



# Structure

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- ✱ **On-farm risk assessment for pesticides**
  - Losses in drainflow
- ✱ **Aquatic ecosystems in the UK agricultural landscape**



Cranfield Centre for  
EcoChemistry

# On-farm risk assessment for pesticides

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**Kathy Lewis, University of Hertfordshire**

# What is EMA?

- ✱ **Environmental management software for the agricultural industry**
- ✱ **A UK-based technology transfer tool**
  - ✱ Environmental models
  - ✱ Performance assessment routines
  - ✱ Information on best practice
  - ✱ Decision support
- ✱ **Managed by University of Hertfordshire**



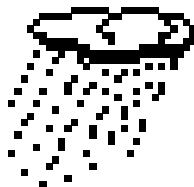
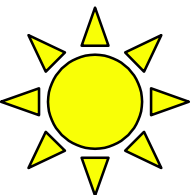


## p-EMA

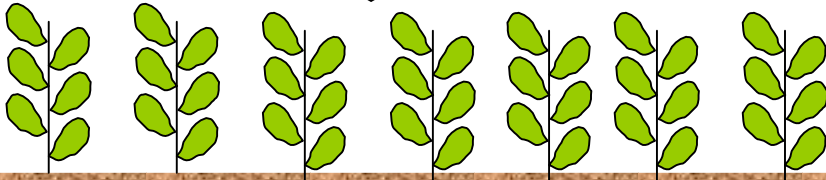
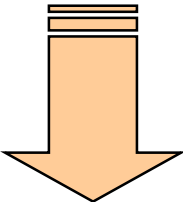
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- ✱ **UK government committed to reduction in pesticide use coupled to risk minimisation**
- ✱ **Tool to assess risk at local scale responsive to site- and practice-specific factors**
- ✱ **Upgrade from hazard- to risk-based system**
- ✱ **In tune with regulatory procedures**
  - Prevent mixed messages to pesticide users
  - Avoid alienation of stakeholders - industry and regulators

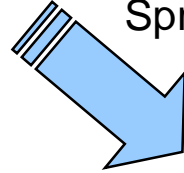
# Exposure calculations



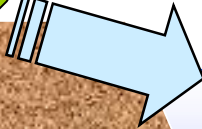
Pesticide application



Spray drift



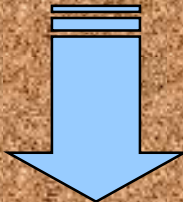
(Runoff)



Edge of field

Soil

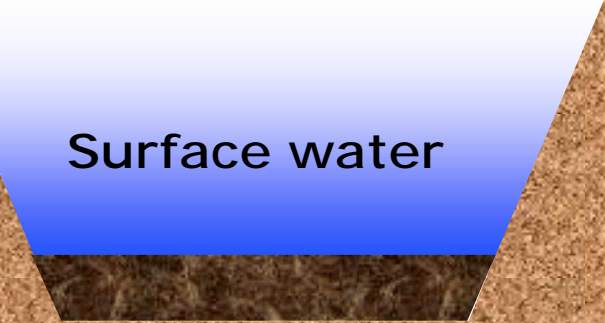
Leaching



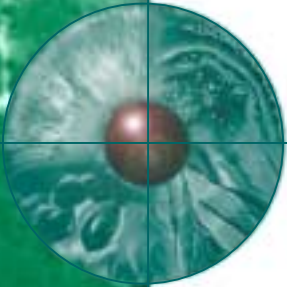
Drain discharge



Surface water



Groundwater



# Factors included for entry to surface water via drains

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## *Site-specific*

Crop type and stage

Soil type

Presence and dimensions of surface water body

Presence and type of drain

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## *Practice-specific*

Rate of application

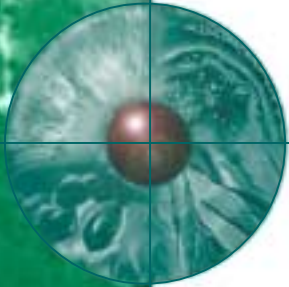


## PSD method to predict losses to surface waters in drainflow

<i>Mobility classification</i>	<i>Koc (g/ml)</i>	<i>% a.s. transported per 10 mm drain water</i>
Very mobile	<15	1.9%
Mobile	15-74	1.9%
Moderately mobile	75-499	0.68%
Slightly mobile	500-999	0.5%
Slightly mobile	1000-4000	0.02%
Non-mobile	>4000	0.008%

