CAVERTI: Communicating and Visualizing Erosion-Associated Risks to Infrastructure

Caspar Hewett, Carolyn Simpson and John Wainwright

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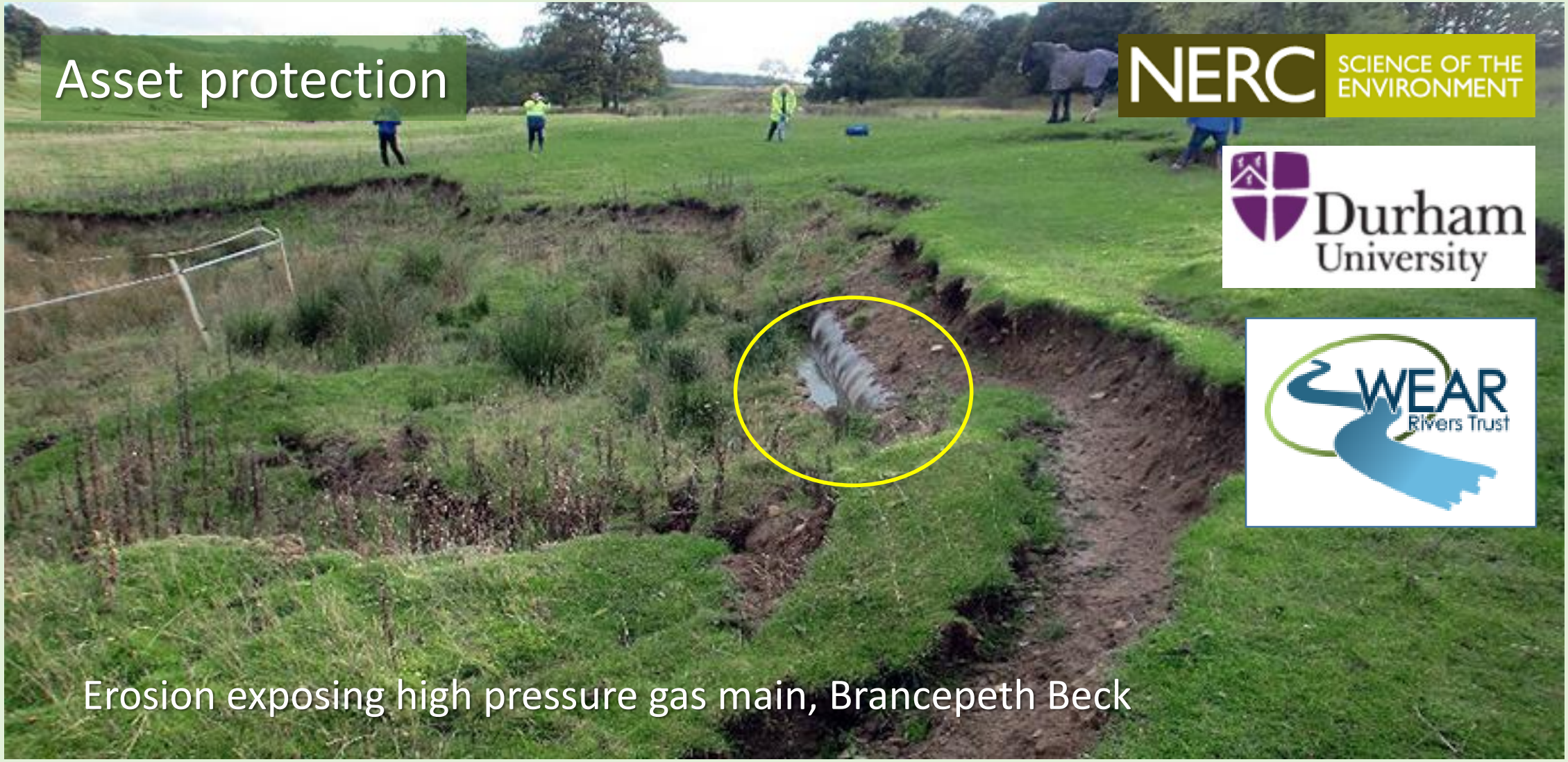

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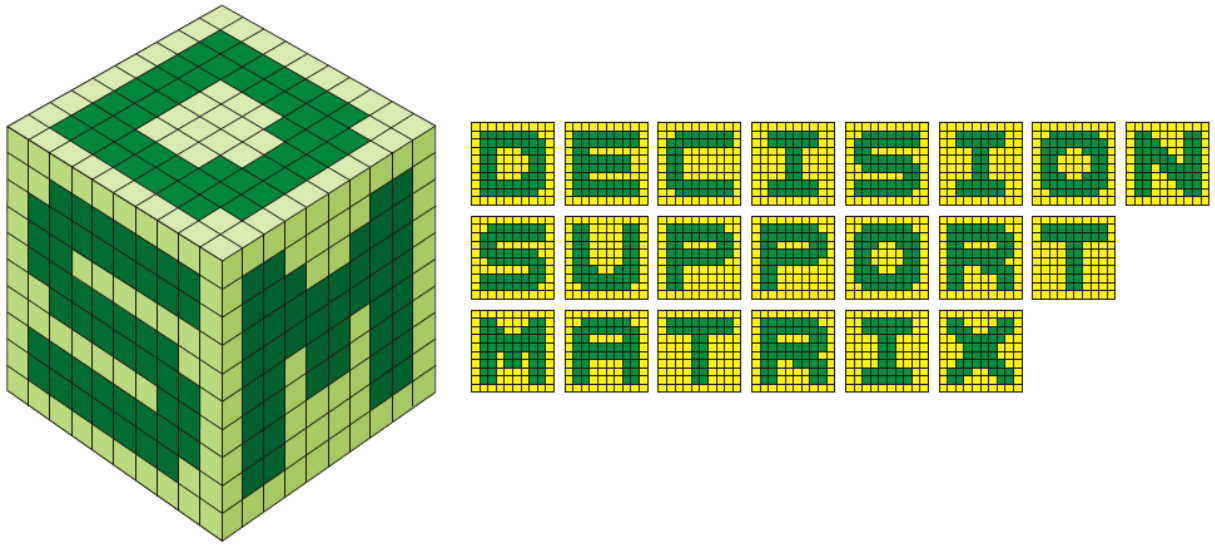
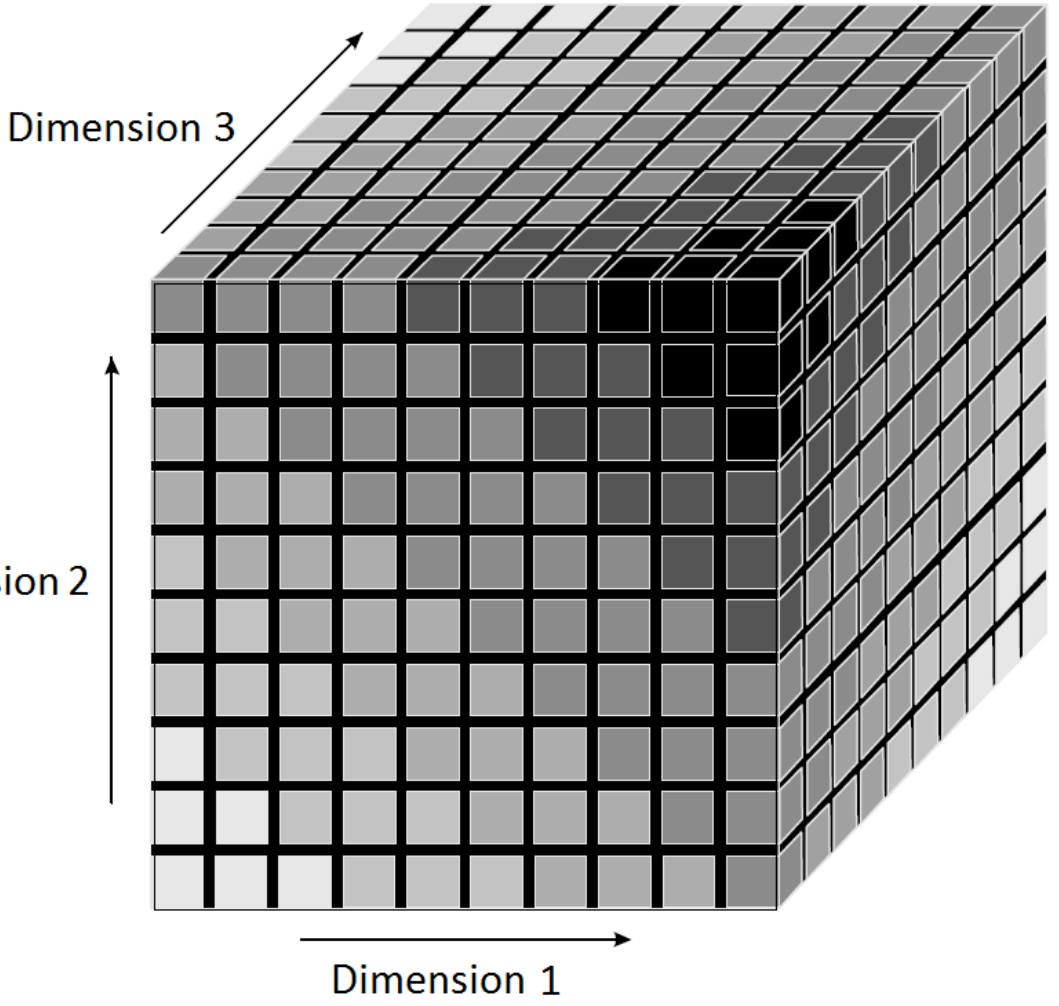


