

# Data Input Existing Collection: Climate Data – Present Day

**Name:** Climate Data – Present Day

**Description:** Data on various climatic variables at a national scale provided by an on-line source. Specifically, average values for monthly precipitation, and mean, maximum, and minimum temperatures for 1981 through 2010 at 800m resolution were downloaded from the PRISM Climate Group website: <http://prism.oregonstate.edu/>.

**Format:** PRISM data are made available in ASCII grid (.asc) format.

**Quality Checks:** No validation or verification of the data was performed. This is a peer-reviewed dataset (see Citation).

**Source:** Data were obtained from an on-line source, specifically the PRISM Climate Group website: <http://prism.oregonstate.edu/>. The PRISM Climate Group is at Oregon State University.

**Data Processing and Scientific Workflows:** A variety of variables were derived from the downloaded climate data. Specifically, 19 commonly used bioclimatic variables (see list here: <http://www.worldclim.org/bioclim>) were calculated using the “bioclim” function in the “climates” package for R (<http://www.rforge.net/climates/git.html>). Data were converted to shapefile, then geodatabase table, and finally .csv format for the purpose of importing them into R. Once the package in R was run, the data was converted back to .asc format for use with two bioclimatic-envelope modeling programs (Maxent and the SAHM package for Vistrails). Correlations among the 19 bioclimatic variables will be assessed. One variable in each variable pair found to be highly correlated will be removed prior to bioclimatic-envelope model development.

**Backup and Storage:** Once downloaded for use in this project, all data are backed up daily to a server maintained by New Mexico State University's IT staff and weekly to an external hard drive maintained by project personnel.

**Volume Estimate:** GB

**Access and Sharing:** Data are provided by the PRISM Climate Group at Oregon State University.

**Restrictions:** PRISM data can be used for non-commercial purposes and the source of the data must be clearly stated ([http://prism.oregonstate.edu/documents/PRISM\\_terms\\_of\\_use.pdf](http://prism.oregonstate.edu/documents/PRISM_terms_of_use.pdf)).

**Fees:** There are no fees for the PRISM data that will be used in this project.

**Citation:** PRISM Climate Group, Oregon State University, <http://prism.oregonstate.edu>, created July 2012. Data described in more detail by Daly, C., M. Halbleib, J.I. Smith, W.P. Gibson, M.K. Doggett, G.H. Taylor, J. Curtis, and P.P. Pasteris. 2008. Physiographically sensitive mapping of climatological temperature and precipitation across the conterminous United States. *International Journal of Climatology* 28:2031-2064.

**ScienceBase ID:**

# Data Input Existing Collection: Downscaled Climate Data – Future Scenarios - CCAFS

**Name:** Downscaled Climate Data – Future Scenarios - CCAFS

**Description:** Climate data projected according to various IPCC emissions scenarios will be used in combination with bioclimatic-envelope models to assess the effects of future climate conditions on species distributions. Data projected according to SRES emissions scenarios and downscaled to roughly 1km resolution will be obtained at a global scale from the Climate Change, Agriculture and Food Security (CCAFS) Downscaled GCM Data Portal (<http://www.ccafs-climate.org/>). Data are available for 30 year averages for present day conditions (1961-1990) and seven future periods between 2020 and 2080. Climatic variables provided include 19 bioclimate variables (<http://www.worldclim.org/bioclimate>), as well as minimum, mean, and maximum temperature and monthly precipitation.

**Format:** CCAFS data are made available in ASCII grid format.

**Quality Checks:** No quality checks are planned. Data provided through the CCAFS portal has been cited in many peer-reviewed publications (<http://www.ccafs-climate.org/citations/>).

**Source:** Data will be obtained from the CCAFS portal (<http://www.ccafs-climate.org/>), which is associated with several partners.

**Data Processing and Scientific Workflows:** Data are provided in an appropriate file format (.asc) for use with two bioclimatic-envelope modeling programs (Maxent and the SAHM package for VisTrails). Data will be subset to the United States and correlations among the 19 bioclimatic variables will be assessed. One variable in each variable pair found to be highly correlated will be removed prior to bioclimatic-envelope model development.

**Backup and Storage:** Once downloaded for use in this project, all data are backed up daily to a server maintained by New Mexico State University's IT staff and weekly to an external hard drive maintained by project personnel.

**Volume Estimate:** GB

**Access and Sharing:** Data are provided by the partners of the research program on CCAFS.

**Restrictions:** Data from CCAFS cannot be used for commercial purposes or redistributed unless the user obtains written permission, and users should acknowledge CCAFS as the data source in reports and publications. See GCM Data Portal Disclaimer here: [http://www.ccafs-climate.org/downloads/docs/GCM\\_Data\\_Portal\\_Disclaimer.pdf](http://www.ccafs-climate.org/downloads/docs/GCM_Data_Portal_Disclaimer.pdf).

**Fees:** There are no fees for CCAFS data.

**Citation:** CCAFS data is accessed at the Climate Change, Agriculture and Food Security (CCAFS) Downscaled GCM Data Portal: <http://www.ccafs-climate.org/>; and the dataset downscaled using the delta method can be cited as: Ramirez, J. and A. Jarvis. 2008. High resolution statistically downscaled future climate surfaces. International Center for Tropical Agriculture (CIAT); CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Cali, Colombia.

**ScienceBase ID:**

# Data Input Existing Collection: Downscaled Climate Data – Future Scenarios - NEX

**Name:** Downscaled Climate Data – Future Scenarios - NEX

**Description:** Climate data projected according to various IPCC emissions scenarios will be used in combination with bioclimatic-envelope models to assess the effects of future climate conditions on species distributions. The data will be obtained from the USGS Geo Data Portal (<http://cida.usgs.gov/gdp/>). The downscaled NASA Earth Exchange (NEX) CMIP5 climate projections are provided at 800 m resolution for the continental US. They provide information on 34 models for each of four greenhouse gas emissions scenarios (Representative Concentration Pathways; RCPs). Data are provided on monthly average maximum and minimum temperature and precipitation for 1950 through 2099.

