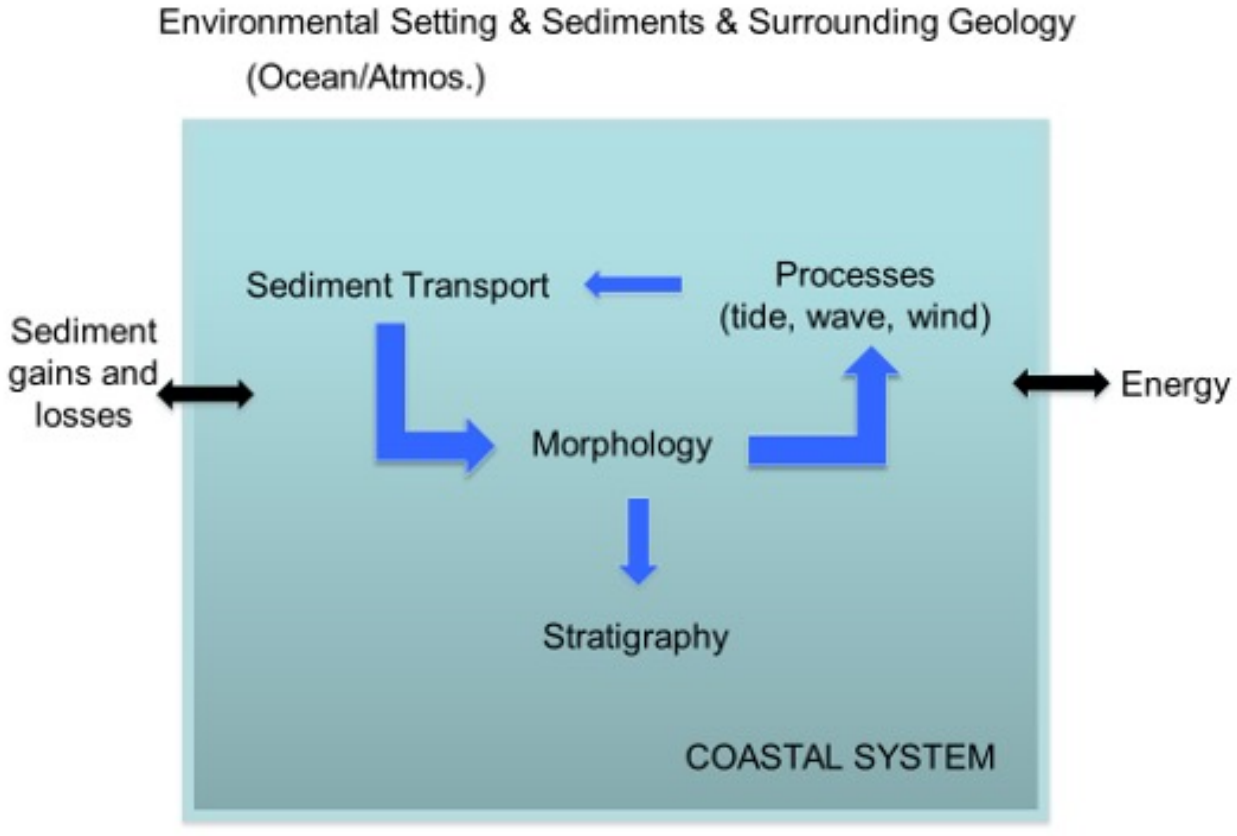
Challenges and opportunities in Shoreline Management

Prof. Andrew Cooper

Ulster University

Coasts are Dynamic, Natural Ecosystems



That deliver multiple ecosystem services

"**Ecosystem services** are the benefits provided by ecosystems that contribute to making human life both possible and worth living" (UK NEA)

Coasts Change

- Hourly
- Daily
- Monthly
- Seasonally
- Annual
- Decades (Storms/ Sea-level/sediment supply)
- Centuries (sea level)
- Millennia

