

# The Natural Boom & Bust Cycle of Forest Carbon

Carbon **uptake** & **storage** (growth)

Carbon **uptake** & **storage** (re-growth)

**CARBON**

Carbon **release** (fire)

Carbon **release** (decomposition) & **storage** in dead trees

Below-ground carbon **storage** (in roots & soil) is about 50% of forest carbon

# The closed loop of FOREST CARBON in the ATMOSPHERE

# Carbon Cycle

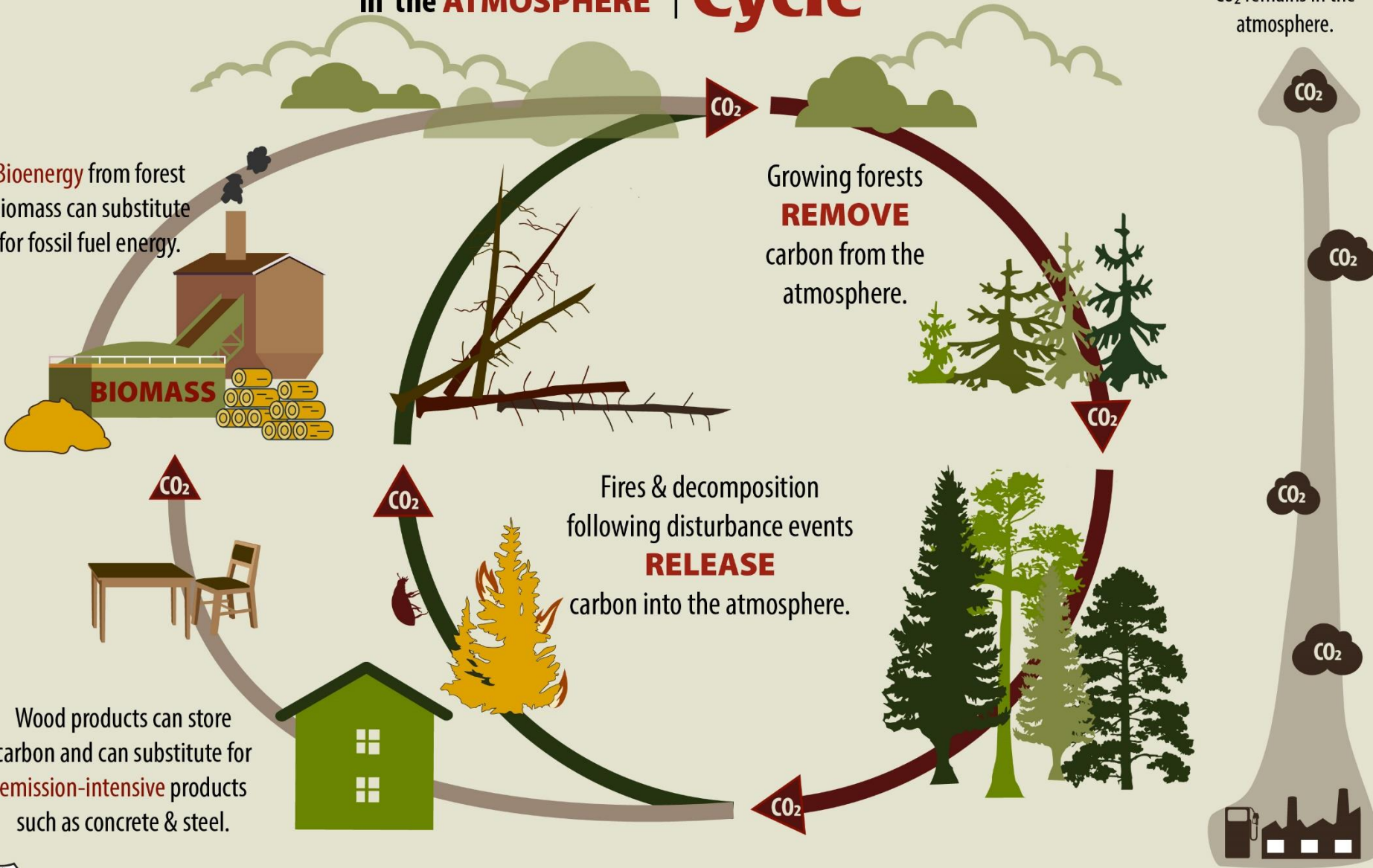
Fossil fuel use is an **OPEN SYSTEM** where CO<sub>2</sub> remains in the atmosphere.

