An Introduction to Climate Change

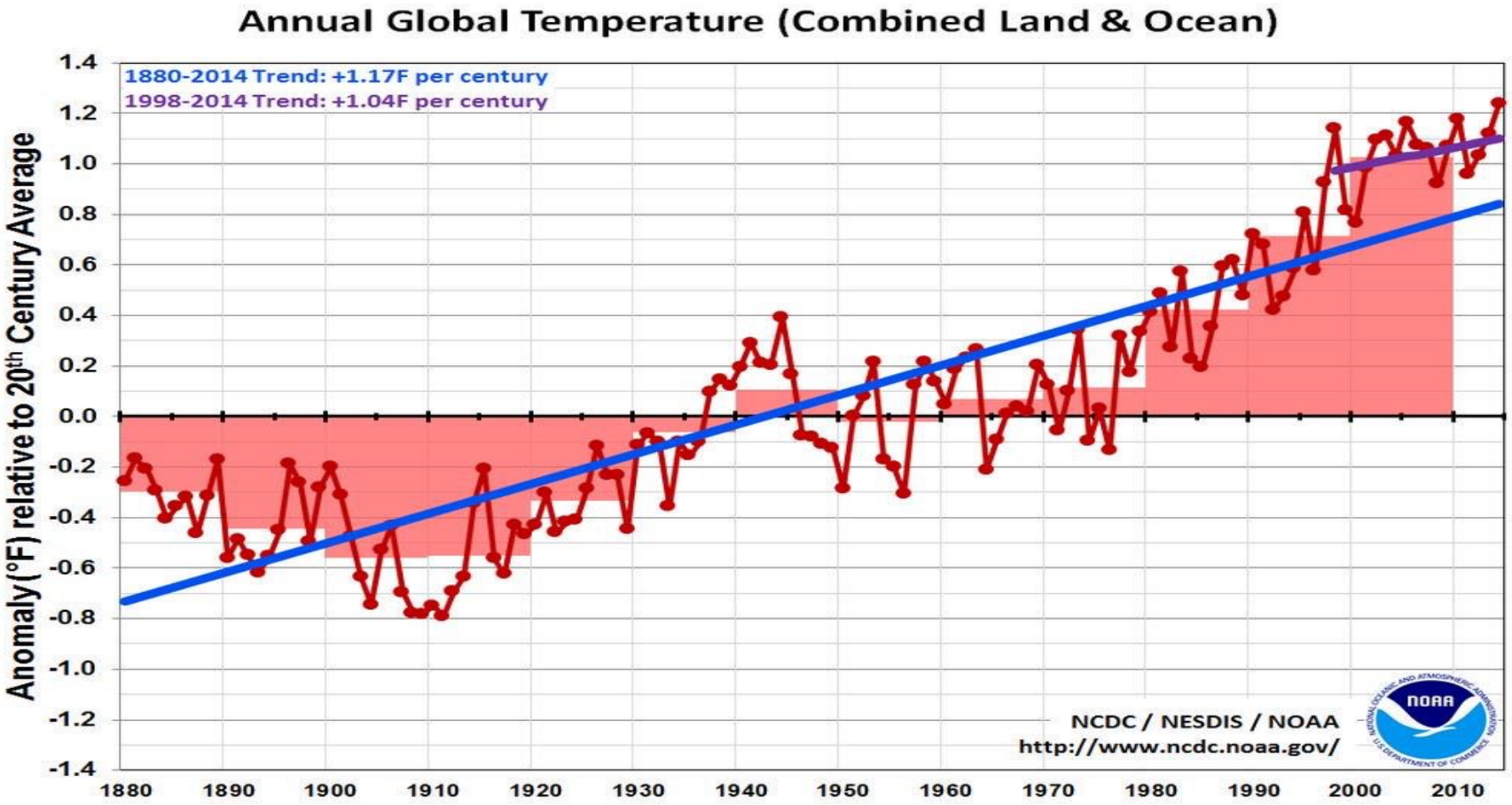
Climate Change – Definition

Climate is the average weather at a given point and time of year, over a long period (typically 30 years).

We expect the weather to change a lot from day to day, but we expect the climate to remain relatively constant.

If the climate doesn't remain constant, we call it climate change.

Climate Change Example – Global Temperature



Anthropogenic Climate Change

Anthropogenic = Caused by humans

Human activities have contributed substantially to climate change by adding CO2 and other heat-trapping gases (known collectively as Greenhouse Gases) into the atmosphere.

These Greenhouse Gases have increased the Greenhouse Effect and caused Earth's surface temperature to rise.

The primary human activity affecting the amount and rate of climate change is Greenhouse Gas output produced from the burning of fossil fuels.

The Greenhouse Effect

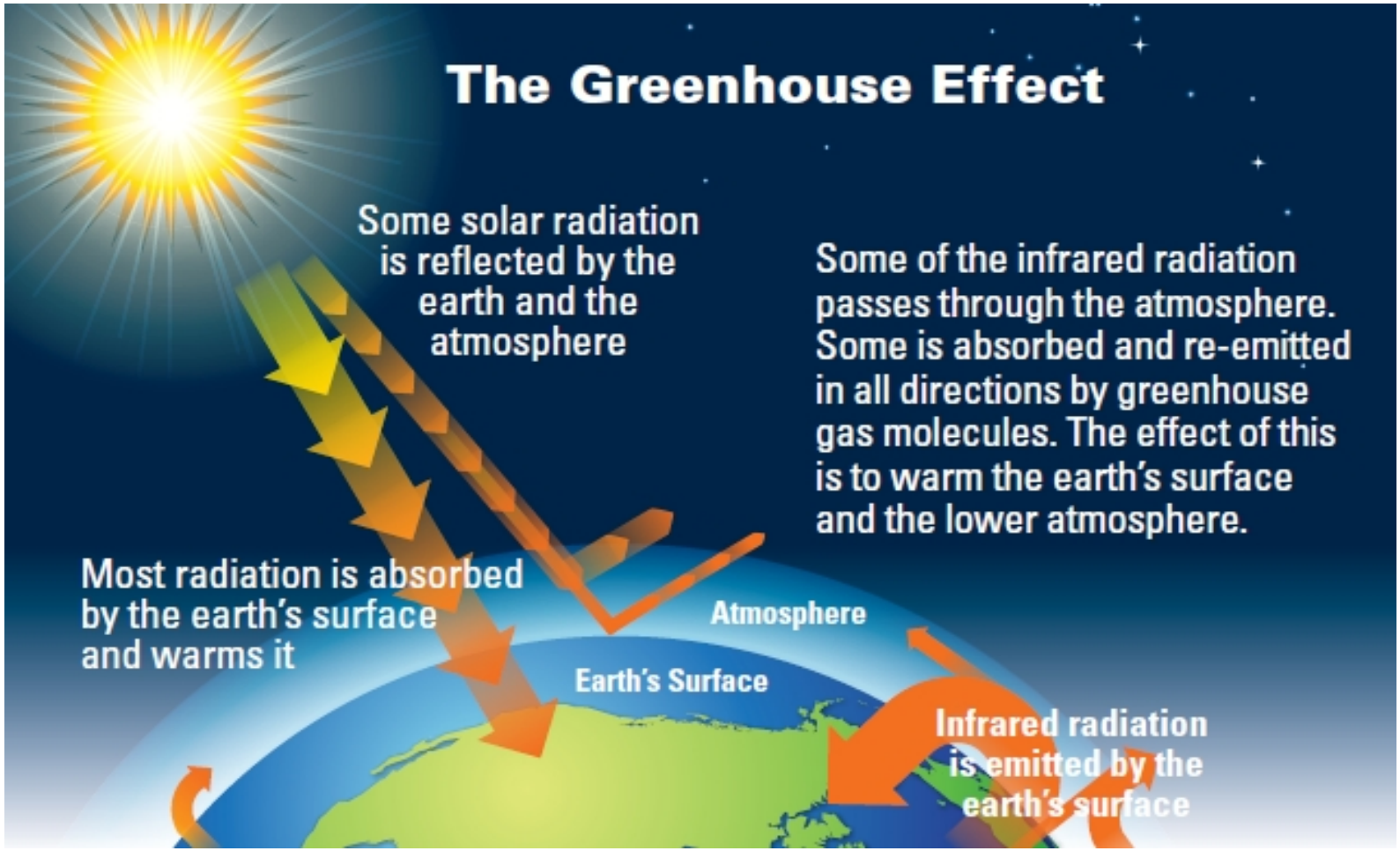
Greenhouse Gases absorb heat and send some of it back to earth, this causes temperatures to rise.