This is how they survive


Portrush July 2014

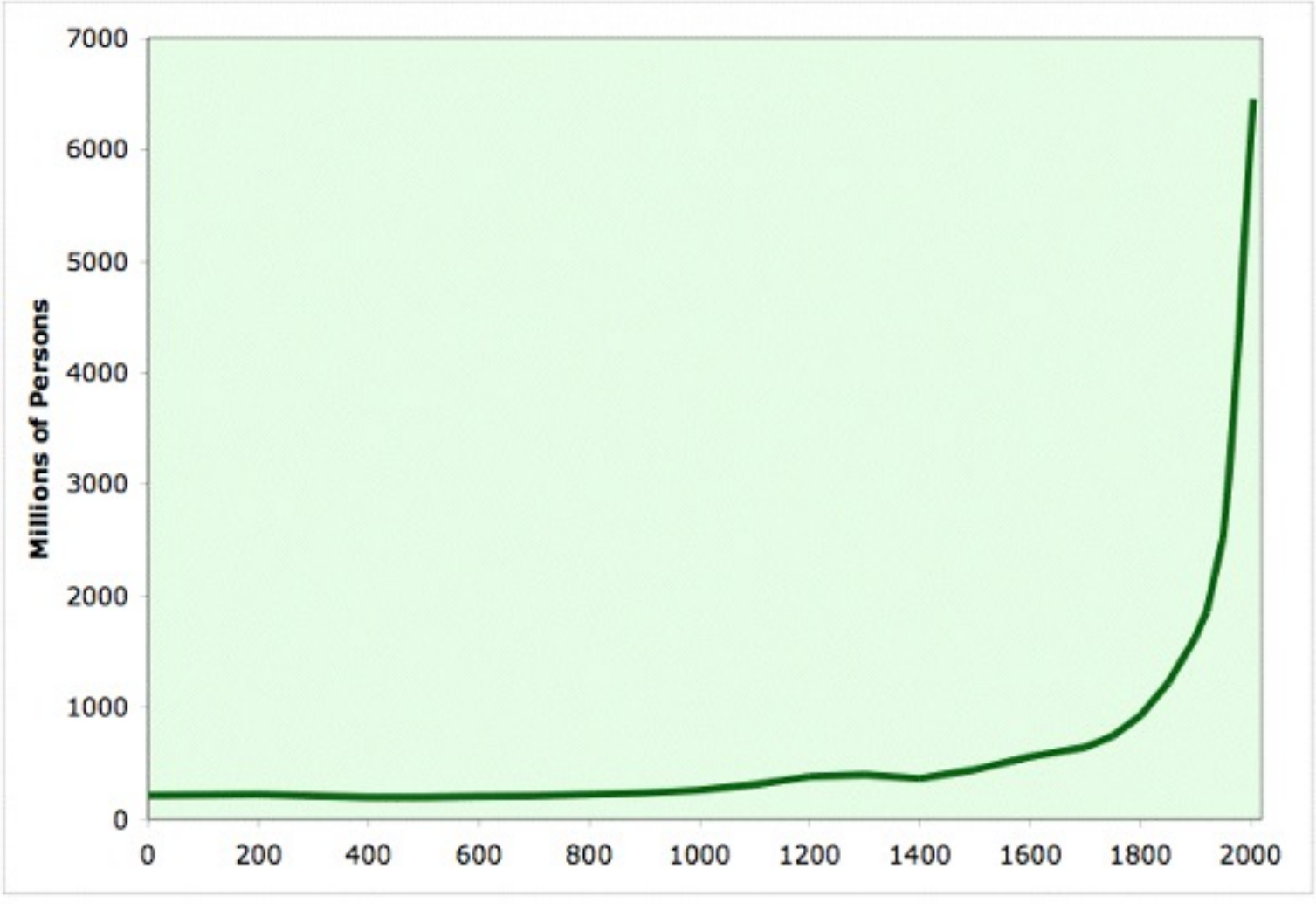

Portrush Feb 2015


Portstewart summer

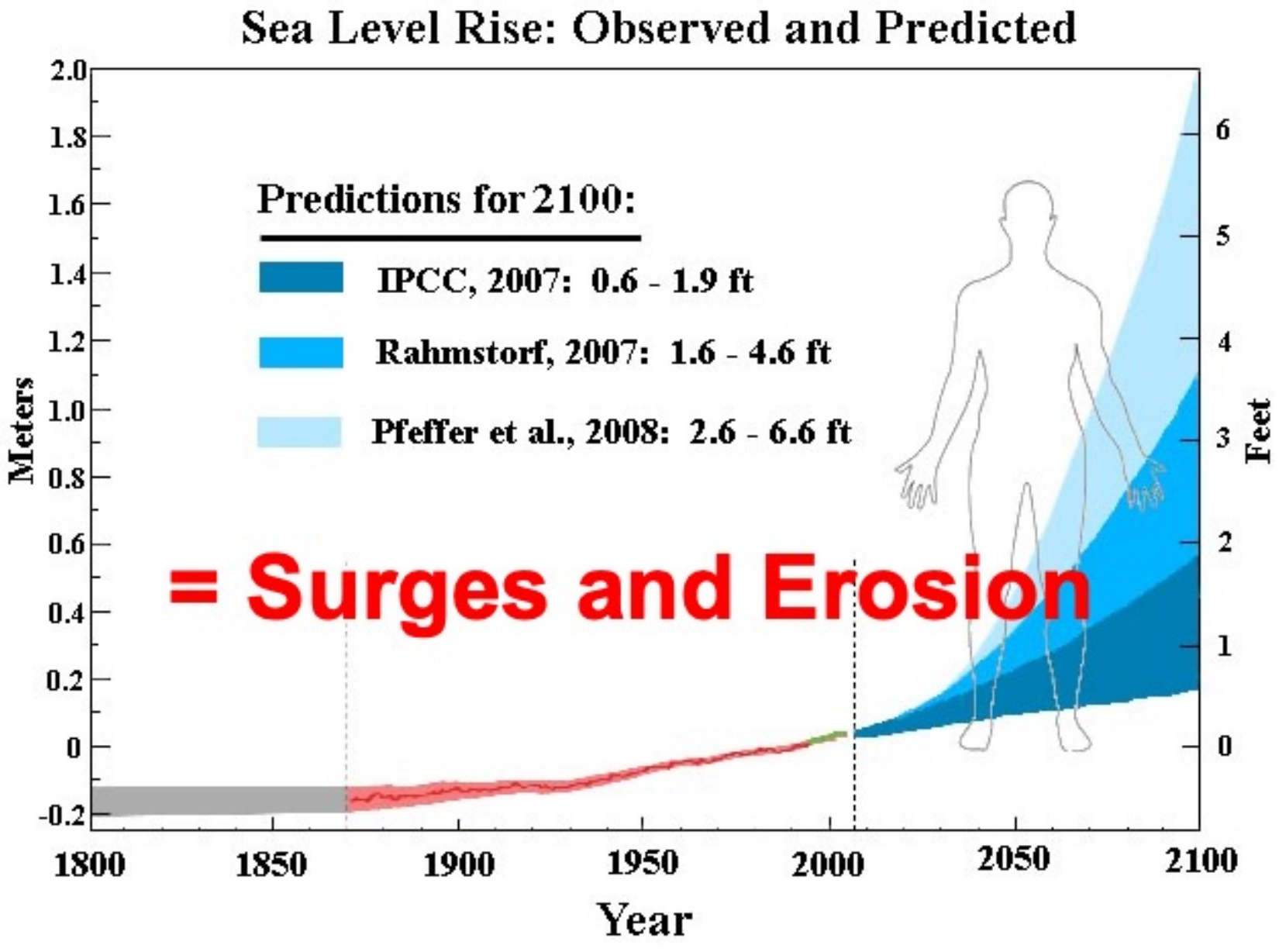

Portstewart storm


FULL UP


Q Tower
Gold Coast
Australia



Human populations since 0 AD


Sea Level Rise: Observed and Predicted
Predictions for 2100:
IPCC, 2007: 0.6 - 1.9 ft
Rahmstorf, 2007: 1.6 - 4.6 ft
Pfeffer et al., 2008: 2.6 - 6.6 ft
= Surges and Erosion
Meters
Feet
Year
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
-0.2
6
5
4
3
2
1
0
1800
1850
1900
1950
2000
2050
2100


Anegada, BVI
Surges?
Erosion?


Kinnego Bay, Donegal
Surges?
Erosion?


Black Rock, South Africa
Surges?
Erosion?


Dauphin Island, Georgia
Surges?
Erosion?

The Maldives
Velidhu Island

Pompano
Beach, Florida

Surges?
Erosion?

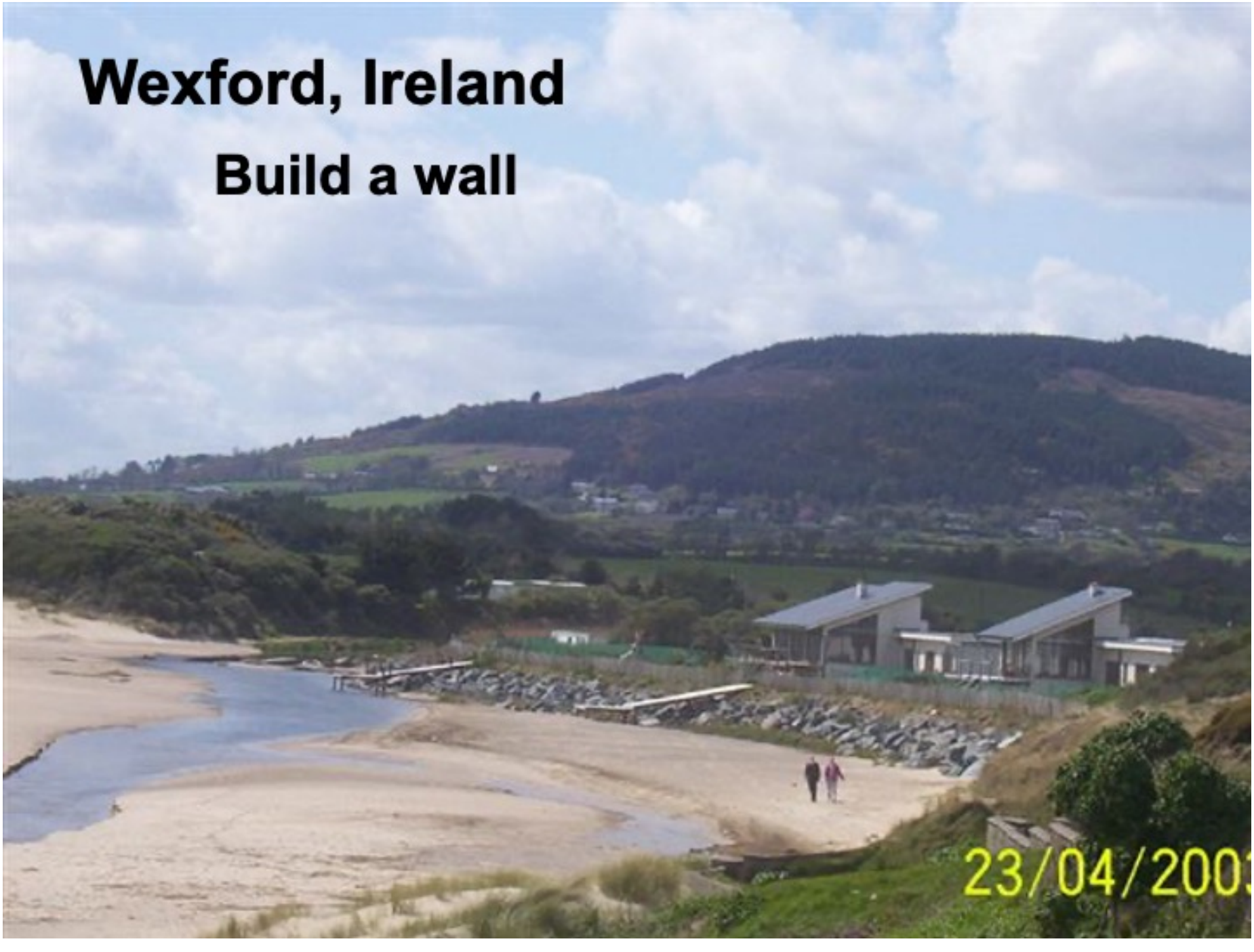

Mar Menor,
Espana
La Manga
10 km


Erosion Problem

How to Adapt?

- **Hard Defences**
- **Soft Defences**
- **Retreat (passive/active)**
- **Advance**


Millisle, Northern Ireland
Build a wall


Wexford, Ireland
Build a wall
23/04/200


Rossnowlagh, Ireland
Rock Armour


Porthcawl, Wales Tarmac the beach
Photo- Mike Philips (Swansea)


Donegal, Ireland Build a wall?


Carnoustie, Fife


Blackpool


Maldives


Maldives


South Carolina


British Columbia


Japan

North Carolina

Hawaii


Closer to home…


Gulf of Cadiz, Spain

“NewJerseyization”

Hawaii - beach vs land loss

Hard Defences

Advantages
Protect Property
Easy to implement

Disadvantages
Costly
Ugly
Temporary
Environmental Impact (loss of beach)
Encourages Development

Modes of Beach Destruction by Seawalls

PLACEMENT LOSS: Construction beyond the high tide line (Miami Beach)

