IMPORTANT INVERTEBRATE AREA PROFILE

Thames Estuary North

Left: Canvey Wick © Steven Falk. Right: Distinguished Jumping Spider (*Attulus distinguendus*) © Roman Willi www.endlessfields.ch

The Thames Estuary North Important Invertebrate Area (IIA) is part of a lowland landscape extending between East London and Canvey Island in Essex and is situated in the Northern Thames Basin National Character Area. The climate is more continental than in most of Britain, so that summers are warm with high levels of sunshine, and soil-water deficits are frequent between May and August. The proximity of the River Thames means that winter temperatures are relatively mild, and the coastal location near mainland Europe is well-placed to receive colonising species.

The River Thames defines the southern extent of the area and created inland sand or gravel deposits known as the Thames Terraces. These were laid down between 500,000 and 15,500 years ago, after the River Thames was diverted into its present valley. Soils over the gravels are usually well-drained, friable, and mineral deficient, encouraging the development of open, acid grasslands. The terraces have been extensively quarried, although there are a few areas of relict acid grassland and grass-heath. Mucking Heath Local Wildlife Site (LoWS) survives in the rough around Orsett Golf Course and supports species including money spiders such as the Serrated Tongue -spider (*Centromerus serratus*), Small-tongued Stranger (*Mioxena blanda*) and the Ground Dwarf Spider (*Wiehlea calcarifera*), the Stone Zipper (*Zelotes petrensis*) ground spider, and the Greater Ridgeback clown beetle (*Onthophilus punctatus*).

A remarkable feature of the Thames Estuary North IIA is the extent of brownfield sites which provide analogues for semi-natural habitats, especially where these are associated with remnant unimproved areas. Two of the most important locations are the Pulverised Fuel Ash (PFA) deposits at Tilbury, West Thurrock Lagoon and Marshes Site of Special Scientific Interest (SSSI) and West Thurrock Lagoon LoWS. The Critically Endangered Distinguished Jumping Spider (*Attulus distinguendus*)

occurs on a PFA lagoon at Thurrock and is otherwise only found at one site in Kent. Tilbury ash fields are home to species including the Canvey Island Gound Beetle (*Scybalicus oblongiusculus*), the Robust Wolf-spider (*Trochosa robusta*) and the Great Sneak-spider (*Harpactea rubicunda*). The varied plant communities developed on the ash support high diversity of flower -visiting and phytophagous invertebrates, such as the Scarce Black Mining Bee (*Andrena nigrospina*) and the weevil *Pseudostyphlus pumilus*.

Marine dredgings provide another valuable habitat, for example at Wennington Silt Lagoons near Rainham, and Canvey Wick SSSI in Essex. Canvey Wick was created in the 1970s and over four decades without routine management developed a remarkable invertebrate assemblage, including the Critically Endangered Stripe-eyed Paragus (*Paragus albifrons*), Levels Cleg (*Haematopota subcylindrica*), the ground beetle *Acupalpus brunnipes*, the weevils *Bagous argillaceus* and *Coelositona cinerascens*, the tumbling flower beetle *Mordellistena pygmaeola*, and the Mugwort Bell moth (*Eucosma metzneriana*).

A critical feature of drought-stressed or contaminated substrates is that early successional vegetation can remain open for extended periods without routine management. This provides continuity in the presence of bare ground and supports the lifecycles of species which require extended availability of forage, or that are associated with later season plant resources including fruits, seedheads and dead stems. Variation in topography or local disturbance encourages the creation of a habitat mosaic, with south-facing banks offering nesting sites for warmth-loving invertebrates, next to unmanaged flower-rich grassland for foraging and hunting. The habitat mosaic can also include ephemeral wetlands, dry reedbeds, lichen heath, and scattered scrub.

Further east beyond Tilbury, the Thames opens out to form a long coastline deeply indented by creeks. There are extensive mudflats and fringing saltmarsh, and some of the low-lying coastal land behind the sea wall has been reclaimed to form wet grazing marshes. Associated invertebrate assemblages are particularly well-developed on Vange and Fobbing Marshes SSSI, Pitsea Marsh SSSI and Bowers Marshes south of Basildon, including species such as the soft-winged flower beetle *Clanoptilus strangulatus*, Fancy-legged Fly (*Campsicnemus magius*), Dyke Hoverfly (*Lejops vittatus*), Striped Horsefly (*Hybomitra expollicata*), Fen Sac-spider (*Clubiona juvenis*), and Red Tongue-spider (*Centromerus capucinus*).

