IMPORTANT INVERTEBRATE AREA PROFILE

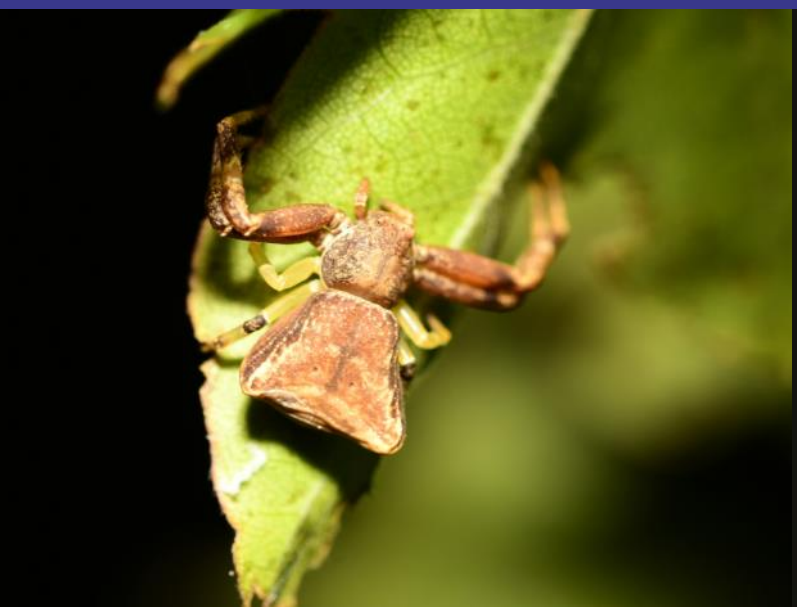
Kent Downs and Stour Valley

Left: The marshes at Stodgmarsh © Rog Frost (CC BY-SA 2.0 DEED). Right: Wart Biter Bush-cricket (*Decticus verrucivorus*) © Kostas Zontanos (CC-BY-NC)

The Kent Downs and Stour Valley Important Invertebrate Area (IIA) includes some of the most important sites for wildlife in Kent. The wetlands and dunes of Sandwich Bay and the ancient woodlands of Church Wood Site of Special Scientific Interest (SSSI), Ellenden Wood SSSI, West Blean and Thornden Woods SSSI, Chequers Wood and Old Park SSSI found within and around the Blean Complex Special Area of Conservation (SAC) have been known to entomologists since the 19th century. The IIA falls across the North Kent Plain and Kent Downs National Character Areas and is partially in the Kent Downs National Landscape.

The Great Stour river, which has its headwaters in the chalk of the downs above Ashford, flows north east through the Kent Downs National Landscape to Canterbury and onto the Ash Levels via the extensive reedbeds and wetlands of Stodmarsh SSSI/Ramsar/SAC where it converges with the Little Stour and flows into the English Channel at Sandwich Bay SAC. Parts of these rivers and their tributaries are chalk streams holding populations of the Globally Endangered White-clawed Crayfish (*Austropotamobius pallipes*). The south coast is defined by the internationally famous White Cliffs of Dover, where the IIA covers the chalk grasslands of the Dover to Kingsdown SAC, and Dover to Folkestone Heritage Coast, as well as sites in the dry valleys around Dover and Folkestone such as Folkestone to Etchinghill Escarpment SSSI/SAC, and Lydden and Temple Ewell Downs SSSI/SAC where the Endangered Wart-biter Bush-cricket (*Decticus verrucivorus*) is found along with an important assemblage of chalk grassland Lepidoptera including the Endangered Straw Belle moth (*Aspitates gilvaria*).

Sandwich Bay to Hacklinge Marshes SSSI includes sand dunes and freshwater marshes supporting a diverse




Left: Truncated Spider (*Pistius truncatus*) © lilcar (CC-BY-NC). Right: The flea beetle *Longitarsus aeruginosus* © zmrdk (CC-BY-NC)

range of threatened invertebrates including the European Vulnerable Moss Carder Bee (*Bombus muscorum*), the threatened Dainty Damselfly (*Coenagrion scitulum*), the Endangered Sandwich Click Beetle (*Melanotus punctolineatus*), and the Endangered Norfolk Hawker (*Anaciaeschna isoceles*). Threatened Lepidoptera at Sandwich Bay include the Sandhill Pygmy (*Stigmella zelleriella*) at its only British site, the Pointed Case-bearer (*Coleophora chalcogrammella*), and the Endangered Scarce Pug (*Eupithecia extensaria*).

The ancient dry oak woodlands and heaths of the Blean Complex hold the South East's largest population of the Endangered Heath Fritillary (*Melitaea athalia*) and is the only modern British site for the Critically Endangered Truncated spider (*Pistius truncatus*) and is one of only three UK sites for the Daisy Case-bearer (*Coleophora ramosella*). On the Kent Downs, the ancient chalk woodlands and downs support the European Vulnerable Southern Oyster Mushroom Beetle (*Triplax lacordairii*), the Endangered Duke of Burgundy butterfly (*Hamearis lucina*), and Britain's entire population of the Endangered Black-veined Moth (*Siona lineata*).

The mobile soft rock cliffs of Folkestone Warren SSSI are the only modern site in Britain for the Critically Endangered flea beetle *Longitarsus aeruginosus*, where it has been found on Hemp Agrimony. It is also a stronghold for the Fiery Clearwing moth (*Pyropteron chrysidiformis*).

