



TRINITY COLLEGE DUBLIN
COLÁISTE NA TRÍONÓIDE, BAILE ÁTHA CLIATH

THE
UNIVERSITY
OF DUBLIN



Workshop 3A: Understanding Climate Change and Coastal Impacts





South West Mayo
 DEVELOPMENT COMPANY LTD
Comhacht Fíorbartha
 IonRialaíocht Inbhaíocht Fíor-Tuá



MAYO CLIMATE ACTION AWARENESS WORKSHOPS















Rialtas na hÉireann
 Government of Ireland



Rialtas na hÉireann
 Government of Ireland









Climate Action Awareness Group



- South West Mayo Development Company Ltd.
- CARO (Climate Action Regional Office)
- Mayo County Council
- Moy Valley Resources IRD
- Mayo North East Development Company Ltd.



Comhairle Contae Mhaigh Eo
Mayo County Council



Energy Co-Op



Energy Co-operatives Ireland

Building community energy networks

energyco-ops.ie





OVERVIEW

South West Mayo Development Company, as part of a Climate Action Awareness Group, are delivering a bespoke workshop programme 'Mayo Climate Action Awareness Workshops' in 5 Mayo Towns. These workshops will look at a number of topics related to climate change, the relative impacts and adaptation and mitigation actions that can be taken.

The format of these workshops will allow for educating and creating awareness of climate change issues and for interactive discussion around these issues and associated actions that can be taken individually or as a community. The training material will be a combination of both generic and specifically local information using local case studies directed at communities.

This programme will run over a period of 6 weeks, starting the 4th of February 2020 with 3 workshops running in 5 locations around the county. The first two workshops in each location will be common across all 5 locations, with the final workshop focusing on different themes in each location, but open to participants across the whole county.