There are many other important sites across the IIA, such as urban brownfields with rubble mounds in east London where Streaked Bombardier (*Brachinus sclopeta*) is found, and woodlands on the Langdon Ridge near Basildon with White-letter Hairstreak (*Satyrium w-album*). Disused chalk pits at Chafford Hundred had a nationally important invertebrate fauna and while housing was built in some of these, species including the Bird's-nest Long-palp (*Tipula peliostigma*) have been recorded since the development within the Grays Thurrock Chalk Pit SSSI and a network of well managed LoWS.

Reasons for selection

The Thames Estuary North IIA supports at least 107 qualifying IIA species of conservation concern. This includes the following species which are threatened on a European scale, and Critically Endangered or Endangered on a national scale:

- Critically Endangered Distinguished Jumping Spider (*Attulus distinguendus*)
- Critically Endangered Stripe-eyed Paragus (*Paragus albifrons*)
- Endangered ground beetle *Bradycellus distinctus*
- Endangered ground beetle *Ophonus puncticollis*
- Endangered leaf beetle *Longitarsus ferrugineus*
- Endangered Serrated Tongue-spider (*Centromerus serratus*)
- Endangered Ground Dwarf-spider (*Wiehlea calcarifera*)
- Endangered White-letter Hairstreak (*Satyrium w-album*)

Stripe-eyed Paragus (*Paragus albifrons*) © P R Harvey

- European Vulnerable Hairy-saddled Colletes (*Colletes fodiens*)

The IIA also supports an assemblage of nationally Vulnerable species, including the ant-like flower beetle *Anthicus angustatus*, the soft-winged flower beetle *Axinotarsus pulicarius*, Canvey Island Ground Beetle, Thames Door Snail (*Balea biplicata*), the Robust Wolf-spider and the Great Sneak-spider . The area is also a stronghold for other restricted species that are known from only a handful of other counties, including the Scarce Black Mining Bee, the soft-winged flower beetle *Clanoptilus strangulatus*, the weevil *Bagous argillaceus*, Striped Horsefly, Levels Cleg, and Dyke Hoverfly.

Populations of these important invertebrates rely on the Thames Estuary North IIA's unique range of habitats, including post-industrial wastes, quarries, urban derelict sites, remnant grassland and grass-heaths, as well as freshwater wetlands and saltmarsh. Whilst some of the sites are designated as Sites of Special Scientific Interest, and many have been identified as Local Wildlife Sites, large areas have no legal protection. This is concerning as there is huge pressure for development on brownfields in the Thames corridor, and the existence of a landscape-scale habitat network may be important in supporting viable populations of some species.

Key habitats for rare invertebrates in the 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.

Tapestry Moth (*Trichophaga tapetzella*) © Popi Bormpoudaki (CC-BY-NC)

- **Short sward and bare ground** (including sward/field layer; exposed sand; litter & ground layer; stones, boulders, shingle and scree; and soil & roots) e.g. Scarce Black Mining Bee, Hairy-saddled Colletes, Long-combed Spider Thief (*Evagetes pectinipes*), White-spot Groundling (*Neofriseria peliella*), Canvey Island Ground Beetle, the weevil *Pseudostyphlus pillumus*, Distinguished Jumping Spider, and Small Plain Stiletto (*Thereva fulva*).
- **Tall sward and scrub** (including sward layer; litter & ground layer; and soil & roots) e.g. the soft-winged flower beetle *Axinotarsus pulicarius*, the weevil *Protapion varipes*, the flea beetle *Longitarsus ferrugineus*, Goosefoot Runner (*Scythris limbella*), Knapweed Case-bearer (*Coleophora conspicuella*) and Obscure Neb (*Oxypteryx immaculatella*) moths, and the Bitter Crab Spider (*Xysticus acerbus*).
- **Arboreal** (only broadleaved including canopy; foliage; flowers; carr/wet woodland; and honeydew & sap runs) e.g. the weevils *Anthonomus chevrolati* and *Neocoenorrhinus pauxillus*, Southern Case-bearer (*Coleophora adjectella*) moth, and Poplar-gall Heringia hoverfly (*Heringia brevidens*).
- **Saltmarsh** (including saltmarsh vegetation; saline silt; and tidal litter) e.g. the soft-winged flower beetle *Clanoptilus strangulatus*, the ant-like flower beetle *Cyclodinus salinus*, Blite Case-bearer (*Coleophora deviella*) and Goldilocks Case-bearer (*Coleophora linosyridella*) moths, and Striped Horsefly.
- **Acid and sedge peats** (including wetland vegetation; deep litter; shallow freshwater pond; and wet/damp peat) e.g. the soft-winged flower beetle *Cerapheles terminatus*, the moss beetle *Hydrochus ignicollis*, Fen Sac-spider, the solitary wasp *Passaloecus clypealis*, and the long-legged fly *Thrypticus smaragdinus*.
- **Decaying wood** (mainly broadleaved including sapwood & bark decay, heart-rot, dead trunks & branches, bark & cambium, wet hollows, and roots & underground wood) e.g. the weevils *Cossonus parallelepipedus* and *Lymantor coryli*, and Plain Dark Bee.
- **Brackish pools & ditches**, e.g. the weevil *Bagous argillaceus*, Fancy-legged Fly, the long-legged fly *Poecilobothrus ducalis*, Levels Cleg, and Dyke Hoverfly.