The largest contributor to the Greenhouse Effect is the naturally occurring Greenhouse Gas of water vapour.

Other Greenhouse Gases occur in much smaller quantities but play an important role in the Greenhouse Effect.

These include carbon dioxide, methane, and nitrous oxide

The Greenhouse Effect



Greenhouse Gases

Carbon Dioxide

The primary Greenhouse Gas contributing to Climate Change

Natural sources - Animal/Plant respiration, volcanic eruptions & the ocean-atmosphere exchange

Human sources - The burning of fossil fuels (eg. Oil) & changes in land use (eg. Deforestation)

Greenhouse Gases

Methane

Has a much shorter lifetime than carbon dioxide but is far more efficient at trapping solar radiation

Natural sources - Wetlands, termites & oceans

Human sources - Fossil fuel production, livestock farming, landfills, biomass burning & rice agriculture

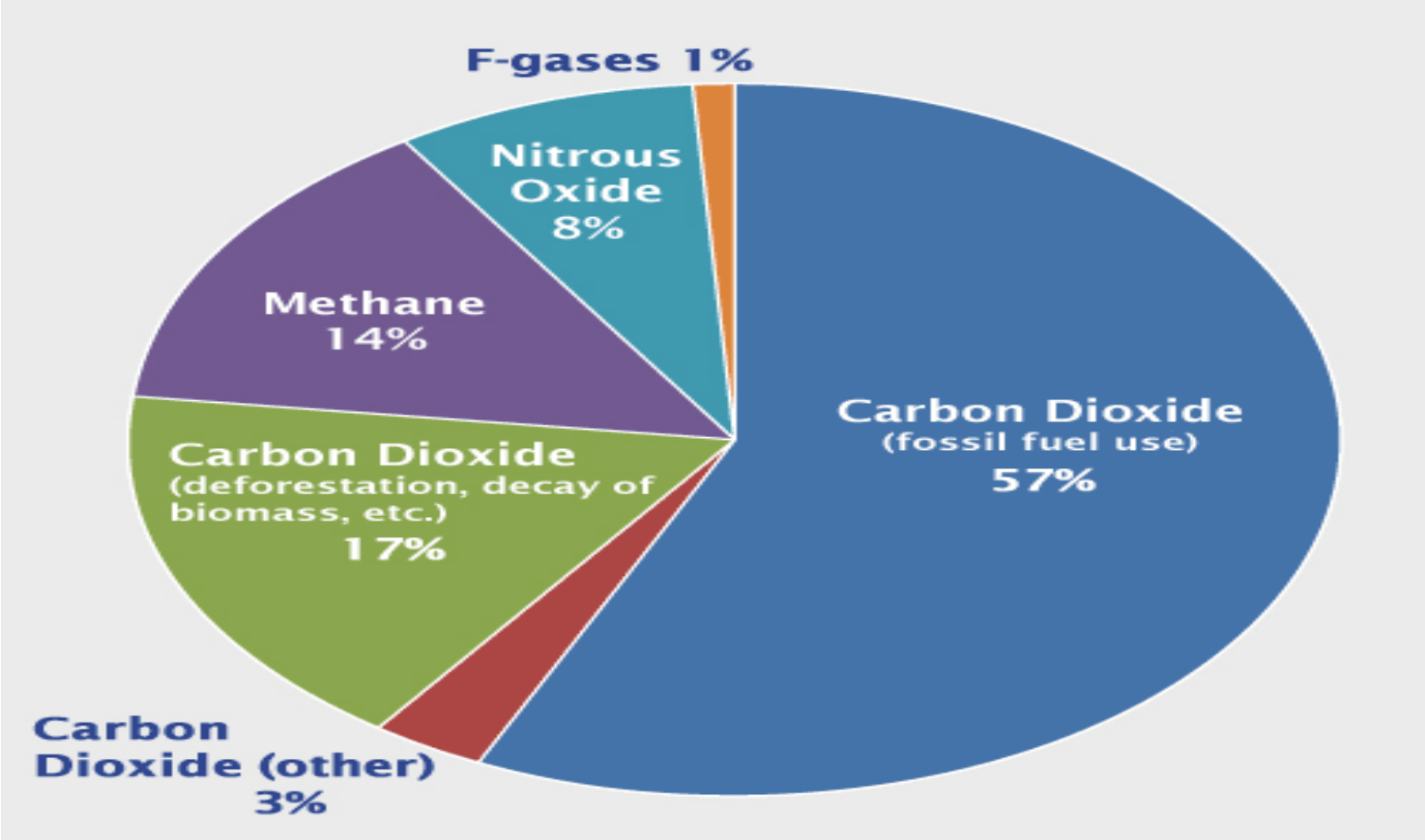
Greenhouse Gases

Nitrous Oxide

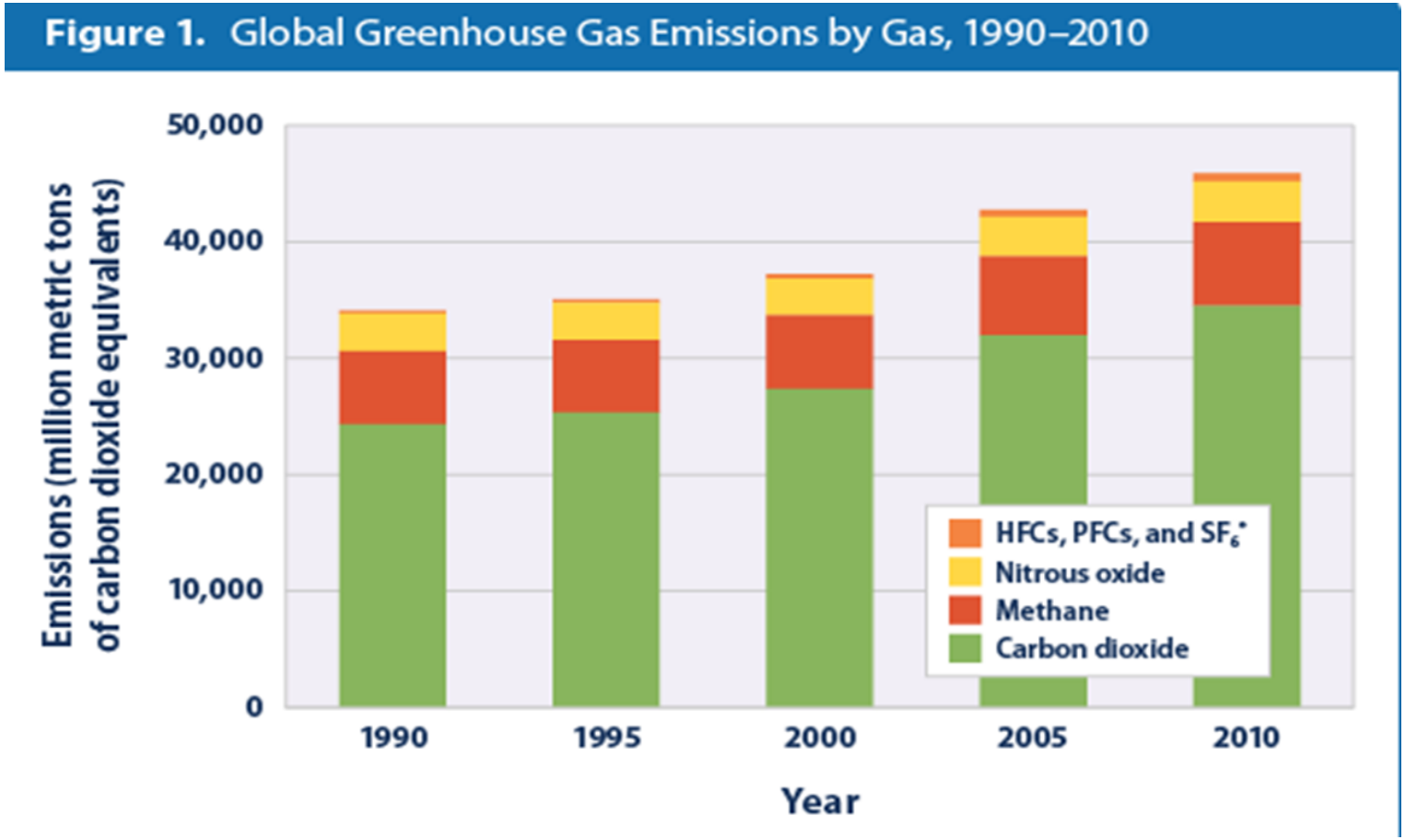
Natural sources - Soils under natural vegetation, oceans & chemical reactions in the atmosphere

Human sources – Agriculture, biomass burning, human sewage & fossil fuel burning.

