SAMFHIRES

Saltmarsh Function and Human Impacts in Relation to Ecological Status

bec CONSULTANTS

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An Ghníomhaireacht um Chaomhnú Comhshaoil

Introduction

The **Saltmarsh Function and Human Impacts in Relation to Ecological Status (SAMFHIRES)** project is a 36-month multi-disciplinary collaboration between Botanical, Environmental and Conservation (BEC) Consultants Ltd. and the Department of Botany, Trinity College Dublin (TCD). Through field survey, collation of existing data, modelling and analysis, the project will link anthropogenic pressures to changes in saltmarsh communities and investigate the ecosystems services and ecological functions of saltmarshes in Ireland. By integrating the outputs of this research, it will refine the tool developed by the recent SMAATIE (Saltmarsh Angiosperm Assessment Tool for Ireland) project for the purposes of the Water Framework Directive. The tool, which assesses ecological status for part of the angiosperm Biological Quality Element in coastal and transitional waters, will be tested in the field and applied to a selection of water bodies.

The project consists of three work packages (WPs). There is synergy between WP1 and WP2, with outputs from both feeding into WP3.

Work Package 1: Anthropogenic pressures on Irish saltmarshes

The objectives of this WP are to:

1. Review the literature pertaining to anthropogenic pressures on saltmarshes
2. Collate existing data on anthropogenic pressures on Irish saltmarshes
3. Investigate impacts of grazing pressure on Irish saltmarsh communities
4. Investigate patterns and impacts of eutrophication on Irish saltmarsh communities
5. Identify potential refinements to SMAATIE related to anthropogenic pressures

Work Package 2: Ecosystem services and ecological function of Irish saltmarshes

The objectives of this WP are to:

1. Review the literature pertaining to ecosystem services and ecological function
2. Investigate the regulating services/functions of saltmarshes
3. Investigate the habitat/supporting services/functions of saltmarshes
4. Identify potential refinements to SMAATIE related to function/services

Work Package 3: Refinement and testing of SMAATIE

The objectives of this WP are to:

1. Finalise list of water bodies for which saltmarsh monitoring is needed
2. Record data on under-recorded saltmarsh communities
3. Refine tool and methodology
4. Field test the tool and methodology at a selection of contrasting sites

Expected Outputs:

The SAMFHIRES project outputs will include a fully detailed final report, a non-technical synthesis report and a revised Practitioner's Manual reflecting the revised assessment tool. Other project outputs will include final metric and Ecological Quality Ratio (EQR) data for all assessed water bodies in Microsoft Excel format, vegetation quadrat data in Turboveg format and GIS data in ESRI format defining Potential Saltmarsh Area. At least two oral conference presentations will be made and three to four papers will be published in peer-reviewed journals. TCD will hold two seminars where progress on the project will be presented and feedback can be received, and more newsletters will be produced and disseminated in PDF format.
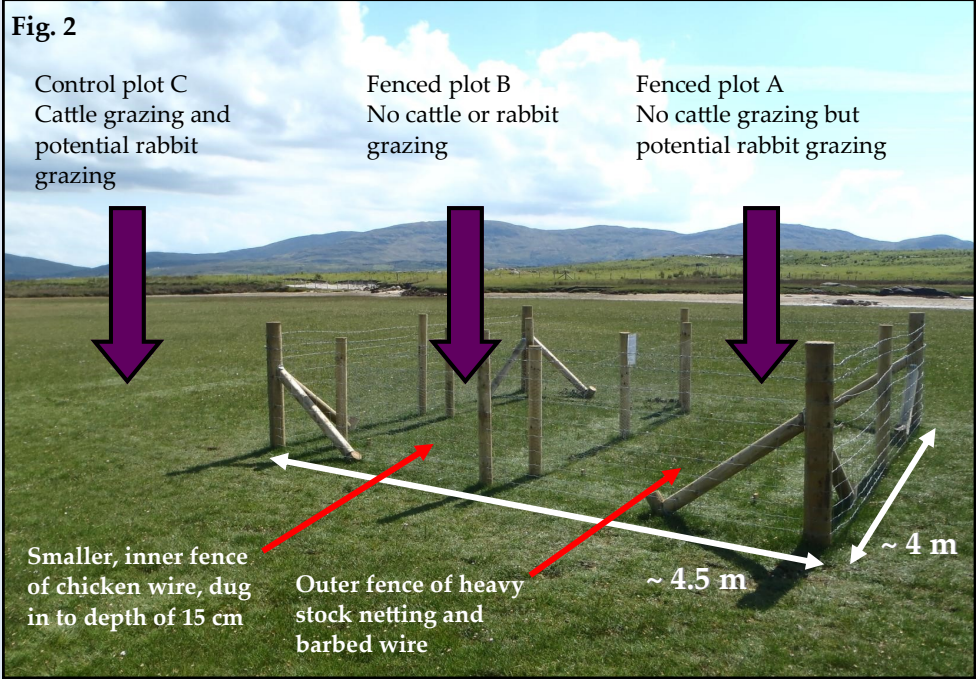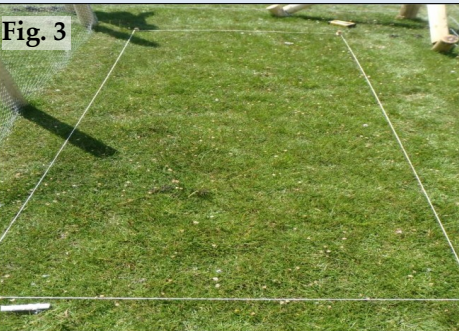
Work Package 1: Anthropogenic pressures on Irish saltmarshes

