



## Chapters 12 & 13: Land Use

[Tasso Azevado: Brazil Rainforest Ted Talk](#)



## Central Case: Battling over the last big trees

- In 1993, protestors blocked loggers from cutting ancient trees on Vancouver Island, British Columbia
  - Most of Canada's old-growth temperate rainforest is already gone
  - 20% of the jobs depends on the timber industry

Both sides struck a deal allowing environmentally friendly practices and encouraging ecotourism



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## Land is generally broken up into two general categories:

**Urban**

- Contains 2,500 or more people.
- Has a government or city council.

**Rural**

- Few people.
- Large open spaces.

## Resource Management.....

- Is harvesting resources in a way that doesn't deplete them

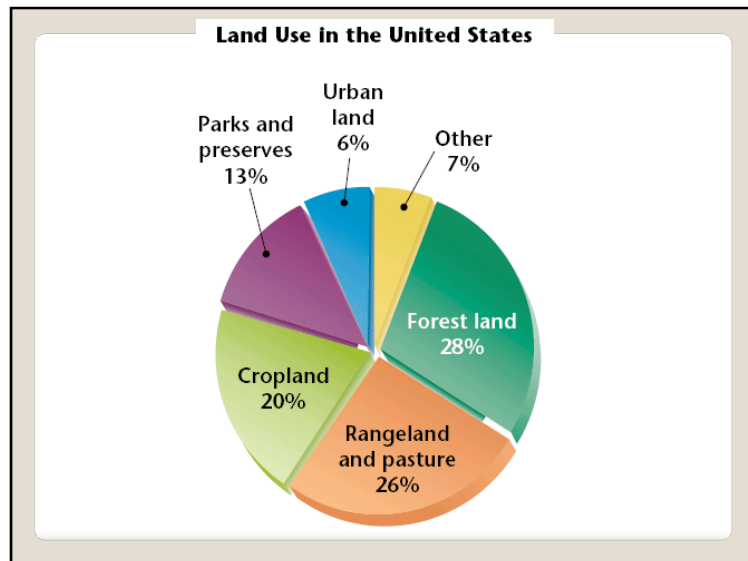
Examples of Ecosystem Services
purification of air and water
preservation of soil and renewal of soil fertility
prevention of flood and drought
regulation of climate
maintenance of biodiversity
movement and cycling of nutrients
detoxification and decomposition of wastes
aesthetic beauty

### Primary Land-Use Categories

Rangeland	Land used to graze livestock and wildlife.
Forest land	Land used for harvesting wood, wildlife, fish, nuts, and other resources.

### Primary Land-Use Categories

Cropland	Land used to grow food and fiber.
Parks and preserves	Land used for recreation and scenic enjoyment and for preserving native animal and plant communities and ecosystems
Wetlands, mountains, deserts, etc.	Land that is difficult to use for human purposes
Urban land	Land that is used for houses, businesses, industry, and roads.



# Resource management

## Maximum Sustainable Yield

- extraction of the maximum amount of a resource w/o depleting the resource from one harvest to the next
- Favors keeping populations at intermediate levels

The graph shows population size on the y-axis and time on the x-axis. A red curve starts at a low point, rises through a 'Fastest growth' phase, and then levels off at a 'Carrying capacity' (Population size in the absence of harvesting). A horizontal dashed line marks the carrying capacity. A vertical line indicates the 'Managers harvest at this population size to obtain maximum sustained yield', which is at a level below the carrying capacity. The growth rate is labeled as 'Slow growth' at both the beginning and end of the curve.

*Reducing populations so drastically affects other species and can change the entire ecosystem*

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- **Ecosystem-base management** - manages resources in a way that minimizes impact on whole ecosystems; difficult to implement since ecosystems are so complex

**Adaptive management** - tests different techniques and aims to improve methods over time; may be complicated and time-consuming and draw resistance

# Forest Management

## Forests...

- Cover 30% of Earth's land surface
- Most are boreal forests or tropical rainforests
- Provide many different niches for forest life, help prevent erosion, regulate the water cycle, slow runoff, prevent floods, purify water, regulate the climate, provide economic goods

Function	Percentage
Timber production	34.1%
Multiple purposes	33.8%
Biodiversity conservation	11.2%
Soil and water protection	9.3%
Unspecified function	7.8%
Social services	3.7%

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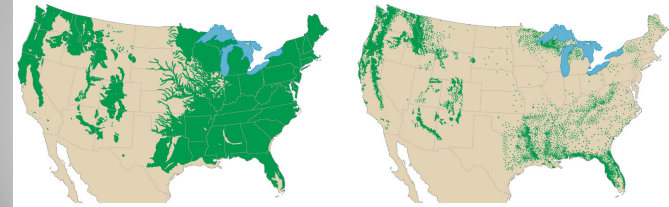
## Deforestation



