

New Initiatives to Control Soil Erosion In England

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ABSTRACT

In the last 15 years, there have been indications that soil erosion has increased in both lowland and upland areas of England. Attention has focused on off-site effects and damage to landscape and ecosystems. This paper outlines the problems and the steps taken to address the problems.

Erosion has increased where certain soil and slope conditions coincide with changes in management practices. These include increased areas of autumn sown cereals; the use of tramlines for in-crop operations; the removal of traditional boundary features such as hedges and ditches; the increase of outdoor pig keeping and poaching of land by grazing livestock, particularly along river banks. The confounding effect of decreasing soil organic matter contents is unclear.

Farmers usually dismiss soil erosion as the result of exceptional rainfall events. They are more concerned at immediate crop losses and the risk of financial penalties for clearing sediment from roads or drainage channels than long-term sustainability. There is increased pressure to prevent damage to fisheries by sediment in spawning gravels.

The Ministry of Agriculture, Fisheries, and Food has funded research work which has led to the development of a provisional five-class risk system as an extension tool supported by guidance on practical solutions. The need to manage livestock to reduce erosion is also highlighted. Local demonstrations and seminars are being undertaken. These publications and activities support a Soil Code, published in 1993 and revised in 1998 (MAFF, 1998), which provides advice on avoiding long-term damage to soils through erosion, contamination, and other factors.

INTRODUCTION

Agriculture in England can be divided into three broad physical and climatic areas. The eastern part of the country with annual rainfall from 550-800 mm is characterized by intensive arable-based systems. Land is generally less than 200m OD with soils of all major textural classes occurring on topography ranging from flat to moderately sloping. In the west and north where rainfall up to 3000 mm can occur, livestock based systems predominate. Intensively managed grassland is found at lower elevations, whilst sheep and beef cattle are reared on semi-natural vegetation and low input permanent pasture on land from 200 to 850m. However in the last 30 years, in areas below 150 m and rainfall up to

1000 mm, economic pressures have increased the area of arable cropping. Some of the most serious erosion events of recent years have taken place in such situations.

Soil erosion by water has increased in England in recent years but major problems still tend to be localized (e.g. Boardman, 1992). The off-site effects of sediment and the pollutants it carries are of increasing concern to the Environment Agency and statutory conservation bodies. Local authorities in the worst affected areas may seek to recover the cost of removing sediment from roads and damage to private property has resulted in claims for damages.

Although erosion has the capacity to deplete fertility removing organic matter, clay particles, and nutrients and over time reduce the depth of soil farmers rarely perceive such long term and poorly quantified effects as a problem. They are more concerned about short-term costs such as loss of crop and extra cultivations. Management practices are used to correct any problems rather than to prevent them (Skinner and Chambers, 1996).

Skinner and Chambers (1996) and Chambers et al. (2000) have reported surveys of water erosion in lowland catchments. Areas typically affected by water erosion are gentle to moderately sloping sites (2° – 7°) under arable cultivation with sandy or silty soils or shallow soils over Cretaceous Limestone. Although the intensity of rainfall is important, problems are worse where annual rainfall exceeds 800 mm. Losses of soil in excess of 50 t ha⁻¹ per year are seen in high-risk areas but in a 5-year monitoring study median losses of 0.48 t ha⁻¹ per annum were recorded. Exceptional events in the south west of the country have left gullies 2.5m deep and hundreds of meters in length, as thousands of tonnes of soil have been lost.

In addition, almost any upland area with high rainfall is at risk of erosion if the vegetation cover is disturbed. Peat soils are the most susceptible. Overstocking, drainage works and human recreational activities are commonly cited as initiating erosion. Studies are currently in progress to look in more detail at the causes of erosion in the uplands and the issue is not considered further in this paper.

Wind erosion is largely confined to sandy and peaty soils in eastern areas with intensive arable production. Typically, it occurs in dry springs before crop cover is established. Over the years, more farmers have adopted control measures for wind than for water erosion. The more obvious economic effects of losing seeds, fertilizers and herbicides not to mention loss of crop through having to re-drill after the optimum time all encourage control measures to be taken.

