

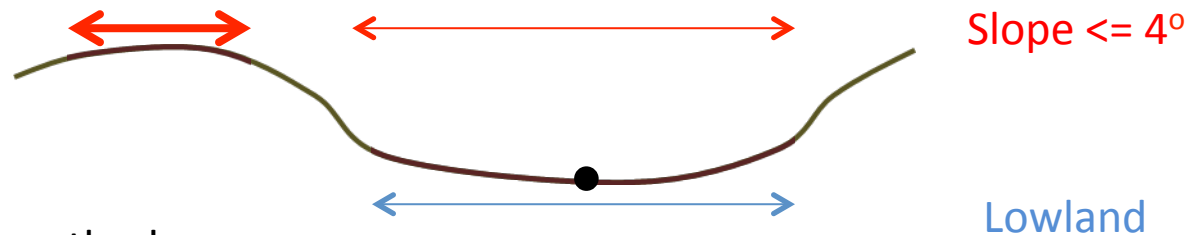
# Predisposition model – final version

**Hypothesis:** Thermokarsts occur in lowland peatland with ice rich permafrost site.

# Lowland definition

Lowlands were defined as follows:

Within each watershed we determined the point with lower elevation (black dot). From this point, we integrated as lowland all the area connected to this point with a slope  $\leq 4$  degree (blue double arrow).



Justification of the method:

Using a cost function from small scale watersheds, avoid considering flat uplands (thick red double arrow) as lowland, which would be the case with using only slope to identify lowlands.

Model comparison:

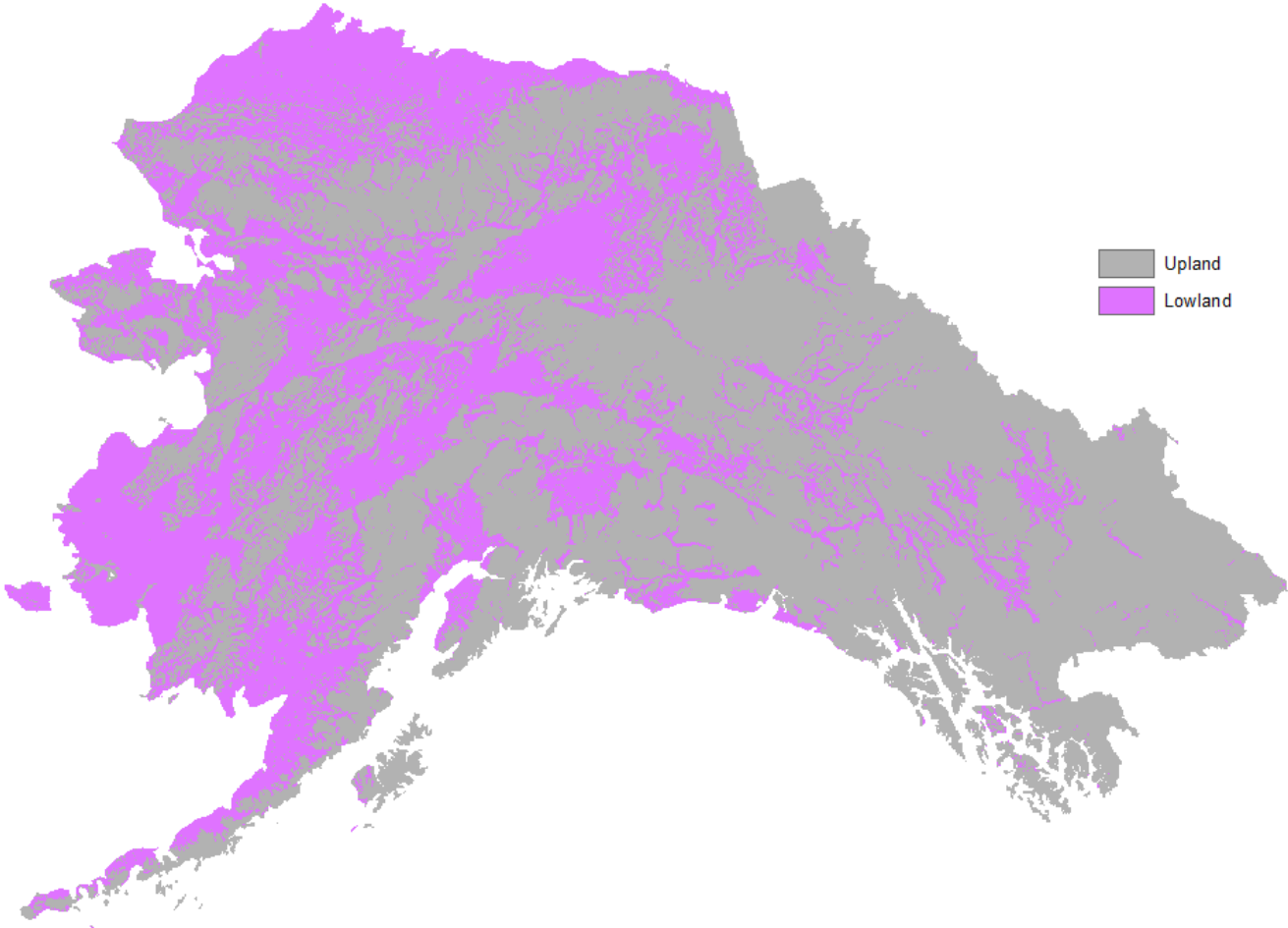
This lowland map has been compared with wetland distributions from [Whitcomb 2009](#) and [NLCD 2001](#). The postulate we used was that all wetlands should occur in lowland. From this comparison, we found that 92.4% and 93.7% of the wetlands from Whitcomb and NLCD resp. were located in lowland areas as defined above. These wetlands were covering 49.9% and 14.8% of the lowlands from Whitcomb and NLCD wetland distributions respectively.

