Specific Management and Robust Targeting of Riparian Buffer Zones

Daire Ó hUallacháin

eagasc
Agriculture and Food Development Authority

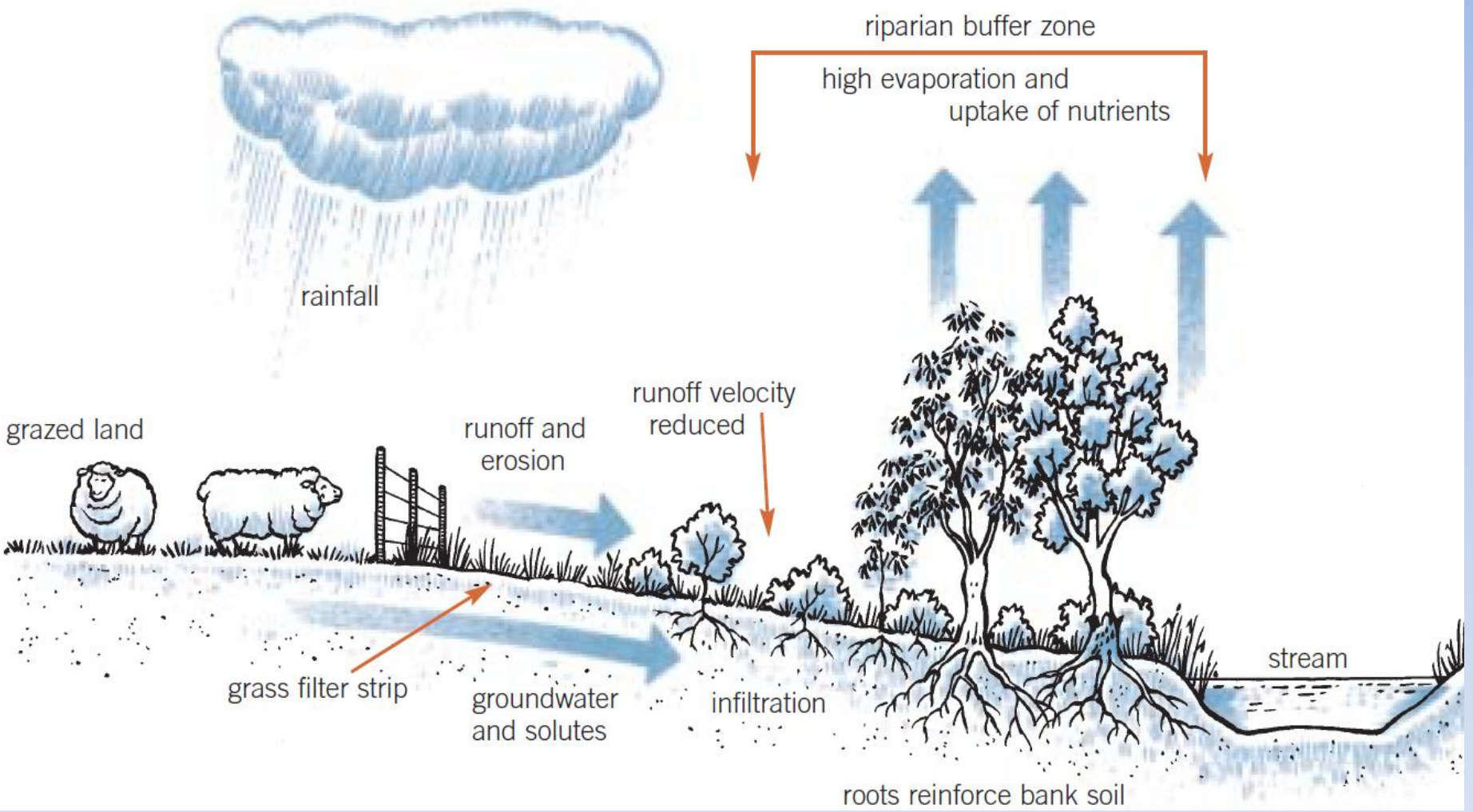
The James Hutton Institute

epa
Environmental Protection Agency

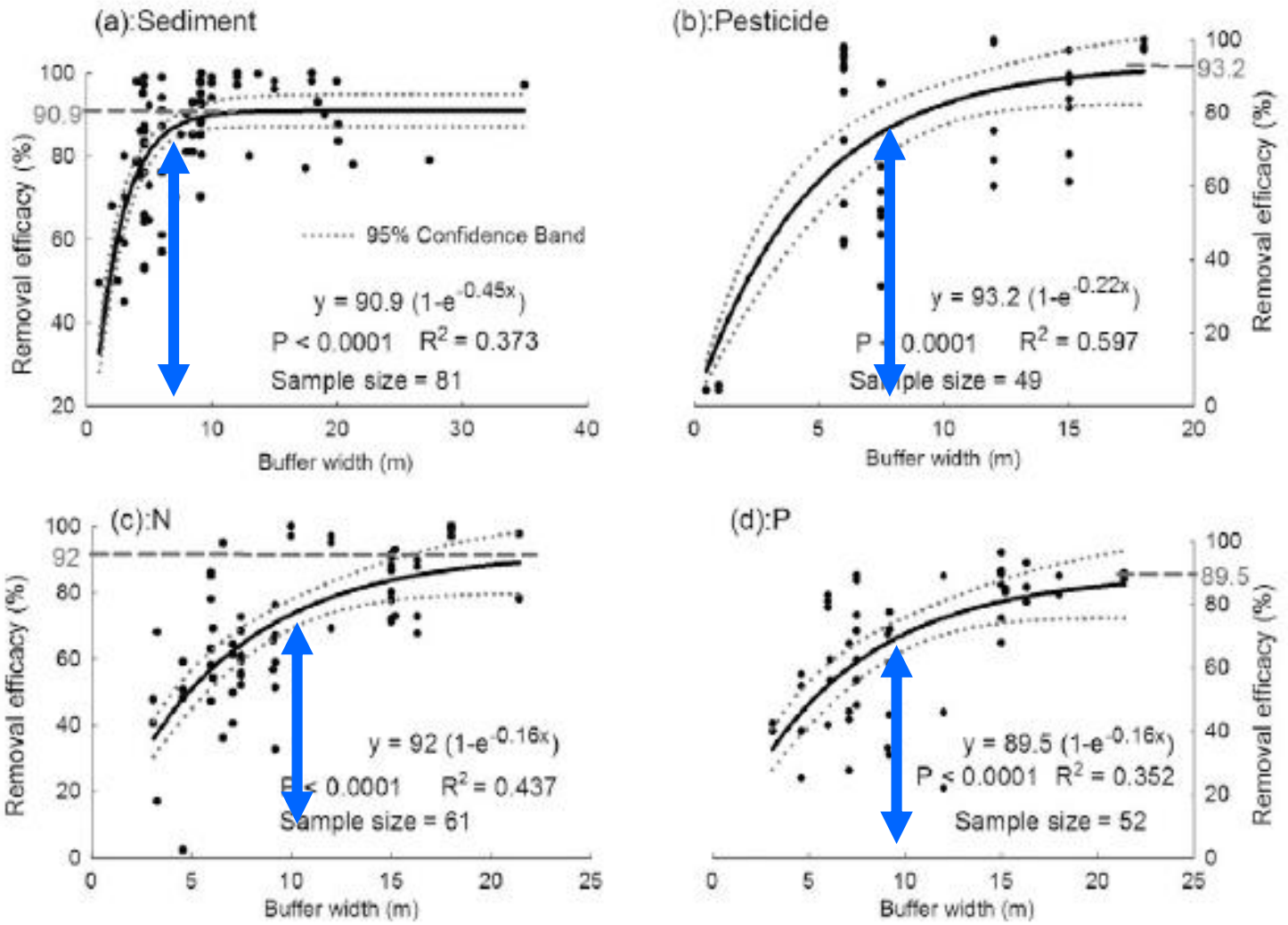
Riparian margins

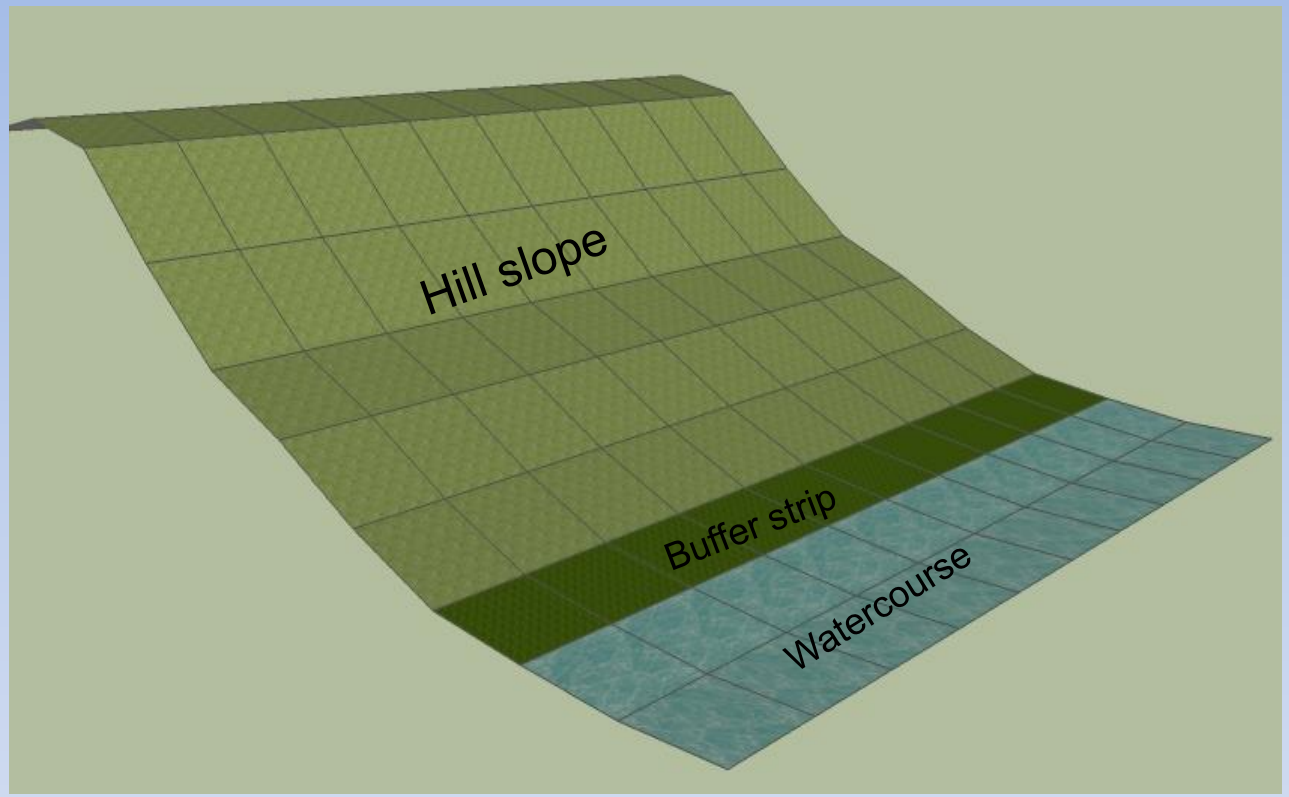
- Bands of land adjacent to water bodies that are planted with permanent vegetation
- Play a significant role in the reduction of diffuse inputs
- Four main processes
  - sedimentation,
  - infiltration,
  - adsorption,
  - dilution.

