



**An Phríomh-Oifig Staidrimh**  
Central Statistics Office

# Use of GIS in CSO Environment Statistics

Irish Organisation for Geographic Information  
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Nova Sharkey [nova.sharkey@cs0.ie](mailto:nova.sharkey@cs0.ie)

Linh Trieu Nolan [linh.nolan@cs0.ie](mailto:linh.nolan@cs0.ie)



# CSO and GIS

- Historically, GIS was used by the Census of Population area for fieldwork and results visualisation
- For Census 2011 and 2016, each enumerated household (including vacant dwellings) has been linked to the GeoDirectory, and so has X/Y coordinates that can be used to compile environment-related statistics



# Environment Statistics and Accounts Division

- Set up as a standalone CSO Division in early 2015
- Initial focus was on producing statistics for legal and voluntary environmental accounts modules for Eurostat
- Use of GIS within the Division began in 2016



# Land Cover and Land Use Project

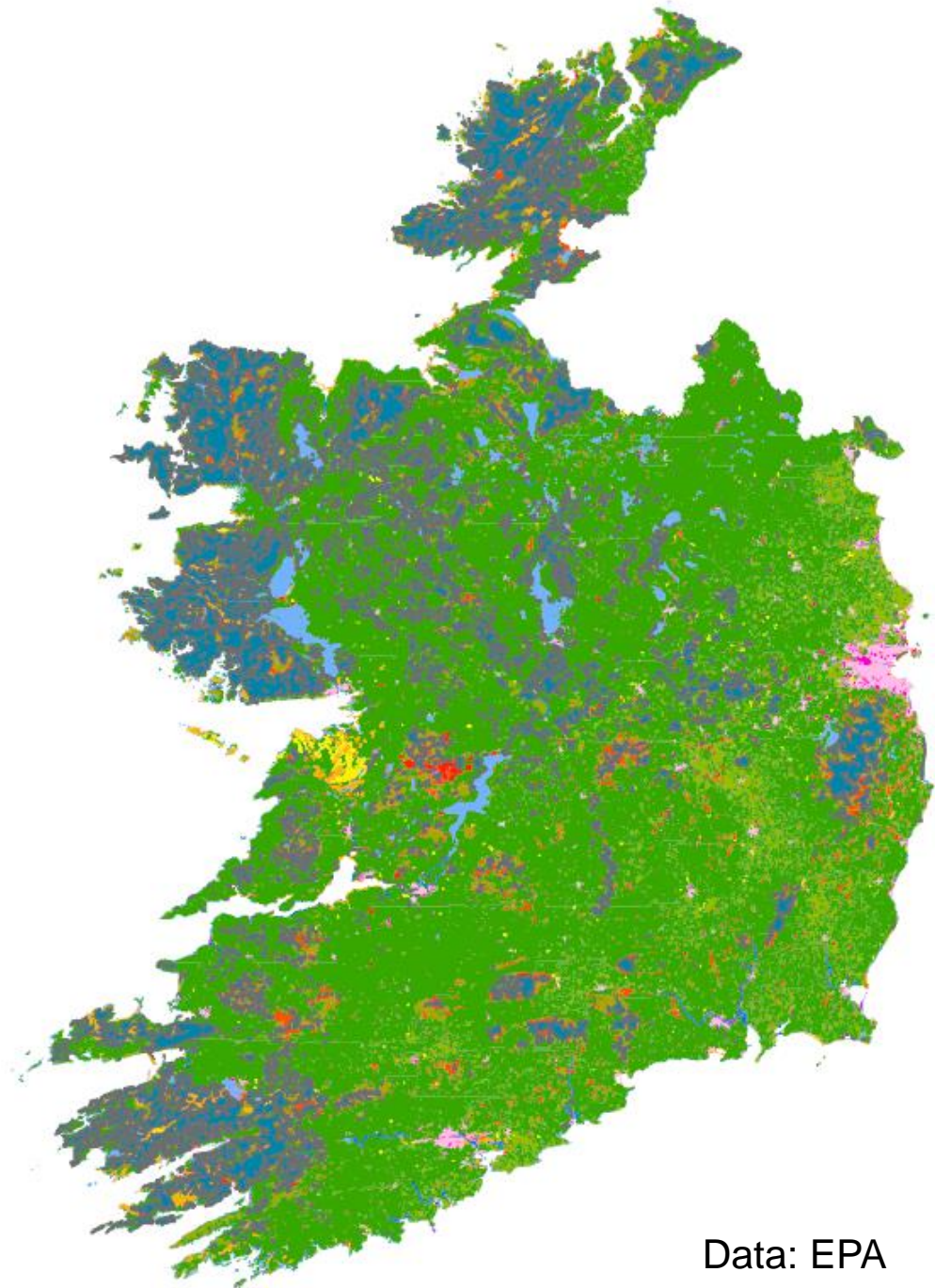
- First GIS-related project was a Eurostat land cover and land use questionnaire at NUTS 2 level – this was the first time CSO has completed this questionnaire
- This work was completed using:
  - 2012 CORINE land cover data from EPA
  - OSi Prime2 data
  - DAFM forest inventory data



# Land Cover (Corine 2012)

## LandCover

-  C1\_1 - Roofed built-up areas
-  C1\_2 - Artificial non built-up areas
-  C1\_3 - Other built-up areas
-  C2\_1 - Cropland
-  C3\_1\_2 - Broadleaved forest
-  C3\_1\_3 - Coniferous forest
-  C3\_1\_4 - Mixed forest
-  C4 - Shrubland
-  C5 - Grassland
-  C6\_1 - Consolidated bare surfaces and deposits
-  C6\_2 - Unconsolidated bare surfaces and deposits
-  C7\_1 - Inland water bodies
-  C7\_2 - Inland running water
-  H - Wetlands