Tankerton Slopes and Swalecliffe SAC on the North Kent coast is designated for its population of Hog's Fennel which is the foodplant of the moths: Fisher's Estuarine Moth (*Gortyna borelii*) and Estuarine Flat-body (*Agonopterix putridella*).

Reasons for selection

The Kent Downs and Stour Valley IIA supports at least 147 qualifying IIA species of conservation concern. The area supports the following species which are threatened on a Global or European scale and of Critically Endangered or Endangered status on a national scale:

- Globally Endangered White-clawed Crayfish (*Austropotamobius pallipes*)
- Critically Endangered crawling water beetle *Haliplus varius*
- Critically Endangered flea beetle *Longitarsus aeruginosus*
- Critically Endangered Truncated Spider (*Pistius truncatus*)
- Endangered Sandwich Click Beetle (*Melanotus punctolineatus*)
- Endangered ground beetle *Bradycellus distinctus*
- Endangered Necklace Ground Beetle (*Carabus monilis*)
- Endangered Duke of Burgundy (*Hamearis lucina*)
- Endangered Heath Fritillary (*Melitaea athalia*)
- Endangered White-letter Hairstreak (*Satyrium w-album*)
- Endangered Norfolk Hawker (*Anaciaeschna isoceles*)
- Endangered Straw Belle moth (*Aspitates gilvaria*)
- Endangered Scarce Pug (*Eupithecia extensaria*)
- Endangered Feathered Beauty (*Peribatodes*

secundaria)
- Endangered Black-veined Moth (*Siona lineata*)
- Endangered Wart-biter Bush-cricket (*Decticus verrucivorus*)
- Endangered Dune Lantern-spider (*Agroeca lusatica*)
- Endangered Paradox-knee Spider (*Gonatium paradoxum*)
- Endangered Spineless Pit-head (*Trichopterna cito*)
- European Vulnerable Moss Carder Bee (*Bombus muscorum*)
- European Vulnerable Southern Oyster Mushroom Beetle (*Triplax lacordairii*)

Key habitats for rare invertebrates in IIA

Using the Pantheon analytical tool, we identified some of the key habitats and microhabitats for the selected rare invertebrates and listed a selection of invertebrates associated with them.

- **Short sward and bare ground** (including sward/ field layer; exposed sand; litter and ground layer; dung and carrion; stones, boulders, shingle and scree; and soil and roots) e.g. the dung beetle *Euheptaulacus sus*, White-bellied Mining Bee (*Andrena gravida*), the seed weevil *Omphalapion beuthini*, Large Plain Stiletto fly (*Thereva cinifera*), the ground beetle *Bradycellus distinctus*, the weevil *Hypera pastinacae*, Sandwich Click Beetle, Straw Belle moth, Heath Fritillary, and Black-veined Moth.
- **Tall sward & scrub** (including sward/field layer; litter & ground layer; and soil and roots) e.g.

Necklace Ground Beetle (*Carabus monilis*) © Matt Berry

Carthusian Snail (*Monacha cartusiana*), Necklace Ground Beetle, Fisher's Estuarine Moth, Estuarine Flat-body, Sanicle Flat-body (*Agonopterix astrantiae*), Kent Case-bearer moth (*Coleophora galbulipennella*), the Paradox-knee Spider, Duke of Burgundy, the millipede *Propolydesmus testaceus*, and the weevil *Liparus germanus*.
- **Arboreal** (including canopy; foliage; flowers (adult); and honeydew & sap runs (adult)) e.g. White-letter Hairstreak, Truncated Spider, Sandhill Pigmy moth, Feathered Beauty moth, Wood Pistol Case-bearer moth (*Coleophora currucipennella*), Spruce Groundling moth (*Coleotechnites piceaella*), Cloaked Pug moth (*Eupithecia abietaria*), and Hornbeam Pigmy moth (*Stigmella carpinella*).
- **Decaying wood** (including sapwood & bark decay; flowers (adult); fungal fruiting bodies; heartrot; and wood decay in soil) e.g. Plain Dark Bee (*Stelis phaeoptera*), Stag Beetle (*Lucanus cervus*), the cranefly *Tipula hortorum*, the anthribid weevil *Pseudeuparius sepicola*, Southern Oyster Mushroom Beetle, and the narrow bark beetles *Rabocerus foveolatus* and *Lissodema cursor*.
- **Shaded woodland floor** (including woodland litter) e.g. Mitre Spider, Midland Beech Tongue-spider, Clay Fan-foot moth (*Paracolax tristalis*), and Thatch Tubic moth (*Borkhausenia minutella*).
- **Running Water** (including unmodified fast flowing streams; seepages; exposed riverine sediment; bankside trees; and woodland streams) e.g. White-clawed Crayfish, the flea beetle *Longitarsus aeruginosus*, the long-legged fly *Hydrophorus viridis*, the cranefly *Nephrotoma dorsalis*, and the phantom cranefly *Ptychoptera longicauda*.
- **Acid & sedge peats** (including wetland vegetation; and shallow freshwater pond) e.g. Norfolk Hawker, Dainty Damselfly, White-mantled Wainscot (*Archanara neurica*), and the crawling water beetle *Haliplus variegatus*.
- **Sandy beach** (including saline silt; and tidal litter) e.g. Dune Tiger Beetle (*Cicindela maritima*), East Coast Dune Walker beetle (*Hypocaccus metallicus*), and Scarce Mirror Clown beetle.
- **Marshland** (including drawdown zone: mud/shallow litter; and shallow freshwater pond) e.g. the ground beetle *Acupalpus brunnipes*.
- **Saltmarsh** e.g. Scarce Pug moth (*Eupithecia extensaria*).