Participatory Action Research

Co-production of knowledge and tools

Researchers and stakeholders

Visualization and Communication of risk



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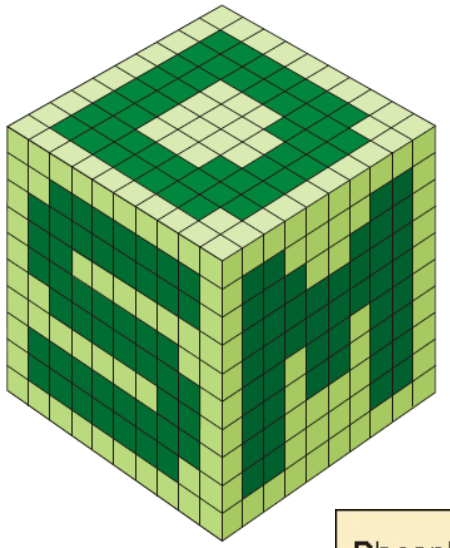
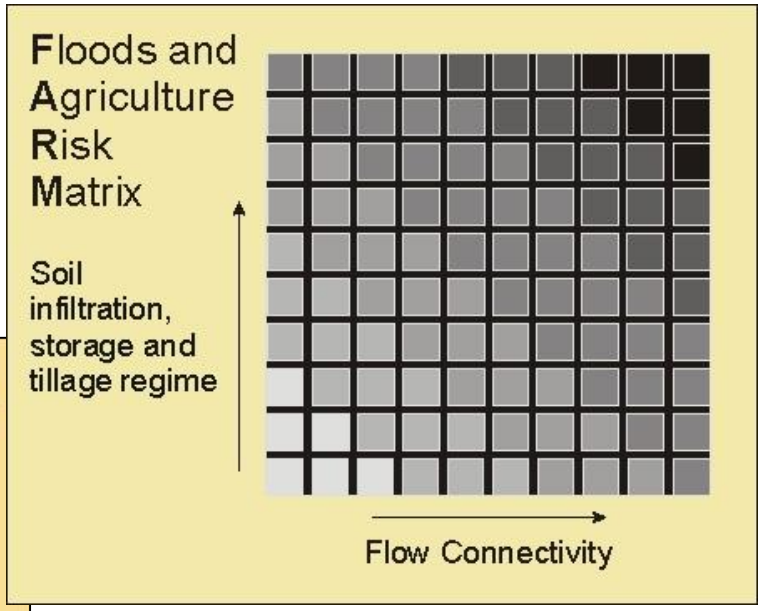
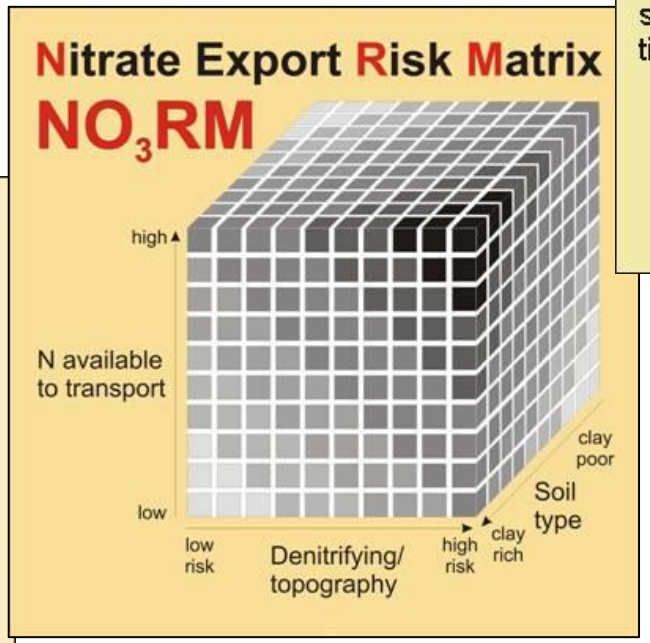
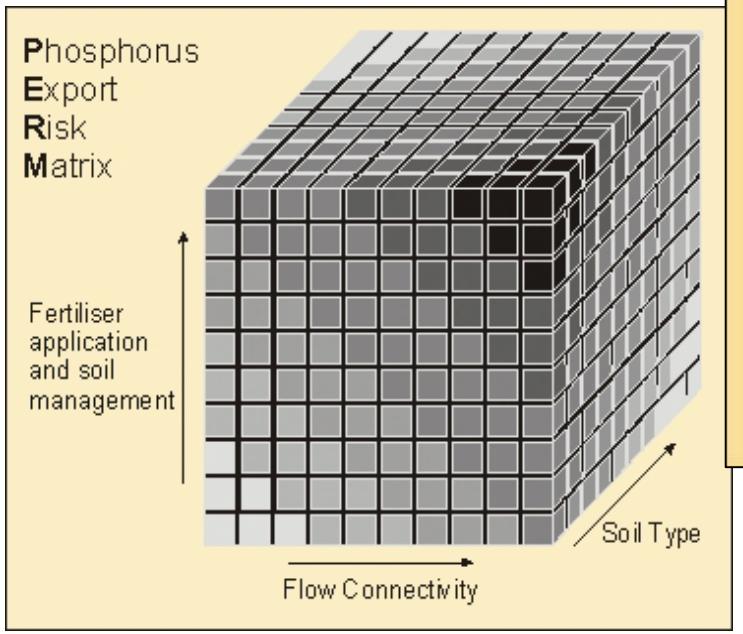


DECISION SUPPORT MATRIX







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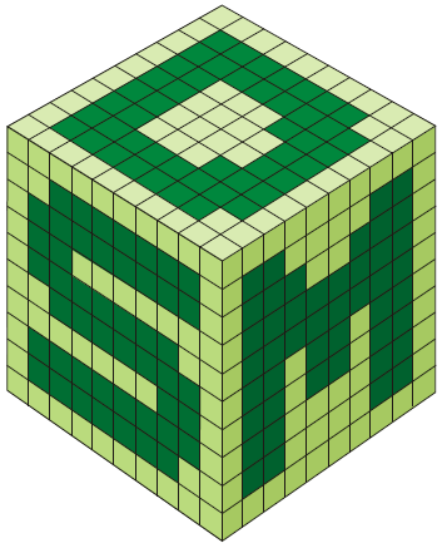


Nitrate Export Risk Matrix

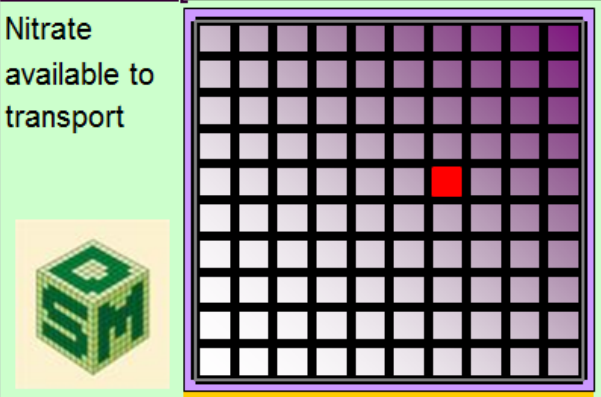
TheNORM.xls [Compatibility Mode] - Microsoft Excel

File | Home | Insert | Page Layout | Formulas | Data | Review | View

A1

Risk Loss Assessment for Flow Connectivity

Nitrate available to transport



Flow connectivity

Return to Welcome | Next

Q1 Crop Cover

50 - 75% protection from crop cover

Q2 Land Drains

partially operating land drains

Q3 Point sources such as muck heap, slurry lagoon, silage clamp

Partial containment but far from receiving waters

Q4 Livestock access to waterways

river fenced with livestock drinking bays

Q5 Tramlines

low density tramlines across hillslope, large distance from ditches

Q6 Tyre tracks and roads

low density

Welcome | NORM Examples | NORM 1 | NORM 2 | Flow Connectivity | Low Risk

Ready | 120%

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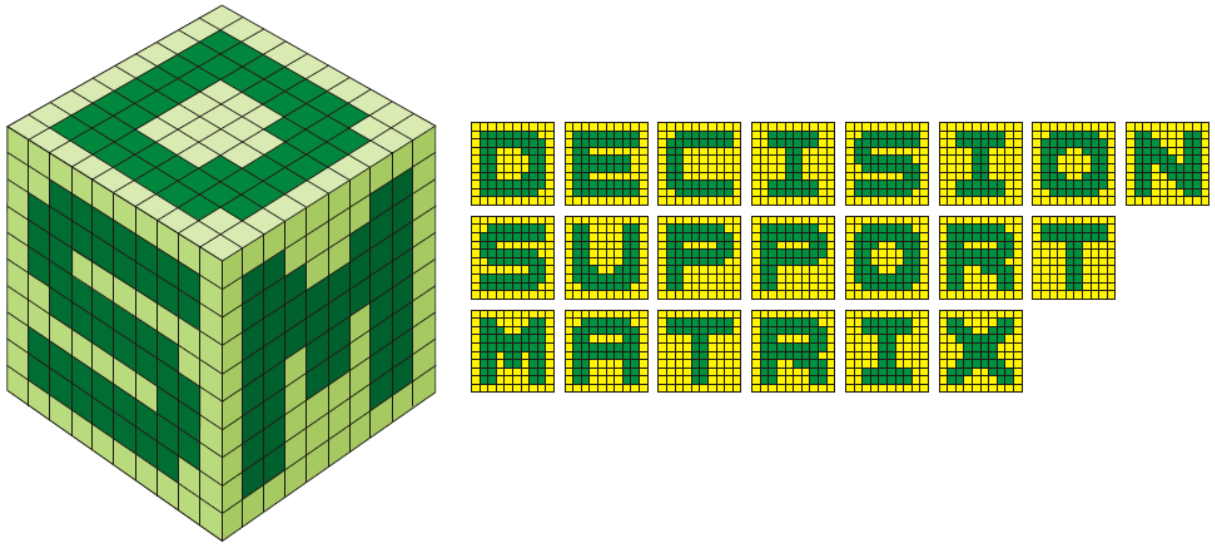