**Format:** NEX data are made available in netCDF format.

**Quality Checks:** No quality checks are planned.

**Source:** Data will be obtained from the USGS Geo Data Portal (<http://cida.usgs.gov/gdp/>).

**Data Processing and Scientific Workflows:** A variety of variables will be derived from the projected and downscaled climate data. Specifically, 19 commonly used bioclimatic variables (see list here: <http://www.worldclim.org/bioclim>) will be calculated using the “bioclim” function in the “climates” package for R (<http://www.rforge.net/climates/git.html>). Data will be converted to .csv files for use in R and back to .asc or geotiff format for use with two bioclimatic-envelope modeling programs (Maxent and the SAHM package for VisTrails). Correlations among the 19 bioclimatic variables will be assessed. One variable in each variable pair found to be highly correlated will be removed prior to bioclimatic-envelope model development.

**Backup and Storage:** Once downloaded for use in this project, all data are backed up daily to a server maintained by New Mexico State University's IT staff and weekly to an external hard drive maintained by project personnel.

**Volume Estimate:** GB

**Access and Sharing:** Data are provided by NASA.

**Restrictions:** NEX data is only intended for use in scientific research. Commercial applications and other uses should not be done without first consulting with a qualified expert. Feedback regarding improvements and validations of the dataset can be sent to the technical point of contact for the dataset. Information on the dataset is provided in a technical note available here: [http://portal.nccs.nasa.gov/portal\\_home/published/NEX-DCP30\\_Tech\\_Note\\_v0.pdf](http://portal.nccs.nasa.gov/portal_home/published/NEX-DCP30_Tech_Note_v0.pdf). Users of the data are asked to acknowledge and cite the NEX dataset in all publications (see Citation).

**Fees:** There are no fees for NEX data.

**Citation:** Data is accessed at the USGS Geo Data Portal: <http://cida.usgs.gov/gdp/>. Dataset should be cited as: Trasher, B., J. Xiong, W. Wang, F. Melton, A. Michaelis, and R. Nemani. 2013. New downscaled climate projections suitable for resource management in the U.S. Eos, Transactions American Geophysical Union (in review). The dataset should be acknowledged as: Climate scenarios used were from the NEX-DCP30 dataset, prepared by the Climate Analytics Group and NASA Ames Research Center using the NASA Earth Exchange, and distributed by the NASA Center for Climate Simulation (NCCS).

**ScienceBase ID:**

# Data Input Existing Collection: Downscaled Climate Data – Future Scenarios - WorldClim

**Name:** Downscaled Climate Data – Future Scenarios - WorldClim

**Description:** Climate data projected according to various IPCC emissions scenarios will be used in combination with bioclimatic-envelope models to assess the effects of future climate conditions on species distributions. The data will be obtained from WorldClim ([http://www.worldclim.org/cmip5\\_30s](http://www.worldclim.org/cmip5_30s)). WorldClim data are provided at a global scale for the years 2050 and 2070 at roughly 1 km resolution. Climate variables include monthly average minimum and maximum temperature, monthly total precipitation, and 19 bioclimatic variables (<http://worldclim.org/bioclim>).

**Format:** WorldClim data are made available in GeoTIFF format.

**Quality Checks:** No quality checks are anticipated. The baseline climate data is described in a peer-reviewed article (see Citation).

**Source:** Data will be obtained from WorldClim ([http://www.worldclim.org/cmip5\\_30s](http://www.worldclim.org/cmip5_30s)).

**Data Processing and Scientific Workflows:** Data will be subset to the continental United States and converted, as needed, to .asc format for use with two bioclimatic-envelope modeling programs (Maxent and SAHM package for VisTrails). Correlations among the 19 bioclimatic variables will be assessed. One variable in each variable pair found to be highly correlated will be removed prior to bioclimatic-envelope model development.

**Backup and Storage:** Once downloaded for use in this project, all data are backed up daily to a server maintained by New Mexico State University's IT staff and weekly to an external hard drive maintained by project personnel.

**Volume Estimate:** GB

**Access and Sharing:** Data are provided by multiple scientists associated with different institutions.

**Restrictions:** Data from the WorldClim website is freely available for academic and non-commercial use. The data cannot be used for commercial purposes or redistributed unless the user obtains permission. Data will be appropriately cited in all project products including reports and publications. Known issues with different versions of the WorldClim data are posted here: <http://www.worldclim.org/issues>.

**Fees:** There are no fees for WorldClim data.

**Citation:** WorldClim data is accessed at the WorldClim – Global Climate Data: Free climate data for ecological modeling and GIS website: [http://www.worldclim.org/cmip5\\_30s](http://www.worldclim.org/cmip5_30s). The preferred citation for WorldClim listed on the website is: Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones, and A. Jarvis. 2005. Very high resolution interpolated climate surfaces for global land areas. *International Journal of Climatology* 25:1965-1978.

**ScienceBase ID:**

# Data Input Existing Collection: Integrated Climate and Land Use Scenarios

**Name:** Integrated Climate and Land Use Scenarios

**Description:** Results of models run using the toolset from the Integrated Climate and Land Use Scenarios (ICLUS) project. The model produces maps of future housing densities projected according to four different IPCC greenhouse gas emissions scenarios. Data are provided in 10 year intervals from 2010 to 2100 at the national scale at 100 m resolution.

