



Recreation : Land-based recreation : Soil

Soil compaction

Assessing the magnitude of soil compaction

Soil compaction measures

Natural factors influencing soil compaction

Most land-based recreational activities carried out in the vicinity of marine features, whether carried out on foot, horseback or vehicle, exert forces on the surface of that feature which can result in compaction. The magnitude of the pressure and the characteristics of the feature will determine the nature of any impact.

Impacts can include:

- erosion of soils and upper levels of less durable marine features
- changes in the level and diversity of vegetation within a site or feature
- changes in feature density, porosity and penetrability

Changes to a feature associated with soil compaction do not necessarily imply a significant adverse impact. There is an important difference between change and impact and this can only be determined at the specific site-level.

Assessing the Magnitude of Soil Compaction

It is possible to make an assessment of the magnitude of soil compaction caused by different activities by reviewing the different static ground pressures exerted by activities. This involves dividing the weight exerted by an activity on the ground by the area in contact with the ground.

Soil

Activity	Average of total Weight (g)	Ground contact area (cm ²)	Pressure (g/cm ²)	Source of data
Human				
Bare footed	73,000	262	279	Liddle (unpublished)
Shoes	73,000	406	180	Liddle & Grieg-Smith (1975)
Animal				

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Horse & rider (shoes only)	613,000	140	4,380	Liddle (unpublished)
Vehicle				
Trail-bike	229,000	114	2,008	Eckert et al (1979)
Quad bike	140,000	1,400	100	Slaughter et al (1990)
Saloon car and driver	1,282,000	855	1,500	Liddle & Greig-Smith (1975)
Four wheel drive Toyota, loaded four people and gear	2,500,000	1,483	1,686	Liddle (unpublished)

Compaction Measures

Liddle (1997)

The greatest static pressure is exerted by horse and rider, mainly because of the small ground area over which the weight is spread, followed by motorised vehicles. This has implications for those features which are particularly sensitive to compaction, such as sand dunes, where activities such as horses riding are likely to occur.

In those areas where wildfowling takes place, there may be observable trampling effects on vegetation, although because the activities tend to take place in tidal areas, compaction impacts are likely to be minimal. Wildfowling is likely to cause less overall trampling-related impacts than an activity such as dog walking for example, as levels of participation in wildfowling are at a much lower level.

Natural Factors Influencing Soil Compaction

Marine features are supported by underlying layers of rock and soil which determine their overall resilience to ground pressure. The different natural characteristics are just as important in determining the impact of recreational activities, as are the relative ground pressures exerted by those activities. Uneven, stony or rocky ground, as found on rocky shores, results in a person's weight being distributed over a much smaller area. In such an area, the static pressure of a person can be greater than that of a vehicle, with associated implications for sensitive rocky shore vegetation.

For example, in areas where underwater reefs extend to the shore, people who go 'rock pooling' or gathering rock pool species at low tide can exert a significant static ground pressure, with consequential implications for density and diversity of species.

Conversely, soft ground such as mudflats, sandflats and saltmarsh enables the load of a person to be spread over a greater area and therefore results in lower ground pressure. However, communities found in such habitats can be very vulnerable to even low pressure activities, particularly if they live in the upper layers of the mud or sand flat. Heavy vehicles accessing these areas therefore have the potential to cause significant damage to such communities.



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Recreation : Land-based recreation : Erosion

Erosion from land-based recreation

The causes of erosion

The causes of feature erosion

Shrinking beaches

As with soil compaction, erosion of a feature is also caused by exertion of pressure. However, the greatest erosional forces exerted on a feature come from natural sources such as rain, wind and, in the intertidal area, wave action. At a site level, these forms of erosion will be much more significant than that caused by recreation. However, as recreational activities tend to be concentrated along specific access routes or in small areas, their impact can be magnified, causing significant erosional patches within a site or feature. Such erosion is particularly evident in coastal areas frequented by walkers and in the vicinity of heavily used access points.

The rate of erosion is not simply dependent upon the intensity of activities in the vicinity of a feature. It is also related to the erodibility of the soil, which in turn is linked to its texture, its capacity to absorb and filter water and its organic and chemical content. Figure 6.1 illustrates this relationship.