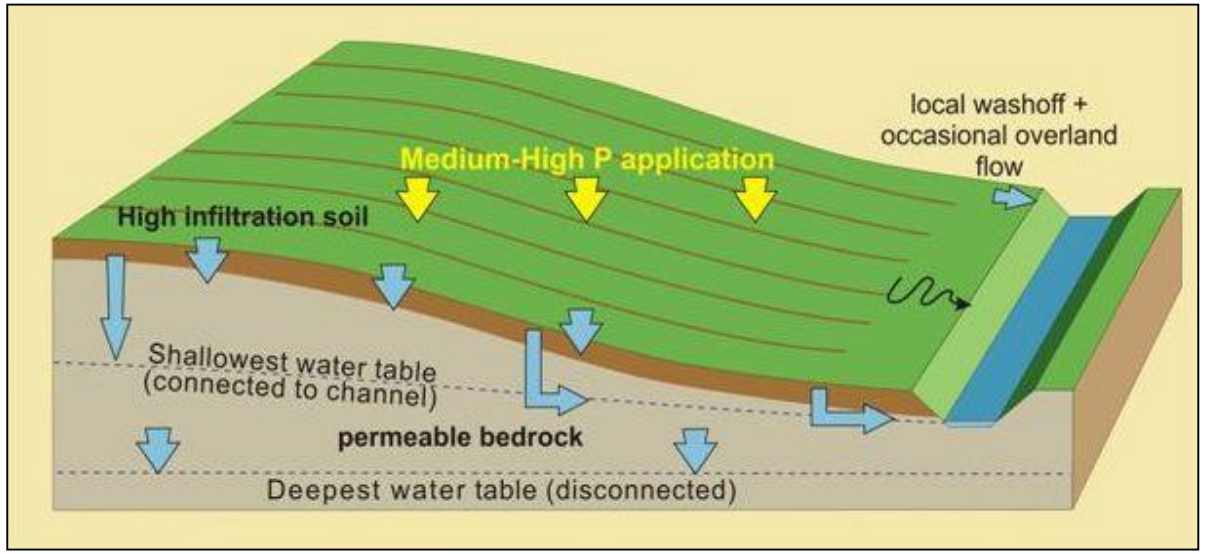

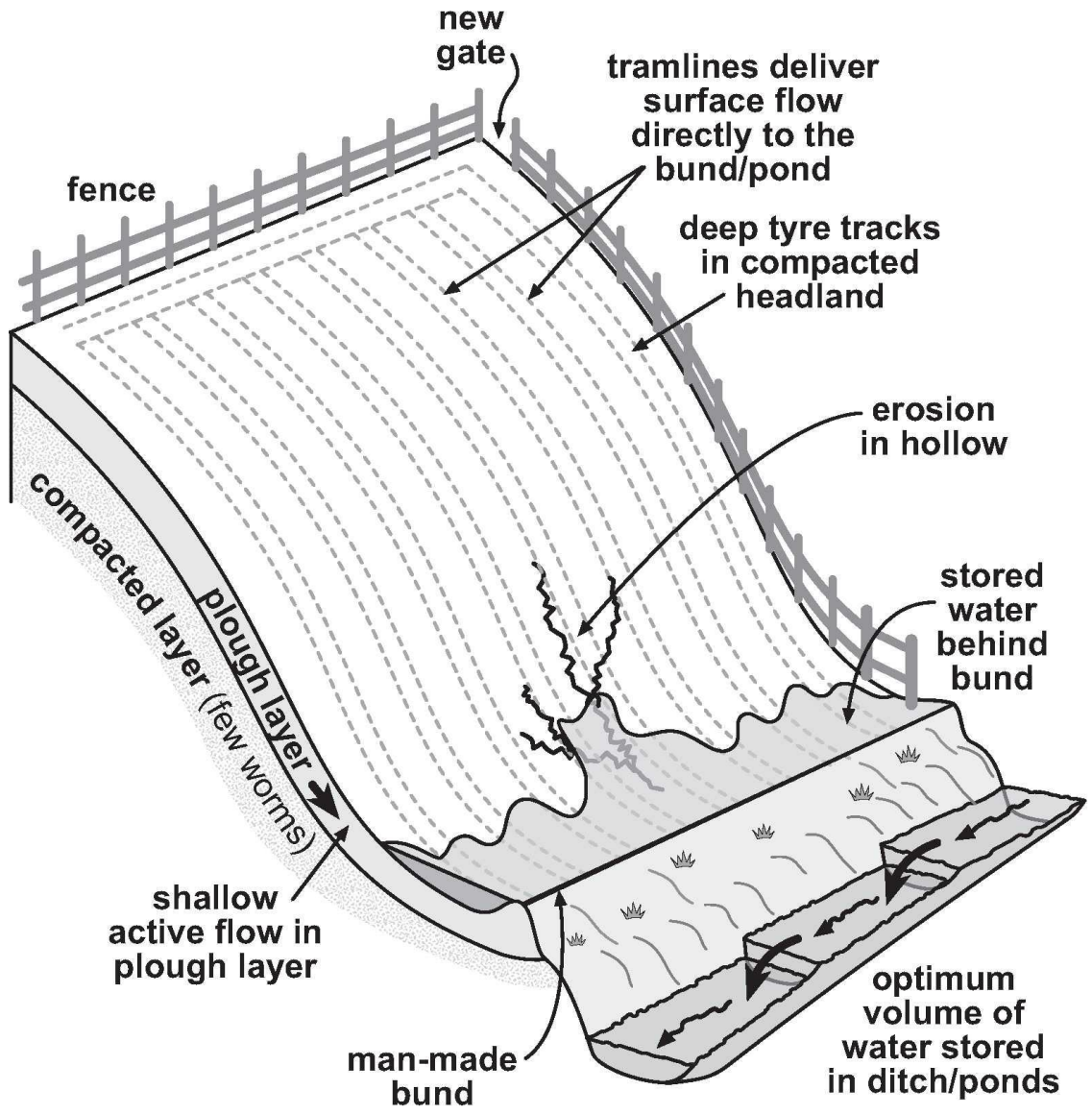

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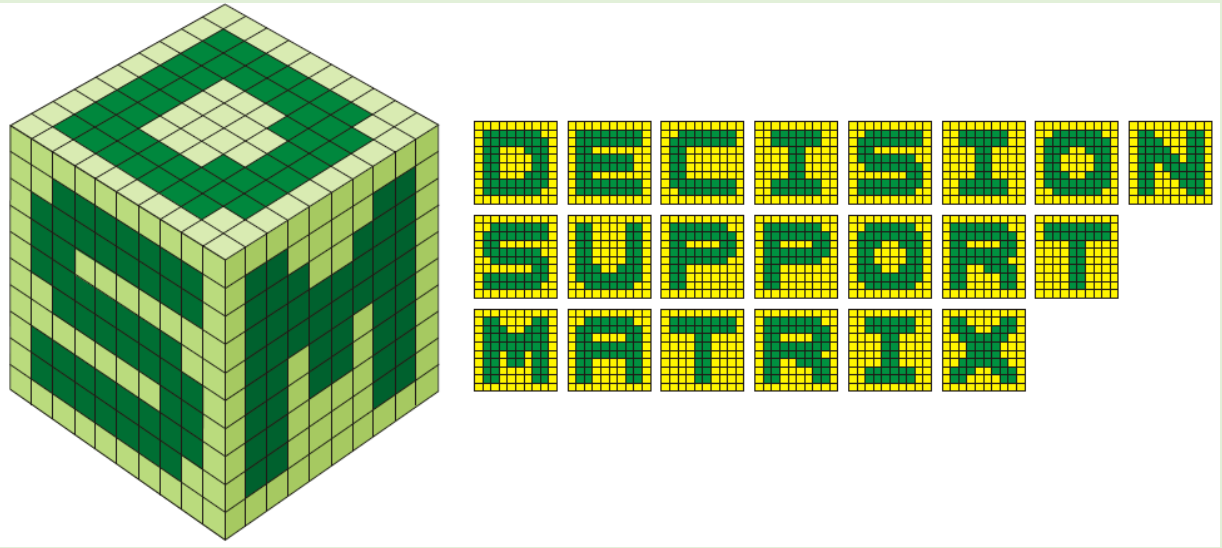

