Sandy Soils

Soils with predominantly loamy sand or sand texture throughout the upper 1m of soil or to rock have inherently weak structure, low fertility and small water holding capacity because of their small clay and silt contents (see Figure 1). As a result, although easily worked, they are susceptible to topsoil structural degradation caused by collapse and compaction when trafficked. Under agriculture they also require regular fertilizer applications.

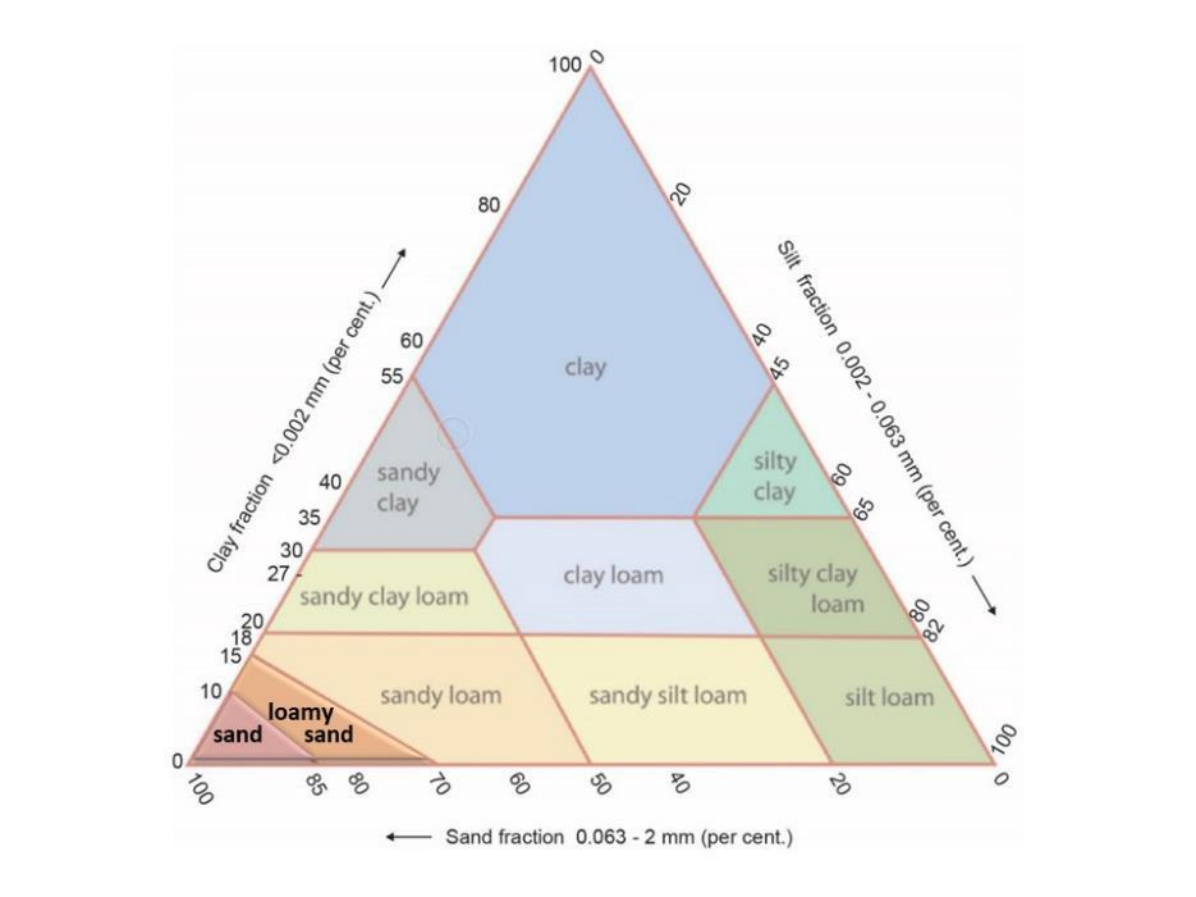

Figure 1 Texture triangle showing particle size groupings based on sand, silt and clay contents with the loamy sand and sand groupings highlighted.

