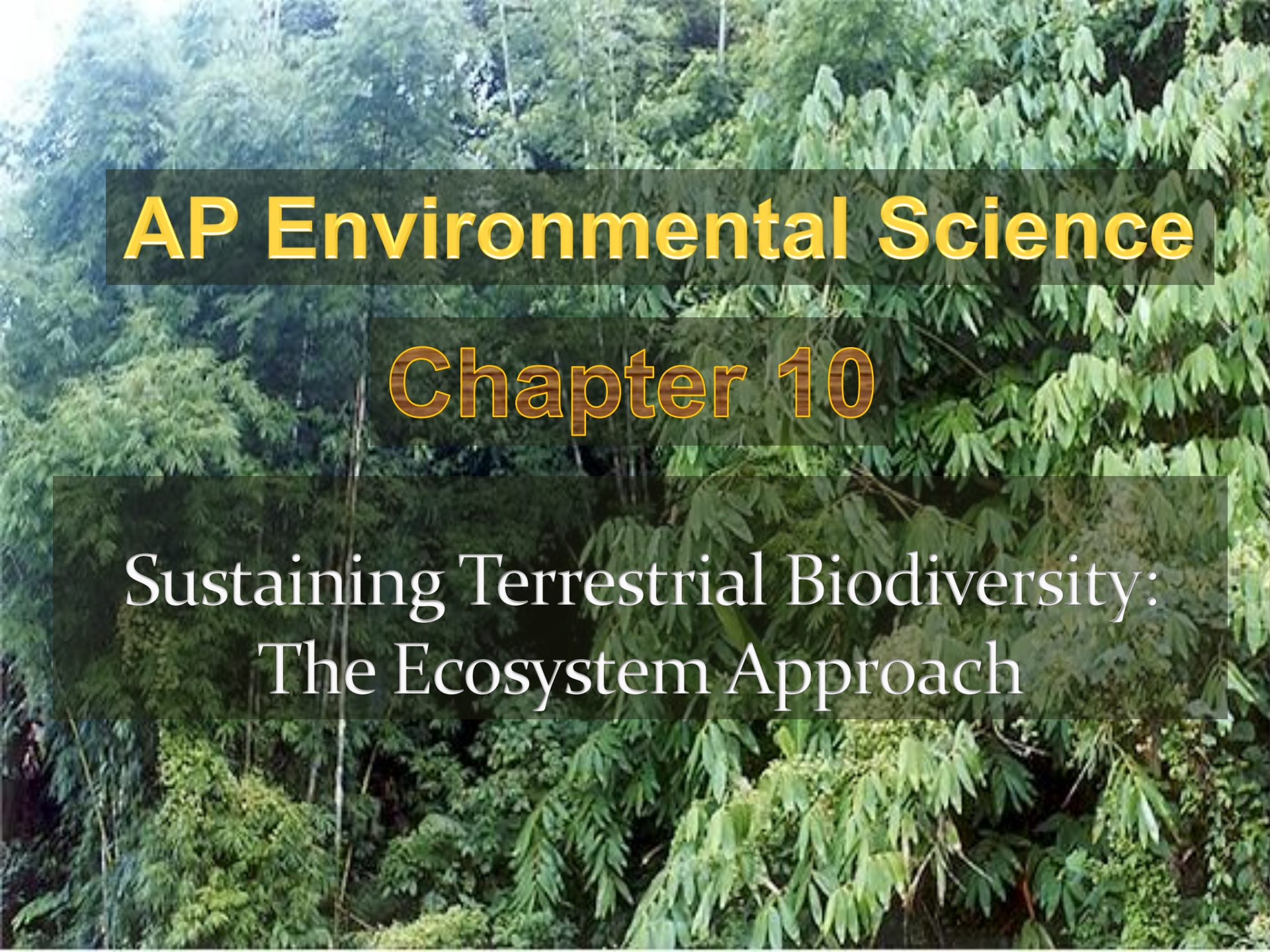


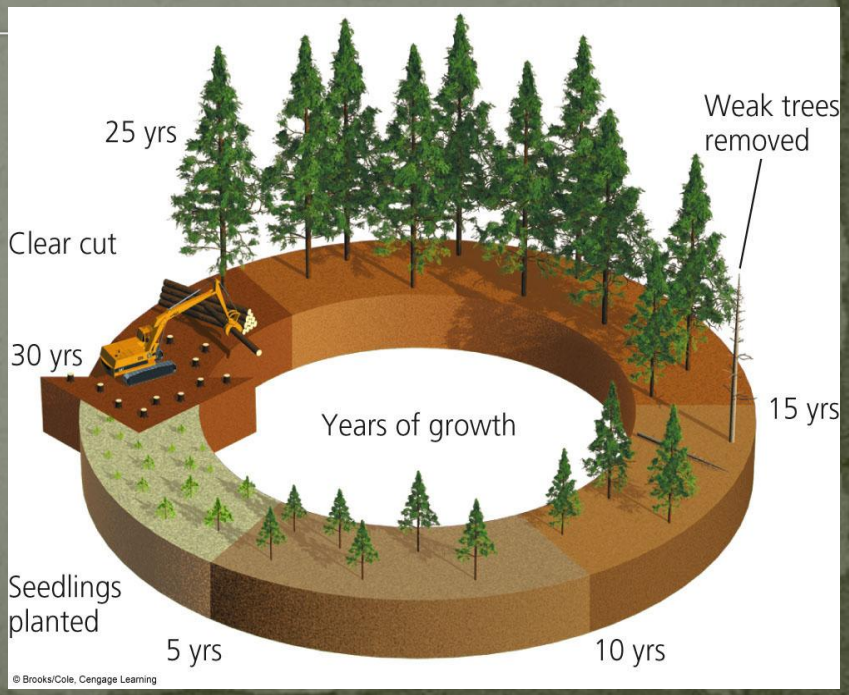
AP Environmental Science

Chapter 10

Sustaining Terrestrial Biodiversity: The Ecosystem Approach

10-1 What are the Major Threats to Forest Ecosystems

- **Forest vary in Their Make-Up, Age and Origins**
  - **Natural Forests 2 Major Types:**
    - **Old-Growth Forest -** an uncut or regenerated primary forest that has not been seriously disturbed by human activities or natural disasters for 200 years or more.
    - **Second-Growth Forest -** a stand of trees resulting from secondary ecological succession. Develop after an area has been removed by human activities or natural disasters.
      - **Tree Farm – (plantation)** a managed tract of trees that are clear-cut , harvested and then replanted continuously.



- **According to 2007 estimates the world's forests are broken down:**
  - **60 % second-growth**
  - **36% Old or Primary growth**
  - **4 % tree farms**

- **Forests provide Important Economic and Ecological Services**
  - photosynthesis – removing CO_2 and storing it as biomass.
  - help stabilize earth's temp (slow global warming)
