Supplementary Materials

Land Use/Land Cover Changes and Their Driving Factors in the Northeastern Tibetan Plateau Based on Geographical Detectors and Google Earth Engine: A Case Study in Gannan Prefecture

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Table S1. Images comprising each study year and the previous and subsequent years composite.

Satellite	Years	Paths	Rows	No. of Images
Landsat 5 TM	1999-2001	129-132	35-37	121
Landsat 5 TM	2008-2010	129-132	35-37	148
Landsat 8 OLI	2017-2019	129-132	35-37	150

Table S2. Definition of land use classes of classification scheme adopted in this study.

This study	Value	Description
Farmland	1	At least 60% of area is cultivated cropland.
Grassland	2	Dominated by herbaceous annuals (<2 m).
Forest land	3	Dominated by trees (canopy>2 m). Tree cover >60%.
Water area	4	Rivers, lakes, permanent snow and ice
Wetland	5	Marshland, swampland and beach
Construction land	6	At least 30% impervious surface area including urban, residential area, traffic land, industrial and mining land.
Unused land	7	Sandy, saline, bare and desert.

We collected more than 1323 reference points in 2000, 2009, and 2018, covering seven LULC types (Figure S1).

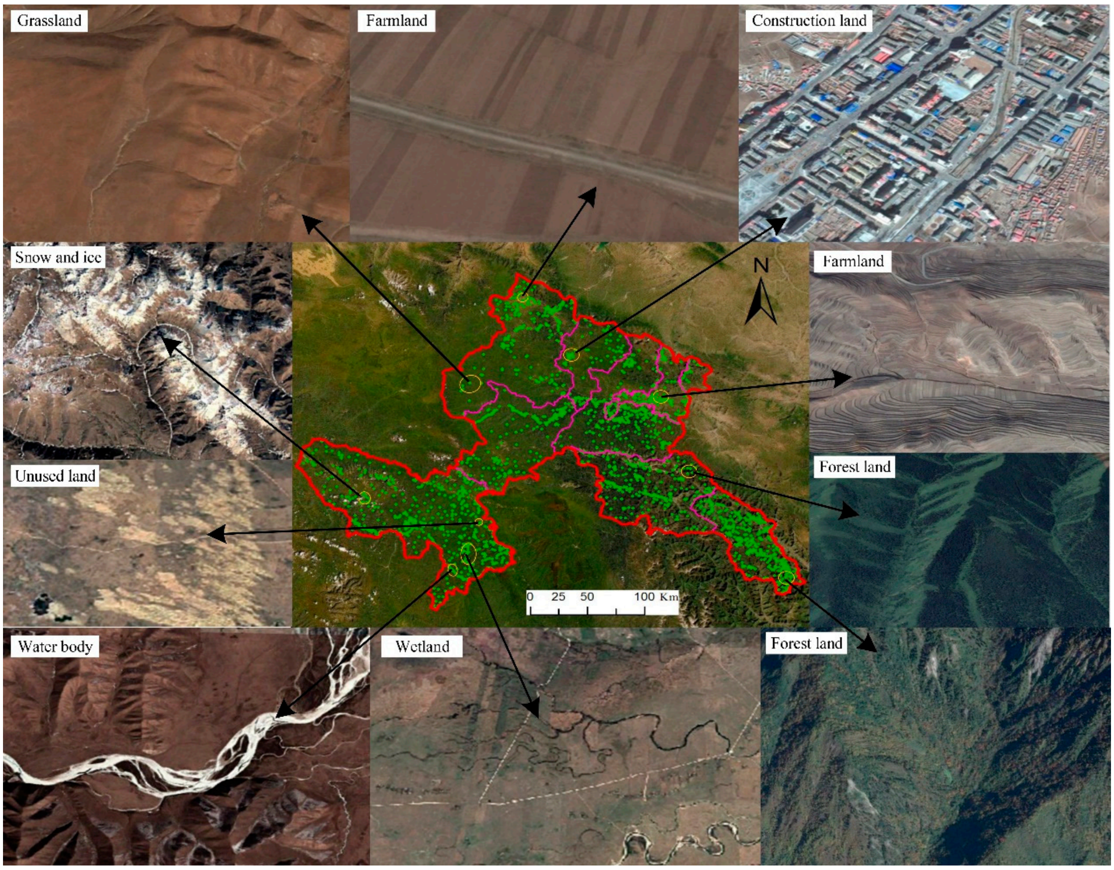

Figure S1. Map of the reference training and validation data of Gannan Prefecture collected using Google Earth high spatial resolution imagery

Text S1 JavaScript code used within GEE for image classification, including data filtering, cloud masking, and mosaicking, RF classification, and accuracy assessment. The following is the classification code for 2009.

