Cefas[14]
Centre for Environment Fisheries & Aquaculture Science

Clean Atlantic[13]
Interreg Atlantic Area European Regional Development Fund EUROPEAN UNION

What Is the Potential of Satellite Data in Mapping Plastic Litter Hotspots?

Lenka Fronkova[15]

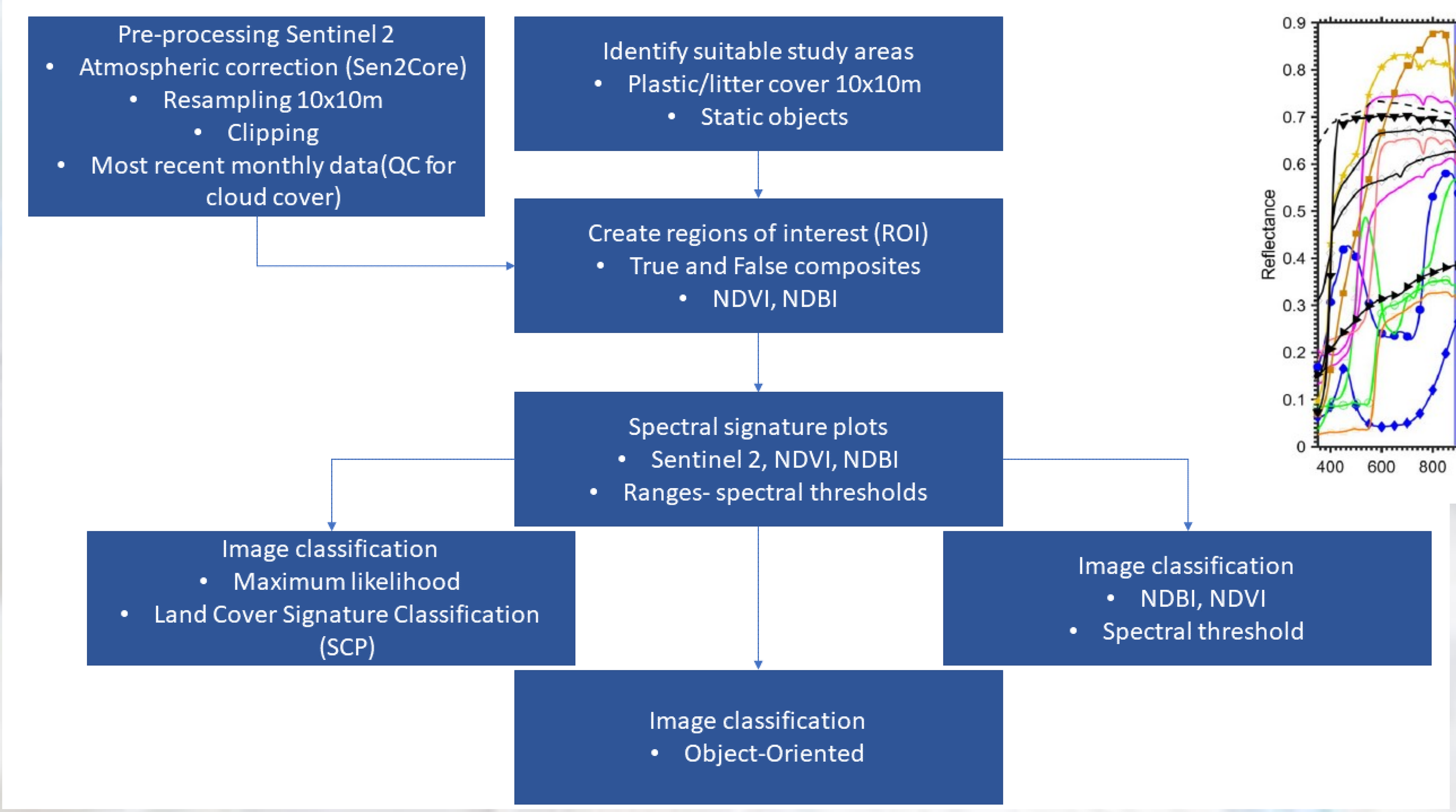
METHODOLOGY

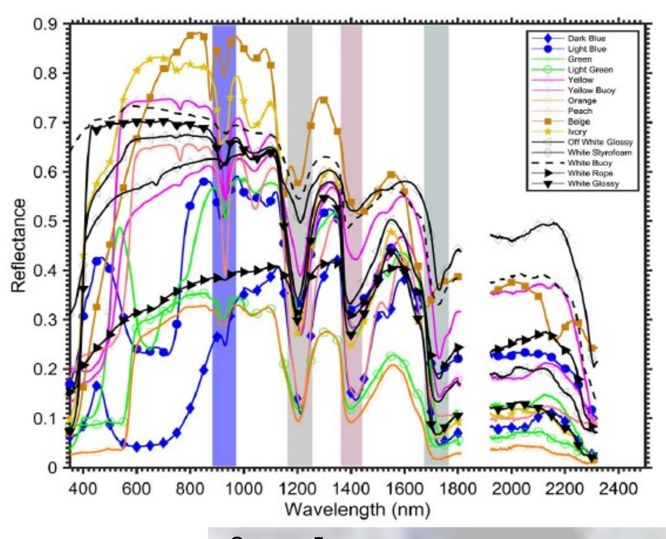
OBJECTIVES

- Assess feasibility of Copernicus data in identifying plastic litter hotspots.
- What are the spectral ranges of polymers using Sentinel 2 data?
- Can higher spatial and spectral remote sensing data improve polymer identification? A comparison of Sentinel 2 and WV3 data sets.
- Developing a method of plastic litter hotspots identification.

PAST STUDIES

Author	Findings
Garaba and Dierssen 2018[5]	Absorption band depths of dry and wet macro/micro plastics at 1215 and 1732 nm; Hydrocarbon index- AVIRIS (landfill)
Murphy et al., 2018[6]	model to detect floating debris (optical and geometric properties); single (750nm) or dual (NIR and SWIR) band algorithms
Asner, 2016[7]	spectroscopy of polymers- does not require a high spatial resolution if spectral resolution is high; spectral library of marine debris is needed
Guardado et al., 2015[8]	Spectral fingerprints of 12 Plastic Resin Groups (SWIR &MIR)- multispectral library
Moroni et al., 2015[9]	PET and PVC absorption peaks (~1200 nm ~1600nm)