➤ Experiment on a heavy clay soil at Brimstone Farm

# Drained soils



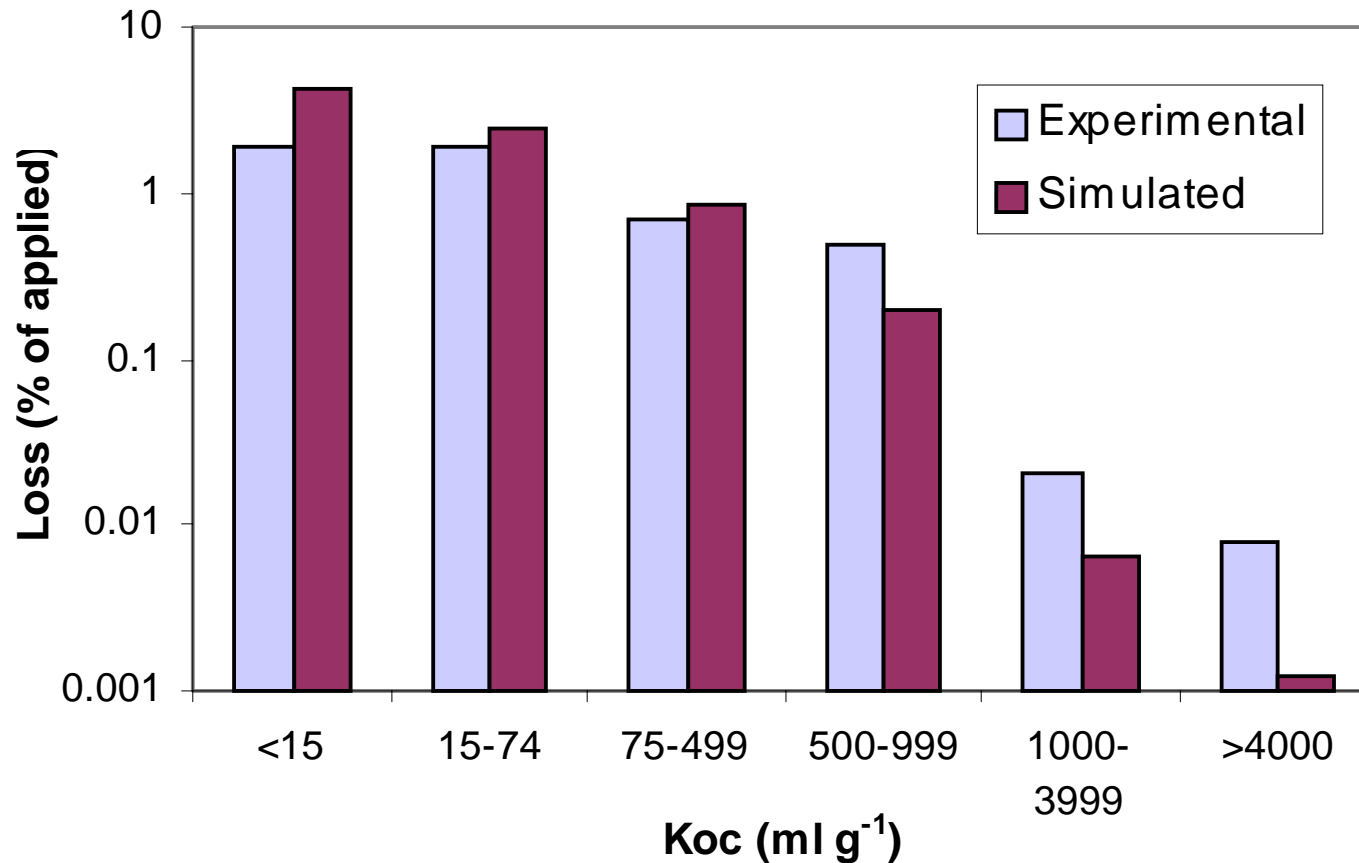
<i>Texture group</i>	<i>Topsoil %sand</i>	<i>Topsoil %silt</i>	<i>Topsoil %clay</i>	<i>Reason for drains</i>
<b>Sands</b>	<b>70</b>	<b>19</b>	<b>11</b>	<b>1</b>
<b>Light loams</b>	<b>55</b>	<b>30</b>	<b>15</b>	<b>1</b>
<b>Light silts</b>	<b>19</b>	<b>59</b>	<b>22</b>	<b>1</b>
<b>Medium loams</b>	<b>43</b>	<b>33</b>	<b>24</b>	<b>2</b>
<b>Medium silts</b>	<b>19</b>	<b>52</b>	<b>29</b>	<b>2</b>
<b>Clays</b>	<b>11</b>	<b>29</b>	<b>60</b>	<b>2</b>

