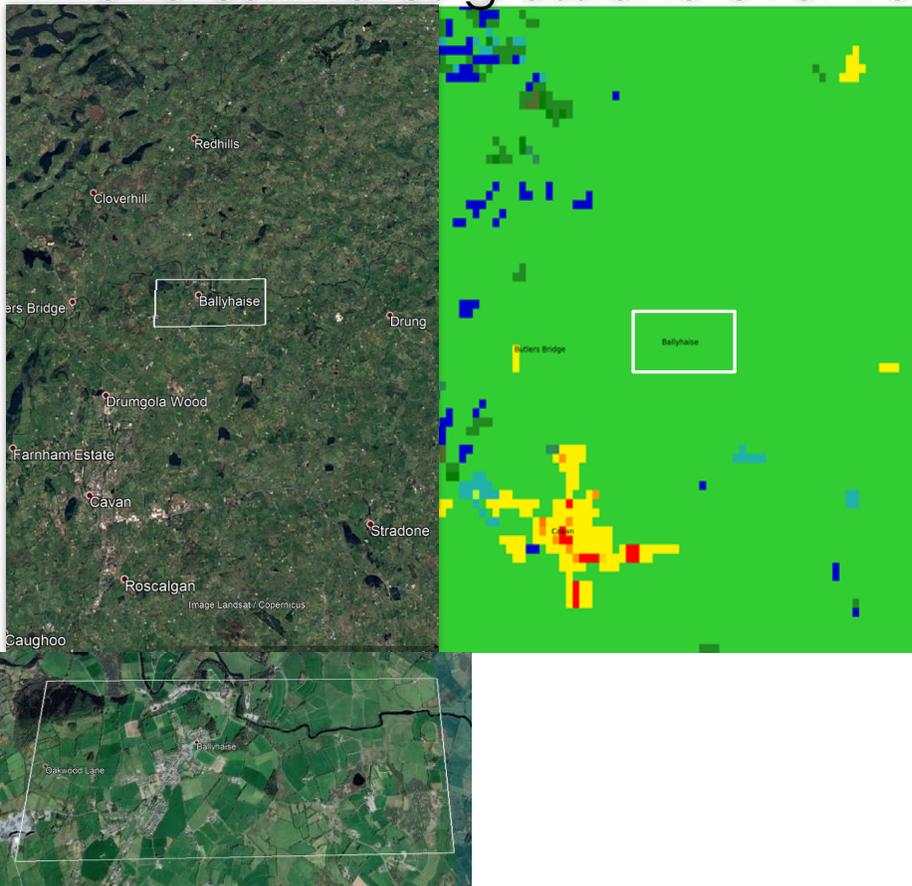


An update on physiography activities at Met Éireann

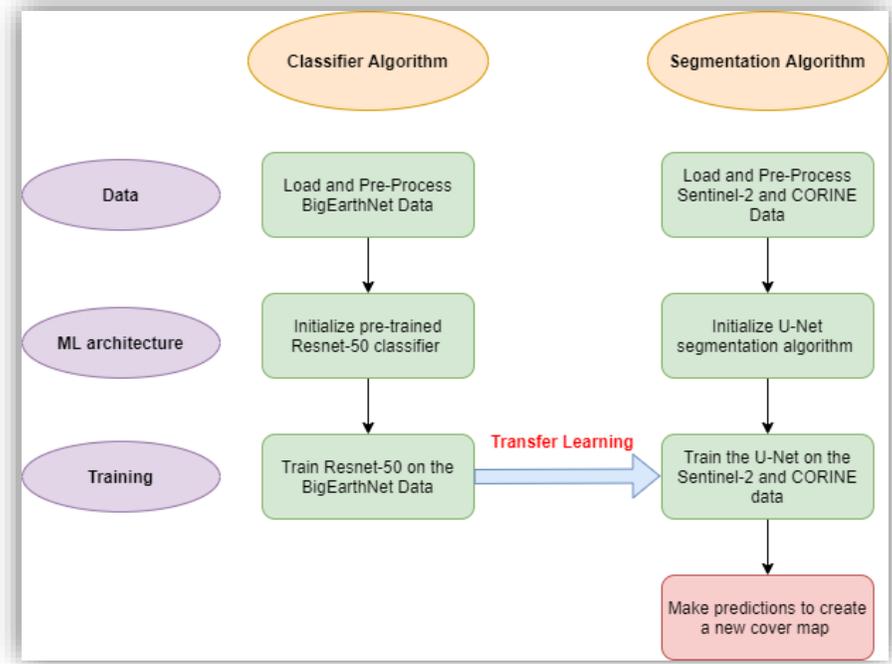
Geoffrey Bessardon, Odhrán Dooley, Emily Gleeson, Eoin Walsh, Stephen Mullins,

Context

ECOCLIMAP-SG used in HARMONIE-AROME overestimates grassland over Ireland



2020 work:
Segmentation of Sentinel-2 imagery over Ireland
Creation Ulmas-Walsh map