- Clearing and loss of forests
- Impacts greatest in.....
  - tropical areas due to loss of biodiversity
  - arid regions due to desertification
- Contributes to global climate change due to less trees available to take in CO<sub>2</sub>
- Occurring fastest in developing countries to make room for high population #s, better economies, and for fuel

## Growth of U.S. fed by deforestation:

- **Primary forest** = natural forest uncut by people
  - Little remained by the 20th century
- **Second-growth trees** = grown to partial maturity after old-growth timber has been cut



(a) 1620: Areas of uncut forest

(b) 1920: Areas of uncut forest

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Matthias Klum, *Stavros*, 2008. A bird's-eye view offers indisputable evidence of environmental destruction as timber and tropical forest trees are harvested by forest of land managers to the old fields over. The probability of palm oil has with the crop growing within an area of the island.


## Timber

- Fear of "timber famine" led to many public forest reserves set aside for new growth to prevent future scarcities of lumber
- U.S. Forest Service set up the national forest system with 77 million ha across the country and manages logging and sales on these public lands
- Most logging in U.S. takes place on private land owned by timber companies
- Timber harvesting has stabilized over the past 40 years and growth is exceeding removal in many areas ☺, except on private land owned by timber companies ☹




## Harvesting Methods



- **Even-aged stands:** single-species monoculture planted at same time, harvested at same time, and replaced with new seedlings (viewed as a type of agriculture rather than an actual forest)



- **Uneven-aged stands:** mix of different species at different ages and more similar to a natural forest



## Harvesting Methods

Clear-cutting	Selective cutting
 <ul style="list-style-type: none"> <li>• <b>Clear-cutting:</b> all trees in an area are cut; cost efficient, but most damaging</li> </ul>	 <ul style="list-style-type: none"> <li>• <b>Selective cutting:</b> middle-aged or mature trees are cut leaving young ones to continue to grow; allows uneven-aged management; disliked by most timber companies</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Seed-tree/shelterwood approach:</b> few seed-producing trees are left to reseed area or provide shelter for new seeds to grow</li> </ul>	

## Public forests managed for many things

- **The National Forest Management Act (1976)** = Mandated that resource management plans had to be drawn up for every national forest (managed by [U.S. Forest Service](#))
- **Multiple use policy** = national forests were to be managed for recreation, habitat, minerals and other uses
  - In reality, timber production is the primary use




## Fire policy stirs controversy

- For over 100 years, the Forest Service suppressed all fires
  - But many ecosystems depend on fires
  - Fire suppression allows woody accumulation, which produces kindling for future fires
    - Which are much worse
- Housing development near forests and climate change will increase fire risk




## Prescribed fires are misunderstood

- **Prescribed (controlled) burns** = burning areas of forests under carefully controlled conditions
  - public misunderstanding and political interference come from fear that fires could get out of control
- **Healthy Forests Restoration Act (2003)** = promotes removal of small trees, underbrush and dead trees
  - Passed in response to severe forest fires

## Salvage logging

- Removal of dead trees following a natural disturbance
- Seems logical, but is really destructive
  - **Snags** (standing dead trees) provide nesting cavities for countless animals
  - Removing timber from recently burned areas increases erosion and soil damage
  - Increases commercial logging in national forests



## Sustainable forestry is gaining ground

- **Sustainable forestry certification** = only products produced sustainably can be certified



*International Organization for Standardization (ISO), Forest Stewardship Council (FSC)* have different standards

Consumers look for logos to buy sustainably produced timber

- Encourages better logging practices





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## Agricultural land use

- Agriculture covers 38% of the Earth's terrestrial surface
  - 26% supports pasture, 12% supports crops
  - Governments spend billions of dollars on subsidies
  - Proponents say farmers need this insurance against bad years
  - Critics say farmers should buy their own insurance



