Comparison of Grassland Type classification output (EUGW) with the Habitat Mapping Layer of Czechia
&
Workflow for validation of other classification models outputs

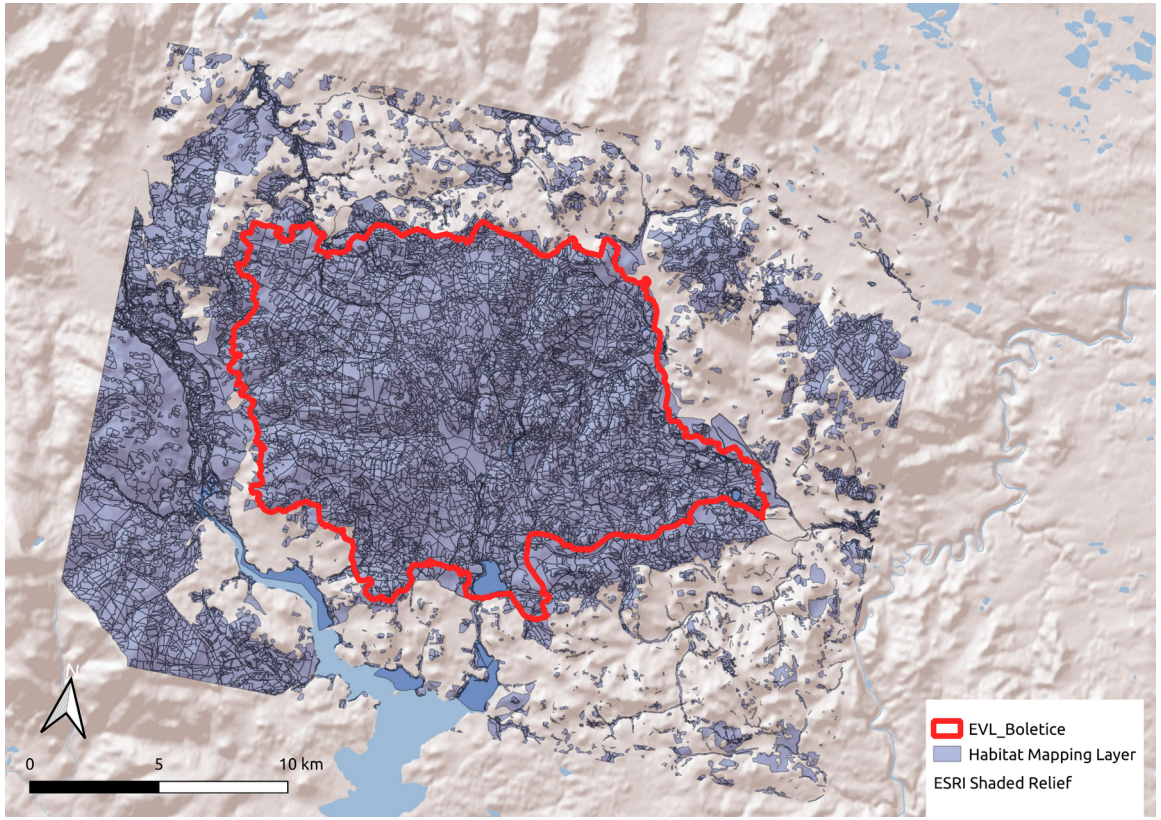
Jakub & Dan, Habitat Pilot workshop in Oulu, June 2025

Aims

- **visual representation** of the comparison of the Grassland Type Characterization Component (GT) with the Habitat Mapping Layer of Czechia (VMB)
- Natura 2000 site Boletice and surrounding landscape

