

Spatial resolution of Normalized Difference Vegetation Index and greenness exposure misclassification in an urban cohort

Raquel B. Jimenez^{a*}, Kevin J. Lane^a, Lucy R. Hutyra^b, and M. Patricia Fabian^a

Supplementary Information

^a Department of Environmental Health, School of Public Health, Boston University, 715 Albany St, Boston, Massachusetts 02118. United States of America

^b Department of Earth and Environment, Boston University, 685 Commonwealth Avenue, Boston, Massachusetts 02215. United States of America

Contact:

* Corresponding author: raque@bu.edu

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1. Google Earth Engine script

```
//Author: Raquel B. Jimenez  
//Contact: raque@bu.edu  
//Date: 20200107
```

```
//This script calculates greenest pixel composites for Sentinel-2, Landsat 8, and MODIS data; and a mosaic for  
NAIP imagery using imagery for the summer season of 2016.
```

```
//NOTE: ROI is a feature collection with the outline of the study area. Import prior running code
```

```
//1. SENTINEL-2
```

```
//1.1. Create function to mask clouds and import image collection
```

```
// Function to mask clouds
```

```
function maskS2clouds(image) {  
  var qa = image.select('QA60');
```

```
  var cloudBitMask = 1 << 10;
```

```
  var cirrusBitMask = 1 << 11;
```

```
  // Zero indicates clear conditions
```

```
  var mask = qa.bitwiseAnd(cloudBitMask).eq(0).and(  
    qa.bitwiseAnd(cirrusBitMask).eq(0));
```

```
  //Return masked and scaled data
```

```
  return image.updateMask(mask)  
    .divide(10000)  
    .select("B.*")  
    .copyProperties(image, ["system:time_start"]);
```

```
// Import collection
```

```
var S2 = ee.ImageCollection('COPERNICUS/S2')  
  .filterBounds(ROI)  
  .filterDate('2016-07-01', '2016-08-05')  
  .filter(ee.Filter.lt('CLOUDY_PIXEL_PERCENTAGE', 10))  
  .map(maskS2clouds);
```

```
//1.2. Map function over collection
```

```
var addNDVI = function(image) {  
  var ndvi = image.normalizedDifference(['B8', 'B4']).rename('NDVI');  
  return image.addBands(ndvi);  
};
```

```
var S2withNDVI = S2.map(addNDVI);
```

```
// 1.3. Greenest pixel composite.
```

```
var S2_greenest = S2withNDVI.qualityMosaic('NDVI').select('NDVI').clip(ROI);
```

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```
//2. MODIS MOD13Q1
//2.1. Import image collection
var MODIS = ee.ImageCollection('MODIS/006/MOD13Q1')
    .filterBounds(ROI)
    .filterDate('2016-07-01', '2016-08-05');

//2.2. Greenest pixel composite.
var MOD_greenest_INT = MODIS.qualityMosaic('NDVI').select('NDVI').clip(ROI);
print(MOD_greenest_INT, 'MODIS Integer');

// 3. Landsat 8
// 3.1. Import L8 surface reflectance collection
var L8 = ee.ImageCollection('LANDSAT/LC08/C01/T1_SR')
    .filterBounds(ROI)
    .filterDate('2016-07-01', '2016-08-05');

// 3.2. Mask Clouds
// Function to mask clouds
function maskL8sr(image) {
  // Bits 3: shadows, 5: clouds
  var cloudShadowBitMask = (1 << 3);
  var cloudsBitMask = (1 << 5);

  // Extract QA band.
  var qa = image.select('pixel_qa');
  var mask = qa.bitwiseAnd(cloudShadowBitMask).eq(0)
    .and(qa.bitwiseAnd(cloudsBitMask).eq(0));
  return image.updateMask(mask);
}

// Map function over collection
var L8masked = L8.map(maskL8sr);

// 3.3. Add NDVI to images in collection
var addNDVI = function(image) {
  var ndvi = image.normalizedDifference(['B5', 'B4']).rename('NDVI');
  return image.addBands(ndvi);
};

var L8withNDVI = L8masked.map(addNDVI);

// 3.4. Greenest pixel summer mosaic
var L8_greenest = L8withNDVI.qualityMosaic('NDVI').select('NDVI').clip(MB);