When intensively cropped, sandy soils have significant management issues related to surface capping, erosion, and compaction, but these differ slightly depending on their profile characteristics of which there are three broad types. It is therefore important to know which type of sandy soil you are managing. However, each one is relatively easy to recognise by exposing a cross section down to at least 60cm depth and preferably to 1m. Examples of the three different types are shown below:

Sandy soils are widespread in the UK, the most extensive areas being formed over weakly consolidated reddish sandstones around Exeter, north Shropshire, Worcestershire, west Warwickshire, Nottinghamshire, and The Brecklands of East Anglia. Elsewhere they form discrete areas of various sizes throughout the recently glaciated lowlands from Midland England northwards. They also dominate the extensive heath and woodland areas of Dorset, the Surrey Hills, and western fringes of The Weald.

Type 1. Free-draining sandy soils with brownish colours.

This type has a simple sequence of brownish topsoil, subsoil, and soft bedded parent material with no obvious structural components to be seen in any layer.

Figure 2 Illustration of a Type 1 sandy soil. This profile was affected by rainfall after excavation and now shows topsoil and subsoil material slumping across the boundaries with the underlying layer, illustrating the structural weakness of these soils.

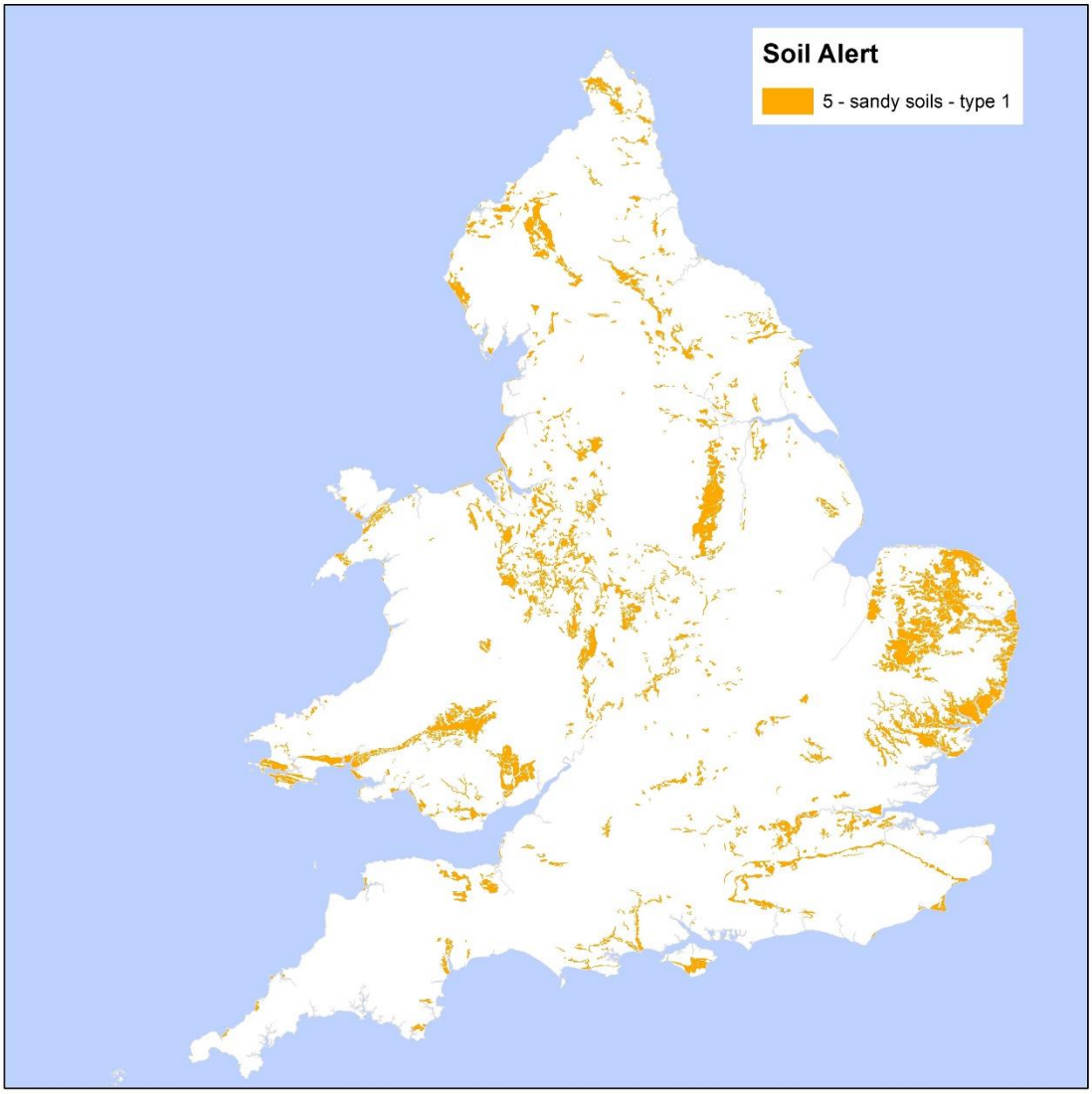

Figure 3 Distribution of Type 1 sandy soils.

On the National Soil Maps of England and Wales **Type 1** sandy soils dominate soil Associations:

361 SANDWICH
521 METHWOLD
551a BRIDGNORTH
551b CUCKNEY 1
551c CUCKNEY 2
551d NEWPORT 1
551e NEWPORT 2
551f Newport 3
551g NEWPORT 4
552a KEXBY
552b Ollerton
554a FRILFORD
554b WORLINGTON
555 Downham

They also occur as minor components in Soil Associations:

541r WICK 1
541t WICK 3
541A MILFORD
571e FYFIELD 2
571f FYFIELD 3
571g FYFIELD 4
571w Hucklesbrook
571x Ludford
572n BURLINGHAM 1
573b Wix

Type 2. Former Heathland sandy soil (podzol) now reclaimed and farmed.

In this type there is an obvious dark coloured plough layer that often contains ‘bleached’ sand grains or paler components and usually directly overlies the remains of one or more dark coloured and/or ochreous coloured ‘podzolic’ subsoil layers.

Figure 4 Illustration of a Type 2 sandy soil.

Figure 5 A Type 2 sandy soil from an un-reclaimed heathland sandy soil (podzol) profile showing the organic-rich topsoil, pale 'bleached' layer and underlying dark coloured organic enriched layer. A classic podzol sequence.