Bioenergy from forest biomass can substitute for fossil fuel energy.

Growing forests **REMOVE** carbon from the atmosphere.

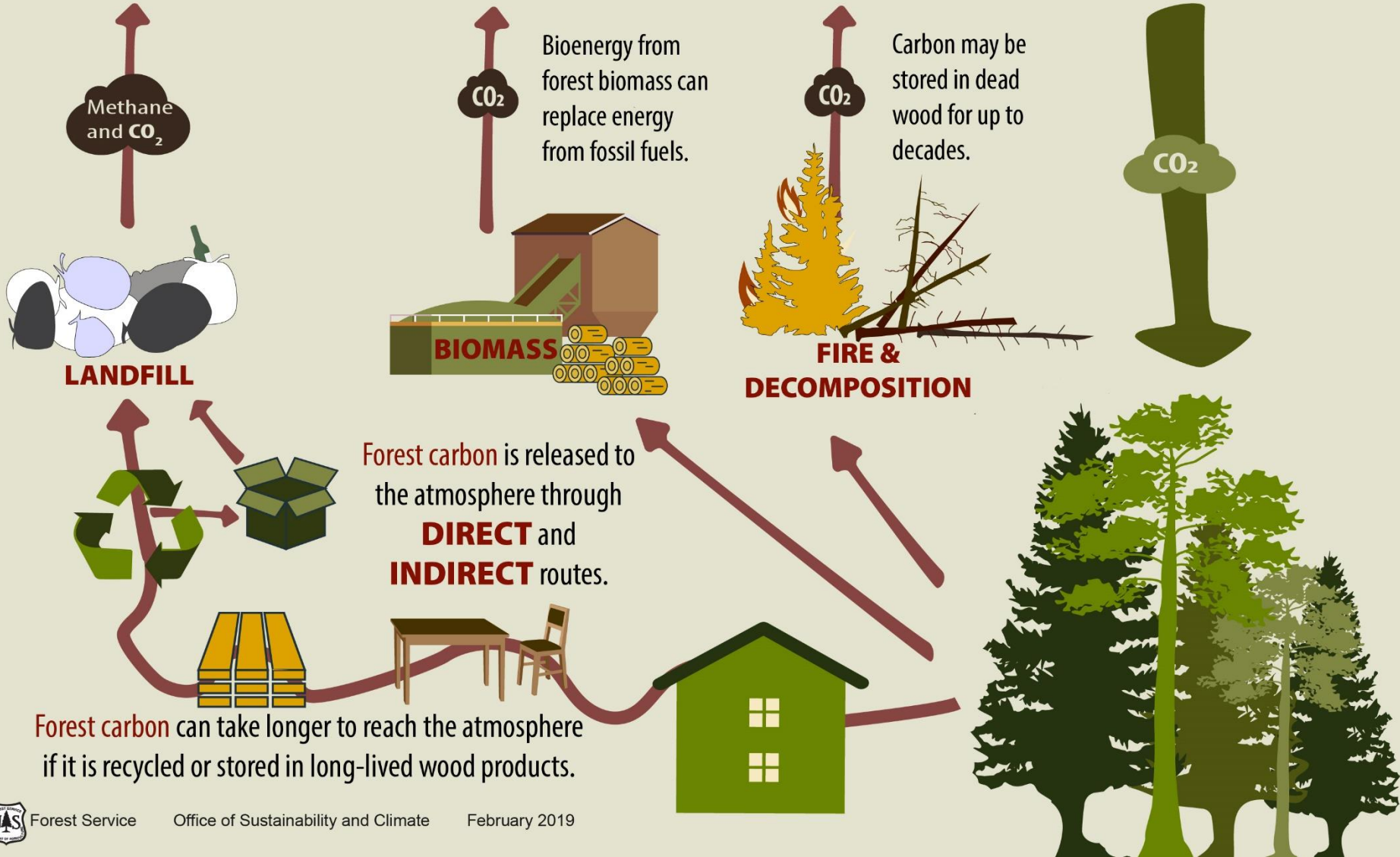
Fires & decomposition following disturbance events **RELEASE** carbon into the atmosphere.

Wood products can store carbon and can substitute for **emission-intensive** products such as concrete & steel.