Data: EPA



# Land Cover (Corine 2012)

| CODE | TITLE   | NUTS<br>IE0 | NUTS<br>IE01 | NUTS<br>IE02 |
|------|---|-------------|--------------|--------------|
| C1   | Artificial land                                 | 2%          | 1%           | 3%           |
| C2   | Cropland  | 6%          | 2%           | 9%           |
| C3   | Woodland  | 5%          | 5%           | 6%           |
| C4   | Shrubland                                       | 5%          | 6%           | 5%           |
| C5   | Grassland                                       | 62%         | 58%          | 66%          |
| C6   | Bare land, lichens, glaciers and permanent snow | 1%          | 1%           | 2%           |
| C7   | Water   | 4%          | 5%           | 2%           |
| H    | Wetland   | 15%         | 21%          | 9%           |

Data: EPA



# Example Land Use Categories

| CODE 1 | TITLE  | NUTS IE0 | NUTS IE01 | NUTS IE02 |
|--------|--|----------|-----------|-----------|
| U1     | Primary Production                               | 14.4%    | 10.4%     | 19.7%     |
| U1_1   | Agriculture                                      | 5.0%     | 2.0%      | 8.8%      |
| U1_2   | Forestry   | 9.1%     | 8.3%      | 10.8%     |
| U1_3   | Mining and Quarrying                             | 0.1%     | 0.1%      | 0.2%      |
| U1_4_1 | Aquaculture                                      | 0.2%     |           |           |
| U3     | Tertiary Production                              | 0.3%     | 0.2%      | 0.5%      |
| U3_4   | Cultural Entertainment and Recreational Services | 0.2%     | 0.1%      | 0.3%      |
| U4_1_1 | Road Transport                                   | 1.8%     | 1.5%      | 2.3%      |
| U5     | Residential Use (includes other compatible use)  | 3.8%     | 3.0%      | 5.1%      |
| U6_3   | Natural areas not in other economic use          | 0.8%     | 0.8%      | 0.9%      |

Data: OSI



# Land Use Overview

- Land Use change over time
  - Potential to analyse Land Parcel Information System data to examine changes at field level, crop location level, farm level, habitat level etc.
  - EPA and other institutions have already carried out work in this area
  - CSO could add to this through combining Census and other data, e.g. location of new dwellings





# Continuing our GIS Work

- Land cover and land use is a good starting point for compiling ecosystem accounts
- Need for CSO to identify and obtain access to a time series of geocoded microdata
- National Parks and Wildlife Service (NPWS) have the lead role for Ireland on ecosystem accounts



# Geocoded Microdata

- Useful datasets for CSO archive include:
  - Crop areas at parcel level and livestock numbers at farm level
  - Census of Population data at household level
  - Forestry data at land parcel level
  - Utilities data at meter level
  - Administrative data from government departments and agencies
  - CSO Business Register data at local unit and enterprise level
  - Public expenditure on water supply and waste water management at county level
  - EPA water quality data
  - EPA air quality data



# Microdata Validation and Geocoding

- Validation and completion of geocoding of datasets
- Eircodes
  - Common identifier to match datasets
  - Most important public sector registers were pre-coded
  - Government departments and agencies need to complete coding by collecting Eircodes of non-unique addresses (around 35% of total)



# Using the Microdata

- The datasets can be associated with digitised areas such as water catchments, habitats, special areas of conservation, etc.
- By relating the geocoded microdata to specific areas, work on assessing the pressures on them can begin
- Work with other data holders and users to efficiently meet data needs



