



Green Shores

Restoring fringe saltmarshes to the Tay & Eden Estuaries & the Dornoch Firth



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Coast Bordeaux 2017



Habitat restoration in context

- Convention on Biological Diversity 1992
- Aichi Targets 2011 to 2020



	1 Understand values		8 Reduce pollution		15 Enhance resilience
	2 Mainstream biodiversity		9 Reduce invasive spp.		16 Implement Nagoya Prot.
	3 Address incentives		10 Minimize reef loss		17 Revise NBSAPs
	4 Sustainable production		11 Protected areas		18 Respect and conserve TK
	5 Halve rate of loss		12 Prevent extinctions		19 Improve knowledge
	6 Sustainable fisheries		13 Conserve gene pool		20 Mobilize resources
	7 Manage within limits		14 Restore ecosystems		

- ▶ Eliminate subsidies harmful to biodiversity.
- ▶ Halve, or bring close to zero, the rate of loss of all natural habitats.
- ▶ Sustainably manage and harvest all fish and invertebrate stocks and aquatic plants.
- ▶ Reduce pollution to levels that are not detrimental to ecosystems and biodiversity.
- ▶ Control or eradicate prioritized invasive alien species.
- ▶ Minimize anthropogenic pressures on coral reefs.
- ▶ Conserve at least 17% of terrestrial and 10% of coastal and marine areas in protected zones.
- ▶ Prevent the extinction of known threatened species.
- ▶ Restore at least 15% of degraded ecosystems.

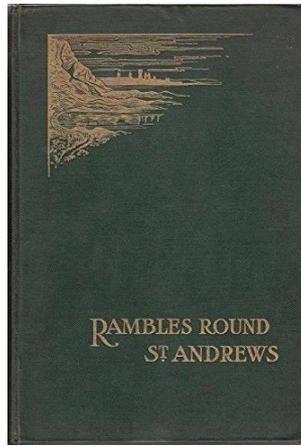
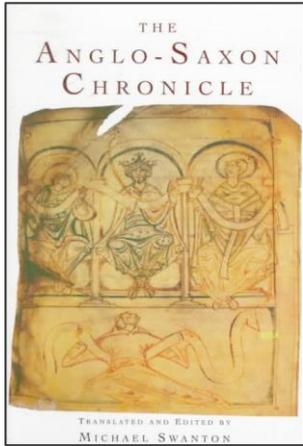
- Society of Ecological Restoration



INTERNATIONAL STANDARDS FOR THE PRACTICE OF ECOLOGICAL RESTORATION - INCLUDING PRINCIPLES AND KEY CONCEPTS



Historical saltmarsh restoration



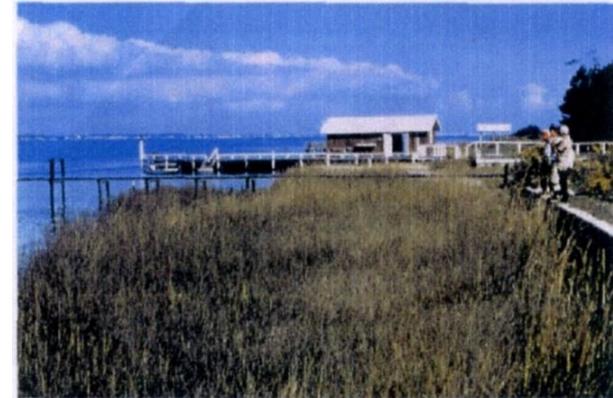
JH Wilson 1910
'vast acres of saltmarsh,
'few signs of erosion'
'turf stripped from
saltmarsh for golf links'

9th Century 'spread ye rhizomes'
(over East Anglican mudflats)

Spartina anglica, Eden Estuary, 1947 to 1980



Craft et al, 1999 S.
alterniflora transplants, N.
Carolina, USA. 1974 (top),
after three years (middle)
and 21 years (bottom)



