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Curve Number Estimation for Hydrological Modeling in a Study Area

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Title: Curve Number Estimation for Hydrological Modeling in a Study Area

Introduction: This report outlines the process of estimating Curve Numbers (CN) for hydrological modeling using soil and land use/land cover (LULC) data in a specified study area. The study employs the Digital Soil Map of the World and ESRI Landcover data for soil and LULC information, respectively. The objective is to generate accurate CN values that play a crucial role in predicting runoff in hydrological models.

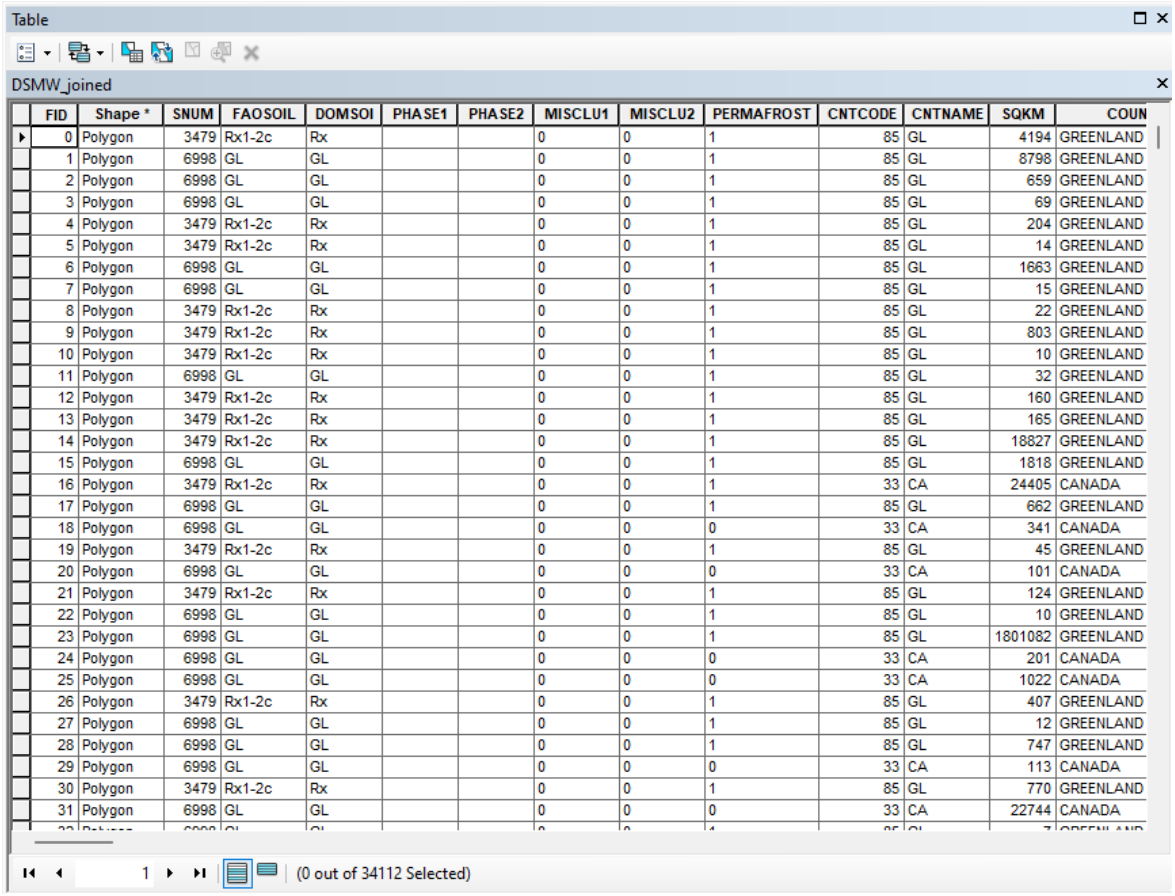
1. Soil Data Processing:

1.1 **Download Soil Data:**

- Download the Digital Soil Map of the World from the provided link.
- https://data.apps.fao.org/map/catalog/srv/eng/catalog.search#/metadata/446ed430-8383-11db-b9b2-000d939bc5d8

1.2 **Define Projection and Join Table:**

- Define the soil data projection to WGS 1984.
- Join the soil data table with the usersoil table of the SWAT Metadata base.