// 4. NAIP 2016
// 4.1. Import image collection
var NAIP = ee.ImageCollection('USDA/NAIP/DOQQ')
```

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```
.filterBounds(ROI)
.filterDate('2016-07-01', '2016-08-05');

//4.2. Map function over collection
var addNDVI_NAIP = function(image) {
  var ndvi = image.normalizedDifference(['N', 'R']).rename('NDVI');
  return image.addBands(ndvi)};

var NAIPwithNDVI = NAIP.map(addNDVI_NAIP);

// 4.3. Greenest pixel summer mosaic
var NAIP_mosaic = NAIPwithNDVI.qualityMosaic('NDVI').select('NDVI').clip(ROI);

//5. Download NDVI composites
// MODIS
Export.image.toDrive({
  image: MODIS_greenest,
  description: 'MODIS',
  scale: 250,
  region: ROI,
  folder: 'Out_GEE'});

// Landsat 8
Export.image.toDrive({
  image: L8_greenest,
  description: 'L8',
  scale: 30,
  region: ROI,
  folder: 'Out_GEE'});

// Sentinel-2
Export.image.toDrive({
  image: S2_greenest,
  description: 'S2',
  scale: 10,
  region: ROI,
  folder: 'Out_GEE'});

// NAIP
Export.image.toDrive({
  image: NAIP_mosaic,
  description: 'NAIP',
  scale: 1,
  region: ROI,
  folder: 'Out_GEE'}
```

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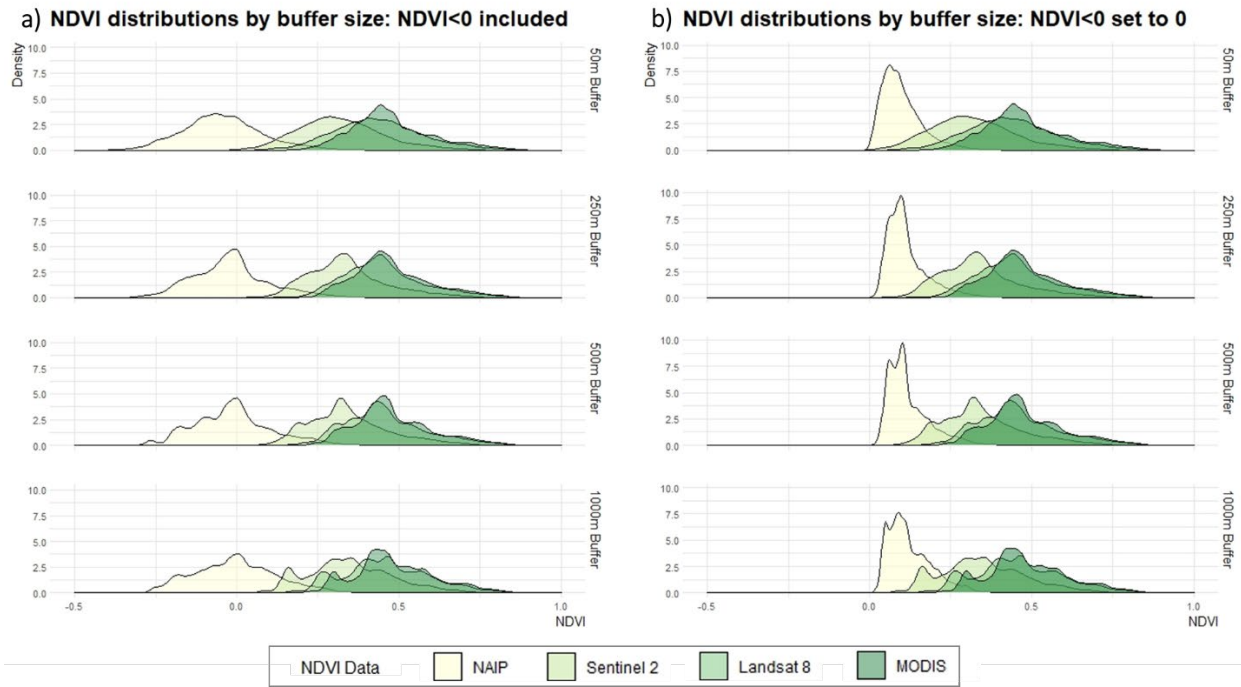


Figure SI.1. Comparison of greenness exposure distributions across buffers when different approaches for treating pixels with negative NDVI values. The panel on the left (a) shows distributions of exposure estimates where negative NDVI values were included in calculations, while the panel of the right (b) shows distributions of exposure estimates where pixels with negative NDVI have been set to zero.