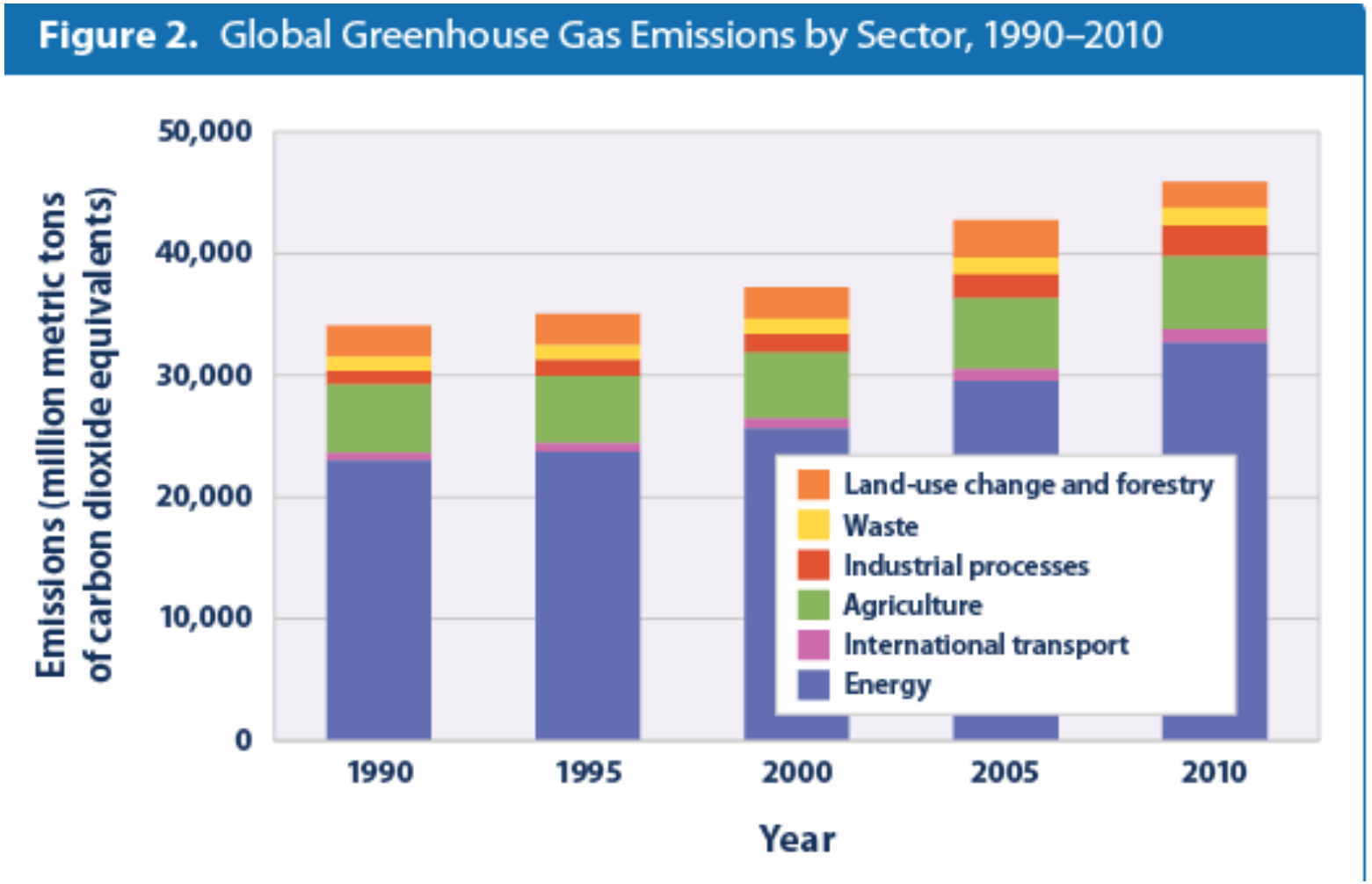
Greenhouse Gases in the Atmosphere



Greenhouse Gases

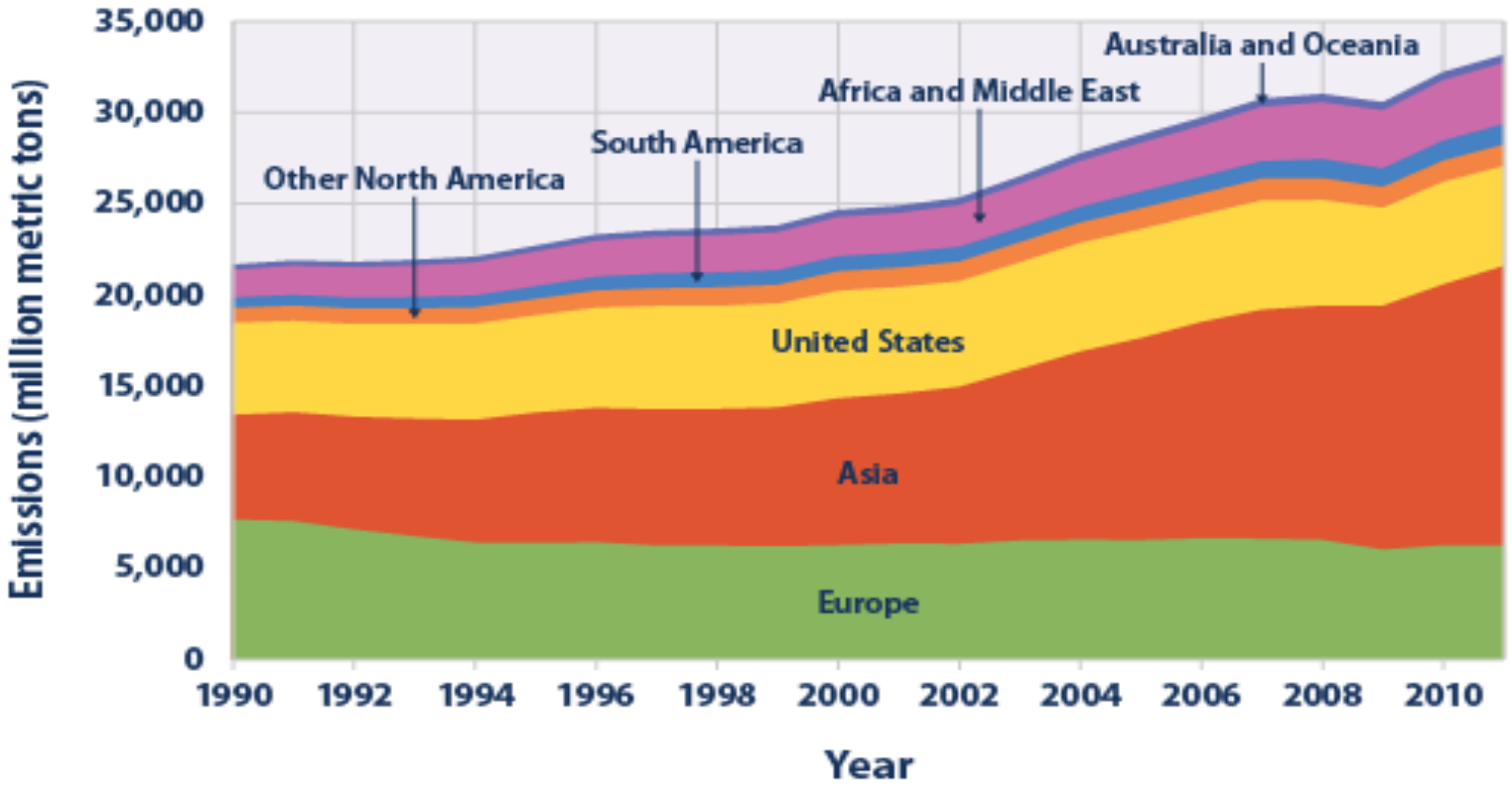


Greenhouse Gases



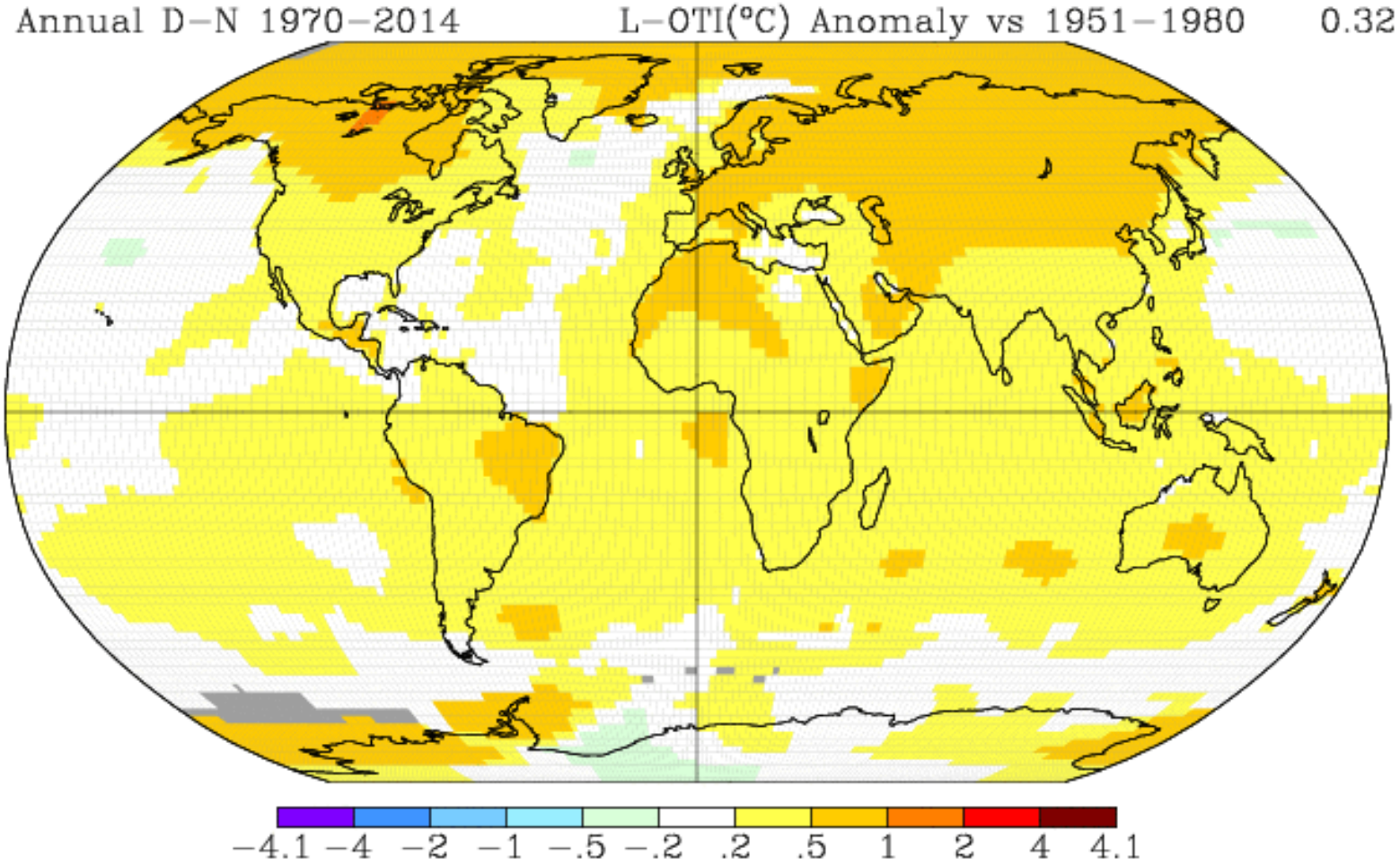
Greenhouse Gases

