i-Tree Eco Batch Run for Colombia in 2016

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1. Introduction

i-Tree Eco was run for each of secondary partitions (counties) in Europe using 2015 data to quantify ecosystem services provided by trees, which include:

1. Minimum, average, and maximum of annual air pollutant (CO, NO_2, O_3, PM_{10*}, $PM_{2.5}$, and SO_2) removals (metric tons/year).
2. Monetary value (US dollars/year) associated with air pollutant removal (externality values for CO and PM_{10*}, BenMAP health effects for NO_2, O_3, $PM_{2.5}$, and SO_2).
3. Hydrologic parameters
   a. Transpiration (m^3/year)
   b. Evaporation (m^3/year)
   c. Rainfall Interception (m^3/year)
   d. Avoided Runoff (m^3/year)

To calculate these, tree cover (%), evergreen (%), maximum leaf area index (LAI) in the growing season, impervious cover (%) for each secondary partition, as well as hourly surface weather, upper air (height and temperature), and air pollutant concentration data measured within or at the closest monitor station were employed. This document presents maps showing these parameters and measuring locations, as well as the source for these data. The complete list of the metadata is provided in the associated file.

2. Data Employed

2.1. Land Cover

Dominant Leaf Type (DLB) 2015 data from Copernicus (Copernicus Europe's eyes on Earth 2022) was employed to calculate tree cover percent for each of the secondary partitions (Fig. 1). Evergreen percent was calculated based on the area ratio between “coniferous” and “coniferous” + “broadleaved” leaf types for the secondary partitions (Fig. 2).

