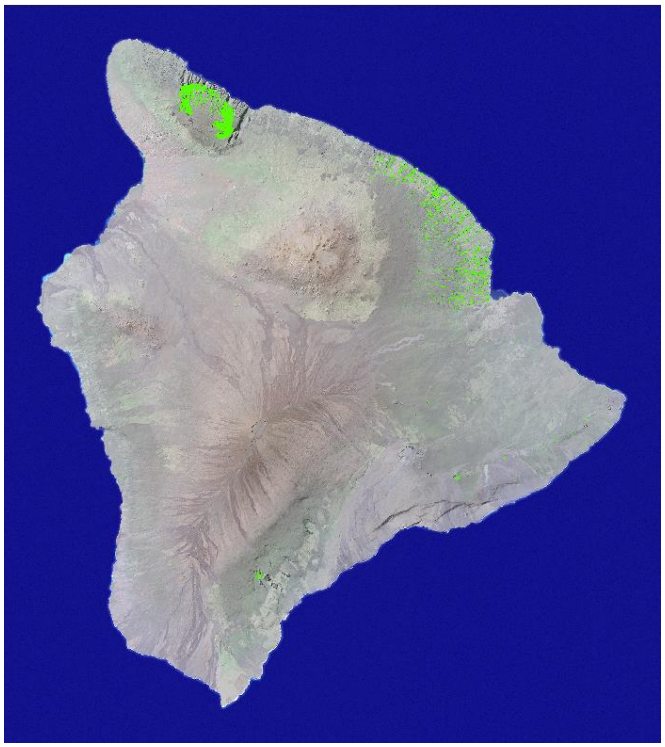
Lab assignment 3: Spatial Analyst Tools (continued)

This assignment covers the Map Algebra, Neighbourhood and Zonal functions in Spatial Analyst.

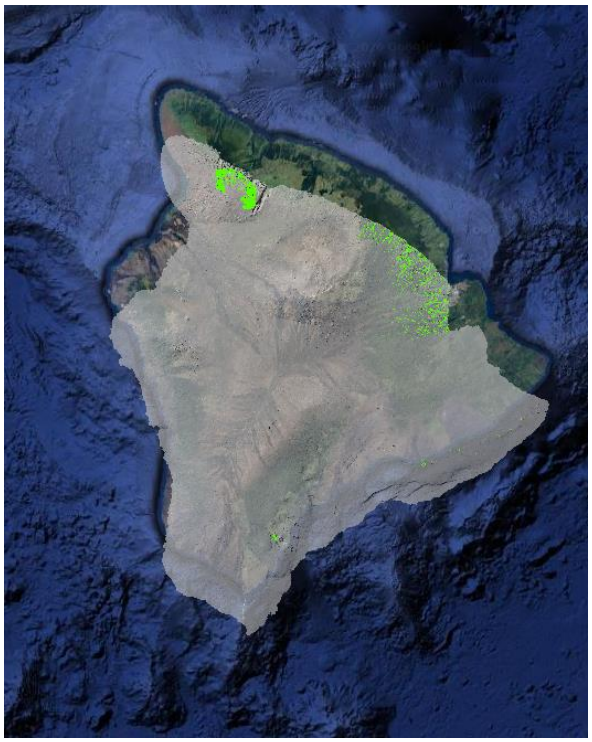
Question 1

This question covers simple use of Map Algebra and the Raster Calculator, using Hawaiian rainfall data (from the Rainfall Atlas of Hawaii – www.rainfall.geography.hawaii.edu).

a) From the Hawaii folder, add the annual rainfall raster for the island of Hawaii as well as the DEM.
b) From the DEM – use the terrain analysis tool to calculate the **slope** raster for Hawaii. The slope should be calculated in degrees.
c) Using the **raster calculator** tool in Map Algebra, create a new output raster that shows areas of high rainfall (>3000mm per year) and areas of steep slope (>=15 degrees) and an elevation of <1200m in order that preventative measures for rockfalls can be put in place. You should do this using **one expression** in the raster calculator.
d) Create a simple map displaying your results from the two methods in the question above, overlaid onto a **hillshade raster** to enhance visualisation of the results. Use a basemap aerial image for context as well. Insert the map below.



Basemap: Landsat from University of Hawaii



Basemap: **Google_Satellite.xml**

in **WGS_84_Pseudo_Mercator**

ArcMap may not be able to reproject .xml into NAD 1983 UTM Zone 5N, I tried for 2hrs!

Question 2

This question allows you to work with Neighbourhood statistics function. We would like to calculate a sprawl index for residential land in Massachusetts, USA. The sprawl index is determined by working out the percentage of open space surrounding each cell classified as residential.

a) Add the raster file "massa" – this is the landcover for Massachusetts. Reclassify this to extract firstly all urban cells (land cover values 21, 22, 23 and 85) – call it mass_urb.

b) Repeat this step, but this time extract only the residential cells (21, 22) – call it mass_res.

c) Calculate the percentage of urban cells in a ~1km^2 neighbourhood around each urban cell using Focal Statistics.

