



## 5 Human Impacts on the Environment: Crash Course Ecology #10

Crash Course: Ecology

<https://youtube.com/watch?v=5eTCZ9L834s>

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At this point people have been studying the impacts that humans have had on the world around us for a solid fifty years, and while it's hard to get a handle on exactly how the choices we make every day affect the environment, there's no question that our lifestyles, our cars, our need for more farmland and our love of all kinds of plastic stuff are putting the hurt on ecosystems all over the world.

Human activity all by itself, just people doing what they do, could be responsible for the extinction of nearly 1000 plant and animal species to date—most of them over the last century.

And even if you don't particularly care about the Barbary lion, or the St. Helena olive, or the passenger pigeon, or anything else we've driven into extinction, the thing is: we need these other organisms.

### Ecosystem Services

(0:41) The ecosystems of the world are working very hard for us every day, filtering water, sucking carbon dioxide out of the air, producing all the food we eat... all very important ecosystem services, benefits that the natural world provides us for free.

So having ecosystems and keeping them intact is important not only for the organisms who live in them, but also for us, the animals who rely on them for thousands and thousands of things that we could never do for ourselves.

Over the next two episodes we're going to look at these systems and how our actions are affecting the ecosystems that we need for our survival. Basically we're messing up the environment six ways from Sunday, but to make it easy on ourselves, let's start with the top five.

(Intro)

We often hear about all the different ways that our behavior is affecting the biosphere: extinctions, climate change, deforestation, acid rain, desertification, pollution and more! But you're asking, "Why are all those things bad? What is going on? How is this stuff turning the Earth into sausage? I don't understand."

Well, I do understand which is why I'm qualified to make this video so let me lay it on you.

The services that ecosystems provide for us, all the dirty work they do, can be broken up into four different categories. They're things that we could never, ever, ever duplicate or work around, no matter what kind of smarty-pants technology we come up with.

First, healthy ecosystems provide *support services* that create and replenish the foundation of the earth's biological systems. These services include recycling all of the compounds that are necessary for life, through the carbon, water, nitrogen and phosphorous cycles.

They also include other processes we've talked about before, like forming new soils and producing atmospheric oxygen. Some ecosystems contribute more to these services than others, but none of them can get these basic jobs done unless they are intact.

Two: Ecosystems also perform *provisioning services*, giving us the raw materials we need to live. Like, the ocean provides *food* in the form of fish sticks and stuff. And rivers and aquifers and other freshwater sources give us *water*.

Plants and animals also yield all kinds of *fiber* that we use for clothing and shelter. And all around us we find sources of *fuel*, whether it's biomass in the form of grasses or wood, hydropower in the form of flowing water, or the carbon locked in millions-of-years-old trees that we're now re-releasing into the atmosphere.

But I'm getting ahead of myself.

Ecosystems also perform super-important *regulating services*, moderating many of the earth's systems that can get dangerous if they get out of whack. Like as we learned in Biology: fungi and other organisms take on the task of decomposing dead things and poop.

Meanwhile, plants help filter the water you drink and the air you breathe, and provide flood control. And they also absorb all that carbon you exhale and that your car belches out, which in turn, helps regulate the climate.

And finally, number four, ecosystems are just kind of awesome. It's nice to be surrounded by happy plants and critters, doing their business. Nice, robust ecosystems give us places to play, scenes to inspire us, and things to just discover and learn about. These are their less tangible, but still important *cultural services*.

An interesting thing about ecosystem services is that economists actually can, and do, calculate the monetary value they provide for humanity. If, for example, we had to do all of the things that ecosystems do for us, it would cost us 46 trillion dollars per year. Which is a lot, considering that the output of the global economy is 66 trillion dollars per year. So, yeah, we should be happy that we don't have to pay for all that.

### The Importance of Biodiversity

(4:07) But you'll notice that I keep saying that ecosystems can only serve up all this awesome sauce if they are "intact." By that I mean they specifically have to have their *biodiversity intact*, because ecosystems are just a bunch of living and nonliving things working together, so unless their living parts are healthy, they're basically just rocks and weather.

The main reason biodiversity is so important is that it makes ecosystems more resilient to that never-ending change (*succession*) we talked about a few weeks ago. Ecosystems with high biodiversity are way more resilient to disturbances than those with low biodiversity.

In a high-biodiversity system, if you take one species out of the mix, it's less likely that the ecosystem will collapse.

Take a hectare of Amazonian rainforest: in that little patch of land, there are more different species of plants and animals than there are in all of Europe. So if a species of insect goes extinct, there's less risk that the whole house of cards will fall than, say, in the Sonoran Desert, where there are very few organisms, so the disappearance of one species could affect the entire ecosystem.

So the best way to understand our impacts on the environment is through how we affect biodiversity. Unfortunately, it turns out that we've been doing a really bang-up job of endangering some of the highest biodiversity ecosystems on the planet. In some cases, we're having impacts on the organisms themselves directly, in other cases, we're affecting biodiversity indirectly, by creating one or two changes in that ecosystem that cascade into all kinds of problems for living things.

