

Biomes, Land Use and Nature Preserves

BIOME:

a broad, regional type of ecosystem characterized by distinctive climate and soil conditions and a distinctive kind of biological community adapted to those conditions.

~Deserts:

characterized by low moisture levels and infrequent, unpredictable precipitation

- plant adaptations to conserve water and protect from predation
- seasonal leaf production, water storage tissues, thick epidermal layers
- spines and thorns
- warm, dry, descending air creates desert bands at 30 degrees N and S
- deserts at high latitudes are cool
- sand dunes are rare away from the coast
- 2-2" of rain per year
- soil organic layer extremely thin. Rocky and dry
- sparse but species-rich community dominated by shrubs and small trees
- animals- structural and behavioral adaptations
- hide in burrows or rocky shelters to escape daytime heat
- mice and rats obtain moisture from the seeds and grains they eat
- highly concentrated urine and dry feces to conserve water
- easily disturbed by humans
- slow to recover because of harsh climate
- EX. tracks still visible from army trucks in WWII, overgrazing, and use for farmland

~Grasslands/Savannas:

rich biological communities of grasses, seasonal herbaceous flowering plants, and open savannas.

-seasonal cycles for temperature and precipitation">vegetative growth">enriches soil->

good farmland

mostly found on dry continental interiors

- 10-60" rain per year
- few trees b/c of inadequate rainfall, daily and seasonal temperature ranges, and frequent grass fires
- some are artificially created and maintained by native people using fire (balance ecosystem)

soils very deep with humus (organic matter)

-large grazing animals EX. bison, deer, elk

-human disturbances

one of the hardest hit by human disruption. <1% of original grassland left in US

- fire suppression
- conversion into farmland
- overgrazing">soil erosion
- hunting, fencing, wetland drainage, introduction of alien species">diminished wildlife population

~Tundra:

characterized by a short growing season, cold, harsh winters, and the potential for frost at any time

- far N and S, and high elevations
- less than 10" rainfall per year
- no trees
- arctic-low productivity, low diversity, and low resilience
- long, dark winters
- in summer-only top few centimeters are unfrozen, the rest is permafrost
- surface soil waterlogged b/c of permafrost
- no deep root growth b/c of permafrost">not many plants
- alpine- thin mountain air">permits intense solar bombardment">plants w/dark pigment that shields inner cells
- hot daytime ground temps, freezing nighttime temps
- gravelly, rocky soil
- slope causes quick moisture drainage
- ALL this adds up to a drought problem
- dominant plants- dwarf shrubs, sedges, grasses, mosses, and lichens
- animals must be adapted to harsh climate and sparse food supply
- EX. mosquitos, arctic musk ox and caribou, alpine mountain goats and mountain sheep
- migration and hibernation
- birds nest in the tundra during the summer
- human disturbances
- one of the least disturbed biomes by man. Human population still low.
- slow to heal
- oil and natural gas wells in the arctic
- mineral excavation in mountain regions
- truck ruts and tracks

~Conifer Forest:

regulated by fires

- 20-40" of rain per year
- conifer trees can survive harsh winters or extended droughts
- boreal forest- northern coniferous forest
- mixture of coniferous and deciduous trees
- b/w 45 and 50 degrees N latitude
- dominant conifers- pine, hemlock, spruce, cedar, and fir
- dominant deciduous trees- birches, aspens, and maples
- many lakes, potholes, bogs, and fens
- mosquitoes and biting flies are abundant
- taiga- northernmost edge of the boreal forest.
- harsh climate">limited productivity and resilience of community
- cold temps, wet soil, and acids produced by fallen conifer needles"> full decay of organic matter">peat (semi-decayed organic material)
- peat mining could be severe and long-lasting
- southern pine forest-characterized by a warm, moist climate and sandy soil
- managed for timber, turpentine, and rosin
- temperate coniferous forests of the pacific coast- mild temps and abundant precipitation
- up to 100" of rain per year
- luxuriant plant growth and huge trees
- EX. California redwood- largest tree in the world, largest organism EVER
- in its wettest parts, the coniferous forest becomes a temperate rain forest