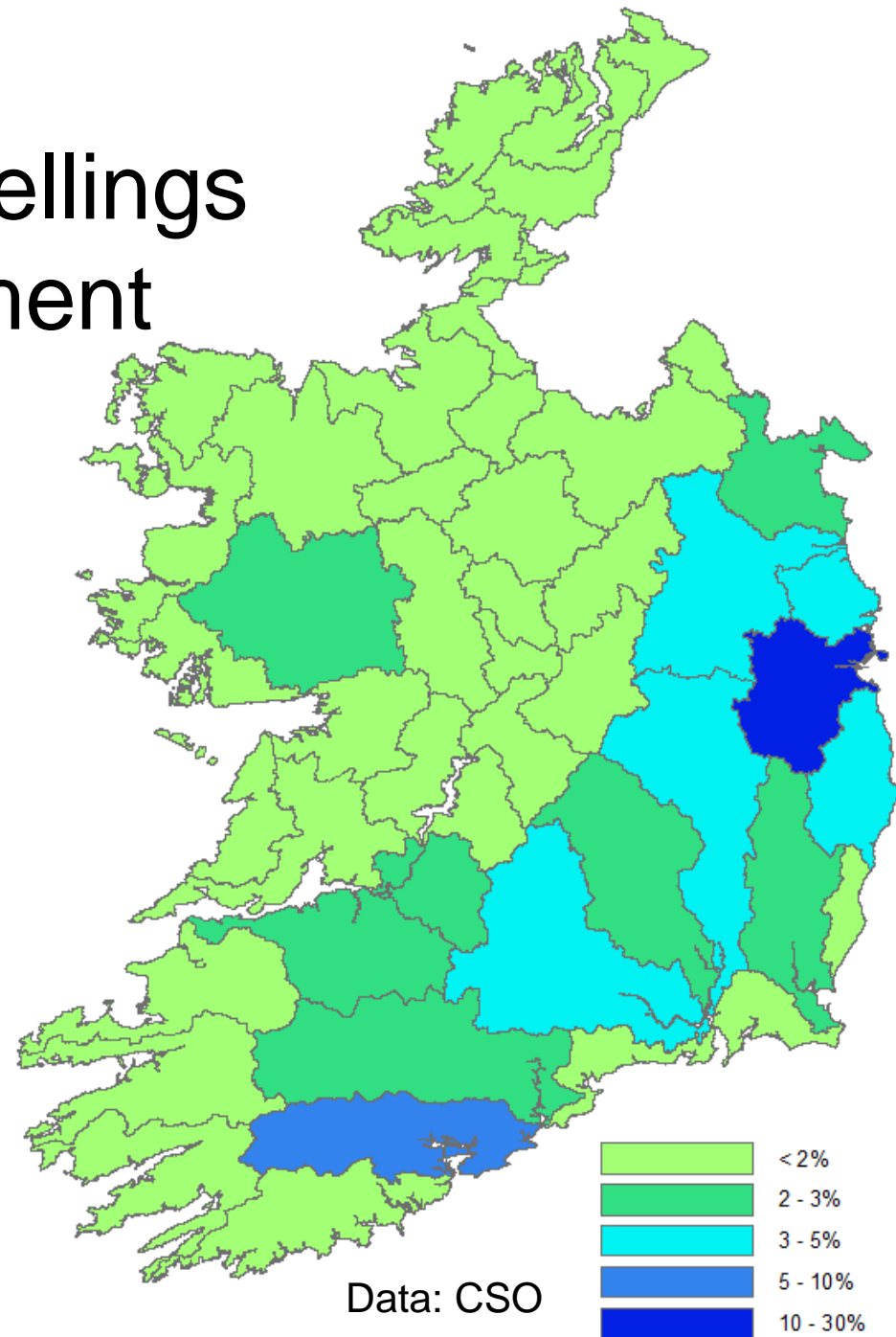
# Water Catchments

- Water Framework Directive requirement
- DECLG and EPA have lead roles
- Inter-departmental Water Statistics Working Group
- EPA provided CSO with digitised water catchment areas
- CSO Environment is analysing microdata to assist with catchment characterisation:
  - Crop areas
  - Livestock numbers
  - Numbers of households
  - Enterprise locations by NACE sector and associated employment data etc.



# 2011 Census of Population – Dwellings by Water Catchment

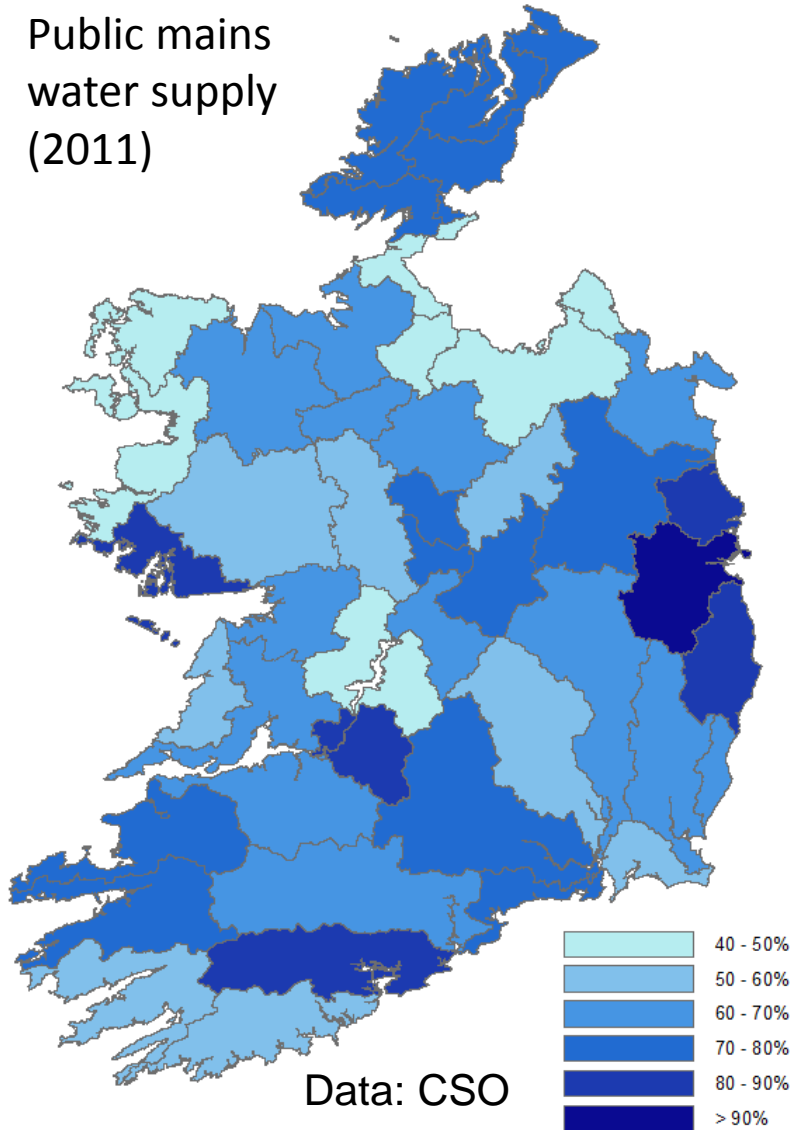
- 46 water catchments
- % of national total number of dwellings in each catchment
- 28% in Liffey and Dublin Bay Catchment



