Response of shrubby sea-blite *Suaeda vera* to cutting on a sea wall flood defence at Goldhanger, Essex, England

Tim Gardiner

Environment Agency, Fisheries, Recreation & Biodiversity (FRB), Iceni House, Cobham Road, Ipswich, Suffolk, IP3 9JD, UK

Corresponding author e-mail: tim.gardiner@environment-agency.gov.uk

SUMMARY

In the UK, shrubby sea-blite *Suaeda vera* is a 'Nationally Scarce' species restricted to coastal localities in eastern and southern England. It is locally common on the tidal face of sea wall flood defences in Essex. However, its dense bushy growth makes the engineering inspection of these important defences by the Environment Agency (the government agency responsible for flood defence maintenance) difficult. In consultation with Natural England it was agreed that *S. vera* could be flailed (cut) to a height of 30 cm along a 2.8 km length of sea wall in Essex to ease inspection, and as a trial to assess *S. vera* response to such cutting. The initial response three months after cutting was encouraging with 94% of cut plants showing signs of regrowth. Eight months after cutting the mean height of the cut shrubs (79.7 cm) was about equivalent to that of uncut *S. vera* (82.1 cm) in a nearby uncut area (of similar height prior to cutting), indicating good vertical growth after flailing. However, the mean width of the cut shrubs (115.8 cm) was less than that of the uncut plants (177.4 cm). This is attributed to the cutting method (using a side-arm flail which reduced plant width in places, as well as removing the often broader, mid-crown growth), which coincidentally further eased inspection. These short-term results suggest that a one-off cut of *S. vera* can be used to allow sea wall inspection without detrimental damage to *S. vera* populations.

BACKGROUND

Shrubby sea-blite *Suaeda vera* is a halophytic evergreen shrub growing to a height of 1.2 m (Stace 1991). Within the UK it is considered 'Nationally Scarce', occurring only along restricted stretches of the eastern and southern English coastline. Large stands are mainly restricted to the eastern counties of Norfolk, Suffolk and Essex, and the south coasts of Dorset and Kent. It grows along shingle drift lines and the drier upper areas of salt marsh (Leach 1994). It also grows on the drift line at the base of earth embankments that form coastal flood defences, particularly where they adjoin shingle banks or salt marsh. *S. vera* flowers from July to September, with fruits appearing from September to November (Leach 1994). The seeds are water-borne and can be washed up, accumulating in drift line debris, with germination occurring in spring. The shrub has freely rooting underground stems which spread laterally. Detached vegetative fragments (from storms or cutting) can also wash up and colonise new sites (Leach 1994).

In Essex, it is a scarce shrub of shingle spits such as Colne Point (Jermyn 1974), but also it occurs in a few localities along the drift line amongst the gaps between concrete block revetment on the seaward slope of sea wall embankments. In places, particularly in the Steeple and Osea Island areas, recent survey work (Jon Diss pers.comm. 2010) revealed that *S. vera* is so abundant on sea wall blockwork revetment that it makes inspection of the integrity of these important coastal flood defences very difficult (i.e. dense bushy cover makes it hard to ascertain whether large cracks are present in the sea wall). The shrub has established this dense cover in the absence of regular cutting of the seaward slope of the embankments and the root system can damage the integrity of the blockwork revetment (e.g. concrete blocks can be shifted out of place), although this is of relatively minor concern at present. However, although removal has been muted, this must be balanced against the threats to *S. vera* populations, including 'coastal squeeze' due to rising sea levels gradually reducing the area of its salt marsh and shingle habitats on the tidal side of the defences, now limiting it to a narrowing strip of the drift line in concrete revetment on the seaward side of several sea walls in Essex. The shrub is included in the Essex Red Data List due to the significant but localised populations on the coast.

Due to the need to inspect and thus protect the integrity of sea walls in Essex, a programme of scrub clearance by cutting was instigated by the Environment Agency (EA; the UK government advisor for flood defence/risk) in 2009. It was acknowledged that areas of scrub would have to be cut back on the folding (or landward berm), landward slope, crest, and seaward slope of the otherwise grass-dominated embankments, and that this may lead to detrimental impacts on scarce plants such as *S. vera*, which are listed as an important feature in conservation designations on the Essex coast, including Ramsar sites, Sites of Special Scientific Interest (SSSIs), and the Essex Estuaries Special Area of Conservation (SAC). Due to EA and Natural England (NE; the government advisor for nature conservation) concerns about the response of *S. vera* to scrub management, a trial cut was undertaken along a 2.8 km seaward slope stretch of sea wall at a height of about 30 cm above the soil surface using a tractor mounted flail. It was hoped that, whilst allowing inspection of the integrity of the sea wall, it would also allow regrowth of *S. vera* from the cut stems. This paper presents the initial monitoring results of the response of *S. vera* to this untested and experimental cutting regime.

