

Habitat Mapping of Overgrown Pastures on Učka and Kvarner Islands (Task 3.4.2.)



Project title	<p>Securing a future for Griffon vultures in Croatia</p> <p>LIFE SUPport</p> <p>(Project 101074212 — LIFE21-NAT-HR-LIFE SUPport)</p>
Coordinating beneficiary	Association BIOM
Associated beneficiary	<p>STICHTING THE VULTURE CONSERVATION FOUNDATION (VCF)</p> <p>JAVNA USTANOVA PRIRODA (JU Priroda)</p> <p>HEP-OPERATOR DISTRIBUCIJSKOG SUSTAVA DOO ZA DISTRIBUCIJU I OPSKRBU ELEKTRICNE ENERGIJE D.O.O. (HEP-ODS d.o.o.)</p> <p>OPĆINA BAŠKA</p> <p>Affiliated partner: TRGOVAČKO DRUŠTVO BAŠKA d.o.o.</p> <p>Associated partner: Directorate for Nature Protection of the Ministry of Economy and Environmental Protection of the Republic of Croatia</p>
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Contents

Summary.....	1
Introduction	2
Methodology.....	3
Results.....	6
Conclusions	12
References:.....	12



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Summary

The project area is facing problems that are common to rural regions, such as depopulation, land abandonment and lack of interest in sustainable agriculture and as a consequence, once widespread dry grassland are in decline. Most of the grasslands are overgrown by shrubby woody vegetation, but the degree of overgrowing has not been systematically assessed so far. In order to assess the current situation regarding the succession to scrubland or forest, we conduct a mapping study of dry grasslands in the project area and the resulting map should tell us the current amount of open and overgrown grassland.

The project area was divided into 5 separate locations – the mainland and 4 Kvarner islands and the result of the mapping was presented only for the 4 islands. The mapping was carried out using remote sensing methods with most of the work done through visual interpretation of ortho-photo images in QGIS.

We selected existing grassland patches of Natura 2000 habitats Eastern sub-mediterranean dry grasslands (*Scorzoneratalia villosae*) and Eu- and stenomediterranean rocky pastures (*Cymbopogono-Brachypodion ramosi*) and subdivided each patch into three habitat classes (open grassland, transition, woodland), gaining the amount of the patch area that is still an open grassland.

We identified in total 807 grassland patches in the whole project area, with the highest number on the largest island (Krk - 253). The average size of the patch in the whole area is 30,46ha, with the largest patches on average on the islands of Cres and Krk and the smallest on Lošinj.

The average proportion of open grasslands in the patches on the 4 islands is on average rather small (30,14%), and the largest amount is recorded for the island of Rab (37,43%), while the smallest is present on Cres (20,73%), indicating a high degree of succession on all grassland patches in the project area. A similar situation has been recorded for the mainland and we can conclude that the grasslands in the project area are slowly despairing through the encroachment of woody vegetation.

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Introduction

The abandonment of extensive sheep farming in the Kvarner islands and on the neighbouring mainland in the last decades resulted in the overgrowing of formerly extensive karstic pastures that used to be an important source of local livelihood. The spread of woodland is exacerbated by a drastic change in the lifestyle in these last decades, as people don't need wood for heating and cooking that much so cutting of shrubs for personal use is quite uncommon today.

The project area is facing problems that are common to rural regions today, such as depopulation, land abandonment and lack of interest in sustainable agriculture. Once widespread dry grasslands, used extensively for livestock, are now being reclaimed by the surrounding forest on the mainland and by shrubland on the islands. The problems are well known and have been present in the area for a long time, but the degree of overgrowing has not been systematically assessed so far.

So, in order to assess the current situation regarding the succession to scrubland or forest, we conduct a mapping study of dry grasslands in the project area and the resulting map should tell us the current amount of open and overgrown grassland.

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Methodology

The project area can be divided into 5 separate locations – the mainland (HR1000018 Učka and Ćićarija) and 4 Kvarner islands (as well as all the islets that are part of HR1000033 Kvarnerski otoci). This division was used to analyse the results. In order to assess the condition of dry grasslands regarding succession, we first selected all the dry grasslands present in the project area, according to the Map of non-forest terrestrial habitats of Republic of Croatia (Bardi et al. 2016). We used only polygons where the only or dominant habitat type represents Natura 2000 habitat Eastern sub-mediterranean dry grasslands (*Scorzoneratalia villosae*) and Eu- and stenomediteranean rocky pastures (*Cymbopogono-Brachypodium ramosi*) (**Figure 1.**). Merging together polygons that shared a border, we created grassland patches from which we removed areas with permanent infrastructure elements (roads, railroads, settlements), as well as permanent agricultural areas, with the aid of a Digital ortho-photo form 2021/2022 (Geoportal 2024). Then we reviewed all the patches and removed those that currently have no grassland areas in them, as they are probably a result of a mapping errors in the original map. The remaining patches represent the extent of dry grasslands in the survey area in 2016 (**Figure 2.**). Using a Digital ortho-photo form 2021/2022, we created a map of grassland encroachment for every patch by delineating three habitat classes (**Figure 3.**):