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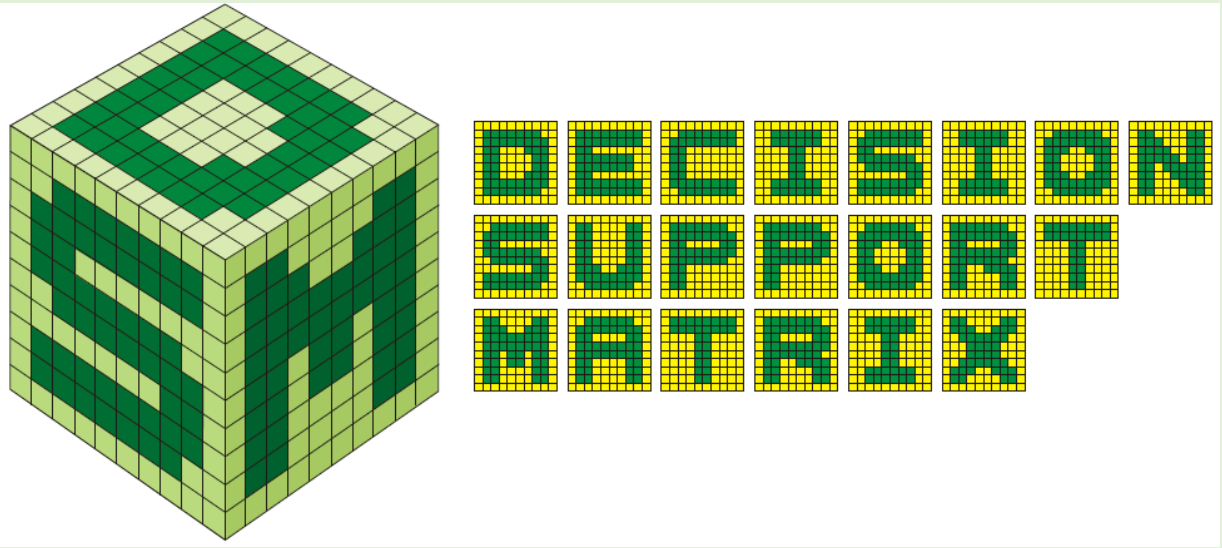
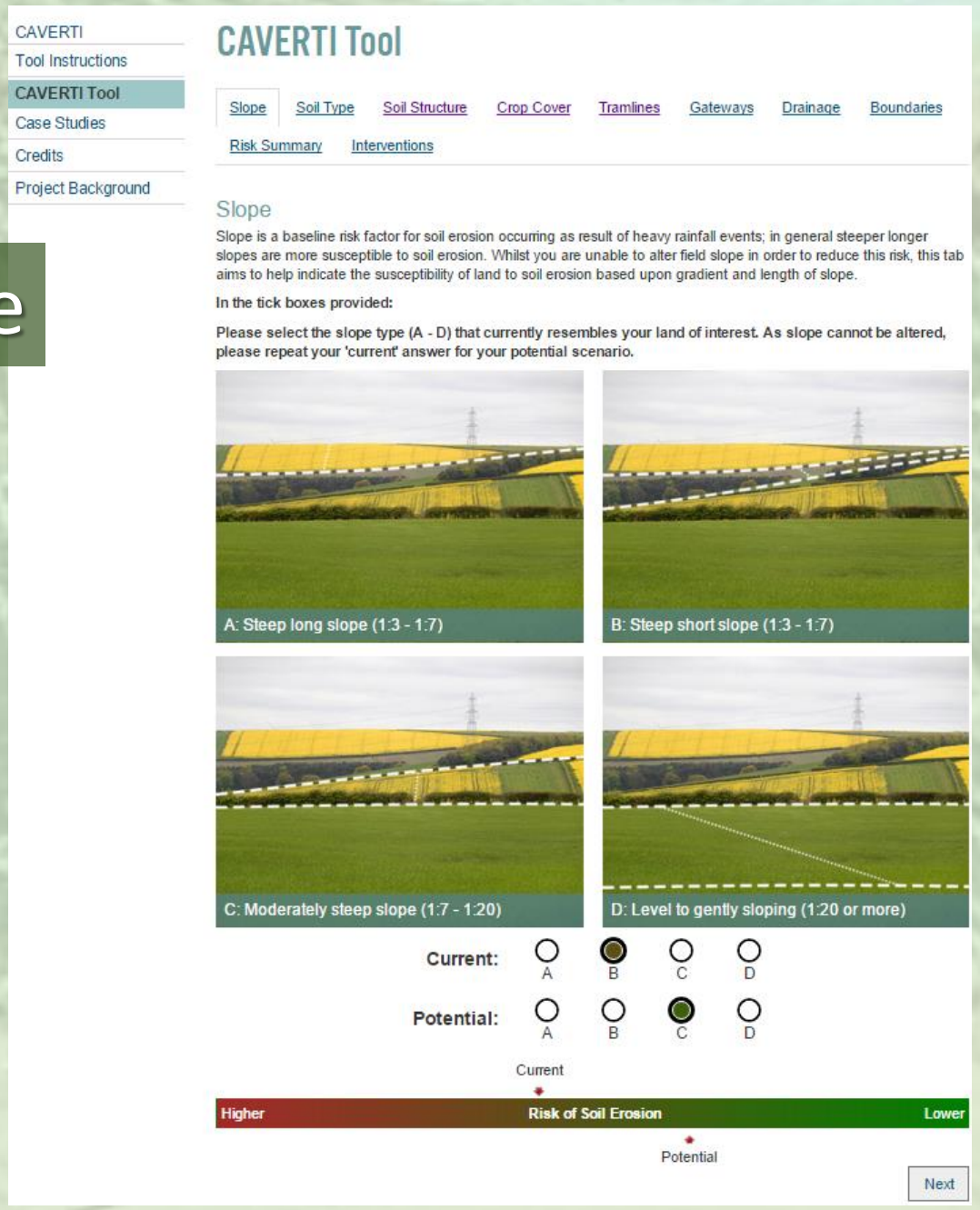
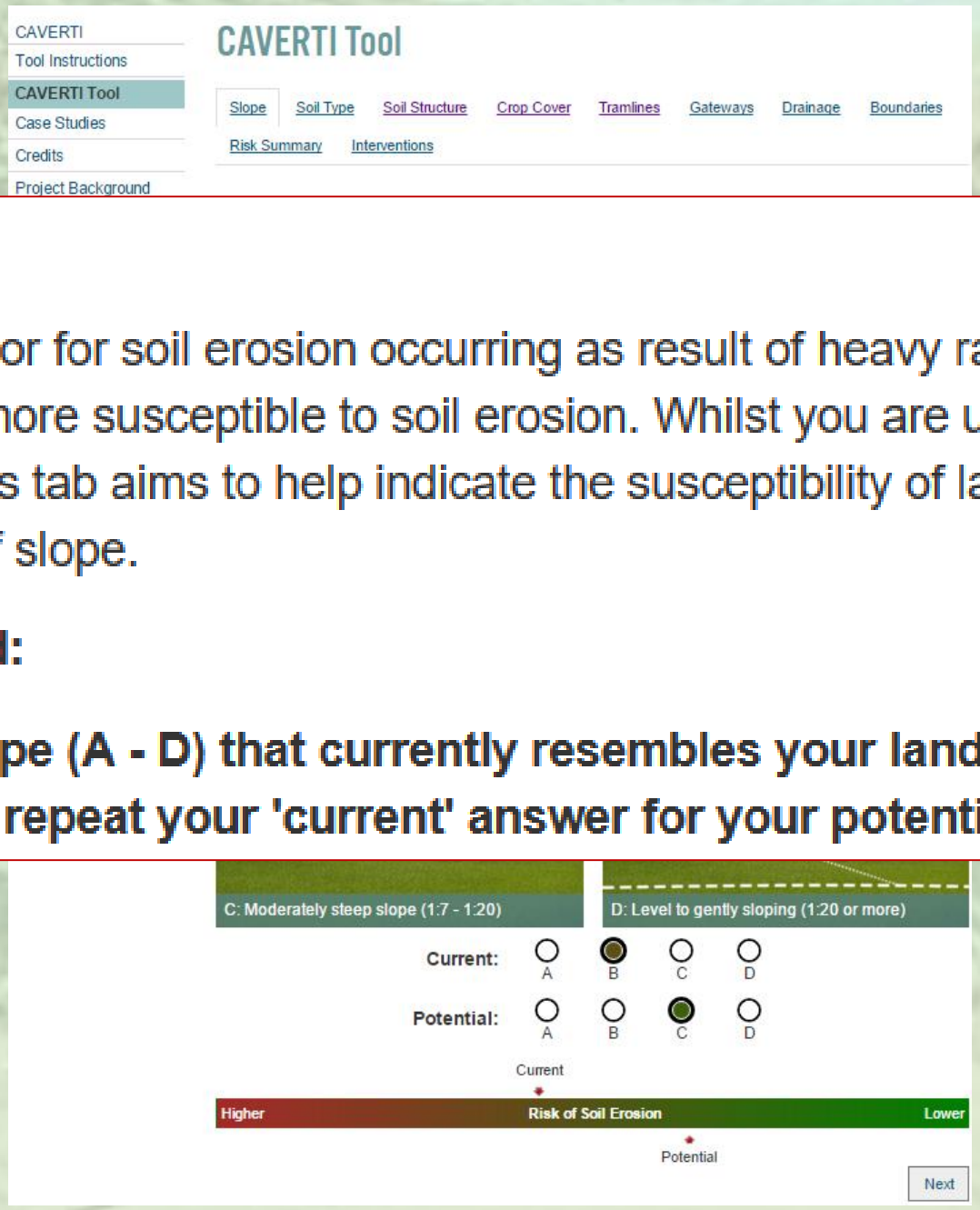