# Lowland map

Variables	Characteristics	Alaska	Canada
Watersheds	Source	<a href="#">USGS</a>	<a href="#">Natural Resources Canada</a>
	Definition	5 <sup>th</sup> level (HUC 10)	~ HUC 8
	Average size (km <sup>2</sup> )	740	8,394
DEM	Source	USGS	Geobase Canada
	Resolution	60 m	30 to 60 m
Outputs	Lowland area (10 <sup>3</sup> km <sup>2</sup> )	670.8	93.3
	Lowland proportion (%)	45.2	4.5

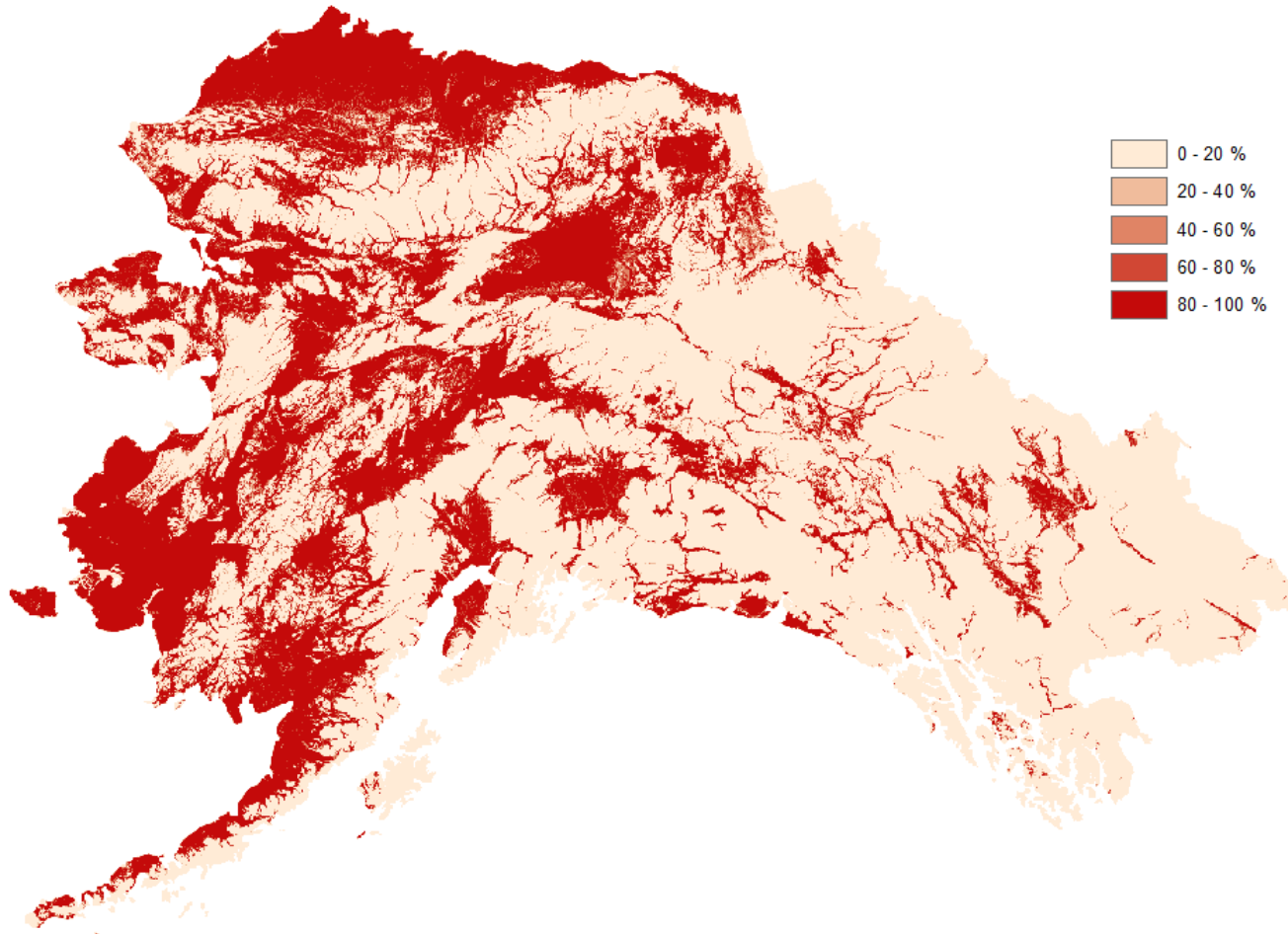
# Lowland mosaic – presence/absence (60m)