~Broad-Leaved Deciduous Forest:

lush summer plant growth when rain is plentiful

- requires adaptations for the frozen season
- 30-100" rain per year
- four seasons
- deciduous trees- produce summer leaves and then shed them at the end of the growing season
- EX. oak, maple, birch, beech, elm, ash
- form canopy over smaller shrubs, trees, and herbaceous plants
- soils rich in humus and partially decayed leaves
- human disturbances- most hard hit by man (NE cleared 100 years ago)
- trees harvested for timber

~Tropical Rain Forest:

one of the most complex and biologically rich biomes

- ample rainfall
- uniform temperatures (about 80 degrees)
- cloud forests- high in the mountains
- fog and mist keep vegetation wet
- tropical rain forest- rainfall abundant (90-180" per year)
- warm to hot temps year round
- thin, acidic, and nutrient-poor soil
- 1/2 to 2/3 of all species of terrestrial plants and insects live in tropical forests
- 90% of nutrients in the nutrient cycle are in the bodies of living organisms
- growth depends on the decomposition and recycling of dead organic material
- human disturbance
- deforestation">loss of soil fertility b/c the thin soil cannot support crops or resist Erosion
- forest doesn't recover from clear cutting

AQUATIC ECOSYSTEMS

- ~Estuaries- bays of brackish water (mix of salt and fresh water) from where river enters ocean
- contain rich sediments carried downstream
- forming mud flats that nurture aquatic life
- sheltered from most ocean action other than tides
- high species diversity and productivity
- ~Wetlands: land surface is covered with standing water at least part of the year
- vegetation is adapted for growth under these conditions
- swamps- wetlands with trees
- marshes- wetlands w/out trees
- bogs and fens- wetlands w/ or w/out trees that have waterlogged soils that accumulate peat
- low productivity
- swamps and marshes- flowing water and high productivity
- fens- fed by ground water and surface runoff
- bogs- fed by precipitation
- 5% of world's landmass and one of the most devastated
- high biomass production
- **40% net primary productivity interfered by humans.**

Terms to know for marine ecosystems

- Intertidal- between high and low tide which is subjected to periods of wet and dry
- Aphotic (abyssal)- deep water areas where no sun penetrates

Neritic- area from low tide to the edge of the continental shelf. Relatively stable in salinity, oxygen and temperature.

Benthic- bottom-dwelling organisms**

Oceanic (pelagic)- open ocean surface layers

RESTORATION ECOLOGY

-to repair or reconstruct ecosystems damaged by humans or natural forces.

-Restoring the Earth conference in Berkeley, California brought 800 scientists, policy-makers and activists to share ideas and experiences

~Restoration: bring something back to a former condition

-re-create species composition and ecosystem processes as close to the original state as possible

~Rehabilitation: rebuild elements of structure or function in an ecosystem without achieving complete restoration to its original condition

-bring an area back to a useful state for human purposes

~Remediation: cleaning chemical contaminants from a polluted area by physical or biological methods

-a first step toward protecting human and ecosystem health

~Recreation: attempts to construct a new biological community on a severely disturbed site.

-may be modeled on what we think was there before human interruption

-may be something that never existed on the site, but we think it fits well with conditions there

~Mitigation: take steps to create a new habitat completely unlike the existing one. Purpose is to trade destroying one habitat for making a new one.

The areas most severely underrepresented in protected areas are grasslands, aquatic ecosystems and islands. The least disturbed biomes are temperate conifer forests and arctic tundra.

Parks and Nature Preserves

History and Park Origins

- Most biologically productive land in private hands.

- Early parks were for higher classes to hunt and for royal recreation.

- Natural landscaping- (Lancelot Brown) A way of making nature look natural, rejecting straight lines, using rolling hills and all natural looking features.

- Used by modern zoos.