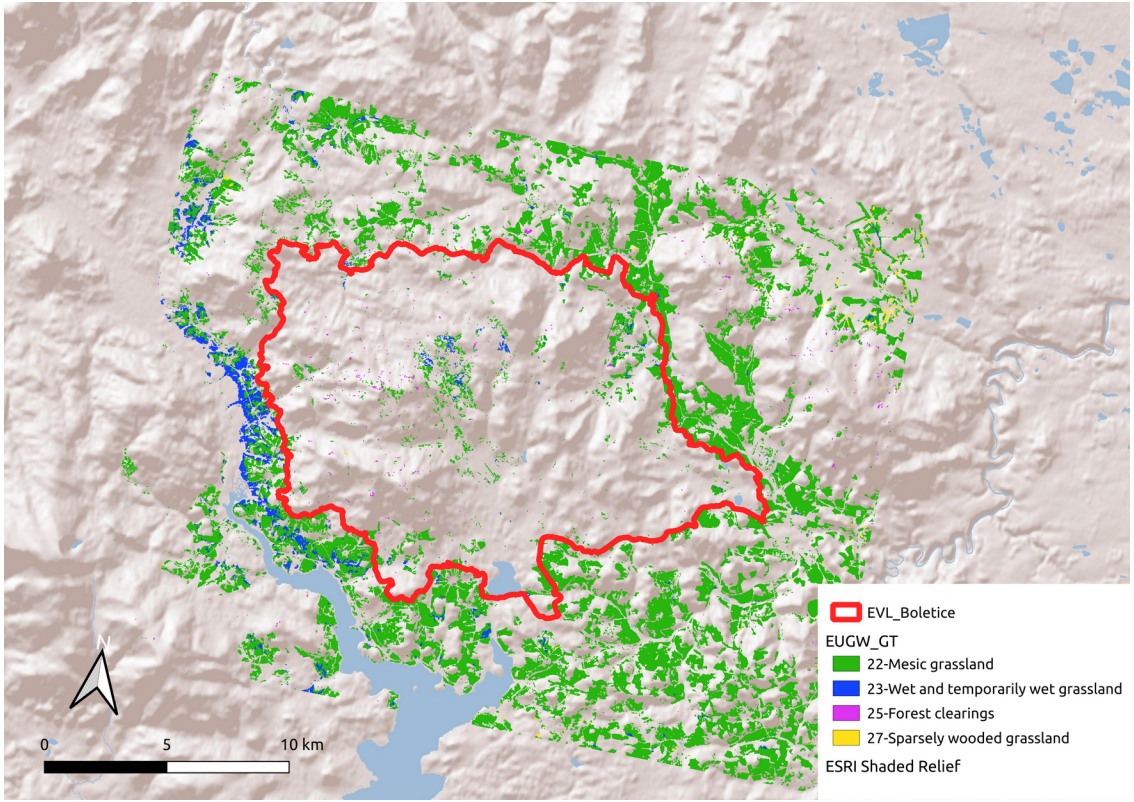
- proposal of validation process for classification models outputs based on vector polygon ground truth data

Data – Habitat Mapping Layer of Czechia



- vector polygon data
- collected in field
- Czech national classification system
- Annex 1 also included

