**R Cleaning**

Follow Rscript until instructed to switch programs to excel. Follow “EDDPoints Excel Methods” below. After completing the excel section, return to the Rscript for further instructions.

**EDDPoints Excel Methods**

In the EDD.points.csv, a new column labeled “Year” was created. Dates recorded in “ObsDate” were used to fill in the new column. When dates were formatted as 00-00-00, the last two digits were used to as the year.

**Pacific Northwest Shapefile**

To build a general guideline for the area of the Pacific Northwest, GADM boundaries including countries, province/states, and regions (gad36\_0.shp, gadm36\_1.shp, gadm36\_2.shp) were added to the map. A new shapefile layer was created (encoding: UTC-8, type: polygon, CRS: WGS84) and roughly drawn using the province/state boundaries (gadm36\_1.shp) to contain the lower third of British Columbia and the states of Washington and Oregon. Next, Köppen Climate Classifications from 1976 – 2000 (Rubel and Kottek 2010a) and 2001 – 2025 (Rubel and Kottek 2010b) were added to the map. The shapefile was then roughly shaped to the main climate classes contained within the area of interest (Cfb and Csb). Next, the GADM region layer (gadm36\_2.shp) was used and the shapefile was edited to the outline of the regional boundaries that roughly contained the Cfb and Csb climate classifications. Google Satellite Imagery was added to the map as an XYZ connection (Google undated a). This imagery was then used to further edit the shapefile using limiting geographic features (i.e., coastlines and mountain ranges) to ensure a more congruent environment throughout the study area. Lastly, the created shapefile was exported as a SHP.

**Map Visualization**

To display the .tiff files produced in R, the files were imported into QGIS (v. 3.24.1 Tisler) for visualization. In the Symbology panel, each raster was set to the *Singleband pseudocolor* render type. The minimum value was set to 0 while the maximum was set to 1000 to match the model output value range. The interpolation method was set to *Linear* with the “Magma” color scheme, which was inverted, so the light colors represented lower numerical values. The binning mode was set to *Equal Interval* with 50 classes and a label precision of 0 so that only whole numbers would be displayed. This symbology was used for all species and scenarios.

**Binary Maps**

Model rasters downloaded from R were imported into QGIS (v. 3.24.1 Tisler). Each raster was then put through the *Raster Calculator* to convert the values to only “0” and “1” with the following expression: (“filnename”<cutoffvalue)\*0+(“filename”>=cutoffvalue)\*1. The cut-off values were determined by the modeling methods used in R. Next the rasters were run through the calculator again to remove all zero values using the following expression: (“filename”)/(“filename” !=0). The rasters were then converted to vectors using the *Vectorize* function to create polygons. The temporal difference between polygons (i.e. current versus RCP 4.5 2050) was determined by using the *Difference* function to create both “Gained” and “Lost” polygons. The “Lost” polygons were created by using the current climate as the input layer and the future projection as the overlay layer. The “Gained” polygons were created by reversing the order so that the future projection was the input layer and the current climate was the overlay.