  - site of many derived medicines or drugs
  - home to 2/3 of earth's terrestrial species
  - home to 300 million people

NATURAL CAPITAL

Forests

Ecological Services

- Support energy flow and chemical cycling
- Reduce soil erosion
- Absorb and release water
- Purify water and air
- Influence local and regional climate
- Store atmospheric carbon
- Provide numerous wildlife habitats

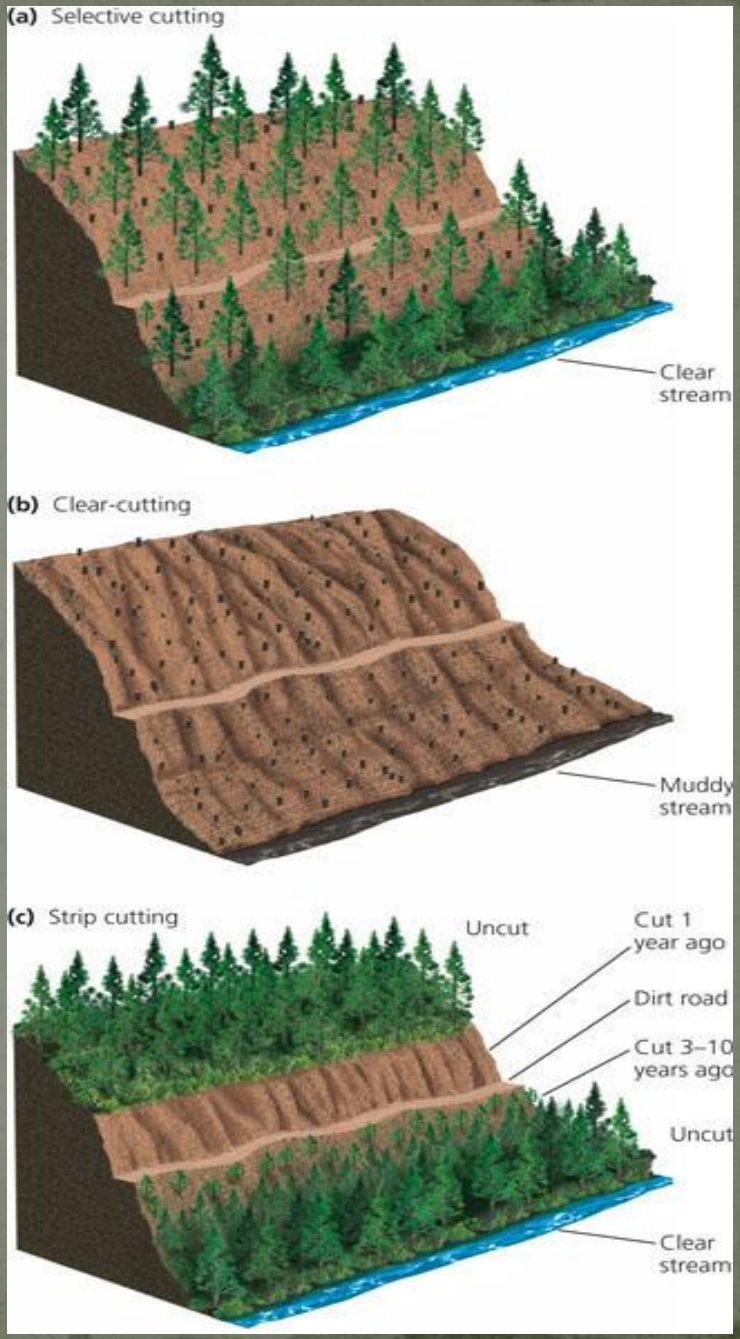
Economic Services

- Fuelwood
- Lumber
- Pulp to make paper
- Mining
- Livestock grazing
- Recreation
- Jobs

Unsustainable Logging is a Major Threat to Forest Ecosystems

- **Problems Include:**
  - * Roads built to reach trees (Habitat Fragmentation)
  - * Access by others from the new roads to these areas
  - * Invasion of nonnative pests, diseases and wildlife
  - * Over harvesting

- **Types of Harvesting:**
  - **Selective Cutting -** intermediate or mature trees are cut singly or in small groups
  - **Clear Cutting** - loggers remove all the trees from an area
  - **Strip Cutting** - type of clear cutting that only remove strips allowing regeneration.