**1 Shallow groundwater present**

**2 Slowly permeable subsoil**



# MACRO (preferential flow) model applied to the field data



0.4

0.8

0.8

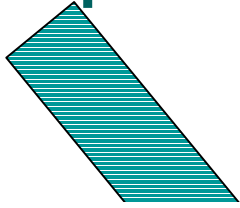
2.5

3.1

6.7

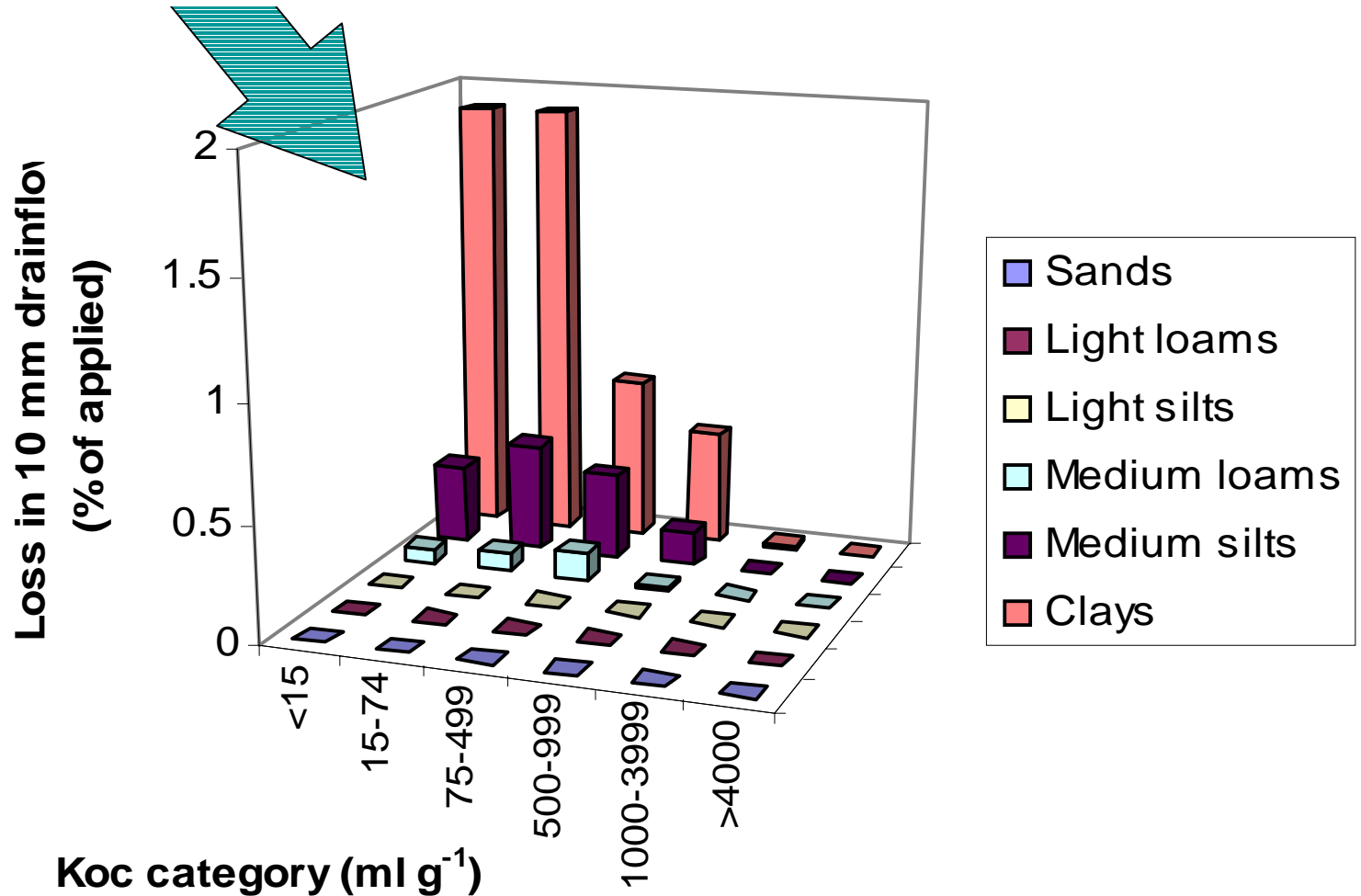
**Koc-specific accuracy factors**

MACRO predictions



