EGU General Assembly 2020
Online | 4–8 May 2020

OPERANDUM
OPEn-air laboRAtories for Nature baseD solUtions to Manage hydro-meteo risks

H2020 funded project
GA no. 776848

UCD DUBLIN

Investigating land use and land cover changes in Dublin, Ireland using Satellite Imagery: A comparative analysis

Bidroha Basu, Arunima Sarkar Basu, Srikanta Sannigrahi, and Francesco Pilla

Presented by:

Bidroha Basu
Architecture, Planning and Environmental Policy
University College Dublin
04 May 2020

Significance of the work

- **Increase** in **Hydro-meteorological** events such as **hurricanes, floods** results in exposure to population each year.
- 1998-2018, Europe experienced **2,796** **hydro-meteorological** related hazards whose overall damage including overall losses and insured losses cost reached about **$720 billion**.
- Massive deforestation, over-building of rural and coastal areas, modification of natural watersheds have made territories more prone to hazards.
- Understanding changes in **land use/land cover** is essential to mitigate effect of those natural hazards.

Observing land use/land cover change in Dublin

- Observing how the land use/land cover change occurred in inner Dublin area over the past few years.
- Observed the changes in vegetation, build up areas and water bodies.
- The changes have been observed in **summer and winter months.**

The study area considered is that of Inner Dublin area because of rapid growth and expansion of the city over the past few years.

(picture credit - https://www.viamichelin.ie)

