CONSIDERING DIFFUSE URBAN AND AGRICULTURAL SOURCES OF PESTICIDES AT THE LANDSCAPE AND CATCHMENT SCALE

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Introduction

There is a strong move towards landscape and catchment scale risk assessments as this allows for integrated risk assessments that consider multiple sources of pollutants, different exposure pathways, and different receptors within a single risk assessment framework. This landscape/catchment approach moves away from realistic worst case scenarios, designed to be protective of a wide range of usage situations, to a more realistic representation of usage environments that the risk assessment is trying to protect. There is also a move towards harmonising risk assessments between different chemical regulation frameworks, necessitating a wider consideration of other regulations; for example, under the Biocidal Products Regulation combined exposure is considered for different product types that may overlap spatially or temporally.

Two important diffuse sources of pesticide residues emitted to surface water bodies are from urban (hard surface and amenity) and agricultural uses. At present these sources are risk-assessed using very different scenario-based risk assessment approaches in isolation, potentially under different regulations: the Plant Protection Products directive (1107/2009/EC) and the BPR (EU 528/2012). Urban amenity pesticide uses may be risk assessed using approaches like HardSPEC (Hollis et al., 2004) while agricultural uses are risk assessed using the FOCUS surface water risk assessment framework at EU and Zonal levels and in some Member States (MS). While this is not necessarily an issue for many compounds registered for use, as they do not have both urban and agricultural uses, there are a number of compounds where this may be the case, and joint risk assessments may be required when considering risk to surface water bodies at a landscape scale.

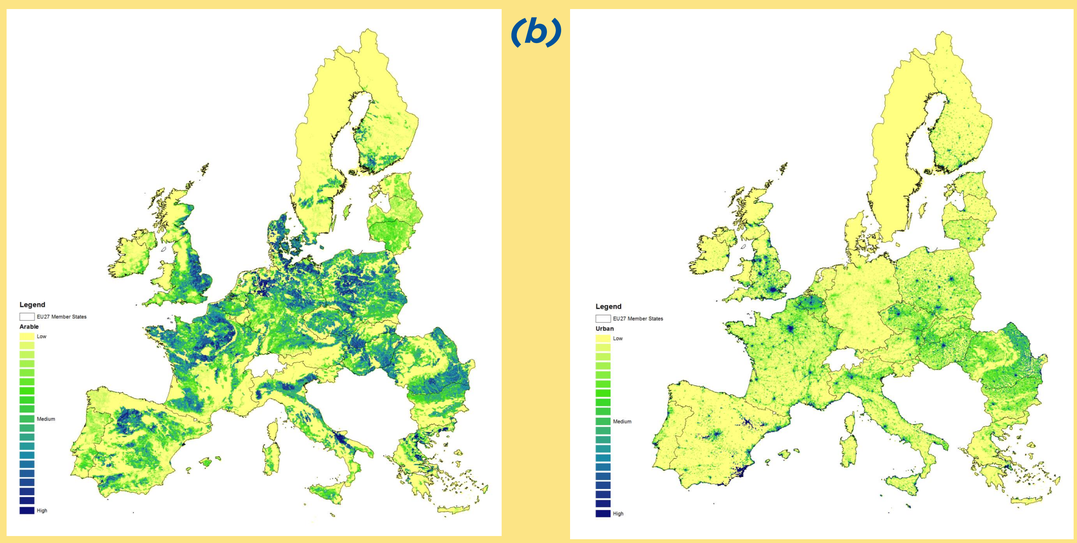
Aim

This study compares landscape and catchment scale estimates of pesticide emitted to local surface waterbodies from urban and rural diffuse sources of pesticides, using a simplified approach with a view to considering the likely spatial coincidence of these sources of pesticide residues. While originally intended to identify catchments for stewardship programmes, the approach is used here to assess the need for these two sources to be considered jointly within landscape and catchment scale risk assessments.

Methodology

Pesticide losses for a hypothetical herbicide arising from diffuse urban hard surface and road uses were assessed using an adapted event mean concentration (EMC) approach (after Mitchell *et al.*, 2001) which accounts for population density and usage rates. Account was also taken of Member States with restricted or specified hard surface usage. Diffuse agricultural losses for the same hypothetical herbicide were assessed using FOCUSsw modelling approaches for each crop present in each of ~182 000 grid cells at 5 km resolution across the EU. Local surface water body predicted environmental concentrations (PEC) were area-weighted by their associated landuse area, which was informed by a CEA landuse dataset constructed from CORINE landcover and agricultural census datasets. This resulted in an integrated index of pesticide pressure within each 5 km grid cell. Using the JRC's Catchment Characterisation and Modelling pan-European catchment dataset (Vogt *et al.*, 2003), catchment totals of the pesticide pressure were also generated.

