



# Introducing *Climate Fife*: Fife's response to the climate emergency

APSE Scotland Nov 2020

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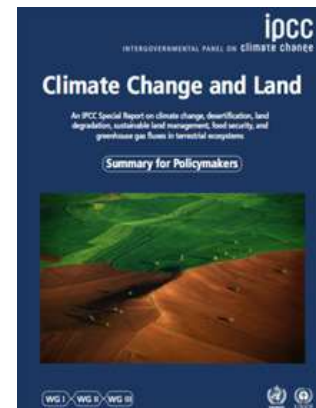
# ...a continual flow of reports, agreements, policy and legislation

IPCC Special Reports on:

- *Global Warming of 1.5° C;*
- *IUCN Climate Change and Land; and the*
- *IUCN Ocean and Cryosphere in a Changing Climate*



ipcc



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# Another Scottish summer...

Stonehaven rail



Kirkcaldy hospital



Burntisland caravan park



Perth floods



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# Why is climate change suddenly an emergency?

- We have **less than 10 years** left to prevent runaway climate change
- **Must decarbonise ASAP & limit warming <1.5C**
- **Current trajectory = near certainty of catastrophe (3-6C warming by 2100)**
- **Feedbacks no longer just theoretical they are happening now. We are at a tipping point.** Feedback would dwarf anthropogenic emissions
- Paris Agreement which seeks to limit warming to <2C will deliver 50+% likelihood of climate breakdown by 2100
- **Would you put your kids on a plane with 50% odds of crashing?**
- **If we limit warming to <1.5C our odds of disaster are still 33%**

**Scotland declares 'climate emergency' following school strikes**

**'Untold human suffering': 11,000 scientists from across world unite to declare global climate emergency**

'Despite 40 years of major global negotiations, we conduct business as usual and have failed to address this crisis,' group says



# Today's 1C warming is scary – how much worse can 1.5C and 2C of warming be?

Met Office confirms new UK record temperature of 38.7C

The Ocean Is Warming at a Rate of 5 Atom Bombs Per Second, Scientists Warn

Antarctica ice melt has accelerated by 280% in the last 4 decades

Worst-case global warming predictions are the most accurate, say climate experts

Keep global warming under 1.5C or 'quarter of planet could become arid

Melting Antarctic ice will raise sea level by 2.5 metres - even if Paris climate goals are met, study finds

**HOTTEST YEARS ON RECORD GLOBALLY**  
'We ain't seen anything yet': Even the Arctic is burning as wildfires rage around the world

A third of my country was just underwater. The world must act on climate

Greenland's ice sheet melting seven times faster than in 1990s

Victoria Falls dries to a trickle after worst drought in a century

The North Pole is an insane 20C warmer than normal as winter descends

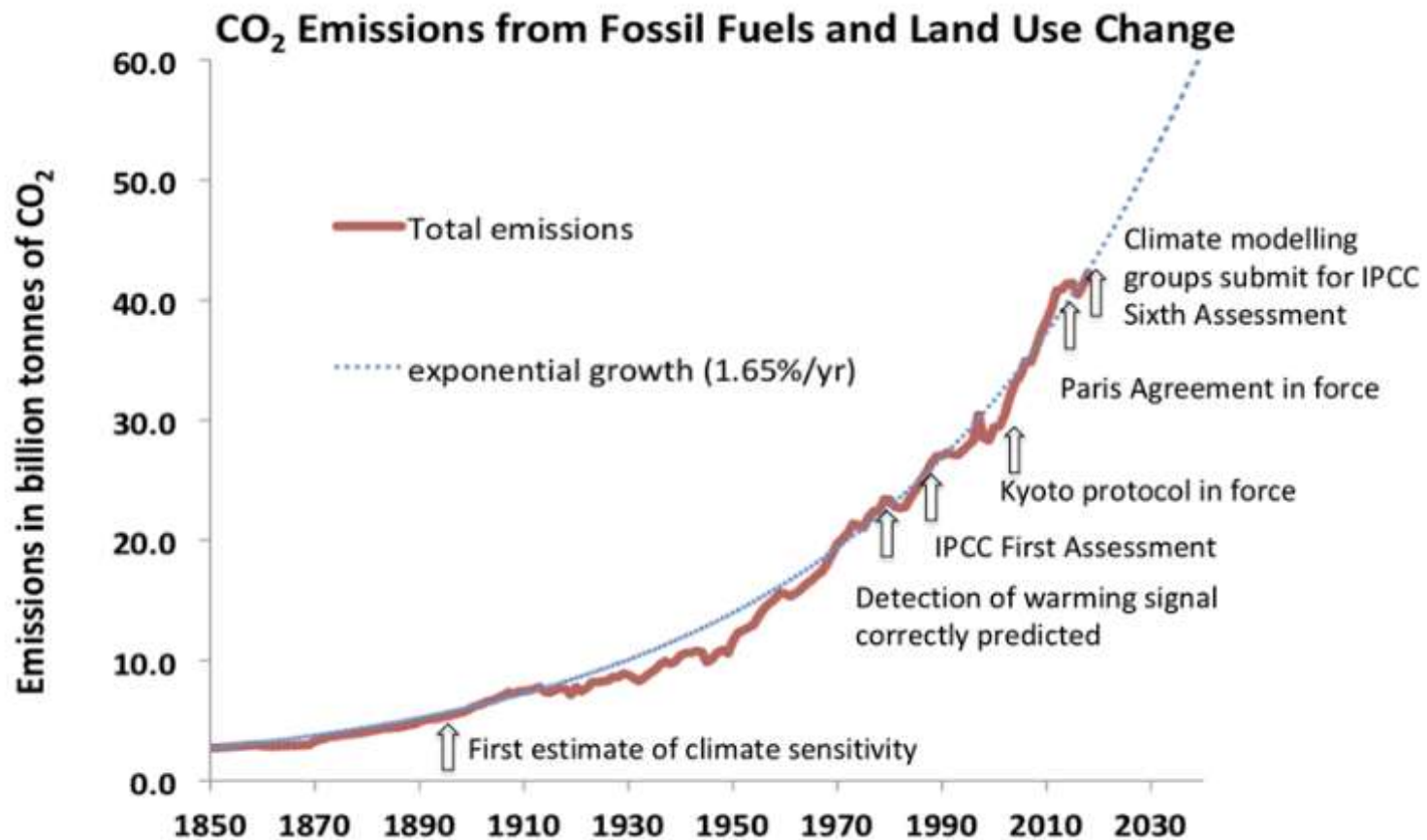
Amazon near tipping point of switching from rainforest to savannah - study