- **Wet woodland** (including woodland stream) e.g. the phantom cranefly *P. longicauda.*

Other habitats that don't have any qualifying species but are important in supporting the wider invertebrate assemblages in the IIA include:

- **Brackish pools & ditches**
- **Saline lagoon**
- **Rocky shore**
- **Lake**
- **Shingle**

Threats and Opportunities

Running water

Threats

- Water pollution and nutrient enrichment from agricultural run-off (e.g. artificial or natural fertilisers, worm treatments and pesticides), sewage discharges, or chemical water treatment affect the water quality and disrupts invertebrates
- The introduction and spread of invasive non-native crayfish species, such as the North American Signal Crayfish (*Pacifastacus leniusculus*), has led to White-clawed Crayfish being aggressively out-competed for food and habitat.
- Disease, such as crayfish plague, spread on clothing, equipment and vehicles is one of the causes of the White-clawed Crayfish decline.
- Exploitation of populations as a result of illegal White-clawed Crayfish fishing.
- Engineering activities such as flood alleviation schemes, straightening of watercourses, dredging and water storage have modified flows in some rivers and streams, lowered water tables and removed available habitat. This can also include the loss of areas of gravel that support specialist rare invertebrates, such as the White-clawed Crayfish. This is particularly exacerbated when there are incidents of sediment flushing down the watercourse.
- Barriers such as weirs and dams disrupt natural flow processes and prevent salmonid fish from moving freely. Walls and piling prevent the watercourse from spreading onto its floodplain, replenishing wetlands and creating damp habitats.
- Removal of riparian vegetation, particularly trees can result in increased water temperatures which make conditions in the river less suitable for many invertebrates.
- Conversely, excessive scrub encroachment on the channel through the lack of grazing or woodland management can lead to overshading.
- Activities such as ploughing and development can increase sediment run-off into streams and rivers, which changes the habitat, and oxygen and light levels.
- Non-native species such as Himalayan Balsam and Japanese Knotweed can be a particular problem to rivers and their associated wetlands, crowding out native plant species and habitats. Similarly, the presence of North American Signal Crayfish (*Pacifastacus leniusculus*) can result in increased bank erosion and sediment movement.
- Low flows due to drought or abstraction can result in sedimentation and deterioration of river habitats.

Left: Heath Fritillary (*Mellicta athalia*) © gwynmwilliams (CC-BY-NC). Right: Fiery Clearwing (*Pyropteron chrysidiforme*) © giroege1959 (CC-BY-NC)

Opportunities

- Creation of isolated new refuge sites - known as “Ark sites” - where new populations of White-clawed Crayfish can be established, safe from non-native crayfish and crayfish plague. Ark sites are now recognised as an essential part of any White-clawed Crayfish conservation strategy. An Ark site is an isolated, self-contained site with running water, still water, or both, which can support a healthy, self-sustaining population of White-clawed Crayfish with little need for ongoing management.
- Monitor water quality and protect running waters from land-borne pollution through negotiations with local farmers and businesses.
- Restore a more natural flow regime by removing barriers (e.g. weirs) and by re-profiling watercourses from fast-flowing, straight and steep channels to meandering shallow channels with varying speed in water flows.
- Establish vegetation buffers and woodland around running waters, such as Alder and willows, to improve water quality and habitat for invertebrates – this helps with trapping pollutants in run-off events, stabilises riverbanks, and creates shaded areas, which are particularly useful for White-clawed Crayfish for both shelter from predators and cooler refuge areas within the water.
- Keep livestock and vehicles from entering the watercourse or moving across gravel bars and beaches as this compacts the gravels, disturbing and potentially damaging invertebrates living within the substrate. It can also increase bank erosion and nutrient enrichment, as livestock enter the watercourse and defecate directly into the water. Livestock notably increase phosphates and nitrates through their faeces, disturb and potentially damage White-clawed Crayfish present in the watercourse.
- Aim to reduce or eliminate the use of artificial lighting around watercourses wherever possible.
- Control or remove invasive species.
- Create in-water refuges, by placing cobbles, boulders, bricks, breeze blocks or hessian sacks on river banks and margins. Please ensure you seek advice from the Environment Agency before undertaking this work.

The water beetle *Halipus varius* © Gerard Beersma (CC BY-NC 4.0 DEED)

- Clean and disinfect waterproof clothing, fishing tackle and water-sports equipment, to prevent the spread of non-native aquatic species and diseases they may carry. Guidance can be found on the Check-Clean-Dry Website.

Mudflats and saltmarsh

Threats

- Land reclamation of mudflats and saltmarshes for use as farmland, industrial development, transport infrastructure, and waste disposal sites causes direct removal of the available invertebrate habitat.
- As sea levels rise, fixed sea defences prevent coastal habitats and high-water mark from moving inland, squeezing out intertidal flats, reducing their extent and quality. Coastal squeeze and erosion are exacerbated by the increasing frequency of storms and rising seas.
- Creation of enclosed bays for amenity or perceived aesthetic reasons destroys mudflats and saltmarshes and the associated invertebrate interest.
- Dredging for navigation has a negative impact on sediment supply and dynamics, and the sediment invertebrates.
- Industrial and agricultural run-off, polluted storm-water discharges, oil spillages or waste tipping can create abiotic areas or encourage the growth of algal

mats that will adversely affect invertebrate communities.

