HIGH-RESOLUTION LAND USE LAND COVER DATASET FOR METEOROLOGICAL MODELLING: ECOCLIMAP-SG+

ACCORD surface working week

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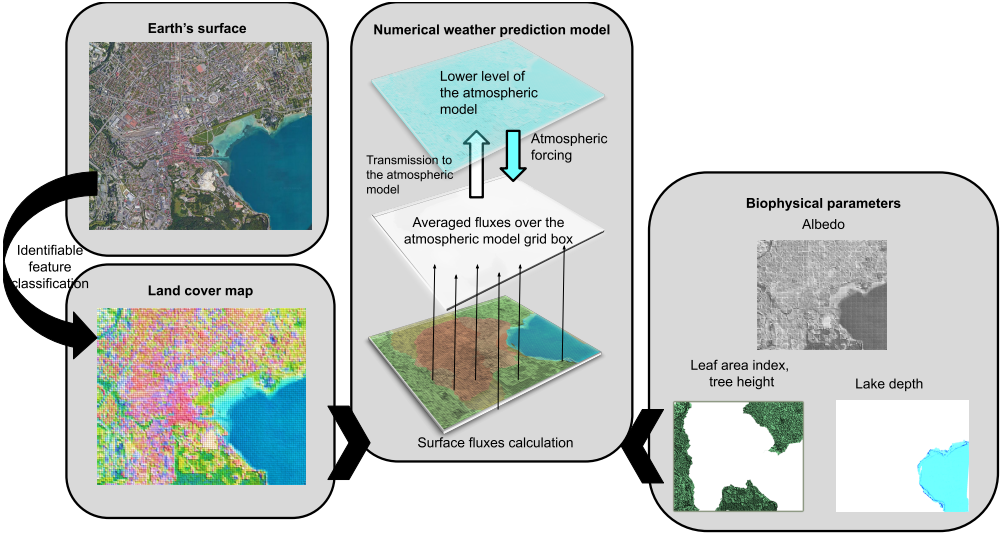
STRUCTURE

1. Introduction
2. Method
3. Evaluation
4. Conclusion

INTRODUCTION

LAND COVER MAP AND ITS USE IN NWP

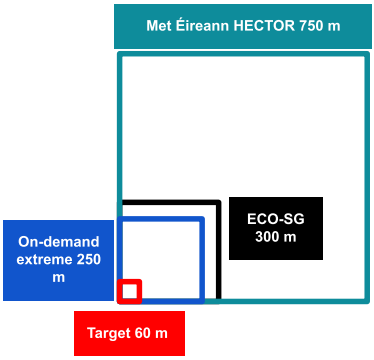


LIMITATIONS IN ECOCLIMAP-SG (ECO-SG)

- Hectometric NWP requires fine resolution land cover map
- ECO-SG 300 m resolution is not sufficient for hectometric NWP
- ECO-SG is based on ESA-CCI v1.6.1 which starts to be outdated

Objective

Leverage open-access data to produce a high-resolution (60m) physiography map with ECO-SG labels.

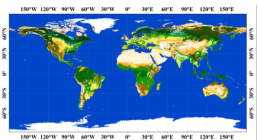


PROBLEMS WITH EXISTING HIGH-RESOLUTION DATASET

Existing products are **heterogeneous, and all have limitations** due to spatial coverage, spatial accuracy, semantic accuracy, and how up-to-date they are.

Issue for NWP

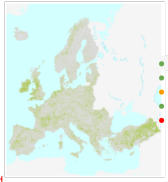
no high-resolution dataset with European or global coverage with ECOSG labels available



Overview of GLC_FCS30D for 2022; the color-coded legend is derived from the European Space Agency (ESA) Climate Change Initiative land-cover dataset

GLC_FCS30D 2022

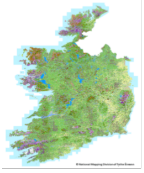
- Up-to-date
- 30 m resolution
- Global
- Open source
- Only one urban class



