

APES Ch. 11 Notes: Ecosystem Capital Use and Restoration

11.1 Notes

- I. Global Perspective on Biological Systems
 - A. Major Systems, Goods and Services (see Ch. 3)
 - 1) **biomes**—*a distinct ecological community of plants, animals, and microbes living together in a particular climate*
 - 2) **natural capital**—*natural resources*
 - 3) ecosystems provide goods and services
 - a) **natural goods**—*what is produced or provided by ecosystems* (food, fresh water, fuel wood, fiber, genetic resources)
 - b) **natural services**
 - *regulating services*—*benefits obtained from regulation of ecosystem processes* (climate regulation, disease control, flood control, detoxification)
 - *supporting services*—*services that maintain conditions for life on Earth* (soil formation, nutrient cycling, pollination, primary production, O₂ production, provision of habitats)
 - 4) natural ecosystems are undervalued because some functions they perform are not obvious
 - 5) intellectual and emotional “disconnection” to the natural environment makes it easier to overexploit it
 - 6) incremental value—how changes in goods or services affect humans

Adapted from R. Costanza <i>et al.</i> , "The Value of the World's Ecosystem Services and Natural Capital," <i>Nature</i> Vol. 387 (1997).	
Annual global value of Ecosystems Services = values in trillion \$ U.S.	
<ul style="list-style-type: none"> • 17.1 Soil formation • 3.0 Recreation • 2.3 Nutrient cycling • 2.3 Water regulation and supply • 1.8 Climate regulation • 1.4 Habitat • 1.1 Flood and storm protection 	<ul style="list-style-type: none"> • 0.8 Food and raw materials production • 0.8 Genetic resources • 0.7 Atmospheric gas balance • 0.4 Pollination • 1.6 other
TOTAL = \$ 33,000,000,000,000 (\$33 trillion)	

THE VALUE OF NATURE AND THE NATURE OF VALUE

“The world’s ecosystems are capital assets. If properly managed, they yield a flow of vital services, including the production of goods (such as seafood and timber), life support processes (such as pollination and water purification), and life-fulfilling conditions (such as beauty and serenity). Moreover, ecosystems have value in terms of the conservation of options (such as genetic diversity for future use). *Unfortunately, relative to other forms of capital, ecosystems are poorly understood, scarcely monitored, and (in many cases) undergoing rapid degradation and depletion. Often the importance of ecosystem services is widely appreciated only upon their loss.*”

- B. Ecosystems as Natural Resources
 - 1) valuing
 - a) **natural goods** are easy to be given monetary values (direct-use value)
 - b) **natural services**—*regulating and supporting service*—are difficult to have specific monetary value assigned to them (indirect-use value)
 - 2) private lands

- *an area will be protected IF society deems the natural goods and services are more valuable than converting it to more direct human use*
- b) public lands
- a) public-owned (state and federal lands) and not owned (ocean ecosystems)
 - b) “sustainable exploitation” can maintain their functions

BIOMES OF THE WORLD
AQUATIC BIOMES

1) fresh water	http://www.ucmp.berkeley.edu/exhibits/biomes/freshwater.php
	<ol style="list-style-type: none"> a) ponds and lakes b) streams and rivers c) temporary pools d) wetland (marsh, swamp, bog)
2) marine salt water	http://www.thewildclassroom.com/biomes/MARINE.html
	<ol style="list-style-type: none"> a) coral reef b) estuary c) ocean
	<ol style="list-style-type: none"> i. abyssal ii. benthic iii. coastal
	<ol style="list-style-type: none"> 1. temperate coastal 2. tropical coastal
	<ol style="list-style-type: none"> iv. intertidal / littoral v. oceanic vent vi. pelagic

TERRESTRIAL BIOMES

1) desert	https://earthobservatory.nasa.gov/Experiments/Biome/biodesert.php
	<ol style="list-style-type: none"> a) hot and dry b) semiarid c) coastal d) cold
2) tundra	https://earthobservatory.nasa.gov/Experiments/Biome/biotundra.php
	<ol style="list-style-type: none"> a) alpine tundra b) arctic tundra
3) forests	
	<ol style="list-style-type: none"> a) deciduous forest https://earthobservatory.nasa.gov/Experiments/Biome/biotemperate.php b) coniferous forest; boreal / taiga https://earthobservatory.nasa.gov/Experiments/Biome/bioconiferous.php c) tropical rainforest https://earthobservatory.nasa.gov/Experiments/Biome/biorainforest.php d) scrub forest (tropical, temperate) http://wwf.panda.org/about_our_earth/ecoregions/mediterranean_forests_scrub.cfm e) chaparral http://www.californiachaparral.com/chaparralfacts.html
4) grassland	https://earthobservatory.nasa.gov/Experiments/Biome/biograssland.php
	<ol style="list-style-type: none"> a) savanna (tropical grassland) b) steppe c) temperate grassland

