# FCWG SCIENCE SERIES

FOREST-CLIMATE WORKING GROUP

& LATTE LEARN

## Forests and Climate 101:
Understanding the Science Behind Forest Carbon Management, Adaptation, and Future Opportunities

**DEC. 8, 9AM EST**

In this Forest-Climate Working Group (FCWG) educational series, designed for policymakers and their support staff, experts will introduce key concepts related to forests' role in climate change mitigation. These morning sessions will explore the science underlying forest health, products, and benefits in a changing climate. Participants can expect a follow up email after the event with key takeaways and talking points.

**Presentations by:**
Lauren Cooper (MSU FCCP)
Chris Swanston (NIACS)
Cathy Macdonald (TNC)

**Q&A panel discussion:**
Moderated by Ann Bartuska (RFF)

**Register at:**
**https://bit.ly/3nWPpoM**

**45** minute sessions

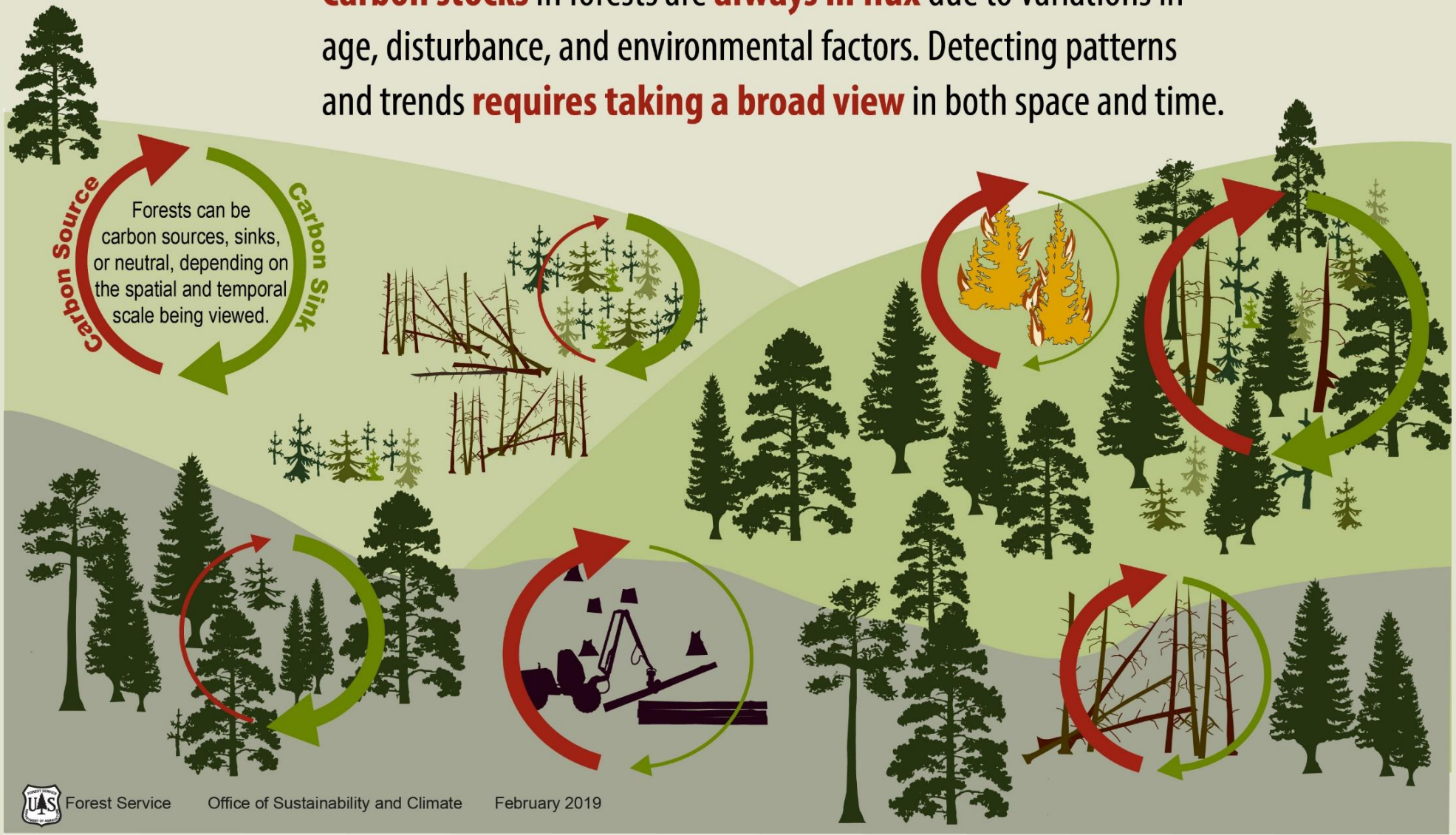
**Upcoming topics:** • Reforestation • Disturbance and resilience • Harvested wood products • Forests ecosystem services • Monitoring and measurement • Forest owner decision-making

