My NASA Data

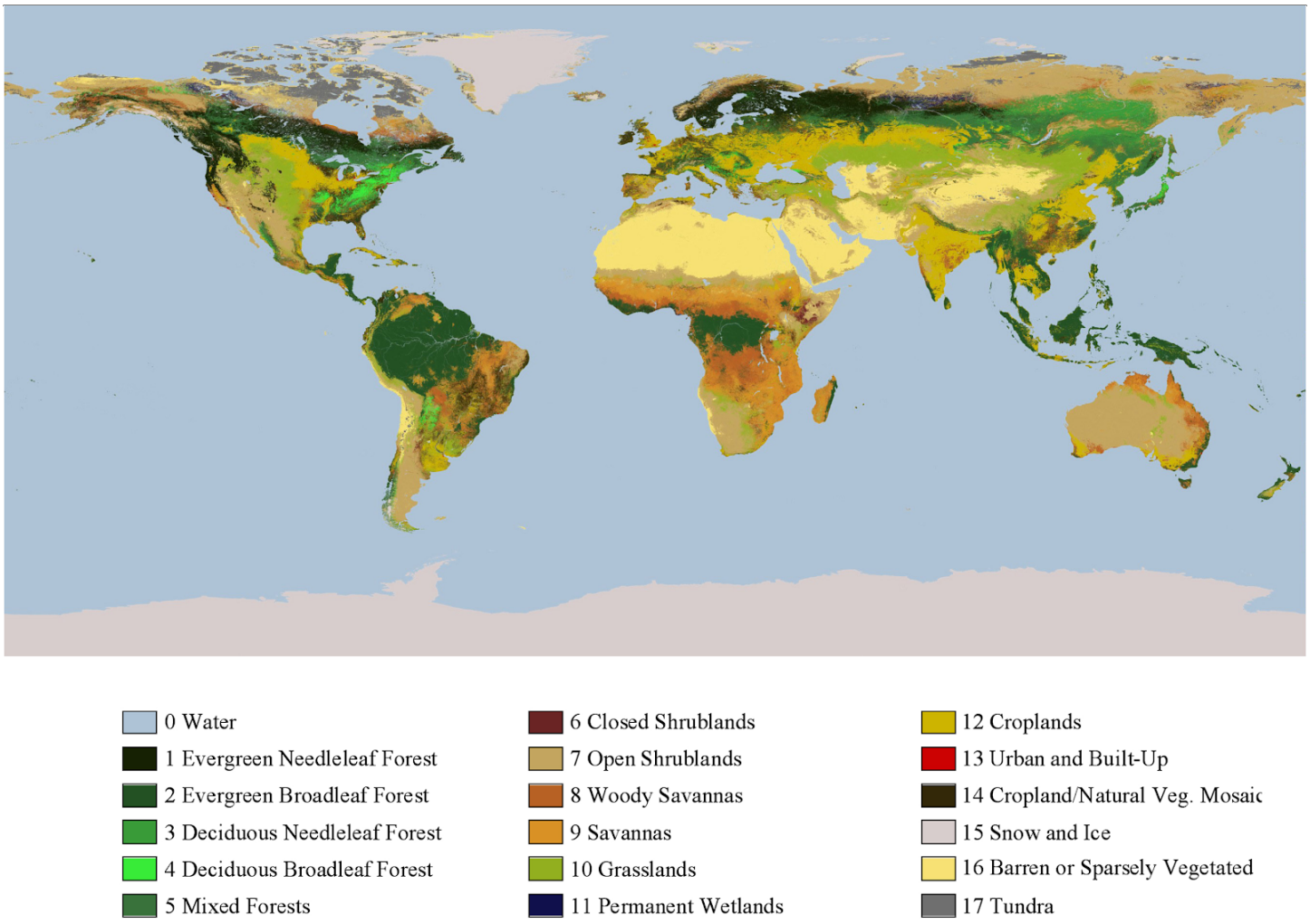
Deforestation

Forests are an important and common feature of the Earth’s land cover, covering 31 percent of the total land surface. There are two regions in particular where forests are common. A large area of forests (the taiga, or boreal forest) is found across northern North America, Europe, and Asia. Stretching out from the equator on all Earth’s land surfaces is another wide belt of forests of amazing diversity and productivity. These tropical forests include dense rain forests, where rainfall is abundant year-round. They also include seasonally moist forests, where rainfall is abundant but seasonal, and drier, more open woodlands.

Human activity and other factors result in deforestation. Humans clear the natural landscape to make room for farms and pastures, to harvest timber, and to build roads and houses. Tropical forests of all varieties, in particular, are disappearing rapidly by human activity. Other causes of deforestation may include drought, forest fires, and climate change. Although deforestation meets some human needs, it also causes major problems, including social conflict, the extinction of plants and animals, and climate change. These challenges aren’t just local. Deforestation also has global impacts.

Where are the World's Forests Located?

Tropical forests span both sides of the Equator, thriving in the warm, usually wet, climate, under the Sun’s most direct rays. Boreal forests are found across the high latitudes of all land areas in the Northern Hemisphere.



This image shows land cover through a color-coded classification. There are 17 types of land cover, ranging from evergreen needleleaf forest to tundra. Water is depicted in light blue. Credit: NASA GSFC

How Do Deforestation Events Occur?