11.2 Notes

- II. Conservation, Preservation, Restoration
 - A. conservation vs. preservation
 - 1) **conservation**—management and regulation of use
 - 2) **preservation**—protection of ecosystems and species

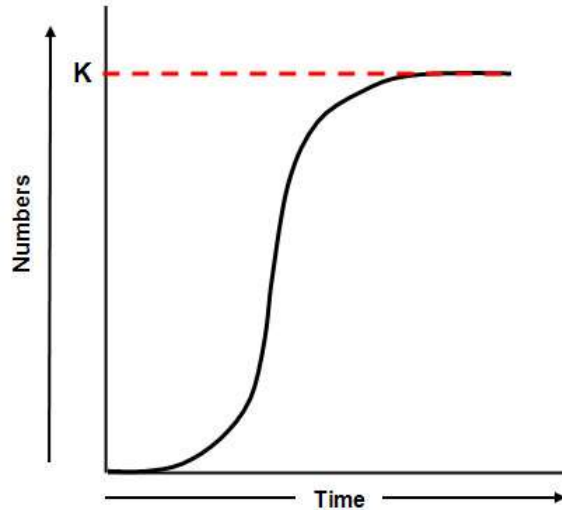
Two opposing factions had emerged within the environmental movement by the early 20th century: the conservationists and the preservationists. The conservationists (such as Gifford Pinchot, the first Chief of the United States Forest Service 1905–1910 and the Republican Governor of Pennsylvania) focused on the proper use of nature, whereas the preservationists sought the protection of nature from use. Conservation sought to regulate human use while preservation sought to eliminate human impact altogether.

The idea of protecting nature for nature’s sake began to gain more recognition in the 1930s with American writers like Aldo Leopold, calling for a “land ethic” and urging wilderness protection. It had become increasingly clear that wild spaces were disappearing rapidly and that decisive action was needed to save them.

Global conservation became an issue at the time of the dissolution of the British Empire in Africa in the late 1940s. The British established great wildlife preserves there. As before, this interest in conservation had an economic motive: in this case, big game hunting. Nevertheless, this led to growing recognition in the 1950s and the early 1960s of the need to protect large spaces for wildlife conservation worldwide. The World Wildlife Fund (WWF), founded in 1961, grew to be one of the largest conservation organizations in the world.

Preservation again came to the forefront in the 1960s with the publication of Rachel Carson’s Silent Spring in 1962 which was the genesis of the modern environmental movement. Major environmental groups such as the Sierra Club shifted from protesting to working with politicians to influence environmental policy.

- B. patterns of use of natural ecosystems
 - 1) consumptive use vs. productive use
 - a) **consumptive use**—people utilizing natural resources for food, clothing, tools, fuel, etc. (*subsisting from the land*)
 - b) **productive use**— This sounds like a positive term, but it is not!—*exploiting natural resources for monetary gain*
 - timber industry (pulp, lumber, fuel, rattan, cork, nuts)
 - commercial fishing industry
 - “bush meat”—commercial hunting of African wild game
 - domestication of wild species
- C. **MSY: Maximum Sustainable Yield**—*the highest rate of use which can still maintain ecosystem balance*
 - 1) **optimal population**—*1/2 the number of a population at the carrying capacity*
 - 2) **carrying capacity (K)**—the maximum population size that an ecosystem can support sustainably



3) **Precautionary Principle** (see Ch. 15)

“When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.”

When we have a reasonable suspicion of harm, and scientific uncertainty about cause and effect, then we have a duty to take action to prevent harm.

D. using the commons

- 1) **commons = common pool resource:** *owned by many people or no one*
- 2) **Tragedy of the Commons** (essay by Garrett Hardin in 1968)

The cause of any tragedy of the commons is that when individuals use a public good, they do not bear the entire cost of their actions. If each seeks to maximize individual utility, he or she ignores the costs borne by others. The best (non-cooperative) short-term strategy for an individual is to try to exploit more than his or her share of public resources. Assuming a majority of individuals follow this strategy, the theory goes, the public resource gets overexploited.