Table

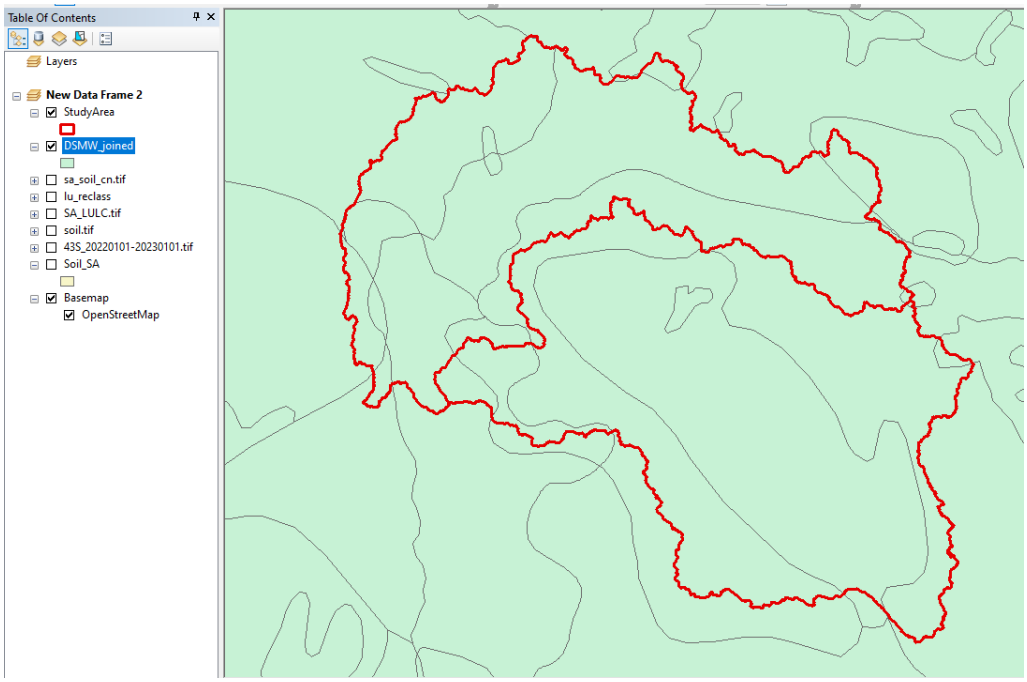
DSMW_joined

FID	Shape *	SNUM	FAOSOIL	DOMSOI	PHASE1	PHASE2	MISCLU1	MISCLU2	PERMAFROST	CNTCODE	CNTNAME	SQKM	COUN
0	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	4194	GREENLAND
1	Polygon	6998	GL	GL			0	0	1	85	GL	8798	GREENLAND
2	Polygon	6998	GL	GL			0	0	1	85	GL	659	GREENLAND
3	Polygon	6998	GL	GL			0	0	1	85	GL	69	GREENLAND
4	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	204	GREENLAND
5	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	14	GREENLAND
6	Polygon	6998	GL	GL			0	0	1	85	GL	1663	GREENLAND
7	Polygon	6998	GL	GL			0	0	1	85	GL	15	GREENLAND
8	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	22	GREENLAND
9	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	803	GREENLAND
10	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	10	GREENLAND
11	Polygon	6998	GL	GL			0	0	1	85	GL	32	GREENLAND
12	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	160	GREENLAND
13	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	165	GREENLAND
14	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	18827	GREENLAND
15	Polygon	6998	GL	GL			0	0	1	85	GL	1818	GREENLAND
16	Polygon	3479	Rx1-2c	Rx			0	0	1	33	CA	24405	CANADA
17	Polygon	6998	GL	GL			0	0	1	85	GL	662	GREENLAND
18	Polygon	6998	GL	GL			0	0	0	33	CA	341	CANADA
19	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	45	GREENLAND
20	Polygon	6998	GL	GL			0	0	0	33	CA	101	CANADA
21	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	124	GREENLAND
22	Polygon	6998	GL	GL			0	0	1	85	GL	10	GREENLAND
23	Polygon	6998	GL	GL			0	0	1	85	GL	1801082	GREENLAND
24	Polygon	6998	GL	GL			0	0	0	33	CA	201	CANADA
25	Polygon	6998	GL	GL			0	0	0	33	CA	1022	CANADA
26	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	407	GREENLAND
27	Polygon	6998	GL	GL			0	0	1	85	GL	12	GREENLAND
28	Polygon	6998	GL	GL			0	0	1	85	GL	747	GREENLAND
29	Polygon	6998	GL	GL			0	0	0	33	CA	113	CANADA
30	Polygon	3479	Rx1-2c	Rx			0	0	1	85	GL	770	GREENLAND
31	Polygon	6998	GL	GL			0	0	0	33	CA	22744	CANADA