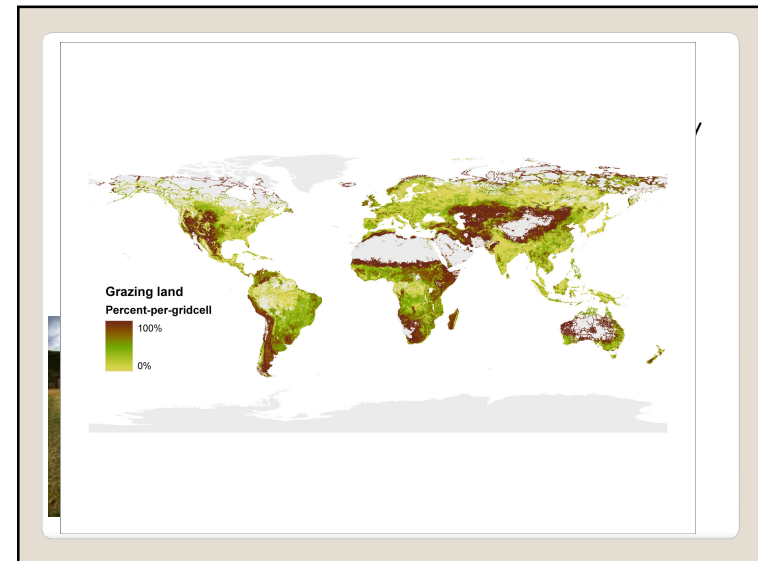
- Many crop lands grow on former wetlands
- Governments encouraged wetland draining in past to promote settlement and farming
- Less than half the wetlands remain
- Many people now view wetlands as valuable ecosystems

## Wetlands have been drained for farming





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- **Conservation Reserve Program (1985)** subsidized farmers to take highly erodable land out of production



## Parks and reserves

- Reasons for establishing parks and reserves include:
  - **Monumentalism** = preserving areas with enormous, beautiful or unusual features, such as the Grand Canyon
  - recreational value
  - Protect areas with utilitarian benefits, such as clean drinking water
  - Use sites that are otherwise economically not valuable and are therefore easy to protect
  - Preservation of biodiversity

## Federal parks & reserves began in U.S.

- **National parks** = public lands protected from resource extraction and development
  - Yellowstone National Park was established in 1872
- **The Antiquities Act of 1906** = president can declare selected public lands as national monuments
- Nat'l Park Service = Created in 1916 to administer parks and monuments






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## National Wildlife Refuges

- Begun in 1903 by President Theodore Roosevelt
- 37 million ha in 541 sites
- U.S. Fish and Wildlife Service administers refuges
  - Management ranges from preservation to manipulation
  - Allows hunting, fishing, wildlife observation, photography, education



## Wilderness areas



- **Wilderness areas** = area is off-limits to development of any kind  
Wilderness Act est. in 1964
  - Open to the public for hiking, nature study, etc.
  - Must have minimal impact on the land
  - Opposed by the **wise-use movement**: individuals/industries that oppose environ. protection; Farmers, ranchers, loggers, mineral and fossil fuel industries aim to protect private property, transfer federal lands to state or private hands, promote motorized recreation on public lands

## Nonfederal entities also protect land

- **Land trusts** = local or regional organizations that purchase land to protect it
  - The Nature Conservancy is the world's largest land trust with holdings in 50 states and Canada as well as Latin Am., Caribbean, and Asia; headquarters in VA



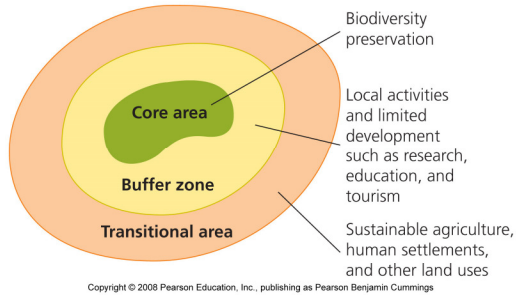
## Parks and reserves are increasing internationally

- Many nations have established national parks and benefit from ecotourism (cover 9.6% of land area)
- Parks do not always receive necessary funding (esp. in developing countries)
- **Transboundary park** = an area of protected land overlapping national borders
- **Peace parks** = transboundary reserves that help ease tensions by acting as buffers between nations
- **Biosphere reserves** = land with exceptional biodiversity
  - Couple preservation with sustainable development



## Biosphere reserves have several zones

- This can be a win-win situation for everyone



## Mining and Minerals



[Mining accident video](#)

## Surface mining control and reclamation act- 1977

- Legislation which...
  - limits amount of disturbance
  - Provides that the land must be reclaimed.
- Reclamation
  - Restoring land to the natural state after destruction associated with some economic activity
    - Surface mining



## We Use a Variety of Nonrenewable Mineral Resources

- **Mineral resource**
  - Fossil fuels
  - Metallic minerals
  - Nonmetallic minerals
- **Ore**
  - High-grade ore
  - Low-grade ore
- Ore extracted by mining
  - Ore mineral**
  - Gangue**
  - Smelting**



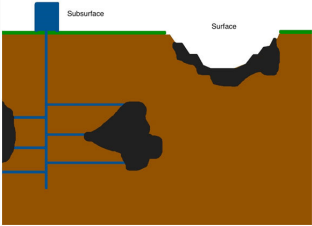
# Types of Mining

- Type of surface mining used depends on
  - Resource
  - Local topography

- Subsurface mining- mining for resources that are 100 m below Earth's surface.