- The invasive Common Cord-grass has been extensively planted to stabilise mudflats as a prelude to land reclamation and is spreading along the coast, often producing extensive monoculture swards of reduced wildlife value and disrupting the ecology.
- In saltmarsh, abandonment of traditional grazing creates areas dominated by rank grasses in the mid to upper marshes, lowering the botanical diversity. Conversely, introducing grazing onto previously ungrazed sites can impact on assemblages that have developed free of grazing pressures. Grazing by sheep should be avoided as it reduces the structural diversity of vegetation needed for many invertebrates.
- Draining and reseeding in areas behind flood embankments leads to direct losses of saltmarsh communities.

<u>Opportunities</u>

- Ensure that natural tidal movements are not impeded and that there is continued presence of brackish pools, ditches, and muddy creeks. This could be achieved by re-alignment of sea defences to allow for expansion of these habitats or by creating a managed breach in the sea wall, where the land can be intentionally flooded, creating more saltmarsh and mudflat habitats. Retain any old flood embankments as retreats for species less tolerant of flood conditions and to act as refugia for hibernation.

The ground beetle *Acupalpus brunnipes* © Thorsten Pietsch (CC BY-NC)

- Maintain natural hydrological regimes and transition zones, by opening any previously canalised or infilled creeks, creating areas with a varying degree of tidal inundation and salinity.
- Aim to retain a full transition of vegetational stages on saltmarshes, from open saline pools and salts pans, to vegetated terrestrial fringes in upper saltmarsh areas. This will support species of varying salinity tolerance, create a diversity of microhabitats, and provide winter hibernation sites.
- Manage any disturbance such as human trampling, to allow these habitats to undergo the natural processes of erosion, deposition, and plant growth without intervention.
- Biodegradable tidal debris such as driftwood and seaweed support many invertebrates and should not be removed. Avoid any attempts to 'tidy up' the material. Barbecue fires using driftwood should also be discouraged.
- On high transition zones, prevent excessive scrub encroachment and aim for a mosaic of scrub and open terrestrial habitats.
- On saltmarsh sites that have been historically grazed, reinstate, or continue light grazing to prevent grasses from outcompeting other saltmarsh plants and shading out pools and areas of bare mud that provide important invertebrate habitat. Any grazing or cutting of vegetation should be left until late in the season to allow flowering plants to set seed and associated invertebrates to complete autumn activity.
- Avoid introduction of grazing on unmanaged or previously ungrazed sites.
- Freshwater seepages and streams onto saltmarsh should be retained, as they provide rare invertebrate habitat, offering areas of reduced salinity where grasses, rushes and reeds may grow.
- Creating scrapes and pools in larger homogenous saltmarsh systems can diversify invertebrate opportunities. This is suitable within areas of species-poor and overgrazed saltmarsh, or as part of a managed retreat process.

Wetlands

Carthusian Snail (*Monacha cartusiana*) ©Nataël Adam (CC-BY-NC)

Threats

- Water pollution through chemicals, nutrients and sediment from agriculture, sewage discharges and road run-off can directly kill or alter populations of invertebrate and plant species.
- Changes in land cover can result in the release of sediment and nutrients into the water body, causing increased eutrophication, siltation, and anoxic conditions. This is further exacerbated by the removal of waterside vegetation and reedswamp that act as barriers to particulate matter and absorb nutrients.
- The direct loss or damage of wetland features to urbanisation or infilling depletes wetland resources for invertebrates in the countryside. It also increases isolation of the remaining wetlands, making colonisation by less mobile species more difficult.
- Local water abstraction and drainage schemes can change hydrological regimes and lower water tables, causing shallow wetland features like ponds and lakes that are crucial to the lifecycle of many threatened species to dry out.
- Invasive and competitive plant species (e.g. duckweed) can prevent establishment of native plants that are used as shelter and food for invertebrates.
- Lack of management of vegetation around wetland features can lead to scrub encroachment and succession to woodland, removing valuable wet habitat features for invertebrates. Conversely, overgrazing can produce a close-cropped and uniform sward that lacks many key plants, offers little shelter, and provides few flowers for pollinators.

Opportunities

- Discharges of effluent from the sewer network and other sources of pollution should be strictly controlled to ensure water stays clean. For wetland features in improved grassland or arable fields, establish a buffer strip (e.g. unfertilised tussocky grass/reed) to protect them from run-off, pesticide, and fertiliser drift.
- Aim for structural diversity in and around water bodies, including large beds of submerged vegetation, shorter emergent vegetation, and a succession of marginal vegetation from bare substrate to tall herbage, scrub and trees. This will provide places for invertebrates to shelter, feed and breed in, with sheltered areas also helping to mitigate the impact of increasing summer temperatures and climate change.
- Continue grazing on wetland sites where this is appropriate to avoid them scrubbing over, but reduce the grazing pressure if excessive poaching, erosion and loss of diverse vegetation structure becomes evident. Allow livestock some access to pond margins to create areas of poached ground and bare mud that are important for invertebrates such as craneflies.
- Maintain stable water levels in permanent water bodies as extreme fluctuations can be deleterious to some species, however retain temporary pools if these are natural.
- Try and create a diverse bank profile including gently sloping and steeper margins
- Control or remove invasive species.
- Restore active processes in degraded wetlands through the purchase of additional land, blocking of ditches and removal of scrub/tree cover. Target restoration work near to existing high quality wetland sites to improve connectivity and aid species dispersal.