Data – Grassland Type Characterization Component



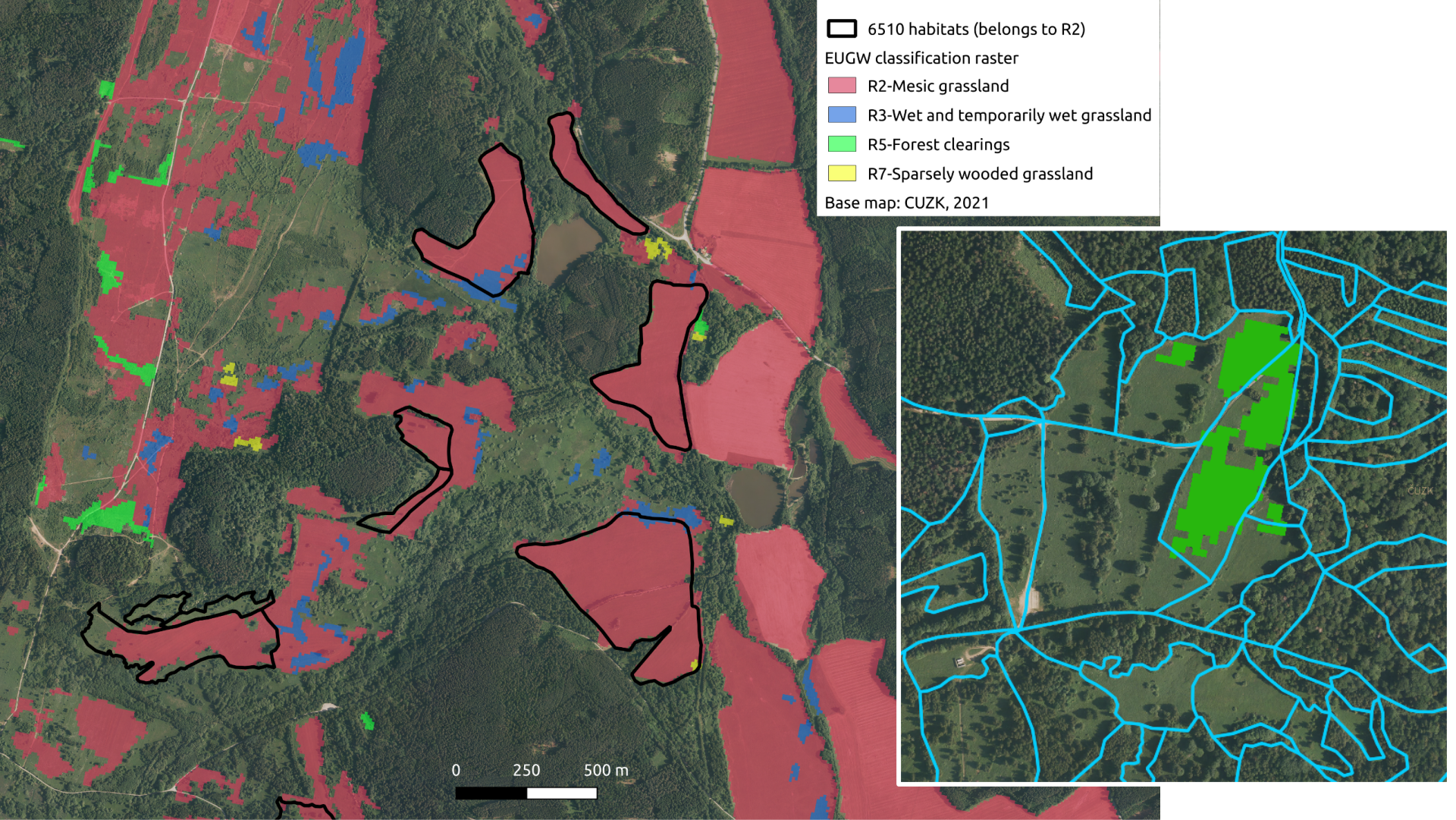
- raster layer
- grassland classification
- recognized 4 grassland types:
  - R2-Mesic grassland
  - R3-Wet and temporarily wet grassland
  - R5-Forest clearings
  - R7-Sparsely wooded grassland

Habitat classification systems

EU-GW	GT 22 Mesic grasslands	GT 23 Wet and temporarily wet grassland	GT 25 Forest clearings	GT 27 Sparsely wooded grassland
EUNIS 2021	R2	R3	R5	R7
Annex 1	6270, 6510, 6520	6410, 6420, 6440, 6450, 6460, 6510	6430	6310, 6530, 9070
Czech	T1.1, T1.2, T1.3	T1.4, T1.5, T1.7, T1.9, T1.10	M5, M7, A4.1, A4.2, A4.3, T1.6, T1.8, T4.1, T4.2	NA

