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This research was funded by CropLife Europe and was supervised by its Non-Target Plant Group: Rena Isemer (Chair; Bayer AG), Joanna Davies (Syngenta), Eileen Patterson (Corteva), Stefania Loutseti (Syngenta), Christoph Julian Mayer (BASF)

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The QUICKScan tool and databases can be downloaded from (http://www.QUICKScan.pro).

Reviewed by:
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The terrestrial plant risk assessment of pesticides is currently based on testing 10 single species in two different test systems. These species are mostly crop species, grown as single species in pots. Higher tier tests of any kind (e.g. field, semi-field, landscape studies) are not standardized. In this study we explored an approach to inform such a higher level by collecting datasets and information at European scale to characterize the vegetation communities that are likely to grow in the off-field areas of wheat and vine crops. This study was performed at the request of CropLife Europe and its Non-Target Plant group. The QUICKScan methodology (http://www.QUICKScan.pro) was used to combine all data. Habitat suitability maps were generated and combined with crop distribution maps for wheat and vine to generate potential occurrence maps of EUNIS habitats and their vegetation in agricultural land surrounding wheat and vine crops and were linked with plant trait information. We conclude that this method is helpful in reaching the objective as described in this report. Its potential is that it can be extended probabilistically or linked to plant effect models.

Keywords: terrestrial plants, risk assessment, agricultural landscape, QUICKScan tool, off-field, plant communities, Europe

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Photo cover: Non-target terrestrial field off-field area alongside a grain crop

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Preface

This study was performed for CropLife Europe in the period 2019 - 2021.

This study was supervised by its Non-Target Plant Group: Rena Isemer (Chair), Joanna Davies, Eileen Patterson, Stefania Loutseti, Christoph Julian Mayer, Tiffany Kung.

Summary

The terrestrial plant risk assessment of pesticides is currently based on testing 10 single species in two different test systems. These species are mostly crop species, grown as single species in pots. Higher tier tests of any kind (e.g. field, semi-field, landscape studies) are not standardized. In this study we explored an approach to inform such a higher level by collecting datasets and information at European scale to characterize the vegetation communities that are likely to grow in the off-field areas of wheat and vine crops. This study was performed at the request of CropLife Europe and its Non-Target Plant group. In the long run, the method should help to describe 5-10 surrogate plant communities that could serve as a reference tier in terms of habitats, functionalities and structures at European level to be used in the risk assessment and/or to inform higher-tier testing for herbicides. As a first step, the year 2019 was dedicated to exploring data that could be used to identify plant communities and plant species and their predictors at the landscape level that are characteristic for the vicinity of agricultural areas in Europe. In 2020/21, further work was performed on linking the available databases, data-sets and expert information by means of the QUICKScan tool (http://www.QUICKScan.pro). This is a spatial modelling environment that combines expert knowledge with spatial and statistical data. The EUNIS (European Nature Information System; https://eunis.eea.europa.eu/) habitat classification has been used as a basis to identify the eight man-made habitats characteristic of agricultural cropped areas. These habitats are spatially identified on the bases of a modelling process where vegetation plots, taken from the European Vegetation Archive (http://euroveg.org/eva-database), were used as observations and climate, soil, topographic, population density parameters and Remote Sensed Essential Biodiversity Variables as predictors. This modelling resulted in habitat suitability maps. The habitats include 329 species, belong to 45 plant families and refer to 46 579 vegetation plot observations in the European Vegetation Archive. The habitat suitability maps were combined with crop distribution maps for wheat and vine to generate potential occurrence maps of EUNIS habitats in agricultural land surrounding wheat and vine crops. Plant traits including leaf type, monocotyledon / dicotyledon category, plant functional type, plant life span (longevity) and seed longevity were requested from the TRY plant trait database (https://www.try-db.org/TryWeb/Home.php), extended with the Raunkiaer life forms and used to collate a characteristic trait spectrum and distribution map per EUNIS habitat. The QUICKScan methodology (https://www.QUICKScan.pro/) was used to combine all these data. We conclude that this method is helpful in reaching the objective as described in this report. Its potential is that it can be extended probabilistically or linked to plant effect models.

Keywords: terrestrial plants, risk assessment, agricultural area, QUICKScan tool, off-field, plant communities, Europe

1 Introduction

The terrestrial plant risk assessment of pesticides is currently based on testing 10 single species in two different test systems. These species are mostly crop species, grown as single species in pots. Higher tier tests of any kind (e.g. field, semi-field, landscape) are not standardized. From the field up to the landscape level, the question arises how such a higher tier assessment could be performed for terrestrial plants. At these higher levels, the biological organization is not the species, but rather the plant community. Therefore, at the request of CropLife Europe (CLE), Non-Target Plant group, a project was initiated to develop a method for the deduction of representative plant communities in the off-field area. As a first step, the year 2019 was dedicated to exploring data that could be used to identify plant communities and plant species and their predictors at the landscape level that are characteristic for the vicinity of agricultural areas in Europe. Subsequently, the QUICKScan method was used to combine all data with focus on plant communities surrounding two crops, i.e. wheat and vine crops. Potentially, the approach could also be used for other crops where data is available. This report explains the datasets at European level used for this study, the background of the QUICKScan methodology and presents the results.

In the long run, the methodology should help to describe 5-10 surrogate plant communities e.g. to inform on reference tier(s) to be used in the risk assessment and/or to inform on non-target plant testing approaches for herbicides and other plant protection products. The specific objectives of this project are in short:

1. Characterization of wild plant communities in the vicinity of agricultural fields (off-field) in Europe;
2. Defining the spatial scale of these communities;
3. Translating these plant communities in terms of habitats and functionalities;
4. Defining the time scale and succession of these plant communities;
5. Describing management of field margins and similar structures in European agricultural landscapes.

It is specifically the aim of the project to look at wild plant communities that are located in the agricultural landscape (just) outside of agricultural fields, the so-called off-field plant communities. In-field plant communities are outside the scope of this project. The project has been divided into different phases. In the year 2018, the proposal has been prepared and granted. Based on this project proposal, a projectplan was developed in more detail in cooperation with a project monitoring group consisting of members of the CLE Non-Target Plant Group. During the first year of the project, which was 2019, the project was dedicated to data selection, data evaluation and exploration of the available literature. The year 2020 was dedicated to data analysis and further development of the QUICKScan methodology. As a case study, wheat crops were elaborated. In 2021 a second crop was added as a case study, i.e. vine. The results of the overall project are published in this report and in a paper.

1.1 Vision on the assignment

We explored a number of databases ready for use in a data analysis to answer the central objectives of the project as described above.

The focus laid on off-crop plant communities and included information on selected crops at European scale. The reason is that there is a relation between plants growing in-field and growing in the off-field area which means that the crop grown on the field should be considered when performing an non-target plant-based risk assessment addressing the plant communities off-field. Factors responsible for this are, among others, soil type, crop type and land management.

1.2 Characterization of vegetation in off-field areas

The 10 anthropogenic vegetation classes as described by Mucina (2016) are part of a scientific vegetation classification (https://www.synbiosys.alterra.nl/evc). This vegetation classification is a hierarchical classification system and is based on a characterization of different plant species groups, i.e. characteristic, discriminating and constant plant species. The EUNIS system is very different from this hierarchical vegetation classification and is a habitat classification that is more practical by nature. As the elaboration of the EUNIS habitat classification for man-made habitats had been finished early 2020 (Schaminée et al., 2020), we could make use of these elaborated data to characterize the off-field habitats of agricultural fields by their vegetation, their plant communities, families and species.

1.3 Aim

At the request of CropLife Europe (CLE), the ultimate aim of this project is to deduce an appropriate number (presumably 5 – 10) of representative plant communities in terms of habitats, functionalities and structures at European level in off-field areas to inform risk assessment for herbicides. The databases include realistic data collected in field studies and vegetation assessments so they are considered quite reliable. Validation of the tool and results would be useful but is not part of this project.

In order to achieve this goal, we applied the QUICKScan spatial modelling environment in which we have included predictors for the occurrence of vegetation (classes, communities and / or habitats characterized by indicator species) and their traits in agricultural off-field areas in Europe.

1.4 Research questions

Based on the general aim of the project, the research questions are:

- Which typical vegetation is likely to grow in the off-field area given biophysical (climate, soil, hydrology, elevation, aspect, slope), plant-sociological and potentially landscape characteristics?
- How can this vegetation be characterized by their plant traits?

In order to answer these questions we applied the QUICKScan spatial modelling tool.

2 Materials and methods

2.1 Data

2.1.1 Overview of collected data

For the data analysis we collated the following datasets and maps:
- Man-made habitats characteristic for the off-field area in agricultural landscapes (par. 2.1.2);
- Plant species information for each of these habitats (par. 2.1.3);
- Habitat suitability maps for the eight EUNIS man-made habitats characteristic in off-field areas (par. 2.1.4);
- Crop distribution maps for wheat and vine (par. 2.1.5);
- Trait databases (par. 2.1.6)

The QUICKScan methodology (https://www.QUICKScan.pro/) was used to combine all these data.

2.1.2 Habitat classification

The EUNIS (European Nature Information System) habitat classification is a reference framework for European habitats (https://eunis.eea.europa.eu/habitats-code-browser.jsp?expand=58#level_58). It intends to classify all habitats in Europe. Recently, the man-made habitats (type I: regularly or recently cultivated agricultural, horticultural and domestic habitats) were revised and published (Schaminée et al., 2020). For the current project, the vegetation communities of these man-made habitats have been expressed in terms of species and distribution maps. Each EUNIS habitat is characterized by all the species occurring in this specific EUNIS type with a frequency > 5%. Six of these man-made EUNIS habitats were initially identified as relevant for agricultural cropped areas (V-habitats V11- V13 en V37 - V39). In order to cover the areas where vine crops are cultivated in Europe, the EUNIS habitats V34 and V35 were added.

These eight habitats are:

V11 Intensive unmixed crops (Cereal and other non-woody crops grown on large, unbroken surfaces in open field landscapes)

V12 Mixed crops of market gardens and horticulture: Intensive cultivation of vegetables, flowers, small fruits, usually in alternating strips of different crops. Includes allotments and small-scale market gardens

V13 Arable land with unmixed crops grown by low-intensity agricultural methods

V34 Trampled xeric grassland with annuals

V35 Trampled mesophilous grassland with annuals

V37 Annual anthropogenic herbaceous vegetation: Stands dominated by annual herbaceous plants developing on recently abandoned urban or agricultural land

V38 Dry perennial anthropogenic herbaceous vegetation: Stands dominated by perennial herbaceous plants, frequently ruderals, developing on dry abandoned urban or agricultural land

V39 Mesic perennial anthropogenic herbaceous vegetation: Stands dominated by perennial herbaceous plants, frequently ruderals, developing on mesic to slightly wet abandoned urban or agricultural land

These EUNIS habitats mostly include nutrient-rich vegetation types, only V13 represents a vegetation type with a lower nutrient status. V34 and V35 are representative of dry and warm (trampled) habitats. The EUNIS habitats were screened for in-field releves as this project is focusing on the off-field area. The in-field releves could be recognized by a high dominance of crop species (wheat in the case of the wheat crop). These releves were deleted from the selection. The in-field releves were only relevant for EUNIS types V11, V12 and V13.

2.1.3 European Vegetation Archive

The primary data source for producing lists of species and maps for the EUNIS habitats were European vegetation plot records. Such plots typically contain a full list of vascular (and often also non-vascular) plant species, estimation of cover-abundance of each species, location and various additional information on vegetation structure and environmental features in the plot (Schaminée et al. 2009). These plots were compiled from the European Vegetation Archive (Chytrý et al. 2016; 2020). On 28 November 2019, the EVA dataset contained a total of 1,847,463 vegetation plots from Europe, of which 1,612,287 were georeferenced (see Figure 1). 46579 plots (Chytrý et al., 2020) were assigned to the eight man-made habitats mentioned in the previous paragraph. Most data used in this exercise were from this century (since the year 2000).

The assignment of vegetation plots to EUNIS habitats was performed through expert rules (Chytrý et al., 2020): formal query routines in which formal definitions of habitats are based on plant species composition, the dominance of specific plant species, and also geographical criteria (Schaminée et al. 2016, 2018; Chytrý et al., 2020). Each habitat was formally defined as a formula in a computer language combining algebraic and set-theoretic concepts with formal logical operators (Chytrý et al., 2020). This expert system was used to classify vegetation plots from the Vegetation Archive (EVA) and other databases. Then species for each habitat were identified by calculating species-to-habitat occurrence frequency in the data set. Finally, the plot locations were mapped for each habitat. Using this approach, all eight man-made habitats were defined with regard to the species and their frequencies found in each habitat. For a more detailed background to this methodology see Chytrý et al. (2020).

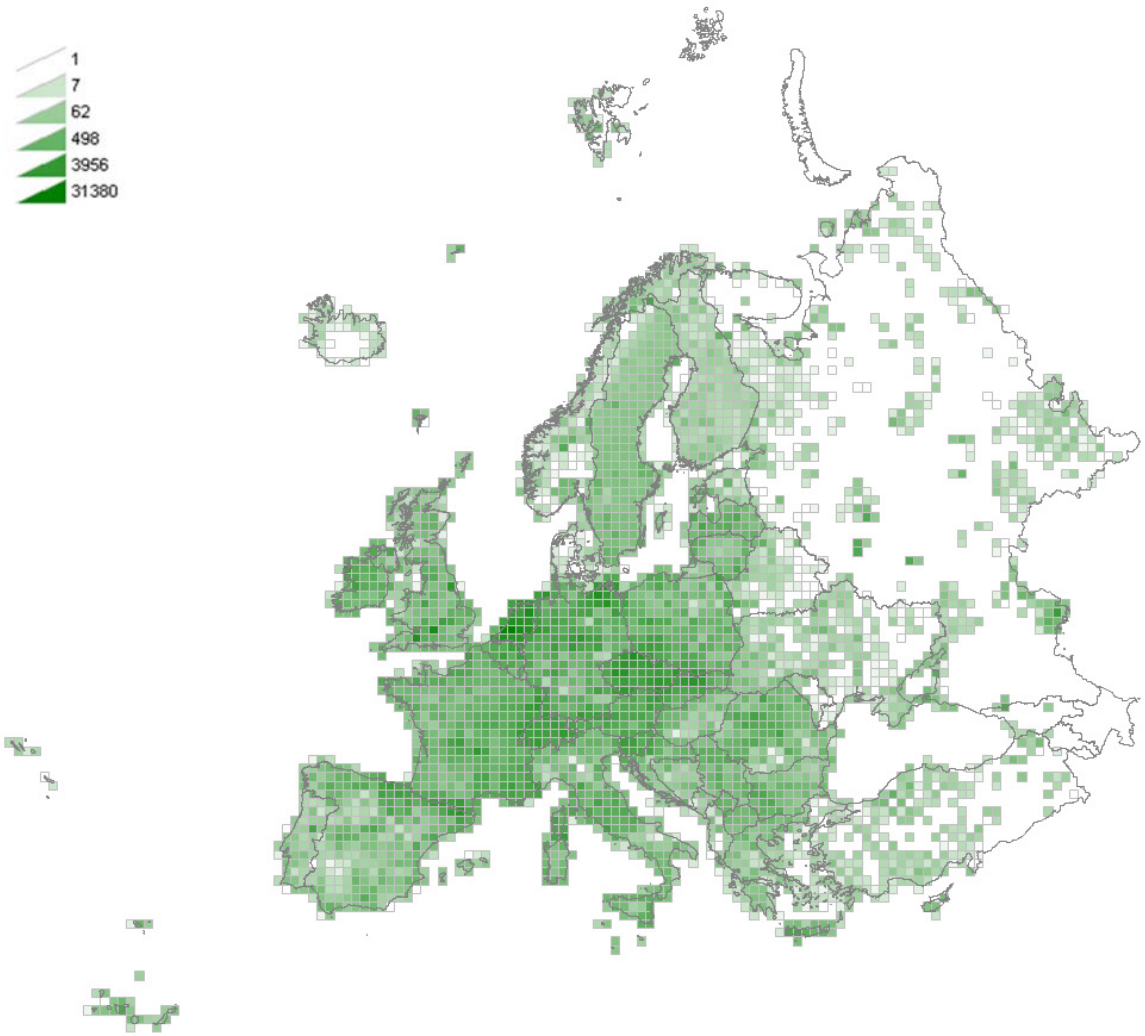


Figure 1 *Density distribution of the total of 1,612.287 georeferenced plots in EVA and other plots provided for this project in 50 x 50 km grid cells (accessed on 28 November 2019).*

2.1.4 Habitat suitability maps

Where a vegetation class or reference community or habitat potentially may occur, can be predicted (modelled) by drivers like climate, soil, topography and remote sensed Essential Biodiversity Variables (RS-EBV's). For the complete list of predictors used check the Annex 1. The result of such prediction is a series of suitability maps (Hennekens, 2020). These maps have currently a resolution of 1 x 1 km.

For habitat suitability modelling, the latest version of the widely used software Maxent1 for maximum entropy modelling of species geographic distributions was used. Maxent is a general-purpose machine-learning method with a simple and precise mathematical formulation, and has a number of aspects that make it well-suited for species distribution modelling when only presence (occurrence) data but not absence data are available (Philips et al. 2006). Because EUNIS habitats have a particular species composition, they are assumed to respond to specific ecological requirements, allowing us to generate correlative estimates of geographic distributions. Modelling habitats that have been floristically defined is a well-known procedure for ecological modelling at local scales, and a promising technique to be applied also at the continental level.

The habitat suitability maps were loaded in the QUICKScan tool and further analysed using the other databases as described in par. 2.1.1.

2.1.5 Crop distribution maps

Crop distribution maps for wheat and vine were based on the Eurostat data from 2010 with a solution of 1 x 1 km. MAPSPAM was suggested as an alternative. MAPSPAM data is based on more than one year and also includes area, yield and crop intensity. For the final analysis Eurostat was used.

2.1.6 Trait databases

The TRY database (Kattge et al., 2020) was used to extract information about plant traits considered relevant to inform the risk assessment for terrestrial plants in the vicinity of agricultural cropped areas. Traits were selected for which information was available for a large number of plants in the TRY database. These traits included leaf type, monocotyledon / dicotyledon category, plant functional type, plant life span (longevity) and seed longevity. An official request for the use of these data was submitted to the TRY database holders and was approved. Subsequently the trait categories were synchronized as diverse categories of original data were used to allocate the data in the TRY database (see Annex 2 for the original references of individual datasets).

[1] Maxent version 3.4.1 was used. http://biodiversityinformatics.amnh.org/open_source/maxent/

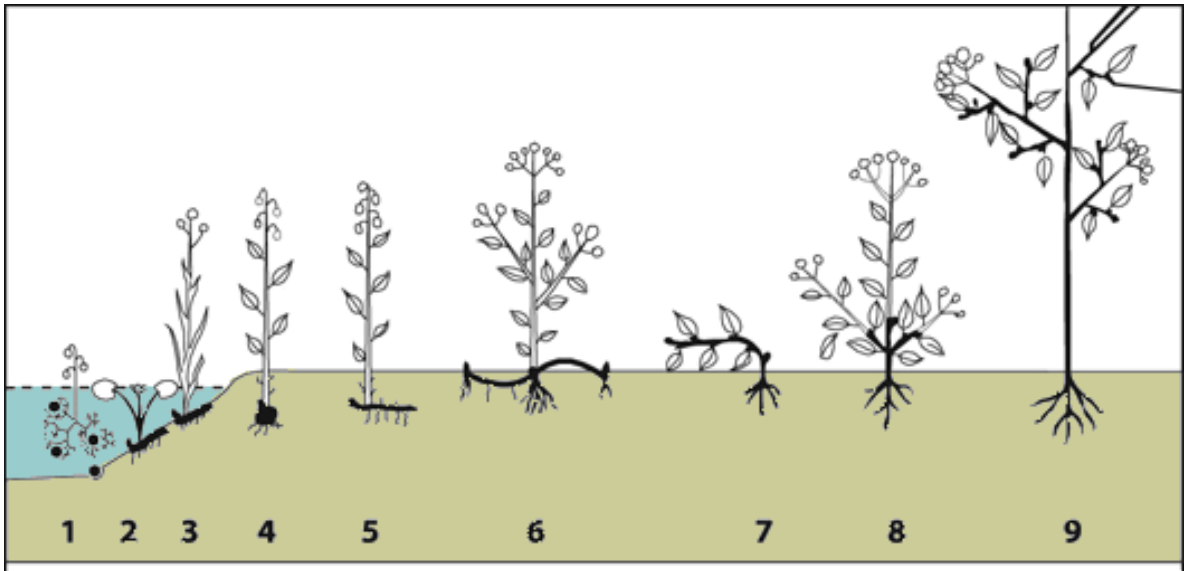


Diagram of the most important life forms based on the classification by Raunkiaer (1934)

1 + 2	Hydrophytes	(Hydr.)	water plants
3	Helophytes	(Helo.)	winter buds under water flowering plants above water
4 + 5	Crytophytes or geophytes	(Geof.)	winter buds below ground
6	Hemicryptophytes	(Hemi.)	winter buds above or just below ground
7 + 8	Chamaephytes	(Cham.)	winter buds up to 50 cm above ground
9	Phanerophytes	(Phan.)	winter buds at least 50 cm above ground (i.e. trees, shrubs and lianes)

Figure 2 *Raunkiaer life forms (Therophytes are missing; https://www.vcbio.science.ru.nl/en/virtuallessons/landscape/raunkiaer/)*

The quantitative data for the species in the EUNIS habitats (species counts) were transformed into total scores. These scores per trait (cumulative frequency values) and per EUNIS habitat have been used to collate a characteristic trait spectrum per EUNIS habitat in the form of tables and pie charts.

The plants traits were extended with the Raunkiaer life forms (Fig. 2) (unpublished data I. Axmanová). Raunkiær (1934) has classified plants according to the place where the growth point is located during the unfavourable season, provided the plant maintains the capability to survive these difficult conditions. Such an unfavourable period might be the cold winter period or the dry summer time.

The life form categories of Raunkiaer include: Phanerophyte, Tree, Shrub, Chamaephyte, Semi-shrub, Dwarf shrub, Hemicryptophyte, Geophyte, Hydrophyte, Therophyte, Epiphyte, Woody Liana. Not all these categories are relevant for the plants growing off-field. The species list in the off-field area was matched with the dataset including the Raunkiaer life forms generating the life forms of the species in the off-field area.

In order to map traits in the QUICKScan tool, the trait categories were simplified and re-ordered into two categories. E.g. the trait plant life span (longevity) includes 5 categories (annual, annual-biennial, biennial, biennial-perennial and perennial. For use in QUICKScan, these trait categories were summarized into two categories: annual and non-annual. Other traits were simplified in a similar way. Only the Raunkiaer growth form was summarized into three categories. For the purpose of a quantitative comparison of the trait spectra among the EUNIS habitats, the traits were scaled towards the maximum trait value and towards the maximum trait category value.

2.2 QUICKScan tool

The QUICKScan tool (https://www.QUICKScan.pro/) was used to link all databases (Verweij et al., 2016). It is a spatial modelling environment that combines expert knowledge with spatial and statistical data. QUICKScan is a participatory modelling method that links stakeholder- and decision maker knowledge and preferences to available spatial and spatio-statistical data. An iterative approach can be followed, starting with simple (knowledge-based) rules and step-by-step adding complexity, using interpretation of model-results. Successive iterations can be used to 1) improve the quality of the model, 2) try out alternative (spatial)plans and policy options and 3) include different stakeholder values and perspectives.

Results are visualized in interactive maps, summary charts and trade-off diagrams. There is a variety of linkable rule types ranging from qualitative knowledge matrices and Bayesian Belief Networks to include uncertainties, to multicriteria, indicator standardization and sustainability limit tools. QUICKScan can show how a result is reached by visualising the chain of knowledge and the data, for any specific location in a study area.

The tool can be applied probabilistically or mechanistically. Both aproaches were explored in this project.

2.3 Method

In order to follow the QUICKScan methodology, we organized several brainstorm sessions, collated data at European level, interactively linked datasets, collected new datasets etc. in an iterative process.

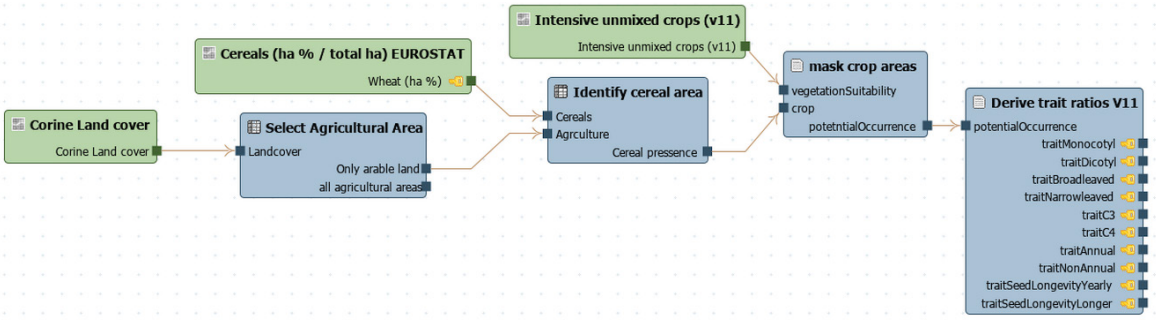


Figure 3 *Flow diagram in QUICKScan.*

Overlays were constructed of the suitability maps for the eight EUNIS habitats with the crop distribution maps for wheat and vine crops. The results are potential occurrence maps for each EUNIS habitat in agricultural wheat and vine off-field areas. The species list in the off-field area was matched with the trait dataset generating the traits of these species. For the purpose of a quantitative comparison of the trait spectra among the EUNIS habitats, the traits were scaled towards the maximum trait value and towards the maximum trait category value. Figure 3 presents the flow diagram in QUICKScan. The same approach was followed for vine.

3 Results

3.1 Species and families in the off-field area

The eight EUNIS habitats include 329 species with a frequency larger than 5% (that means occurring in more than 5% of the releves), belonging to 45 plant families. Annex 3 includes a list of plant families represented in the eight EUNIS habitats. Annex 4 includes the full list of plant species of the eight EUNIS habitats. Annex 5 includes the species list per EUNIS habitat.

Figure 4 presents the diversity in potential plant families in EUNIS habitats.

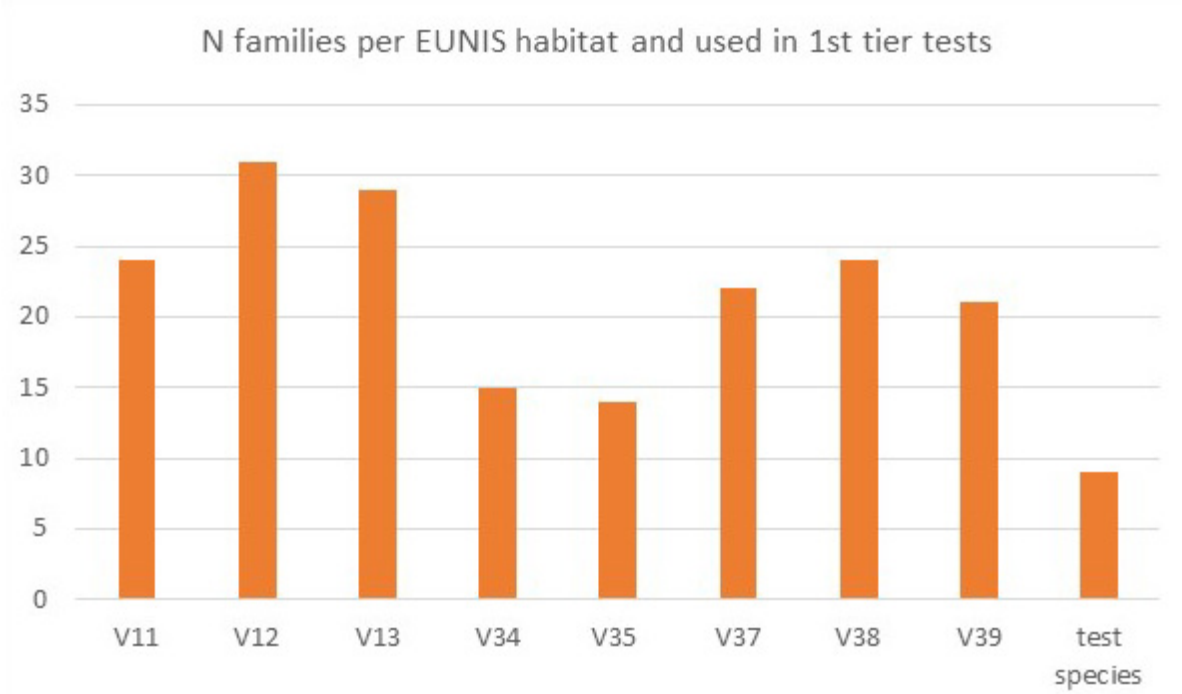


Figure 4 *Number of plant families in EUNIS habitats in agricultural areas compared to the number of families to which the standard non-target plant test species belong.*

3.2 Habitat suitability maps and potential occurrence of EUNIS habitats

The EUNIS V-habitat suitability maps combined with wheat crop distribution maps and vine distribution maps and with plant traits. Figure 5 and 6 present examples of such maps for habitat V11. All maps are included in the attached file 'Habitat suitability and potential occurrence maps' (Annex 7).

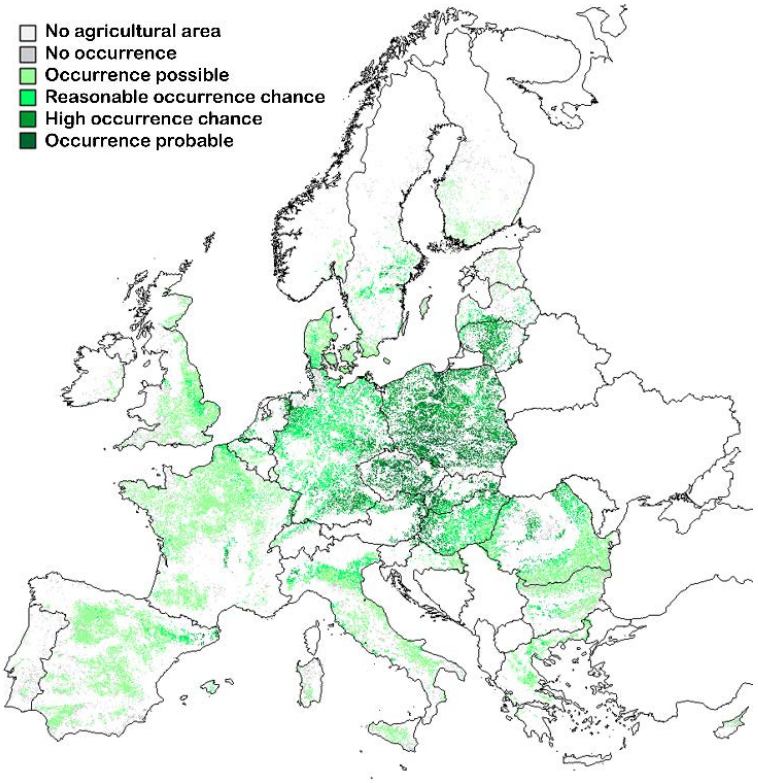


Figure 5 *Potential occurrence of one of the EUNIS habitats (V11) in agricultural land surrounding wheat crops. The higher the potential occurrence, the more intense the green color.*

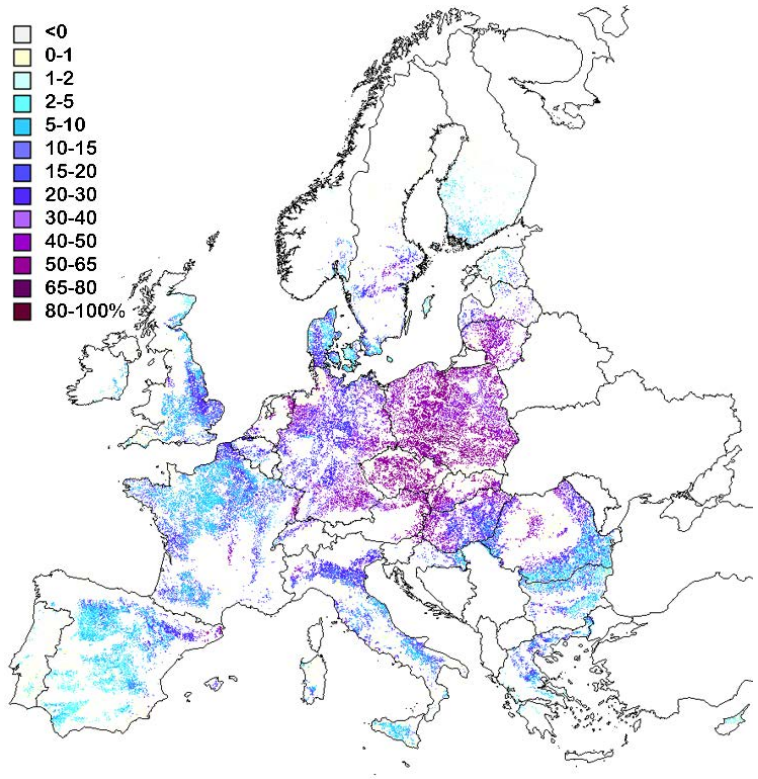
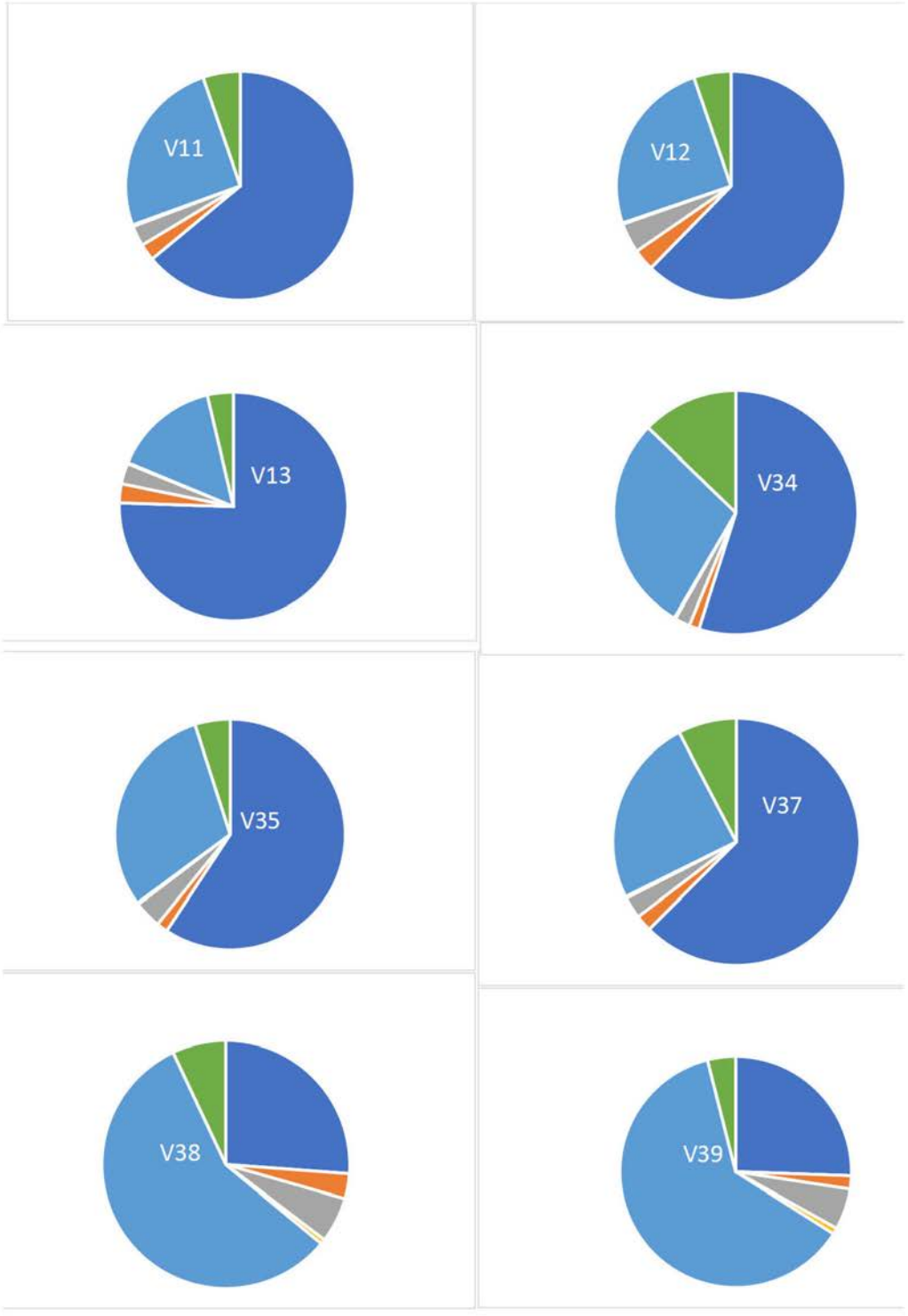


Figure 6 *Potential occurrence of the 'annual species' trait in agricultural land surrounding wheat crops. The higher the trait percentage in this habitat, the more intense the purple color.*

3.3 Plant traits

The results of the plant traits leaf type, monocotyledon / dicotyledon category, plant functional type, plant life span (longevity), seed longevity and Raunkiaer life forms are presented in the next figures in this paragraph. The trait spectra are presented per EUNIS habitat as pie diagrams. The EUNIS habitats are characterized by a long list of plant species (Annex 6) with their trait categories. The distribution of the traits over the habitats is presented in pie diagrams as shown in the next figures in this paragraph.