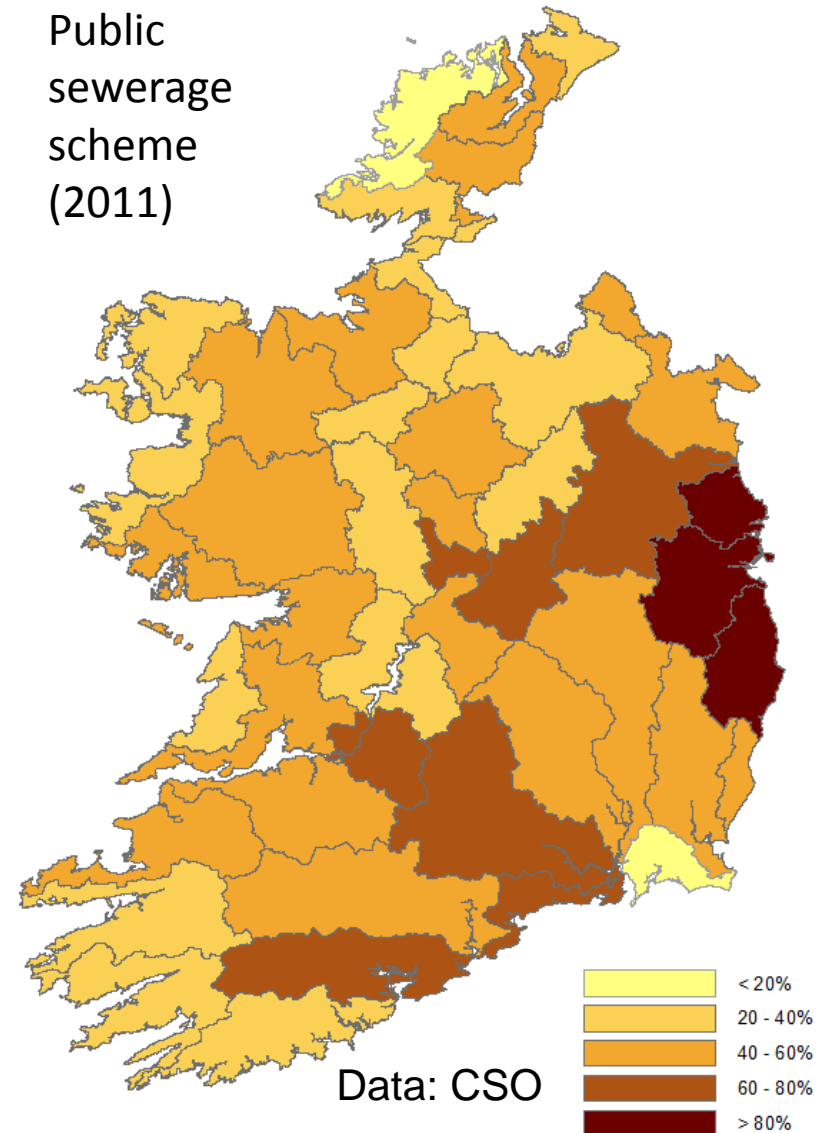


# Mains Water & Waste Water % of Households in Catchment

Public mains  
water supply  
(2011)



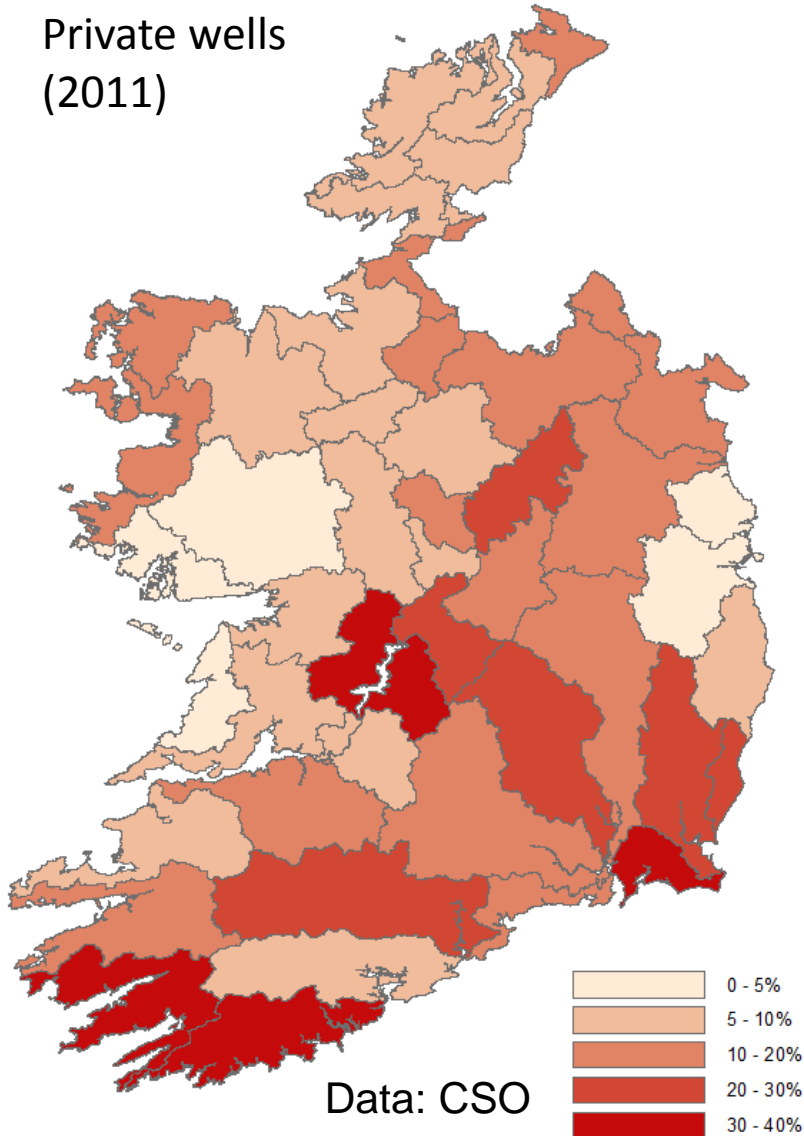
Public  
sewerage  
scheme  
(2011)