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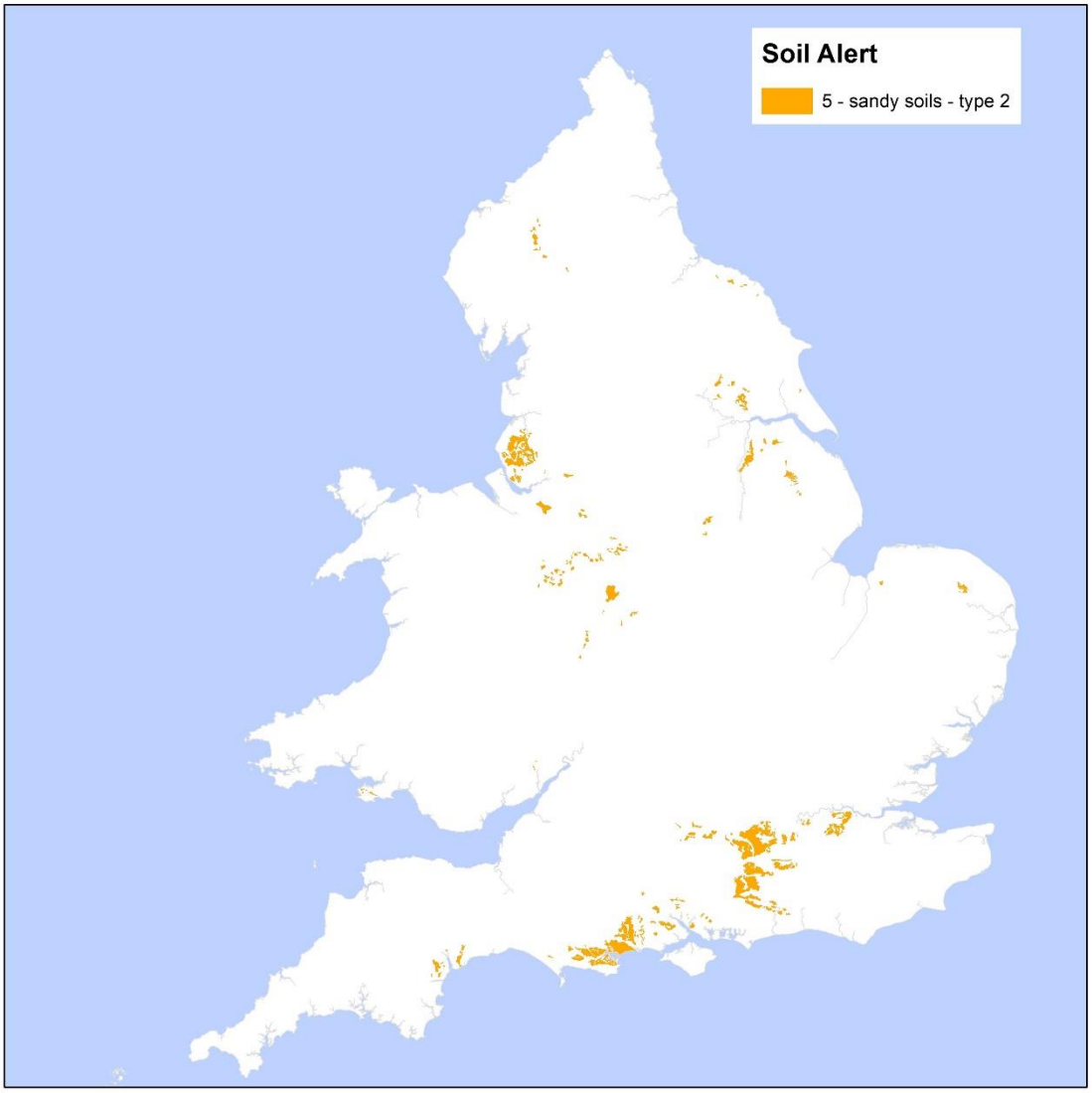

Figure 6 Distribution of Type 2 sandy soils.

On the National Soil Maps of England and Wales **Type 2** sandy soils dominate soil Associations:

631b DELAMERE
631c SHIRRELL HEATH 1
631d SHIRRELL HEATH 2
631e GOLDSTONE
631f Crannymoor
634 SOUTHAMPTON
641a SOLLOM 1
641b Sollom 2
641c HOLME MOOR
643d Felthorpe

They also occur as minor components in Soil Associations:

643a Holidays Hill

Type 3. Sandy soils affected by a groundwater table.

In Type 3 sandy soils, the topsoil plough layer overlies a grey subsoil layer with ‘rusty’ mottles mainly associated with root channels. These colours are the result of saturation with rising groundwater during the late autumn, winter, and early spring periods.

Figure 7 Illustrative profile showing a Type 3 sandy soil.