Grassland 2018 (raster 10 m), Europe, 3-yearly, Aug. 2020

NLC 2018

- Up-to-date
- 10 m resolution
- Europe
- Open source
- Only grassland

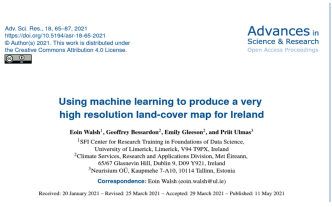


Outline of the new National Land Cover Map for Ireland (NLC 2018)

NLC 2018

- Up-to-date
- 10 m resolution
- Republic of Ireland
- Limited licence
- Ireland specific label not compatible with ECO-SG

PREVIOUS MACHINE LEARNING EFFORTS AT MET ÉIREANN


Adv. Sci. Res., 18, 65–87, 2021
https://doi.org/10.5194/asr-18-65-2021

Advances in Science & Research
Open Access Proceedings

Using machine learning to produce a very high resolution land-cover map for Ireland

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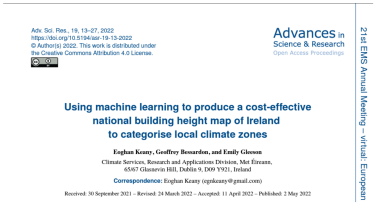
Applied Meteorology and Climatology Proceedings


Adv. Sci. Res., 19, 13–27, 2022
https://doi.org/10.5194/asr-19-13-2022

Advances in Science & Research
Open Access Proceedings

Using machine learning to produce a cost-effective national building height map of Ireland to categorise local climate zones

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21st EMS Annual Meeting – virtual: European

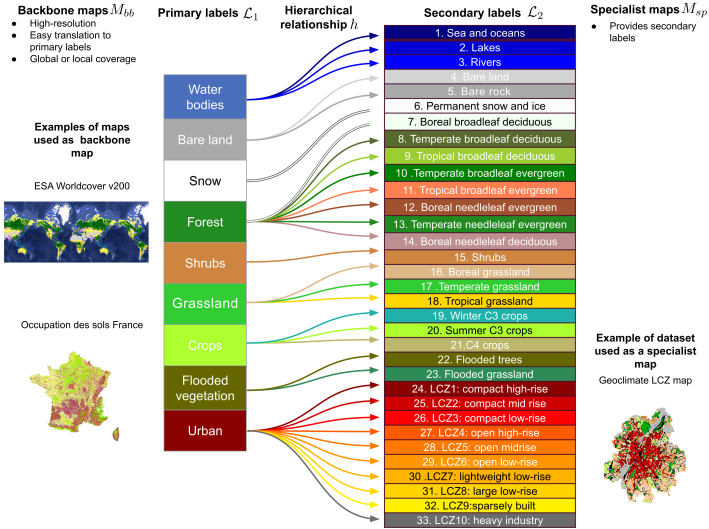
There is no reference dataset available to produce a high-resolution version of ECO-SG

ECOCLIMAP-SG+ OBJECTIVES

- high-resolution (60m) physiography map with ECO-SG labels
- A quality score that indicates certainty to enable the creation of reference data
- Agreement-based method to merge multiple map sources and handle coverage, resolution, and accuracy variations.

