Human Pre-History 101: Agriculture Rocks our World

Take notes from the video about how human activities have changed our societies and the landscape.

Ecosystem Services & Biodiversity
(Crash Course Ecology #10)

Healthy ecosystems provide humans with a range of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** which benefit our lives, and would be extremely expensive to replace. The main types of ecosystem services can be classified as:

**\_\_\_\_\_\_\_\_\_\_\_\_\_Services** – create and replenish the foundation of the earth’s biological systems. Such as recycling necessary compounds (biogeochemical cycles), forming new soils, producing oxygen for us to breathe

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Services** – giving us the raw materials we need to live, such as food, water, fibre, fuel

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Services** – moderating many of the earth’s systems that can be dangerous if they “get out of whack”. Decomposing dead things, filtering the air and water, regulating the climate.

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Services** – ecosystems are just kind of awesome. Ecosystems give us places to play, scenes to inspire us, and things to discover and learn about.

Economists have calculated that if we had to do all the things that ecosystems do for us, it would cost **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** dollars per year…the output of the global economy is only \_\_\_\_\_\_ Trillion dollars per year!
 ***\*Ecosystems can only provide these services if they are intact,
specifically if their \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is intact.\****

**Biodiversity**

Biodiversity makes ecosystems more resilient to change. Ecosystems with high biodiversity are way more resilient to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than those with low biodiversity.

In high-biodiversity system if you take one species out of the mix, it’s less likely that the ecosystem will \_\_\_\_\_\_\_\_\_\_\_\_.

In a hectare of Amazonian rainforest there are more species of plants and animal than in all of Europe! If a species of insect goes extinct it is less likely that the house of cards will fall than in a low biodiversity ecosystem like the Sonoran desert where there are very few organisms, so the disappearance of one species could affect the \_\_\_\_\_\_\_\_\_\_\_\_\_ ecosystem.

The best way to understand our impact on the environment is through how we affect \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**6 Main Human Impacts on the Environment**

-**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – Removing what makes a forest a forest (trees!). Estimated that we are clear cutting about 8000 hectares of trees a day to graze cattle and use the wood. High biodiversity system becomes a low biodiversity system. Also leads to other problems such as erosion.

-**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ –** overgrazing and over irrigation lead to productive ecosystems turning into dessert ecosystems.

-**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ –** More CO2 (the Principle greenhouse gas) in the atmosphere = warmer climate. Deforestation means fewer plants to use up CO2, and at the same time we are releasing greenhouse gases into the atmosphere at high rates by burning fossil fuels. Changes ecosystems and habitats which harms species – and happening at a rate that is difficult for species to react to by adapting or moving; so this also reduces biodiversity.

-**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ –** Introducing non-native species to an ecosystem either intentionally or unintentionally. These invasive species outcompete (or just eat) native species to the point that it “rocks the world of an entire ecosystem”

-**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ –** Most direct impact on biodiversity is overharvesting certain species. We overfish the oceans to mean demand for food sources such as tuna, and we exterminate predators such as wolves to protect livestock. This reduces biodiversity, so those ecosystems become more vulnerable to other disturbances.

A whole separate set of effects on the Biosphere:
-**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – putting the wrong amounts of certain stuff in the wrong place at the wrong time.

A Changing Landscape

Earth as an Island

Planet Earth is a **\_\_\_\_\_\_\_\_\_\_\_** population, similar to a remote **\_\_\_\_\_\_\_\_\_\_**. All humans and other organisms share a limited resource base that they depend on for their long-term **\_\_\_\_\_\_\_\_\_\_\_\_\_\_.** Understanding how humans interact with the biosphere is important to protect these critical resources.

Human Activities

As a species, we depend on **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and biogeochemical **\_\_\_\_\_\_\_\_\_\_\_**. Ecosystems provide a range of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** that provide breathable **\_\_\_\_\_**, drinkable **\_\_\_\_\_\_\_\_\_**, fertile **\_\_\_\_\_\_**, as well as storage and recycling **\_\_\_\_\_\_\_\_\_\_\_\_**, pollinating our food crops, and regulating the climate.