**Format:** Model results are made available as ESRI grids.

**Quality Checks:** No quality checks are planned. This is a peer reviewed dataset (see Citation).

**Source:** The data were obtained from the Environmental Protection Agency (EPA) through the following website: <http://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=257306>.

**Data Processing and Scientific Workflows:** The ICLUS housing density will be subset to the project focus area (New Mexico, Oklahoma, and Texas) and the data format and resolution will be modified as needed to be compatible with the data underlying the Landscape Condition Model from NatureServe.

**Backup and Storage:** Once downloaded for use in this project, all scripts and data are backed up daily to a server maintained by New Mexico State University's IT staff and weekly to an external hard drive maintained by project personnel.

**Volume Estimate:** GB

**Access and Sharing:** Data are provided by the EPA.

**Restrictions:** There are no limitations on model result access. Users are encouraged to acknowledge the EPA and confirm that they have the most recent copy of the data and metadata.

**Fees:** There are no fees associated with acquiring these datasets.

**Citation:** General citation: U.S. EPA, 2010. ICLUS tools and datasets (version 1.3.2). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/143F. Housing density data: US Environmental Protection Agency, 2010. ICLUS v1.3 housing density for the conterminous USA. <http://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=257306>. Further details are provided in the following peer-reviewed manuscript: Bierwagen, B.G., D.M. Theobald, C.R. Pyke, A. Choate, P. Groth, J.V. Thomas, and P. Morefield. 2010. National housing and impervious surface scenarios for integrated climate impact assessments. Proceedings of the National Academy of Sciences 107:20887-20892.

**ScienceBase ID:**

# Data Input Existing Collection: Landscape Condition Model

**Name:** Landscape Condition Model

**Description:** The Landscape Condition Model (LCM), including 30 m resolution datasets and scripts, was provided for the study area (New Mexico, Oklahoma, Texas) by NatureServe. The scripts can be obtained by installing Vista (<https://connect.natureserve.org/products-services/vista/download>). A script and associated datasets used to generate large intact blocks (LIBs) from a modified form of the LCM output was provided by a participant of the Western Governors' Association's (WGA's) Crucial Habitat Assessment Tool (CHAT) project. Additional restricted access datasets may need to be obtained from the WGA.

**Format:** Data were provided in raster (.TIFF) and vector (.gdb) format and scripts were provided as python (.py) files in ArcGIS toolboxes (.tbx). Input for the LIB-generating script was provided as a spreadsheet (.xlsx).

**Quality Checks:** .TIFFs were visually inspected. One dataset was determined to contain no data for the study area. The process for generating the LIBs will be verified using datasets provided by Natural Heritage New Mexico.

**Source:** The datasets and scripts constituting the LCM were provided by NatureServe, with the scripts being obtained by downloading Vista (<https://connect.natureserve.org/products-services/vista/download>). An ArcGIS toolbox/python script and associated data used to generate LIBs from the output of the LCM was provided by a participant of the WGA's CHAT project.

**Data Processing and Scientific Workflows:** The data associated with the LCM will be modified as needed to be compatible with output from the Integrated Climate and Land Use Scenarios (ICLUS) project.

**Backup and Storage:** Once downloaded or otherwise obtained for use in this project, all scripts and data are backed up daily to a server maintained by New Mexico State University's IT staff and weekly to an external hard drive maintained by project personnel.

**Volume Estimate:** GB

**Access and Sharing:** Data were provided by NatureServe and participants of the WGA's CHAT project.

**Restrictions:** Restrictions on use of the Landscape Condition Model are outlined in a data use agreement between the Center for Applied Spatial Ecology (CASE) and NatureServe. Specifically, CASE cannot share any data or information provided by NatureServe prior to NatureServe's publication of the LCM. After publication, CASE will only provide data and metadata not already hosted by NatureServe on a publicly accessible website to ScienceBase in formats approved by NatureServe. The script provided by participants of the WGA CHAT can be used provided that any products of this project indicate that the process used to generate the LIBs is the same as that used by the WGA and cite the WGA CHAT's website and any final reports that the WGA generates on the CHAT project. All data, scripts, and methodologies will be cited appropriately in reports, journal manuscripts and metadata for related project products.

**Fees:** There are no fees associated with acquiring these datasets.

**Citation:** Information on the Landscape Condition Model and development of the LC data is provided here: Comer, P.J., and J. Hak. 2012. Landscape condition in the conterminous United States. Spatial Model Summary. NatureServe, Boulder, Colorado, USA. An updated citation will be provided as soon as the results of the LCM have been published and a nation-wide LC dataset has been made publicly available by NatureServe. Information on the process used to generate the LIB data (referred to as the Large Natural Areas (LNA) data) is provided through the WGA's CHAT website: <http://westgovchat.org/data/metadata> and

<http://westgovchat.org/resources>.

**ScienceBase ID:**



# Data Input Existing Collection: Species Information – Natural Heritage Programs

**Name:** Species Information – Natural Heritage Programs

**Description:** Data on the occurrence of 20 focal species provided by database managers with Natural Heritage Programs in the tri-state study area: New Mexico (NM; <http://nhnm.unm.edu/>), Oklahoma (OK; <http://www.oknaturalheritage.ou.edu/>) and Texas (TX; [http://www.tpwd.state.tx.us/huntwild/wild/wildlife\\_diversity/txndd/](http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/txndd/)). Datasets were provided at the state-level as point or polygon data. The accuracy of the data varied among data points. Data were requested for the years 1950 to 2014.

**Format:** Data were provided in vector formats (.gdb, .shp) and additional attributes were provided in databases (.mdb).

**Quality Checks:** Data points that fell outside the species ranges provided by the USGS National Gap Analysis Program (<http://gapanalysis.usgs.gov/species/data/download/>) were excluded from further analysis.