Koc-specific accuracy factors

Loss of pesticide in  
10 mm drainflow by  
Koc category and  
soil type





# Risk assessment

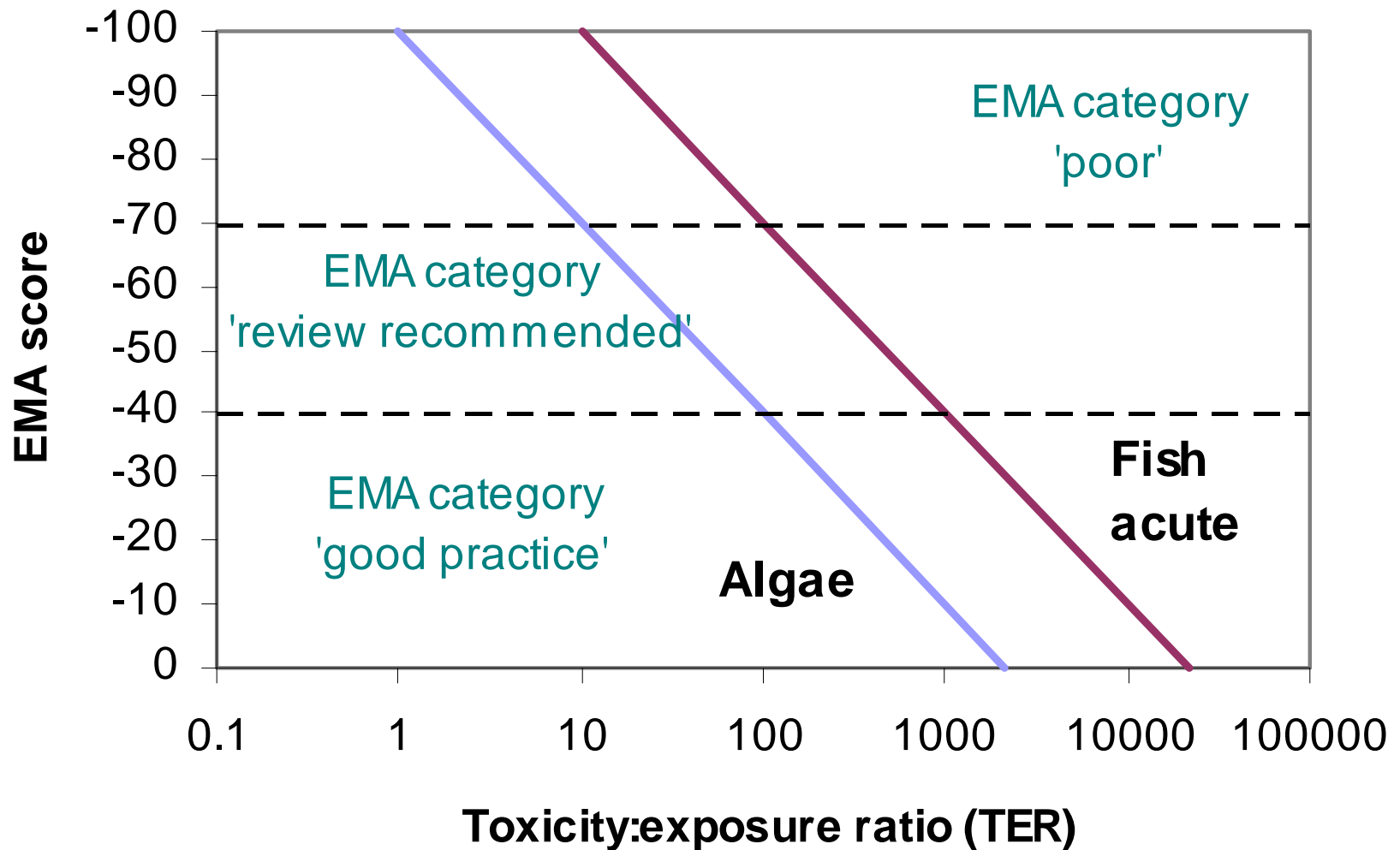
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- ✱ Based on the toxicity:exposure ratio