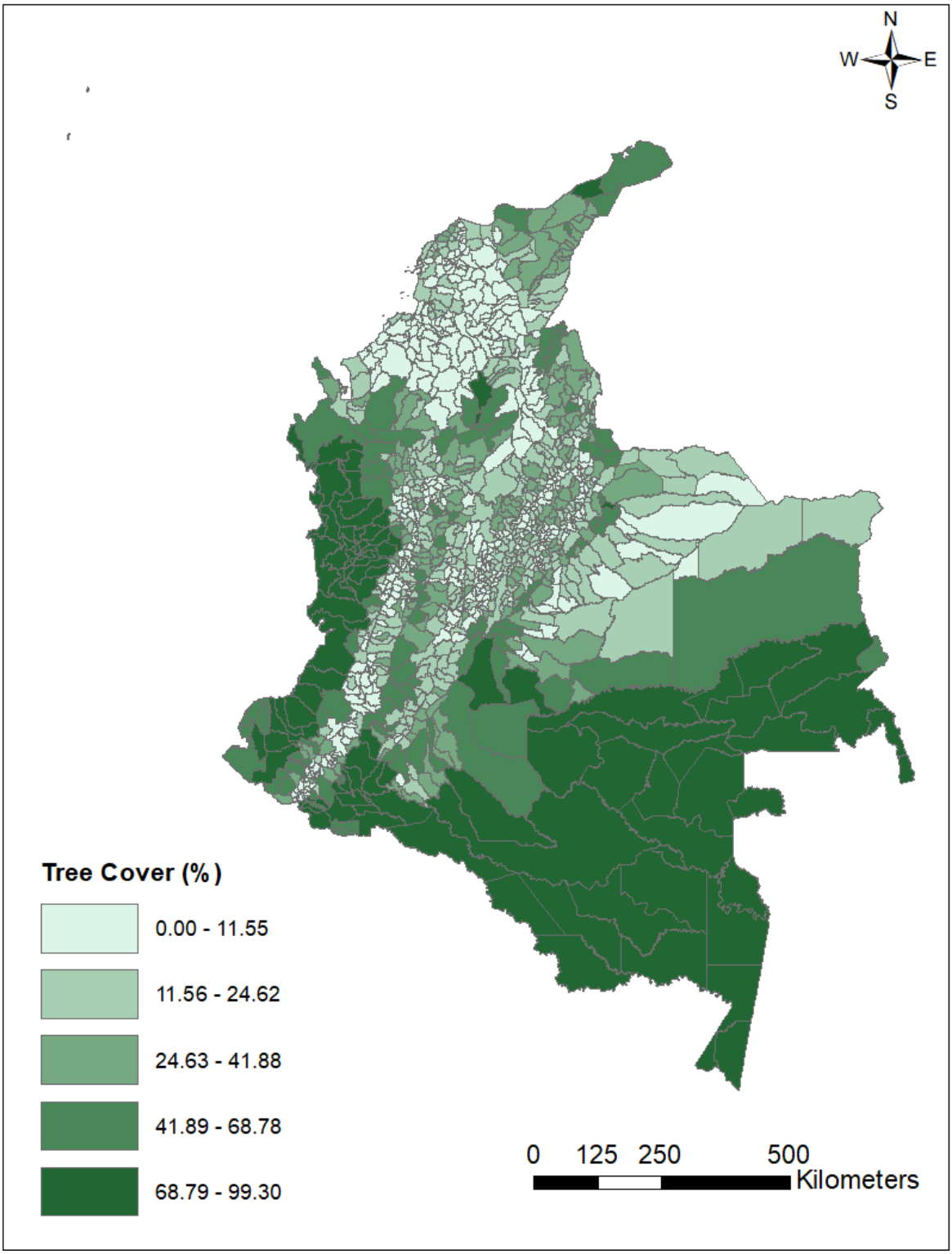

Figure 1 Tree cover percent

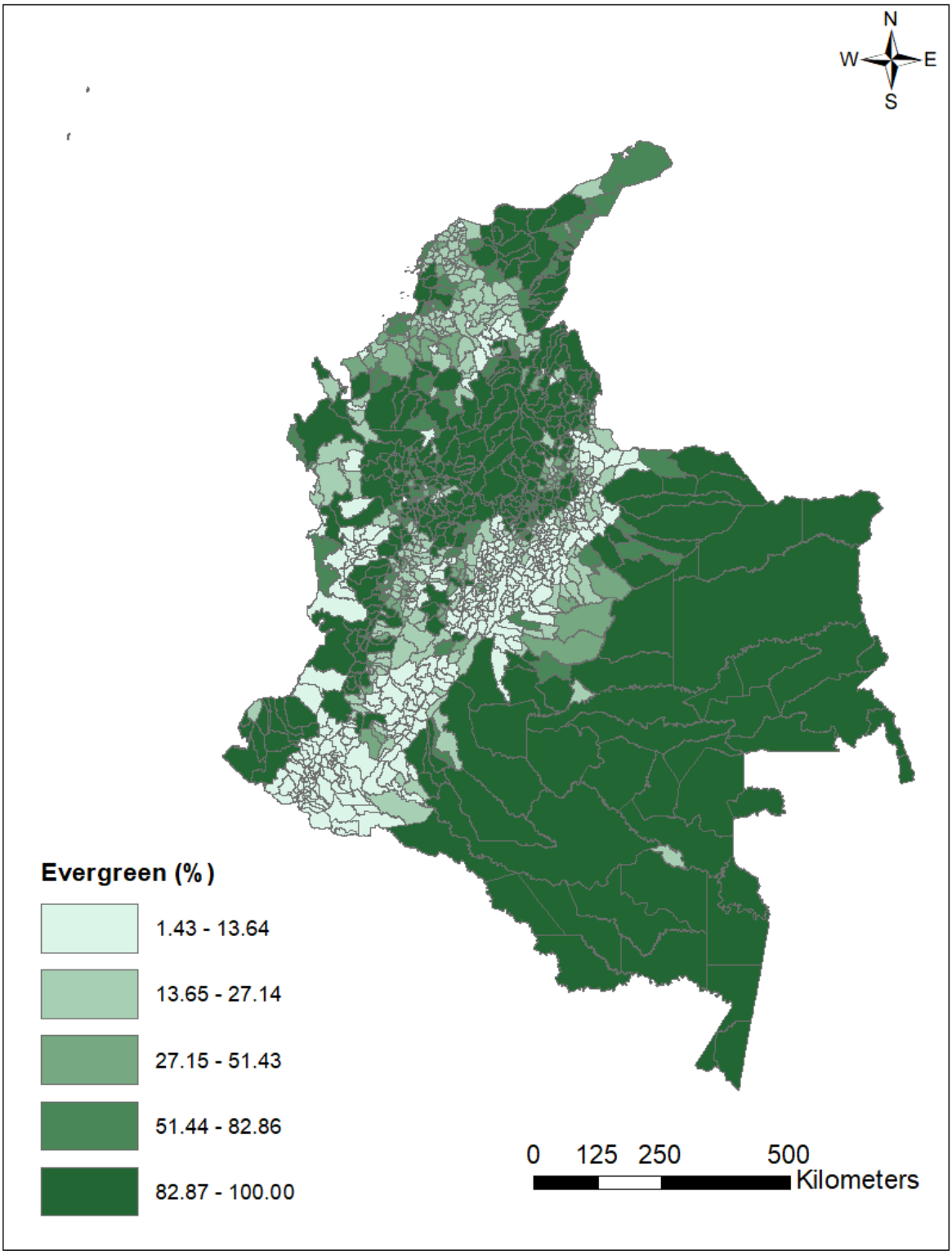

Figure 2 Evergreen percent

Maximum (mid-summer) leaf area index (LAI: m^2 leaf area per m^2 projected ground area of canopy) values for each secondary partition (Fig. 4) were derived from the level-4 MODIS/Terra global Leaf Area Index product (NASA 2022) for the growing season. The year 2015 was used.