Video: North American Forest Dynamics Dataset

North American Forest Dynamics Dataset | https://www.youtube.com/watch?v=rR6gxF9waQE | Source: NASA Goddard

Intentional Deforestation of Tropical Forests

The biggest direct cause of tropical deforestation is turning the land into cropland and pasture. Countries build roads to improve the transportation of goods. The road development itself causes some deforestation. The new roads also provide entry to land that could not be accessed before. Logging often comes after the new roads. In some cases, it is the reason the roads were built. When loggers have harvested all the wood in an area, they move on. The roads and the logged areas attract settlers. The settlers destroy the remaining forest for cropland or cattle pasture.

Government policies to encourage economic growth, like road projects, have caused significant, unintentional deforestation. Global economic factors can also encourage deforestation. These include things like foreign debt or expanding global markets for rainforest timber and pulpwood.

Droughts

As global temperatures continue to rise, droughts are expected to become more frequent and severe in many regions during this century. A new study with NASA participation finds that land ecosystems took longer to recover from droughts in the 20th century. Incomplete drought recovery may become the new normal in some areas, possibly leading to tree death, loss of forest cover, and increased emissions of greenhouse gases.

Forest Fires

Intentional fires get out of control and burn through the understory of nearby forests, killing, but not completely burning small trees, vines, and shrubs. The dead and dying trees collapse, spilling firewood and kindling to the ground and ripping a great tear in the tent of the forest overhead. In the past, thousands of deliberately set forest fires have raged out of control in Indonesia, Brazil, and Mexico, burning millions of hectares of rainforest.

Climate Change

Changes in temperature and rainfall/snowfall affect the health of forests. Many trees in the Western U.S. are already suffering from climate change. With warmer, drier conditions in the region, pine trees are more likely to become infected with insects. These bugs bore into the trees and lay their eggs. Eventually, they kill the tree. Some forests in the West have lost over half their trees already to pine beetles. When the forest is gone, birds and small mammals that lived there have to find new homes--if they can.

Examples of Deforestation & Forest Disturbances

1. Rondônia in western Brazil

Video: International Deforestation Patterns in Tropical Rainforests

International Deforestation Patterns in Tropical Rainforests | https://www.youtube.com/watch?v=6AVkjJKK3iE | Source: NASA Video

2. Peru

Video: Deforestation in Peru

Deforestation in Peru | https://www.youtube.com/watch?v=OBpgo7KxCCk | Source: U.S. Geological Survey

2. Southeast US & Brazil areas are analyzed by NAS Scientist.

Video: NASA | When Trees Fall, Landsat Maps Them

NASA | When Trees Fall, Landsat Maps Them | https://www.youtube.com/watch?v=5XFS_oCETaw | Source: NASA Goddard

Impacts of Deforestation

Biodiversity

Although tropical forests cover only about 7 percent of the Earth's dry land, they probably hold about half of all species on Earth. Many species can only be found in small areas. This makes them more likely to die out. In addition, the forest that remains is more dangerous for the plants and animals still there.

Rainforest products are popular around the world. These include latex, cork, fruit, nuts, timber, fibers, spices, natural oils and resins, and medicines. Some of these products can be taken out of the forest in ways that do not cause harm to the environment. If the forests are destroyed, people will no longer be able to get those products.

Biodiversity matters for another reason: Plants and animals in the rainforest may hold the cures for diseases and ways to improve the food we produce. Many of these plants and animals may not have even been discovered yet.

Soils

With all the life in tropical forests, it can be surprising to learn that tropical soils are actually very thin.

These soils do not have a lot of minerals that plants need to grow, which means they are not ideal for growing crops. The soil comes from rock, and the rain in the tropics washes away its minerals over time. Nearly all the minerals of a tropical forest are in the living plants and the decomposing litter on the forest floor.

When an area is completely deforested for farming, the farmer typically burns what is left. The minerals in the soil are lost. In just a few years, soils often become unable to support crops. If the area is then turned into cattle pasture, it becomes nearly impossible for the forest to be restored.

Global Warming

Deforestation affects rainfall and temperature. Up to 30 percent of the rain that falls in tropical forests is water that the rainforest has recycled into the atmosphere. Water evaporates, condenses into clouds and falls again as rain. In addition to maintaining tropical rainfall, the evaporation cools the Earth's surface. Deforestation is likely to create a drier, hotter climate in the tropics. Tropical deforestation may also affect rainfall patterns far outside the tropics.

Deforestation can also turn the tropics into a larger source of carbon emissions, which increases the greenhouse effect and global warming. The trees and plants in the forests contain a lot of carbon. Through photosynthesis, they use carbon dioxide and store carbon in their stems and leaves. Carbon dioxide escapes back into the atmosphere when these stems and leaves decay. But when people clear the forests, more carbon returns to the atmosphere.

Why Does NASA Study Deforestation?

NASA supports and conducts research on tropical forests from space-based and ground-based perspectives, helping provide the information that national and international leaders need to develop strategies for sustaining human populations and preserving tropical forest biodiversity.

Measurements of global vegetation are valuable to scientists because they provide insight into the carbon cycle. Scientists use vegetation measurements to determine the planet's net primary productivity: how much carbon is being used by the plants to grow. Carbon cycles through the oceans, soil and rocks, plants on land and in the ocean, and atmosphere. The buildup of carbon dioxide released into the atmosphere by burning fossil fuel is the primary cause of global warming. The global biosphere has been helping to offset some of the excess carbon dioxide people have been pumping into the atmosphere.

Video: Tracking Amazon Deforestation

Tracking Amazon Deforestation | https://www.youtube.com/watch?v=c4-KpR1HrNs | Source: NASA Goddard

NGSS Three Dimensional Learning

Crosscutting Concepts

- Patterns
- Cause and Effect
- Scale, Proportion, and Quantity
- Stability and Change