TRADE-OFFS

Clear-Cutting Forests

Advantages

Higher timber yields

Maximum profits in shortest time

Can reforest with fast-growing trees

Good for tree species needing full or moderate sunlight

Disadvantages

Reduces biodiversity

Destroys and fragments wildlife habitats

Increases water pollution, flooding, and erosion on steep slopes

Eliminates most recreational value

Fire, Insects and Climate Change can Threaten Forests

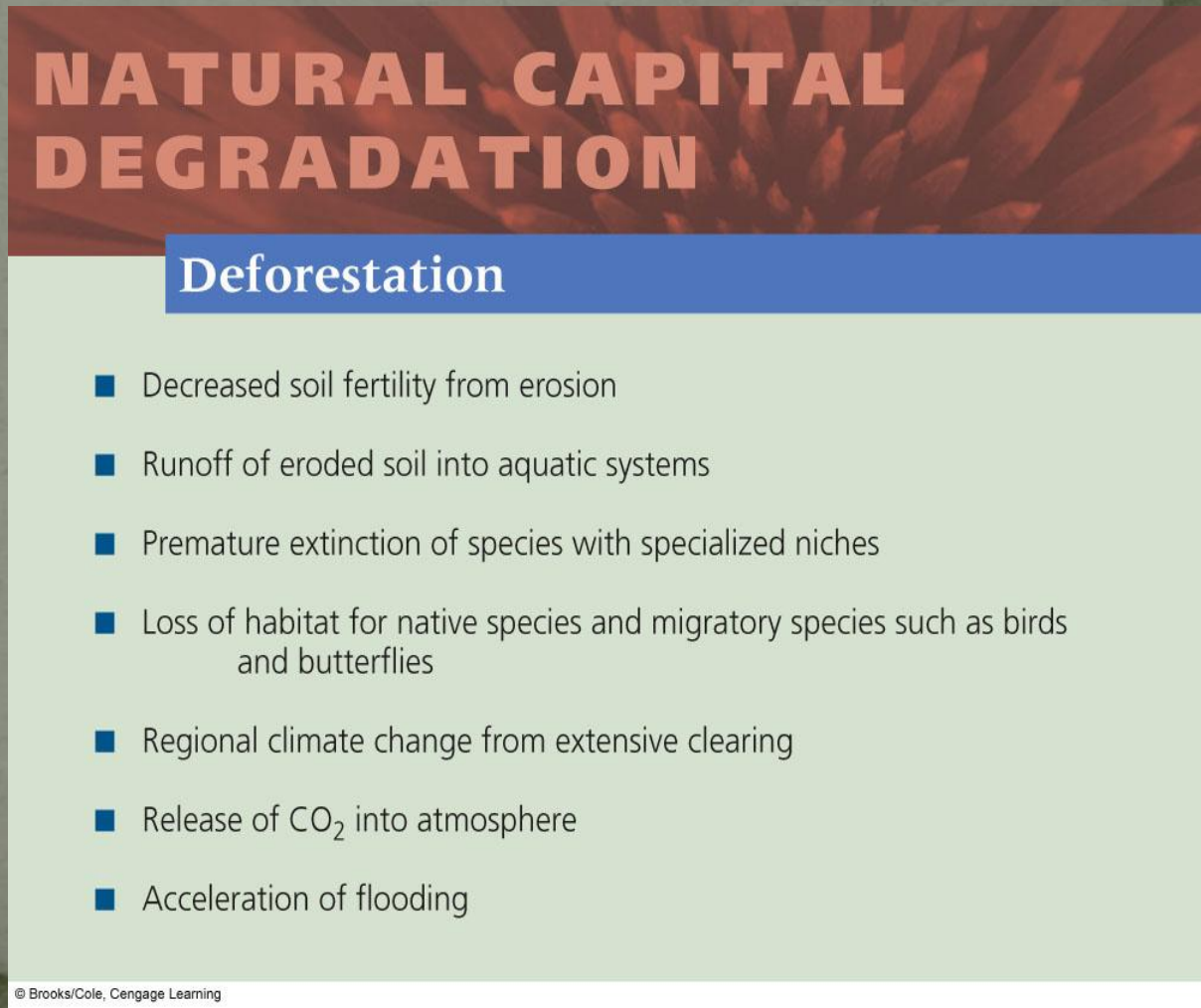
- **Fire Types:**
  - * **Surface Fires –** usually burn only undergrowth and leaf litter on the forest floor. (may kill seedlings but spare most of the mature trees)
  - * **Crown Fires -** extremely hot; leaps to treetops and burns whole trees