Load a study area data

```
var bsjCol = GN.filterBounds(GN.geometry());
var outline = ee.Image().toByte().paint({featureCollection:bsjCol, color:0, width:3});
Map.centerObject(GN, 8);
// Apply cloud mask function
function rmCloud(image) {
  var scored = ee.Algorithms.Landsat.simpleCloudScore(image);
  return image.updateMask(scored.select(['cloud']).lt(30));}
//Data filtering
var imgCol2009 = L5.filterDate("2008-05-01","2008-10-30")
                .merge(L5.filterDate("2009-05-01","2009-9-1"))
                .merge(L5.filterDate("2010-05-01","2010-9-1"))
                .filterBounds(GN)
                .sort('CLOUD_COVER', true)
                .map(rmCloud);
//Generating the indices NDVI, NDBI, and MNDWI.
// adding NDVI
var addNDNI = function(image) {
  var ndvi = ee.Image(image).normalizedDifference(['B4', 'B3']).rename('NDVI');
  return ee.Image(image).addBands(ndvi);};
// adding MNDWI
```

```
var addMNDWI = function(image) {
  var mndwi = ee.Image(image).normalizedDifference(['B2', 'B5']).rename('MNDWI');
  return ee.Image(image).addBands(mndwi);};
// adding NDBI
var addNDBI = function(image) {
  var ndbi = ee.Image(image).normalizedDifference(['B5', 'B4']).rename('NDBI');
  return ee.Image(image).addBands(ndbi);};
//add NDVI、NDWI、MNDWI、NDBI
var Image2009 = imgCol2009.map(addNDNI)
                          .map(addMNDWI)
                          .map(addNDBI);
// Create the dem, elevation and slope
var srtm = ee.Image("USGS/SRTMGL1_003");
var dem = ee.Algorithms.Terrain(srtm);
var elevation = dem.select("elevation");
var slope = dem.select("slope");
var bands = [
  "B1", "B2", "B3", "B4", "B5", "B6", "B7",
  "NDVI", "NDBI","MNDWI", "SLOPE", "ELEVATION"];
var Gn2009 = Image2009.median()
                      .addBands(elevation.rename("ELEVATION"))
                      .addBands(slope.rename("SLOPE"))
                      .clip(GN);
//land use classes of classification scheme
//Farmland:1; Grassland:2; forest:3; water:4; wetland:5; build:6; unused land:7
//Load training data
var sampleData = ee.FeatureCollection("users/chenliliu18/2009TrainPoint");
//Divide the training into Training (70%) and Testing (30%) sample
sampleData = sampleData.randomColumn('random');
var sample_training = sampleData.filter(ee.Filter.lte("random", 0.7));
var sample_validate = sampleData.filter(ee.Filter.gt("random", 0.7));
//Training (70%) sample
var training = Gn2009.sampleRegions({
  collection: sample_training,
  properties: ["type"],
  scale: 30 });
//Testing (30%) sample
var validation2009 = Gn2009.sampleRegions({
  collection: sample_validate,
  properties: ["type"],
  scale: 30
});
//RF classification
// Train a RF classifier with default parameters.
var trained2009 = ee.Classifier.smileRandomForest(500).train({
  features: training,
  classProperty: "type",
  inputProperties: bands
});
//Classify the image with the same bands used for training.
var Gnclassified2009 = Gn2009.classify(trained2009);
Map.addLayer(Gnclassified2009.randomVisualizer(), {}, 'GNLUCC2009');
Map.addLayer(outline, {palette: "ff0000"}, "outline");
```

```
// Accuracy assessment
var validation = validation2009.classify(trained2009);
var errorMatrix2009 = validation.errorMatrix('type', 'classification');
var validated = validation.classify(trained2009);
// Transition matrix
var trainAccuracy = validated.errorMatrix("type", "classification");
print('consumersAccuracy',trainAccuracy.consumersAccuracy());
print('producersAccuracy',trainAccuracy.producersAccuracy());
print('kappa',trainAccuracy.kappa());
print('accuracy',trainAccuracy.accuracy());
// Export the classified image Accuracy
Export.table.toDrive({
  collection: ee.FeatureCollection([
    ee.Feature(null, {
      matrix: trainAccuracy.array(),
      kappa: trainAccuracy.kappa(),
      accuracy: trainAccuracy.accuracy()
    }
  )]),
  description: "2009TrainConf",
  folder:"training01",
  fileFormat: "CSV"
});
// Post-classification processing
var smooth_map = Gnclassified2009.focal_mode({radius: 10, kernelType: 'octagon', units: 'pixels',
                   iterations: 1})
                   .mask(Gnclassified2009.gte(0));
var crude_Gnclassified2009_removal = Gnclassified2009
                    .updateMask(Gnclassified2009.connectedPixelCount(80, false).gte(80))
                    .unmask(smooth_map);
//Export the classified image
Export.image.toDrive({
  image: crude_Gnclassified2009_removal,
  description: 'GnLUCC2009',
  scale: 30,
  region:GN.geometry(),
  maxPixels:1e11});
```