Lowland map for the IEM extent 60m resolution)



# Lowland mosaic – percent cover (1km)

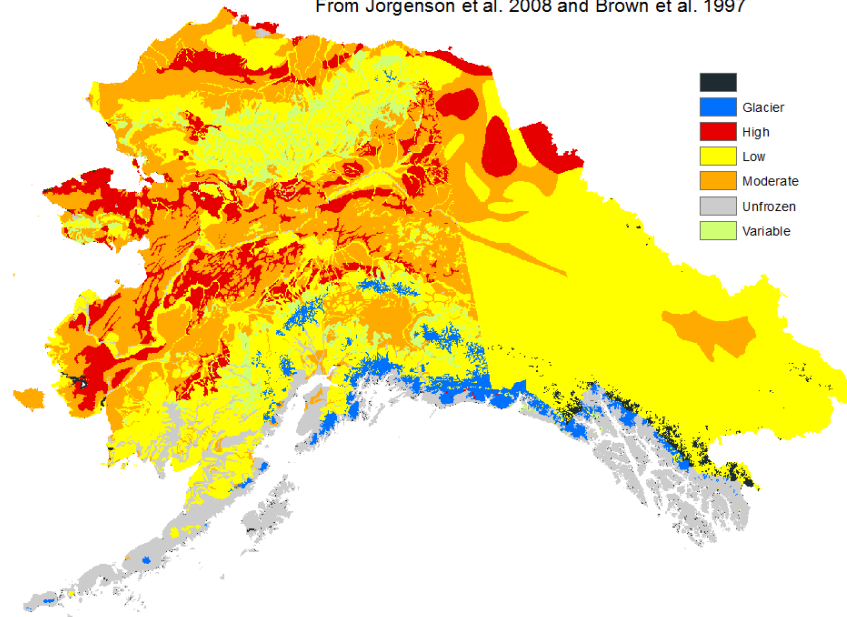
Lowland proportion map for the IEM extent (1km resolution)



# Ice content map

Source	Brown 1997	Jorgenson 2008
Product	Polygons	Polygons
Extent	Circumpolar	Alaska
Polygon avg size (km <sup>2</sup> )	10330	323

