

Ostrov Belyy (White Island), Yamal Peninsula region, Russia:  
Landsat ETM+ false color image, land-cover map, and NDVI map (1:200K scale)

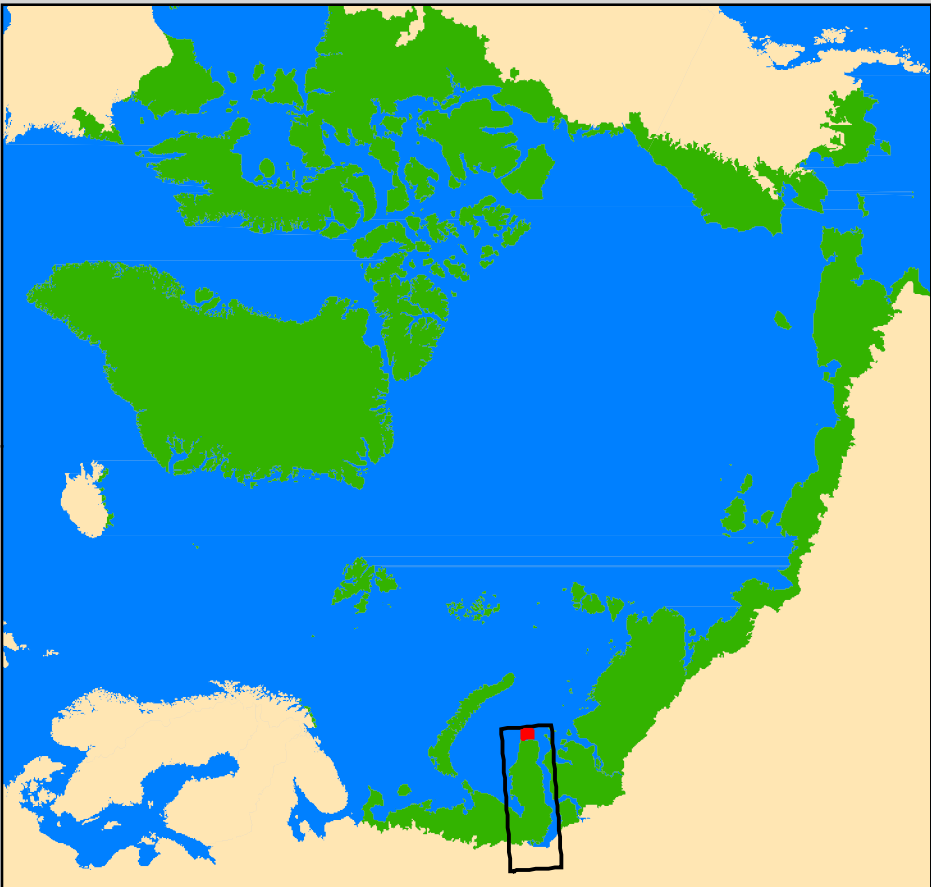
H.A. Maier and D.A. Walker

Alaska Geobotany Center, University of Alaska Fairbanks, Fairbanks, AK. <http://www.geobotany.org/>  
Presented at the Second Yamal Land-Cover Land-Use Change Workshop. Rovaniemi, Finland. 8-10 March 2010.