# Various pathways of FOREST CARBON into the ATMOSPHERE

# Carbon Flux



# The Change from a Wood-based to a Fossil Fuel-based Economy

# Carbon Stocks

The United States **lost 60%**  
of its pre-European forest carbon  
stocks during settlement and into the  
industrial revolution.

About **40%** of the carbon lost  
during the industrial revolution has  
been **recovered** via re-growth.

**CARBON**

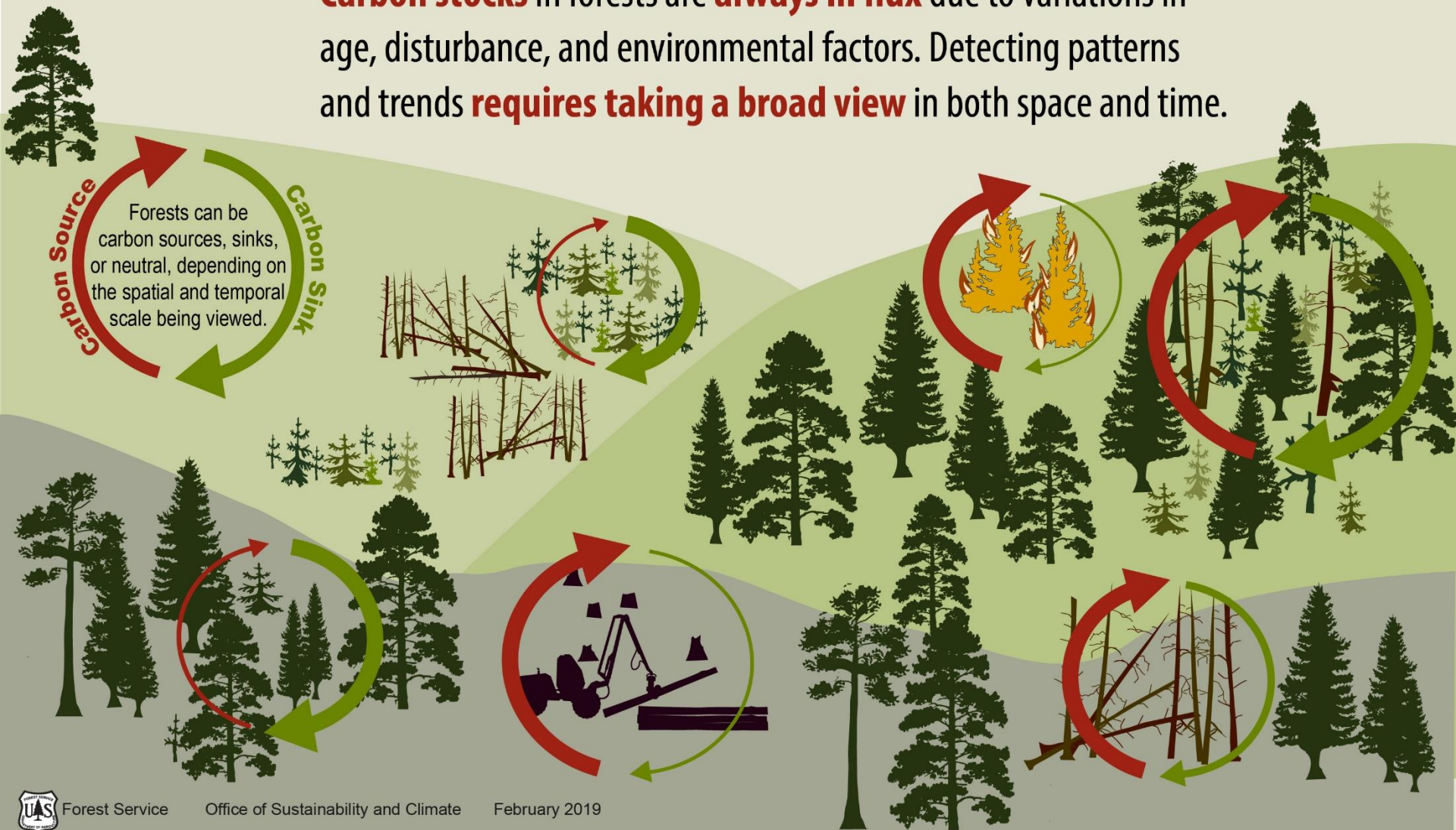
**Wood-based**

**1915**

**Fossil fuel-based**

# A spatial and temporal view | Carbon in Time and Space

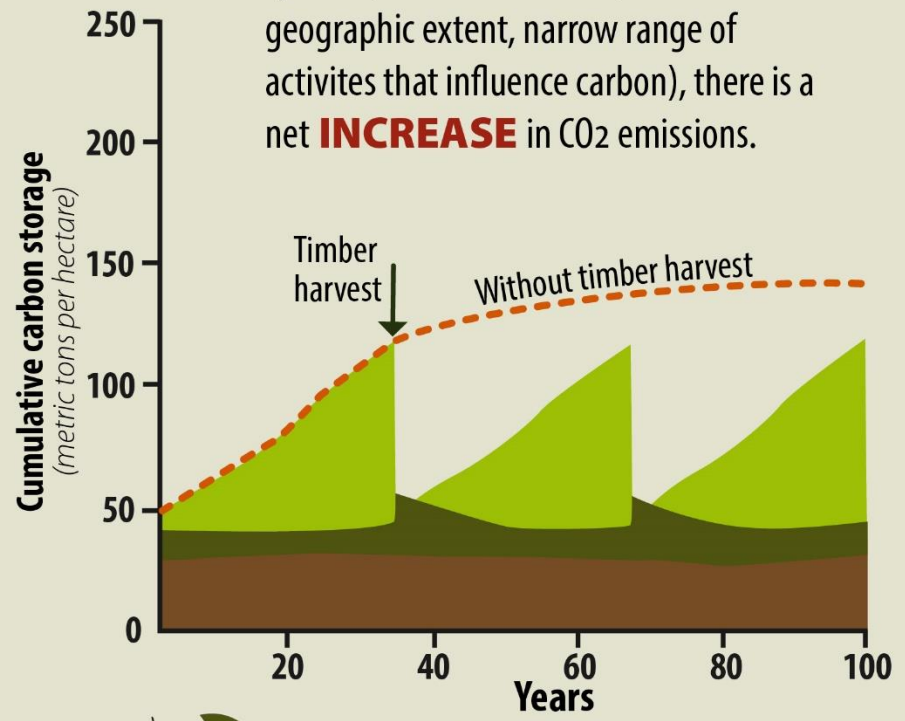