Grazing pressure on Irish saltmarshes

Two nature reserves where the saltmarsh is managed by NPWS through winter grazing agreements with local farmers have been identified (with grazing ~ September to March). These are Ballyteige Burrows in Wexford and Sheskinmore in Donegal (Fig. 1).

Fig. 2

Control plot C
Cattle grazing and potential rabbit grazing

Fenced plot B
No cattle or rabbit grazing

Fenced plot A
No cattle grazing but potential rabbit grazing

Smaller, inner fence of chicken wire, dug in to depth of 15 cm

Outer fence of heavy stock netting and barbed wire

~ 4.5 m

~ 4 m

Fig. 1
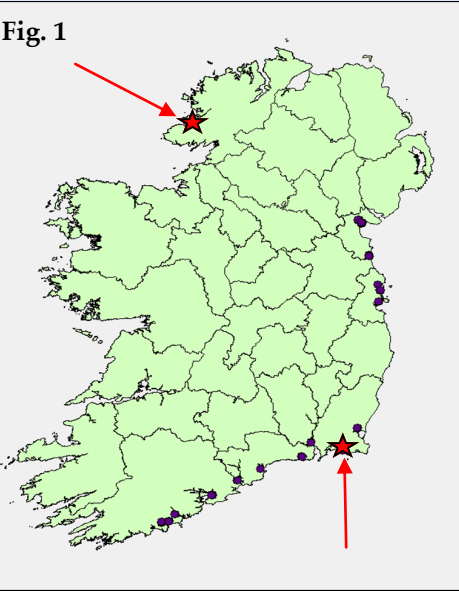
Contact was made with local NPWS staff in January 2016 to discuss the possibilities of erecting a series of grazing exclosures at these sites. Permissions were obtained through the Notifiable Actions procedure. Site visits were conducted in late April and late May to confirm the suitability of the sites, select the locations for fencing and to carry out a rare species survey. Fencing was erected in June by hand by the Project Team. At each site, a series of four 4.0 × 4.5 m cattle-proof exclosures were built in a range of communities all corresponding to EU Habitats Directive Annex I habitat 1330 Atlantic salt meadows. In one half of each exclosure a 2.0 × 3.2 m rabbit-proof fence was erected as there is potential for rabbit grazing at both sites. The experiment will therefore examine the impacts on vegeta-

tion of three grazing treatments: a) no cattle grazing but potential rabbit grazing, b) no cattle or rabbit grazing, c) cattle grazing and potential rabbit grazing (Fig. 2). Baseline monitoring of these exclosures and establishment of control plots was conducted in July 2016 (Fig. 3).

Eutrophication Survey

A methodology for this survey was devised. To limit variability of confounding factors, the work has initially focused on estuarine saltmarshes with predominantly mud substrates and no livestock grazing on the east and south coasts. Fifteen sites (purple dots in Fig. 1) have been selected to fairly equally represent the range of trophic conditions reflected in EPA

Fig. 4

2 m

monitoring data. At each site, four transects of 3-5 2 × 2 m plots were recorded, with each transect running from the bottom to the top of the marsh to represent the variability in saltmarsh vegetation (Fig. 4). Percentage cover abundance of all vascular

