Relation between active-layer depth, NDVI and LAI along the Yamal Transect

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Laborovaya

LAB-1 site (clayey)

LAB-2 site (sandy)
Vaskiny Dachi
Bely Island

BO transects 51-55 (clayey)

CALM grid 25x25m (sandy)

CALM grid 50x50m (clayey)
### Normalized Difference Vegetation Index & Leaf-Area Index vs Active Layer Depth

<table>
<thead>
<tr>
<th></th>
<th>Average value of parameter</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Clayey plots</td>
<td>Sandy plots</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NDVI</td>
<td>LAI</td>
<td>ALD, cm</td>
</tr>
<tr>
<td>Laborovaya</td>
<td>0.73</td>
<td>0.86</td>
<td>84</td>
</tr>
<tr>
<td>Vaskiny Dachi</td>
<td>0.62</td>
<td>0.46</td>
<td>80</td>
</tr>
<tr>
<td>Kharasavey</td>
<td>0.58</td>
<td>0.41</td>
<td>75</td>
</tr>
<tr>
<td>Bely Island</td>
<td>0.59</td>
<td>0.84</td>
<td>63</td>
</tr>
</tbody>
</table>
NDVI on clayey sites

Laborovaya (50x50m)  VD 2 (50x50m)  Kharasavey (50x50m)  Bely Island (50x50m)

0.73  0.62  0.58  0.59
NDVI on sandy sites

- Laborovaya: 0.64
- Vaskiny Dachi: 0.50
- Kharasavey (10x10m): 0.59
- Bely Island (25x25m): 0.45

Ranges:
- Laborovaya: 0.45 – 0.78
- Vaskiny Dachi: 0.34 – 0.76
NDVI at clayey sites were in general higher than on sandy sites due to greater vegetation biomass.
LAI on clayey sites

Bely Island (50x50m)

Laborovaya (50x50m)

Vaskiny Dachi

Kharasavey (25x25m)

Range 0.00 – 1.67

Range 0.00 – 1.36

Laborovaya

Vaskiny Dachi

Kharasavey

Bely Island

Clayey sites

0.86

0.46

0.41

0.84

0,86

0,46

0,41

0,84
LAI on sandy sites

Bely Island
Kharasavey
Vaskiny Dachi
Laborovaya

\[
\begin{align*}
\text{LAB} & : 0.29 \\
\text{VD} & : 0.17 \\
\text{KH} & : 0.08 \\
\text{BO} & : 0.00
\end{align*}
\]

Range
Laborovaya (50x50m) 0.00 – 1.23
Vaskiny Dachi 0.00 – 0.88
Kharasavey (10x10m)

LAI was not detected because of low vegetation cover
LAI at clayey sites were also in general greater than on sandy sites due to dense and higher herbage.
Active layer depth on clayey sites

Laborovaya (50x50m)  Vaskiny Dachi  Kharasavey (50x50m)  Bely Island (50x50m)

84 cm  80 cm  75 cm  63 cm

Range 52 – 80 cm measured
Active layer depth on sandy sites

- **Laborovaya**: 110 cm
- **Vaskiny Dachi**: 123 cm
- **Kharasavey (10x10m)**: 92 cm
- **Bely Island (25x25m)**: 117 cm

**Ranges**:
- **Laborovaya**: 85 – 127 cm measured
- **Kharasavey (10x10m)**: 58 – 98 cm measured
It is well known that active layer depth mainly depends on soil composition and moisture content, vegetation mat thickness, and air temperature. In its turn, vegetation as an active layer control depends on the same zonal and local factors. In the similar soil conditions provided by separate analysis of sandy and clayey plots, variability of vegetation indices is not fully correlated to the active layer depth variability.

Nevertheless, shallow active layer on sandy plots at Kharasavey corresponds to increased NDVI. At the same time, increased values of indices on clayey plot of Bely Island did not provide small values of active layer depth. Probably, this is connected with high wetness.
Conclusion:

Generally, the zonal pattern of vegetation indices and active layer depths from south to north can be followed on both sandy and clayey sites. It depends on decrease of both vegetation biomass and proportion of high shrubs northward (on Bely Island shrubs are completely absent on all established sites).

Deviations from zonal trends are related to local features, such as lithology, drainage, and topography. Vegetation cover on sandy surfaces of flat terraces at Laborovaya and poorly-drained hilltops at Kharasavey is well developed, yielding shallower active layer compared to Vaskiny Dachi and Bely Island. At Bely Island high vegetation indices on clayey sites do not prevent deep thawing, possibly due to high soil moisture content.
Thank you for your attention