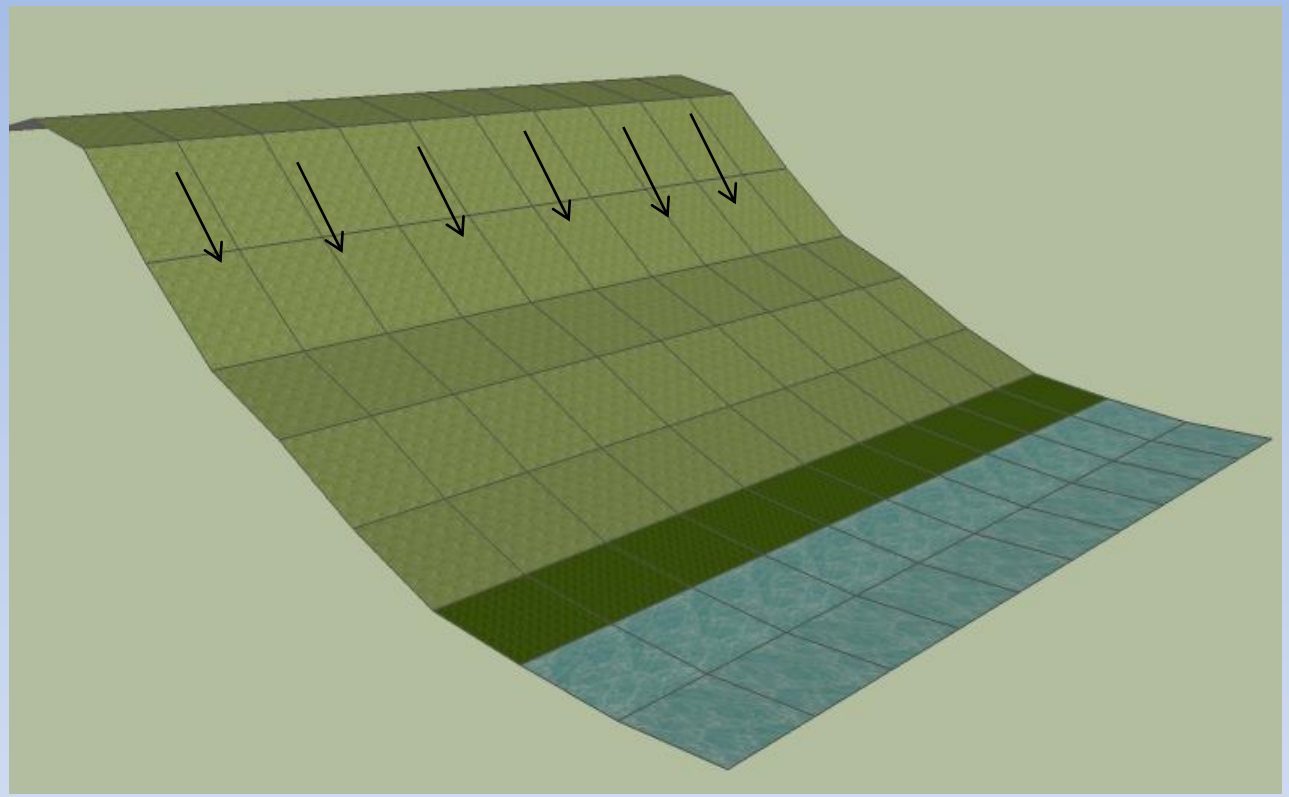
Processes that occur in the riparian zone to improve water quality and stabilise streambanks. Illustration Paul Lennon.

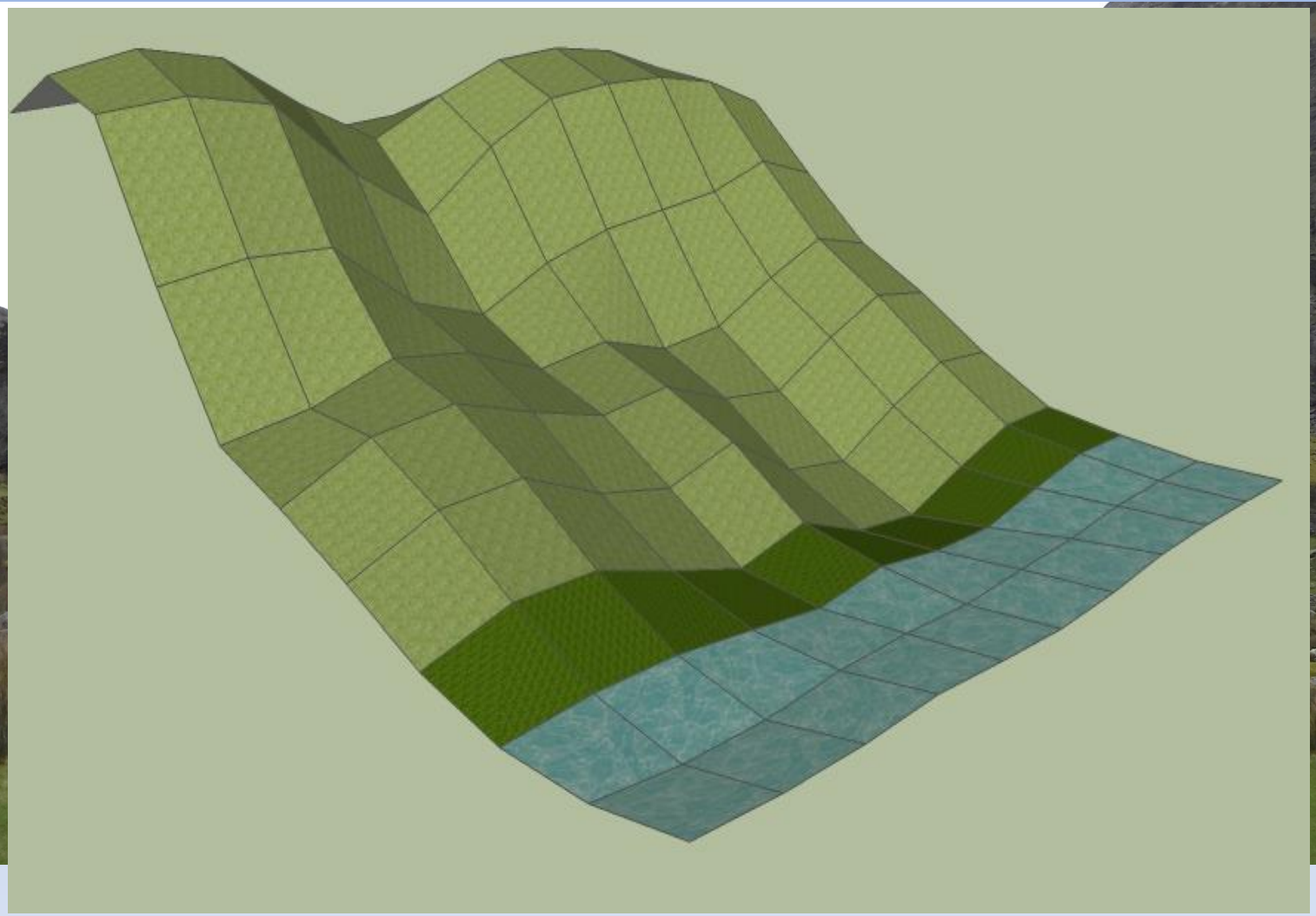


Legislation




Hill slope
Buffer strip
Watercourse





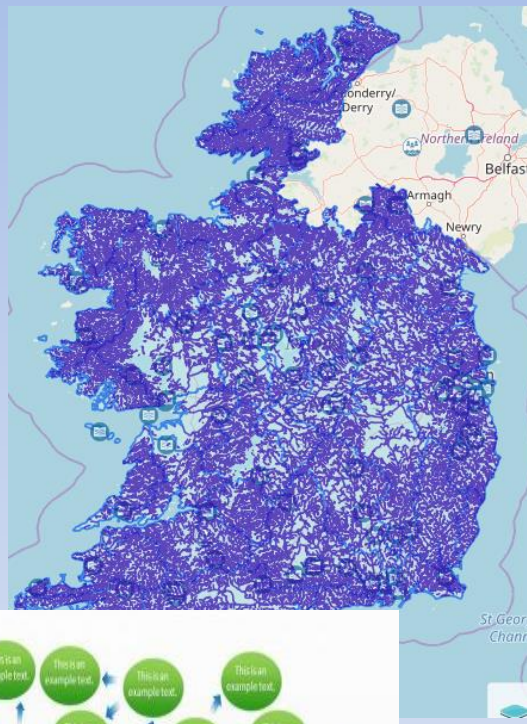
Margin management and design

- GAEC -2m, No fert/pest
- AEOS – Vegetation, No fert/pest, no stock, can mow, GAEC
- GLAS -
  - Rip Margin (3m-30m)- Vegetation, No fert/pest, no stock, mow, GAEC….
    - approx 200 farmers
  - Cattle exclusion (1.5m)- Vegetation, No fert/pest, no stock….
    - 18,000 farmers

Protection of Watercourses from Bovines			€1.50/m/yr
Riparian Margin	a)	3 metre width	€0.90/m/yr
	b)	6 metre width	€1.20/m/yr
	c)	10 metre width	€1.60/m/yr
	d)	30 metre width	€3.60/m/yr