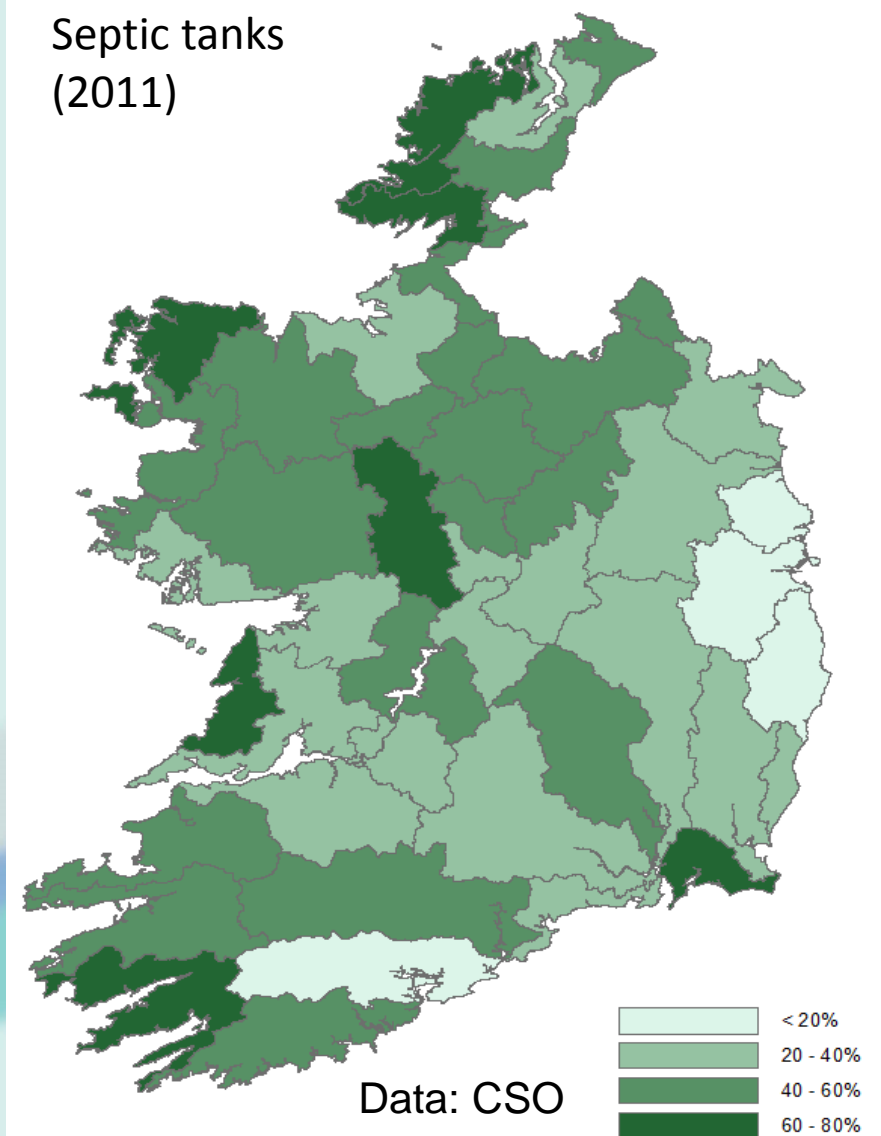


# Private Wells & Septic Tanks % of Households in Catchment

Private wells  
(2011)



Septic tanks  
(2011)