Left: Feathered Beauty (*Peribatodes secondaria*) © Paolo Mezzei (CC BY-NC). Right: Vernal Shieldbug (*Peribalis strictis*) © Lupoli Roland (CC-BY-NC)

Coastal and floodplain grazing marsh

Threats

- Drainage of marshes for agriculture or development restricts water bodies from naturally flooding and depositing silt and nutrients across their floodplain, causing significant changes in vegetation composition and decline in associated invertebrate species.
- Ecologically insensitive flood or sea defence works such as the construction of flood control embankments and channel deepening can lower water tables and cause drying out of floodplain grassland and ditches, impacting aquatic and semi-aquatic invertebrate species.
- Agricultural improvement including cultivation, re-seeding, and fertiliser and pesticide application can be major causes of direct habitat loss. Additionally, eutrophication and pollution from agricultural or industrial run-off can cause contamination of surface or ground water and growth of algal mats, leading to choking of ditches with vegetation and a loss of invertebrate interest.
- Lack of management such as cutting or grazing leads to rank and over-grown ditch banks, development of scrub and eventually carr woodland. Conversely, overgrazing can result in species diversity declines and a homogeneous species composition. Additionally, high soil moisture levels make grazing marshes particularly susceptible to excessive poaching, which can cause soil compaction and colonisation by unfavourable species.
- Inappropriate ditch management such as over-deepening or abandonment can lead to low habitat value for invertebrates and ditches silting up.
- The water regime and invertebrate communities are likely to be impacted by climate change through rising sea levels and changed weather patterns, making marshes more susceptible to invasive plants and erosion.
- In coastal areas, sea level rise can additionally result in direct habitat loss through coastal squeeze and coastal realignment and increased saline intrusion leading to a shift from freshwater to brackish invertebrate communities.
- Applications of pesticides and herbicides directly impact invertebrate survival and can alter soil biology, function and soil invertebrate communities.
- In grazed grassland, endectocides used in the treatment of livestock parasites can negatively affect dung beetles and other dung invertebrates.

Opportunities

- Ensure that water levels in ditches and associated waterways are reasonably high throughout the year by protecting the existing ditch network and creating new areas e.g. on agriculturally improved land, through changes in the field drainage system and management.
- Low level grazing to maintain plant diversity and open conditions across the floodplain is recommended and best achieved by grazing during the summer months and removing or decreasing the numbers of animals in wet winter conditions. A scattering of scrub can be beneficial to act as assemblage, shelter or hibernation points for invertebrates but avoid excessive scrubbing over.

- Encourage mild poaching and trampling by cattle at ditch margins to achieve diverse marginal vegetation, the creation of bare mud patches that offer temporary or permanent mini-pools, and the formation of a berm which supports many specialised water-transition invertebrates.
- Avoid compaction by carefully planning stocking densities especially during the wet months and performing any mechanical works required in the dry months of the year.
- Aim for a patchwork of ditches at different siltation and vegetation successional stages across the site. This is best achieved by adopting a five-year rotational ditch clearing management cycle, where only short sections or only one side of any ditch are cleared in one year and not all adjacent ditches are cleared in the same year.
- Create wildlife-friendly and varied ditch profiles by reducing the angle of hard-edged ditches to a slope of around 35° to provide diverse habitat conditions at all water levels and to allow cattle access to ditch margins.
- At coastal sites, maintain a diversity of salinity levels in ditch networks to support a broad range of invertebrates by allowing seepages and leaking sluices, and managing saline incursion and flooding.

Woodland and trees

Threats

- Historical damage of woodland through industrial use and large-scale conifer timber planting resulted in direct habitat loss of native woodland, causing a slow recolonisation rate of invertebrates into some of these areas. In present times, woodlands are still lost to development, agriculture, or intensive forestry.
- Loss of woodland grazing or management such as maintenance of rides or coppicing, can lead to woodlands becoming over-crowded, shaded, and lacking structural variation, which significantly impacts ground flora vegetation that provides valuable nectar and pollen sources for invertebrates.
- Overgrazing and disturbance by deer, squirrel and rabbit populations prevents young trees from being recruited creating a uniform tree age structure, reduces ground layer vegetation and reduces opportunities for woodland regeneration.
- Important veteran trees and decaying wood sources are often at risk from overzealous management, including the tidying-up of standing and fallen trees and collection of fallen material for firewood. Lack of spatial and temporal continuity of veteran trees can affect the dispersal ability of the associated specialist species.
- Fragmentation of woodlands can lead to inability of invertebrates to move between fragments.
- Invasive non-native species (e.g. Rhododendron, Cherry Laurel, conifers) can negatively affect the vegetation and structural composition of woodlands.
- Ash Dieback and other tree diseases and pests, which are exacerbated by the climate change, can result in changes in tree species and age composition.

Rest Harrow moth (*Aplasta ononaria*) © butterfly-conservation.org

Opportunities

- Overall, aim for a mix of dead wood, healthy live trees, young saplings, scrub areas and open spaces such as glades, rides, or scallops. In addition to the increased light levels in the forest, rides create varied woodland edge microhabitats and allow grasses and wildflowers to regrow.
- Consider long-term age structure, aiming to increase the recruitment of young trees and ensuring a continuity of mature trees. This can be achieved through practices such as coppicing and thinning. Additionally, mark out ‘future veteran’ trees to ensure the existing veterans will be replaced in the future.
- Retain all dead wood, both standing and fallen in situ, and discourage the collection for aesthetic reasons or firewood. Additionally, retain trees showing decay

The weevil *Hemitrichapion reflexum* © Mark Gurney

features and do nothing to damage those features.