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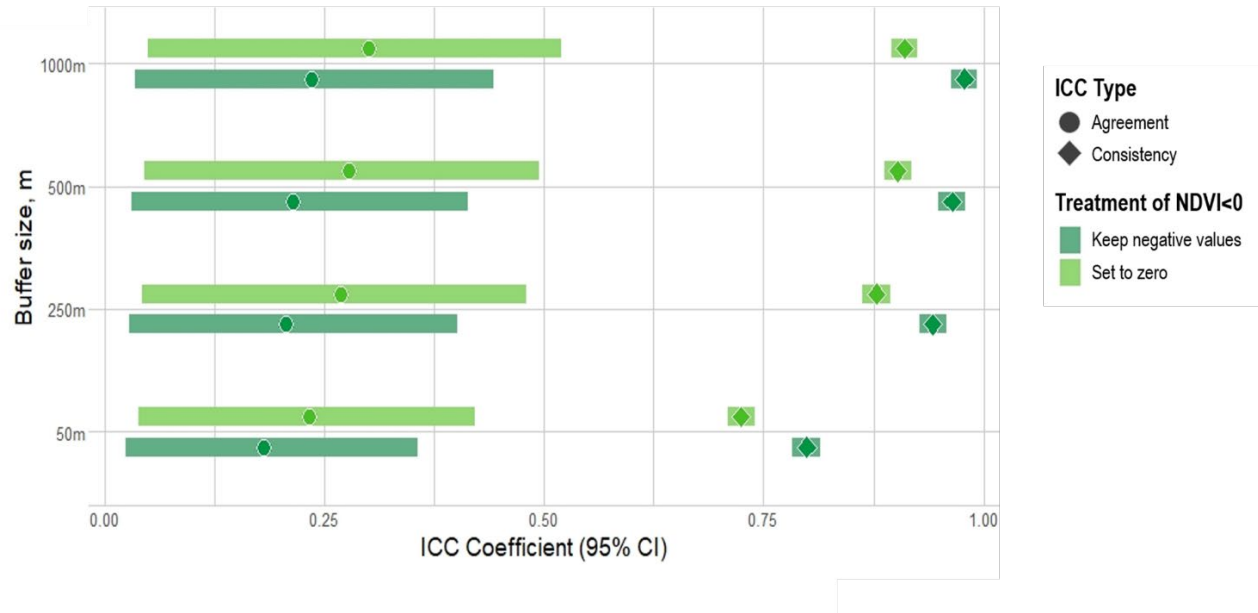


Figure SI.2. Comparison of agreement and consistency in continuous exposure estimates derived keeping pixels with negative NDVI values versus setting pixels with negative NDVI values to zero prior to aggregation.

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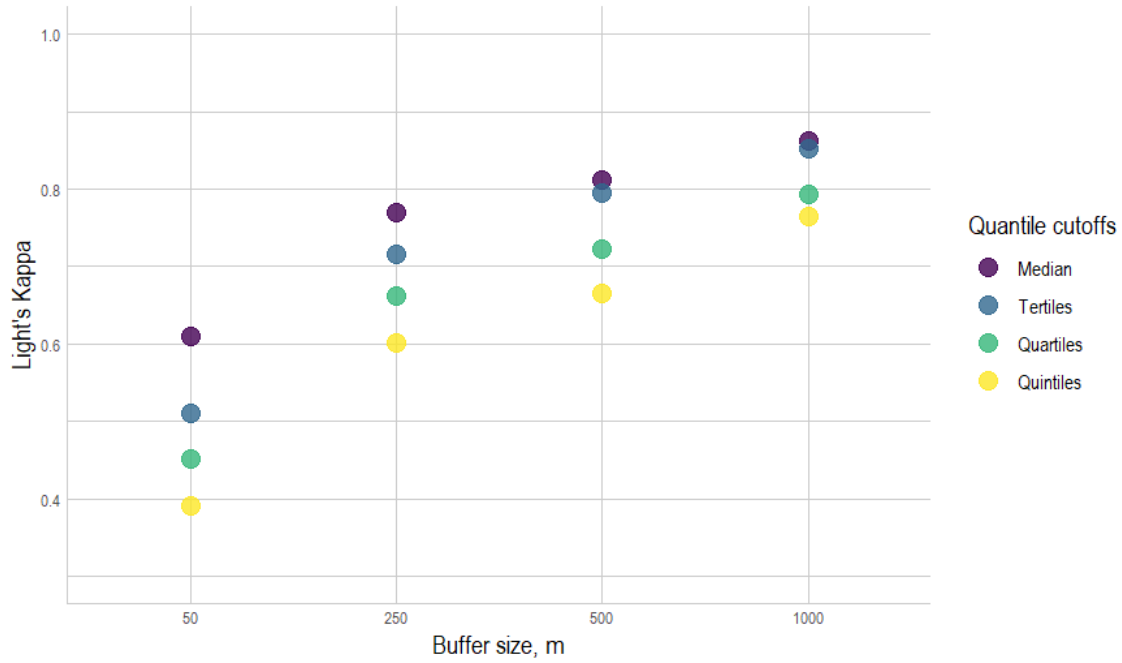


Figure SI.3. Agreement in greenness quantiles from NAIP, Sentinel-2, Landsat 8, and MODIS across buffer size, quantified using Light's κ . Greenness exposure estimates calculated setting pixels with negative NDVI values to zero prior aggregation in buffers.