- 3) limiting freedom: private ownership or regulation of access (such as “clam wardens” on patrol)
- 4) public policies: ideas for sustainable policies
 - a) *Natural resources cannot be treated as commons.*
 - b) *Natural resources should be monitored, evaluated, and have sustainable limits set for use.*
 - c) *Precautionary Principle should be used.*
 - d) *Regulations should be enforced consistently.*
 - e) *Overexploitation and violation of the limits should not provide any financial benefits.*
 - f) *Subsidies supporting overexploitation and violation of the limits should be eliminated.*
 - g) *The environment housing the natural resource should be protected from pollution.*
 - h) *Local consumptive use of the natural resource should be considered.*



E. restoration

- 1) **restoration ecology**—*deliberate repair of a damaged ecosystem that can no longer restore itself*
- 2) example: Florida everglades
 - a) **CERP: Comprehensive Everglades Restoration Plan**

<https://www.evergladesrestoration.gov/>

“...The Florida Everglades was once a vibrant, free-flowing river of grass that provided clean water from Lake Okeechobee to Florida Bay... To restore and preserve this American treasure, enhance water supplies, and maintain flood protection, the U.S. Army Corps of Engineers in partnership with the South Florida Water Management District and numerous other federal, state, local and tribal partners, has developed a plan to save the Everglades.

*The Comprehensive Everglades Restoration Plan (CERP) provides a framework and guide to restore, protect and preserve the water resources of central and southern Florida, including the Everglades. It covers 16 counties over an 18,000-square-mile area and centers on an update of the Central & Southern Florida (C&SF) Project also known as the Restudy. The Plan was approved in the Water Resources Development Act (WRDA) of 2000.** It includes more than 60 elements, will take more than 30 years to construct and will cost an estimated \$7.8 billion.*

...The goal of CERP is to capture fresh water that now flows unused to the ocean and the gulf and redirect it to areas that need it most. The majority of the water will be devoted to environmental restoration, reviving a dying ecosystem. The remaining water will benefit cities and farmers by enhancing water supplies for the south Florida economy.”

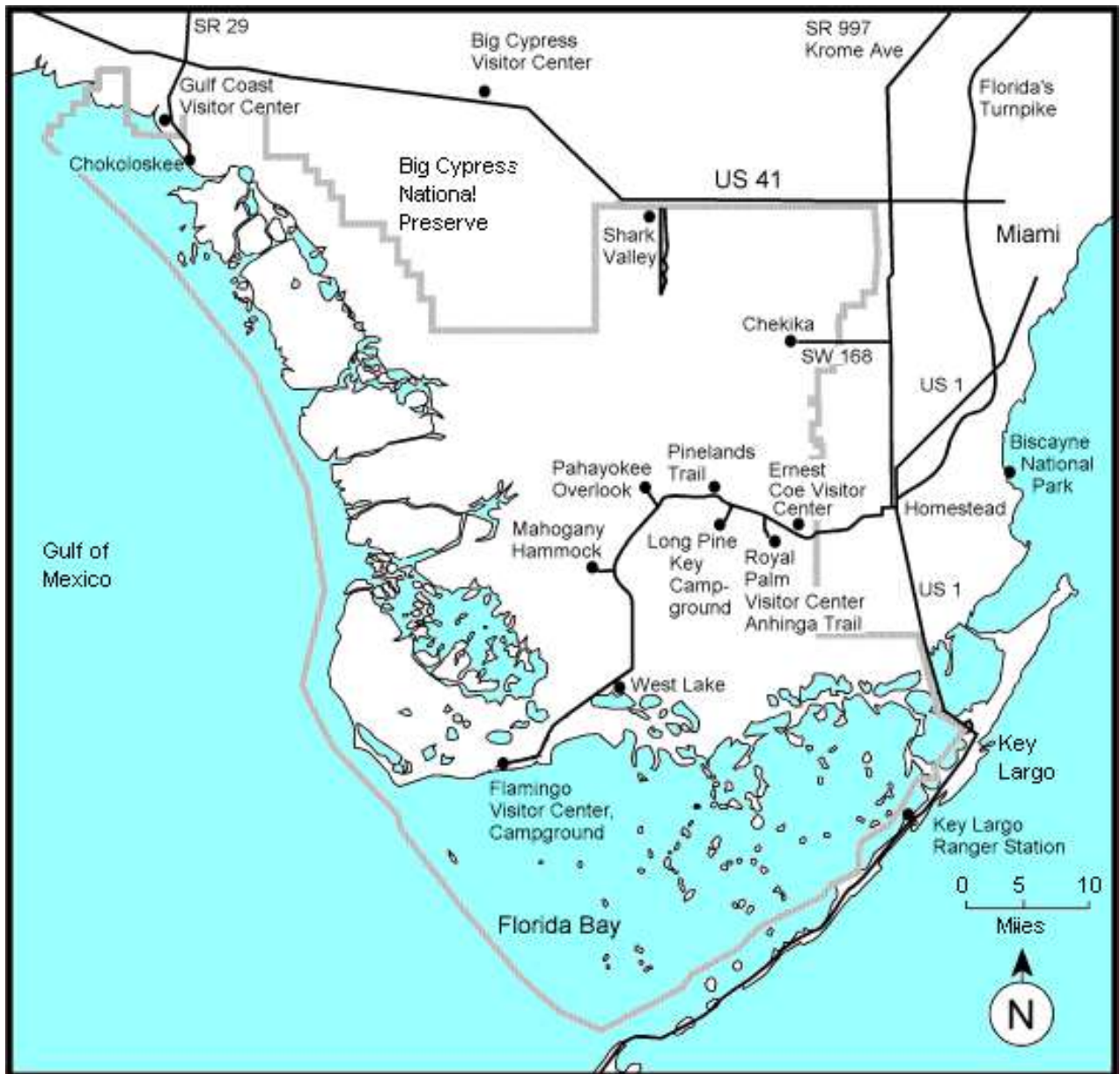
** *Water Resources Development Act (WRDA)*