- Maintain/re-establish light grazing regimes in ancient woodlands to manage understorey vegetation.
- Aim to restock and regenerate native tree species – this creates the important thicket stage habitat and encourages a diversity of foodplant-specific invertebrates such as White-lettered Hairstreak on Elm.
- Promote growth of suitable tree species on land between existing woodland sites to extend and reconnect fragmented patches of woodland.
- Control or remove invasive and competitive species such as Rhododendron, Japanese Knotweed, and bramble.
- Promote tree growth of suitable tree species on land between existing woodland sites to extend and reconnect fragmented patches of woodland.
- If replacing conifer plantations for broadleaved woodland, avoid clear-felling but strip-fell or thin out in multiple stages, so creating a mixed woodland habitat mosaic with some canopy cover at all times.
- Retain or plant blocks of flowering trees and shrubs in open sunny conditions to provide nectar sources for invertebrates where absent or limited; relaxing grazing pressure may achieve similar outcomes.

Dry grassland

Threats

- Grassland 'improvement' through ploughing, re-seeding, fertiliser application, and conversion to arable reduce invertebrate biodiversity through direct habitat loss and reduction in foodplants, flower and pollen resources.
- Site abandonment and lack of appropriate grazing or cutting pressure can contribute to the spread of competitive species such as tussocky grass and scrub resulting in low structural variation and floral diversity and disappearance of the associated invertebrates.
- Applications of pesticides and herbicides directly impact invertebrate survival and can alter soil biology, function and soil invertebrate communities.
- In hay meadows, a shift from hay-making (one annual cut) to silage production (multiple cuts a year) disrupts invertebrate life cycles and considerably lowers foodplant availability.
- In hay meadows, mid-July hay cut without leaving an uncut margin, can deplete plant food sources and vegetation cover for invertebrates if applied uniformly and suddenly across a larger landscape.
- Inappropriate management of hedgerows and field margins can cause gaps in habitat connectivity and a lack of refugia and hibernating sites.

Opportunities

- Avoid damaging land management practices like ploughing, re-seeding, fertiliser/slurry application, winter tilling and drainage, which damage valuable grassland habitat.
- Aim to establish a diversity of plant species through seeding/green-haying to encourage a wide diversity of invertebrates as well as foodplant-specific species in this area such as Kentish Conch (*Cochylimorpha alternana*) on Greater Knapweed, Agate Knot-horn (*Nyctegretis lineana*) on Common Restharrow.
- For sites managed by grazing, create flexible management plans with conservation-led stocking densities and timing of grazing, avoiding excessive poaching and under-grazing.
- Monitor the extent of problem species such as docks, thistles, rushes, dominant scrub and rank grass. Prevent their spreading by targeted removal, lowering the nutrient loading in the soil and establishing appropriate cutting and grazing regimes.
- In hay meadows, if a late summer hay cut is not possible, try and stagger hay cutting times, leaving some areas in flower at all times and creating a varied structural diversity across the site.

- Aim to leave some field margins uncut and hedgerows well-connected – these areas act as refuges for overwintering invertebrates, offer late-season forage, aid connectivity and dispersal, and harbour prey species.
- Where possible, integrate creation of some bare patches or banks within the grassland site, these are essential nesting habitats for solitary bees.

Grassland (including wet meadows, pasture and wood pasture)

Threats

- Grassland 'improvement' through ploughing, re-seeding, fertiliser application, and conversion to arable reduce invertebrate biodiversity through direct habitat loss and reduction in flower and pollen resources.
- Site abandonment and lack of appropriate grazing or cutting pressure causes the spread of competitive species such as Purple Moor Grass and rush, resulting in low structural variation and floral diversity.
- Applications of pesticides and herbicides directly impact invertebrate survival and can alter soil biology, function and soil invertebrate communities.
- In grazed grassland, overgrazing or grazing at the wrong time of the year can create uniform and close-cropped swards without much structural diversity, shelter and plant resources for invertebrates.
- In grazed grassland, endectocides used in the treatment of livestock parasites can negatively affect dung beetles and other dung invertebrates.
- In hay meadows, a shift from hay-making (one annual cut) to silage production (multiple cuts a year) disrupts invertebrate life cycles and considerably lowers nectar and pollen availability.
- In wet grassland, over-stocking or bringing heavy machinery onto sites in the wetter months causes soil compaction, leading to excessive spread of rush. Changes in the water levels as a result of e.g. land drainage can remove valuable seasonal and permanent wet habitat features for invertebrates.
- Inappropriate management of hedgerows and field margins can cause gaps in habitat connectivity and a lack of refugia and hibernating sites.
- In wood pasture and parkland, sustained high levels of grazing can result in low wildflower numbers and no recruitment of new trees, causing gaps in tree age structure and no suitable habitat for specialist veteran tree invertebrate species. Over-pruning or removal of veteran trees and clearing of dead wood results in removal of essential invertebrate habitats.

