Snow and Climate Change Experiments in the Arctic

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Snow Effects on Shrubs

A. Loading by snow breaks branches and stems.
B. Insulation of snow affects soil temperature, unfrozen water content & soil biological activity: more snow = higher temperatures.
C. Halos of smaller shrubs surround central shrub, taking advantage of snow aprons.
D. Light absorption affects stems and buds.
E. Branches bent and stressed by snow loads: architecture (prostrate or erect) affected by long-term loading history.
F. Desiccation & abrasion of exposed branches by wind & blowing snow.
G. Increased decomposition and nutrient mineralization in the soil where the temperature is higher.
H. Higher nutrients available in spring due to wind-induced transfer and accumulation of litter from neighboring vegetation.

Shrub Effects on Snow

1. Changes in surface wind field leads to drifting.
2. Interaction of dark branches and light snow affects albedo.
3. Litter from shrub affects albedo, snow chemistry and nutrient loading: two types of litter accumulate: local leaf litter and windblown litter from distant sources.
4. Run-off varies due to uneven snow depths resulting from drifting.
5. Infiltration and soil moisture vary due to snow depth insulation effects on ground freezing.
6. Snow stratigraphy and grain types vary with location leading to large lateral variations in snow physical properties.
7. Light penetration and absorption varies depending on snow depth and stem density: this affects rate of melt and the date when that area is snow-free.
Tundra & Taiga Snow
Diametrically different snow properties ...
• Most snow manipulations have tended toward “overkill.”
• Typically manipulations of season length, light, or water produce critical impacts in other uncontrolled variables.
• Manipulation infra-structure frequently has unintended consequences.
• Vegetation impacts take years/decades.
Recommendations

• Including snow depth and cover with other feedbacks is clearly important, but it will be a challenge with regard to experimental design. Keep chamber sidewalls to a minimum and certainly plan to remove infrastructure in the winter.
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- Including snow depth and cover with other feedbacks is clearly important, but it will be a challenge with regard to experimental design. Keep chamber sidewalls to a minimum and certainly plan to remove infrastructure in the winter.
- Plan to include snow from the beginning.
- Use it to advantage by understanding its properties and evolution.
- Always examine sites in winter before designing experiments.
- Use the wide range of available tools and expertise in experimental design.