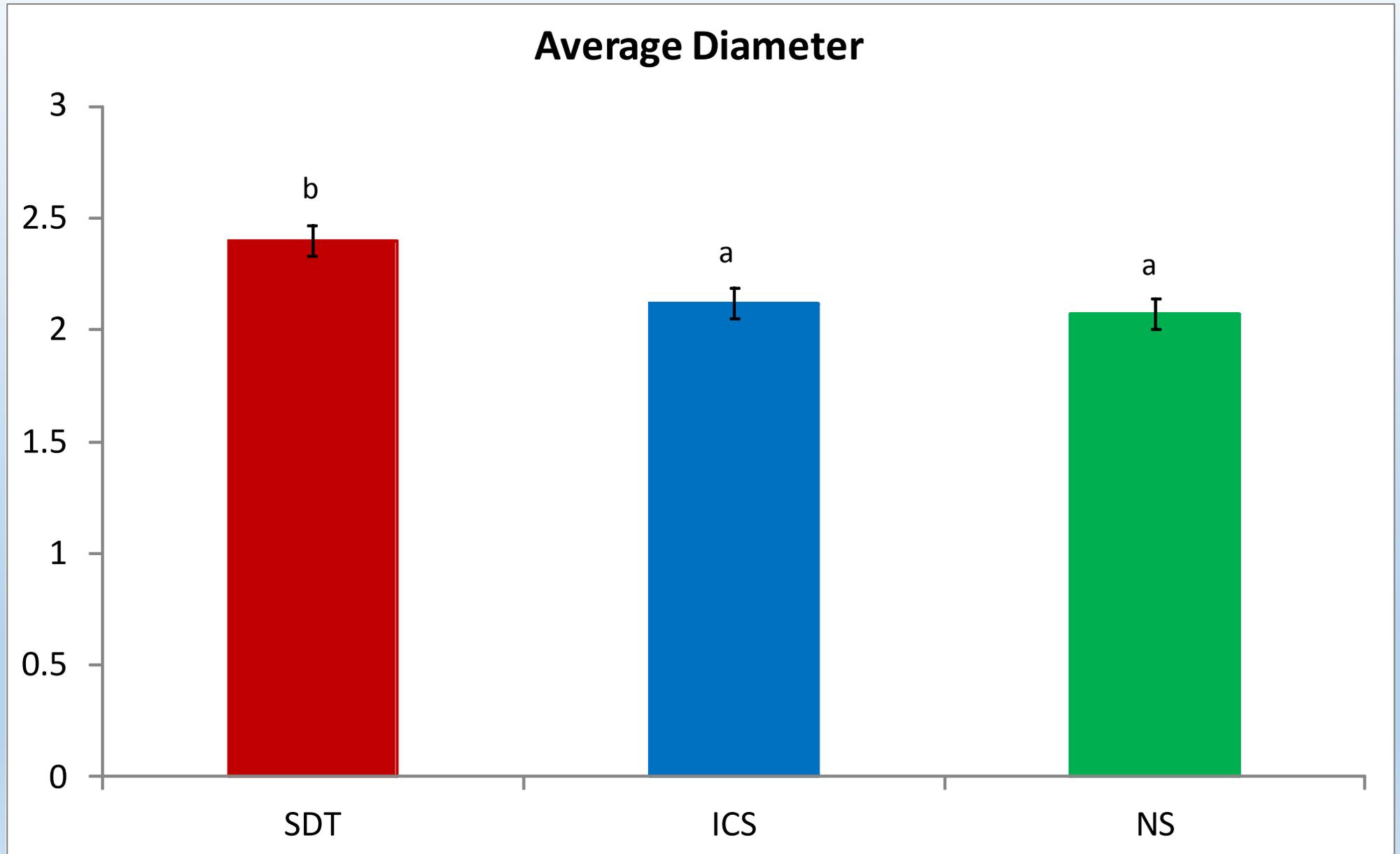
Results: MPV



Results: Average diameter



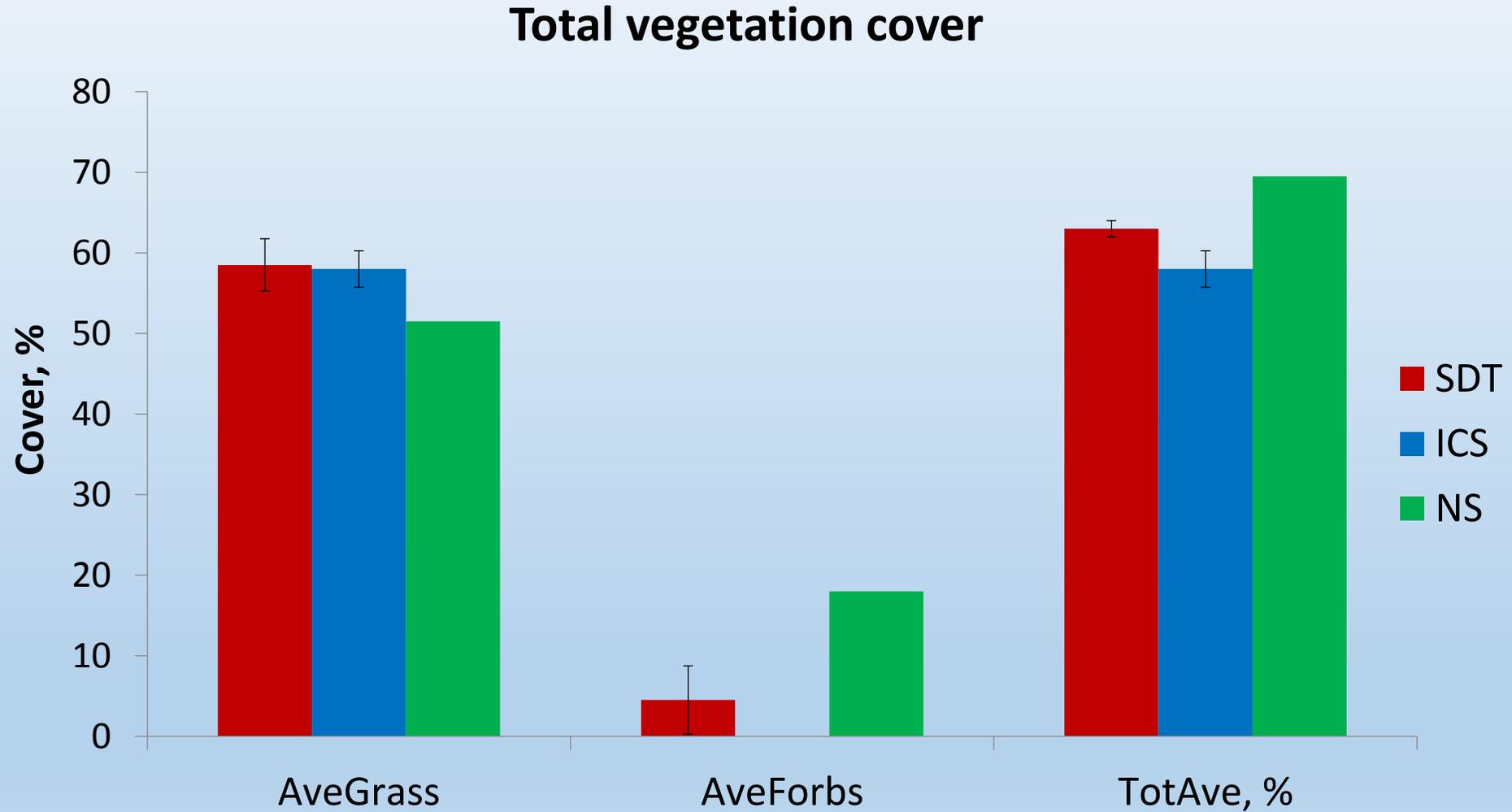
Results: Average Diameter



Results: Patterns of Variation

- Coefficient of variation (mean/SD) and residuals (observation – mean) for RLD, MVP and AD.
- Detected no differences in these metrics that would indicate greater heterogeneity in one cap type than another, or in caps compared to the natural site

Results: Vegetation cover



Discussion

- ICS had greater RLD than NS at the shallowest depth
- At about 100 cm, SDT had greater RLD than NS
- ICS had greater RLD than SDT at the deepest depth
- MPV did not differ among cap types across depth
- Average diameter was greater in SDT than ICS & NS
- Vegetation cover did not differ between SDT & ICS

Report Contents

- Format of the report...
- Hard copies
 - Report
- Electronic copies
 - Raw data
 - Images
 - Analysis JMP and excel files



Natural Site