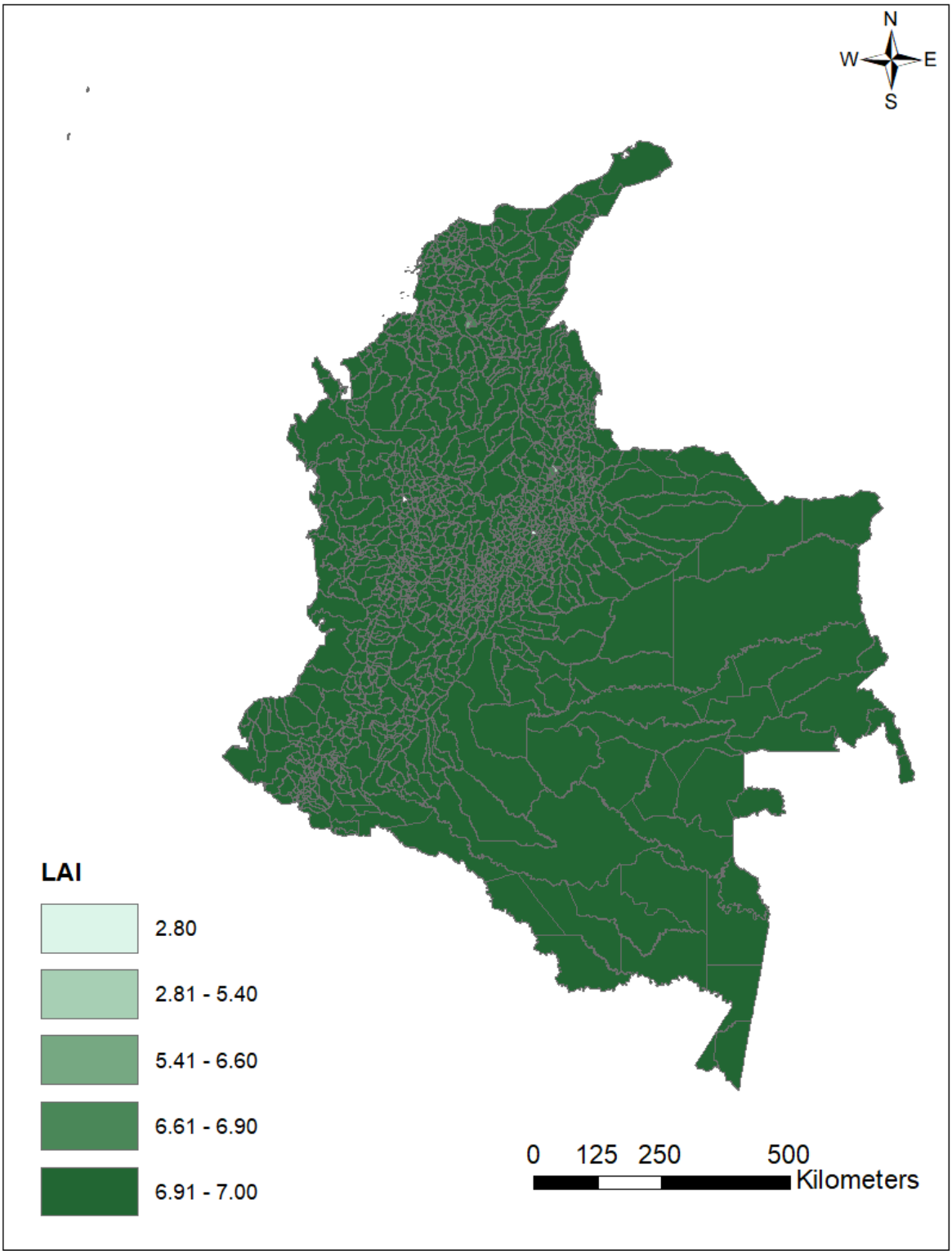

Figure 3 Leaf Area Index

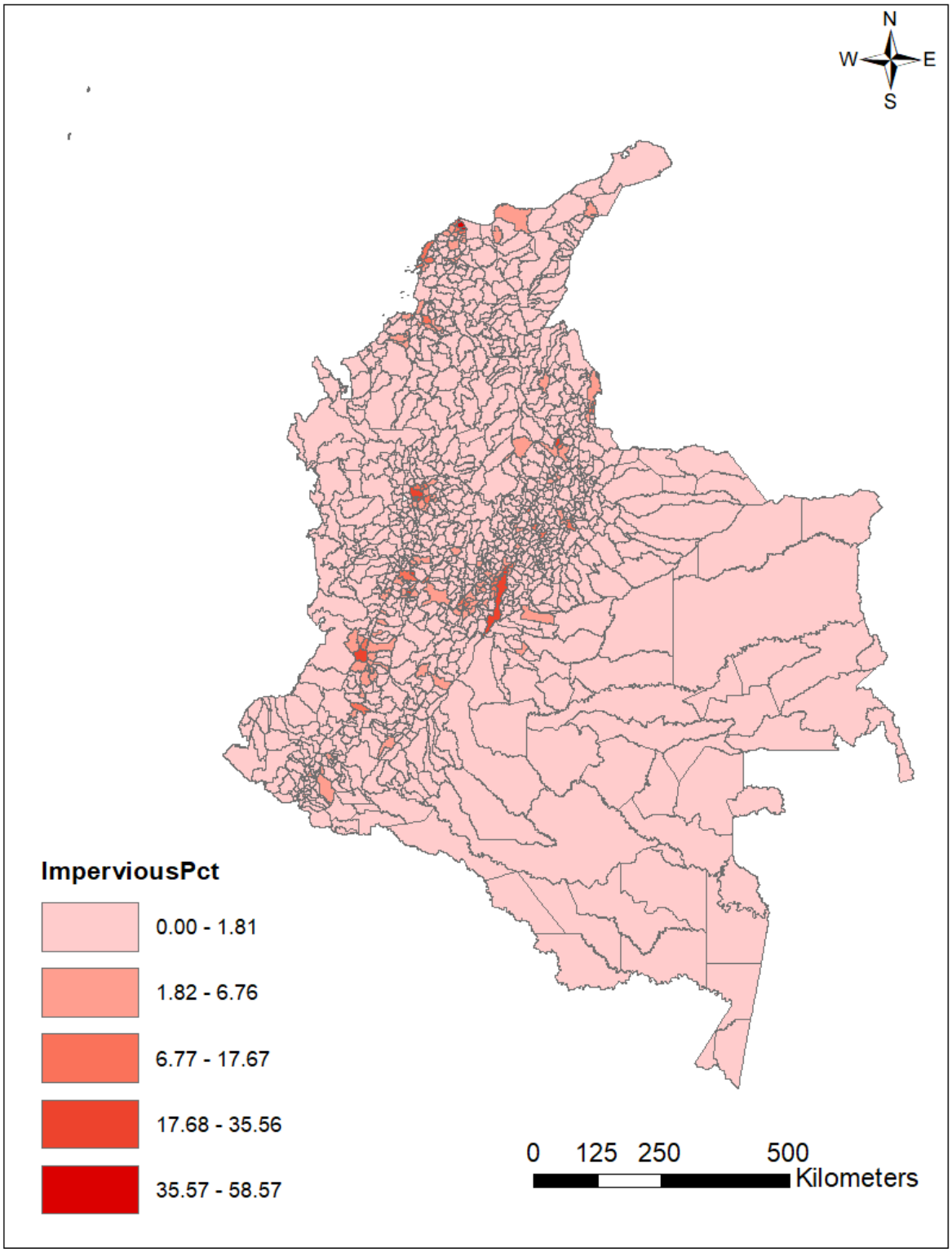
N
W
E
S
ImperviousPct
0.00 - 1.81
1.82 - 6.76
6.77 - 17.67
17.68 - 35.56
35.57 - 58.57
0 125 250 500
Kilometers

Figure 4

2.2. Monitoring Stations

1.1.1. Surface Weather Stations

Hourly surface weather data for 2015 were employed from National Centers for Environmental Information (NCEI) of National Oceanic and Atmospheric Administration (NOAA) (National Centers for Environmental Information (NCEI) 2022). Measurements at the station closest to the centroid of each secondary partition were used. The station names and locations were presented in Fig. 4.

Figure 5 Surface weather stations

1.1.2. Precipitation

The NCEI surface weather data in Europe generally lack hourly precipitation data (PCP01). To complement this, Global Precipitation Measurement (GPM) The Integrated MultisatellitE Retrievals for GPM (IMERG) Final Precipitation L3 Half Hourly 0.1 degree × 0.1 degree V06 (GPM_3IMERGHH) (NASA 2022) was employed. Hourly precipitation data were aggregated in to hourly data and attached to the location of each NCEI weather station used in the batch process.