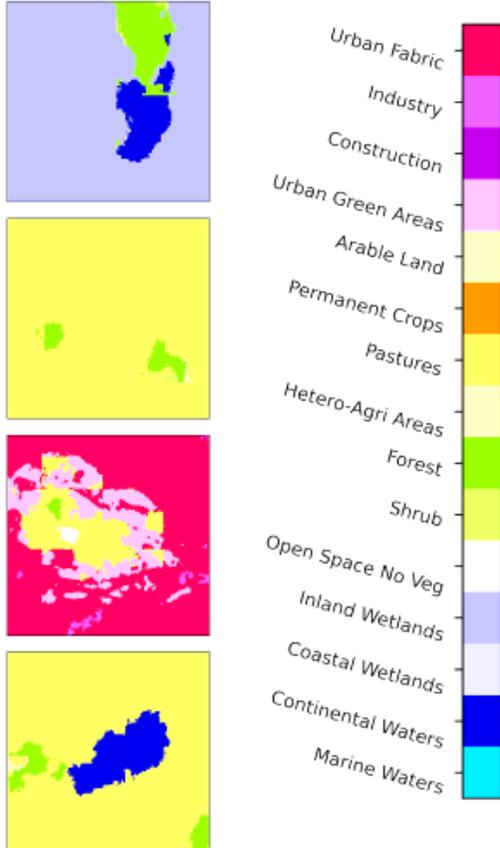
Walsh et al. 2021
Using machine learning to produce a very high resolution land-cover map for Ireland <https://doi.org/10.5194/asr-18-65-2021>

Ulmas-Walsh has promising results

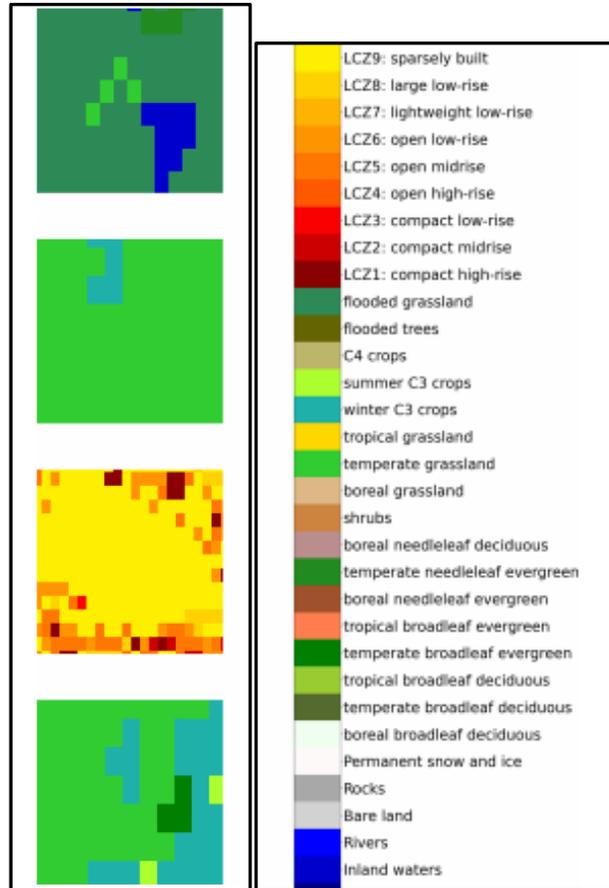
Sentinel-2



Ulmas-Walsh



ECOCLIMAP-SG



Bog in county Galway

County Tipperary

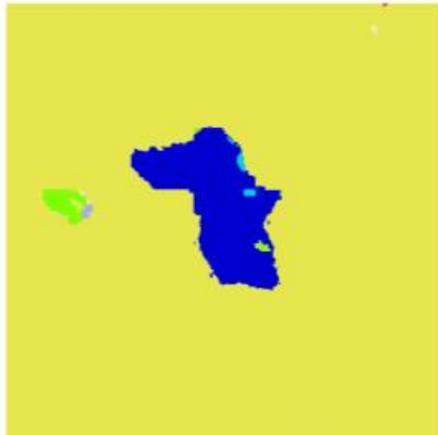
Phoenix Park (Dublin)

Lake in county Galway

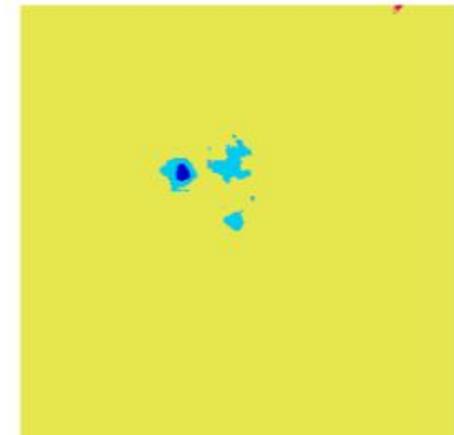
- Bog shape is looks better
- Forests are captured in Country Tipperary
- Differences in Phoenix Park are due to label definition
- ECO-SG misses lake in Galway

Seasonal lake evolution (Turlough)

