Lesson 7:
Forest Resources and Conservation

Gro Torsethaugen, PhD

Penn State Biology - BISC 003: Environmental Science
Forested regions of the world are among the most popular regions for human habitation. Trees once dominated the temperate zones, and now humans prevail. However, in some areas, the forests are actually gaining ground again, while deforestation is currently a big concern in many tropical regions of the world today.

One can subdivide different forest types botanically and contrast gymnosperm forests with angiosperm forests. Gymnosperms are softwood or coniferous trees and angiosperms are hardwood, broadleaf, deciduous trees. The three main groups of forests in a climatic classification system are boreal, temperate, and tropical. Pines and related gymnosperm trees dominate boreal forests. These are most common in the northern regions of the world. Consider the classic Christmas tree shape with drooping branches and waxy needles—it is ideal for shedding the heavy snows of the north. Evergreen trees are ideal for short growing seasons as they are able to "leap into" photosynthesis, no need to wait for new leaves to grow in the spring. Temperate mixed forests with both deciduous trees, that drop leaves in a coordinated way, and evergreen conifers account for much of the land in the temperate zones of the world. Tropical forests round out the climatic categories of forests. Evergreen and/or deciduous angiosperms dominate tropical forests.

Beyond the botanical and climatic categories, we can classify forests by their ecological status. Old growth forests are forests whose composition is not dictated by humans. These include true virgin forests untouched by logging and other human activities as well as forests that have remained

Lesson 7 Learning Objectives

- Learn to identify and distinguish the different forest types.
- Understand how the world's wood harvest is used both in the developed and developing world.
- Understand the reasons and mechanics of deforestation.
- Review how we can conserve our forest lands.
- Explore how conservation and economic growth can progress hand in hand.
undisturbed long enough to regain the characteristics of a virgin, old growth forest. Most forested regions of the eastern U.S. are replants. Finally, there are plantation forests. These consist of trees planted for specific harvest targets. They are usually a monoculture of trees for fuel, lumber, or pulp. Christmas tree farms are also examples of a plantation forest. Plantation forests may no longer act as fully functioning ecosystems, though they can be important short-term carbon sinks and they do provide economically valuable products.

**Forest Classification**

- **Botanical**
  - Gymnosperm (softwood, coniferous)
  - Angiosperm (hardwood, broadleaf, deciduous)

- **Climatic**
  - Boreal (mostly evergreen conifer)
  - Temperate (deciduous + evergreen conifers)
  - Tropical (deciduous + evergreen angiosperms)

- **Ecological status**
  - Old growth forests
  - Replanted forests
  - Plantation forests

What Good Is a Forest Anyway? Just like the pandas, trees and plant life have value. First, trees can be things of beauty that brighten our lives and landscapes.

In addition trees provide numerous ecological services, including shelter and habitat for wild life, flood control, oxygen production and carbon absorption. As you may remember, carbon dioxide is a substrate in photosynthesis, while oxygen is a product. So the forests of the world are important in the global carbon cycle, but also in the water cycle. Transpiration is the evaporation of water from plant surfaces and transpiration from tropical forests are key players in setting the weather patterns across the globe.

Even in urban settings, trees make your life better. They act as noise buffers and are also important habitats for urban wildlife. An then there is shade. Contemplate a parking lot in the heat of summer and the premium of a “shade spot.” A study conducted California, called “Cover your asphalt” found that planting trees for shade in parking lots:
• Lowered the temperature inside vehicles by an average of 47 degrees
• Decreased parking lot runoff containing metals, oil and grease
• and also that shaded lots lead to higher profits for local businesses and improved customer satisfaction

As you continue your reading, bear in mind these services that trees provide, above and beyond their direct economic value.

Value of Trees and Forests

• Beauty
• Ecological services
  – Shelter and Habitat
  – Flood control
  – Oxygen production
  – Carbon absorption
  – Climate regulation (transpiration)
  – Noise buffers
  – Shade

Parking lots with shade provided by trees:
• Lowers temperature inside vehicles
• Decrease parking lot runoff containing metals, oil and grease
• Higher profits for local businesses and improved customer satisfaction

Economically, many important fruits, nuts and luxury crops such as coffee and cocoa are harvested from trees.

The wood itself is of great value to humans. Worldwide, trees are harvested primarily for 3 uses: for fuel (as the wood itself or to make charcoal), for lumber (for construction, furniture, and other "whole wood" products), and for paper and other pulpwood products. How the developed (industrialized) world uses wood products is strikingly different from how the developing world uses their share of the wood harvest.