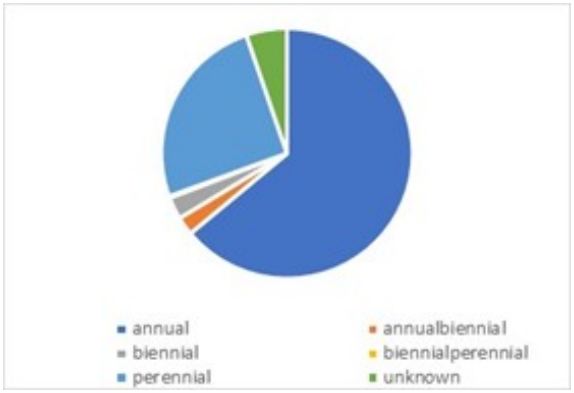
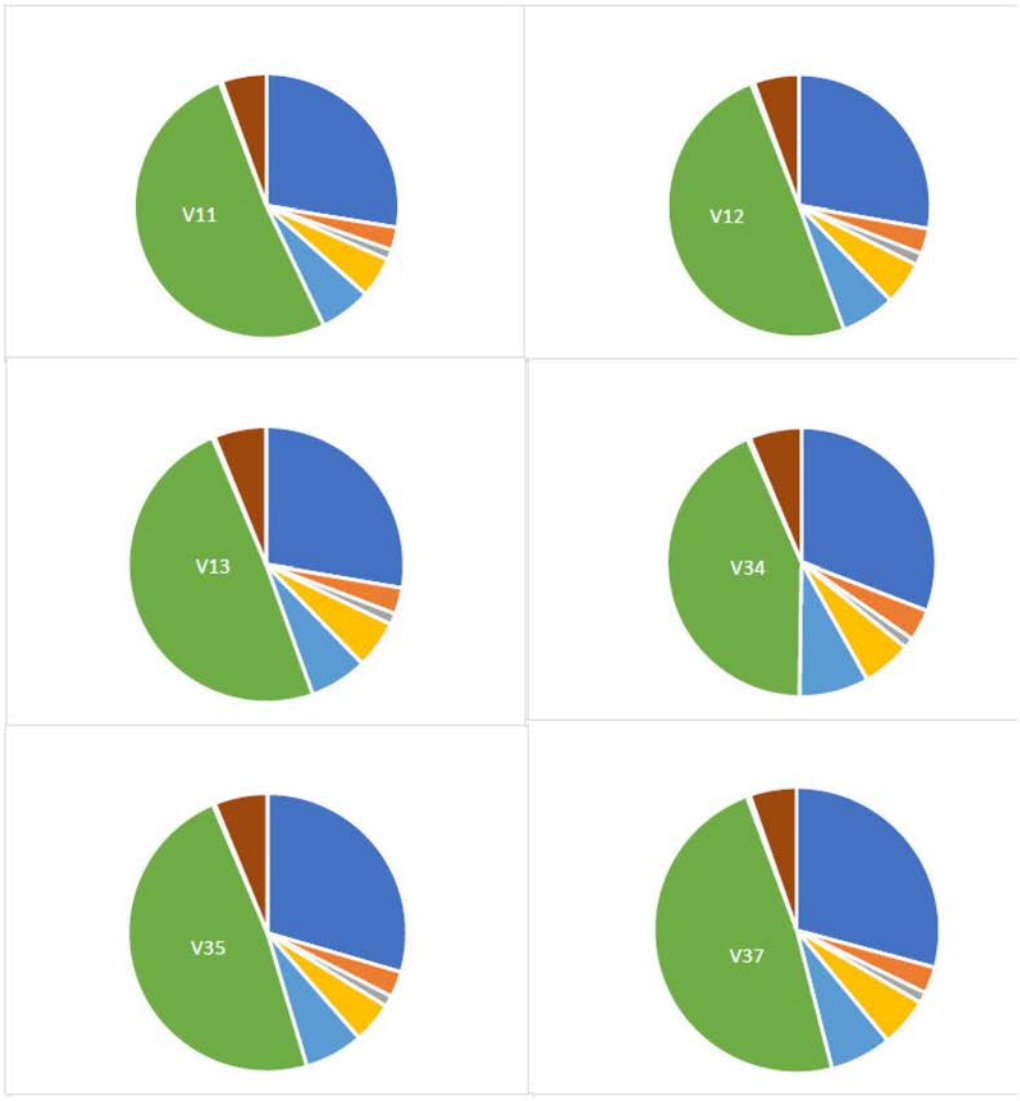


Figure 7 *Spectra of the trait 'plant lifespan (longevity)' for the eight EUNIS habitats. Each panel of Figure 7 represents a different EUNIS habitat.*

Figure 7 shows that all EUNIS habitats except for habitats V38 and V39 are dominated by annual plants (the dark blue color in the pie diagrams). Annual species are plant species that perform their full life cycle, from germination until production of seeds, within one year. On the contrary, the EUNIS habitats V38 and V39 are dominated by perennial plant species. These plant species live longer than two years.



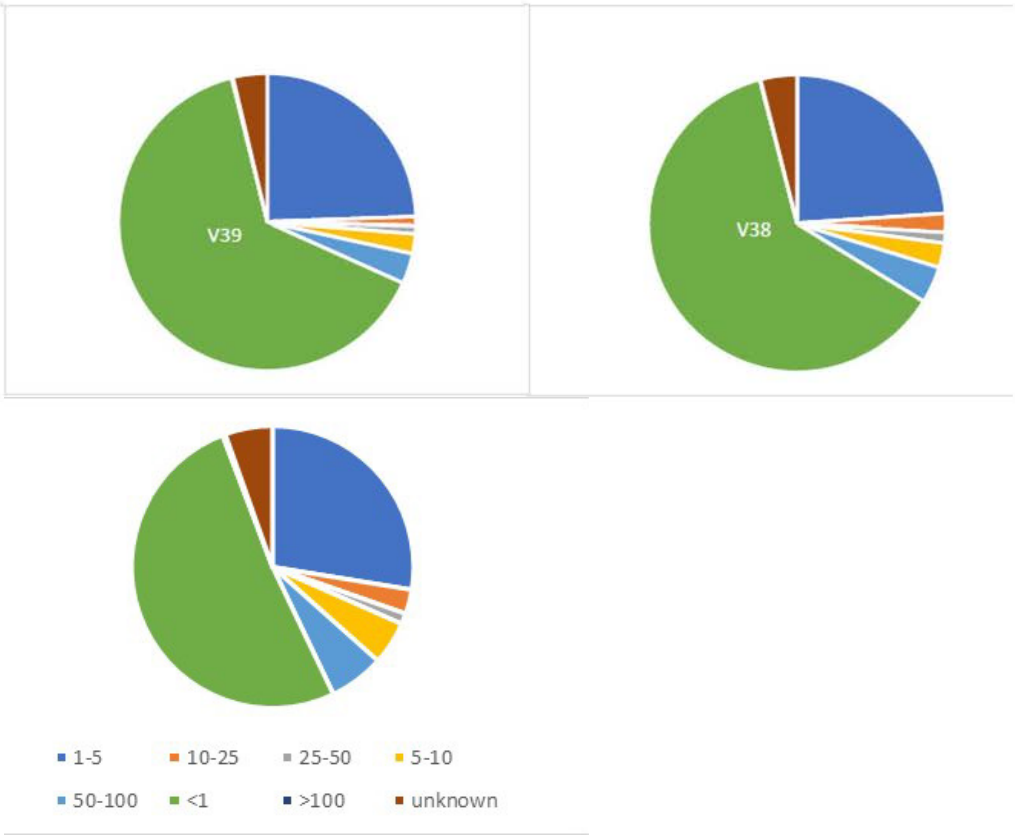


Figure 8 *Spectra of the trait 'seed longevity' for the eight EUNIS habitats. Each panel of Figure 8 represents a different EUNIS habitat. The numbers represent years.*

Figure 8 shows that the seed bank of the species in these habitats is predominantly short-living, that means it exists for less than one year. Habitats V38 and V39 have an even bigger part of the seedbank that is assigned to the short-living category, although more than half of the species in these habitats are perennial. In general, most habitats are dominated by annual species with a short-living seed-bank (about three-quarters with a seedbank with a longevity below 5 years).

All EUNIS habitats are mainly characterized by broadleaved plant species (Annex 6).

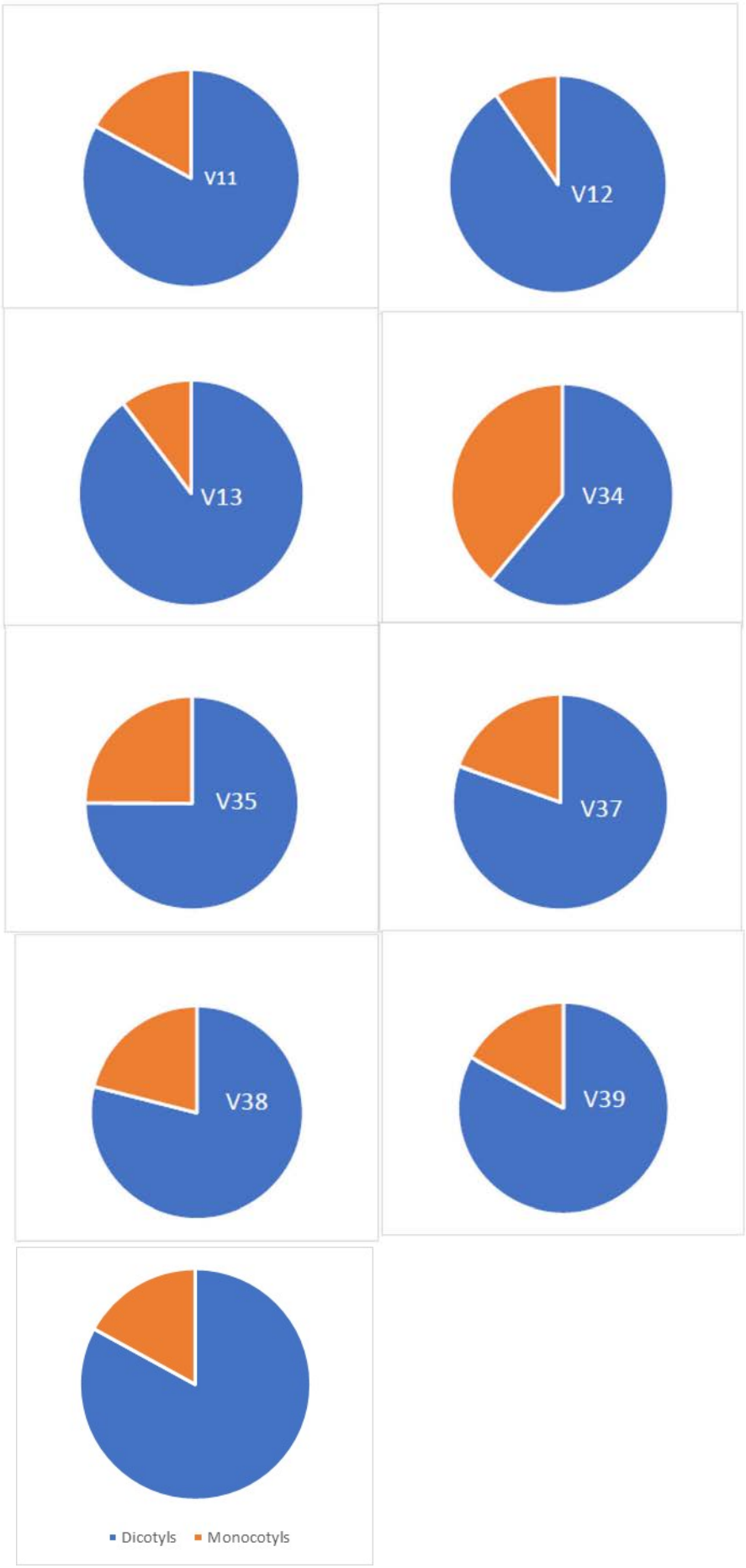


Figure 9 *Spectra of the trait 'monocotyledonous / dicotyledonous' for the eight EUNIS habitats. Each panel of Figure 9 represents a different EUNIS habitat.*

Figure 9 shows that all EUNIS habitats are mainly characterized by dicotyledonous plant species. EUNIS V34 habitat has a larger contribution of monocotyledonous species. Dicotyledonous species have seeds with two embryonic leaves or cotyledons. The other group of flowering plants are monocotyledons species, typically having one cotyledon. These two groups form the two divisions of the flowering plants.

The spectra of the trait 'plant functional type' are included in Table 1. The categories C3 and C4 refer to the photosynthetic pathway of a plant. Among terrestrial plants, three photosynthetic pathways exist: C3, C4, and crassulacean acid metabolism (CAM) photosynthesis (Ehleringer & Cerling, 2002). C3 photosynthesis is the ancestral pathway for carbon fixation and occurs in all taxonomic plant groups. It is the dominant pathway in tropical and temperate areas (Sage, 2013). The term C3 photosynthesis is based on the observation that the first product of photosynthesis is a 3-carbon molecule. In C4 photosynthesis, the initial photosynthetic product is a 4-carbon molecule. CAM and C4 photosynthesis include physiological mechanisms for concentrating CO2 to be re-used in photosynthesis. CAM photosynthesis is limited in its distribution and occurs in many epiphytes and succulents from very arid regions. CAM photosynthesis is not relevant in the case of the species in the selected EUNIS habitats in agricultural areas.

Table 1 *Spectra for the trait 'plant functional type'. The trait scores (cumulative frequency values) are derived from quantitative data for the species present in the EUNIS habitats (counts).*

EUNIS	trait class	score
V11	C3	2428
V11	C4	149
V12	C3	6731
V12	C4	145
V13	C3	8103
V13	C4	76
V34	C3	1016
V34	C4	540
V35	C3	1325
V35	C4	32
V37	C3	1847
V37	C4	258
V38	C3	2742
V38	C4	64
V39	C3	1502
V39	C4	10

C3 is the dominant photosynthetic pathway in the terrestrial plants of the EUNIS habitats. All terrestrial EUNIS habitats also include terrestrial plants with C4 photosynthetic pathway to a lesser extent. EUNIS habitat V34 has the largest relative representativity of plant species with the C4 photosynthetic pathway. This is consistent with Figure 9, in which the EUNIS V34 habitat has a larger contribution of monocotyledonous species.

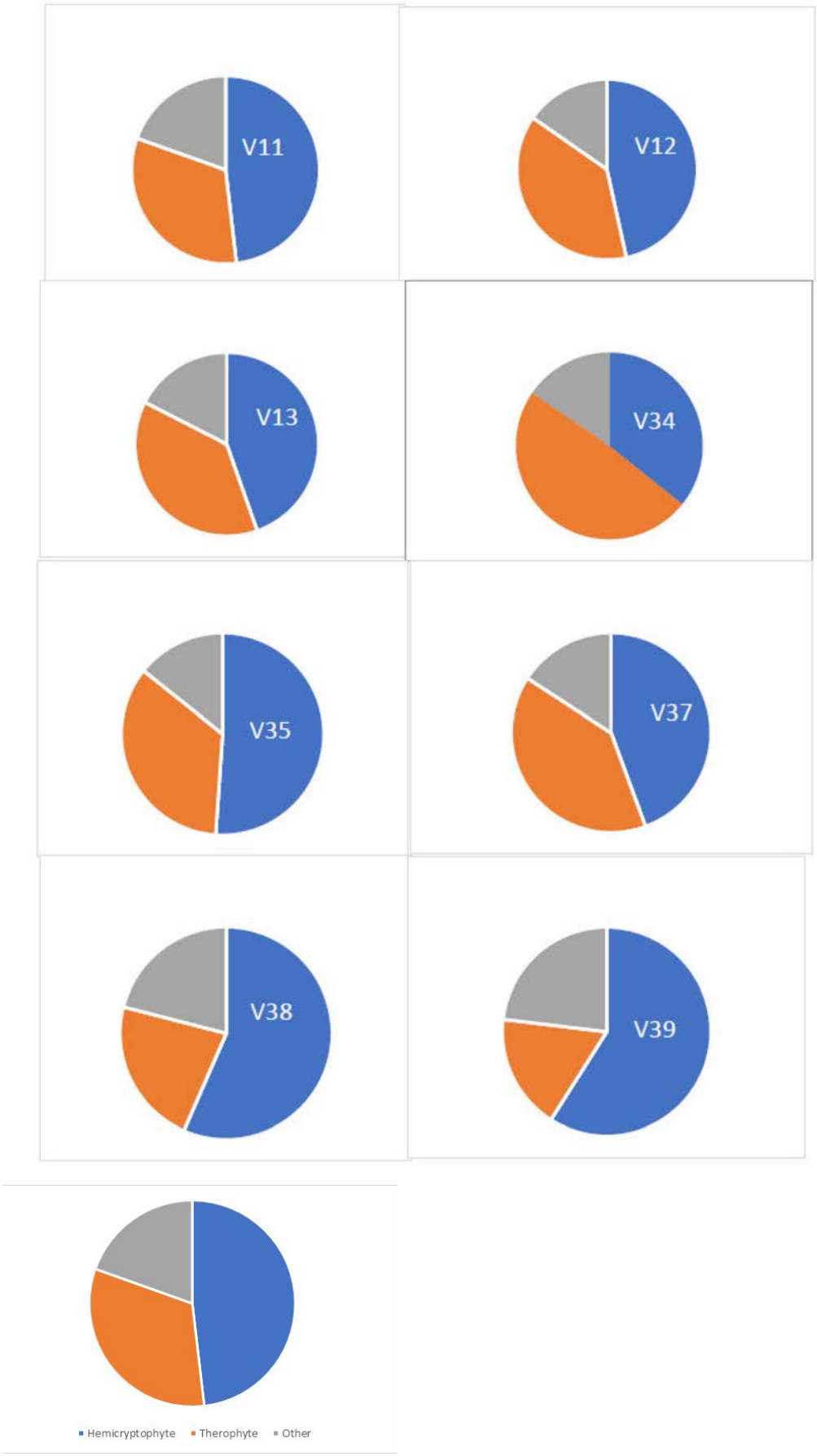


Figure 10 *Spectra of the Raunkiaer life form for the eight EUNIS habitats. Each panel of Figure 10 represents a different EUNIS habitat.*

The analysis of the Raunkiaer life forms shows that two life forms are dominating the vegetation in the eight EUNIS habitats in the off-field area: the hemicryptophyte life form and the therophyte (annual) life form. Figure 10 shows that the EUNIS V34 habitat has the highest proportion of therophytes (annuals), while EUNIS habitats V38 and V39 have the highest proportion of hemicryptophyte life forms (i.e. winterbuds just above or belowground).

3.4 Summary of traits for use in QUICKScan

For use in QUICKScan we summarized each trait into two categories (Annex 6). Only the Raunkiaer growth form was summarized into three categories.

3.5 Trait maps

Annex 7 is a PDF file attached to this document. Besides the habitat suitability maps and potential occurrence maps, the annex includes trait maps for one selected trait, i.e. the trait annual – non-annual plants. Other trait maps can be generated based on the datasets delivered for this project (https://www.QUICKScan.pro).

4 Conclusions and discussion

4.1 Characterizing the off-field area

With this study we characterized typical herbal vegetation in the off-field area. We identified eight EUNIS habitats that are relevant in the agricultural off-field area of wheat and vine crops and which could be defined in terms of plant communities, families and species (Chytrý et al., 2020; Table 1). As is shown in Chytrý et al. (2020; Table 1), not all man-made habitats can be expressed in terms of plant communities, families and species, e.g. hedgerows cannot be characterized in that way. This restricted the number of man-made habitats that could be considered in this study. The eight man-made habitats have been defined in terms of 329 species that occurred in more than 5% of the releves), belonging to 45 plant families. Up to 31 plant families occur in the EUNIS habitats that are richest in species (EUNIS habitats V12 and V13), while EUNIS habitats V34 and V35 show the lowest number of families (up to 15). Each EUNIS habitat is characterized in terms of plant species with their frequency of occurrence and their mean abundance if present in the releve.

In this project we focused on the natural vegetation in the off-field area. Grass strips were not considered as these are sown and managed by farmers. Also wooden vegetation such as hedges, tree lines and bush mixed structures were not covered in this project because of reasons explained above (phyto-sociologically not characterized), although they are considered as an important vegetation habitat in the off-field area.

In general, variation over the seasons is important when considering vegetation. This aspect was not studied in this project, as the dataset was predominantly analyzed in space (covering European scale with focus on wheat and vine crops) and not in time. It is uncertain if the dataset enables an analysis over the seasons, that means if seasonal variation can be deduced from the dataset.

The plant traits show that the off-field area is in general dominated by annual species. Only EUNIS habitats V38 and V39 are dominated by perennial species. The EUNIS habitats in general have a short-living seed bank. This is most obvious for the EUNIS habitats V38 and V39. Dicotyledonous species are dominant in the EUNIS habitats, while relatively the highest proportion of monocotyledonous species is represented in the EUNIS habitat V34. C3 is the dominant photosynthetic pathway with the exception of EUNIS habitats V34, where also the C4 photosynthetic pathway is present in a significant proportion. Hemicryptophytes and therophytes (annuals) are the dominant growth forms. Hemicryptophytes are also represented in EUNIS habitats V38 and V39, while V34 shows a lower representation of hemicryptophytes and a higher representation of therophytes (annuals).

We compared our findings with literature on traits of plants growing in field boundaries. Bergholz (2014; 2016) found that field boundaries are dominated by competitive perennials that are adapted to high nutrient availability (based on high Ellenberg indicator value for nutrients) but that these field boundaries also contain a large proportion of (less competitive) annuals and species that occur naturally in unproductive (nutrient-poor) habitats. These results are in line with the findings of our study.

Datasets and maps were integrated and combined in the QUICKScan tool. This tool was used to generate potential occurrence maps for the eight EUNIS habitats based on habitat suitability maps and crop occurrence maps for wheat and vine.

In this study, wheat and vine crops were used as case studies. The potential occurrence maps with vine show less coverage in some parts of Europe. The vegetation plot data in these vine areas were less compared to those in agricultural wheat areas. Also, vineyards seem to be less specifically characterized in terms of specific EUNIS habitats compared to the agricultural wheat areas.

The EUNIS habitats are habitats defined at a high aggregation level. They represent broadly defined habitats. This is considered as an appropriate approach to be applied at European level which was the focus of this study. However, as a consequence of this we conclude there is overlap in the distribution of the EUNIS habitats in Europe and there is not always a clear separation.

One of the topics intended to elaborate in this project was to describe the management of field margins and similar structures in European agricultural landscapes. Management of off-field areas might differ over Europe. Long-term research has shown that several management measures might contribute to a higher plant diversity, e.g. field margins should have at least a 5 m width, at water courses 10 m, to be left unsown for self-establishment and to be mowed every second or third year (El Titi, 1999). In-depth literature search was not performed in this study, but the intention is to explore this further in future.

The characterization of the vegetation in the off-field area and the data collated in this study can be used as a basis to deduce 5 – 10 surrogate plant communities that might be used to inform the risk assessment. The characterization of these surrogate communities might include a number of traits as were quantified in this study.

Conclusions in light of the research questions

Which typical vegetation is likely to grow in the off-field area ?
The off-field habitats characterized by the eight EUNIS habitats include 329 species, belong to 45 plant families and refer to 46 579 vegetation plot observations in the European Vegetation Archive (for further details per EUNIS habitat see Annexes 3 – 5).

How can this vegetation be characterized by their plant traits?
- Wheat and vine off-field areas are dominated by annual species;
- Only EUNIS habitats V38 and V39 are dominated by perennial species;
- The EUNIS habitats in general have a short-living seed bank;
- Dicotyledonous species are dominant in the EUNIS habitats, while relatively the highest proportion of monocotyledonous species is represented in the EUNIS habitat V34;
- C3 is the dominant photosynthetic pathway with the exception of EUNIS habitat V34;
- Hemicryptophytes and therophytes are the dominant growth forms.

What were the experiences with the QUICKScan spatial modelling tool that was used to answer the research questions ?
- QUICKScan is a scientific tool that would need more elaboration for direct application in a regulatory process (validation, standardized scenarios, etc.), however it can serve as a basis to develop potential reference tiers to be used in non-target plant risk assessment.
- Validation of outcome and methodology needs data all over Europe;
- A future development could be a combination of this tool with an effect model like IBC Grass (Reeg et al., 2017; 2018; 2020);
- Trait spectra were quantified but further extension to other traits is needed.

4.2 Workshop with CropLife Europe

On the 11th and 12th of January 2021, a workshop with CLE was held. The aim of the workshop was to explain the datasets that were used for this study as well as the background of the QUICKScan tool. The workshop was used to further shape and streamline the project as well as to raise (and if possible) answer questions. The following text reflects the discussions done during the workshop.

QUICKScan is a flexible tool. It is a modelling environment and not a fixed model. In general, it was considered as a scientific tool that needs more work to be applicable to the regulatory world. Currently it can be used as a scientific tool adding more knowledge and information in the risk assessment i.e., list of species (sensitive families) next to a crop; information on what needs to be protected in off-crop areas; from list of species derive the ones that may need to be tested further in higher tier studies;

understanding the communities in the off-field area. Participants also expressed the need for a standardized and harmonized tool that would be easy to use and understand for risk assessors and regulators.

It was questioned if and to what extend the tool needs validation. The focus of the current study was on European level. That means that one study in an off-field area is not sufficient as a case study to validate the outcome of the study. A lot more field data all over Europe and in different climate zones are needed to perform such a validation.

It was also suggested that for the future the QUICKScan tool could be combined with an effect model like IBC Grass (Reeg et al., 2017; 2018; 2020). IBC grass is a spatially explicit and individual-based plant community model that was originally designed to test the response of plant communities to different disturbances such as grazing (Reeg et al., 2018). The IBC model was modified to model the effects of herbicides on a number of terrestrial plant species in a community setting using endpoints as generated in toxicity tests.

It was recommended to add other traits. We agree that the number of traits we could use was limited by the available data. We could use data of 5 traits for the 329 species we identified as being part of the EUNIS habitats in the off-field area. During the workshop possible additional traits were suggested such as growth form (e.g., rosette, erect), plant size, competitor vs. non-competitor (e.g., nutrient requirements); reproduction type (e.g., seeds, stolon etc.). As a follow-up action, the Raunkiaer growth forms were added to the database and report.

The long-term target of the exercise was to use the predictions of plant communities and traits as outcome of this project as a reference tier in the risk assessment. The whole project was seen as a step towards the description of a reference tier.

Conclusions from the workshop (summarized from workshop report)
Starting as an exploratory tool, there is still considerable work needed for generating a risk assessment tool. The QUICKScan tool is very transparent (merging GIS and databases together), which was considered as an advantage in the regulatory risk assessment by participants. It was considered as a powerful approach. However, it needs to be more standardized with fixed rules if it is intended to be used as a tool in risk assessment. The workflow and linkages would need to be more robust because at the moment there are limited databases on the traits linked to the tool. More research work may be required to address the 'how' and understand better what the key questions should be.

Although transparency is important, the tool is too open to individuals who can make alterations with no justifications. Actually, the regulatory community may not have the skills to use the tool and so more work is needed to make it simpler. The QUICKScan tool can be used as a dynamic modelling environment to focus on specific crops, on specific crop areas, climate zones or regions. The tool can be downloaded (https://www.QUICKScan.pro/download) where also an instruction manual is available.

Traits database would need more elaboration and traits need to be re-considered. We need to be able to incorporate more crops to choose from in the tool, so the databases would need to be reviewed. There was also a wish for adding temporal aspects, e.g., different growth stages at different seasons.

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Annex 1 Predictors for habitat suitability modelling

Climate

- Potential Evapotranspiration
  https://cgiarcsi.community/data/global-aridity-and-pet-database/
- Solar radiation
  http://www.worldgrids.org/doku.php?id=wiki:inmsre3
- Temperature Seasonality (standard deviation *100)
  https://www.worldclim.org/bioclim
- Mean Temperature of Wettest Quarter
  https://www.worldclim.org/bioclim
- Annual Precipitation
  https://www.worldclim.org/bioclim
- Precipitation Seasonality (Coefficient of Variation)
  https://www.worldclim.org/bioclim
- Precipitation of Warmest Quarter
  https://www.worldclim.org/bioclim
- Solar radiation (× 365/8 kWh m-2)
  www.worldgrids.org
- Potential Evapotranspiration (mm yr-1)
  https://cgiarcsi.community/data/global-aridity-and-pet-database/

Topography

- Distance to water (rivers, lakes, sea)
  derived from the shapefile 'Inland_Waters.shp'
- Digital Elevation Map (DEM)

Soil

- Bulk density of the soil (kg/m³)
  Hengl et al. 2014
  https://soilgrids.org/
- Cation Exchange Capacity of the soil
  Hengl et al. 2014
  https://soilgrids.org/
- Weight in % of clay particles (<0.0002 mm)
  Hengl et al. 2014
  https://soilgrids.org/
- Volume % of coarse fragments (> 2 mm)
  Hengl et al. 2014
  https://soilgrids.org/
- Soil organic carbon content (‰)
  Hengl et al. 2014
  https://soilgrids.org/
- Soil pH (water)
  Hengl et al. 2014
  https://soilgrids.org/
- Weight in % of silt particles (0.0002-0.05 mm)
  Hengl et al. 2014
  https://soilgrids.org/
- Weight in % of sand particles (0.05-2 mm)
  Hengl et al. 2014
  https://soilgrids.org/

RS-EBV's

- Land Use Land Cover (LULC)
  https://land.copernicus.eu/pan-european/corine-land-cover
- Inundation; occurrence
  Global Surface Water Explorer, 1984-2015, 30m, resampled to 1km (resampling methods: average resampling and mode resampling (selects the value which appears most often of all the sampled points))
- Phenology; End of Season (day number)
  End of Season, defined as the point in time where the NDVI drops below the NDVI at the start of the growing season
- Phenology; Length of season (days)
  Length of season, number of days between EoS and Sos [days]
- Phenology; Low of season (day number)
  Phenology; Low of season (day number with lowest NDVI)
- Phenology; NDVI mean
  Mean NDVI [0..10000]
- Phenology; NDVI seasonality
  Minimum NDVI [0..10000]
- Phenology; Peak of season (day number)
  Phenology; Peak of season (day number with highest NDVI)
- Phenology; Start of Season (day number)
  Start of Season, defined as the point in the year with the largest positive rate of change (maximum of 1st derivative) [day of year 1..365]
- Vegetation height (m)
  3D Global Vegetation Map, 2000, 1km

Anthropogenic

- Population density 2018
  https://landscan.ornl.gov/

Annex 2 References of original individual datasets in TRY

Data owner		Dataset
Albrecht	Harald	Seed Longevity of European Early Successional Species
Atkin	Owen	Plant Physiology Database
Atkin	Owen	Global Respiration Database
Baldocchi	Dennis	Photosynthesis Traits Database
Biological Records Centre (BRC)		PLANTATT - Attributes of British and Irish Plants
Blonder	Benjamin	Leaf Structure, Venation and Economic Spectrum
Bruelheide	Helge	Trait and biomass data 2014 and 2015 of the BE_LOW project
Bucher	Solveig Franziska	Garmisch-Partenkirchen elevational gradients
Burrascano	Sabina	Plant Traits from Circeo National Park, Italy
Cerabolini	Bruno E. L.	Leaf Structure and Economics Spectrum
Cerabolini	Bruno E. L.	Flora d'Italia Functional Traits Hoard (FIFTH)
Cerabolini	Bruno E. L.	Malga San Simone Trait Database (MSS)
Ciccarelli	Daniela	Mediterranean psammophytes
Cornelissen	Johannes	Abisko & Sheffield Database
Cornelissen	Johannes	Sheffield Database
Craine	Joseph	Global 15N Database
Dainese	Matteo	Italian Alps Plant Traits Database
de Frutos	Angel	Cabo de Gata-Níjar Natural Park
Díaz	Sandra	Sheffield-Iran-Spain Database
Dwyer	John	Specific leaf area responses to environmental gradients through space and time
Engemann	Kristine	Plant growth form dataset for the New World
Fan Reinfelder	Ying	Global Dataset of Maximum Rooting Depth
Flores	Olivier	Categorical Plant Traits Database
Flowers	Tim	eHALOPH - Halophytes Database (2015)
Flowers	Tim	eHALOPH - Halophytes Database (2018)
Ford	Henry	Ecological Flora of the British Isles
Forey	Estelle	Plant Coastal Dune Traits (France, Aquitaine)
Gachet	Sophie	BASECO: a floristic and ecological database of Mediterranean French flora
Gallagher	Rachael	Climbing Plants Trait Database
Gallagher	Rachael	Climbing plants trait dataset
Günther	Angela	TRY Categorical Traits Dataset (update 2018)
Higgins	Steve	Dispersal Traits Database
Iversen	Colleen	FRED - Fine Root Ecology Database
Jackson	Robert	Nutrient Resorption Efficiency Database
Jansen	Steven	Xylem Functional Traits (XFT) Database
Jansen	Steven	Leaf element composition of ferns and lycophytes
Kattenborn	Teja	KIT herbaceous functional gradient (median)
Kattge	Jens	Leaf Physiology Database
Kleyer	Michael	The LEDA Traitbase
Klimesova	Jitka	CLO-PLA : a Database of Clonal Growth in Plants
Kühn	Ingolf	BiolFlor Database
La Pierre	Kim	Plant traits of grassland species
Lanta	Vojtech	Meadow Plant Traits: Biomass Allocation, Rooting depth
Li	Yuanzhi	Sherbrooke
Lin	Yan-Shih	Global Leaf Gas Exchange Database (I)
Maire	Vincent	Photosynthesis Traits Worldwide
Mehrabi	Zia	Shoot dry mass of annual grassland species
Mencuccini	Maurizio	Whole Plant Hydraulic Conductance
Milla	Ruben	Altitudinal Vicariants Spain
Minden	Vanessa	Antibiotics-effects on plant traits
Minden	Vanessa	Antibiotics-effects on plant elements
Moles	Angela	Global Seed Mass, Plant Height Database
Moretti	Marco	Traits from the Wildfire Project
Ollerer	Kinga	Plant Traits from Romania
Onoda	Yusuke	Leaf Biomechanics Database
Onoda	Yusuke	Onoda 2017 leaf dataset
Ordonez	Jenny	The Netherlands Plant Traits Database
Otto	Sarah	Tree of sex: a database of sexual systems

Pärtel	Meelis	Grassland Plant Trait Database
Pausas	Juli	BROT Plant Trait Database
Peco	Begoña	Plant Traits of Acidic Grasslands in Central Spain
Poorter	Hendrik	Categorical Plant Traits Database
Poschlod	Peter	BIOPOP: Functional Traits for Nature Conservation
Reich	Peter	Reich-Oleksyn Global Leaf N, P Database
Reich	Peter	Global Respiration Database
Rolo Romero	Victor	Leaf nutrient concentrations
Schweingruber	Fritz	The Xylem/Phloem Database
Semchenko	Marina	Aboveground morphological traits of grassland species
Sheremetev	Serge	Herbs Water Relations on Soil Moisture Gradients
Sheremetev	Serge	The Global Leaf Traits
Shipley	Bill	Leaf and Whole Plant Traits Database
van Bodegom	Peter	Categorical Plant Traits Database
Vassilev	Kiril	Functional Traits Of Bulgarian Grasslands
Walker	Anthony	A Global Data Set of Leaf Photosynthetic Rates, Leaf N and P, and Specific Leaf Area
Werner	Gijsbert	Mycorrhizal Association Database
White	Michael	BIOME-BGC Parameterization Database
Wirth	Christian	The Functional Ecology of Trees (FET) Database - Jena
Wright	Ian	Categorical Plant Traits Database
Wright	Ian	GLOPNET - Global Plant Trait Network Database
Wright	Ian	Global leaf size dataset

Annex 3 Plant families per EUNIS habitat

EUNIS	EUNISName	Family	SUM
V11	Intensive unmixed crops	Amaranthaceae	11
V11	Intensive unmixed crops	Apiaceae	22
V11	Intensive unmixed crops	Boraginaceae	18
V11	Intensive unmixed crops	Brassicaceae	65
V11	Intensive unmixed crops	Caryophyllaceae	61
V11	Intensive unmixed crops	Chenopodiaceae	32
V11	Intensive unmixed crops	Compositae	213
V11	Intensive unmixed crops	Convolvulaceae	29
V11	Intensive unmixed crops	Equisetaceae	14
V11	Intensive unmixed crops	Euphorbiaceae	11
V11	Intensive unmixed crops	Fabaceae	119
V11	Intensive unmixed crops	Geraniaceae	16
V11	Intensive unmixed crops	Hypericacaea	7
V11	Intensive unmixed crops	Lamiaceae	31
V11	Intensive unmixed crops	Linaceae	5
V11	Intensive unmixed crops	Paniceae	14
V11	Intensive unmixed crops	Papaveraceae	15
V11	Intensive unmixed crops	Plantaginaceae	60
V11	Intensive unmixed crops	Poaceae	173
V11	Intensive unmixed crops	Polygonaceae	99
V11	Intensive unmixed crops	Primulaceae	11
V11	Intensive unmixed crops	Ranunculaceae	13
V11	Intensive unmixed crops	Rosaceae	13
V11	Intensive unmixed crops	Rubiaceae	24
V11	Intensive unmixed crops	Violaceae	23
V12	Mixed crops of market gardens and horticulture	Amaranthaceae	34
V12	Mixed crops of market gardens and horticulture	Apiaceae	94
V12	Mixed crops of market gardens and horticulture	Boraginaceae	42
V12	Mixed crops of market gardens and horticulture	Brassicaceae	139
V12	Mixed crops of market gardens and horticulture	Caryophyllaceae	108
V12	Mixed crops of market gardens and horticulture	Chenopodiaceae	76
V12	Mixed crops of market gardens and horticulture	Compositae	390
V12	Mixed crops of market gardens and horticulture	Convolvulaceae	43
V12	Mixed crops of market gardens and horticulture	Cucurbitaceae	6
V12	Mixed crops of market gardens and horticulture	Cucurbitaceaea	5
V12	Mixed crops of market gardens and horticulture	Equisetaceae	26
V12	Mixed crops of market gardens and horticulture	Euphorbiaceae	33
V12	Mixed crops of market gardens and horticulture	Fabaceae	151
V12	Mixed crops of market gardens and horticulture	Geraniaceae	34
V12	Mixed crops of market gardens and horticulture	Lamiaceae	84
V12	Mixed crops of market gardens and horticulture	Malvaceae	7
V12	Mixed crops of market gardens and horticulture	Oxalidaceae	8
V12	Mixed crops of market gardens and horticulture	Paniceae	23
V12	Mixed crops of market gardens and horticulture	Papaveraceae	28
V12	Mixed crops of market gardens and horticulture	Plantaginaceae	124
V12	Mixed crops of market gardens and horticulture	Poaceae	175
V12	Mixed crops of market gardens and horticulture	Polygonaceae	196
V12	Mixed crops of market gardens and horticulture	Portulacaceae	8
V12	Mixed crops of market gardens and horticulture	Primulaceae	23
V12	Mixed crops of market gardens and horticulture	Ranunculaceae	27
V12	Mixed crops of market gardens and horticulture	Resedaceaea	5
V12	Mixed crops of market gardens and horticulture	Rosaceae	25

