SOIL PHYSICAL DAMAGE

Problem

Soil structural degradation; compaction, poaching and erosion.

Impact

Soil quality

- increased incidence of surface ponding and waterlogging due to low infiltration rate.
- changes in soil chemistry under reducing conditions.
- reduction on rooting depth or even loss of surface horizon.

Water quality

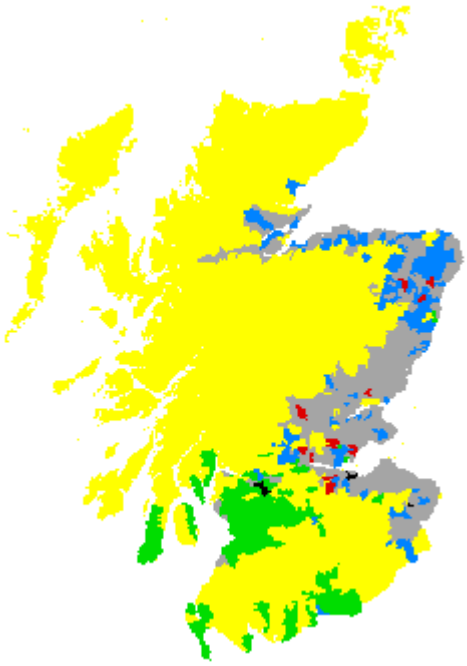
- increased sediment load to rivers and alteration of stream bed conditions.
- increased load of nutrients, agrochemicals and faecal pathogens to rivers.

Plant growth

- reduced air-holding capacity and reduction of oxygen supply to roots.
- changes in major nutrient cycles due to altered soil chemistry.
- loss of seedbed contents or exposure of roots.

Areas at Risk

- **Compaction:** intensive arable production on soils with high silt and clay contents. Higher risk for systems involving multiple passes of machinery under adverse soil conditions (i.e. at or close to field capacity) and systems where yield increases with late harvesting (e.g. root crops) or where multiple cropping takes place (e.g. intensive silage grass).
- **Poaching:** animal production on imperfectly drained soils in the wetter areas in the west of Scotland. Livestock access to grazings on wet soils, direct access to river/streams for watering, application of slurries and wastes when soils are wet.
- **Water-induced erosion:** is often associated with intensive arable production on sandy, coarse-textured soils in the East of Scotland.
- **Wind-induced erosion:** in arable systems is commonly experienced on the sandy soils in Moray. However, it also occurs in extensive systems on the organic soils and peats of the hills and uplands, due to removal of plant cover by heavy grazing or, indeed, human trampling of vegetation.



Distribution of Main Farm Types

	Areas at RIsk		
Farm Type	Localised	Regional	Universal
General Cropping	Wind	Compaction Water erosion	
Mixed	Compaction Water erosion		
Dairy		Poaching	
Pigs and Poultry	Poaching		
Cattle and Sheep	Poaching Water erosion		

Practical Actions

Compaction and poaching

Soil strength decreases significantly with wetness and, thus, access for machinery and animals should be restricted when soil moisture content is at or close to field capacity. Remediation of severe subsoil compaction is costly and carries with it a risk of further damage because of the use of heavy machinery for soil loosening and deep ploughing. Natural regeneration of compacted topsoils can take up to 3 years. Avoidance of damage through sound land management is critical.

The use of engineering solutions such as low ground-pressure tyres, dual wheels and tracked vehicles may be justified in some cases to widen the operating window for land management. 'Sacrificial' systems such as 'tramlines' are now widely employed in cropping systems but may act as a point of initiation of erosion events during heavy rainfall events. In the longer term, liming and increasing soil organic matter contents in mineral soils can encourage the development of good soil structure.

Poaching damage by livestock is again amenable to good land management practices Limiting access of stock to wet soils and fencing of sensitive areas, such as river banks, can all help at the farm level.

Erosion

It is important to recognise that erosion is a natural process, which can be exacerbated by land use and management. It can then be considered as an off-site environmental hazard but only *in extremis* does it become a threat to the soil resource itself. It can be significantly reduced by the maintenance of plant cover throughout the year. Where this is not feasible, e.g. arable crop production, reducing the time interval where bare soil is present can help. The production of very fine seedbeds by power tools has been suggested as a cause of both erosion and 'surface capping' of seedbeds. To limit water erosion, associated with overland flow, contour ploughing is carried out in many countries throughout the world but to a much lesser extent in Scotland. For arable cropping in Scotland there are both technological and topographical limitations to the application of this approach.

The PEPFAA Code only addresses these issues briefly but the MAFF Soil Code contains a much fuller discussion with suggestions for avoiding damage. This reflects a difference in focus between the two with the MAFF Code addressing issues of resource management on farms whereas in Scotland the PEPFAA Code needs to be supplemented by land management information as bulletins and advisory notes (SAC).

Linkages

Nutrient transfers
Faecal pathogens.

Research Gaps

Development of simple field methods to assess structural stability, strength and degradation

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