High-Resolution Orthorectified Imagery and Digital Elevation Models for Study of Environmental Change at Niwot Ridge and Green Lakes Valley, Colorado

ABSTRACT

This data release consists of orthorectified digital photography – as well as Digital Elevation Models (DEM's) and other map layers – for the Niwot Ridge Long-Term Ecological Research (LTER) Site and the Green Lakes Valley portion of the Boulder Creek Critical Zone Observatory (CZO). The high-resolution imagery and data will be useful for a variety of environmental research, including time-series analysis of climate-related changes in vegetation, hydrology, geomorphology, etc. The datasets should also be useful for visualization, mapping, modeling, and other objectives tied to science planning, land management, research, education, and outreach.

The twelve "timeslices" of orthophoto mosaics have a resolution of 0.3 m to 1.0 m and encompass the past seven decades. Previously orthorectified imagery was obtained from various sources for years 2008, 2006, 2005, 2004, 2002, and 1999. Imagery was also orthorectified from historic aerial photography for years 1990, 1985, 1972, 1953, 1946, and 1938. Each high-resolution image has the qualities of a photograph and the functionality of a map layer for use in Geographic Information Systems (GIS) or remote sensing software. Digital scans of the historic photography were fully orthorectified in Leica Photogrammetry Suite (LPS) at INSTAAR, University of Colorado, using air-photo camera models, a 2 m DEM, information from calibration reports, and image-to-image control points linked to the 2008 reference imagery. Horizontal errors (RMSE) average 2.1 m, relative to the 2008 mosaic. The images are provided in georeferenced .tif (GeoTIFF) format, accompanied by pyramid files (.rrd) generated by ArcGIS. The orthophoto mosaics carry a resolution and accuracy as good or better than satellite imagery; they provide a time series for detailed anlaysis of environmental change through time.

Four DEM's provided here vary in resolution and accuracy. Included for convenience are the 30 m and 10 m resolutions of the U.S. Geological Survey's National Elevation Dataset (NED). A 2-m resolution Digital Surface Model (DSM) was generated from photogrammetric data provided by Bohannan Huston Inc.; it documents surface conditions as depicted in the 2008 imagery (including trees and snow cover, etc.). Also, a 2-m resolution Digital Terrain Model (DTM) was provided by Bohannan Huston Inc.; they combined a pre-existing LIDAR point dataset with the 2008 photogrammetric data, added breaklines, flattened lakes, and otherwise enhanced the dataset with stereo editing. Compared to the DSM, the DTM should better represent bare-earth conditions, and is better suited for hydrologic modeling. Each DEM is in ArcGIS GRID format, accompanied by shaded relief layers in GRID and GeoTIFF formats. Together with the previously acquired 1-m LIDAR DEM, these DEM's provide the best available terrain databases for gemorphic or watershed analyses and modeling.

Other datasets in this release include: 1:24,000- and 1:100,000-scale Digital Raster Graphic (DRG) files (depicting the USGS topographic maps for the area); a 30-m Landsat7 mosaic from 1999; and a shapefile outlining the extent of the "nwt" project area.

All datasets share a common rectangular extent, encompassing Niwot Ridge, the Green Lakes Valley, and surrounding areas. All map layers share a common projection and datum (UTM zone 13, NAD83). Thumbnail images are provided as low-resolution .jpg files. Please note that the 2008 imagery is under restricted licensing until February, 2011, and should not be distributed beyond the LTER and CZO projects before then. All other datasets can be readily shared under an unrestricted public license. All together, the data release totals 17 GB. To access the data, see: http://culter.colorado.edu/NWT/. With questions, please contact the Niwot Ridge LTER Data Manager, University of Colorado, Institute of Arctic and Alpine Research (INSTAAR), Niwot Ridge LTER; 1560 30th Street; Boulder, CO 80309-0450; phone: 303-492-4771; email: lternwt@colorado.edu; websites: http://culter.colorado.edu/NWT/ and http://instaar.colorado.edu/QGISL/NWT/.

METADATA AND CITATION

PLEASE READ the FGDC-compliant metadata files that are available for each dataset (in .html, .txt, and .xml formats). These files provide numerous details that may be of interest. Also, please cite this data release as: Manley, W.F., Parrish, E.G., and Lestak, L.R., 2009, High-Resolution Orthorectified Imagery and Digital Elevation Models for Study of Environmental Change at Niwot Ridge and Green Lakes Valley, Colorado: Niwot Ridge LTER, INSTAAR, University of Colorado at Boulder, digital media.