- **Marshland** (including mud/shallow litter in drawdown zone; shallow freshwater pond; and wetland vegetation), e.g. the ground beetle *Acupalpus brunnipes*, the ant-like flower beetle *Anthicus flavipes*, and the moss beetle *Aulacochthebius exaratus*.
- **Shaded woodland floor** (only broadleaved including woodland litter; heavy shade; and light shade) e.g. Bird's-nest Long-palp cranefly, and Serrated Tongue -spider.
- **Running water** (mud/shallow litter in drawdown zone) e.g. German Hairy Snail (*Pseudotrichia rubiginosa*).
- **Wet woodland** e.g. the long-legged fly *Syntormon bicolorellus*.
- **Sandy beach** (including tidal litter) e.g. the ant-like flower beetle *A. angustatus.*

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

- **Lake**

Habitat Threats and Opportunities

Wildlife-rich brownfields

Threats

- The loss of brownfields, through development, inappropriate reclamation, remediation and management, is causing brownfield habitats to become increasingly fragmented. Over time, this can lead to local extinction events, particularly with scarce species that are poor dispersers.
- The 'greening' of brownfields, involving tree planting or the addition of nutrient-rich topsoil and seeding with grass species removes fine-scale habitat mosaics and inevitably leads to the loss of rare and scarce species.
- Clearing and 'tidying up' brownfields for public access, such as the removal of substrates, can destroy valuable habitats for invertebrates.
- The introduction of broad-scale and intensive management, such as cutting large swathes of a site, can disrupt habitat mosaics that are key to brownfield biodiversity. Conversely, an absence of management on long abandoned brownfields can lead to scrub encroachment and the eventual loss of open habitats.
- Invasive non-native species (e.g. Sea Buckthorn and Goat's-rue can negatively affect the vegetation and structural composition of brownfield habitats.

Opportunities

- Identify and protect wildlife-rich brownfields when reviewing Local Development Plans.
- Avoid development, reclamation or remediation proposals that threaten brownfield habitats and their associated invertebrate fauna.
- Introduce a positive management regime that is rotational and done in a piecemeal manner in response to site monitoring. This may involve rotationally creating new scrapes or other periodic disturbance.
- The addition of substrates such as industrial spoil, sand or calcareous aggregates will enhance the floral resource by creating different soil conditions and bare substrates for characteristic plant communities to develop.
- Identify opportunities to diversify topographical features through the creation of scrapes, hollows or depressions — these can create localised warm microclimates where there is bare ground, or form shallow ephemeral pools, inundation grassland or permanently wet areas.
- Control or remove invasive species.

Thames Door Snail (*Balea biplicata*) © Jakob Fahr (CC BY-NC)

The ant-like flower beetle *Anthicus flavipes* © Rasmus Allesoee (CC BY-NC)

Dry grassland

Threats

- The loss of grasslands to development, or '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.
- Where possible, integrate creation of some bare patches or banks within the grassland site, these are essential nesting habitats for solitary bees.
- 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 harbor prey species.

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.
- 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 or squirrel 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. Cherry Laurel, bamboo, 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.