**Carbon stocks** in forests are **always in flux** due to variations in age, disturbance, and environmental factors. Detecting patterns and trends **requires taking a broad view** in both space and time.



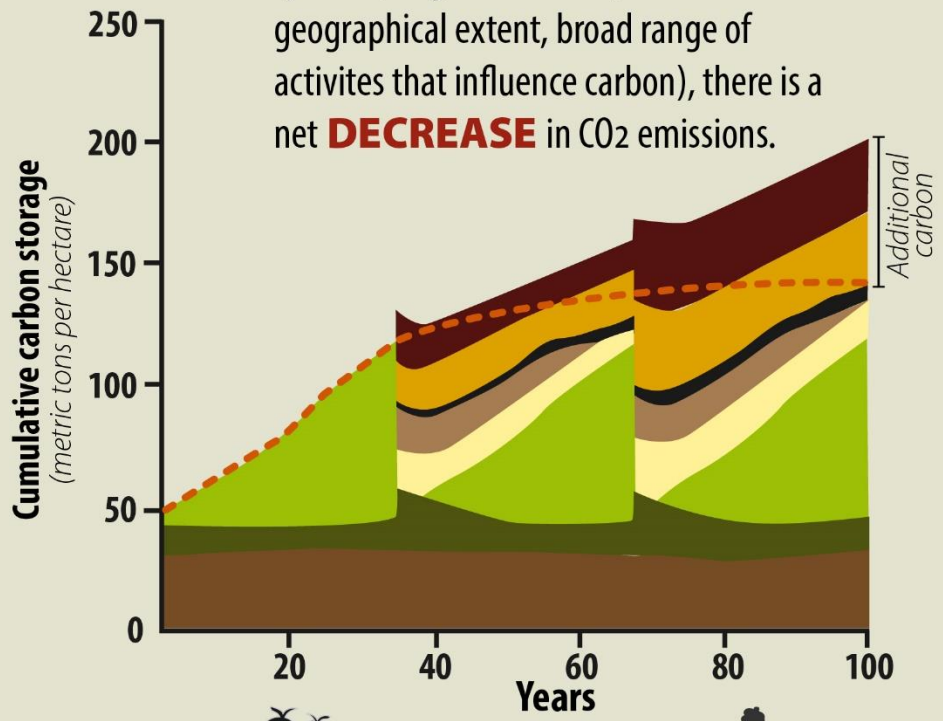
**Carbon BENEFITS in the Broad View**

# How Carbon Stacks Up

In the **NARROW VIEW** of the forest system (shorter time scale, smaller geographic extent, narrow range of activities that influence carbon), there is a net **INCREASE** in CO<sub>2</sub> emissions.