*climate change leapfrogging Brexit as key risk for insurance industry*

China pledges to become carbon neutral before 2060

Fifth of countries at risk of ecosystem collapse, analysis finds

# Actions speak louder than words



- Despite talking about cutting GHG emissions for 30 years they've risen 60%
- 50% of all anthropogenic GHG have been released since 1990
- **Talking about cutting emissions - doesn't cut emissions**  
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# What's the significance of 0.5C?...

- The difference between 1.5C and 2C of warming doesn't sound much but the impact is stark:
  - It is the difference between a world with or without coral reefs;
  - Coral reefs support 25% of ocean life, their loss will destroy the marine food chain;
  - Beyond 1.5C will put the lives of hundreds of millions of people at risk. Conflict is inevitable;
  - 2C of warming doubles the global population exposed to water stress and will lead to environmental migration in the billions;
  - Insect populations are twice as likely to collapse at 2C; more crops would go unpollinated and millions will starve.
- **To have a 66% chance of limiting warming to >1.5C we must decarbonise by 2030**
- Even at net zero, warming would continue for 10-20 years because of thermal inertia and seas would rise for centuries

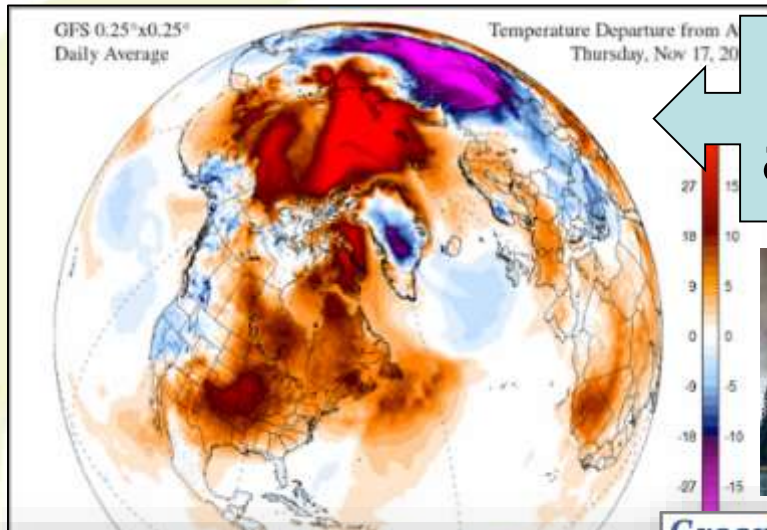
# How to respond to a climate emergency?