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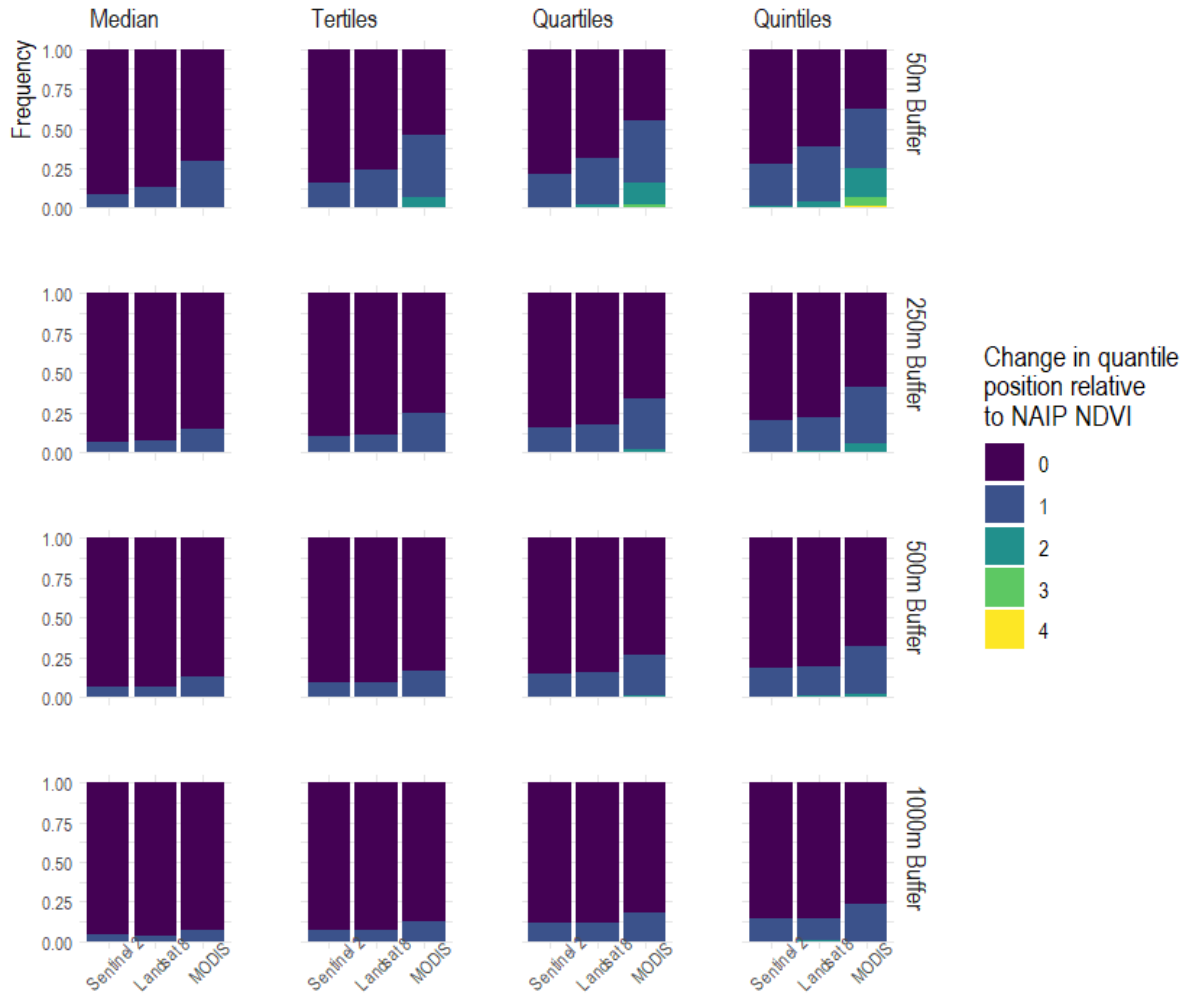


Figure SI.4. Greenness exposure misclassification relative to NAIP data across buffer size and exposure quantiles. This plot series shows the proportion of participants that shift positions in the categorical distribution of greenness exposure derived from Sentinel-2, Landsat 8, and MODIS data in relation to NAIP data. Exposure estimates were calculated setting to zero negative NDVI values prior aggregation in buffers. Plots are organized by buffer size in rows and number of classes of categorical variables in columns. The color legend indicates the magnitude of change in quantile positions relative to NAIP NDVI.