USGS science for a changing world

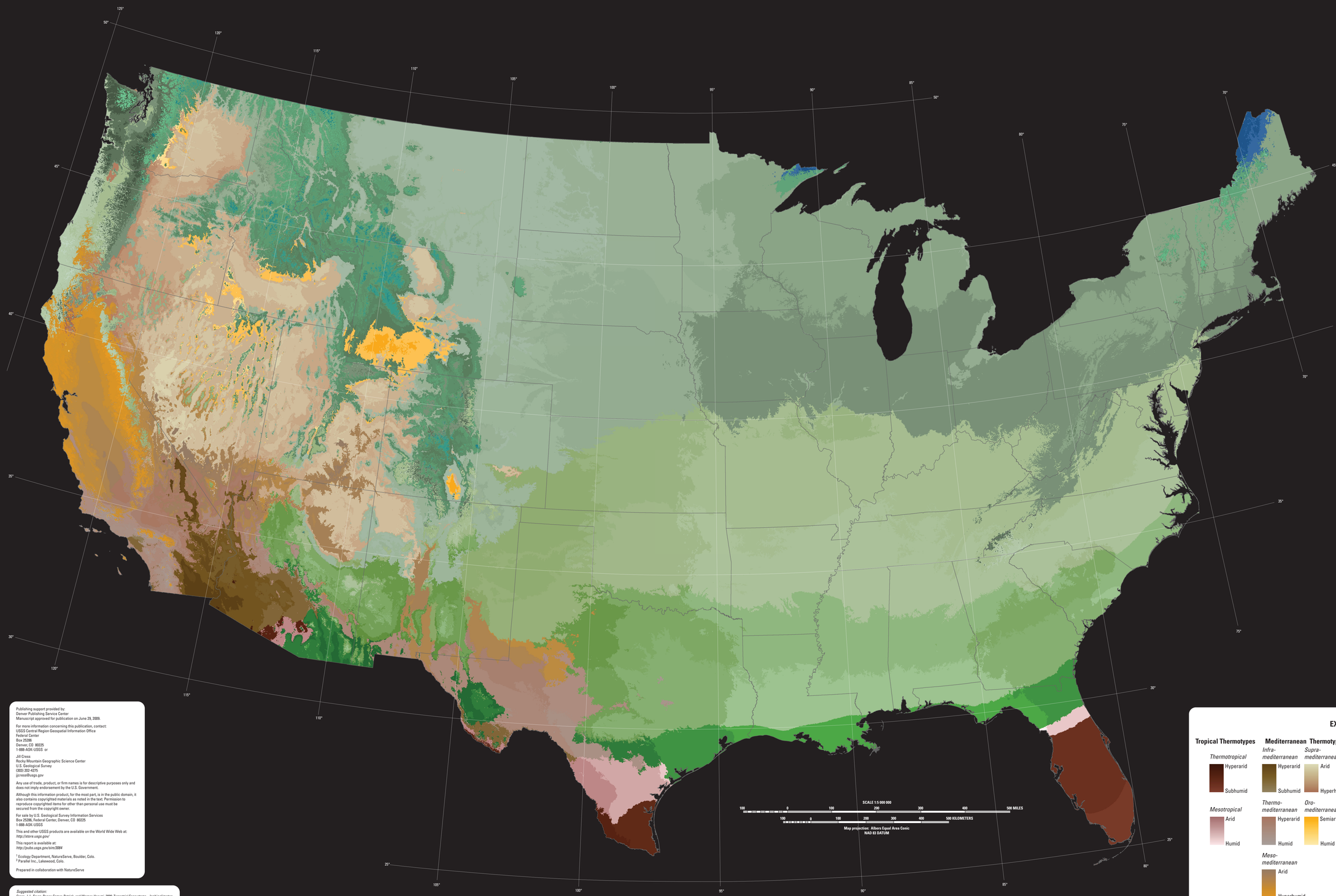
NatureServe

Terrestrial Ecosystems—Isobioclimates of the Conterminous United States

By Jill J. Cress, Roger Sayre, Patrick Comer,[1] and Harumi Warner[2]