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Soils and systems at risk

There have been various estimates of the proportion of soils at risk from run-off and water erosion. These have ranged from less than 10% of those in winter cereals (Soil Survey and Land Use Center 1993 Research Report to MAFF) to more than 40% (Arden-Clarke and Evans, 1993). In reality run-off can take place on virtually any soil if it has been badly managed. Even run-off that looks clear can cause harm to sensitive ecosystems if it contains soluble nutrients or pesticides.

Increased run-off increases the chances of flooding, whilst sediment may block culverts, ditches and streams and compound this problem. The sediment deposited in river gravel is thought to be having a major effect in reducing successful spawning in salmonid fisheries in both upland and lowland rivers (MAFF, 1998). In some areas the Environment Agency are spending considerable sums cleaning river gravels. The sediment and nutrient load can have serious effects on the general ecology of a river and lead to eutrophication of surface waters. English Nature, the Governments Statutory advisers on bio-diversity, is becoming increasingly concerned about conditions in certain catchments which are designated as Sites of Special Scientific Interest. Nutrients and pesticides in the water can lower the quality of water abstracted for public supply. Water Companies have invested in treatment facilities to meet legal quality standards. In one area a water provider has made funds available to farmers to encourage them to convert to organic, or ecological, agriculture to reduce potential problems from pesticides and nitrate (Wessex Water/Soil Association press release, 1998). This is in addition to Government funds for the same process (MAFF 1999 (a)).

Water erosion is considered to have increased due to a number of factors. These include more late sown winter cereals, and increases in silage maize and outdoor pigs particularly on unsuitable sites in higher rainfall areas. Increasing length of slope due to hedge removal is also a factor as are tramlines (wheelings) in crops (Boardman, 1992; Skinner and Chambers, 1996; Chambers et al., 2000). Loss of soil organic matter under arable cultivation is often cited as a major cause of erosion but other factors can override this. The effect of poor grazing management of livestock can give rise to increased soil or bank erosion. This

may arise from badly poached fields when stock are left out in wet weather and treading destroys the protective grass cover; from areas where stock gather for supplementary feeding, from tracks where stock regularly walk back to the farmstead and from uncontrolled grazing of river banks (MAFF, 1998). The Ministry of Agriculture Fisheries and Food and the Environment Agency are working together and with farmers' organizations to reduce erosion and the problems it causes. These initiatives are discussed below.

Development of extension initiatives

The Code of Good Agricultural Practice for the Protection of Soil, which was republished in 1998, includes advice on reducing soil erosion (MAFF 1998). The main messages from this had been included in a general awareness booklet published in 1997 (MAFF, 1997a) and have been supplemented by further booklets on reducing the problems related to livestock management (MAFF, 1999b) and a provisional field guide for risk assessment (MAFF, 1999c). At the same time a manual was published and included more detailed advice on management strategies to reduce the scale of the problem on farms (MAFF 1999 (d)).

A Field Guide for Risk Assessment

This five-class risk assessment has been developed for the Ministry of Agriculture by consultants together with farmers' organizations and the Environment Agency. The detail is based on the observations made in a 5 year monitoring exercise which was set up specifically to provide guidelines to reduce the risk of water erosion on susceptible soils (Chambers et al., 2000). The risk assessment methodology has been released to test its applicability to for use in farm situations with the intention that it will be modified in the light of experience. It is intended for use by consultants or more progressive farmers and as such is based on simple parameters that such people can be expected to recognize: namely annual rainfall, soil texture and slope (Table 1). The classification recognizes that site conditions will influence the actual risk class and it is expected that factors such as organic matter content, slope length, valley features and observed erosional features will be used to modify the classification. The degree of erosion expected to be associated with each risk class is shown in Table 2. This varies from "slight risk" – any run-off is rarely

Table 1. Erosion categories for provisional risk assessment system

SOIL TEXTURES	STEEP SLOPES >7°	MODERATE SLOPES 3-7°	GENTLE SLOPES 2- 3°	LEVEL GROUND < 2°
Sand				
Loamy sand	Very High (High)*	High (Moderate)*	Moderate (Lower)*	Slight
Sandy loam				
Sandy silt loam				
Silt loam				
Silty clay loam	High - Moderate*	Moderate	Lower	Slight
Other mineral soils	Lower	Slight	Slight	Slight

- Where average annual rainfall is less than 800mm, the risk class in brackets applies.

discolored through to “*very high risk*” - rills form in most years and gullies develop in very wet periods. The definitions of the assessment are thus related to the severity of the problem, as it exists in England.

