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Inventorying and monitoring the recent behavior of Afghanistan's glaciers - a component of the USGS Afghanistan Water Resources Assessment

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As part of a nationwide investigation of the water resources of Afghanistan, an assessment of the recent behavior of the country's glaciers is being conducted using remotely sensed data collected between 2001 and 2004 by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) instrument on the Terra spacecraft. Nearly 40 VNIR (visible and near-infrared) digital images, encompassing all of the glacier-covered areas of Afghanistan, are the primary data set being analyzed. These images are processed using a supervised classification to determine the distribution of snow, debris-free glacier ice, debris covered glacier ice, ice-marginal and supraglacial lakes, vegetation, and bare bedrock and soils.

The investigation has two components. The first consists of inventorying and characterizing each glacier using a GIS-based statistical analysis. The second is a synoptic evaluation of the recent behavior of selected glaciers in each of Afghanistan's glacier-covered regions. ASTER imagery analysis results are being compared and contrasted with supervised classification data, stereo anaglyph topographic information, and historic map and terminus position data to determine glacier change and recent landscape feature development. Landsat TM data is used for selected locations to augment interpretations.

Among the glaciers and areas that have received detailed investigations are the large debris-covered glaciers of the central Wakhan Pamir; the small retreating cirque and

valley glaciers of the Koh-I-Baba range located west of Kabul; the retreating, debris-covered glaciers at the western end of the Wakhan panhandle; and the retreating, debris-covered valley glaciers of the Panshir Valley region. Nearly all glaciers analyzed are thinning and/or retreating. Many recently ice-free cirques have been observed in each glacier-covered region.

Early Soviet era topographic map data and published glacier extent and distribution data, especially that of University of Nebraska at Omaha researchers, are the basis for decadal scale terminus position comparisons. An additional component of this investigation is the determination of the location and size of ice-marginal and supraglacial lakes that may pose a threat to outburst flooding and landslide generation. Wherever possible, climate and meteorological data will be acquired and used to better understand the causes of observed glacier change.