Figure 3. Global Carbon Dioxide Emissions by Region, 1990–2011



The Impacts of Climate Change

The primary impact of climate change is that earth is heating up



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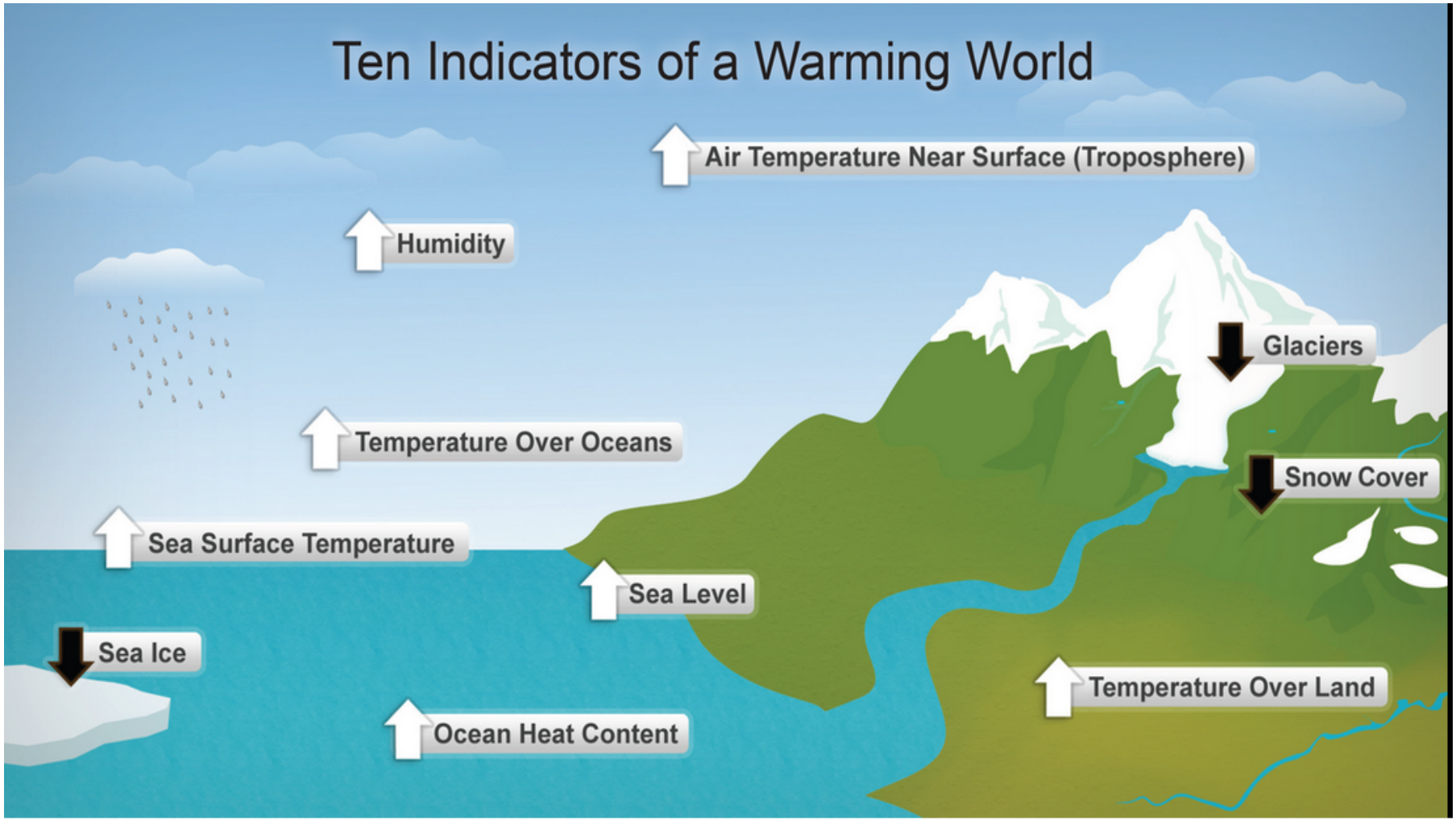

Ten Indicators of a Warming World
Air Temperature Near Surface (Troposphere)
Humidity
Glaciers
Temperature Over Oceans
Snow Cover
Sea Surface Temperature
Sea Level
Sea Ice
Temperature Over Land
Ocean Heat Content

Immediate impacts of rising temperatures:

- Global ice melt
- Sea level rise
- Biodiversity loss
- Biodiversity displacement
- Increased precipitation (Rain & Snow)

Future impacts of rising temperatures:

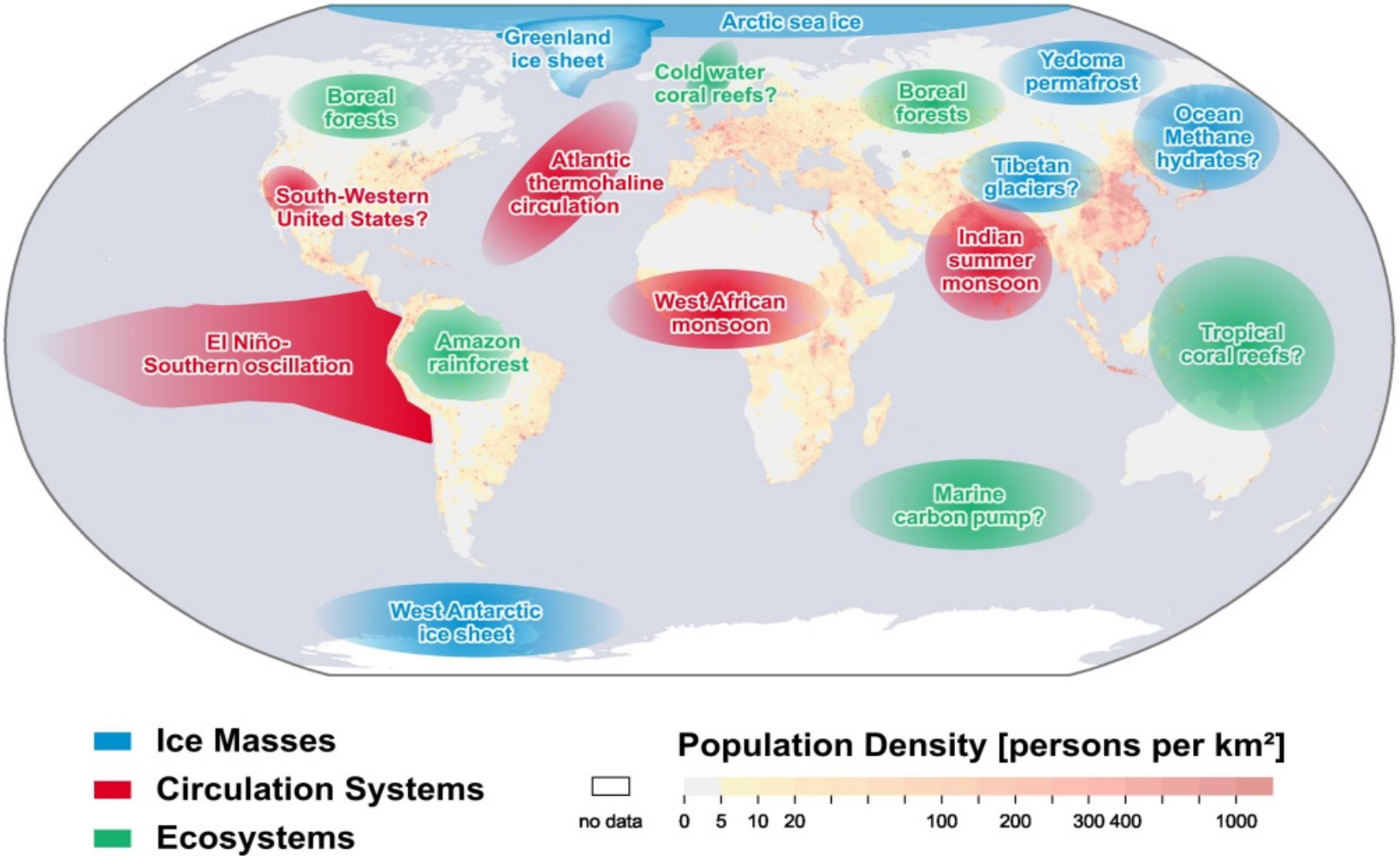
- Sea levels will continue to rise
- Hurricanes and others storms will become more common and stronger
- Floods will become more frequent and severe
- Droughts will become more frequent and severe

continued..

- Disease, such as malaria, will spread
- Ecosystems will change- some species will move farther north or become more successful; others won't be able to move and could become extinct.
- Food supply chains will be threatened

Unknown Impacts of Rising Temperatures - Tipping Points

- Tipping Point: a critical point at which a tiny change can permanently alter the state or development of a system (Lenton et al., 2008)
- Examples in the climate system include the potential collapse of the ice sheets and the destruction of coral reefs


Arctic sea ice
Greenland ice sheet
Cold water coral reefs?
Yedoma permafrost
Boreal forests
Boreal forests
Ocean Methane hydrates?
Atlantic thermohaline circulation
Tibetan glaciers?
South-Western United States?
Indian summer monsoon
West African monsoon
Tropical coral reefs?
El Niño-Southern oscillation
Amazon rainforest
Marine carbon pump?
West Antarctic ice sheet
Ice Masses
Circulation Systems
Ecosystems
Population Density [persons per km²]
no data
0 5 10 20 100 200 300 400 1000

Example 1

Greenland Ice Sheet Collapse

- Causes: Increasing air and water temperatures
- What will happen?: Ice sheet declines and eventually collapses
- Warming of just 1°C could be enough to start process
- It will take 300+ years to happen
- Key Impact: Sea levels will rise

Example 2

Amazon Rainforest Dieback

- Causes: Increased precipitation and dry season length
- What will happen?: The rainforest will decline rapidly
- Warming of 3°C+ would begin dieback
- Would happen in approx. 50 years
- Key Impacts: Biodiversity loss and decreased rainfall

Example 3

West African Monsoon

- Cause: Increased precipitation
- What will happen?: Increased vegetation
- 100mm of rain would be sufficient
- Could happen in just 10 years
- Key impacts: Eradicate drought, increase the amount of crops being grown and subsequently provide more food and income to struggling farmers