Source: 5

IMPORTANCE

Plastics account for almost 99.9% of floating debris. Survey in the Great Pacific Garbage Patch shows that polyethylene (PE) and polypropylene (PP) are the most common polymers[1]. Fluxes of litter in the sea vary, depending on the proximity to urban activities, coastal uses, wind and ocean currents. These factors cause accumulation of marine litter in oceanic convergence zones and on the seafloor. Due to spatial and temporal variability of marine litter, it is important to develop cost effective, repeatable and fast method that estimates its amount and distribution. Estimating litter trends over time is needed for efficient monitoring programs, management and reduction measures[2]. Several regional and global initiatives were launched such as OSPAR Regional Action Plan, G7/G20 Marine Litter Action Plan or UN Sustainable Development Goals which aim for an international litter management program[3]. In October 2015, the G7 Science Ministers highlighted marine litter as a major ocean health issue[4]. As such, developing a method of identifying plastic litter hotspots will lead to improved litter management systems.

STUDY AREAS

1.Mytilene

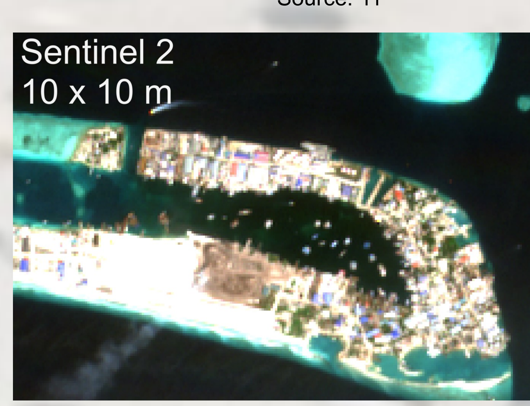
Plastic Litter Project 2018[10] conducted by the University of the Aegean in Greece