**Source:** Database managers with Natural Heritage Programs in NM (<http://nhnm.unm.edu/>), OK (<http://www.oknaturalheritage.ou.edu/>), and TX ([http://www.tpwd.state.tx.us/huntwild/wild/wildlife\\_diversity/txndd/](http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/txndd/)).

**Data Processing and Scientific Workflows:** Polygon data was converted to points located at the polygons' centroid. Data from different Natural Heritage Programs were combined to a single shapefile for each species. This involved adding fields to match those present in shapefiles downloaded from an on-line source (Biodiversity Information Serving Our Nation; BISON; <http://bison.usgs.ornl.gov/>) and then appending points from the Natural Heritage Programs to the shapefiles obtained from BISON. Datasets were exported to be in the same projection as the BISON data prior to dataset combination. Combined datasets were filtered to exclude observations older or more recent than the date range for which present day PRISM climate data (<http://prism.oregonstate.edu/>) were available (i.e., 1981-2010). Data were converted to an appropriate format (.csv) for input to two bioclimatic-envelope modeling program (Maxent and SAHM package for VisTrails).

**Backup and Storage:** Once obtained for use in this project, all data are backed up daily to a server maintained by New Mexico State University's (NMSU) IT staff and weekly to an external hard drive maintained by project personnel.

**Volume Estimate:** MB

**Access and Sharing:** Original datasets are distributed by Natural Heritage New Mexico (NHNM), Oklahoma Natural Heritage Inventory (ONHI), and the Wildlife Diversity Program with Texas Parks and Wildlife Department (TPWD). Project personnel can share data from NHNM that has been generalized to the watershed (10-digit HUC), county, or ecoregion scale.

**Restrictions:** Due to the sensitive nature of locations for rare and endangered species most Natural Heritage Programs put restrictions on disseminating precise locations. This project will be using the data for analysis and the resulting products don't require publication of precise location data, so Natural Heritage data can be obtained for use. NHNM has data use restrictions published at [http://nhnm.unm.edu/im/releasepolicy\\_disclaimer.php](http://nhnm.unm.edu/im/releasepolicy_disclaimer.php). Restrictions on sharing are also outlined in a data sharing agreement between NHNM and project personnel at the Center for Applied Spatial Ecology at NMSU. Specifically, project personnel can only share species data that has been generalized as described under "Access & Sharing" and must acknowledge The University of New Mexico, the Museum of Southwestern Biology, NHNM, and any other original sources of the data in all project reports, publications, and maps.

**Fees:** NHNM is waiving its data fees for this project. There are no fees for data from the ONHI or TPWD.

**Citation:** Citation of NHNM data (taken from <http://nhnm.unm.edu/data/citation.php>; will be modified as needed to cite data from other Natural Heritage Programs): NHNM Species Information. From Natural Heritage New Mexico. 2014. NMBiotics Database. Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM. Online: <http://nhnm.unm.edu>. Accessed on Month Day, Year.

**ScienceBase ID:**

# Data Input Existing Collection: Species Information – On-line Sources

**Name:** Species Information – On-line Sources

**Description:** Data on the occurrence of 20 focal species, both observation and specimen based, obtained from the following on-line information systems: Biodiversity Information Serving Our Nation (BISON; <http://bison.usgs.ornl.gov/>); HerpNet (<http://www.herpnet2.org/search.aspx>); ORNIS (<http://ornis2.ornisnet.org/>); VertNet (<http://portal.vertnet.org/search>). Datasets are species-specific and many cross state boundaries. Data are provided as points or coordinates, sometimes with information on the uncertainty of the location. All suitable data will be used as input to bioclimatic-envelope models.

**Format:** Data were downloaded in one of two formats: shapefile or .csv.

**Quality Checks:** Data for which no coordinates were available were deleted, as were points for which both coordinates had a value of “0” or which had UTM or degree, minute, second values that could not be converted to decimal degree values using the following converters: <http://www.rcn.montana.edu/Resources/Converter.aspx> or <http://transition.fcc.gov/mb/audio/bickel/DDDMSS-decimal.html>. Negative signs were added to or deleted from decimal degree latitudes and longitudes as needed in order to make the points fall in the hemisphere that matches the other location information (county and state) provided for the points. Letters appearing at the end of decimal degree values were also deleted. Data points that fell outside the species ranges provided by the USGS National Gap Analysis Program (<http://gapanalysis.usgs.gov/species/data/download/>) were excluded from further analysis.

**Source:** On-line information systems: BISON (<http://bison.usgs.ornl.gov/>); HerpNet (<http://www.herpnet2.org/search.aspx>); ORNIS (<http://ornis2.ornisnet.org/>); VertNet (<http://portal.vertnet.org/search>).

**Data Processing and Scientific Workflows:** Data from different sources were combined to a single shapefile for each species. This involved renaming and adding fields to match those present in the BISON data and then appending points from other data sources to the shapefiles obtained from BISON. Datasets were initially projected according to projection information provided with the downloaded data; then exported to be in the same projection as the BISON data prior to dataset combination. Combined datasets were filtered to exclude observations older or more recent than the date range for which present day PRISM climate data were obtained (i.e., 1981-2010). Data were converted to an appropriate format for input to two bioclimatic-envelope modeling programs (.csv; Maxent and SAHM package for VisTrails).

**Backup and Storage:** Once obtained for use in this project, all data are backed up daily to a server maintained by New Mexico State University's (NMSU) IT staff and weekly to an external hard drive maintained by project personnel.

**Volume Estimate:** MB

**Access and Sharing:** Original datasets obtained from BISON are distributed by the U.S. Geological Survey on behalf of hundreds of data providers to both the Global Biodiversity Information Facility and BISON. Data obtained from HerpNet, ORNIS, and VertNet are provided by many different museums, universities, and other institutions.