1 (0 out of 34112 Selected)

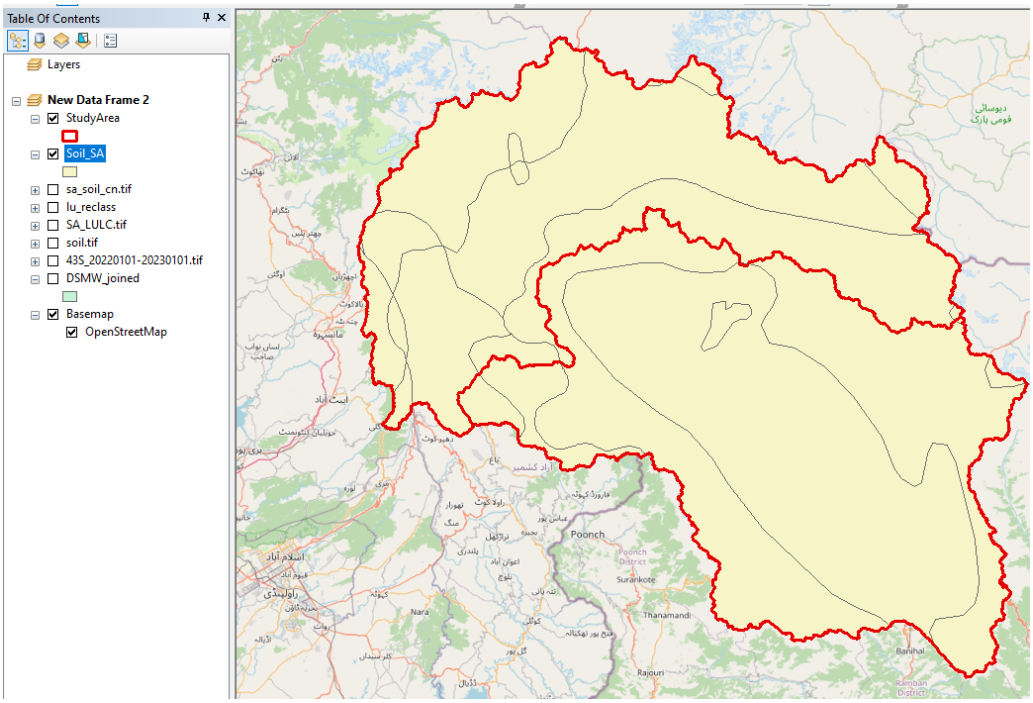
1.3 **Export Soil Shapefile:**

- Export the joined soil data as a Shapefile with an appropriate name.