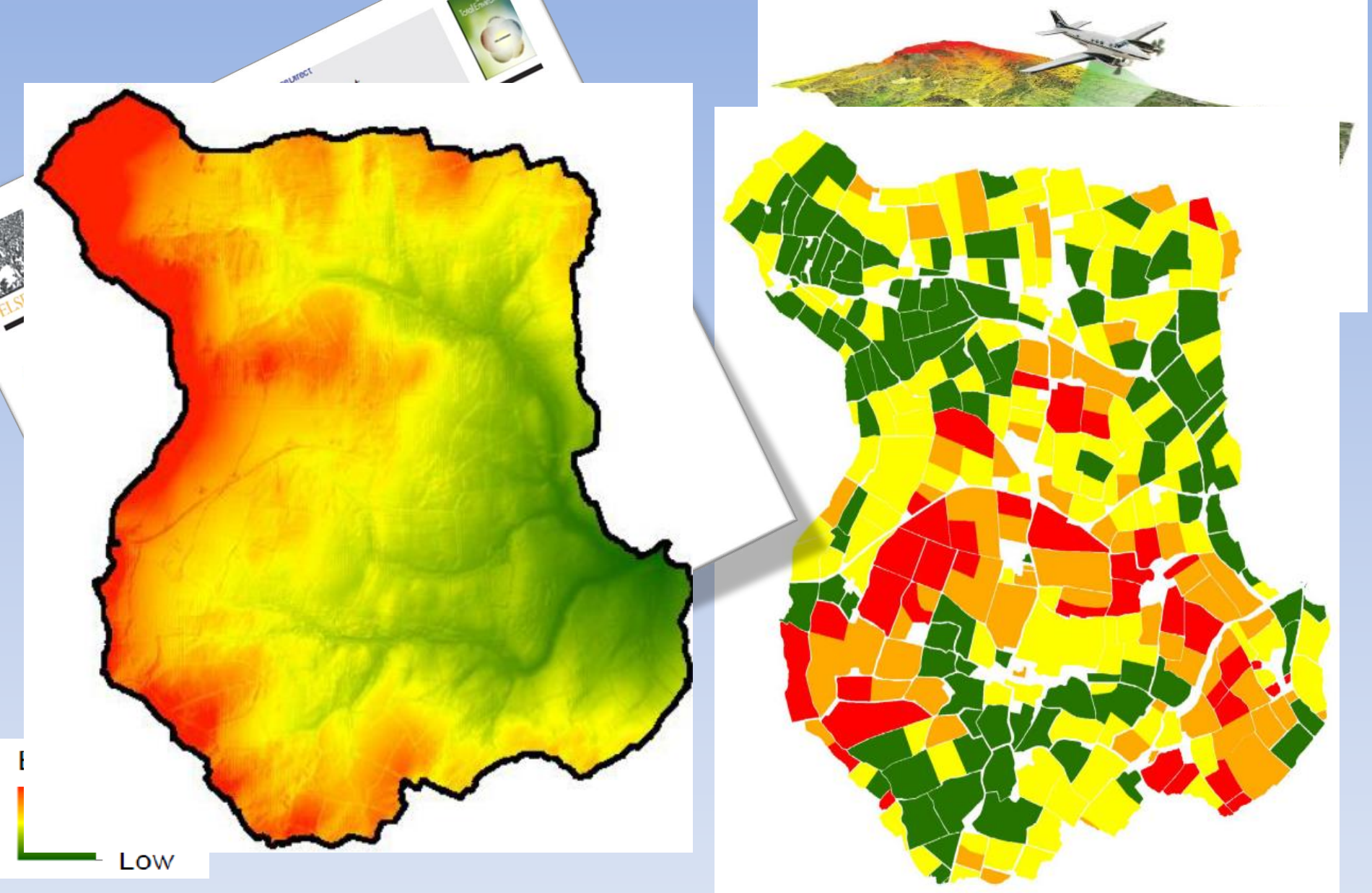
SMARTER_BufferZ

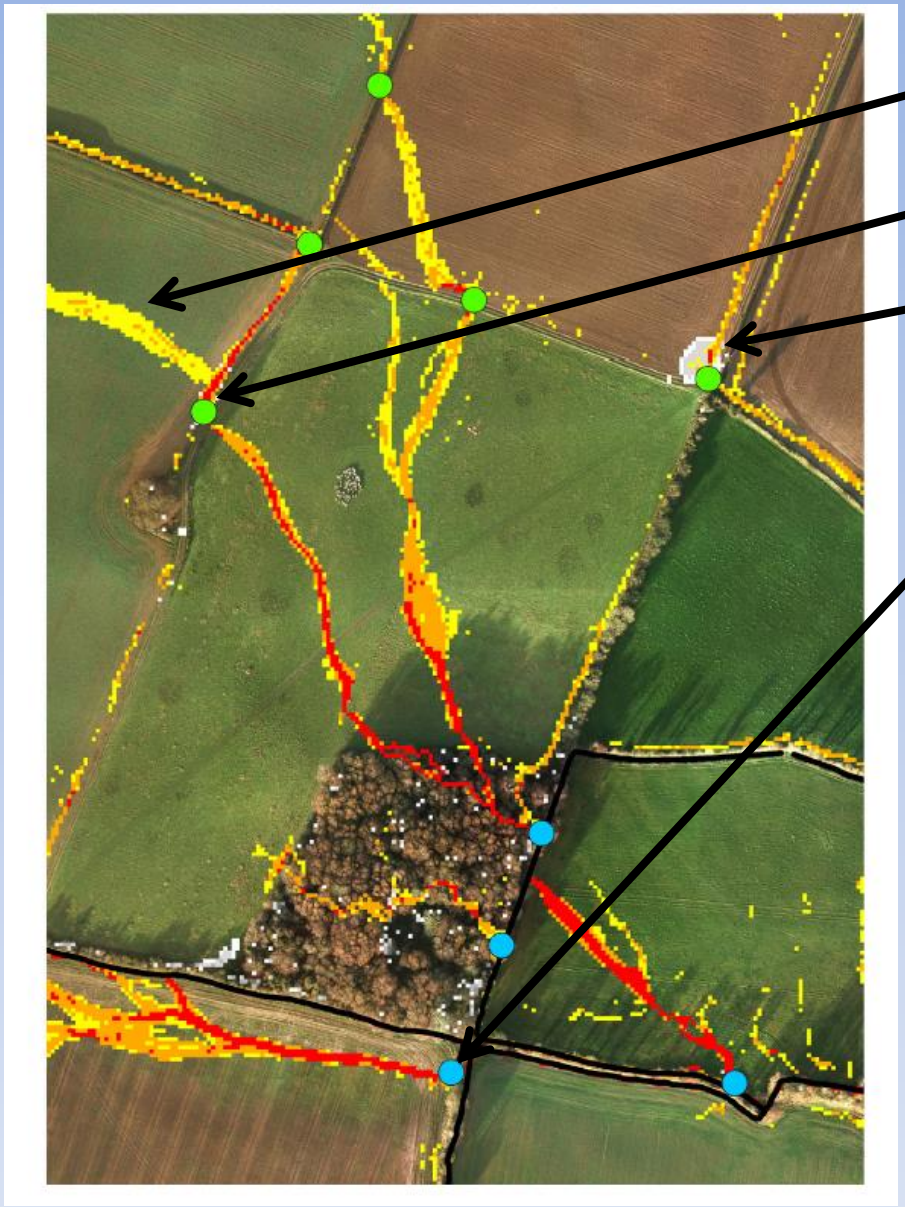
Ensure optimal **targeting** and **management** of riparian **buffers** for the effective management of Irish rivers.



Approach:

- Compile literature on effectiveness and spatial data to guide targeting
- ***Right Place***: Buffer placement within Prioritised Catchments
- ***Right Measure***: Optimise the right buffer for pollution pathways and wider multiple benefits'
- Develop tools to support decision-making on placement, design and maintenance

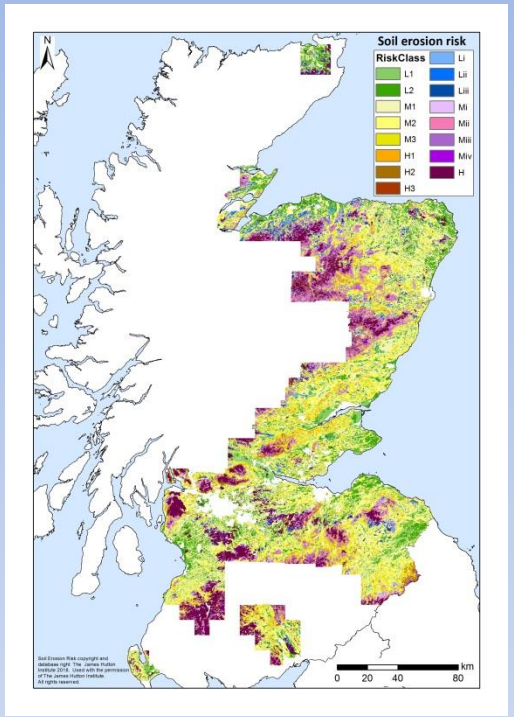

Low



Targeting of riparian margins to ‘Delivery points’ -
Reduction of 89-96% in costs
(compared to blanket implementation)