Major Threats to Forest Ecosystems

- **Accidental or Deliberate introduction of foreign diseases & insects are a major threat.**
  - **Harm =** cause serious damage to certain trees
  - **Ways to Help**
    - ban imported timber,
    - remove diseased trees,
    - develop tree species that are genetically resistant to disease,
    - insect control
      - pesticides or
      - biological control - bug eat bug
- **Final threat is global warming; rising temps cause unfavorable environment!**

- **We have Cut Down almost Half of the World's Forests**
  - **Deforestation –** the temporary or permanent removal of large expanses of forests for agriculture, settlements, or other uses.
    - **Most of the World's 46% loss of original forests have come in the last 60 years!** (Most of these losses are coming from developing countries like: Latin America, Indonesia & Africa) 130,000 square kilometers per year.

- **Tropical Forests are Disappearing Rapidly**
- Tropical forests cover 6% of Earth's land today but it is thought they once covered twice as much as that.
- Majority of the loss has come since 1950 with places like Brazil and Indonesia leading the way in loss.
- Studies indicate that at least half of the world's known species of terrestrial plants & animals live in these forests.



NATURAL CAPITAL DEGRADATION

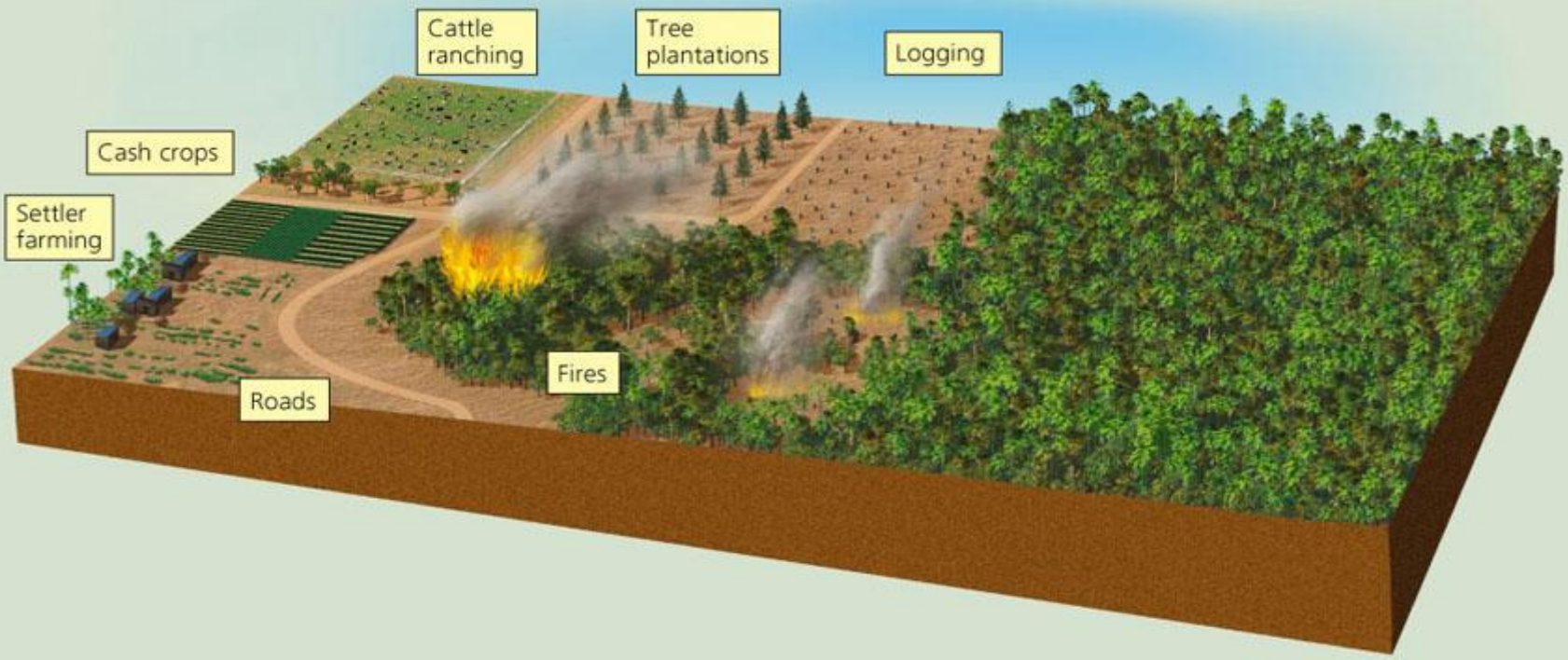
Major Causes of the Destruction and Degradation of Tropical Forests

Basic Causes

- Not valuing ecological services
- Crop and timber exports
- Government policies
- Poverty
- Population growth

Secondary Causes

- Roads
- Fires
- Settler farming
- Cash crops
- Cattle ranching
- Logging
- Tree plantations



• 10-2 How Should we Manage & Sustain Forests?

