

## APPENDIX 7 – DATABASE METADATA AND ORGANIZATION

### Summary

The database included with this thesis contains all of the data used in the analysis including mountain pine beetle infestation data and environmental data. All data was processed in ArcGIS 10.2.1. The data are provided as an archive file format (\*.zip). The data provided here would allow a user to replicate the models used in this analysis.

**Projection:** USA Contiguous Albers Equal Area Conic (ESRI: 102003). This is an ESRI projection equivalent to the North American Albers Equal Area Conic.

*Proj4:*

```
+proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=37.5 +lon_0=-96 +x_0=0  
+y_0=0 +ellps=GRS80 +datum=NAD83 +units=m +no_defs
```

*.PRJ File:*

```
PROJCS["USA_Contiguous_Albers_Equal_Area_Conic",GEOGCS["GCS_North  
_American_1983",DATUM["D_North_American_1983",SPHEROID["GRS_1980"  
,6378137,298.257222101]],PRIMEM["Greenwich",0],UNIT["Degree",0.01  
7453292519943295]],PROJECTION["Albers"],PARAMETER["False_Easting"  
,0],PARAMETER["False_Northing",0],PARAMETER["central_meridian",-  
96],PARAMETER["Standard_Parallel_1",29.5],PARAMETER["Standard_Par  
allel_2",45.5],PARAMETER["latitude_of_origin",37.5],UNIT["Meter",  
1]]
```

**Datum:** North American 1983

**Raster Information:** This applies to all raster data, topographic and climatic.

*Extent*

Top: 1453116.6009

Left: -1715671.06279

Right: -504671.062786

Bottom: -39883.3990072

*Columns, Rows:* 1211, 1493

*Cell size (X, Y):* 1000, 1000 (m)

*Format:* TIFF

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**Description:** These data were collected from a variety of sources and are described below.

***Environmental Data:*** The 1-km DEM was provided by Dr. Andreas Hamann of ClimateWNA and was used to download the climatic data from the ClimateWNA software at 1-km grid cell resolution. Slope and aspect were created by Aaron Sidder in ArcGIS. Historical climate data reflect climate conditions from 1951-1980, current data are from 1981-2010, and future data are from 2040-2069 from the RCP 8.5 emissions scenario. Data from the RCP 4.5 emissions scenario were not included in this database due to space constraints, but are available for download from ClimateWNA.

***Historical MPB data:*** Historical MPB data were digitized from USFS aerial detection surveys collected from USFS regions 1, 2, and 4, and the data here date from 1960-1980. The data were acquired from regional USFS offices: Region 1- Tim Assal (U.S. Geological Survey, Graduate Degree Program in Ecology, CSU); Region 2 - Brian Howell and Justin Backsen (Forest Health Protection, U.S. Forest Service [USFS], Rocky Mountain Region); and Region 4 - Dick Halsey (Forest Health Protection, USFS, Boise Field Office). The original data was separated by year and contained information on numerous forest disturbances and pest outbreaks. This data represent the presence of the mountain pine beetle (MPB) and were extracted from the original data using the search by attributes function (DCA = 11006). After each state's MPB infestation polygons were separated, the data from all years of the study were merged into this master shapefile and all polygons were dissolved into a single feature. This polygon represents the extent of MPB infestation from 1960-1980 across the regions represented.

***Current MPB data:*** Current MPB data were collected from the USFS IDS Database:

<http://foresthealth.fs.usda.gov/ids>. This layer combines all of the MPB aerial detection survey polygons from Colorado, Utah, Wyoming, Montana, and Idaho from the years 1997-2010. The polygons were downloaded from the USFS IDS Explorer website for the years 1997-2010, which also included data on other forest health indicators and pest outbreaks. All MPB polygons were extracted using the search by attributes function (DCA = 11006) for the years 1997-2010 to align with available climate data through Climate WNA. After each state's MPB infestation polygons were separated, the data from all five states were merged into this master shapefile and all polygons were dissolved into a single feature.

***MPB point data:*** These points were randomly generated from MPB polygons and spatially filtered so that no point is within 10 km of another point. The points were randomly generated in the Geospatial Modeling Environment (Beyer 2012) and spatially filtered in the SDM Toolbox (Brown 2014).

***Study Area:*** The study area shapefile was clipped to the current extent and was downloaded from the U.S. Census Bureau TIGER database. The TIGER/Line shapefiles and related database files (.dbf) are an extract of selected geographic and cartographic information from the U.S. Census Bureau's Master Address File / Topologically Integrated Geographic Encoding and Referencing (MAF/TIGER) Database (MTDB).

## **Credits**

Forest Health Protection, U.S. Forest Service; U.S. Census Bureau

ClimateWNA (Wang et al. 2012): <http://climatewna.com/>.

The geodatabase can be credited to Aaron Sidder, M.S. Candidate of the Graduate Degree Program in Ecology of Colorado State University and Dr. Melinda Laituri, Department of Ecosystem Science and the Natural Resource Ecology Laboratory.

**Database Architecture** (Note: The ESRI geodatabase contains all environmental rasters in the main folder; they are not separated into historical, current, and future datasets)

### **Sidder\_Thesis\_data**

- Environmental Data
  - Historic\_envtl\_variables
    - Hist\_Aspect.tif
    - Hist\_bFFP.tif
    - Hist\_CMD.tif
    - Hist\_DD\_0\_sp.tif
    - Hist\_DD\_0\_wt.tif
    - Hist\_DD18\_sm.tif
    - Hist\_eFFP.tif
    - Hist\_elev.tif
    - Hist\_PAS.tif
    - Hist\_PPT\_at.tif
    - Hist\_PPT\_sm.tif
    - Hist\_PPT\_sp.tif
    - Hist\_Slope.tif
    - Hist\_Tmin\_wt.tif
  - Current\_envtl\_variables
    - Curr\_Aspect.tif
    - Curr\_bFFP.tif
    - Curr\_CMD.tif
    - Curr\_DD\_0\_sp.tif
    - Curr\_DD\_0\_wt.tif
    - Curr\_DD18\_sm.tif

- Curr\_eFFP.tif
- Curr\_elev.tif
- Curr\_PAS.tif
- Curr\_PPT\_at.tif
- Curr\_PPT\_sm.tif
- Curr\_PPT\_sp.tif
- Curr\_Slope.tif
- Curr\_Tmin\_wt.tif
- RCP85\_envtl\_variables
  - Aspect\_rcp85.tif
  - bFFP\_rcp85.tif
  - CMD\_rcp85.tif
  - DD\_0\_sp\_rcp85.tif
  - DD\_0\_wt\_rcp85.tif
  - DD18\_sm\_rcp85.tif
  - eFFP\_rcp85.tif
  - elev\_rcp85.tif
  - PAS\_rcp85.tif
  - PPT\_at\_rcp85.tif
  - PPT\_sm\_rcp85.tif
  - PPT\_sp\_rcp85.tif
  - Slope\_rcp85.tif
  - Tmin\_wt\_rcp85.tif
- Occurrence\_data
  - Current\_10km\_albers\_882.shp
  - Current\_1997\_2010\_all\_states.shp

- Historic\_10km\_albers\_882.shp
- Historic\_1960\_1980\_all\_regions.shp
- Study\_Area
  - study\_area\_albers.shp