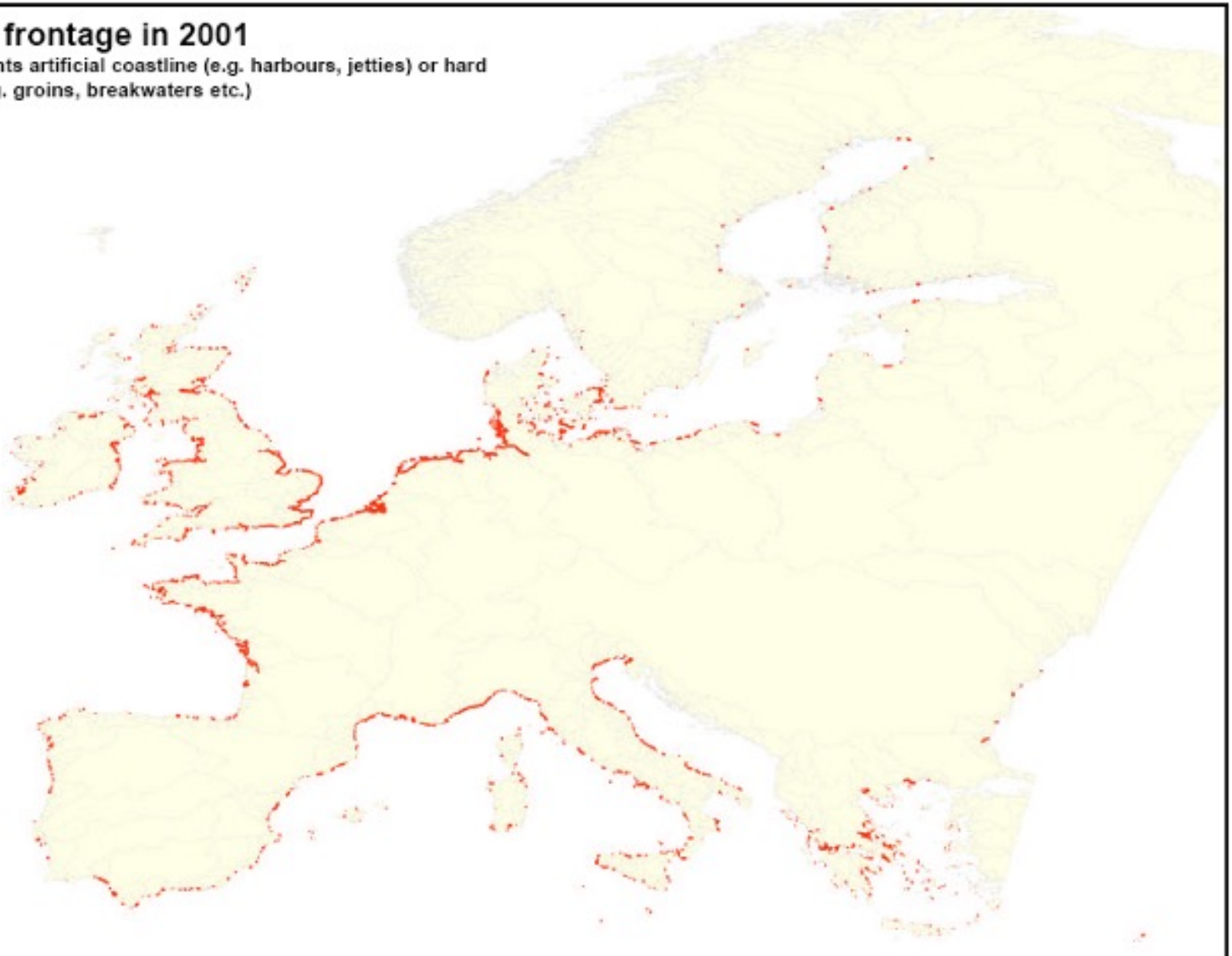
ACTIVE: Surf zone beach narrowing processes interact with the wall

PASSIVE:Beach backs up against the static wall (or static anything) and is eventually lost

- *SEDIMENT SUPPLY*: cut off

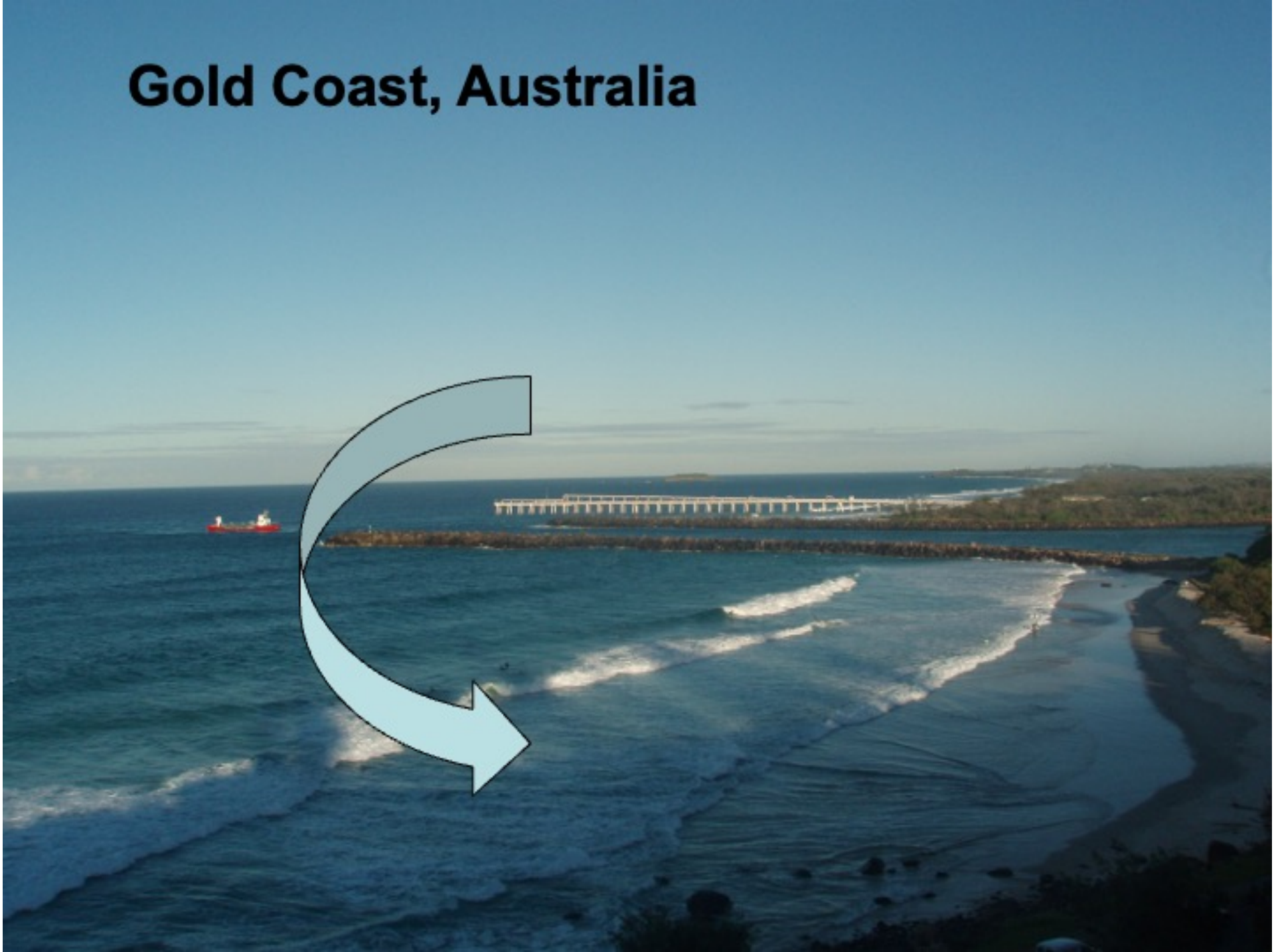
Engineered frontage in 2001

Red spots represents artificial coastline (e.g. harbours, jetties) or hard defence works (e.g. groins, breakwaters etc.)



The Nourishment Option – ‘soft defence’