FILE LIST

File or Folder Name	Title	Resolution (m)	Type	Horiz. Error (m)	Source Date	Source Scale	Size
0README_nwt_orthos_dems.ppt	Powerpoint Overview of This Data Release						
0README_nwt_orthos_dems.pdf	Readme File (this file)						
►Orthoimagery							
►►nwt_ortho_2008_DRAPP	2008 Orthoimagery from the Denver Regional Aerial Photography Project*	0.3	Natural Color & Color Infrared		6/14-29/08	digital	4.5 GB
nwt_ortho_2008_ne.tif*							
nwt_ortho_2008_nw.tif*							
nwt_ortho_2008_se.tif*							
nwt_ortho_2008_sw.tif*							

FILE LIST, Cont'd

File or Folder Name	Title	Resolution (m)	Type	Horiz. Error (m)	Source Date	Source Scale	Size
►►nwt_ortho_2006_DRAPP	2006 Orthoimagery from the Denver Regional Aerial Photography Project	0.328	Natural Color	0.8	4-7/06	digital	2.8 GB
nwt_ortho_2006_ne.tif							
nwt_ortho_2006_nw.tif							
nwt_ortho_2006_se.tif							
nwt_ortho_2006_sw.tif							
►►nwt_ortho_2005_NAIP	2005 Orthoimagery from the National Agricultural Imagery Program	1	Natural Color	2.7	7/11-13/05	?	0.3 GB
nwt_ortho_2005_naip.tif							
►►nwt_ortho_2004_DRAPP	2004 Orthoimagery from the Denver Regional Aerial Photography Project	0.305	Natural Color	0.9	4-7/04	15,000	3.2 GB
nwt_ortho_2004_ne.tif							
nwt_ortho_2004_nw.tif							
nwt_ortho_2004_se.tif							
nwt_ortho_2004_sw.tif							
►►nwt_ortho_2002_DRAPP	2002 Orthoimagery from the Denver Regional Aerial Photography Project	0.3	Natural Color	2.3	Spring, '02	15,000	2.9 GB
nwt_ortho_2002_ne.tif							
nwt_ortho_2002_nw.tif							
nwt_ortho_2002_se.tif							
nwt_ortho_2002_sw.tif							
►►nwt_ortho_1999_DOQ	1999 USGS Digital Orthophoto Quadrangles	1	Black and White	2.8	9/6-13/99	?	0.1 GB
nwt_ortho_1999_DOQ.tif							
►►nwt_ortho_1990_1988	1990 Orthoimagery from USGS NAPP Aerial Photography	0.6	Color Infrared	0.9	8/27/1990 & 9/4/88	40,000	0.8GB
nwt_ortho_1990_1988.tif							
nwt_ortho_1990_1988_source.shp							
►►nwt_ortho_1985	1985 Orthoimagery from USGS NHAP Aerial Photography	0.8	Color Infrared	1.0	9/6/85	58,000	0.5 GB
nwt_ortho_1985.tif							
►►nwt_ortho_1972	1972 Orthoimagery from NASA Historical Aerial Photography	0.8	Color Infrared	1.7	9/16/72	56,000	0.4 GB
nwt_ortho_1972.tif							
►►nwt_ortho_1953	1953 Orthoimagery from USGS Historical Aerial Photography	0.7	Black and White	1.5	9/1/53	46,000	0.2 GB
nwt_ortho_1953.tif							
►►nwt_ortho_1946	1946 Orthoimagery from USFS Historical Aerial Photography	0.3	Black and White	1.8	8/31-9/29/46	20,000	0.7 GB
nwt_ortho_1946.tif							
►►nwt_ortho_1938	1938 Orthoimagery from USFS Historical Aerial Photography	0.3	Black and White	7.0	10/26-29/38	20,000	0.6 GB
nwt_ortho_1938.tif							
►DEMs							
►►nwt_dsm_02m_BHI	2m Digital Surface Model from 2008 DRAPP Photogrammetric Data	2					0.2 GB
nwt_dsm_02	DSM grid						
nwt_dsm_02_sh	Shaded relief grid						
nwt_dsm_02m_shaded_relief.tif	Shaded relief geotiff						
►►nwt_dtm_02m_BHI	2m Digital Terrain Model Combining LIDAR and Stereo-Enhanced Photogrammetric Data	2					0.2 GB
nwt_dtm_02	DTM grid						
nwt_dtm_02_sh	Shaded relief grid						
nwt_dtm_02m_shaded_relief.tif	Shaded relief geotiff						
►►nwt_dem_10m_USGS_NED	10m USGS NED Digital Elevation Model	10					6 MB
nwt_dem_10	DEM grid						
nwt_dem_10_sh	Shaded relief grid						
nwt_dem_10m_shaded_relief.tif	Shaded relief geotiff						
►►nwt_dem_30m_USGS_NED	30m USGS NED Digital Elevation Model	30					1 MB
nwt_dem_30	DEM grid						
nwt_dem_30_sh	Shaded relief grid						
nwt_dem_30m_shaded_relief.tif	Shaded relief geotiff						
►Accessory_Layers							18 MB
nwt_drg_24k.tif	1:24,000 USGS Digital Raster Graphic (DRG)	2.438					
nwt_drg_100k.tif	1:100,000 USGS Digital Raster Graphic (DRG)	10.16					
nwt_landsat7_1999.tif	1999 Landsat 7 False Color Mosaic from the USGS Seamless Server (30m)	30					
nwt_ortho_frames_info.xls	Information about the Aerial Photography Used to Create the 1953-1990 Orthoimagery						
nwt_project_extent.shp	Polygon Shapefile Outlining Extent of the "NWT" Project Area						

* Do not share the 2008 DRAPP orthoimagery beyond LTER and CZO; it is under restricted license until Feb. 2011.

All map layers share a common projection and datum (UTM zone 13, NAD83), and come with FGDC metadata (.txt, .html, and .xml). Map layers also come with thumbnail images (.jpg).