Provided the U.S. Army Corps of Engineers with the authority to re-evaluate the C&SF Project and to recommend improvements and modifications to the project in order to restore the ecosystem.

- b) initial human impact
 - canals, levees, dams to control water flow
 - cropland (sugar industry)
 - urban and suburban development
 - water diverted from its original pathway for irrigation and municipal use
- c) Everglades: water status
 - too little in the winter and too much in the summer
 - increased eutrophication
 - increase in invasive species
- d) highlights of the plan
 - two treatment plants built to purify 220,000,000 gallons/day
 - 181,000 acres of reservoirs built
 - 240+ miles of levees and canals removed
 - runoff water treatment by human-made wetlands
 - 300+ wells to pump water underground (reserves)

SEE MAP ON NEXT PAGE, also p. 298

FLORIDA EVERGLADES MAP from www.chokoloskeefishing.com



11.3 Notes

III. Biomes and Ecosystems under pressure

A. Forest biomes

- 1) **deforestation**—removal of forest to be replaced by another use of the land
- 2) FAO forestry page <http://www.fao.org/forestry/en/>
- 3) FAO Key Findings
 - a) forests cover ~30% of the total land area
 - b) total forest area continues to decrease - but the rate of net loss is slowing
 - c) forests are a vital **carbon sink**
 - d) private ownership of forests is on the rise
 - e) forests are managed for a multitude of uses and values

- f) 11% of the world's forests are designated for the conservation of biological diversity
 - g) 1/3 of the world's forests are primarily used for production of wood and non-wood products
 - h) The value of wood removals is decreasing, while the value of NWFPs [Non-Wood Forest Products] is increasing, and underestimated
 - i) Around 10 million people are employed in forest management and conservation
- 4) Types of forest management
- a) silviculture and silvics

From <http://www.wvu.edu/~agexten/forestry/silvics.htm>

“Forestry is a science. One of the most important of the many disciplines in forestry is silviculture. **Silviculture** is the agriculture of trees—how to grow them, how to maximize growth and return, and how to manipulate tree species compositions to meet landowner objectives.

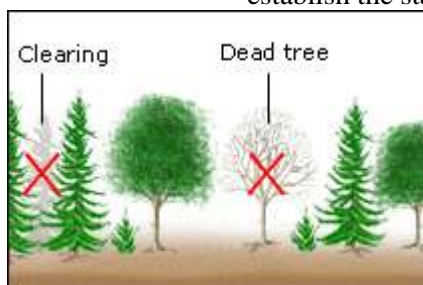
To understand silviculture, one must first understand silvics. **Silvics** involves understanding how trees grow, reproduce, and respond to environmental changes... Silvics also is concerned with seeding requirements, elevation, and location.”

