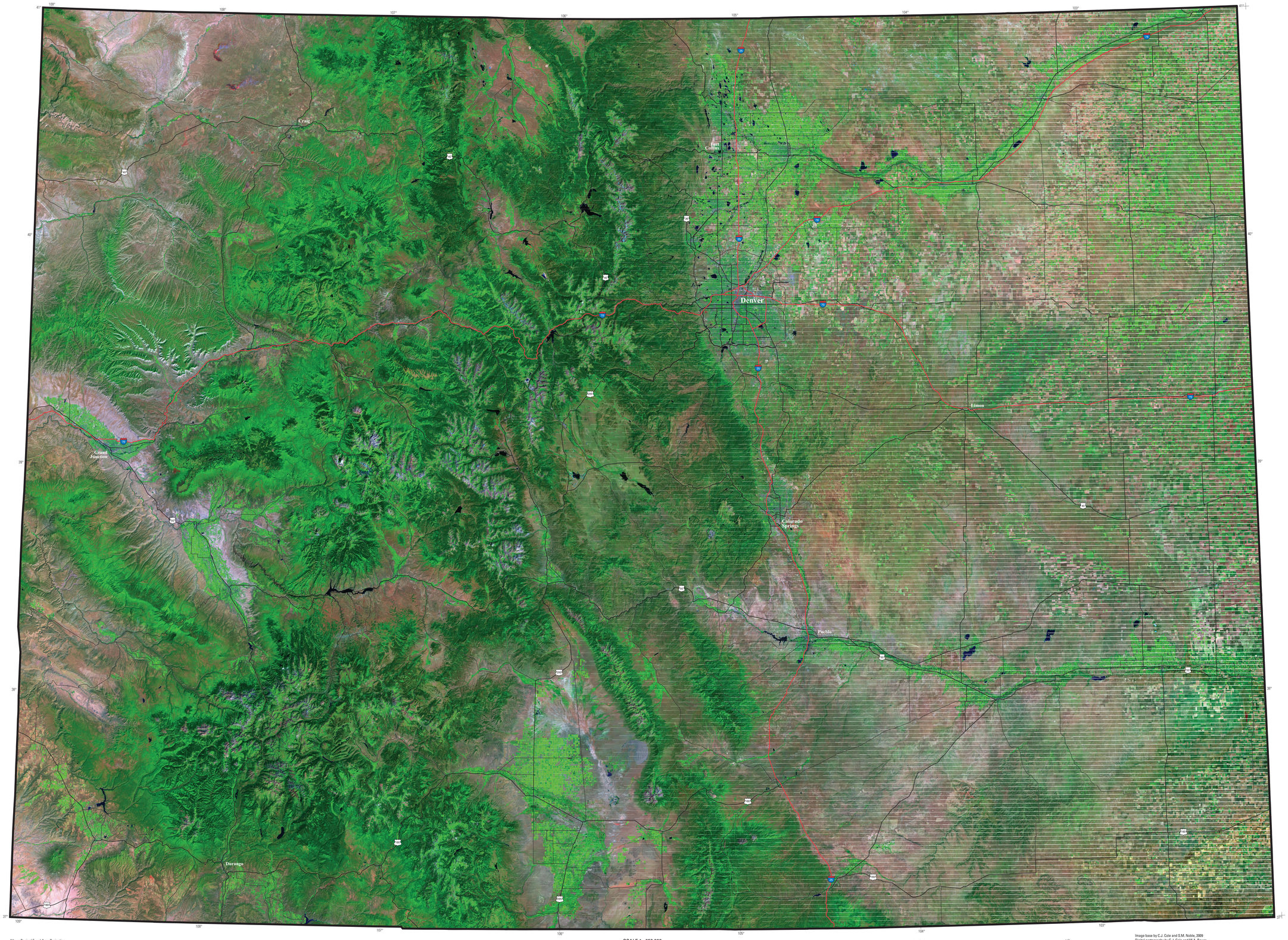

Albers Conical Equal Area Projection
North American Datum 1983 (NAD 83)

State and County boundary information derived from U.S. Census Bureau TIGER/Line data

Base transportation data derived from 1:100,000-scale U.S. Geological Survey National Map digital data, accessed 2009 at http://bpgeo.cr.usgs.gov/viewer.htm

Image base mosaic derived from 30-meter Landsat 5 Thematic Mapper, 2006–2008

The mosaic used to produce this map has been modified for publication purposes. The correct way to display this in ArcMap and other programs is as follows: Red, band 1; green, band 2; and blue, band 3.

SCALE 1 : 650 000

25 0 25 50 75 MILES

25 0 25 50 75 100 125 KILOMETERS

MAP LOCATION

LANDSAT THEMATIC MAPPER IMAGE MOSAIC OF COLORADO

By
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INTRODUCTION

The U.S. Geological Survey (USGS) Rocky Mountain Geographic Science Center (RMGSC) produced a seamless, cloud-minimized remotely-sensed image spanning the State of Colorado. Multiple orthorectified Landsat 5 Thematic Mapper (TM) scenes collected during 2006–2008 were spectrally normalized via reflectance transformation and linear regression based upon pseudo-invariant features (PIFS) following the removal of clouds. Individual Landsat scenes were then mosaicked to form a six-band image composite spanning the visible to shortwave infrared spectrum. This image mosaic, presented here, will also be used to create a conifer health classification for Colorado in USGS Scientific Investigations Map 3103.