Estimates of wood usage are difficult to make, but the United Nations Food and Agriculture Organization (UN FAO) estimates that approximately 50% of the world's wood harvest is used for fuel wood, the bulk
of which is used by the developing world, as you can see here with Asia at 41% and Africa with 33%. Approximately 30% of the total harvest is used as “whole wood” for various purposes. The majority being used by developed countries in Europe and North America. Pulpwood used to make paper accounts for approximately 20% of the total wood harvest. Developed countries also use the bulk of the pulpwood harvest, with the United States leading the world in its per capita consumption of paper.

Tropical Deforestation Causes

- High value hardwoods
- Small scale agriculture
- Large scale agriculture (soybean fields and cattle ranches)
- Harvest of fuel wood
- Forest fires
- Road, pipeline and dam construction

Tropical Deforestation is a major environmental concern. One catalyst for deforestation in the dense tropical forests of South and Central America is the harvest of high value hardwoods. The harvest of a few trees may not seem like the prelude to large scale deforestation but in fact, it is. The harvest leads to damage of surrounding trees. Remember, forests are interconnected layered ecosystems, and this is particularly true in tropical forests. Removal of a single tree can bring down many connected trees. And more importantly, roads are needed for logging of high value hardwoods and the roads open the floodgates, so to speak. Human habitation follows the roads. A reverse migration of the urban poor leads to the establishment of small scale agriculture where the emphasis is on growing crops of high cash value. The thin tropical soils can be quickly exhausted of nutrients, and are also prone to erosion. This process can be accelerated when small scale farms are bought out and replaced by large scale agriculture, such as a soybean fields and cattle ranches in Brazil. This type of deforestation is much more pronounced in Latin America than in other tropical forests of the world.
As already mentioned, approximately half of the world's wood harvest is used for **fuel wood**, and this is particularly true in Africa and Asia. The demand for fuel wood has led to the stripping of forested areas around human settlements. The decreasing availability of fuel wood has put an increased burden on the women and children of the developing world as more and more time is spent by an already burdened population in the quest for fuel for cooking and warmth. Overharvest of wood for fuel not only leads to the loss of forests; it can also contribute to decreased soil fertility and erosion. As wood becomes unavailable, alternatives including dung and crop stubble are collected. These materials that would normally contribute to replenishing soil fertility are removed, and thus the decline in soil fertility continues.

Additional causes for deforestation include forest fires, road, pipeline and dam construction.

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**Tropical Deforestation Effects**

**Loss of**
- biodiversity (food, medicine)
- aesthetic beauty and recreational opportunities
- ecological services (shade, flood control)

**Carbon Cycle:**
- deforestation estimated to contribute 20% of increase in atmospheric CO₂ concentration -> climate change

**Water Cycle:**
- reduced transpiration -> change in precipitation patterns

**Erosion**
- loss of fertile soil
- sediment water pollution

I will not spend much time describing the effects of deforestation here, but they relate back to the value of trees and forests; loss of biodiversity, including potential new food sources and medicines, loss of aesthetic beauty and recreational opportunities, and loss of all the ecological services forests provide. This includes the trees capacity to absorb carbon dioxide from the atmosphere. It is estimated that deforestation contributes to approximately 20% of the increase in atmospheric CO₂ concentrations, which is causing a change in climate. The water cycle is affected because of a change in transpiration rates, which may lead to flooding in some areas and drought in others. And soil is lost to erosion, which is also causing water pollution in the form of sediments.
So, how can deforestation be stopped or slowed? Reducing the demand for tropical hardwoods will slow the harvest. There are a host of tropical and non-tropical hardwoods available to you as raw lumber and finished products. If one is concerned with protecting the world's tropical forests, demand only sustainably harvested wood products. Public pressure has led to increased availability of sustainably harvested tropical hardwoods. These are most likely grown in plantations, but the process of harvesting high value hardwoods by creaming, which is the harvesting of a single high value specimen without regard to protecting the surrounding trees, does continue. If your heart is set on a teak table or a mahogany dresser, the most ecologically sound thing to do is to go antiquing.

Addressing fuel wood shortages is one way that the process can be slowed. As much of the harvest in the tropics will ultimately go to consumption as fuel wood, a reliable and sustainable supply of fuel wood could go a long way in preserving the forests that remain. Between increasing the efficiency of stoves so that they require less fuel and developing alternative ways to cook like the solar cooker in this picture, the current unsustainable harvest could be reversed.