Workshops

FOCUSED WORKSHOPS

DATES AND LOCATIONS



WORKSHOP 3A: UNDERSTANDING CLIMATE CHANGE AND COASTAL IMPACTS

- ✓ [Belmullet](#) - Aras Inis Gluaire
27th February 2020
7pm - 10pm



WORKSHOP 3C: UNDERSTANDING CLIMATE CHANGE AND HOUSEHOLD ENERGY

- ✓ [Castlebar](#) - Leisure Complex Lough Lannagh
3rd March 2020
7pm - 10pm



WORKSHOP 3B: UNDERSTANDING CLIMATE CHANGE AND COMMUNITY ENERGY

- ✓ [Ballina](#) - Family Resource Centre
29th February 2020
10am - 1pm



WORKSHOP 3D: UNDERSTANDING HOW PERSONAL CONSUMPTION AFFECTS CLIMATE CHANGE

- ✓ [Claremorris](#) - Town Hall
5th March 2020
7pm - 10pm

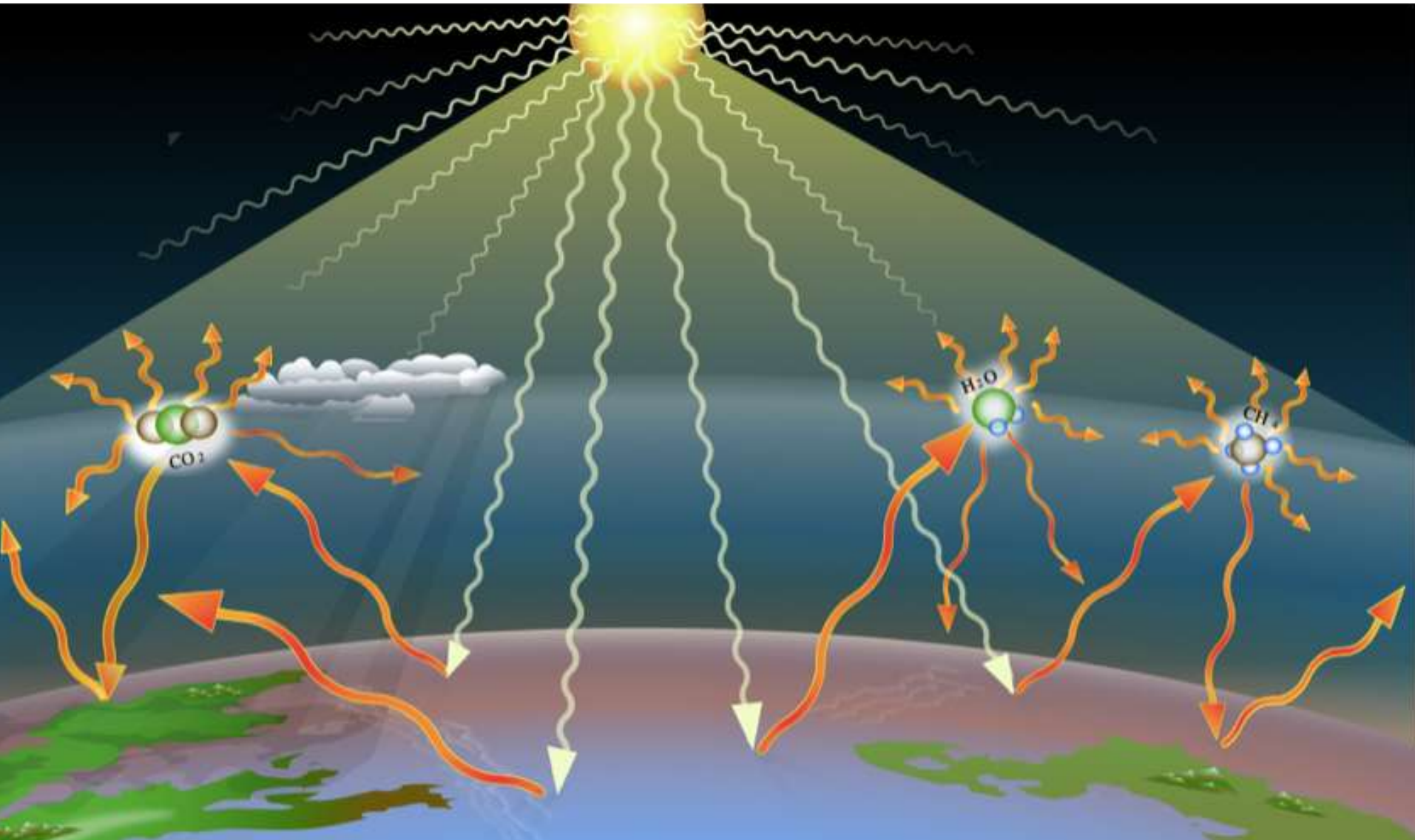


WORKSHOP 3E: UNDERSTANDING HOW TRANSPORT AFFECTS CLIMATE CHANGE

- ✓ [Westport](#) - Leeson Enterprise Centre
7th March 2020
10am - 1pm

Global Warming – Greenhouse

Greenhouse Gases collecting in the atmosphere trap heat



Global Climate Indicators

Indicators which show the changing conditions which humans are causing

Surface temperature

Atmospheric CO₂

Ocean acidification

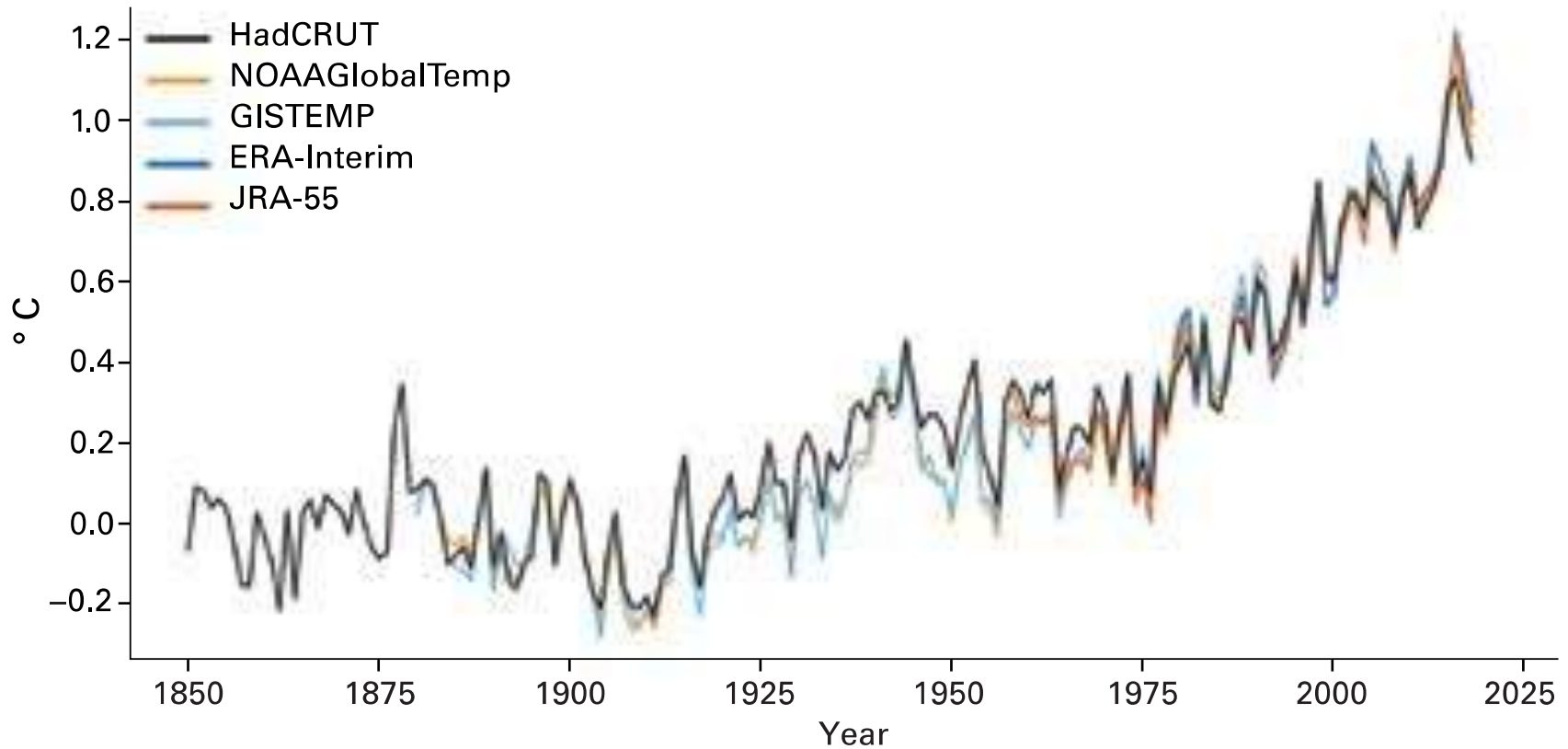
Glaciers

Ocean heat

Sea level

Arctic and Antarctic sea-ice extent

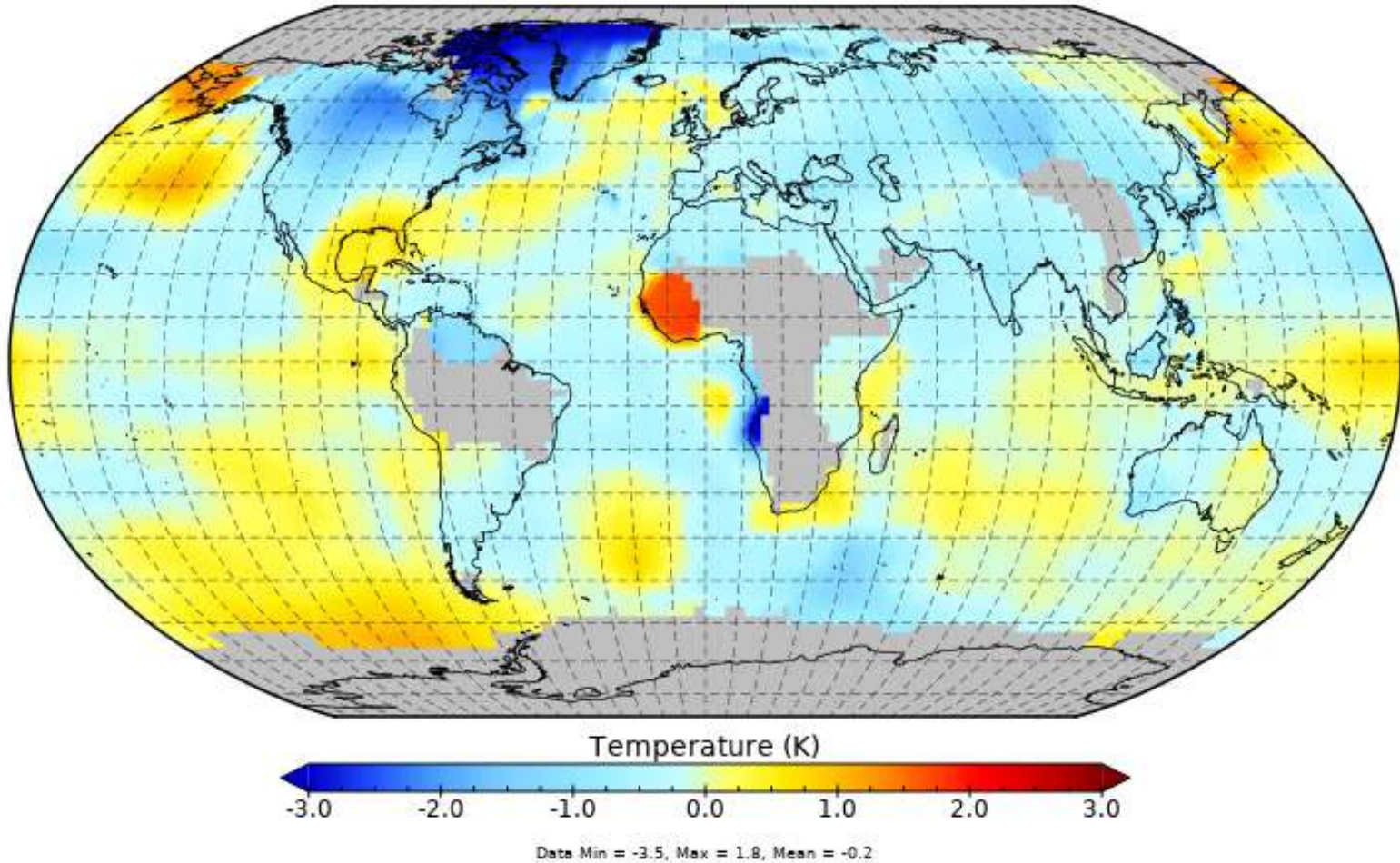
Global Mean Surface Temperature



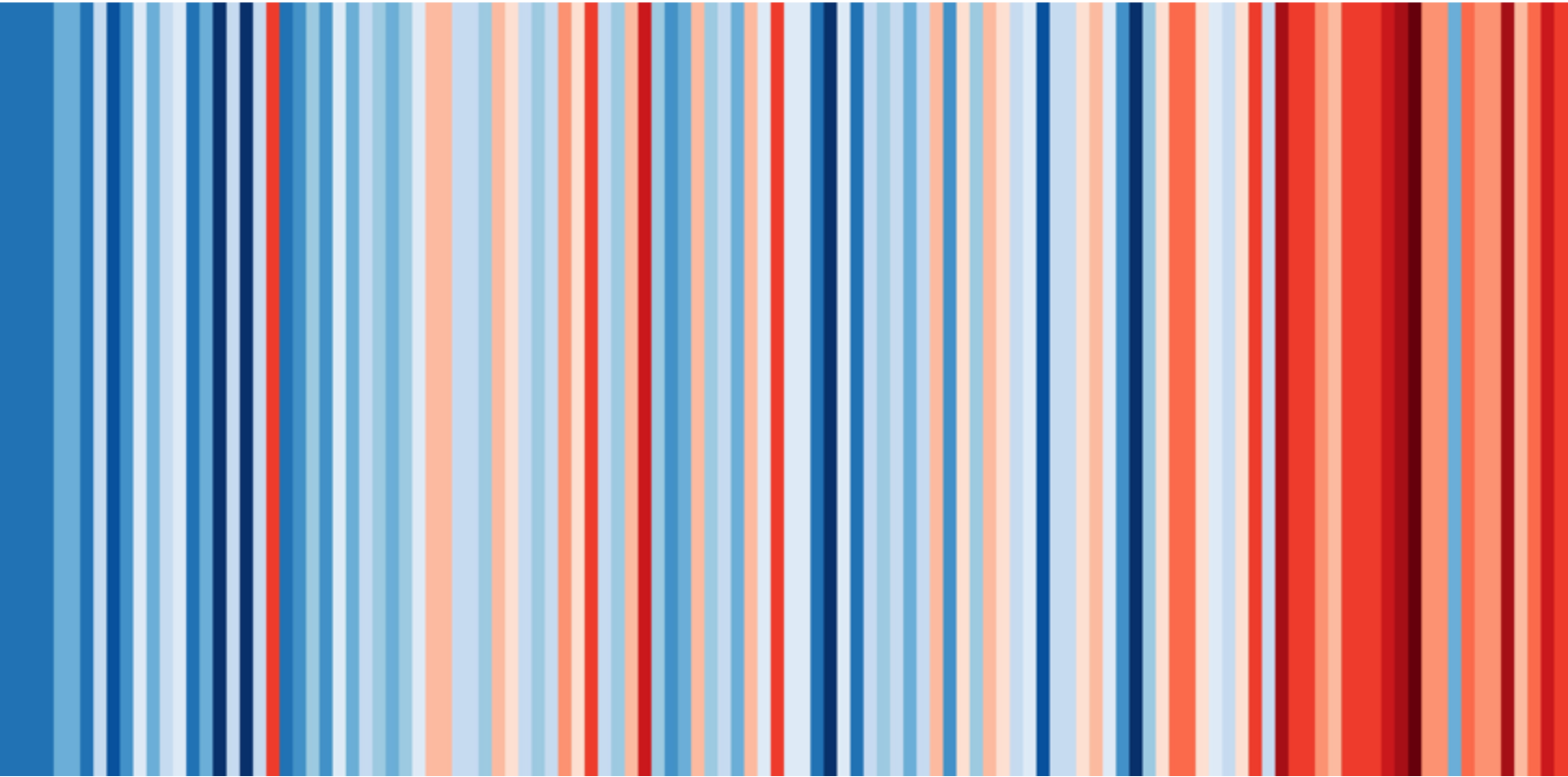
- Combines land & marine data
- In 2015 a record level of 1°C higher than in 1850
- Industrial revolution

Global Mean Surface Temperature 1880-2017

Annual Surface Temperature Anomaly base 1951-1980
1880-1884

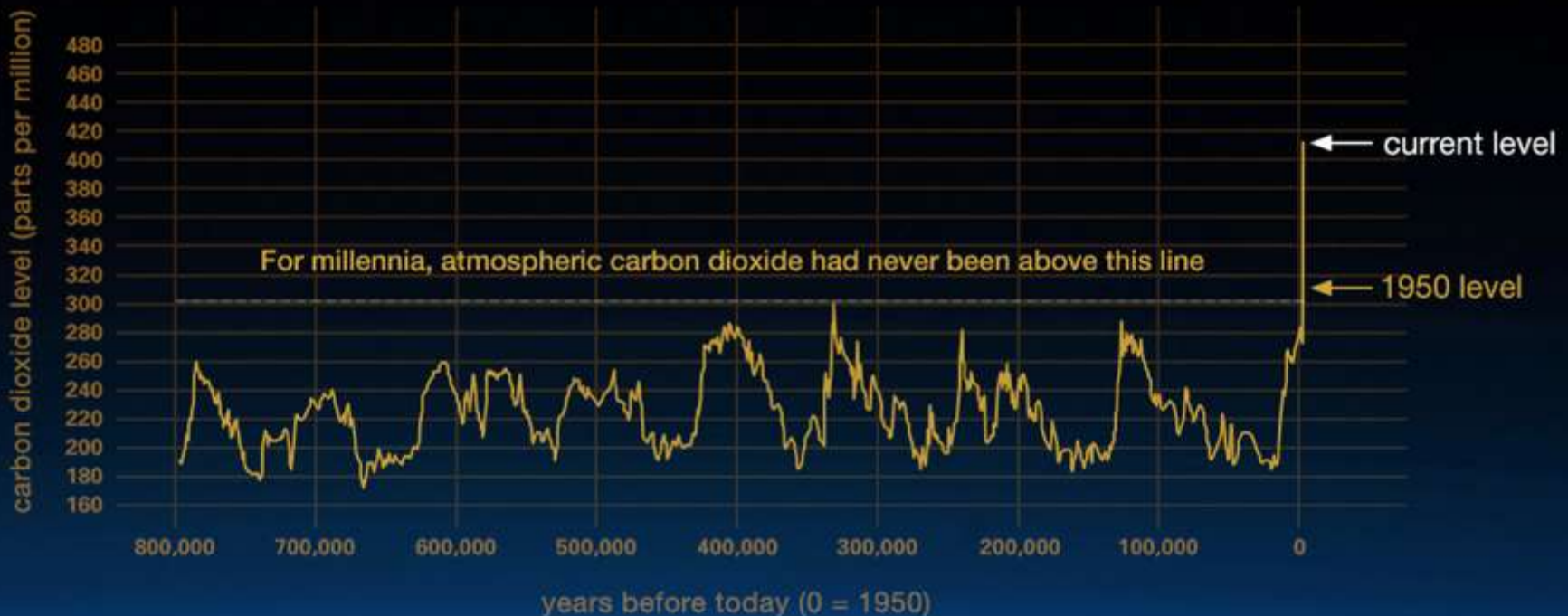


Annual Average Temperatures for Ireland



- The first line on the left is the temperature in 1801 and the temperatures increases as we move across to the 2018 temperature (far right)
- Berkeley Earth data <https://showyourstripes.info/stripes/EUROPE-Ireland--1901-2018-BK>

CO₂ Concentration in the Atmosphere

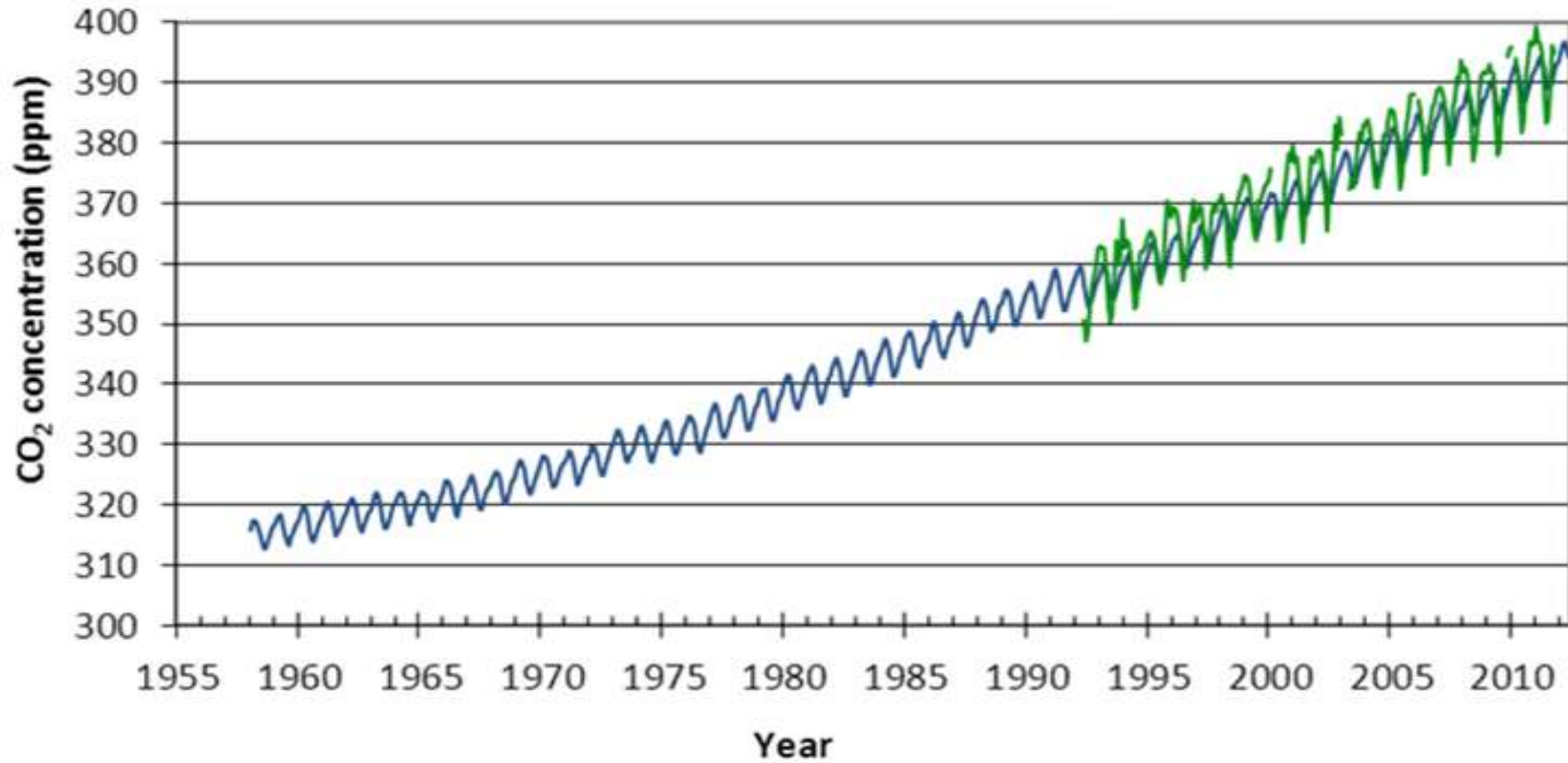


- Graph shows scale of the CO₂ spike over 800,000 years
- Record highs >400 ppm
- Other Greenhouse Gases also like: CH₄, H₂O and N₂O