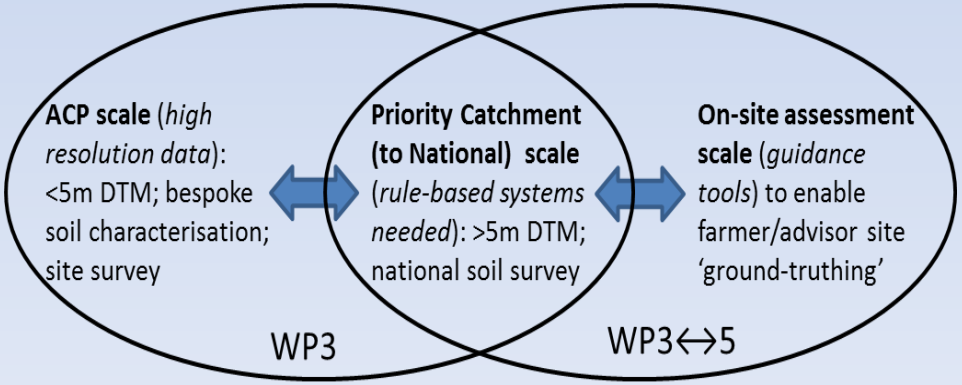
Thomas et al. (2016) *STOTEN*

WP3 - Right Place - Buffer placement within Prioritised Catchments

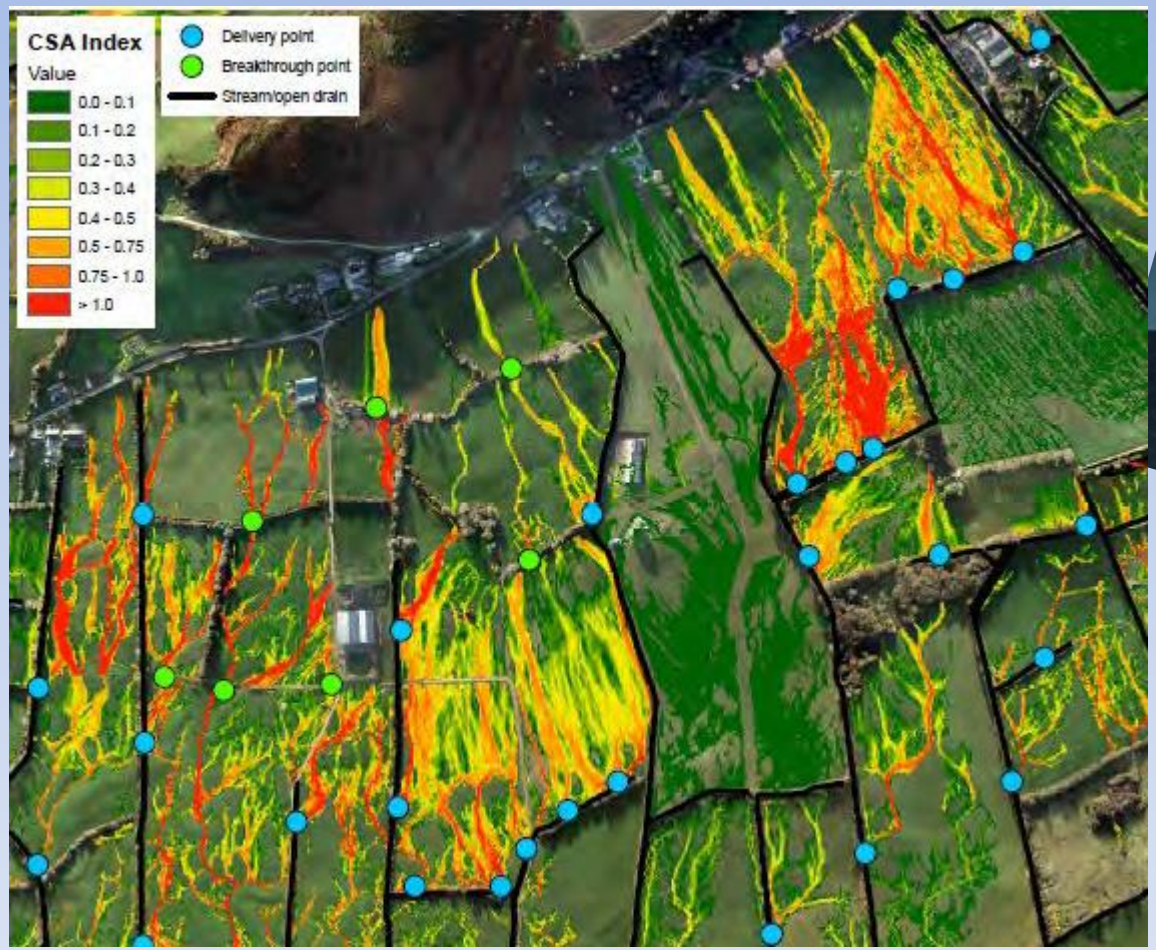


Objectives

- Review landscape factors for siting of riparian buffers
- Buffer placement methods developed for ACP catchments
  - Breakthrough points- Classification
- Risk -impacts tool for a Priority Catchment, then validation on the ACP data-rich catchments –
  - DIFFUSE TOOLS - EPA
- Catchment 'typologies' approach of source-delivery-receptor risk factors



Diffuse tools



Revised WP3

- Combine national datasets (e.g. DiffuseTools) with field-based data (e.g. ACP, new assessments…..others?).
- Characterise
  - Hillslope/pollution pathways
  - Flow path
  - Delivery point

- Role of LAWPRO/ASSAP/others?

SCENARIO 1

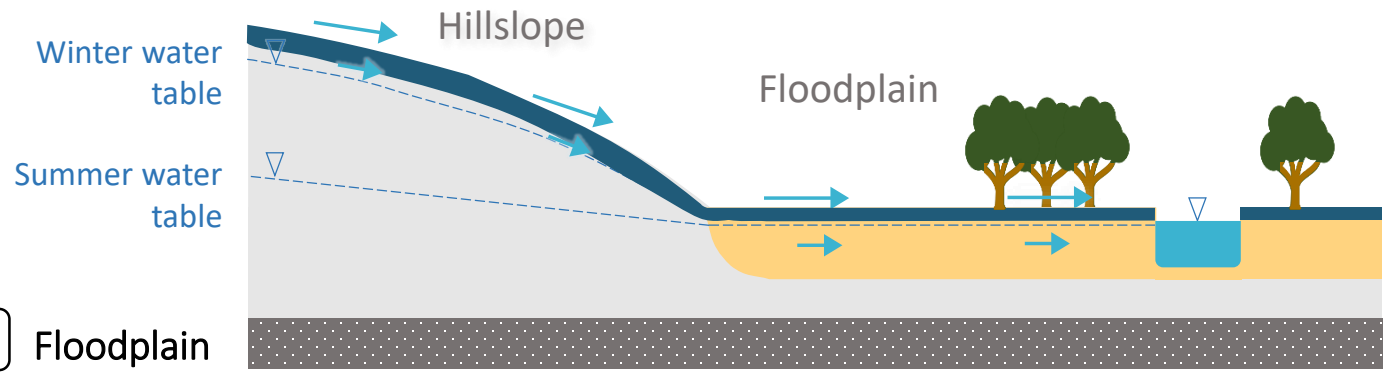
Poorly draining soil and low permeability subsoil

Scenario description

- Main pathways: overland and near surface.
- Vertical pathway: insignificant.
- Bypassing of the floodplain can occur in ditches/small watercourses.
- Main significant issues: PO_4, TP and sediment.

Legend

- Poorly draining alluvium
- Poorly draining soil
- Low permeability subsoil
- Bedrock
- River/Stream
- Flowpaths
- Critical Source Area (CSA)
- Delivery Flowpaths in CSA



1a Floodplain

SCENARIO 2

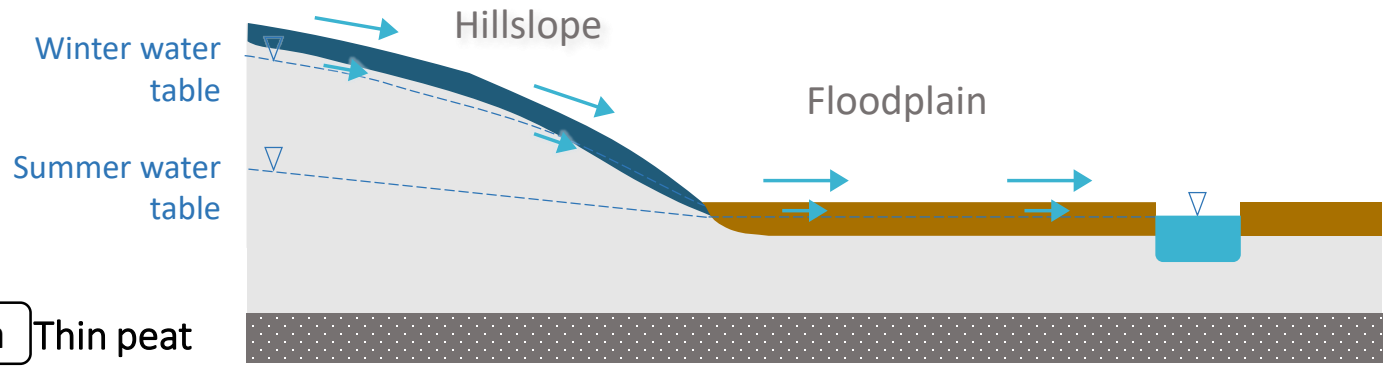
Poorly draining soil and low permeability subsoil with peat in floodplain

Scenario description

- Main pathways: overland and near surface.
- Vertical pathway: insignificant.
- Bypassing of the floodplain can occur in ditches/small watercourses.
- Main significant issues: NH_4, sediment and, potentially, PO_4.

Legend

- Peaty soil on peat
- Poorly draining soil
- Low permeability subsoil
- Bedrock
- River/Stream
- Flowpaths
- Critical Source Area (CSA)
- Delivery Flowpaths in CSA



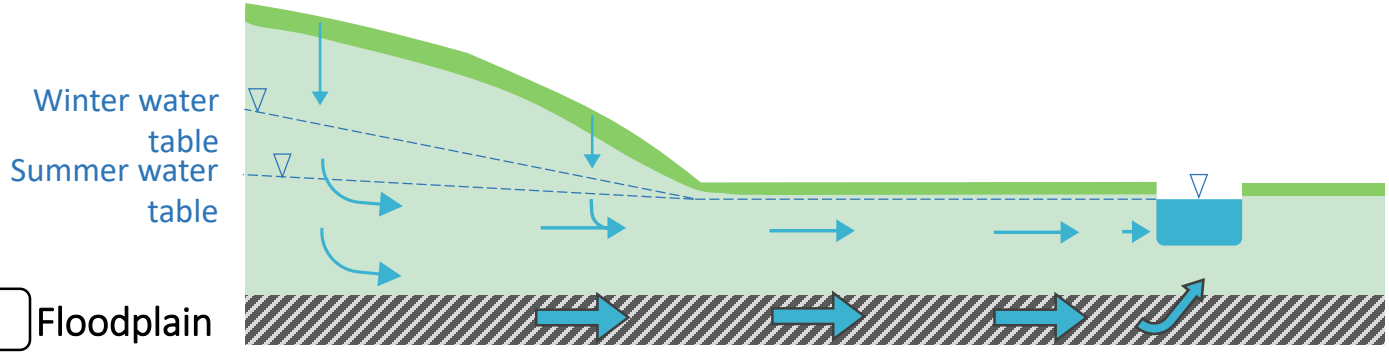
2a Thin peat

SCENARIO 3

Freely draining soil, moderate permeability subsoil and permeable bedrock

Scenario description

- Main pathways: vertical to water table and then horizontal towards the river in subsoil and bedrock.
- In some circumstances, there may be poor draining soils in the floodplain.
- Main significant issue: NO_3.