ACTION

Study site: The cutting trial was conducted along a 4 m high, flood defence earth embankment/sea wall that protects arable farmland, coastal grazing marsh, and Goldhanger village between the Osea Island Causeway (Ordnance Survey grid reference: TL 891070) and Bound's Farm Sluice (TL 903077). This sea wall section is approximately 2.8 km in length with salt marsh on its seaward side and several sections of 'tidal berm' (totaling approx. 0.99 km or 35% of sea wall length) at the toe of the seaward slope of the defence. A tidal berm is a 3-4 m wide vegetated mud shelf located at the base (or 'toe') of the sea wall which at this locality supports a halophytic plant community. These berms provide important habitat for plants of the upper salt marsh zone, such as *S. vera*, and other locally occurring species such as golden samphire *Inula crithmoides* and sea purslane *Halimione portulacoides*.

The seaward slope of the sea wall has four different types of revetment (i.e. a facing, as of masonry, used to support and protect an embankment) along its length: 1) Essex Blocks exposed (30 x 30 cm concrete blocks laid in grid formation at toe of sea wall); 2) Essex Blocks covered with a layer of (naturally accumulated) shallow soil; 3) Canewdon Blocks (1.14 x 1.90 m blocks laid in grid formation at toe of sea wall); and 4) Open Stone Asphalt (a continuous layer of revetment with no gaps at toe of sea wall).

Cutting: In February 2010, vegetation on the seaward slope of the 2.8 km stretch of sea wall was cut using a tractor mounted side-arm flail to a height of approximately 30 cm (as specified by the EA and NE). Cuttings were left *in situ* thus potentially allowing *S. vera* fragments to regenerate, and to avoid further disturbance due to difficulties of removal. Contractors were advised not to cut *S. vera* on the tidal salt marsh berm adjacent to the toe of the sea wall, so that some vegetation remained uncut where other notable plants of the Blackwater SSSI and Essex Estuaries SAC (e.g. *I. crithmoides*) were present.

Shrub monitoring: On 20 May 2010 (about three months after cutting), the 2.8 km section of sea wall was walked and all *S. vera* plants in a 1 m wide band (a continuous transect) were recorded as either showing signs of regrowth (young shoots sprouting or existing branches below 30 cm still alive) or not showing any indications of regrowth (no new shoots, stems brittle). The transect was situated on the seaward slope of the sea wall at the top of the blockwork revetment (high tide drift line) where most *S. vera* bushes were present. The transect passed through several different types of revetment: six sections of Essex Blockwork (exposed) total length 1,347 m; three sections of Essex Blockwork (soil covered) total length 701 m; three sections of Canewdon Blocks total length 270 m; and two sections of Open Stone Asphalt total length 488 m. The mean width of the revetment from the upper salt marsh (toe of embankment) towards the crest of the sea wall was approximately 3 m. In addition to the transect count, the height (highest point of each plant from soil surface) and width (widest point of each plant) of 10 randomly selected *S. vera* plants on the revetment (cut with flail) and the adjacent tidal berm (uncut) were measured on 13 October 2010 to determine the extent of regrowth after one growing season. The *S. vera* plants measured on the cut and uncut sections of sea wall were similar in height (70-100 cm) and width (150-200 cm) prior to cutting.

CONSEQUENCES

In total, 1,548 of 1,644 (94%) *S. vera* plants on the transect showed signs of regrowth three months after cutting (Table 1). Most exhibited regrowth as small shoots sprouting out of the cut stems, in a few cases young shoots were arising from the soil (in gaps between concrete blocks in most instances) next to cut stems. A small number of cut plants (96 individuals or 6% of the total) showed no signs of regrowth (e.g. leaves shed, stems brittle) and may have been killed by cutting. Generally, the proportion of *S. vera* resprouting was broadly similar between the different revetment types (Table 1). It should be noted that exposed Essex Blocks had the highest density of *S. vera* on the transect count, with Open Stone Asphalt the lowest number of plants (mean per 100 m transect length).

The height of *S. vera* bushes on the seaward slope of the sea wall (mean height 79.7 cm) eight months after cutting was almost identical to those on the uncut tidal berm (mean height 82.1 cm), suggesting vertical regrowth was vigorous after flailing (Fig. 1). However, the width of plants was much greater on the uncut tidal berm than on the cut sea wall revetment, suggesting lateral growth was affected by the cutting and there was removal of the broader, sub-crown foliage.

Non-target effects: Other notable plants of the front face of the wall such as *I. crithmoides* and *H. portulacoides* were regrowing quite vigorously after cutting. Although not monitored, casual observations suggest that damage to these other locally occurring species due to cutting was mostly avoided.

Discussion: The initial response of *S. vera* to cutting was encouraging with 92-97% (depending on revetment type) showing signs of regrowth after three months. This suggests that the shrub is able to respond to this level of cutting, with plenty of new shoots emerging from cut stems. Cutting at 30 cm above the substrate surface appears to have encouraged new growth. Lateral growth through underground stems may also have occurred, as several cut plants had young shoots emerging from the soil immediately adjacent to them (Leach 1994).

Table 1. Count of *Suaeda vera* plants along the 2.8 km transect showing plant density (individuals/100 m length of 1 m wide transect) and the proportion regrowing on the four different sea wall revetment types three months after cutting.

