# ACCELERATED LOSS OF NUTRIENTS

## Problem

Increased availability and subsequent transfer of various forms of nitrogen (N) and phosphorus (P) from land to water. Evidence of increased concentration of nutrients, well above the expected expected 'background' conditions in all types of waters. Chronic and acute contamination has a direct implication for human health but also wider concerns for ecosystem structure and functioning.

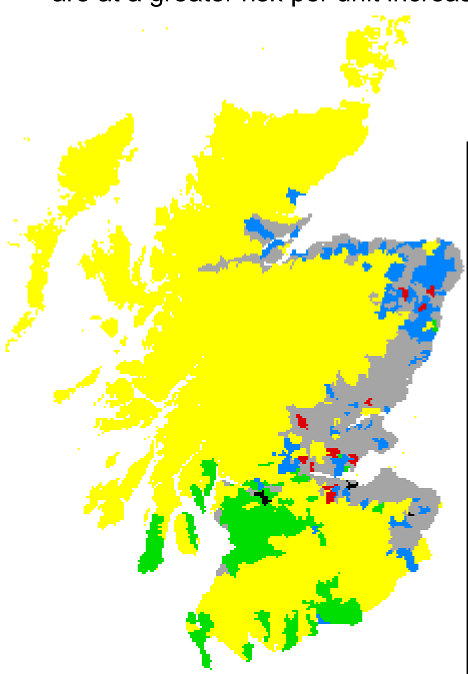
## Impact

Drinking water quality (recent evidence of link to childhood diabetes), localised eutrophication (freshwaters, estuaries and coastal) causing reduced bio-diversity and in some cases potentially toxic 'blue green' algal blooms, long-range and cumulative transport to the marine environment (e.g. North Sea).

## Areas at Risk

The loss of nutrients may occur from throughout an agricultural landscape. However there are particular combinations of the physical environment with management aspects which exacerbate potential loss. A defined transport pathway is important therefore proximity of a 'nutrient source' to a watercourse and particularly the presence of drainage systems increases the risk.

- **Loss of nitrate:** freely draining soils that have the ability to nitrify especially those that are under regular cultivation.
- **Loss of soluble forms of phosphorus:** particularly occurs from coarse textured soils often having a limited capacity to retain (adsorb) P and aggravated by farming systems with a large annual P surplus so that soils become 'saturated'.
- **Loss of particulate associated N and P:**(see 'erosion risk') and also proximity driven factors such as river bank collapse (natural and enhanced by livestock) and runoff from areas of hard standing.
- **Areas at risk:** shallow groundwater is especially at risk from nitrate contamination. Standing waters from cumulative P loading. Some rivers and coastal waters although the impact is site dependant, due to non – linear relationships that exist between solute concentration and algal growth (impact). It is possible that naturally oligotrophic systems are at a greater risk per unit increase in the loss of N or P**.**



Distribution of Main Farm Types

| | Areas at RIsk | | |
|---|---|---|---|
| Farm Type | Localised | Regional | Universal |
| General Cropping | | Loss of soluble phosphorus Particulate losses | Loss of nitrate |
| Mixed | | Loss of soluble phosphorus Particulate losses | Loss of nitrate |
| Dairy | | Loss of nitrate Loss of soluble phosphorus | |
| Pigs and Poultry | Loss of soluble phosphorus Loss of nitrate | | |
| Cattle and Sheep | Loss of nitrate | | |

## Practical Actions

Transport mechanisms and loss pathways for N and P differ. Nitrate (often the predominant form of N lost) is leached and therefore linked to drainage conditions. It can be transported long distances laterally. In contrast, the strong affinity of P for soil means that its loss is often (although not exclusively) associated with soil erosion and fine sediment loss. These significant differences in properties are reflected in the emphasis and approach that specific legislation and remedial measures adopt. For example, while action programmes for Nitrate Vulnerable Zones are inclusive of the total catchment area, those for sediment loss are targeted at specific management actions of localised features (eg. river banks).

**Practical actions** for reducing nutrient enrichment include:

- reducing the N/P capital of the system by removing agricultural land and/or restricting fertiliser/ manure use.(e.g. increasing the proportion of spring sown crops would reduce N applied).
- improving the efficiency of N/P use through farm nutrient budgeting (codes of good agricultural practice), more precise applications and timing of fertilisers/manures (see NVZ guidelines)
- minimising the production (nitrification) of the mobile nitrate anion in soil (e.g by reducing the extent of cultivation).
- intercepting nutrients somewhere along their transport pathway (e.g. riparian buffer strips/wetlands or for sediment, physical boundaries such as hedges). Management of riparian zones has had mixed results, it could be argued that these ‘end of the line approaches’ can only offer short-term improvements. The continued management of riparian zone is critical because of their potentially highly sensitive position adjacent to the watercourse.
- managing sediment ‘hot spots’, achieved through stabilisation of stream bank, fencing of stock, providing drinking troughs, moving feeding rings regularly, separation of clean and dirty water in farm yards, maintenance of drains,
- adopting good soil conservation techniques (e.g. avoid cultivation right up to the stream bank reduces potential for sediment loss and/or direct inputs of fertilisers and pesticides to surface waters; Establishing good ground cover in autumn-sown crops on sensitive soils; reducing seedbed cultivation to keep a coarser tilth.
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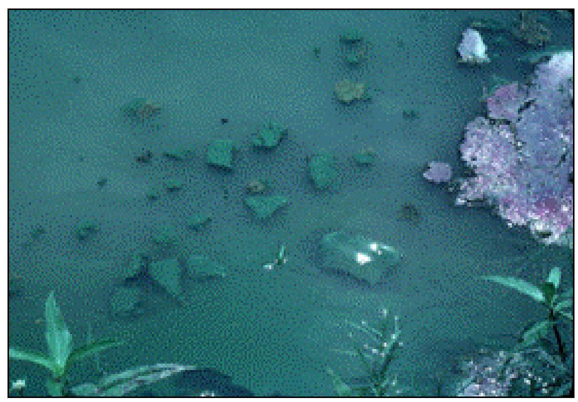

__Linkages__

**Soil erosion** risk reduction through soil conservation.
**Biodiversity** enhanced through appropriately designed riparian woodlands
**Streamwater ecology** potentially improved through improved water quality (reduced sediment and nutrient inputs). Note possible negative effect in terms of shading and inappropriate leaf litter.
**Nutrient surpluses** can be reduced when land removed from agriculture/ nutrient budgeting.

__Research Gaps__

Establish if a direct linear linkage does exist between changes in soil nutrient status and N and P loss. This is essential for the most effective targeting of management options and would question the likely benefits from a nutrient budgeting approach.
Quantifying temporal and spatial lags in the land/water nutrient transfer sequence.
Linking a nutrient concentration with an actual impact.
Integrated nutrient, pesticide and microbiological management at field, farm and catchment scale, (e.g. introducing minimum tillage systems may have benefits for nitrate and sediment loss but there may be a need for greater use of pesticides).
Rigorous testing of buffer strips under Scottish conditions

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