Source: 10

2. Thilafushi

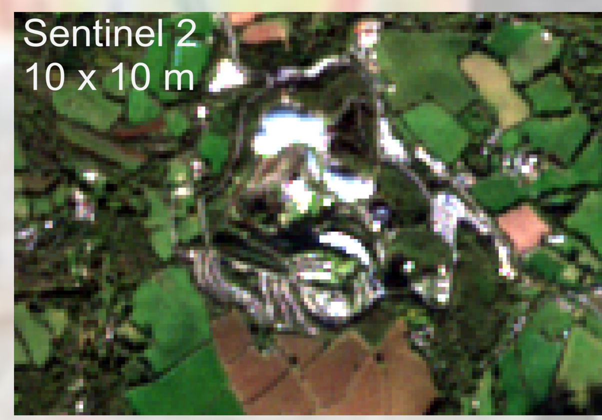
Litter Island in Maldives


Source: 11



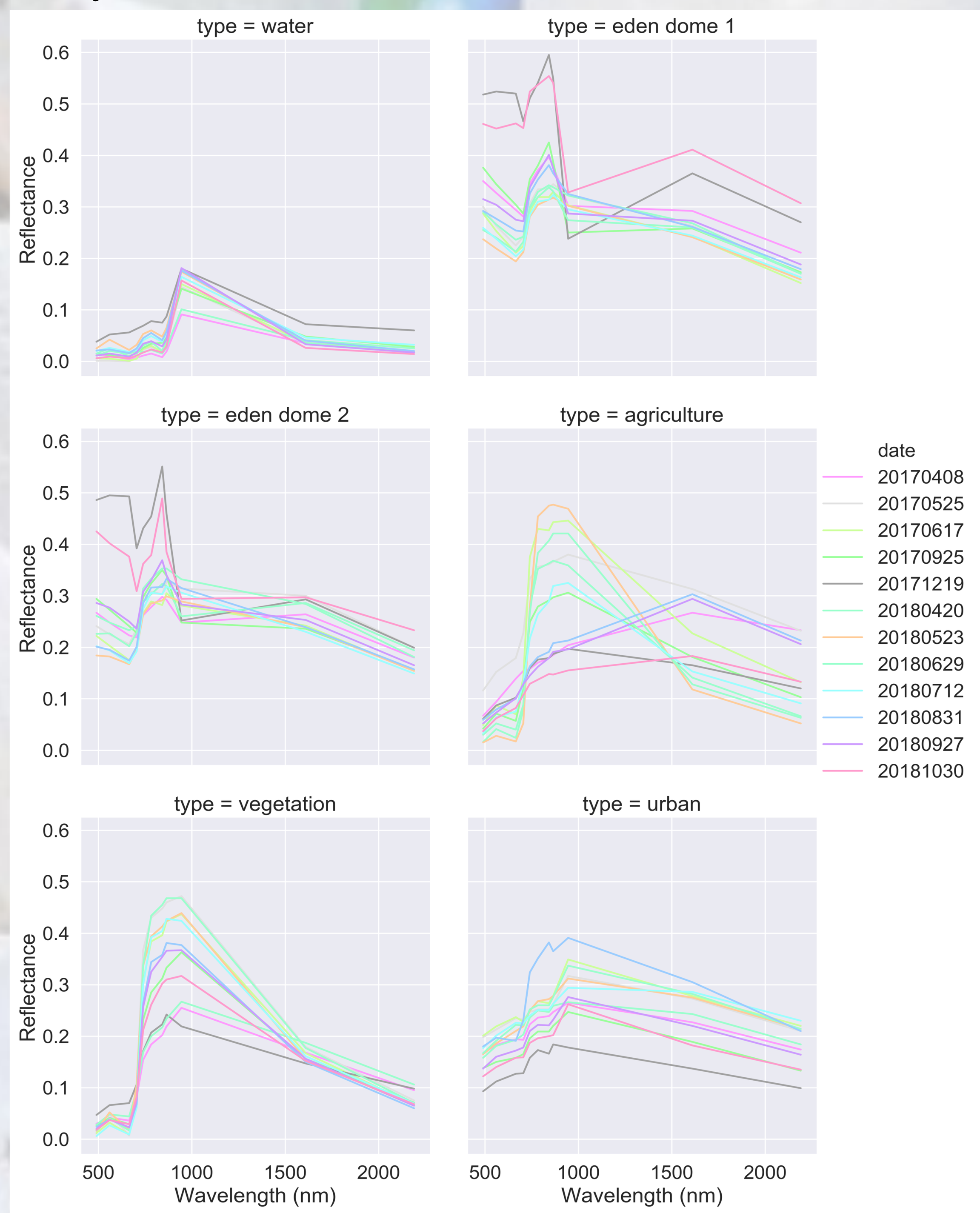
3. Eden Tetra-fluoroethylene copolymer (ETFE) domes in the UK