Atmosphere CO₂ Concentration in Mace Head

Carbon Dioxide (CO₂) (1958-2012)
monthly mean concentration

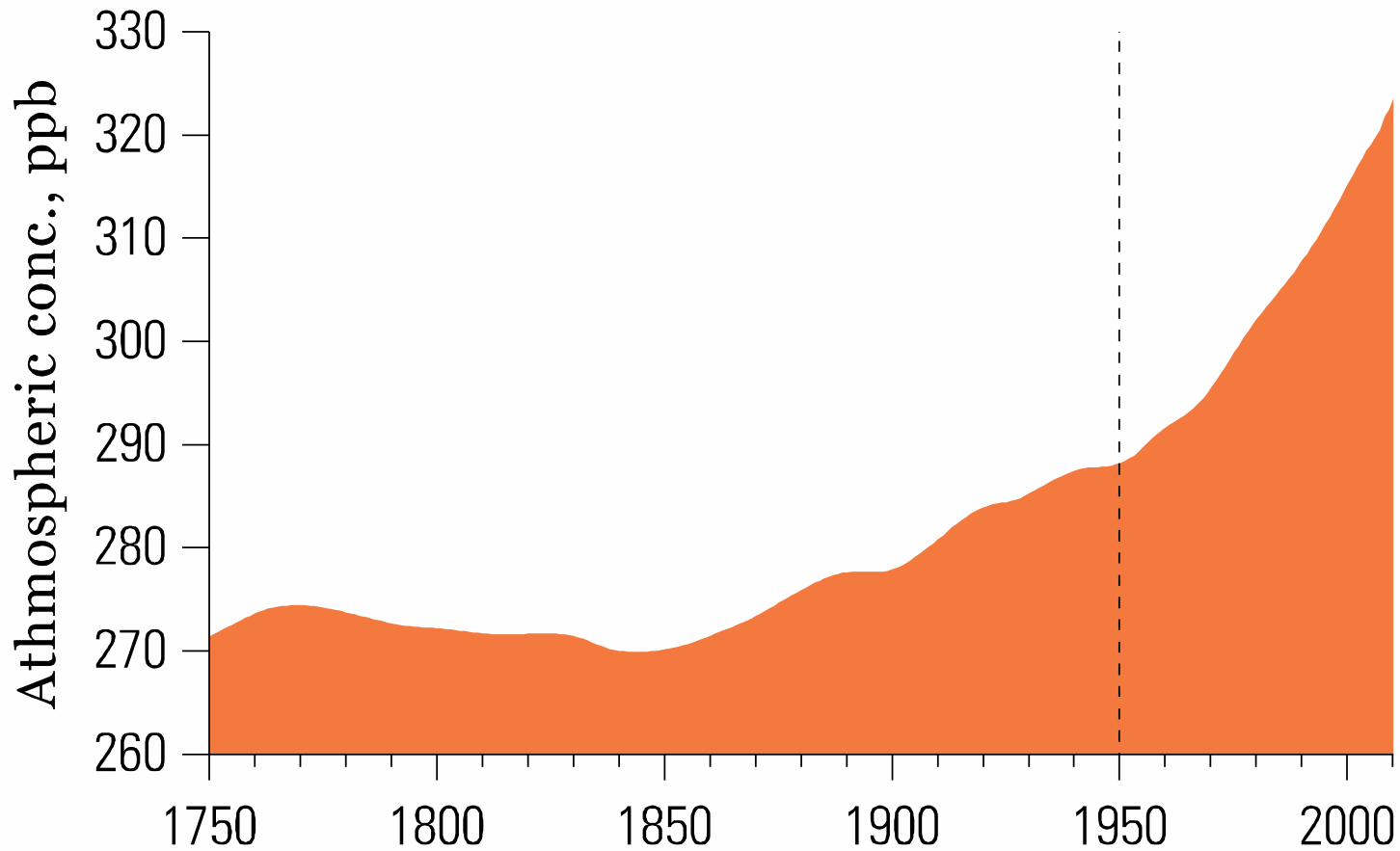
— Mauna Loa (Hawaii) — Mace Head



(Dwyer,2013)

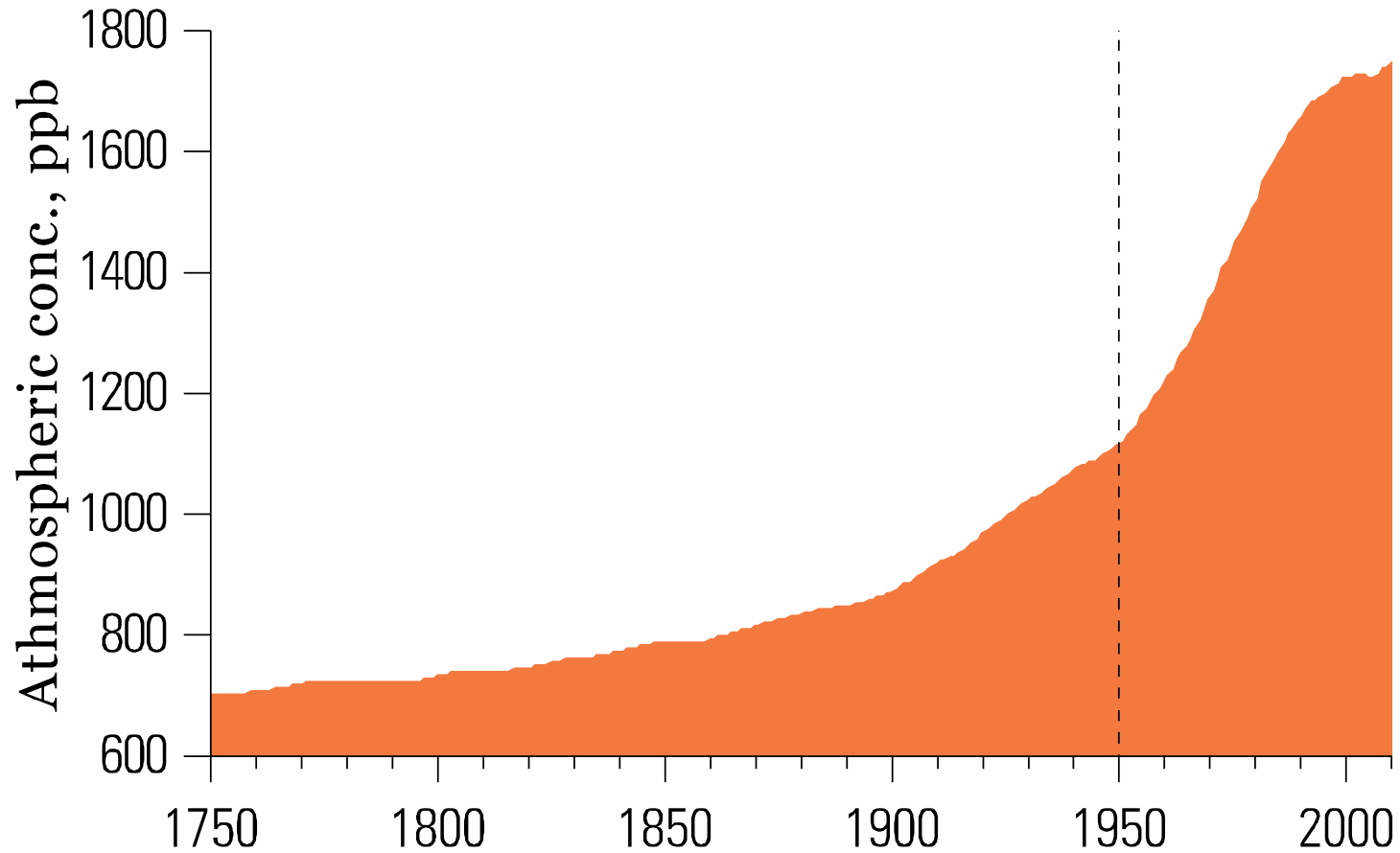
Nitrous Oxide Concentrations in Atmosphere