It is intended that the classification should be shown on a map to assist management and erosion control. It is advised that other factors that affect erosion and sediment transport, such as valley features, gateways, roads, and watercourses, should be noted and marked on the map (Figure 1). Having produced the map farmers or their consultants will have highlighted the most vulnerable areas of the farm and the farmers are then encouraged to plan the measures required to reduce problems. These measures are outlined in the field guide but more details are given in the Manual that is available and could include:

- Alterations to the farm layout. For example, relocation of field entrances to avoid deposition of sediment onto road or into ditches and watercourses or divert runoff entering susceptible fields in the first place. Reinstatement of hedges and ditches might also be appropriate to reduce slope length and intercept run-off before it develops erosive potential. In other countries, the setting up of contour cultivation systems would come into this category but in England, vulnerable areas rarely have large enough areas with regular slope patterns to make this a practical option.
- Adjustments to rotations and cropping/land use. For example, in higher risk areas switching from late sown autumn to spring sown crops can reduce the likelihood of erosion. Other susceptible land uses include potatoes, sugar beet, field vegetables, outdoor pigs, grass re-seeds and maize grown in England as forage crop.
- Adoption of good management practices for erosion control. For example by maintaining crop cover, possibly with specifically sown cover crops, increasing soil organic matter by bulky organic manures or changing the rotation, avoiding overworking the land including the possibility of conservation tillage and by leaving seedbeds as coarse as possible. It is believed the use of powered implements for seedbed preparation and the needs of residual herbicides for fine tilths have contributed to the observed increase in erosion. The installation of grassed interception areas, either across slopes or in valley bottoms, are advocated where appropriate. In most years, farmers are required to set-aside a proportion of their arable area in order to qualify for support payments under the Arable Aid Payment System (AAPS) of the European Union. The possibility of using this land as a low cost option for grassing out to aid erosion control is now being actively promoted.

Targeted promotional campaign

Having produced the risk assessment and accompanying advisory material a promotional campaign has been run in six areas known to have problems of erosion on arable land. These were chosen in consultation with the Environment Agency and English Nature. Support was obtained from farmers’ organizations that publicized and circulated the advisory material. The campaign was planned to include articles in the specialist farming press supported by on-farm

demonstrations and discussion for farmers and for consultants, lecturers, environmental advisors, and staff of the Environment Agency. It was decided to provide separate days for farmers for two reasons. The first was the level of technical explanation provided and the hope that the whole concept would be owned by people in the second group who could comment constructively on the approach proposed and who would be able to cascade the information in the years to come. Also because it was felt that in these initial contacts farmers would discuss their problems more openly in the absence of the regulatory authorities. Both of the types of meetings have been very well received and the program is being reviewed in the light of resources available in the coming year to decide how to develop the initiative. Meanwhile the Environment Agency are considering a similar program for farmers in grassland areas which would link in with another of their initiatives to produce a series of leaflets of Best Management Practices to control diffuse pollution from all agricultural sources (Smith, private communication).

The common factor in all of this work is the emphasis on off-site effects. The farming community in recent years has been coming to terms with the expectations of society that it must reduce its impact on the environment. It is believed they will be more susceptible to these arguments for the need to control erosion than attempting to convince them of the long term sustainability benefits which have current costs but only long term benefits.

Future Developments

Legal controls

There are no legal requirements on farmers to prevent erosion. However there are two existing provisions that can be used to punish or prevent off-site effects. Highway Authorities have powers under Section 151 of the Highways Act 1980 to serve notices on the owner/occupier of adjoining land requiring them to take action to prevent soil from that land being washed onto the road (Anon 1980). The Act enables the Courts to impose a fine if they do not comply. Farmers in certain areas are expecting increased use of these powers if the current problems continue.