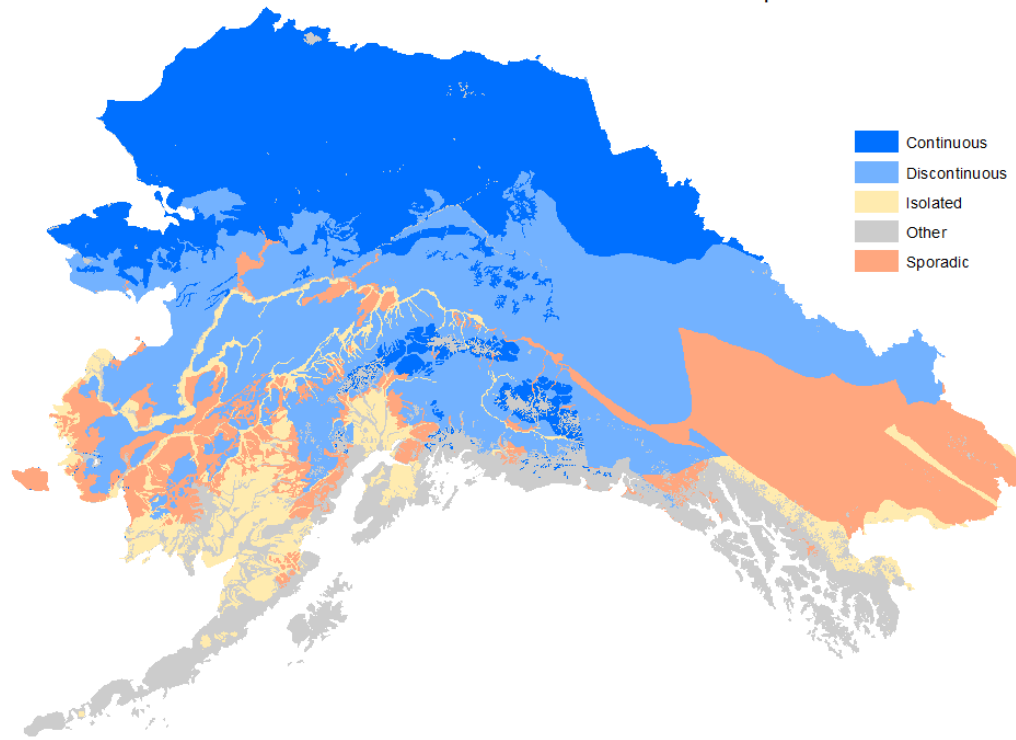
Mosaic of Ice Content Maps for the IEM extent  
From Jorgenson et al. 2008 and Brown et al. 1997



# Permafrost map comparison

Source	Brown 1997	Jorgenson 2008
Product	Polygons	Polygons
Extent	Circumpolar	Alaska
Polygon avg size (km <sup>2</sup> )	10330	323

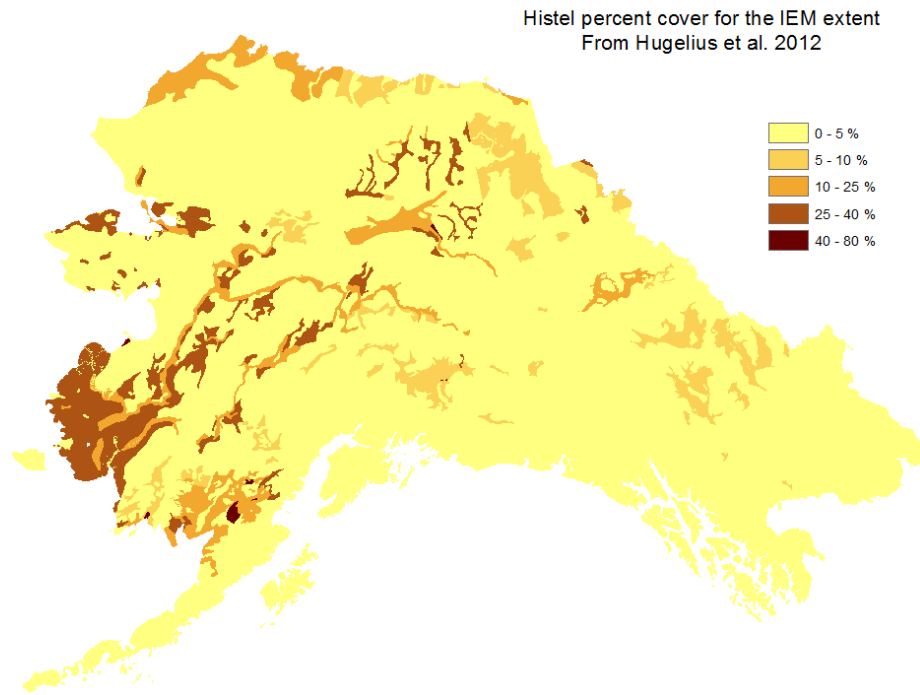
Permafrost Map for the IEM extent





# Histels map

Source	Hugelius et al. 2012
Original product	Polygons
Cover	Circumpolar
Data	Percent cover of histel
Original average polygon size	436 km <sup>2</sup>