In the **BROAD VIEW** of the forest system (longer time scale, broader geographical extent, broader range of activities that influence carbon), there is a net **DECREASE** in CO<sub>2</sub> emissions.



Soil

Litter

Trees

Long-lived forest products

Short-lived forest products

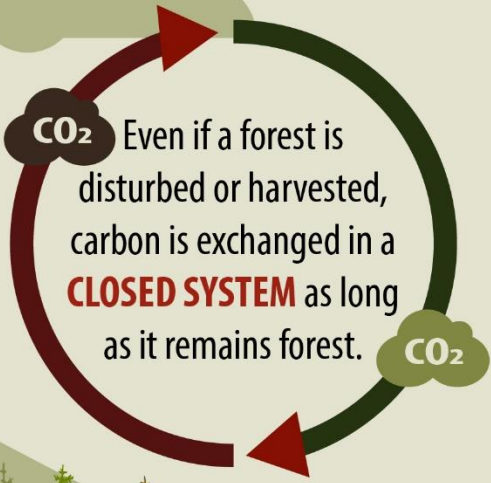
Landfill

Product substitution (building materials)

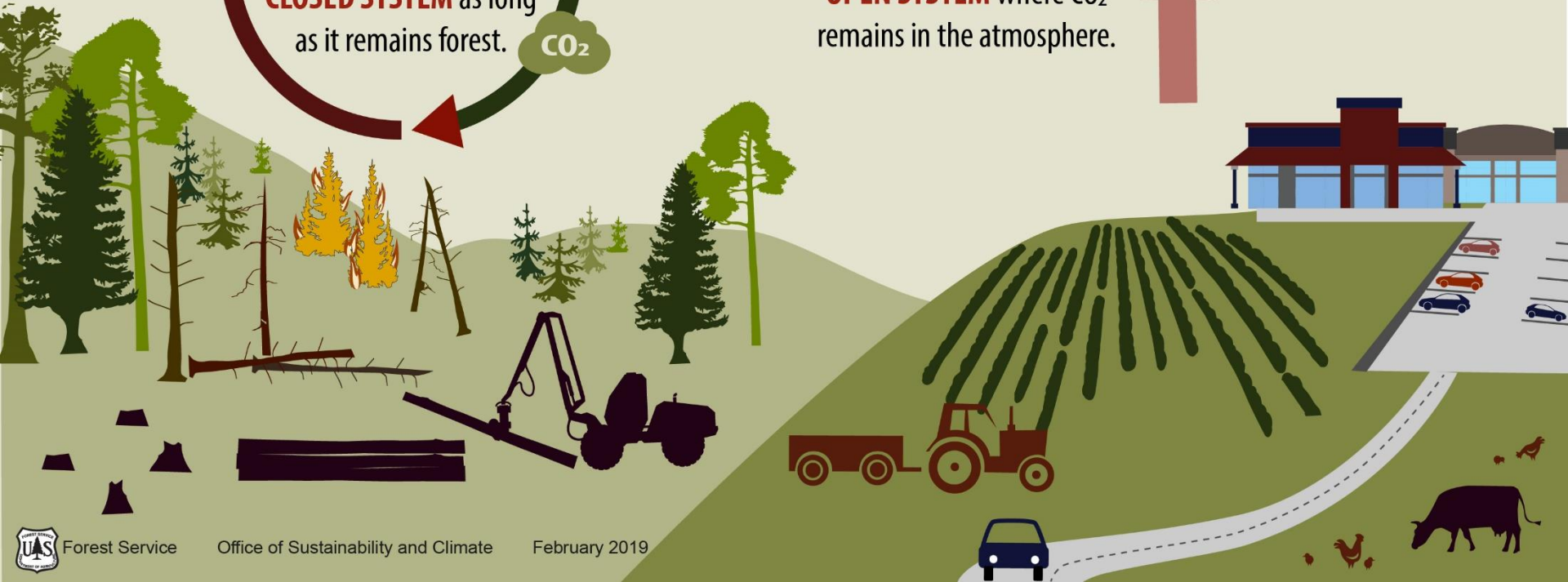
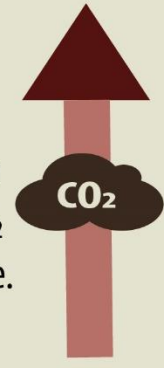
Energy substitution (bioenergy)