b) methods

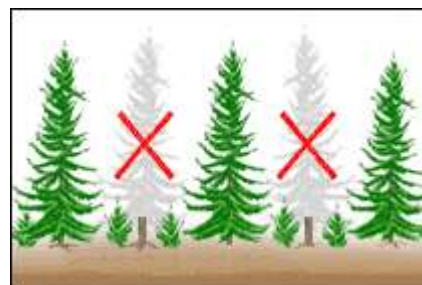
- “**Selection systems [selective cutting]** are partial removals of trees based on the silvicultural objectives of the landowner. This method is used when species of shade tolerance or intermediate tolerance are considered desirable.
- **Seed tree cuts** allow the harvest of all trees except 2 to 10 trees per acre. These remaining trees are chosen for their good form, genetics, species, and ability to produce seed crops. The job for these remaining trees is to rain down genetically good-quality seed on the freshly disturbed areas...
- **Clearcutting** is also a silvicultural method. This much-embattled method is truly a viable silvicultural practice. It is most often prescribed where sun-loving species are desired for the future timber stand. It is also prescribed in poor-quality or problem stands which have been abused by fires or repeated high-grading...”

From <http://ecosys.cfl.scf.rncan.gc.ca> archives

- “**Shelterwood cutting** is used in even-aged forests (where the trees are very close in age) and relies on natural regeneration to re-establish the stand.”



SELECTION CUTTING



SHELTERWOOD CUTTING

- 5) Sustainable forestry
- a) **sustained yield**—wood production is maintained at levels which do not destroy the forest

- b) **sustainable forest management**—*forests are treated as functioning ecosystems*, with stability and biodiversity in mind
- c) *Sustainable Forestry Initiative* principles of action: <http://www.sfiprogram.org/index.cfm>
 - *stewardship ethic*
 - *economically and environmentally responsible practices*
 - *forest health and productivity*
 - importance of sites of special significance
 - continuous improvement
- 6) Tropical forests – reasons for deforestation
From <http://earthobservatory.nasa.gov/archives>
 - a) *main sources of deforestation: conversion to cropland and pasture (“slash-and-burn”)*... examples:
 - *Amazon: industrial-scale cattle ranching*
 - *Amazon: soybean, sugarcane, corn farming*
 - *Indonesia: palm tree plantations for biofuel export*
 - b) *debt: developing countries need revenue, so they sell the lumber, etc.*
 - c) *population growth*
 - d) *building of roads to transport goods to newly inhabited areas*
 - e) *railway expansion projects*
 - f) *logging, both legal and illegal, from previously inaccessible areas*
- 7) Tropical Forests – what can be done
 - a) sustainable forest management
 - b) forest plantations
 - c) forests as “extractive reserves” (nuts, fruit, rubber, etc.)
 - d) forests as tourism sites
 - e) more control given to the indigenous people
 - f) satellite data collection (SIVAM: System for the Vigilance of the Amazon)
 - g) World Bank loans and grants
 - h) Certification by the Forest Stewardship Council (<http://www.fscus.org>)

USDA US Forest Service blog <https://www.fs.fed.us/blogs>

-
- B. Ocean ecosystems
 - 1) marine fisheries
 - a) the catch
 - *TAC = total allowable catch* (a fishing free-for-all, which determined when the season would end)
 - *IQ = individual quota system* (you are awarded a calculated allotment of the TAC, and you can fish during a predetermined length of time)
 - b) stats from <http://www.greenfacts.org/fisheries/index.htm#1>
(stat years listed are not the most current)

Production

- | |
|---|
| <ul style="list-style-type: none"> • 2006 global production from fishing/aquaculture ~144 million tons • aquaculture has been expanding |
|---|

- China and Peru continue to have the largest catches
- Oceans/seas provide 90% of the worlds catches
- The share of catches from the open ocean, the international waters outside of the fishing zones under the jurisdiction of coastal countries, has increased in recent decades and reached about 13% of all marine catches in 2006. Close to a third of these catches were deep-water species.
- Developing countries, particularly in Asia and Africa, accounted for most of the world's inland water fishing.
- Aquaculture is the fastest growing animal based food-producing sector, particularly in developing countries. This sector alone contributes nearly a third of the world's supply of fish products. China is by far the largest producer.

c) *NOAA's National Marine Fisheries Service (NMFS)*
(NOAA = National Oceanic & Atmospheric Administration)

From <http://www.nmfs.noaa.gov>

“NOAA’s National Marine Fisheries Service is the federal agency, a division of the Department of Commerce, responsible for the stewardship of the nation’s living marine resources and their habitat. NOAA’s National Marine Fisheries Service is responsible for the management, conservation and protection of living marine resources within the United States’ *Exclusive Economic Zone* (water 3-200 miles offshore).