Revetment type	No. plants/100 m	No. plants with regrowth	No. plants without regrowth	% plants with regrowth
Canewdon Blocks	11	29	1	96.7
Essex Blocks (soil covered)	30	198	11	94.7
Essex Blocks (exposed)	103	1,308	83	94.0
Open Stone Asphalt	3	13	1	92.9
Means or totals	59	1,548	96	94.2

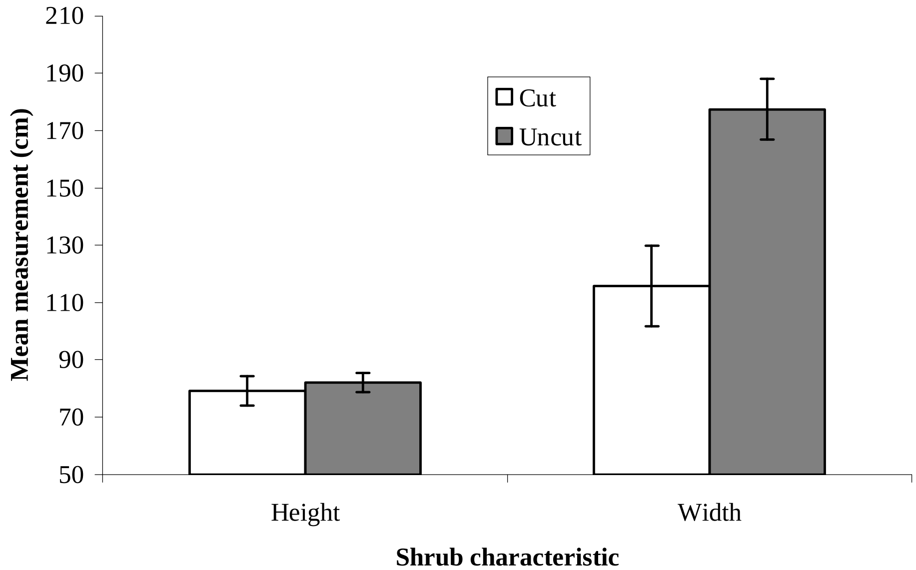

Figure 1. Mean height and width of *Suaeda vera* bushes on the Goldhanger sea wall eight months after cutting (standard error bars shown).

By October (8 months after cutting), the cut *S. vera* was approximately the same height as the uncut plants on the tidal berm, suggesting vigorous regrowth after flailing. However, width of cut shrubs was much less than established uncut *S. vera* on the tidal berm, suggesting that the cut plants had quick vertical regrowth, but did not necessarily achieve the bushy lateral growth that they had before cutting. A side-arm flail was used to cut the *S. vera*, this may have led to branches of the plant being cut at an angle in some instances (due to orientation of cutting flail on the slope) reducing the width of the bushes. Therefore, the low shrub width after cutting may make it easier to inspect the condition of the defences in the first year after management. It is intended to cut the seaward slope of the sea walls on a 3-4 year rotation (monitoring will be undertaken to assess if *S. vera* can withstand this intensity of cutting), facilitating easier inspection of the flood defences whilst retaining this scarce species.

It was apparent from the transect count that the different revetment types were not all suitable for *S. vera*. The smaller sized Essex Blocks (30 x 30 cm) arranged in grid formation on the seaward side of the sea wall (many gaps between blocks) had been colonised by *S. vera*. In contrast, the larger Canewdon Blocks (1.14 x 1.9 m) had less gaps and a correspondingly lower density of *S. vera*. Open Stone Asphalt formed a continuous surface cover of the tidal side of the defence in places, and was the least well colonised of the revetment surfaces due to the almost complete absence of gaps for *S. vera* to establish. This has important implications for the management of coastal flood defences with regards to *S. vera* populations; the changing of revetment type from Essex Blocks to Open Stone Asphalt would likely remove a vast area of habitat for the shrub. Increasingly, Open Stone Asphalt is being used to replace Essex Blocks on sea walls in the county due to the enhanced protection it gives to the seaward face. Open Stone Asphalt provides the most effective form of coastal protection in that it is very durable, although expensive to install. Therefore, when changing revetment type on sea walls supporting *S. vera* (and other local plants), the presence of the shrub needs to be carefully considered, particularly where it forms a feature of designated Ramsar sites, SSSIs and SACs.

ACKNOWLEDGEMENTS

Environment Agency Operations Delivery staff organised the management of the shrub along the section of sea wall (particular thanks go to Jon Diss, Ben Grant and Helen Morgan). Natural England, in particular Michael Parkin and Carol Reid, assisted with the consenting and management guidelines for *S. vera* in relation to the SSSI. Kim Thirlby assisted with the October measurements of the shrub.

REFERENCES

Jermyn S.T. (1974) *Flora of Essex*. Essex Naturalists' Trust, Colchester, UK.

Leach S.J. (1994) *Suaeda vera* Forsskål ex J. Gmelin shrubby sea-blite. In: Stewart A., Pearman D.A. & Preston C.D. (eds.) *Scarce Plants in Britain*. Joint Nature Conservancy Council, Peterborough, UK, p. 401.

Stace C. (1991) *New flora of the British Isles*. Cambridge University Press, Cambridge, UK.