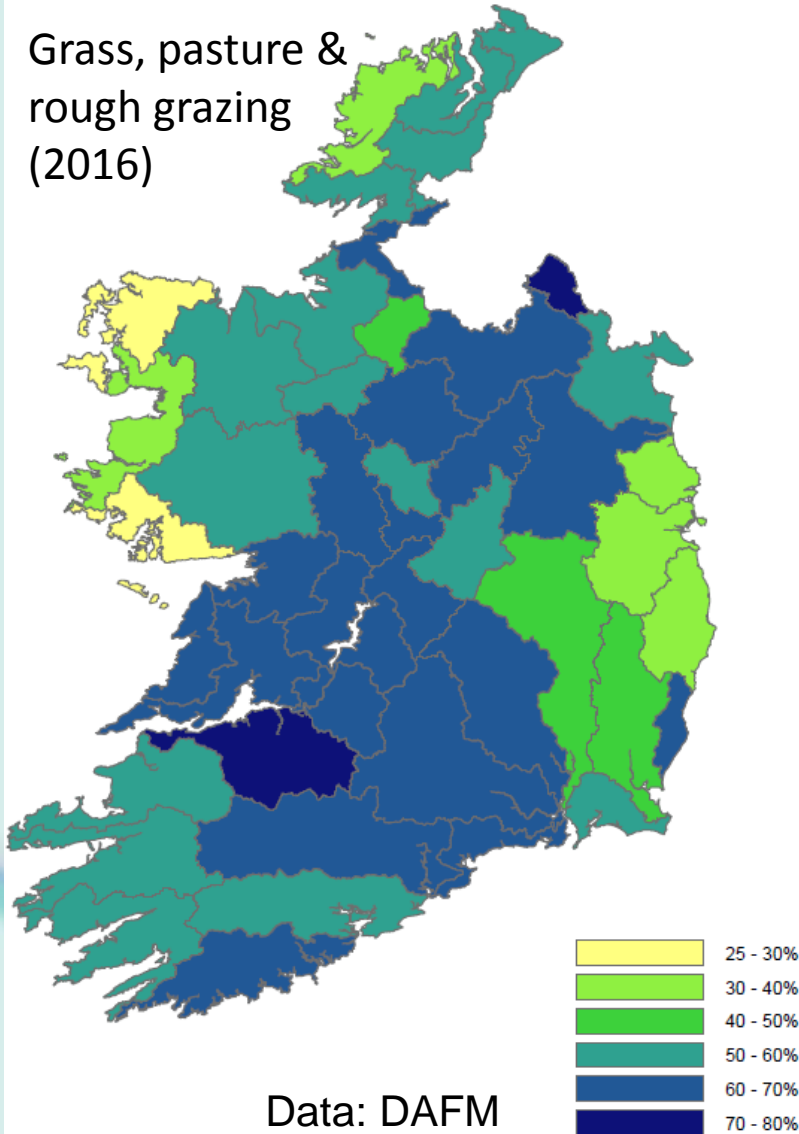




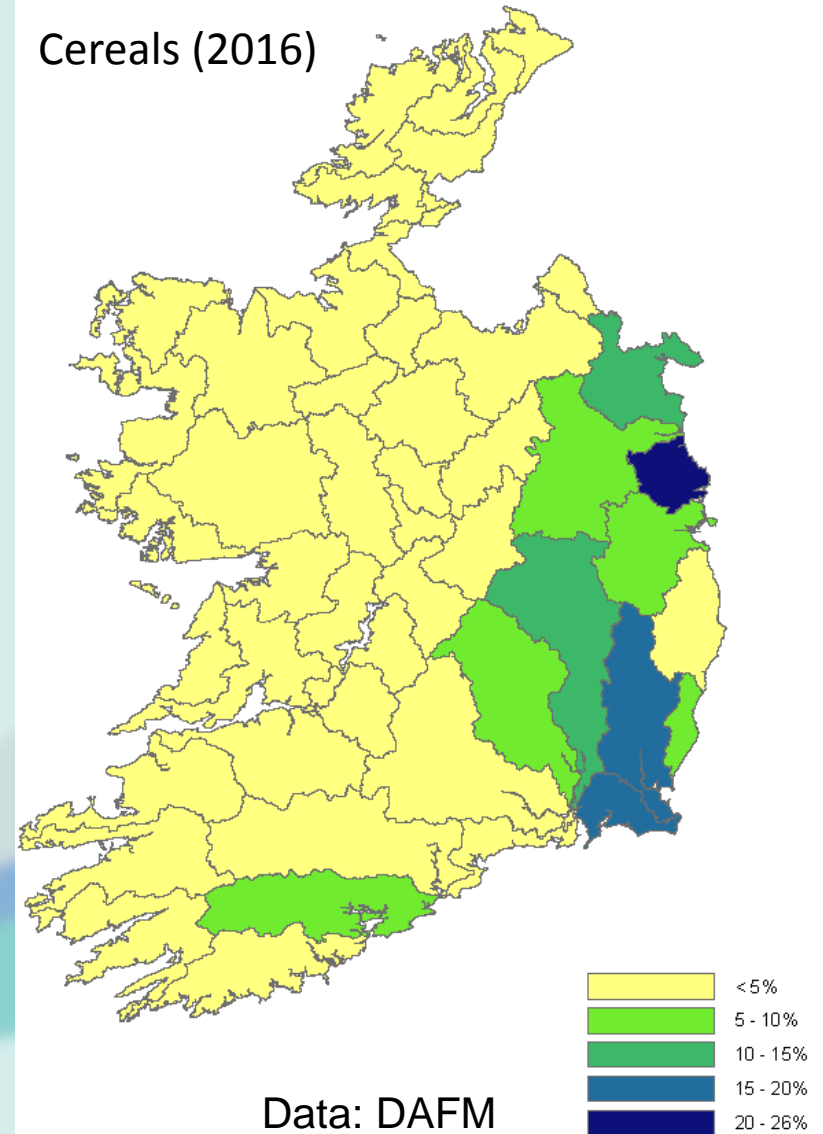


# LPIS Land Use Data % of Catchment Area

Grass, pasture &  
rough grazing  
(2016)



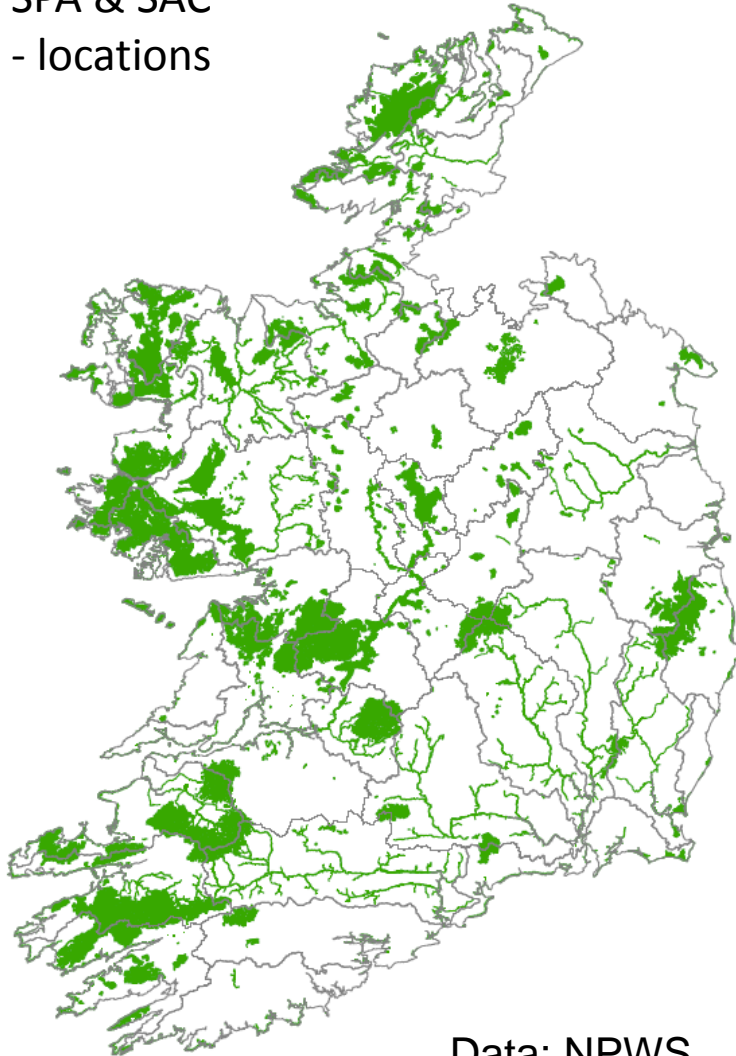
Cereals (2016)





