Processing Teams Soil & Landcover Data

## RQ 1: Land Use Change

Team: Patricia, Kristy, Kaelin

#### Process/Approach

1970’s Land Use + SSURGO C 2010’s Land Use + SSURGO C Clip out -> past forest diff. (things changed)

#### Data Requirements

2 periods of SSURGO data? Overlapping land-use areas Are consistent or changing land uses needed?

#### Data Processing

Using a layer Patricia provided, Big Island points were appended with land use/cover data 1. Open’Big\_Island\_LC\_pedon\_w\_OC.xlsx’ and save as a csv. 2. Upload the Big\_Island\_LC\_pedon\_w\_OC.csv as points into QGIS([how-to](https://www.qgistutorials.com/en/docs/importing_spreadsheets_csv.html)) 3. Download statewide soil order shapefile from [Hawaii Soil Atlas](http://gis.ctahr.hawaii.edu/SoilAtlas). Download link: <http://gis.ctahr.hawaii.edu/downloads/soilAtlas/SoilOrderSeries.zip>. 4. Download low-res NOAA C-CAP Land Cover data for each island (Niihau, Kauai, Oahu, Maui County, Hawaii) for each year (1992, 2001, and 2005) from [C-CAP FTP TOOL](https://coast.noaa.gov/ccapftp/#/). 5. Load Soil Orders and C-CAP data into QGIS. 6. Extract values from C-CAP rasters to hawaii\_bc data points in QGIS using ‘Add raster values to points’ from SAGA additional processing toolbox. [How-to](https://tutorials.ecodiv.earth/toc/sample_raster_in_qgis.html). 7. Extract values from Soil Orders shapefile to output layer of previous step (with hawaii\_bc/C-CAP data) in QGIS using ‘Add polygon attributes to points’ from SAGA additional processing toolbox. 8. Export layer with all points as **‘bi\_lc.csv’** via ‘Save as’. 9. Upload csv into GoogleDocs and combine the C-CAP output columns of each island by year. I.e., make a single column from the data from each island for a single time period (1992, 2001, 2005). 10. If feeling kind or patient, recode the numeric values in the three columns with the appropriate text version of the land cover found in the metadata of the C-CAP files. 11. Export GoogleDoc as csv.

## RQ 2: Land Uses by Soil Type

Team: Jon, Jackie, Kat

#### Process/Approach

C% -> land use + crop type, pasture, forest Delineate by soil type to isolate variability

#### Data Requirements

Using organic carbon or total carbon, lat. and long., land cover data (Hunter’s layers), and soil type Clean categories to something that makes sense. Three categories: grass, forest, urban Four soils types each

#### Data Processing

1. Subset Powell Center (John’s code)

#bring in CSV data from USGS PowellCenter  
usgs <- read.csv("c:/Users/Jon Wells/OneDrive/Comps/USGSPowellCenter/USGSPowell\_database.csv")  
  
#subset by lat long to bound Hawaii  
usgs <- usgs[(usgs$lat > 16 & usgs$lat < 25),]  
usgs <- usgs[(usgs$long > -165 & usgs$long < -150),]  
  
#use ddply to simplify to columns of interest  
usgs\_subset <- ddply(usgs,.(X,dataset\_name,lat,long,veg\_note\_profile,c\_tot,n\_tot, fe\_dith, fe\_ox, fe\_py,   
 al\_dith, al\_ox, al\_py, cat\_exch, ph,ph\_h2o,ph\_cacl),nrow)  
usgs\_subset <- usgs\_subset[,-18]  
  
#you could also subset by column numbers  
usgs\_subset2 <- usgs[,c(1:35)]  
  
#importantly, each metric will have to be checked for repeat values from each study  
usgs\_c <- ddply(usgs,.(dataset\_name,c\_tot), nrow)  
(usgs\_c <- usgs\_c[(!is.na(usgs\_c$c\_tot)),])  
str(usgs\_c)  
summary(usgs\_c)  
  
write.csv(usgs\_subset, file="C:/Users/Jon Wells/OneDrive/Comps/USGSPowellCenter/Hawaii\_subset.csv")

1. Upload the Hawaii\_subset.csv as points into QGIS([how-to](https://www.qgistutorials.com/en/docs/importing_spreadsheets_csv.html))
2. Select and download desired agricultural land use layers. *This code has the visualization of the ag land use layer timelines with links to the documention for each layer*