- Tackling climate change requires 3-fold attack:
- Managing the unavoidable – **adaptation**
  - Responding to the inevitable climate changes coming
  - Increasing resilience to existing extremes
  - Traditionally, the ugly sister of climate change
  - All ecosystems will have to adapt (not just human society) some may not be able to
- Avoiding the unmanageable – **mitigation**
  - Cutting GHG emissions i.e. stop adding fuel to the fire!
  - More we mitigate = less we need to adapt
  - With sceptics now powerbrokers global mitigation cannot be assumed, local adaptation is even more critical.
  - Active removal of GHG from the atmosphere – sequestration
- A Just transition – **fair for all**
  - A place in this new future, be it a job, reduced poverty or protected environment

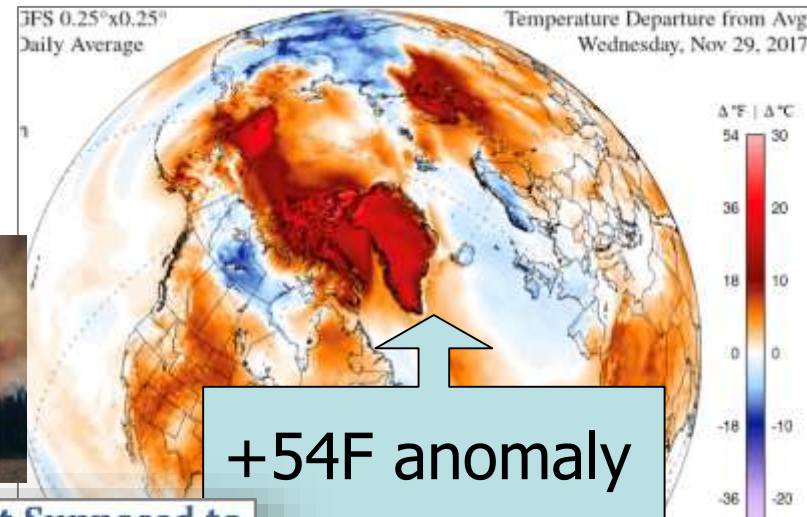
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# Why care about remote changes?



-32F anomaly



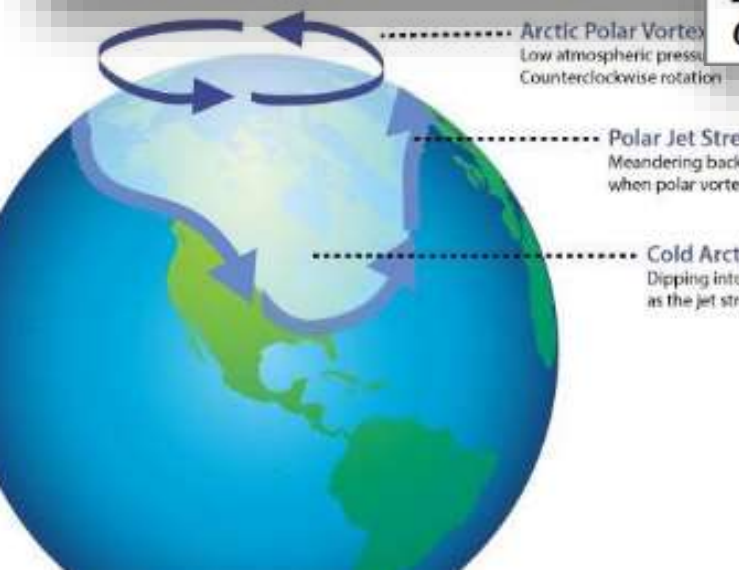
+54F anomaly



Ice Loss and the Polar Vortex: How a Warming Arctic Fuels Cold Snaps

Greenland's Ice Wasn't Supposed to Melt Like Last Week Until 2070

Europe's Heat Wave, Fueled by Climate Change, Moves to Greenland



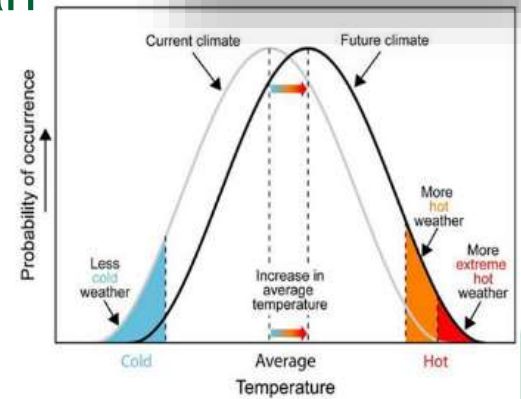
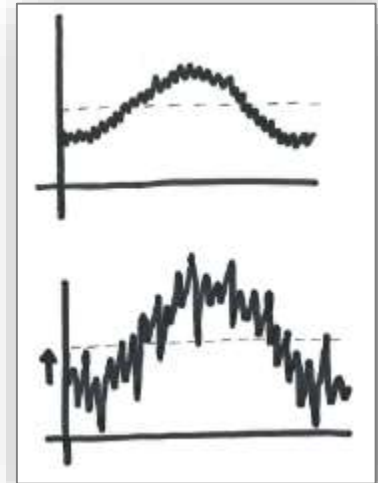
A weak Arctic Vortex allows arctic air to drop south, or heatwaves to head north