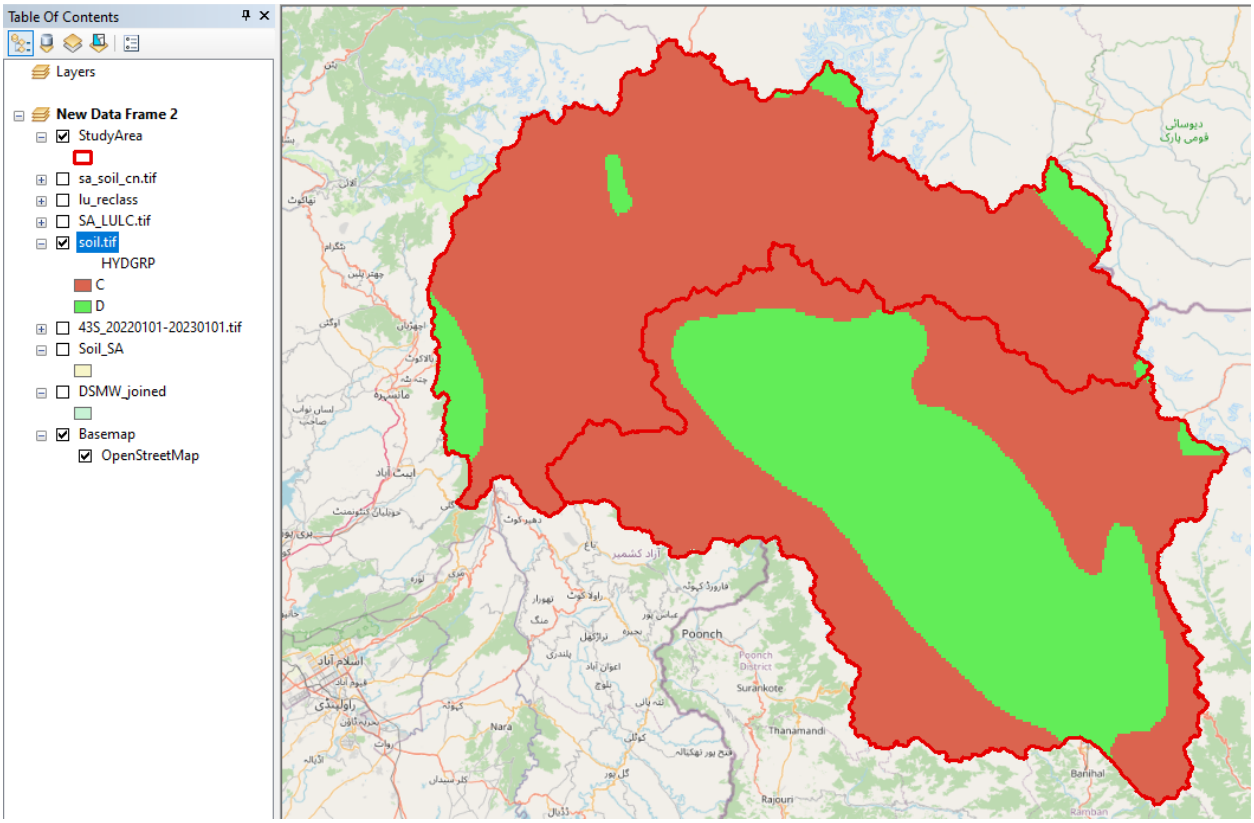
1.4 **Clip and Convert to Raster:**

- Use the exported Shapefile to clip the study area.
- Convert the clipped data to a raster format.



1.5 **Projection and Output Cell Size:**

- Project the raster data to UTM WGS_1984_UTM_Zone_43N.
- Ensure the output cell size is set to 10m for finer resolution.