Using the tools provided by the **Magnuson-Stevens Act**, NOAA’s National Marine Fisheries Service assesses and predicts the status of fish stocks, ensures compliance with fisheries regulations and works to reduce wasteful fishing practices.

Under the **Marine Mammal Protection Act** and the **Endangered Species Act**, NOAA’s National Marine Fisheries Service *recovers protected marine species* (i.e. whales, turtles) without unnecessarily impeding economic and recreational opportunities. *With the help of the six regional offices and eight councils, NOAA’s National Marine Fisheries Service is able to work with communities on fishery management issues.*

NOAA’s National Marine Fisheries Service works to promote sustainable fisheries and to prevent lost economic potential associated with overfishing, declining species and degraded habitats. NOAA’s National Marine Fisheries Service strives to balance competing public needs.”

d) legislation

- **Magnuson-Stevens Fishery Conservation and Management Act (MSA)**

From <http://www.nmfs.noaa.gov/sfa/magact/>

“The Magnuson-Stevens Fishery Conservation and Management Act (MSA) is the primary law governing marine fisheries management in United States federal waters. The Act was first enacted in 1976... Most notably, the Magnuson-Stevens Act aided in the development of the domestic fishing industry by phasing out foreign fishing. *To manage the fisheries and promote conservation, the Act created eight regional fishery management councils.* The 1996 amendments focused rebuilding overfished fisheries, protecting essential fish habitat, and reducing bycatch [living creatures that are caught unintentionally by fishing gear].”

- **Sustainable Fisheries Act (SFA):** SFA amended the MSA in 1996 with numerous provisions requiring science, management, and conservation actions

- 2) International whaling
 a) International Whaling Commission (IWC)

From <https://iwc.int/home>

“The International Whaling Commission (IWC) was set up under the International Convention for the Regulation of Whaling which was signed in Washington DC... in 1946. The purpose of the Convention is to provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry.” (73 member nations)

- b) whale stakes

<https://iwc.int/catches> , <https://iwc.int/catches> , https://iwc.int/table_objection

“In 1982, the Commission took a decision, which came into force for the 1985/86 seasons, that catch limits for all commercial whaling would be set to zero... the Scientific Committee has developed and the Commission adopted the Revised Management Procedure for commercial whaling. This has not been implemented, awaiting agreement from the Commission on the Revised Management Scheme which includes additional non-scientific matters including inspection and observation.

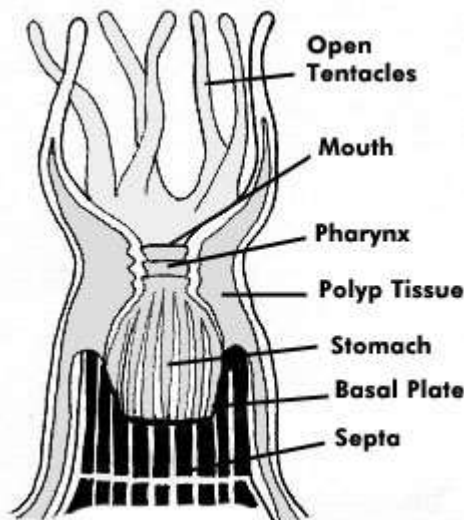
At the 2003 meeting, as in previous years, the Commission did not adopt a proposal by Japan for an interim relief allocation of 50 minke whales to be taken by coastal community-based whaling. As Norway has lodged objections to the relevant items in the Schedule, it has exercised its right to set national catch limits for its coastal whaling operations for minke whales. The Commission passed a Resolution calling on Norway to halt all whaling activities under its jurisdiction.” *Since 1985, over 24,000 whales have been taken “under objection,” mostly by Norway, Iceland, and Japan.*

- c) whale watching – top 10 best places

Alaska	The Maldives (Island chain in Indian Ocean)
Western Cape (South Africa)	Antarctic Peninsula
Iceland	Baja California Peninsula (Mexico)
Canadian Arctic	Vancouver Island (Canada)
Isle of Mull (Scotland)	
Dominica (Caribbean)	

Entertainment and scientific value (whales are in Order Cetacea)

- 3) coral reefs
 a) coral anatomy – a living *polyp*, from MarineReef archives



- b) coral facts
 - corals are small invertebrate animals (Cnidarians), of varying size
 - coral reefs are the second most productive ecosystem (rainforest is first)
- c) **hard coral** build reefs
- d) **soft coral** do not build reefs; they are tree-like and look like vegetation
- e) **zooxanthellae** from <http://www.uvi.edu> archives

“Zooxanthellae are unicellular yellow-brown (dinoflagellate) algae which live symbiotically in the gastrodermis of reef-building corals. It is the nutrients supplied by the zooxanthellae that make it possible for the corals to grow and reproduce quickly enough to create reefs. Zooxanthellae provide the corals with food in the form of photosynthetic products. In turn, the coral provides protection and access to light for the zooxanthellae.”