Since we depending on these services for our **\_\_\_\_\_\_\_\_\_\_**, it’s important to understand how we **\_\_\_\_\_\_\_\_\_\_** local and global environments. As a species, we use as much energy, and transport as much material, as all Earth’s other multicellular species **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**! We are the most important source of environmental **\_\_\_\_\_\_\_\_\_\_\_\_** on the planet.

Some of the most important activities that affect the environment are hunting & gathering, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, and **\_\_\_\_\_\_\_\_\_\_\_\_** development.

Hunting & Gathering

For must of human history, humans got their food through hunting and gathering.

* Hunted birds, **\_\_\_\_\_\_\_\_\_\_\_\_\_**, and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in lakes and rivers
* Gathering wild **\_\_\_\_\_\_\_\_\_\_\_**, **\_\_\_\_\_\_\_\_\_**, and **\_\_\_\_\_\_\_\_\_\_**.

These early hunters changed their environment – about 12000 years ago caused a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of animals in North America. Among the animals that disappeared from the continent or became extinct worldwide include woolly **\_\_\_\_\_\_\_\_\_\_\_\_\_**, giant ground **\_\_\_\_\_\_\_\_\_\_**, sabre tooth tigers, as well as cheetahs, zebras, and yaks.

Some groups of people around the world still follow a hunter-gatherer lifestyle, at least some of the time. These hunters have relatively **\_\_\_\_\_\_\_\_\_** impact on the environment, but today most use some form of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, such as manufactured tools, guns, and snowmobiles.

Agriculture

Over time hunter-gatherers learned which plants were useful for **\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_\_**. Around the end of the last ice age, about 11000 years ago, humans began planting and cultivating some of those plants, including **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_\_**. They also started domesticating **\_\_\_\_\_\_\_\_\_\_\_\_\_** for food or other uses, such as **\_\_\_\_\_\_\_\_\_**, goats, **\_\_\_\_\_\_\_\_,** pigs, as well as **\_\_\_\_\_\_\_** and horses. Agriculture was a major development in human history – it provided a stable and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** food supply, allowing larger, stable **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, and the development of governments, laws, and writing.

**Changes in Agriculture Over Time**

* Farmers acquired tools and basic machinery such as **\_\_\_\_\_\_\_\_\_\_\_** and seed drills
* Exploration of the world caused an **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of crops around the world
	+ Potatoes and squash from the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** were brought to Europe
	+ Rice from **\_\_\_\_\_\_\_\_\_\_** was brought to the Americas and to Europe
* Advances in science and technology in the 1800s and 1900s
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in dry areas such as the western US and Canada made them much more productive
	+ Improved **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** for plowing, planting, and harvesting made it more efficient
	+ Scientists developed **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** with higher yields. These crops were often planted as **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, where very large fields were planted with a single crop over and over
	+ Synthetic fertilizers and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** helped increase yields and reduce losses to pests
* The **\_\_\_\_\_\_\_\_\_\_\_** Revolution – middle of Twentieth Century
	+ Despite advances in agriculture, there were food **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in many parts of the world
	+ Governments & scientists worked to increase food production in these regions:
		- **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of wheat and rice were developed and shared
		- Modern **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** such as monocultures, technology, and synthetic fertilizers were introduced to these regions
		- These efforts greatly increased the world’s **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and nutrition
			* Wheat production in Mexico increased by **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in 20 years.
			* **\_\_\_\_\_\_\_\_\_** and China produced enough food to feed their growing populations
			* Global food production doubled over **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* Future Challenges – modern agriculture has produced ecological **\_\_\_\_\_\_\_\_\_\_\_**
	+ Large-scale monocultures can lead to problems with insect **\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ Chemical **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** can damage beneficial insects, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**water supplies, and accumulate in the environment
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** requires a large amount of water, which can cause issues
		- A major portion of food production is dependent on irrigation
		- This irrigation can contribute to drying up natural **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* We need to find ways to maintain the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of modern agriculture, which reducing these ecological **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Industrial Growth & Urban Development

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** Revolution - new machines and factories to increase **industrial** development
	+ Lead to most of the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of modern life, including our homes, clothes, electronic devices, cars, farm machinery. This has lead to major increases in our **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**
	+ All of these advances require **\_\_\_\_\_\_\_\_\_\_\_**, primarily from fossil fuels
	+ Increased **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**: wastes from cities, agriculture, and industries pollute the air, water, and soil.
* Crowded **\_\_\_\_\_\_\_\_\_\_\_** centres lead to people moving to the suburbs, causing cities to spread and replace **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and natural **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, plus increased pollution from commuters
* How can we control the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of human activity, while preserving our standard of living, and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** the standard of living in **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** parts of the world?