Mitigation & Adaptation

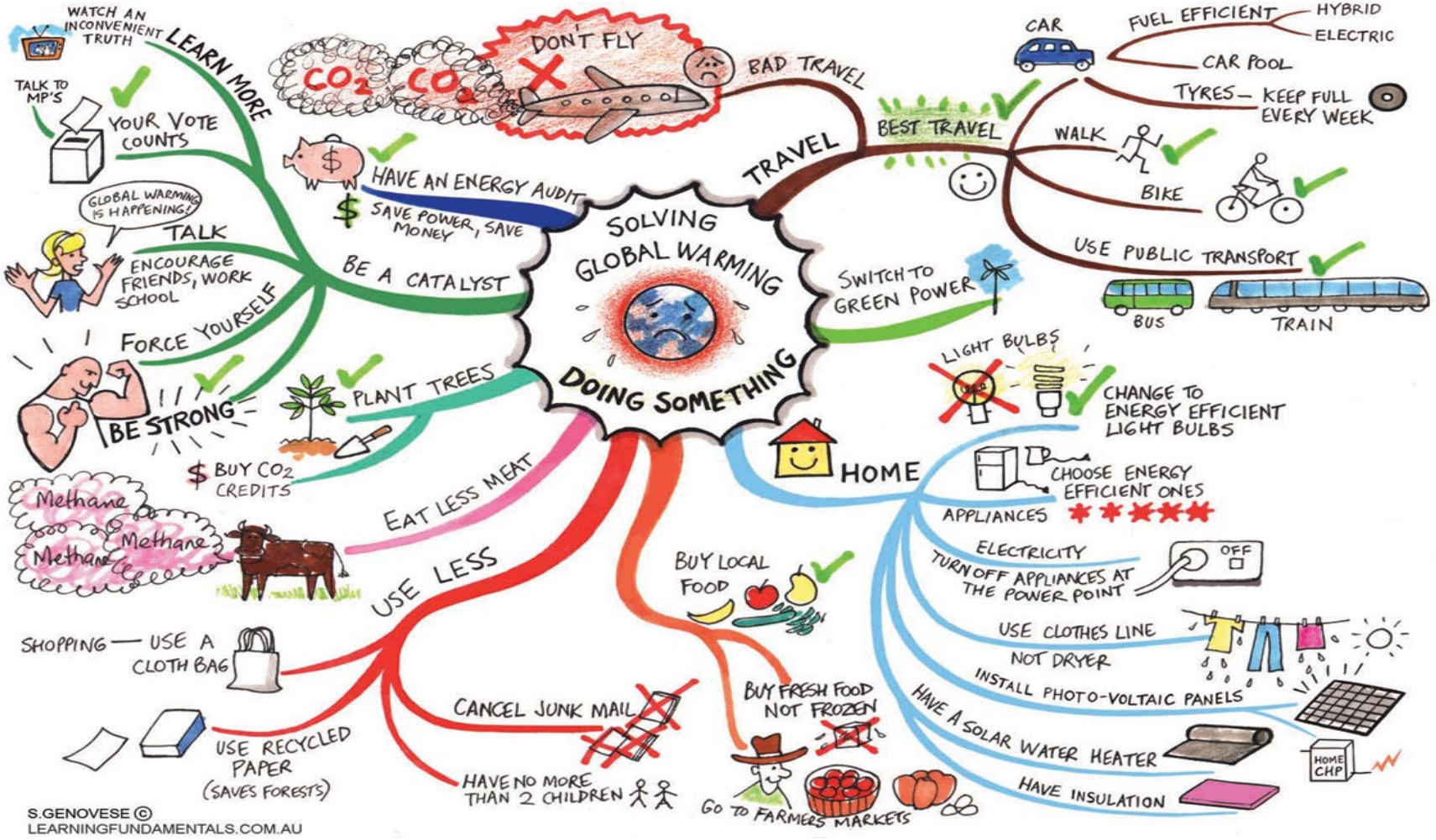
Two processes used to deal with climate change:

- Mitigation: “to make (something) less severe, harmful, or painful”
- Adaptation: “adjusting to environmental conditions”

Local Mitigation: How to reduce Greenhouse Gas emissions

Everyone in this room can reduce local greenhouse gas emissions by:

- Using Public Transport or Walk/Cycle Places
- Switching to energy efficient appliances at home
- Reducing, Reusing & Recycling
- Insulating your home
- Using Water Efficiently
- Buying Locally & Organically
- Divestment by Local Institutions
- Spreading the Word


SOLVING GLOBAL WARMING
DOING SOMETHING
LEARN MORE
WATCH AN INCONVENIENT TRUTH
TALK TO MP'S
YOUR VOTE COUNTS
BE A CATALYST
GLOBAL WARMING IS HAPPENING!
TALK
ENCOURAGE FRIENDS, WORK SCHOOL
FORCE YOURSELF
BE STRONG
HAVE AN ENERGY AUDIT
SAVE POWER, SAVE MONEY
PLANT TREES
BUY CO_2 CREDITS
EAT LESS MEAT
Methane
Methane
Methane
USE LESS
SHOPPING — USE A CLOTH BAG
USE RECYCLED PAPER (SAVES FORESTS)
CANCEL JUNK MAIL
HAVE NO MORE THAN 2 CHILDREN
BUY LOCAL FOOD
BUY FRESH FOOD NOT FROZEN
GO TO FARMERS MARKETS
TRAVEL
DON'T FLY
CO_2 CO_2
BAD TRAVEL
BEST TRAVEL
CAR
FUEL EFFICIENT
HYBRID
ELECTRIC
CAR POOL
TYRES — KEEP FULL EVERY WEEK
WALK
BIKE
USE PUBLIC TRANSPORT
BUS
TRAIN
SWITCH TO GREEN POWER
HOME
LIGHT BULBS
CHANGE TO ENERGY EFFICIENT LIGHT BULBS
CHOOSE ENERGY EFFICIENT ONES
APPLIANCES
ELECTRICITY
TURN OFF APPLIANCES AT THE POWER POINT
OFF
USE CLOTHES LINE NOT DRYER
INSTALL PHOTO-VOLTAIC PANELS
HOME CHP
HAVE A SOLAR WATER HEATER
HAVE INSULATION
S.GENOVESE ©
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How to reduce Greenhouse Gas emissions on a global scale

On a global scale greenhouse gas emissions are the responsibility of governments. They can reduce emissions by:

- Not Using Fossil Fuels as an Energy Source
- Switching to Renewable Energy (Wind or Solar)
- Stopping Deforestation
- Planting New Forests
- Making Agriculture More Energy Efficient

Adaptation: Soft Methods

Focus on information, policies and strategies (Brains)

Examples:

Early Warning Systems
Land Use Planning
Fixing Broken Pipes

Adaptation: Hard Methods

Focus on technology, engineering and capital (Brawn)

Examples:

Dykes
Seawalls
Reinforced Buildings

Climate Change and the Council

Regional Approach

- Fingal County Council
- Dublin City Council
- South Dublin County Council
- Dún Laoghaire–Rathdown County Council
- Codema - Dublin's Energy Agency and was set up as a not-for-profit limited company by Dublin City Council in 1997

Focus Areas

- Citizen Engagement
- Planning
- Energy
- Transport
- Water
- Waste
- Ecosystems & Biodiversity

❖ Agriculture?