The causes of erosion

NATURAL PROCESSES

1. Wind
2. Rain
3. Waves

RECREATIONAL ACTIVITIES

1. Types of activity
2. Location of activity
3. Level of activity



NATURAL IMMUNITY OF FEATURE

1. Texture
2. Infiltration capacity
3. Chemical/biological content



EROSION OF FEATURE

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UK CEED (1998)

Soft coastal habitats tend to face the greatest risk of erosion from both natural processes and also human activities, including recreation. Recreation may have a particular erosional impact on sand dunes and sand flats. Table 6.2 summarises the main causes of erosion on marine features.

Causes of Feature Erosion

Feature	Soil Type	Erosional Impact of Recreation	Main Causes of Erosion (descending order of magnitude)
Sand dune	Sands	ü	<ul style="list-style-type: none"> • Wind action • Recreation - access routes to beaches • Off-road vehicles and horse riding
Mudflat	Silt/mud	ü	<ul style="list-style-type: none"> • Wave action • Recreation - accessing water at low tide
Sand flats	Sands	ü	<ul style="list-style-type: none"> • Wind and wave action and runoff • Recreation - motorised vehicles can destabilise upper surface level and make it more vulnerable to natural erosion
Sandbanks	Sand covered by sea water	r	<ul style="list-style-type: none"> • Wave and storm action
Rocky shores	Rocks and gravel	r	<ul style="list-style-type: none"> • Insignificant erosion
Sea caves	Rock	r	<ul style="list-style-type: none"> • Wind and wave action

UK CEED (1998)

Key

ü Significant recreational impact ü Small recreational impact

r Little or no recreational impact

Shrinking Beaches

Many of the UK's shorelines, consisting of soft rock expanses, mud and sand flats, are undergoing a process of 'retreat', whereby the sea is eroding the intertidal features in front of static sea defences. Such shrinking is largely a result of a number of natural processes, including wave and wind actions and sea level rise. However, these processes can be

accentuated by erosional pressures caused by recreational activities.

The decrease in the width of sandy beaches, which is common throughout Europe, can have a serious effect upon the ability of the habitat to support indigenous species. It can also have a significant impact upon its amenity value for tourism and recreation. It can also have the knock-on effect of putting greater recreational pressure on other similar sites. The impact on tourist incomes could have important indirect effects on the environment as less money may be available for management and nature conservation purposes.

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Modification of habitats from land-based recreation

Wherever land- or water-based recreational activities take place in formal or semi-formal areas, car parking and toilet facilities are usually required by participants. At a launch site, car parking often needs to cater for car and trailer. At marinas, boatyards and yacht clubs where boats are moored on water, car parks will invariably cater for just the participant's car. However, larger facilities often have a significant land area set aside for dry boat storage and owner maintenance.

The construction of car parks and other landside development, such as offices and boat associated businesses will often entail extensive site preparation, including levelling, concreting, tarmacing and other subsequent construction work. Generally, the larger the facility required, the greater the potential for significant permanent environmental impact.

However, it should be borne in mind that although the provision of new car parking facilities in some areas can cause environmental impacts, it may be that, over the long term, the magnitude of such impacts may be less than the impacts of continuous unmanaged parking in sensitive areas, such as in between sand dunes. The sacrifice of a less important area in terms of nature conservation may be beneficial in the long term for the protection of the overall site.

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Damage caused by littering from land-based recreation

Plastic

Paper

Glass bottles and jars

Dog faeces

Angling line and lead weights

Discarded shotgun cartridges

Although the source of most marine pollution is industrial activity and agriculture, recreational activities can contribute to localised pollution issues. Perhaps the most obvious issue linked to recreation in coastal areas is that of discarded litter. Although the amenity impact of litter is more significant than its environmental impact, discarded litter can have direct impacts on both plant and animal species which inhabit designated coastal features. The following section reviews some of the different types of litter and their possible implications for the environment.

Plastic

Much of the plastic found in coastal areas is derived from accidental spillage from ships or from factories close to rivers. There is no doubt, however, that in areas of intensive recreational activities, litter from participants can contribute to localised problems.

Food and equipment packaging tends to be the most commonly discarded item connected to recreational activities. These can enter the marine environment either because of deliberate littering or from overflowing or inappropriately designed waste bins.

The very characteristics that make plastic so useful - strength, durability and light weight - tend to make it the most persistent and visible form of rubbish. Not only is plastic litter unsightly, it can be dangerous to birds and animals. Birds and fish can often mistake plastic floating in the water for food and, once ingested, it can cause severe internal injuries. Wildlife can also become caught up in discarded plastic, with four pack plastic holders being a particular problem.