Gold Coast, Australia

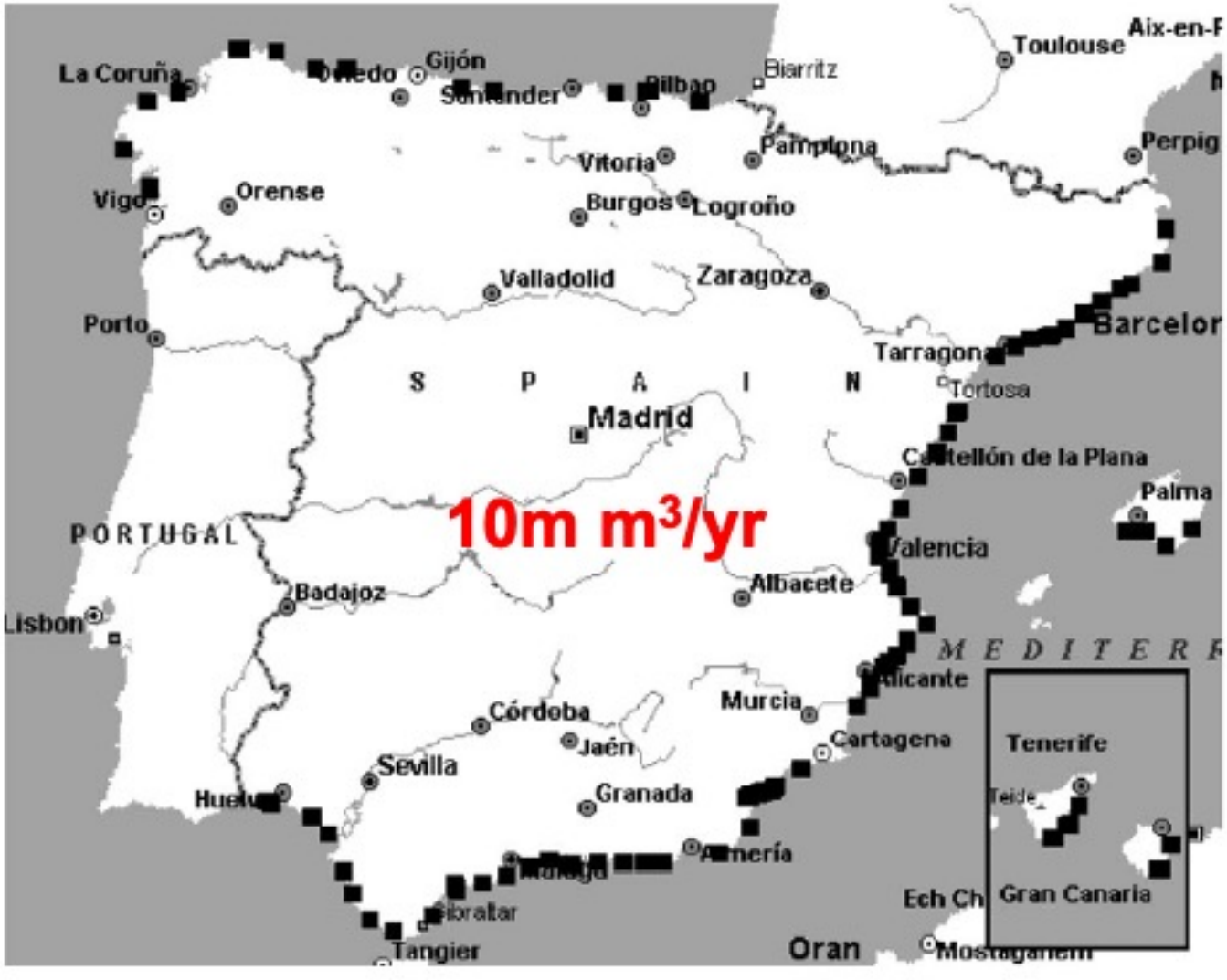


Cesme, Turkey

Durban, South Africa

Nourishment modes

Beach Nourishment schemes France and Italy (after Hanson et al., 2002)



Beach Nourishment schemes, Spain (after Hanson et al., 2002)

Beach Nourishment:

Advantages

Provides recreational beach

Appearance of natural conditions

Disadvantages

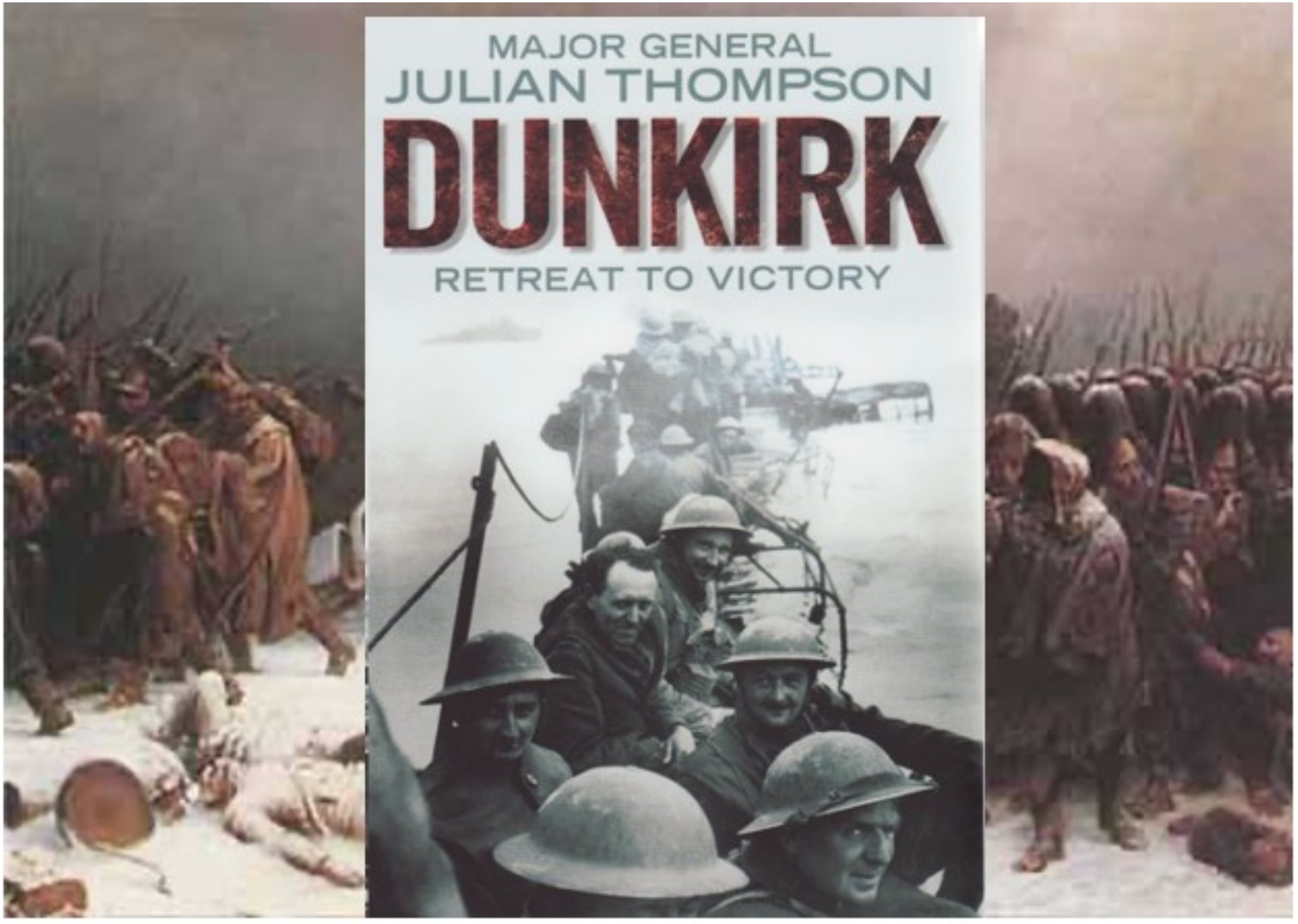
Costly (and who pays?)

Temporary

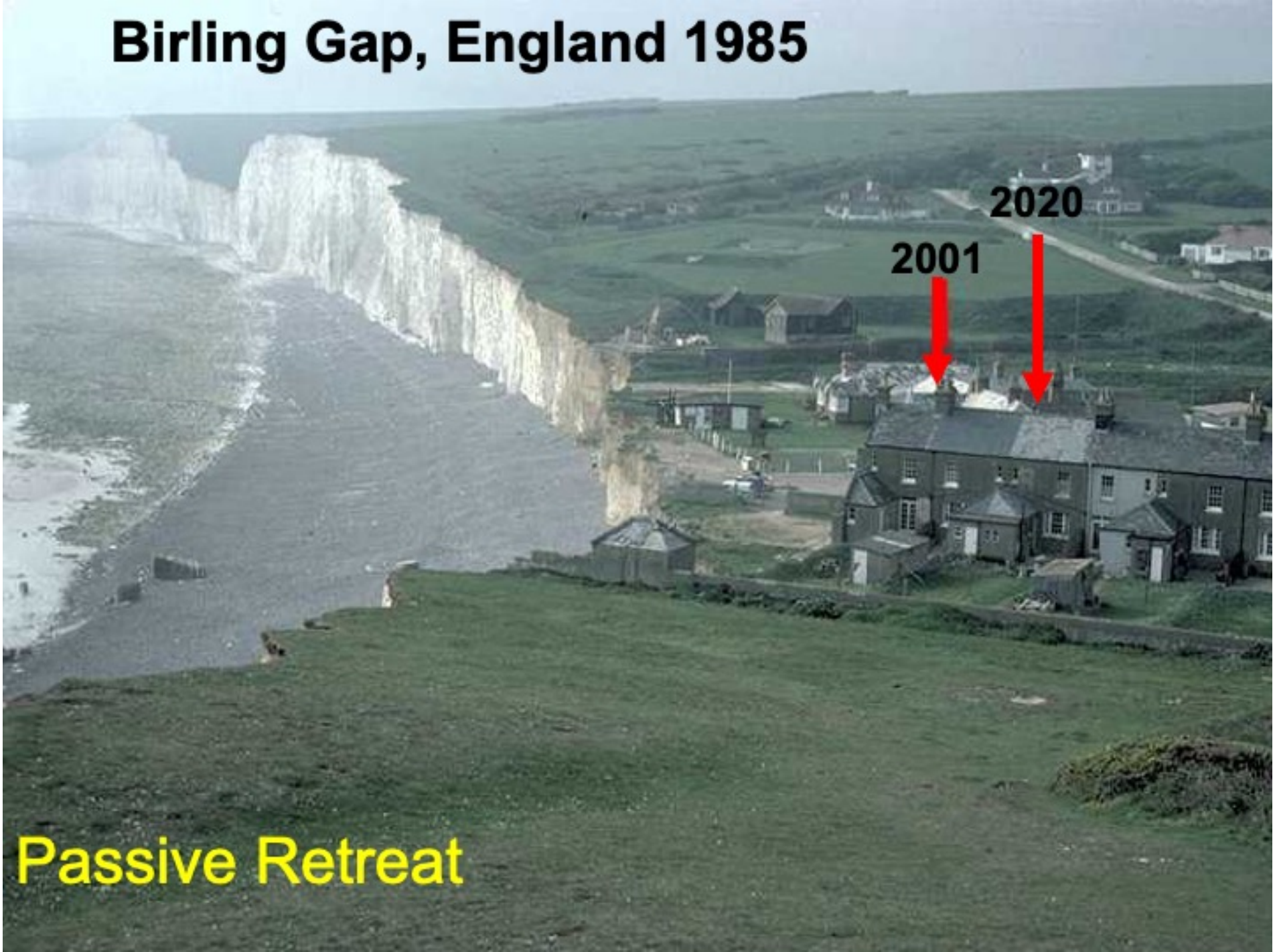
Source of Sand

Environmental Impact (source and sink)