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# Climate vs weather

- “Climate is what you expect, weather is what you get”
- The difference between weather and climate is time
  - Weather is what you see out of the window
  - Climate is what you could reasonably expect to see, based on the last 30 years observations
- Climate change is affecting the frequency and severity of extremes
- An extreme winter or cold summer do not mean climate change is not happening
- Climate data speaks in averages but this can be dangerous



# Why do the projected changes for Scotland seem so modest?

- There are several good reasons for this mostly related to what is and isn't included in the modelling
- Which GHG is the largest contributor to climate change?
  - Water vapour (60% of the warming effect)
- What would cause the most sea level rise?
  - Loss of the Greenland (8m) and West Antarctic (5m) ice sheets.
- What is the driving force behind UK weather?
  - The jet stream.
- Projections use the latest science right?
  - No. Because of lengthy review cycles, typically the data is 10 years old
- Are we making reasonable assumptions about future emissions?
  - No again, the convention is to use the medium emissions scenario
- Any other unknowns?
  - Tipping points leading to runaway global warming

**NOT INCLUDED**

# Why does the projected economic impact seem so modest?

- **IPCC:**  $\sim 2^{\circ} C$  annual economic losses 0.2 to 2.0% of income.
- **What is included?**
  - Limits impacts to outside activities  $\sim 90\%$  of GDP not included
  - Climate impacts – the report uses present day temperature impact on GDP
  - Scientists asked to comment  $\sim$  non-supportive responses not used

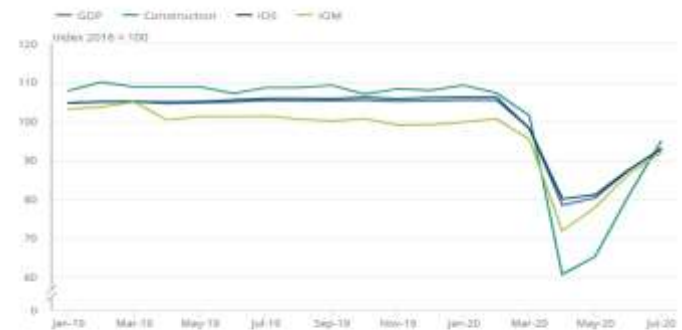
**NOT INCLUDED**

- **How is C-19 impacting GDP?**

Lessons to drive climate action now...

- Apr-Jun 2020 saw a record GDP fall of 20.4%
- C-19 shows what even moderate global crisis can do to GDP

Monthly gross domestic product (GDP) and components index, seasonally adjusted, UK, January 2019 to July 2020