2. LULC Data Processing:

2.1 **Download LULC Data:**

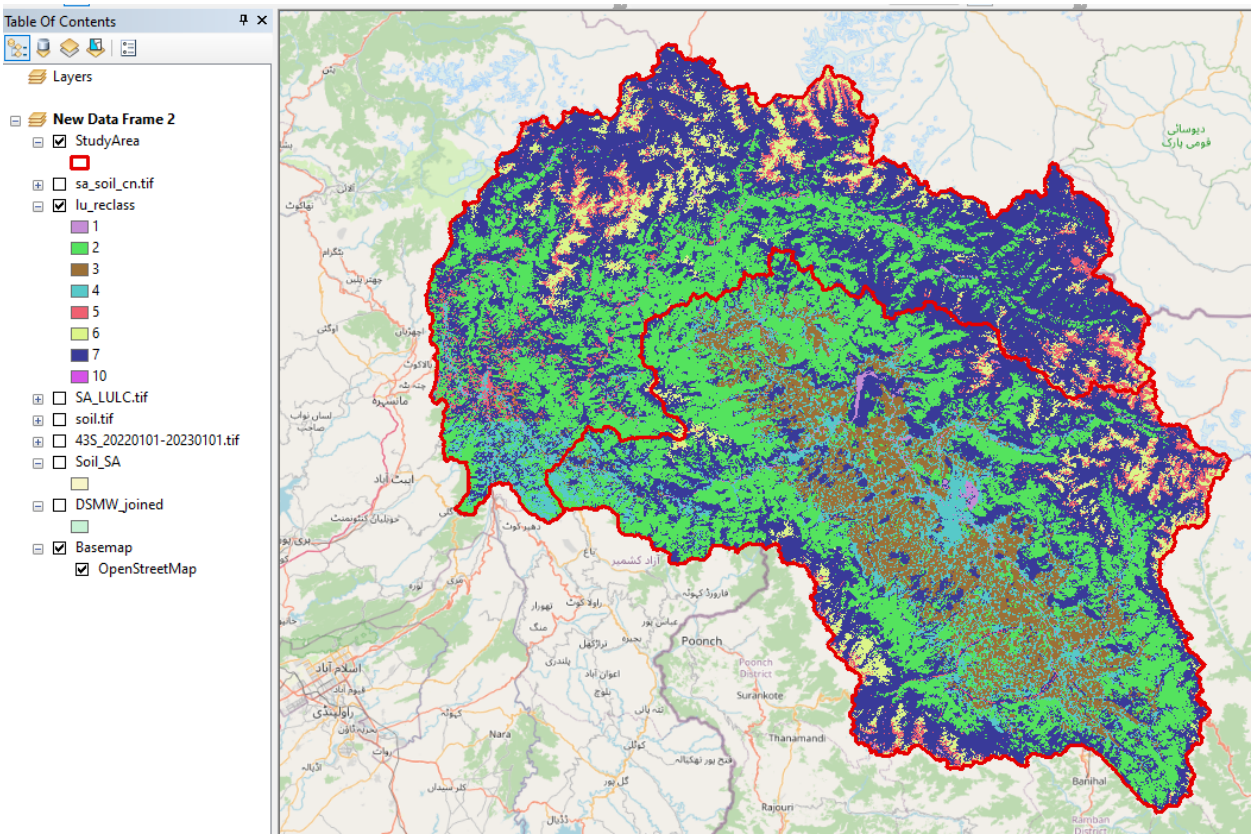
- Download ESRI Landcover data for the year 2022.

https://livingatlas.arcgis.com/landcoverexplorer/#mapCenter=122.517%2C47.055%2C2&mode=step&timeExtent=2017%2C2022&year=2022

2.2 **Clip and Reclassify:**

- Clip or extract the LULC data to match the study area.
- Reclassify the LULC data based on the provided table.

Original Value	Reclassified Values	LULC
1	1	Water
2	2	Trees
4	7	Flooded Vegetation
5	3	Crops
7	4	Built Area
8	5	Bare Ground
9	6	Snow/Ice
11	7	Range Lands



3. Curve Number Estimation:

3.1 Raster Renaming:

- Rename the reclassified LULC raster as 'lu_reclass' and the soil raster as 'soil' in the table of contents.