NITROUS OXIDE

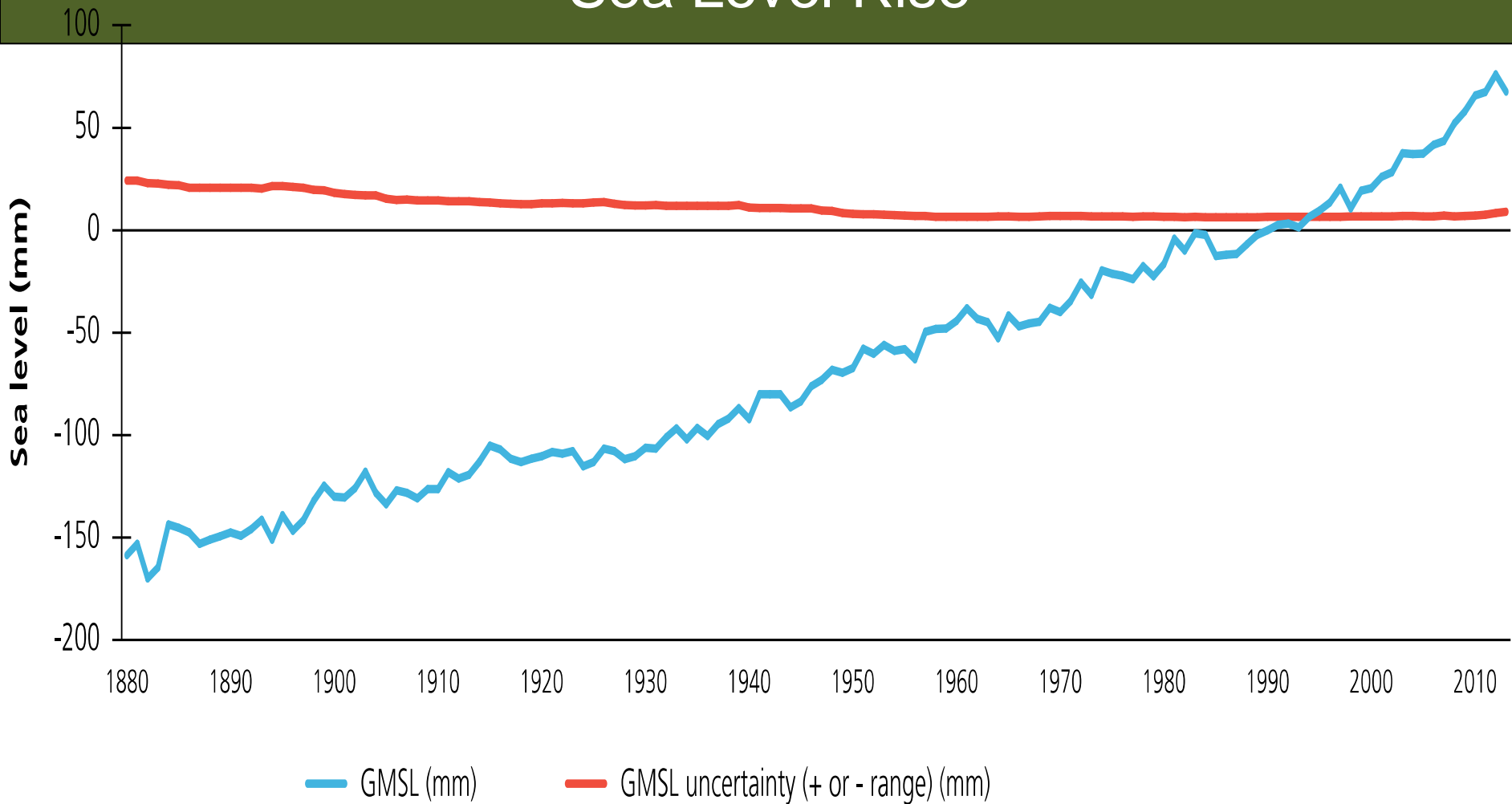


Methane Concentrations in Atmosphere

METHANE



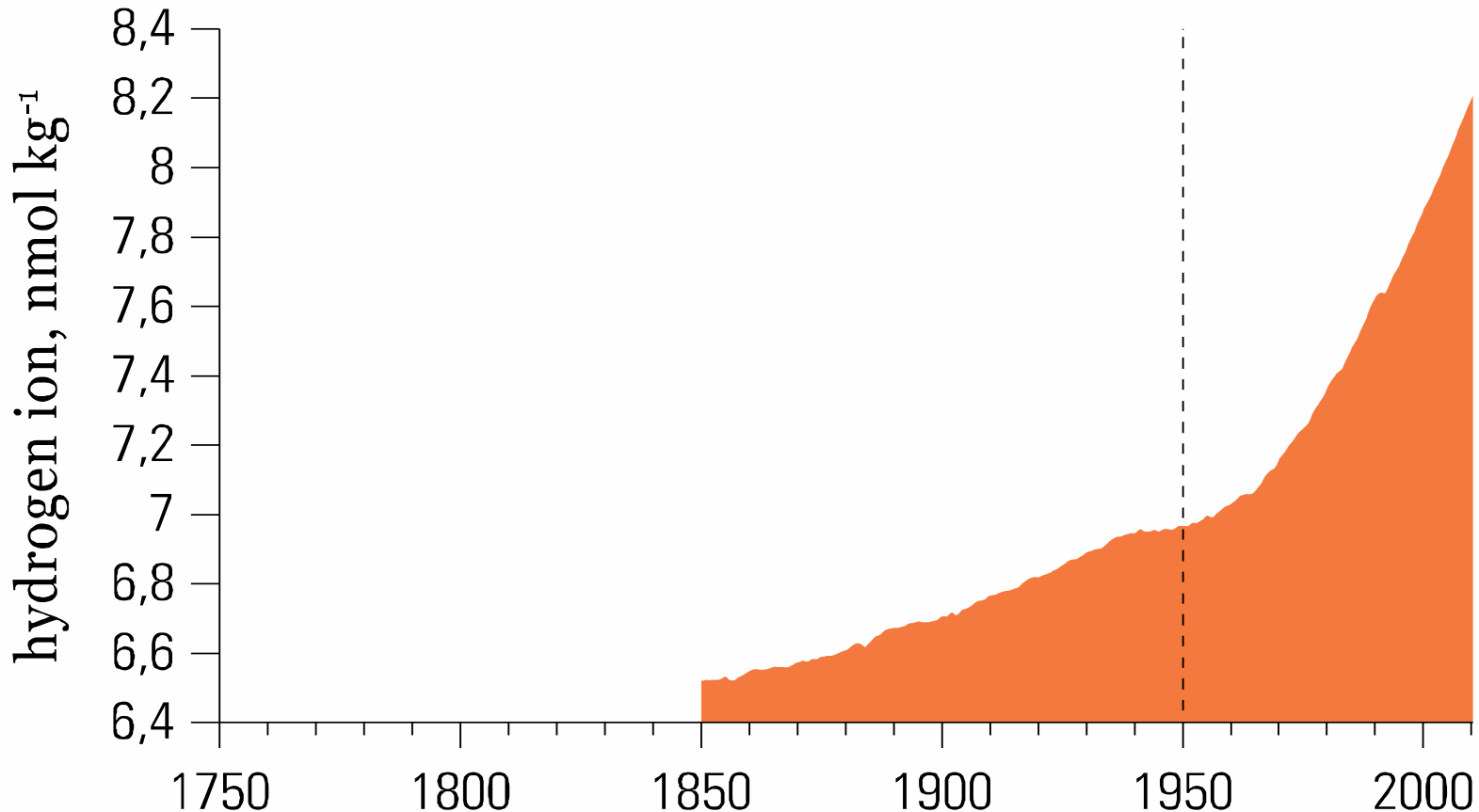
Sea Level Rise



- Heat trapped by oceans leads to thermal expansion
- Global sea level rise of 2 cm each decade in the last century
- Since 1993, average sea level by just over 3 cm per decade

Ocean Acidification

OCEAN ACIDIFICATION



- CO₂ combines with sea water making it acidic
- Changing the chemistry of our oceans

Ice Melt



- Muir Glacier disappears (1941-2004)
- National Snow and Ice Data Centre (link below)
- Photos by W.O. Field and B.F. Molnia

http://nsidc.org/data/glacier_photo/index.html

Iceland Mourns Loss of Glacier

Bréf til framtíðarinnar

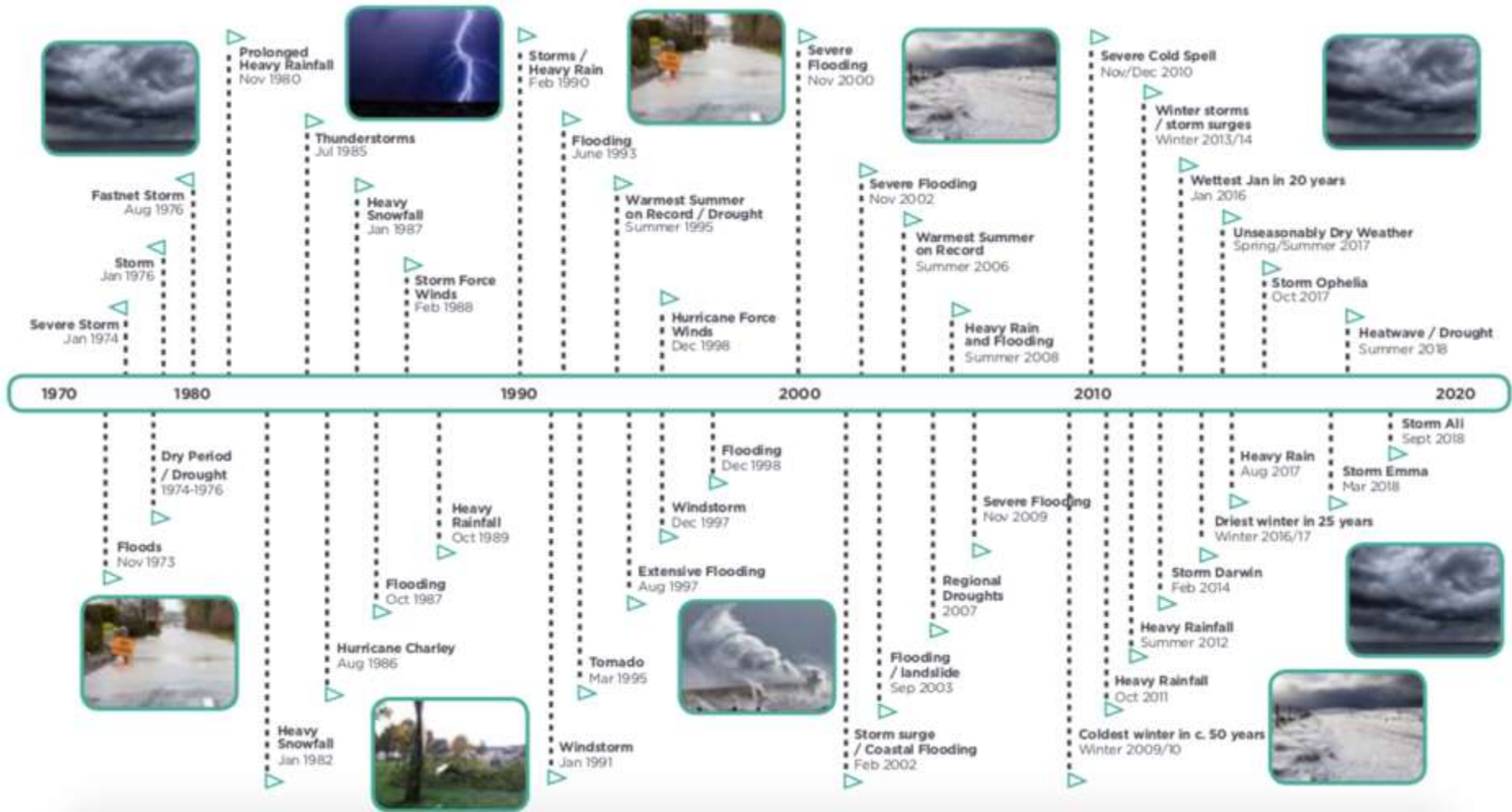
Ok er fyrsti nafnkunni jökullinn til að missa titil sinn.
Á næstu 200 árum er talið að allir jöklar landsins fari sömu leið.
Þetta minnismerki er til vitnis um að við vitum
hvað er að gerast og hvað þarf að gera.
Aðeins þú veist hvort við gerðum eitthvað.

A letter to the future

Ok is the first Icelandic glacier to lose its status as a glacier.
In the next 200 years all our glaciers are expected to follow the same path.
This monument is to acknowledge that we know
what is happening and what needs to be done.
Only you know if we did it.

Ágúst 2019
415ppm CO₂

History of Mayo Climate Events



Observed Changes

- **Temperatures** are rising
- **Precipitation** is changing
- **Sea levels** are rising
- Increasing **frequency of extreme weather events**
- Increases in the **frequency and intensity of coastal inundation** and erosion

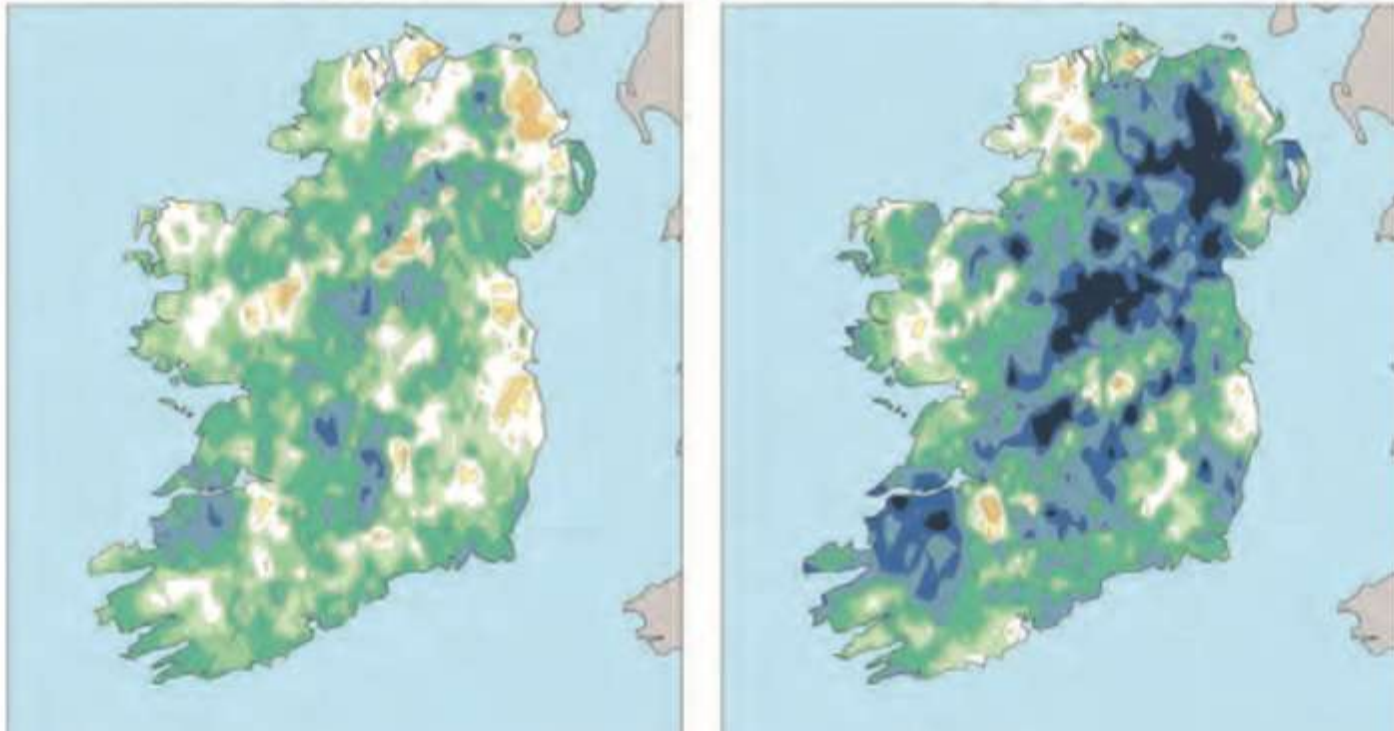
Projections on Wind and Storms



Projections for 2041-2060 compared to 1981–2000

- **A decrease in wind speeds for summer and increases for winter**
- Small increases in extreme wind speeds
- The tracks of intense storms will extend further south
- **Increase in the intensity** of extreme wind storms affecting western Europe