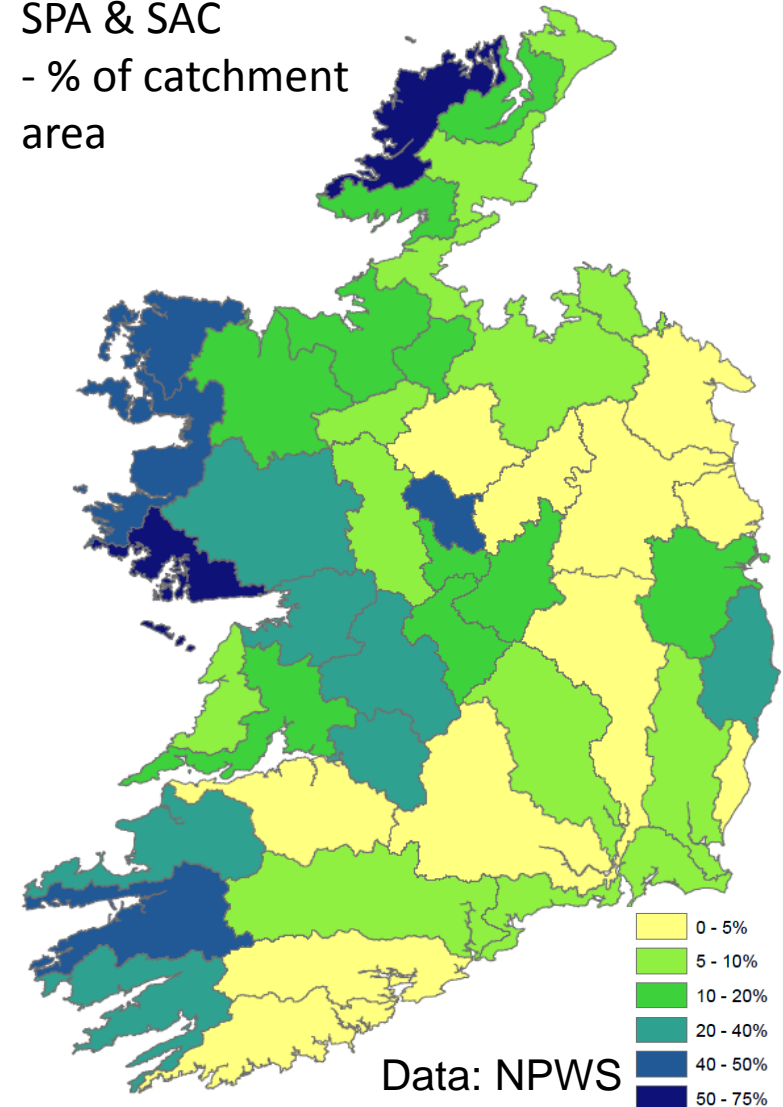
# National Parks and Wildlife Service Protected and Conservation Areas