The Eden Estuary's saltmarshes & shoreline

Cool oceanic, muddy, organic



Mediterranean, sandy, dry



The PhD study

BEFORE: early 2000s



AFTER: late 2000s



The application: Project I

Saltmarshes, Seawalls & Storms: 2010 – 2013

USTAN, SEPA, RAF Leuchars & St Andrews Links Trust

- Two sites: 1,500 m² (500 linear metres) of *Bolboschoenus maritimus* (Sea Club Rush)
- Transplant survival rates between 40% and 90%, depending on year and site
- Limiting factors
 - Size of donor marsh
 - Winter wash out rate
 - Using volunteers



The application: Project I







The application: Project II

Saltmarshes on the Fringe: 2014 – 2016 (USTAN, SNH & Fife Environment Trust)

- Greenhouse studies
 - Transplant yield increased twenty fold
 - Seeds relatively easy to germinate
 - Conditions for successful vegetative-based transplants



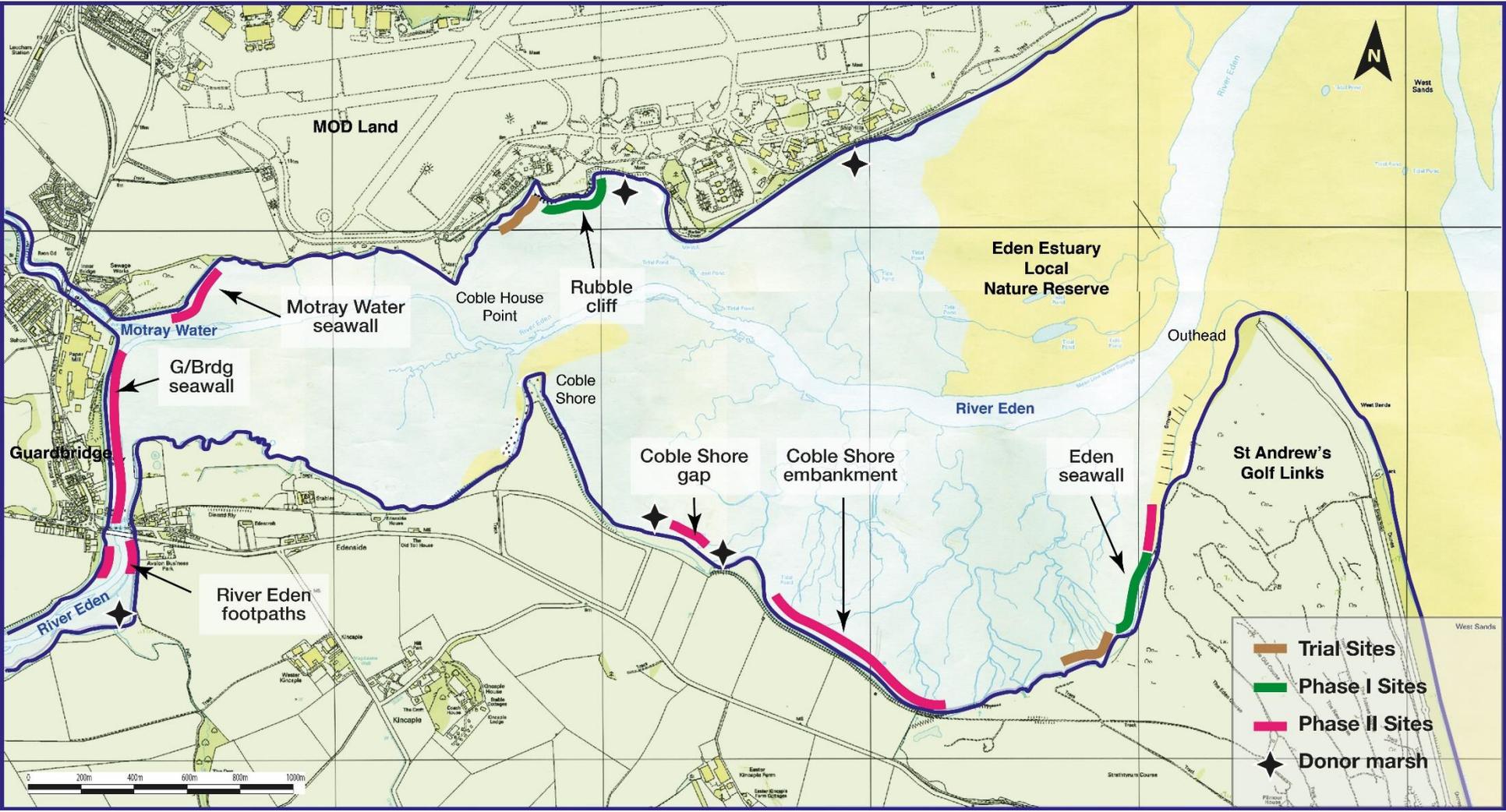
Project II

- Another four sites of Sea Club Rush planted (1,600 m² or 750 linear metres)
- Trials with other saltmarsh species successful



- More than 25,000 transplants from 2,500 plugs
- More than 250 volunteers and 100s of hours of heavy field labour, many practical problems to overcome

Restoration Phases



Application & Studies: Project III

Green Shores: 2017 – 2020

(USTAN, Leader, St Andrews Links Trust, Royal Dornoch Golf Club, Fife Council, Ministry of Defence)