Open Grasslands (1) – no or a small amount of woody vegetation is visible in the polygon which is dominated by grasses (open habitats);

Transition (2) – on at least 15% of the polygon area there is a visible cover of woody vegetation (up to 60%). These polygons are in between classes (1) and (3) and comprise a very broad category that covers areas with a variable degree of openness in respect to the woody vegetation;

Woodland (3) – the polygon is dominated by a dense cover of woody vegetation or mature trees with a sparse understory (closed habitats, more than 60% of the area is covered by woody vegetation).

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Figure 1. Dry grassland and rocky pastures patches extracted from the Map of non-forest terrestrial habitats (basemap: OSM 2021, Hillshade based on EU-DEM (Copernicus Land 2021))

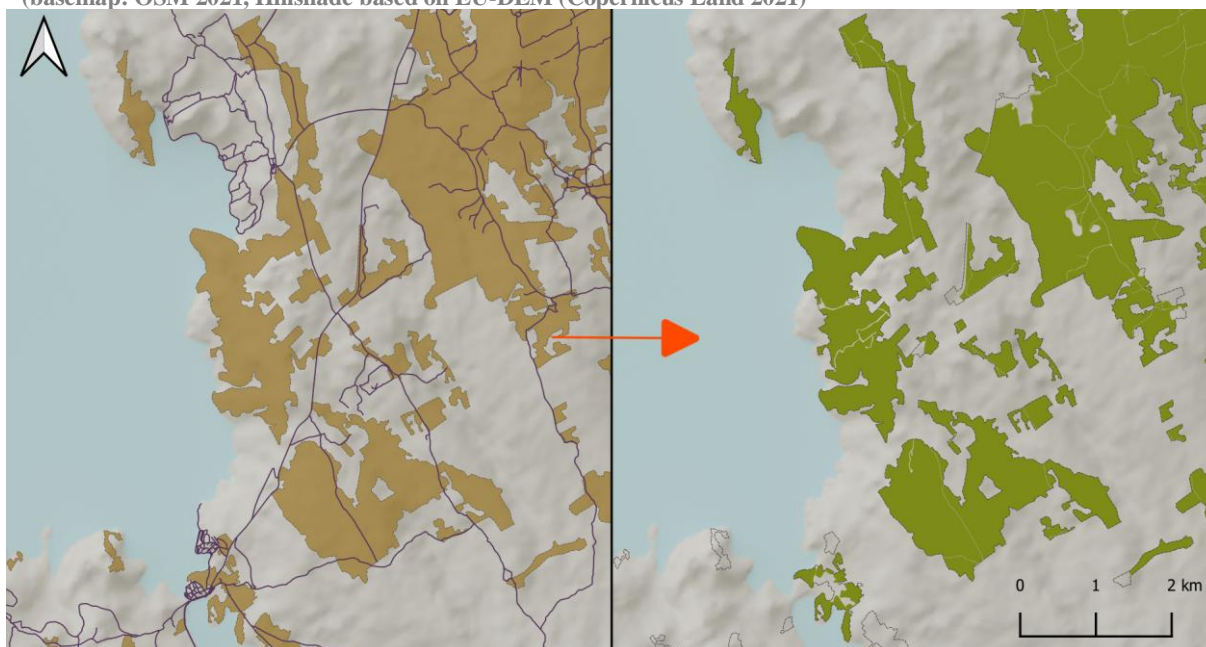


Figure 2. Grassland patches without landcover elements of anthropogenic origin (e.g. infrastructure, agriculture) (basemap: OSM 2021, Hillshade based on EU-DEM (Copernicus Land 2021))