Predictor results when applied on an April image

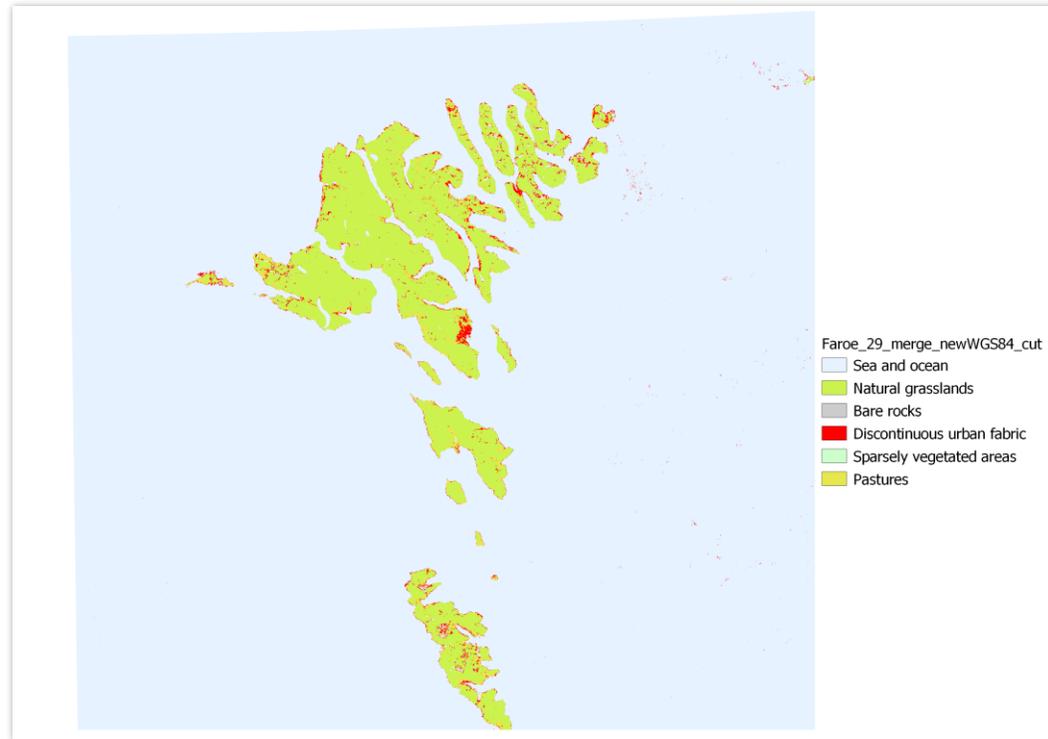


Predictor results when applied on an August image



The change in the water body size is also detected however there are issues between coastal and continental water

Extension to other countries: example Faroe



- The prediction counts most of the country as grassland
- Issue: not enough bareland and lakes in the training dataset
- Ongoing work with continental dataset

New S2GLC land cover map

- Map produced by ESA with 13 cover types
- ML method using sentinel-2
- 10 m resolution
- Overall accuracy 86% similar to CORINE

Where does it stand compared to other maps over Ireland?



Ireland


Land Cover Map

Legend

-  Clouds
-  Artificial surfaces and constructions
-  Cultivated areas
-  Vineyards
-  Broadleaf tree cover
-  Coniferous tree cover
-  Herbaceous vegetation
-  Moors and Heathland
-  Sclerophyllous vegetation
-  Marshes
-  Peatbogs
-  Natural material surfaces
-  Permanent snow covered surfaces
-  Water bodies



Copyright: Contains modified Copernicus Sentinel data.
Processed by CBK PAN.

Projection: WGS 84, EPSG:3857

Comparison of multiple maps over Ireland (Odhrán Dooley)

- Ulmas-Walsh, S2GLC, CORINE, ESA-CCI and ECOCLIMAP-SG were compared
- Translation
- 5 cover types
 - **Artificial Surfaces (Urban)**
 - **Water**
 - **Agricultural Areas**
 - **Wetlands (Bogs/Marshes)**
 - **Forest & Semi-Natural Areas (Everything else)**

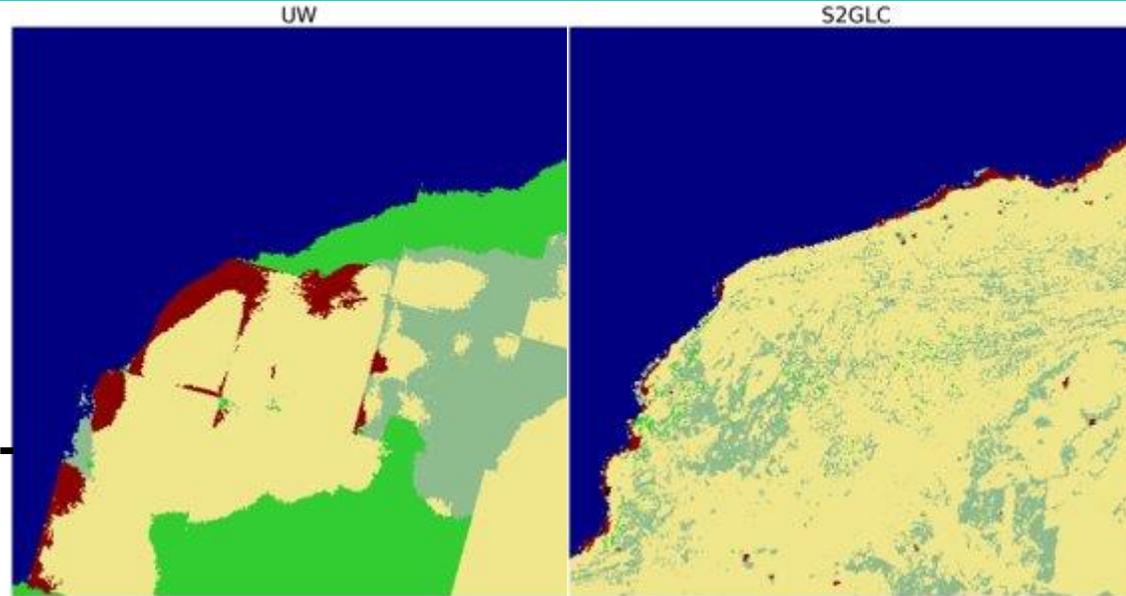
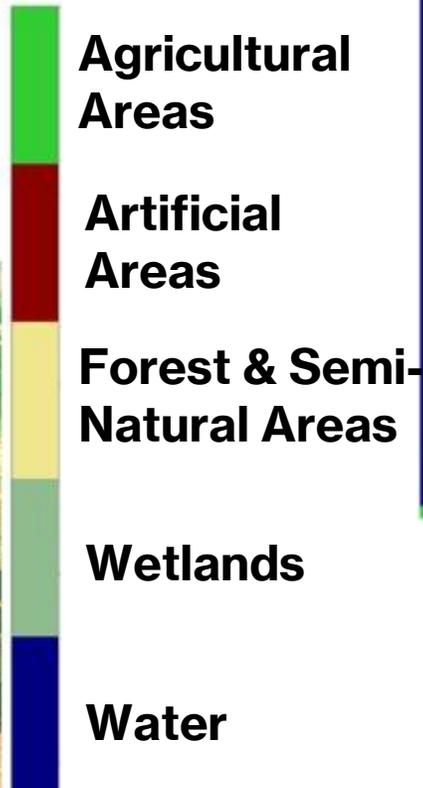


