Problem Statement: ***2. Change Detection based on AWIFS or LISS III Datasets***

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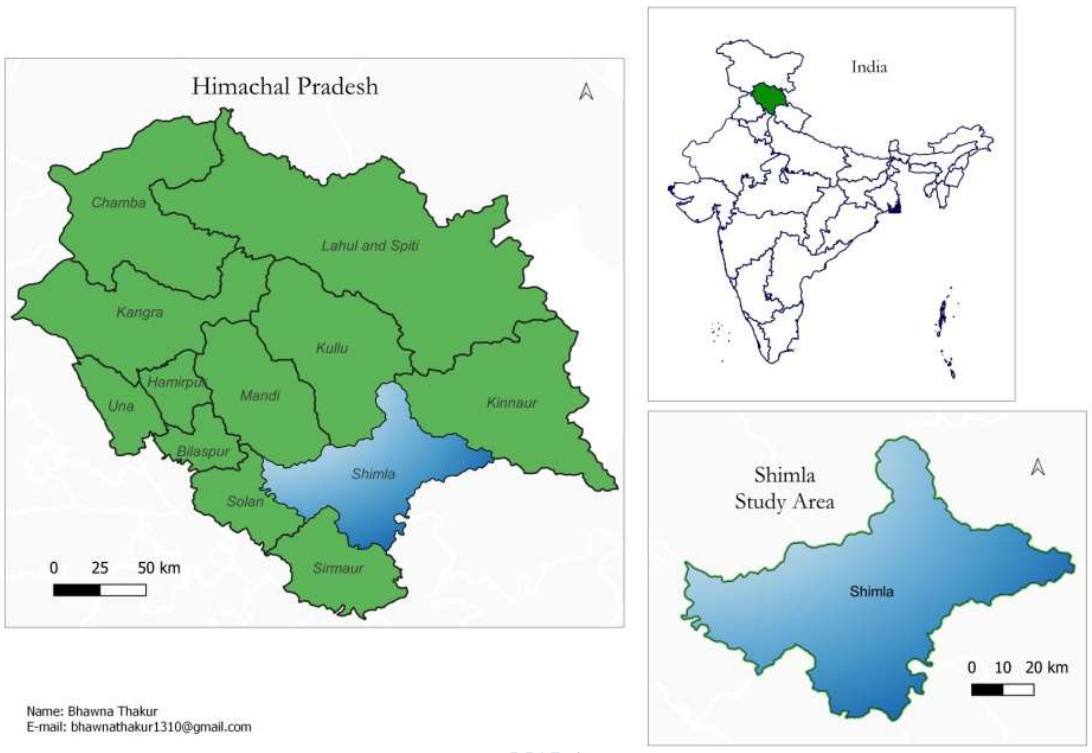
Methodology:

Study Area:

The problem statement selected is used for analyzing Change Detection for Shimla, one of the twelve districts of Himachal Pradesh.
During the past decade, the state has witnessed a higher inflow of tourists to the state leading to urbanization and land degradation in the form of conversion of forest to croplands, croplands to built-up etc. to meet the needs.



MAP 1

Data and Software Used:

For the process, **Resourcesat 1-2 LISS III** data has been used as it has better spatial resolution than AWIFS and is downloaded from BHUVAN. The sensor collects data in four spectral bands i.e. **Band 2 (VIS) - .52 to .59 um, Band 3 (VIS) - .62 to .68, Band 4 (NIR) - .77 to .86** & **Band 5 (SWIR) – 1.55 to 1.75**. As October is a month of clear skies in Shimla, images of 18th and 23rd October 2008 are compared with the images of 19th and 24th October 2017. The data was processed and analyzed using **QGIS 3.14** and plugins were **Semi-Automatic Classification Plugin** (**SCP**) and **Landscape Ecology**.

Steps Used (Brief):

District Shimla is covered by 20 tiles and the downloaded data is a zip folder with 4 layers (containing the spectral data) each. These layers were merged with each layer as separate band in the composite image so formed. Then a virtual raster of all 20 tiles was created. The data is in GCS WGS 84 hence it is projected to WGS 84/ UTM Zone 43.

1. Visual Interpretation: (Refer map 2)

   For the purpose of visual identification of the area showing change a land-use land-cover map was classified for each year i.e. 2008 and 2017 using SCP. A broad classification (supervised) is done with 4 major classes: Vegetation/ Forest, Built-up, Water and Barren Land. Agriculture is not considered as a separate class because it's a sowing period hence the land has signatures similar to barren land. Signatures from snow covered regions are classified as built-up because they both have similar reflectance. A table was prepared for land cover percentage using Landscape Ecology.