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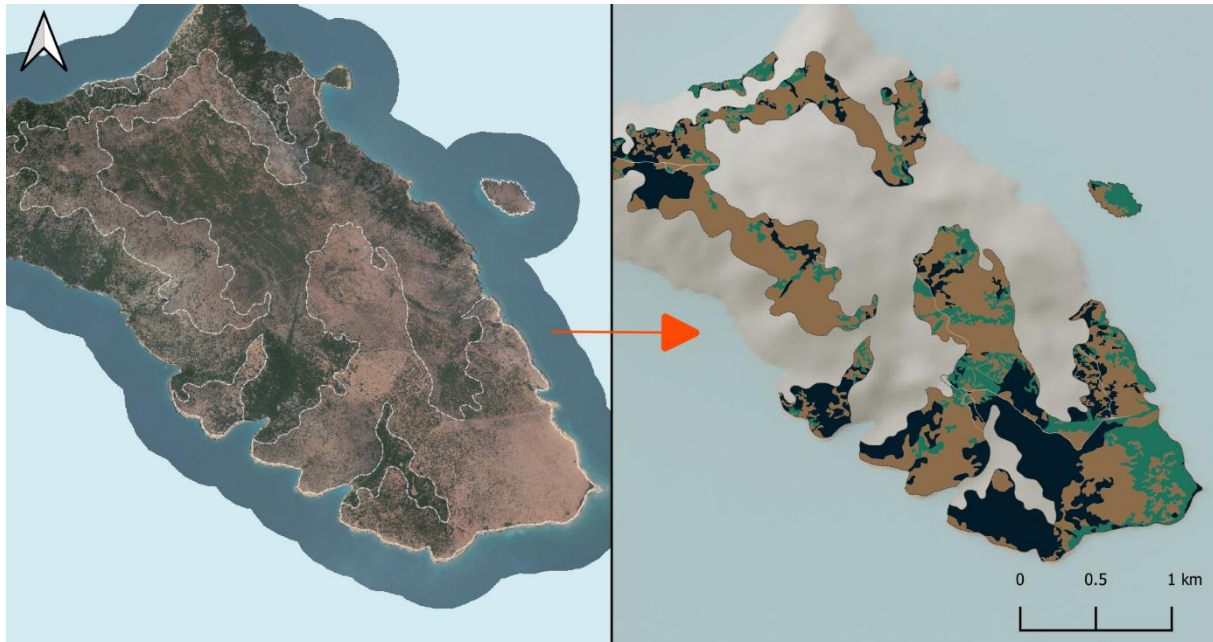


Figure 3. Division of an ortho-photo map into three classes: **grassland (green)**, **transition (brown)**, **woodland (black)** (basemap: OSM 2021/2022 (Geoportal 2024), Hillshade based on EU-DEM (Copernicus Land 2021))

We then dissolved all the polygons based on the patch Id and the three classes so we can calculate the area of each class per patch. Everything described so far was done in QGIS (version 3.28). The data was transferred to Excel where we calculated the percentages. The amount of grassland class in a patch indicates the current degree of succession of the grasslands in the project area. Patches with 80% or more grassland are in a good condition, while patches with less than 50% are not grasslands anymore. These thresholds are arbitrary and are based on a rationale that in whatever way we map grasslands, we'll always have a small amount of space in the patch covered by something else other than grasslands, and having more than 2/3 of the patch actually covered by grasslands can be considered a naturally good result. In the same way, if 50% or more of the mapped space is used by something other than grassland, this patch should not be interpreted as grassland anymore.

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Results

In total we identified 807 grassland patches in the whole project area, with the highest number on the island of Krk (253) and on the mainland (227). The average size of the patch in the whole area is 30,46ha, with the largest patches on average on the islands of Cres and Krk (42,04ha and 40,77ha respectively) and the smallest on the Lošinj (13,90ha). The total area of grasslands as was recorded in 2016 (Bardi et al 2016) differs significantly between the different parts of the project area, and for the islands is proportional to their size, with the highest values for islands Krk and Cres and the lowest value for Lošinj (**Figure 4**).