The importance of  
**KEEPING FORESTS**  
as forests

# Carbon & Land Use Changes

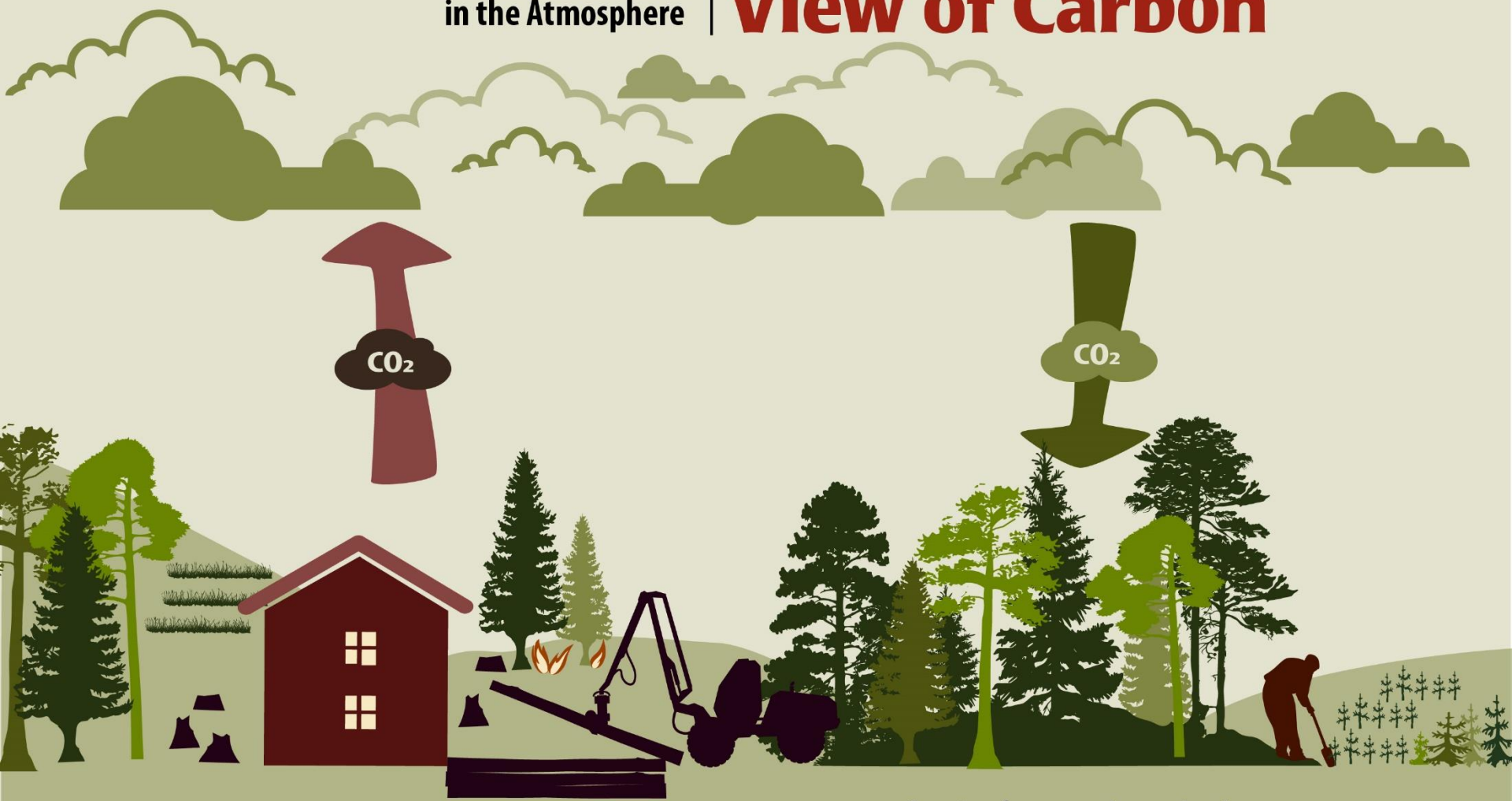


Conversion of forests to non-forest land uses is an **OPEN SYSTEM** where CO<sub>2</sub> remains in the atmosphere.