# Install package  
library(timevis)  
  
# Direct to viz  
timevis(data = data.frame(  
 start = c("2001-01-01","2015-01-10", "2012-01-11",  
 "1978-01-20", "1998-01-1","2010-01-01", "1976-01-10"),  
 end = c(NA, NA, NA, NA, NA, NA, NA),  
 content = c("GAP Land Cover, <a href=https://gapanalysis.usgs.gov/>USGS</a>",  
 "Agricultural Land Use Baseline, <a href=http://hdoa.hawaii.gov/salub/ class=bar>HDOA</a>",   
 "Food Self-Sufficiency Baseline, <a href=http://records.co.hawaii.hi.us/weblink/1/doc/73723/Electronic.aspx>Hawaii County</a>",  
 "Agricultural Land Use Maps (ALUM), <a href= http://files.hawaii.gov/dbedt/op/gis/data/alum.pdf>HDOA</a>",   
 "Land Use on the Island of Oahu, <a href =https://pubs.er.usgs.gov/publication/wri20024301>USGS</a>",   
 "Maui Land Use, <a href =https://water.usgs.gov/GIS/metadata/usgswrd/XML/maui\_land\_use\_circa\_2010.xml>USGS</a>",   
 "Land Use Land Cover, <a href=http://geoportal.hawaii.gov/datasets/land-use-land-cover-lulc>GIRAS</a>"),  
 group = c(1, 1, 2, 1, 6, 3, 1)),  
 groups = data.frame(id = 1:7, content = c("Statewide", "Hawaii", "Maui", "Lanai","Molokai", "Oahu", "Kauai")))

1. Download low-res NOAA C-CAP Land Cover data for each island (Niihau, Kauai, Oahu, Maui County, Hawaii) for each year (1992, 2001, and 2005) from [C-CAP FTP TOOL](https://coast.noaa.gov/ccapftp/#/).
2. Load ag land use and C-CAP data layers into QGIS.
3. Extract values from ag land use and C-CAP rasters to hawaii\_bc data points in QGIS using ‘Add raster values to points’ from SAGA additional processing toolbox. [How-to](https://tutorials.ecodiv.earth/toc/sample_raster_in_qgis.html).
4. Export layer with all points as a csv via ‘Save as’ (powell\_landcover.csv)
5. Upload csv into GoogleDocs and combine the C-CAP output columns of each island by year. I.e., make a single column from the data from each island for a single time period (1992, 2001, 2005).
6. If feeling kind or patient, recode the numeric values in the three columns with the appropriate text version of the land cover found in the metadata of the C-CAP files.
7. Export GoogleDoc as csv.

## RQ 3: Hawaii vs Global\*\* Team: Casey, Genelle, Hannah

#### Team Process/Approach

Compare “Beyond Clay” conceptual model, statistical model Global vs Hawaii specific data Lat/Long

#### Data Requirements

SOC Database extraction filters Hawaii (via lat/long) Primary filter Soil order May require search function development based on how soil input was coded Secondary filters Bulk density and total carbon Ph Iron and aluminum extracts Exchangeable calcium

#### Data Processing

The Beyond Clay Data processing took a couple of different routes. The first used the “Final\_Cleaned\_Beyond\_Clay1\_Dataset.csv” file, and the second used the NCSS Database.

Process A: Final\_Cleaned\_Beyond\_Clay1\_Dataset

1. Download Final\_Cleaned\_Beyond\_Clay1\_Dataset.csv from GoogleClassroom link and process a subset of only Hawaii data points.

library(dplyr)  
  
#bring in CSV data from BeyondClay  
bc <- read.csv("/Users/hh/Downloads/Final\_Cleaned\_Beyond\_Clay1\_Dataset.csv")  
  
# Check out the column names and/or view the file  
colnames(bc)  
View(bc)  
  
#Since there is a state\_code column we can subset for Hawaii points using that  
bc <- filter(bc, state\_code == "HI")  
  
# Alternatively you can subest by lat/long boundaries  
# bc <- bc[(bc$latitude\_decimal\_degrees > 16 & bc$latitude\_decimal\_degrees < 25),]  
# bc <- bc[(bc$longitude\_decimal\_degrees > -165 & bc$longitude\_decimal\_degrees < -150),]  
  