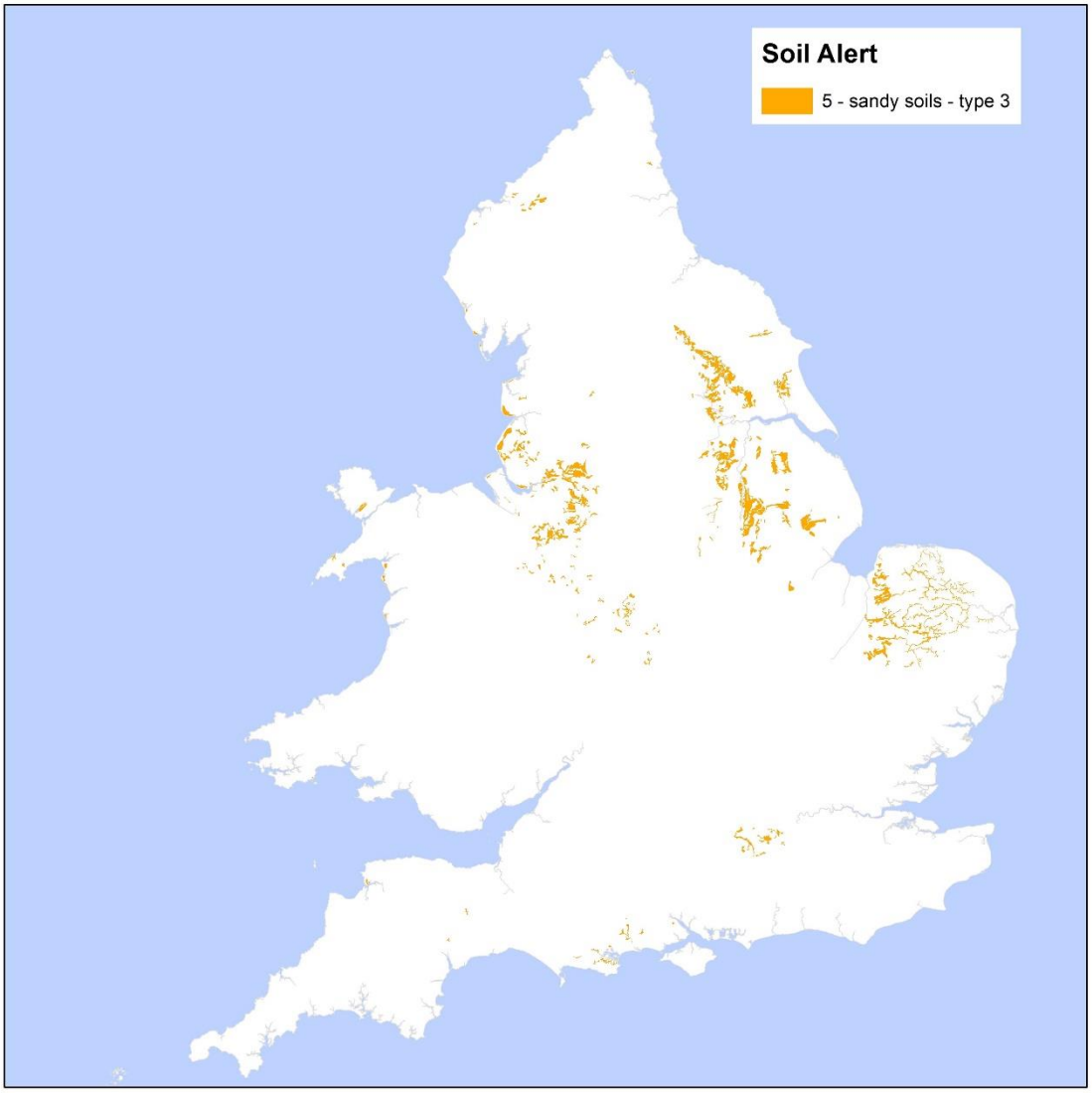

Figure 8 Distribution of Type 3 sandy soils.

On the National Soil Maps of England and Wales **Type 3** sandy soils dominate soil Associations:

821a EVERINGHAM
821b BLACKWOOD
861a Isleham 1
861b Isleham 2

They also occur as minor components in Soil Associations:

711o RUFFORD
841c SWANWICK
851c DOWNHOLLAND 3
1024b ADVENTURERS' 2

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Individual soil series affected by this soil alert:

Type 1	Type 2	Type 3
1.1 RAW SANDS	6.31 CRANNYMOOR	8.21 BLACKWOOD
3.21 BECKFOOT	6.31 DELAMERE	8.21 EVERINGHAM
3.61 SANDWICH	6.43 FELTHORPE	8.21 FORMBY
5.51 BRIDGNORTH	6.31 GOLDSTONE	8.61 ISLEHAM
5.51 COTTENHAM	6.41 HOLME MOOR	
5.51 CUCKNEY	6.42 LAKENHEATH	
5.55 DOWNHAM	6.32 LEZIATE	
5.54 EBSTREE	6.43 RAPLEY	
5.54 EUSTON	6.31 REDLODGE	
5.54 FERNHILL	6.31 SHIRRELL HEATH	
5.54 FRILFORD	6.41 SOLLOM	
5.52 KEXBY	6.34 SOUTHAMPTON	
5.54 LYNN		
5.21 METHWOLD		
5.51 NEWPORT		
5.53 RUDGE		
5.54 ST ALBANS		
5.54 STANDHILL		
5.54 WORLINGTON		

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sandy soils

Farm Management

Sandy soils generally represent some of the most easily worked soils in England and Wales and are frequently used for mixed farming, predominantly cereals with break crops of grassland, oilseed rape, maize and even cash crops such as potatoes, sugar beet, and occasionally vegetables. In most years trafficability for planting and harvesting these crops is good with little risk of causing soil structural damage, whilst poaching risk in grassland is low enough to allow over-wintering of stock. However, there are two main problems with this type of farming on sandy soil.

Firstly, because of their inherently weak structure, sandy soils are particularly susceptible to erosion both by wind and water (see Figure 9, Figure 10 and Figure 11). Whilst this applies to all sandy soil types, Type 1 is the most vulnerable. Type 2 soils are somewhat less so because of their greater topsoil organic matter content, whilst Type 3 soils are usually located on low-lying level ground and thus less susceptible to water erosion.

Secondly their reputation for easy working and access can result in fields being trafficked or stocked when they remain wet, especially when contract labour is used. This will cause structural damage from compaction in topsoils and upper subsoils which is easily overlooked.

The key strategy that significantly reduces erosion risk is to minimise or even eliminate periods when the soil lies bare, particularly over the late autumn, winter, and early spring. The aim of any cover-crop should be to provide 100% coverage of the soil surface during these periods. This will ensure rainfall does not slake the surface and form a cap, which can considerably reduce the infiltration of rainfall into the soil profile (see Figure 11). Where this occurs in soils that have also recently suffered compaction the loss of coarse pore spaces in topsoil and upper subsoils increases the risk of surface runoff on sloping ground. This can rapidly lead to rill and gulley erosion, depositing large amounts of soil on low-lying flat land (see Figure 11) or into local streams. It is also important to avoid planting late harvested crops such as maize and sugar beet on sloping ground (see Figure 10).

Figure 9 Wind erosion of Type 1 sandy soils showing accumulation of blown sand at a field boundary.

Planting up and down slopes NOT across, plus poor cover crop development in maize

Gulley development with car parked on deposition in the flat field bottom

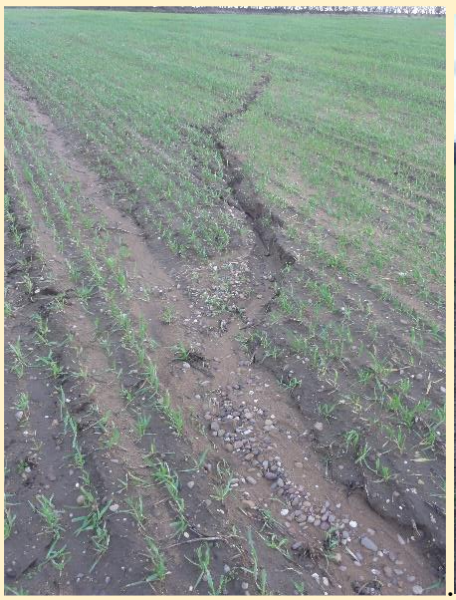
Figure 10 Erosion problems in a maize crop caused by planting up and down sloping ground.

Minimal crop cover in winter

Degraded surface with minimal crop cover

Surface slaking

Soil surface pan



Development of small rill

Deposition of sand at base of slope

Figure 11 Structural problems in sandy soils leading to compaction and soil erosion.

In addition, maintaining topsoil organic carbon contents of at least 1.5% and preferably above 2% will help to improve structural stability (see Figure 1 in Soil Alert 6, capping soils), although this can be difficult because of their small topsoil clay content, usually less than about 12% and often around 6 to 7%. Clay content is important in stabilising soil organic carbon.