**Restrictions:** Users of BISON data must respect restrictions on access to sensitive data and must keep information on data publishers with the data they download, acknowledge the data publishers, and follow any conditions placed on the data by the publishers. The BISON data use agreement can be viewed when data is downloaded from the BISON website (<http://bison.usgs.ornl.gov/>). Users of data provided by HerpNet and ORNIS must also abide by the individual data-use policies of data providers and are strongly encouraged to verify the data. HerpNet and ORNIS data may not be repackaged, sold, or distributed without written consent of the institutions providing the

data. All original data providers and HerpNet or ORNIS must be cited in all presentations and publications arising from the data. The data use agreement can be viewed when data is downloaded from the HerpNet and ORNIS websites: <http://www.herpnet2.org/search.aspx>, <http://ornis2.ornisnet.org/>.

**Fees:** There are no fees for data provided by BISON, HerpNet, ORNIS, or VertNet.

**Citation:** Citation of data from BISON: Biodiversity occurrence data published by: (Accessed through Biodiversity Information Serving our Nation (BISON), [bison.usgs.ornl.gov](http://bison.usgs.ornl.gov), YYYY-MM-DD). Citation of data from ORNIS (modified as necessary to cite data from HerpNet and VertNet): Bird data used in this study obtained from the [List provider institutions] (Accessed through the ORNIS2 Portal, [ornis2.ornisnet.org](http://ornis2.ornisnet.org/), YYYY-MM-DD).

**ScienceBase ID:**

# Data Input Existing Collection: USGS GAP Analysis Models and Land Cover Data

**Name:** USGS GAP Analysis Models and Land Cover Data

**Description:** Species distribution models, land cover data, and projected land use land cover (LULC) data will be obtained from the U.S. Geological Survey (USGS) for use in refining maps of future species distributions. Species data can be downloaded here: <http://gapanalysis.usgs.gov/species/data/download/>; land cover data can be obtained here: <http://gapanalysis.usgs.gov/gaplandcover/data/download/>; LULC is being posted here as it becomes available: [http://www.usgs.gov/climate\\_landuse/land\\_carbon/Data.asp](http://www.usgs.gov/climate_landuse/land_carbon/Data.asp). The extent of the species data depends on the size of the species' geographic range and has a 30 m spatial resolution. The land cover data can be downloaded at the national, state- or LCC-level, has 30 m resolution, and is based on satellite imagery from 1999-2001. The LULC data is available for EPA level II ecoregions at 250 m resolution and is projected according to three different IPCC greenhouse gas emissions scenarios on an annual basis through 2050.

**Format:** Species data can be downloaded in ESRI grid format; land cover data can be downloaded in .IMG or ESRI grid formats; LULC data can be downloaded in .IMG or netCDF formats.

**Quality Checks:** No quality checks are planned. Products from the USGS GAP and LandCarbon projects have been published in multiple peer reviewed articles ([http://gapanalysis.usgs.gov/wp-content/uploads/2011/03/Bibliography\\_2011\\_1-12.pdf](http://gapanalysis.usgs.gov/wp-content/uploads/2011/03/Bibliography_2011_1-12.pdf); [http://www.usgs.gov/climate\\_landuse/land\\_carbon/Publications.asp](http://www.usgs.gov/climate_landuse/land_carbon/Publications.asp)).

**Source:** Data will be obtained from the USGS from the following on-line sources: <http://gapanalysis.usgs.gov/species/data/download/>; <http://gapanalysis.usgs.gov/gaplandcover/data/download/>; [http://www.usgs.gov/climate\\_landuse/land\\_carbon/Data.asp](http://www.usgs.gov/climate_landuse/land_carbon/Data.asp).

**Data Processing and Scientific Workflows:** Wildlife-habitat relationships driving the species distribution models and land cover types in the present day land cover data will be crosswalked to the projected LULC data. As needed, species distribution models and the LULC data will be converted to the same format as the output from two bioclimatic-envelope models (Maxent and SAHM package for VisTrails; .asc or GeoTIFF) and aggregated to match the spatial resolution of downscaled projected climate data (roughly 1 km).

**Backup and Storage:** Once downloaded for use in this project, all data are backed up daily to a server maintained by New Mexico State University's IT staff and weekly to an external hard drive maintained by project personnel.

**Volume Estimate:** GB

**Access and Sharing:** Data are provided by the USGS.

**Restrictions:** The metadata for the species data provides a list of appropriate and inappropriate uses of the data: <http://gapanalysis.usgs.gov/wp-content/uploads/2013/09/GAPSpeciesDistributionModelmetadata.pdf>. The land cover data are intended for use with regional assessments and not at scales finer than 1:100,000. Users of the LULC data are cautioned that they contain uncertainties and errors and that level II EPA ecoregions constitute an appropriate scale at which to apply the data ([http://www.usgs.gov/climate\\_landuse/land\\_carbon/Data.asp](http://www.usgs.gov/climate_landuse/land_carbon/Data.asp)). All datasets will be appropriately cited in reports and journal manuscripts.