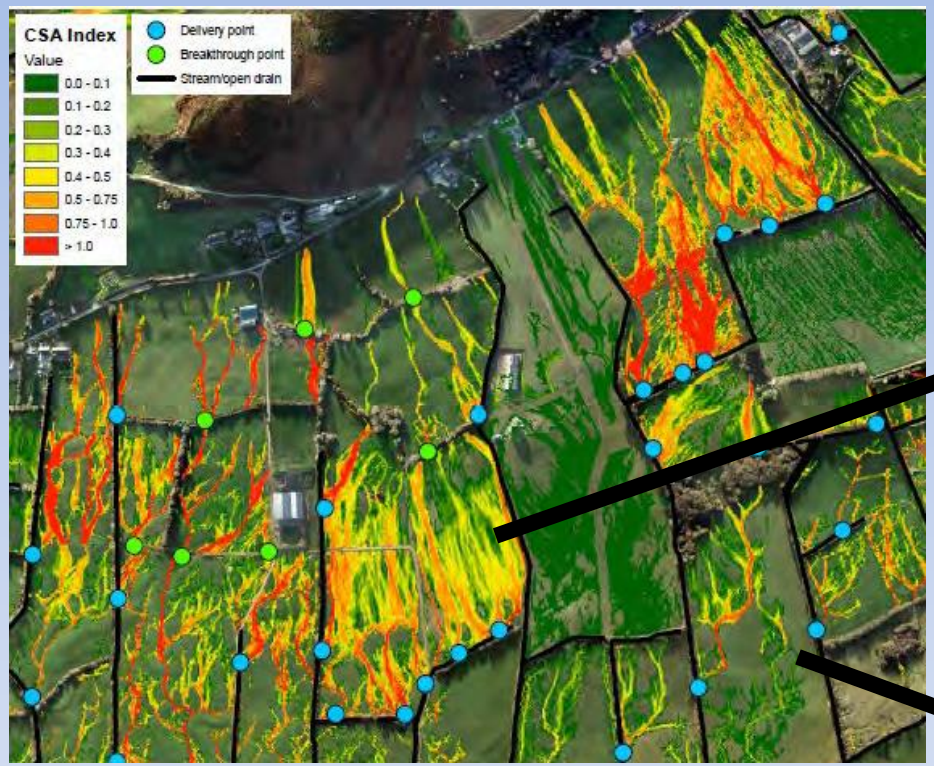


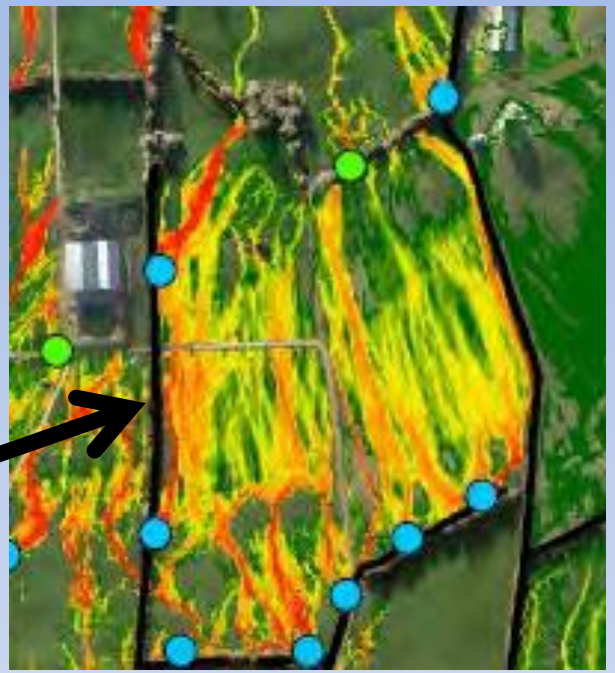
3a Floodplain

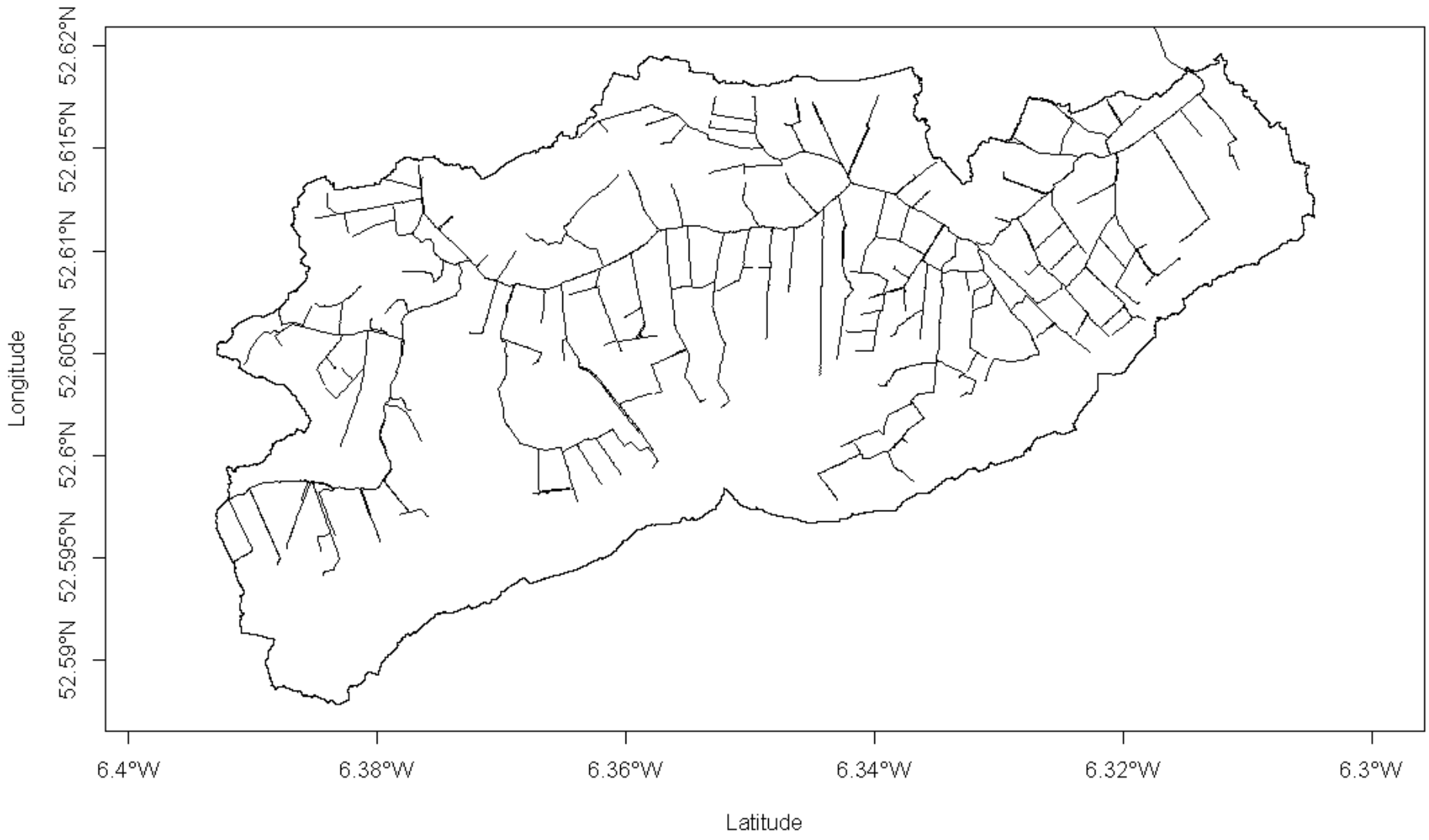
Legend

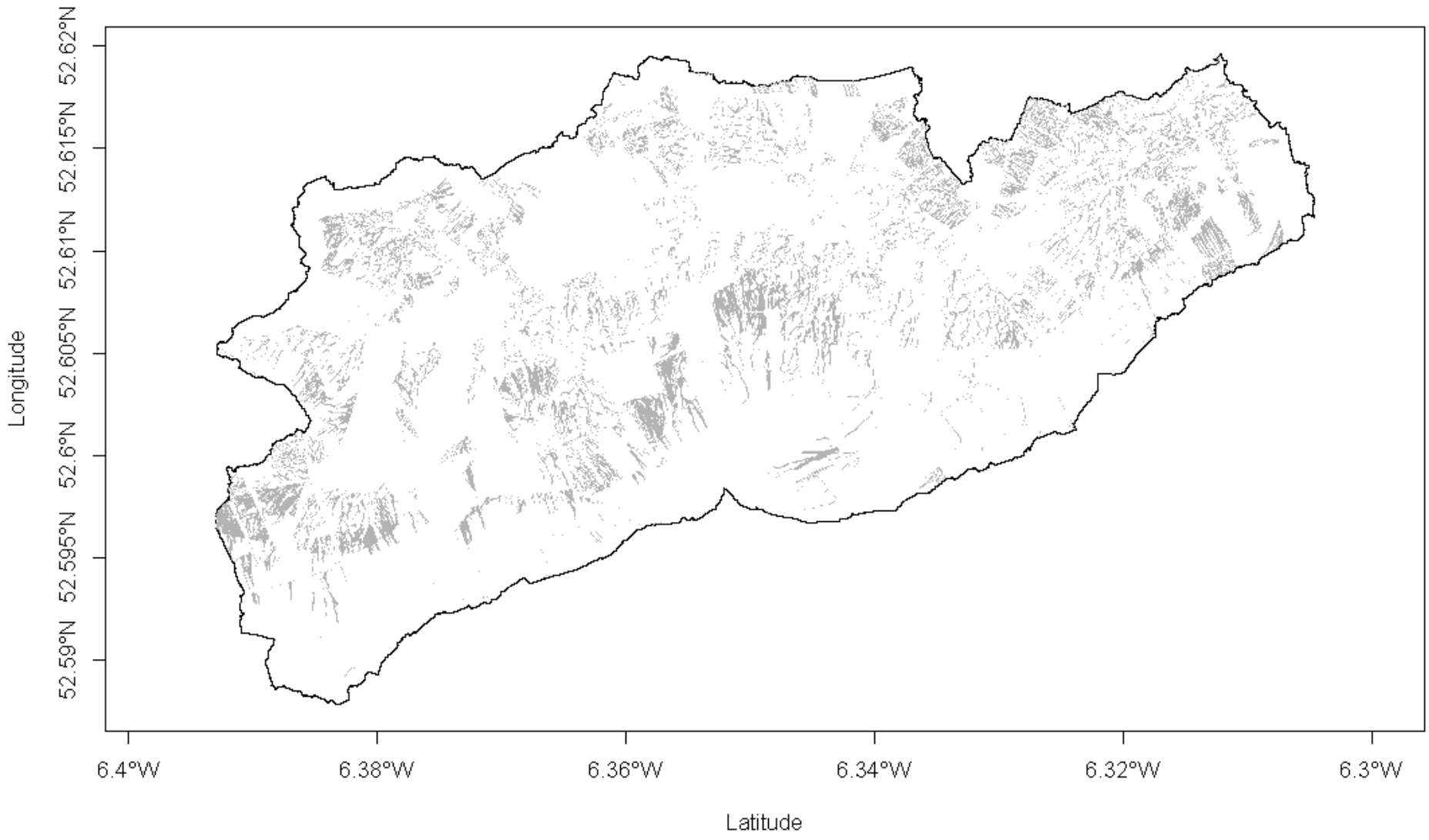
- Freely draining soil
- Poorly draining soil
- Moderate/high permeability subsoil
- Permeable bedrock
- River/Stream
- Flowpaths
- Dominant flowpaths