USDA United States Department of Agriculture

A spatial and temporal view

# Carbon in Time and Space

**Carbon stocks** in forests are **always in flux** due to variations in age, disturbance, and environmental factors. Detecting patterns and trends **requires taking a broad view** in both space and time.




Forest Service Office of Sustainability and Climate February 2019

# The Greenhouse Effect

Sun

Atmosphere

Greenhouse Gases

**1.** Solar radiation passes through the clear atmosphere.

**2.** Some solar radiation is reflected by the atmosphere and earth's surface

**3.** Remaining solar radiation passes to earth's surface

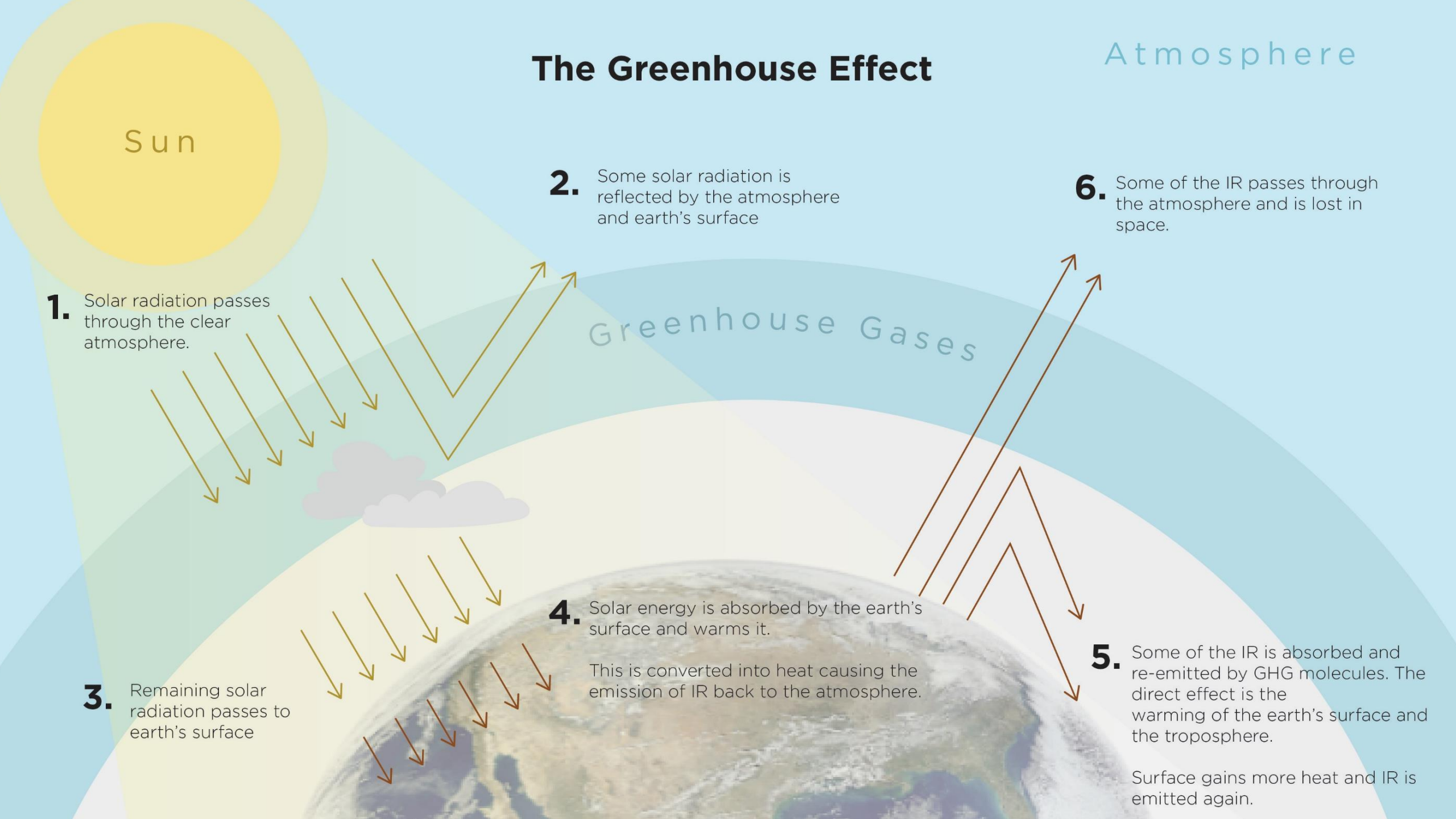
**4.** Solar energy is absorbed by the earth's surface and warms it.