LULC Value	LULC	A	B	C (1)	D (2)
1	Water	100	100	100	100
2	Trees	40	66	77	85
3	Crops	50	63	74	83
4	Built Area	81	88	91	93
5	Bare Ground	68	79	86	89
6	Snow/Ice	98	98	98	98
7	Range Lands	63	77	85	88

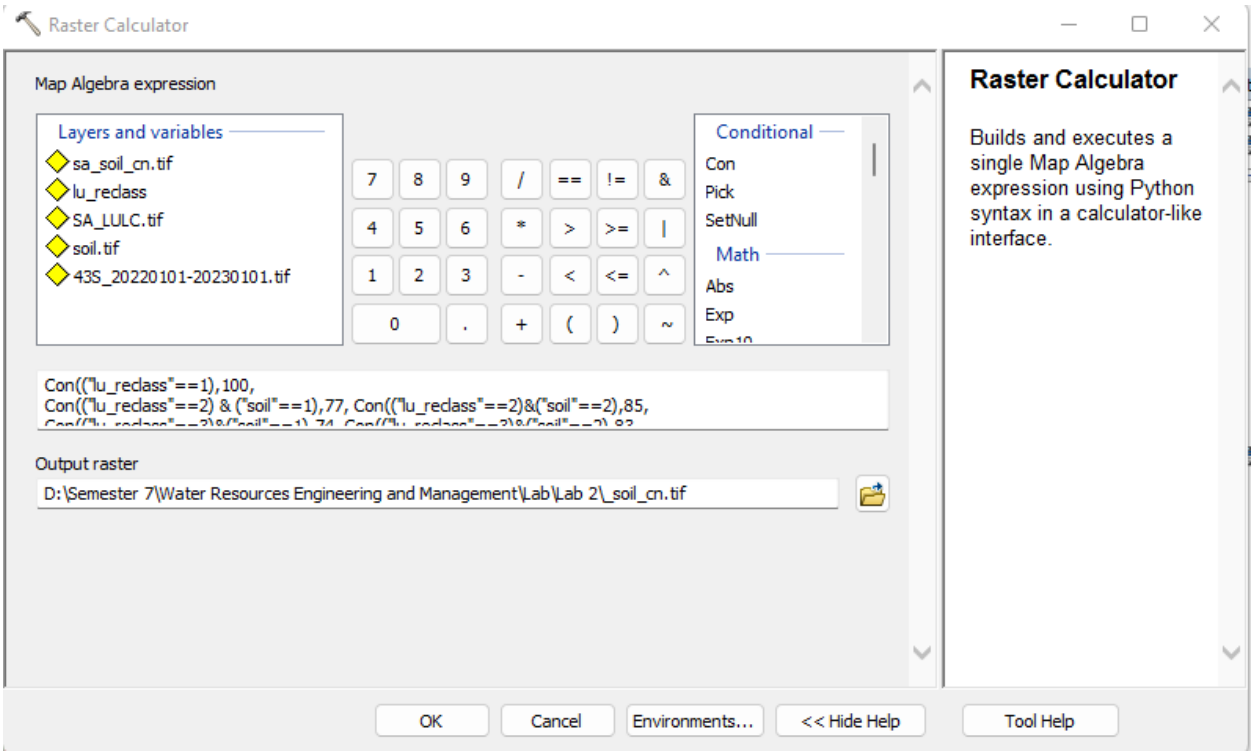
3.2 **Raster Calculator:**

- Open the Raster Calculator and input the following query:

pythonCopy code

```
Con(("lu_reclass"==1),100, Con(("lu_reclass"==2) & ("soil"==1),77,
Con(("lu_reclass"==2)&("soil"==2),85, Con(("lu_reclass"==3)&("soil"==1),74,
Con(("lu_reclass"==3)&("soil"==2),83, Con(("lu_reclass"==4) & ("soil"==1), 91,
Con(("lu_reclass"==74)&("soil"==2),93, Con(("lu_reclass"==5)&("soil"==1), 86,
Con(("lu_reclass"==5)&("soil"==2),89, Con(("lu_reclass"==6),98,
Con(("lu_reclass"==7)&("soil"== 1),85, Con(("lu_reclass"==7)&("soil"==2),88,0))))))))))))
```

- Modify the query according to your dataset if necessary.



Conclusion: This manual provides a step-by-step guide for processing soil and LULC data to estimate Curve Numbers for hydrological modeling. Following these instructions will result in accurate CN values, which are essential for predicting runoff in a given study area. Ensure each step is meticulously executed for optimal results in your hydrological modeling endeavors.