Encourages Development



Retreat - in disgrace or with dignity


Birling Gap, England 1985
2020
2001
Passive Retreat

Norfolk, England

Passive Retreat

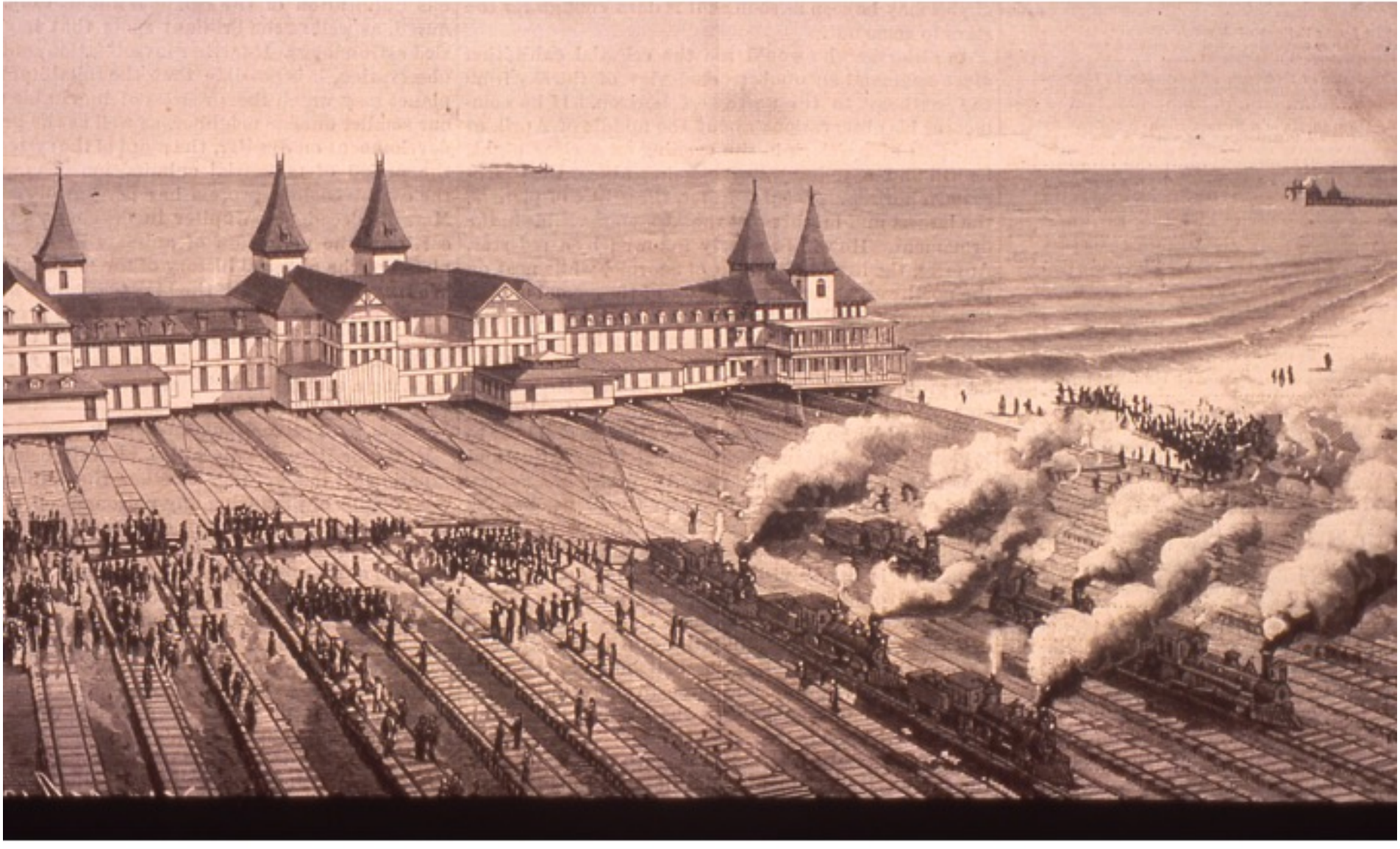
North Carolina, USA


Ocean Isle Beach, NC


North Topsail Beach, NC

Active Retreat

An entire listed 16th-century Kent farmhouse, weighing 450 tons, is moved away from the line of the Channel Tunnel rail link, July 2000



The Outlaw House, North Carolina


Cape Hatteras, NC

Six villages lost in Norfolk flood plan

By Nick Allen

A LARGE swathes of Norfolk, including six villages, could be flooded under a controversial plan to deal with the effects of climate change.

The proposal would effectively admit defeat in the battle to maintain coastal defences. About 16,000 acres (25 sq miles) in the Norfolk Broads would be allowed to flood.

The villages of Eccles, Sea Palling, Waxham, Horsey, Hickling and Potter Heigham would be destroyed, together with five freshwater lakes.

Hundreds of homes and thousands of acres of farmland would be wiped out over the next 20 to 50 years under the plan by Natural England, an environmental group. Villagers have called it "devastating" and "horrifying".

The proposal is based on an assumption that the area's coastal defences will not stand up to rising sea levels caused by global warming. The proposal to "realign the coast" is seen as a cheaper long-term option than trying to maintain the barrier.

The sea would be allowed to breach 15 miles of the north Norfolk coast between Eccles-on-Sea and Winterton and flood low-lying land. Two new sea walls would be erected further back. Natural England says the area would revert to saltmarsh and create a new habitat for wildlife.

Opponents say the plan would involve relocating and compensating hundreds of people. Property would become unsaleable.

The proposal was discussed at a meeting between Natural Englan... Agency, ... and No... last mo... has not ...

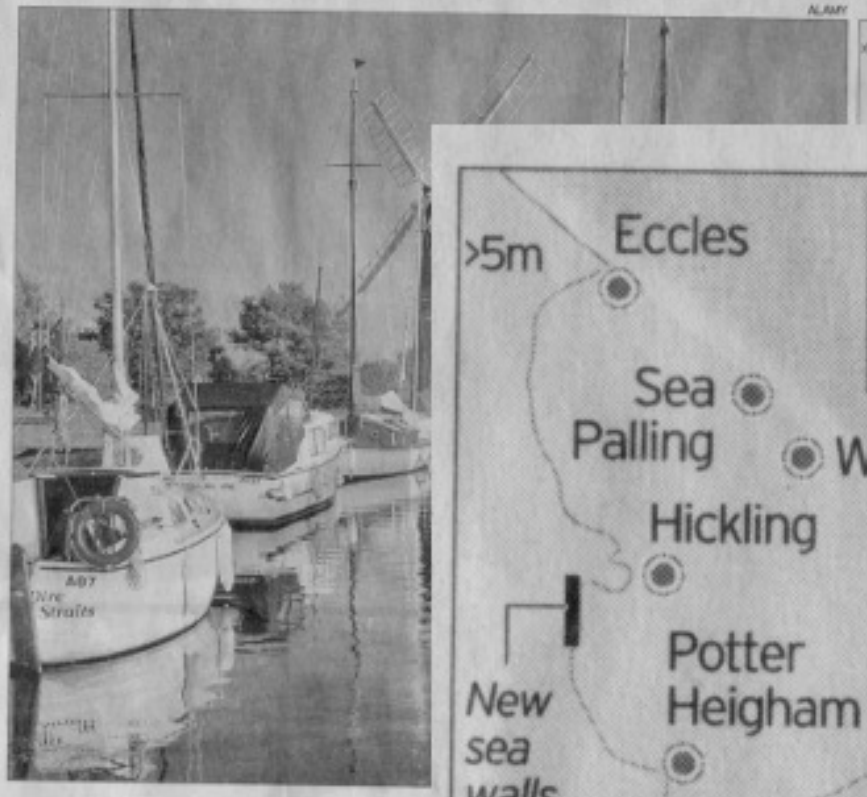
But Norman Lamb, the North Norfolk Liberal Demo-

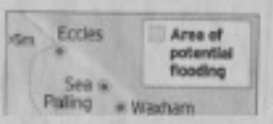
involved. What shocks me is that profound, devastating implications are being discussed at a conference between delegates without the communities affected being part of the decision."