Source: Office for National Statistics – Monthly GDP



# COVID & CO2e

↓ 17% April '20

...reality  
check - only  
2006 levels

## United in Science

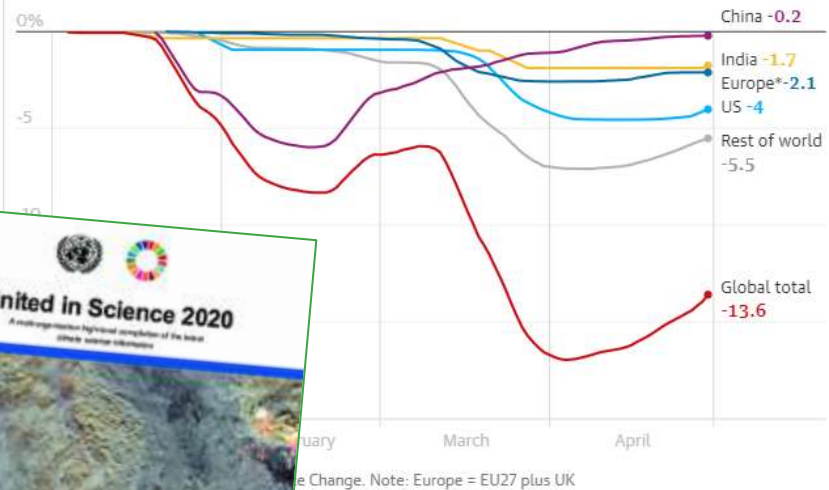
↓ 5% Nov '20

UN report: Covid crisis does  
little to slow climate change

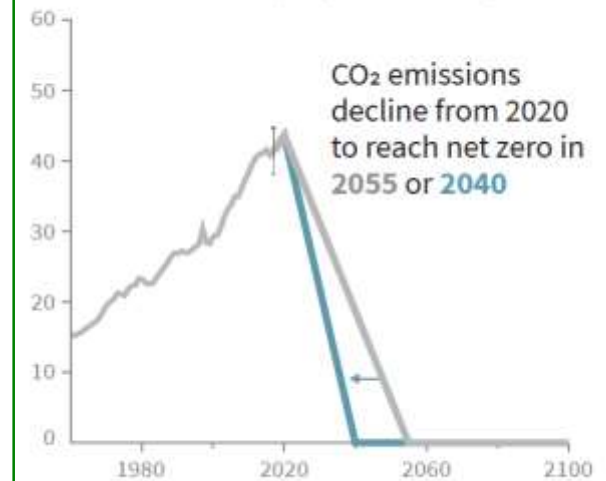


### Daily global fossil CO2 emissions fell by 17% in early April 2020 compared with 2019

% change in global daily fossil CO2 emissions attributed to each country or region



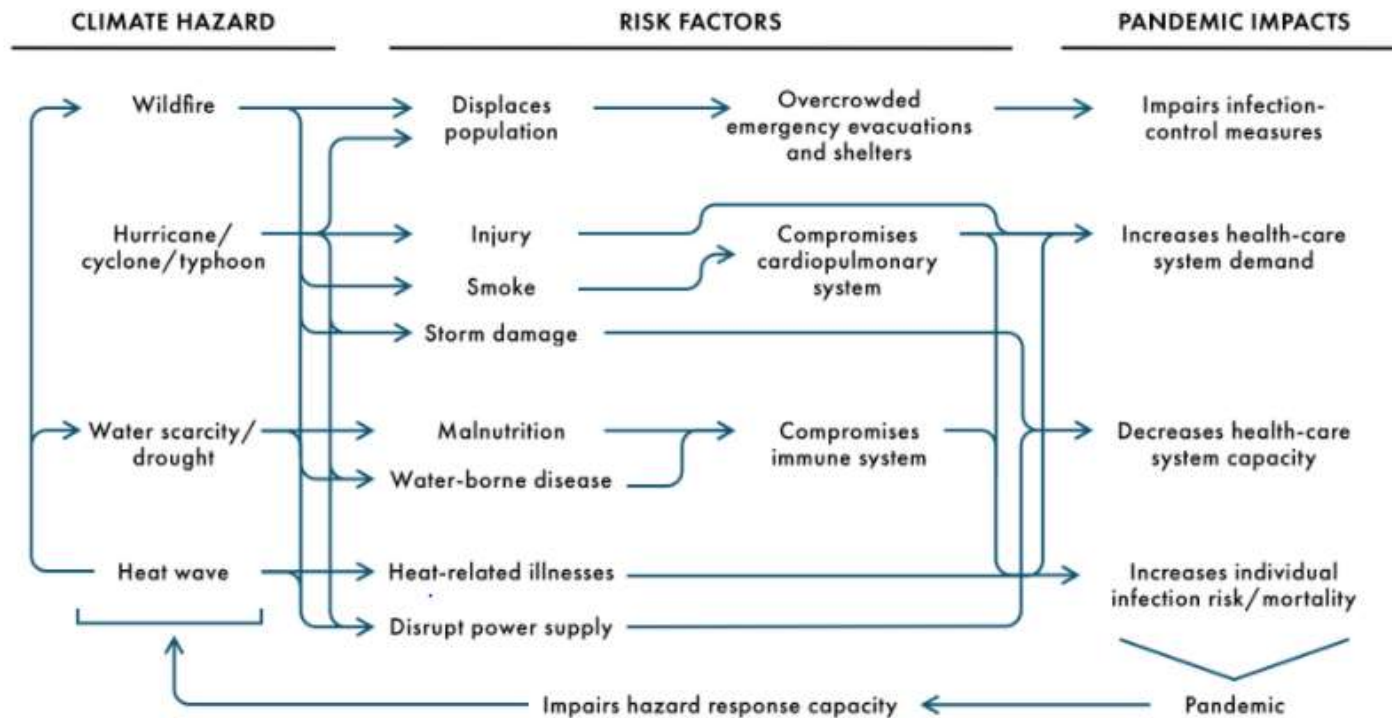
### b) Stylized net global CO2 emission pathways Billion tonnes CO2 per year (GtCO2/yr)