Renewable & Non-Renewable Resources

**\_\_\_\_\_\_\_\_\_\_\_ of the Commons** – when a resource (grazing lands, ground water for irrigation, fish in the ocean, etc), is unregulated and anyone can use it, it often becomes destroyed because no-one is responsible for it.

Classifying Resources - Environmental goods and services can be classified as either renewable or non-renewable.

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** resources can **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – living things and non-living resources that are replenished by biogeochemical cycles. However they are still **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ Examples: **\_\_\_\_\_\_\_**, grazing lands, fresh **\_\_\_\_\_\_\_\_\_\_,** populations of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** resources **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** be replenished by natural processes.
	+ Examples: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (coal, oil, natural gas)

**Sustainable Development**

**Sustainability** (2 Definitions)

**-** Improving the quality of human life while living within the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of supporting
ecosystems

 **-** The capacity of our human society to continue \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ within the natural cycles of the earth.

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Generations Concept:** an ecological concept that urges the current generation of humans to live sustainably and work for the benefit of the seventh generation (about **\_\_\_\_\_\_\_\_\_\_** years) into the future.

-this idea comes from Iroquois teachings:
Chief Oren Lyons of the Onondaga Nation has written that it is a responsibility of chiefs to “make every decision that we make relate to the welfare and well-being of the **\_\_\_\_\_\_\_\_\_\_\_\_** generation to come”

**4 Basic Care Instructions for our Planet –** developed by scientists in **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* Reduce our dependence on **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and heavy metals
* Reduce our dependence on **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** that persist in nature
* Reduce our **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of nature
* Ensure we are not stopping people globally from meeting their **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Sustainable Development:**Development that meets the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** without compromising the ability of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  to meet their own needs

Land Resources

Arable (farmable) land is required for agriculture, but plowing and intensively planting and/or grazing this land can lead to **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** ( 47 tons of topsoil lost per hectare, every year) and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.

Sustainable techniques: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (using the shape of the land to reduce erosion), **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (leaving stems and roots of the previous crop in place to hold the soil), and planting **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** like rye to reduce erosion in the offseason.

Forest Resources

Living forests act as the **\_\_\_\_\_\_\_\_\_\_** of the Earth, cleaning the air, taking up carbon dioxide, and producing oxygen. They also store nutrients, provide habitats, moderate climate, limit soil erosion, and protect freshwater supplies. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, partially or completely removing these trees from an area, has huge negative effects on all of these systems.

Since trees can be replanted after they are cut down, forestry products are often considered **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**. However, harvesting trees also reduces the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of the forest ecosystem, and makes it less resilient to disturbances.

* Negatively affects the organisms that depend on those trees for food and habitat
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** takes a long time to replenish those habitats
* Usually replanting projects only replace 1 or **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** species of trees, regardless of how many species were harvested from the area
* While the trees are gone, soil is no longer held in place, so \_\_\_\_\_\_\_\_\_\_\_\_ can occur quickly

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ forests** are forests that have never been cut, they are the most important to **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in terms of their ecosystem value and services. They are often home to a rich diversity of species, which will be lost if these trees are cut.

Sustainable practices:

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ harvesting** of a few mature trees from throughout the forest can promote succession and the growth of younger trees, while leaving most of the ecosystem intact.
* Focussing harvesting on **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  that have already been cut and are regularly replanted, while preserving old growth forests. New fast-growing varieties of trees can help to make these tree farms a truly renewable resource.