# The output of either is 554 points.   
  
# create a csv of new Hawaii subset  
write.csv(bc, file="/Users/hh/Downloads/hawaii\_bc.csv")

1. Upload the new hawaii\_bc.csv as points into QGIS([how-to](https://www.qgistutorials.com/en/docs/importing_spreadsheets_csv.html))
2. Download statewide soil order shapefile from [Hawaii Soil Atlas](http://gis.ctahr.hawaii.edu/SoilAtlas). Download link: <http://gis.ctahr.hawaii.edu/downloads/soilAtlas/SoilOrderSeries.zip>.
3. Download low-res NOAA C-CAP Land Cover data for each island (Niihau, Kauai, Oahu, Maui County, Hawaii) for each year (1992, 2001, and 2005) from [C-CAP FTP TOOL](https://coast.noaa.gov/ccapftp/#/).
4. Load Soil Orders and C-CAP data into QGIS.
5. Extract values from C-CAP rasters to hawaii\_bc data points in QGIS using ‘Add raster values to points’ from SAGA additional processing toolbox. [How-to](https://tutorials.ecodiv.earth/toc/sample_raster_in_qgis.html).
6. Extract values from Soil Orders shapefile to output layer of previous step (with hawaii\_bc/C-CAP data) in QGIS using ‘Add polygon attributes to points’ from SAGA additional processing toolbox.
7. Export layer with all points as a csv via ‘Save as’.
8. Upload csv into GoogleDocs and combine the C-CAP output columns of each island by year. I.e., make a single column from the data from each island for a single time period (1992, 2001, 2005).
9. If feeling kind or patient, recode the numeric values in the three columns with the appropriate text version of the land cover found in the metadata of the C-CAP files.
10. Export GoogleDoc as csv.

Next is the process using the NCSS data:

1. Download National Cooperative Soil Survey Microsoft Access Database. Accessible from <https://ncsslabdatamart.sc.egov.usda.gov/querypage.aspx>. *Note: Website states that .zip file is 1.1 MB, it is actually 219.6 MB*.
2. Attempt to learn to use Microsoft Access, but succeed in learning why everyone hates microsoft access.
3. Use “Query Wizard” to select the tables and column data that you want to compile into a new table.

Tables Used: NCSS\_Site\_Location, NCSS\_Pedon Taxnomy, NCSS\_Layer, Carbon\_and\_Extractions, CEC\_and\_Bases, Organic, pH\_and\_Carbonates, Bulk\_Density\_and\_Moisture

Full listing of all columns grabbed: “NCSS\_Site\_Location\_site\_key” “siteiid” “usiteid”  
“site\_obsdate” “latitude\_decimal\_degrees” “longitude\_decimal\_degrees”  
“state\_code” “Organic\_c\_tot” “Organic\_n\_tot”  
“Organic\_c\_n\_ra” “ph\_cacl2” “ph\_h2o”  
“cec\_sum” “cec\_nh4” “cec\_nhcl”  
“Bulk\_Density\_and\_Moisture\_labsampnum” “result\_source\_key” “Bulk\_Density\_and\_Moisture\_prep\_code” “db\_13b” “db\_od” “COLEws”  
“w6clod” “w10cld” “w3cld”  
“w15l2” “w15bfm” “adod”  
“wrd\_ws13” “aggstb” “cec7\_cly”  
“w15cly” “c\_adod” “fe\_dith”  
“fe\_dith\_code” “al\_dith” “al\_dith\_code”  
“al\_fe\_ox” “fe\_ox” “fe\_ox\_code”  
“al\_ox” “al\_ox\_code” “si\_ox”  
“si\_ox\_code” “fe\_pyp” “fe\_pyp\_code”  
“al\_pyp” “al\_pyp\_code” “Carbon\_and\_Extractions\_prep\_code”  
“Carbon\_and\_Extractions\_c\_tot” “c\_tot\_code” “Carbon\_and\_Extractions\_n\_tot”  
“n\_tot\_code” “s\_tot” “oc”  
“oc\_code” “Carbon\_and\_Extractions\_c\_n\_ra” “texture\_description”  
“NCSS\_Layer\_labsampnum” “project\_key” “NCSS\_Layer\_site\_key”  
“pedon\_key” “layer\_sequence” “hzn\_top”  
“hzn\_bot” “state\_name” “county\_code”