- Create coastal plant hub to develop propagation techniques and produce a supply of transplants for the restoration effort

Saltmarsh Grass (*Puccinellia maritima*)

Red Fescue (*Festuca rubra*)

Sea Plantain (*Plantago maritima*)

Sea Club Rush (*Bolboschoenus maritimus*)

Sea Aster (*Aster tripolium*)

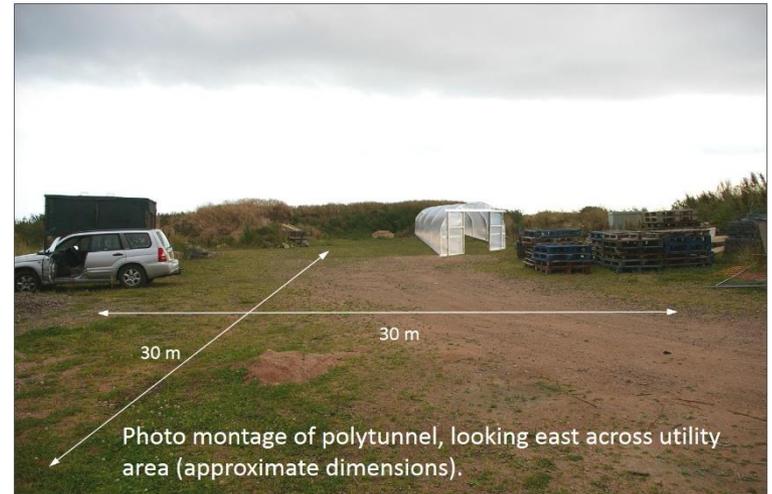
Annual Glasswort (*Salicornia europaea* agg.)

Sea Lyme (*Leymus arenarius*)

Marram grass (*Ammophila arenaria*)

Eelgrass (*Zostera* spp.)

Dwarf Hairgrass (*Eleocharis parvula*)



Green Shores

- Deploy protective wave baffles to provide accommodation space for the creation of thousands of square metres of saltmarsh





- Substantial investments to conserve biodiversity should provide significant environmental, economic and social benefits in return.
 - £300,000 (one university, two community funders, two government agencies & four landowners)
 - Significant returns?
 - Trials over 16 years: 80 m² to 2,000 m²
 - Phase I over 6 years: 1,500 m² to ?
 - Phase II over 2 years: 1,600 m² to ?
- Aichi Target 15: Restore at least 15% of degraded ecosystems
 - Eden Estuary shoreline is 10km long - so far 2.5km restored = **25%**

Fringe saltmarsh restoration: my worst site



Fringe saltmarsh restoration: my favourite site