   Advantage: An estimate can be made of land-cover type.
   Disadvantage: Due to varying solar elevation, shadowed region is classified as forest or water irrespective of its land-cover type.

2. Analysis:

(A) Change for each band (Refer map 3): Commonly called as image differencing is a method of calculating the change in the Digital Number (DN) values. Here DN value of 2nd image i.e. 2017 is subtracted from 1st image i.e. 2008. The pixels are grouped into three classes; No Change, Increase (Negative Value) and Decrease (Positive Value).
Advantage: Here the pixel values are directly used hence the human error that is added in classification is removed.
Disadvantage: Information about the land cover cannot be extracted.

(B) Change for each class (Refer map 4): This is a method of identifying pixels that have changed their class. This analysis is run over the Land Cover classified images. The map shows pixel that have changed over time from the specified class to another class. This helps us in locating points changed.

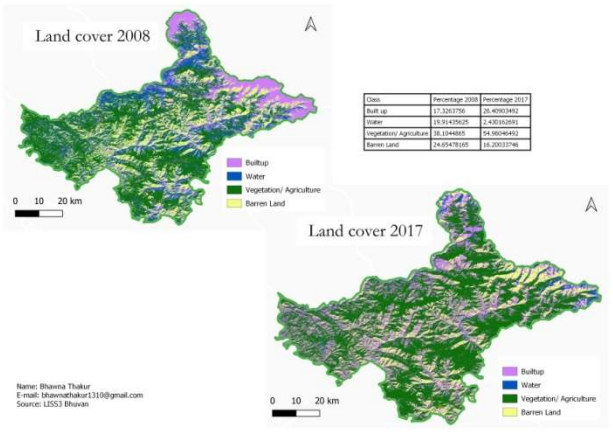
Advantage: Quick identification of pixels that have changed class
Disadvantage: The human error of classification is added.

Applications and Uses:

Land Cover Map: This map gives an areal distribution of the Land Cover type. In the higher reaches of the district we can see that snow region has changed to barren land implying change in snow pattern or receding snow line indicating climate change as both the images are from the same month. We can even see an increase in the built-up area.
This map can be used for assessing Land Cover Change and see the impact of Climate Change

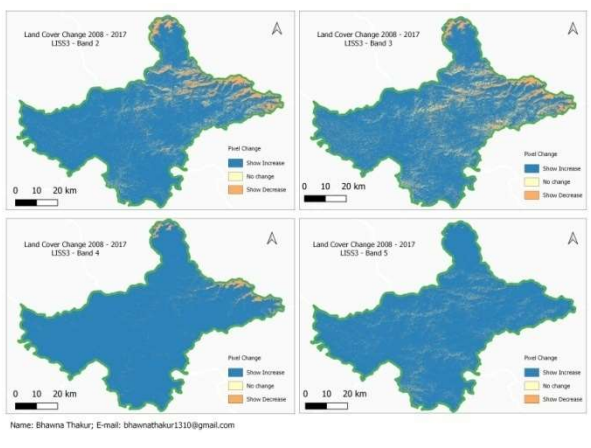
Change per band: All the bands collect data in different spectral regions and each object has different spectral signatures in them. Here each band show change in pixel value for the cell. A decrease in value suggests that reflectance has decreased and vice-versa.
These maps can be useful in deciding the bands that can be used for seeing a particular type of change. As we can see that the Band 5 does not calculate the change in the snow covered region.

Change per class: These maps give a visual view of the change of pixels class from 2008 to 2017. A separate transformation for each class can be seen.
These maps can be used for visual interpretation of hotspots for change for a particular class.
Higher resolution maps are attached along with the submission.

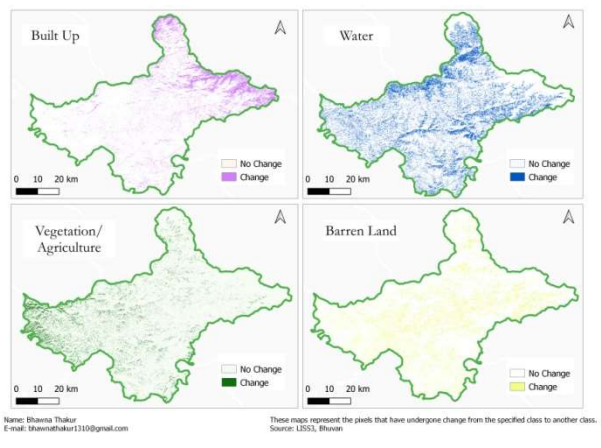


Class	Percentage 2008	Percentage 2017
Built up	17.3261756	20.40903492
Water	19.91435625	2.430162691
Vegetation/ Agriculture	38.1044865	54.96046492
Barren Land	24.65478105	16.20033746

MAP 2



MAP 3



MAP 4