Carbon  
**EXCHANGE**  
in the Atmosphere

# A Narrow View of Carbon



Deforestation and forest management activities (harvests, thinning, prescribed fires) **release** carbon to the atmosphere.

Growing forests and tree planting (afforestation/reforestation) **take up and store** carbon from the atmosphere.

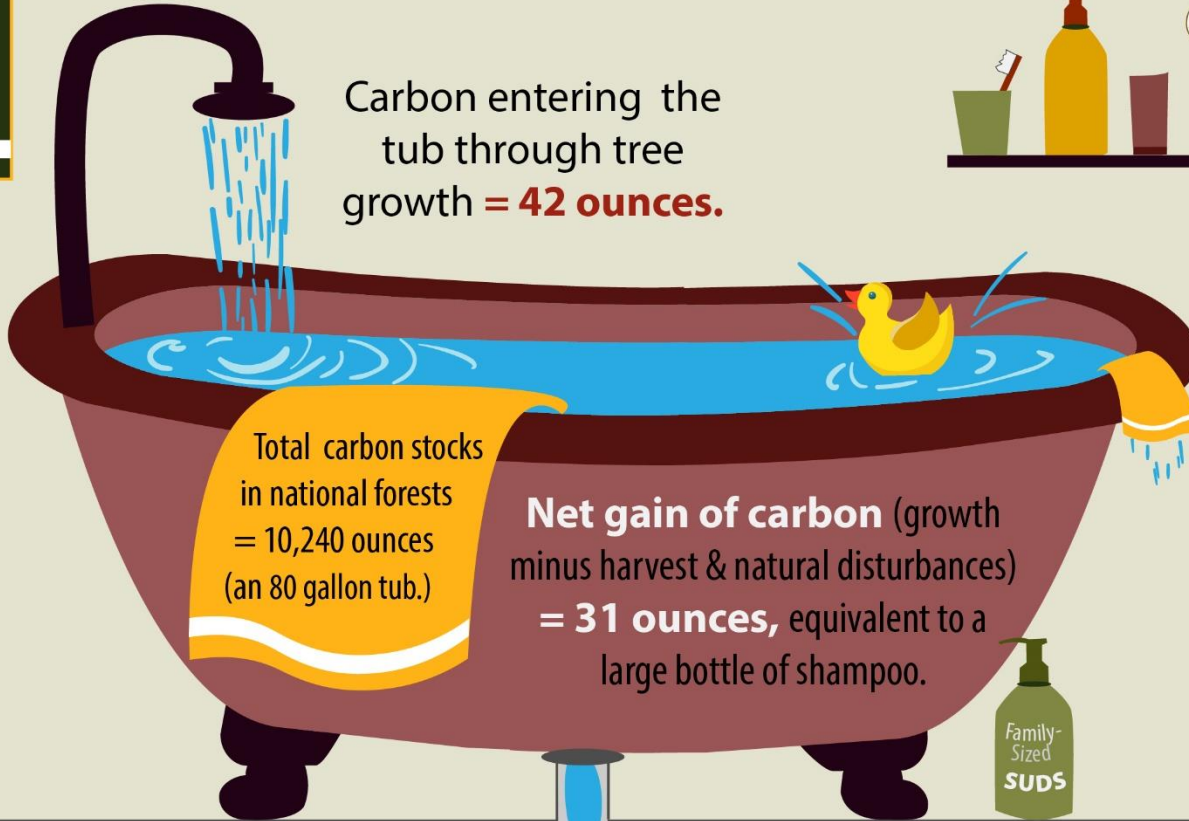
# The Carbon Bathtub of National Forests

# Carbon Dynamics

Numbers are for national forests only.



Carbon entering the tub through tree growth = **42 ounces.**



Total carbon stocks in national forests = 10,240 ounces (an 80 gallon tub.)

**Net gain of carbon** (growth minus harvest & natural disturbances) = **31 ounces**, equivalent to a large bottle of shampoo.

Carbon leaving the tub from harvesting = **3 ounces**, equivalent to what a washcloth can absorb.

Carbon leaving the tub through natural disturbances = 8 ounces.