Slope



https://www.dur.ac.uk/geography/research/caverti/tool/ launched December 2015



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CAVERTI

CAVERTI Tool

A: Steep long slope (1:3 - 1:7)

B: Steep short slope (1:3 - 1:7)

C: Moderately steep slope (1:7 - 1:20)

D: Level to gently sloping (1:20 or more)

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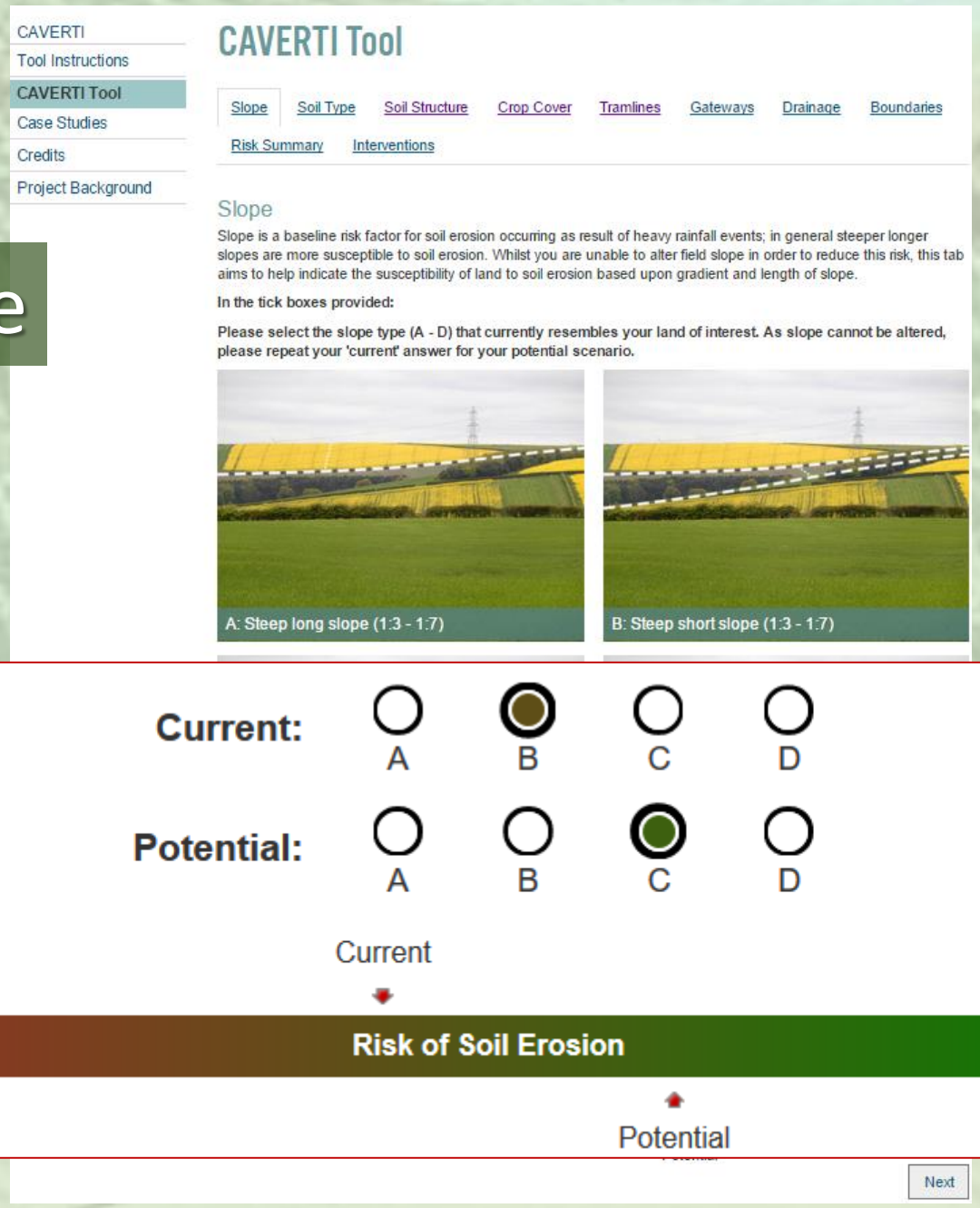
Slope



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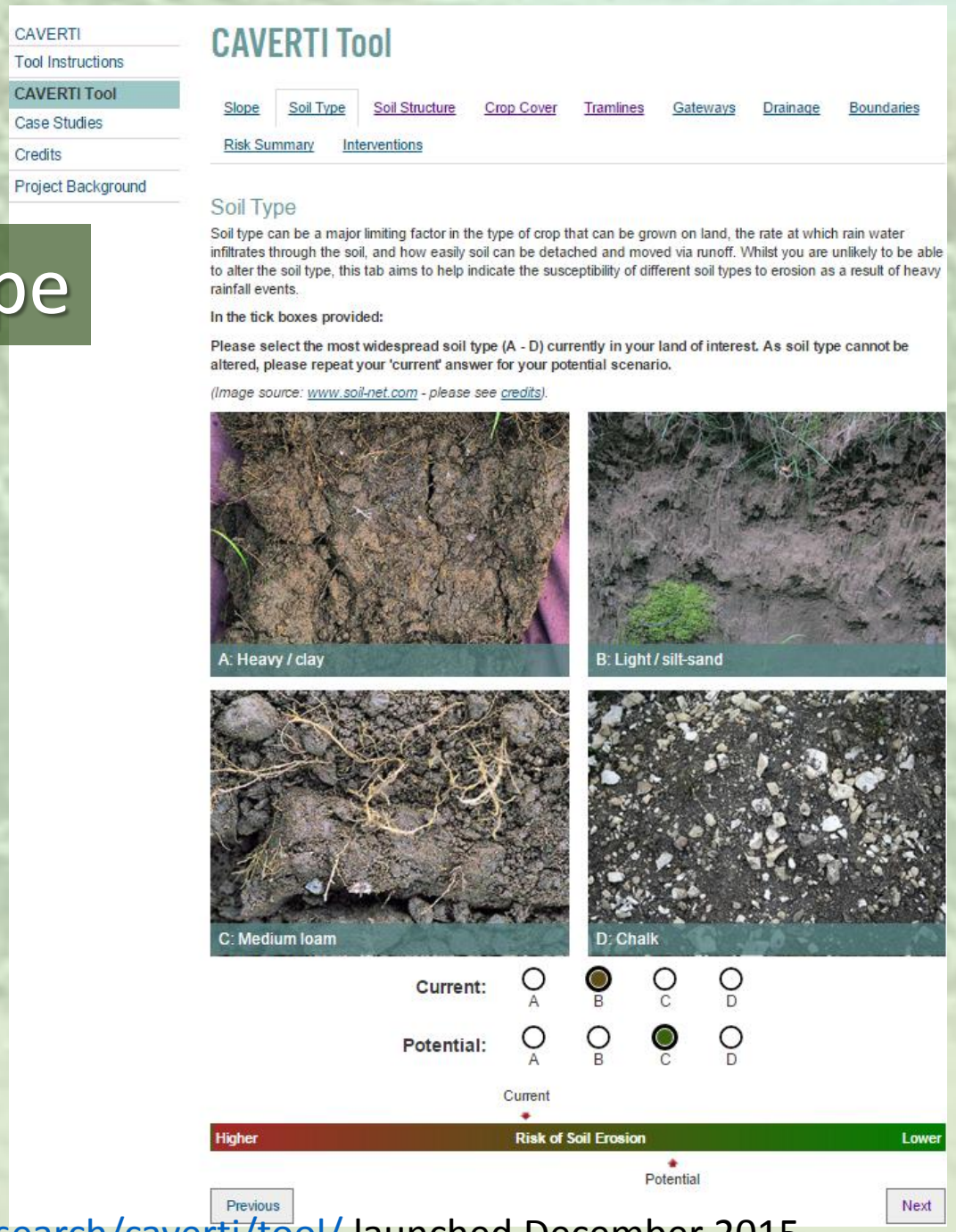
Soil Type