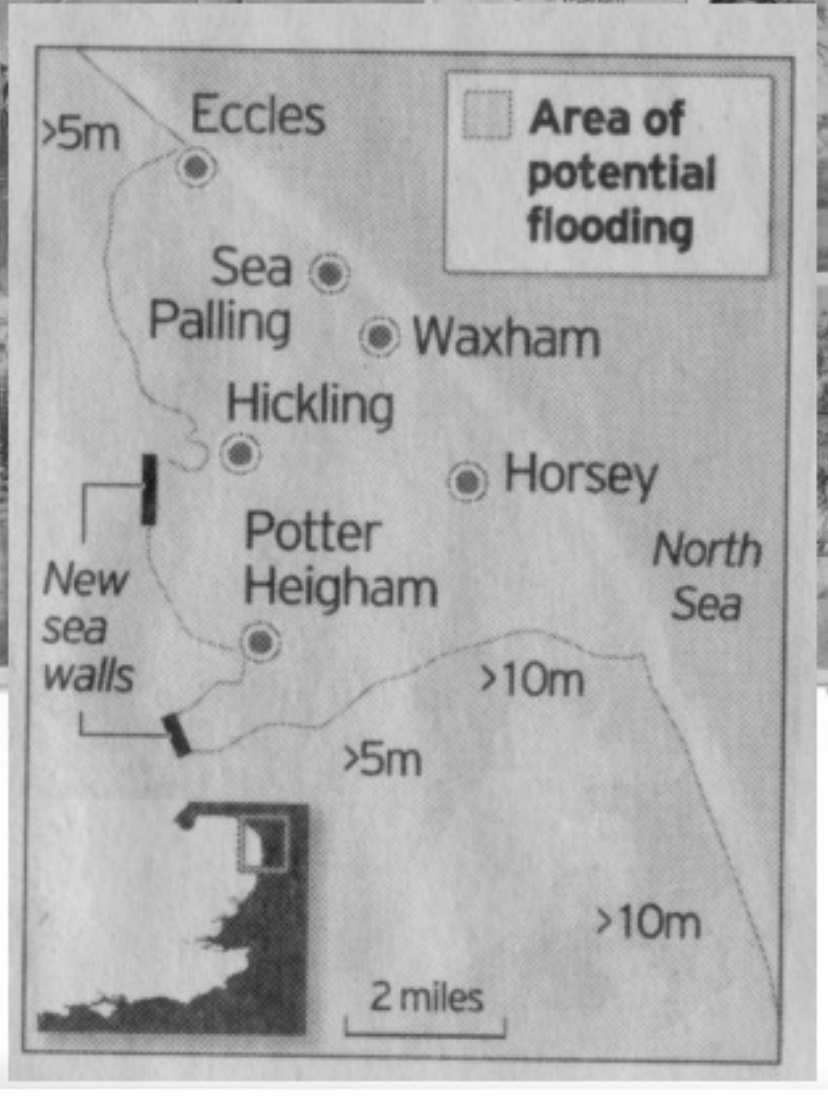
Dr Martin George, of the Broads Society, said: "I'm just horrified by the proposal."

He said one eighth of the Broads would be lost, including Hickling Broad, the most ... Envi... was ...ning ... the next 50 years.

Natural England said the







March 2008

Retreat

“Paradise almost lost:
Maldives seek to buy a new homeland”

“The Maldives will begin to divert a portion of the country's billion-dollar annual tourist revenue into buying a new homeland - as an insurance policy against climate change…”

“The last days of paradise

The president of the Maldives wants to buy a new home for all 300,000 of his people... “

November 2008

Retreat

Advantages

- Responds to sea-level rise
- Preserves the coastal system
- Saves shoreline stabilization costs
- Can Preserve Buildings
- Sustainable

Disadvantages

- Politically difficult
- Potentially costly
- Loss of land/property


2003
DUBAI
Advance
Image NASA
Data U.S. Navy
Google
25°06'10.85" N 55°13'06.07" E
Eye alt 62.07 km


2007
Sep 25, 2007
Data U.S. Navy
Image © 2009 DigitalGlobe
Google
25°06'10.85" N 55°13'06.07" E
Eye alt 62.07 km


Select date
Image © 2009 DigitalGlobe
2009 Google
Imagery Date: May 1, 2006
25°07'09.77" N 55°08'37.24" E
Eye alt 8.10 km


Dec 26, 2005
Data U.S. Navy
Image © 2009 DigitalGlobe
©2009 Google
Imagery Dates: Dec 23, 2004 - Dec 26, 2005 25°13'49.34" N 55°10'03.27" E
Eye alt 8.24 km


Nov 10, 2006
Data U.S. Navy
Image © 2009 DigitalGlobe
©2009 Google
Imagery Dates: Oct 28, 2006 - Nov 10, 2006 25°13'49.34" N 55°10'03.27" E Eye alt 8.24 km


Select date
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2009 DigitalGlobe
©2009 Google
Imagery Date: May 1, 2006
25°13'49.34" N 55°10'03.27" E
Eye alt 8.24 km

Feb 2023

1. Mohamed Alabbar announces $3.5bn mega 'nature' island in Abu Dhabi

Mohamed Alabbar is to launch a spectacular new $3.5 billion island project off the coast of Abu Dhabi, *Arabian Business* can reveal.

The project, known as Ramhan Island, will feature 1,800 beach villas, 1,000 branded residences, a hotel and marina.

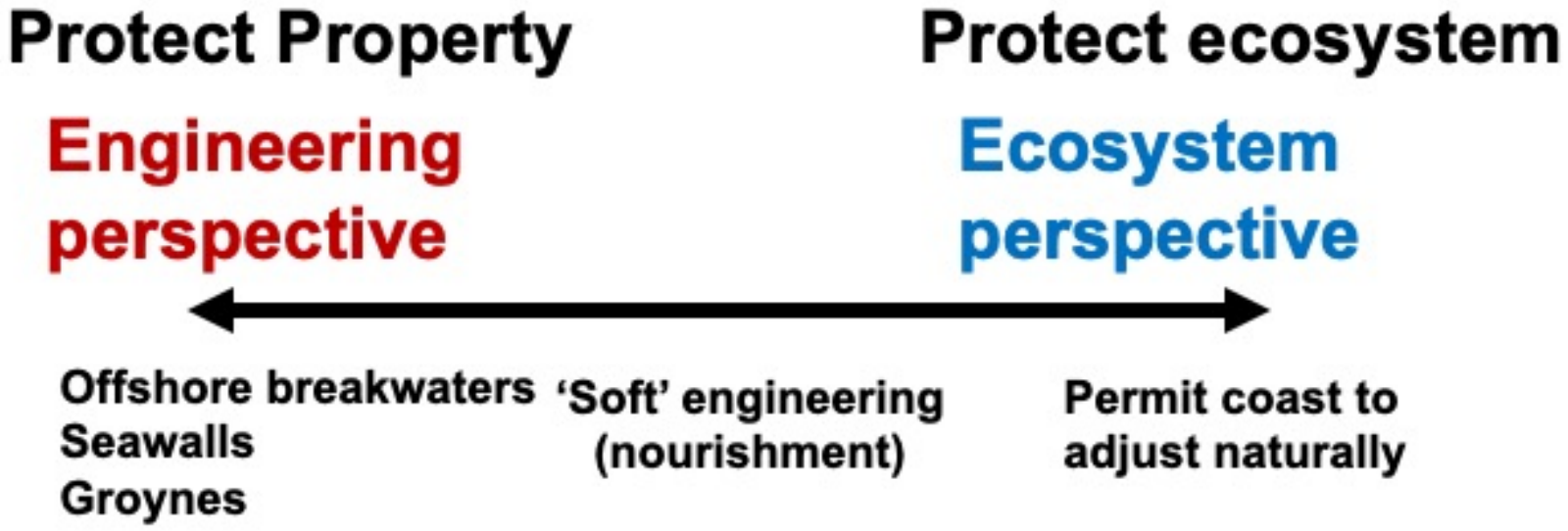
SMP- Shoreline Management Plans

The function of a SMP is to consider the coast as a whole from the perspective of managing coastal flood and erosion risk.

i.e. Managing Environmental change that may affect Human Interests

The Alternative (Conservation) View:

Managing human activities that may damage coastal systems



"Coastal Protection"

Shoreline Management Plan (SMP)