Projections on Precipitation and Temperature



Projections for 2041-2060 compared to 1981–2000

- Increases in **summer dry periods**
- Increase in the number of “**wet days**” (>20mm rainfall)
- Increase in the number of “**very wet days**” (>30mm rainfall)
- The number of **frost days** is projected to decrease by over 50%
- Increase in the length of **growing season** of over 35 days per year

Projections on Sea Levels and Surge



- Satellite observations indicate that sea level around Ireland has risen by **4-6cm since 1990**

[The Status of Ireland's Climate 2012. N. Dwyer]

- Increase in **global sea levels** by 26-55cm (low emissions) and 52-98cm (high emissions)

[The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change]

- **Surge levels** likely to increase by up to 9cm to 2100

[The Impact of Climate Change on Storm Surge over Irish Waters. Ocean Modelling]

Coastal Mayo



- 21% of the country's total coastline
- 6,000 areas of archaeological importance (7,000 years old)
- 78 piers/harbours, 12 blue flag beaches, 7 green beaches
- These increase **vulnerability** to climate change, increased rainfall, drought, erosion and rising seas
- **The next few slides discuss the impacts and vulnerabilities**

<https://www.climateireland.ie/#/>

Flooding and Erosion



- Coastal inundation and sand dune and beach erosion
- Weakening natural resilience and infrastructure
- Material can be thrown onto the shore and removed from the shore
- Change in beach gradients
- Threat to communities and coast
- Natural cycles of dune damage and repair (continual monitoring)

Flooding and Erosion



Storms reveal 7,500-year-old 'drowned forest' on north Galway coastline

Evidence confirms Galway Bay once covered in forests and lagoons



The stump of a 7,500-year-old tree at a drowned forest site exposed by storms at Spiddal, Co Galway.
Photograph: Joe O'Shaughnessy

EPA, 2016 and Farrell et al, 2016

Flooding and Erosion

Winter Storms 2013/2014 County Mayo

- Mayo's coastline severely impacted
- Weakening infrastructure
- Westport, Carrowholly, Achill, Erris
- Roads and pavements destroyed
- Bridges destroyed (Carrowholly)
- Piers damaged
- Blue flag beaches spoiled
- River Moy burst its banks in Ballina

At Elly Bay near Belmullet, a man had to be rescued from his car by the Belmullet fire brigade.



After standing for over a hundred years, the bridge that linked Rosmoney and Westport in Co Mayo was brought down by the waves and winds



Dooagh Village in Achill suffered coastal damage due to high tides and storms

Flooding and Erosion

Impacts worst when high tide and storm happen at the same time



The Claddagh Galway



Comhairle Cathrach na Gaillimhe

WARNING

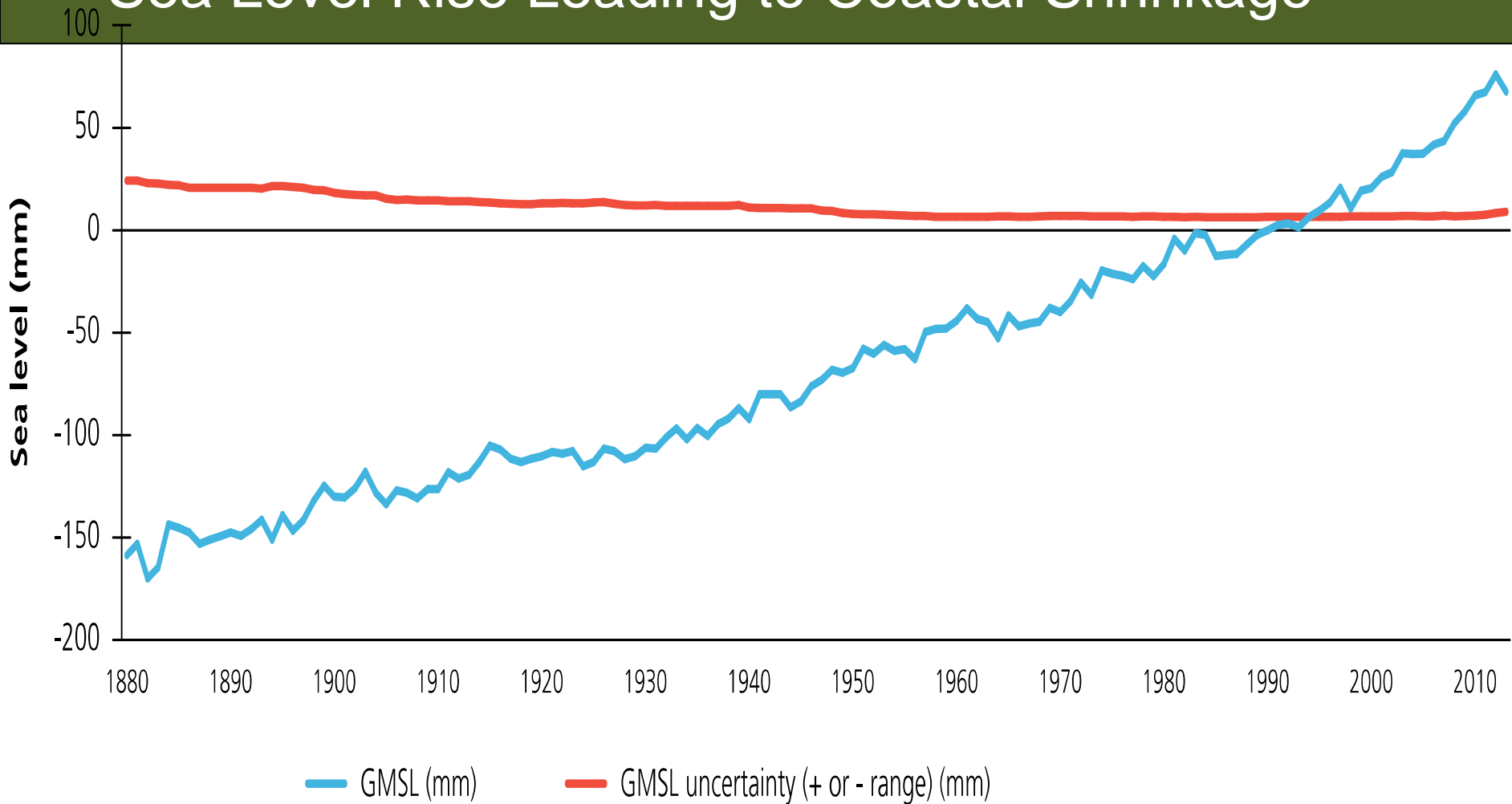


**This area is liable to flooding
at high tide**

Local Man Ferries Residents out of their Flooded Estate, Limerick

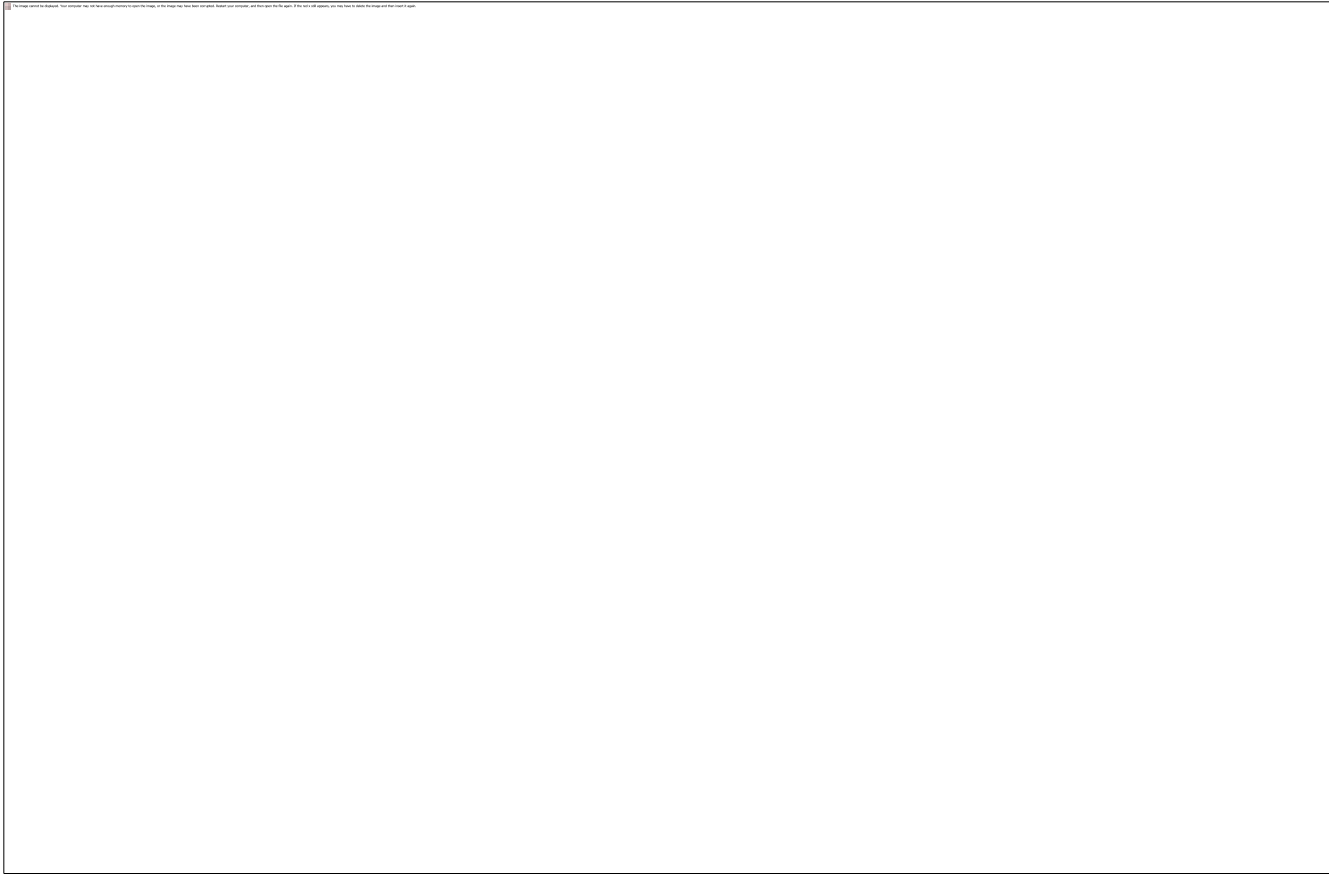


Sea Level Rise Leading to Coastal Shrinkage



- Heat trapped by oceans leads to thermal expansion
- Global sea level rise of 2 cm each decade in the last century
- Since 1993, average sea level by just over 3 cm per decade

Coastal Squeeze and Habitat Shrinking



- Coastal shrinking
- Satellite observations indicate sea level has risen 4-6cm since 1990
- Shrinking shoreline habitats
- Pressure from developments seaward too