This is converted into heat causing the emission of IR back to the atmosphere.

**5.** Some of the IR is absorbed and re-emitted by GHG molecules. The direct effect is the warming of the earth's surface and the troposphere.

Surface gains more heat and IR is emitted again.

**6.** Some of the IR passes through the atmosphere and is lost in space.



# Recent Trends in $CO_2$ and Temperature

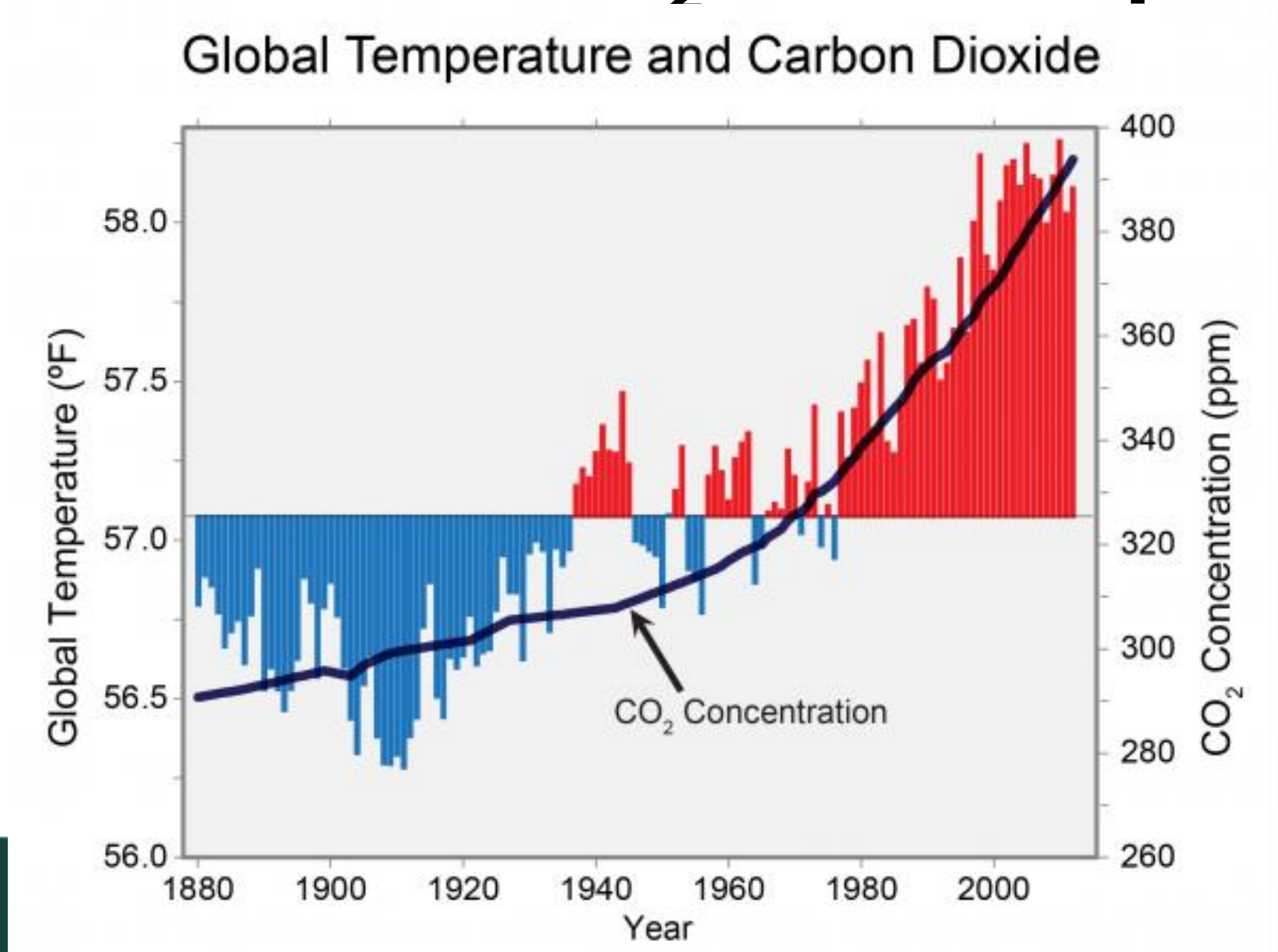



*Image: https://www.globalchange.gov/browse/multimedia/global-temperature-and-carbon-dioxide*