Maximum height recorded from each plot quarter
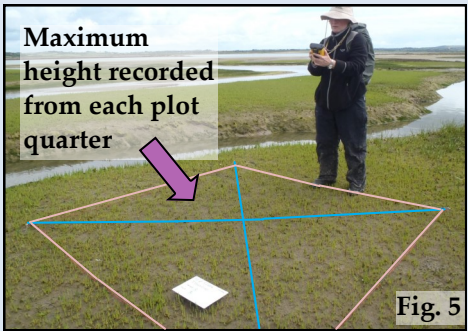
Fig. 5

plant species at each plot was recorded, as was maximum vegetation height (Fig. 5). The vegetation was recorded between June and August. Also, in August, the plots were relocated and samples were taken of sediment, above-ground biomass and below-ground biomass for lab analysis (Fig. 6). Permission was obtained from


Fig. 6

NPWS for SAC and SPA sites. Research into appropriate procedures for the lab analysis has been conducted. Selected parameters for sediment samples are TON, NH_4, labile P, TN, TP, salinity, pH, % moisture, % OM and % sand/mud.


Fig. 3

Work Package 2: Ecosystem services and ecological function of Irish saltmarshes

Flood defence and sea level rise

The investigation into flood defence has so far focussed on the impacts of sea-level rise on saltmarsh distribution. A number of previous studies have been reviewed and modelling software tested (e.g. SLAMM). Consequently, a customised modelling procedure coded using the R statistical environment that utilises LiDaR data has been developed. So far, this has been tested on data from Bull Island, Dublin (Fig. 7 & 8). The model uses

Fig. 7
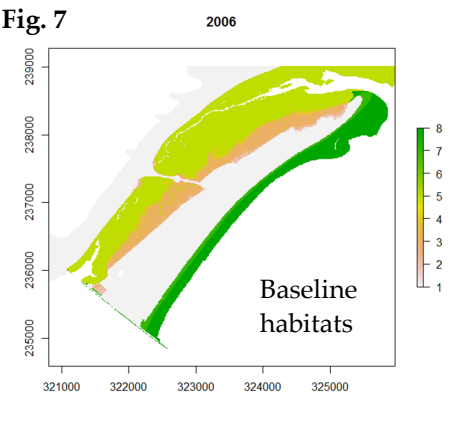
Baseline habitats

100-year sea level rise scenarios, taking into account isostatic uplift, accretion, connectivity to saline habitats, substrate and erosion potential. This can be used to model projected changes over 100–year scenarios including managed retreat through proactive breaching of sea defences.