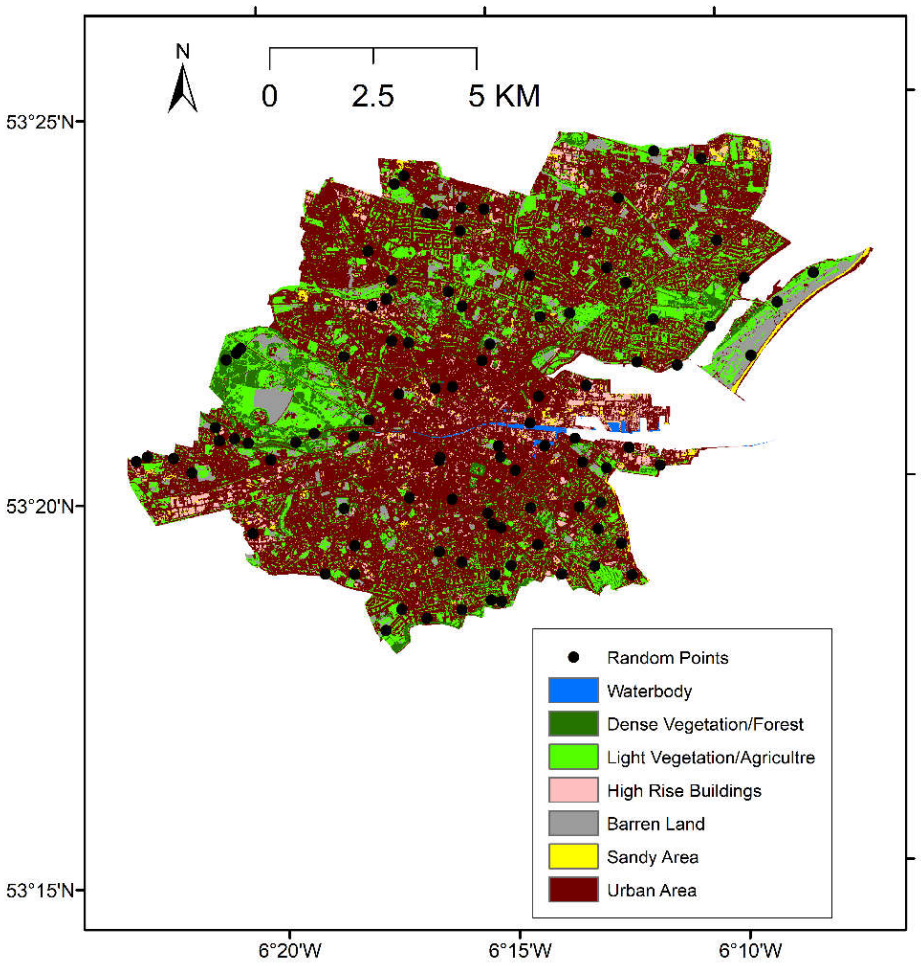
Methodology

- Inter-comparison of sentinel-2 imagery – summer 2018 and winter 2016
- Six Bands – #2 (BLUE), #3 (GREEN), #4 (RED), #8 (NIR), #11 (SWIR1) were considered
- Maximum Likelihood based Supervised classification were used to classify **seven** land use/land cover
  - Waterbody
  - Dense Vegetation/Forest
  - Light Vegetation/Agriculture
  - High Rise Buildings
  - Barren Land
  - Sandy Area
  - Urban Area

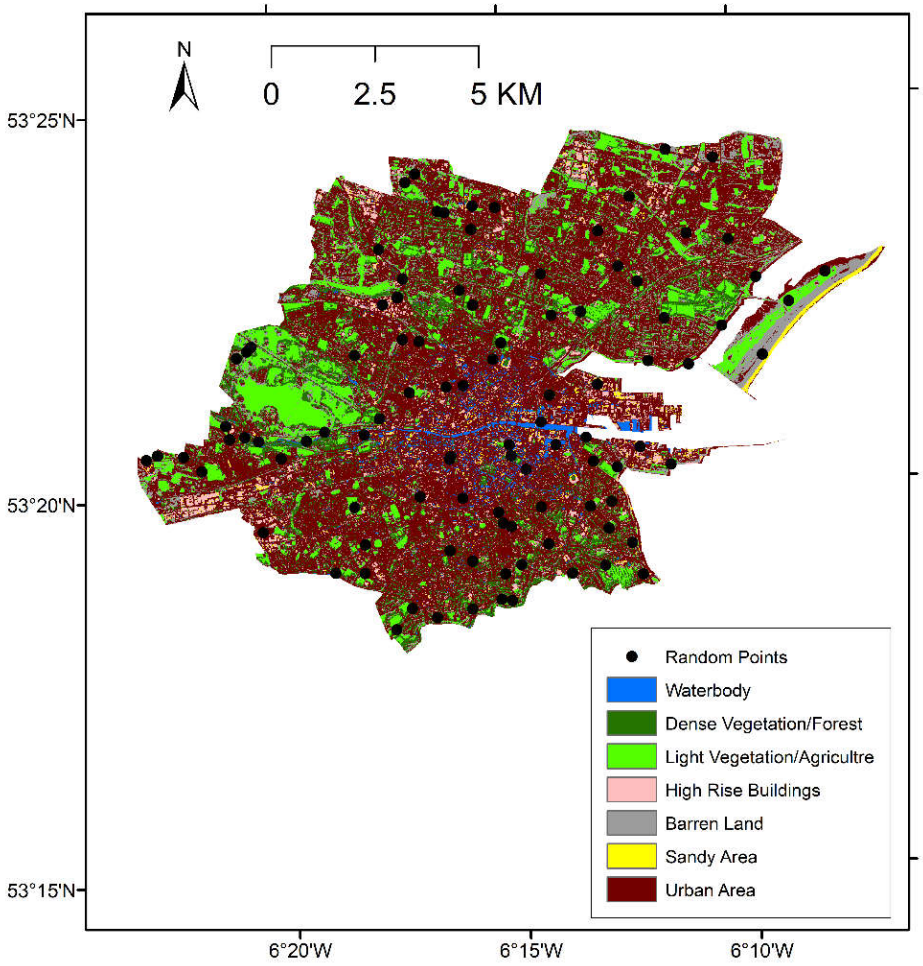
Sl	Sentinel-2 Bands	Wavelength (microm)	Resolution	Acronym
1	Band1 Coastal Aerosol	0.443 (0.43-0.45)	60	
2	Band2 Blue	0.490 (0.45-0.51)	10	BLUE
3	Band3 Green	0.560 (0.53-0.59)	10	GREEN
4	Band4 Red	0.665 (0.64-0.67)	10	RED
5	Band5 Vegetation Red	0.705	20	
6	Band6 Vegetation Red	0.740	20	
7	Band7 Vegetation Red	0.783	20	
8	Band8 NIR	0.842	10	NIR
9	Band9 Water Vapour	0.945	60	
10	Band10 SWIR Cirrus	1.375 (1.36-1.38)	60	
11	Band11 SWIR	1.610 (1.57-1.65)	20	SWIR1/MIR
12	Band12 SWIR	2.190 (2.11-2.29)	20	SWIR2

