Monitoring wood and plastic debris in rivers

The development and application of a new tool for measuring wood debris and macro-plastic fluxes in river channels.

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Introduction:

Lack of macro-plastic studies

Plastics found in most remote freshwater environments

Fluvial Plastic Pollution

Rivers help move plastic to the oceans

Various sources like fly tipping, inadequate wast management etc

Main Aim:

- Use an algorithm and labelled images to identify wood and plastic fluxes in river channels.

Example of labelled objects:

Videos taken in UK, France and Chile at 15-minute intervals. Both images here are from UK. White boxes show plastic and green boxes show leaves.

How does large woody debris impact river channels?

Changes sediment storage

Provides additional food sources

Encourages channel complexity

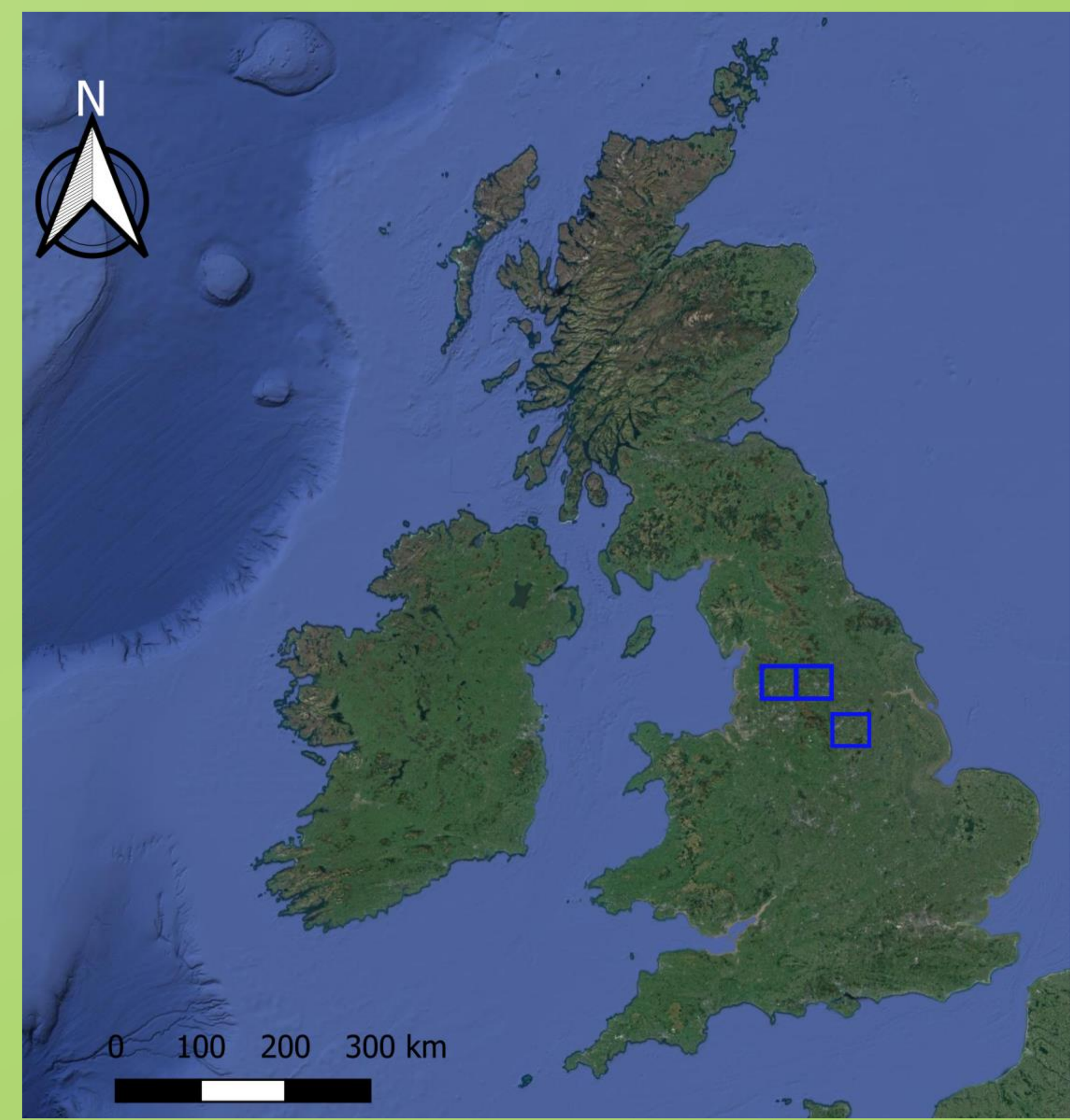
Regulates water quality

Greater variety of habitats

Alters erosional processes

Results:

Graph shows, at each river channel studied, the percentage of the labels that are wood, plastic or leaves.



UK rivers with the most plastic debris:
1. River Irwell (88.8%)
2. River Sheaf (84.4%)
3. River Calder (42.0%)

(% of labels were plastic)

Labelled objects

Plastics	Wood	Leaves	Total
489	557	131	1177

- Natural debris (wood and leaves) were found in 58% of the images.
- The most common plastic debris found was traffic cones.

Conclusions:

- River Irwell has the highest level of plastic debris, followed by the River Sheaf and Calder. This project didn't take into account micro-plastics, this would give a more comprehensive idea of how polluted these rivers are.
- Further object labelling and inputting into the algorithm would be useful to obtain more detail regarding these debris fluxes.

Background to the approach used:

- Humans have limitations, like limited memory and attention span, which intelligent agents and artificial intelligence may alleviate[1].
- Object detection predictions locations through bounding boxes as well as classifying the different objects[2].
- YOLO trains on full-sized images and optimises performance. Fast YOLO is the quickest object detector in literature[3].

References:

1 Tecuci, G. (2012) *Artificial Intelligence,* WIREs Comput Stat, 4, 168-180.

2 Huang, R., Pedoeem, J., & Chen, C. (2019). YOLO-LITE: A Real-Time Object Detection Algorithm Optimized for Non-GPU Computers. *Proceedings - 2018 IEEE International Conference on Big Data, Big Data 2018*, 2503–2510. https://doi.org/10.1109/BigData.2018.8621865. Accessed September 2019.

3 Redmon, J., & Farhadi, A. (2018). *YOLOv3: An Incremental Improvement.* Retrieved from http://arxiv.org/abs/1804.02767. Accessed September 2019.