Fig. 8

Projected habitats
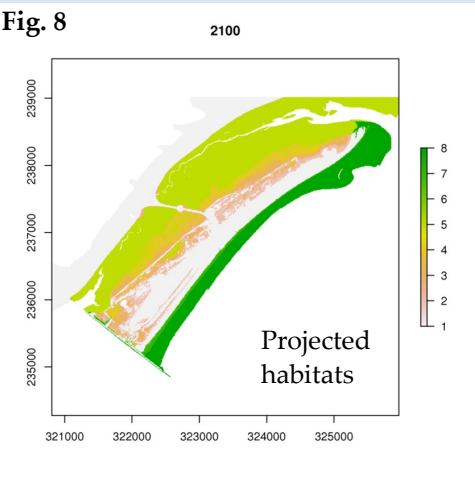
Saltmarsh habitats are represented by orange and pink in Figures 7 and 8.
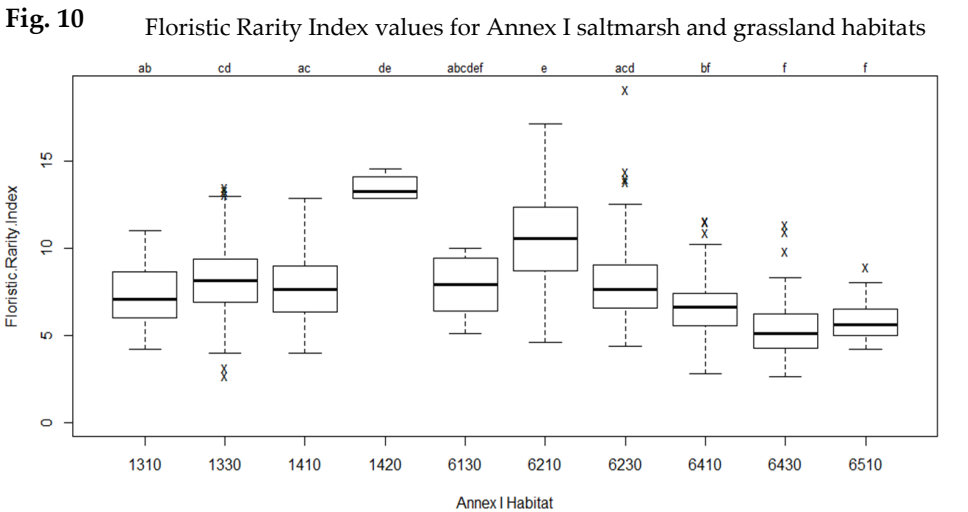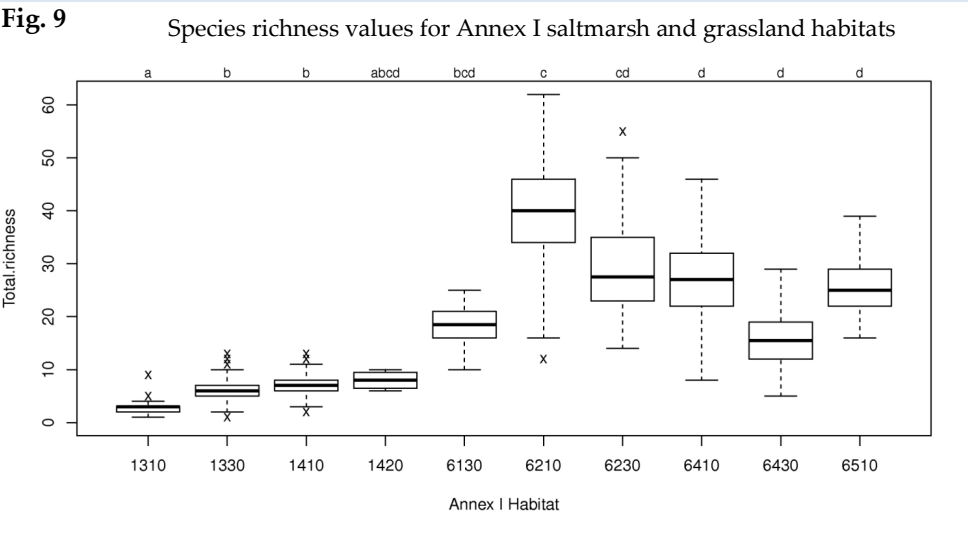
Biodiversity

Four indices related to a Floristic Quality Index were developed by BEC as part of the Irish Vegetation Classification project at the end of 2015 and incorporated into the online ERICA data analysis application (http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/erica/).

The four indices are Mean Rarity Coefficient (Mean RC), Floristic Rarity Index (FRI), Abundance-weighted Mean RC (Mean wRC) and Abundance-weighted Floristic Rarity Index (wFRI). They were calculated as shown, where RC_i is the RC of species i, A_i is the percentage cover of species i and S is the number of species.

Species distribution and native status data for all saltmarsh plants have now been added to the latest version of this application. Preliminary analysis has been conducted comparing the biodiversity value of Annex I saltmarsh habitats as described by these indices with that of other Annex I habitats (Fig. 9 & 10). The indices can now be applied to the data gathered by other tasks during this project.

$$Mean\ RC = \frac{\sum_{i=1}^{S} RC_i}{S}$$

$$FRI = Mean\ RC\left(\sqrt{S}\right)$$

$$Mean\ wRC = \frac{\sum_{i=1}^{S} RC_i A_i}{\sum_{i=1}^{S} A_i}$$

$$wFRI = Mean\ wRC\left(\sqrt{S}\right)$$

Fig. 9

Species richness values for Annex I saltmarsh and grassland habitats

Fig. 10

Floristic Rarity Index values for Annex I saltmarsh and grassland habitats

Work Package 3: Refinement and testing of SMAATIE

Water body list for saltmarsh monitoring

Potential Saltmarsh Area (PSA) needs to be calculated for all water bodies before the list of water bodies for which saltmarsh monitoring is needed can be finalised. All 306 coastal and transitional water bodies have had PSA calculated based on analysis of historical Ordnance Survey maps (Fig. 11). Approximately 20% of these water bodies have subsequently had PSA corrected to the High Astronomical Tide (HAT) line, which was produced by the processing of LiDaR data. Approximately 4,591 ha PSA has been mapped for coastal waters and 23,864 ha PSA for transitional waters. Fifty-five water bodies have no PSA according to analysis of historical Ordnance Survey maps. These figures will change as the remaining 80% of water bodies have PSA corrected to the HAT line.