SOLUTIONS

Sustainable Forestry

- Identify and protect forest areas high in biodiversity
- Rely more on selective cutting and strip cutting
- No clear-cutting on steep slopes
- No logging of old-growth forests
- Sharply reduce road building into uncut forest areas
- Leave most standing dead trees and fallen timber for wildlife habitat and nutrient recycling
- Plant tree plantations primarily on deforested and degraded land
- Certify timber grown by sustainable methods
- Include ecological services of forests in estimating their economic value

- **We can improve the management of Forest Fires:**
  - work to eliminate bad fires and better control prescribed fires.

- **We can reduce the Demand for Harvested Trees**
  - up to 60% of the wood consumed in the U.S. is wasted unnecessarily.
  - Inefficient construction, excess packaging, junk mail, improper paper recycling, failure to reuse, etc…

- **Governments & Individuals can act to Reduce Tropical Deforestation**

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•<u>One Solution</u> = use fast growing Kenaf to replace current tree dependant paper. within 20-30yrs

SOLUTIONS

Sustaining Tropical Forests

Prevention

Protect the most diverse and endangered areas

Educate settlers about sustainable agriculture and forestry

Subsidize only sustainable forest use

Protect forests with debt-for-nature swaps and conservation concessions

Certify sustainably grown timber

Reduce poverty

Slow population growth

Restoration

Encourage regrowth through secondary succession

Rehabilitate degraded areas

Concentrate farming and ranching in already-cleared areas

- **10-3 How Should We Mange and Sustain Grasslands?**
- **Some Rangeland are Overgrazed**
  - **Rangelands =** unfenced grasslands in temperate and tropical climates that supply forage or vegetation for grazing animals. (Cattle, sheep and goats graze about 42% of the world's grassland).
    * **Pasture** = managed grassland or enclosed meadow for foraging animals.
    * **Overgrazing =** when too many animals graze for too long and exceed the carrying capacity of a rangeland area.
      * Other problems caused by it: reduction of grass, exposure to soil erosion by wind or water, compacts soil, and increased susceptibility of invasive species.
- **We can Manage them more sustainably:**
  * Control #'s of animals and duration of grazing.
  * Rotational Grazing
  * Control invading species
  * Replant barren areas

- **10-4 How Should we Manage and Sustain Parks and Nature Reserves?**
- **National Parks face many Environmental Threats**
  - *** 1,100 major national parks found in more than 120 countries.** (However most of these are too small to sustain a lot of large animal species and many suffer from invasions of nonnative species.
  - * **the parks found in developing countries contain the greatest biodiversity.** (but only 1% of them are protected)
- **<u>Problems Include:</u>**
  - **illegal entry in search of wood, crop land, game animals, and other natural products.**
  - **loggers, miners operate illegally**
  - **poachers**
  - **most park services are under funded and can't protect them properly**

*Damage from off-road vehicles (recreation)