- Olmstead designed central park then left and became commissioner of Yosemite. (1864)

- Lincoln authorized Yosemite to save it from the exploitation of the settlers.

- Grant made first National parks, Yellowstone and Yosemite. After this, many other places designated National parks to save wild nature and places with scenic beauty and cultural importance.

North American Parks

- Mexico's Parks smaller than neighbors but encompass more diversity.

- US National Parks encompass 280000 + km² w/ 376 different parks.

- Most visited parks are recreational; the best are the unspoiled ones.

- Alaska lands act double the area of the park system.

- Canada has 150000 km² w/1471 parks

- Some Canadian parks allow hunting, logging, mining and environmental manipulation.

- Problems -

- Parks are being clear-cut right up to their boundaries.

- Mines contaminate water shed

- Tourist traps are at the entrances taking away from the beauty.
- Parks need money, traffic to parks increase by 1/3 in the last decade while funding went down _.
- Some have proposed to sponsor the parks, but most rejected.
- In Yosemite, people over crowd and destroy the valley floor, plans have been made to remove all buildings, and make inaccessible to cars to help preserve what is left.
- Other parks such as the ones in the Canadian Rockies, Jasper, California Desert, and the Everglades, are facing over commercialism and pollution.
- Smog is destroying beautiful vistas and reducing visibility.
- Conservation groups want to use federal money to buy private land in parks so that miners can't go in parks to private land.
- Wildlife -
- Bad animals were killed in the beginning of the parks to increase the amount of good animals.
- Favoring species creates an unbalanced eco system. Good species take over and deplete food sources so smaller species have no food.
- IUNC (International Union for the Conservation of nature and natural resources.) divides protection into five levels.
- 1. Ecological reserves and wilderness areas- little human impact
- 2 .National Parks- Low to little impact
- 3. Natural Monuments and Archeological sites- low/medium
- 4. Habitat and wildlife management areas/ National Wildlife Refuge- medium. hunting okay.
- 5. Cultural or scenic landscapes, recreational areas, National Forests- medium/high.
- Parks need more than just a large boundary to protect an ecosystem, it needs to protect watershed, air shed. Unfortunately, most parks are designed based on political not ecological considerations. A **BIOGEOGRAPHICAL AREA** refers to the entire ecosystem.
- Grand Staircase-Escalante National monument made by presidential decree, locals outraged because it stopped them from using rich resources.
- Lesson, it's not easy to make a new park.
- Clinton made an 84,000,000 acre underwater preserve. This saved from tourism and fishing. He also made a combined 1.1 million ha of protection.
- Bush moved to revoke much of this once he took office.
- Canada's green plan called to double reserves, including an entire watershed.
- World parks and preserves -
- 530 million ha, reserves, nearly 4 % of earths surface.
- Most protected biomes, Tropical dry forests, Savannahs, Temperate deciduous forests, tundra. (many to small to protect ecosystem, excluding tundra.)
- Least protected areas: Islands, Lakes, Wetlands, Grasslands.
- IUNC Made the most significant areas of the world Biosphere Reserves.
- Best countries for reserves, Costa Rica, Tanzania, Rwanda.
- Protecting Natural Heritage -
- In many parks, there is political and economic priorities that come before preservation.
- IUNC made a world conservation strategy, maintain earth so humans can survive, preserve genetic biodiversity, and to ensure that any utilization of species and ecosystems is sustainable.

- SIZE AND DESIGN-

*Optimum size and shape for a preserve is large enough to support populations, keep ecosystems intact and isolate critical core areas from human disturbance.

Buffer zones act as a divide between heavily impacted multiple use area and the pristine critical core.

*Corridors between natural habitats allow for movement of animals between preserves and protect them from being wiped out in case of a calamity.

Edge effect is when a forest is exposed to a clear cut area and dies back.