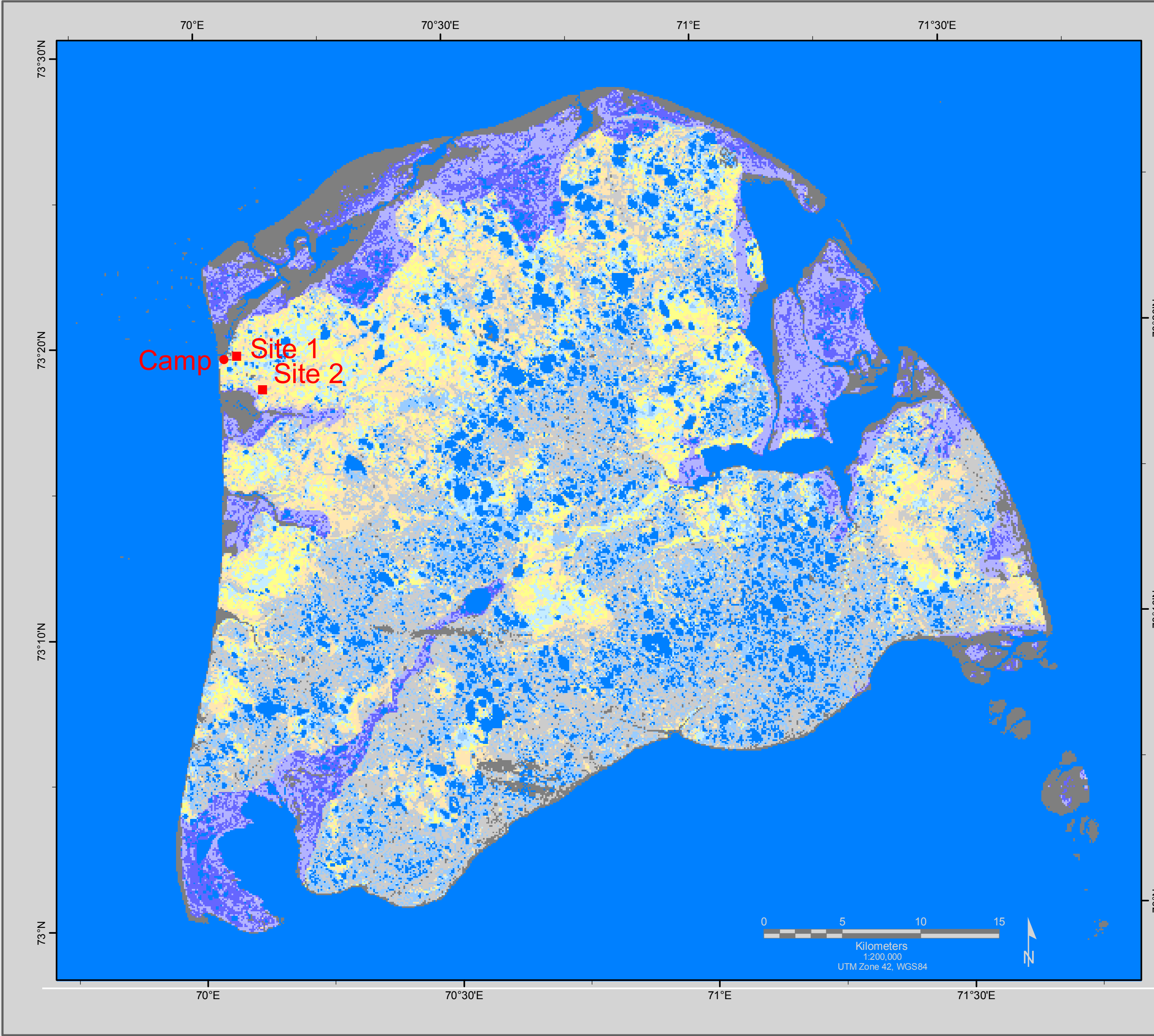
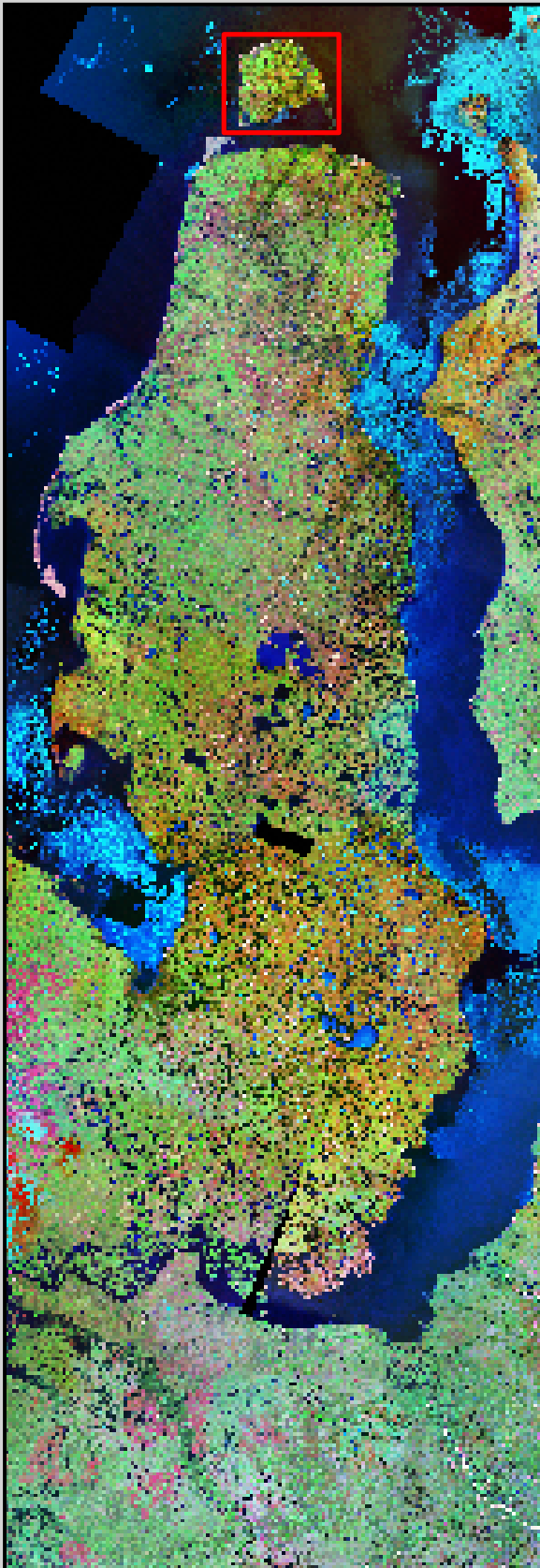