First, let's look at that hectare of Amazonian rainforest again, because even though it's one of those super-resilient ecosystems, we're having a serious impact on it. How? Well, first by removing a lot of what makes a forest a forest: trees. According to some estimates, we're clear-cutting around eight thousand hectares of trees a day to provide land to graze cattle on, and to harvest wood to make coffee tables or whatever.



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When you cut down a hectare of rainforest, suddenly a place where a few thousand species used to live turns into a place where just a handful of species live: some grass, some weeds, maybe some rats or mice, some insects and, you know, some cows. Because man, we love cows.

And when you take out so many of the living things on that hectare of land, a bunch of things happen. For starters, you're not just affecting that ecosystem, but neighboring ecosystems as well. For instance, all those trees that were cut down provided the service of regulating the flow of all that rain that rainforests get, not only by absorbing some of it but also by slowing down runoff, letting the water seep into the soil, before slowly making its way into streams and rivers and ultimately the ocean.

But when those trees are gone, the water hits the land and shoots off into the nearest stream, causing erosion and washing minerals and chemicals all the way to the sea, where it affects marine ecosystems. And when I say "affect," I don't mean in a good way.

### Deforestation

(6:42) This, my friends, is what's called a cascade effect, in this case caused by *deforestation*, one of the most obvious, observable human impacts.

### Desertification

(6:49) In addition to causing more flooding and changes in water quality, deforestation on a large scale can lead to another impact: *desertification*, or the spread of dry, unproductive landscapes. But cutting down trees doesn't automatically turn a forest into a desert, desertification is driven along by additional factors, like overgrazing by cattle, and over-irrigation.

So how can over-watering something make it turn into a desert? Well, when we use groundwater to irrigate crops, the natural salts in the groundwater build up in the soil, eventually making it so salty that nothing wants to live there.

Over time, fertile land near desert ecosystems becomes overtaxed, and the desert spreads. And this is exactly what has happened in China over the past century, where overgrazing and the cities' unquenchable thirst for water have caused the Gobi Desert to grow by 3,600 square kilometers every year.

Now, these two impacts by themselves clearly limit the biodiversity of otherwise lush ecosystems. But because they also result in fewer trees that provide the all-important services of releasing oxygen and absorbing CO<sub>2</sub>, you know what domino's gonna fall next: the climate.

### Global Warming

(7:52) Carbon dioxide: the principle greenhouse gas. It insulates the Earth. So it stands to reason that the more CO<sub>2</sub> there is in the atmosphere, the warmer the earth will be. And the thing is, we're reducing the size of forests at the same time as we're unleashing all kinds of greenhouse gases by burning fossil fuels.

This double-whammy is much of what's driving *global warming*. As a result, we're seeing decreases in the levels of polar sea ice, which means less habitat for polar bears, seals and sea birds. More temperate animals are moving closer to the poles, and hotter, drier conditions are causing more grass fires and forest fires.

And while the climate has changed many times in the past, those changes usually took place over centuries or even millennia, giving organisms time to adapt or move. These changes are taking place within our lifetimes and it's kind of a huge deal, and it's complicated. It'd take me at least, like, 10 minutes and 52 seconds to explain it all in detail. Which is why I did that in another

video.

By now hopefully you can see how one human impact can lead to another, and how, even indirectly, they can end up reducing biodiversity.

### Invasive Species

(8:51) But it's hard to overlook the more immediate impacts we can have on ecosystems. One of the more in-your-face ways we affect biodiversity is by introducing *nonnative species*, either intentionally or unintentionally. Again, there are so many examples of this that you can learn more about it in another video I did.

But suffice it to say: whether it's kudzu in North America, or cane toads in Australia, invasive species have a knack for out-competing or outright eating native species to the point that it rocks the world of an entire ecosystem.

### Overharvesting

(9:20) And finally, probably the most direct impact we have on biodiversity is simply *overharvesting* certain organisms. We're overfishing the oceans to meet growing demand for popular fish species, like tuna, while on land we're exterminating important predators, like wolves, to protect livestock... those cows again.

And the less diverse those ecosystems are, the more vulnerable they become to disturbances, including those other four impacts I just mentioned.

And the fact is, there's a bunch more where those came from because there's a whole separate set of effects that humanity has on the biosphere that stems simply from us putting the wrong amounts of certain stuff in the wrong place at the wrong time.

That's what we call pollution, so tune in next time when we'll explore what it really is, where exactly it's coming from, and what we can do about it.

Thank you for watching another kind of depressing episode of Crash Course Ecology and thanks to everyone who helped us put it together. There's a table of contents over there if you want to click to review anything. Or the links are down below in the description. And if you have any questions or comments or ideas for us, please leave them on Facebook or Twitter or of course, down in the comments below.