

## 9. Appendix

### I. Python code for analyzing pixel change between two pictures

```
import cv2
import numpy as np
import os
def compute_pixel_differences(images):
    # Read the first image to get dimensions
    ref_img = cv2.imread(images[0], cv2.IMREAD_GRAYSCALE)
    height, width = ref_img.shape
    # Initialize arrays to hold differences
    diff_sum = np.zeros((height, width), dtype=np.float32)
    diff_count = 0
    # Compute differences for each image
    for img_path in images[1:]:
        # Read image
        img = cv2.imread(img_path, cv2.IMREAD_GRAYSCALE)
        # Check if dimensions match
        if img.shape != (height, width):
            raise ValueError("Image dimensions do not match.")
        # Compute absolute differences
        diff = ref_img.astype(np.float32) - img.astype(np.float32)
        diff_sum += diff
        diff_count += 1
    # Compute mean differences
    mean_diff = diff_sum / diff_count
    return mean_diff
```

```

def main():

    # Directory containing TIFF files

    directory = (*****)

    # List all TIFF files in the directory

    tiff_files = [os.path.join(directory, file) for file in os.listdir(directory) if file.endswith('.tif')]

    if len(tiff_files) < 2:

        print("There should be at least 2 TIFF files for comparison.")

        return

try:

    # Compute pixel differences

    pixel_diffs = compute_pixel_differences(tiff_files)

    # Save the pixel difference plot as a TIFF file

    output_path = (*****)

    # Normalize pixel differences to range [0, 255]

    normalized_diffs = cv2.normalize(pixel_diffs, None, 0, 255, cv2.NORM_MINMAX,
dtype=cv2.CV_8U)

    # Apply colormap to differentiate between pixels added and removed

    colormap_diffs = cv2.applyColorMap(normalized_diffs, cv2.COLORMAP_COOL)

    cv2.imwrite(output_path, colormap_diffs)

    print(f"Pixel difference plot saved as {output_path}")

except ValueError as e:

    print("Error:", e)

if __name__ == "__main__":

    main()

```

## II. Collected district data

District	Number	% pop. change 01 - 21	Net cropland change
Taplejung	1	-10	-7
Panchthar	2	33	-5
Ilam	3	-1	-25
Jhapa	4	45	-242
Morang	5	36	-164
Sunsari	6	48	-183
Dhankuta	7	-10	-14
Terhathum	8	-22	-5
Sankhuwasabha	9	-1	-8
Bhojpur	10	-22	-17
Solukhumbu	11	-3	-1
Khotang	12	-24	-27
Okhaldhunga	13	-9	-25
Udayapur	14	18	-54
Saptari	15	24	-246
Siraha	16	29	-45
Dhanusa	17	29	-59
Mahottari	18	28	-18
Sarlahi	19	36	-39
Rautahat	20	49	-58
Bara	21	36	-46
Parsa	22	32	-15
Sindhuli	23	7	-50
Ramechhap	24	-20	-5
Dolakha	25	-15	-14
Sindhupalchok	26	-14	-6
Kavrepalanchok	27	-6	-6
Lalitpur	28	63	-4
Bhaktapur	29	92	-2
Kathmandu	30	89	-17
Nuwakot	31	-11	-17
Rasuwa	32	4	-2
Dhading	33	-4	-32
Makwanpur	34	19	-47
Chitawan	35	52	-248
Gorkha	36	-13	-25
Lamjung	37	-12	-5
Manang	38	-41	0
Kaski	39	58	-20
Tanahu	40	2	-52
Syangja	41	-20	-38
Parbat	42	-17	-8
Baglung	43	-7	-6
Myagdi	44	-6	-2
Mustang	45	-4	-1
Nawalparasi East	46	39	-45

District	Number	% pop. change 01 - 21	Net cropland change
Palpa	47	-15	-2
Nawalparasi West	48	-9	-13
Rupandehi	49	58	-80
Kapilbastu	50	42	-67
Arghakhanchi	51	-15	-3
Gulmi	52	-17	-28
Rukum East	53	18	-2
Rolpa	54	12	-3
Pyuthan	55	9	-19
Dang	56	46	-96
Banke	57	56	-100
Bardiya	58	20	-139
Rukum West	59	19	-4
Salyan	60	12	-11
Surkhet	61	44	-23
Jajarkot	62	40	-11
Dailekh	63	12	-4
Dolpa	64	45	0
Jumla	65	32	0
Kalikot	66	38	-2
Mugu	67	47	0
Humla	68	36	-1
Bajhang	69	13	-4
Bajura	70	27	-1
Achham	71	-1	-8
Doti	72	-1	-13
Kailali	73	47	-126
Kanchanpur	74	36	-42
Dadeldhura	75	11	-1
Baitadi	76	3	-4
Darchula	77	9	-14