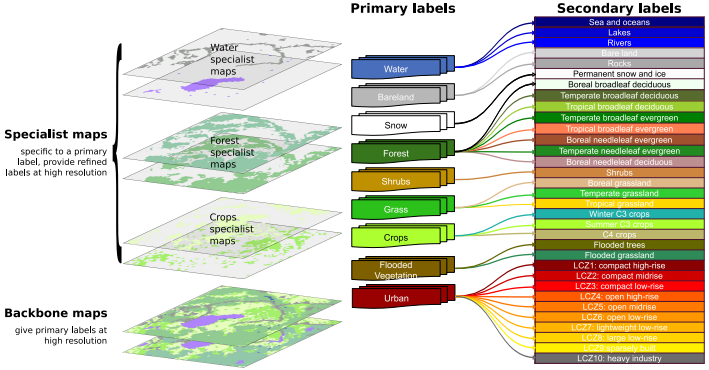
METHOD

OVERCOME HETEROGENEOUS SEMANTIC COVERAGE

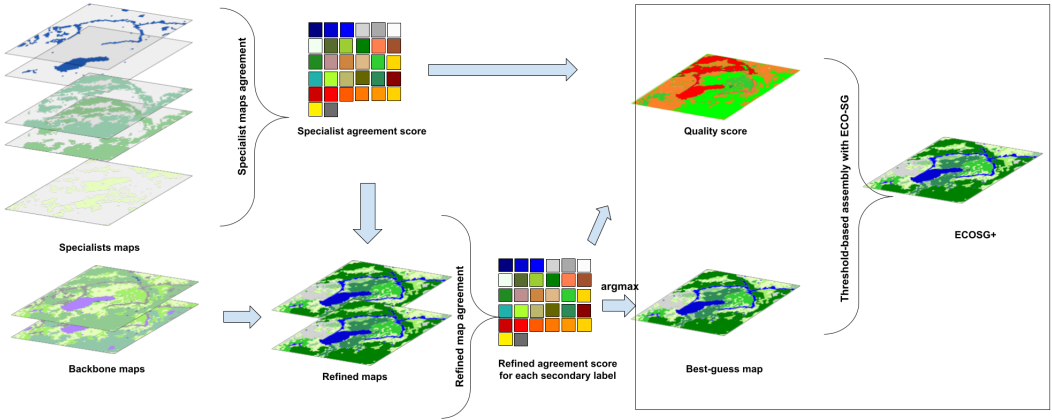


METHOD IDEA

Superpose the specialist maps

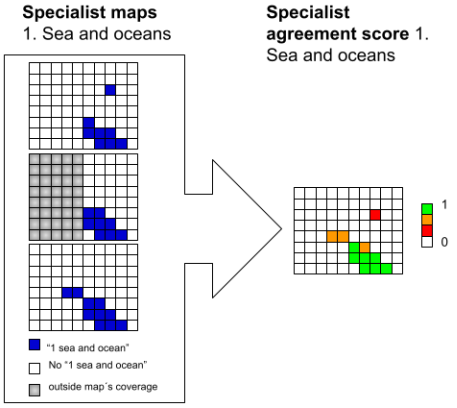


METHOD OVERVIEW



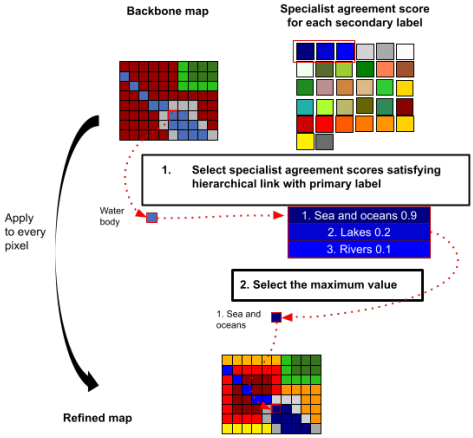
SPECIALIST AGREEMENT SCORE

Ratio between the number of specialist maps that agree with a secondary label and the number of specialist maps available at that location



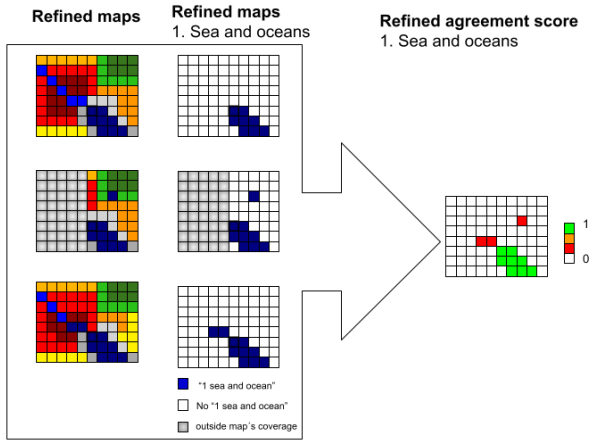
REFINED MAP

Best-guess map secondary label with the highest refined agreement score, quality score, the geometric mean of Specialist and Refined agreement score



