



Mapping wetland and forest landscapes in Siberia with Landsat data

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Landsat data availability provides opportunity for improving the knowledge of the Siberian ecosystems necessary for quantifying the response of the regional carbon cycle to the climate change. We developed a new wetland map based on Landsat data for whole West Siberia aiming at scaling up the methane emission observations. Mid-summer Landsat scenes were used in supervised classification method, based on ground truth data obtained during multiple field surveys. The method allows distinguishing following wetland types: pine-dwarf shrubs-sphagnum bogs or ryams, ridge-hollows complexes, shallow-water complexes, sedge-sphagnum poor fens, herbaceous-sphagnum poor fens, sedge-(moss) poor fens and fens, wooded swamps or sogra, palsa complexes. In our estimates wetlands cover 36% of the taiga area. Total methane emission from WS taiga mires is estimated as 3.6 TgC/yr, which is 77% larger as compared to the earlier estimate based on partial Landsat mapping combined with low resolution map due to higher fraction of fen area.

We make an attempt to develop a forest typology system useful for a dynamic vegetation modeling and apply it to the analysis of the forest type distribution for several test areas in West and East Siberia, aiming at capability of mapping whole Siberian forests based on Landsat data. Test region locations are: two in West Siberian middle taiga (Laryegan and Nyagan), and one in East Siberia near Yakutsk. The ground truth data are based on analysis of the field survey, forest inventory data from the point of view of the successional forest type classification. Supervised classification was applied to the areas where ample ground truth and inventory data are available, using several limited area maps and vegetation survey. In Laryegan basin the upland forest areas are dominated (as climax forest species) by Scots pine on sandy soils and Siberian pine with presence of fir and spruce on the others. Those types are separable using Landsat spectral data alone.

In the permafrost area around Yakutsk the most widespread succession type is birch to larch succession. Three stages of the birch to larch succession are detectable from Landsat image. When Landsat data is used in both West and East Siberia, distinction between deciduous broad-leaved species (birch, aspen, and willow) is difficult due to similarity in spectral signatures. Same problem exists for distinguishing between dark coniferous species (Siberian pine, fir and spruce). Forest classification can be improved by applying landscape type analysis, such as separation into floodplain, terrace, sloping hills.