The most successful approach incorporates both economic incentives and involvement of the local population. In addition, it is hypocritical to demand that the developing world not exploit its natural resources for economic growth as the developed world has done in the past. The Biocultural Restoration projects of Costa Rica, where local residents are active participants and beneficiaries of reforestation projects, are models that could be employed in other locations. Debt for Nature Swap is a program...
established by the U.S. Congress Tropical Forest Conservation Act of 1998, where international debt relief is exchanged for preservation of tropical forests. Although promising, the monitoring of such projects has proven to be challenging and the jury is still out on their success. The United Nations collaborative program "Reducing Emissions from Deforestation and Degradation" (REDD) was introduced in 2008. REDD’s mission is to limit the effect of deforestation on climate change by assisting developing countries in forest preservation, or in other words funding one of the ecological services (carbon absorption) provided by tropical forests.

Let’s take a look at the history of deforestation in the US. Since the 1600s, 90% of the original virgin forests in the US have been cleared as can be seen in the figure to the left. The overall forest cover in the US has increased since the 1920s. The map to the right show forest covers in the US in 1995. However, a very small percentage of this forest is virgin, old growth forest.

US forests are managed by USDA Forest Service and are designated as multi use, such as recreation, lumber harvest and ecological services. The largest tracts of undisturbed old growth forests are in the North West. This temperate rain forest has lush vegetation and is the home to highly specialized organisms, including the famous Northern Spotted Owl. As you can read about in the textbook, plans for logging in these woods have sparked considerable controversy, a classic example of the need to balance

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**Solutions to Tropical Deforestation**

- Reduce demand for tropical hardwoods
- Demand sustainably harvested wood and products
- Fuel wood alternatives
  - more efficient stoves
  - alternative energy sources
- Involving local population – Costa Rica
- Economic incentives
  - Debt for Nature Swap
  - Reducing Emissions from Deforestation and Degradation (REDD)
economic growth and the need for wood products with preservation of ecosystems and endangered species.

### Temperate Forests

![Temperate Forests](image)

Whether they are old growth or plantation, most forests in the U.S. are harvested by clear-cutting. In a plantation setting, clear-cutting may be a suitable method of harvest, but in other situations, this leads to erosion and loss of biodiversity. On a steep slope, clear-cutting is never a good idea. There are alternatives to this practice that permit harvest of valuable lumber while preserving the diversity of the forest and the soil. Strip cuts, shelterwood cuts, and selective cutting, which is harvesting only selected trees and leaving the bulk of the forest intact, facilitate succession and recovery of the ecosystem.

What are some of the major issues that the U.S. forests face? Your textbook points out that roads and fire management are two of the most controversial points. Many argue that the USDA Forest Service should "get out of the road building business," as they are arguably a subsidy for the timber industry. Beyond the subsidy for logging operations, roads and logging contribute to habitat loss and fragmentation, a major contributor to biodiversity loss on a global basis.

The other hot button issue of temperate forests is fire management. Many of us grew up with the idea that all forest fires were bad and they should be suppressed at all costs. As pointed out in our review of succession, this is not always true. In fact, many ecosystems need fire to help maintain them. Even forests that are not fully fire adapted need an occasional burn to help clear out debris. We have a
problem due to a huge buildup of fuel as a result of years of active fire suppression. The debate continues as to the best way to handle this impending crisis. Once a fire starts, it can easily burn out of control and cause millions of dollars of damage.

The Healthy Forests Initiative is a plan for clearing the brush accumulation. From a libertarian point of view, both brush clearing and fighting the fires themselves to prevent property damage amounts to a subsidy for people who choose to live in remote fire prone areas. A best management practice towards sustainable forestry, as outlined by the USDA Forest Service, is a step in the right direction. Taking a holistic approach towards our national forests in the long run is bound to pay off. It is important to remember that forests are our resources and should be managed to benefit the entire population rather than just lumber companies.