Landsat ETM+ False Color Image

The pan-sharpened false color image of Ostrov Belyy (left) was created from a Landsat ETM+ scene (USGS 2000; 15 Aug 2000; Path 168, Row 8). The false color composite displays Landsat bands 4 (750-900 nm), 3 (630-690 nm) and 2 (525-605 nm) as red, green and blue channels. The image was sharpened to a resolution of 15 m using the panchromatic band (band 7) and a Simple Mean algorithm (ArcGIS 9.3). Vegetated areas are displayed as shades of red. The brightest reds generally indicate the most densely vegetated areas and the duller reds the least vegetated areas. Water is displayed as black and sparsely vegetated or barren areas as light colors. The mosaic of landsat scenes for the Yamal (lower right) was created from the USGS Landsat TM Orthorectified Mosaics data collection (acquired 1986-1995) and shows the location of Ostrov Belyy.



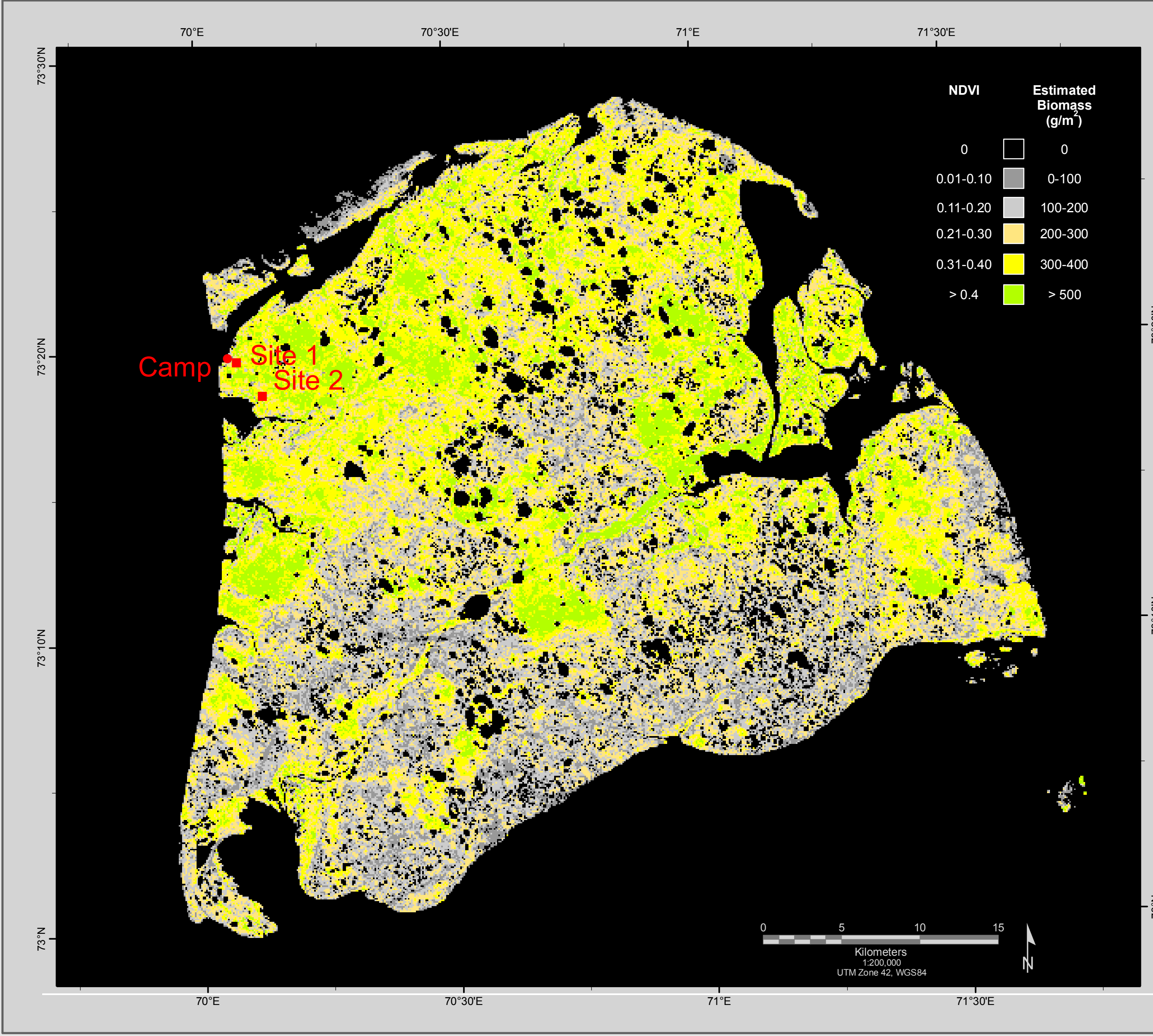
Location of Ostrov Belyy and the Yamal Peninsula within the Circumpolar Arctic region (above) and the Location of Ostrov Belyy within the Yamal Region, Russia (right).