Coastal Squeeze and Habitat Shrinking

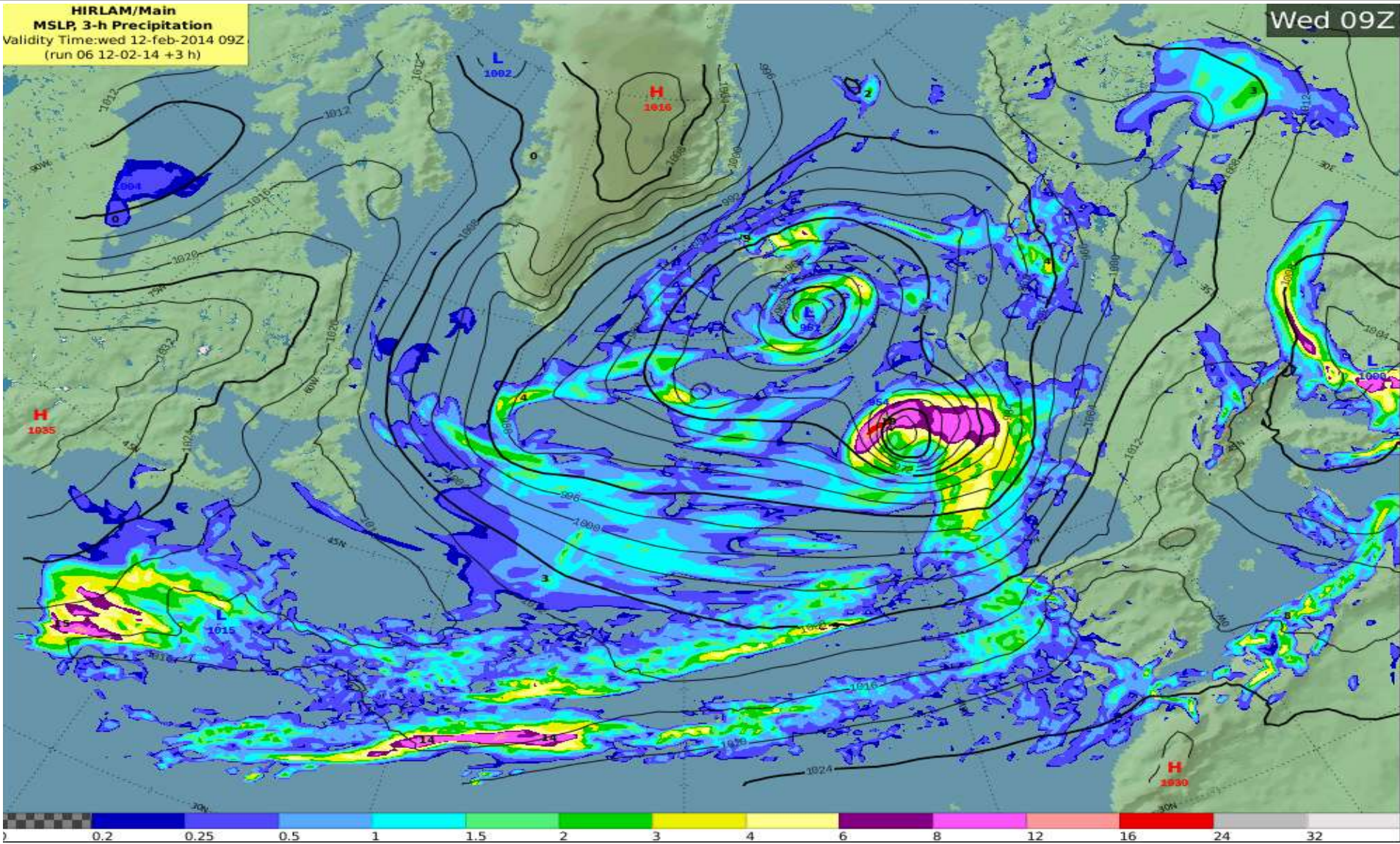


**Kerry County Council receives
Government funding of €3.3m to
repair storm damage**

Sunday, December 28th, 2014 at 1:10 pm.

Farrell et al, 2016

Case Study – Sea Level Rise & Storm Surge – Winter 2013/14



Case Study – Sea Level Rise & Storm Surge – Winter 2013/14

1. Where **storms coincided with high tides**: severe impacts
2. Very strong winds, periods of extremely heavy rain and thunderstorms
3. **120km/h recorded at Mace Head**
4. Constant threat in river catchments of **severe flooding from the rainfall**
5. Rainfall amounts **2 times normal** and led to saturation & waterlogging
6. Significant disruption to individuals, business, infrastructure and habitats
7. **Estimated repair costs for Mayo Co Co almost €7.5m**
8. Damage to and loss of **infrastructure**, roads, bridges, piers, sea walls, car parks

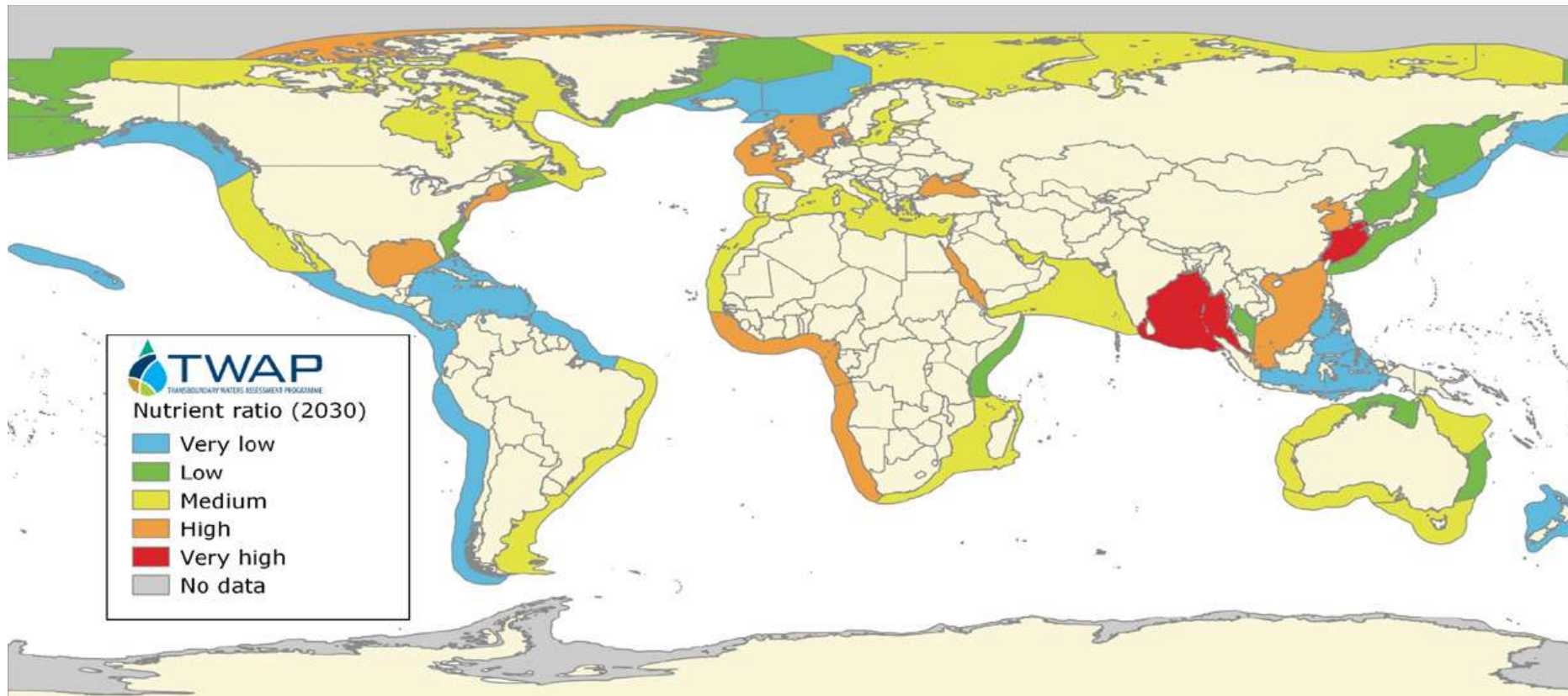


Lahinch Storm Winter 2013/2014



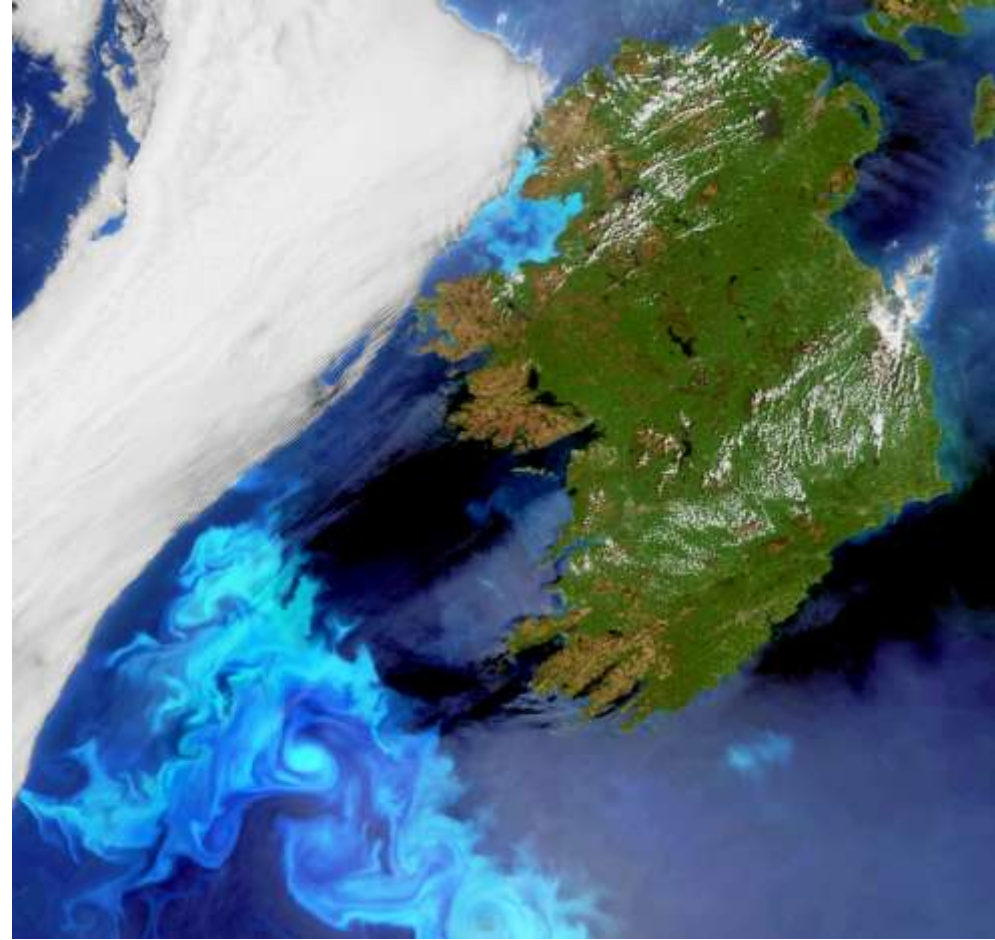
Flooding, sea surge, inundation (EPA, 2016).

Algal Blooms – oxygen depleted dead zones



- Algal bloom prominent in high nutrient and warm waters
- Impacts seawater and freshwater
- Excess of minerals, Nitrogen is a major factor here
- Rapid growth of tiny marine plants (phytoplankton)

Algal Blooms – oxygen depleted dead zones



- Toxic phytoplankton
- Bottom of the marine food chain
- Harmful to fish and humans
- Migration of fish North to colder waters

Marine Ecosystem Service Impacts

- Value of the ocean
 - Major food source
 - 30,000 jobs
 - €1.8 billion in 2016
 - Oceans produce half of the oxygen in the atmosphere
 - And absorb 30% of all CO2 emissions
- The blue economy
- Damage to services due to rising sea levels, increasing marine temperatures, severe weather events, coastal flooding etc
- Lower Oxygen levels
- More algal blooms
- Northern fish geographic range diminished
- Southern fish geographic range increased

Breakout Session



What coastal impacts have you noticed locally? (30 minutes)

Ideas, examples.....



Tea Break – 15 minutes



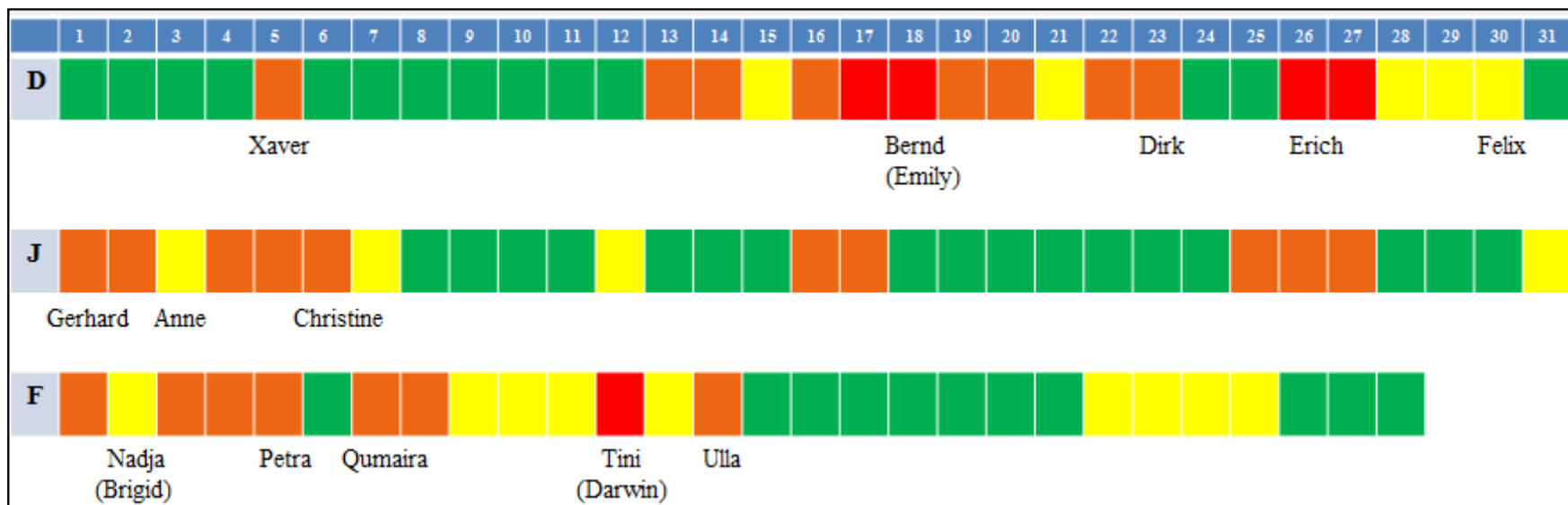
So how many storms were there in Winter 2013/2014?