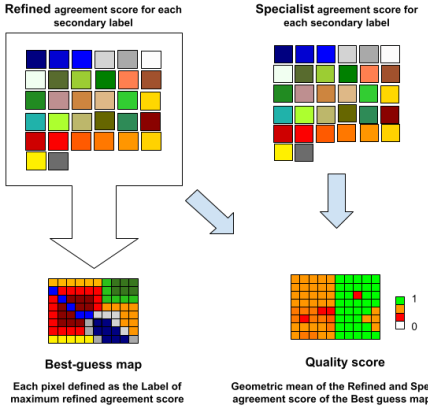
REFINED AGREEMENT SCORE

Ratio between the number of refined maps that agree with the secondary label at a location versus the maximum number of overlapping maps



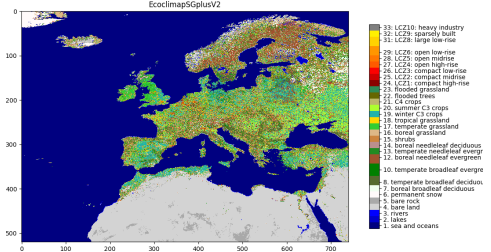
BEST GUESS MAP AND QUALITY SCORE

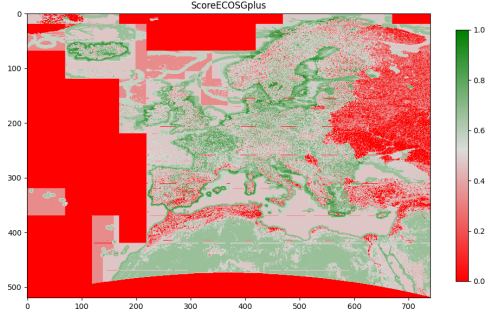
Secondary label with the highest specialist agreement score while satisfying the hierarchical link with the backbone map primary label



THRESHOLD BASED ASSEMBLY

ECO-SG if Score < 0.525 best-guess map else

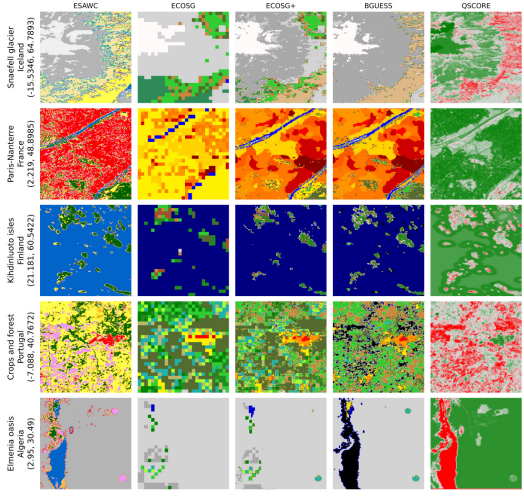




EVALUATION

- Qualitative evaluation
- Evaluation over Europe against the in-situ dataset LUCAS
- Detailed evaluation of primary label against Ireland´s NLC2018
- Full set of label evaluation against Icelandic version of ECO-SG (Bolli Palmasson)