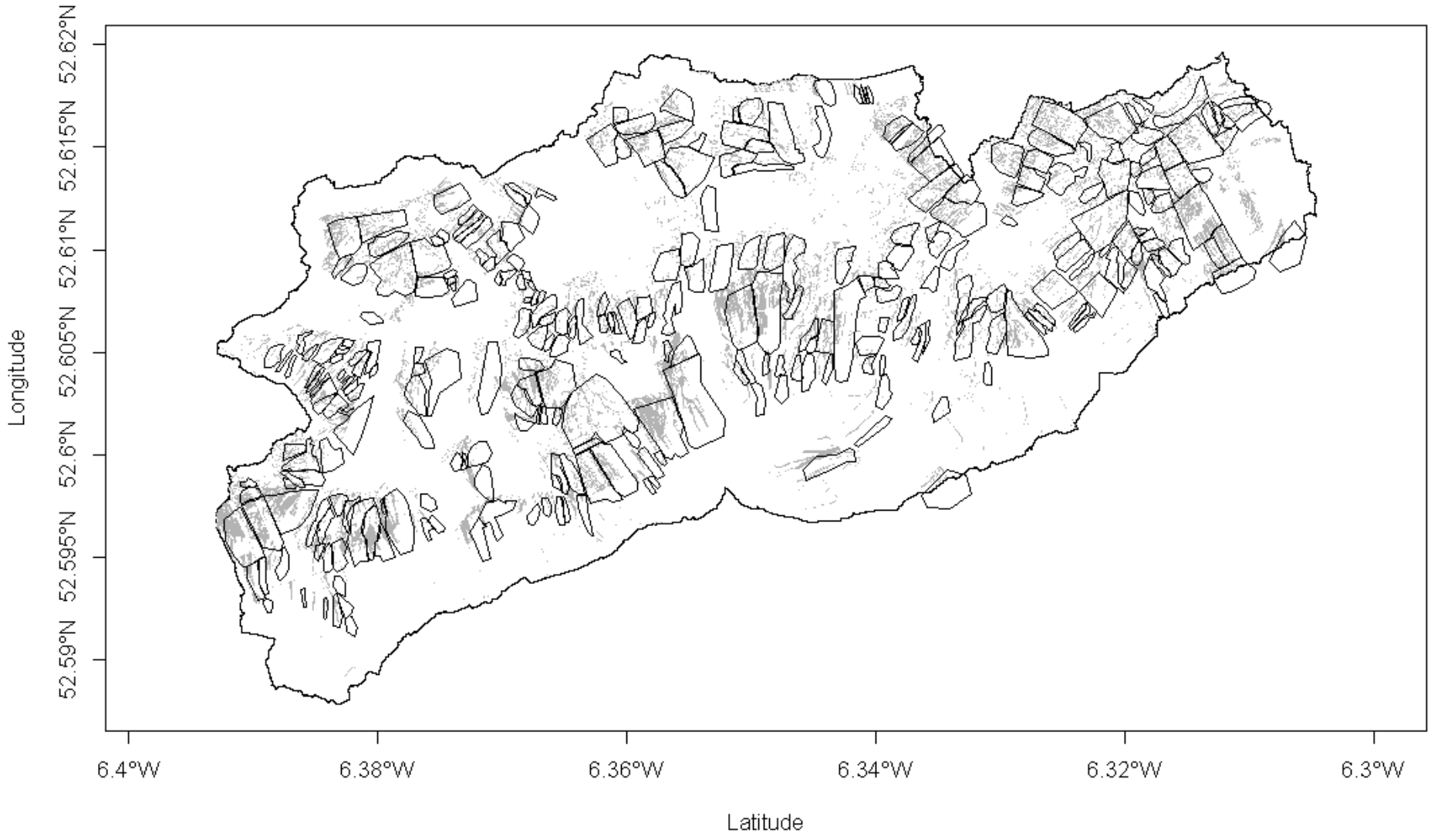
Characterise Flowpaths



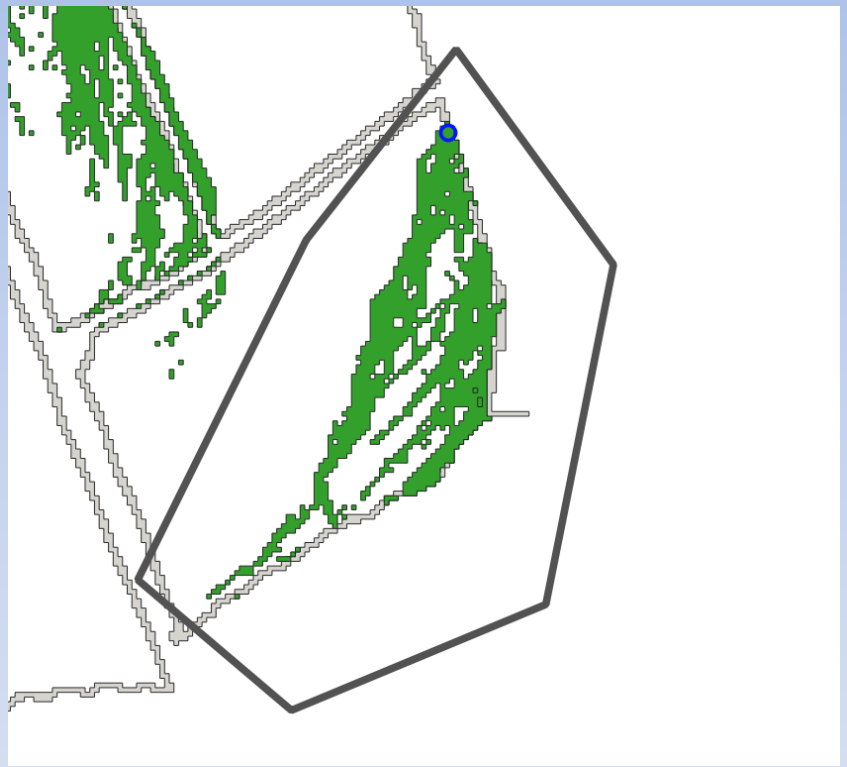


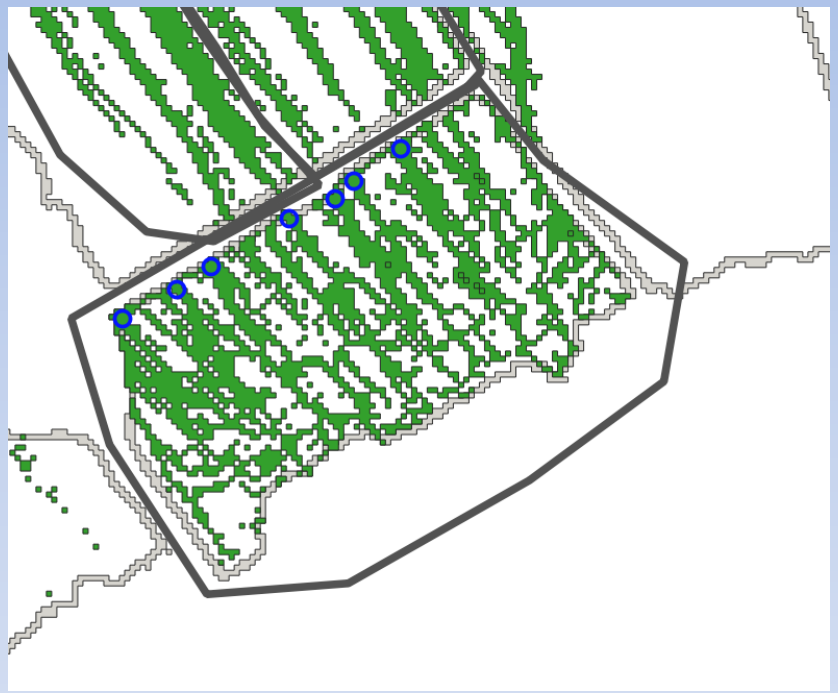

Longitude
52.62°N
52.615°N
52.61°N
52.605°N
52.6°N
52.595°N
52.59°N
6.4°W
6.38°W
6.36°W
6.34°W
6.32°W
6.3°W
Latitude

