Alpine Snow Mold
Thick mat on forest floor
Ephemeral, rapidly disappear once the snow is gone
What conditions favor fungal growth?
Stable temperature and abundant moisture
Grows under snow
Alpine Snow Mold Culture
At Snowmelt…

Large Fungal Community Crashes

<table>
<thead>
<tr>
<th>SEASON</th>
<th>Biomass µg C / g soil</th>
<th>F/B Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under-snow</td>
<td>363 (18)</td>
<td>15</td>
</tr>
<tr>
<td>Snowmelt</td>
<td>244 (21)</td>
<td>7</td>
</tr>
<tr>
<td>Summer</td>
<td>125 (32)</td>
<td>7</td>
</tr>
</tbody>
</table>

Schadt et al. 2003 Science 301: 1359
Fungal biomass peaks under the snow

(metabolize salicylate at 3°C or 22°C)

Fungal biomass peaks under the snow

From Schmidt et al. 2007 Ecology 88:1379
What happens to disappearing biomass?
At Snowmelt...

Flush of Nutrients

Seasonal fluctuations of microbial biomass and available N in alpine soils

From Schmidt and Lipson 2004 *Plant and Soil* 259: 1
Major Carbon Source

- Half of yearly carbon fixed by plants is respired out by soil microbes under the snow pack

- Highest rates of CO$_2$ flux out of soils occur just prior to melt out.

Monson et al. 2006 *Nature* 439: 711
At Snowmelt…

Appearance of Novel Groups

- Environmental clone libraries--fungi
- Zygomycetes
- Ascomycetes

Schadt et al. 2003 *Science* 301: 1359; Meyer 2004
Research Program

Goal: understand microbial ecology of soil at snowmelt

- Culture snow molds & identify them
- Temperature dependent growth rates
- Enzyme attributes
- Substrate preferences
Fast, Unique Zygomycetes

- Grow at -2C, similar to datalogger snowmelt soil temperatures
- Grow 10X faster than Antarctic soil Zygos
- Fastest recorded growth rates for filamentous fungi at -2C
- Grow fast enough to account for extensive snow mold mats

From Schmidt et al., *Microbial Ecology*, submitted 2007
Enzyme Profile

- Enzymes of 316-1 and 319-1 similar to free soil enzymes
- Different enzyme profiles suggest different niches for different SMs

From Schmidt et al., *Microbial Ecology*, submitted 2007
Proposed Niche for SM

- r-selected (fast, inefficient)
- Exploit high nutrient conditions under snow pack
- Receive nutrients from soil below
- Receive water and $O_2$ from snow pack above
- Responsible for high CO$_2$ fluxes from snow pack?

From Schmidt et al., *Microbial Ecology*, submitted 2007
Current and Future Studies

• Substrate preferences
• Grow ‘Coral’
• Anaerobic growth--other members of community?
• Carbon dynamics--respiration, substrate use, isotope fractionation?