Citizen Engagement

- Roll out regional public climate awareness programmes
- Encourage citizens to become ‘prosumers’ of their own energy
- Work with existing local authority networks to engage citizens in the climate change challenge
- Involve citizens in more workshops and focus groups on the topic of climate change

Planning

- Explore the possibility of energy masterplans for appropriate new development zones
- Ensure Development Plan design guidanc and standards support climate change mitigation/adaptation
- Use planning policy to promote near zero energy buildings for new developments
- Develop a regional emissions inventory

Energy

- Become leaders in the use of energy efficiency design at project development stage
- Take an exemplar role in the use of Green Public Procurement
- Support and facilitate low-carbon district heating networks
- Move towards near-zero-energy in council new-build buildings, in line with EU policy

Transport

- Promote high-density development along public transport corridors through close collaboration with our planning departments
- Upgrade the councils' fleets to more sustainable and energy efficient vehicles
- Work with ESB ecars to help facilitate a network of electrical charge points
- Continue to develop efficient traffic management systems

Water

- Plan for flood adaptation for the next 50-100 years using the natural environment, including using natural ecosystems to attenuate water
- Increase flood awareness in Dublin
- Work closely with Irish Water
- Advise the public on how to best protect their properties from flooding

Waste

- Move towards a circular waste economy model
- Encourage collaborative methods of consumption (eg. leasing, allotments and the use of the Internet of Things)
- Increase public awareness ofrecycling and collaborative consumption options (i.e. by engaging with Green Schools and community groups)

LINEAR ECONOMY

CIRCULAR ECONOMY

Ecosystems & Biodiversity

- Create effective strategies for controlling climate-related Invasive Alien Species (IAS) and work in partnership with other stakeholders to control IAS throughout th Dublin area
- Explore the use of ecosystem services assessments to inform future policies and decisions
- Facilitate, develop and implement green infrastructure strategies to promote adaptation and mitigation

Next Stages?

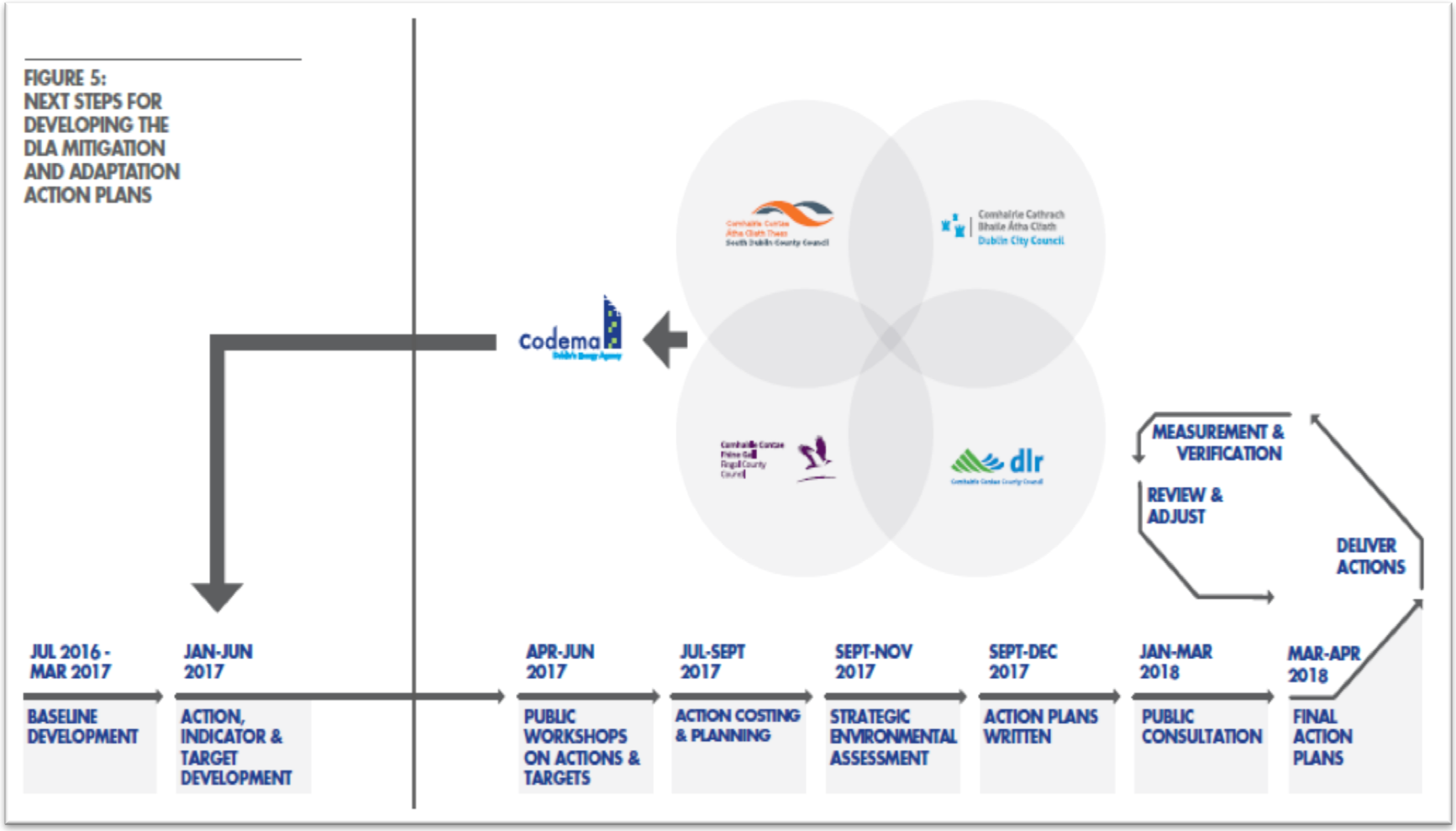
FIGURE 5:
NEXT STEPS FOR DEVELOPING THE DLA MITIGATION AND ADAPTATION ACTION PLANS
Codema
dlr
MEASUREMENT & VERIFICATION
REVIEW & ADJUST
DELIVER ACTIONS
JUL 2016 - MAR 2017
BASELINE DEVELOPMENT
JAN-JUN 2017
ACTION, INDICATOR & TARGET DEVELOPMENT
APR-JUN 2017
PUBLIC WORKSHOPS ON ACTIONS & TARGETS
JUL-SEPT 2017
ACTION COSTING & PLANNING
SEPT-NOV 2017
STRATEGIC ENVIRONMENTAL ASSESSMENT
SEPT-DEC 2017
ACTION PLANS WRITTEN
JAN-MAR 2018
PUBLIC CONSULTATION
MAR-APR 2018
FINAL ACTION PLANS

Any Questions?