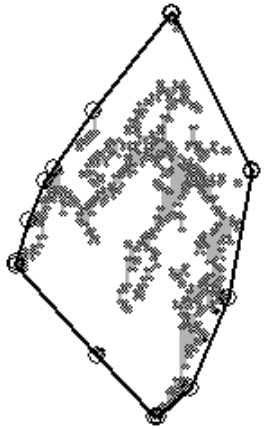
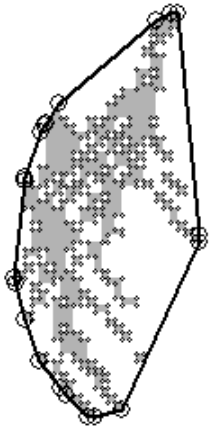
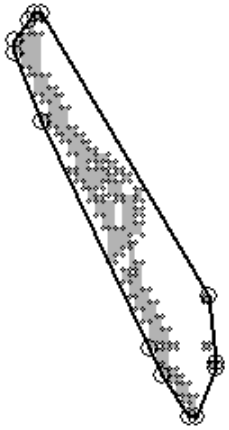
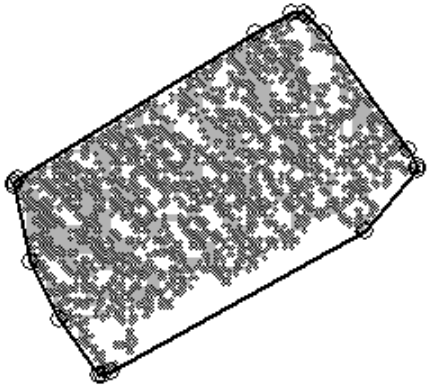
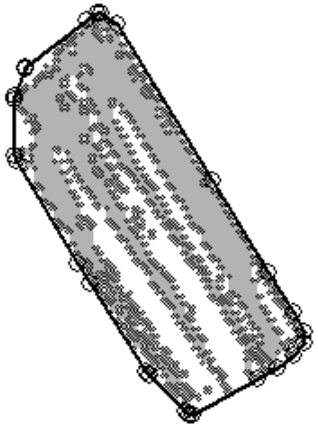

Longitude
52.62°N
52.615°N
52.61°N
52.605°N
52.6°N
52.595°N
52.59°N
6.4°W
6.38°W
6.36°W
6.34°W
6.32°W
6.3°W
Latitude

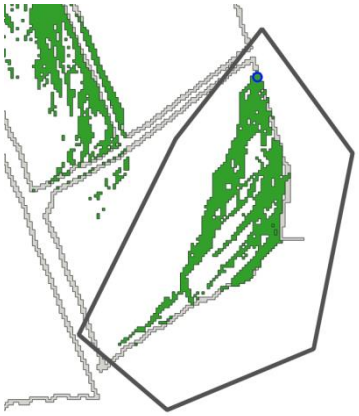
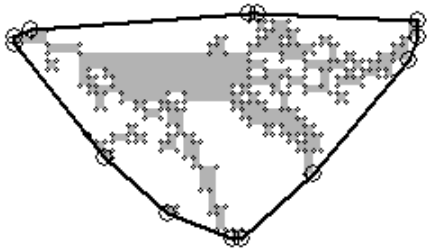

Longitude
52.62°N
52.615°N
52.61°N
52.605°N
52.6°N
52.595°N
52.59°N
6.4°W
6.38°W
6.36°W
6.34°W
6.32°W
6.3°W
Latitude

Two more examples……

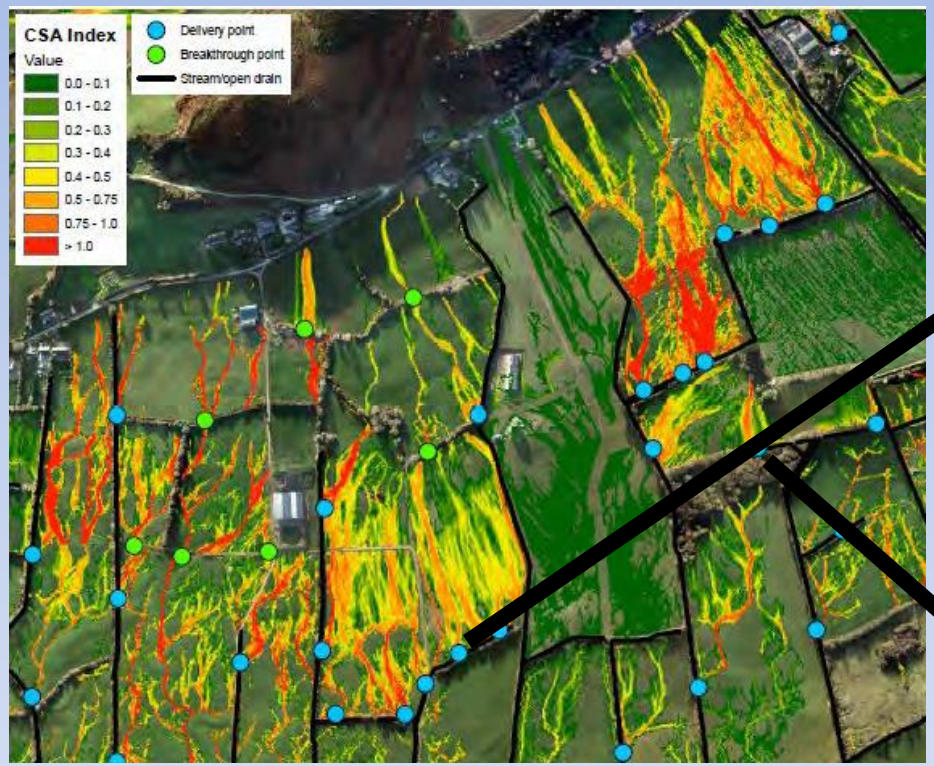




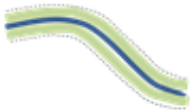
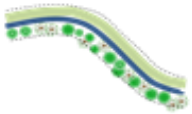
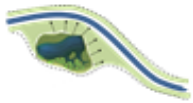
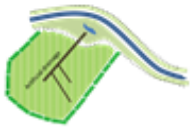
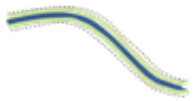
Characterise delivery points