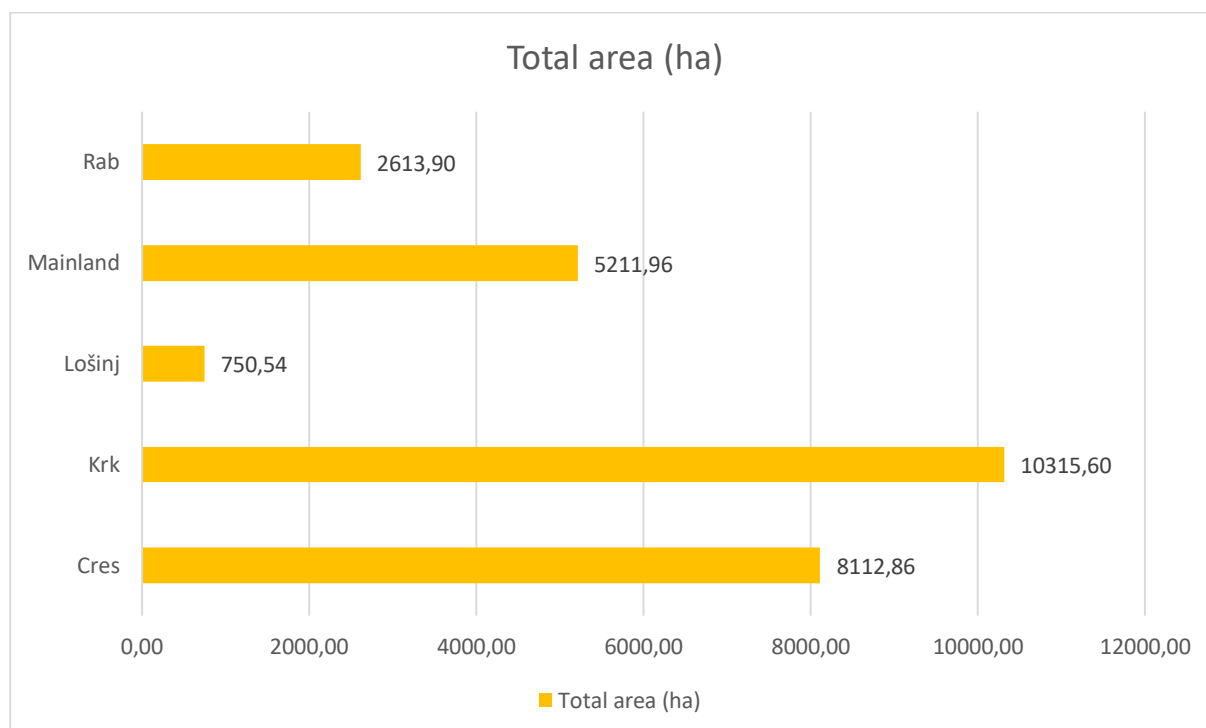


Figure 4. Total area of all grassland patches in the project area. The grassland patches are from Bardi et al. (2016)

Although the total area of grasslands in the project area is rather large, the status of these grassland patches is not great. The average proportion of open grasslands in the patches is largest for Rab (37,43%), while the smallest value is present on Cres (20,73%), indicating that the grassland on Cres are significantly more overgrown than the ones on Rab (Figure 5.). On average, the amount of open grasslands in the project area is rather small and covers a little less than 1/3 of the patch area (30,14%), indicating a high degree of succession on all grassland patches. But these values should be interpreted with care, since the minimal mapping unit (MMU) in Bardi et al. (2016) was 1,56ha, while our minimal mapping unit was 25m² (0,0025ha), allowing us to get a more detailed delineation of open grassland areas within the patches. Despite the differences in the methodology, it can still be used as an indication of the change in the grassland area in the last 8 years.

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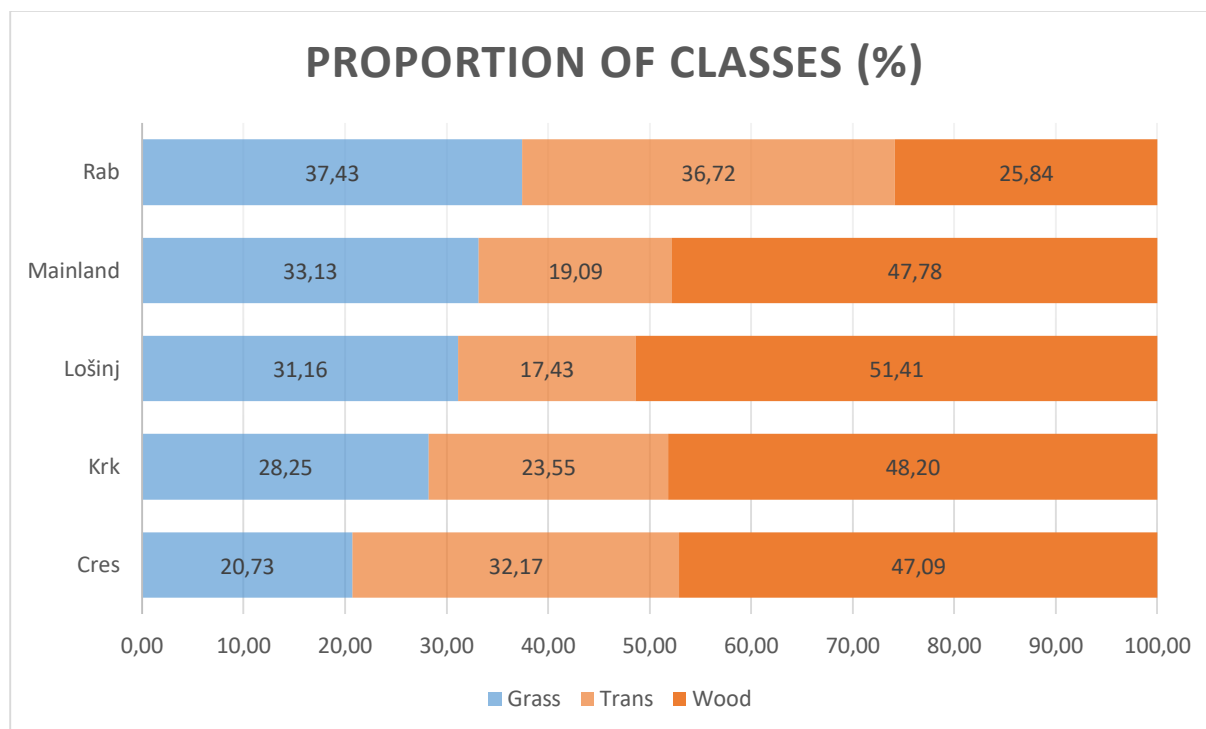