1.1.3. Radiosonde Stations (Upper Air)

Radiosonde data for 2015 obtained from Earth System Research Laboratory (ESRL) of NOAA (Earth System Research Laboratory (ESRL) 2022) were used. Measurements at the station closest to the centroid of each secondary partition were used. The station names and locations were presented in Fig. 5.

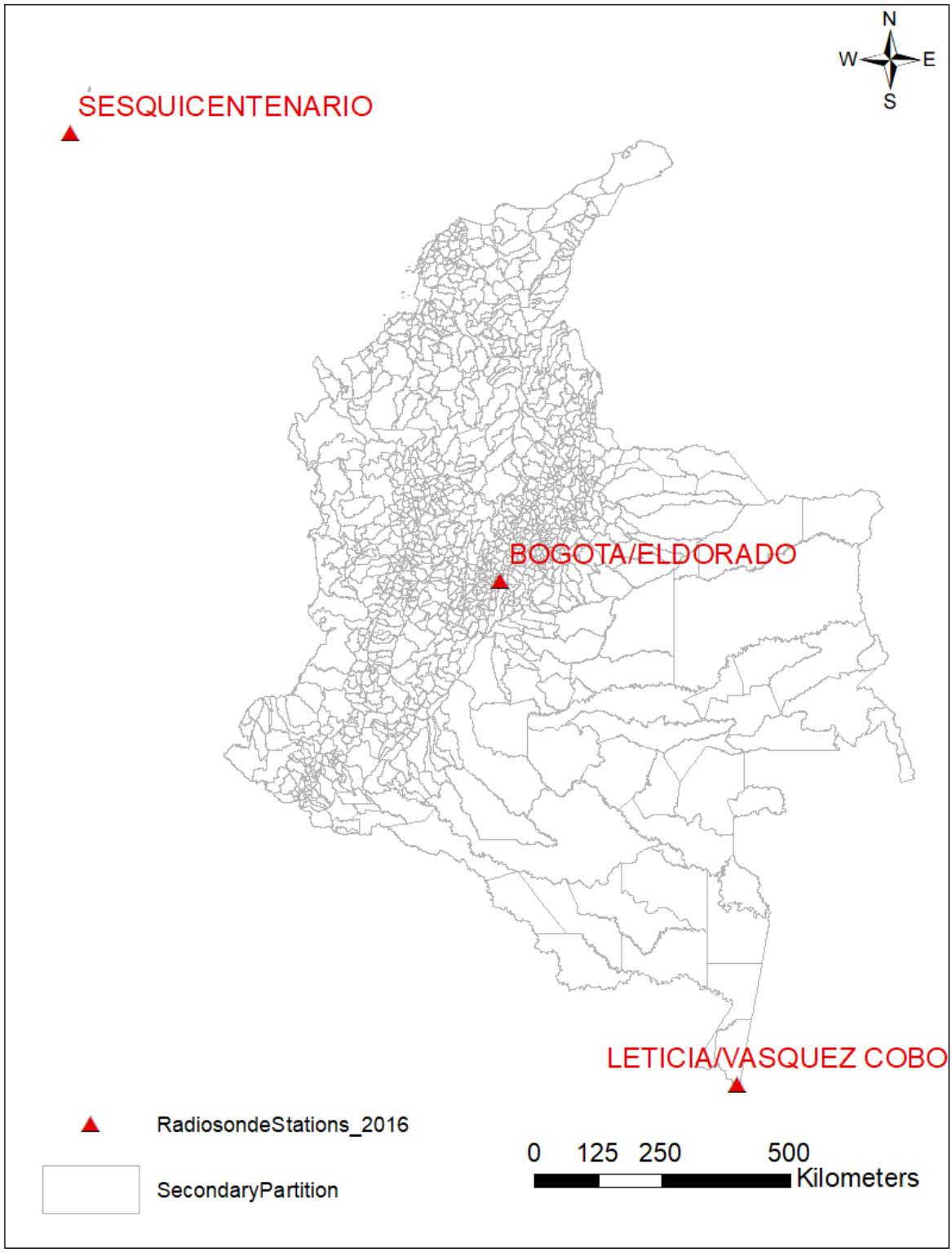

Figure 6 Radiosonde stations

1.1.4. Air pollutant monitors

CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, and SO_2 data for 2015 obtained from European Environment Agency's Air Quality e-Reporting (AQ e-Reporting) (European Environment Agency 2022) were used. When multiple monitors were located within the boundary of a secondary partition these monitor data were all used to calculate hourly air pollutant removal estimates and the average across the monitor location was taken for the yearly estimate. When only one monitor was included in a secondary partition, that monitor was used, while when no monitor was included the one closest to the centroid of the partition was used. The location and monitor ID's used in i-Tree Eco for monitors used in the batch processes were presented in Figs. 8 – 13.