SPA & SAC  
- locations



Data: NPWS

SPA & SAC  
- % of catchment  
area

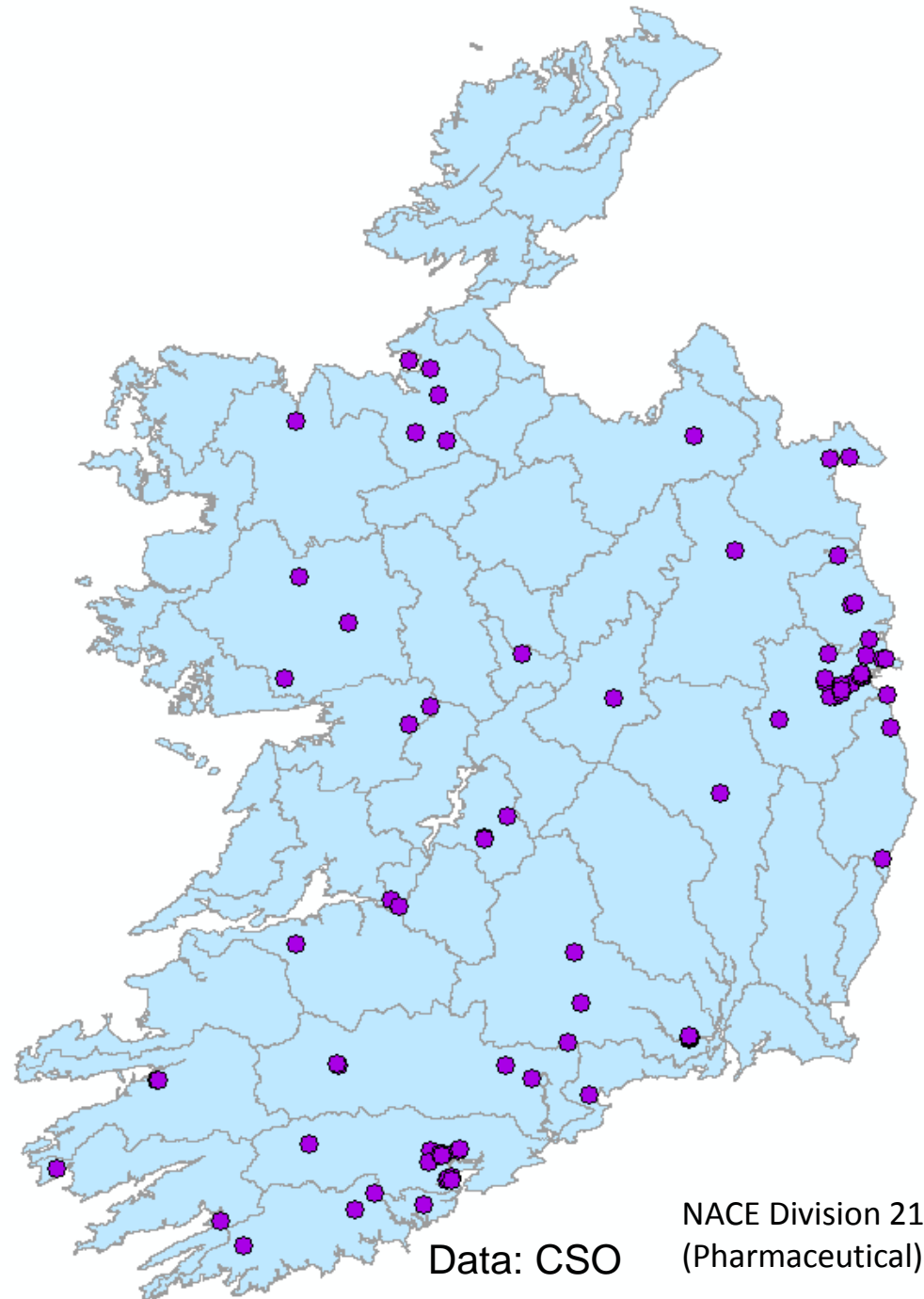


Data: NPWS



# CSO Business Register (2014)

- Location of pharmaceutical enterprises
- Work-in-progress (no X/Y for some enterprises)



NACE Division 21  
(Pharmaceutical)

Data: CSO



# Sample Catchment Characterisation

| River Basin District                            | Eastern                      | South Western                           | Western                 | South Eastern        |
|---|------------------------------|---|-------------------------|----------------------|
| <b>Catchment</b>                                | <b>Liffey and Dublin Bay</b> | <b>Lee Cork Harbour and Youghal Bay</b> | <b>Galway Bay North</b> | <b>Suir</b>          |
| Area (km <sup>2</sup> )                         | 1,623km <sup>2</sup>         | 2,181km <sup>2</sup>                    | 1,017km <sup>2</sup>    | 3,553km <sup>2</sup> |
| Number of dwellings                             | 467,103                      | 121,144                                 | 16,145                  | 69,381               |
| % national total dwellings                      | 28%                          | 7%                                      | 1%                      | 4%                   |
| % households in catchment with                  |                              |   |                         |                      |
| - public mains water supply                     | 91%                          | 83%                                     | 82%                     | 75%                  |
| - private wells                                 | 1%                           | 10%                                     | 2%                      | 10%                  |
| - public sewerage scheme                        | 92%                          | 77%                                     | 57%                     | 61%                  |
| - septic tank                                   | 3%                           | 17%                                     | 35%                     | 32%                  |
| % catchment under grass, pasture, rough grazing | 34%                          | 59%                                     | 26%                     | 62%                  |
| % catchment under cereals                       | 7%                           | 6%                                      | 0%                      | 5%                   |
| % catchment designated as SPA/SAC               | 17%                          | 3%                                      | 73%                     | 4%                   |



# Definition of Natural Capital

... biodiversity, including ecosystems that provide essential goods and services, from fertile soil and multi-functional forests to productive land and seas, from good quality fresh water and clean air to pollination and climate regulation and protection against natural disasters



# EU MAES Project

- EU Mapping and Assessment of Ecosystem Services project (MAES)
- National Parks and Wildlife Service (NPWS) has lead role - CSO asked to assist
- NPWS has established group to map Ireland's terrestrial and marine systems (National Land Cover and Habitat Mapping project)



# Ecosystem Accounts

- Measures depletion and degradation of our natural assets from economic activity
- Concepts and methodologies are still being developed
- MAES project is a step towards compiling ecosystem accounts



# Ecosystem Accounts

- **Assets**
  - extent account (changes in areas)
  - condition account by ecosystem type (biodiversity, carbon, soils, vegetation, water)
  - monetary account (net present value)
- **Services** - physical and monetary supply and use tables
- Compiling ecosystem accounts requires use of very high resolution imagery e.g. 2.5 metres





# Compiling Ecosystem Accounts

- MAES work will develop with bottom-up approach using local area studies
- National level work may require more top-down approach using imagery, aerial photos, and geocoded data
- Need for both approaches during development of methodology



# Conclusions

- CSO needs staff with GIS skills
- Many potential uses for geocoded data in environment-related statistics
- Needs inter-departmental, inter-agency, and subject-matter experts collaboration
- Needs broad range of geocoded microdata
- Need to archive geocoded microdata for long time-series analyses of land cover and land use changes, and pressures from economic and social activity



# Thanks

- Thanks to all data providers
- Thank you for listening