Bare rock confusion

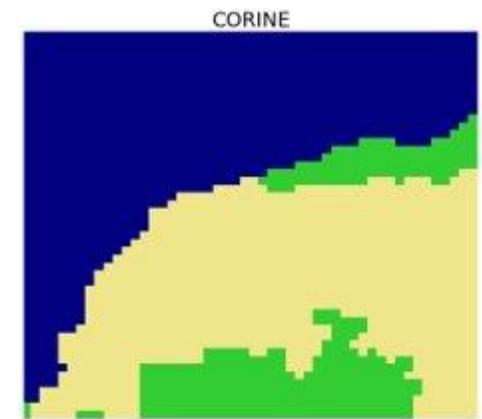
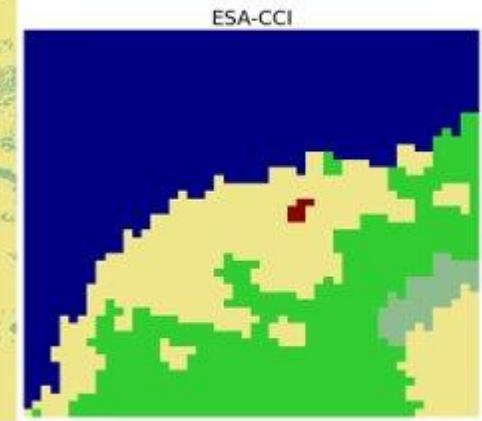
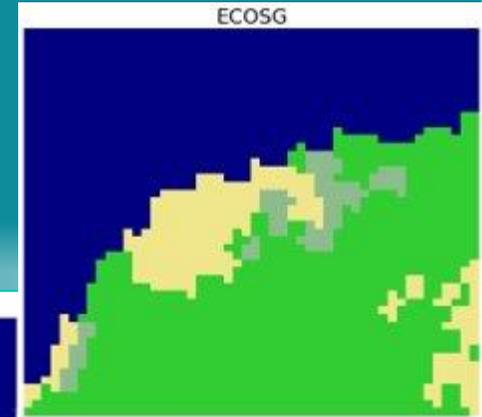
The Burren