EUNIS	EUNISName	Family	SUM
V12	Mixed crops of market gardens and horticulture	Rubiaceae	36
V12	Mixed crops of market gardens and horticulture	Solanaceae	44
V12	Mixed crops of market gardens and horticulture	Triticeae	11
V12	Mixed crops of market gardens and horticulture	Urticaceae	19
V12	Mixed crops of market gardens and horticulture	Violaceae	34
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Amaranthaceae	5
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Apiaceae	46
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Boraginaceae	83
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Brassicaceae	174
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Campanulaceae	12
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Caryophyllaceae	203
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Chenopodiaceae	38
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Compositae	340
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Convolvulaceae	50
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Equisetaceae	37
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Euphorbiaceae	25
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Fabaceae	156
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Geraniaceae	29
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Juncaceae	9
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Lamiaceae	64
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Oxalidaceae	9
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Paniceae	6
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Papaveraceae	67
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Plantaginaceae	117
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Poaceae	185
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Polygonaceae	178
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Primulaceae	38
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Ranunculaceae	49
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Rosaceae	31
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Rubiaceae	53
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Solanaceae	10
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Triticeae	68
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Valerianaceae	9
V13	Arable land with unmixed crops grown by low-intensity agricultural methods	Violaceae	65
V34	Trampled xeric grassland with annuals	Amaranthaceae	38
V34	Trampled xeric grassland with annuals	Brassicaceae	27
V34	Trampled xeric grassland with annuals	Caryophyllaceae	14
V34	Trampled xeric grassland with annuals	Chenopodiaceae	26
V34	Trampled xeric grassland with annuals	Compositae	82
V34	Trampled xeric grassland with annuals	Convolvulaceae	20
V34	Trampled xeric grassland with annuals	Euphorbiaceae	12
V34	Trampled xeric grassland with annuals	Fabaceae	16
V34	Trampled xeric grassland with annuals	Paniceae	12
V34	Trampled xeric grassland with annuals	Plantaginaceae	42
V34	Trampled xeric grassland with annuals	Poaceae	225
V34	Trampled xeric grassland with annuals	Polygonaceae	50
V34	Trampled xeric grassland with annuals	Portulacaceae	29
V34	Trampled xeric grassland with annuals	Solanaceae	7
V34	Trampled xeric grassland with annuals	Zygophyllaceae	9
V35	Trampled mesophilous grassland with annuals		6
V35	Trampled mesophilous grassland with annuals	Brassicaceae	61
V35	Trampled mesophilous grassland with annuals	Bryophyta	17
V35	Trampled mesophilous grassland with annuals	Caryophyllaceae	34
V35	Trampled mesophilous grassland with annuals	Chenopodiaceae	10
V35	Trampled mesophilous grassland with annuals	Compositae	144
V35	Trampled mesophilous grassland with annuals	Convolvulaceae	5
V35	Trampled mesophilous grassland with annuals	Fabaceae	33
V35	Trampled mesophilous grassland with annuals	Juncaceae	5

EUNIS	EUNISName	Family	SUM
V35	Trampled mesophilous grassland with annuals	Malvaceae	5
V35	Trampled mesophilous grassland with annuals	Plantaginaceae	82
V35	Trampled mesophilous grassland with annuals	Poaceae	148
V35	Trampled mesophilous grassland with annuals	Polygonaceae	76
V35	Trampled mesophilous grassland with annuals	Ranunculaceae	5
V35	Trampled mesophilous grassland with annuals	Rosaceae	5
V37	Annual anthropogenic herbaceous vegetation	Amaranthaceae	60
V37	Annual anthropogenic herbaceous vegetation	Apiaceae	7
V37	Annual anthropogenic herbaceous vegetation	Brassicaceae	78
V37	Annual anthropogenic herbaceous vegetation	Caryophyllaceae	19
V37	Annual anthropogenic herbaceous vegetation	Chenopodiaceae	54
V37	Annual anthropogenic herbaceous vegetation	Compositae	207
V37	Annual anthropogenic herbaceous vegetation	Convolvulaceae	37
V37	Annual anthropogenic herbaceous vegetation	Equisetaceae	7
V37	Annual anthropogenic herbaceous vegetation	Fabaceae	15
V37	Annual anthropogenic herbaceous vegetation	Geraniaceae	14
V37	Annual anthropogenic herbaceous vegetation	Lamiaceae	7
V37	Annual anthropogenic herbaceous vegetation	Malvaceae	20
V37	Annual anthropogenic herbaceous vegetation	Paniceae	16
V37	Annual anthropogenic herbaceous vegetation	Papaveraceae	6
V37	Annual anthropogenic herbaceous vegetation	Plantaginaceae	28
V37	Annual anthropogenic herbaceous vegetation	Poaceae	149
V37	Annual anthropogenic herbaceous vegetation	Polygonaceae	56
V37	Annual anthropogenic herbaceous vegetation	Portulacaceae	8
V37	Annual anthropogenic herbaceous vegetation	Rubiaceae	8
V37	Annual anthropogenic herbaceous vegetation	Solanaceae	20
V37	Annual anthropogenic herbaceous vegetation	Urticaceae	21
V37	Annual anthropogenic herbaceous vegetation	Verbenaveae	6
V38	Dry perennial anthropogenic herbaceous vegetation	Anacardiaceaea	6
V38	Dry perennial anthropogenic herbaceous vegetation	Apiaceae	32
V38	Dry perennial anthropogenic herbaceous vegetation	Boraginaceae	16
V38	Dry perennial anthropogenic herbaceous vegetation	Brassicaceae	22
V38	Dry perennial anthropogenic herbaceous vegetation	Caryophyllaceae	23
V38	Dry perennial anthropogenic herbaceous vegetation	Chenopodiaceae	12
V38	Dry perennial anthropogenic herbaceous vegetation	Compositae	300
V38	Dry perennial anthropogenic herbaceous vegetation	Convolvulaceae	30
V38	Dry perennial anthropogenic herbaceous vegetation	Cyperaceae	5
V38	Dry perennial anthropogenic herbaceous vegetation	Equisetaceae	9
V38	Dry perennial anthropogenic herbaceous vegetation	Euphorbiaceae	12
V38	Dry perennial anthropogenic herbaceous vegetation	Fabaceae	75
V38	Dry perennial anthropogenic herbaceous vegetation	Hypericacaea	13
V38	Dry perennial anthropogenic herbaceous vegetation	Lamiaceae	10
V38	Dry perennial anthropogenic herbaceous vegetation	Malvaceae	5
V38	Dry perennial anthropogenic herbaceous vegetation	Onagraceae	5
V38	Dry perennial anthropogenic herbaceous vegetation	Plantaginaceae	40
V38	Dry perennial anthropogenic herbaceous vegetation	Poaceae	182
V38	Dry perennial anthropogenic herbaceous vegetation	Polygonaceae	24
V38	Dry perennial anthropogenic herbaceous vegetation	Ranunculaceae	5
V38	Dry perennial anthropogenic herbaceous vegetation	Resedaceaea	6
V38	Dry perennial anthropogenic herbaceous vegetation	Rosaceae	17
V38	Dry perennial anthropogenic herbaceous vegetation	Rubiaceae	21
V38	Dry perennial anthropogenic herbaceous vegetation	Urticaceae	20
V39	Mesic perennial anthropogenic herbaceous vegetation	Adoxaceae	9
V39	Mesic perennial anthropogenic herbaceous vegetation	Apiaceae	96
V39	Mesic perennial anthropogenic herbaceous vegetation	Balsaminaceae	9
V39	Mesic perennial anthropogenic herbaceous vegetation	Brassicaceae	24
V39	Mesic perennial anthropogenic herbaceous vegetation	Cannabaceae	5
V39	Mesic perennial anthropogenic herbaceous vegetation	Caryophyllaceae	20

EUNIS	EUNISName	Family	SUM
V39	Mesic perennial anthropogenic herbaceous vegetation	Chenopodiaceae	5
V39	Mesic perennial anthropogenic herbaceous vegetation	Compositae	143
V39	Mesic perennial anthropogenic herbaceous vegetation	Convolvulaceae	30
V39	Mesic perennial anthropogenic herbaceous vegetation	Equisetaceae	5
V39	Mesic perennial anthropogenic herbaceous vegetation	Fabaceae	6
V39	Mesic perennial anthropogenic herbaceous vegetation	Geraniaceae	8
V39	Mesic perennial anthropogenic herbaceous vegetation	Lamiaceae	61
V39	Mesic perennial anthropogenic herbaceous vegetation	Papaveraceae	20
V39	Mesic perennial anthropogenic herbaceous vegetation	Plantaginaceae	17
V39	Mesic perennial anthropogenic herbaceous vegetation	Poaceae	136
V39	Mesic perennial anthropogenic herbaceous vegetation	Polygonaceae	26
V39	Mesic perennial anthropogenic herbaceous vegetation	Ranunculaceae	13
V39	Mesic perennial anthropogenic herbaceous vegetation	Rosaceae	39
V39	Mesic perennial anthropogenic herbaceous vegetation	Rubiaceae	58
V39	Mesic perennial anthropogenic herbaceous vegetation	Urticaceae	70

Annex 4 List of 329 plant species of the eight EUNIS habitats

Speciesname	Family	Group
Achillea millefolium	Compositae	Dicotyls
Adonis aestivalis	Ranunculaceae	Dicotyls
Aegopodium podagraria	Apiaceae	Dicotyls
Agrostemma githago	Caryophyllaceae	Dicotyls
Agrostis capillaris	Poaceae	Monocotyls
Agrostis gigantea	Poaceae	Monocotyls
Alliaria petiolata	Brassicaceae	Dicotyls
Amaranthus albus	Amaranthaceae	Dicotyls
Amaranthus blitoides	Amaranthaceae	Dicotyls
Amaranthus deflexus	Amaranthaceae	Dicotyls
Amaranthus hybridus	Amaranthaceae	Dicotyls
Amaranthus retroflexus	Amaranthaceae	Dicotyls
Anagallis arvensis	Primulaceae	Dicotyls
Anagallis foemina	Primulaceae	Dicotyls
Anchusa arvensis	Boraginaceae	Dicotyls
Anethum graveolens	Apiaceae	Dicotyls
Anisantha sterilis	Poaceae	Monocotyls
Anthemis arvensis	Compositae	Dicotyls
Anthemis austriaca	Compositae	Dicotyls
Anthoxanthum aristatum	Poaceae	Monocotyls
Anthoxanthum odoratum	Poaceae	Monocotyls
Anthriscus sylvestris	Apiaceae	Dicotyls
Apera spica-venti	Poaceae	Monocotyls
Aphanes arvensis	Rosaceae	Dicotyls
Arabidopsis thaliana	Brassicaceae	Dicotyls
Arctium lappa	Compositae	Dicotyls
Arctium minus	Compositae	Dicotyls
Arctium tomentosum	Compositae	Dicotyls
Arenaria serpyllifolia	Caryophyllaceae	Dicotyls
Argentina anserina	Rosaceae	Dicotyls
Armoracia rusticana	Brassicaceae	Dicotyls
Arnoseris minima	Compositae	Dicotyls
Arrhenatherum elatius	Poaceae	Monocotyls
Artemisia absinthium	Compositae	Dicotyls
Artemisia campestris	Compositae	Dicotyls
Artemisia vulgaris	Compositae	Dicotyls
Atriplex nitens	Amaranthaceae	Dicotyls
Atriplex patula	Amaranthaceae	Dicotyls
Atriplex tatarica	Amaranthaceae	Dicotyls
Avena fatua	Poaceae	Monocotyls
Avena sativa	Poaceae	Monocotyls
Ballota nigra	Lamiaceae	Dicotyls
Berteroa incana	Brassicaceae	Dicotyls
Beta vulgaris	Brassicaceae	Dicotyls
Beta vulgaris subsp. vulgaris	Chenopodiaceae	Dicotyls
Bidens tripartita	Compositae	Dicotyls
Bifora testiculata	Apiaceae	Dicotyls
Brassica napus	Brassicaceae	Dicotyls
Brassica oleracea	Brassicaceae	Dicotyls
Brassica rapa	Brassicaceae	Dicotyls
Bromus hordeaceus	Poaceae	Monocotyls
Bromus hordeaceus subsp. hordeaceus	Poaceae	Monocotyls

Speciesname	Family	Group
Bromus inermis	Poaceae	Monocotyls
Bromus secalinus	Poaceae	Monocotyls
Bromus sterilis	Poaceae	Monocotyls
Bromus tectorum	Poaceae	Monocotyls
Bryum argenteum	Bryophyta	Bryophyta
Buglossoides arvensis	Boraginaceae	Dicotyls
Calamagrostis epigejos	Poaceae	Monocotyls
Calystegia sepium	Convolvulaceae	Dicotyls
Camelina microcarpa	Brassicaceae	Dicotyls
Campanula rapunculoides	Campanulaceae	Dicotyls
Capsella bursa-pastoris	Brassicaceae	Dicotyls
Cardaria draba	Brassicaceae	Dicotyls
Carduus acanthoides	Compositae	Dicotyls
Carduus crispus	Compositae	Dicotyls
Carex praecox	Cyperaceae	Monocotyls
Caucalis platycarpos	Apiaceae	Dicotyls
Centaurea cyanus	Compositae	Dicotyls
Cerastium fontanum subsp. vulgare	Caryophyllaceae	Dicotyls
Cerastium glomeratum	Caryophyllaceae	Dicotyls
Ceratodon purpureus		
Chaerophyllum aureum	Apiaceae	Dicotyls
Chaerophyllum bulbosum	Apiaceae	Dicotyls
Chaerophyllum temulum	Apiaceae	Dicotyls
Chamomilla recutita	Compositae	Dicotyls
Chamomilla suaveolens	Compositae	Dicotyls
Chelidonium majus	Papaveraceae	Dicotyls
Chenopodium album	Chenopodiaceae	Dicotyls
Chenopodium album aggr.	Chenopodiaceae	Dicotyls
Chenopodium hybridum	Chenopodiaceae	Dicotyls
Chenopodium polyspermum	Chenopodiaceae	Dicotyls
Chondrilla juncea	Compositae	Dicotyls
Cichorium intybus	Compositae	Dicotyls
Cirsium arvense	Compositae	Dicotyls
Cirsium vulgare	Compositae	Dicotyls
Conium maculatum	Apiaceae	Dicotyls
Consolida regalis	Ranunculaceae	Dicotyls
Convolvulus arvensis	Convolvulaceae	Dicotyls
Conyza bonariensis	Compositae	Dicotyls
Conyza canadensis	Compositae	Dicotyls
Conyzanthus squamatus	Compositae	Dicotyls
Coronopus squamatus	Brassicaceae	Dicotyls
Cota austriaca	Compositae	Dicotyls
Cruciata laevipes	Rubiaceae	Dicotyls
Cucumis sativus	Cucurbitaceaea	Dicotyls
Cucurbita pepo	Cucurbitaceae	Dicotyls
Cyanus segetum	Compositae	Dicotyls
Cynodon dactylon	Poaceae	Monocotyls
Dactylis glomerata	Poaceae	Monocotyls
Datura stramonium	Solanaceae	Dicotyls
Daucus carota	Apiaceae	Dicotyls
Descurainia sophia	Brassicaceae	Dicotyls
Digitaria sanguinalis	Poaceae	Monocotyls
Echinochloa crus-galli	Paniceae	Monocotyls
Echium vulgare	Boraginaceae	Dicotyls
Eleusine indica	Poaceae	Monocotyls
Elsholtzia ciliata	Lamiaceae	Dicotyls
Elymus repens	Poaceae	Monocotyls
Elytrigia repens	Poaceae	Monocotyls

Speciesname	Family	Group
Equisetum arvense	Equisetaceae	Dicotyls
Eragrostis cilianensis	Poaceae	Monocotyls
Eragrostis minor	Poaceae	Monocotyls
Eragrostis pilosa	Poaceae	Monocotyls
Erigeron annuus	Compositae	Dicotyls
Erigeron canadensis	Compositae	Dicotyls
Erodium cicutarium	Geraniaceae	Dicotyls
Erophila verna	Brassicaceae	Dicotyls
Eryngium campestre	Apiaceae	Dicotyls
Erysimum cheiranthoides	Brassicaceae	Dicotyls
Euphorbia cyparissias	Euphorbiaceae	Dicotyls
Euphorbia esula subsp. tommasiniana	Euphorbiaceae	Dicotyls
Euphorbia exigua	Euphorbiaceae	Dicotyls
Euphorbia helioscopia	Euphorbiaceae	Dicotyls
Euphorbia maculata	Euphorbiaceae	Dicotyls
Euphorbia peplus	Euphorbiaceae	Dicotyls
Falcaria vulgaris	Apiaceae	Dicotyls
Fallopia convolvulus	Polygonaceae	Dicotyls
Festuca pratensis	Poaceae	Monocotyls
Festuca rubra	Poaceae	Monocotyls
Fumaria officinalis	Papaveraceae	Dicotyls
Galeopsis bifida	Apiaceae	Dicotyls
Galeopsis tetrahit	Apiaceae	Dicotyls
Galinsoga ciliata	Compositae	Dicotyls
Galinsoga parviflora	Compositae	Dicotyls
Galinsoga quadriradiata	Compositae	Dicotyls
Galium album	Rubiaceae	Dicotyls
Galium aparine	Rubiaceae	Dicotyls
Galium mollugo	Rubiaceae	Dicotyls
Galium spurium	Rubiaceae	Dicotyls
Galium tricornutum	Rubiaceae	Dicotyls
Galium verum	Rubiaceae	Dicotyls
Geranium dissectum	Geraniaceae	Dicotyls
Geranium pusillum	Geraniaceae	Dicotyls
Geranium robertianum	Geraniaceae	Dicotyls
Geum urbanum	Rosaceae	Dicotyls
Glechoma hederacea	Lamiaceae	Dicotyls
Gnaphalium uliginosum	Compositae	Dicotyls
Gypsophila muralis	Caryophyllaceae	Dicotyls
Helianthus annuus	Compositae	Dicotyls
Helianthus tuberosus	Compositae	Dicotyls
Heliotropium europaeum	Brassicaceae	Dicotyls
Heracleum sphondylium	Apiaceae	Dicotyls
Holcus lanatus	Poaceae	Monocotyls
Holcus mollis	Poaceae	Monocotyls
Hordeum distichon	Poaceae	Monocotyls
Hordeum murinum	Poaceae	Monocotyls
Hordeum murinum subsp. leporinum	Poaceae	Monocotyls
Hordeum vulgare	Poaceae	Monocotyls
Humulus lupulus	Cannabaceae	Dicotyls
Hypericum perforatum	Hypericacaea	Dicotyls
Impatiens parviflora	Balsaminaceae	Dicotyls
Inula britannica	Compositae	Dicotyls
Juncus bufonius	Juncaceae	Monocotyls
Lactuca sativa	Compositae	Dicotyls
Lactuca serriola	Compositae	Dicotyls
Lamium album	Lamiaceae	Dicotyls
Lamium amplexicaule	Lamiaceae	Dicotyls

Speciesname	Family	Group
Lamium maculatum	Lamiaceae	Dicotyls
Lamium purpureum	Lamiaceae	Dicotyls
Lapsana communis	Compositae	Dicotyls
Lathyrus pratensis	Fabaceae	Dicotyls
Lathyrus tuberosus	Fabaceae	Dicotyls
Legousia speculum-veneris	Campanulaceae	Dicotyls
Leontodon autumnalis	Compositae	Dicotyls
Lepidium ruderale	Brassicaceae	Dicotyls
Leucanthemum vulgare	Compositae	Dicotyls
Linaria vulgaris	Plantaginaceae	Dicotyls
Linum usitatissimum	Linaceae	Dicotyls
Lipandra polysperma	Chenopodiaceae	Dicotyls
Lolium perenne	Poaceae	Monocotyls
Lolium rigidum	Poaceae	Monocotyls
Lotus corniculatus	Fabaceae	Dicotyls
Lycopersicon esculentum	Solanaceae	Dicotyls
Malva neglecta	Malvaceae	Dicotyls
Malva sylvestris	Malvaceae	Dicotyls
Matricaria perforata	Compositae	Dicotyls
Medicago lupulina	Fabaceae	Dicotyls
Medicago sativa	Fabaceae	Dicotyls
Medicago sativa subsp. falcata	Fabaceae	Dicotyls
Melilotus alba	Fabaceae	Dicotyls
Melilotus officinalis	Fabaceae	Dicotyls
Mentha arvensis	Lamiaceae	Dicotyls
Myosotis arvensis	Boraginaceae	Dicotyls
Myosotis stricta	Boraginaceae	Dicotyls
Neslia paniculata	Brassicaceae	Dicotyls
Ochlopoa annua	Poaceae	Monocotyls
Oenothera biennis	Onagraceae	Dicotyls
Onopordum acanthium	Compositae	Dicotyls
Oxalis corniculata	Euphorbiaceae	Dicotyls
Oxalis stricta	Oxalidaceae	Dicotyls
Papaver argemone	Papaveraceae	Dicotyls
Papaver dubium	Papaveraceae	Dicotyls
Papaver rhoeas	Papaveraceae	Dicotyls
Papaver somniferum	Papaveraceae	Dicotyls
Pastinaca sativa	Anacardiaceaea	Dicotyls
Persicaria lapathifolia	Polygonaceae	Dicotyls
Persicaria maculosa	Polygonaceae	Dicotyls
Phalaris arundinacea	Poaceae	Monocotyls
Phleum pratense	Poaceae	Monocotyls
Phragmites australis	Poaceae	Monocotyls
Picris hieracioides	Compositae	Dicotyls
Pisum sativum	Fabaceae	Dicotyls
Plantago coronopus	Plantaginaceae	Dicotyls
Plantago lanceolata	Plantaginaceae	Dicotyls
Plantago major	Plantaginaceae	Dicotyls
Plantago major subsp. intermedia	Plantaginaceae	Dicotyls
Plantago major subsp. major	Plantaginaceae	Dicotyls
Poa angustifolia	Poaceae	Monocotyls
Poa annua	Poaceae	Monocotyls
Poa bulbosa	Poaceae	Monocotyls
Poa compressa	Poaceae	Monocotyls
Poa pratensis	Poaceae	Monocotyls
Poa trivialis	Poaceae	Monocotyls
Polycarpon tetraphyllum	Caryophyllaceae	Dicotyls
Polygonum arenastrum	Polygonaceae	Dicotyls

Speciesname	Family	Group
Polygonum aviculare	Polygonaceae	Dicotyls
Polygonum aviculare aggr.	Polygonaceae	Dicotyls
Polygonum hydropiper	Polygonaceae	Dicotyls
Polygonum lapathifolium	Polygonaceae	Dicotyls
Polygonum persicaria	Polygonaceae	Dicotyls
Polygonum tomentosum	Polygonaceae	Dicotyls
Portulaca oleracea	Portulacaceae	Dicotyls
Potentilla anserina	Rosaceae	Dicotyls
Potentilla argentea	Rosaceae	Dicotyls
Potentilla reptans	Rosaceae	Dicotyls
Prunella vulgaris	Lamiaceae	Dicotyls
Ranunculus arvensis	Ranunculaceae	Dicotyls
Ranunculus bulbosus	Ranunculaceae	Dicotyls
Ranunculus repens	Ranunculaceae	Dicotyls
Raphanus raphanistrum	Brassicaceae	Dicotyls
Raphanus sativus	Brassicaceae	Dicotyls
Reseda lutea	Resedaceaea	Dicotyls
Reynoutria japonica	Polygonaceae	Dicotyls
Rorippa sylvestris	Brassicaceae	Dicotyls
Rostraria cristata	Poaceae	Monocotyls
Rubus caesius	Rosaceae	Dicotyls
Rumex acetosa	Polygonaceae	Dicotyls
Rumex acetosella	Polygonaceae	Dicotyls
Rumex crispus	Polygonaceae	Dicotyls
Rumex obtusifolius	Polygonaceae	Dicotyls
Sagina apetala	Caryophyllaceae	Dicotyls
Sagina procumbens	Caryophyllaceae	Dicotyls
Sambucus nigra	Adoxaceae	Dicotyls
Sanguisorba minor	Rosaceae	Dicotyls
Scandix pecten-veneris	Apiaceae	Dicotyls
Scleranthus annuus	Caryophyllaceae	Dicotyls
Sclerochloa dura	Poaceae	Monocotyls
Secale cereale	Triticeae	Dicotyls
Senecio jacobaea	Compositae	Dicotyls
Senecio vulgaris	Compositae	Dicotyls
Setaria pumila	Poaceae	Monocotyls
Setaria verticillata	Poaceae	Monocotyls
Setaria viridis	Poaceae	Monocotyls
Sherardia arvensis	Rubiaceae	Dicotyls
Silene latifolia	Caryophyllaceae	Dicotyls
Silene latifolia subsp. alba	Caryophyllaceae	Dicotyls
Silene noctiflora	Caryophyllaceae	Dicotyls
Silene vulgaris	Caryophyllaceae	Dicotyls
Sinapis arvensis	Brassicaceae	Dicotyls
Sisymbrium loeselii	Brassicaceae	Dicotyls
Sisymbrium officinale	Brassicaceae	Dicotyls
Solanum nigrum	Solanaceae	Dicotyls
Solanum tuberosum	Solanaceae	Dicotyls
Solidago canadensis	Compositae	Dicotyls
Solidago gigantea	Compositae	Dicotyls
Sonchus arvensis	Compositae	Dicotyls
Sonchus asper	Compositae	Dicotyls
Sonchus oleraceus	Compositae	Dicotyls
Sorghum halepense	Poaceae	Monocotyls
Spergula arvensis	Caryophyllaceae	Dicotyls
Spergularia rubra	Caryophyllaceae	Dicotyls
Stachys annua	Lamiaceae	Dicotyls
Stachys palustris	Lamiaceae	Dicotyls

Speciesname	Family	Group
Stellaria graminea	Caryophyllaceae	Dicotyls
Stellaria media	Caryophyllaceae	Dicotyls
Symphytum officinale	Boraginaceae	Dicotyls
Tanacetum vulgare	Compositae	Dicotyls
Taraxacum officinale	Compositae	Dicotyls
Taraxacum sect. Ruderalia	Compositae	Dicotyls
Taraxacum sect. Taraxacum	Compositae	Dicotyls
Taraxacum species	Compositae	Dicotyls
Teesdalia nudicaulis	Brassicaceae	Dicotyls
Thlaspi arvense	Brassicaceae	Dicotyls
Torilis japonica	Apiaceae	Dicotyls
Tribulus terrestris	Zygophyllaceae	Dicotyls
Trifolium arvense	Fabaceae	Dicotyls
Trifolium campestre	Fabaceae	Dicotyls
Trifolium incarnatum	Fabaceae	Dicotyls
Trifolium incarnatum subsp. molinerii	Fabaceae	Dicotyls
Trifolium pratense	Fabaceae	Dicotyls
Trifolium repens	Fabaceae	Dicotyls
Trifolium striatum	Fabaceae	Dicotyls
Tripleurospermum maritimum	Compositae	Dicotyls
Tripleurospermum perforatum	Compositae	Dicotyls
Triticosecale rimpaui	Poaceae	Monocotyls
Triticum aestivum	Triticeae	Monocotyls
Tussilago farfara	Compositae	Dicotyls
Urtica dioica	Urticaceae	Dicotyls
Urtica urens	Urticaceae	Dicotyls
Valerianella dentata	Valerianaceae	Dicotyls
Verbena officinalis	Verbenaveae	Dicotyls
Veronica agrestis	Plantaginaceae	Dicotyls
Veronica arvensis	Plantaginaceae	Dicotyls
Veronica chamaedrys	Plantaginaceae	Dicotyls
Veronica hederifolia	Plantaginaceae	Dicotyls
Veronica persica	Plantaginaceae	Dicotyls
Veronica polita	Plantaginaceae	Dicotyls
Veronica triphyllos	Plantaginaceae	Dicotyls
Vicia cracca	Fabaceae	Dicotyls
Vicia hirsuta	Fabaceae	Dicotyls
Vicia sativa	Fabaceae	Dicotyls
Vicia sativa subsp. nigra	Fabaceae	Dicotyls
Vicia tetrasperma	Fabaceae	Dicotyls
Vicia villosa	Fabaceae	Dicotyls
Viola arvensis	Violaceae	Dicotyls
Xanthium spinosum	Compositae	Dicotyls
Xanthium strumarium	Compositae	Dicotyls
Zea mays	Poaceae	Monocotyls

Annex 5 Species list per EUNIS habitat

V numbers refer to man-made habitats. Frequency in percentages. Mip = mean abundance if present

V11

Species name	Frequency	Mip
Chenopodium album	32	5
Elymus repens	32	6
Capsella bursa-pastoris	31	7
Cirsium arvense	29	3
Convolvulus arvensis	29	3
Stellaria media	28	8
Medicago sativa	26	45
Fallopia convolvulus	25	3
Viola arvensis	23	3
Plantago lanceolata	19	3
Achillea millefolium	18	3
Taraxacum officinale	17	5
Polygonum aviculare	16	3
Equisetum arvense	14	3
Veronica persica	14	4
Echinochloa crus-galli	14	5
Myosotis arvensis	13	4
Dactylis glomerata	13	7
Trifolium repens	13	4
Tripleurospermum perforatum	13	5
Sonchus arvensis	13	4
Veronica arvensis	13	3
Lolium perenne	12	5
Trifolium pratense	12	5
Galium aparine	12	4
Poa annua	12	5
Rumex crispus	12	3
Artemisia vulgaris	11	4
Polygonum lapathifolium	11	5
Anagallis arvensis	11	2
Thlaspi arvense	11	2
Euphorbia helioscopia	11	2
Sonchus oleraceus	11	3
Lamium purpureum	11	4
Amaranthus retroflexus	11	6
Erodium cicutarium	11	3
Rumex acetosella	11	4
Centaurea cyanus	10	4
Vicia hirsuta	9	3
Medicago lupulina	9	3
Taraxacum sect. Ruderalia	9	5
Plantago major	9	2
Sinapis arvensis	9	5
Setaria pumila	9	5
Raphanus raphanistrum	9	6
Polygonum persicaria	9	3
Spergula arvensis	9	3
Apera spica-venti	9	7
Polygonum aviculare aggr.	9	3
Papaver rhoeas	9	5
Lamium amplexicaule	8	4

Species name	Frequency	Mip
Lotus corniculatus	8	3
Setaria viridis	8	3
Galeopsis tetrahit	8	4
Galinsoga parviflora	8	9
Conyza canadensis	8	4
Ranunculus repens	8	2
Poa pratensis	8	3
Matricaria perforata	8	4
Cichorium intybus	8	4
Vicia sativa subsp. nigra	8	2
Eryngium campestre	7	3
Galium verum	7	3
Lactuca serriola	7	2
Sanguisorba minor	7	3
Scleranthus annuus	7	5
Festuca rubra	7	6
Arrhenatherum elatius	7	7
Bromus hordeaceus subsp. hordeaceus	7	4
Daucus carota	7	3
Trifolium campestre	7	3
Lapsana communis	7	3
Hypericum perforatum	7	2
Poa trivialis	7	6
Trifolium incarnatum subsp. molinerii	6	22
Stachys palustris	6	3
Sonchus asper	6	2
Arenaria serpyllifolia	6	3
Vicia sativa	6	2
Fumaria officinalis	6	3
Mentha arvensis	6	3
Rumex acetosa	6	4
Bromus sterilis	6	4
Silene latifolia subsp. alba	6	2
Potentilla argentea	6	2
Festuca pratensis	6	5
Poa bulbosa	5	3
Vicia cracca	5	3
Gnaphalium uliginosum	5	3
Senecio vulgaris	5	3
Trifolium striatum	5	6
Trifolium incarnatum	5	41
Veronica polita	5	4
Anthemis arvensis	5	3
Geranium pusillum	5	3
Ranunculus bulbosus	5	3
Sherardia arvensis	5	3
Anthoxanthum odoratum	5	4
Erysimum cheiranthoides	5	2
Cerastium fontanum subsp. vulgare	5	3
Chamomilla recutita	5	6
Cynodon dactylon	5	11
Phleum pratense	5	2
Holcus lanatus	5	4
Sorghum halepense	5	11
Anchusa arvensis	5	4
Chamomilla suaveolens	5	2
Leucanthemum vulgare	5	4

V12

Species name	Frequency	Mip
Stellaria media	53	8
Chenopodium album	49	4
Daucus carota	45	4
Convolvulus arvensis	43	5
Fallopia convolvulus	41	5
Cirsium arvense	40	2
Capsella bursa-pastoris	39	2
Veronica persica	37	3
Polygonum persicaria	35	3
Elymus repens	35	3
Galeopsis tetrahit	34	6
Viola arvensis	34	3
Poa annua	31	5
Sonchus oleraceus	29	2
Trifolium repens	29	2
Lamium purpureum	27	2
Ranunculus repens	27	3
Equisetum arvense	26	3
Galinsoga parviflora	26	16
Euphorbia helioscopia	26	2
Solanum tuberosum	26	2
Achillea millefolium	25	2
Myosotis arvensis	25	3
Sonchus arvensis	24	5
Mentha arvensis	24	6
Anagallis arvensis	23	2
Echinochloa crus-galli	23	6
Sonchus asper	22	2
Polygonum aviculare	21	4
Polygonum lapathifolium	21	3
Plantago lanceolata	21	2
Vicia hirsuta	20	3
Rumex crispus	20	2
Galium aparine	20	5
Taraxacum officinale	20	2
Lapsana communis	19	3
Atriplex patula	19	3
Plantago major	19	2
Artemisia vulgaris	18	3
Medicago lupulina	18	2
Matricaria perforata	18	4
Sinapis arvensis	18	2
Galinsoga ciliata	17	9
Potentilla anserina	17	3
Polygonum aviculare aggr.	17	3
Tussilago farfara	16	2
Pisum sativum	16	10
Geranium pusillum	16	2
Plantago major subsp. intermedia	16	3
Amaranthus retroflexus	15	3
Armoracia rusticana	15	4
Brassica rapa	15	19
Setaria pumila	15	5
Chenopodium album aggr.	15	4
Taraxacum sect. Ruderalia	15	3
Avena sativa	14	41
Silene latifolia subsp. alba	14	2

Species name	Frequency	Mip
Trifolium pratense	13	4
Stachys palustris	13	9
Papaver rhoeas	13	2
Setaria viridis	13	2
Anthemis arvensis	13	6
Vicia sativa	13	3
Erodium cicutarium	13	2
Veronica arvensis	13	2
Erysimum cheiranthoides	12	3
Chenopodium polyspermum	12	5
Vicia sativa subsp. nigra	12	2
Rumex obtusifolius	12	2
Polygonum tomentosum	12	3
Centaurea cyanus	11	2
Thlaspi arvense	11	2
Spergula arvensis	11	3
Veronica polita	11	2
Lycopersicon esculentum	11	24
Avena fatua	11	2
Secale cereale	11	64
Urtica dioica	10	2
Dactylis glomerata	10	2
Senecio vulgaris	9	2
Raphanus raphanistrum	9	2
Polygonum hydropiper	9	4
Urtica urens	9	4
Tripleurospermum perforatum	9	3
Conyza canadensis	8	2
Chamomilla suaveolens	8	2
Vicia cracca	8	2
Papaver somniferum	8	2
Oxalis stricta	8	2
Rumex acetosella	8	4
Potentilla reptans	8	2
Anethum graveolens	8	2
Gnaphalium uliginosum	8	3
Helianthus annuus	8	3
Brassica oleracea	8	2
Scleranthus annuus	8	14
Stellaria graminea	8	2
Lamium amplexicaule	8	2
Portulaca oleracea	8	16
Galium spurium	8	2
Sherardia arvensis	8	10
Digitaria sanguinalis	8	4
Agrostis gigantea	8	2
Apera spica-venti	8	4
Poa trivialis	8	2
Hordeum distichon	8	52
Anchusa arvensis	7	10
Arabidopsis thaliana	7	2
Arenaria serpyllifolia	7	2
Euphorbia peplus	7	3
Galeopsis bifida	7	4
Fumaria officinalis	7	2
Malva neglecta	7	3
Linaria vulgaris	7	2
Solanum nigrum	7	12

Species name	Frequency	Mip
Cerastium fontanum subsp. vulgare	7	1
Lactuca sativa	6	7
Tanacetum vulgare	6	5
Cucurbita pepo	6	20
Vicia villosa	6	3
Melilotus officinalis	6	2
Prunella vulgaris	6	2
Elsholtzia ciliata	6	2
Setaria verticillata	6	17
Cichorium intybus	5	2
Bidens tripartita	5	2
Lactuca serriola	5	2
Symphytum officinale	5	2
Echium vulgare	5	2
Beta vulgaris	5	2
Cucumis sativus	5	66
Lathyrus pratensis	5	4
Lotus corniculatus	5	4
Geranium dissectum	5	4
Reseda lutea	5	2

V13

Species name	Frequency	Mip
Centaurea cyanus	66	5
Viola arvensis	65	3
Fallopia convolvulus	58	4
Convolvulus arvensis	50	3
Cirsium arvense	48	3
Secale cereale	45	57
Stellaria media	43	5
Apera spica-venti	42	10
Scleranthus annuus	42	6
Myosotis arvensis	39	3
Anthemis arvensis	38	4
Chenopodium album	38	4
Elymus repens	38	5
Capsella bursa-pastoris	37	3
Equisetum arvense	37	4
Vicia hirsuta	36	4
Veronica arvensis	34	3
Papaver rhoeas	34	5
Raphanus raphanistrum	33	3
Anagallis arvensis	33	3
Vicia sativa subsp. nigra	28	3
Rumex acetosella	28	4
Achillea millefolium	28	2
Galium aparine	26	4
Polygonum aviculare	26	3
Aphanes arvensis	25	4
Spergula arvensis	24	4
Buglossoides arvensis	23	3
Triticum aestivum	23	55
Arenaria serpyllifolia	23	4
Matricaria perforata	22	6
Veronica persica	22	3
Arabidopsis thaliana	20	4
Galeopsis tetrahit	19	3