   Repeat this process using Block Statistics to calculate the percentage of urban cells in a 1km^2 neighbourhood.

   How big does the cell around each scanning cell? (Hint: The cell size of the raster is 30m.)

   Which statistic would you calculate to determine the percentage of urban cells in this neighbourhood?

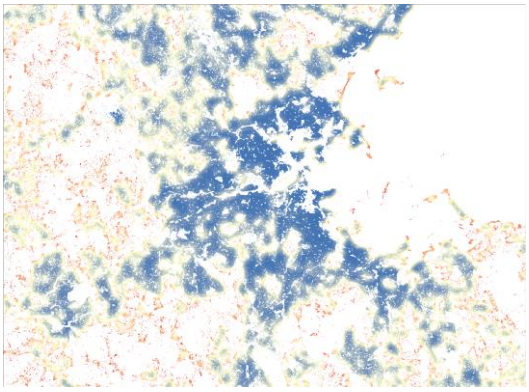
   Call the results "mass_urb_perc_focal" and "mass_urb_perc_block".

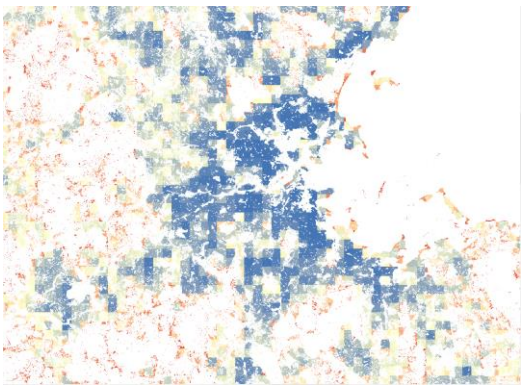
Apply the following steps to both your results.

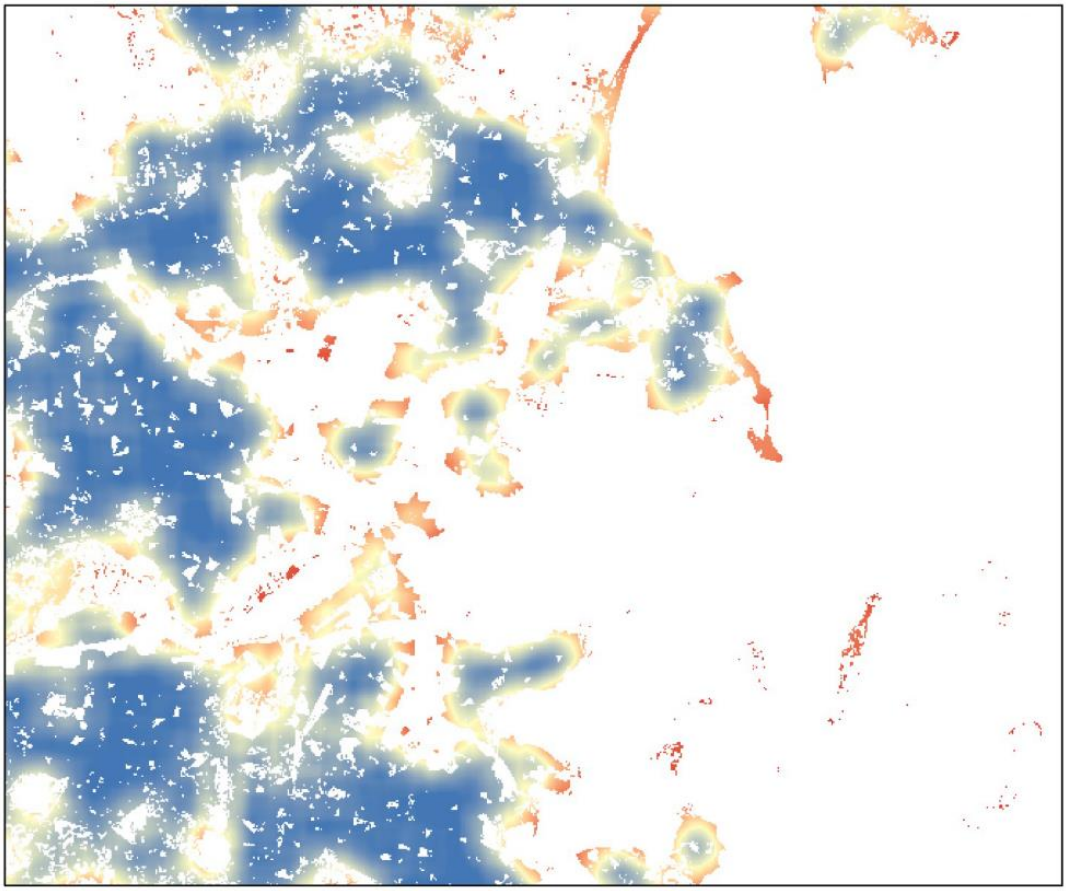
d) Once you have this, you have to convert percentage of urban space to percentage of open space. How would you accomplish this? Call the results "mass_urb_open_focal" and "mass_urb_open_block".

e) As you are only interested in the percentage of open space surrounding residential cells, how can you ensure that you have a raster with only the residential cells' open space (or sprawl index) values? Call the result "mass_res_open_focal" and "mass_res_open_block".