The Burren, north of Doolin, Co. Clare
5km x 5km

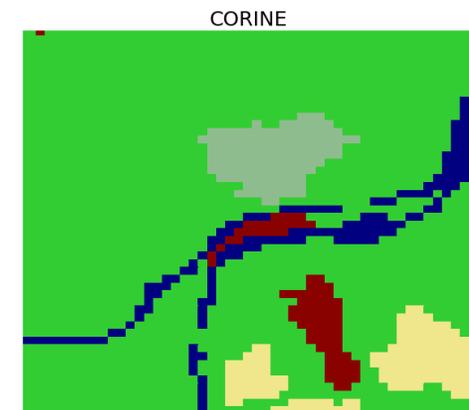
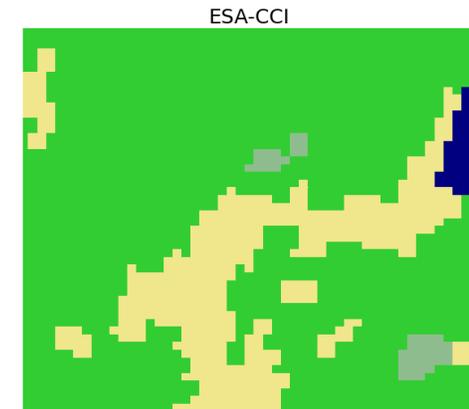
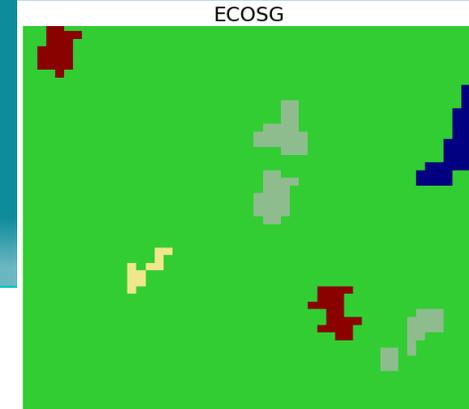
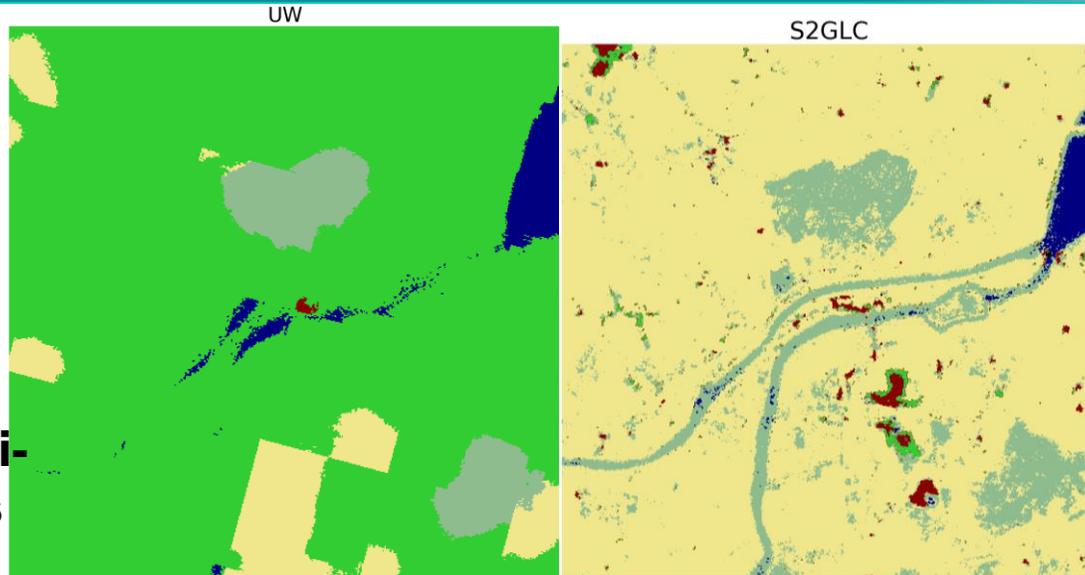
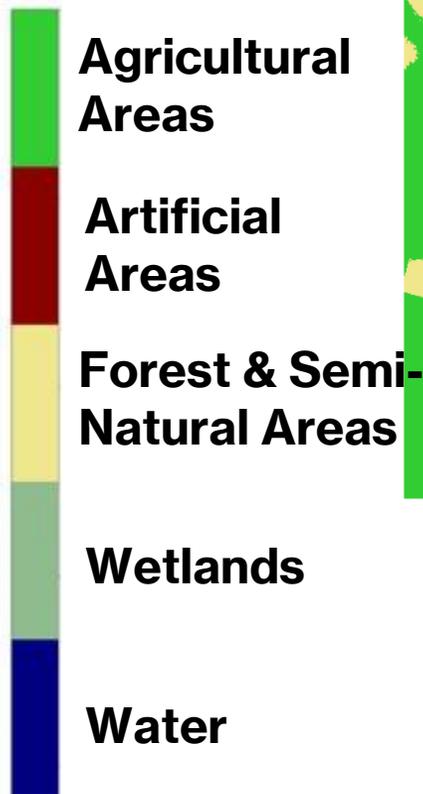


- S2GLC (produced by ES) using machine learning is good at representing roads
- Ulmas-Walsh has a sporadic “checked effect”
- CORINE (Copernicus) does a decent work



Rivers & Roads

O'Briensbridge



- S2GLC mislabels rivers as wetlands
- CORINE has the best river shape
- S2GLC represents well urban area

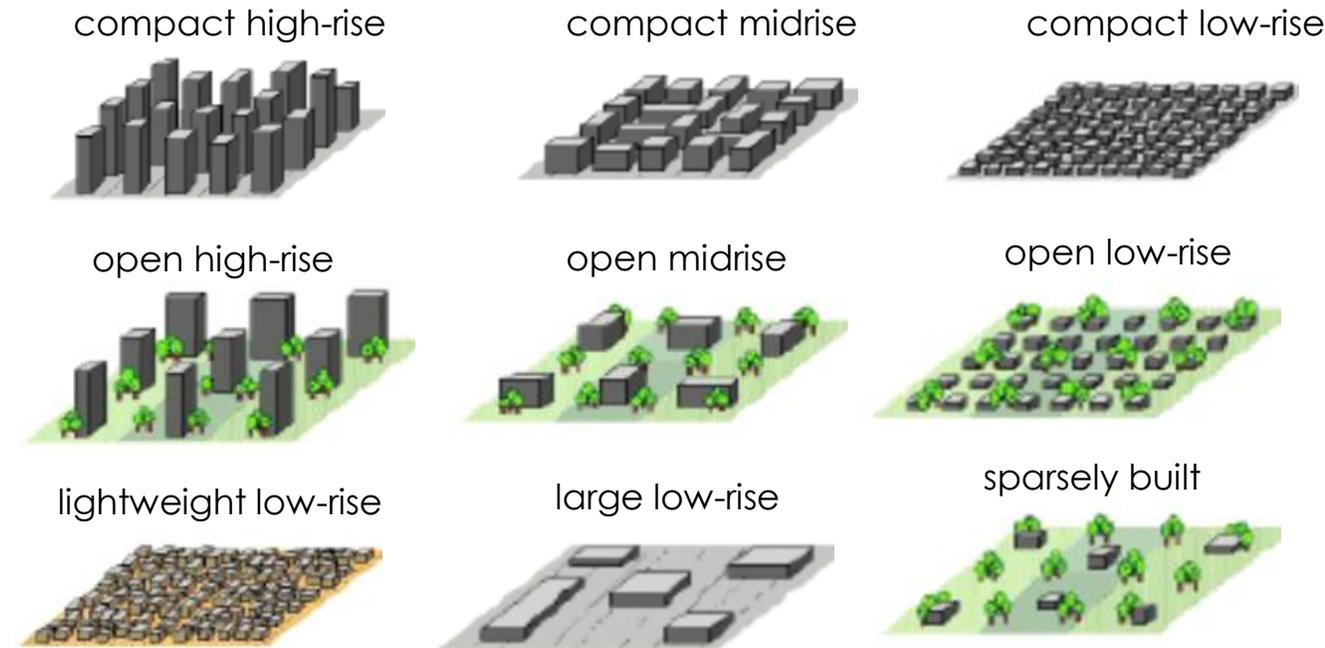
O'Briensbridge, Clare/Limerick
5km x 5km