Species name	Frequency	Mip
Sonchus arvensis	19	4
Papaver argemone	18	3
Sinapis arvensis	18	4
Thlaspi arvense	18	3
Lamium amplexicaule	17	2
Vicia tetrasperma	17	3
Agrostemma githago	17	3
Euphorbia helioscopia	16	2
Ranunculus repens	16	3
Veronica hederifolia	16	6
Polygonum aviculare aggr.	16	3
Mentha arvensis	16	4
Consolida regalis	16	5
Polygonum persicaria	14	3
Medicago lupulina	14	3
Rumex crispus	14	2
Vicia sativa	14	3
Myosotis stricta	13	4
Erodium cicutarium	13	2
Artemisia vulgaris	13	2
Arnoseris minima	13	4
Lamium purpureum	13	2
Veronica triphyllos	13	5
Taraxacum officinale	12	2
Stachys palustris	12	3
Trifolium repens	12	4
Ranunculus arvensis	12	4
Vicia villosa	12	5
Sherardia arvensis	12	3
Lapsana communis	12	3
Sonchus asper	11	2
Cerastium fontanum subsp. vulgare	11	2
Setaria pumila	10	6
Agrostis gigantea	10	5
Neslia paniculata	10	2
Silene latifolia subsp. alba	10	2
Lolium rigidum	10	5
Valerianella dentata	9	3
Juncus bufonius	9	4
Gnaphalium uliginosum	9	2
Galium tricornutum	9	4
Erophila verna	9	4
Daucus carota	9	2
Euphorbia exigua	9	3
Oxalis stricta	9	3
Polygonum tomentosum	8	3
Poa annua	8	3
Polygonum lapathifolium	8	3
Geranium pusillum	8	2
Anchusa arvensis	8	3
Plantago major	8	2
Stellaria graminea	8	3
Setaria viridis	8	4
Geranium dissectum	8	2
Silene noctiflora	8	3
Fumaria officinalis	8	2
Tripleurospermum perforatum	8	6
Conyza canadensis	7	2

Species name	Frequency	Mip
Chamomilla recutita	7	8
Sonchus oleraceus	7	3
Teesdalia nudicaulis	7	4
Veronica polita	7	2
Silene vulgaris	7	3
Galeopsis bifida	7	2
Papaver dubium	7	3
Bromus secalinus	7	4
Avena fatua	7	4
Legousia speculum-veneris	7	5
Holcus mollis	7	5
Trifolium arvense	6	3
Polygonum hydropiper	6	3
Stachys annua	6	7
Plantago lanceolata	6	2
Trifolium pratense	6	6
Lathyrus tuberosus	6	4
Galium spurium	6	3
Erysimum cheiranthoides	6	2
Echinochloa crus-galli	6	5
Plantago major subsp. intermedia	6	4
Potentilla anserina	6	3
Scandix pecten-veneris	6	4
Camelina microcarpa	6	3
Veronica agrestis	5	3
Anthoxanthum aristatum	5	15
Campanula rapunculoides	5	3
Descurainia sophia	5	2
Anthemis austriaca	5	14
Vicia cracca	5	3
Tussilago farfara	5	4
Poa pratensis	5	3
Rorippa sylvestris	5	3
Adonis aestivalis	5	4
Caucalis platycarpos	5	4
Galinsoga parviflora	5	9
Poa trivialis	5	3
Lactuca serriola	5	2
Anagallis foemina	5	3
Cerastium glomeratum	5	3
Atriplex patula	5	3
Gypsophila muralis	5	2

V34

SynBioSys name	Frequency	Mip
Cynodon dactylon	43	21
Polygonum aviculare	31	13
Digitaria sanguinalis	31	17
Portulaca oleracea	29	9
Chenopodium album	25	3
Eragrostis minor	24	13
Poa annua	22	3
Conyza canadensis	20	3
Convolvulus arvensis	19	3
Amaranthus retroflexus	17	3
Lolium perenne	17	5
Setaria viridis	17	5

SynBioSys name	Frequency	Mip
Plantago major	16	3
Polygonum arenastrum	14	12
Capsella bursa-pastoris	14	2
Plantago coronopus	13	12
Plantago lanceolata	13	3
Setaria verticillata	13	16
Setaria pumila	12	8
Echinochloa crus-galli	12	5
Sclerochloa dura	11	31
Sonchus oleraceus	10	2
Heliotropium europaeum	9	9
Tribulus terrestris	9	12
Amaranthus albus	9	4
Taraxacum sect. Ruderalia	8	2
Polycarpon tetraphyllum	8	6
Conyza bonariensis	8	6
Taraxacum officinale	8	3
Medicago lupulina	8	2
Trifolium repens	8	2
Solanum nigrum	7	3
Cichorium intybus	7	2
Euphorbia maculata	6	28
Chondrilla juncea	6	2
Amaranthus blitoides	6	6
Hordeum murinum	6	3
Polygonum aviculare aggr.	6	9
Rostraria cristata	6	3
Hordeum murinum subsp. leporinum	5	3
Conyzanthus squamatus	5	3
Chamomilla recutita	5	3
Amaranthus deflexus	5	10
Eragrostis cilianensis	5	7
Lepidium ruderale	5	2
Eragrostis pilosa	5	12
Lactuca serriola	5	2
Sagina apetala	5	5

V35

SynBioSys name	Frequency	Mip
Poa annua	83	18
Plantago major	64	9
Chamomilla suaveolens	47	11
Lolium perenne	43	6
Polygonum aviculare	41	23
Capsella bursa-pastoris	36	3
Trifolium repens	28	4
Polygonum arenastrum	22	27
Taraxacum sect. Ruderalia	22	3
Bryum argenteum	18	13
Sagina procumbens	16	12
Taraxacum officinale	14	3
Polygonum aviculare aggr.	14	22
Plantago lanceolata	13	3
Lepidium ruderale	12	11
Conyza canadensis	12	3
Chenopodium album	9	2
Stellaria media	9	3

SynBioSys name	Frequency	Mip
Artemisia vulgaris	9	2
Elymus repens	8	3
Sisymbrium officinale	8	3
Tripleurospermum perforatum	8	2
Spergularia rubra	8	11
Achillea millefolium	8	2
Poa pratensis	7	3
Coronopus squamatus	7	16
Ceratodon purpureus	7	10
Chamomilla recutita	6	5
Dactylis glomerata	6	2
Medicago lupulina	6	2
Ranunculus repens	6	2
Potentilla anserina	6	5
Leontodon autumnalis	6	2
Sonchus oleraceus	6	2
Plantago major subsp. major	5	8
Agrostis capillaris	5	4
Juncus bufonius	5	6
Taraxacum species	5	2
Malva neglecta	5	4

V37

Species name	Frequency	Mip
Chenopodium album	48	11
Convolvulus arvensis	37	6
Capsella bursa-pastoris	30	4
Amaranthus retroflexus	26	9
Cirsium arvense	23	6
Polygonum aviculare	22	5
Conyza canadensis	22	5
Elymus repens	21	5
Lactuca serriola	20	7
Stellaria media	19	8
Sonchus oleraceus	18	3
Lolium perenne	18	5
Poa annua	18	5
Artemisia vulgaris	17	4
Echinochloa crus-galli	16	7
Bromus sterilis	15	14
Solanum nigrum	15	5
Sisymbrium officinale	14	6
Hordeum murinum	14	26
Plantago major	13	3
Tripleurospermum perforatum	13	6
Senecio vulgaris	12	3
Urtica dioica	12	5
Malva neglecta	12	19
Cynodon dactylon	11	7
Bromus tectorum	11	12
Setaria viridis	11	5
Atriplex patula	11	8
Plantago lanceolata	10	2
Setaria pumila	10	7
Descurainia sophia	10	8
Taraxacum sect. Ruderalia	10	2
Taraxacum officinale	10	2

Species name	Frequency	Mip
Fallopia convolvulus	9	3
Urtica urens	9	10
Galium aparine	8	3
Digitaria sanguinalis	8	8
Portulaca oleracea	8	7
Sonchus asper	8	3
Medicago lupulina	8	2
Achillea millefolium	8	3
Malva sylvestris	8	7
Trifolium repens	7	3
Polygonum aviculare aggr.	7	5
Erodium cicutarium	7	4
Dactylis glomerata	7	3
Geranium pusillum	7	5
Daucus carota	7	3
Atriplex tatarica	7	24
Galinsoga parviflora	7	4
Ballota nigra	7	3
Sisymbrium loeselii	7	13
Rumex crispus	7	3
Equisetum arvense	7	9
Sinapis arvensis	6	5
Lepidium ruderale	6	4
Polygonum lapathifolium	6	4
Atriplex nitens	6	29
Sonchus arvensis	6	3
Chamomilla recutita	6	7
Xanthium spinosum	6	10
Cichorium intybus	6	2
Chenopodium hybridum	6	6
Papaver rhoeas	6	3
Verbena officinalis	6	3
Carduus acanthoides	5	3

V38

Species name	Frequency	Mip
Elymus repens	41	15
Artemisia vulgaris	39	13
Convolvulus arvensis	30	3
Cirsium arvense	26	4
Achillea millefolium	22	3
Daucus carota	20	4
Dactylis glomerata	20	4
Urtica dioica	20	7
Conyza canadensis	19	5
Plantago lanceolata	18	3
Calamagrostis epigejos	18	26
Tanacetum vulgare	17	14
Medicago lupulina	16	5
Echium vulgare	16	6
Cichorium intybus	15	3
Bromus inermis	14	26
Lactuca serriola	13	3
Hypericum perforatum	13	3
Silene latifolia subsp. alba	13	3
Tussilago farfara	12	20
Melilotus alba	12	17

Species name	Frequency	Mip
Chenopodium album	12	3
Lolium perenne	12	4
Carduus acanthoides	12	9
Artemisia absinthium	11	13
Poa angustifolia	11	7
Plantago major	11	3
Arrhenatherum elatius	11	6
Taraxacum sect. Ruderalia	11	2
Poa compressa	11	8
Cirsium vulgare	11	4
Linaria vulgaris	11	3
Melilotus officinalis	11	9
Picris hieracioides	10	5
Tripleurospermum perforatum	10	4
Ballota nigra	10	8
Taraxacum officinale	10	3
Trifolium repens	10	3
Equisetum arvense	9	6
Berteroa incana	9	7
Poa pratensis	9	4
Galium verum	9	3
Rumex crispus	9	2
Capsella bursa-pastoris	8	3
Arctium lappa	8	11
Rumex obtusifolius	8	11
Vicia cracca	7	3
Potentilla argentea	7	6
Trifolium pratense	7	3
Polygonum aviculare	7	4
Bromus sterilis	7	5
Euphorbia esula subsp. tommasiniana	7	2
Galium aparine	7	3
Erigeron annuus	7	7
Lotus corniculatus	7	2
Eryngium campestre	6	3
Senecio jacobaea	6	3
Pastinaca sativa	6	4
Onopordum acanthium	6	25
Poa annua	6	4
Bromus tectorum	6	5
Falcaria vulgaris	6	7
Poa trivialis	6	4
Reseda lutea	6	4
Sonchus oleraceus	5	2
Potentilla reptans	5	4
Arctium minus	5	8
Arenaria serpyllifolia	5	4
Rubus caesius	5	3
Agrostis capillaris	5	5
Sonchus arvensis	5	5
Arctium tomentosum	5	9
Solidago canadensis	5	12
Ranunculus repens	5	4
Euphorbia cyparissias	5	3
Carex praecox	5	9
Cardaria draba	5	15
Galium mollugo	5	3
Inula britannica	5	2

Species name	Frequency	Mip
Artemisia campestris	5	5
Festuca rubra	5	6
Malva sylvestris	5	4
Silene vulgaris	5	4
Oenothera biennis	5	4
Medicago sativa subsp. falcata	5	4

V39

Species name	Frequency	Mip
Urtica dioica	70	19
Galium aparine	42	8
Dactylis glomerata	28	4
Artemisia vulgaris	28	4
Elymus repens	27	6
Aegopodium podagraria	25	16
Geum urbanum	21	4
Cirsium arvense	20	4
Anthriscus sylvestris	20	9
Calystegia sepium	20	8
Chelidonium majus	20	11
Ballota nigra	18	13
Glechoma hederacea	17	6
Poa trivialis	17	4
Alliaria petiolata	14	9
Heracleum sphondylium	14	3
Arrhenatherum elatius	14	5
Lamium album	14	6
Taraxacum sect. Ruderalia	14	2
Rumex obtusifolius	13	4
Ranunculus repens	13	3
Rubus caesius	12	3
Lamium maculatum	12	4
Convolvulus arvensis	10	3
Stellaria media	10	4
Lapsana communis	10	3
Silene latifolia subsp. alba	10	2
Veronica chamaedrys	10	2
Achillea millefolium	9	2
Bromus sterilis	9	6
Calamagrostis epigejos	9	32
Sambucus nigra	9	3
Impatiens parviflora	9	16
Geranium robertianum	8	7
Poa pratensis	8	4
Reynoutria japonica	8	70
Arctium lappa	7	3
Chaerophyllum aureum	7	55
Poa annua	7	3
Chaerophyllum temulum	7	20
Arctium tomentosum	7	8
Plantago major	7	2
Lolium perenne	7	4
Helianthus tuberosus	7	59
Taraxacum officinale	7	2
Arctium minus	7	4
Erigeron annuus	7	5
Conium maculatum	6	39

Species name	Frequency	Mip
Chaerophyllum bulbosum	6	35
Potentilla reptans	6	3
Cruciata laevipes	6	25
Vicia cracca	6	2
Galeopsis tetrahit	6	4
Chenopodium album	5	3
Equisetum arvense	5	3
Humulus lupulus	5	5
Torilis japonica	5	13
Carduus crispus	5	5
Tanacetum vulgare	5	3
Rumex crispus	5	3
Solidago gigantea	5	20
Galium album	5	2
Capsella bursa-pastoris	5	2
Phragmites australis	5	14
Sisymbrium officinale	5	2
Phalaris arundinacea	5	4
Galium mollugo	5	3
Sonchus oleraceus	5	2

Annex 6 Summary of traits (binary categories) for use in QUICKScan.

		Intensive unmixed crops	Mixed crops of market gardens and horticulture	Arable land with unmixed crops grown by low-intensity agricultural methods	Trampled xeric grassland with annuals	Trampled mesophilous grassland with annuals	Annual anthropogenic herbaceous vegetation	Dry perennial anthropogenic herbaceous vegetation	Mesic perennial anthropogenic herbaceous vegetation
	Code	V11	V12	V13	V34	V35	V37	V38	V39
		a	a	a	a	a	a	a	a
TraitClass	mono-/dicotyl	Dicotyls	Dicotyls	Dicotyls	Dicotyls	Dicotyls	Dicotyls	Dicotyls	Dicotyls
	Total Score	912	1860	1933	372	460	678	703	664
	/Max	47.2%	96.2%	100.0%	19.2%	23.8%	35.1%	36.4%	34.4%
	/Max MonoDi	47.2%	96.2%	100.0%	19.2%	23.8%	35.1%	36.4%	34.4%
TraitClass	leaftype	broad-leaved	broad-leaved	broad-leaved	broad-leaved	broad-leaved	broad-leaved	broad-leaved	broad-leaved
	Total Score	19395	14954	16177	16266	36062	20853	18637	13137
	/Max	53.8%	41.5%	44.9%	45.1%	100.0%	57.8%	51.7%	36.4%
	/Max Broad Narrow	53.8%	41.5%	44.9%	45.1%	100.0%	57.8%	51.7%	36.4%
TraitClass	plant functional type	C3	C3	C3	C3	C3	C3	C3	C3
	Total Score	2428	6731	8103	1016	1325	1847	2742	1502
	/Max	30.0%	83.1%	100.0%	12.5%	16.4%	22.8%	33.8%	18.5%
	/Max PFT	30.0%	83.1%	100.0%	12.5%	16.4%	22.8%	33.8%	18.5%
TraitClass	Lifespan	annual	annual	annual	annual	annual	annual	annual	annual
	Total Score	20470	32041	48242	7090	12259	15637	4922	4097
	/Max	42.4%	66.4%	100.0%	14.7%	25.4%	32.4%	10.2%	8.5%
	/Max Life span	42.4%	66.4%	100.0%	14.7%	25.4%	32.4%	10.2%	8.5%
TraitClass	seed longevity	< 1 year	< 1 year	< 1 year	< 1 year	< 1 year	< 1 year	< 1 year	< 1 year
	Total Score	82071	128835	120107	25148	50336	56522	67317	71702
	/Max	63.7%	100.0%	93.2%	19.5%	39.1%	43.9%	52.3%	55.7%
	/Max Seed type	63.7%	100.0%	93.2%	19.5%	39.1%	43.9%	52.3%	55.7%
TraitClass	Lifeform	Hemicryptophyte	Hemicryptophyte	Hemicryptophyte	Hemicryptophyte	Hemicryptophyte	Hemicryptophyte	Hemicryptophyte	Hemicryptophyte
	Total Score	859	1464	1481	326	462	600	814	741
	/Max	58.0%	98.9%	100.0%	22.0%	31.2%	40.5%	55.0%	50.0%
	/Max Life form	58.0%	98.9%	100.0%	22.0%	31.2%	40.5%	55.0%	50.0%

		Intensive unmixed crops	Mixed crops of market gardens and horticulture	Arable land with unmixed crops grown by low-intensity agricultural methods	Trampled xeric grassland with annuals	Trampled mesophilous grassland with annuals	Annual anthropogenic herbaceous vegetation	Dry perennial anthropogenic herbaceous vegetation	Mesic perennial anthropogenic herbaceous vegetation
	Code	V11	V12	V13	V34	V35	V37	V38	V39
		b	b	b	b	b	b	b	b
TraitClass	mono-/dicotyl	Monocotyls	Monocotyls	Monocotyls	Monocotyls	Monocotyls	Monocotyls	Monocotyls	Monocotyls
	Total Score	187	198	223	237	153	165	187	136
	/Max	9.7%	10.2%	11.5%	12.3%	7.9%	8.5%	9.7%	7.0%
	/Max MonoDi	78.9%	83.5%	94.1%	100.0%	64.6%	69.6%	78.9%	57.4%
TraitClass	leaftype	narrow-leaved	narrow-leaved	narrow-leaved	narrow-leaved	narrow-leaved	narrow-leaved	narrow-leaved	narrow-leaved
	Total Score	112	173	263	50	47	87	110	84
	/Max	0.3%	0.5%	0.7%	0.1%	0.1%	0.2%	0.3%	0.2%
	/Max Broad Narrow	42.6%	65.8%	100.0%	19.0%	17.9%	33.1%	41.8%	31.9%
TraitClass	plant functional type	C4	C4	C4	C4	C4	C4	C4	C4
	Total Score	149	145	76	540	32	258	64	10
	/Max	1.8%	1.8%	0.9%	6.7%	0.4%	3.2%	0.8%	0.1%
	/Max PFT	27.6%	26.9%	14.1%	100.0%	5.9%	47.8%	11.9%	1.9%
TraitClass	Lifespan	non-annual	non-annual	non-annual	non-annual	non-annual	non-annual	non-annual	non-annual
	Total Score	8756	14399	11174	3912	6903	6703	10625	10277
	/Max	18.2%	29.8%	23.2%	8.1%	14.3%	13.9%	22.0%	21.3%
	/Max Life span	60.8%	100.0%	77.6%	27.2%	47.9%	46.6%	73.8%	71.4%
TraitClass	seed longevity	> 1 year	> 1 year	> 1 year	> 1 year	> 1 year	> 1 year	> 1 year	> 1 year
	Total Score	69145	116555	109740	29419	47701	54293	36623	35453
	/Max	53.7%	90.5%	85.2%	22.8%	37.0%	42.1%	28.4%	27.5%
	/Max Seed type	59.3%	100.0%	94.2%	25.2%	40.9%	46.6%	31.4%	30.4%
TraitClass	Lifeform	Therophyte	Therophyte	Therophyte	Therophyte	Therophyte	Therophyte	Therophyte	Therophyte
	Total Score	576	1197	1257	446	313	537	324	225
	/Max	38.9%	80.8%	84.9%	30.1%	21.1%	36.3%	21.9%	15.2%
	/Max Life form	45.8%	95.2%	100.0%	35.5%	24.9%	42.7%	25.8%	17.9%

		Intensive unmixed crops	Mixed crops of market gardens and horticulture	Arable land with unmixed crops grown by low-intensity agricultural methods	Trampled xeric grassland with annuals	Trampled mesophilous grassland with annuals	Annual anthropogenic herbaceous vegetation	Dry perennial anthropogenic herbaceous vegetation	Mesic perennial anthropogenic herbaceous vegetation
	Code	V11	V12	V13	V34	V35	V37	V38	V39
		c	c	c	c	c	c	c	c
TraitClass	mono-/dicotyl								
	Total Score								
	/Max								
	/Max MonoDi								
TraitClass	leaftype								
	Total Score								
	/Max								
	/Max Broad Narrow								
TraitClass	plant functional type								
	Total Score								
	/Max								
	/Max PFT								
TraitClass	Lifespan								
	Total Score								
	/Max								
	/Max Life span								
TraitClass	seed longevity								
	Total Score								
	/Max								
	/Max Seed type								
TraitClass	Lifeform	Other	Other	Other	Other	Other	Other	Other	Other
	Total Score	349	482	580	140	129	214	302	290
	/Max	23.6%	32.5%	39.2%	9.5%	8.7%	14.4%	20.4%	19.6%
	/Max Life form	60.2%	83.1%	100.0%	24.1%	22.2%	36.9%	52.1%	50.0%

Annex 7 47 maps including suitability maps for the eight EUNIS habitats, the potential occurrence maps of the eight EUNIS habitats in agricultural land surrounding wheat crops and surrounding vineyards and trait maps for the example trait annual vs non-annual

Annex 7 includes 47 maps i.e. the habitat suitability maps for the eight EUNIS habitats, the potential occurrence maps of the eight EUNIS habitats in agricultural land surrounding wheat crops and in agricultural land surrounding vineyards and trait maps for the trait annual vs non-annual.

The maps are designed in such a way that the more intense the colour, the more suitable the habitat is supposed to be (habitat suitability maps), the higher the occurrence (potential occurrence maps) and the higher the representation of annual or non-annual species in the EUNIS habitat.

Habitat suitability v-types

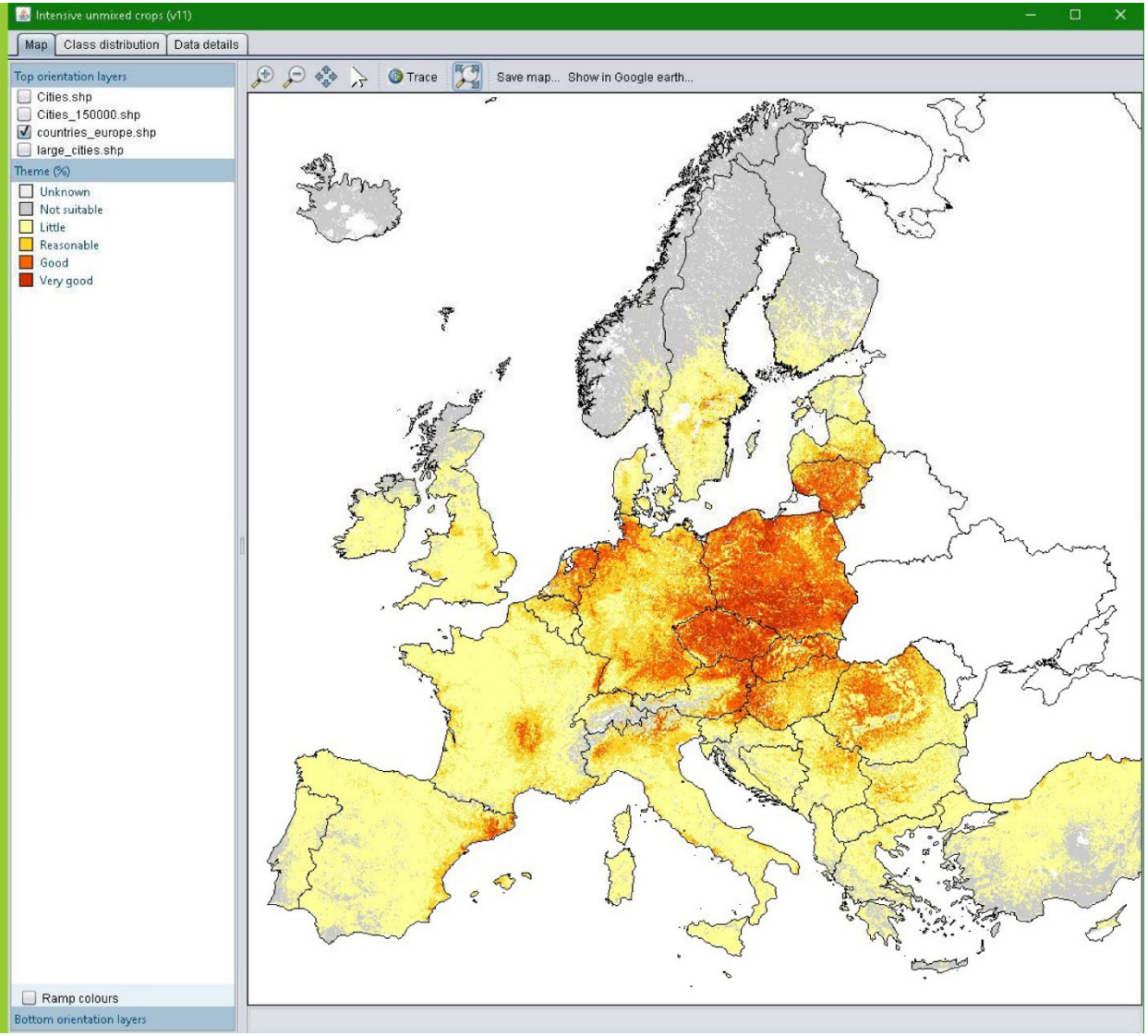
HABITAT SUITABILITY %

V11 Habitat suitability

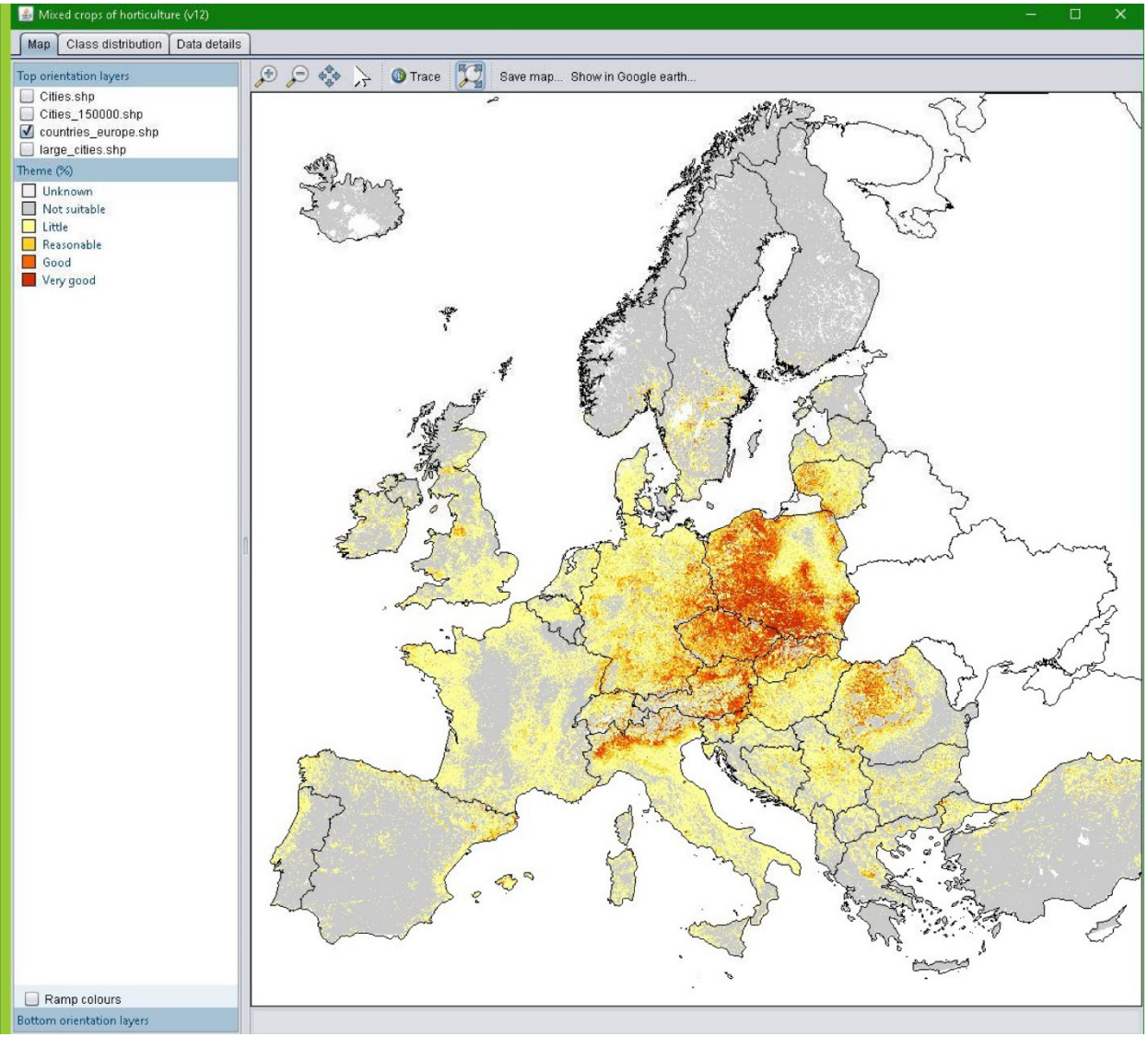
Numerical ◉ Ratio ○ Interval Units %

Colour	Name	Value
	Unknown	[-1.0; 0.0>
	Not suitable	[0.0; 3.0>
	Little	[3.0; 25.0>
	Reasonable	[25.0; 50.0>
	Good	[50.0; 75.0>
	Very good	[75.0; 100.0]