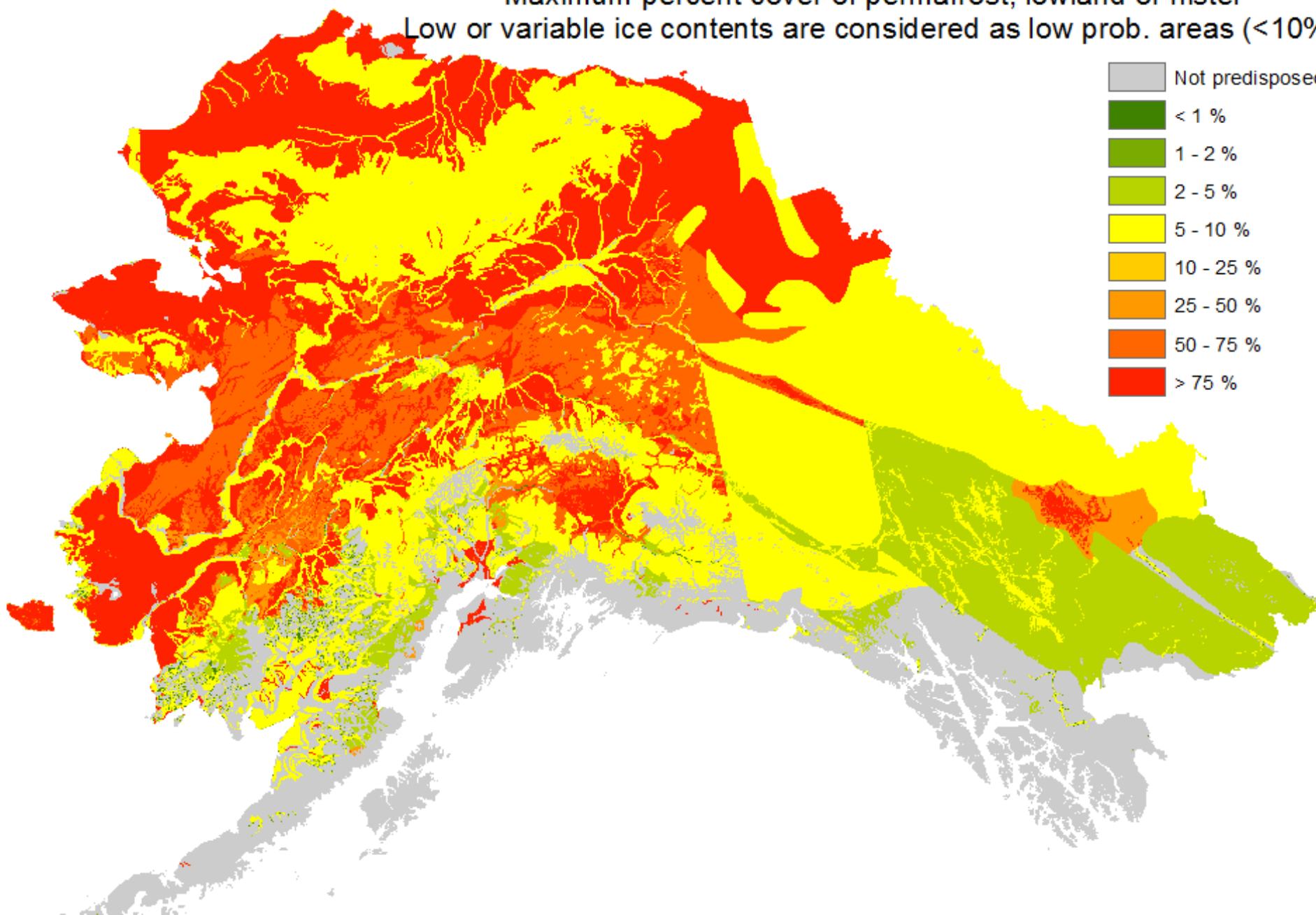


# Model

- Maximum percent cover among histel, lowland and permafrost in areas with high to moderate ice content;
- 10% of the maximum percent cover among histel, lowland and permafrost in areas with low or variable ice content.

Ice content class	Maximum probability of TK
High to moderate	100%
Low or variable	10%
Null (glacier or unfrozen)	0%

Maximum percent cover of permafrost, lowland or histel  
Low or variable ice contents are considered as low prob. areas (<10%)



# References

- [Brown, J., O.J. Ferrians, Jr., J.A. Heginbottom, and E.S. Melnikov. 1998, revised February 2001. \*Circum-arctic map of permafrost and ground ice conditions\*. Boulder, CO: National Snow and Ice Data Center. Digital media.](#)
- [Jorgenson, T., K. Yoshikawa, M. Kanevskyi, Y. Shur, V. Romanovsky, S. Marchenko, G. Grosse, J. Brown, B. Jones. 2008. Permafrost Characteristics of Alaska. Institute of Northern Engineering, University of Alaska Fairbanks, NICOP.](#)
- [Hugelius, G., C. Tarnocai, G. Broll, J.G. Canadell, P. Kuhry, D.K. Swanson. 2013. The Northern Circumpolar Soil Carbon Database: spatially distributed datasets of soil coverage and soil carbon storage in the northern permafrost regions. \*Earth System Science Data\* 5: 3–13](#)