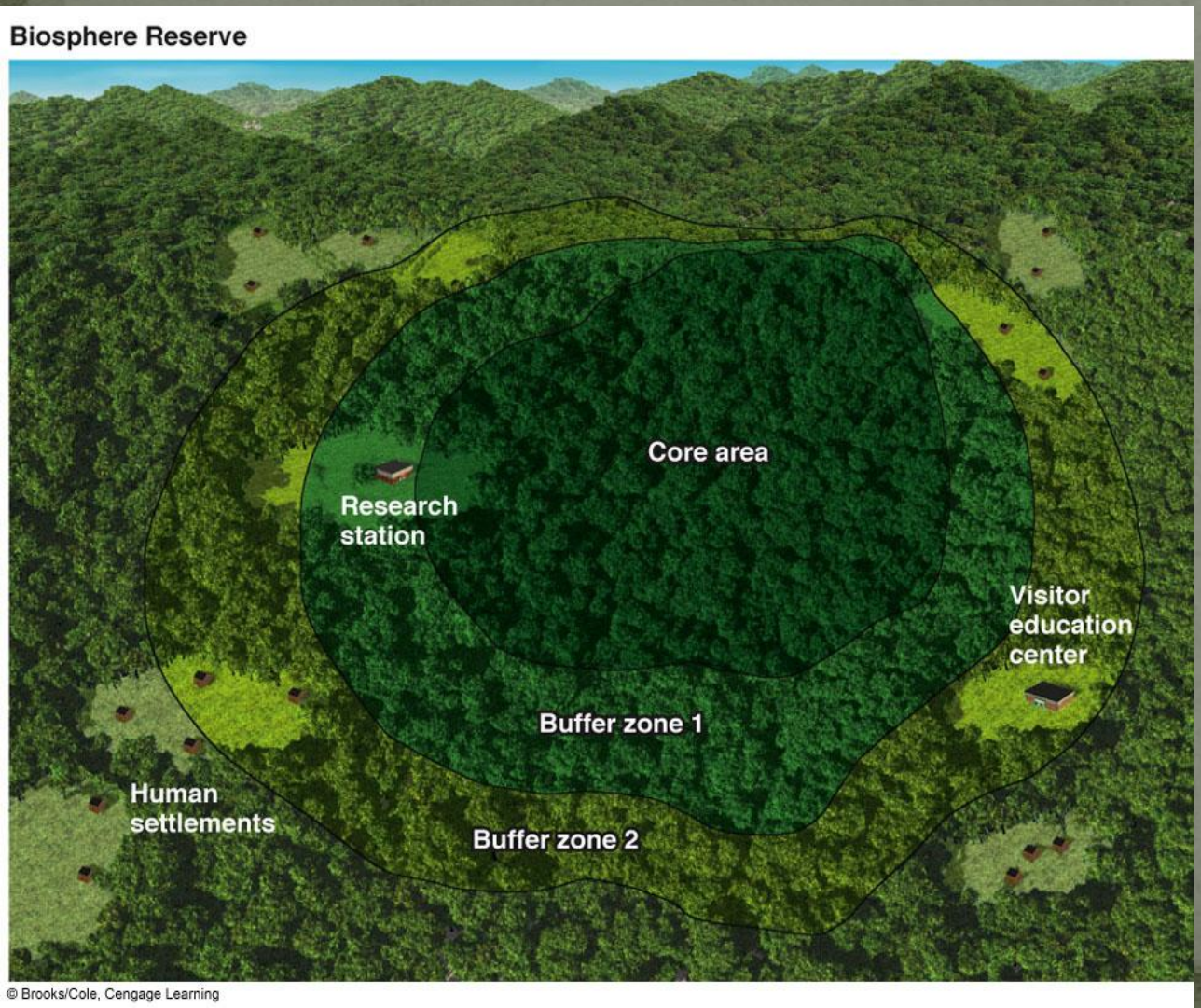
SOLUTIONS

National Parks

- Integrate plans for managing parks and nearby federal lands
- Add new parkland near threatened parks
- Buy private land inside parks
- Locate visitor parking outside parks and provide shuttle buses for people touring heavily used parks
- Increase federal funds for park maintenance and repairs
- Raise entry fees for visitors and use resulting funds for park management and maintenance
- Seek private donations for park maintenance and repairs
- Limit the number of visitors in crowded park areas
- Increase the number of park rangers and their pay
- Encourage volunteers to give visitor lectures and tours

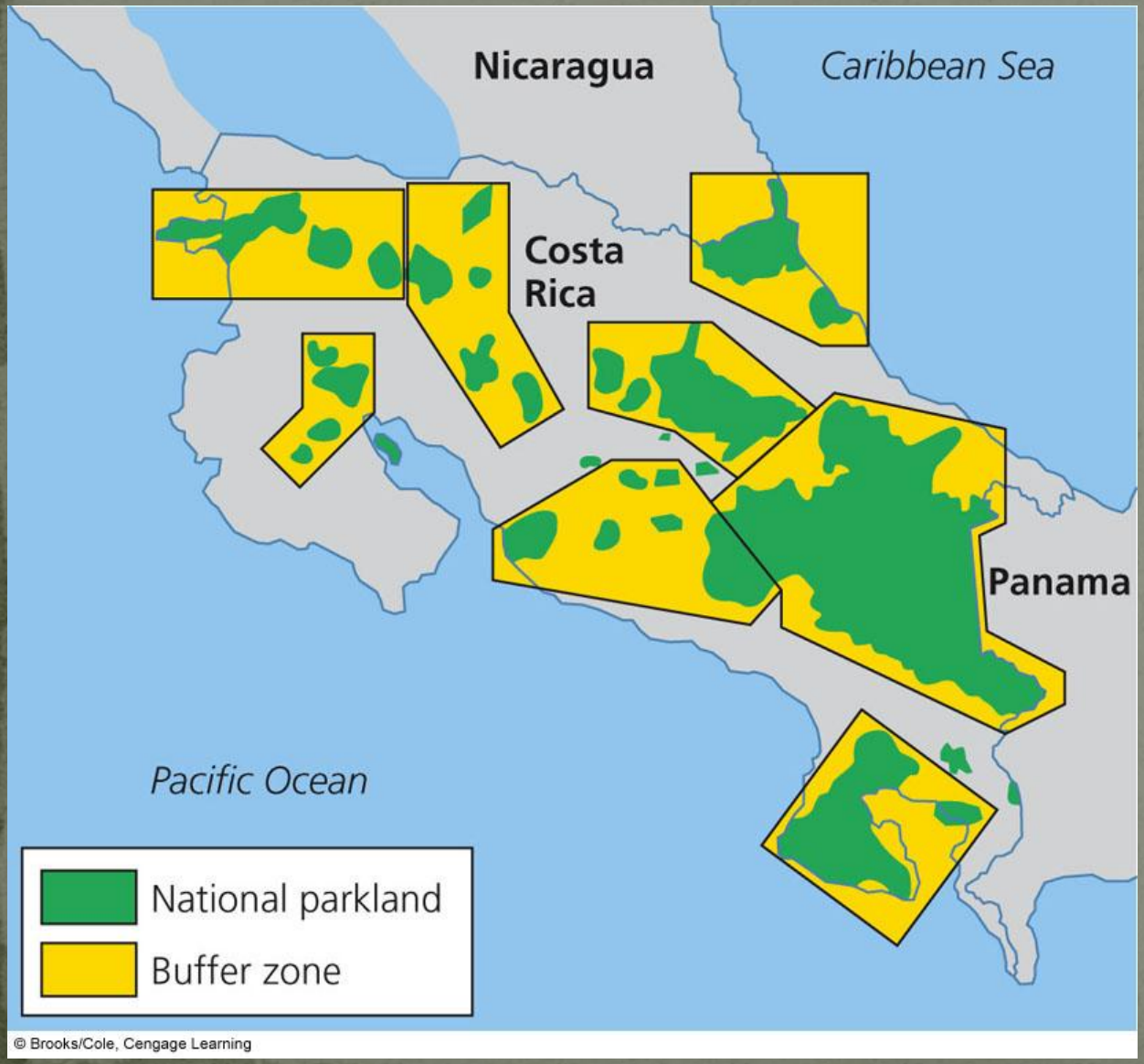
- **Currently, only 12% of the earth's land area is protected strictly or partially in nature reserves, parks, wildlife refuges, wilderness, and other areas. (5% strictly protected)**
- **95% must be reserved for Human Use!**