Deep deposits removed

- Surface mining-method of mining used to extract minerals and metals near the surface of the Earth.



# Surface Mining vs Subsurface Mining

TABLE 8.2 Types of mining operations and their effects					
Type of mining operation	Effects on air	Effects on water	Effects on soil	Effects on biodiversity	Effects on humans
Surface mining	Significant dust from earth-moving equipment	Contamination of water that percolates through tailings	Most soil removed from site; may be replaced if reclamation occurs	Habitat alteration and destruction over the surface areas that are mined	Minimal in the mining process, but air quality and water quality can be adversely affected near the mining operation
Subsurface mining	Minimal dust at the site, but emissions from fossil fuels used to power mining equipment can be significant	Acid mine drainage as well as contamination of water that percolates through tailings		Road construction to mines fragments habitat	Occupational hazards in mine; possibility of death or chronic respiratory diseases such as black lung disease

Recycling

© Brooks/Cole, Cengage Learning


# Types of Surface Mining

Surface mining- removing minerals that are close to Earth's surface.


- Strip mining**- removing strips of soil and rock to expose ore.
- Open pit mining**- the creation of a large pit or hole in the ground that is visible from the surface.
- Mountain top removal**- removing the entire top of a mountain with explosives.
- Contour mining**- mining around the natural topographic features of a hill or mountain

Shallow deposits removed

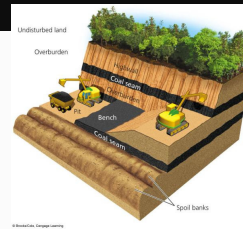
## Natural Capital Degradation: Open-Pit Mine in Western Australia



Strip mining



## Natural Capital Degradation: Contour Strip Mining Used in Hilly or Mountainous Region



Mountaintop removal



[Video Clip](#)

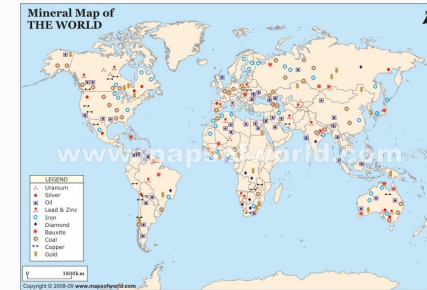
## Mineral Use Has Advantages and Disadvantages

- Advantages
  - Converting minerals into useful products
- Disadvantages
  - Use of mercury
  - Damage to streams
  - Soil erosion
  - Habitat fragmentation and destruction
  - Large amounts of solid waste



## Mineral Resources Are Distributed Unevenly (1)

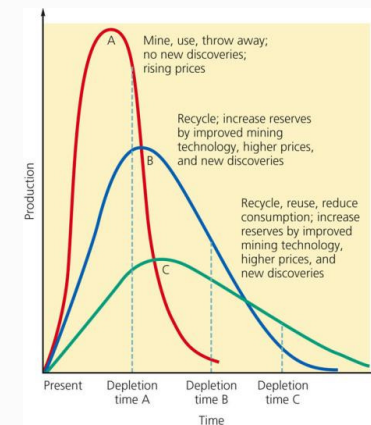
- Most of the nonrenewable mineral resources supplied by
  - United States
  - Canada
  - Russia
  - South Africa
  - Australia
- **Strategic metal resources**
  - Manganese (Mn)
  - Cobalt (Co)
  - Chromium (Cr)
  - Platinum (Pt)



## Supplies of Nonrenewable Mineral Resources Can Be Economically Depleted

- Future supply depends on
  - Actual or potential supply of the mineral
  - Rate at which it is used
- When it becomes **economically depleted**
  - Recycle or reuse existing supplies
  - Waste less
  - Use less
  - Find a substitute
  - Do without

## Natural Capital Depletion: Depletion Curves for a Nonrenewable Resource



## Solutions: Sustainable Use of Nonrenewable Minerals

- Do not waste mineral resources
  - Recycle and use 60-80 % of minerals
  - Include the harmful environmental costs of mining
  - Reduce mining subsidies
  - Increase subsidies for recycling, reuse, and finding substitutes
  - Redesign manufacturing processes to use less mineral resources
  - Use mineral resources wastes of one manufacturing process as raw materials for other processes
  - Slow population growth
-