**Fees:** The species, land cover, and LULC data are freely available.

**Citation:** Species data: U.S. Geological Survey Gap Analysis Program (USGS-GAP). [Year]. National Species Distribution Models. Available: <http://gapanalysis.usgs.gov>. Accessed [date]. Further information on national GAP

models can be obtained from: Aycrigg, J., G. Beauvais, T. Gotthardt, K. Boykin, S. Williams, S. Lennartz, K.T. Vierling, S. Martinuzzi, and L.A. Vierling. 2010. Mapping species ranges and distribution models across the United States. Pages 12-20 in Maxwell, J., K. Gergely, and J. Aycrigg, editors. Gap Analysis Bulletin 18, USGS/BRD/Gap Analysis Program, Moscow, Idaho, USA. Land cover data: U.S. Geological Survey, Gap Analysis Program (GAP). 2011. National Land Cover, Version 2. Available: <http://gapanalysis.usgs.gov/gaplandcover/data/download/>. Accessed [date]. LULC data: U.S. Geological Survey. 2013. National Assessment of Ecosystem Carbon Sequestration and Greenhouse Gas Fluxes: FORE-SCE Model Variables – Land Cover – LULC, [http://www.usgs.gov/climate\\_landuse/land\\_carbon/Data.asp](http://www.usgs.gov/climate_landuse/land_carbon/Data.asp).

**ScienceBase ID:**

# Data Output: Bioclimatic-Envelope Models

**Name:** Bioclimatic-Envelope Models

**Description:** Models of focal species distributions based on both present day and projected environmental variables will be developed using first Maxent and then the Software for Assisted Habitat Modeling (SAHM) package for VisTrails. Model results will be refined using U.S. Geological Survey GAP species distribution models, land cover, and land use land cover datasets and ESRI software. Model results will be published as map services and displayed in the New Mexico (NM) Crucial Habitat Assessment Tool (CHAT). The species distribution models will have regional to national extents with a spatial resolution of roughly 1 km. Models will provide information on present day as well as multiple future time periods (2050 and 2070 at a minimum).

**Data Management Resources:** As part of Tasks 2, 3, 4 and 6, bioclimatic-envelope models will be created, projected, refined, and published as map services. The cost of this effort is included within Tasks 2, 3, 4 and 6. These tasks, as they pertain to this data output, will take approximately 3/5 of the total budget to complete.

**Format:** The model results will be generated in a range of formats. These will include raster formats, such as ASCII grid (.asc) and GeoTIFF (.tif), and other formats (e.g., .html and .csv). They will be maintained and made available for the NCCWSC repository in appropriate formats (e.g., .GeoTIFF for rasters). They will also be published as map services using ArcGIS for Server software from map document (.mxd) files created using ArcGIS for Desktop. Information on map services will be accessible through the ArcGIS REST services directory, which is hosted on the Center for Applied Spatial Ecology (CASE) webserver and can be viewed in any web browser. The map services can be incorporated into the NM CHAT and other web mapping applications using their REST service URLs. The model results will also be described in project reports and manuscripts submitted for publication.

**Data Processing and Scientific Workflows:** Species occurrence data from Natural Heritage Programs and various on-line sources and present day PRISM climate data will be used in conjunction with two bioclimatic-envelope modeling programs (Maxent and SAHM package for VisTrails) to generate bioclimatic-envelope models of present-day distributions of the project focal species. The present day distribution models will then be projected to future time periods and potential climatic conditions using downscaled projected climate data from three different sources. The present day and potential future bioclimatic-envelope models will be refined by using species distribution models provided by the U.S. Geological Survey (USGS) National Gap Analysis Program (GAP) as a mask. Bioclimatic-envelope models will be further refined to areas projected to be suitable for individual species under different IPCC emissions scenarios. This will be done by combining the wildlife-habitat relationships used to generate the GAP models with both present day land cover data and projections of future potential land use land cover distributions provided by the USGS. Bioclimatic-envelope model outputs will be displayed and combined (as necessary) in ArcGIS for Desktop. The model outputs will then be published as map services (REST format) from map document (.mxd) files using ArcGIS for Server. Map services will be incorporated into the NM CHAT using ArcGIS Viewer for Flex.

**Quality Checks:** Species selection was done in consultation with wildlife biologists and other species experts and project stakeholders. Models will be developed with training and test datasets, such that a subset of the observation data will be held back from model development (test data) and used to evaluate the model. Models will be evaluated using one or more standard criteria, for example area under the Receiver Operating Characteristic curve values. Species distribution maps will be reviewed by project personnel and potentially by wildlife managers that contributed to the species selection process. Model results will be peer reviewed following submission of manuscripts describing project results to journals.

**Metadata:** FGDC or ISO 19115.

**Volume Estimate:** GB

**Backup and Storage:** All data and model outputs will be backed up daily to a server maintained by New Mexico State University's (NMSU's) IT staff and weekly to an external hard drive maintained by project personnel. Finalized model outputs will be stored and served up on the CASE webserver. All map services will be backed up daily and stored on virtual machines in a cloud maintained by NMSU IT.

**Repository for Data:** The refined present-day and projected future bioclimatic-envelope models will be submitted to the NCCWSC repository (ScienceBase) in appropriate formats. The bioclimatic-envelope models will also be made available for download in raster file format from the CASE webserver. The map services published from model outputs will be made available for viewing through the NM CHAT and for public access and integration to other web mapping applications via a REST services directory on the CASE webserver. The process for developing the bioclimatic-envelope models will be described in at least one journal article manuscript that will be written based on key project results; the website for the journal that accepts the manuscript will serve as another repository for this data output.

**Access and Sharing:** Bioclimatic-envelope model outputs and associated map services will be publicly available once they are in a final form and have been reviewed.

**Exclusive Use:** No exclusive use period is needed. Details of model development, selection, and evaluation will be available in the final project report. Map services will be made available for viewing in the NM CHAT and for integration to other web mapping applications by the end of the project.

**Restrictions:** There are no limitations on access or reuse of the model results or resulting map services. Model input data from Natural Heritage Programs is sensitive and cannot be released. The one exception is for data from Natural Heritage New Mexico (NHNM) that has been generalized to the watershed (10-digit HUC), county, or ecoregion scale ([http://nhnm.unm.edu/im/releasepolicy\\_disclaimer.php](http://nhnm.unm.edu/im/releasepolicy_disclaimer.php); data use agreement between NHNM and CASE at NMSU).