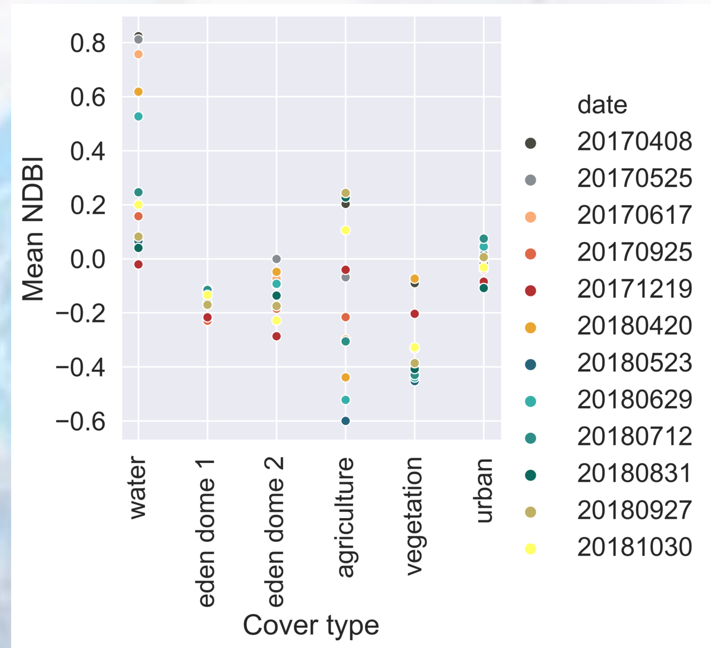

Source: 12

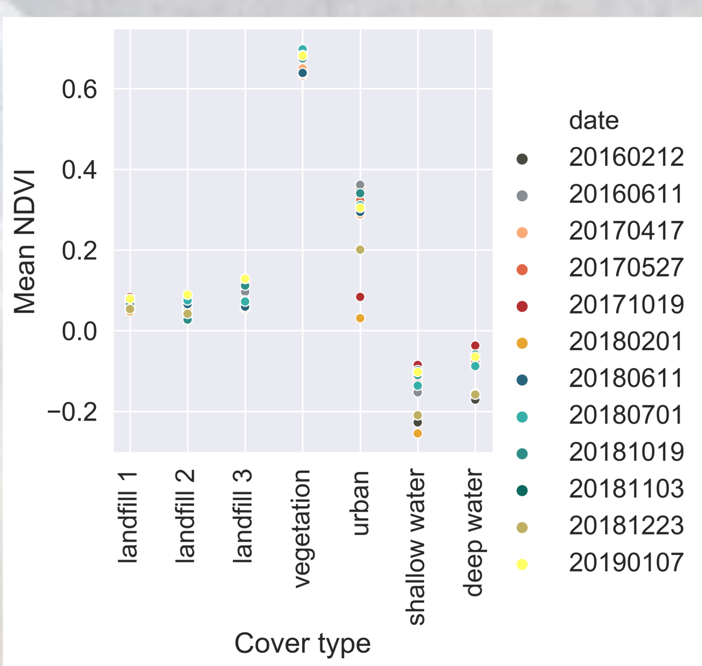


PRELIMINARY RESULTS

Study Area 3: Eden







CONCLUSION AND FUTURE WORK

Spectral signature plots:

1. Overall increase in reflectance between 740-865 nm (NIR) for synthetic hydrocarbons (Sentinel 2– B06, B07, B08, B8A).
2. Reflectance peaks in B08 (842 nm central wavelength).
3. Reflectance valley or absorption band in B09 (945 nm central wavelength).
4. Spectral ranges of plastics can coincide with vegetation.
5. Thilafushi landfill spectral signature plots do not show the same pattern as the other study areas (spectral mixing).

Future work:

1. Add another area with high plastic density and static objects (ground “truthing”).
2. Define spectral thresholds of the ROIs from all study areas.
3. Feed this information to image classification methods.
4. Compare the results of open source RS data (Sentinel) to commercial (WV3)- can higher spatial and spectral (SWIR) resolution help in identifying plastic litter hotspots?
5. Create a workflow/method to identify plastic litter hotspots.

REFERENCES

1 - Lebreton et al. (2018) , Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic, in *JO - Scientific Reports*

2 - Galgani, Hanke and Maes (2015) Global Distribution, Composition and Abundance of Marine Litter, Chapter 2 in *Marine Anthropogenic Litter*

3 - http://ices.dk/news-and-events/news- archive/news/Pages/FEATURE%20ARTICLE%20%E2%80%93%20Marine%20litter%20and%20monitoring.aspx

4 - https://www.bmbf.de/files/English_version.pdf

5 - Garaba and Dierssen (2018) An airborne remote sensing case study of synthetic hydrocarbon detection using short wave infrared absorption features identified from marine harvested macro and microplastics in *Remote Sensing of Environment*, V. 205

6 - Murphy et al. (2018) Concept for a hyperspectral remote sensing algorithm for floating marine macro plastics in *Marine Pollution Bulletin,* V. 126

7 - Asner (2017) Imaging Spectroscopy—Science and Mission, Pdf from http://iprc.soest.hawaii.edu/NASA_WS_MD2016/pdf/Asner2016.pdf

8 - Guardado et al. (2015) Multi-spectral infrared spectroscopy for robust plastic identification in Applied Otics, Vol. 54(24)

9 - Moroni et al. (2015) PET and PVC Separation with Hyperspectral Imagery in Sensors, Vol. 15

10 - https://mrsg.aegean.gr/?content=&nav=55

11 - https://www.flickr.com/photos/dyingregime/8283823882/in/photostream/

12 - https://www.youtube.com/watch?v=cNhGh5hJYAA and https://www.edenproject.com/eden-story/behind-the-scenes/architecture-at-eden

13 - Clean Atlantic website: http://www.cleanatlantic.eu/

14 - CEFAS: https://www.cefas.co.uk/

15 - lenka.fronkova@cefas.co.uk