Paper

Discarded paper is largely an aesthetic issue and is unlikely to have any significant environmental impacts on features or their associated flora and fauna.

Glass Bottles and Jars

Discarded glass containers are unlikely to cause direct damage to a marine feature, but can ignite fires in the vicinity of a feature. This can have a severe effect on the vegetation and

species in those areas. In addition, glass and broken glass can be hazardous to small mammals which live in the vicinity of the designated areas.

Dog Faeces

Dog walking is one of the most popular recreational activities in coastal areas. The problems associated with dog faeces are largely an amenity issue and cause little or no significant impacts to marine features.

Angling Line and Lead Weights

Accidentally or deliberately discarded nylon line and netting have no impacts on the geomorphology of designated habitats but can have an impact on designated species, such as seals, particularly in the vicinity of typical haul out sites. Line and equipment discarded in intertidal areas can also adversely affect wading birds by becoming entangled around their legs. Ingested lead weights can cause serious illness in marine wildlife.

Discarded Shotgun Cartridges

Spent shotgun cartridges from wildfowling and other hunting activities are unlikely to have any significant impact on marine features, other than those related to amenity, although they may cause impacts to wildlife if ingested.

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Disturbance to wildlife from land-based recreation

Table – recreation and disturbance to wildlife

Disturbance to seals

A considerable amount of research has been undertaken on the disturbance effects of recreation. This is summarised below. A list of key sources of research is provided in the Appendices.

Land-based recreation can disturb species both through presence of participants and also through direct interference. Liddle (1997) suggests that there are three levels of disturbance which may affect a species:

- the species is aware of the physical presence of the recreational participant but there is no contact (e.g. wildlife watching) and it may or may not alter its behaviour as a result.
- the species may have its habitat physically modified by an activity (e.g. pathway creation, camping activities). The consequences of this disturbance may be positive or negative for the species.
- the species may come into direct and damaging contact with humans (e.g. wildfowling, fishing or vehicle collision).

Different types of recreational activities have different levels of interaction with species and therefore different levels of disturbance or impact. The table below is taken from Duffus and Dearden (1990) and links recreational activities to the types of wildlife disturbance identified by Liddle (as 1,2,3 above). It suggests that the provision of recreational infrastructure such as toilets, roads and visitor centres has a much greater potential to disturb wildlife than the recreational activity itself. However, it also indicates that recreational activities involving dogs or vehicles have the greatest potential to cause impacts.

Table - Recreation and disturbance to wildlife

Activity	Types of Disturbance		
	1	2	3
Walking	2	1	
Walking with dogs	4	1	
Horse riding	3	2	
Trial-bike	5	2	?
Bird watching	1	1	



Animal photography	1	1	
4x4 (off road vehicle)	5	3	?
Hunting with rifle on foot	2	1	0-5b
Hunting with shotgun	2	1	0-5b
Hunting with dogs only	5	2	0-5b
Fishing from bank	2	2	0-5b
Fishing by wading	2	2	0-5b
Camping in wilderness	2	2	?
Camping in campsite	4	4	
Presence of toilets	4	4	?
Car park frequently used	4	4	?
Large development (visitor centre)	5	5	0-5
Presence of roads	2-3	2-3	

Duffus and Dearden (1990)

Key:

1= low effect

5= high effect

B 0= hunting unsuccessful

B 3 = animal injured

B 5 = animal killed

Disturbance to Seals

Within the mSAC demonstration project the only *designated* species susceptible to land-based recreational disturbance are Common and Grey Seals. The following section identifies disturbance issues associated specifically with these two species.

Tourism and recreation based wildlife watching is a growing and lucrative business and is presently unconstrained by specific legislation. The attraction of seal watching is increasingly promoted by companies and individuals involved in these activities.

Seals are quite elusive in the water and so are most commonly visible whilst ashore. Here they can be very susceptible to disturbance, particularly while resting, breeding and rearing young.

Seal watching activities can contribute to disturbance on land, especially as people can have direct and often unrestricted access to them while they are out of the water.

A recent report to SNH by Brown and Prior (1998) concluded that the most significant source of human disturbance to breeding sites on Mousa SAC was from recreational activities.