*Satisfy conflicting needs and desires of humans manage them this way:

(1) recreation areas- human entertainment

- (2) historic areas- preserve a landscape from previous time
- (3) conservation reserves- set aside to maintain ecological functions
- (4) pristine research areas- baseline of nature for research
- (5) inviolable preserves- for sensitive species human interference not allowed

*The smaller the reserve the faster species disappear. The exposed edge of the preserve is more vulnerable to destruction. The preserve with the least edge exposure make the best parks.

-Conservation and Economic Development-

*Tropics has a lot of threatened species and ecosystems

*Basic needs for humans take precedence over the environmental goals

*Tropics are suffering the greatest destruction and species loss in the world

*Ecotourism can benefit the environment more than logging or mining etc.

* Tourism can be utilized as a source of income for the people but also save the wildlife

-Indigenous Communities and Biosphere Reserves-

*UNESCO initiated Man and Biosphere (MAB) program that encourages division of protected areas into multi-use areas. The inner area, or core, is preserved while a buffer zone protects it. Multiple use areas make up the outside of the park.

*Paseo Pantera- a plan to create a thousand mile long series of preservations with corridors linking them along the coast of Central America

-Wilderness Areas-

*indigenous people were significantly hurt by the European diseases

*wilderness: "an area of undeveloped land affected primarily by the forces of nature, where man is a visitor who does not remain; it contains ecological, geological, or other features of scientific or historic value; it possesses outstanding opportunities for solitude or a primitive and unconfined type of recreation; and it is an area large enough so that continued use will not change its unspoiled natural conditions."

*Arguments pro-wilderness:

(1) refuge for endangered wildlife

(2) chance for solitude and recreation

(3) baseline for research

(4) area where it is simply in its natural state and left that way

*people in developing countries don't regard environmental problems as very important matters

*Saving culture, landscapes and history are good reasons to protect an area

-Wildlife Refuges-

*1901 Teddy Roosevelt established 51 wildlife refuges. There are now 511 in nearly 40 million hectares of land

*Franklin D. Roosevelt and Harold Ickes impacted refuges as did Jimmy Carter who signed the Alaska National Interest Land Act which added 22 million ha to the already existing land

-Refuge Management-

*intended to be sanctuaries but by passing of a compromise in 1948 allowed hunting for duck etc on the land.

*Refuges face threats from external activities such as water pollution

*biggest battle currently is about drilling in Alaska

-International Wildlife Preserves-

*The ecosystems in Kenya and Tanzania are very diverse and can hold many species from elephants to hyenas and vultures

*poachers are the major threat in Africa they pursue elephants and rhinos even in the park. Wildlife is worth more alive as an ecotourism lure than dead as a one time commodity.

*makes the supposedly peaceful areas like war zones and the rangers try to stop it, but the poachers have a lot of gun power

-Wetlands, Floodplains and Coastal Regions-

*extremely important sources of biodiversity and a key component of natural freshwater storage and purification systems

-Wetland Values-

*wetlands occupy less than 5 % of land in the US

*they improve water quality and act as a natural water purification system removing silt and absorb nutrients and toxins

*coastal and inland wetlands also provide recreational activities, stabilize shoreline from erosion, and provide food for offshore species.

-Wetland Destruction-

*US Swamp Lands Act of 1850 allowed individuals to buy swamps and marshes for as little as 10 cents per acre. Most wetlands have been converted to farmlands.

*66% of wetlands were destroyed as a result of such acts

*1972 Clean Water Act began protecting wetlands because they requested permits for discharging waste into the waters.

-Floods and Flood Control-

*floodplains: low lands along riverbanks, lakes, coastlines subjected to periodic inundation of water

*The fertile soil in areas prone to floods gives the land it is on a lot of value

*\$25 billion elaborate Mississippi river flooding plan works well, except for the fact that it does not allow the water to go anywhere but forces it down the river quickly with no place to go and levees break

*Federal Emergency Management Agency has National Flood Insurance Program that aids people who can't buy insurance and allows them to collect on damage to their house by floods only if they rebuild on the same sight

-Wetlands and Floodplain Conservation-

*Many different organizations work hard to preserve the floodplains and wetlands, such as Ducks Unlimited and The Department of Agriculture's Wetland Reserve Program

*Globally wetland losses are monitored by Ramsar Convention

-Beaches, Barrier Islands, and Estuaries-

*Estuaries- where salt water mixes with fresh water

*Construction directly on the beaches can cause a lot of damage to the ecosystem

*Damaging vegetation, breaching dune systems to create roads and sand dredging, building artificial barriers.