$$\text{TER} = \text{EC} / \text{PEC}$$

- ✱ Terrestrial: birds, mammals, honeybees, beneficial arthropods, earthworms, groundwater
- ✱ Aquatic: fish, daphnia, algae, lemna
- ✱ TER's converted to performance scores and aggregated for applications and fields

# Risk assessment - conversion to performance indicator



### Information Box

Farm Summary



Risk Assessment



Environmental Fate Data



Regulatory Compliance

Field by Field Detail

Click the icons above for detailed explanations, click grid cells for more information.

Width of grid cols (except farm summary) can be altered by grabbing header row lines and dragging.

### Farm Summary

Field Reference	Field Eco-rating	Performance Banding	Largest contributor to risk (from Eco-rating)	No. applications / typical	Alerts	...	
School	-16 (15% Data unavailable - unknown risk)	Good practice	simazine - Click for help	4 / 5	1x	1x	1x
Hill	-3 (0% Data unavailable)	Good practice	tebuconazole - Click for help	8 / 6			
Shelter	-3 (0% Data unavailable)	Good practice	tebuconazole - Click for help	7 / 6			
Fosters	-2 (1% Data unavailable - unknown risk)	Good practice	cypermethrin - Click for help	12 / 6		1x	
Chase	-2 (0% Data unavailable)	Good practice	isoproturon - Click for help	13 / 6			
FARM TOTAL	-5 (3% Data unavailable - unknown risk)	Good practice					

### System Control



Farm Level

Field Level

Application Level

Main Menu

Advisory

Icon key

Report Menu

Cancel

# Current status

- ✱ Prototype software distributed for evaluation
- ✱ Included with EMA upgrades (3000+ copies)
- ✱ Bounded by regulatory procedures and data availability
  - Almost entirely acute risk assessment
- ✱ Currently adding fruit/orchard routines



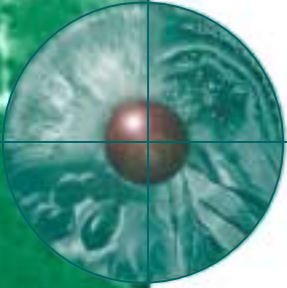


Cranfield Centre for  
EcoChemistry

# Aquatic ecosystems in the UK agricultural landscape

Pond Conservation Trust, ADAS,  
Syngenta, Cranfield Centre for  
EcoChemistry





## **Project aim**

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**Provide detailed information about the nature of aquatic ecosystems in the UK agricultural landscape**