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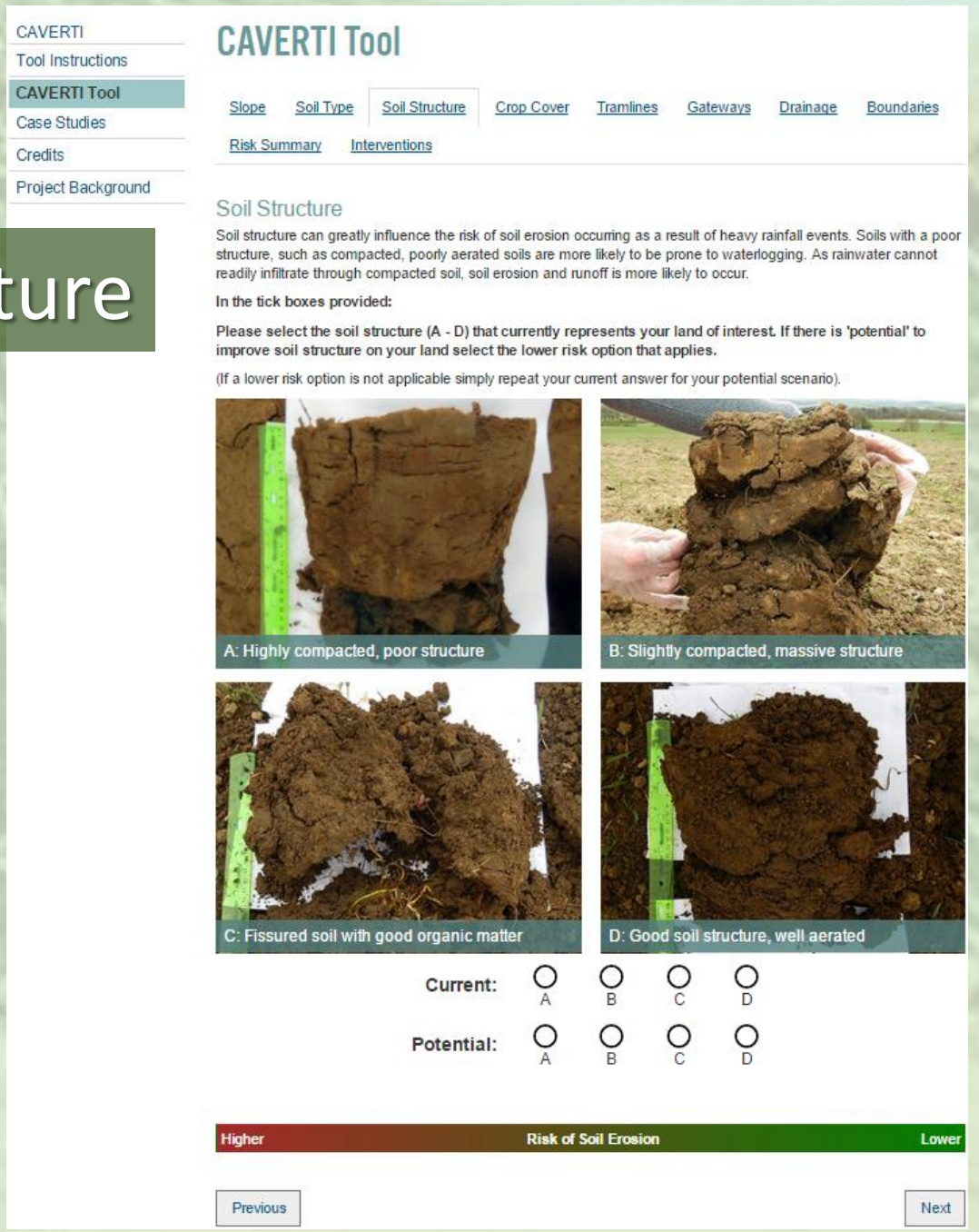
Soil Structure



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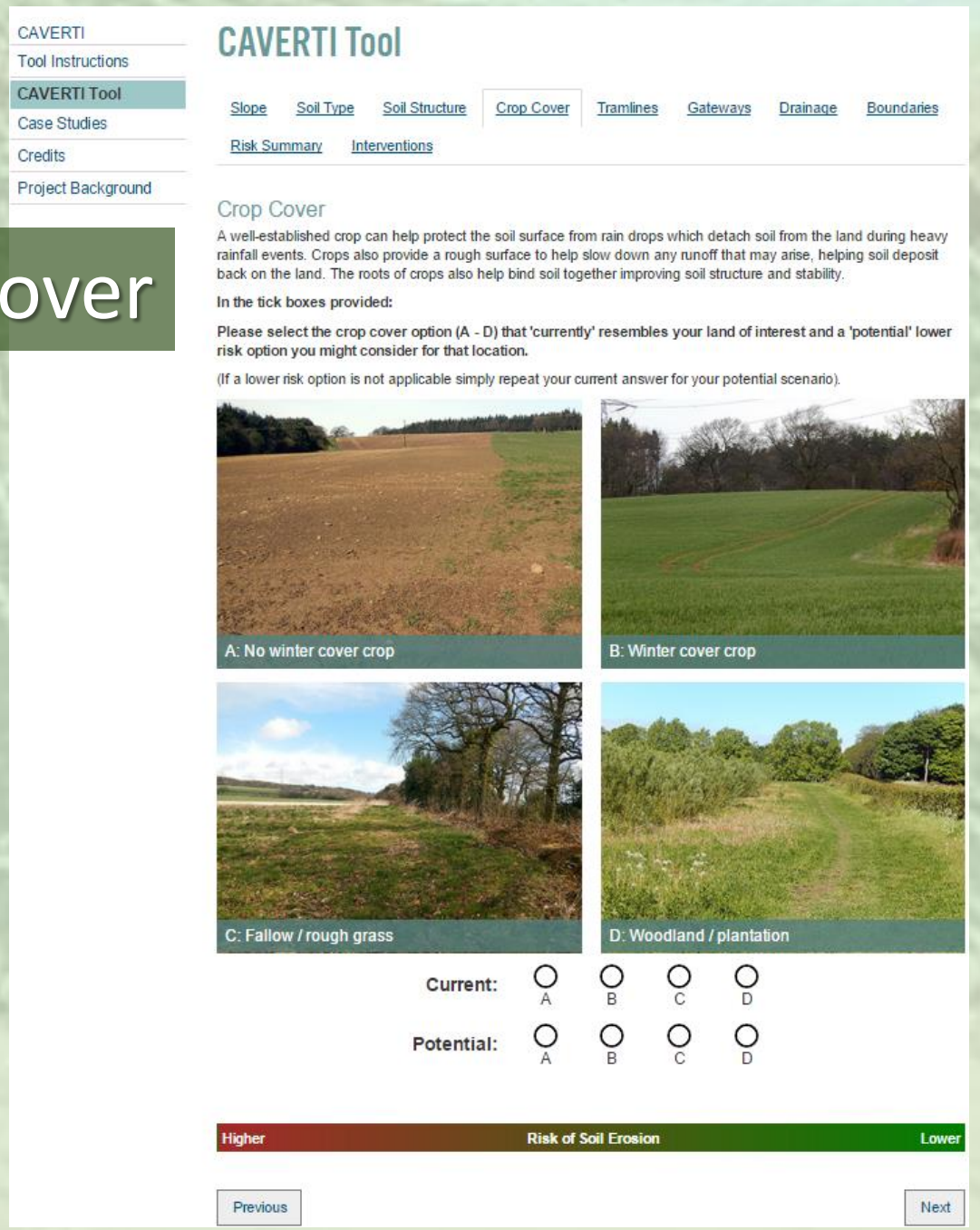
Crop Cover



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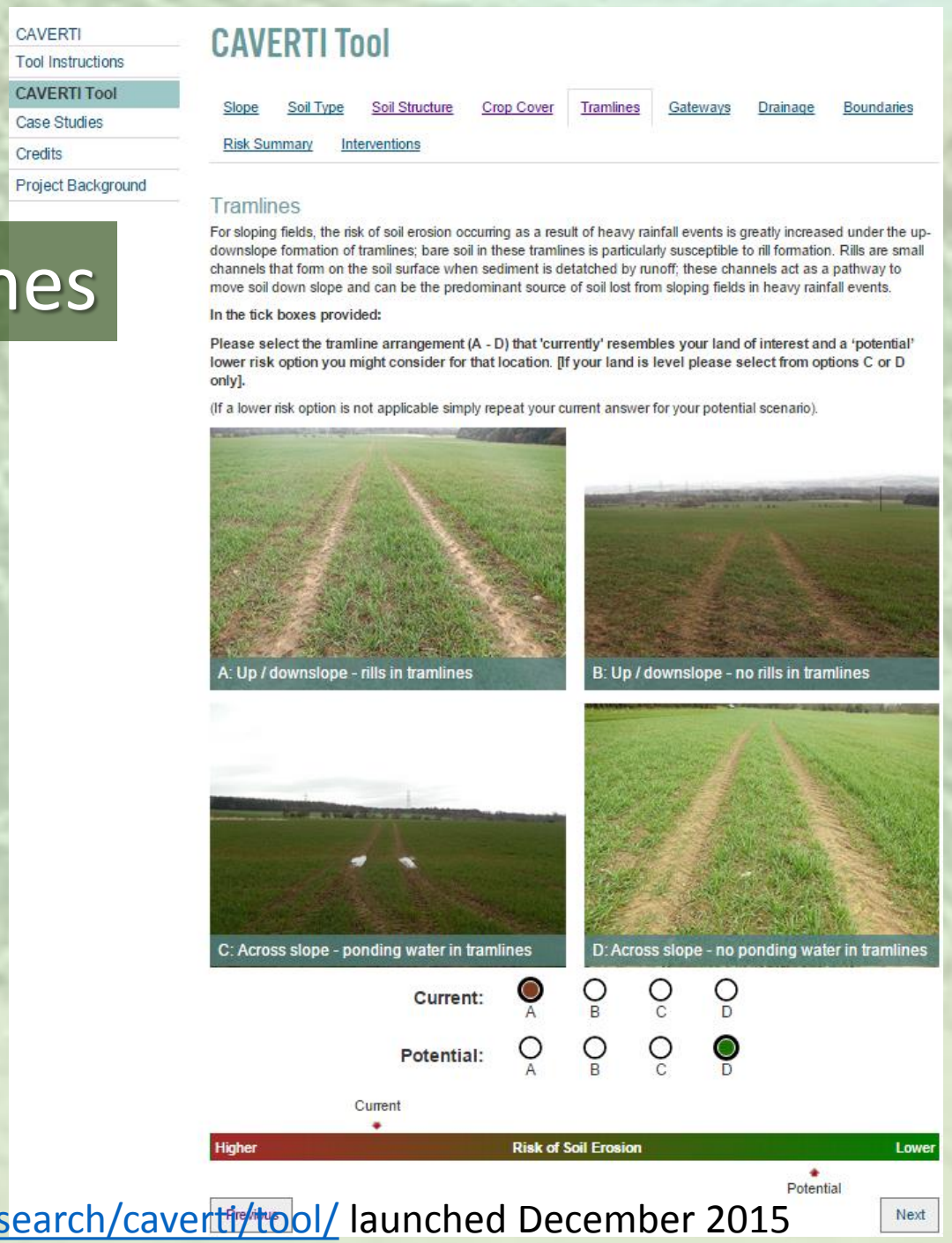
Tramlines