Pros and cons of the different maps

Map	S2GLC	UW	CORINE	ECO-SG	ESA-CCI
Pros	<ul style="list-style-type: none"> • High res • Very accurate • Picks out even small rivers 	<ul style="list-style-type: none"> • High res • Readily updateable • Inexpensive • Produced by Met Éireann 	<ul style="list-style-type: none"> • Accurate • Large rivers well projected 	<ul style="list-style-type: none"> • More consistent than ESA-CCI • HARMONIE-AROME are using its labels 	<ul style="list-style-type: none"> • Picks up villages that CORINE or ECOSG don't
Cons	<ul style="list-style-type: none"> • Struggles with bare rock • Mislabeled rivers 	<ul style="list-style-type: none"> • Fine tuning needed (blocky) 	<ul style="list-style-type: none"> • Mixed urban labels • 'Discontinuous urban fabric' 	<ul style="list-style-type: none"> • Low res • Overestimates grassland 	<ul style="list-style-type: none"> • Low res • Not very accurate • Inconsistent urban areas

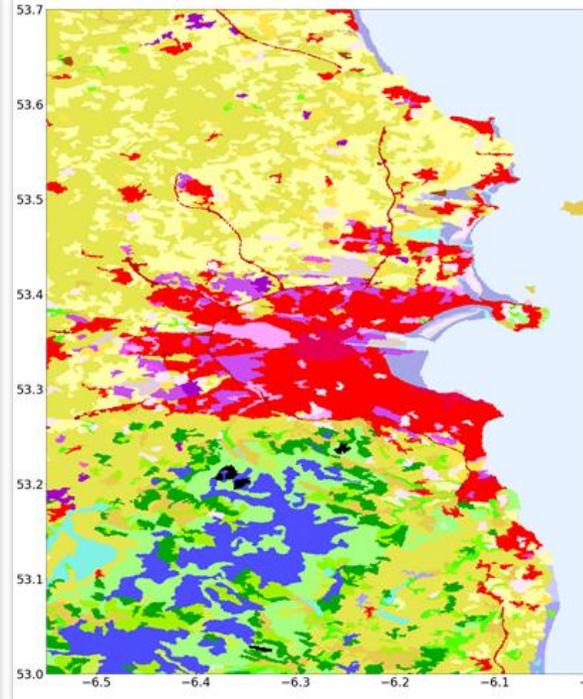
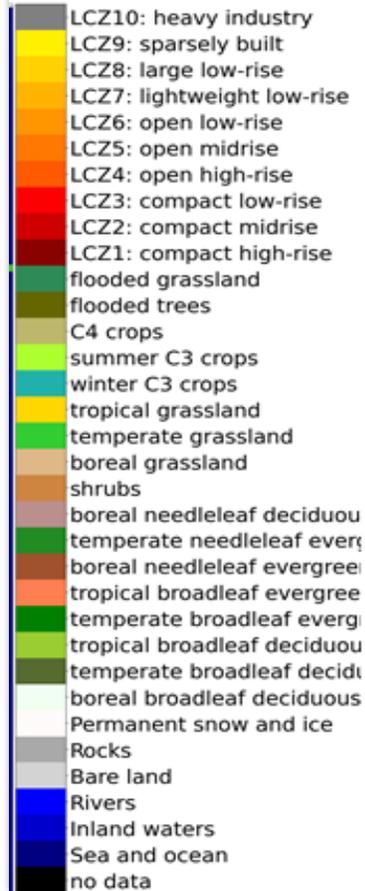
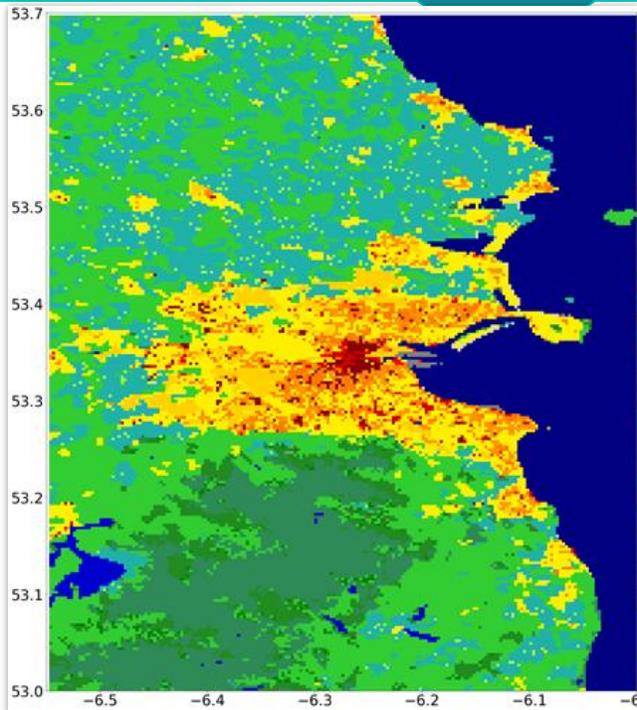
Make maps usable in HARMONIE-AROME: urban area issues (Eoghan Keany)