2009

Scientific Investigations Map 3084
Version 1.0



Introduction

As part of an effort to map terrestrial ecosystems, the U.S. Geological Survey (USGS) has generated isobioclimate classes to be used in creating maps depicting standardized, terrestrial ecosystem models for the conterminous United States (Sayre and others, 2009), using an ecosystems classification developed by NatureServe (Comer and others, 2003). A biophysical stratification approach, developed for South America (Sayre and others, 2008) and now being implemented globally (Sayre and others, 2007), was used to model the ecosystem distributions. Bioclimate regimes strongly influence the differentiation and distribution of terrestrial ecosystems, and are therefore one of the key input layers in this biophysical stratification.

The Rivas-Martínez methodology is based on the concept of establishing a quantifiable classification system which would closely relate the distribution of vegetation to climatic parameters and indices (Rivas-Martínez and others, 1999). This method first establishes bioclimatic indices calculated from various ranges of temperature and precipitation data, compares these indices to defined thresholds, and finally applies sets of decision rules to identify the climate classes. The climate classification is hierarchical with four levels: macrobioclimates, bioclimates, thermotypes, and ombrotypes. Thermotypes, which represent thermoclimatic belts, are identified using the positive annual temperature (Tp) thresholds or the compensated thermicity index (Itc) thresholds (Rivas-Martínez, 2004; Rivas-Martínez and others, 1999, 2004). Ombrotypes, which represent ombroclimatic belts, are based on the ombrothermic index (Io) which is calculated as a function of both the total positive precipitation and temperature (Rivas-Martínez, 2004; Rivas-Martínez and others, 1999, 2004). For this national implementation the source data used for establishing the bioclimatic indices was Daymet (*http://www.daymet.org/dataSelection.jsp*). Daymet temperature and precipitation data were developed from 18 years (1980–1997) of climatological records and is available at a spatial resolution of 1 kilometer (Thornton, 1997). This implementation of the Rivas-Martínez methodology resulted in the generation of four climate layers for the conterminous United States: macroclimates, bioclimates, thermotypes, and ombrotypes.

However, the biophysical stratification approach used for the ecosystems modeling effort required a single climate layer that accurately reflected regional variation in wet/dry gradients and hot/cold gradients, with a manageable number of classes. Therefore, the data layers for thermotypes and ombrotypes were combined, yielding 127 unique thermotype-ombrotype combinations.The isobioclimates image shows ombrotypic regions (dry/wet gradients) for each thermotypic (warm/cold) region. **Additional information about this map and any of the data developed for the ecosystems modeling of the conterminous United States is available online at *http://rmgsc.cr.usgs.gov/ecosystems/*.**

References Cited:

Comer, Patrick, Faber-Langendoen, Don, Evans, Rob, Gawler, Sue, Josse, Carmen, Kittel, Gwen, Menard, Shannon, Pyne, Milo, Reid, Marion, Schulz, Keith, Snow, Kristin, and Teague, Judy, 2003, Ecological systems of the United States—A working classification of U.S. terrestrial systems: NatureServe, Arlington, Va. Accessed Oct. 2008 at http://www.natureserve.org/library/usEcologicalsystems.pdf.

Daymet, 2006, Daymet—Daily surface weather and climatological summaries: Missoula, Mont., University of Montana, Numerical Terradynamic Simulation Group (NTSG). Accessed Jan. 2006 at http://www.daymet.org/dataSelection.jsp.

Rivas-Martínez, Salvador, 2004, Global Bioclimatics (Clasificación bioclimática de la Tierra): Version 27–08–04. Phytosociological Research Center: Madrid, University Complutense of Madrid. Accessed Oct. 2008 at http://www.globalbioclimatics.org/book/bioc/global_bioclimatics_2.htm#2.

Rivas-Martínez, Salvador, Sánchez-Mata, Daniel, and Costa, Manuel, 1999, North American Boreal and Western Temperate Forest Vegetation (Syntaxonomical synopsis of the potential natural plant communities of North America, II): Itinera Geobotanica 12:5–316, Phytosociological Research Center, 2001: Madrid, University Complutense of Madrid. Accessed Oct. 2008 at http://www.globalbioclimatics.org/book/namerica2/namerica.htm.