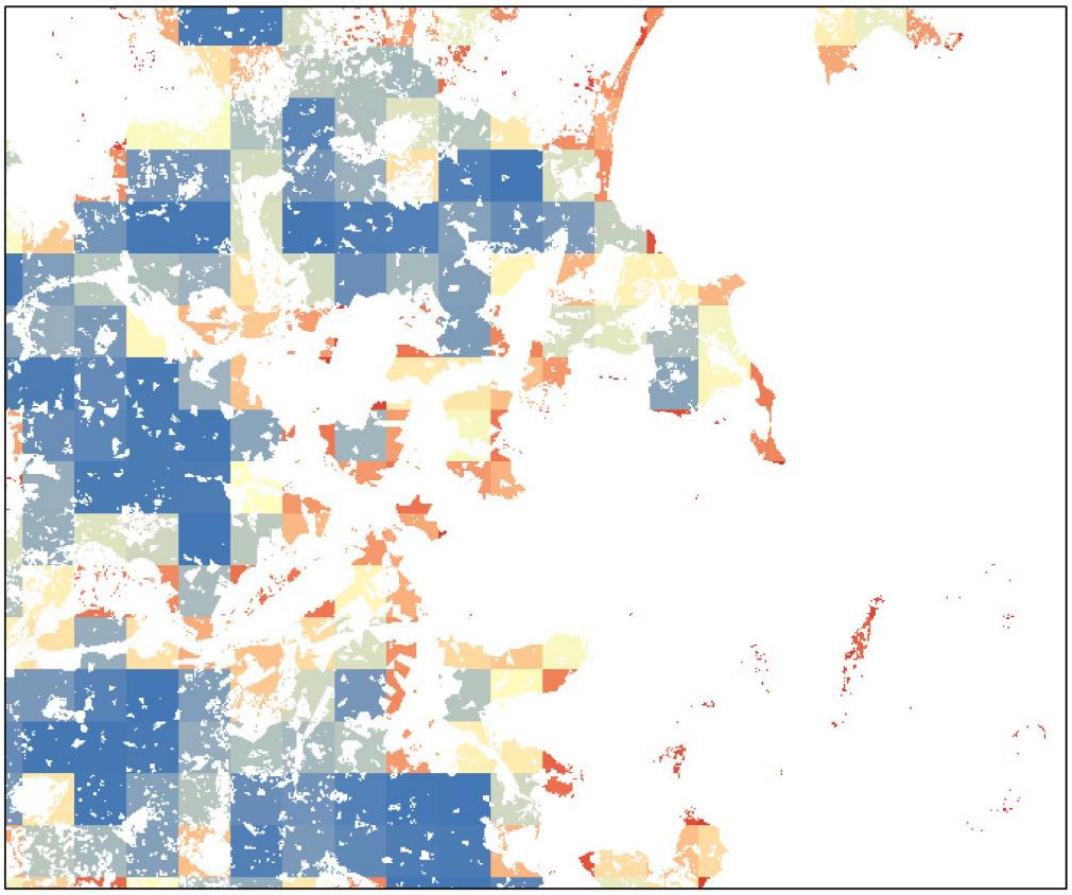
f) Insert a screenshot of your results (zoomed in to a suitable area for visual purposes) for the sprawl index (percentage of open space) for the residential cells in Massachusetts for both the focal and block statistics methods. What is the reason for the difference in the results?







massa_RES_Open-focal



massa_RES_Open-block

Question 3

This question is a continuation of the previous question and allows you to use the Zonal statistics function. You have the calculated a sprawl index (percentage of open space) for each residential cell in Massachusetts, but you would like to know which of the Metropolitan Statistical Areas (MSAs) which cover the Massachusetts area has the highest sprawl index.

a) Add the zones feature file mass_MSA.shp. Use this file as your zones layer in the *zonal statistics as table* function to calculate the average sprawl index for each zone. Which MSA has the highest sprawl index using the focal statistics result?

b) Repeat the *zonal statistics* function for the focal and block results for the sprawl index, this time using the counties as the zones. Are there differences in your results for the different methods? What do you attribute these differences to? Which method do you think is more accurate?

c) Create a simple map showing the counties classified according to the mean sprawl index, with the residential sprawl index overlaying them. Insert the result into the space below.