

Terrestrial Biodiversity

Chapter 23

Land use in the world

US Land Use

Types of Public Lands

- ✳ Multiple use lands: national forests; national resource lands
- ✳ Moderately-restricted use lands: National wildlife refuges
- ✳ Restricted-use lands: national park system and national wilderness preservation system

Lands managed by the federal government

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Mineral deposits on federal and private land

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Multiple Use Lands

- ✳ 156 forests
- ✳ Logging
- ✳ Mining
- ✳ Livestock grazing
- ✳ Farming
- ✳ Oil and gas extraction
- ✳ Recreation
- ✳ Sport hunting, fishing
- ✳ Commercial fishing
- ✳ Conservation of soil, watershed, soil and wildlife resources

Moderately restricted use lands

- ✳ 524 national wildlife refuges
- ✳ Protect habitats and breeding areas for waterfowl
- ✳ And for big game to provide a harvestable supply for hunters
- ✳ Few protect endangered species
- ✳ Oil and gas development
- ✳ Mining, logging, grazing
- ✳ Some military activities and farming

Restricted Use lands

- ✳ National park system 385 parks
- ✳ Camping
- ✳ Hiking

- ✘ Sport fishing
- ✘ Boating
- ✘ Motor vehicles stay on road
- ✘ Some allow mining, oil/gas drilling

National wilderness preservation system

- ✘ Found within the other described areas
- ✘ No roads-no motorized vehicles
- ✘ Hiking, camping, boating, some horseback riding
- ✘ Everything else banned unless those activities predate the designation of the wilderness area

Managing US Public Land

- ✘ Biodiversity and ecological function
- ✘ No subsidies or tax breaks for use
- ✘ Public should get fair compensation
- ✘ Users held responsible for actions
- ✘ Takings and property rights

Proposals by developers

- ✘ Sell public lands (at less than market value)
- ✘ Slash fed funding for regulatory administration of public lands
- ✘ Cut all old growth forest and replace with tree farms
- ✘ Open all areas to mining, drilling
- ✘ END NPS and do private theme parks
- ✘ Mine w no royalties paid or env cleanup

Proposals by developers (2)

- ✘ Repeal endangered species act
- ✘ Redefine govt protected wetlands so half no longer protected
- ✘ Prevent individuals or groups from legally challenging these uses of public land for private financial gain

Proposals by Environmentalists

- ✘ Ban or limit grazing where it results in desertification, degradation of habitat, or is otherwise ecologically unsound
- ✘ Allow individuals and environmentalists to buy grazing licenses and not graze
- ✘ Encourage ranchers to develop conservation easements w tax write offs

Classification of Forests

- ✘ Tropical, subtropical, temperate, boreal
- ✘ Old growth: uncut forests, or regenerated forests undisturbed for several hundred years
- ✘ Second growth forests: stands of trees resulting from secondary succession
- ✘ Tree farms: managed tracts with uniformly aged trees of one species harvested by clear-cutting and replanted

Ecological Importance of Forests

- ✳ Food webs and energy flow
- ✳ Water regulation
- ✳ Local and regional climate
- ✳ Numerous habitats and niches
- ✳ Air

Different habitats a tree can afford

Economic Importance of Forests

- ✳ Fuelwood (50% of global forest use)
- ✳ Industrial timber and lumber
- ✳ Pulp and paper
- ✳ Medicines
- ✳ Mineral extraction and recreation

Types of Forests

- ✳ Old growth (frontier forests): uncut forests or regenerated forests that have not been perturbed for hundreds of years
- ✳ Second-growth forests: secondary succession forests
- ✳ Tree farm/plantations: managed tracts with uniformly aged trees of one species (produce about 10% of timber globally)

Forest management

- ✳ Rotation cycle
- ✳ Even-aged management
- ✳ Industrial forestry
- ✳ Uneven-aged management
- ✳ Improved diversity
- ✳ Sustainable production
- ✳ Multiple - use