A research study looking at the effects of human disturbance on the maternal behaviour of grey seals at Donna Nook in Lincolnshire (Lidgard, 1996) showed that females preferred to give birth in areas of low disturbance and that pups born in such areas gained weight more quickly than pups born in areas of greater disturbance levels. However, the study was unable to conclude that these differences in weight gain were as a direct result of human impacts. During periods of high human disturbance, females were more protective towards their pups and the pups were more vigilant. The study suggests that these behavioural changes may divert energy away from the pup leading to reduced growth rate and increased pup mortality. In conclusion the report suggested that:

"Overall it does not appear that the Grey Seal population at Donna Nook is in jeopardy from human disturbance. The colony has dramatically increased in size since 1990, the mortality rate of pups is similar to that reported in other UK colonies and the weaning and growth rate of pups is higher than those reported in other colonies" Lidgard (1996).

The breeding season is an important consideration as it coincides with the 'low' season for most recreational activities. However, in the Scilly Isles, the breeding season for Grey Seals begins in July, whereas in South West England it begins in late August to early September and becomes progressively later in a clockwise direction around the country. As a result, the Grey Seal breeding season may actually coincide with summer activities in certain locations or areas. In the breeding and pupping season, the species is more vulnerable to disturbance than at other times of the year and therefore, even with fewer recreational participants, the potential for disturbance to have an impact is greater. Common seals are particularly vulnerable to recreation as their breeding and moulting season lasts from June to August coinciding with the 'peak' tourist and recreational season.

The study by Brown and Prior (1998) found that recreational participants who carried cameras or camcorders approached the seals much more closely than those without, and that the closer approaches resulted in greater levels of disturbance. This study also showed that not all people visiting the site caused disturbance. Almost 40% of the visitors observed caused no disturbance at all. However, 40% did cause serious disturbance resulting in the seals abandoning the haul out site for a period of time.

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[Recreation](#) : [Land-based recreation](#) : [Birds](#)

Disturbance to birds from land-based recreation

Many land-based activities have the potential to disturb birds including walking - particularly with dogs - wildfowling and bait collecting. The potential impacts of bait collecting are considered in more detail through the UK Marine SACs Project in a related report by Fowler (1999).

There has been a great deal of research undertaken on the impacts which wildfowling has on wildlife. However, there is limited research available on the impact which the activity may have on marine features.

Many studies have been conducted which examine the correlation between wildfowling and significant population impacts. There is some evidence to suggest that wildfowling may cause disturbance to the feeding and roosting grounds of non-quarry species. This will depend upon the intensity of the activity on the site and the feeding and roosting requirements of quarry and on-quarry species. However, the evidence linking episodes of disturbance to longer term population changes is much less clear and there are many other significant factors also having an effect.

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[Recreation](#) : [Land-based recreation](#) : [Fires](#)

The effects of fires from land-based recreation

Some of the species supported by designated intertidal features are susceptible to fire damage. This risk is particularly prevalent in the peak season when vegetation can become tinder dry and a single spark can cause a fire. Discarded cigarettes and glass have, in the past, been the main cause of such fires. However, the problems associated with peak season fires have recently grown with the development of the disposable barbecue and the increasing desire of recreational participants to be self sufficient in terms of food provision.

This issue was highlighted on the site visit to the Solway Firth mSAC demonstration site. Rangers in the area reported scorch marks on the ground and spoke of their concern about potential damage of the site through accidental fires. Where used too close to dry vegetation, disposable barbecues can decimate large areas of vegetation in sensitive areas. Vegetated sand dunes are particularly susceptible as people often light barbecues in close proximity to car parks or in-between sand dunes in an attempt to avoid the wind

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A summary of potential effects

Soil compaction

Erosion

Modification of habitat

Littering

Disturbance to wildlife

Fire

Intertidal areas can come under considerable pressure from recreational activities as not only do they support a variety of land based activities, such as walking and horse riding, but they also provide access channels to the water for waterside recreation.

There are a range of potential impacts which land-based recreational activities may have on the natural environment. Some will be as a direct result of the activity (e.g. erosion caused by trampling), whereas others are indirect (e.g. the clearing of land to provide parking or other facilities).

Changes to the feature associated with land-based recreation do not necessarily lead to impacts. The level of acceptable change determines the stage at which a site-level change will become an impact.