Figure 5. Average amount of habitat classes (Grass – open grassland; Trans – transition; Wood - woodland) per location (Mainland and 4 islands)

In order to get a better understanding of the current status of the grasslands in survey area, we grouped the grassland patches in 7 categories, according to the proportion of grassland class present in the patch:

Category 1: 0% grassland
Category 2: 0,1 – 10% grassland
Category 3: 10,01 – 30% grassland
Category 4: 30,01 – 50% grassland
Category 5: 50,01 – 70% grassland
Category 6: 70,01 – 80% grassland
Category 7: 80,01 – 100% grassland

The choice to divide patches into 7 categories was arbitrary, as well as the thresholds for the categories. These categories are meant to simplify the interpretation of the results and highlight the extremes (that is why the patches with no grasslands have their own category).

So, categories 1 – 4 cannot be considered grasslands as less than 50% of the patch area is not covered by grasslands. And the patches that can be considered currently in good condition, would be only the

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ones in category 7. This categorization was done only for the islands as the one for the mainland can be found in Škunca and Grgić (2021). Out of a total of 580 grassland patches on 4 islands, only 16,55% can still be considered grasslands, as in the last three categories we have only 94 patches (60 in category 5, 14 and 22 patches in categories 6 and 7). Moreover, a total of 56 patches have no open grassland at all (category 1) and 97 patches have up to 10% of open grassland (category 2), which is more then the last three categories combined. The largest number of patches belong to category 3 (223).

Between the islands, Lošinj and Rab have a higher amount of patches in the last three categories (27,78% and 27,50 respectively), while Cres has the lowest amount (only 8,29%). The island of Krk is somewhere in the middle with 17% of patches that can be considered grasslands (**Figure 6-8.**). We can conclude that the grasslands in the project area in a bad shape and slowly despairing through the encroachment of woody vegetation, as there is less than a third of open grassland area in the patches that should have at least 85% of grassland cover. A similar situation has been assessed for the mainland (Škunca and Grgić 2021) (**Figure 10.**)

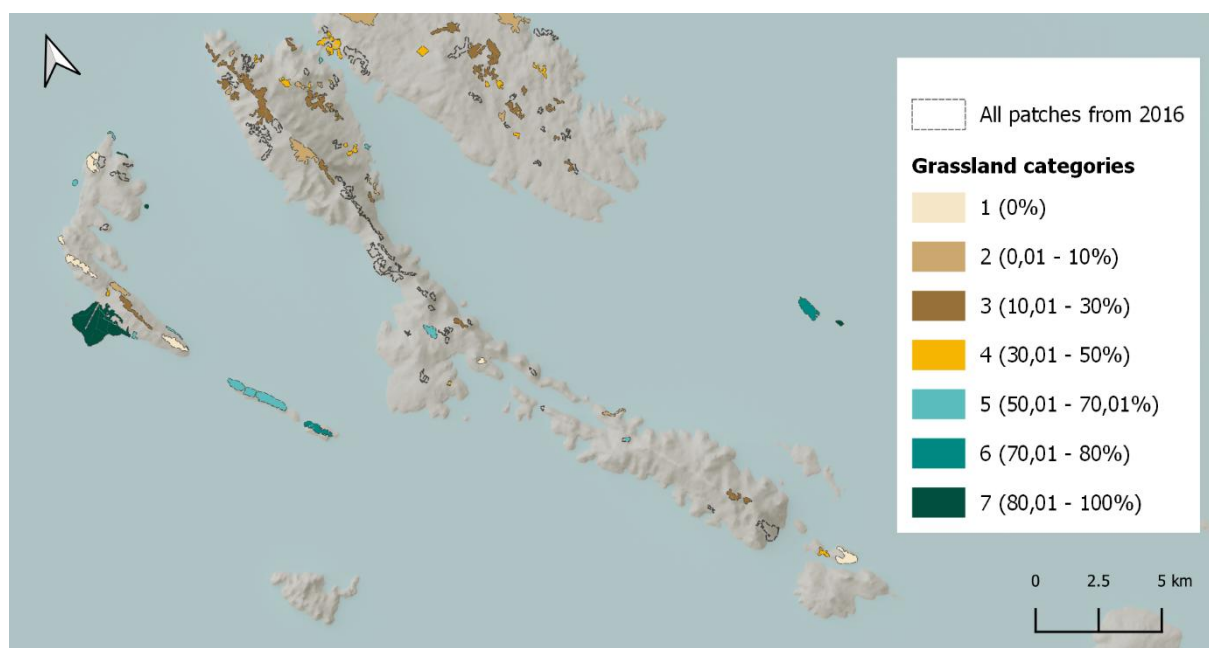


Figure 6. Grassland patches on Lošinj, divided into 7 categories (basemap: OSM 2021/2022 (Geoportal 2024), Hillshade based on EU-DEM (Copernicus Land 2021))