Rivas-Martínez, Salvador, Sánchez-Mata, Daniel, and Costa, Manuel, 2004, Synoptical Worldwide Bioclimatic Classification System: Madrid, University Complutense of Madrid. Accessed Oct. 2008 at: http://www.globalbioclimatics.org/book/bioc/tabla3.htm.

Sayre, Roger, Yanosky, Alberto, and Muchoney, Doug, 2007, Mapping global ecosystems—The GEOSS approach: Group on Earth Observations, ed.: London, U.K., Tudor Rose.

Sayre, Roger, Bow, J., Josse, C., Sotomayor, L., and Touval, J., 2008, Terrestrial ecosystems of South America, Campbell, J.C., Jones, K.B., and Smith, J.H., eds., *in* North America Land Cover Summit—A Special Issue of the Association of American Geographers: Association of American Geographers, p. 131–152.

Sayre, Roger, Comer, Patrick, Warner, Harumi, and Cress, J.J., 2009, A new map of standardized terrestrial ecosystems of the conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p. Accessed July 20, 2009 at http://pubs.usgs.gov/pp/1768.

Thornton, P.E., 1997, Daymet—Climatological summaries for the conterminous United States, 1980–1997, User's Guide: Missoula, University of Montana. Accessed Oct. 2008 at: http://www.daymet.org/daymetus_userguide.pdf.

Thornton, P.E., Running S.W., and White, M.A., 1997, Generating surfaces of daily meteorological variables over large regions of complex terrain: Journal of Hydrology, 190, p. 214–251.

EXPLANATION

Tropical Thermotypes

Thermotropical
- Hyperarid
- Subhumid

Mesotropical
- Arid
- Humid

Mediterranean Thermotypes

Infra-mediterranean
- Hyperarid
- Subhumid

Supra-mediterranean
- Arid
- Hyperhumid

Thermo-mediterranean
- Hyperarid
- Humid

Oro-mediterranean
- Semiarid
- Humid

Meso-mediterranean
- Arid
- Hyperhumid

Temperate Thermotypes

Infra-temperate
- Semiarid
- Humid

Supra-temperate
- Semiarid
- Ultrahyper-humid

Thermo-temperate
- Semiarid
- Ultrahyper-humid

Oro-temperate
- Dry
- Ultrahyper-humid

Meso-temperate
- Semiarid
- Ultrahyper-humid

Cryoro-temperate
- Dry
- Ultrahyper-humid

Boreal Thermotypes

Thermoboreal
- Subhumid
- Hyperhumid

Mesoboreal
- Humid
- Hyperhumid

Supraboreal
- Hyperhumid

Publishing support provided by:
Denver Publishing Service Center
Manuscript approved for publication on June 29, 2009.

For more information concerning this publication, contact:
USGS Central Region Geospatial Information Office
Federal Center
Box 25286
Denver, CO 80225
1-888-ASK-USGS or

Jill Cress
Rocky Mountain Geographic Science Center
U.S. Geological Survey
(303) 202-4275
jjcress@usgs.gov

For sale by U.S. Geological Survey Information Services
Box 25286, Federal Center, Denver, CO 80225
1-888-ASK-USGS

This and other USGS products are available on the World Wide Web at:
http://store.usgs.gov/

This report is available at:
http://pubs.usgs.gov/sim/3084

[1] Ecology Department, NatureServe, Boulder, Colo.
[2] Parallel Inc., Lakewood, Colo.

Prepared in collaboration with NatureServe

Suggested citation:
Cress, J.J., Sayre, Roger, Comer, Patrick, and Warner, Harumi, 2009, Terrestrial Ecosystems—Isobioclimates of the conterminous United States: U.S. Geological Survey Scientific Investigations Map 3084, scale 1:5,000,000, 1 sheet.

U.S. Department of the Interior
U.S. Geological Survey