Soil Compaction

Impacts associated with trampling vary according to the nature of the site, the soil which constitutes the feature, and the levels and types of recreational activities.

Impacts are particularly severe in and around sand dune areas. This is because these areas form major access points to beaches and also possibly because participants are unaware of their significance and vulnerability.

Erosion

As with soil compaction, erosion of a feature is also caused by exertion of pressure. However, the greatest erosional forces exerted on a feature come from natural sources such as rain, wind and, in the intertidal area, wave action

As recreational activities tend to be concentrated along specific access routes or in small areas, their impact can be magnified, causing significant erosional patches within a site or feature. Such erosion is particularly evident in coastal areas frequented by walkers and in the vicinity of heavily used access points. Recreation may have a particular erosional impact on sand dunes and sand flats.



Modification of Habitat

The construction of car parks and other landside development often involves extensive site preparation and can result in feature modification and impact.

Over the longer term, the magnitude of impacts from formal car parking may be partially offset by a reduction in the impacts associated with unmanaged parking in sensitive areas, such as in between sand dunes.

Littering

Recreational participants may be a localised source of litter, although much of the litter found on beaches and intertidal areas originates from other landside sources or from ships.

Disturbance to Wildlife

Seals are a particularly attractive species for wildlife watchers. As a result, accessible colonies of seals in mSAC areas are coming under increasing pressure from visitors. These visitors can cause disturbance to the seals, although the long-term impacts are uncertain.

Disturbance to birds may result from many activities. The evidence of the impact of these short term events on wider population levels is not conclusive.

Fire

Where used too close to dry vegetation, disposable barbecues can decimate large areas of vegetation in sensitive areas. Vegetated sand dunes are particularly susceptible as people often light barbecues in close proximity to car parks or in-between sand dunes in an attempt to avoid the wind.

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Guidelines for recreational activities in European marine sites

This section builds on the information in previous sections to provide, in the form of activity guides of recreational activities that take place in and around European marine sites. The individual activity guides provide the following information for each activity:

- participation rates
- key activity characteristics
- methods of disseminating information to users
- locations where the activity is likely to take place
- environmental effects
- impacts on features (high, medium, low)
- availability of codes of practice
- address of governing body

The table of environmental effects for each activity is based both on the information contained within preceding chapters and also on a consideration of the characteristics of the activity and the typical location in which it occurs. Although there is limited scientific information detailing the specific cause and effect relationships of changes in marine features over time, the summary tables provide a starting point for identifying which activities are likely to have an impact upon marine features. It should be stressed that the tables are not designed to be definitive guides to the impact of activities at specific sites - this can only be determined by site assessment. It is also vital to consider recreational activities in the context of natural factors and other human influences not connected with recreation.

The reader should take the following key issues into account in relation to the information contained within this section.

The intensity of both land and water-based recreation in European marine sites is determined largely by the accessibility of the area to those people who wish to take part in the activity.

Recreational activities can have a wide range of impacts on the marine environment. These range from physical effects such as trampling to biological effects such as the suspension of hydrocarbons in the water column. However, the impacts of an activity upon a feature depends upon the ecological requirements of that feature (its sensitivity) and the likelihood of the activity occurring at a damaging level.

The *potential* for an activity to have an impact on a marine feature does not imply that it *will* have an impact on that feature or that an observed impact at one site will occur at all sites.

Only investigation on a site specific basis, preferably over time, can determine the actual link between recreational activities and observed changes in marine features.

Where the impacts of an activity are uncertain, the Department of the Environment, Transport and the Regions (1998) suggests that the precautionary principle should be applied. This implies that such uncertainty should not be used as a justification for postponing measures to protect the environment. However, there should be strong circumstantial evidence of cause and effect before implementing specific controls on activities.

Motorboating

Sailing-yachts

Dinghy sailing

Personal water craft

Water skiing

Sub aqua and snorkelling

Sea fishing and shoreline angling

Sea kayaking and canoeing

Infrastructure for water-based recreation

Walking, hiking and dog walking

Horse riding

Bird watching

Wildfowling

Quad biking

Wildlife watching, including seal and dolphin watching

Beach recreation



Recreation Report

Guidance on the potential impacts of recreational activities in UK European marine sites.

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The information above has been sourced from:

UK CEED 2000. A review of the effects of recreational interactions within UK European marine sites. Countryside Council for Wales (UK Marine SACs Project) 264pp.

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