- ECOCLIMAP-SG urban local climate zones (LCZs) labels (*Stewart, I.D. and Oke, T.R. (2012)*)
- LCZs require information on building density and heights
- None of the recent map provide these information
- **Eoghan Keany: “Mapping of building heights for Ireland using Sentinel-1 and Sentinel-2 time series”**



LCZ definition schematic from *Stewart, I.D. and Oke, T.R. (2012)*

Make maps usable in HARMONIE-AROME: vegetation issue

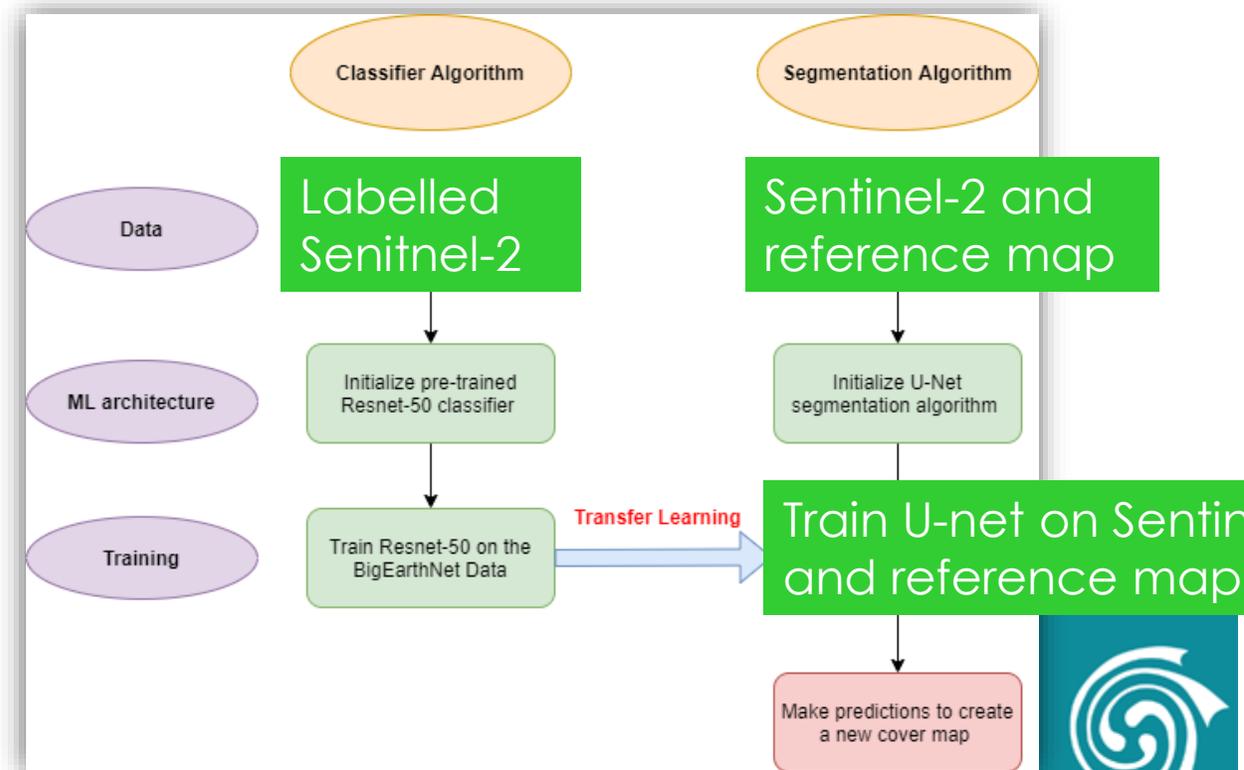


- ECOCLIMAP-SG uses pure vegetation type
- Other map aren't and there is no vegetation map of its kind available