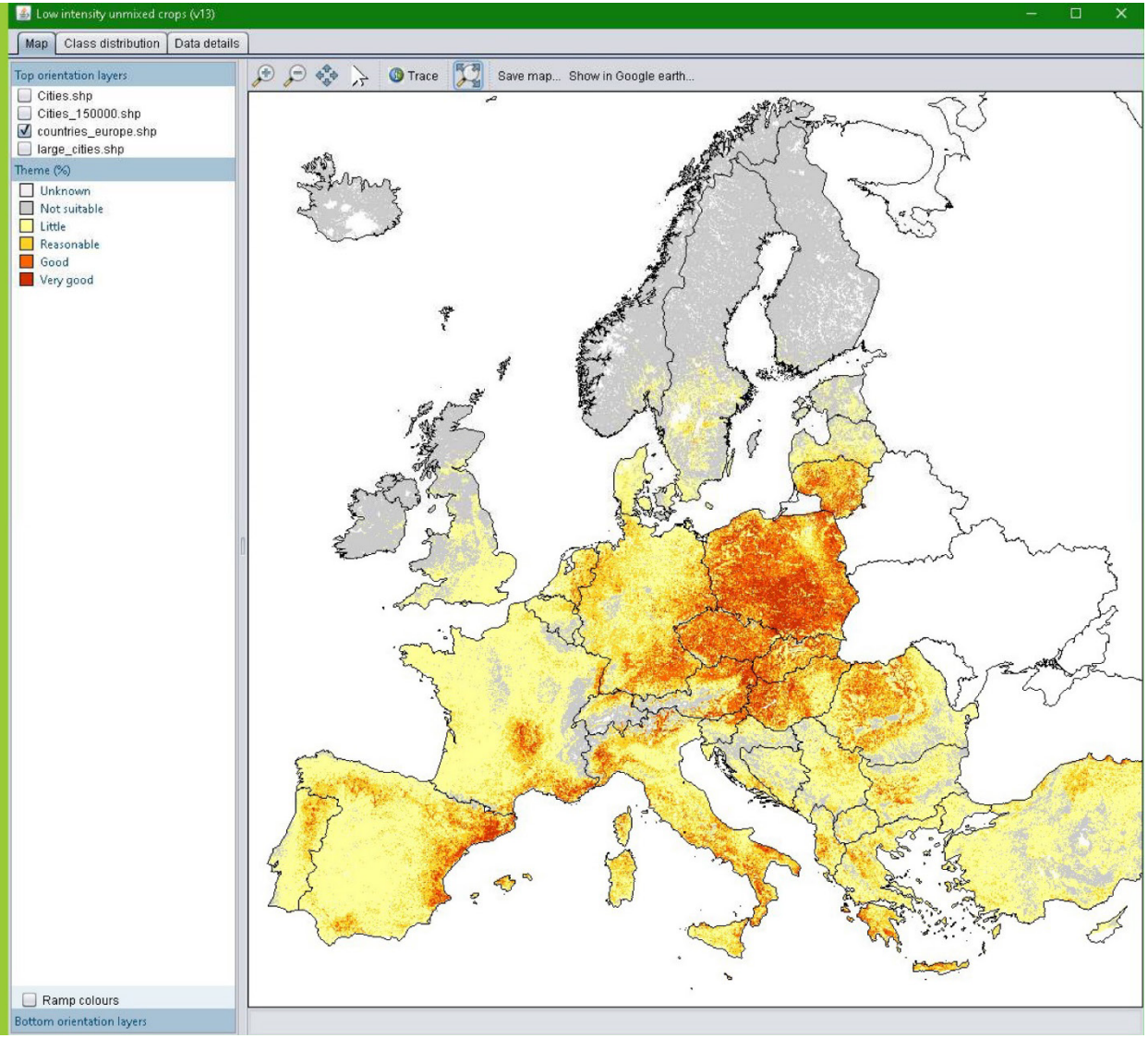
quickscan



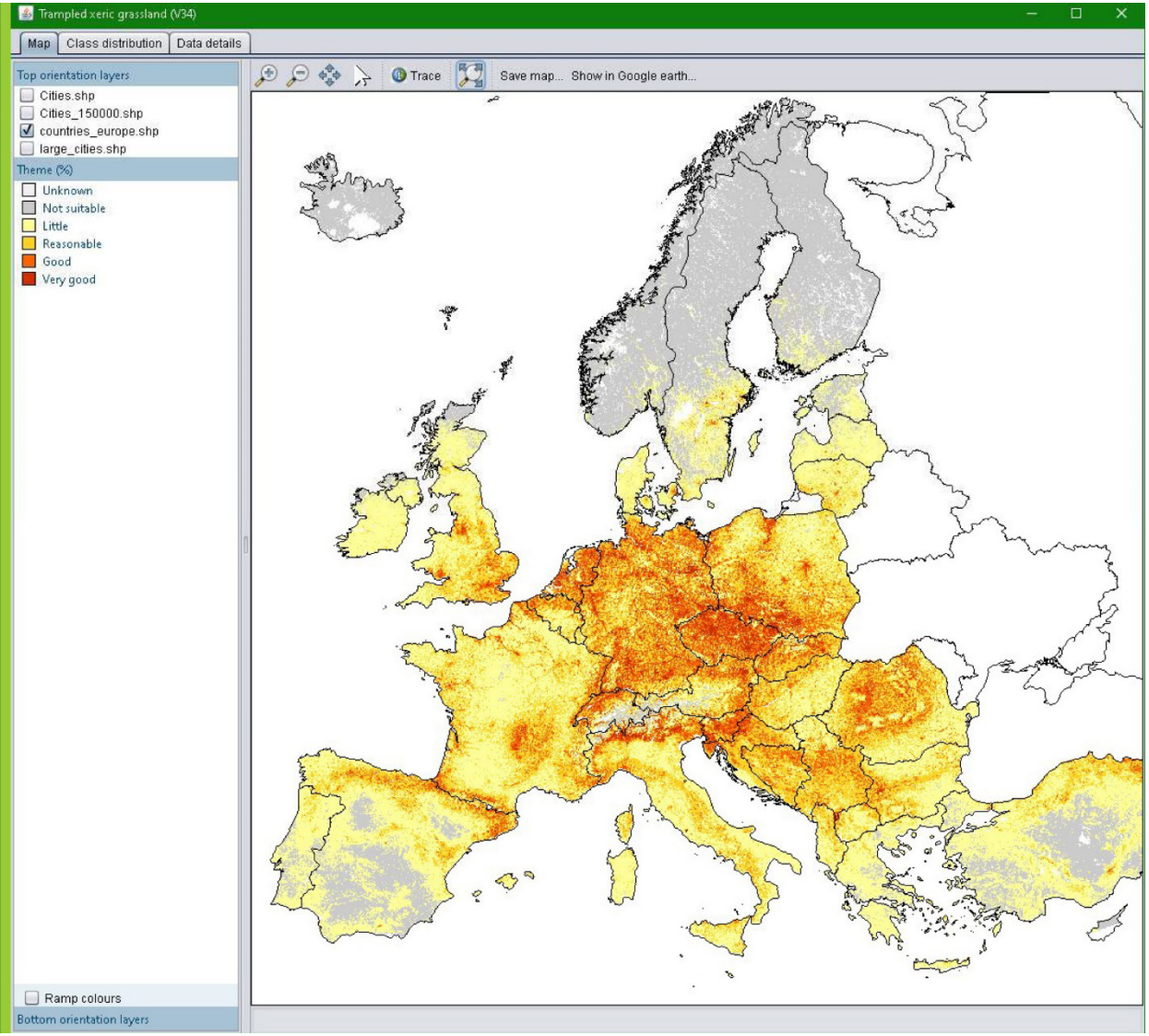
V12
Habitat suitability



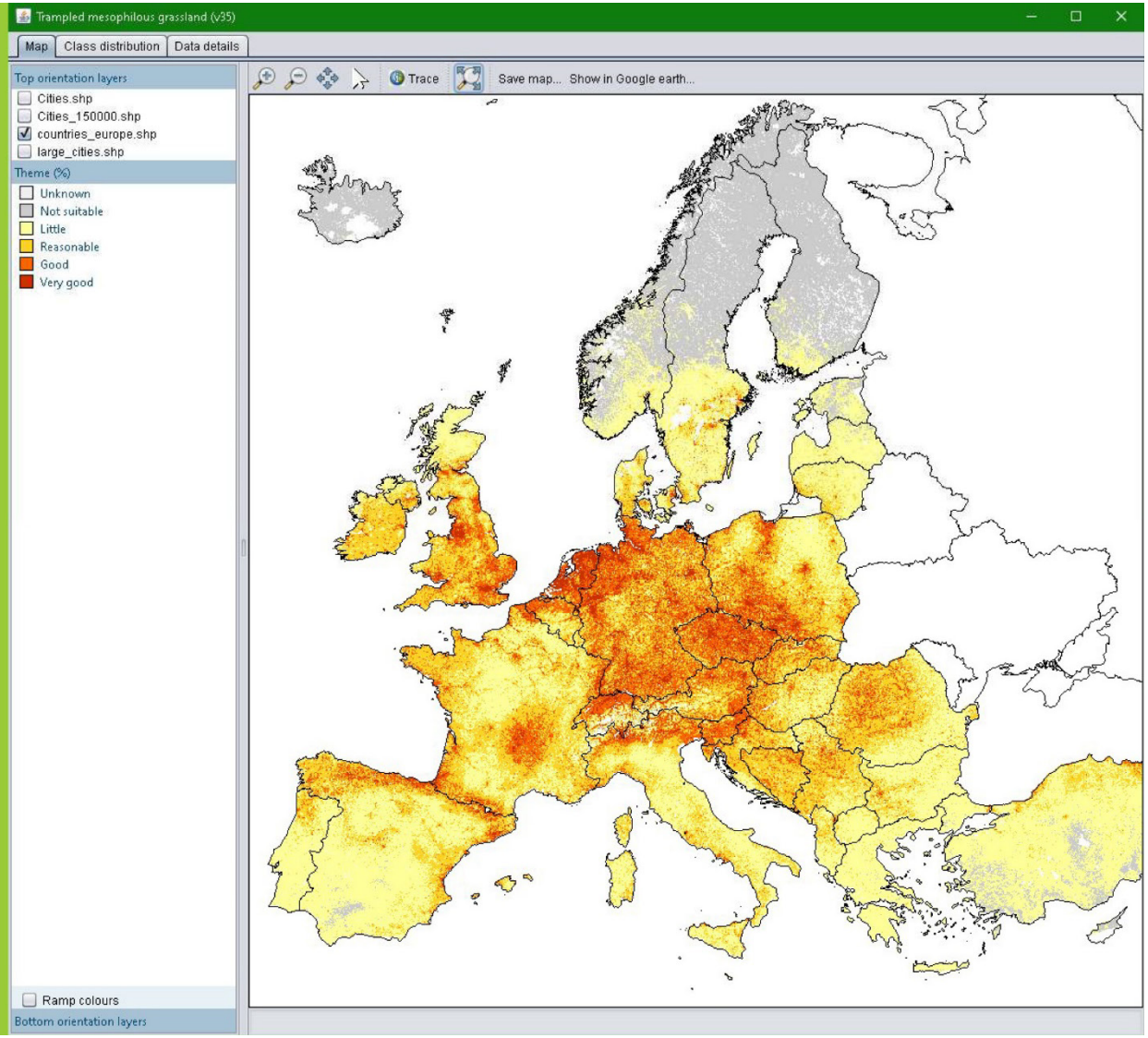
V13 Habitat suitability



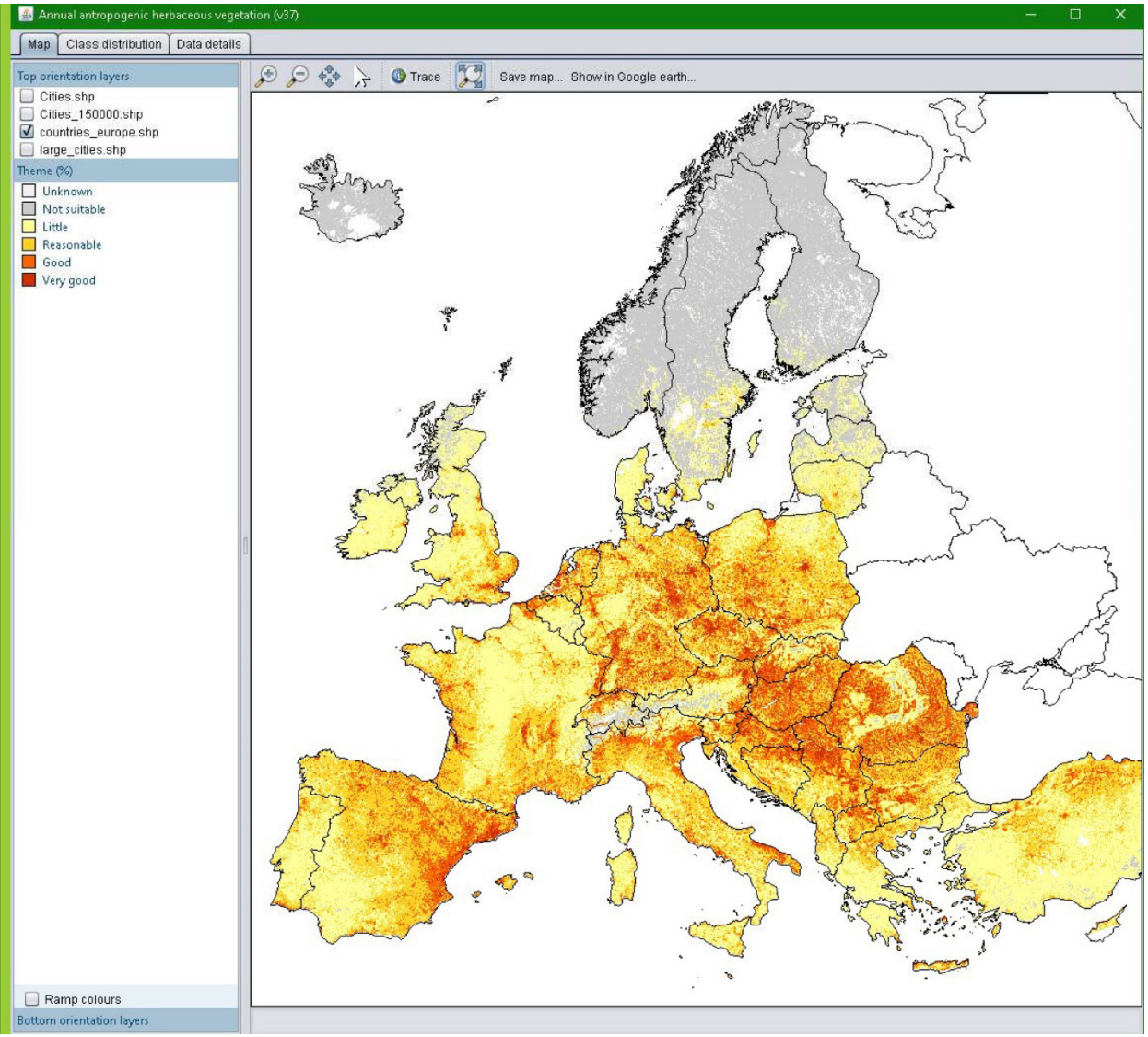
V34 Habitat suitability



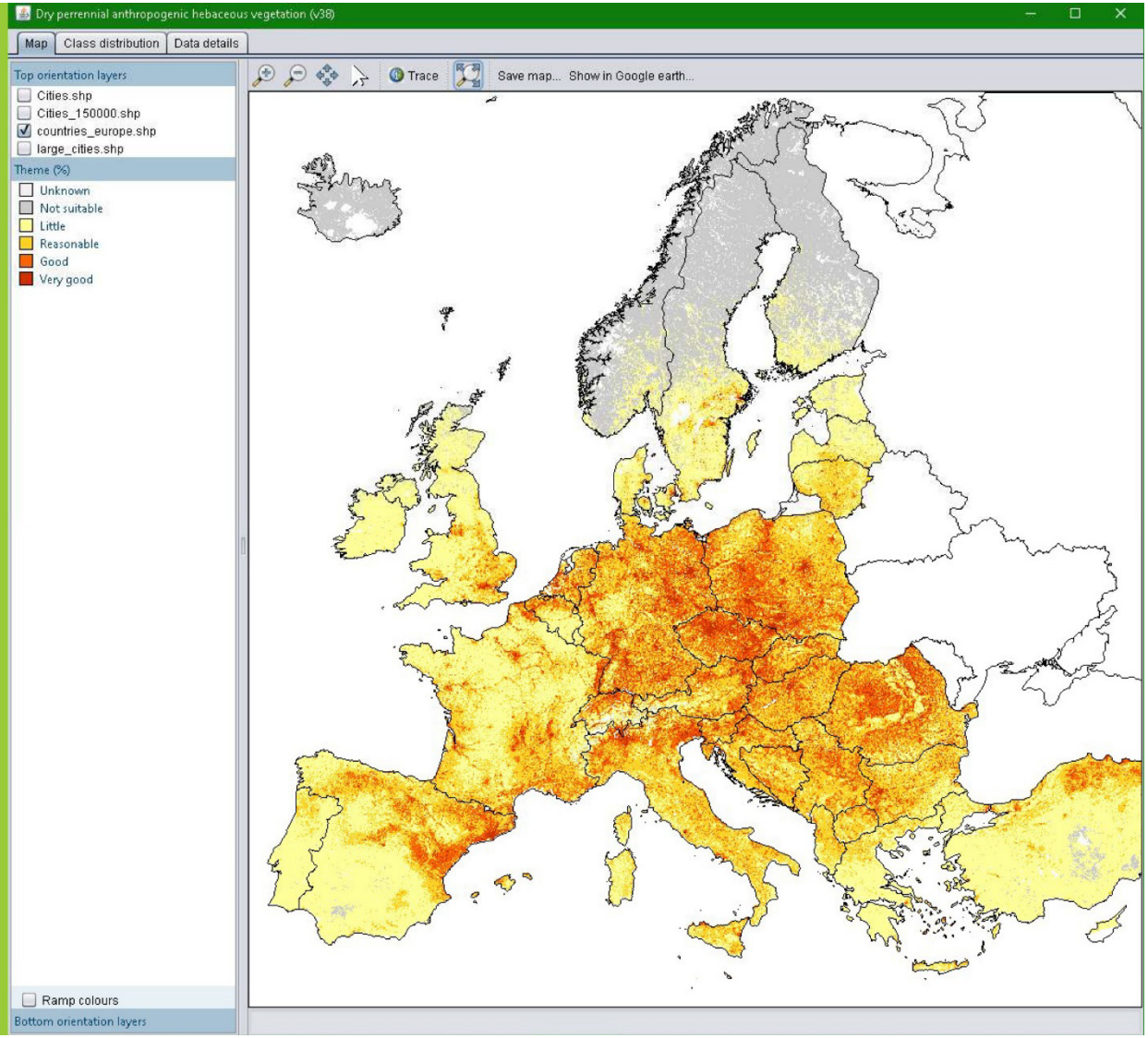
V35 Habitat suitability



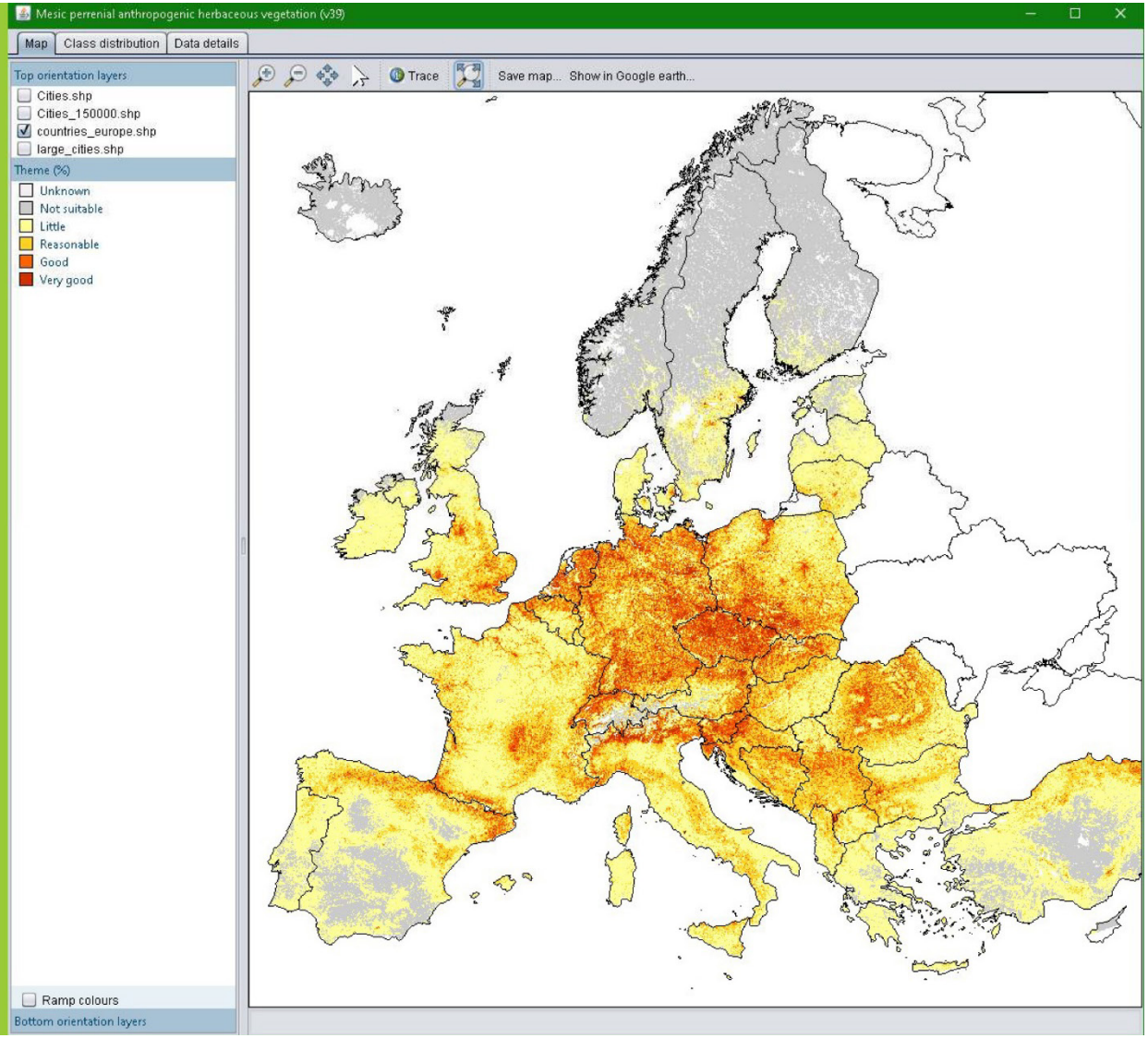
V37
Habitat suitability



V38 Habitat suitability



V39 Habitat suitability



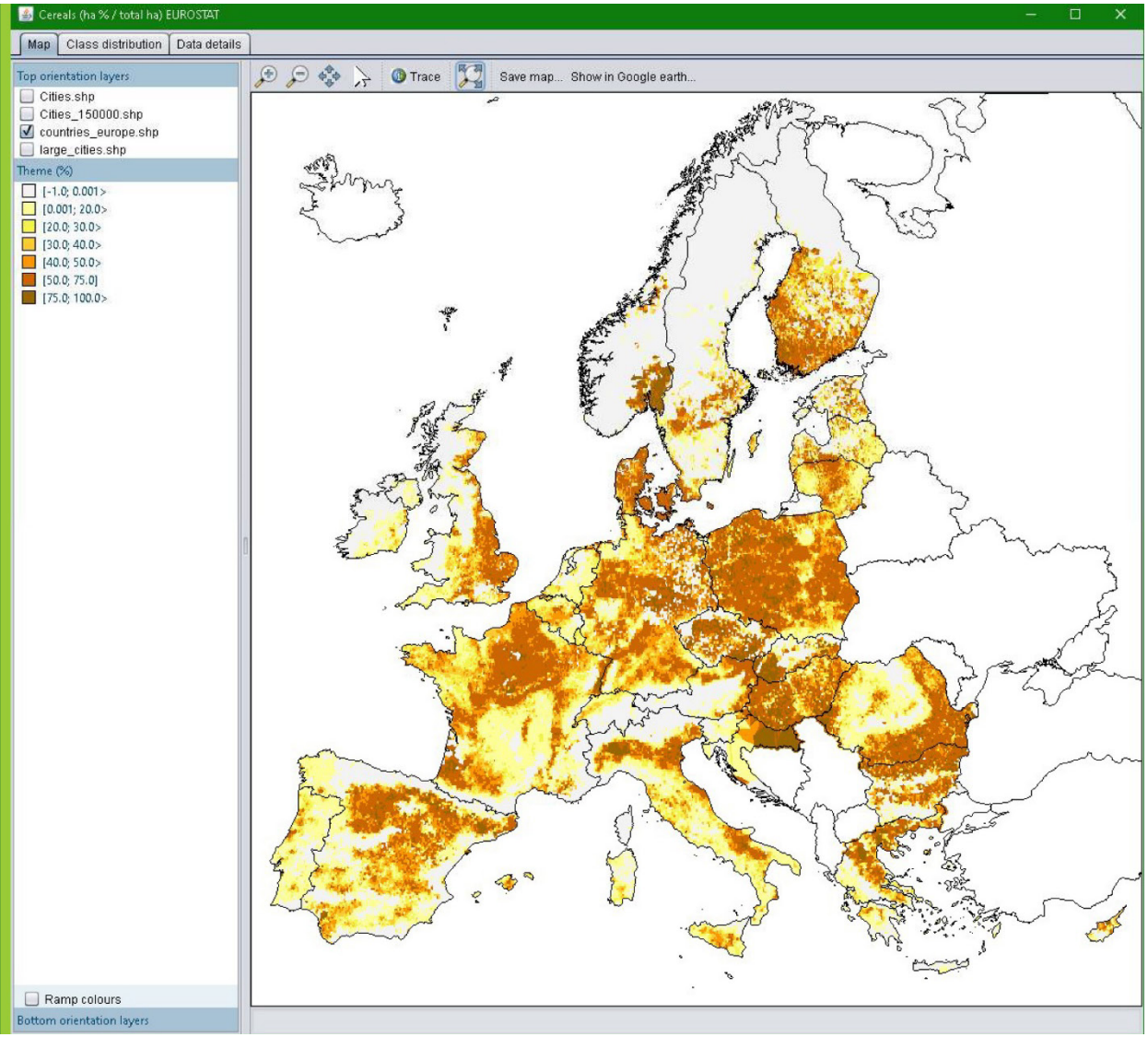
Cereals

HABITAT SUITABILITY &

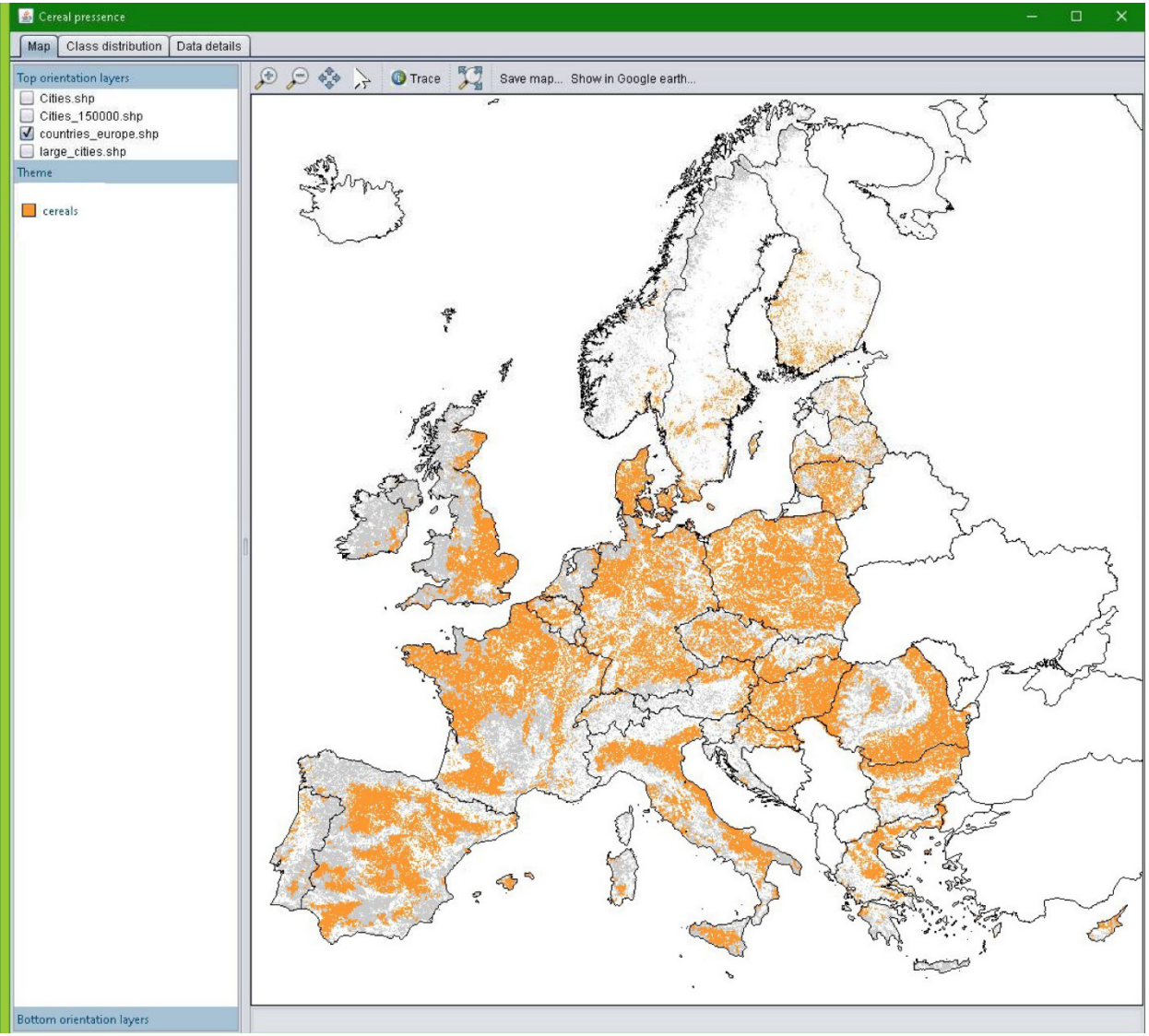
POTENTIAL OCCURRENCE (SUITABILITY X FSS2010-CROP PRESENCE)

Cereals FSS2010

(% ha / total ha crops)



Cereals FSS2010 x Agricultural Mask

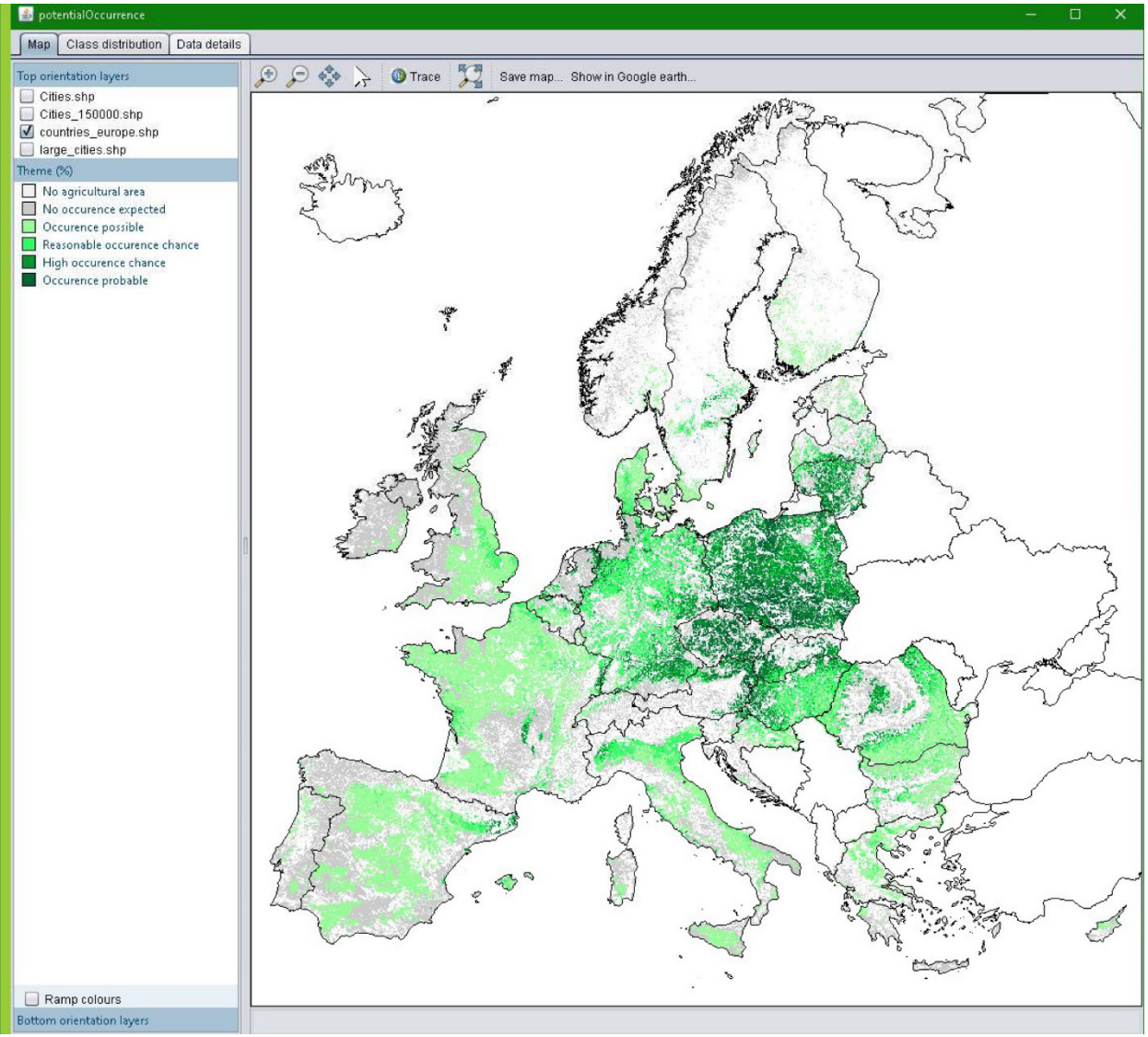


V11 potential occurrence

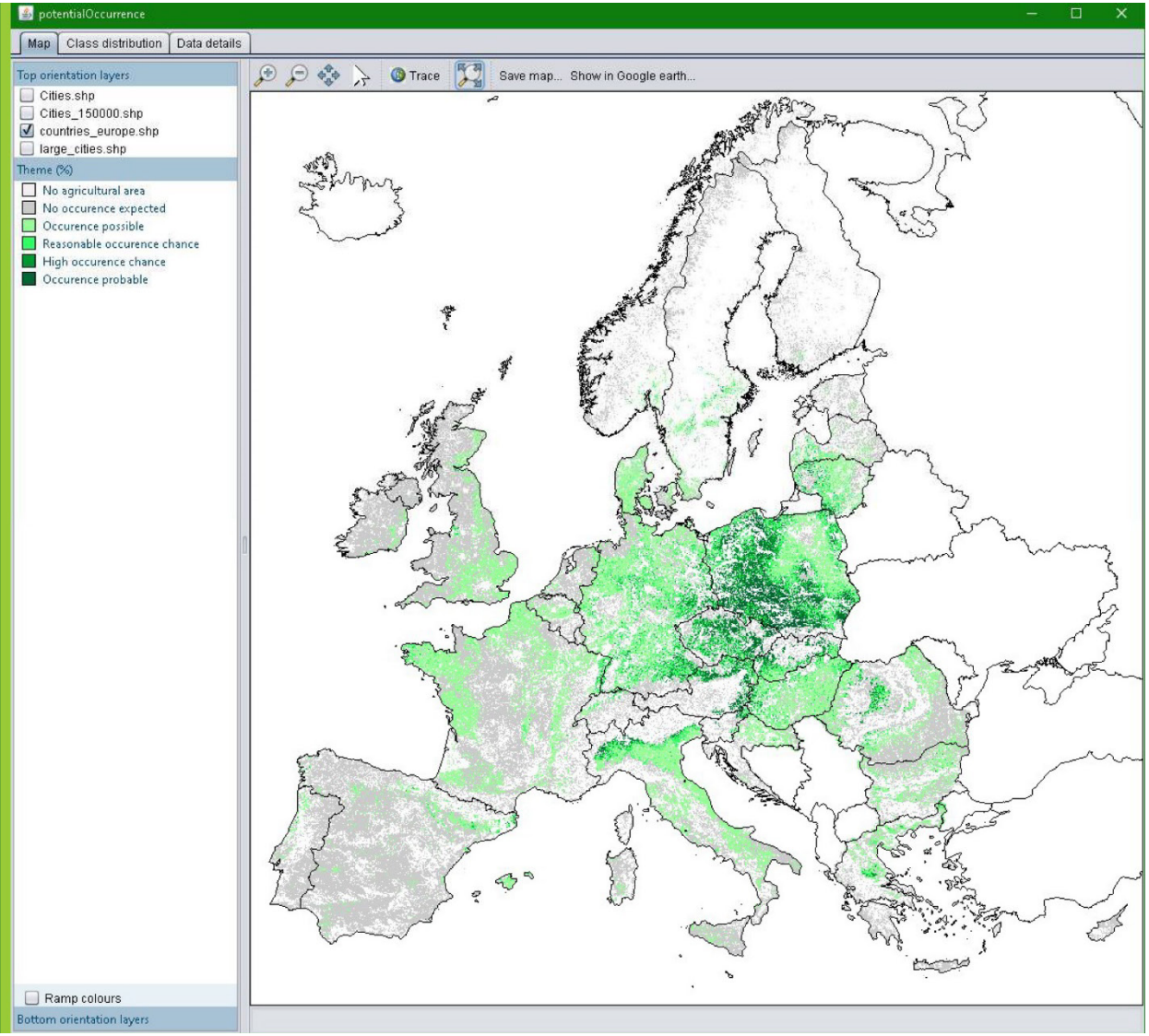
Numerical ◉ Ratio ○ Interval Units %

Colour	Name	Value
	No agricultural area	[-1.0; 0.0>
	No occurence expected	[0.0; 3.0>
	Occurence possible	[3.0; 25.0>
	Reasonable occurence c...	[25.0; 50.0>
	High occurence chance	[50.0; 75.0>
	Occurence probable	[75.0; 100.0]