*Government policies tend to encourage building where there shouldn't be any

*Tactics employed such as "wise use" movement and dozens of "taking" bills, to repeal coastal and floodplain zoning and park and green belt establishment etc.

Land Use: Forests and Range lands

[Land Use Distribution of World:](#)

- 29% Forest and woodlands
- 33% Tundra, desert, wetlands, and urban areas
- 27% Range and pasture
- 11% Cropland

Benefits of Forests: regulate climate, control water runoff, prevent erosion, conserve biodiversity, provide shelter and food and purify the air. Plus they are pretty to look at!

[Good News:](#)

- Forests in NE USA (Temperate) are rejuvenating!
- Debt for Nature Swap: Bank loans owed by third world countries are bought by conservation groups. These groups offer to cancel the debt if the country in debt protects some of its land!

- Small controlled burns actually reduce the chance of major forest fires. (Less fuel build up.) Some plants need fires to germinate.
- Land reform gives indigenous people the right to land ownership reducing overexploitation.

Bad News:

- Only 5% of the original (**OLD GROWTH**) forests are left in USA. Deforestation occurs in America because of agriculture and urban development.
- Tropical jungles are declining the fastest of all areas being deforested in Africa, S. America and Asia (3rd world). Once the forest/jungle is cleared the soil can only support one or two crops until it is totally depleted and useless.
- Roughly half the world's use of timber is fuel and the other half for paper.
- 1/4 of the world's population uses wood or charcoal as their main energy source!!! Yikes.
- Fires have been suppressed for years in parks which create conditions for more destructive fires.
- **THE HEALTHY FOREST INITIATIVE** started by George Bush to thin forests in order to suppress fires (and log remote forests without having to go through pesky environmental review procedures) actually encourages more destructive fires! Fire prone shrubs grow in the cleared areas.

FOREST MANAGEMENT (OR MISMANAGEMENT):

MONOCULTURE FORESTRY: is the most profitable but the most destructive to the health of the forest.

In the United States and Canada, the two main issues in timber (mis)management are

(1) Cutting the last remains of old-growth forest :(

(2) **CLEAR CUTTING** is when every tree in a given area is cut regardless of size. The concentration of nitrates in the runoff increases and soil erosion soars. **STRIP CUTTING** entails harvesting all trees in a narrow corridor.

SUSTAINABLE FORESTRY: In both temperate and tropical regions, certification programs are being developed to identify sustainably produced wood products. Increasingly, non-timber forest products (nuts, latex, medicines) are seen as an alternative to timber production.

- **SELECTIVE CUTTING** is when only a small percentage of the mature trees are taken in each 10- or 20- year rotation. The habitat impact is much less.
- Slash and burn or swidden agriculture is sustainable mixed perennial polyculture. Diversity rules!

GRASSLANDS

RANGE LANDS: Pasture (generally enclosed domestic meadows or managed grasslands) and open range (unfenced, natural prairie and open woodlands) occupy about 22% of the world's land surface.

OVERGRAZING AND PROTECTION: About one-third of the world's range is severely degraded by

overgrazing, making this the largest cause of soil degradation. The process of denuding and degrading a once-fertile land initiates a desert-producing cycle that feeds on itself and is called **DESERTIFICATION**.

ROTATIONAL GRAZING; confining animals to a small area for a short time (often only for a day or two) before shifting them to a new location; stimulates the effects of wild herds. This allows the animals to trample and fertilize the ground without damaging it.