- f) **coral bleaching** from <http://www.uvi.edu> archives

*“Coral bleaching is the whitening of coral colonies due to the loss of symbiotic zooxanthellae from the tissues of polyps. This loss exposes the white calcium carbonate skeletons of the coral colony. Corals naturally lose less than 0.1% of their zooxanthellae during processes of regulation and replacement. However, adverse changes in a coral’s environment can cause an increase in the number of zooxanthellae lost. *There are a number of stresses or environmental changes that may cause bleaching including disease, excess shade, increased levels of ultraviolet radiation, sedimentation, pollution, salinity changes, and increased temperatures.*”*

- g) *Anthropogenic exploitation of coral reefs due to human expansion and development*
 - *increased runoff: sediments, pollutants, etc.*
 - *overfishing for “tropical” fish – disrupts ecosystem balance*
 - *use of coral for knickknacks and jewelry*
 - *commercial and private marine vessels: fuel spills, etc.*
- h) Natural threats to coral reefs
 - hurricanes and typhoons
 - predators and fish, notably the crown-of-thorns starfish, *Acanthaster planci*, which inverts its stomach onto parts of a reef to digest it

4) Mangroves

- a) general info - mangrovesgy

from <http://www.mangrovesgy.org/home/index.php/2014-04-27-16-39-08/types-of-mangroves>

“The word ‘Mangroves’ refers to a group of plants which may actually belong to several families (species that distinctly belong to their own evolutionary group). The term therefore indicates an ecological rather than a taxonomical (scientific classification) grouping - the species are not related. They are unique plants because of their ability to grow in unstable tough environments.

*Mangroves are unique because they are able to thrive in areas where the water is poor in oxygen content, in salt water, in fresh water and in brackish water (a mixture of salt and fresh water). Mangroves are fast-growing trees taking several years to reach up to 25 meters when they are fully grown. Of the seven types of mangroves, three are most dominant-- the **red**, **black** and **white** types.”*

- b) general info - earthisland
from <http://www.earthisland.org/> archives

“Mangroves are the rainforests by the sea. The majority of the subtropical and tropical coastline is dominated by mangroves, estimated to cover an area of 22 million hectares. However, over the past several decades, *the global area in mangroves has increasingly diminished as a result of a variety of human activities, such as overharvesting, freshwater diversion and conversion to other uses...*

Mangrove forests are comprised of taxonomically diverse, salt-tolerant tree and other plant species which thrive in inter-tidal zones of sheltered tropical shores, ‘overwash’ islands, and estuaries. Mangrove trees have specially adapted aerial and salt-filtering roots and salt-excreting leaves that enable them to occupy the saline wetlands where other plant life cannot survive.”

11.4 Notes

- IV. Public and Private Lands in the U.S.:
National Parks, National Wildlife Refuges, and National Forests
- 1) **National Park Service (NPS)** <http://www.nps.gov/faqs.htm>
 - a) when created: 1916
 - b) first national park: Yellowstone National Park, 1872
 - c) National Park System areas:

“The system includes 417 areas covering more than 84 million acres in every state, the District of Columbia, American Samoa, Guam, Puerto Rico, and the Virgin Islands. These areas include national parks, monuments, battlefields, military parks, historical parks, historic sites, lakeshores, seashores, recreation areas, scenic rivers and trails, and the White House.”

- d) Largest National Park: Wrangell-St. Elias National Park and Preserve, Alaska (13.2 million acres)
- e) Smallest: Thaddeus Kosciuszko National Memorial, PA, at 0.02 acres
- f) Total recreation visitors to the national parks in 2015: 307,247,252

2) **National Wildlife Refuge System (NWR)**

<https://www.fws.gov/refuges/>

- a) Special Management Areas
 - *Biosphere Reserves*
 - *Research Natural Areas*
 - *Shorebird Reserves*
 - *Wetlands of International Importance*
 - *Wilderness*

“Congress has designated 75 wilderness areas... in 26 states. About 90 per cent — or 18.6 million acres — of Refuge System wilderness is in Alaska. The remaining 2.5 million wilderness acres are in the lower 48 states.”