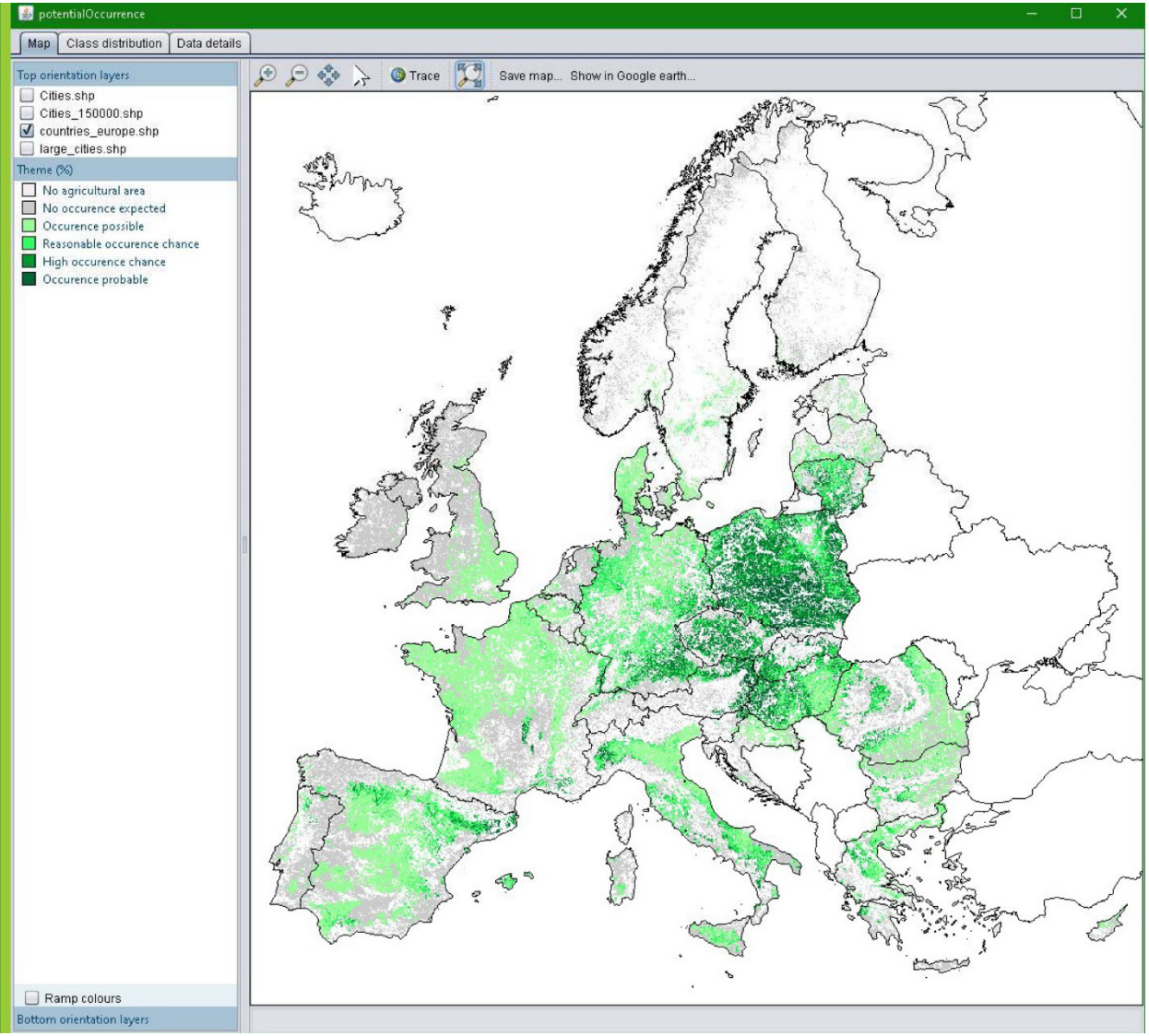
quickscan



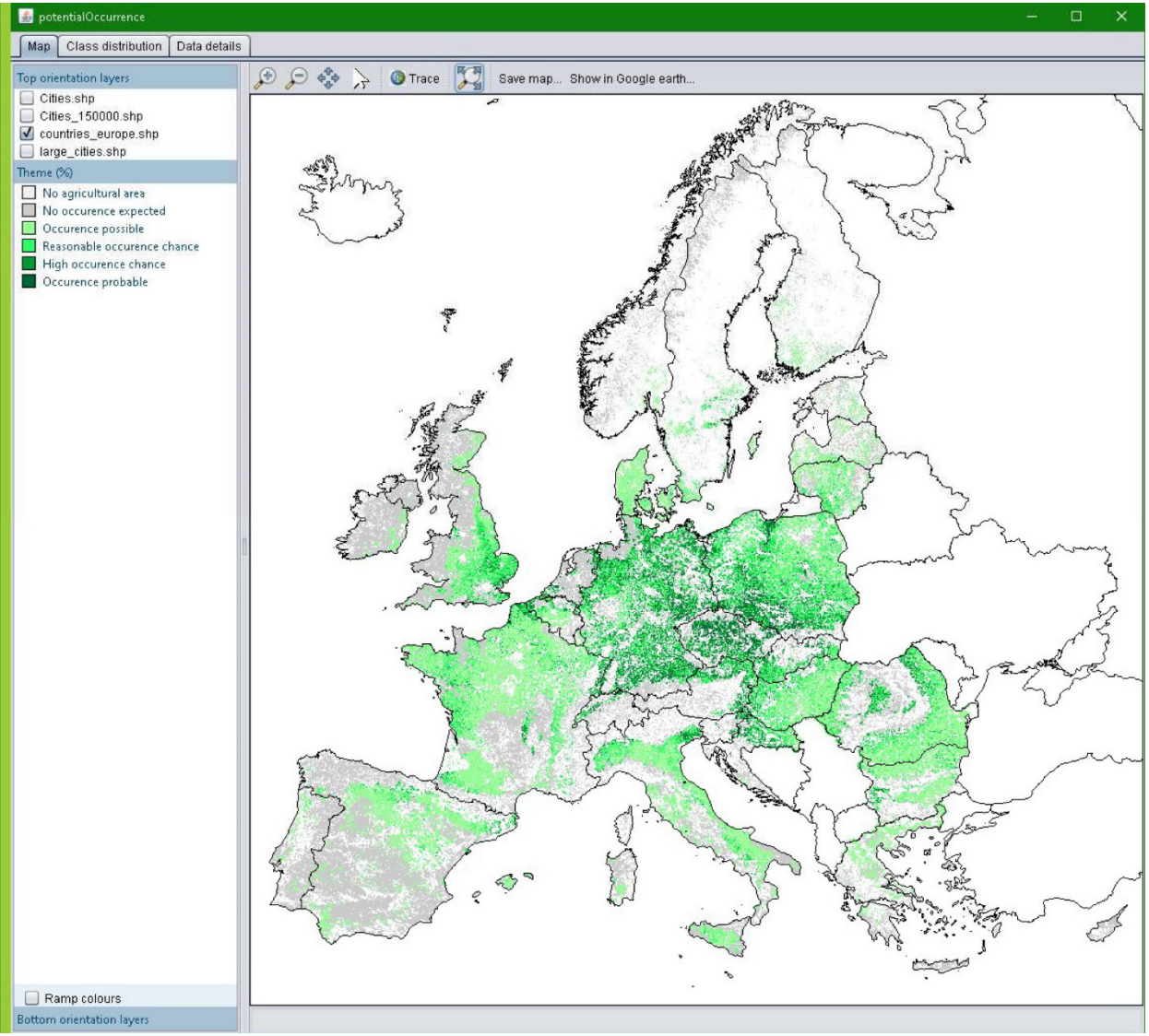
V12 potential occurrence



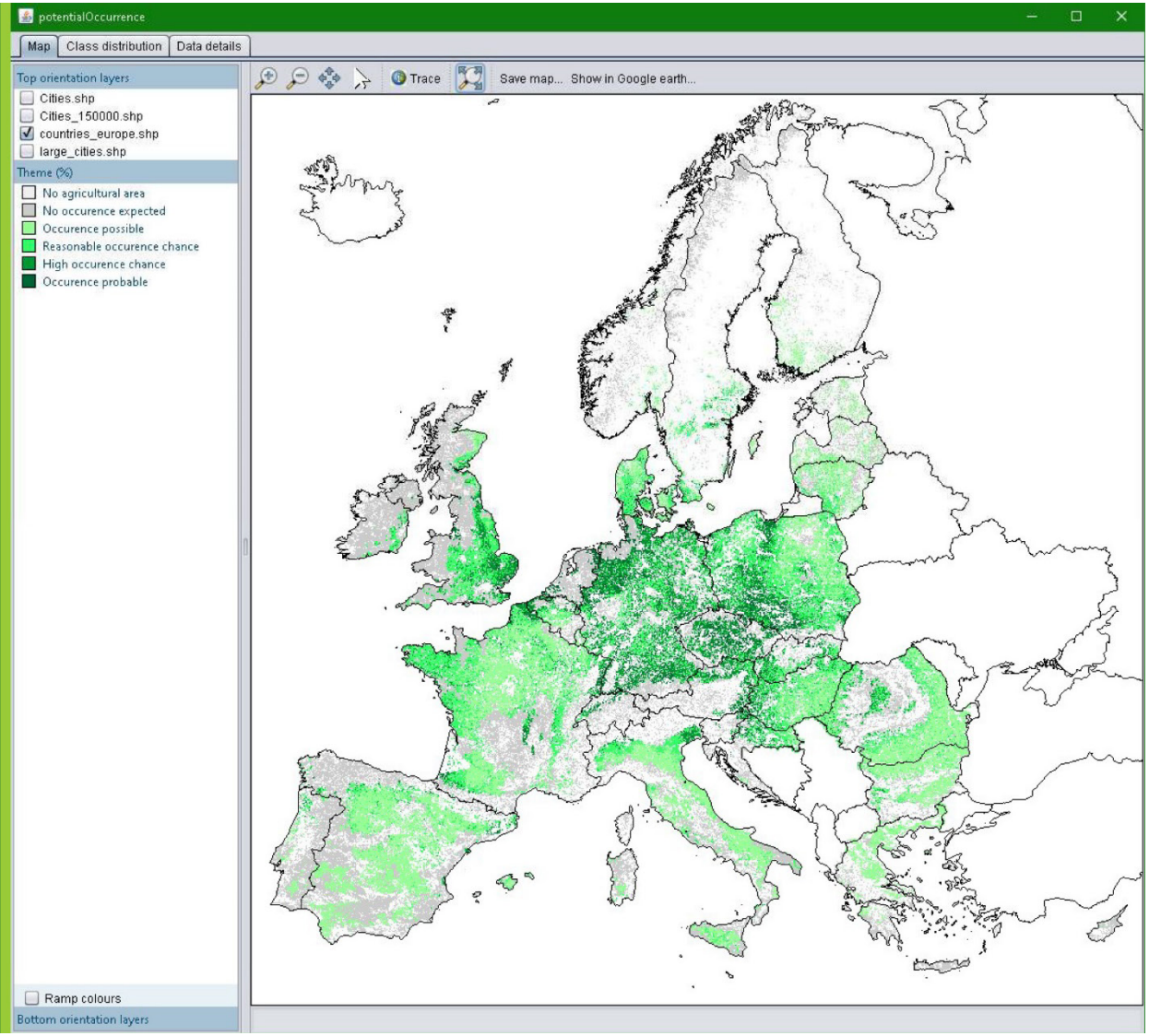
V13 potential occurrence



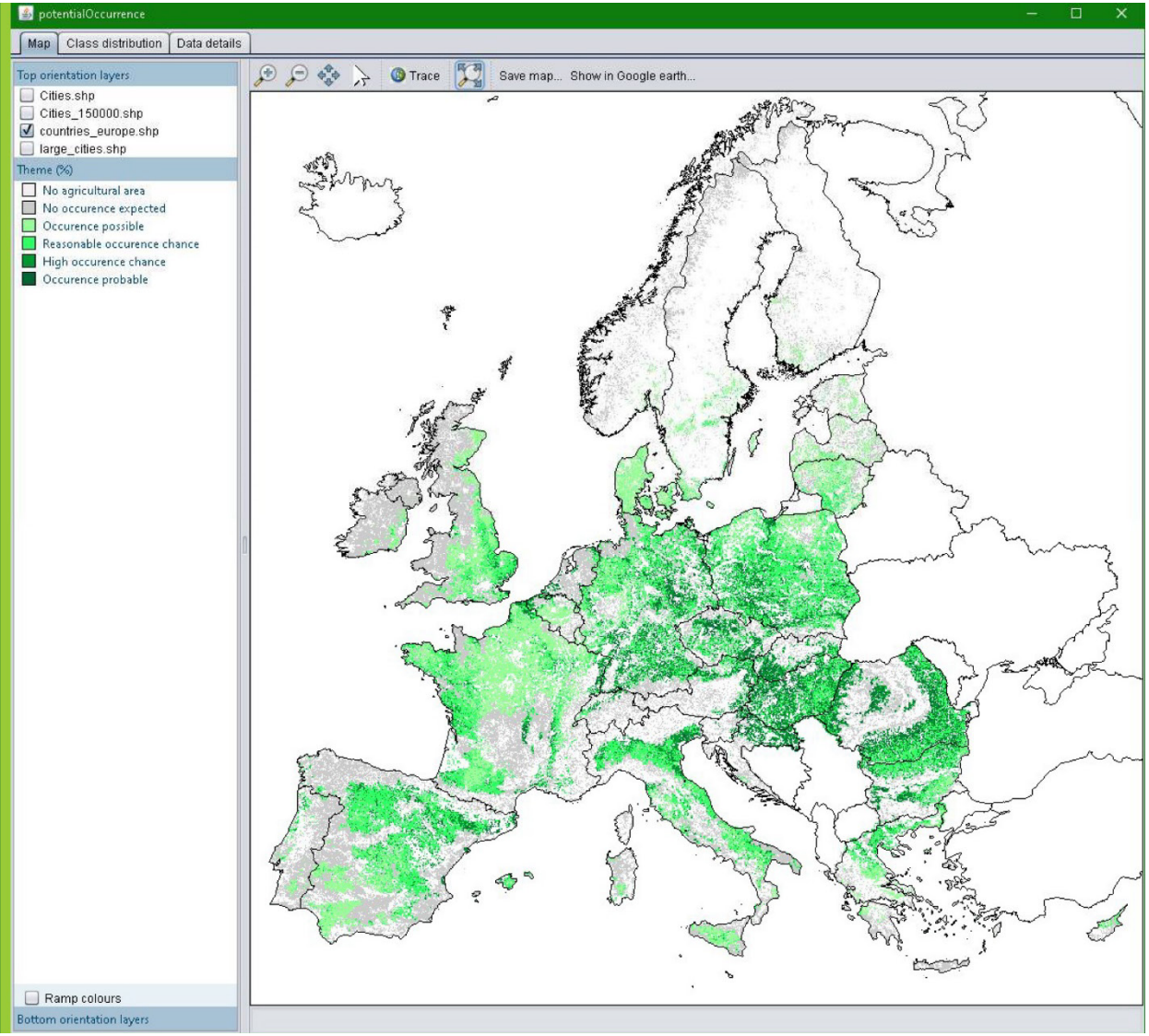
V34 potential occurrence



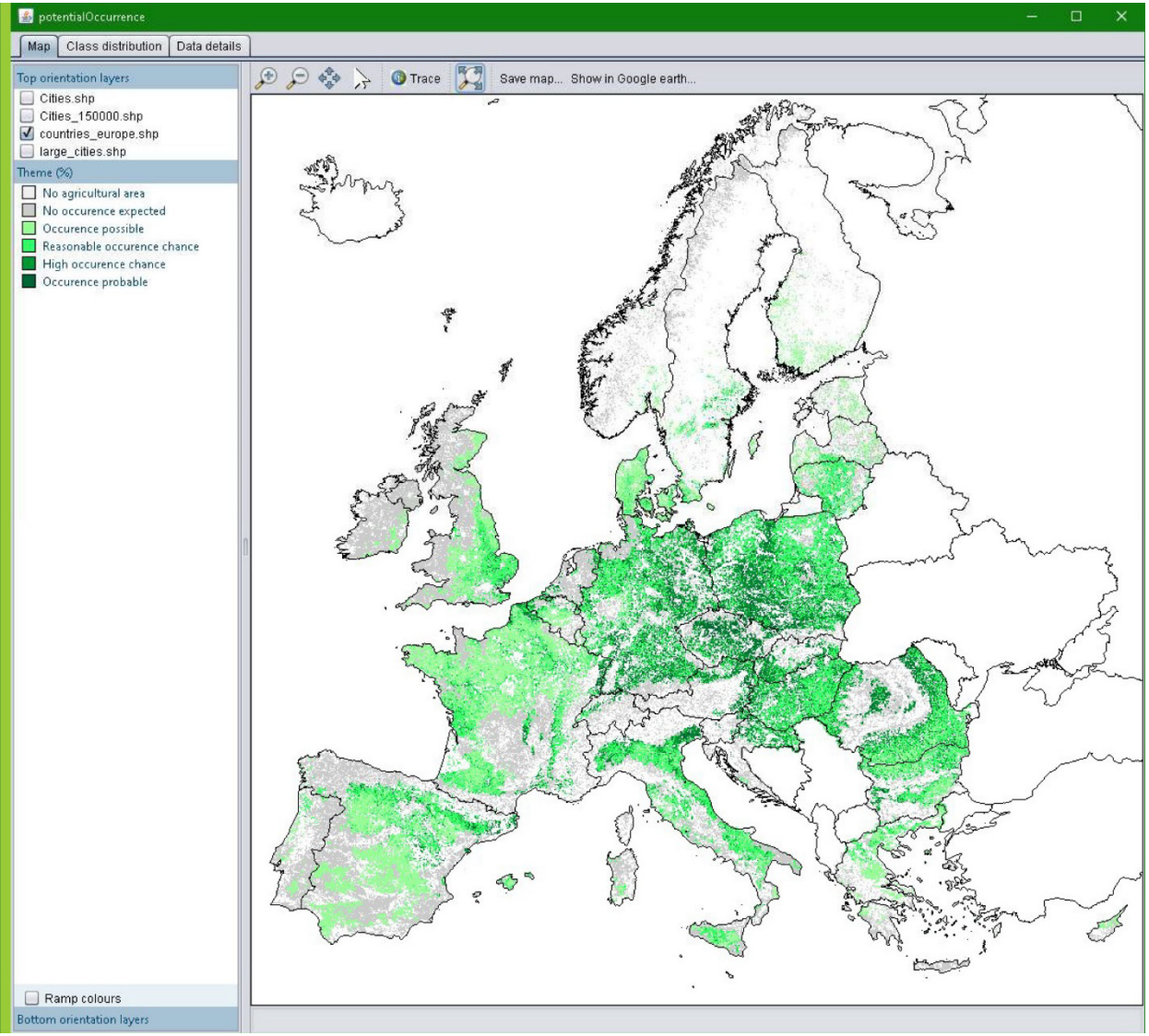
V35 potential occurrence



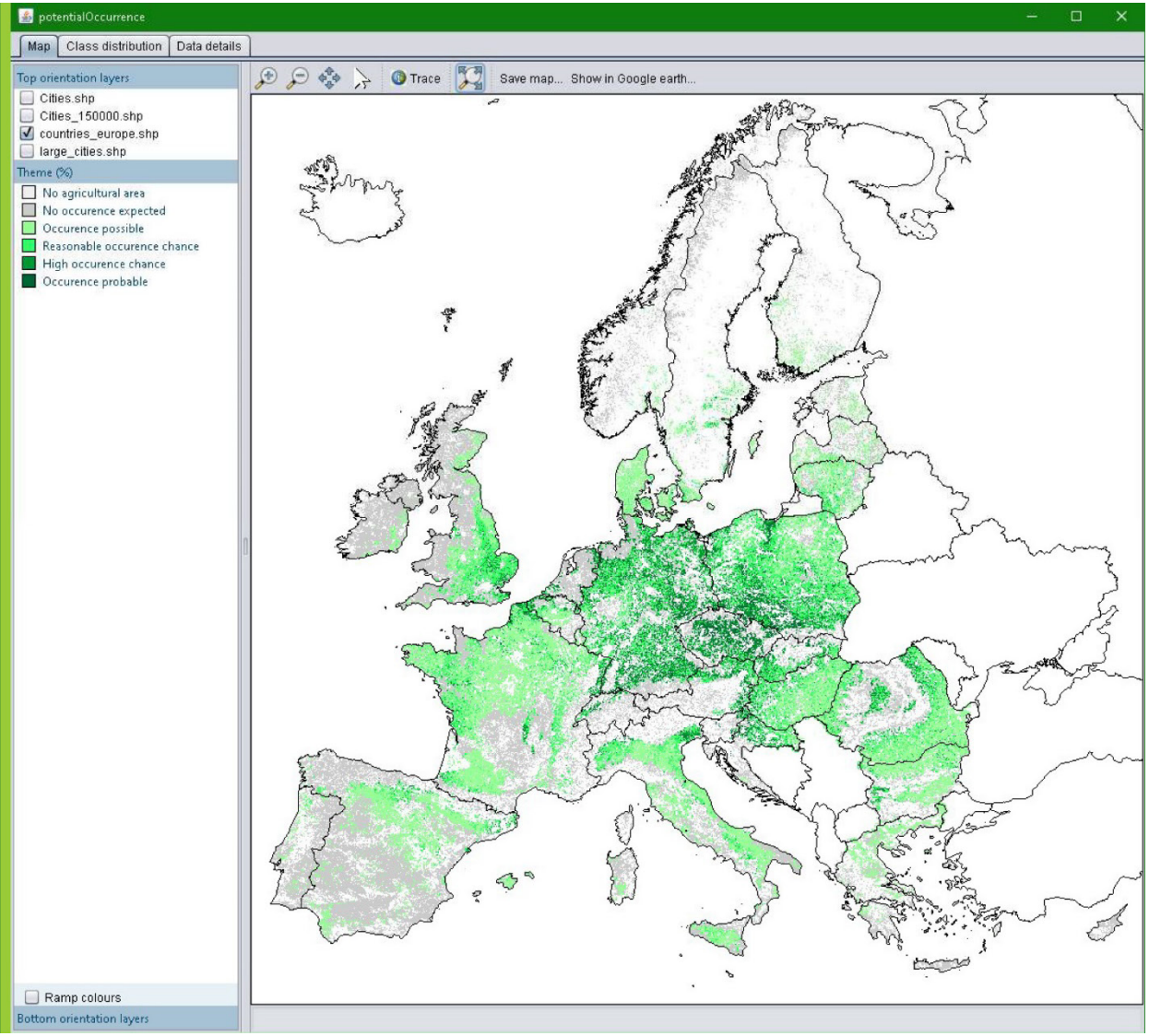
V37 potential occurrence



V38 potential occurrence



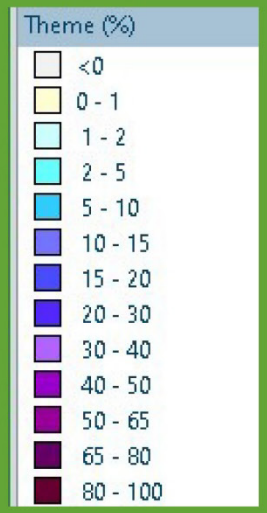
V39 potential occurrence

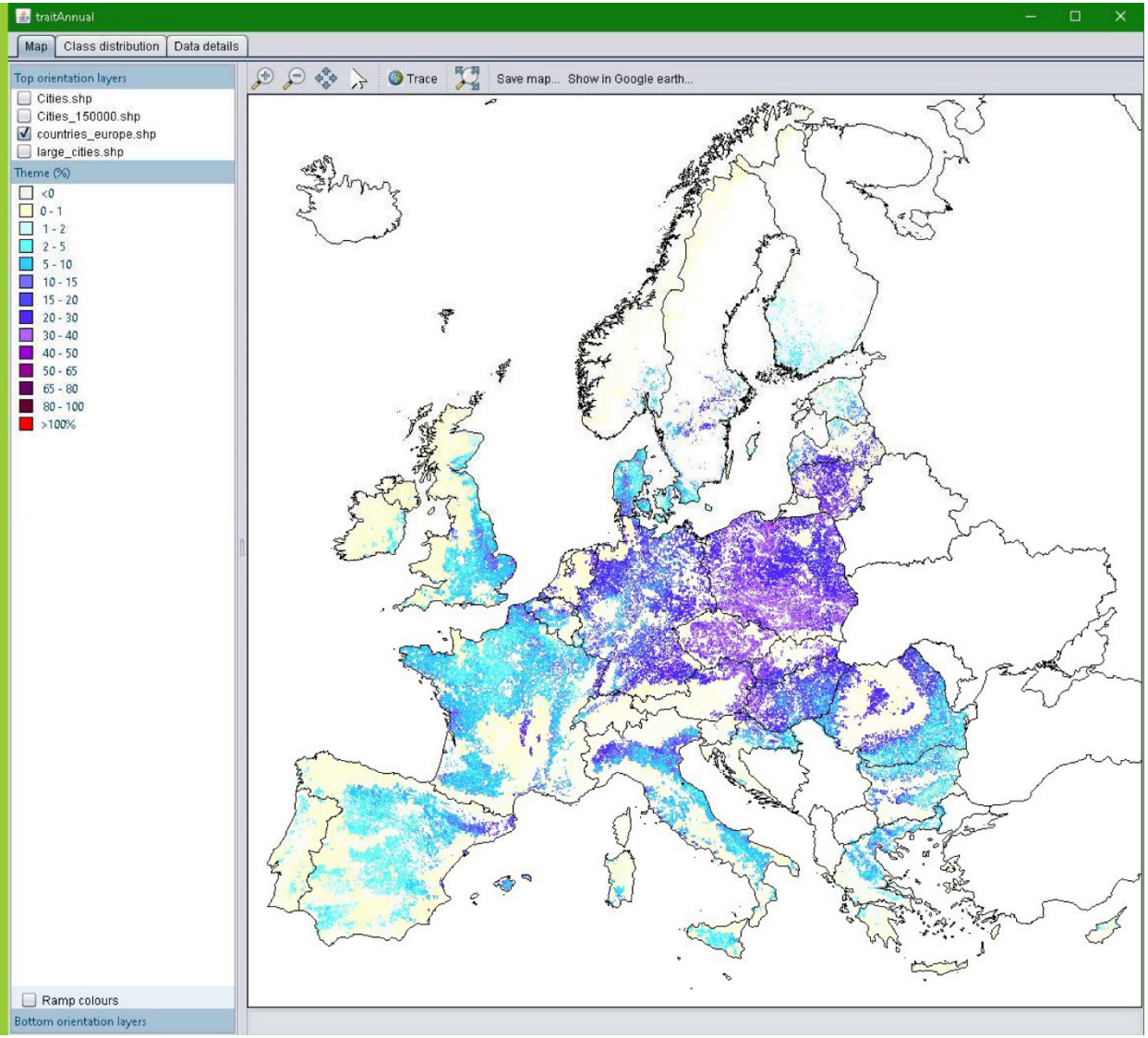


Cereals

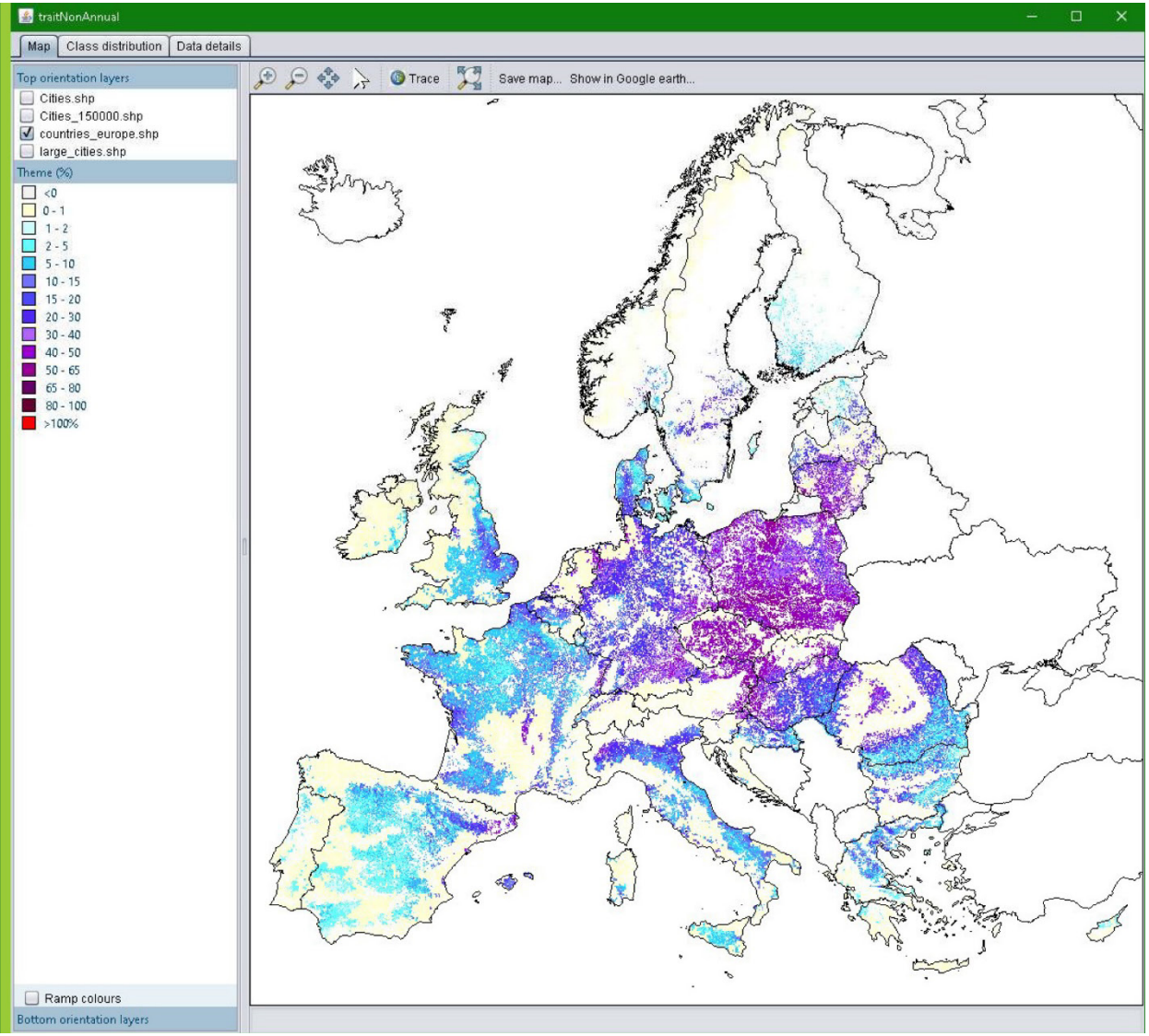
TRAITS

V11 Traits Annual



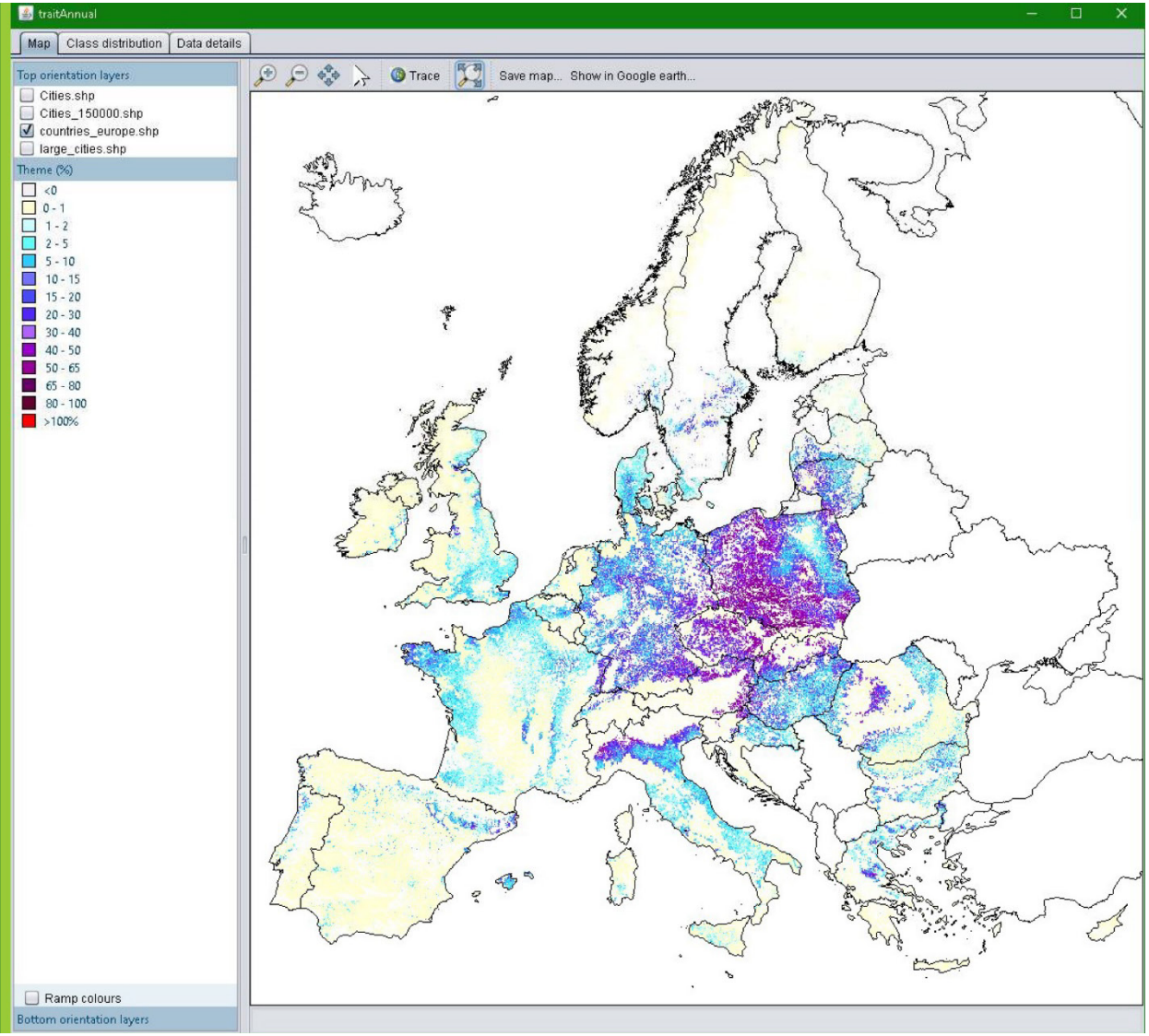


V11 Traits Non-annual

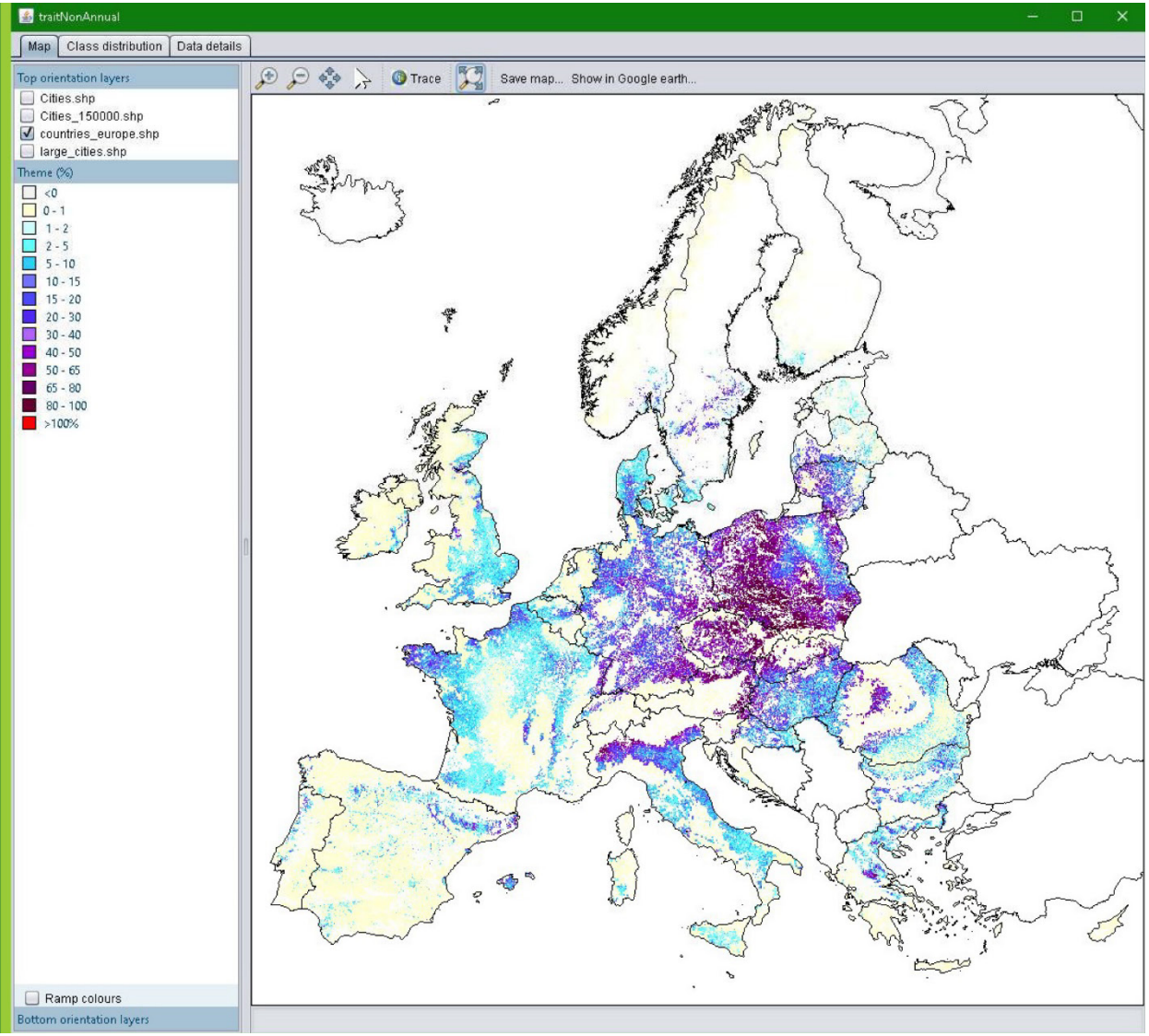


quickscan

V12 Traits Annual

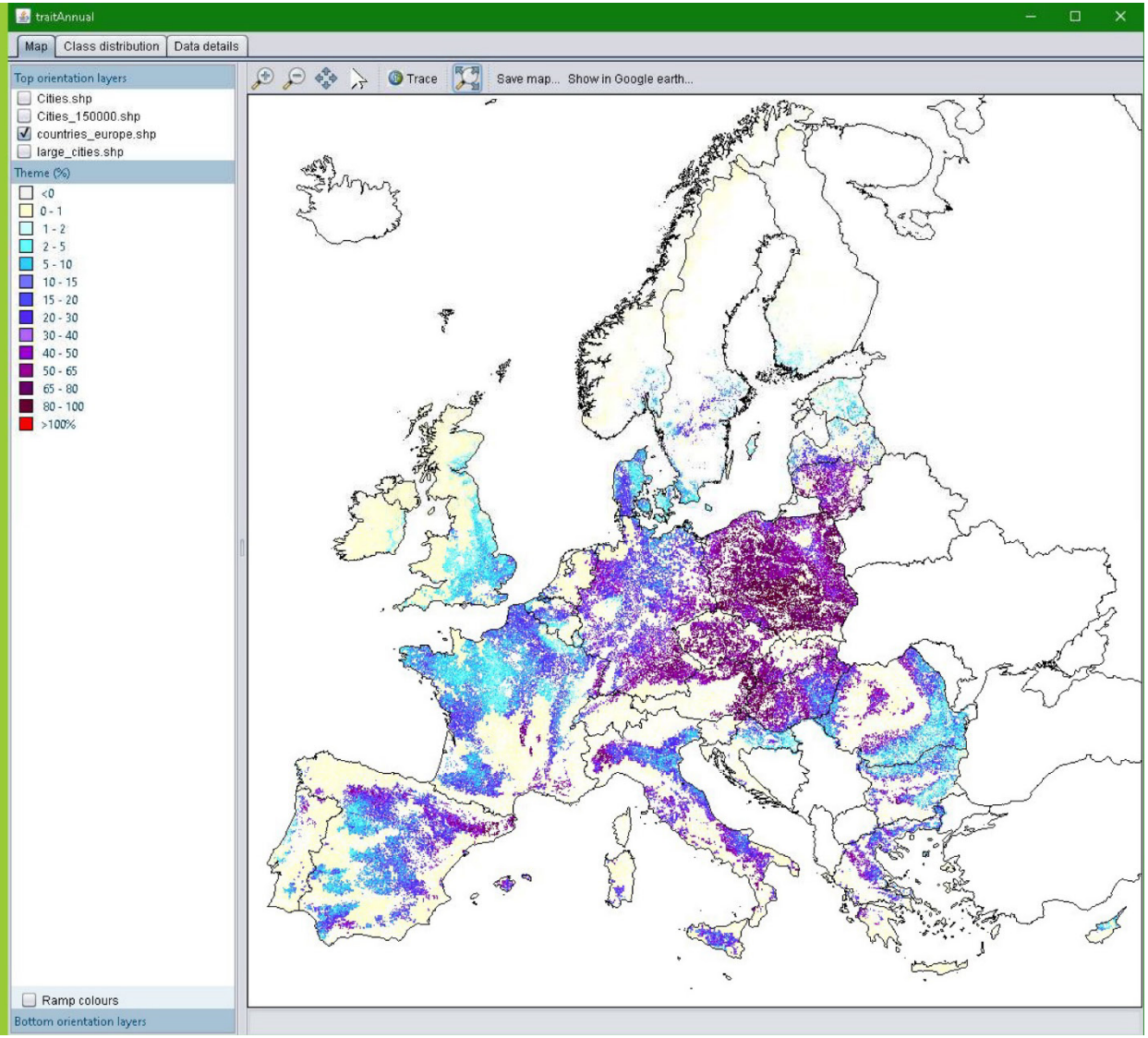


V12 Traits
Non-annual

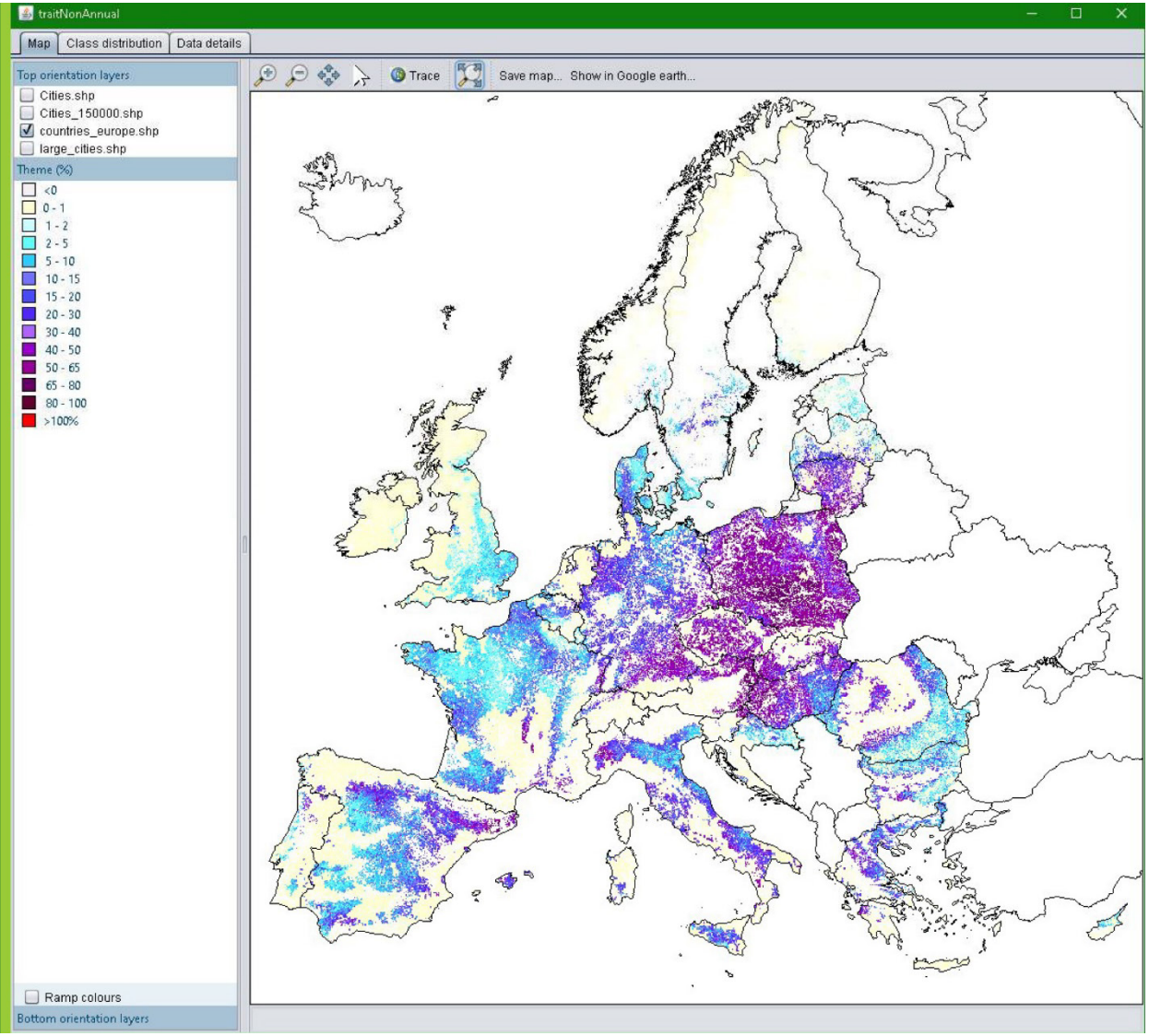