How many storms were there in Winter 2013/2014?

13!

How many storms were there in Winter 2013/2014?



Responses to Extreme Storm Events – any suggestions?



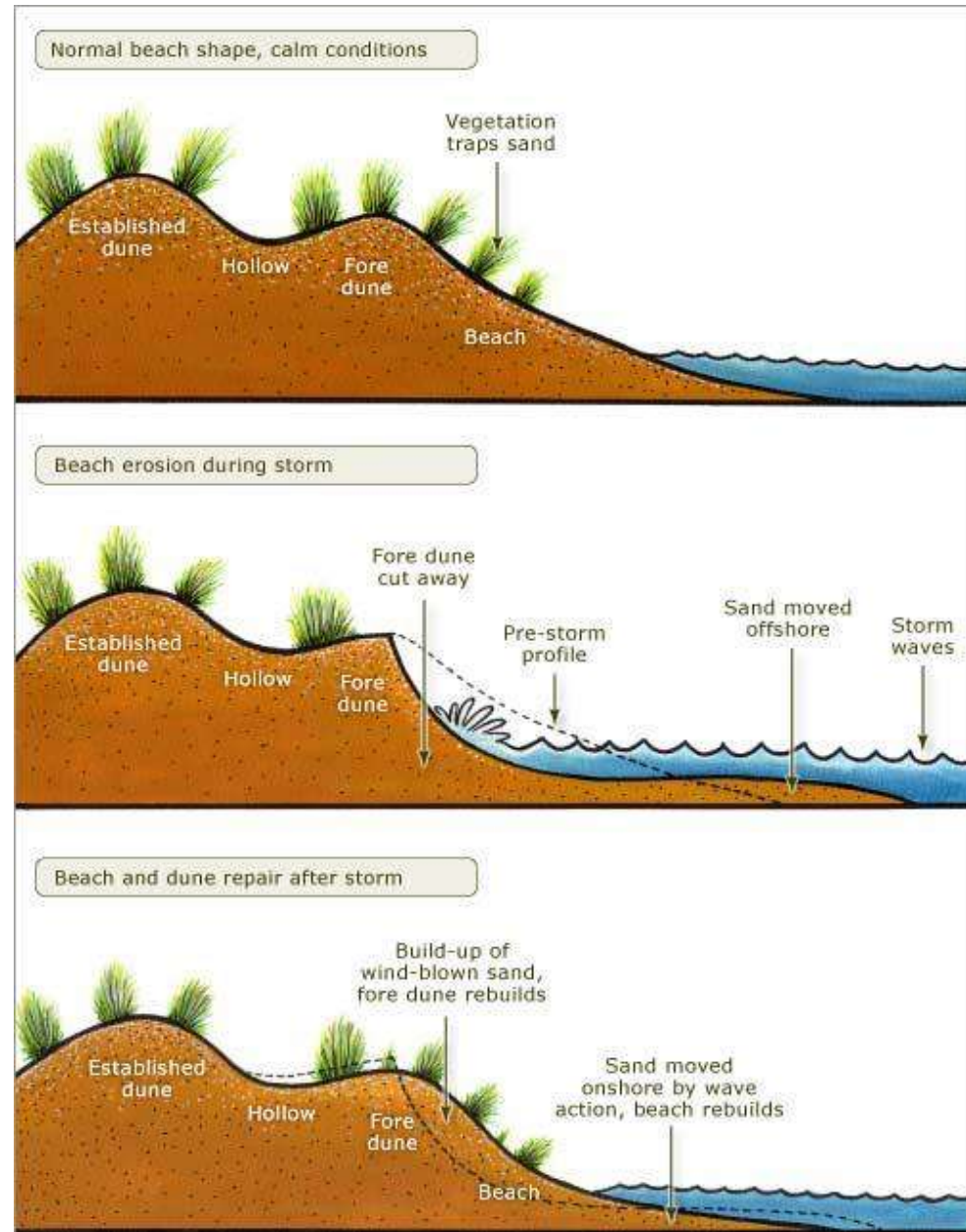
Responses to Extreme Storm Events



There are 3 key parts to your response

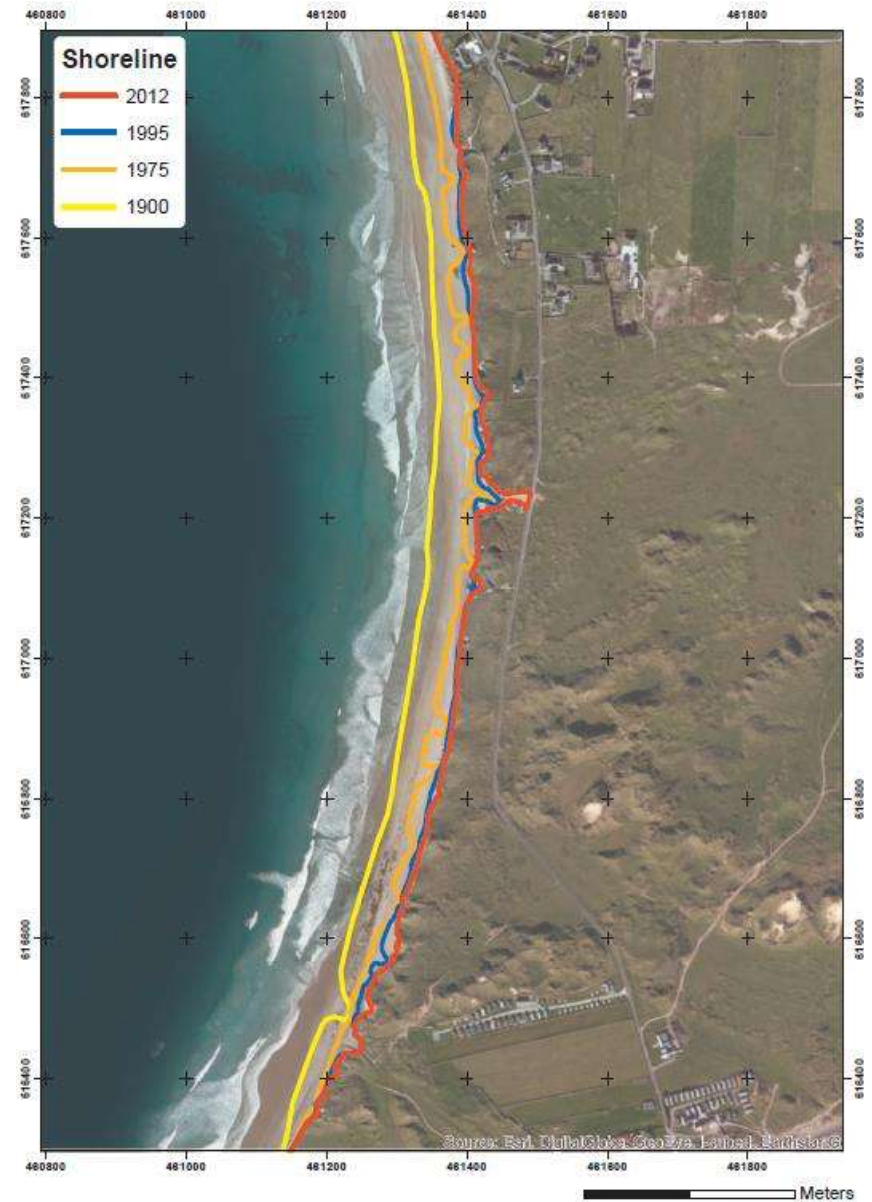
Knowhow is Key

- Lack of baseline scientific information relating to the coast
- The amount of sand stays constant, it moves around
- EPA Research
- OPW Research
- Aerial photographs
- Build knowledge; historic and current
- Local responses: prepare through early collaboration



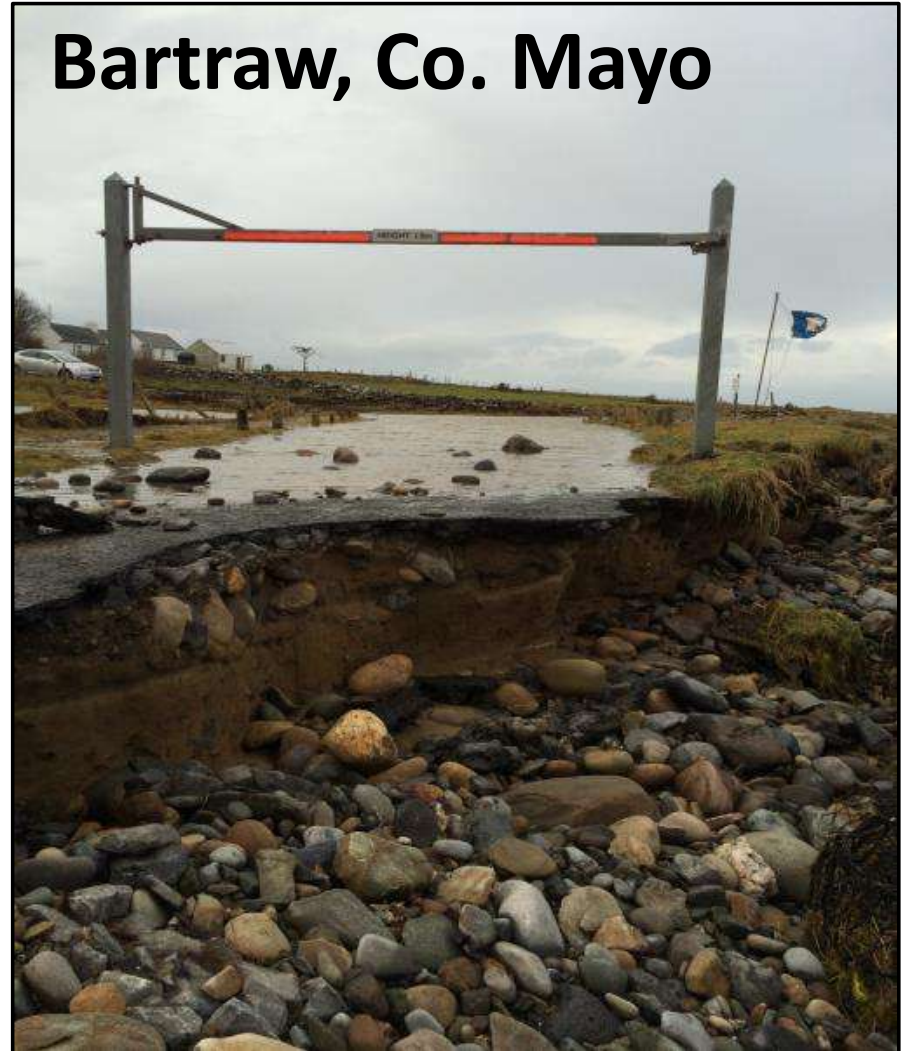
Collaboration and Contacts are Key

- Build knowledge; historic and current
- 1900-2012
- Knowledge is building
- Evidence based solution design
- Early collaboration between communities, OPW and County Council is key!
- Early collaboration, knowledge building and sharing
- Crossmolina monitoring



Funding is Key

- OPW Funds
- Minor Flood Mitigation Works and Coastal Protection Scheme
- Community engaged
- <€500,000
- Up to 90% of cost
- Risk Management Study necessary
- <75m coastline
- Liase with your county council
- Start to plan now



Striking a Balance

- Brisbane, Australia
- Population 1 million
- 2011 heavy rain
- Dam holding issues – floods
- 24 lives lost
- Strong public realm
- Community engagement and support not common



- Dhaka, Bangladesh
- Population 25 million
- Large amounts of slums
- 1998 Monsoon
- 918 deaths
- Absence of strong public realm
- Presence of strong local community was of little help to residents



Striking a Balance

Hurricanes Irene and Sandy (2011 & 12) underlined the need to enhance resilience. Differing views on measures:

Armour

"....armoring . . . the coastline, which is very, very expensive but alsoaccelerates the erosion elsewhere."

NJ Conservation Stakeholder

Replacing eroded sand

"beach nourishment....really isn't the long-term answer. It's going to get more expensive over time because the material is going to erode more quickly."