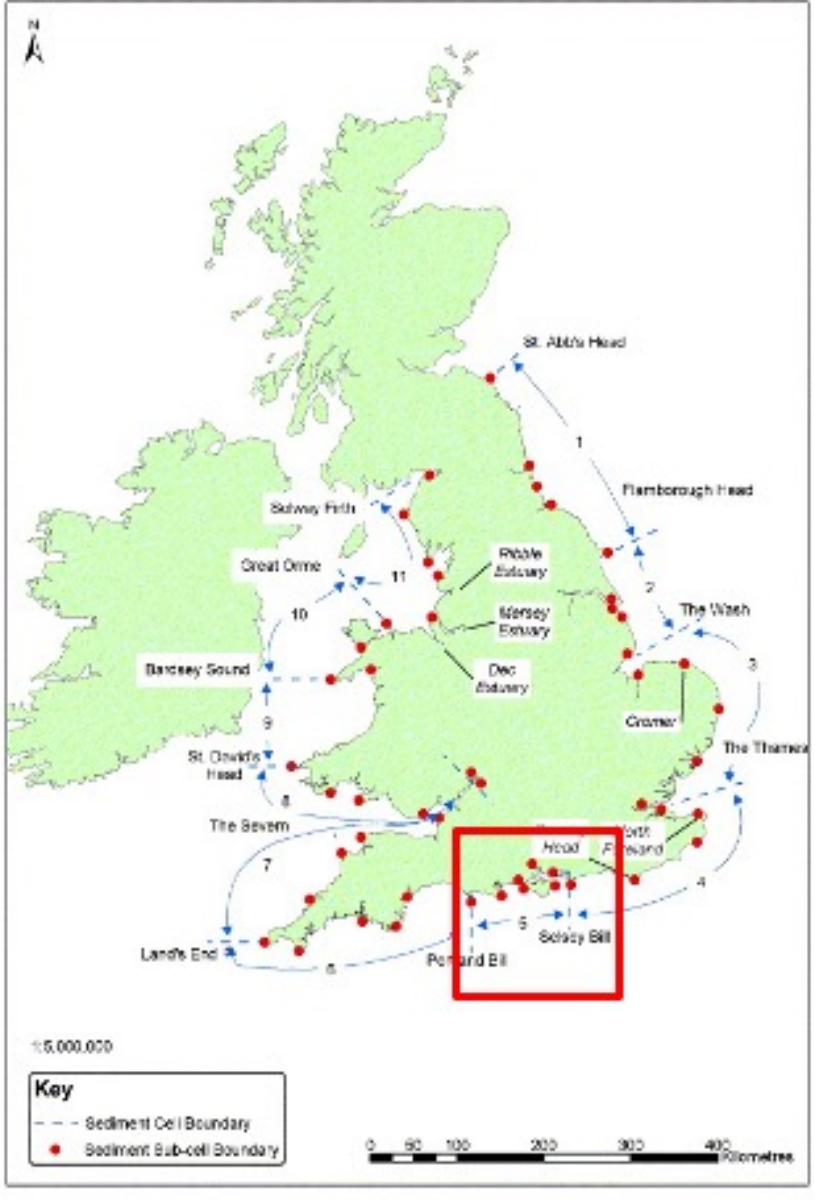
Non-statutory, high level policy document for coastal flood and erosion risk management planning

Assessment of the risks associated with coastal processes, and aims to reduce these risks to people and the environment

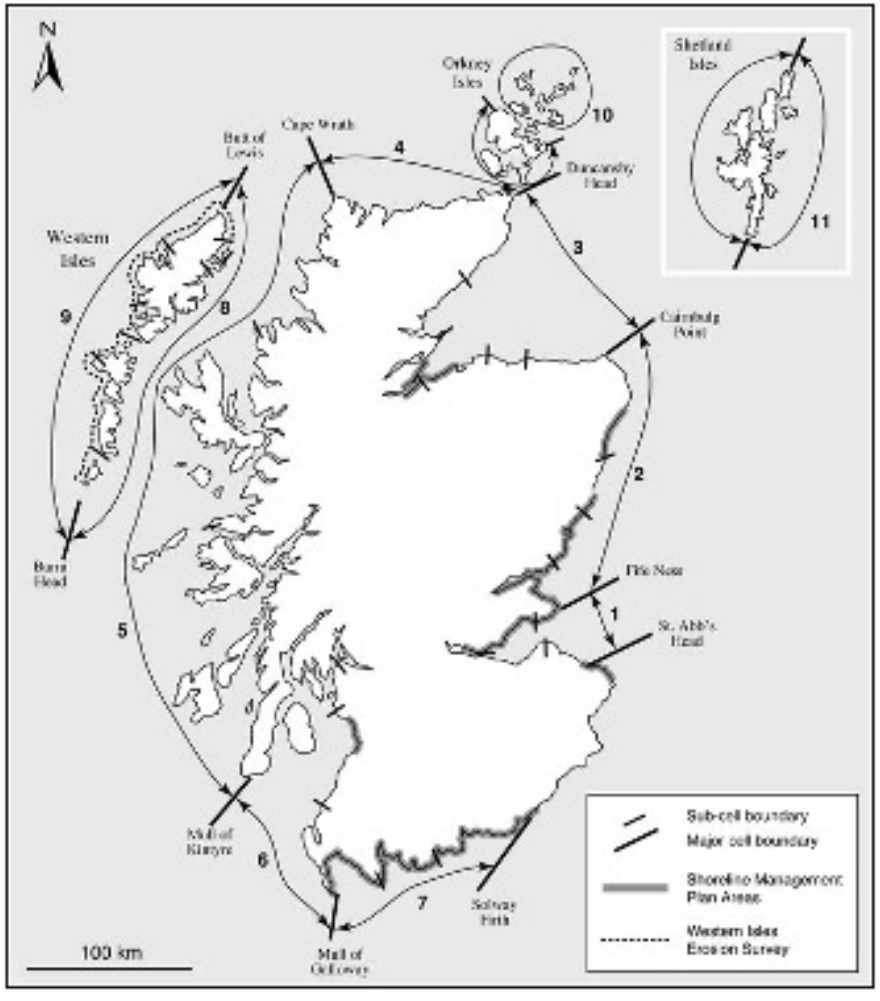
Identifies policies for managing risks in the short-term (0-20 years), medium-term (20-50 years) and long-term (50-100 years).

- **Hold the Line**
- **Advance the Line**
- **Managed realignment**
- **No Active Intervention**