The dung beetle *Euheptaulacus sus* © Otto Bylén Claesson (CC-BY-NC)

Opportunities

- Avoid damaging land management practices like ploughing, re-seeding, fertiliser/slurry application, winter tilling, and drainage, which damage valuable grassland habitat and reduce plant and invertebrate diversity.
- Aim to establish a diversity of plant species through seeding/green-haying to encourage a wide diversity of invertebrates.
- Monitor the extent of problem species such as docks, thistles, rushes, dominant scrub and rank grass. Prevent their spreading by targeted removal, lowering the nutrient loading in the soil and establishing appropriate cutting and grazing regimes.
- For sites managed by grazing, create flexible management plans with conservation-led stocking densities and timing of grazing, avoiding poaching and under-grazing. If possible, reduce the number of animals or remove grazing between April and August to allow wildflowers to bloom and set seed.
- In hay meadows, if a late hay cut is not possible try and stagger hay cutting times, leaving some areas in flower at all times and creating a varied structural diversity across the site.
- In wet grassland, avoid compaction by carefully planning stocking densities especially during the wet months and perform any mechanical works required in the dry months of the year.
- Aim to leave some field margins uncut and hedgerows well-connected – these areas act as

refuges for overwintering invertebrates, offer late-season forage, aid connectivity and dispersal and harbour prey species.
- Where possible, integrate creation of some bare patches or banks within the grassland site, these are essential nesting habitats for solitary bees.
- In wood pasture and parkland, create sensitive and flexible grazing management plans with the aim to create a mosaic of habitats with young trees being recruited and areas of open grassland or heathland ground vegetation. Retain all existing old trees where possible and retain dead wood of all ages, both standing and fallen.

Clifftop grassland and soft rock cliffs

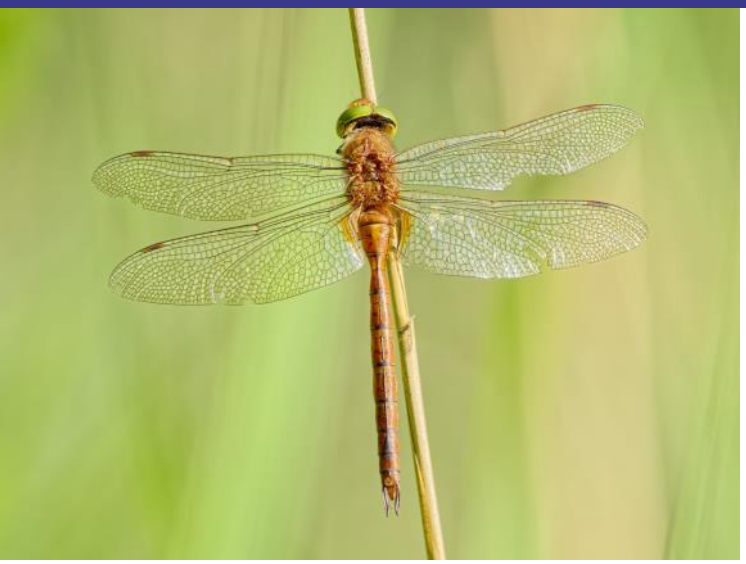
Threats

- The direct loss of cliff top grasslands to intensive grazing and arable agriculture or development such as sea defences, caravan parks or golf courses, reduces the wildflower-rich habitats that cliff specialists utilise for foraging, overwintering or to disperse between sites.
- Retreating cliff lines on many sections of coast have left only a thin remnant strip of cliff top wildflower-rich grasslands, leading to coastal squeeze.
- Overgrazing or grazing at the wrong time of year can lead to a loss of structural variation and a short sward that lacks the flowers and shelter needed by many invertebrates.
- Although limited scrub or patches of scrub provide important shelter, nectar and pollen, the loss of grazing or other management can lead to areas becoming dominated by thick grass, bracken and scrub at the expense of valuable flowery grassland and bare ground.
- Applications of pesticides and herbicides directly impact invertebrate survival, can alter soil biology, function and soil invertebrate communities as well as leach out to the nearby coastal slopes and cliffs.
- While well-structured footpaths receiving moderate use can be of very high value (e.g. by maintaining open bare ground), excessive recreational pressure can alter vegetation communities through trampling, soil compaction and erosion – this can affect habitat continuity.
- Invasive non-native plant species (e.g. Cotoneaster) can negatively affect the vegetation and structural composition of cliff top grasslands.

Opportunities

- Enhance existing species-poor grasslands through changes in grazing management and overseeding/ green haying where appropriate, to improve connectivity between small and isolated cliff top grasslands.
- Although valuable in limited amounts or patches, dominant scrub on cliff top grasslands should be removed by cutting or grazing to encourage areas of wildflower-rich grasslands and scrub mosaic. Aim to produce a mosaic of successional stages, from bare ground in short sward areas, through to tall swards with establishing and established scrub.
- Restore species-rich grassland via arable reversion where opportunities occur.
- Try for flexible coastal squeeze solutions, moving inland in line with retreating coastlines to maintain the extent of useful cliff top habitat.
- When reviewing grazing strategies, consider reducing intensity and avoiding spring and summer grazing to enable wildflower species to flower and set seed. Winter grazing can help to encourage a more wildflower-rich sward by controlling grasses and creating germination opportunities.
- On agricultural land, create buffers (by planting wildflower strips of leaving tussocky grasses which are cut every 2-3 years) to improve the water quality of freshwater cliff features.
- Manage recreational pressures using fencing and signage to divert people away from sensitive areas.
- Ensure Shoreline Management Plans recognise the

The weevil *Stenopterapion intermedium* © Mark Gurney (CC-BY-SA 2.0)



Norfolk Hawker (*Anaciaeschna isoceles*) © Pierre Bornand (CC BY-NC 2.0 DEED)

importance of soft cliffs for biodiversity and avoid damaging management. Any activity that changes the natural rate of cliff and slope erosion or extent of bare ground and seepages, such as re-profiling or the introduction of coastal defences, should be avoided wherever possible.
- Drainage of soft cliffs by surface or sub-surface measures or by inland abstraction has a direct impact on the geomorphological functioning of sites and should be prevented.
- Control or remove invasive species.