quickscan

V13 Traits Annual

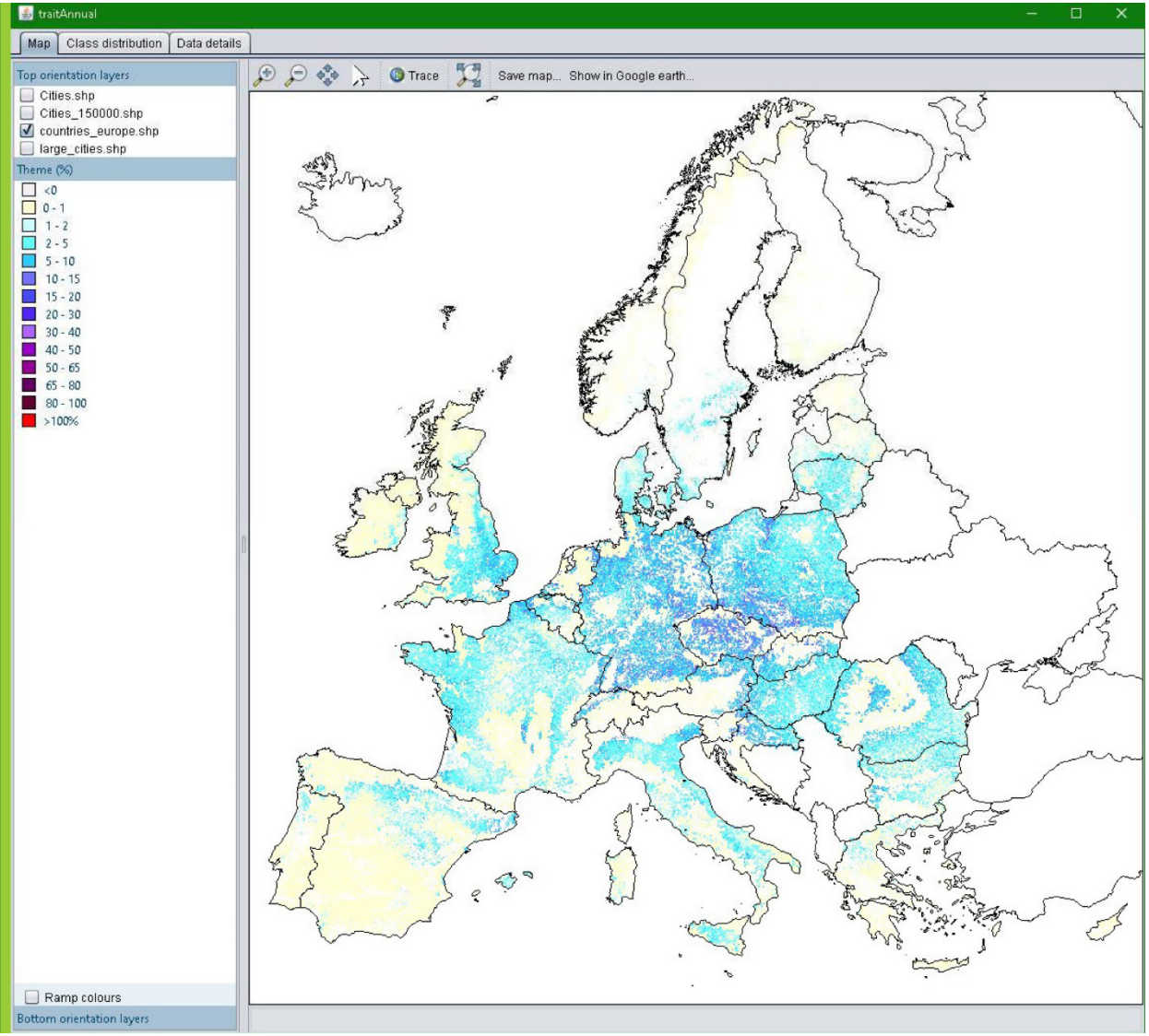


V13 Traits Non-annual

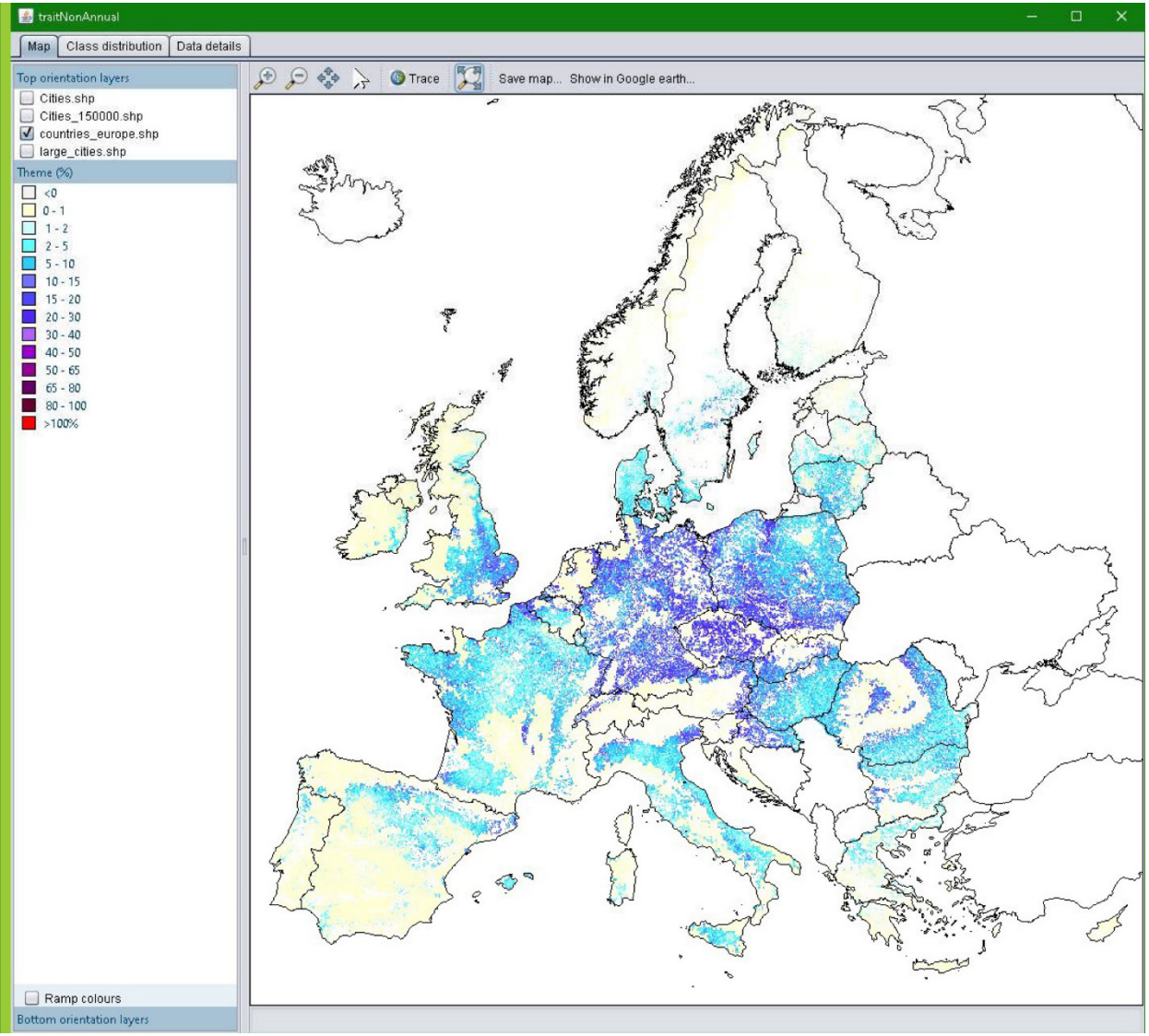


quickscan

V34 Traits Annual



V34 Traits Non-annual



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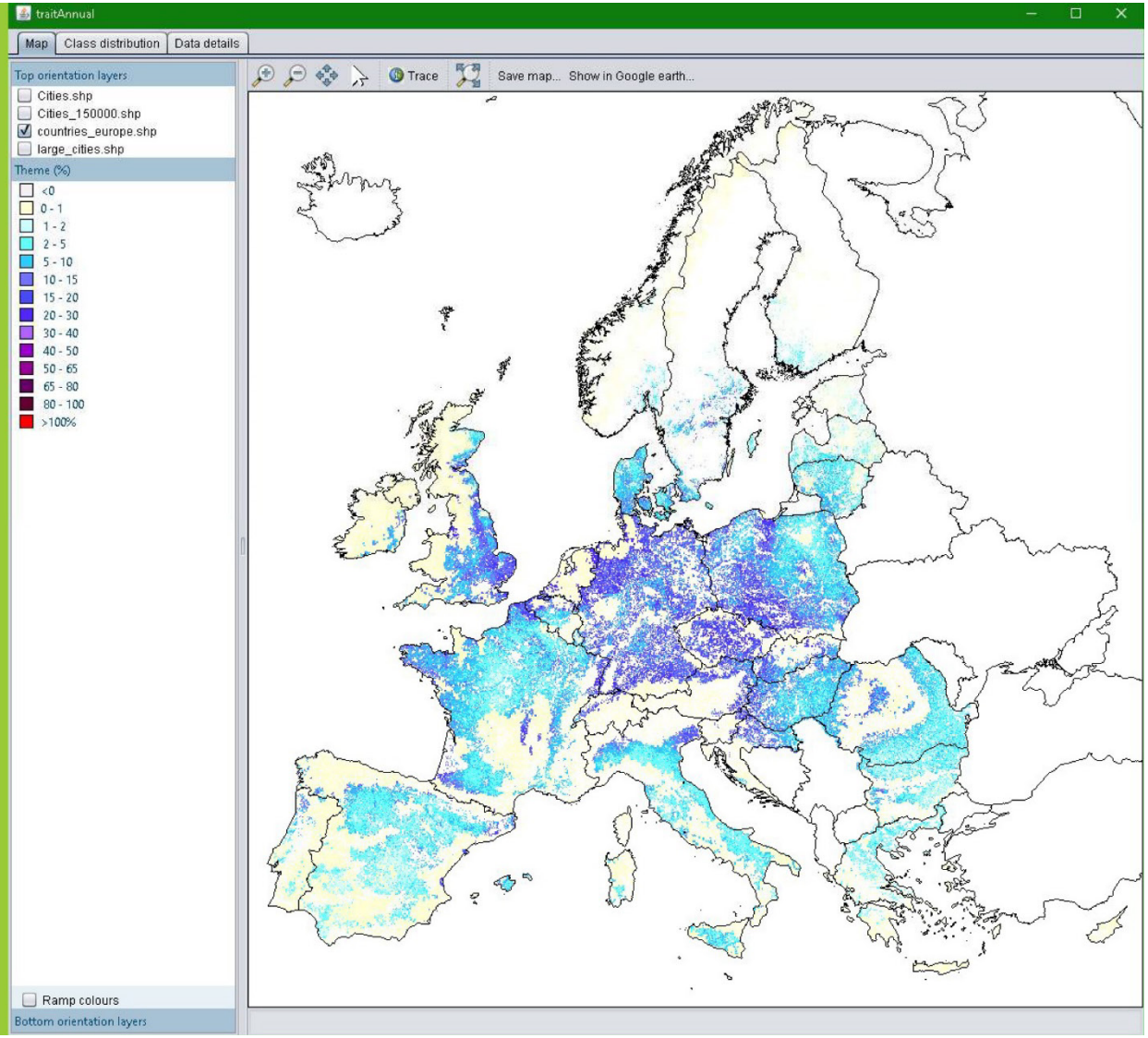
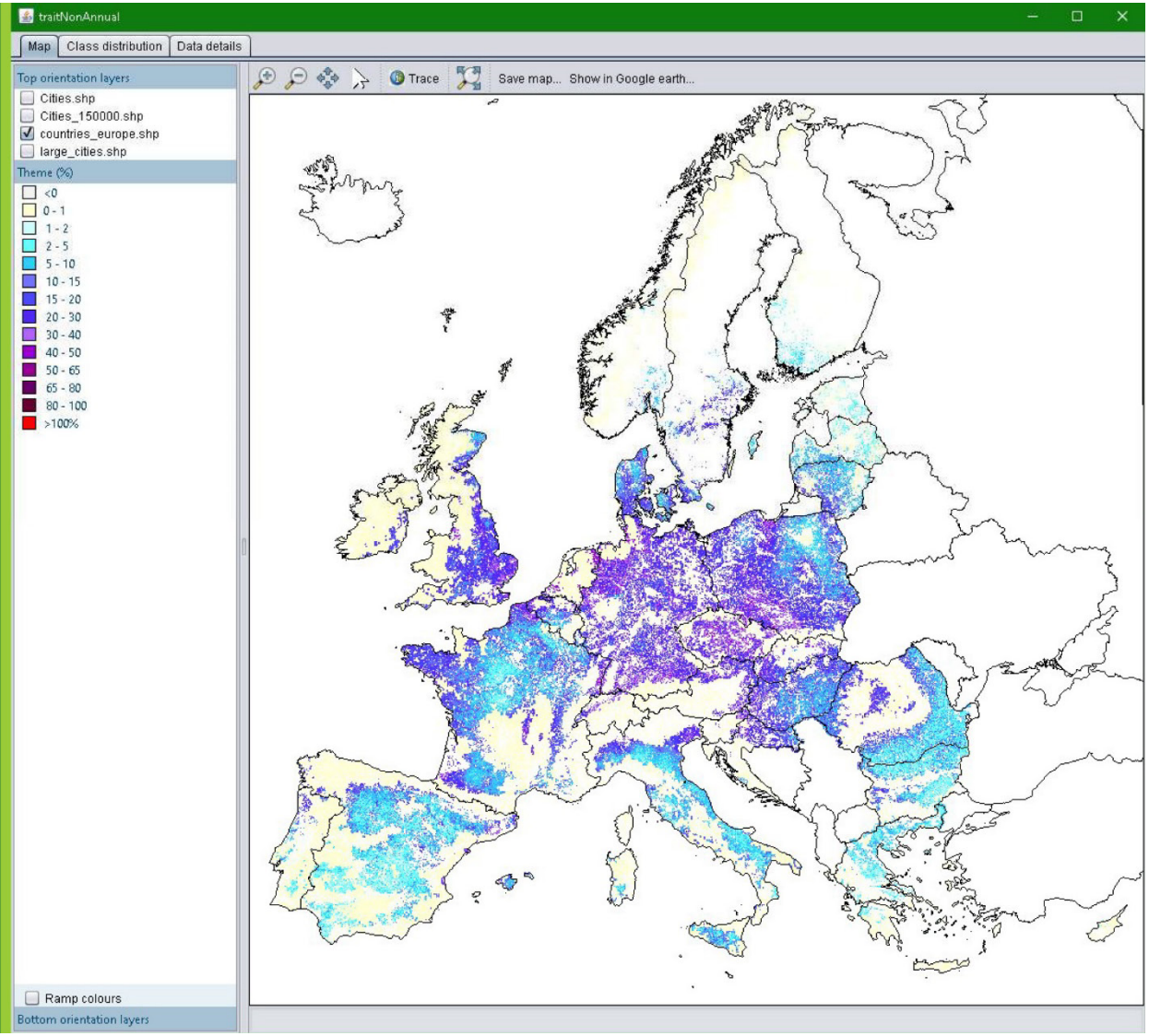
V35 Traits Annual



V35 Traits Non-annual



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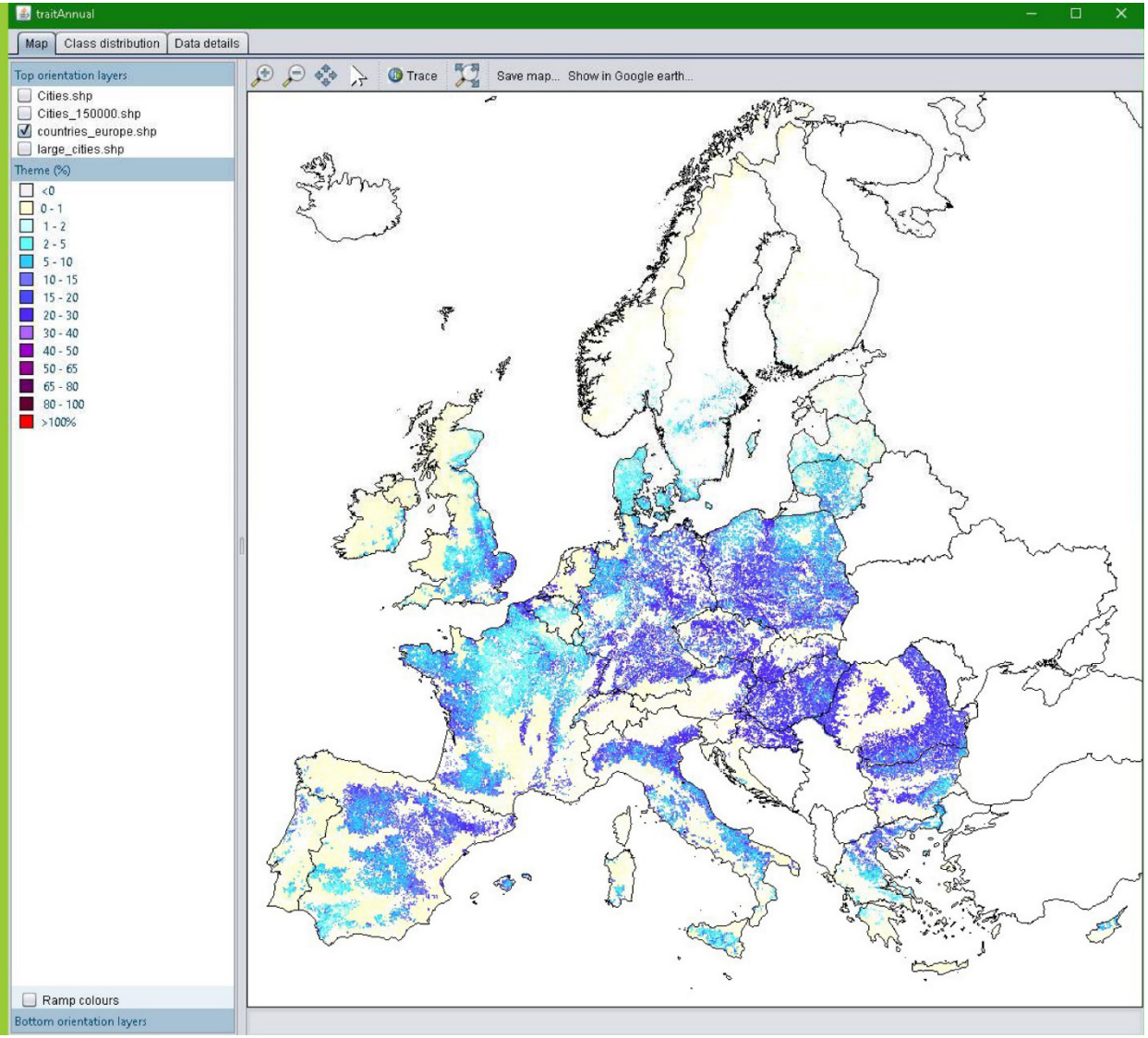
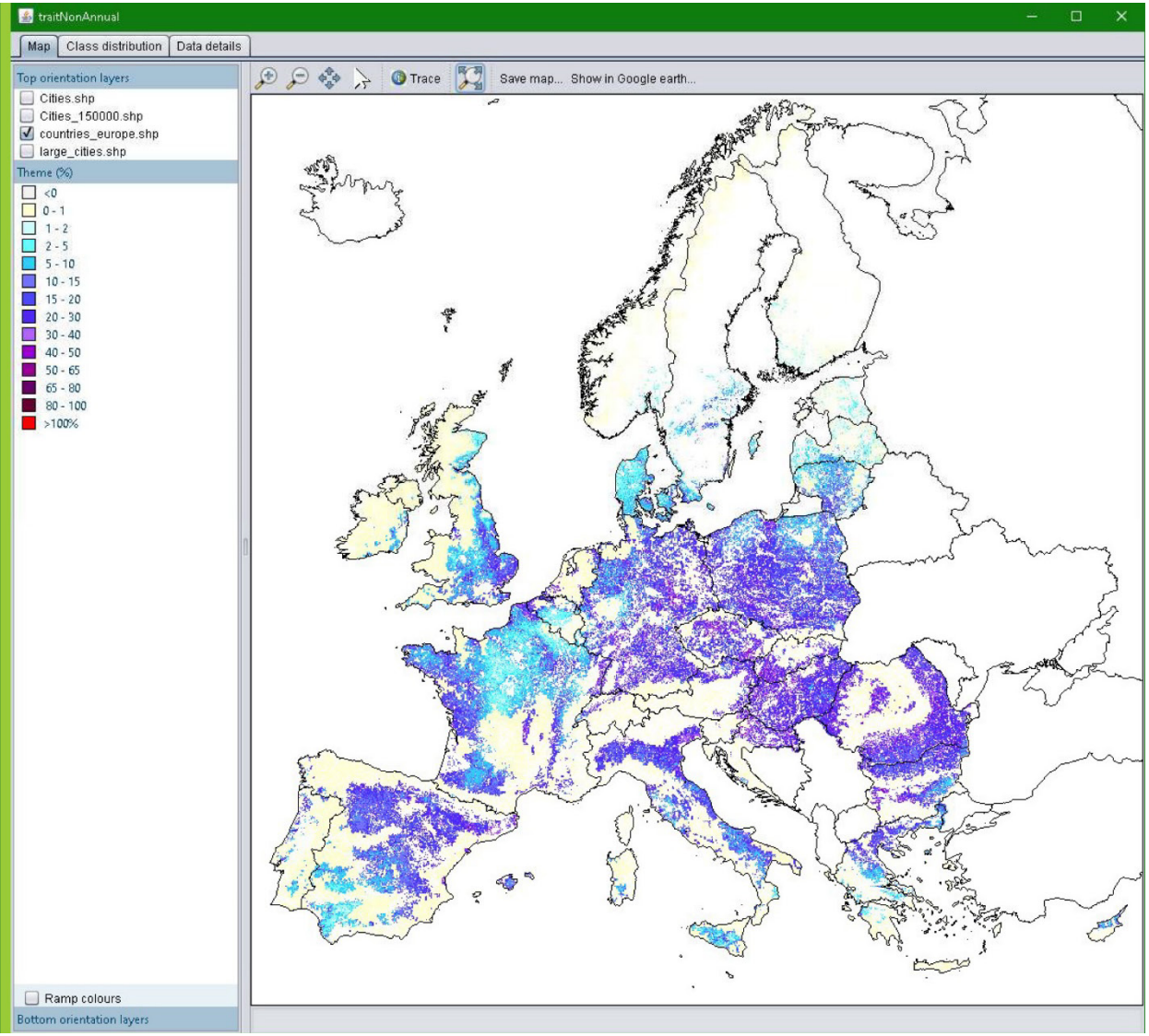
V37 Traits Annual

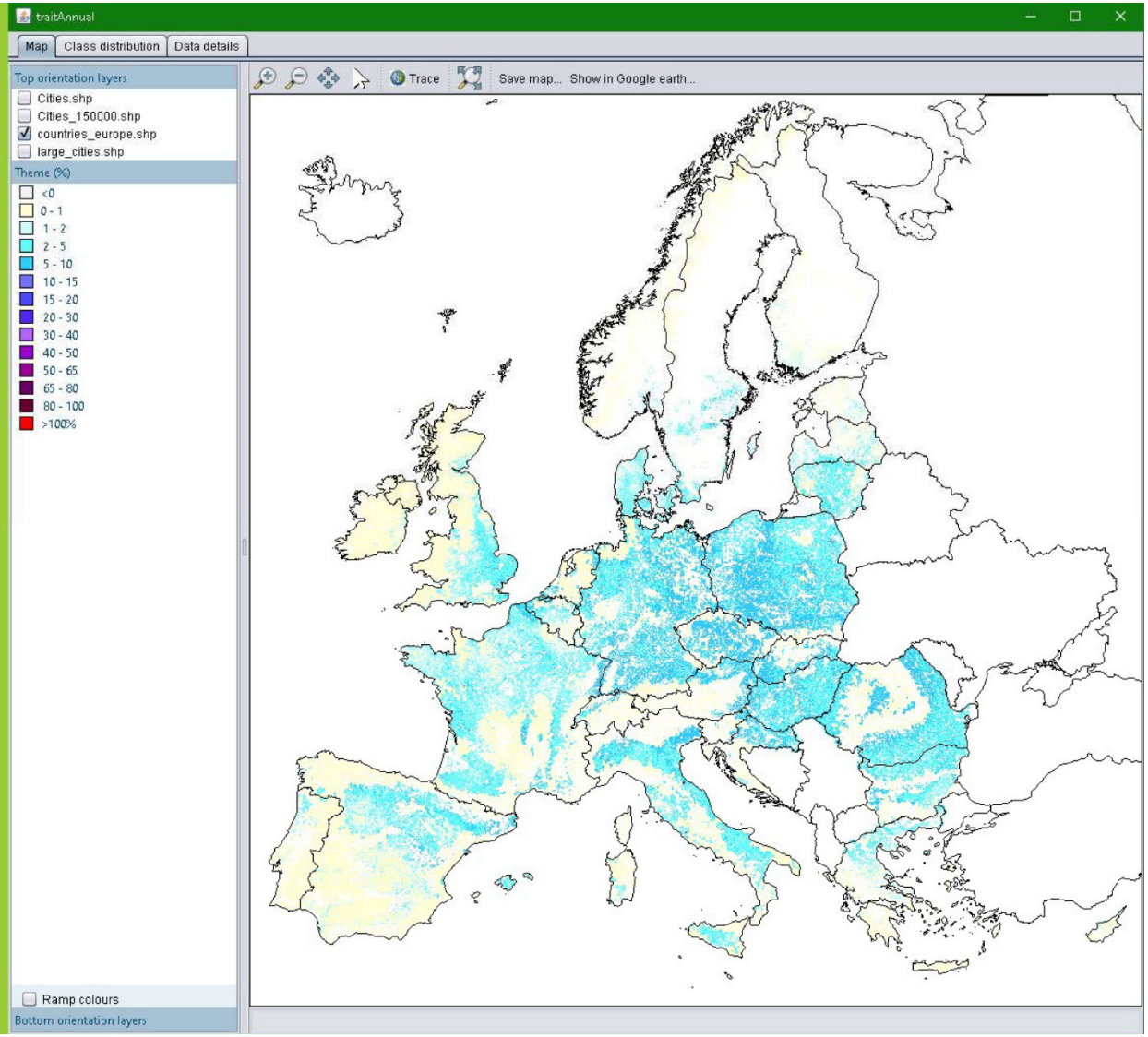


V37 Traits Non-annual

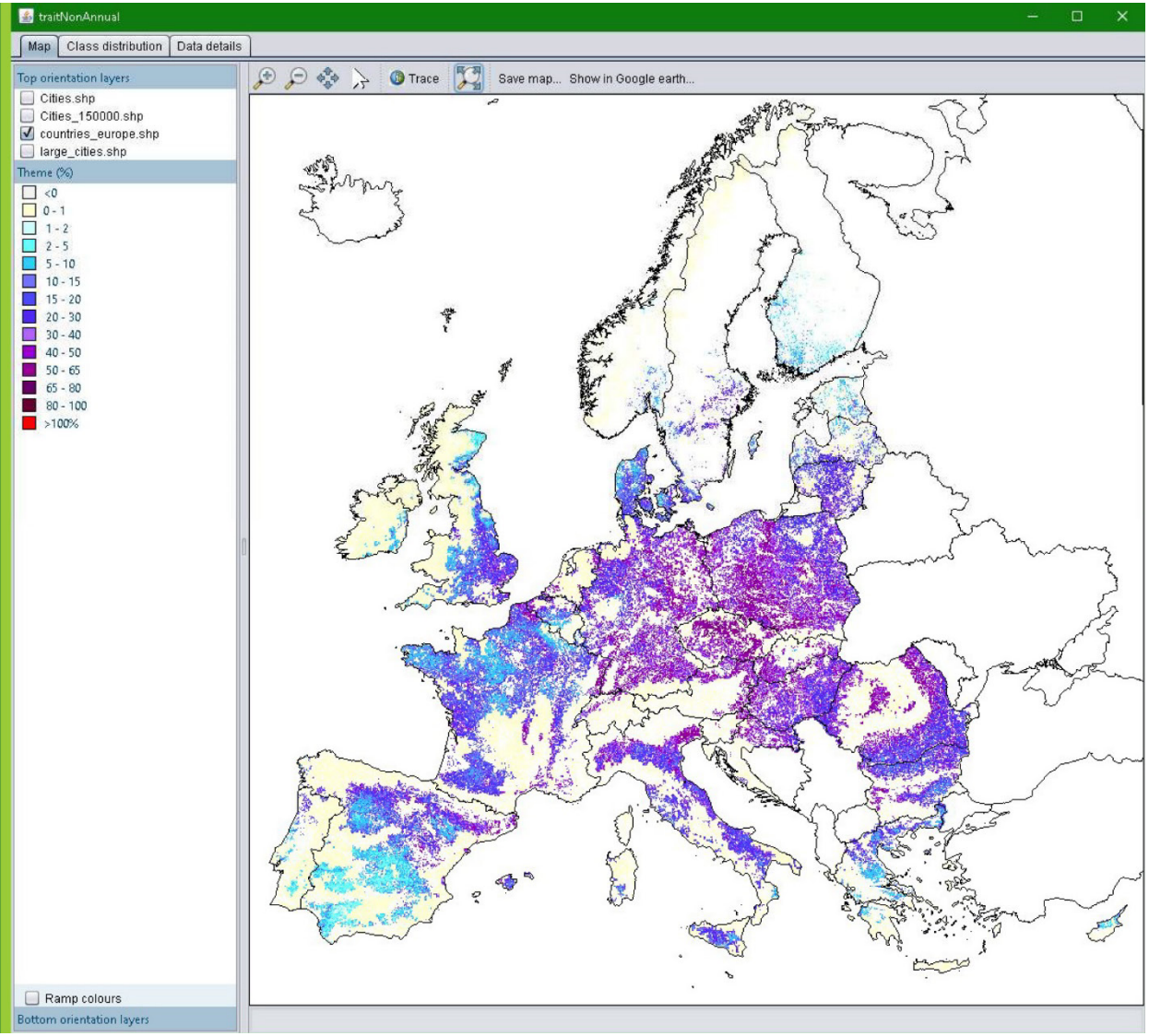


quickscan

V38 Traits Annual



V38 Traits Non-annual



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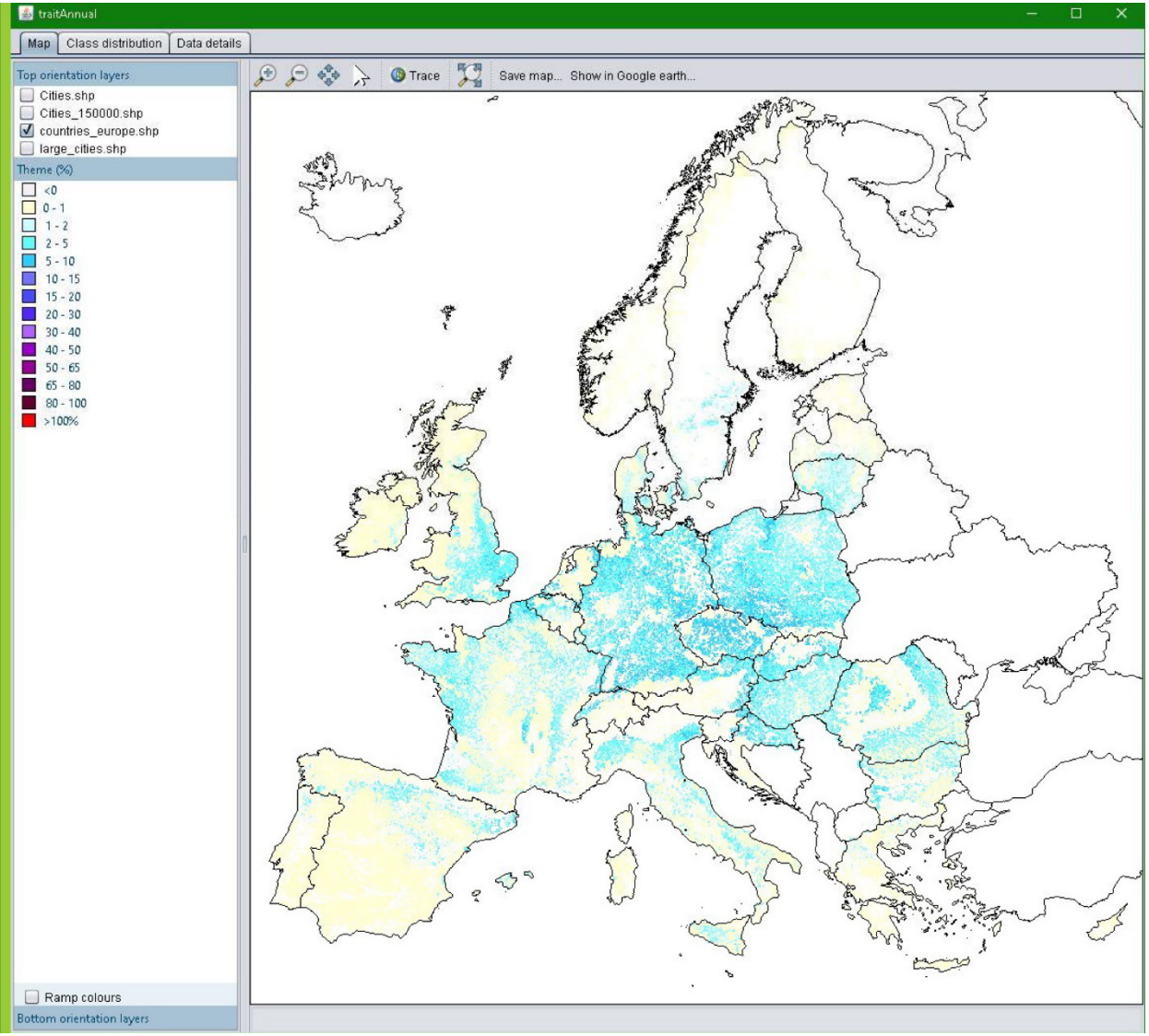
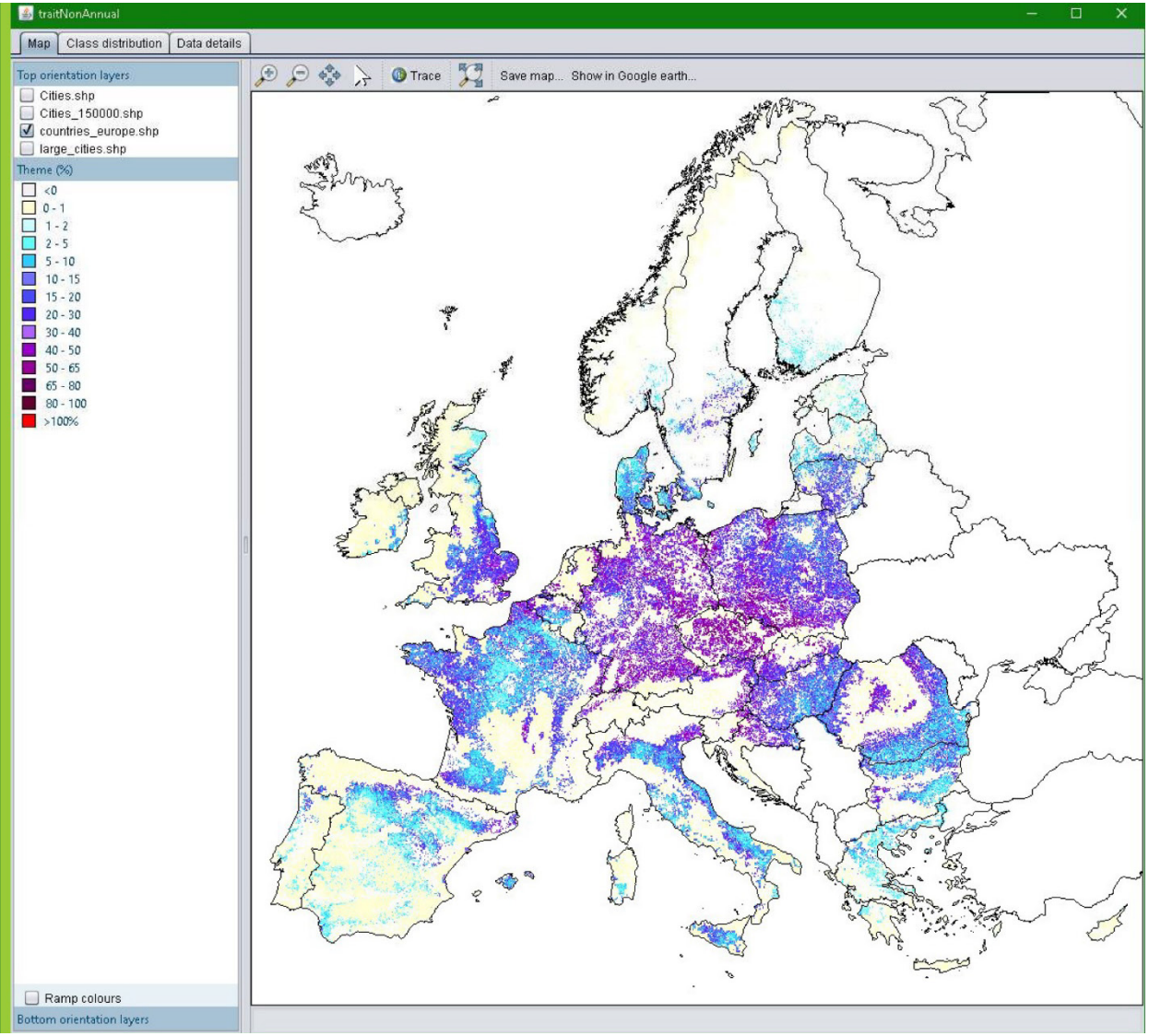
V39 Traits Annual