Fig. 11

Existing saltmarsh (red)

Existing saltmarsh (red)
PSA (blue)
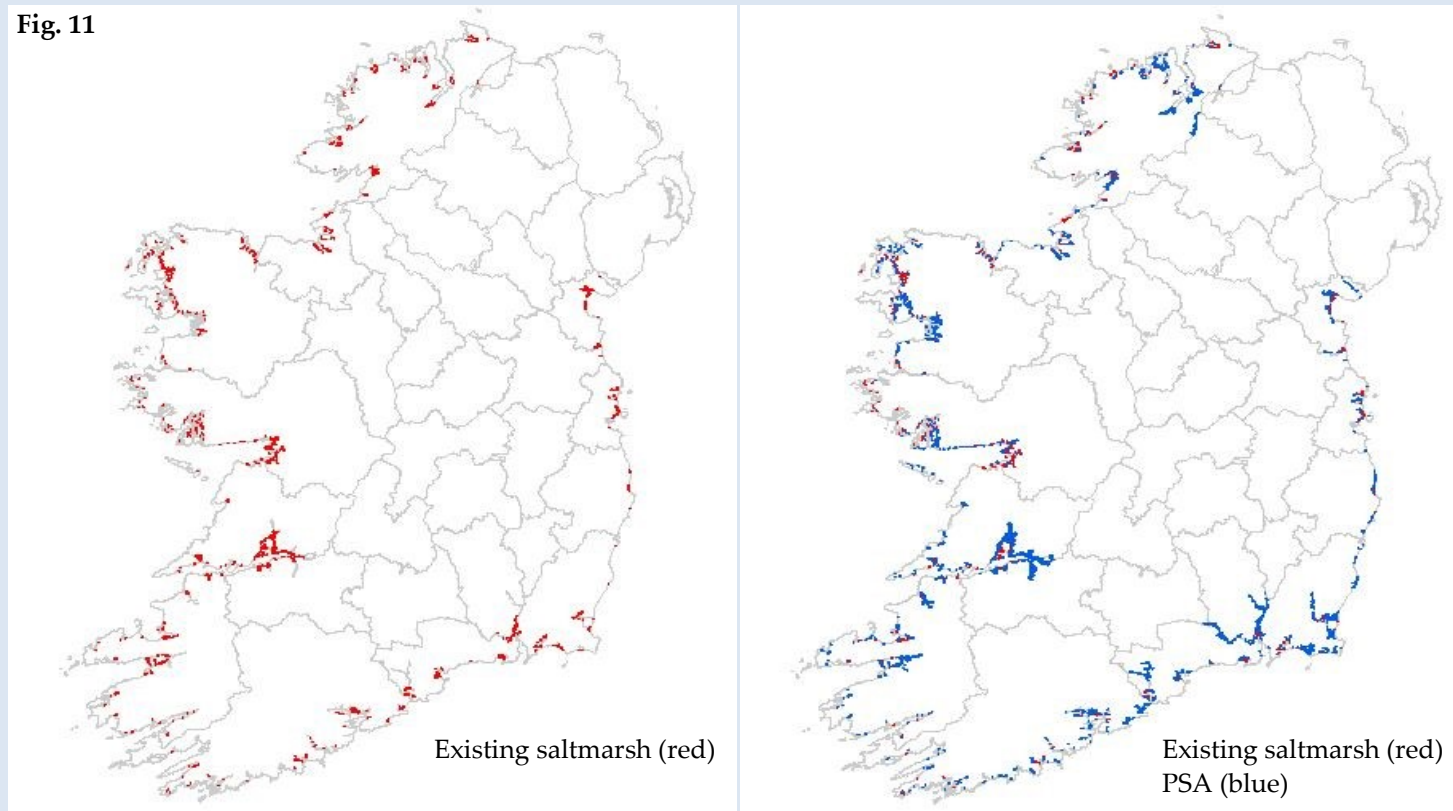
Recording of rare communities

Examples of *Juncus acutus* stands, *Elytrigia repens* swards and communities of *Blysmus rufus* were identified in the field during work on Work Package 1 in July. Subsequently, *Juncus acutus* stands have been recorded (Fig. 12). *Blysmus rufus* and *Elytrigia repens* swards, identified in Sheskinmore, have yet to be recorded.

Fig. 12

Milestones for the next 6 months

* Update website with progress and preliminary results in February

* Completion of PSA estimates by February

* Processing and analysis of collected biomass and soil samples by February

* Preliminary analysis of eutrophication project data by February

* Selection of sites for 2017 field surveys by May

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