QUALITATIVE EVALUATION



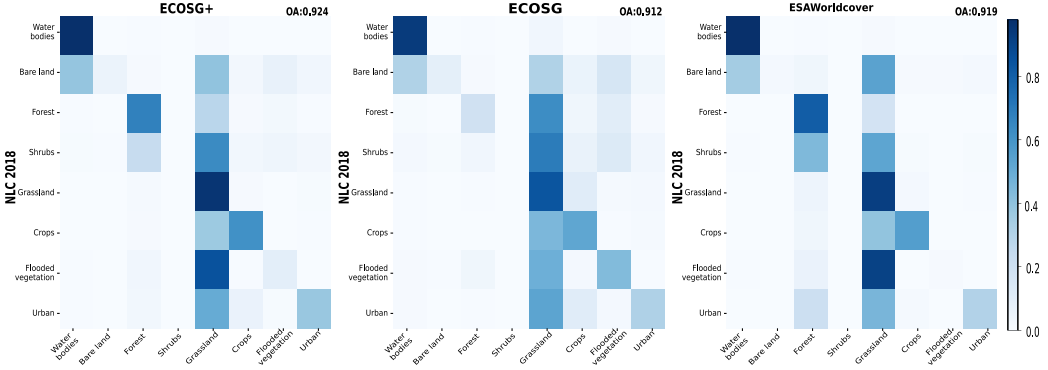
F1-SCORE LUCAS OVER EUROPE

ECOSG+ F1-score is superior for every primary label, a downsampled version ECOSG+300 is superior for every label except shrubs

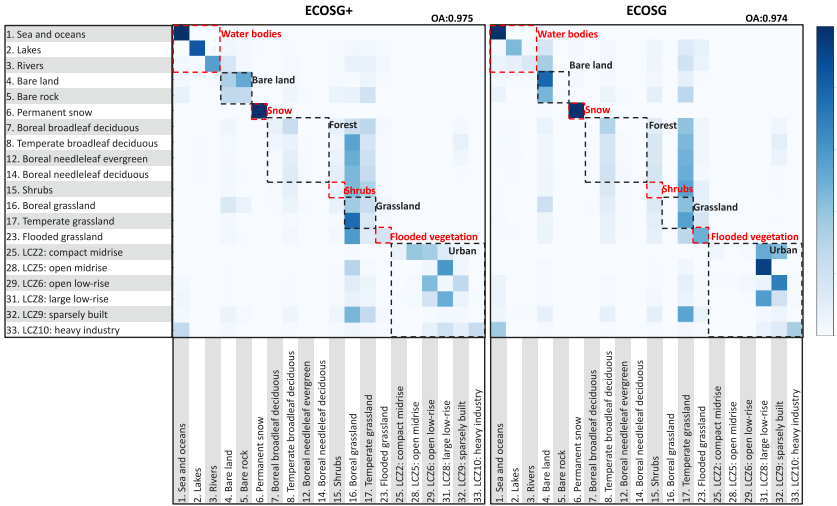
	ECOSG+	ECOSG+300	ECOSG	ESA WorldCover
Water bodies	0.762	0.726	0.625	0.782*
Bare land	0.154*	0.151	0.125	0.120
Snow	0.763*	0.760	0.695	0.606
Forest	0.666	0.645	0.550	0.685*
Shrubs	0.100	0.084	0.092	0.141*
Grassland	0.534	0.510	0.303	0.547*
Crops	0.587	0.572	0.477	0.648*
Flooded vegetation	0.405*	0.374	0.344	0.336
Urban	0.338*	0.319	0.279	0.326

EVALUATION AGAINST IRELAND´S NLC 2018

ECOSG+ is similar to ESAWorldcover and reduces ECO-SG grassland overestimation



EVALUATION AGAINST ICELANDIC VERSION OF ECO-SG (BOLLI PALMASSON)



CONCLUSION

CONCLUSION

- We built a reference map (ECOSG+) at 60 m resolution with ECOSG labels by mixing existing LULC maps
- ECOCLIMAP-SG+ outperforms ECO-SG regarding the F1-score against LUCAS 2022 over Europe and the Irish national land cover 2018 dataset.
- Similarly, it outperforms ECOSG against the Icelandic version of ECO-SG for most of the represented secondary labels
- Quality is heterogeneous the method is flexible to insert new datasets
- The addition of a quality score enables machine learning application
- ECOSG+ is available here **https://zenodo.org/records/10944693**
- The code to produce ECOSG+ is available here **https://gitlab.com/gbessardon/ecoclimap-sg_plus.git**