**Citation:** Seamster, V.A., E. Muldavin, R. McCollough, T.B. Neville, and K.G. Boykin. 2014. Modeling the effects of environmental change on crucial wildlife habitat: Bioclimatic-envelope models and associated map services. Center for Applied Spatial Ecology, New Mexico Cooperative Fish and Wildlife Research Unit and Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Las Cruces, New Mexico, USA.

**Digital Object Identifier, Link:** A DOI will be obtained when the data output is submitted to ScienceBase.

**Contact:** Dr. Ken Boykin, [kboykin@nmsu.edu](mailto:kboykin@nmsu.edu), 575-646-6303.

**ScienceBase ID:**



# Data Output: Projected Large Intact Block Data

**Name:** Projected Large Intact Block Data

**Description:** The Landscape Condition Model (LCM) developed by NatureServe will be modified using model results from the Integrated Climate and Land Use Scenarios (ICLUS) project toolset to reflect potential future urban grow out patterns. These maps of the potential future distribution of Landscape Condition (LC) will be used in conjunction with a script and additional processing steps developed by participants in the Western Governors' Association's (WGA's) Crucial Habitat Assessment Tool (CHAT) project to generate data on Large Intact Blocks (LIBs) of land that can be incorporated into the New Mexico (NM) CHAT.

**Data Management Resources:** As part of Tasks 5 and 6, ICLUS output will be used to modify the data underlying the LCM from NatureServe. The cost of this effort is included within Tasks 5 and 6. The portions of tasks 5 and 6 which pertain to this data output will take approximately 3/10 of the total budget to complete.

**Format:** Data underlying the LCM and ICLUS output are available in raster file format (i.e., ESRI grid, .TIFF). The projected LIB data will be maintained and made available in a raster file format appropriate for the NCCWSC repository (e.g., .GeoTIFF). They will also be published as map services using ArcGIS for Server software from map document (.mxd) files created using ArcGIS for Desktop. Information on map services will be accessible through the ArcGIS REST services directory, which is hosted on the Center for Applied Spatial Ecology (CASE) webserver and can be viewed in any web browser. The map services can be incorporated into the NM CHAT and other web mapping applications using their REST service URLs. Projected LIB data will also be described in project reports and a journal manuscript.

**Data Processing and Scientific Workflows:** Data underlying the LCM will be modified to reflect potential future distributions of housing densities using results from the ICLUS project and then run through the LCM. The modified LCM output will then be run through the same set of steps that participants of the WGA's CHAT used to generate the Large Natural Areas (i.e., LIB) data displayed in the New Mexico CHAT (<http://nmchat.org/map/>). This will include converting the data to Landscape Integrity (LI) values by multiplying by 10,000 and inverting the scale and subsetting the data according to ecodevision groups. A script will be used that aggregates the LI data to a resolution of 1000 ha and applies eco-division specific thresholds. Initial thresholds are calculated based on LI values within protected areas delineated by the Protected Areas Database of the United States (PAD-US) provided by the U.S. Geological Survey (<http://s3.amazonaws.com/AppGeo/WestGovChat/Downloads/LIB%20Methods.pdf>). The script employs thresholds based on high, medium, and low quantiles of the LI values within protected areas that meet these initial thresholds. The LIBs generated by the script will be combined to a single dataset, after higher ranked LIBs are erased from those with lower ranks, and they will be given a score based on their size and initial ranking as having high, medium, or low landscape integrity (<http://s3.amazonaws.com/AppGeo/WestGovChat/Downloads/WGA%20Landscape%20Integrity%20Workgroup%20Recommendations.pdf>). Areas of LIBs with each score (1, 2, 3 or 0) will be calculated and used to assign a LIB priority value to each square mile hexagon in New Mexico (<http://westgovchat.org/data/metadata/newmexico>). Multiple datasets displaying information on potential future distributions of LIBs will be generated. Projected LIB data will be displayed and combined (as necessary) in ArcGIS for Desktop. This data will then be published as map services (REST format) from map document (.mxd) files using ArcGIS for Server. Map services will be incorporated into the NM CHAT using ArcGIS Viewer for Flex.

**Quality Checks:** The datasets will be reviewed by project personnel and compared with the LIB data for present day conditions (which can be downloaded from the NM CHAT: <http://nmchat.org/map/>). Datasets will also be subjected to peer review following the submission of a journal article manuscript.

**Metadata:** FGDC or ISO 19115.

**Volume Estimate:** GB

**Backup and Storage:** All data and model outputs will be backed up daily to a server maintained by New Mexico State University's (NMSU's) IT staff and weekly to an external hard drive maintained by project personnel. Finalized model outputs will be stored and served up on the CASE webserver. All map services will be backed up daily and stored on virtual machines in a cloud maintained by NMSU IT.

**Repository for Data:** The projected LIB data will be submitted to the NCCWSC repository (ScienceBase) in appropriate formats. The map services published from the projected data will be made available for viewing through the NM CHAT and for public access and integration to other web mapping applications via a REST services directory on the CASE webserver. The process for developing the modified data will be described in at least one journal article manuscript that will be written based on key project results; the website for the journal that accepts the manuscript will serve as another repository for this data output.

**Access and Sharing:** Projected LIB data and associated map services will be publicly available once they are in a final form and have been reviewed.

**Exclusive Use:** No exclusive use period is needed. The process for dataset generation will be described in project annual and final reports. Map services will be made available for viewing in the NM CHAT and for integration to other web mapping applications by the end of the project.