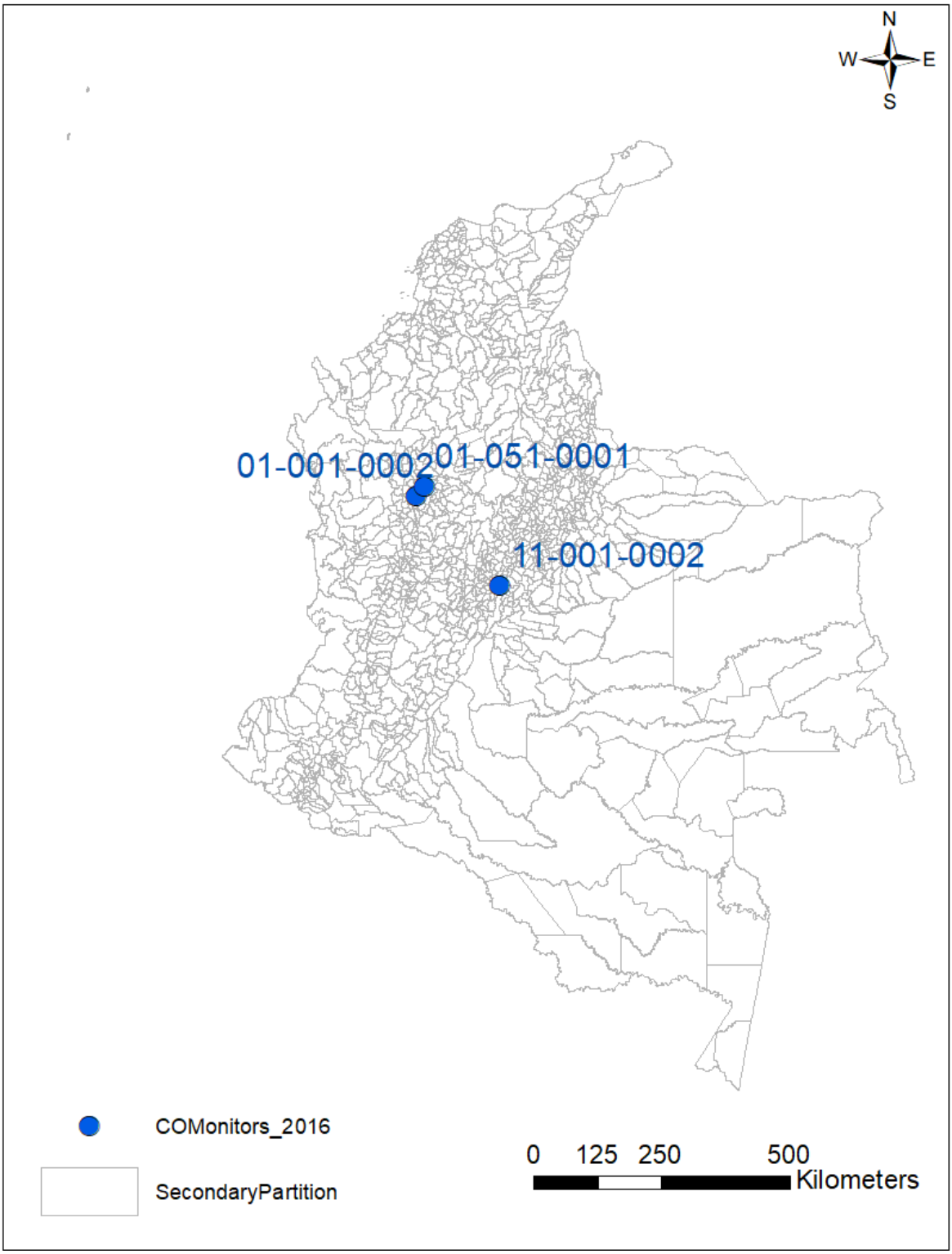

Figure 7 CO monitors

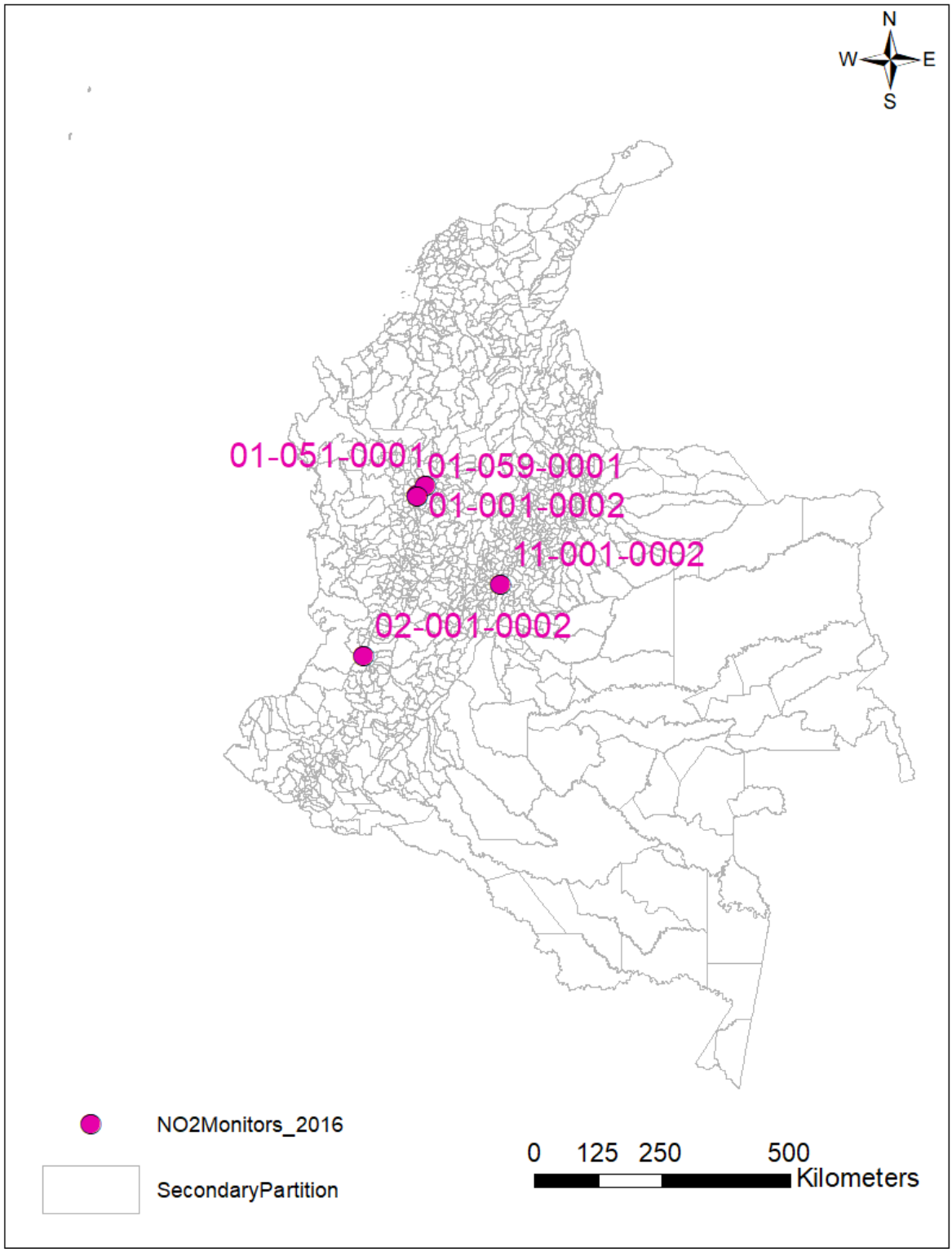

Figure 8 NO_2 monitors

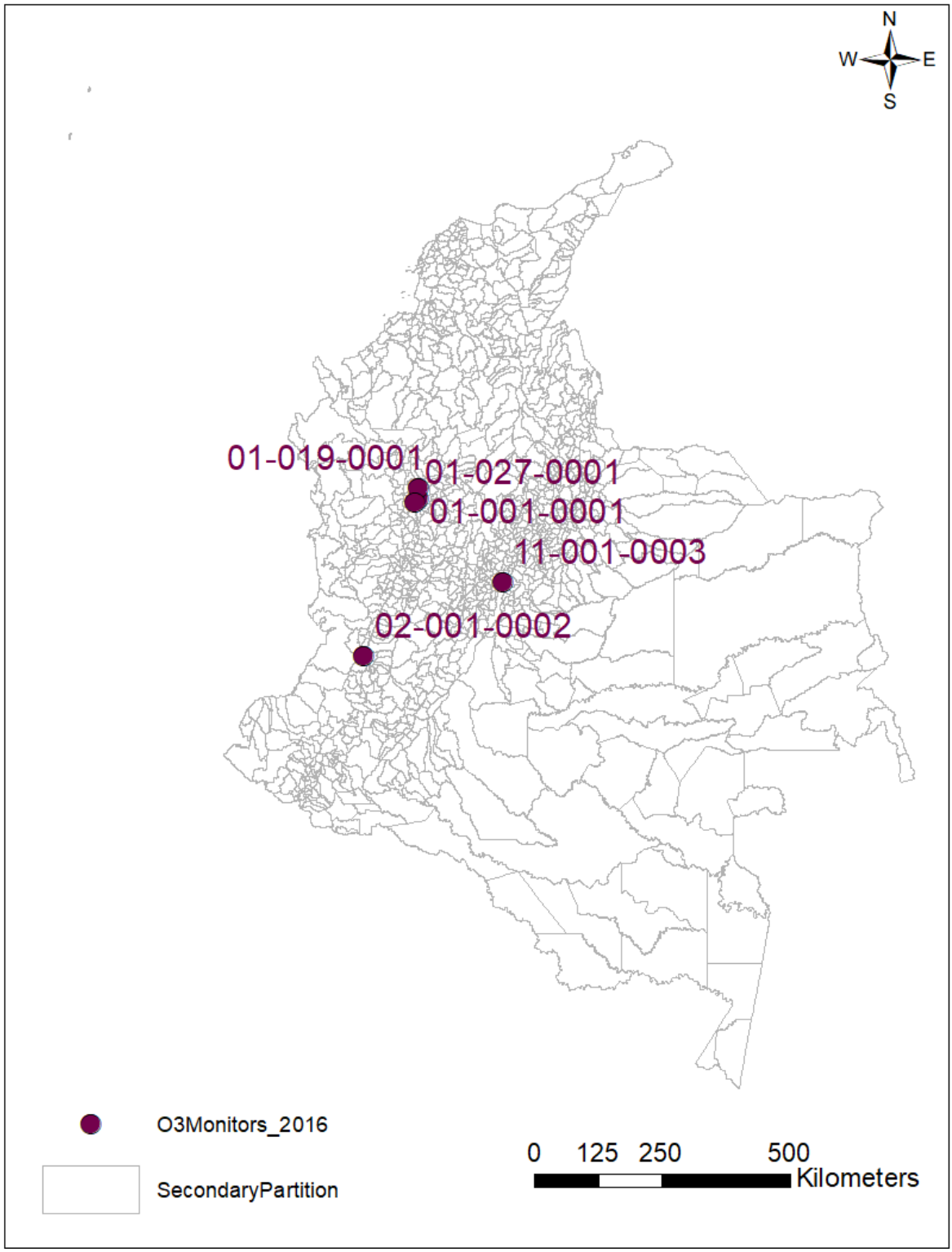

Figure 9 O_3 monitors

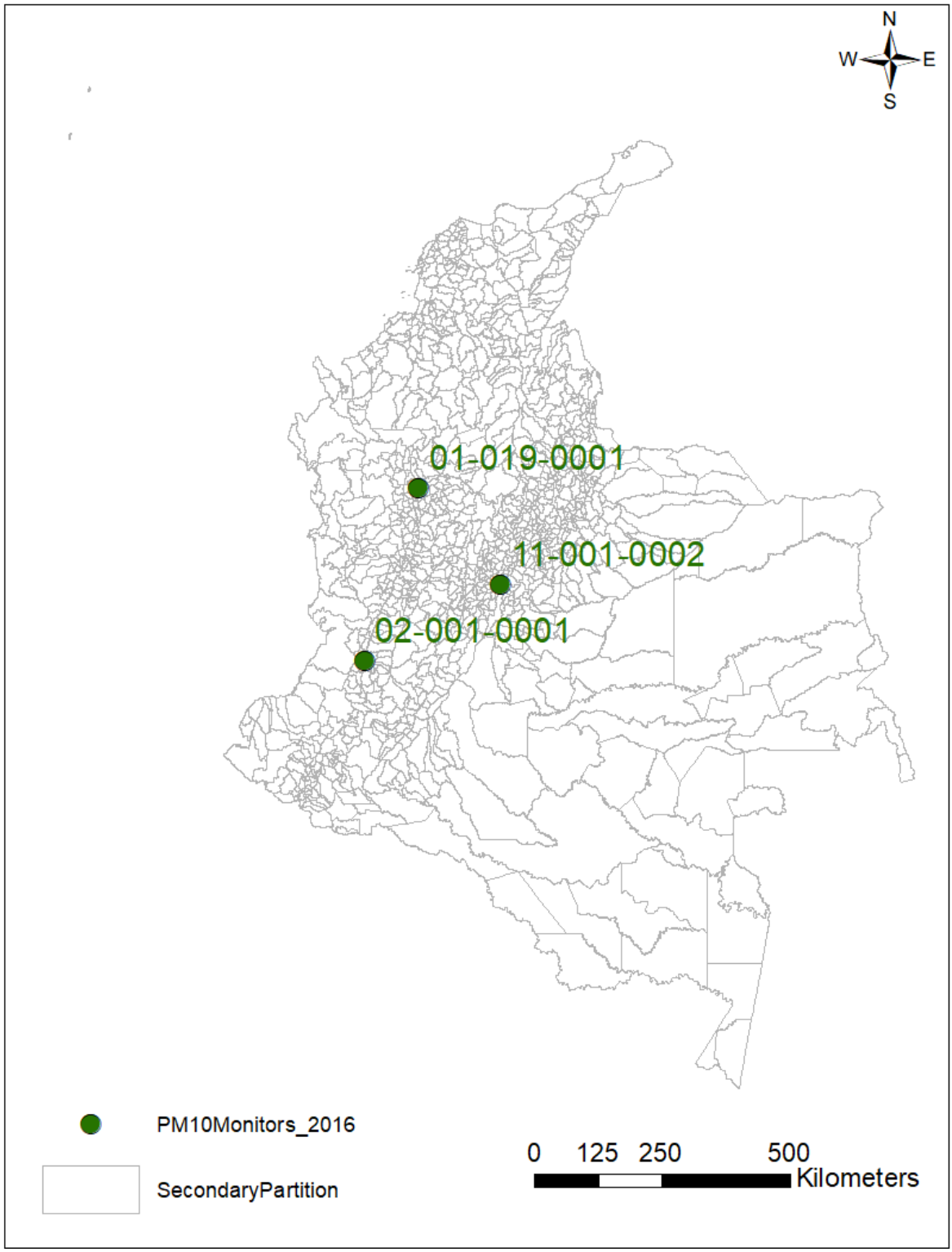

Figure 10 PM_{10} monitors

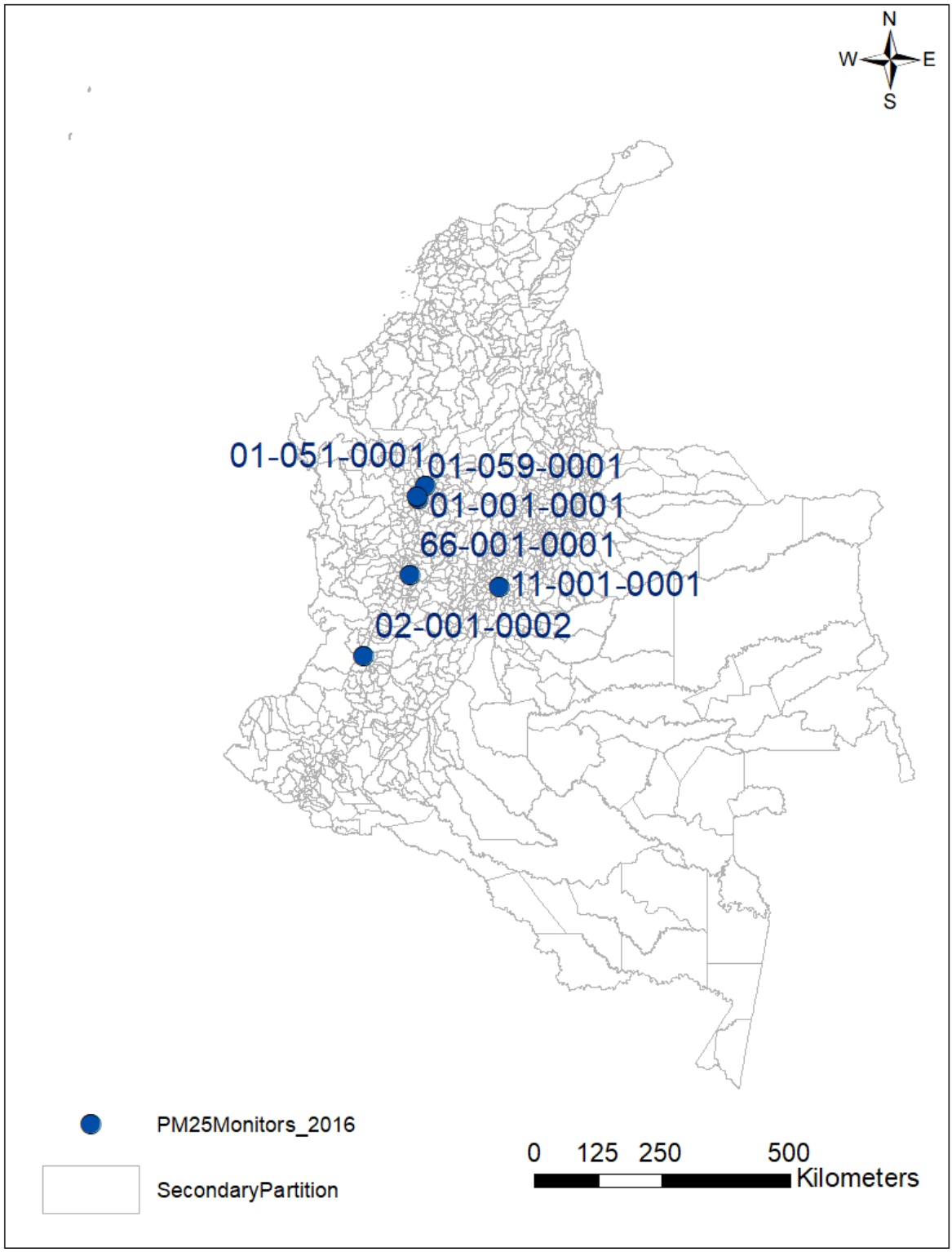

Figure 11 $PM_{2.5}$ monitors

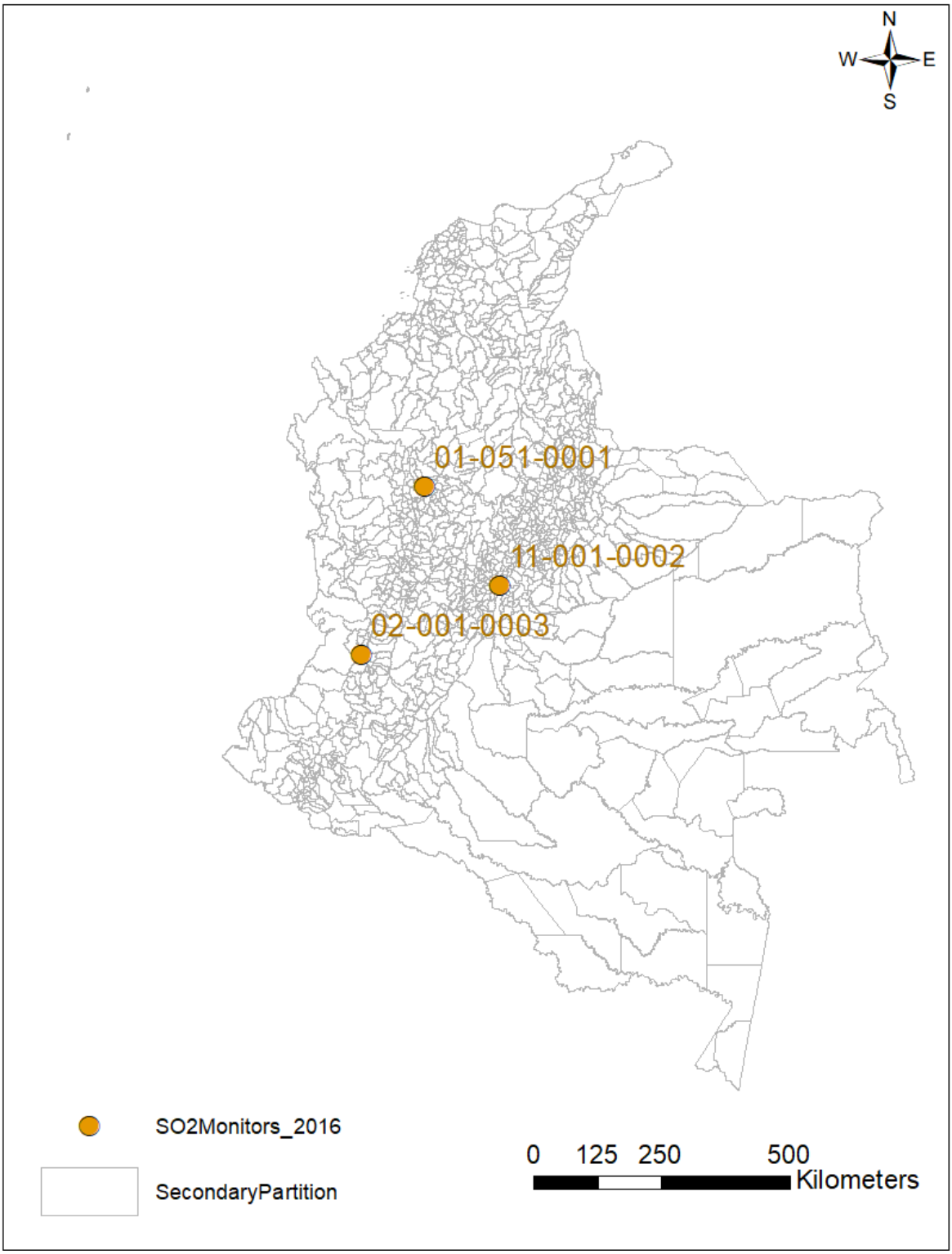

Figure 12 SO_2 monitors

3. Results

Tables 1 and 2 present examples for air pollutant removal and hydrologic parameters, respectively, estimated by batch-running i-Tree Eco for secondary partitions.

Table 1 Example of air pollutant removal results