Rotation: Management of Forests

- ✳ Take inventory of the site
- ✳ Develop a forest management plan
- ✳ Build roads into site
- ✳ Prepare site for harvest
- ✳ Harvest timber
- ✳ Regenerate and manage the site until the next harvest

Even aged management

- ✳ Industrial forestry
- ✳ Plots of same age clear cut
- ✳ Some pine can be harvested every 6 years, other species are slow (too slow for this type of management 100 year)

Uneven aged forest management

- ✳ Different trees and ages due to different succession and environmental conditions
- ✳ Selective cutting can contribute to the resilience of the ecosystem by maintaining biodiversity
- ✳ this type of management has long term sustainability at the core
- ✳ The forest can continue its role in production of timber (human service), wildlife habitat, watershed protection, and recreation

Common style of forest management (this forest is usually a monoculture)

Annual Deforestation rates: consider that if the forest has already been cut or is being managed, then it won't be in these figures

Forest Management: Steps

- ✳ Inventory site
- ✳ Develop forest management plan
- ✳ Build roads into site
- ✳ Prepare site for harvest
- ✳ Harvest
- ✳ Regenerating and managing site until next harvest

Adding roads fragment the habitat; species/pathogens from outside are introduced and forest species/pathogens can move to other populations or ecosystems; erosion and runoff >

Harvesting timber and clearing plots for various uses contributes to loss of ecosystem function and degradation of the forest

Harvesting Trees

- ✳ Selective cutting: cut singly or small groups; most marketable first
- ✳ High-grading: cutting largest and best trees
- ✳ Shelterwood cutting: remove all mature over 2-3 cuttings
- ✳ Seed-tree cutting: harvest all but few seed producing trees
- ✳ Clearcutting: remove all trees
- ✳ Strip cutting: clear out w land contour; self generating

Pros of Clear Cutting

- ✳ Increases timber yield per hectare
- ✳ Permits reforestation with genetically improved stocks of fast-growing trees
- ✳ Shortens the time needed to establish a new stand of trees
- ✳ Takes less skill and planning
- ✳ Provides max economic return in shortest time
- ✳ Best way to harvest trees that need full or moderate sunlight

Cons of Clearcutting

- ✳ Leaves moderate to large forest openings
- ✳ Eliminates most recreational value for decades
- ✳ Reduces biodiversity, fragments habitats
- ✳ Makes nearby trees vulnerable to windfall
- ✳ Leads to severe soil erosion

Sustainable Forestry

- ✳ Longer rotations
- ✳ Selective or strip cutting
- ✳ Minimize fragmentation
- ✳ Improved road building techniques
- ✳ Certified sustainable grown
- ✳ Balance estimated ecological services with estimates of their economic value

Pathogens

- ✳ Fungal Diseases: chestnut blight, Dutch elm disease
- ✳ Insect Pests: bark beetles, gypsy moth

Reducing Impacts of Tree pathogens and pests

- ✳ Preserving biodiversity
- ✳ Banning imported timber that might introduce new pathogens or pests
- ✳ Removing infected and infested trees or clear cutting infected areas and burn
- ✳ Treat trees w antibiotics
- ✳ Develop tree species that are disease resistant
- ✳ Applying pesticides
- ✳ Using integrated pest management

Fire Climax Communities

- ✳ Depend on intermittent natural fires set by lightning to maintain the ecosystem (forcing function is fire)
- ✳ Savanna, temperate grasslands, chaparral, southern pine forests (jack pine), western forest (sequoias), & evergreen coniferous forests
- ✳ Surface fires: burn only undergrowth and leaf litter on forest floor, stimulate release of nutrients and for some plants, are necessary for seeds to open

Surface Fires

- ✳ Burn away flammable ground material
- ✳ Release nutrients
- ✳ Increase activity of nitrogen-fixing bacteria
- ✳ Stimulate germination
- ✳ Help control pathogens and insects
- ✳ Maintains habitats for some species
- ✳ New vegetation is a food source for some species