Habitats present in study area

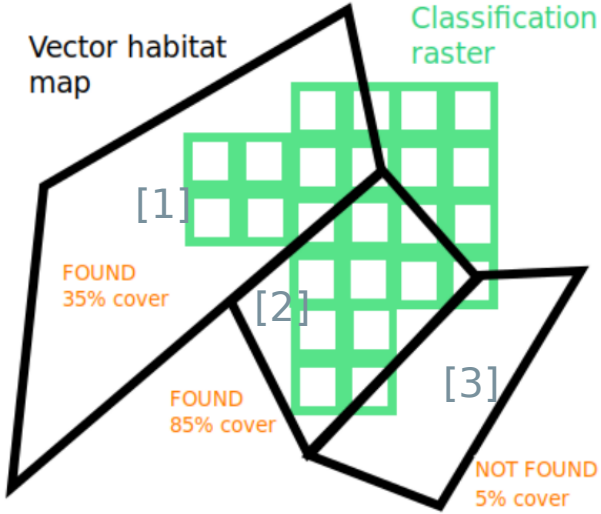
EU-GW	GT 22 Mesic grasslands	GT 23 Wet and temporarily wet grassland	GT 25 Forest clearings	GT 27 Sparsely wooded grassland
EUNIS 2021	R2	R3	R5	R7
Annex 1	~~6270~~, **6510**, **6520**	**6410**, ~~6420, 6440, 6450, 6460,~~ **6510**	**6430**	~~6310, 6530, 9070~~
Czech	**T1.1**, **T1.2**, **T1.3**	**T1.4**, **T1.5**, ~~T1.7~~, **T1.9**, ~~T1.10~~	~~M5, M7, A4.1, A4.2, A4.3,~~ **T1.6**, ~~T1.8, T4.1,~~ **T4.2**	~~NA~~


6510 habitats (belongs to R2)
EUGW classification raster
R2-Mesic grassland
R3-Wet and temporarily wet grassland
R5-Forest clearings
R7-Sparsely wooded grassland
Base map: CUZK, 2021
0
250
500 m
ČUZK

Metrics

1. if the **polygon has been identified** as given cathegory
   → binary output, threshold dependent
   → → → *proportion of polygons identified*

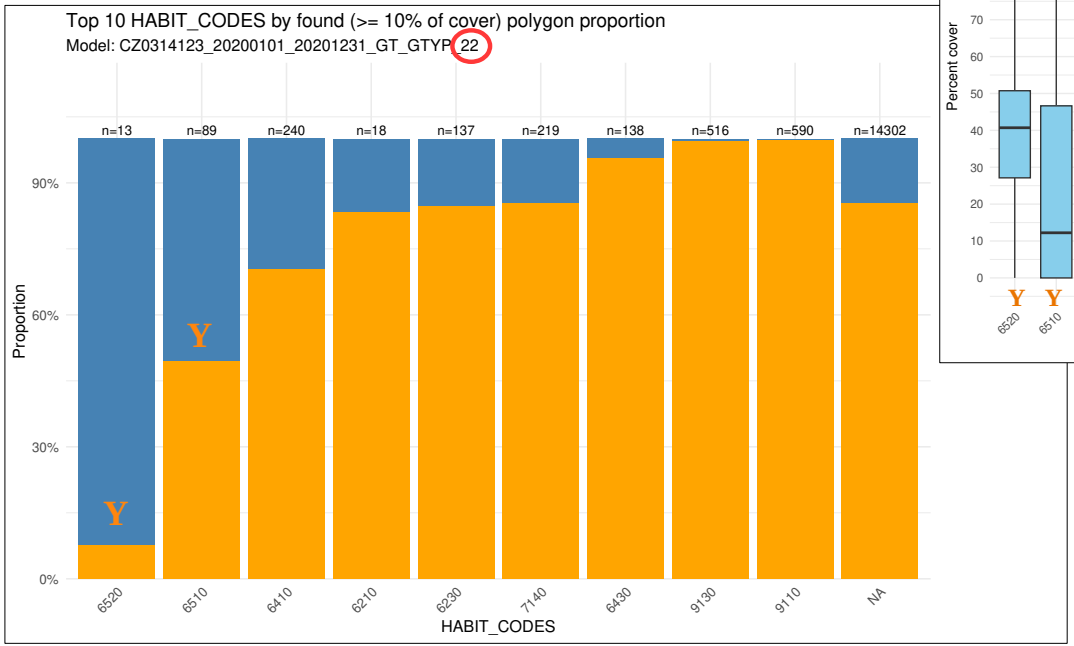
2. the **percentage of polygon area covered** by classified cathegory
   → from 0 to 100%
   → → → *coverage distribution within habitat cathegories*