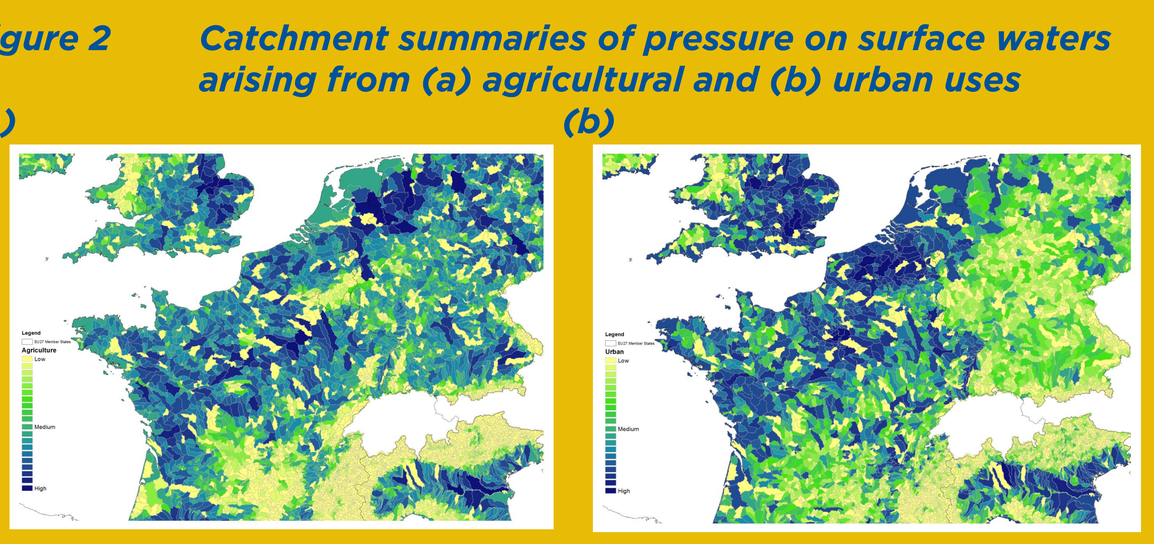
Figure 1 ***Pressure on surface water bodies arising from (a) arable and (b) urban uses of pesticide***



Results

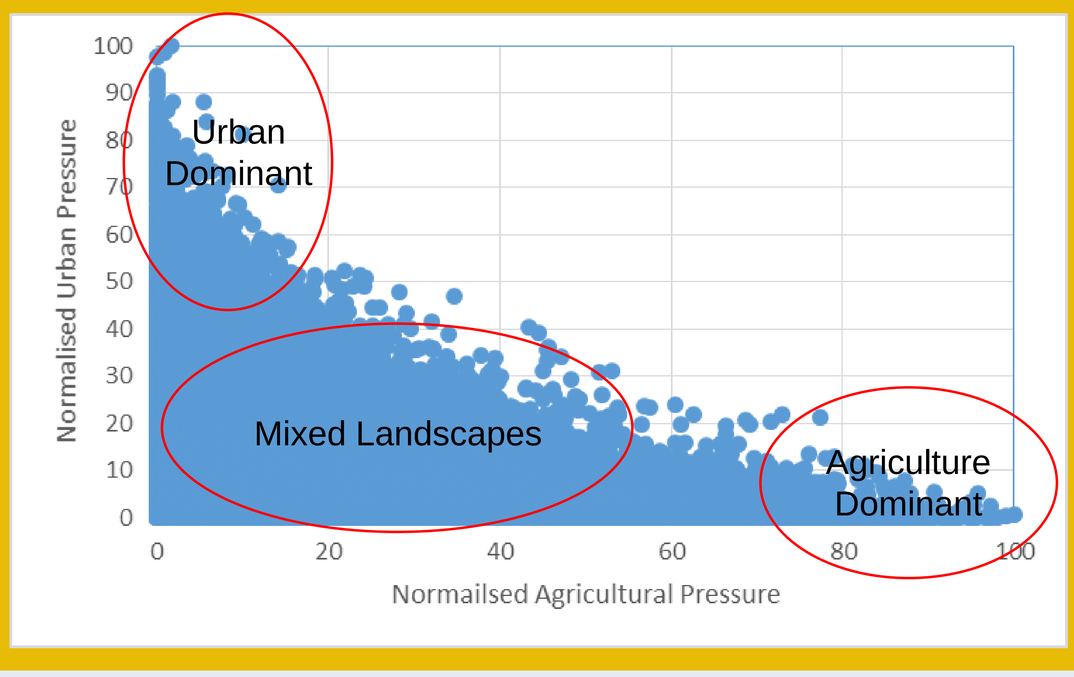
The agricultural results are in line with what would be expected given the cropping patterns across the EU e.g. vines in Southern France; olives/citrus in Southern Spain; vegetables/arable in eastern England, northern France, northern Italy and western Germany. The urban results reflect major urban centres/infrastructure and the MS usage restrictions built into the approach.

Figure 2 ***Catchment summaries of pressure on surface waters arising from (a) agricultural and (b) urban uses***



Comparison of the modelled pesticide pressures on surface waterbodies arising from urban and agricultural uses indicates what we would expect based on the underlying landuse patterns – the higher urban pressures are typically associated with the lower agricultural pressures and vice versa.

Figure 3 ***Plot comparing normalised modelled urban and agricultural pesticide pressures***



Conclusions

- Assessment of pressures on surface water bodies arising from agricultural and urban uses of pesticides suggests that landscape risk assessments would likely need to consider multiple sources as even in environments dominated by one source there are contributions from the other source. A grid resolution of 5 km was used in this work; finer resolution would provide greater clarity. This conclusion is amplified when considering pressures at a catchment scale.
- Landscape and catchment assessments of pressure and risk can be used to:
  - Assess the protectiveness and representativeness of existing scenarios
  - Target monitoring and stewardship programmes

References:
Hollis *et al.*, 2004. HardSPEC: A First-tier Model for Estimating Surface- and Ground-Water Exposure resulting from Herbicides applied to Hard Surfaces. Final Report for the Pesticides Safety Directorate (DEFRA project PL0531).
Mitchell *et al.*, 2001. Pollution Hazard from Urban Nonpoint Sources: A GIS-Model to Support Strategic Environmental Planning in the UK., Technical Report, School of Geography, University of Leeds.
Vogt *et al.*, 2003. Catchments and rivers – CCM River and Catchment Database for Europe, Version 1.0., EUR 20756 EN, JRC European Commission, Ispra, Italy.