Results

2018 June 22nd Sentinel Image



2016 January 14th Sentinel Image



For accuracy assessment 100 randomly generated points were considered for ground truth using Google image obtained on 24th June 2018 and 31st December 2015, respectively.
The points were considered to be the same for both images.

Accuracy Assessment

Sentinel 2016 January Image (Overall Accuracy=81%, Cohen's Kappa=0.683)

	Waterbody	Dense Vegetation/ Forest	Light Vegetation/ Agriculture	High Rise Buildings	Barren Land	Sandy Area	Urban Area	Total	Error of Commission
Waterbody	0	0	0	0	0	0	0	0	0.000
Dense Vegetation/Forest	0	12	0	0	0	0	1	13	0.077
Light Vegetation/Agriculture	0	3	7	0	0	0	4	14	0.500
High Rise Buildings	0	0	0	2	0	0	0	2	0.000
Barren Land	0	0	0	1	8	0	3	12	0.333
Sandy Area	0	0	0	0	0	0	0	0	0.000
Urban Area	0	4	1	0	0	2	52	59	0.119
Total	0	19	8	3	8	2	60	100	
Error of Omission	0.000	0.368	0.125	0.333	0.000	1.000	0.133		

Sentinel 2018 June Image (Overall Accuracy=85%, Cohen's Kappa=0.741)

	Waterbody	Dense Vegetation/ Forest	Light Vegetation/ Agriculture	High Rise Buildings	Barren Land	Sandy Area	Urban Area	Total	Error of Commission
Waterbody	0	0	0	0	0	0	0	0	0.000
Dense Vegetation/Forest	0	5	1	0	0	0	5	11	0.545
Light Vegetation/Agriculture	0	1	15	0	0	0	2	18	0.167
High Rise Buildings	0	0	1	2	0	0	0	3	0.333
Barren Land	0	0	0	2	7	0	0	9	0.222
Sandy Area	0	0	0	0	0	0	0	0	0.000
Urban Area	0	0	3	0	0	0	56	59	0.051
Total	0	6	20	4	7	0	63	100	
Error of Omission	0.000	0.167	0.250	0.500	0.000	0.000	0.111		

$$K = \frac{\text{(Total number * Sum of Correct) - Sum of the all the (Row Total * Column total)}}{\text{(Total number Squared – Sum of the all the (Row Total * Column Total)}}$$

Changes in land use/land cover

Class No.	Class Name	2016 Jan (winter)	2018 June (summer)	Change
1	Waterbody	1.85	0.36	-1.49
2	Dense Vegetation/ Forest	12.03	6.16	-5.86
3	Light Vegetation/ Agriculture	11.85	18.46	6.60
4	High Rise Buildings	4.32	3.56	-0.76
5	Barren Land	10.85	5.65	-5.20
6	Sandy Area	1.41	1.67	0.26
7	Urban Area	**57.69**	**64.15**	**6.45**

- Decrease in waterbody in summer 2018, an uncharacteristic warm summer
- Majority of land that were barren during winter are being used for vegetation in the summer months.
- Considerable changes in densely vegetated areas through urban expansion are being noted within a period of two and half years.

Questions?