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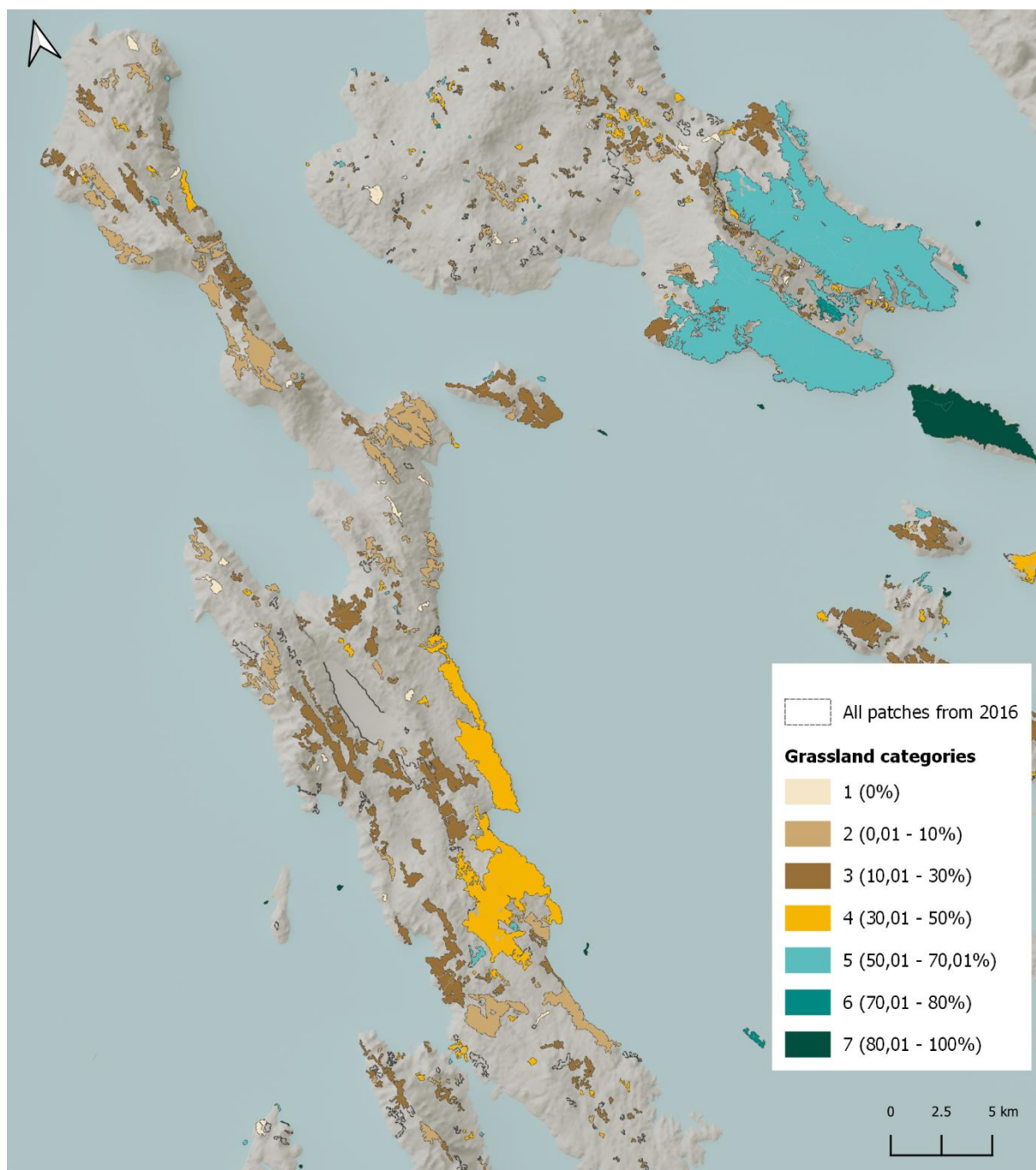


Figure 7. Grassland patches on Cres, divided into 7 categories (basemap: OSM 2021/2022 (Geoportal 2024), Hillshade based on EU-DEM (Copernicus Land 2021))