- **Designing & Connecting Nature Reserves**
- **Ways Include:**
  - **Buffer zones –** to design & manage reserves by protecting the inner core by two buffer zones in which locals can extract resources from sustainably without harming inner core. (win, win approach)



- **Habitat Corridors -** between isolated reserves helps to support more species and allows migration by vertebrates that need large ranges.
- <u>Problem</u> – they can also allow movement of pest species.

- **Protecting Wilderness is an Important Way to Preserve Biodiversity**
  - **One way is by legally taking undeveloped land and setting it aside from human exploitation, a.k.a. *wilderness***

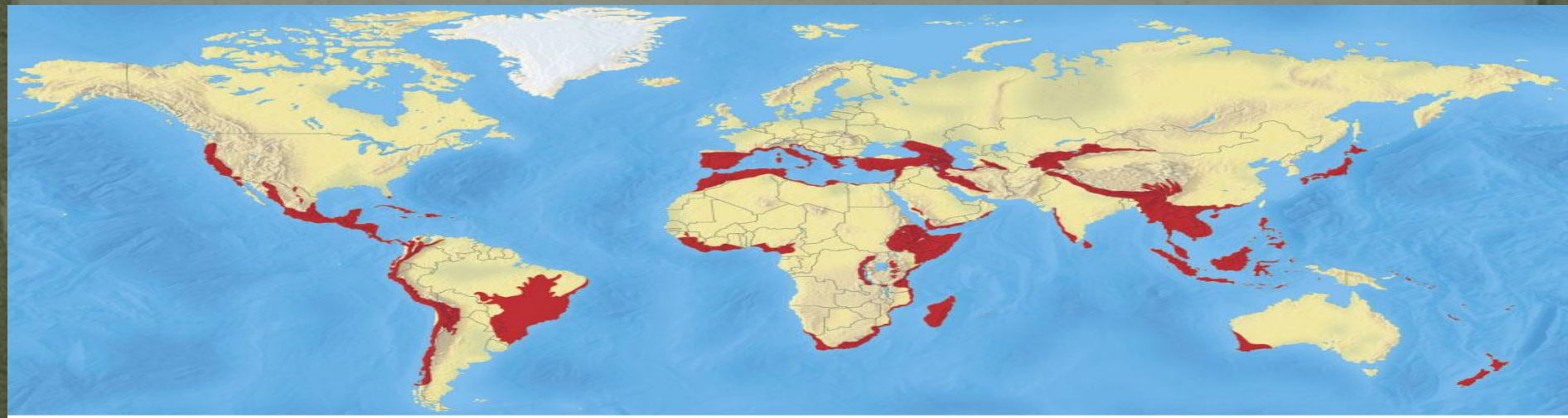


Example by Costa Rica:

•Green areas are protected reserves & Yellow are buffer zones!

• In the **U.S**. the "Wilderness Act in 1964 allowed for protected land to increase tenfold from 1970-2007.