Crown Fires

- ✱ HOT
- ✱ Occur if there have not been regular natural surface fires
- ✱ Destroy most vegetation
- ✱ Kill wildlife
- ✱ Increase soil erosion (mud slides)

Ground Fires

- ✱ UNDERGROUND
- ✱ Persist for years, decades
- ✱ Common in peat bogs
- ✱ May occur in veins of coal

Protecting Forests from Crown Fires

- ✱ Prevention
- ✱ Prescribed burns
- ✱ Presuppression
- ✱ Require burning permits
- ✱ Closing natural areas during times of drought to cars and camping
- ✱ Education of public

Forest Resources and Management in the US

- ✱ Habitat for threatened and endangered species
- ✱ Water purification services
- ✱ Recreation
- ✱ 3% of timber harvest
- ✱ Sustainable yield and multiple use
- ✱ Substitutes for tree-products

Timber Harvesting over Time

Incidence of Recreational Use of Forests

Use Wood Efficiently

- ✱ Ways to stop junkmail: <http://www.obviously.com/junkmail/>
- ✱ <http://www.41pounds.org/?gclid=CKLnr-7R05ECFQPsIgodgEfRaQ>
- ✱ Reduce inefficiency in construction projects
- ✱ Reduce excess packing materials
- ✱ Recycle paper and cardboard
- ✱ Reuse wooden shipping containers

Tropical Deforestation

- ✱ Rapid and increasing
- ✱ Loss of biodiversity
- ✱ Cultural extinction
- ✱ Unsustainable agriculture and ranching
- ✱ Clearing for cash crop plantations
- ✱ Commercial logging
- ✱ fuelwood

Deforestation has contributed to habitat fragmentation and loss of biodiversity in Madagascar

Loss of Tropical Forests

- ✳ Primary Causes
- ✳ Rapid population growth
- ✳ Poverty
- ✳ Exploitative government policies
- ✳ Exports to developed countries
- ✳ Failure to include ecological services in evaluating forest resources
- ✳
- ✳ Secondary Causes
- ✳ Roads
- ✳ Logging
- ✳ Unsustainable peasant farming
- ✳ Cash crops
- ✳ Cattle ranching
- ✳ Tree plantations
- ✳ Flooding from dams
- ✳ Mining
- ✳ Oil drilling

Reducing Tropical Deforestation

- ✳ Identification of critical ecosystems
- ✳ Reducing poverty and population growth
- ✳ Sustainable tropical agriculture
- ✳ Encourage protection of large tracts
- ✳ Debt-for-nature swaps
- ✳ Less destructive harvesting methods

Debt for Nature Swap to allow some conservation while using large tracts for economic development

Fuelwood Crisis

- ✳ Planting fast-growing fuelwood plants
- ✳ Burning wood more efficiently
- ✳ Switching to other fuels

Scarcity of Fuelwood: Biomass Burning as major source of energy

Use of dung as fuel deprives soil of nutrients

Managing and Sustaining National Parks

- ✳ Most parks are too small to maintain biodiversity
- ✳ Invasion by exotic species
- ✳ Popularity a major problem
- ✳ Traffic jams and air pollution
- ✳ Visitor impact (noise, pollution)
- ✳ Natural regulation
- ✳ Better pay for park-staff

Large reserves designed to sustain 80% biodiversity
These are the 19 most biologically diverse countries.
Establishing, Designing, and Managing Nature Reserves
Forests (preserves)

- ✦ Include some moderate disturbance
- ✦ Sustain natural ecological processes
- ✦ Protect most important areas
- ✦ Buffer zones
- ✦ Gap analysis
- ✦ Wilderness areas

Buffer zones around a forest or preserve can reduce the effects of anthropogenic influences.

These are hot spots of biodiversity that are in danger due to deforestation and habitat fragmentation

Ecological Restoration

- ✦ Ecological restoration
- ✦ Restoration ecology
- ✦ Rehabilitation
- ✦ Replacement
- ✦ Creating artificial ecosystems
- ✦ Natural restoration