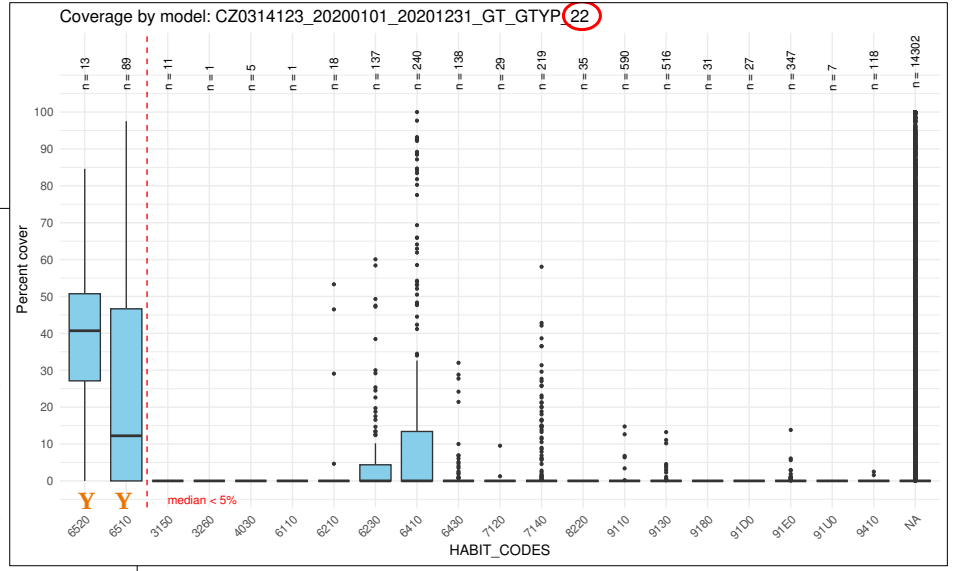


→ → computed for each polygon separately, than summarised in a graphs

Results for Boletice, prototype data of EUGW grassland type characterization component (GT)