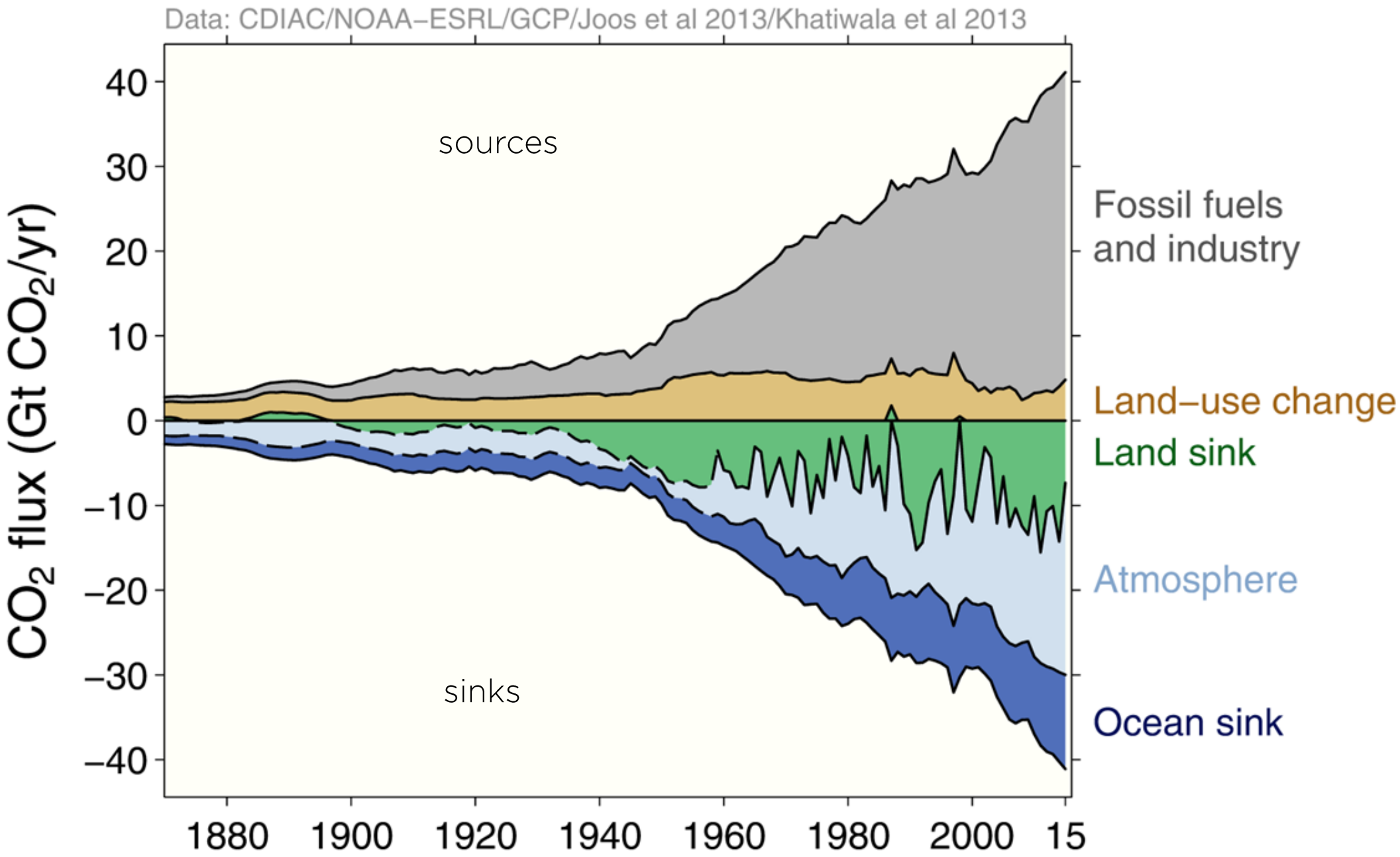





Image Source: http://www.globalcarbonproject.org/carbonbudget/16/presentation.htm