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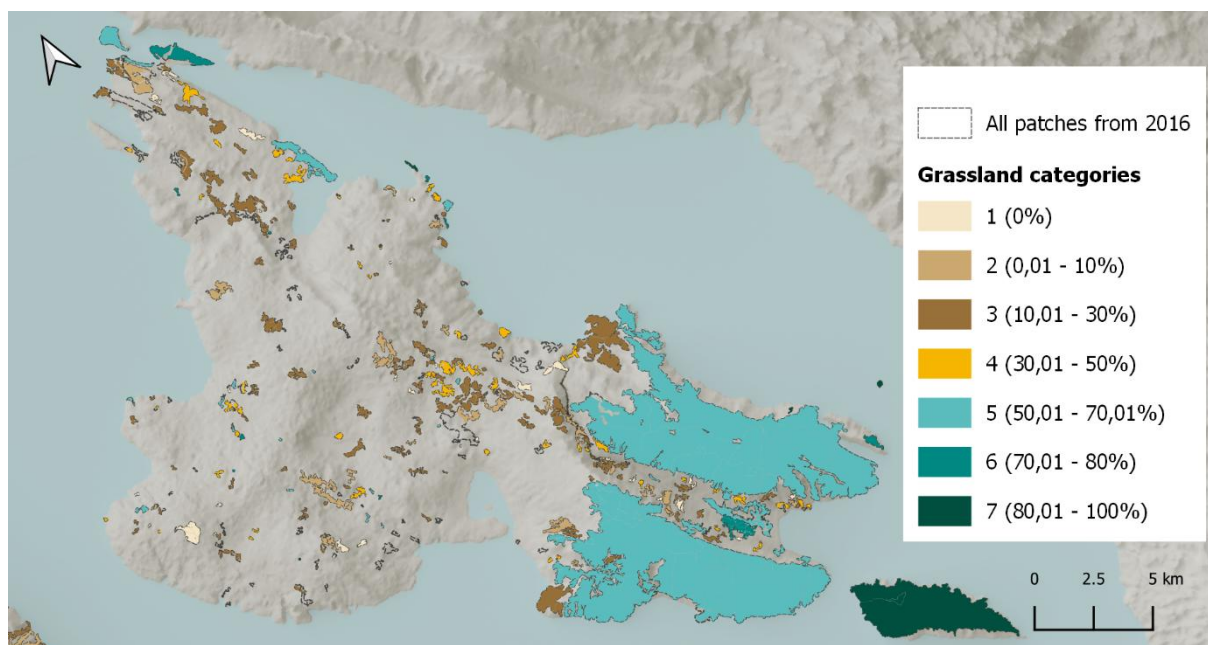


Figure 8. Grassland patches on Lošinj, divided into 7 categories (basemap: OSM 2021/2022 (Geoportal 2024), Hillshade based on EU-DEM (Copernicus Land 2021))

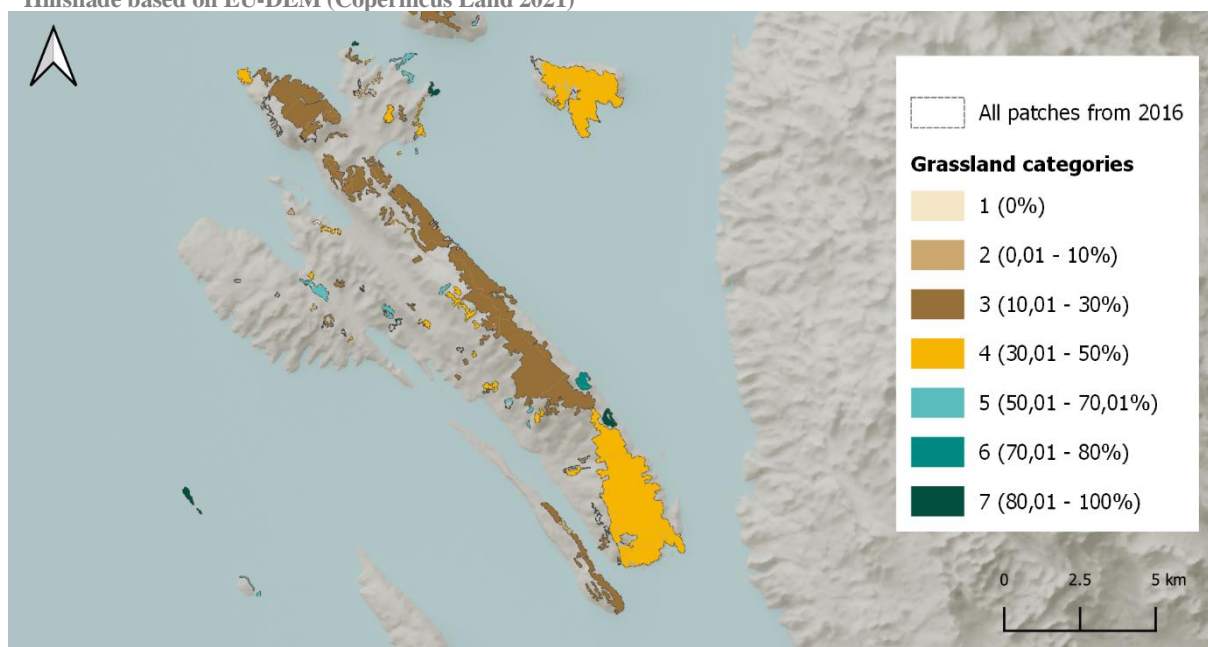


Figure 9. Grassland patches on Rab, divided into 7 categories (basemap: OSM 2021/2022 (Geoportal 2024), Hillshade based on EU-DEM (Copernicus Land 2021))