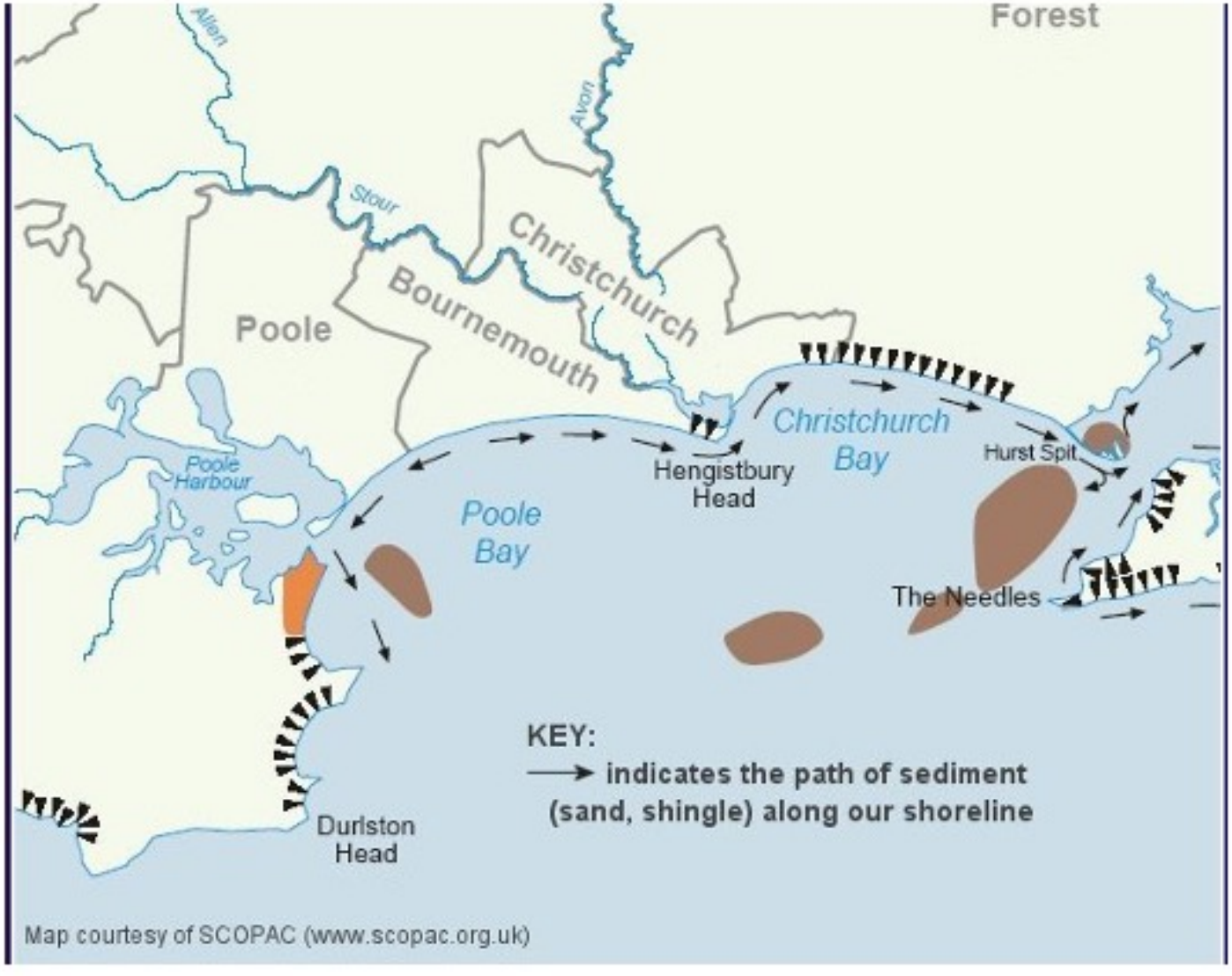
Coastal Cells

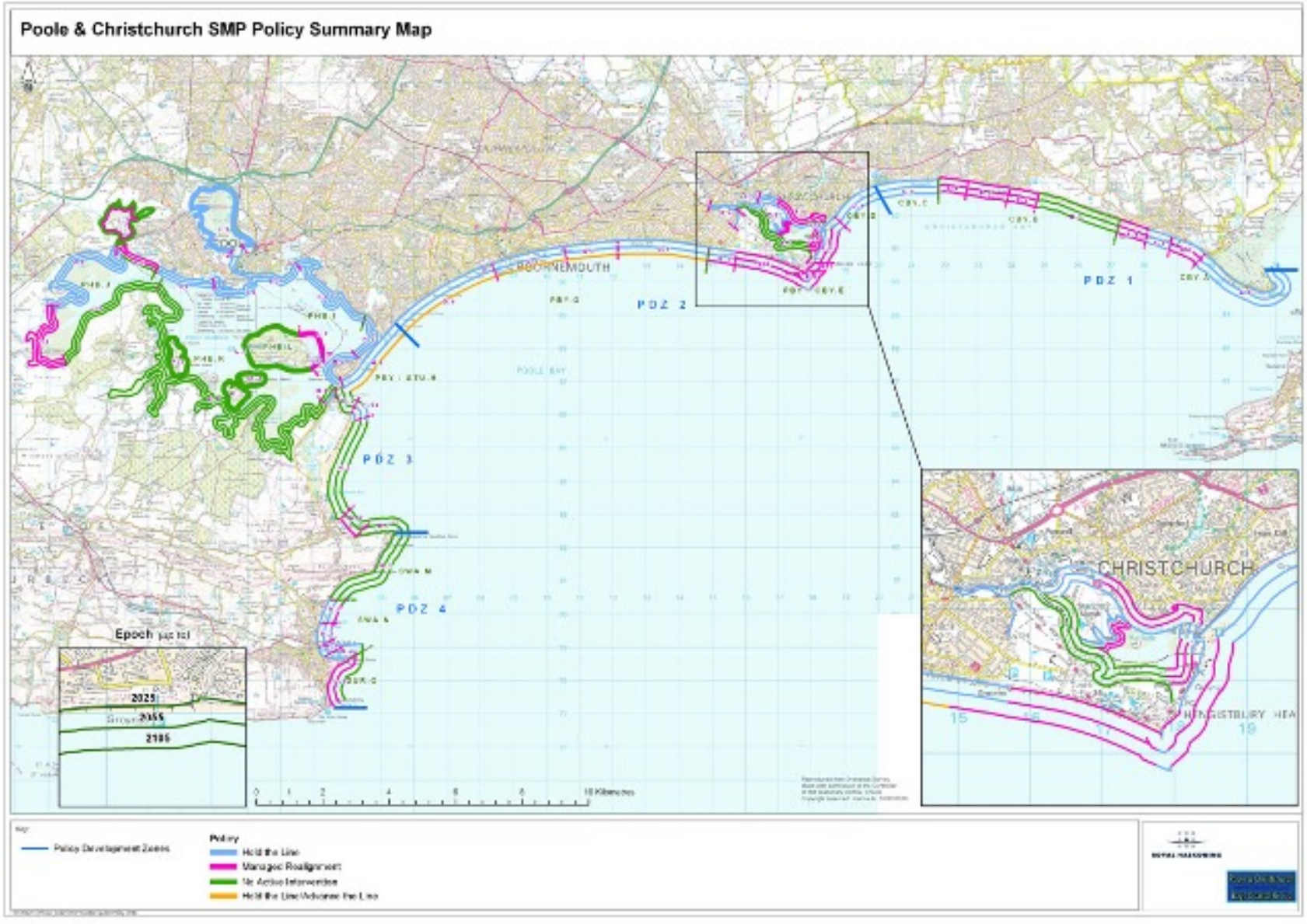


Cooper, N.J. and Pontee, N.I., 2006. Appraisal and evolution of the littoral 'sediment cell' concept in applied coastal management: experiences from England and Wales. Ocean & Coastal Management, 49(7-8), pp.498-510.

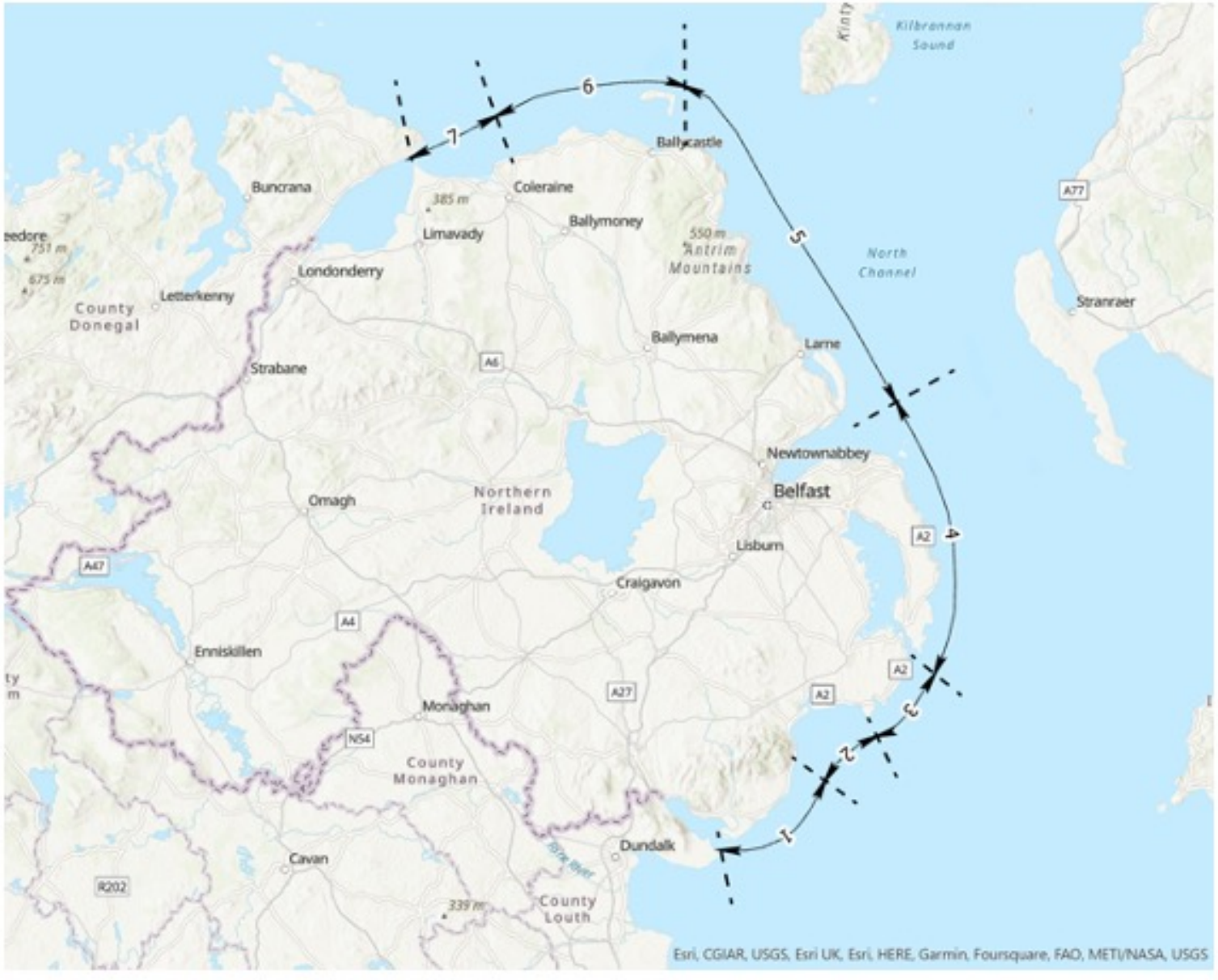


Hansom, J.D. and McGlashan, D.J., 2004. Scotland's coast: understanding past and present processes for sustainable management. Scottish Geographical Journal, 120(1-2), pp.99-116.


Forest
Allen
Avon
Stour
Christchurch
Bournemouth
Poole
Poole Harbour
Poole Bay
Christchurch Bay
Hengistbury Head
Hurst Spit
The Needles
Durlston Head
KEY:
indicates the path of sediment (sand, shingle) along our shoreline
Map courtesy of SCOPAC (www.scopac.org.uk)



https://twobays.net/smp2.htm


Kilbrannan Sound
Ballycastle
Buncrana
Coleraine
385 m
Limavady
Ballymoney
550 m
Antrim Mountains
North Channel
Londonderry
751 m
675 m
Letterkenny
County Donegal
Ballymena
Larne
Strabane
A6
A77
Stranraer
Newtownabbey
Belfast
Northern Ireland
Omagh
Lisburn
A2
A47
Craigavon
A4
Enniskillen
A27
Monaghan
N54
County Monaghan
Dundalk
Cavan
R202
339 m
County Louth
Esri, CGIAR, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Northern Ireland Shoreline Armouring

Loughs: Carlingford 40%; Belfast 50%; Larne 30%, Foyle 50%
Sandy Beaches : 25%

Cooper, J.A.G., O'Connor, M.C. and McIvor, S., 2020. Coastal defences versus coastal ecosystems: a regional appraisal. *Marine Policy*, 111, p.102332.