**Restrictions:** The only limitation on access to, or reuse of, projected LIB data, and associated map services, is that users will be asked to cite the LCM from NatureServe and process for LIB generation used by the WGA for the CHAT project. Metadata for both the projected LIB data and map services displaying the projected LIBs will include these citations. For the LCM, the initial report (Comer, P.J., and J. Hak. 2012. Landscape condition in the conterminous United States. Spatial Model Summary. NatureServe, Boulder, Colorado, USA) and any subsequent publications should be cited. For the process for generating LIBS, the WGA's CHAT website (<http://westgovchat.org/>) and any final reports on the CHAT project should be cited. Any further restrictions desired by the WGA or NatureServe will be added as they become known.

**Citation:** Seamster, V.A., E. Muldavin, T.B. Neville, and K.G. Boykin. 2014. Modeling the effects of environmental change on crucial wildlife habitat: Projections of large intact blocks of land under various urban grow out scenarios and associated map services. Center for Applied Spatial Ecology, New Mexico Cooperative Fish and Wildlife Research Unit and Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Las Cruces, New Mexico, USA.

**Digital Object Identifier, Link:** A DOI will be obtained when the data output is submitted to ScienceBase.

**Contact:** Dr. Ken Boykin, [kboykin@nmsu.edu](mailto:kboykin@nmsu.edu), 575-646-6303.

**ScienceBase ID:**

# Data Output: Species Selection Documentation

**Name:** Species Selection Documentation

**Description:** Documentation of the process used to select focal species for bioclimatic-envelope modeling efforts.

**Data Management Resources:** Species will be selected as a part of Task 1. The cost of this effort is included within Task 1. Task 1 will require approximately 1/10 of the budget to complete.

**Format:** Documentation will be generated and maintained in .xls and .doc format and made available in .csv and .pdf format.

**Data Processing and Scientific Workflows:** A species list provided by Natural Heritage New Mexico will be converted to a matrix in Microsoft Excel containing species-specific values for criteria used to select project focal species. A separate word document containing further details regarding the criteria, how they are used to select project focal species, and references used in filling out the species matrix will be written.

**Quality Checks:** The species selection process will be vetted with project personnel and wildlife managers. The selection process will also be subjected to peer review following the submission of journal article manuscripts describing the key results of the project.

**Metadata:** FGDC

**Volume Estimate:** MB

**Backup and Storage:** All files will be backed up daily to a server maintained by New Mexico State University's IT staff and weekly to an external hard drive maintained by project personnel.

**Repository for Data:** The species selection documentation will be submitted to the NCCWSC repository (ScienceBase) in appropriate formats. A description of the process for selecting project focal species will also be included in at least one journal article manuscript based on key project results; the website for the journal that accepts the manuscript will serve as a second repository for this data output.

**Access and Sharing:** Documentation of the species selection process will be publicly available once it is in a final form and has been reviewed.

**Exclusive Use:** No exclusive use period is needed. Details of the species selection process will be provided in project annual and final reports.

**Restrictions:** There are no restrictions on the use of the documentation of the species selection process.

**Citation:** Seamster, V.A., T.B. Neville, and K.G. Boykin. 2014. Modeling the effects of environmental change on crucial wildlife habitat: Focal species selection matrix and documentation. Center for Applied Spatial Ecology, New Mexico Cooperative Fish and Wildlife Research Unit and Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Las Cruces, New Mexico, USA.

**Digital Object Identifier, Link:** A DOI will be obtained when the data output is submitted to ScienceBase.

**Contact:** Dr. Ken Boykin, kboykin@nmsu.edu, 575-646-6303.

**ScienceBase ID:**

# Software and Other Need: Bioclimatic-Envelope Modeling Program

**Name:** Bioclimatic-Envelope Modeling Program

**Description:** Software that can be used to develop models of species geographic distributions based on environmental variables. Both Maxent and Software for Assisted Habitat Modeling (SAHM) package for VisTrails will be used.

**Restrictions:** Maxent can be used for educational and research activities, not for commercial or for-profit purposes. The software cannot be further distributed. Information on the use of the SAHM package is provided here: <http://www.fort.usgs.gov/Products/Software/disclaimer.asp>. VisTrails is open source. R is required to run the SAHM package and is also open source. Information on the use, citation, and distribution of R is provided here: <http://cran.r-project.org/doc/FAQ/R-FAQ.html>.

**Fees:** There are no fees associated with Maxent, the SAHM package, Vistrails, or R.

**Source, Link:** Maxent can be downloaded here: <http://www.cs.princeton.edu/~schapire/maxent/>. The installer for both VisTrails and the SAHM package is available here: <https://www.sciencebase.gov/catalog/folder/503fbe63e4b09851b69ab463>. R can be obtained here: <http://cran.r-project.org/bin/windows/base/>.

**ScienceBase ID:**

# Software and Other Need: ESRI ArcGIS Software

**Name:** ESRI ArcGIS Software

**Description:** ArcGIS for Desktop, ArcGIS for Server, and ArcGIS Viewer for Flex are all needed for this project.

**Restrictions:** ArcGIS for Desktop and Server are licensed to New Mexico State University (NMSU) by ESRI and can only be used by NMSU students, faculty, and staff. Download of ArcGIS Viewer for Flex requires a user name and login on the ESRI website and acknowledgement of the ESRI license agreement.

**Fees:** The use of ArcGIS for Server and Desktop licenses require an annual fee (\$2,500). ArcGIS Viewer for Flex can be downloaded for free.

**Source, Link:** ArcGIS for Desktop and Server can be obtained by Dr. Seamster and Dr. Boykin on DVD or USB from NMSU IT. Recent versions of these programs are already installed on servers at the Center for Applied Spatial Ecology at NMSU. ArcGIS Viewer for Flex can be downloaded here:  
<http://resources.arcgis.com/en/communities/flex-viewer/index.html>.

**ScienceBase ID:**