GT 22 – Mesic grasslands



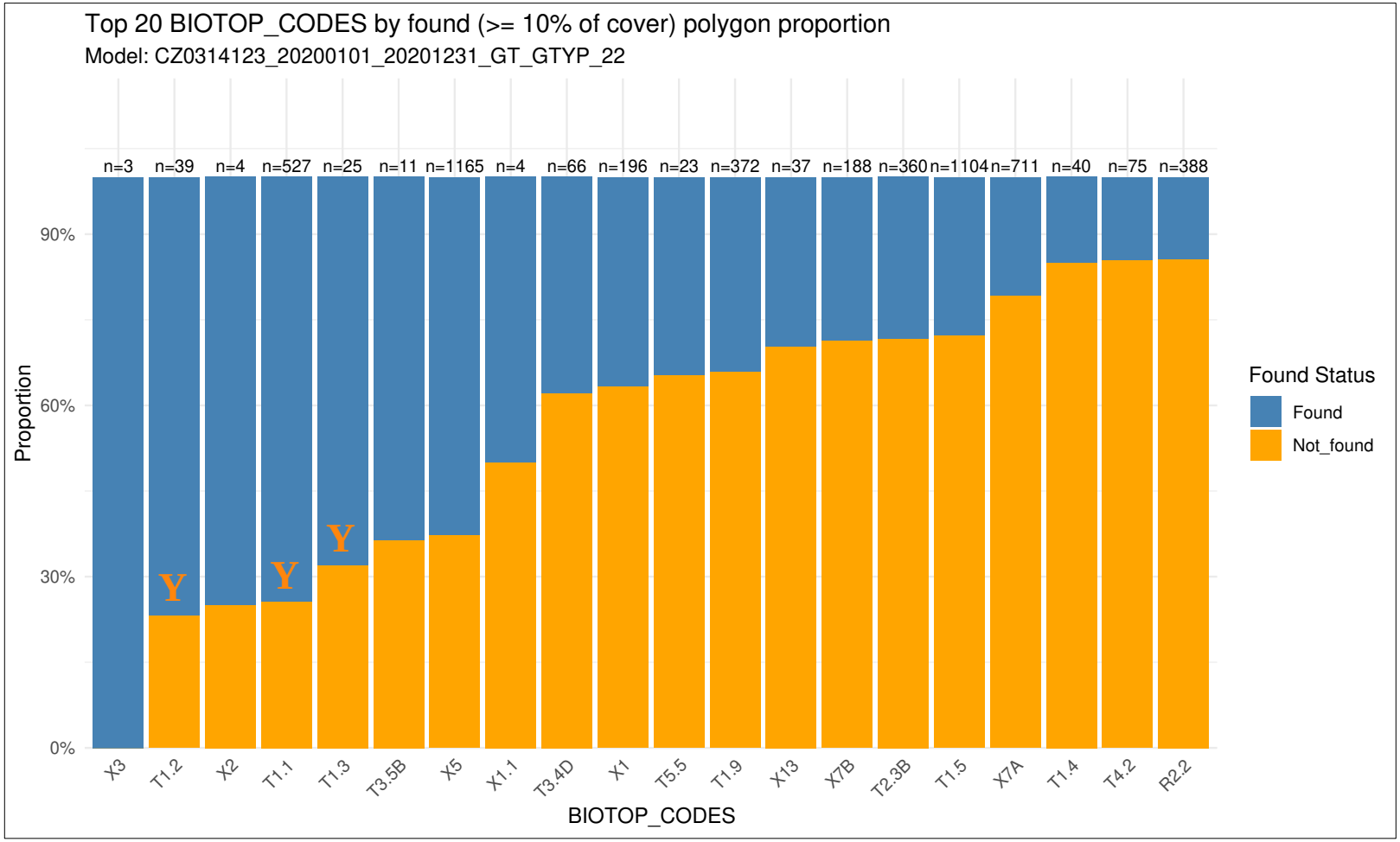


→ classification prefers correct habitats, but does not capture their full size

→ → NA here represents polygons, which are not Annex1 habitats, but they have czech cathegory assigned