The SQL query used to grab the colummns from the tables (generated post-facto after using Query Wizard): SELECT NCSS\_Site\_Location.site\_key AS NCSS\_Site\_Location\_site\_key, NCSS\_Site\_Location.siteiid, NCSS\_Site\_Location.usiteid, NCSS\_Site\_Location.site\_obsdate, NCSS\_Site\_Location.latitude\_decimal\_degrees, NCSS\_Site\_Location.longitude\_decimal\_degrees, NCSS\_Site\_Location.state\_code, Organic.c\_tot AS Organic\_c\_tot, Organic.n\_tot AS Organic\_n\_tot, Organic.c\_n\_ra AS Organic\_c\_n\_ra, pH\_and\_Carbonates.ph\_cacl2, pH\_and\_Carbonates.ph\_h2o, CEC\_and\_Bases.cec\_sum, CEC\_and\_Bases.cec\_nh4, CEC\_and\_Bases.cec\_nhcl, Bulk\_Density\_and\_Moisture.labsampnum AS Bulk\_Density\_and\_Moisture\_labsampnum, Bulk\_Density\_and\_Moisture.result\_source\_key, Bulk\_Density\_and\_Moisture.prep\_code AS Bulk\_Density\_and\_Moisture\_prep\_code, Bulk\_Density\_and\_Moisture.db\_13b, Bulk\_Density\_and\_Moisture.db\_od, Bulk\_Density\_and\_Moisture.COLEws, Bulk\_Density\_and\_Moisture.w6clod, Bulk\_Density\_and\_Moisture.w10cld, Bulk\_Density\_and\_Moisture.w3cld, Bulk\_Density\_and\_Moisture.w15l2, Bulk\_Density\_and\_Moisture.w15bfm, Bulk\_Density\_and\_Moisture.adod, Bulk\_Density\_and\_Moisture.wrd\_ws13, Bulk\_Density\_and\_Moisture.aggstb, Bulk\_Density\_and\_Moisture.cec7\_cly, Bulk\_Density\_and\_Moisture.w15cly, Bulk\_Density\_and\_Moisture.c\_adod, Carbon\_and\_Extractions.fe\_dith, Carbon\_and\_Extractions.fe\_dith\_code, Carbon\_and\_Extractions.al\_dith, Carbon\_and\_Extractions.al\_dith\_code, Carbon\_and\_Extractions.al\_fe\_ox, Carbon\_and\_Extractions.fe\_ox, Carbon\_and\_Extractions.fe\_ox\_code, Carbon\_and\_Extractions.al\_ox, Carbon\_and\_Extractions.al\_ox\_code, Carbon\_and\_Extractions.si\_ox, Carbon\_and\_Extractions.si\_ox\_code, Carbon\_and\_Extractions.fe\_pyp, Carbon\_and\_Extractions.fe\_pyp\_code, Carbon\_and\_Extractions.al\_pyp, Carbon\_and\_Extractions.al\_pyp\_code, Carbon\_and\_Extractions.prep\_code AS Carbon\_and\_Extractions\_prep\_code, Carbon\_and\_Extractions.c\_tot AS Carbon\_and\_Extractions\_c\_tot, Carbon\_and\_Extractions.c\_tot\_code, Carbon\_and\_Extractions.n\_tot AS Carbon\_and\_Extractions\_n\_tot, Carbon\_and\_Extractions.n\_tot\_code, Carbon\_and\_Extractions.s\_tot, Carbon\_and\_Extractions.oc, Carbon\_and\_Extractions.oc\_code, Carbon\_and\_Extractions.c\_n\_ra AS Carbon\_and\_Extractions\_c\_n\_ra, NCSS\_Layer.texture\_description, NCSS\_Layer.labsampnum AS NCSS\_Layer\_labsampnum, NCSS\_Layer.project\_key, NCSS\_Layer.site\_key AS NCSS\_Layer\_site\_key, NCSS\_Layer.pedon\_key, NCSS\_Layer.layer\_sequence, NCSS\_Layer.hzn\_top, NCSS\_Layer.hzn\_bot, NCSS\_Site\_Location.state\_name, NCSS\_Site\_Location.county\_code FROM ((NCSS\_Site\_Location INNER JOIN NCSS\_Pedon\_Taxonomy ON NCSS\_Site\_Location.[site\_key] = NCSS\_Pedon\_Taxonomy.[site\_key]) INNER JOIN ((((NCSS\_Layer INNER JOIN Carbon\_and\_Extractions ON NCSS\_Layer.[labsampnum] = Carbon\_and\_Extractions.[labsampnum]) INNER JOIN CEC\_and\_Bases ON NCSS\_Layer.[labsampnum] = CEC\_and\_Bases.[labsampnum]) INNER JOIN Organic ON NCSS\_Layer.[labsampnum] = Organic.[labsampnum]) INNER JOIN pH\_and\_Carbonates ON NCSS\_Layer.[labsampnum] = pH\_and\_Carbonates.[labsampnum]) ON NCSS\_Pedon\_Taxonomy.[pedon\_key] = NCSS\_Layer.[pedon\_key]) INNER JOIN Bulk\_Density\_and\_Moisture ON NCSS\_Layer.[labsampnum] = Bulk\_Density\_and\_Moisture.[labsampnum];

1. Filter the resulting query output using the ‘state\_code’ column and ‘HI’. The **result now has 397 data points.**
2. Export query output as csv (‘Beyond\_Clay\_hawaii.csv’)
3. Upload the new Beyond\_Clay\_hawaii.csv as points into QGIS([how-to](https://www.qgistutorials.com/en/docs/importing_spreadsheets_csv.html))
4. Download statewide soil order shapefile from [Hawaii Soil Atlas](http://gis.ctahr.hawaii.edu/SoilAtlas). Download link: <http://gis.ctahr.hawaii.edu/downloads/soilAtlas/SoilOrderSeries.zip>.
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