Lakes & Freshwater ponds

Threats

- Water pollution and nutrient enrichment from agricultural run-off, sewage discharges and other sources can directly kill invertebrates and change the vegetation and structural composition of lakes.
- Excessive water abstraction in the catchment can change hydrological regimes and water tables, removing and modifying available habitat.
- Activities such as ploughing can increase soil erosion within the catchment and increase water-borne sediments in lakes. Excessive sediment loading can contribute to invertebrate decline in various ways.
- Fish introduced for angling can have an adverse effect on lake ecosystems by eating the invertebrates that graze algae and keep it in check, encouraging algal blooms.
- Water-borne traffic can damage aquatic plants at the point of launch, or through bankside wave erosion, passage through strands of vegetation, or the cutting action of propellers.
- Invasive non-native species, such as the American Signal Crayfish (*Pacifastacus leniusculus*), can disrupt the ecological balance of water bodies, eliminating native species, such as the White-clawed Crayfish.

Opportunities

- Discharges of effluent from wastewater treatment works and other point sources of pollution should be strictly controlled.
- Work with neighbouring landowners to reduce nutrient inputs and maintain the quality of water entering lakes. Additionally, local water companies should be made aware of the sensitivity of pools to changes in water abstraction patterns or groundwater quality.
- Introduce more sympathetic management practices for invertebrates when reviewing catchment management plans such as wider pesticide use and any changes to the hydrology.
- Establish buffers around lakes to maintain or improve water quality by trapping and removing various non-point source pollutants.
- Control or remove invasive species.

Coastal dunes

Threats

- Conversion of fixed dunes to agricultural land or direct development for housing or golf courses, causes fragmentation of dune habitats and severely modifies the vegetation by re-seeding, fertilising and mowing of the vegetated areas.
- A cessation of grazing (including rabbit grazing) on previously grazed dunes risks an invasion of coarse grasses and scrub, which outcompete the fixed dune vegetation communities and ultimately remove the bare sand and early successional habitats important for thermophilic invertebrates.
- Conversely, overgrazing can lead to a loss of structural variation, and a short uniform sward lacking the flowers and shelter needed by many invertebrates.
- Water abstraction and drainage of adjacent land for agriculture or housing leads to a long-term lowering of the water table and may lead to the loss of specialist dune-slack invertebrate communities as the slacks dry out.
- Beach cleaning can remove the washed-up strandline

material such as seaweed and driftwood, removing the vital shelter and breeding habitat for specialist invertebrates.
- Fast-growing and invasive species (e.g. Sea Buckthorn, buddleia) can smother dunes in a dense thicket of spiny scrub to the detriment of the rest of the flora and invertebrate fauna.
- Excessive pedestrian use, car parking and use of off-road vehicles cause high levels of erosion on dunes, removing the plant resources for invertebrates.
- Engineered sea defences and stabilisation systems, even some distance away, generally interrupt the sediment flow and reduce the natural dynamism of dune systems, and hence their biodiversity.

Opportunities

- Maintain a full range of successional stages of sand stabilisation across the dune system, from mobile sparsely vegetated foredunes, young dunes with dense Marram Grass clumps, to more established dunes with varied vegetation, stable sandy grassland or heath, open sandy areas and dune slacks. This will provide nesting, sheltering and feeding resources for a wide variety of invertebrates.
- Retain and protect any transitions with adjacent habitats such as saltmarsh, fen, woodland or rivers and any other features of interest including seepages, creeks, or areas of wet mud.
- Prevent damage by excessive disturbance or overuse, especially on vulnerable young sparsely vegetated foredunes – these can be periodically fenced off to aid recovery.
- Retain and encourage small and controlled areas of native scrub and tree species which provide shelter, nectar sources, and overwintering sites for many dune invertebrates. Active management of Sea Buckthorn might be necessary.
- Maintain the water table in dune slacks by avoiding any water abstraction, drainage, or creation of scrapes and pools on nearby land. Additionally, avoid deepening dune slacks to make them permanent – seasonal dune slacks that flood in winter but dry to mossy pools in the summer are especially important for scarce invertebrates.
- Where suitable and required, consider grazing or rotational cutting management to create a diversity of sward heights, to control overgrown areas, or to create more bare ground. Rabbits, where not in excessive numbers, and sheep, while avoiding overgrazing, can be very effective at achieving a vegetation mosaic.
- Retain biodegradable tidal debris.
- Avoid over-stabilisation of dunes by carefully planning any new sea defences and where possible, remove any disused barriers to improve accretion of dunes. Embryonic dune development can be encouraged by the creation of sand trap beach groynes which collect wind-blown sand on the foreshore and over-stabilised dunes can be enhanced by artificially creating blow-outs.

Sandwich Click Beetle (*Melanotus punctolineatus*) © Ed Fulton (CC-BY-NC)

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