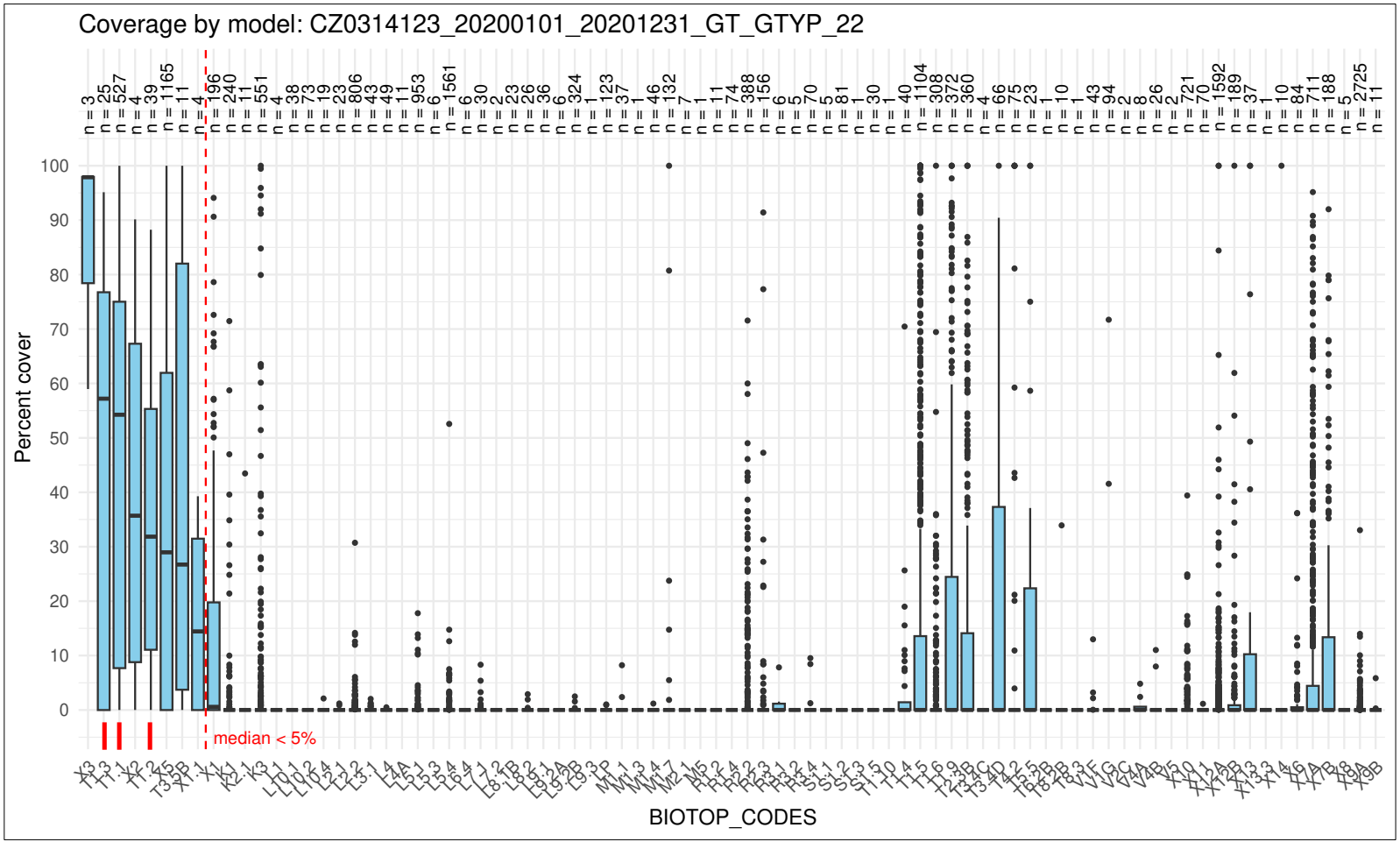
GT 22 – Mesic grasslands

Czech classification system perspective



GT 22 – Mesic grasslands

Czech classification system perspective



When plotted on **graphs**, it is possible to better assess how well the model performs on different habitat types, while **revealing trends in classification successes and failures**.

On the other hand, this general assessment **does not allow for a comparison between different models**.