Graphic from the IPCC's special report on 1.5C

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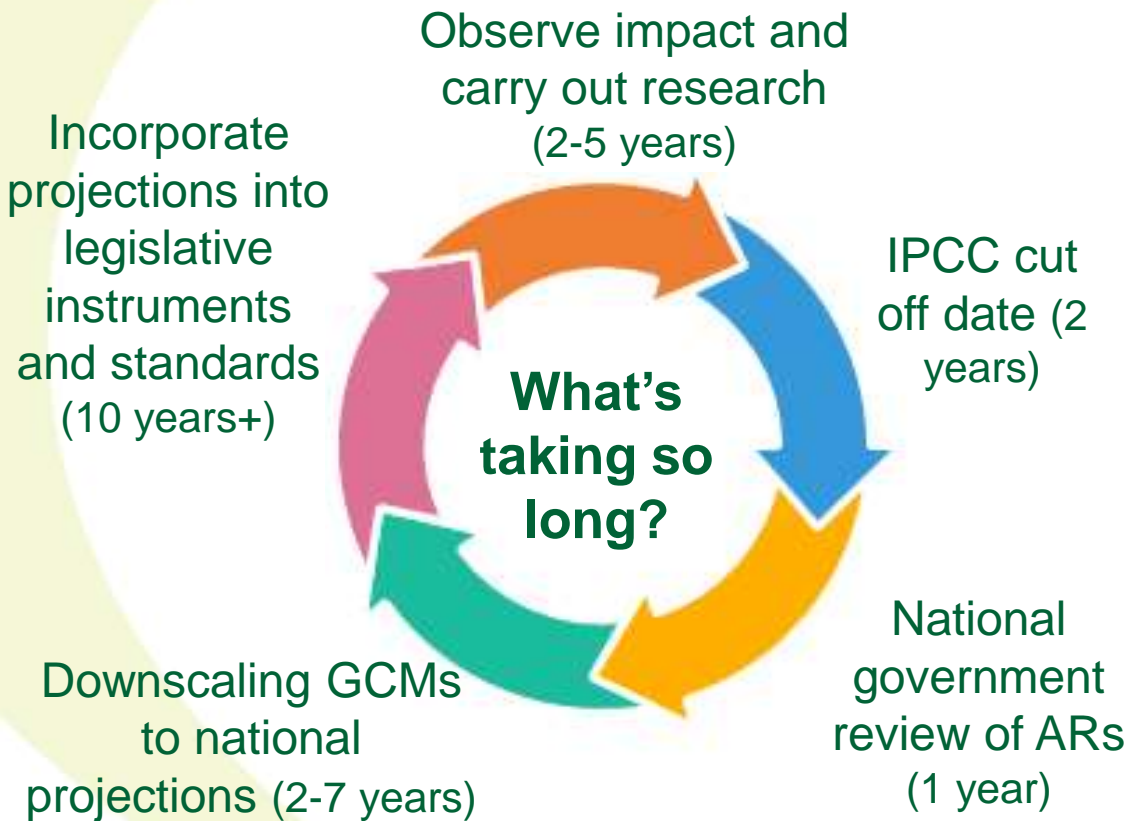
# Infectious Diseases, Pandemics, NCD's and Climate Hazards



Note: The following sources were used to create the flow chart: [www.nytimes.com/2020/08/04/climate/hurricane-isaias-apple-fire-climate.html](http://www.nytimes.com/2020/08/04/climate/hurricane-isaias-apple-fire-climate.html), doi:10.2105/AJPH.2020.305744 and doi:10.1038/s41558-020-0804-2.

# Science is progressing too fast for policy to keep up

## - we have to be agile



- Scotland: world leading in climate legislation
- But huge gap between policy aspirations and instruments used to deliver
- Many are dangerously out of date i.e. building standards, flood mapping
- **Building to legal minimums will create liabilities**
- The more we know, the worse it gets!
  - Views that were extreme outliers 10 years ago, now proved to be too optimistic!
  - Science will keep on moving

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# How do we adapt buildings?

Minimise external hardstanding, maximise SUDS

Super insulation

Elevated ring mains and plug sockets to minimise flood damage

High thermal mass / heavy weight construction

Ground floor parking

Green roofs, walls and passive solar screening (i.e. trees to provide seasonal shade)

Rain gardens, water butts, rainwater harvesting, water efficient appliances

Triple glazing and storm doors



Oversized drainage and guttering

Watertight barriers for door / window apertures

Passive solar design – i.e. orientating buildings according to purpose

Robust detailing designed for increased wind-loading, rot and pest risks

Secondary heating and battery storage RE generation to respond to supply interruptions

Backflow valves and basement pumps

Passive ventilation

Use topography to enhance flood resilience

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# How do we decarbonise buildings?

