Environmental Changes in Central Asian High Elevation Communities: Land Surface Phenology and Snow Cover Seasonality in Kyrgyz Highlands

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Prior to the Soviet era, highlanders in Central Asia practiced vertical transhumance in raising livestock—sheep and goats—for wool, meat, milk, and hides. Collectivization disrupted this practice with multiple external subsidies. Since 1991 montane agro-pastoralism has been disrupted by withdrawal of external subsides and introduction of a market economy. Moreover, Montane agropastoralism is highly vulnerable to environmental change. Our project evaluates four aspects of environmental change in human settlements and associated pasturelands in representative areas of the Kyrgyz Republic and Uzbekistan during the satellite era and projected changes into the middle of the 21st century to assess impacts on these highland communities and the pastures upon which they depend. The four aspects of environmental change are (1) changes in the thermal regime including growing season timing and extremes, (2) changes in the moisture regime including peak precipitation timing and snow cover duration, (3) changes in socio-economic conditions including income, education, agricultural production and practices, and institutions, and (4) changes in land cover, land use, and land condition including alterations in terrain from landslides and earthquakes. To date we have been focusing on highland communities in four rayons in the Kyrgyz Republic: At-Bashy and Naryn in Naryn oblast, and Alay and Chong-Alay in Osh oblast. Here we will present results of blending Landsat TM/ETM+/OLI and MODIS products with 30 m DEM data to characterize land surface phenology and snow cover seasonality in highland pastures using the thermal time metrics growing degree-days and frost degree-days, respectively, calculated from MODIS land surface temperature data. Of particular interest are the influences of snow cover melt date and snow cover duration on subsequent metrics of land surface phenology—peak height and thermal time to peak—as modulated by terrain (elevation, slope, and aspect).

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