**Use the information to assist the future development of higher-tier risk assessment procedures**



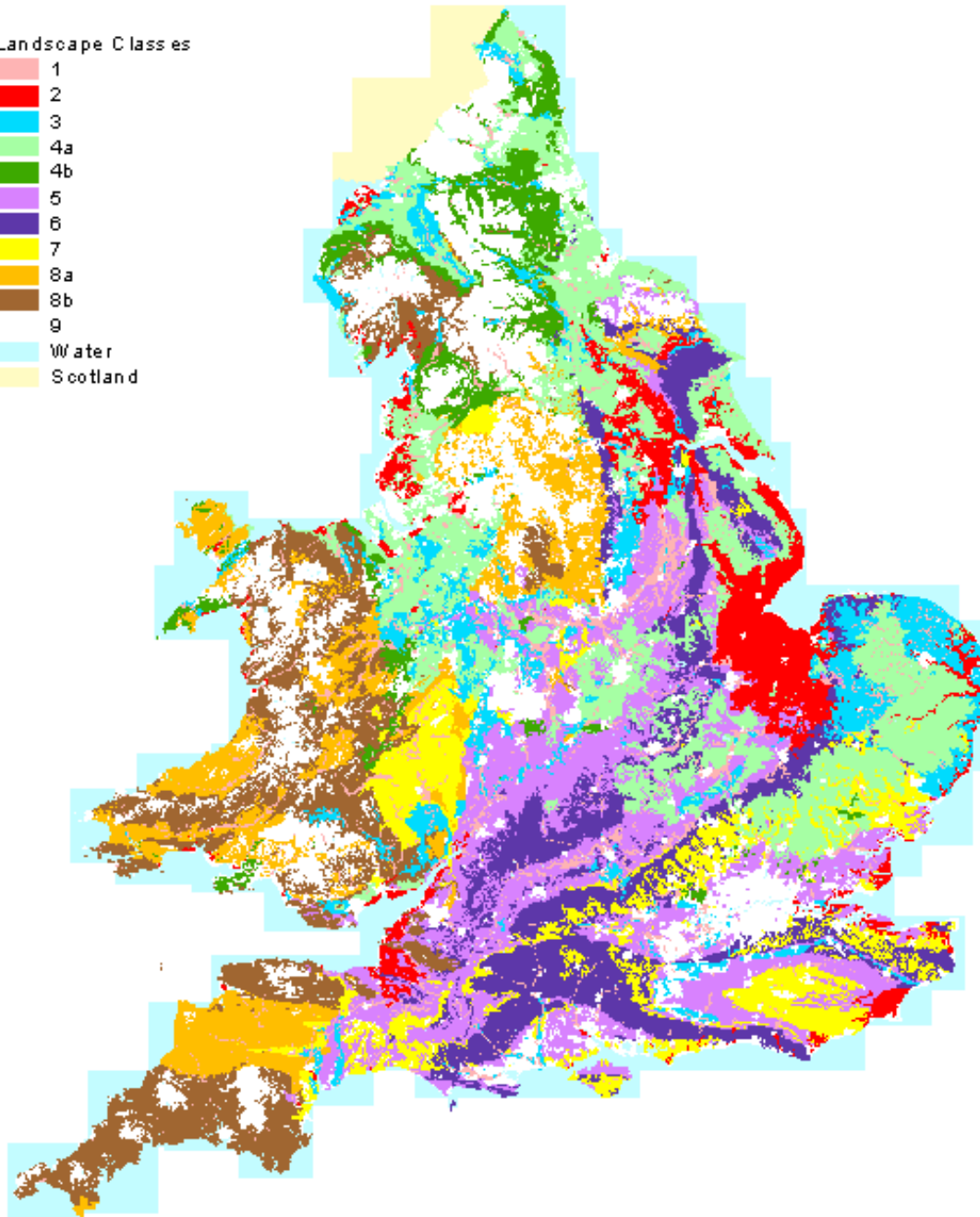
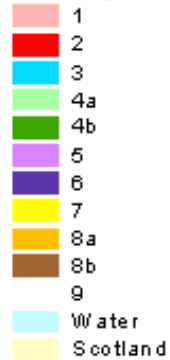
# Aquatic ecosystems

- ✱ **Distribution of different types of aquatic habitats which can be exposed to pesticides (ditches, streams, canals, ponds, lakes)**
  - 10 agricultural landscape classes (land use, hydrology, topography)
  - Definition of aquatic habitats
  - Spatial distribution
  - Temporal change

# Aquatic ecosystems

- ✱ **Biodiversity, ecology, physico-chemical and morphological characteristics**
  - Analysis of existing datasets
  - Targeted field work to fill information gaps and for validation

Landscape Classes



## Class 5

**Prequaternary clay landscapes.**

**Level to gently sloping vales.**

**Slowly permeable clays and heavy loams.**

**High base status (eutrophic)**

**Ditches, streams, ponds and rivers**

**HOST 21, 23-25**

# Aquatic Ecoystems

- ✱ **Factors influencing the magnitude and duration of exposure**
  - Pesticide usage (e.g. timing, frequency)
  - Routes of exposure and modifying factors (e.g. bankside vegetation).
- ✱ **Factors which might influence the potential for ecosystems to recover**
- ✱ **Potential for use in probabilistic risk assessments**
- ✱ **Potential for use of GIS**