Passive solar design  
– i.e. orientating  
buildings according  
to purpose

Building integrated renewables  
or low carbon heat generation

Smart metering, smart  
appliances and BEMS –  
full re-wiring likely

Loft, wall and floor  
insulation (including,  
potentially, over-cladding)

Minimise water use (10% of carbon  
emissions arise from treating and  
pumping water)

Energy efficient  
appliances and lighting

High thermal mass /  
heavy weight construction  
for new builds

Connect to local heat  
network (might need to  
resize radiators)

Triple glazing, insulated  
doors and draught  
proofing to achieve  
minimal air-change rates

Remove old fossil fuel  
heating systems and  
inefficient electric heating

EV charging points

PassivHaus  
standard for  
new builds

Passive solar screening (i.e.  
trees to provide seasonal  
shade) to avoid artificial  
cooling demand

Passive  
ventilation

Bike storage







Potentially knocking  
down and  
rebuilding(!)



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# There's lots to do, and very little time to do it ....

- Existing buildings will need:
  - rewiring, replumbing, reroofing;
  - new: metering, appliances, lighting, roofing, external cladding, glazing, insulation, renewables, heat network connections or new heating systems....

No. of intervention stages		No. of houses to be retrofitted per year
1 x		= 6,400 x 
2 x		= 12,800 x 
4 x		= 25,600 x 

- In Fife alone there are 170,000 existing homes - MASSIVE TASK
- Every time developers build homes that are not zero carbon or climate adaptive - the retrofit task gets bigger**

We have 12 years to limit climate change catastrophe, warns UN

Climate change: 12 years to save the planet? Make that 18 months

**Worst-case global warming predictions are the most accurate, say climate experts**

# What about at the masterplan scale?

Risk mapping:  
prioritising  
critical assets /  
infrastructure

Renewable energy and  
district heating

Regreening / reforestation

Porous surfaces

De-culverting  
/ daylighting  
water courses

Greening existing  
buildings i.e. green  
roofs on multi-story  
car parking

Street trees provide  
shade, prevent  
overheating reduce run-off  
and improve air quality

Flood protection;  
keep runoff from  
entering sewers

Blue-green  
infrastructure / flood  
plain parks allow  
room for flooding,  
biodiversity, and  
provide active travel  
spaces



Shelter belts to  
minimise wind damage

In-street rain  
gardens, water  
roads, SUDS and  
permeable surfaces

Design out car  
dependency

Community hub /  
refuges minimise  
the need to travel in  
extreme weather

Reduce hard standing  
car parking by improving  
public transport,  
providing multi-stories

Community growing  
spaces increase  
food security and  
community cohesion

Work with  
topography

Think about  
shading, orientation  
and solar gain

Assume the worst  
case scenario

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# A brighter future for Scotland?

Reduced reliance on insecure imports protects Fife's economy from price shocks / supply disruption

Fall in fuel poverty and inequality

Tree planting decontaminates old industrial sites, reduces flood risk and provides local biomass energy

Local energy systems mean more money goes to the local economy

Reduced damage, disruption and repair costs

Sustainable energy and biomass industries replace declining industrial sectors and boost employment



Tourism industry and food and drink sector boosted

Fewer people are injured or killed on the roads, and by extreme weather and flooding

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Properties are resilient to current extremes as well as future change