Fishery Resources

Fish and other marine species are a source of food for human communities. However **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (fishing grounds) are often an example of a **\_\_\_\_\_\_\_\_\_\_\_** of the commons. People from different provinces, states, and countries often harvest from the same fishery, viewing it as a renewable resource that could be harvested **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, but this use has been largely unregulated, so **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (harvesting fish faster than they can replenish the population) has been common, leading to major declines on species like Cod and Haddock.

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  (fish farms for human consumption) is one option to reduce the stress on natural fisheries, however it can also cause **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** due to the use of chemicals to improve production, and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** to reduce disease (remember antibiotic **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**?) Some new forms of aquaculture are being developed to try to reduce these issues.

Sustainable Fisheries: using **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**data on fish populations to produce **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and guidelines for commercial fishing can lead to much more sustainable fishing industries. These guidelines regulate the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_** (age) of fish that can be caught, and which regions can be harvested at particular times of year to allow for mating to occur naturally.

Air Resources

We require air to breathe every second of our lives. The **\_\_\_\_\_\_\_\_\_\_\_\_** of this air has major impacts on our health, and on the health of ecosystems. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  are any harmful materials that enter the biosphere through the land, water, or air.

* **\_\_\_\_\_** is a mixture of chemicals in a grey-brown haze in the atmosphere over a city or industrial centre.
	+ Largely due to exhaust from vehicles and industrial **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ Has major effects on people with respiratory problems such as **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** pollution – fine particles of ash and dust that are inhaled and cause major health problems
	+ Caused by the burning of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** & wood
	+ A major problem in regions where people cook and heat their homes by burning **\_\_\_\_\_\_\_\_\_\_** or oil in their home – lots of **\_\_\_\_\_\_\_\_\_\_\_\_** air pollution
* Nitrates and Sulphates combine with water vapour in the atmosphere to produce **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ Kills **\_\_\_\_\_\_\_\_\_\_\_\_** by damaging leaves and roots and changing the pH of the soil
	+ Changes the pH of standing water ecosystems, killing **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** organisms

Sustainable Practices:

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** regulations and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** regulations have led to reductions in air pollution in North America and in Europe
	+ Many of these problems can be reduced through technology that “**\_\_\_\_\_\_\_\_\_\_**” these particles and chemicals out of emissions before they leave the smokestack or tailpipe
* Air pollution from **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  and home heating and **\_\_\_\_\_\_\_\_\_\_\_\_** is still a major problem in other parts of the world

Water Resources

While water is a renewable resource, the total amount of water is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, and the quality of water must be preserved. Humans use water for consumption, but much larger amounts are used in **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and in **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.

Water Pollution

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** from industry and agriculture can enter streams and rivers if not properly disposed of
* Wastes discarded on land (such as in **\_\_\_\_\_\_\_\_\_\_\_**) can seep into the ground and enter ground water
* Domestic **\_\_\_\_\_\_\_\_\_\_\_\_** (water from sinks and toilets)
* contains nitrates and phosphates which can lead to **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* contains microorganisms that can spread **\_\_\_\_\_\_\_\_\_\_\_\_**

Sustainable Practices

* Most cities in North America and Europe now **\_\_\_\_\_\_\_\_\_\_\_\_** their sewage before it enters the water systems to remove disease-causing microbes and reduce nitrates and phosphates
	+ However this **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** happen all over the world – sanitation is still a major issue
* Reducing the use of industrial and agricultural **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, and requiring strict procedures for disposal of harmful substances so they don’t get into the water sources
* Protecting & restoring natural systems in the water cycle such as **\_\_\_\_\_\_\_\_\_\_\_** to help purify water
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** water in homes, industry, and agriculture helps reduce pressure on these systems
	+ For example: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  to reduce water loss through evaporation

Biodiversity

What is Biodiversity?

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**: the sum total of the genetically based variety of all organisms in the biosphere

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ diversity**: the variety of habitats, communities, and ecological processes in the living world.

**\_\_\_\_\_\_\_\_\_\_\_\_\_ diversity:** the number of different species in the biosphere. 1.5 species have been identified and named in the biosphere, it’s estimated that millions more will be discovered in the future

**\_\_\_\_\_\_\_\_\_\_\_\_\_ diversity:** the sum total of all different forms of genetic information carried by all organisms living on Earth today. Within a species, this means all the different forms of genes present in that species.