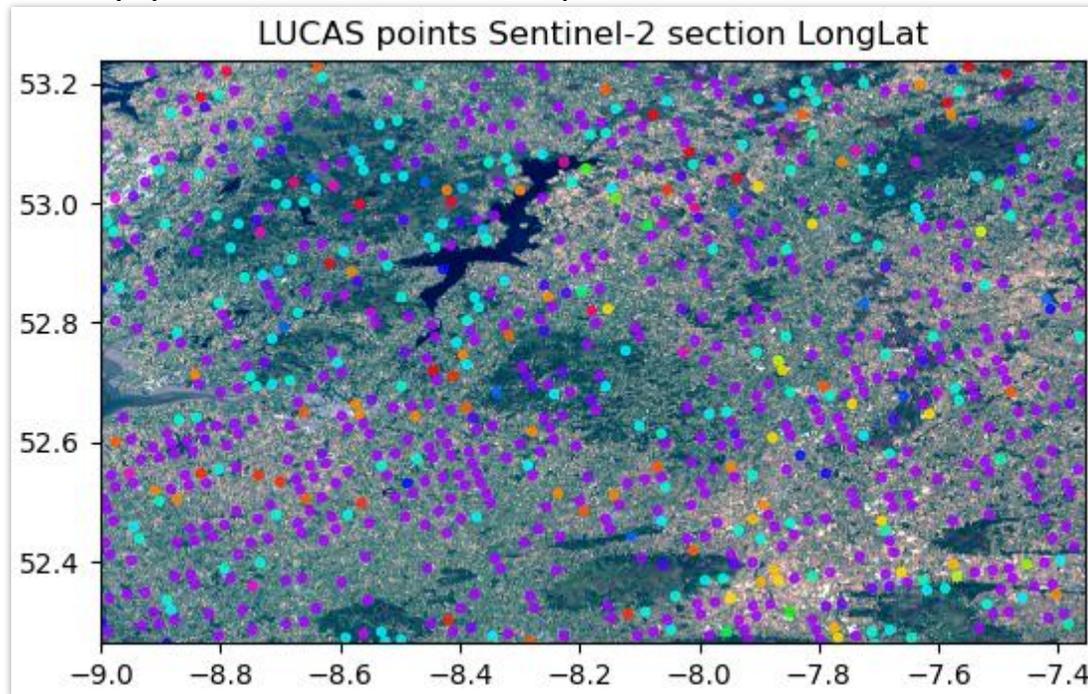
Crop type identification for land-cover mapping (Stephen Mullins)

- Similar method to Ulmas-Walsh:
 - Train a classifier on labelled Sentinel-2 images
 - Train a U-net segmentation algorithm with the trained classifier as encoder on Sentinel-2 image and a reference crop map
 - Make prediction using the trained U-net

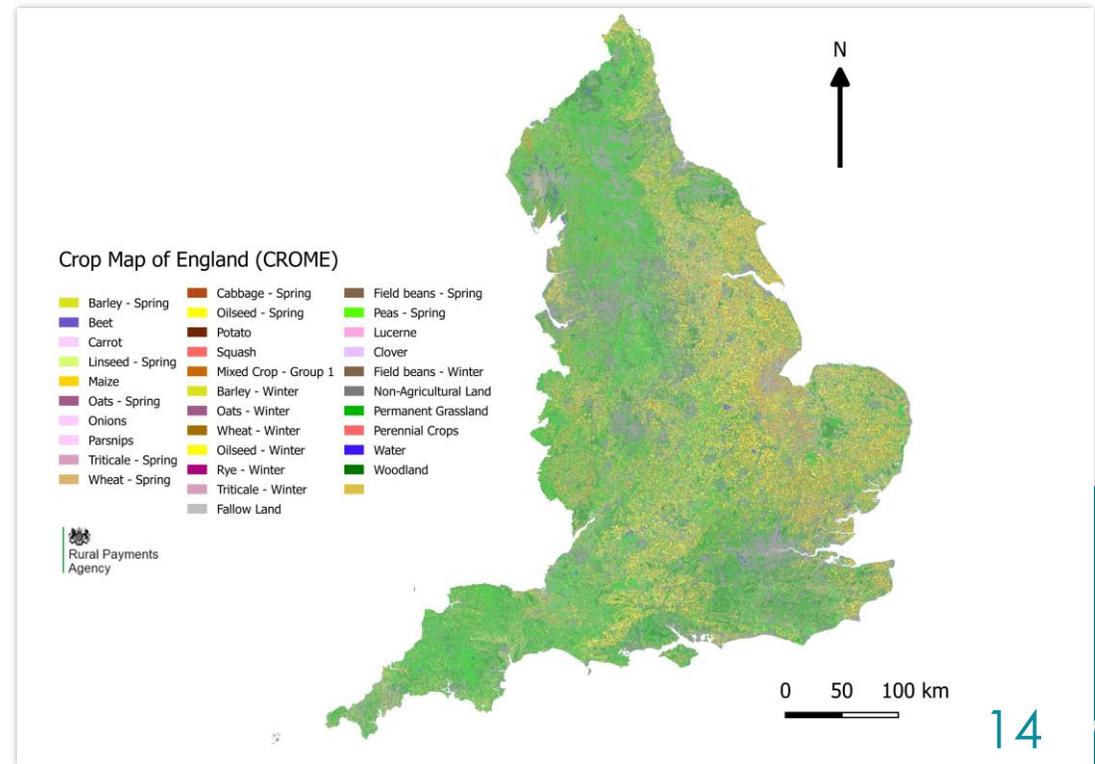


What reference maps are available

Land Use and Coverage Area frame Survey (LUCAS)
Only points not the shape of the field



Crop Map of England
Seems like the perfect training dataset



To be continued...

Conclusions

- ECOCLIMAP-SG has some limitations that can be resolved in the future
- All land cover maps have pro and cons
- ML methods are showing some potential but still need some improvement
- Add-on maps are necessary to produce a map that is able to improve ECOCLIMAP-SG