

An updated landuse dataset for use in European regulatory environmental risk assessments

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Introduction

Spatial analyses as well as spatially distributed environmental fate simulation modelling are increasingly used to refine estimates of pesticide exposure within environmental risk assessments. A key dataset underpinning these analyses is the distribution of crops within the European Union. The CAPRI2000 landuse/landcover dataset is frequently used for this purpose and is currently distributed as part of an EFSA data package available from the JRCs European Soil Portal. However, this dataset is ~15 years old for most crop types and as such does not account for changes in crop areas and distributions in the intervening period and does not necessarily compare well with the agricultural areas reported in recent agricultural census datasets. The aim of this project was to build on / develop ("update") this dataset with more recent agricultural census statistics but not recreate the dataset given its regulatory acceptance by EFSA. During this process additional landuses were also defined by unbundling groups of crops and landcovers.

Methodology

The distributions of the crops within the agricultural landscape were developed using the following datasets:

1. The CORINE 2006 100 m raster layer describing land cover (Büttner *et al.*, 2012),
2. The CAPRI 2000 100 m raster layer describing landuse for a range of crops for circa the year 2000 (Kempen *et al.*, 2005; Leip *et al.*, 2008)
3. Sub-national agricultural census statistics (NUTS2 or NUTS3 level) for a more recent year than 2000.

The 3 datasets outlined above were combined by (See Figure 1):

1. The area of CAPRI crop types were summarised up to NUTS2 and NUTS3 level and compared with the more recent agricultural census statistics.
2. The CAPRI areas were then scaled:
 1. down where production had fallen with the extra agricultural land "reclassified" as 'all other arable land' or
 2. up to match the agricultural statistics with the extra agricultural land taken from 'all other arable land'.
3. In a number of places the CAPRI dataset underestimated the amount of land in use (required) for specific crops and the 'all other arable land' class was insufficient to accommodate the extra area required. In this instance, 1 km grid squares with additional arable land in excess of the CAPRI2000 totals were identified with the CORINE2006 landcover dataset.

Results

The resulting data consist of 1 km resolution landuse surfaces for a large number of crops (See Figure 1). Further sub-division into other classes is dependent on the availability of comparable agricultural census statistics for each Member State.

- Annual Outdoor Crops: Wheat, rye, barley, oats, other cereals, maize, pulses, potatoes, sugar beet, oilseed rape, other industrial crops, brassicas for stock feed, other stock feed, field vegetables (lambs lettuce, lettuce, other leafy vegetables, carrots, other root vegetables, bulb vegetables, tomatoes, other fruit vegetables), flowers.
- Annual Protected crops: Lambs lettuce, lettuce, strawberries, tomatoes, other fruit vegetables, all other vegetables, flowers.
- Permanent Crops: Pome fruit, stone fruit, citrus fruit, soft fruit (e.g. strawberries, blackcurrants, raspberries, other), vineyards, olives.

Usage Example – Surface Runoff Risk Contextualisation

The movement of pesticides to surface waterbodies *via* surface runoff requires (i) the generation of surface runoff and (ii) the delivery of this surface runoff. However, many of the crops that are treated with pesticides are grown in regions which have:

- a low in-field runoff generation potential as they are flat, characterised by lighter soils as well as low rainfall amounts or intensities (See Figure 2)
- the probability of this runoff, if it is generated, actually reaching surface water bodies is limited owing to lower drainage density (See Figure 3)

The extent of annual arable crops on surface runoff vulnerable soils in the Southern Zone is typically less than 10% and often <5% (See Figure 2). In most southern European Member States for most crops, the percentage of crops that are statistically likely to be proximate to surface water bodies is low, typically <10% and often below 5% (See Figure 3).

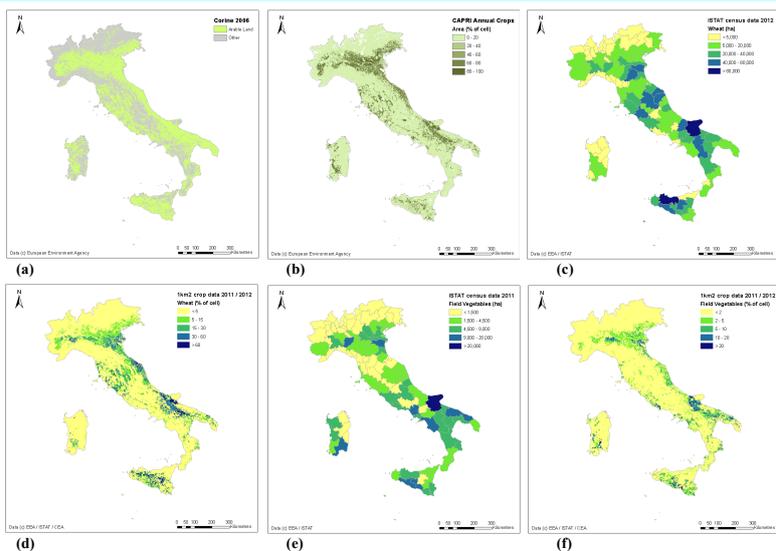


Figure 1: Examples from Italy of input datasets (a) CORINE landcover 2006, (b) Capri annual crops (c) national wheat and (d) field vegetable crop statistics, and output datasets (e) wheat and (f) field vegetable crops, used to develop the 1 km resolution landuse datasets.