**Biodiversity is one of Earth’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ resources.** Species of many kinds have provided us with foods, industrial products, and medicines, including painkillers, antibiotics, heart drugs, antidepressants, and anticancer drugs.

Threats to Biodiversity

Humans reduce biodiversity by altering **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** species to extinction, introducing **\_\_\_\_\_\_\_\_\_\_** compounds into food webs, and introducing foreign **\_\_\_\_\_\_\_\_\_\_\_\_\_** to new environments.

These threats can lead to species becoming **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  (a species that has a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** population size in a way that places it in danger of disappearing entirely), which can lead to **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (when a species **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** from all or part of its range). As a population of a species declines, the species loses genetic diversity, which makes them more vulnerable to extinction.

**Altering Habitats**

As human development increases and spreads, natural habitats are often **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**. This can lead to the species becoming endangered or extinct. Another issue is **habitat \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, when development splits natural ecosystems into smaller pieces – such as by **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_**, mining, clear cutting or degrading some areas of the ecosystem, or creating small parks surrounded by city and industrial development. These small patches of usable habitat become **biological \_\_\_\_\_\_\_\_\_\_\_**, which are isolated from other habitat areas, have small population sizes, and are more **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** to disturbances than larger patches of habitat.

**Demand for Wildlife Products**

Throughout history, humans have pushed many species to extinction by hunting them for food or other products. Examples: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and Carolina parakeet in the 1800s.

In the US and Canada today, endangered species are protected from **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**. However in other parts of the world, such as Africa, South America, and Southeast Asia, hunting is still a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** to rare animals. Some species are hunted for **\_\_\_\_\_\_\_\_\_**, fur, or hides, while others are hunted for **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** that are thought to have **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**properties or other uses such as exotic pet trade and supposed aphrodisiacs.
Examples: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, **\_\_\_\_\_\_\_\_\_\_\_\_** eggs, slow loris, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The Convention on International Trade in Endangered Species (**\_\_\_\_\_\_\_\_\_\_**) bans international trade of any product from an endangered species, however it is often difficult to **\_\_\_\_\_\_\_\_\_\_\_\_** these laws in remote areas.

**Biomagnification**

Pollution is always a problem for biodiversity, but the worst effects occur when chemicals persist and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in the tissues of organisms. The most famous example of this is DDT. DDT was one of the first widely used **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** It seemed perfect: cheap, remains active for a long time, can control both agricultural pests and disease-carrying **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* When sprayed, DDT leached into water systems in relatively low concentrations. It is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* When **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** pick up DDT from the water, it doesn’t get eliminated from **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** once absorbed.
* When herbivores eat the plants, the DDT is **\_\_\_\_\_\_\_\_\_\_\_\_** in their tissues. Herbivores eat **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** over their lifetimes, so the DDT builds up over their lives.
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** eat many herbivores, and the DDT builds up further. The farther up the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** you move, the more DDT found in the tissues. Biomagnification affects the entire food web, but **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** carnivores are at highest risk. One effect of DDT on birds such as **\_\_\_\_\_\_\_\_\_\_\_\_\_,** Osprey, and Brown Pelicans, is to make their **eggs so \_\_\_\_\_\_\_\_\_\_**they can’t survive.

DDT was **\_\_\_\_\_\_\_\_\_\_\_\_** in the US and Canada and most industrialized countries in the **\_\_\_\_\_\_\_\_\_\_\_\_.** These bird populations have started to recover. However DDT is still used in many developing countries, especially as a method of controlling **\_\_\_\_\_\_\_\_\_\_\_\_** -carrying mosquitos.

**Introduced and Invasive Species**

Apparently harmless plants and animals are often **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** by humans (intentionally or accidentally). If these species become established in new habitats, they can become **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** that reproduce rapidly and outcompete (or simply eat) native species. Invasive species can often experience very fast population growth because their new habitat lacks the predators and parasites (**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**) that usually control their population “back home.”

**Examples:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in the Great Lakes, Asian carp in Great Lakes, European green crab in the Maritime Provinces, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, emerald ash borer in QC and ON, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in Eastern Canada.