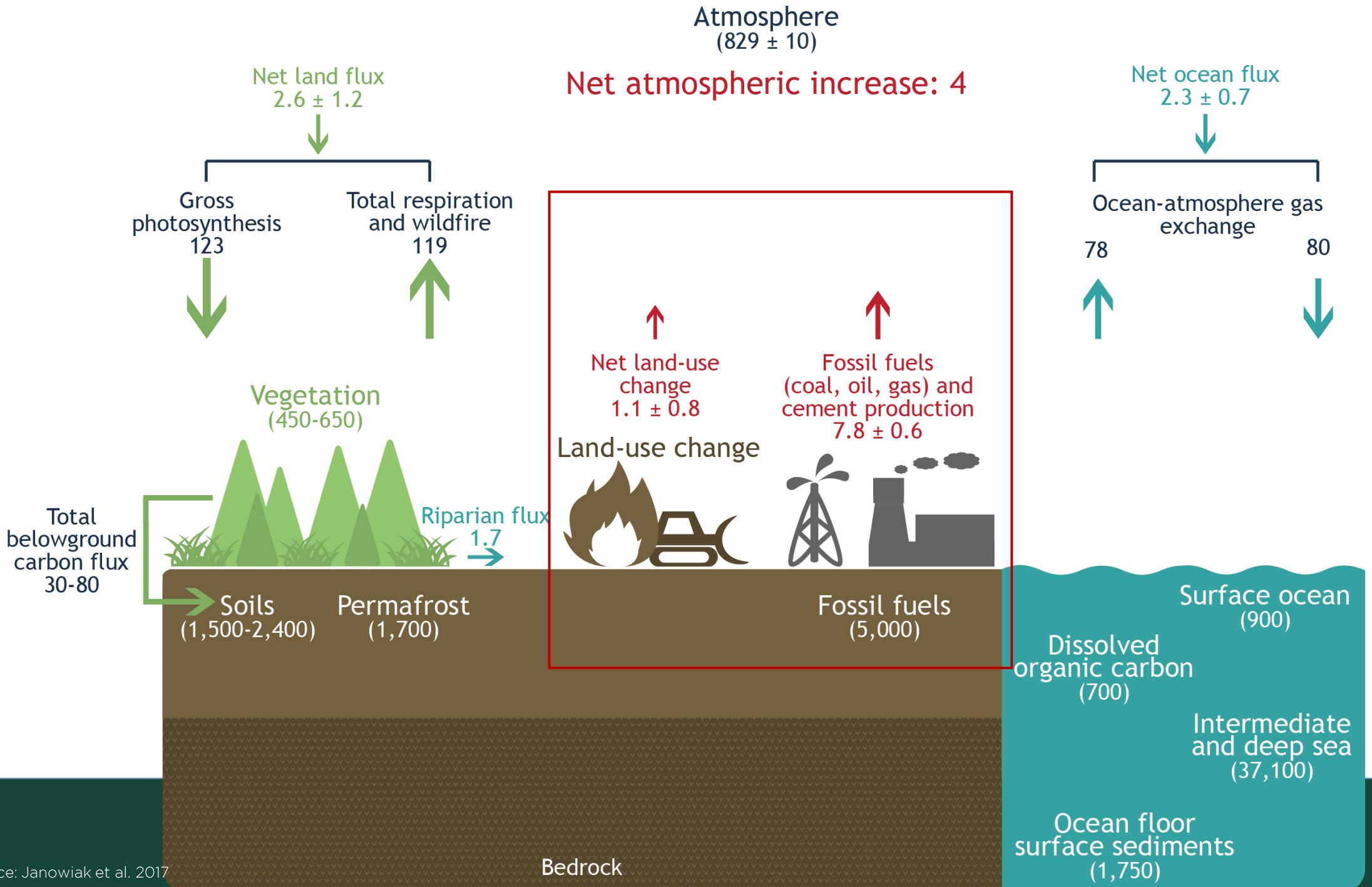
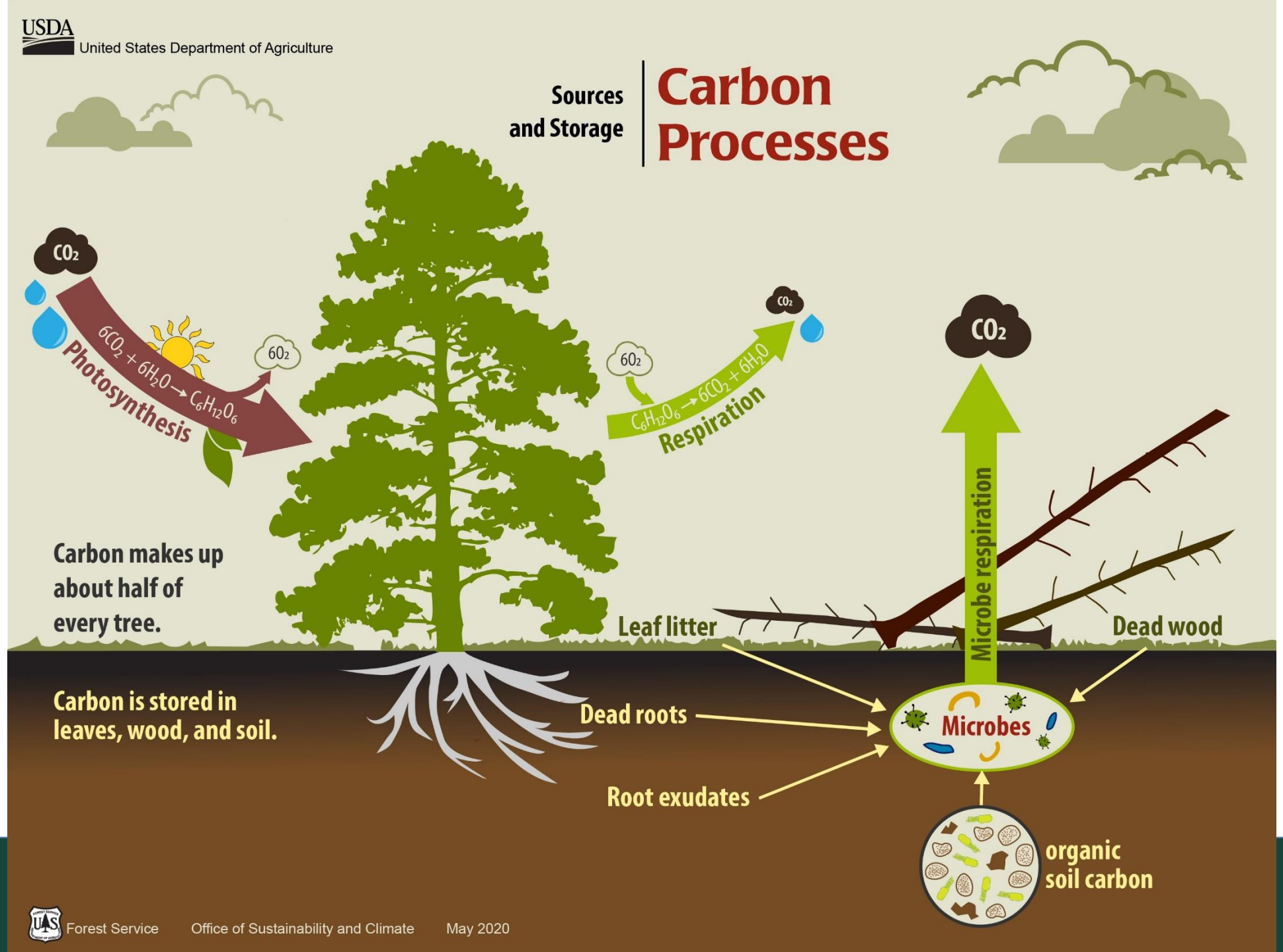



Image Source: Janowiak et al. 2017


USDA
United States Department of Agriculture
Sources and Storage
Carbon Processes
$CO_2$
$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6$
Photosynthesis
$6O_2$
$6O_2$
$C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O$
Respiration
$CO_2$
Microbe respiration
Carbon makes up about half of every tree.
Leaf litter
Dead wood
Carbon is stored in leaves, wood, and soil.
Dead roots
Root exudates
Microbes
organic soil carbon
Forest Service
Office of Sustainability and Climate
May 2020

# Forest Ecosystem Carbon Pools

Living Biomass
Leaves, twigs, stems, coarse roots and fine roots of trees, shrubs and herbaceous plants

Dead Biomass
Standing dead trees, downed trees, leaf litter (forest floor), dead roots

Soil Carbon or Soil Organic Matter (SOM)
Humus, microbial biomass

# Forest-based strategies for mitigating climate change


Increase or maintain forestland

Reforestation and Avoiding Deforestation


Maintain or Increase carbon stocks

Changing management plan; Adapting to Climate Change


Increase Wood Use

Substituting wood for energy-intensive building materials