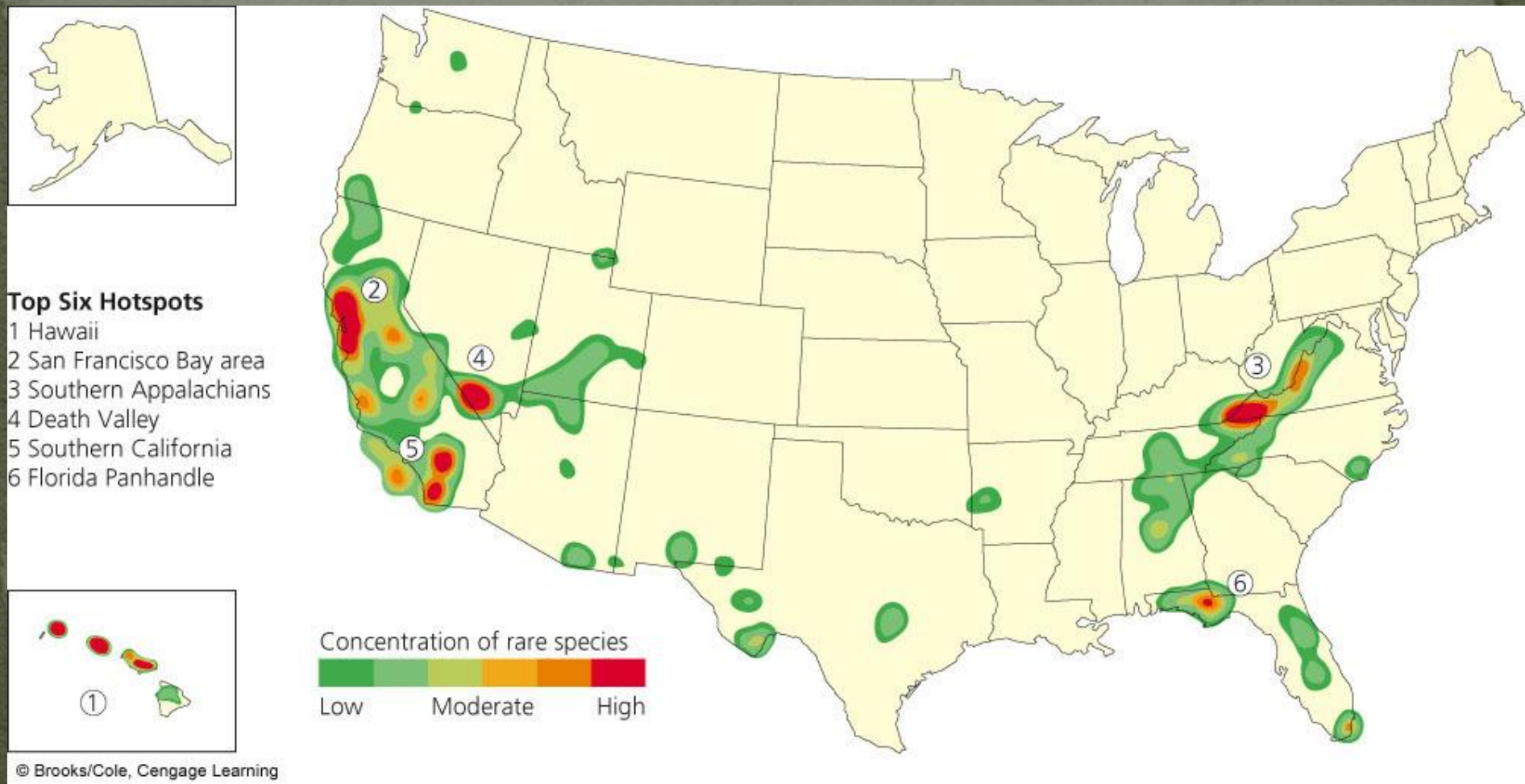
- **10-5 What is the Ecosystem Approach to Sustaining Biodiversity?**
- **We can use a 4-point Strategy to Protect Ecosystems:**
  - Map global ecosystems and create an inventory of the species contained in each of them and the ecosystem services they provide.
  - Locate and protect the most endangered ecosystems and species, with emphasis on protecting plant biodiversity and ecosystem services.
  - Seek to restore as many degraded ecosystems as possible.
  - Make development biodiversity-friendly by providing significant financial incentives (such as tax breaks and write-offs) and technical help to private landowners who agree to help protect endangered ecosystems.
  - **Protecting HotSpots is Urgent!**
    * to protect as much of the earth's remaining biodiversity as possible, we need emergency action strategies to identify and quickly protect ***Biodiversity Hotspots***



- **Protecting Ecosystem Services is also an Urgent Priority**

* 2005 UN Millennium Ecosystem Assessment (4 yr study); pointed out that 62% of the earth's natural services in various ecosystems around the world are degrading or overused.

* It outlined ways to help sustain these vital ecosystem services for human and nonhuman life. Example: Identifying <u>life – raft ecosystems</u>



- **We can Rehabilitate and Restore Ecosystems that we have Damaged**
  - **Ecological Restoration -** process of repairing damage caused by humans to biodiversity and dynamics of natural ecosystems.
    * Examples: replanting forests, wetlands, and stream banks
  - **Approaches:**
    - **Restoration –** returning a particular habitat or ecosystem to a condition as similar as possible to its natural state.
    - **Rehabilitation** - turning degraded ecosystems into functional or useful ecosystems without trying to restore its original condition.
    - **Replacement** – replacing a degraded ecosystem with another type of ecosystem. Tree plantation on a degraded forest example.
    - **Creating artificial ecosystems** – example; creating artificial wetlands to help reduce flooding or to treat sewage.

- **4 – Point Strategy to carry out most forms of ecological approaches:**
  - Identify what caused the degradation
  - Stop the abuse by eliminating or reducing these factors.
  - If necessary, reintroduce species – especially pioneer, keystone or foundation species, to help restore natural ecological processes.
  - Protect the area from further degradation
  - **Will Restoration Encourage Further Destruction?**
    * this suggests that a problem we cause can be undone; not always the case!
  - **We Can Share areas we Dominate with Other Species**
    * Reconciliation or Applied Ecology = this science focuses on inventing, establishing and maintaining new habitats to conserve species diversity in places where people live, work or play. "Sharing"
    - **This would involve Community-Based Conservation!**
      - Example – creating a black howler museum in Belize allowed farmers to help protect the species and also bring in ecotourism and revenue.

WHAT CAN YOU DO?

Sustaining Terrestrial Biodiversity

- Adopt a forest
- Plant trees and take care of them
- Recycle paper and buy recycled paper products
- Buy sustainably produced wood and wood products
- Choose wood substitutes such as bamboo furniture and recycled plastic outdoor furniture, decking, and fencing
- Help to restore a nearby degraded forest or grassland
- Landscape your yard with a diversity of plants natural to the area