Opportunities

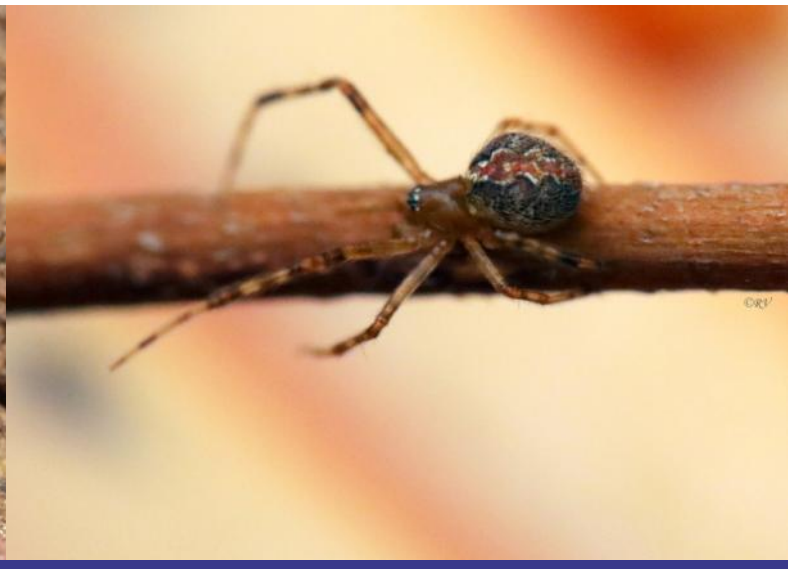
- Overall, aim for a mix of dead wood, healthy live trees, young saplings, scrub areas and open spaces such as glades, rides or scallops. In addition to the increased light levels in the forest, rides create varied woodland edge microhabitats and allow grasses and wildflowers to regrow.
- Consider long-term 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 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-letter 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 Cherry Laurel, bamboo, and bramble.

Wetlands

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

Left: The clown beetle *Saprinius viriscens* © Mark Gurney (CC-BY-NC-SA 2.0 DEED). Right: Chobham Combfoot (*Theradon pinastri*) © ramune_vakare (CC BY NC SA)



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.
- 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 anthelmintic treatments, 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.

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 for 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

German Hairy Snail (*Pseudotrichia rubiginosa*) ©Владимир Семашко (CC-BY-NC)

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.

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.
- Aim for a patchwork of ditches at different siltation and vegetation successional stages across the site. This is best achieved by adopting a 5-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.

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.

Opportunities

- 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 get 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.
- 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 supports 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.

Four-banded Weevil-wasp (*Cerceris quadricincta*) © thomas_lange CC-BY-NC

Running water

Threats

- Water pollution and nutrient enrichment from agricultural run-off (e.g. artificial or natural fertilisers, worm treatments), sewage discharges or chemical water treatment can alter the composition and disrupt the lives of aquatic and semi-aquatic invertebrates.
- 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 exposed riverine sediments that support specialist rare invertebrates.

- Barriers such as weirs and dams disrupt natural flow processes and prevent some species 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 affect cold-loving species. Conversely, excessive scrub encroachment on the channel through the lack of grazing or woodland management can lead to overshading and impact on the dispersal abilities of flying species to adjacent sites.
- Activities such as ploughing can increase sediment run-off into streams and rivers, which can contribute to invertebrate declines in various ways e.g. clogging of gills, changes in habitat and prey availability, 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 for invertebrates.
- Sedimentation and drying, caused by reduced water flow, can result in the deterioration of shingle bank habitats.
- Light pollution disrupts the lives of nocturnal insects and can contribute to insect decline.

<u>Opportunities</u>

- 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 to improve water quality and habitat for invertebrates – this helps with trapping pollutants in run-off events, stabilises riverbanks, and creates shaded areas.
- Allow some grazing on riverbanks as this creates marginal habitat with tussocky vegetation for roosting and mating, and varied microhabitats along the water edge such as poached areas.
- Keep livestock from entering the watercourse or moving across gravel bars and beaches as this compacts the gravels, increases bank erosion and nutrient concentrations through their faeces.
- Aim to reduce or eliminate the use of artificial lighting around watercourses wherever possible.
- Control or remove invasive species such as Himalayan Balsam and Japanese Knotweed.

Shrill Carder Bee (*Bombus sylvarum*) © Steven Falk

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