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Monitoring drought stress across multiple vegetation communities within the upper Colorado River Basin

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Drought events have been frequent, often severe, and prolonged in the Upper Colorado River Basin (UCRB) during the late 20th and early 21st centuries, and indeed, over much of the intermountain West. From 1999 to 2010, drought conditions were prevalent across most of the UCRB during eight of twelve years. This multi-year drought had many serious effects on society and the environment including wildfires, major forest die-back, reduced agricultural productivity, and less water availability for municipal and agricultural use. Scientists at the U.S. Geological Survey (USGS) Earth Resources Observation and Science Center and the National Drought Mitigation Center (NDMC) have developed a drought monitoring methodology to address the considerable spatial and temporal variability of drought called the Vegetation Drought Response Index (VegDRI). VegDRI is based on models that incorporate satellite-based normalized differenced vegetation index (NDVI) data along with biophysical variables and historical and near-real time climate data to create a tool to monitor drought stress in vegetation. This tool provides more spatially-precise information than traditional drought indices. The integration of the NDVI and other observations into drought monitoring applications allows for the near-real time creation of spatially continuous and relatively detailed (1 km2) data of biweekly and weekly drought conditions across the conterminous United States. VegDRI is provided at spatial and temporal scales relevant to decision makers working at local to national levels. Data and maps are currently updated regularly and available from two main map services (http://www.drought.unl.edu/vegdri/VegDRI_Main.htm and http://vegdri.cr.usgs.gov/viewer/viewer.htm). A historical record of the VegDRI from 1989 to 2010 was the source for a detailed analysis of multi-year drought effects on vegetation across the UCRB. We analyzed the spatial differences in drought patterns within various natural vegetation types (e.g. forests, shrublands, grasslands) and investigated the variability in seasonal and cumulative drought stress. Comparisons with station-based drought indices and other spatial indicators show the value of the VegDRI information at the regional and watershed level. The most severe drought effects were seen in VegDRI during the growing season in 2002. And cumulative drought conditions spanning 2000 to 2004 caused significant drought-related vegetation changes in shrublands, grasslands, and forests.