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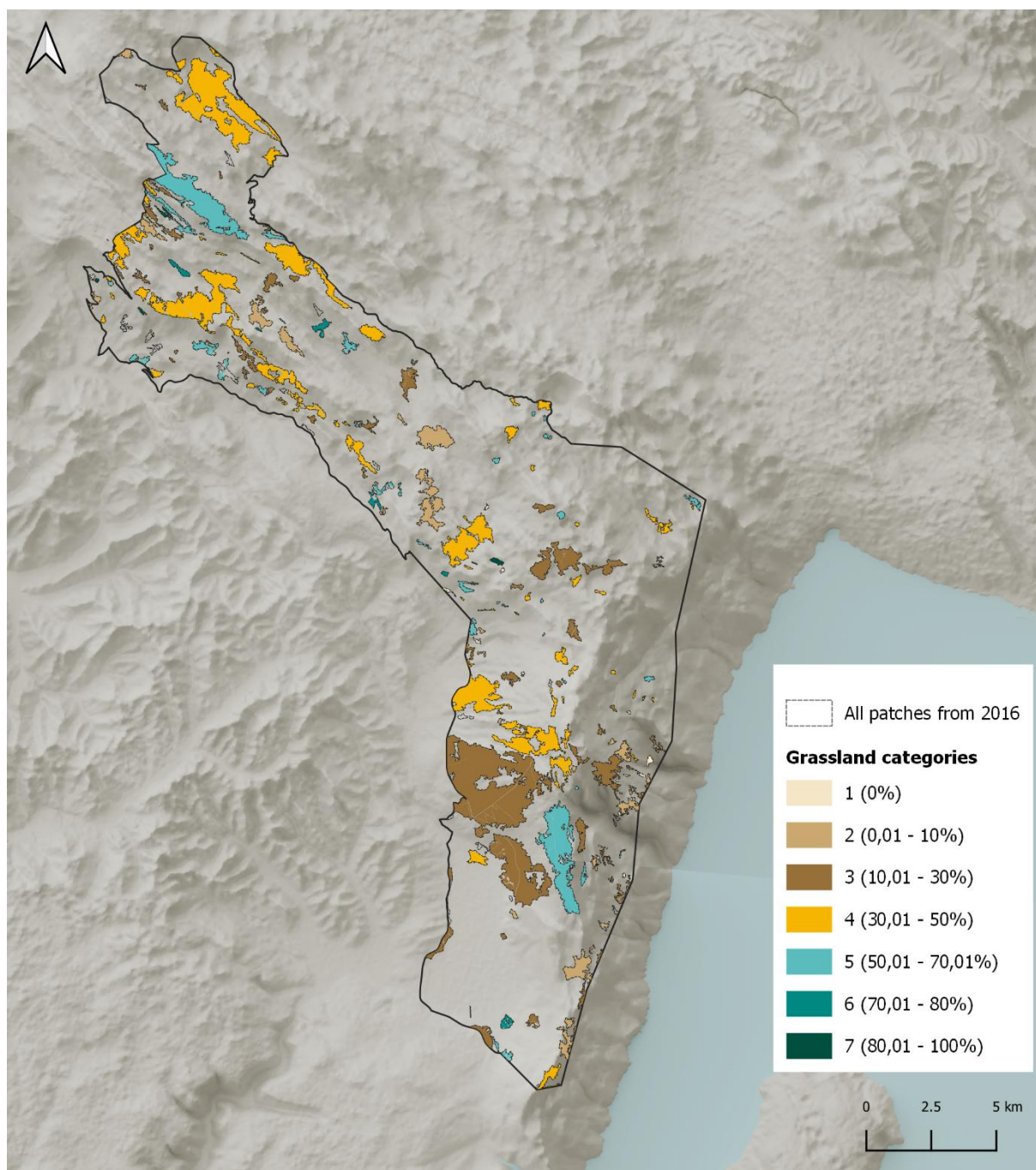


Figure 10. Grassland patches on the mainland section, divided into 7 categories (basemap: OSM 2021/2022 (Geoportal 2024), Hillshade based on EU-DEM (Copernicus Land 2021))

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We selected existing grassland patches of Natura 2000 habitats Eastern sub-mediterranean dry grasslands (*Scorzonera villosa*) and Eu- and stenomediterranean rocky pastures (*Cymbopogon-Brachypodium ramosi*) and subdivided each patch into three habitat classes (open grassland, transition, woodland), gaining the amount of the patch area that is still an open grassland.

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