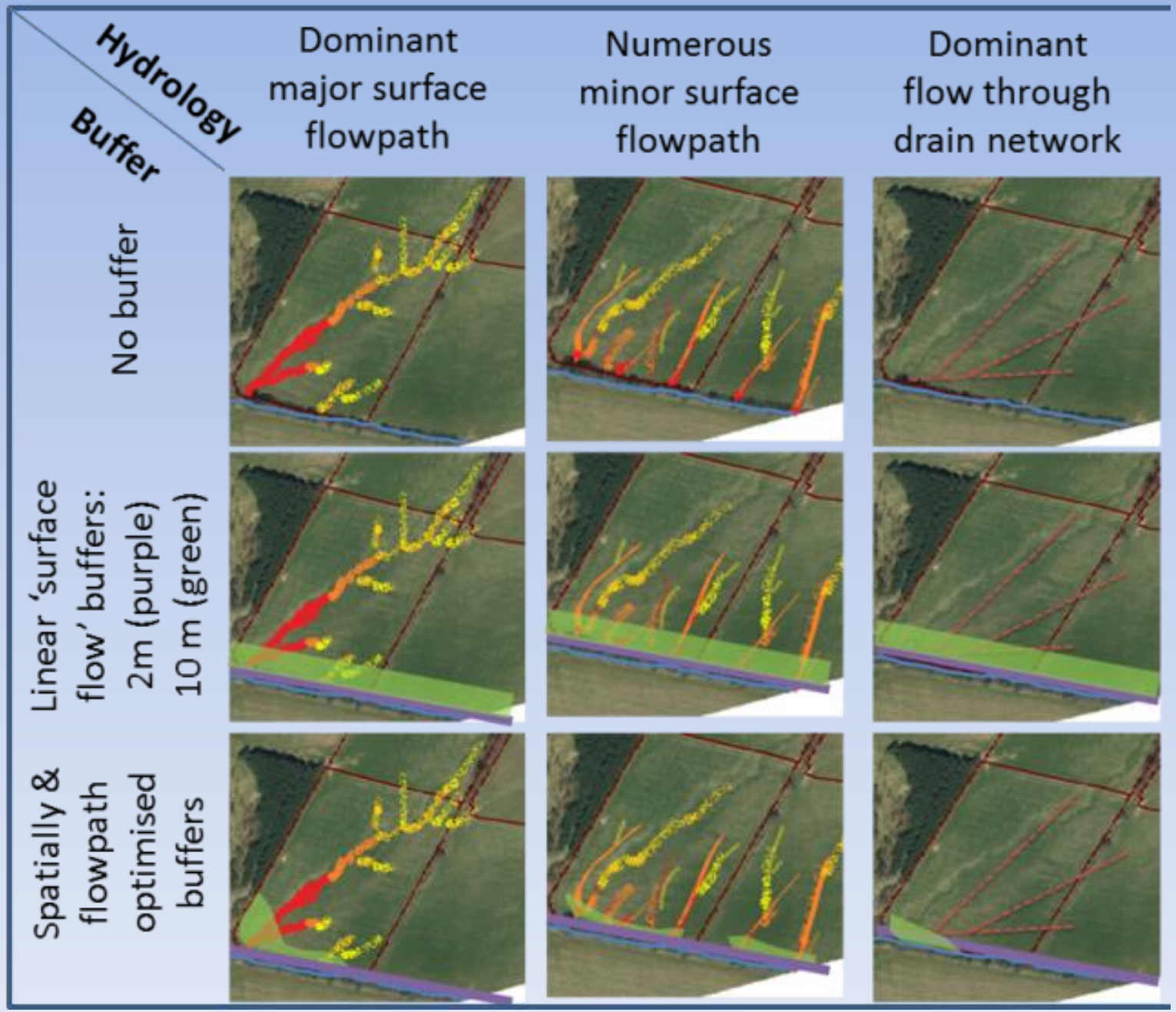


WP4 - Right Measure: Optimising the right buffer for the risk situation

Objectives

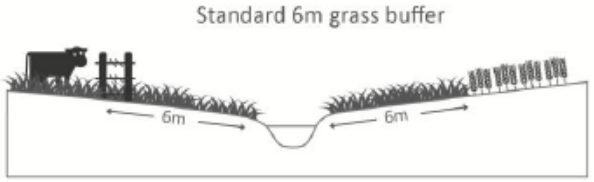
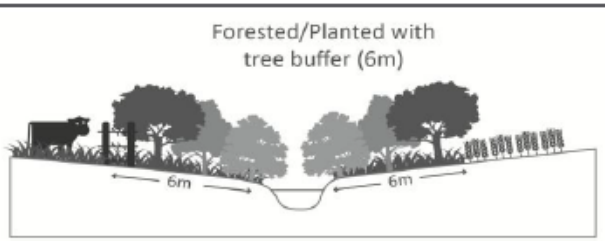
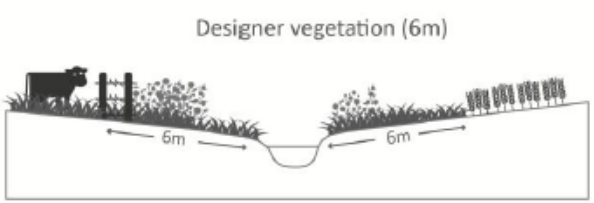
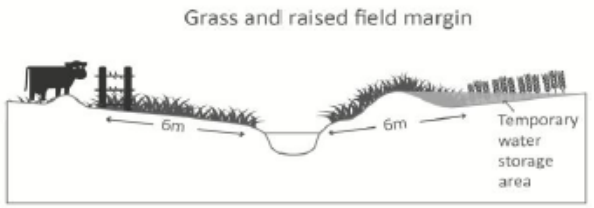
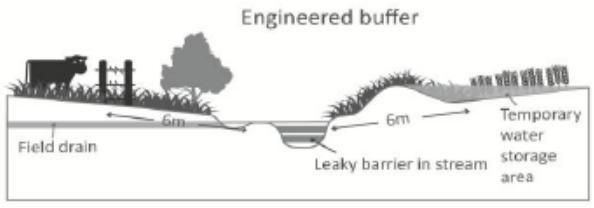
- Effectiveness review: detailed for P, N and SS.
- Evidence for varying buffer P mitigation across a matrix of differing buffer designs in interaction with different landscape.
- ACP + other data used to quantify P delivery mitigation scenarios for the different buffer design/landscape combinations.
- Model in a number of AforA

Mitigation action	Diagrammatic representation		Mode of action
	Cross section	Aerial view	
Linear grass buffer strip over all field edges bordering a watercourse			Sets back agricultural activities with a linear strip that is enhanced over the regulatory minimum width. *Provides*: moderate erosion interception, limited habitat improvement, no interception of subsurface pathways
Linear buffer strip with managed vegetation			Trees or wildflower specific seed mixes planted. *Provides*: Enhanced habitat benefits and tree roots and canopy intercept subsurface and aerial pollutant pathways.
Targeted denitrification buffer zone protecting areas of groundwater upwelling			Buffer widths are maximised at key locations of upwelling groundwater (and minimised elsewhere). *Provides*: Denitrification is locally encouraged by letting water pass slowly through saturated soils where organic matter contents are large.
Targeted grass erosion buffer zone at surface runoff delivery points			Buffer widths are maximised at key locations of erosion delivery to the channel (and minimised elsewhere). *Provides*: A widened grass filter strip capable of trapping moderate erosion at delivery hot-spots.
Targeted erosion buffer zone with erosion traps (sculpted ground)			Widened buffer areas contain engineered sediment traps at erosion hot-spots (widths minimised elsewhere). *Provides*: Sculpted ground (bunds) and leaky barriers provide more certain functioning for erosion control at challenging delivery locations.
Targeted buffer zone with actions to intercept subsurface artificial soil drains			Widened buffer widths contain approaches to intercept subsurface tile drains (widths minimised elsewhere). *Provides*: A range of solutions (mini-wetlands, ability to irrigate drain water onto topsoils) that tackle major preferential subsurface pathways
Do only the regulatory minimum			The minimum mandatory widths of no cultivation and no spread zones for slurry/manure are applied.


Hydrology
Buffer
Dominant major surface flowpath
Numerous minor surface flowpath
Dominant flow through drain network
No buffer
Linear 'surface flow' buffers: 2m (purple) 10 m (green)
Spatially & flowpath optimised buffers

5 measures packages based on a 6 m margin

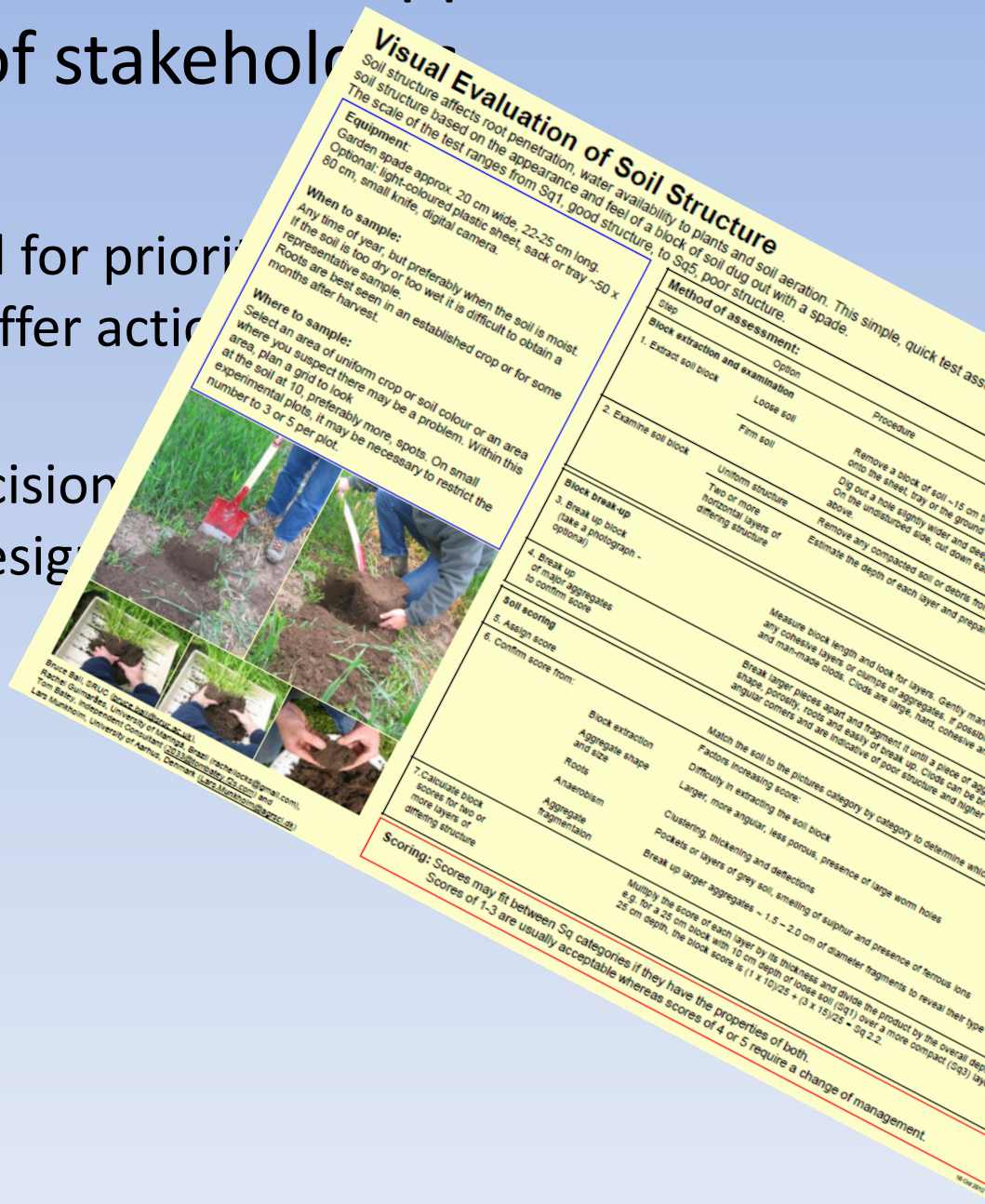
The James Hutton Institute

Package	Schematic	Cost & effort	Acceptance	Specific aspects
Vegetated Buffer				Commonly adopted, familiar measure for basic set of outcomes
Wooded Buffer				Acceptable, benefits for C, biodiversity, airborne spray drift, deep rooting to GW
Designer vegetation				Specific biodiversity goals, pollinator habitat, can use nutrient mining plants
Raised field margin				Raised ground for more extreme erosion control, fine particles, flood benefits
Engineered buffer				Specific options to tackle drains and bring wetness diversity. Includes margin and cross-ditch measures

WP5 – Development of Decision Support Tools for a variety of stakehol

Objectives

- Develop a screening level tool for priori
  opportunities mapping for buffer acti
  to catchment scales
- Develop a local scorecard/decision
  for local constraints, buffer desig
  prescriptions
- Tools
  - Buffer demonstration
  - Interactive web resource
  - Lessons learnt
  - Best practice.



Buffer Demonstration

- Link with ongoing/future work
  - EIPs
  - LIFE sites
  - Blue Dot sites
  - Teagasc Farms in AforA
  - Other projects - SlowWater
  - ASSAP/LAWPRO sites?

Web resources + Dissemination

- www.smarterbufferz.ie
- @smarter_bufferz

Lessons learned + Best practice

Lessons learned

Best practice

Novel solutions

Engagement with LAWPRO& ASSAP +

- Recommending potential trial/ demonstration catchments
- Interaction with existing data for trial catchments
  - Potential for additional data collection by field officers?
- Development of scorecards
- Dissemination
  - Collation of best practice
- ASSAP + LAWPRO suggestions?

Policy

Advisory

Agriculture

Research

Farmers

Local authorities

Water managers

NGOs

THANK YOU

Daire.ohuallachain@teagasc.ie

Simon.parker@teagasc.ie

Model Catchments

	Poorly drained	Well drained
Agricultural Catchments Programme	• Owenavorragh (Ballycanew - ACP)	• Lough Mask and Carra (?) (Cregduff-ACP)
Teagasc Farm in catchment	• Annalee (Teagasc Ballyhaise)	• Dead and Cauteen (Teagasc Solohead) • Clonakilty (Teagasc Clonakilty)
EIP/LIFE	• Upper Caragh (KerryLIFE; Freshwater Pearl Mussel EIP)	• Glenaboy (BRIDE EIP) • Bannow (Duncannon EIP)
Natura2000	• Upper Caragh (Caragh River Catchment SAC) • Annalee (Ballyhaise) (Lough Oughter SAC)	• Clonakilty (Clonakilty) (Clonakilty SAC) • Glenaboy • Bannow (Bannon Bay SPA Hook Head SAC • Lough Mask and Carra Mweelrea SAC/ Lough Mask SPA
LAWPRO/ ASSAP suggestion*	• ??	• ??
Blue Dot	Multiple….	Multiple…

*Suggestions could be based on availability of high resolution data, good catchment walkover data, good farm walk data, good farmer engagement