It is an offence under Section 85 of the Water Resources Act 1991 to cause or knowingly discharge polluting matter

Table 2. Typical erosion effect expected in each risk class.

RISK CLASS	TYPICAL EFFECT
Very high	Rills form in most years. Gullies may develop in wet periods
High	Rills develop in wet periods
Moderate	Sediment is deposited in roads, ditches, and watercourses in wet periods. Rills may develop in very wet periods
Lower	Discolored water may enter and pollute ditches and watercourses
Slight	Run-off water is rarely discolored

or solid waste into any controlled waters without the proper authority (Anon 1991). At the time of writing the Environment Agency has brought no prosecutions relating to soil erosion. However they have been considering doing so for some time and it is believed only the perceived difficulty of being able to prove who was responsible for a specific problem has stopped them to date (Smith, private communication).

In addition, there is the possibility of common law action by individuals or companies seeking damages for the effects of erosion related incidents. Such claims have been submitted, notably in respect of severe damage to property caused by flooding and silt deposition. Insurers have settled these cases before they have come to court (Boardman, private communication) presumably to limit future liabilities. As a result, no case law has been developed and no scale of penalties established.

Ancient hedgerows are protected in England and revision of the existing Regulations is being considered. A discussion paper has been submitted highlighting the importance of hedgerows in moderating erosion in certain circumstances. It is possible in future that the removal of hedgerows will have to take into account the risk of erosion being increased.

There is increasing public debate, generated from environmental organizations, of the need to introduce additional controls on agriculture to prevent erosion. This could involve the imposition of Codes of Good Agricultural Practice in sensitive areas or even specific controls on land use where sensitive habitats could be identified. Such initiatives are not currently part of government policy, which is to encourage the voluntary approach to reducing the problems currently observed.

Financial incentives

The possibility of utilizing set-aside payments to fund erosion control activities has been discussed above. Farmers may also be eligible to switch AAPS eligible land suffering erosion for other land on the holding. This encourages arable production to be switched to sites that are more favorable without financial penalty through loss of aid payments. However, such switches will only be made if production potential is maintained in the short term.

Financial support for controlling erosion can be obtained indirectly from Agri-Environment Scheme payments, which are funded jointly by the European Union and the United Kingdom Government. Uptake can cover 80% of the land in an eligible area but any benefits for erosion control are secondary to the primary objectives relating to biodiversity or the visual landscape. Any incentive scheme, which encourages major land use changes, can help. Arable reversion payments are possible under many Environmentally Sensitive Area Schemes. In the South Downs area in Sussex, where erosion is a particular problem, payments of £250ha⁻¹ per annum are available (MAFF 1997(b)). However, because as only a small proportion of sites at risk of erosion are suitable for re-establishing semi-natural grassland the areas protected have been small and no detailed analysis has been carried out. Environment Agency and English Nature are actively supporting Countryside Stewardship agreements alongside rivers to help protect

them from damage by stock (Anon 1998). In upland areas, intensification schemes and controls on stocking rates also help reduce problems. In addition to these specific possibilities there are general requirements under such schemes that recipients of aid should observe the Codes of Good Agricultural Practice. To date these have not however been actively enforced as far as soil erosion is concerned.

Reform of the Common Agricultural Policy, known as the Agenda 2000, has raised the possibility of requiring compliance with Codes of Good Agricultural Practice under the penalty of withholding support payments. Policy on this matter has yet to be decided.

Meanwhile however market lead developments are increasingly requiring farmers to be able to demonstrate compliance with specific practices under Quality Assurance Schemes. Protocols exist for both crops and livestock systems and variously include good environmental management, which could develop to impose aspects that will reduce the risk of erosion.

CONCLUSION

Soil erosion in England is not the serious threat that it is in many other parts of the world. However, a significant number of farmers need to improve their land management practices to reduce environmental impact and protect the long-term productivity of their soils. Erosion is now receiving increased attention from a number of official sources designed to raise awareness and action among farmers and the general public. This includes the development of an official government policy for soil protection in the form of "A Soil Strategy". Consultations have already commenced and a final document is expected by the end of the year.

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