Conservation

Conservation refers to the wise **management** of natural resource, as well as the **preservation** of habitats and wildlife. Conservation Biology seeks to protect and preserve **biodiversity**, and uses information and techniques from many scientific disciplines to achieve this goal.

Some conservation efforts focus on **individual species** that are vulnerable, and preserve those individuals in zoos and other reserves, including using captive breeding programs. A growing focus is on preserving **entire ecosystems** through national, state, and provincial parks and other programs. It is especially important to preserve **biodiversity hot spots** – locations with high biodiversity and many unique species. This strategy often provides the most “**bang for our buck**” in terms of preserving the most species and most genetic diversity.

Protecting resources and habitats for the future is not always easy – it requires people to **change** the way they live and **earn their living** today. However, if we do not take action to protect these resources now, then those resources, such as fisheries are likely to **collapse completely** in the future, causing even more serious hardship.

Conservation and Poverty – Wangari Maathai and the Greenbelt Movement video

Conservation Biology & Restoration Ecology – Crash Course Ecology Video

**Human Impacts on a Global Level**

Two issues that impact the biosphere as a whole, and are caused by human activities, are depletion of the ozone layer, and global climate change.

Ozone Depletion

The **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** is a region 20-50 km about the Earth’s surface with a high concentration of ozone gas. This layer absorbs a large amount of **ultra violet** (UV) radiation before it reaches the Earth’s surface.

UV radiation causes **sunburn**, **\_\_\_\_\_\_\_\_\_\_**, damage to the eyes, and decreases organisms’ resistance to disease. Intense UV radiation also damages plant **\_\_\_\_\_\_\_\_\_\_\_\_\_** and phytoplankton in the ocean. By shielding the biosphere from intense UV light, the ozone layer is essentially a global **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.

In the 1970s, scientists found satellite data that showed a **\_\_\_\_\_\_\_\_\_** (thin area) in the ozone layer over **Antarctica** in the winter. It appeared to be getting larger and lasting longer. A similar hole appeared over the **Arctic**. In 1974, scientists discovered that **chlorofluorocarbons**, or **\_\_\_\_\_\_\_\_** (used in aerosol cans, coolant in refrigerators and freezers, and in producing plastic foams), could damage the ozone layer. Due to this finding, the US and many other countries began **reducing the use of CFCs** in 1987. CFCs can persist for up to 100 years, so improvements have been slow, but they are noticeable. It may take another **\_\_\_\_\_\_\_\_\_\_\_\_** for the holes to disappear.

Global Climate Change

The **greenhouse effect** allows the Earth to stay warm enough for life to exist on our planet. The **carbon cycle** impacts how high the concentrations of greenhouse gasses get to in the atmosphere, which influences how much **solar radiation** stays within the biosphere.

**Evidence of Global Warming**

Global climate and weather data from around the world shows that the earth has been getting warmer over the past century or so – since **1880** (pre-industrial times) the global average temperature has already increased by **\_\_\_\_\_\_\_\_\_\_**. This may not seem like a lot, but remember this is an **average** over the entire planet – much more extreme effects are seen in each location around the globe.

Evidence from **ice cores** from the polar ice caps also show longer term trends in both **global temperatures**, and atmospheric levels of **Carbon Dioxide** and other greenhouse gasses (due to human activities such as burning **fossil fuels** and reducing **forest** cover). As these gasses increase in the atmosphere, more heat is **trapped**, and the temperature goes up.

**Glaciers**, polar **ice caps**, and sea ice are already **melting** at an alarming rate, and the reduction in albedo (reflectance) means that even more heat from sunlight is absorbed by the water and the earth, causing the ice to melt faster.

**Effects of Global Warming**

Some of the effects that we are already seeing include:

-“**weather weird-ing**”: more extreme or unusual weather (floods, droughts, hurricanes, extra cold winters, cooler summers, heat waves, etc.)
-melting glaciers & ice caps which leads to **rising sea levels** and climate **refugees**
-melting **permafrost** (which releases more trapped carbon)
-shifting ranges for plants and animals which is leading to more **extinctions**