Real Estate Stakeholder



Lessons from Leenane - Inconvenience

- Bridge over Lahill River
- Carried up to 4,000 cars each day
- Collapsed 18th July 2007
- Torrential rain brought landslides
- Significant repair
- Better foresight & response
- Large round about trip
- Need transport response
- Community and Public
- Buses and journey sharing



Lessons from Lahinch – Include all Stakeholders




- Lahinch promenade damaged
- Clare Co Co immediate response
- Engineering response, bouldering
- Many stakeholders appreciate this
- Lack of engagement
- Poor co-design
- Surfers not happy
- Reduced access to shoreline
- Summer schools, recreation, tourism and business impacted

Lessons from Cork – Inclusion

- Cork City Council response to build anti-flood walls, raise the banks
- 'Save Cork city': locals determined to stop walls being built on River Lee
- Feel that so-called “Lee wall” will have a severe negative impact on the Environment, cultural heritage and economy of the city
- They recommend a tidal barrier
- High Court Challenge to Cork City Council Plans
- With solution co-design and strong engagement such expensive, drawn out legal contests can be avoided
- Strong public realm
- Strong stakeholders and community input



Getting it Right

Locals fortify retreating dunes to protect at-risk homes [Independent.ie](https://www.independent.ie) 



Protrane, Co. Dublin

Local volunteer, 9 year old Darragh Brett helps out with repairs to the eroded sand dunes at The Burrow. Portrane.

Co-design and Co-management Solutions



- Images: Southpark, Galway & Waterville, County Kerry
- Shoreline defence structures
- Armour/boulders
- Typical of shoreline protection works commonly found at Irish coastal sites
- **Lessons learned:**
- **Strong public realm**
- **Connected community**
- **Co-design**
- **Co-management**

Vulnerability

The degree to which a community is **susceptible to and is unable to cope with adverse effects of a single, or of several hazards or stresses.**



Example of Vulnerability Roonagh Pier



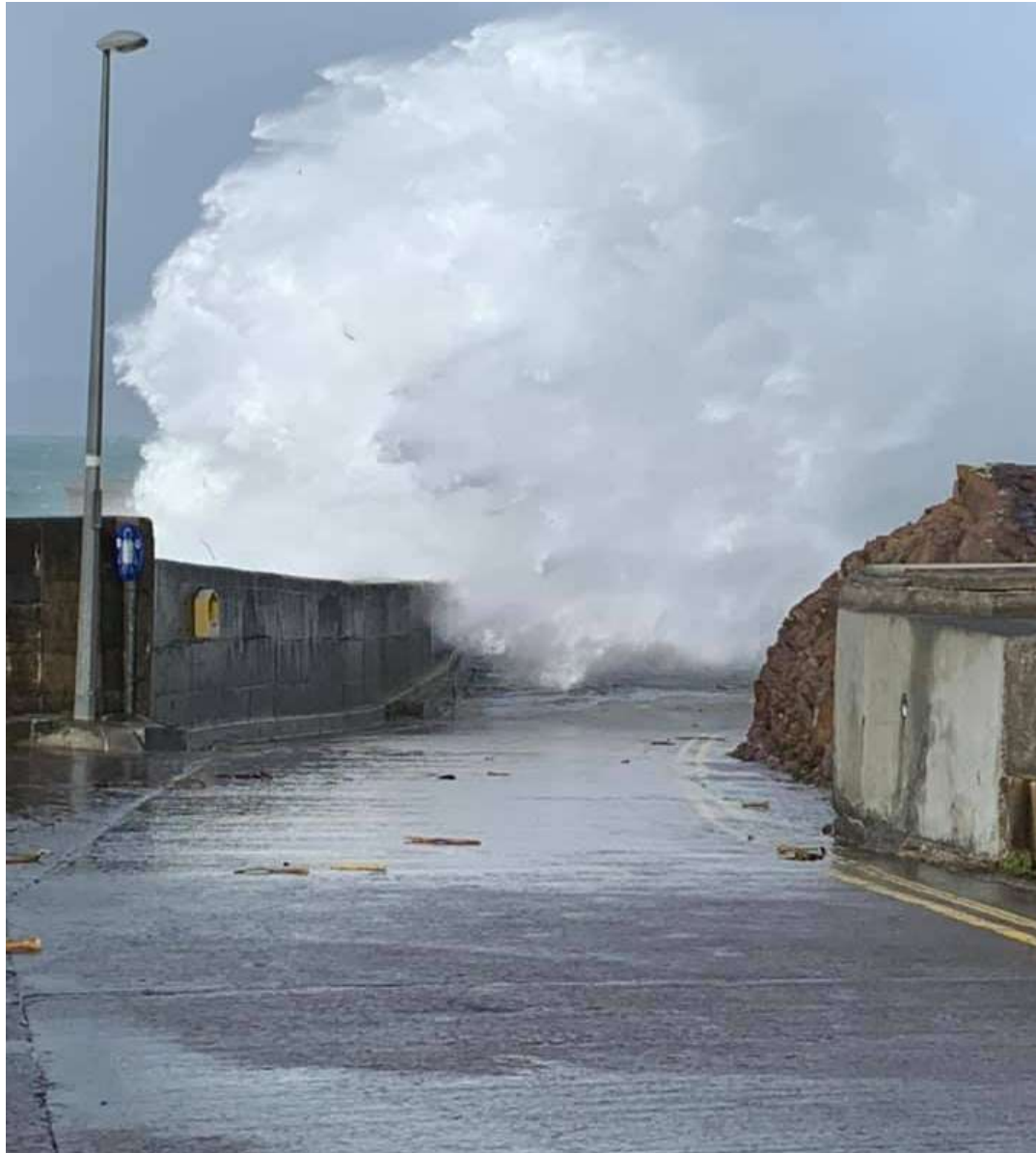
Example of
Vulnerability
Roonagh Pier



Example of
Vulnerability
Roonagh Pier



Example of
Vulnerability
Roonagh Pier



Example of
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Example of
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Example of
Vulnerability
Roonagh Pier



Community Resilience

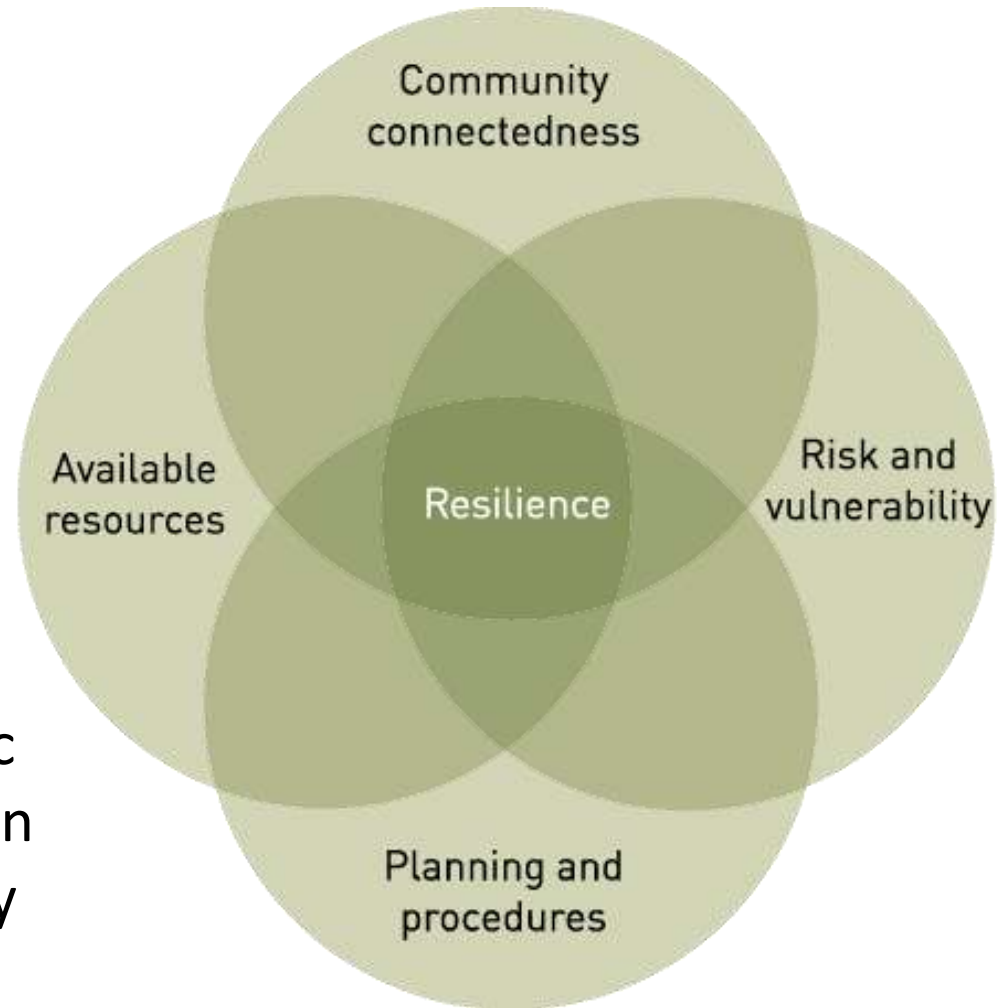
- **Resilience is the ability to anticipate risk, limit impact and bounce back or recover rapidly** in the face of major disruption
- Eg. **Return** employees to work, **reopen** business, **restore** essential services quickly etc.
- Resilience and vulnerability are important features of a community for policy makers and practitioners to explore and understand
- **Critical to share the design of solutions**
- **Communities thrive in co-management**

Key elements of resilience:

- Prepare for threats
- Absorb impacts
- Recover & adapt

Building Resilience – Key Elements

- Community – organised, ready to respond, collaborate
- Effective governance systems – collaborate, plan, design, flexibility
- Risk identification
- Response identification
- Adaptation resources available like sandbags, flood barriers etc
- Information and communication
- Community and Local Authority working together



(Norris *et al.* 2008)

Building Resilience – Key Elements

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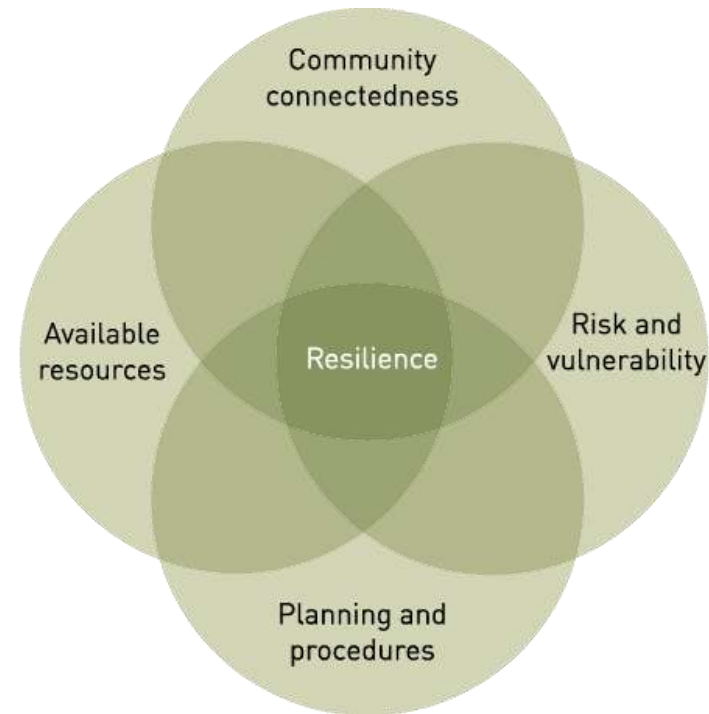
(Norris *et al.* 2008)

Arbon, 2014. Developing a model and tool to measure community disaster resilience
<https://ajem.infoservices.com.au/items/AJEM-29-04-04#sthash.DitYa9i5.dpuf>

Plan

Resilience is strengthened when you work with Local Authority or OPW and generate and submit to plans, local, regional and national:

1. Flood Risk Management Plans
2. Biodiversity Management Plan
3. Conservation Action Plan (CANN)
4. Surface Water Management Plan
5. Peatland Management Plan
6. Community Resilience Plan
7. Community Futures Plans
8. Neighbourhood Climate Action Plan
9. Business Continuity Plan
10. Invasive Species Management Plan
11. County Development Plans
12. Climate Mitigation Strategy Plan
13. Local Economic and Community Plan

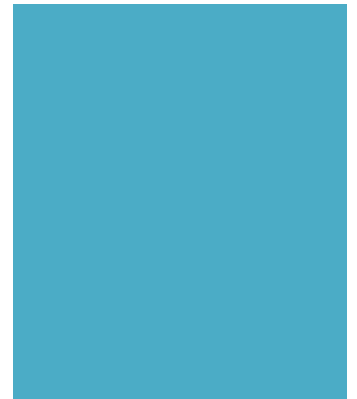


Breakout Session



How would you protect your coastal communities and habitats? (30 minutes)

Ideas, examples.....





Please complete the workshop evaluation

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Email: rethinkgalway@gmail.com

Email: vincent.carragher@tcd.ie