V39 Traits Non-annual



quickscan

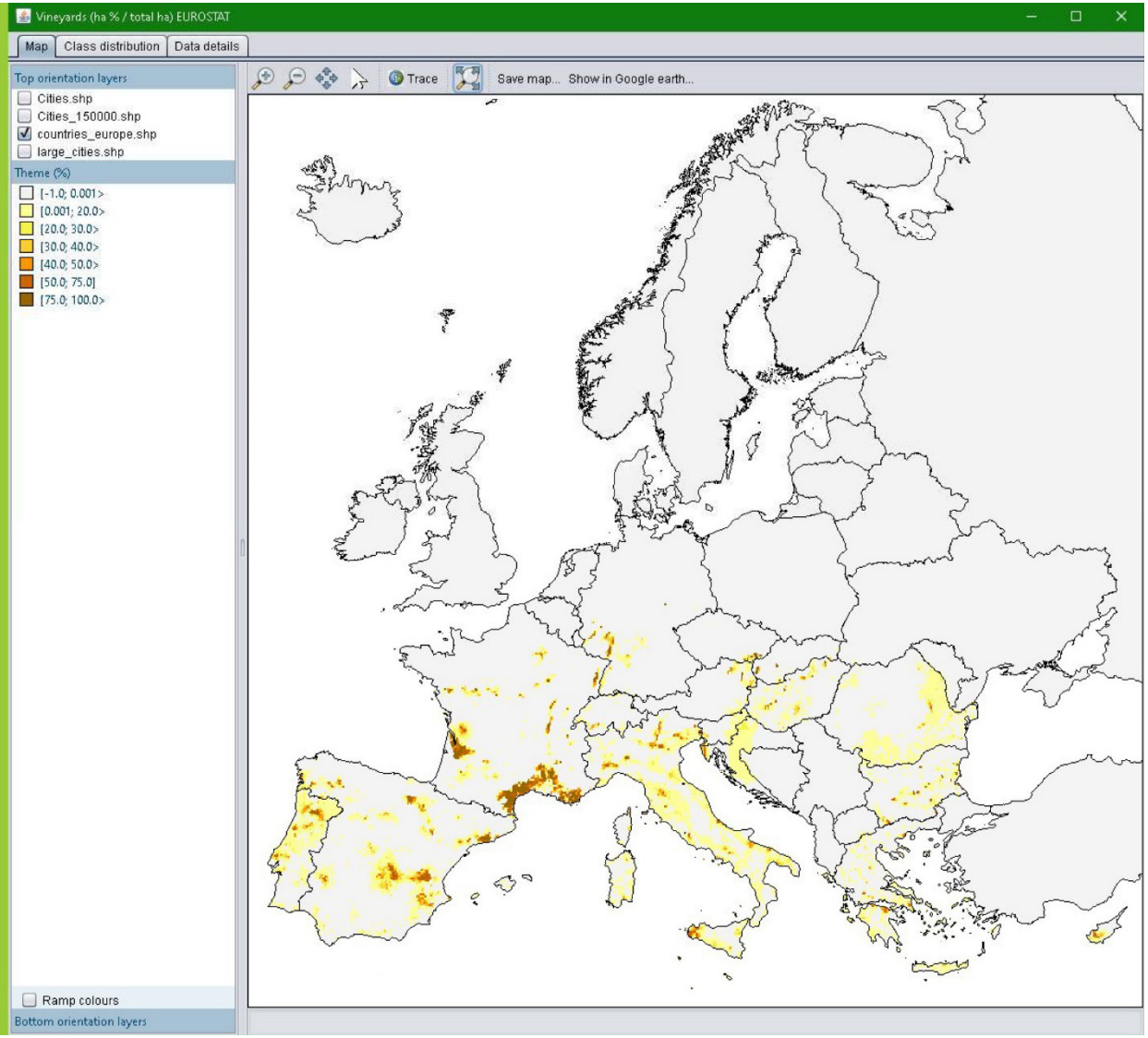
Vineyards

HABITAT SUITABILITY &

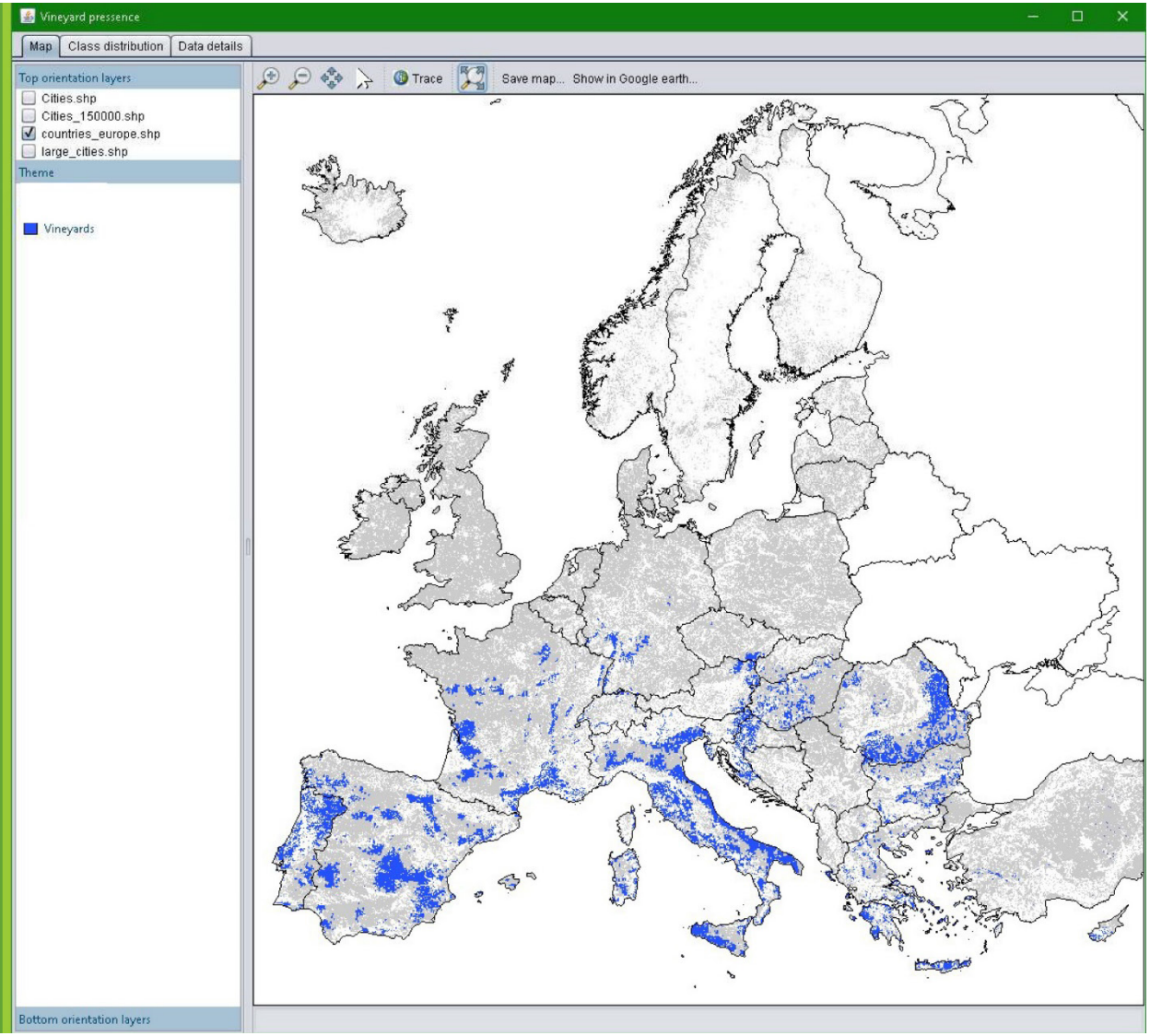
POTENTIAL OCCURRENCE (SUITABILITY X FSS2010-CROP PRESENCE)

Vinyards FSS2010

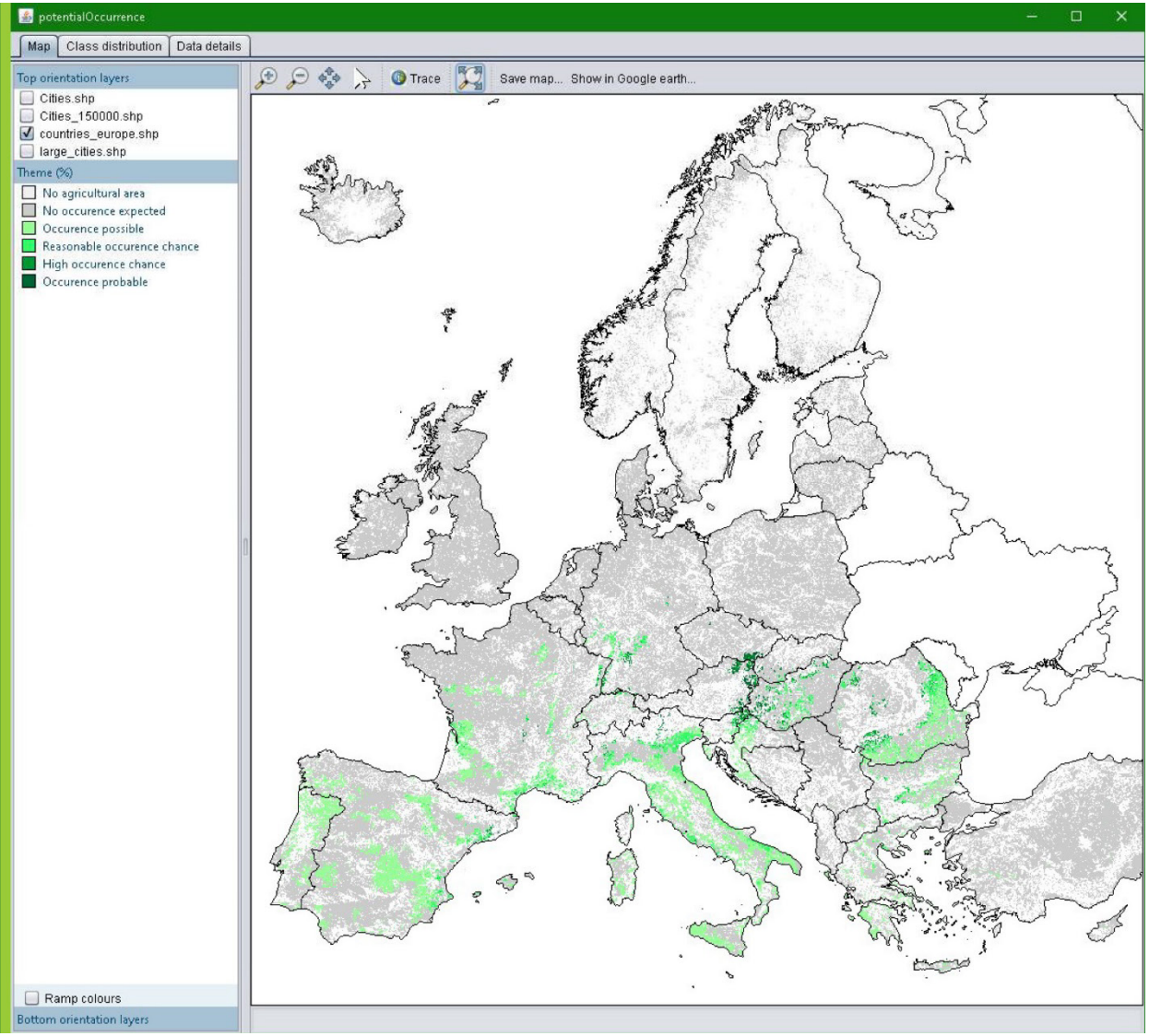
(% ha / total ha crops)



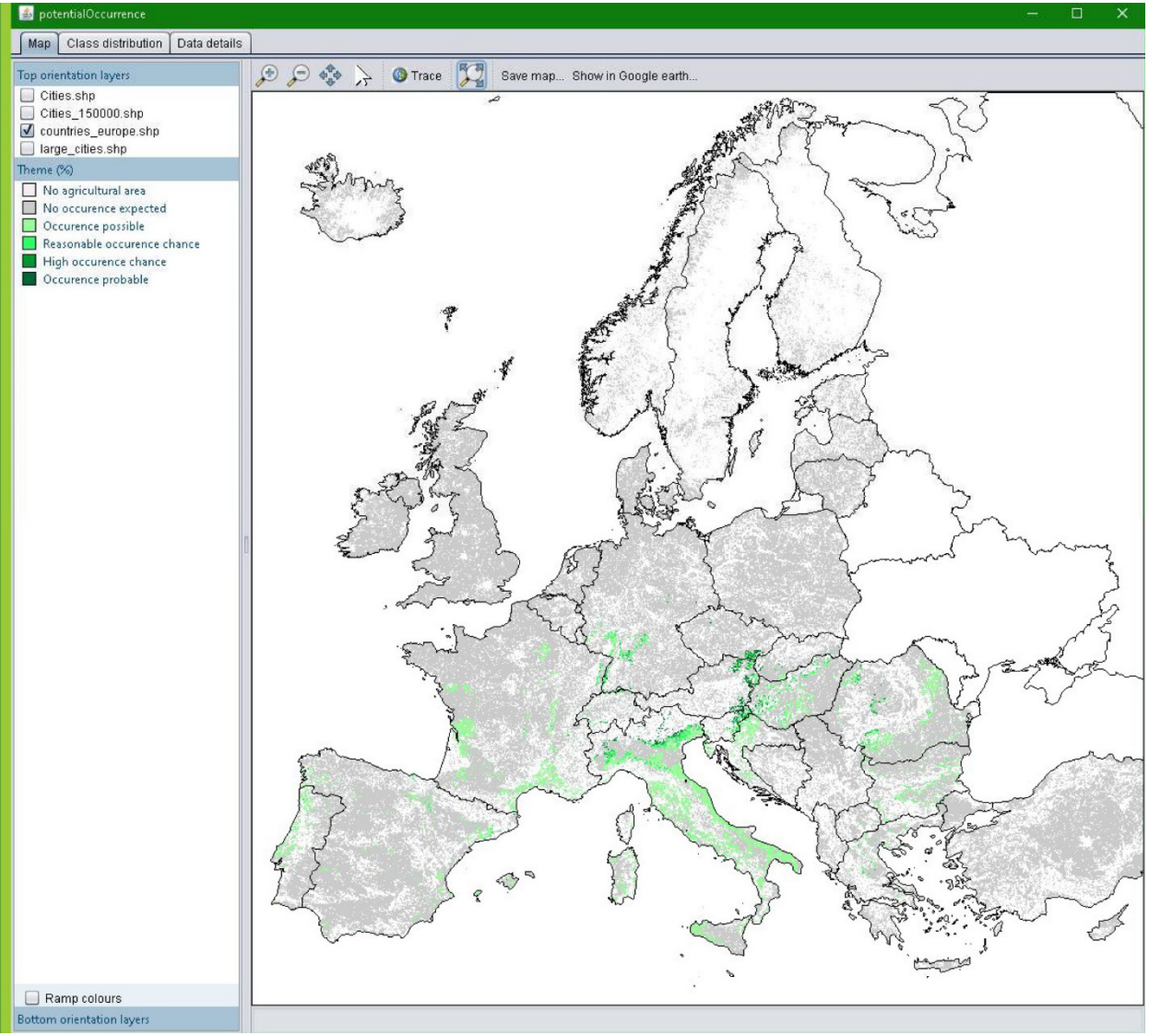
Vineyards FSS2010 x Agricultural Mask



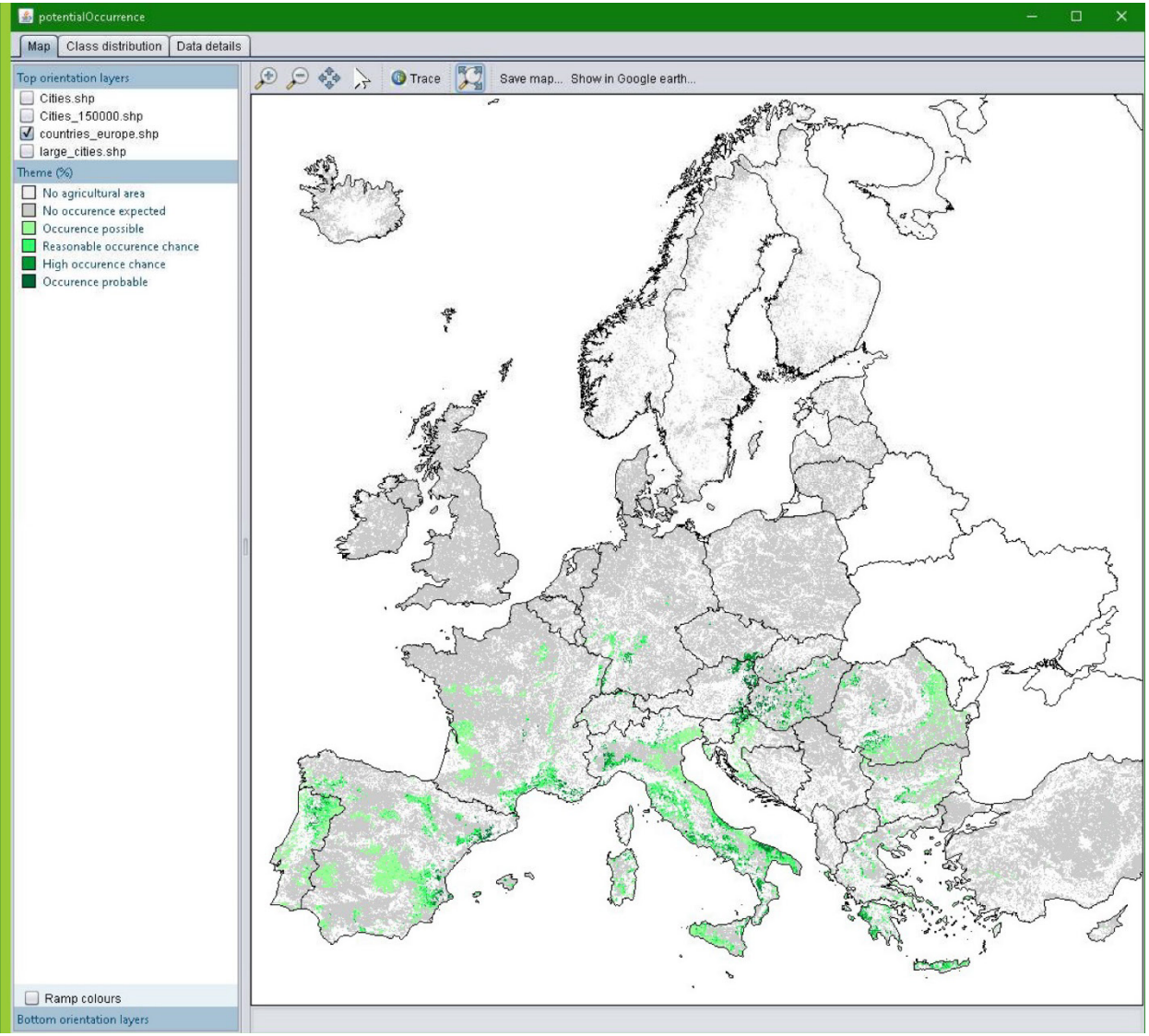
V11 potential occurrence Vineyards



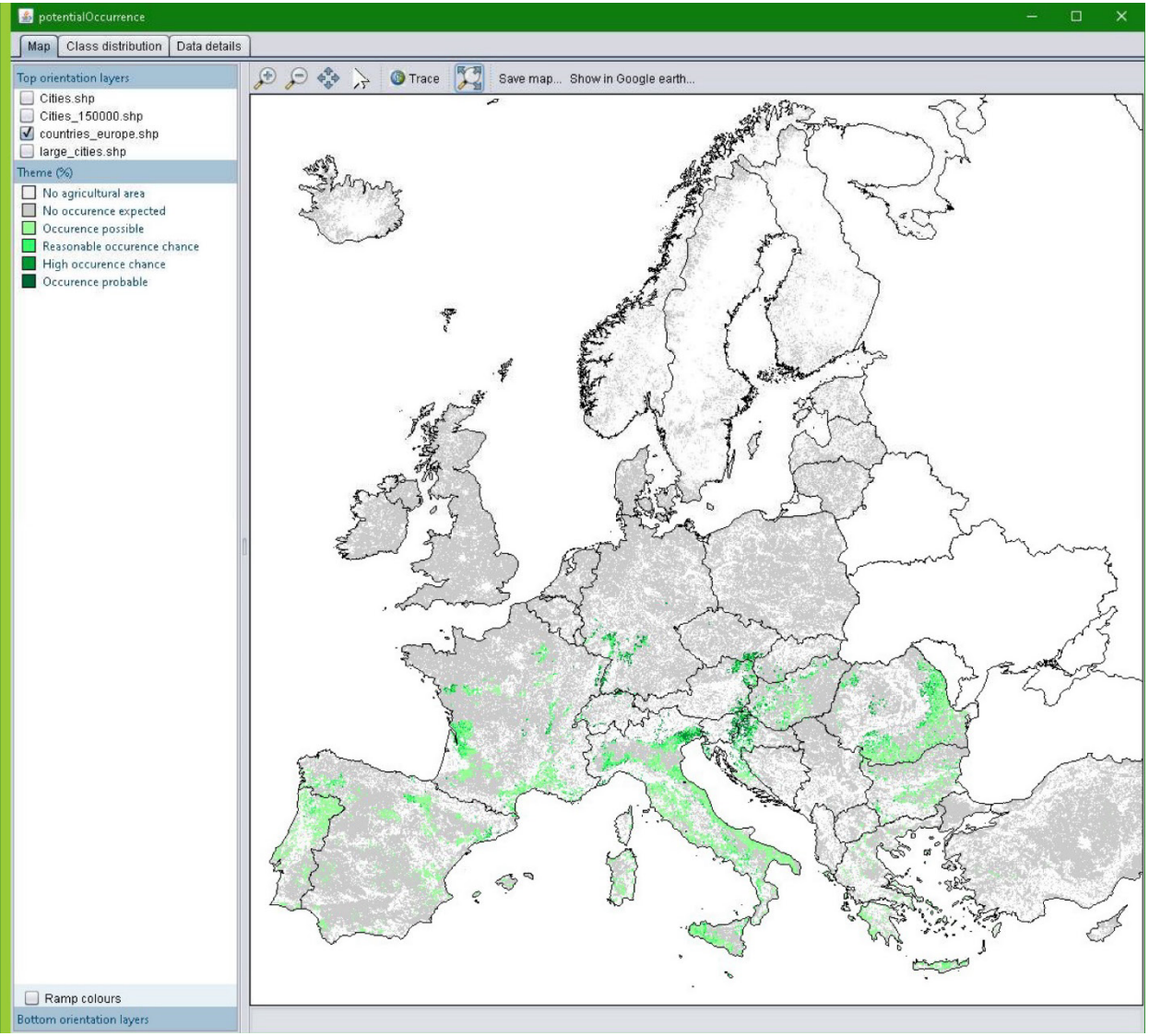
V12 potential occurrence Vineyards



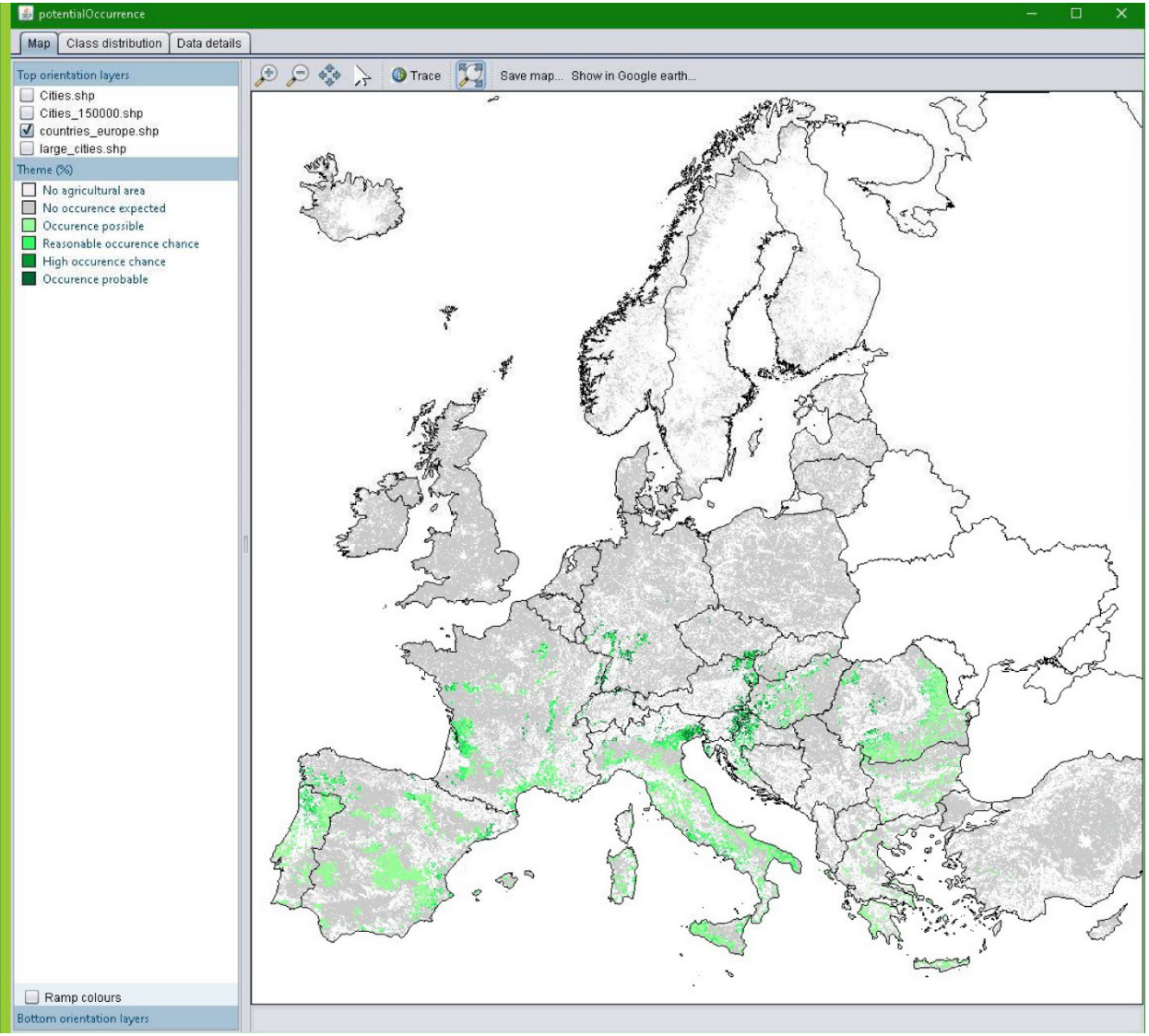
V13 potential occurrence Vineyards



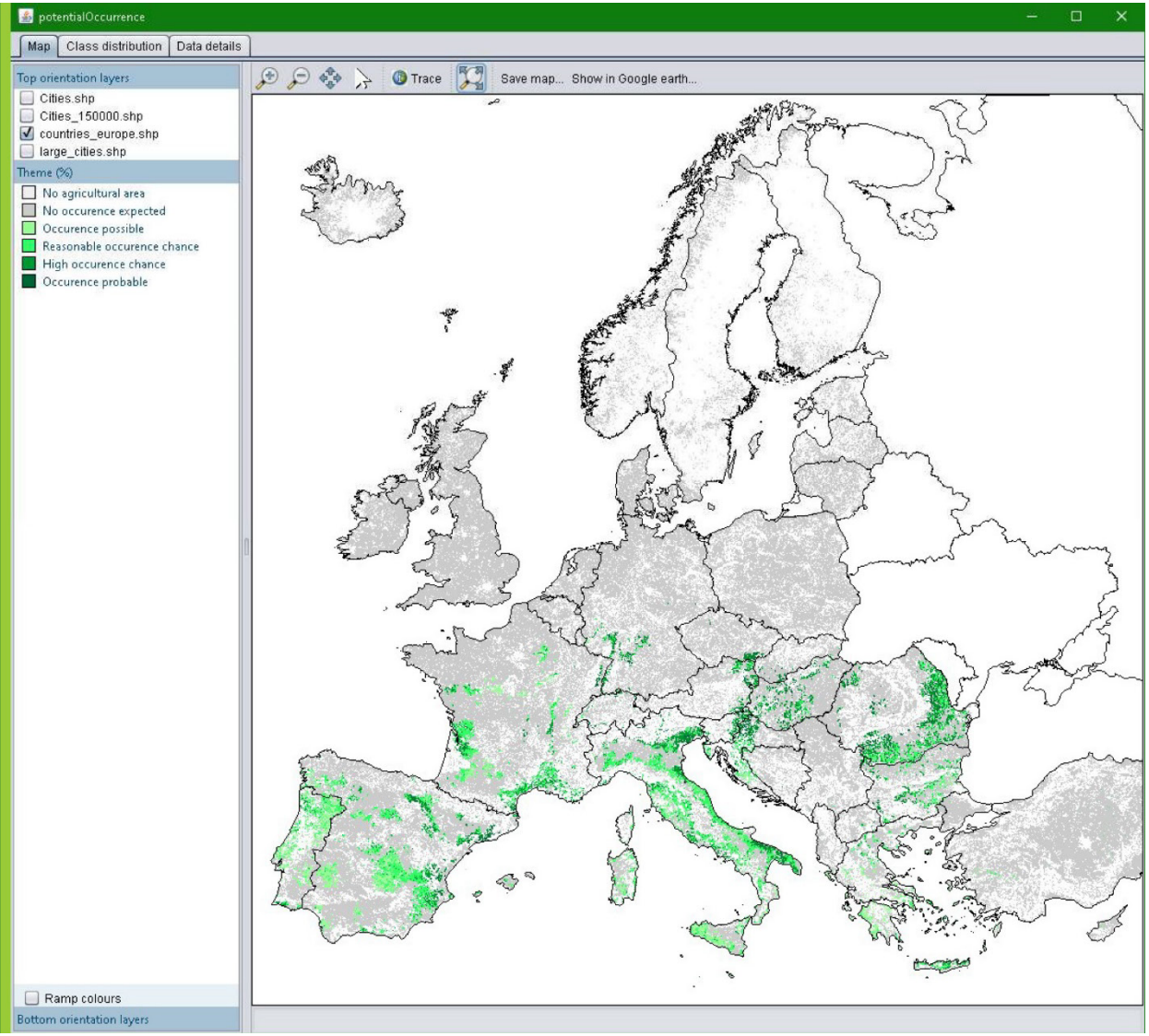
V34 potential occurrence Vineyards



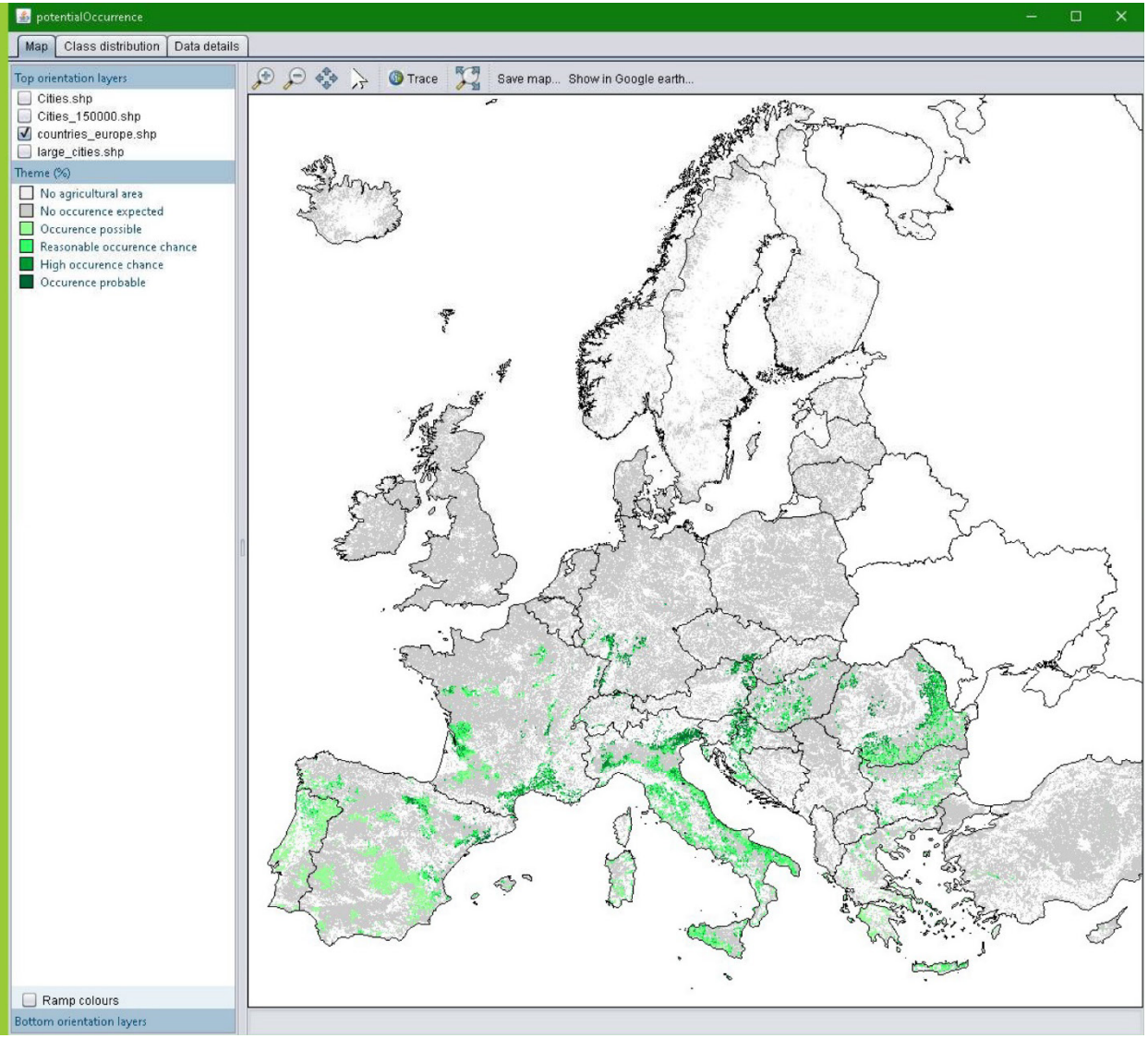
V35 potential occurrence Vineyards



V37 potential occurrence Vineyards

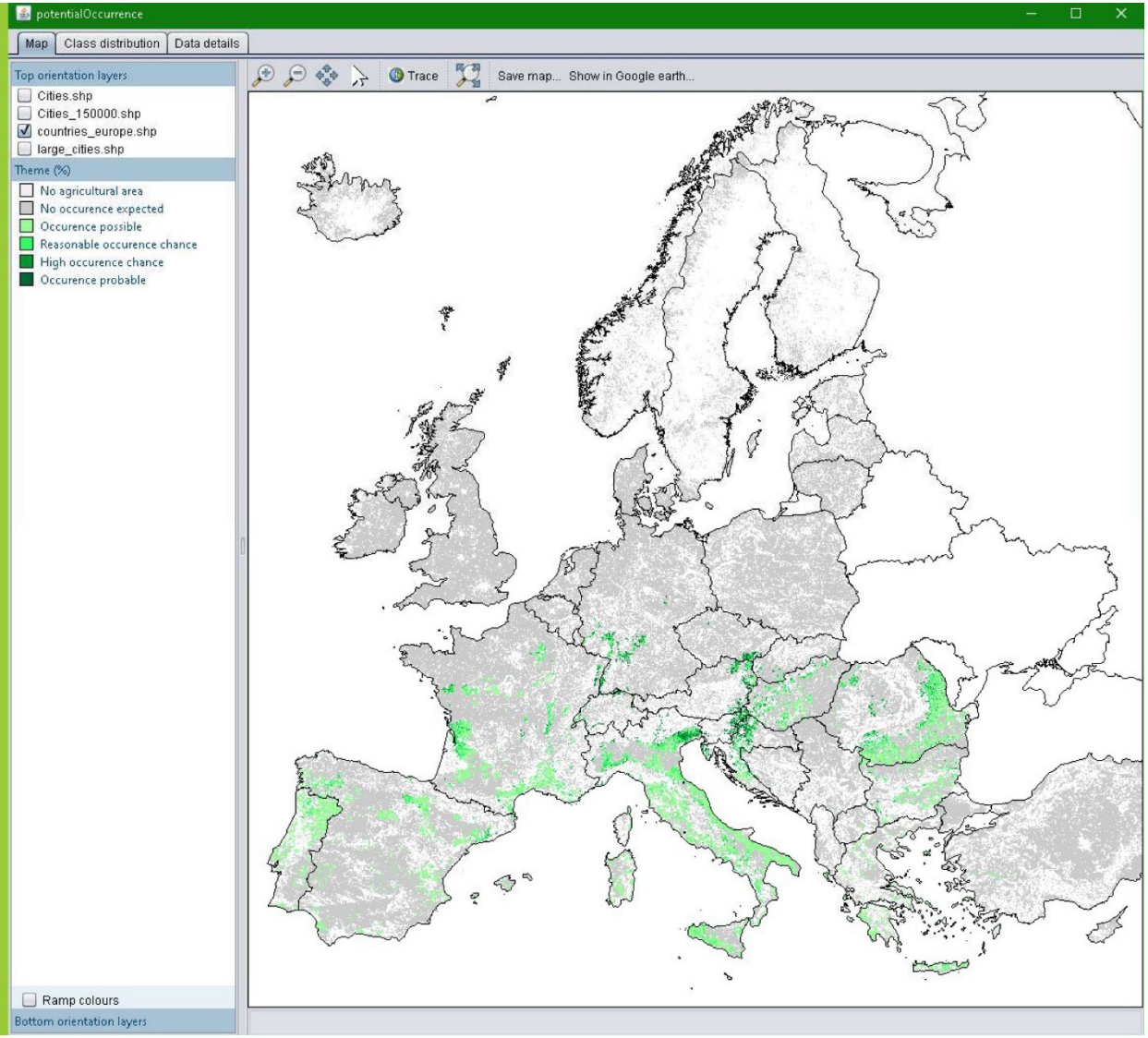


V38 potential occurrence Vineyards



quickscan

V39 potential occurrence Vineyards



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