References

- Büttner, G., Kosztra, B., Maucha, G. and Pataki, R., 2012. Implementation and achievements of CLC2006. Revised Final Report to the EEA. 65pp.
- EEA, 2012. European Environment Agency Catchments and Rivers Network System ECRINS v1.1: Rationales, building and improving for widening uses to Water Accounts and WISE applications. EEA Technical report No 7/2012, 116pp.
- Kempen, M., Heckelet, T., Britz, W., Leip, A., Koeble, R. and Marchi, G., 2005. Computation of a European Agricultural Land Use Map - Statistical Approach and Validation. Technical Paper, Institute for Food and Resource Economics, University of Bonn, Bonn, 17pp.
- Leip, A., Marchi, G., Koeble, R., Kempen, M., Britz, W. and Li, C., 2008. Linking an economic model for European agriculture with a mechanistic model to estimate nitrogen losses from cropland soil in Europe. *Biogeosciences* 5(1), 73-94
- Vogt, J.V., Colombo, R., Bertolo, F., 2003. Deriving drainage networks and catchment boundaries: a new methodology combining digital elevation data and environmental characteristics. *Geomorphology* 53, pp.281-298.

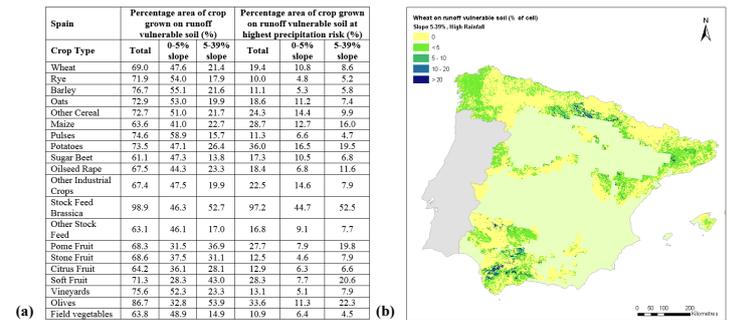


Figure 2: Example runoff contextualisation for Spain (a) Summary of the runoff vulnerability statistics for each crop, (b) Extent of wheat areas on surface runoff vulnerable land considering soils, slope and climatic factors.

Southern Zone	Wheat	Rye	Barley	Oats	Other Cereals	Maize	Pulses	Potatoes	Sugar Beet	Oilseed Rape	Other Industrial Crops	Stock Feed	Other Stock Feed	Pome Fruit	Stone Fruit	Citrus Fruit	Soft Fruit	Vineyards	Olives	Field Vegetables	
Area (ha)	15,048,839	24,944	1,183,824	782,547	3,287,027	1,884,621	983,730	975,381	485,581	1,648,088	4,246,774	187,003	3,022,248	24,098	476,475	540,883	182,474	3,003,933	1,462,068	82,833	
Percentage Statistics (%)	4.8	0.7	3.8	2.4	10.1	5.8	3.0	3.0	1.5	5.1	13.1	0.8	9.4	0.7	1.4	1.6	0.6	9.4	4.5	2.5	
LDGE Statistics (%)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

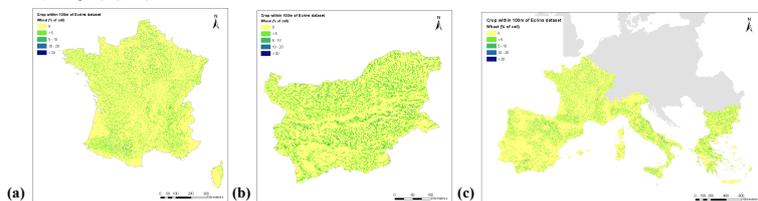


Figure 3: Southern Zone - Summary of the (i) Percentage of each crop that is within 100 m of the surface water bodies described by ECRINS (EEA, 2012) and (ii) Percentage of crops across each landscape drainage density index class (Vogt *et al.*, 2003). Example of the screening aquatic proximity analysis showing wheat within 100 m of ECRINS for (a) France, (b) Bulgaria and (c) Southern Zone