Title:

Using a maximum entropy approach for delineation of the northern forest line on Lovozersky tundra mountains

Authors & affiliations:

M.V. Zimin[1], A.A.Saveliev[2], H. Tømmervik[1], A. Hofgaard[1]
[1]Norwegian Institute for Nature Research, Norway; [2]Kazan State University, Russia
mikhail.zimin@nina.no

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In the case of increased attention to global climate change it is worth noting the high significance of studies of the transition taiga – the tundra zone – as the zone most sensitive to climate changes. Vegetation is the face of the landscape and thus reflects changes in its components. Fixation of the present state of the northern boundary of the forest will continue to reveal the nature of the change, and consequently the extent of climate change. The basis of such studies should be remote sensing data as the most relevant and precise source of information.

The main problem of automated interpretation of the northern boundary of the forest is the heterogeneity of the transition taiga-tundra zone. It is expressed in the species diversity of the dominant species composition and depth of the transition zone itself, which in mountainous areas can differ by several tens of meters, and on the plains by up to several tens of kilometres. Standard algorithms of interpretation are not very suitable to produce a clear correlation of each pixel and its corresponding class of images and smooth gradients do not provide adequate results.

In this study, we used multi-seasonal imagery from Landsat 5/7, SPOT-4 and IRS-P6 satellites. The Lovozersky tundra mountains in the Kola Peninsula, Russia, were selected for the study. All the images were classified into classes of forest and non-forest by the maximum entropy method, and the results were compared with different techniques of remote sensing. To validate the results, we have used field data and very high-resolution imagery.

These results provide a more precise selection of borders of the forest zone obtained by using methods of maximum entropy. It is worth noting that by using the probabilistic model of neighbouring pixels belonging to classes of forest, the boundary conditions of non-forest can be more accurately found on the basis of a comparison with field studies. The maximum entropy method is more sensitive when dealing with gradient plots of transition forest-tundra zone and allows a more accurate determination of the boundaries, rather than using classical algorithms for interpretation.

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