**Forest Management**

- Clear-cutting
  - erosion and loss of biodiversity
- Alternative harvest methods
  - strip cuts, shelter wood cuts, selection cutting
- Roads
  - subsidy for logging companies
  - habitat loss and fragmentation
- Fire management
  - Suppressing forest fires
  - Healthy Forest Initiative: clearing of brush

National Forests – benefit entire population, not just lumber companies

You can purchase all the picture books you want and have an Ansel Adams calendar on your wall, but unless you have been to Yosemite and other National Parks in the U.S., it is hard to appreciate the spectacular beauty of these sites. The United States is one of the leaders in the world for setting aside land for other organisms. Through our system of National Forests, National Parks, Wildlife Refuges, Wilderness Preserves and State Parks, approximately 22% of US lands have some type of protected status. These national treasures belong to us all and are designated as multiple use land; for our enjoyment, recreation and education in addition to ecosystem conservation. In recent years, the National Park Service has fallen on hard times. Continual budget cuts along with increased traffic and
use have led to a system some would argue is in crisis. Different proposals have been made to mitigate these problems, from privatizing services to increasing access fees, which are still very low. Various forms of water and air pollution and careless use by visitors are other issues.

You can read about the efforts to conserve natural areas across the globe in the textbook. The biggest challenge facing habitat preservation is to balance the needs of human society with those of other organisms.

In this lessons’ discussion forum you get to share your own personal experience with parks and nature reserves, and also discuss how we as a society should prioritize conservation efforts.

### National Parks and Nature Reserves

**United States (22% of total land protected)**
- National forests
- National parks
- Wildlife refuges
- Wilderness preserves
- State parks

**Multi-purpose**
- Recreation
- Education
- Ecosystem conservation

**Challenges**
- Funding
- Overuse
- Pollution

**Balance habitat protection and human needs**

On an individual basis, there are things you can do to reduce your forest impact. As pointed out in the textbook, conserving paper by recycling and using electronic recordkeeping is one place to start. If you get many unwanted catalogs and other junk mail, check out catalogchoice.org to cancel them.

Avoid tropical hardwoods unless you know they have been harvested in a sustainable way and be a responsible consumer of other goods that can be harvested sustainably from tropical forests. Avoid beef and produce from areas where tropical forests are cleared for agriculture. This relates to the food activity in lesson 6, know where your food comes from.
Be a responsible forest visitor by following the guidelines for ecotourism to minimize your direct personal impact. As you travel through parks and natural areas, stay on the designated trails and do not disturb the flora or fauna. When camping, if you bring it in, be willing to bring it out, and minimize your resource use. If you plan a trip to other countries, read and learn about the area you are visiting so that you are familiar with local customs and cultural norms and are able to avoid embarrassing social blunders as well. Respect both the culture you are visiting as well as the ecosystems and organisms you observe. If possible, consider combining your trip with a service activity.

### What Can We Do?

- **Reduce paper use**
  - recycling
  - electronic correspondence and record keeping
  - cancel catalogs and junk mail (www.catalogchoice.org)

- **Purchase certified wood and other sustainable forest products**

- **Avoid products that encourage tropical deforestation**

- **Responsible forest visitor**
  - stay on designated trails
  - bring in and out when camping

- **Educated tourist**

One final note on being an environmentally sensible consumer, you do not have to sweat every single decision. There are several activities that may be labeled as bad for the environment, but use critical thinking to evaluate the overall environmental impact of your options. Let’s illustrate with a few examples.

What is better, cloth or paper diapers? Paper diapers use forest resources and contribute to landfill waste, but cloth diapers require a lot of water and energy for cleaning. Which is better may depend on whether landfill space or water conservation is the bigger issue in your area, whether you air dry cloth diapers or use an electric dryer will also affect the overall impact.
Should you use paper or plastic bags at the store? Trees are used to make paper bags, while oil is used to make plastic. Plastic bags are not biodegradable and contribute to plastic pollution. The best alternative? Bring your own reusable bags.

So how bad are disposable paper cups, plates, and napkins: not that big of an impact if you use them on an occasional basis, and there are now biodegradable alternatives on the market that you can put in the compost after use. However, even when including the water and energy used for cleaning of reusable cups and plates, that is still more sustainable for daily use. And although not directly related to forest resources; spray cans and Styrofoam cups have less impact now than they used to have since Chlorofluorocarbon, or CFCs, were banned in the late 80s. CFCs are responsible for breaking down the ozone layer, but more about that in lesson 11.

**Cloth or Paper Diapers?**
Forest resources/landfills vs water/energy

**Paper or Plastic Bags?**
Trees vs plastic pollution.
Bring your own reusable bags!

**Disposable cups, plates and napkins?**
OK for occasional use, choose biodegradable

**Spray cans and Styrofoam?**
Less impact since CFC ban