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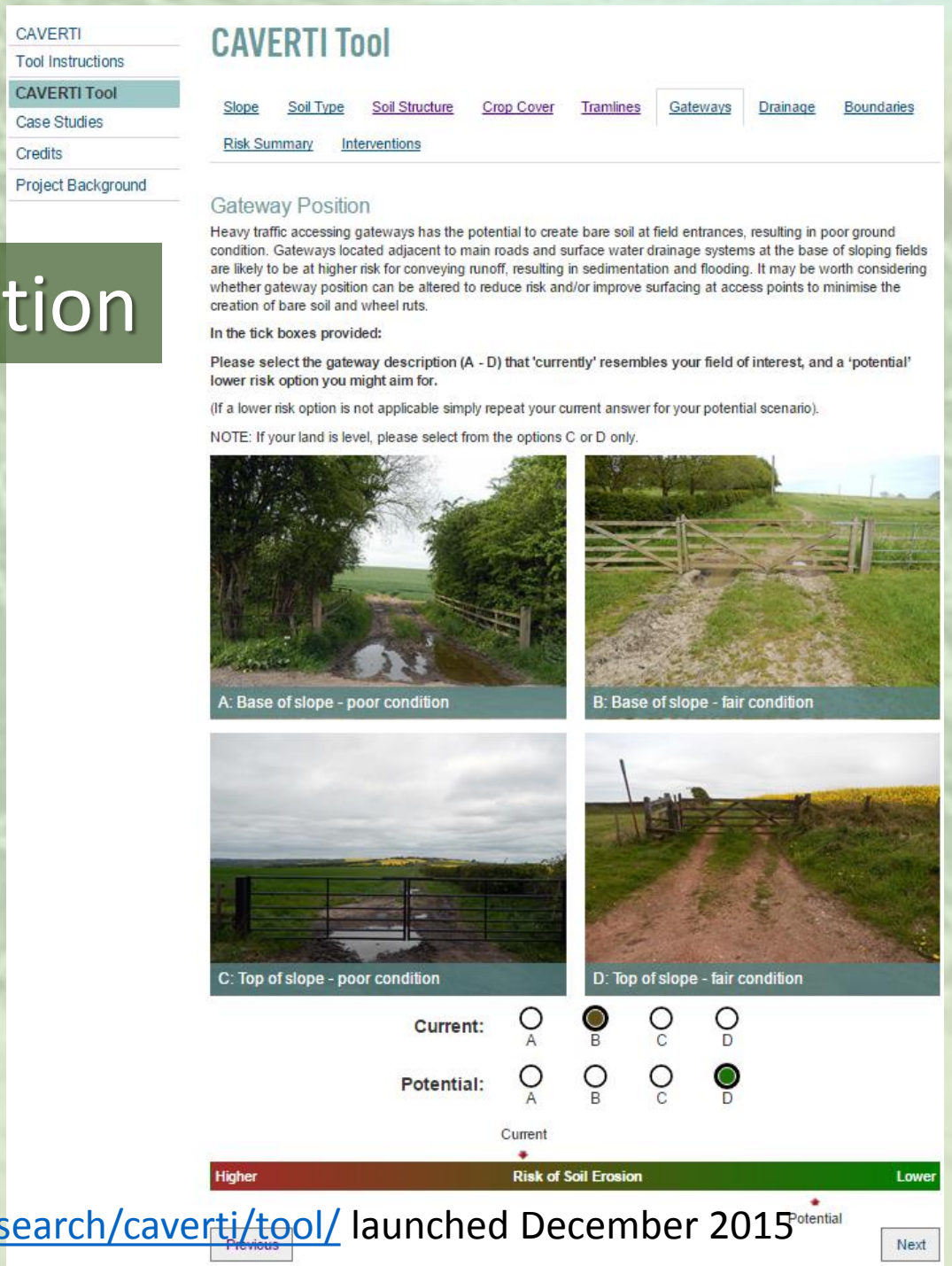
Gateway Position



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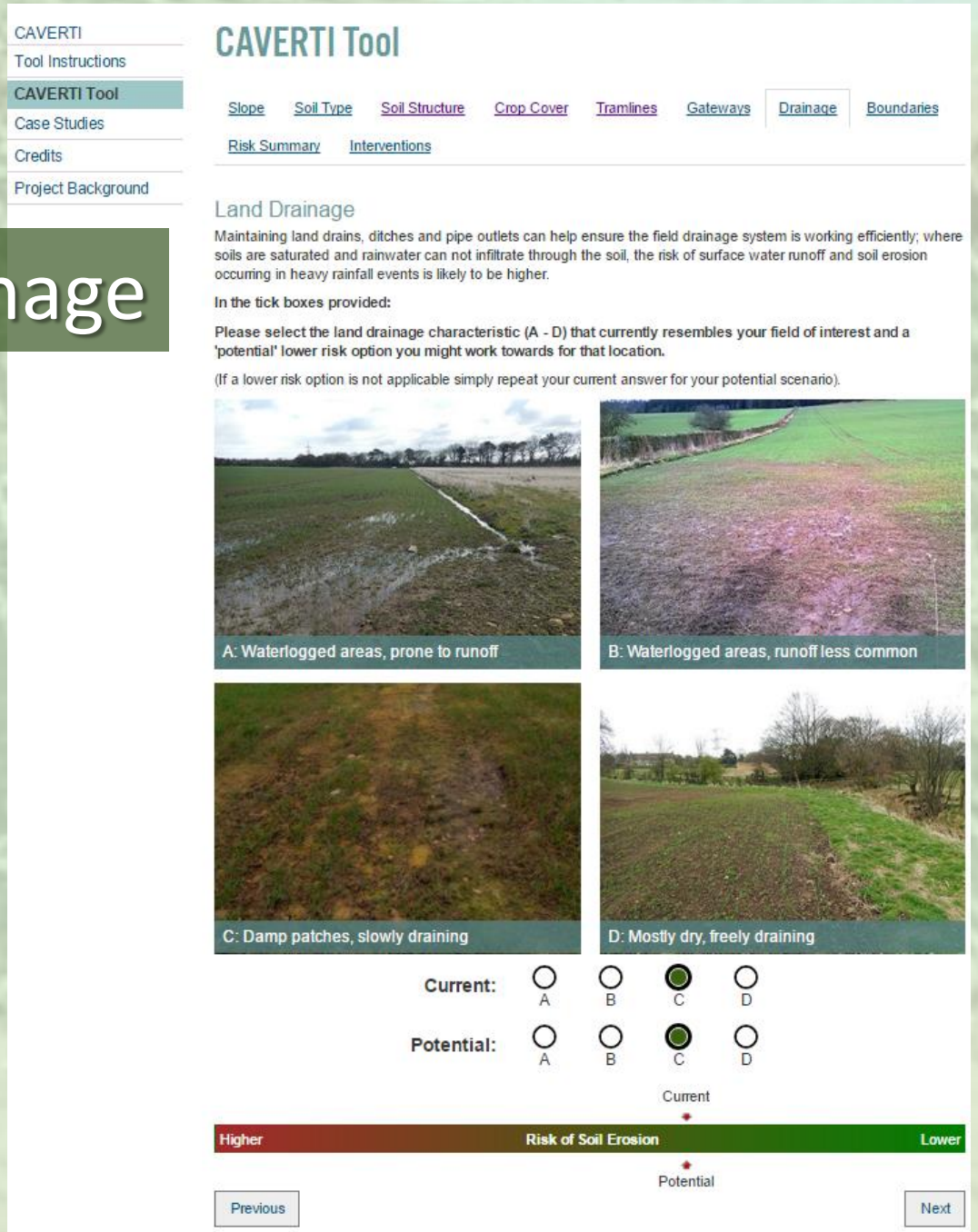
Land Drainage