Investors are confident long term investments are secure

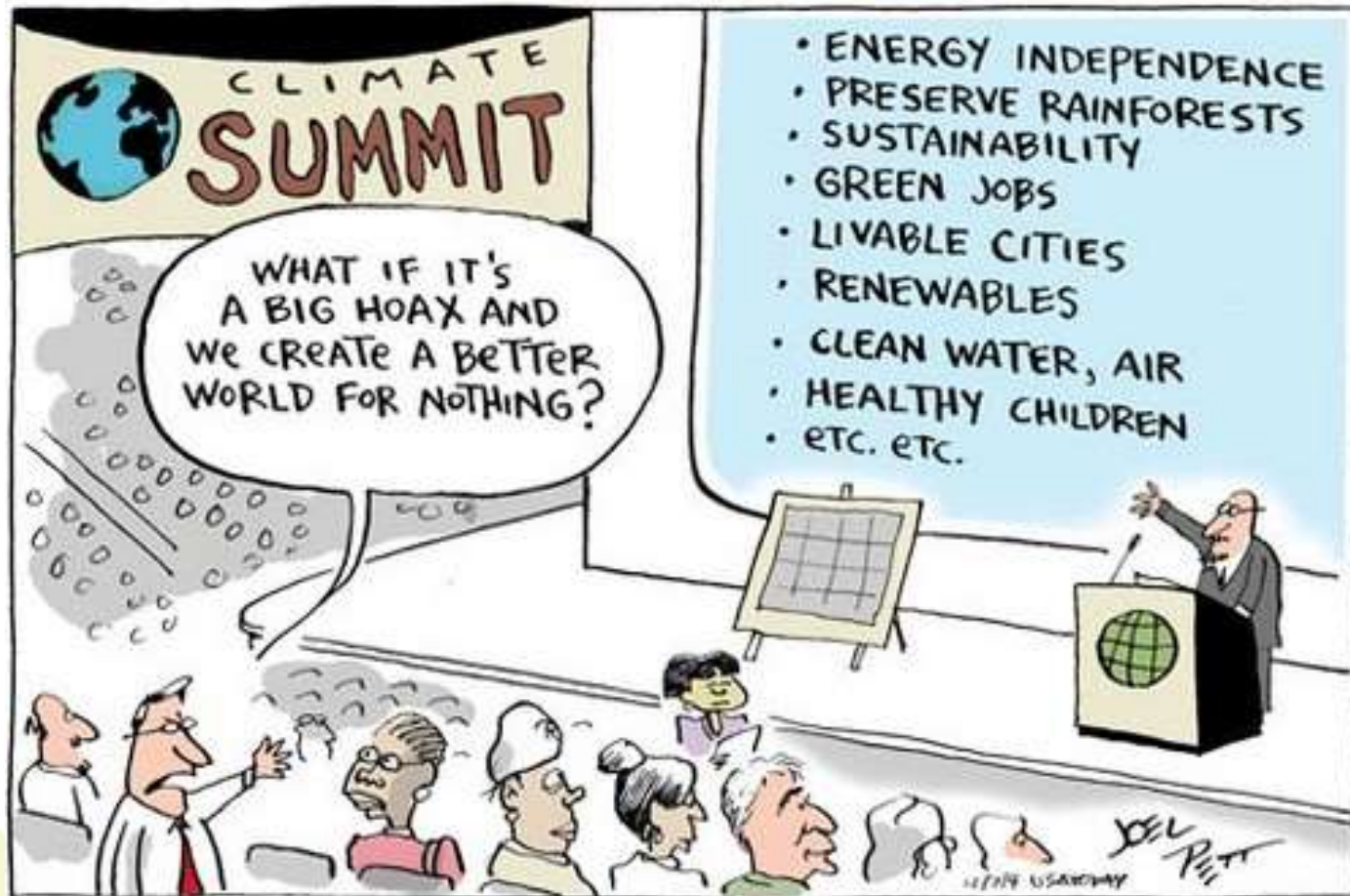
Sustainable transport reduces congestion and improves quality of life

Deprived areas, once most at risk of flooding, are able to regenerate securely

Health benefits (asthma, cardiovascular disease and mental health)



# What's the worst that could happen if we act?



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Thanks for your time

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# Exponential growth – What? Why?

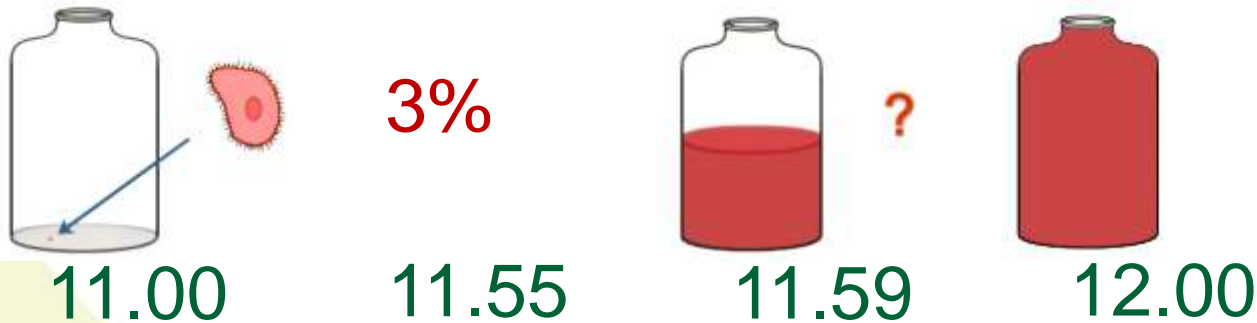
- Chess board and grains of wheat story
- Doubling time – period of time required for a quantity to double in size or value
- Simple maths – to find doubling time divide 70 by % growth.
  
- Example for 3% growth                       $70 / 3 = 23.3$
  
- Global GDP for those 28 yrs av. 2.81% to 2017
- GDP doubled 1993-2017

Prof. Al Bartlett

**“The greatest shortcoming of the human race is our inability to understand the exponential function.”**

...a bacteria doubles every minute...

What time will the bottle be half full?





Prof. Al Bartlett

**“The greatest shortcoming of the human race is our inability to understand the exponential function.”**

...a bacteria doubles every minute...