Land-Cover Map

An unsupervised classification was performed on bands 1-7 of the Landsat image using the Iso Cluster and Maximum Likelihood algorithms (ArcGIS 9.3 software). Pixels were grouped into 15 clusters based on their spectral similarity. Each cluster was then assigned to one of 9 land-cover classes with names and colors modified from those of the Circumpolar Arctic Vegetation Map (Walker et al. 2005). Salt marshes near the coast (laydas, violet colors on the map) were delineated by drawing polygons around these areas (photo interpretation) on the false-color image and then reclassifying the pixels within the layda regions. Plant species and soils information in the legend is based on field surveys (17-30 Jul 2009) in the vicinity of the base camp near the Popov Hydrometeorological Polar Station in the northwest corner of the map (Walker et al. 2009) and supplemented with photos taken during helicopter based aerial transects that were flown across the island during arrival and departure from the base camp.

- 1. Barrens, sparsely vegetated and clouds (clusters 9 and 15)**  
Includes barren coastal beaches, floodplains, mud flats, and sandy blowouts. Also a few clouds.
- 2. Dry, cryptogamic-crust, prostrate dwarf-shrub tundra (cluster 13)**  
Well-drained, sandy uplands, often with networks of small non-sorted polygons, on streams bluffs, and raised microsites between small lakes especially in the central and southern parts of the island. Plant communities are dominated by liverworts (*Gymnomitron coralloides*), lichens (*Ochrolechia frigida*, *Alectoria nigricans*, *Bryocaulon divergens*, *Cladonia coccifera*, *C. uncialis*, *Sphaerophorus globosus*, *Thamnolia vermicularis*), prostrate dwarf-shrubs (*Salix nummularia*, *Dryas octopetala*) and mosses (*Racomitrium lanuginosum* in cracks between small non-sorted polygons). Other common species include *Luzula confusa*, *Carex bigelowii*, *Oxyria digyna*, *Pedicularis hirsuta*, *Pogonatum dentatum*, and *Polytrichum strictum*.
- 3. Moist, graminoid, prostrate dwarf-shrub, moss tundra (cluster 14 = drier facies, tan; cluster 12 = wetter facies, light yellow)**  
Moderately drained, mainly loamy uplands, sometimes with non-sorted circles, mainly in the northwestern part of the island and scattered elsewhere. Drier facies of the plant community are dominated by sedges (*Carex bigelowii*), rushes (*Luzula confusa*), grasses (*Calamagrostis holmii*, *Arctagrostis latifolia*, *Poa arctica*), prostrate dwarf shrubs (*Salix polaris*, *Dryas octopetala*), and mosses (*Aulacomnium turgidum*, *Hylocomium splendens*, *Dicranum elongatum*, *D. acutifolium*, *Oncophorus wahlenbergii*, *Polytrichum strictum*, *Tomentypnum nitens*). Other common species include liverworts (*Placidium ciliare*) and scattered lichens (*Cetraria islandica*, *Cladonia uncialis*, *Dactylina arctica*, *Ochrolechia frigida*, *Parmelia omphalodes*, *Sphaerophorus globosus*, *Thamnolia vermicularis*). Wetter facies have few non-sorted circles, and much less *Dryas*, *Luzula confusa*, and lichens.
- 4. Wet, graminoid, moss tundra (cluster 10)**  