An archive of past and current Landsat imagery exists and is available to the scientific commu- nity (http://glovis.usgs.gov/), but significant pre-processing was required to produce a statewide mosaic from this information. Much of the data contained perennial cloud cover that complicated analysis and classification efforts. Existing Landsat mosaic products, typically three band image composites, did not include the full suite of multispectral information necessary to produce this assessment, and were derived using data collected in 2001 or earlier.

METHODS

Thirty orthorectified 30-meter Landsat 5 Thematic Mapper (TM) scenes (U.S. Geological Survey, 2009) were used to generate the mosaic for Colorado (fig.1, table 1). Landsat blue (band 1), green (band 2), red (band 3), near infrared (band 4), and shortwave infrared spectral information (bands 5 and 7) were used to produce this mosaic. Thermal Infrared (band 6) was excluded from this mosaic, due to its 60-meter spatial resolution. The collection date of the Landsat scenes ranged from 2006–2008, with the majority being collected in 2008 (table 1). All Landsat scenes were converted to at-sensor reflectance, to reduce inter-scene variability that was due to differences in solar elevation angle and acquisition date (Huang and others, 2002). Areas affected by clouds in the base imagery were identified as data "gaps." Landsat scenes which were not cloud affected in these areas were then selected and subset to "fill" these data gaps. Whenever possible, the "fill" scenes were collected in 2008. In cases where no such data existed, imagery from 2006–2007 was used. Landsat "fill" data were then normalized to the base imagery via linear regression based upon pseudo-invariant features that are spectrally consistent, and should not appreciably change by scene date (Hadjimitsis and others, 2009; Schott and others, 1988). The normalized, reflectance converted, cloud-filled Landsat scenes were then mosaicked using ERDAS IMAGINE image processing software (ERDAS, 2009).

SUMMARY

A six-band image mosaic covering Colorado was produced. This mosaic includes blue (band 1), green (band 2), red (band 3), near infrared (band 4), and shortwave infrared information (bands 5 and 7). The image composite shown here displays three of the Landsat bands (7, 4, and 2), which are sensitive to the shortwave infrared, near infrared, and green ranges of the electromagnetic spectrum. Vegetation appears green in this image, while water looks black, and unforested areas appear pink. The explanation shows some generalized land cover features.

The Landsat mosaic used to produce this map has been modified for publication purposes. IMAGINE software (ERDAS, 2009) was used to apply a standard deviation stretch to increase scene contrast and enhance image interpretation.

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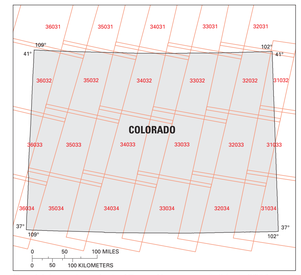

Figure 1. Index map showing Landsat 5 Thematic Mapper coverage for Colorado, WRS-2 (Worldwide Reference System 2). Numbers refer to the path and row of the scene, and red lines indicate extent of the scene. Scenes overlap. Scenes may be obtained from U.S. Geological Survey Earth Resources Observation Science Center (EROS), at *http://glovis.usgs.gov/* (U.S. Geological Survey, 2009).

Table 1. *Landsat scenes used to derive mosaic*
[Scenes were obtained from U.S. Geological Survey Earth Resources Observation and Science Center (EROS), available at: *http://glovis.usgs.gov/* (U.S. Geological Survey, 2009)]

Scene Identifier	Path/Row	Image Date
LT50310332008274EDC00	31/33	September 30, 2008
LT50310342008162EDC00	31/34	June 10, 2008
LT50320322008201EDC00	32/32	July 19, 2008
LT50320332007230EDC00	32/33	August 18, 2007
LT50320342008281EDC00	32/34	October 7, 2008
LT50330322008224EDC00	33/32	August 11, 2008
LT50330322008240EDC00	33/32	August 27, 2008
LT50330332008224EDC00	33/33	August 11, 2008
LT50330332008240EDC00	33/33	August 27, 2008
LT50330342007237EDC00	33/34	August 25, 2007
LT50330342008192EDC00	33/34	July 10, 2008
LT50330342008224EDC00	33/34	August 11, 2008
LT50340322006209EDC00	34/32	July 28, 2006
LT50340322006241EDC00	34/32	August 29, 2006
LT50340322007212EDC00	34/32	July 15, 2007
LT50340332006241EDC00	34/33	August 29, 2006
LT50340332007196EDC00	34/33	July 15, 2007
LT50340332007228EDC00	34/33	August 16, 2007
LT50340332008215EDC00	34/33	August 2, 2008
LT50340342006193PAC01	34/34	July 12, 2006
LT50340342006241EDC00	34/34	August 29, 2006
LT50340342007196EDC00	34/34	July 15, 2007
LT50340342008215EDC00	34/34	August 2, 2008
LT50350322007251EDC00	35/32	September 8, 2007
LT50350322008235EDC00	35/32	August 25, 2008
LT50350332007235EDC00	35/33	August 23, 2007
LT50350332008190EDC00	35/33	July 8, 2008
LT50350332008235EDC00	35/33	August 25, 2008
LT50350342007251EDC00	35/34	September 8, 2007
LT50350342008206EDC00	35/34	July 24, 2008
LT50360322008197EDC00	36/32	July 15, 2008
LT50360332008213EDC00	36/33	July 31, 2008

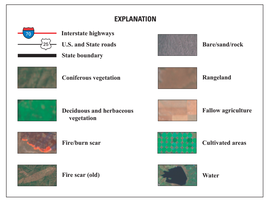

Figure 2. Index map showing Colorado and its counties. Derived from U.S. Census Bureau TIGER/Line data available at: *http://www.census.gov/geo/www/tiger/tgrshp2009/tgrshp2009.html* (U.S. Census Bureau, 2009).

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