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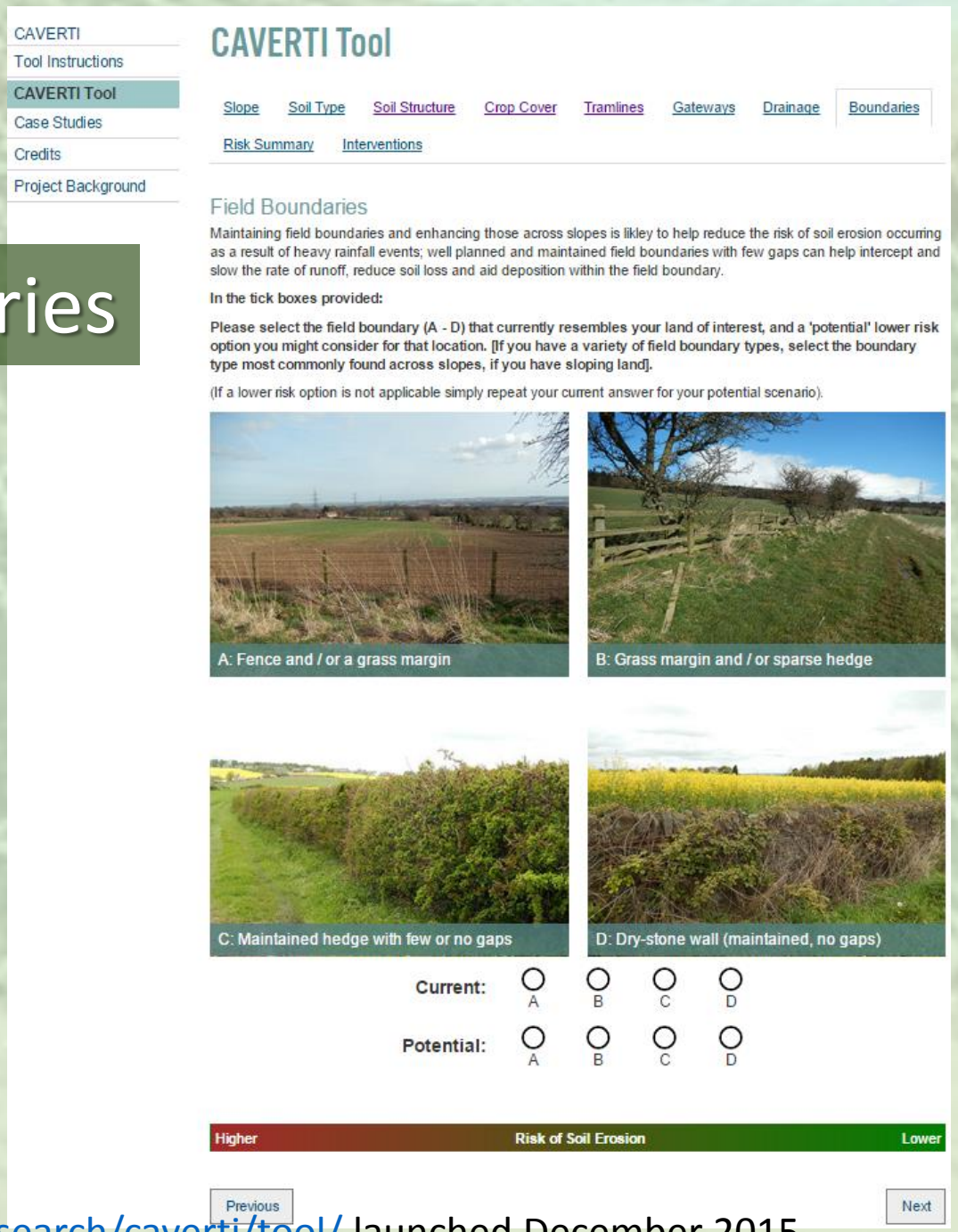
Field Boundaries



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Current

Higher **Risk of Soil Erosion** Lower

Potential

Risk Factor	Current	Potential
Slope	High	Medium
Soil Type	High	Medium
Soil Structure	High	High
Crop Cover	Very high	Medium
Tramlines	Very high	Low
Gateways	Very high	Low
Drainage	High	Medium
Boundaries	Very high	Medium
Overall Risk	**High**	**Medium**

Risk Factor	Interventions to help mitigate risk of soil erosion and erosion-associated risks to infrastructure
Slope	As you can not alter slope, manage other risks factors where possible, especially where your baseline risk of erosion is high owing to a relatively steep or long slope. Break up slopes with across slope buffer features that will help slow runoff and intercept soil whilst offering benefits for wildlife: e.g. beetle banks, in-field grass strips (minimum 3m wide). • http://www.cfeonline.org.uk/campaign-themes/arable/ *(also see boundaries options below).*
Soil Type	As you can not alter soil type, manage other risk factors where possible, especially where your baseline risk of erosion is high owing to a heavy clay or very light sandy and loamy soils. Check the optimum cropping regime for your soil type: • http://www.landis.org.uk/soilscapes/
Soil Structure	Avoid soil compaction by using dual or flotation tyres on farm vehicles to help spread the load over a large area. To encourage top-soil stability apply organic manures; avoid over-deep working of the land and over-deep cultivation. Use minimal cultivation techniques for susceptible soils e.g. by ploughing and rolling in one operation with the crop sown at right-angles to the direction of rolling. A variety of manuals are available to help assess your soil structure and optimise soil organic matter which can improve drainage and crop yields. For guidance and links to other information see: • https://www.gov.uk/soil-management-standards-for-farmers • http://www.soilassociation.org/whatisorganic/organicfarming/organicmatter • https://www.gov.uk/managing-soil-types

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Risk Factor	Interventions to help mitigate risk of soil erosion and erosion-associated risks to infrastructure
Crop Cover	Limit the area and duration for which soil surface is left bare over winter by sowing autumn crops; sow crops early to help them establish and form deeper roots. Sowing winter cover crops can help minimise the risk of nitrate leaching and also help imrpove soil fertility. Incorporate conservation management in your crop cover choice: • http://www.kingscrops.co.uk/ If an area is particularly susceptible to soil erosion and can not be improved by changes in husbandry or cropping, consider sowing permanent grass or planting a woodland. Help towards costs of planting and materials may be available from the Woodland Trust Morewoods scheme or from the Forestry Commission through Countryside Stewardship woodland capital grants: • http://www.woodlandtrust.org.uk/get-involved/plant-trees/on-farms/ • https://www.gov.uk/government/publications/guide-to-countryside-stewardship-woodland-capital-grants-2015/guide-to-countryside-stewardship-woodland-capital-grants-2015
Tramlines	If safe to do so (in relation to the risk of farm vehicles tipping), carry out cultivations that will create tramlines across slope, avoiding the creation of up/downslope tramlines. Avoid access when the soil is wet. Shift the tramline pattern to avoid repeat compaction of land in tramlines / tracks.
Gateways	If road safety and security requirements are met, situate gateways at the top of any sloping fields. Also consider surfacing access gateways with hardcore and filling in wheel ruts. If a site is particularly susceptible to run-off consider installing a sediment trap to collect surface water and intercept soil: • http://www.demonstratingcatchmentmanagement.net/wp-content/uploads/2013/01/Intercepting-diffuse-pollution-pathways-.pdf Install interceptor ditches (silt traps) to channel surface-water away from areas prone to erosion (e.g. areas frequently accessed by farm machinery, and at the base of long steep slopes) or away from areas with connectivity to water courses, roads or drains (e.g. potentially at gateways).

Risk Factor	Interventions to help mitigate risk of soil erosion and erosion-associated risks to infrastructure
Drainage	Identify areas where drainage efficiency could be improved: • http://www.swarmhub.co.uk/sub_soils.php?id=2604 Follow best practice guidelines for maintaining field drains, ditches and outlets in efficient working condition to minimise ponding and run-off: • https://www.gov.uk/manage-water-on-land-guidance-for-land-managers#drainage-and-water-levels Reduce run-off by increasing surface drainage by using subsoilers or mole ploughs: Consider constructing a farm wetland to manage run-off, protect the water-environment and improve ecological condition: http://www.wwt.org.uk/conservation/saving-wetlands-and-wildlife/influencing-action/guidance/constructed-farm-wetlands/
Boundaries	Where possible, plant up field boundaries with hedges which when established and if well maintained, help increase infiltration rates, slow run-off and intercept soil: • http://www.hedgelink.org.uk/farm-environment-schemes.htm Use permanent grass buffer strips both within fields and between fields to reduce field erosion, and alongisde ponds or water courses to help intercept sediments and nutrients or pesticides. Encourage regeneration of trees and shrubs to stabilise borders adjacent to flowing water.

Conclusion

Visualization and communication tools co-developed by researchers and stakeholders are the best means of ensuring that mitigation measures are undertaken across the landscape to reduce soil erosion.

The CAVERTI tool has proven to be an effective means of encouraging farmers and land owners to act to reduce erosion, providing multiple benefits from protecting local infrastructure to reducing pollution of waterways.