Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MIS003-P04 Room:Convention Hall Time:May 26 10:30-13:00

Possible new crops in southern Siberia under climate change

Nadezhda Tchebakova[1*]

[1]Institute of Forest, Russian Academy, [2]Institute of Geography, Russian Academy, [3]National Climatic Data Center, [4]NASA Langley Research Center

The southern portion of Siberia is a subboreal forest-steppe and steppe ecozone and is known to have high agroclimatic potential due to favorable climatic and soil resources. Potential northward forest shifts over the plains and upslope in the mountains were modeled using our Siberian bioclimatic vegetation model (SiBCliM) in 2020, 2050 and 2080 coupling climate predictions from the Hadley A2 and B1 scenario projections. At the expense of forests, approximately 40% of Siberia was predicted to be covered by forest-steppe and steppe ecozones by the end of the century. Crops of food, forage, and biofuels primarily reside in steppe and forest-steppe zones in southern Siberia, and these crops are resistant to frequent droughts and the cold climate. Our goals are: 1) to evaluate ongoing climate change in southern Siberia from observed data: pre-1960; in the baseline period 1960-1990; in 1990-2010; and to predict related hot spots of potential agriculture change in the contemporary climate; 2) to predict agriculture in the future from the Hadley 2020, 2050 and 2080 climate change projections; and 3) finally, to develop a new agroclimatic zonation (agricultural regions) based on a new agroclimatic potential that may evolve as climate changes. Potential agricultural lands are modeled to appear in new forest-steppe and steppe habitats, extended and shifted northwards. A Siberian agri-crops model was developed that predicts ranges of major Siberian traditional crops (wheat, barley, vegetables, etc) and some exotic crops (melons and gourds, grapes, horticulture) currently non-existent but potentially important in a warming climate. In the model, four basic climatic constrains control crop distributions: growing degree-days and growing season length represent temperature requirements for plant growth and development, negative degree-days define winter cold tolerance, and a moisture index characterizes resistance to moisture stress. The model was applied to the pre-1960, 1960-1990, 1990-2010, 2020, 2050 and 2080 climates to predict potential distributions for both traditional and new crops in southern Central Siberia. Our analyses show that during the century traditional crops could be gradually shifted as far as 400 km northwards (about 50 km per decade) and new crops may be introduced in the very south with a significantly prolonged growing season and thus enlarged growing degree-days which may necessitate irrigation.

Keywords: southern Siberia, climate change, potential crops, traditional crops, exotic crops