Increasing topsoil organic carbon content in these soils has the added benefit of increasing water holding capacity. Type 1 and, except for the Isleham series, Type 3 sandy soils are most likely to benefit from this strategy. Isleham series together with all Type 2 sandy soils, have dark coloured topsoil with inherently larger organic carbon content but, even in this type, organic carbon content is likely to decrease over time if annually cultivated so management strategies to prevent this are necessary.

Both these aims are suited to current ideas for 'regenerative farming' which promotes five main strategies:

- Minimizing soil disturbance.
- Maximizing crop diversity.
- Keeping the soil covered all year round.
- Maintaining living roots all year round.
- Moving to a more mixed farming approach that integrates livestock grazing ensuring an on-farm source of manures for increasing soil fertility and topsoil organic content.

Importantly, the aims are also supported by Defra's Sustainable Farming Incentive (SFI) scheme which provides payment for 'actions for soils', that are focussed on 'improving soil health, structure, organic matter and biology'. To take advantage of this, applicants whose land contains these types of soils should ensure they are included as part of their soil assessment (Action SAM1), whilst their soil management plan should include the use of multiple species winter cover (Action SAM2) and / or the incorporation of herbal leys into the crop rotation (Action SAM3). The plan should also include regular sampling and monitoring of topsoil organic carbon content to ensure that levels are maintained at around 1.5% or more. In addition, for all three types of sandy soils, the plan should include measures to ensure that, following a significant rainfall event within the Autumn, Winter and Spring periods, there should be at least two rain free days before the land is trafficked.

Irrigation

As described above the droughtiness of sandy soils means that their productivity is often limited. They are thus likely to be regularly irrigated, particularly when under the more valuable crops. This practice requires careful management as water falling directly onto any bare surfaces can quickly lead to structural collapse and slaking, resulting in surface runoff and a risk of erosion. It is thus important to ensure that rates of water application do not exceed the soil infiltration rate, especially in relation to wheel tracks. Wherever possible a drip irrigation system should be used rather than a sprinkler system.

Construction

Because of the erodibility of these soils, civil engineering projects that involve soil stripping, storage and eventual replacement should minimise damage from rainfall run-off by ensuring stockpile gradients are as minimal as site constraints permit, whilst seeding of freshly constructed stockpiles should be carried out as soon as possible to ensure structural collapse is minimised. If site constraints mean that stockpile gradients risk rainfall run-off, then site boundaries should be constructed to restrict run-off leaving the site.

Natural Habitat Biodiversity

Soil Association 361 Sandwich comprises sandy soils formed on sand dunes, marine shingle, and other beach deposits. Its areas of sand dunes include both 'fixed' dunes, stabilized by vegetative cover, as well as 'shifting' dunes with little vegetation. The latter provide a valued and unique habitat type that has dramatically reduced over recent decades. As a result, where there are no public interest reasons for stabilising dunes (encroachment on property etc), efforts are being made to remove scrub and create cuttings through which the wind can keep the sand shifting and allow the colonising plants and fauna to become established in a more natural dynamic environment. This has already been done at Formby and is currently underway at Penhale dunes in Cornwall, which has been designated both nationally as a Site of Special Scientific Interest (SSSI) and internationally as a Special Area of Conservation (SAC). Cornwall Wildlife Trust - digging Penhale dunes

Type 2 sandy soils are widespread under semi-natural land cover providing an important variety of dry and wet heath and woodland habitats. Where such land lies in the path of infrastructure projects, the aim should be to restore the site so it can revert to its former habitat type relatively easily. In restoring these sandy soil types care must be taken not to mistake the dark coloured 'podzolic' subsoil layer for topsoil (see Soil Alert 3, Humus Podzols).

Sources of further information

More detailed information on Defra's SFI Actions for Soil can be found on: SFI actions for soils - GOV.UK.

More specific information on soil associations is also available in LandIS: LandIS - Land Information System - Associations.