Work in progress

- universal script
- vector polygon + raster layer(s)
- according to the user input produces the presented graphs
- pixel based confusion matrix

```
Confusion Matrix and Statistics

          Reference
Prediction      22      23      25      27     NaN
        22   64258   31142     817       0 1220641
        23    2933   11054     240       0   71785
        25     233     479      30       0   11840
        27     660     478       0       0   12799
        NaN  44423  133137   33037       1 5704013

Overall Statistics

               Accuracy : 0.7869
                 95% CI : (0.7867, 0.7872)
    No Information Rate : 0.956
    P-Value [Acc > NIR] : 1

                  Kappa : 0.0615

 Mcnemar's Test P-Value : NA

Statistics by Class:

                     Class: 22 Class: 23 Class: 25 Class: 27 Class: NaN
Sensitivity            0.57115  0.062703 8.791e-04 0.000e+00    0.81241
Specificity            0.82679  0.989542 9.983e-01 9.981e-01    0.34784
Pos Pred Value         0.04880  0.128517 2.384e-03 0.000e+00    0.96439
Neg Pred Value         0.99199  0.977234 9.953e-01 1.000e+00    0.07858
Precision              0.04880  0.128517 2.384e-03 0.000e+00    0.96439
Recall                 0.57115  0.062703 8.791e-04 0.000e+00    0.81241
F1                     0.08991  0.084285 1.285e-03       NaN    0.88190
Prevalence             0.01532  0.024005 4.647e-03 1.362e-07    0.95603
Detection Rate         0.00875  0.001505 4.085e-06 0.000e+00    0.77669
Detection Prevalence   0.17931  0.011712 1.713e-03 1.898e-03    0.80537
Balanced Accuracy      0.69897  0.526123 4.996e-01 4.991e-01    0.58012
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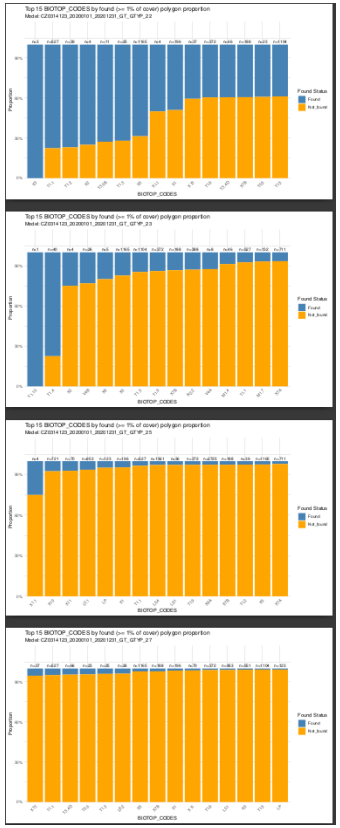

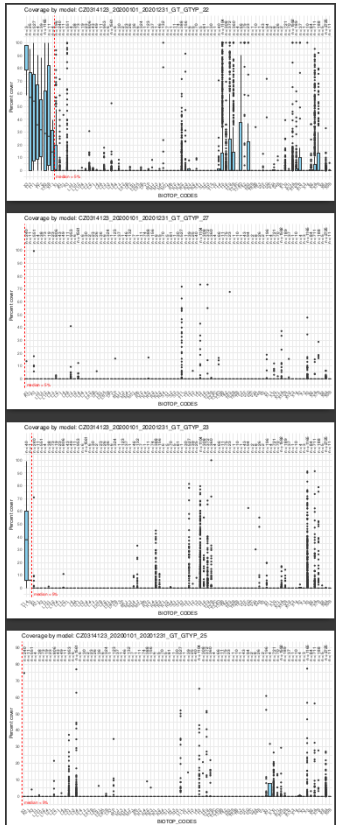

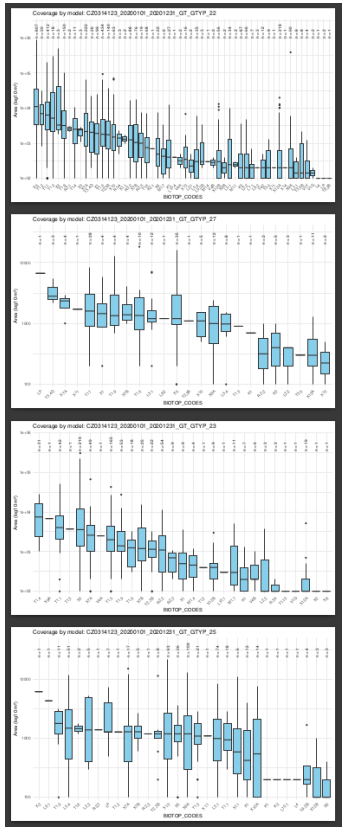

Confusion Matrix

- function caret::confusionMatrix
- prediction and reference **must share classification system** and all levels must be present in data

```
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```

Transferability, what data is needed?

- **Vector polygon layer** representing ‘ground truth’ (e.g. field mapped habitats)
  - unique identifier of polygon
  - habitat cathegory represented by polygon
- **Classification raster(s)**
  - for ‘**confusion matrix** analysis’ there should be **identical levels in both** raster and vector layers (use of same classification system and all classified cathegories by model should be present in focal area – if not, its shouting errors, but I will improve it to stop make it happening)
  - for ‘**graphical** analysis’ **any classification system** could be used (since it does not really compare anything)

- code is already hanging on Github (*github.com/zbubster/vmb_validater*), but some essential parts still missing