Sites with saturated soils but generally not summer-long standing water. Plant communities are dominated by sedges (*Carex aquatilis*, *Eriophorum angustifolium*, *E. russeolum*, *E. scheuchzeri*), grasses (*Dupontia fisheri*, *Arctophila fulva*, *Hierochloa pauciflora*) and mosses (*Drepanocladus* spp., *Sphagnum squarrosum*, *Sphagnum* spp.).
- 5. Aquatic, herbaceous marsh (clusters 8 and 11)**  
Vegetated margins of lakes and areas with water up to about 50 cm deep. Plant communities are dominated by grasses (*Arctophila fulva*), and sedges (*Carex aquatilis*), and occasionally a few forbs (*Ranunculus palasii*, *Batrachium trichophyllum*).
- 6. Moist to wet, brackish, graminoid marsh (brackish laydas) (clusters 10, 12, 13 in laydas)**  
Coastal areas and estuaries that are less frequently inundated by salt water. Plant communities are dominated by grasses (*Dupontia fisheri*, *D. psilosantha*, *Alopecurus alpinus*, *Arctophila fulva*), sedges (*Eriophorum scheuchzeri*, *Carex bigelowii*) and a few forbs (*Stellaria humifusa*, *Cochlearia groenlandica*).
- 7. Wet saline, graminoid marsh (saline laydas) (clusters 8 and 11 in laydas)**  
Coastal areas that are frequently inundated by salt water, especially along the northern coast, and estuaries of several streams. Common plant communities are dominated by grasses (*Puccinellia phryganodes*), sedges (*Carex subspatheacea*, *C. ursina*, *C. glareosa*), and a few forbs (*Stellaria humifusa*, *Cochlearia groenlandica*).
- 8. Water (clusters 1 to 7)**  
Includes ocean, lakes, and other mainly unvegetated bodies of water.



Normalized Difference Vegetation Index

The Normalized Difference Vegetation Index (NDVI) was calculated from band 3 (630-690 nm) and band 4 (750-900 nm) of the Landsat image. NDVI is an index of vegetation photosynthetic capacity that can be related to plant biomass. The values were calculated as:  $NDVI = (NIR - R) / (NIR + R)$ ; where NIR and R are the spectral reflectance values of the near-infrared (band 4) and red (band 3) bands, respectively. Water and barrens are generally displayed as black and sparsely vegetated areas are displayed in gray. Vegetation density increases with darker shades of green. Live biomass values were scaled linearly with NDVI from 0 g/m<sup>2</sup> to >500 g/m<sup>2</sup>; based on biomass information from (Walker et al. 2009). Low biomass value occur in the dry sandy areas, intermediate values in mesic loamy zonal areas and highest values in the moist to wet tundra sites.

**Credits:**  
Funding was provided by the NASA Land Cover Land-Use Change program, grant no. NNG6GE00A.

**References:**  
USGS Earth Resources Observation and Science Center (EROS). 2000. Landsat\_ETM - Path: 168 Row: 8 for Scene: LE716800820002285GS00. <http://earthexplorer.usgs.gov/>.

Walker, D.A., Reynolds, M.K., Daniëls, F.J.A., Einarsson, E., Elvebakk, A., Gould, W.A., Katenin, A.E., Kholod, S.S., Markon, C.J., Melnikov, E.S., N.G., M., Talbot, S.S., Yurtsev, B.A., and CAVM Team. 2005. The Circumpolar Arctic Vegetation Map. *Journal of Vegetation Science*. v. 16, p. 267-282.

Walker, D.A., Orekhov, P., Frost, G.V., Matyshak, G., Epstein, H.E., Leibman, M.O., Khitun, O., Khomotov, A., Daanen, R., Gobroski, K., and Maier, H.A. 2009. The 2009 Yamal Expedition to Ostrov Belyy and Khar, Yamal Region, Russia. Alaska Geobotany Center Data Report. NASA Grant No. NNG6GE00A, p. 49.