- a) From www.wilderness.net

“*The United States was the first country to officially designate land as ‘wilderness’ through the **Wilderness Act of 1964**. Wilderness designation helps preserve the natural state of the land and protect flora and fauna by prohibiting development and providing for non-motorized recreation... Wilderness designations are granted by an Act of Congress for Federal land that retains a “primeval character” and that has no human habitation or development. Approximately 100 million acres (400,000 km²) are designated as wilderness in the United States. This accounts*

for 4.71% of the total land of the country; however, 54% of wilderness is in Alaska, and only 2.58% of the continental United States is designated as wilderness.

There are 680 separate wilderness designations in the United States.”

a) From the **Wilderness Act of 1964**

"...lands designated for preservation and protection in their natural condition..."

"...an area where the earth and its community of life are untrammelled by man..."

"...an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvement or human habitation..."

"...generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable..."

"...has outstanding opportunities for solitude or a primitive and unconfined type of recreation..."

"...shall be devoted to the public purposes of recreation, scenic, scientific, educational, conservation and historic use."

b) Wilderness stats

- first designated wilderness: Great Swamp NWR (NJ)—3,660 acres in 1968
- smallest wilderness area: less than two-acre Wisconsin Islands Wilderness, Green Bay NWR
- largest wilderness area: 8 million acres of the Arctic NWR

3) **National Forests**

a) general stats

From <http://www.wilderness.org> archives

*"The American people own **155 national forests** and **20 national grasslands**, totaling more than 191 million acres. These lands can be found in 40 states plus Puerto Rico, with 87 percent of national forest land having a home in the West. These lands are managed for 'multiple use' by the Forest Service, a branch of the Department of Agriculture.*

*National Forests contain valuable habitat for fish and wildlife (including many endangered species), watersheds that provide clean water for many communities in the West, and some of the finest recreation areas in the country. Nearly 60 million acres of the most pristine national forest land was protected under the 2001 **Roadless Area Conservation Rule**..."*

b) **multiple-use** forestry—"managing a forested area to simultaneously provide more than one of the following resource objectives: *fish and wildlife, wood products, recreation, aesthetics, grazing, watershed protection, and historic or scientific values*" (From <http://www.sfrc.ufl.edu/Extension/>)

c) **Roadless Area Conservation Rule (Roadless Rule)**

- Number of Acres Affected: 58.5 million
- Percent of US Landbase: 2%
- Percent of Forest Service Landbase: 31%
- IRA= inventoried roadless area

From <https://www.fs.usda.gov/roadmain/roadless/2001roadlessrule>

"The 2001 Roadless Rule establishes prohibitions on road construction, road reconstruction, and timber harvesting on 58.5 million acres of inventoried roadless areas on National Forest System lands. The intent of the 2001 Roadless Rule is to provide lasting protection for inventoried roadless areas within the National Forest System in the context of multiple-use management."

d) *ecosystem management*—long-term stewardship

From <https://www.fs.usda.gov/>



e) fires

National Interagency Fire Center <https://www.nifc.gov>

“The National Interagency Fire Center (NIFC), located in Boise, Idaho, is the nation's support center for wildland firefighting. Eight different agencies and organizations are part of NIFC. Decisions are made using the interagency cooperation concept because NIFC has no single director or manager.... The Boise Interagency Fire Center (BIFC) was created in 1965 because the US Forest Service, Bureau of Land Management (BLM), and National Weather Service saw the need to work together to reduce the duplication of services, cut costs, and coordinate national fire planning and operations. The National Park Service and Bureau of Indian Affairs joined BIFC in in the mid 1970s. The US Fish and Wildlife Service later joined in 1979. The Center's name was changed in 1993 from the Boise Interagency Fire Center to the National Interagency Fire Center to more accurately reflect its national mission. The US Fire Administration-FEMA joined NIFC in 2003.”

4) Protecting Nonfederal lands—land trusts

a) Land Trust Alliance <http://www.lta.org/>

“A **land trust** is an agreement whereby one party (the trustee) agrees to hold ownership of a piece of real property for the benefit of another party (the beneficiary). Land trusts are used by nonprofit organizations to hold conservation easements, by corporations and investment groups to compile large tracts of land, and by individuals to keep their real estate ownership private, avoid probate and provide several other benefits.”

b) can be community or conservation land trusts