Nation ID	Nation	Primary Partition ID	Primary Partition Name	Secondary Partition ID	Secondary Partition Name	Pollutant	Benefit Value (US$/yr)	Avg Removal Rate (t/yr)	Min Removal Rate (t/yr)	Max Removal Rate (t/yr)
229	Austria	01	Ostosterreich	011	Mittelburgenland	CO	0.7291	0.0007	0.0007	0.0007
229	Austria	01	Ostosterreich	011	Mittelburgenland	NO2	60079.2	2086.4	1177.4	2698.3
229	Austria	01	Ostosterreich	011	Mittelburgenland	O3	3395266.8	17205.4	5531.8	24015.2
229	Austria	01	Ostosterreich	011	Mittelburgenland	PM10*	26449856.1	4981.1	1945.7	7783.0
229	Austria	01	Ostosterreich	011	Mittelburgenland	PM2.5	7516033.8	1081.7	152.6	2130.3
229	Austria	01	Ostosterreich	011	Mittelburgenland	SO2	3700.2	356.8	221.3	591.9

Table 2 Example of hydrologic parameter results

Nation ID	Nation	Primary Partition ID	Primary Partition Name	Secondary Partition ID	Secondary Partition Name	Transpiration (m3/yr)	Evaporation (m3/yr)	Vegetation Interception (m3/yr)	Avoided Runoff (m3/yr)
229	Austria	01	Ostosterreich	011	Mittelburgenland	320.1	397518759.3	398140507.5	63325339.6
229	Austria	01	Ostosterreich	002	Mostviertel-Eisenwurzen	981.3	289126094.5	289282012.4	43971231.3
229	Austria	01	Ostosterreich	003	Niederosterreich-Sud	176.5	59490569.4	59676315.2	9255176.8
229	Austria	01	Ostosterreich	001	Nordburgenland	446.8	234322101.7	234561492.8	33027952.8
229	Austria	01	Ostosterreich	004	Sankt Polten	83.9	162800379.6	163027771.4	28180123.5

4. References

Copernicus Europe's eyes on Earth. 2022. *Dominant Leaf Type.* Accessed 7 8, 2022. https://land.copernicus.eu/pan-european/high-resolution-layers/forests/dominant-leaf-type.

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National Centers for Environmental Information (NCEI). 2022. Accessed 7 7, 2022. https://www1.ncdc.noaa.gov/pub/data/noaa/.