Lesson 2

Nature, soil and the future of food.

Key Points

Concepts

➔ *Role Models* - our role models shape our aspirations and ideals. Over the last 300 years, the world's societal role models have shifted away from thinkers (like philosophers and scientists), towards celebrities.

➔ *Winning* - we are often taught that to win is to dominate, but this is at odds with nature. The big winners in nature are those that become a valued part of their communities.

➔ *Soil Before Plants* - if we look after the soil, it will produce much healthier food for us: we shouldn't be prioritising looking after our plants; we should be putting the soil first.

◆ *Soil Is Alive* - one teaspoon of soil contains more living things than the entire human population. Adding chemical fertilisers upsets this balance in the long term.

◆ *Soil Stores Carbon* - the top couple of meters of soil contain about 3x as much carbon as the entire atmosphere. Restoring degraded soils to their former health has the potential to capture a significant proportion of our carbon emissions.

◆ *The Wood Wide Web* - Healthy soil is interconnected by vast, complex networks of fungal strands, which ploughing destroys. These networks make the plants healthier, more resilient and better to eat too.

◆ *Monoculture* - when one plant dominates the landscape, it's bad for the health of the soil and surrounding nature in the long term. We use monocultures because they're easier to farm industrially on a large scale.

➔ *Nature & Wildlife* - the nature and wildlife of our planet is in rapid decline, with much of it already gone.

◆ *Biodiversity* - is the complex diversity and variety of all living things. Almost all living things depend upon other living things to survive.

◆ *A Part of Nature* - mobility gives us the illusion of being separate from the Earth, but we are part of Earth's biodiversity and entirely dependent upon it, for our food, oxygen, medicines and more.

◆ *Extinctions* - species are going extinct a thousand times faster than normal. An estimated 1 million species are now at risk of disappearing forever. We estimate that when we get to ⅛ of species becoming extinct, it will be a tipping point for accelerating collapse of the natural world, affecting all living things, including us.

◆ *Population Decline* - many living things aren't going extinct globally, but are disappearing locally. This is why changes in the populations of living things often tell a clearer story of the extent of loss than global extinctions. In the last 50 years we've lost almost 70% of wildlife on land and 90% of mammals. In the last 100 years, we've lost 90% of large fish in the oceans.

◆ *Land Use* - our takeover of most of the world's land (and our influence on the oceans too) is the primary reason for the rapid decline of nature.

◆ *Changing Climate* - the speed of climate change is also having a negative effect on nature, since many living things can't move or adapt fast enough to keep up. 1°C in the last couple of hundred years might seem small to us, but nature thinks otherwise.

◆ *Rewilding* - is the word used for allowing or helping a part of the world to return to its natural state. This could be as simple as removing human influence and letting nature do the rest, or it might involve reintroducing some living thing (like wolves, wildcats, crayweed etc.) that previously flourished before the arrival of humans.

➔ *Anthropocene* - the climate and balance of nature have now been so significantly altered by humans, that we have entered a new geological epoch, called the Anthropocene. Humans and our domesticated mammals now account for 96% of all land mammal mass on Earth.

➔ *Food, Farming & Land* - farms take up 50% of all the habitable land on Earth: they're the main thing replacing forests and wild spaces.

◆ *Farming Emissions* - much of the greenhouse gas emissions from farming aren't because of cows burping or tractors burning fuels; they're due to the opportunity cost of the land not being what it could be naturally without human interference.

◆ *Animals Are Inefficient* - 77% of the world's farmland is used to create animal products, which account for only 18% of our food. It takes a lot of space to create a small amount of "animal product" because we need to grow a lot of plants to feed the animals, which they convert to meat, milk etc. very inefficiently.

◆ *Plants Are Efficient* - 23% of the world's farmland is growing plants for humans to eat. This supplies most (82%) of our food.

◆ *Getting Enough Protein* - most of us eat much more protein than we can possibly use. Most of the protein in our diets actually comes from plants, not animal

products. It is true that animal products are richer in protein, but even Roman gladiators were strong and healthy on mostly vegetarian diets.

◆ *Food Waste* - about ⅔ of all food is wasted before it's eaten, because our food system is set up to maximise profits rather than to minimise our impact on the planet.

Solutions / Actions

➔ *Supporting Farmers* - farmers can easily be the heroes of this story, if they're empowered to put soil first and focus on producing plants more than animals. By voting for the right politics and spending a little more money for food grown on diverse, mixed farms, with minimally ploughed soil and no chemical fertilisers, we're moving the dial towards storing more carbon, protecting nature and improving human health too.

➔ *Shifting Diets* - we can significantly (and easily) contribute to protecting nature by shifting to a more plant-based diet. The more we shift, the more space there is on Earth to feed everyone, and for the rest of nature.

◆ *Farming Is Complicated* - some animal products claim to be "sustainable" or "good for nature", but these claims are rarely backed by science. If in doubt about how sustainable animal products are, it's best to avoid them.

◆ *Reducing Waste* - by minimising food waste, we reduce our negative impact on nature.

◆ *Supporting Diversity* - ⅔ of all crops come from just 9 species of plants. This makes us vulnerable to one of them getting a disease or becoming poorly adapted to a changing climate. We can help to make our food system more secure by choosing to buy diverse plants to eat.

➔ *Conservation Works* - it's scientifically proven that without conservation efforts, many more species would have become extinct by now. By supporting and publicising the work of organisations like the Rainforest Trust and the WWF, we make a big positive difference.

➔ *Ecocide* - individual changes and actions add up quickly and they're important for shifting public and political opinion, but to protect nature effectively and quickly, we need proper laws in place. The Ecocide Law campaign is working internationally to criminalise the large scale destruction of nature, and it needs our support.

➔ *Putting Nature First* - we have become accustomed to the idea that nature is disposable, that it will always support us and that we don't need to worry about it. This is no longer a

reasonable point of view. We need to give nature a place at every boardroom, political and kitchen table, and consider it in all our thinking and planning, giving it the space it needs to thrive, be it through active rewilding, or simply by leaving it alone!
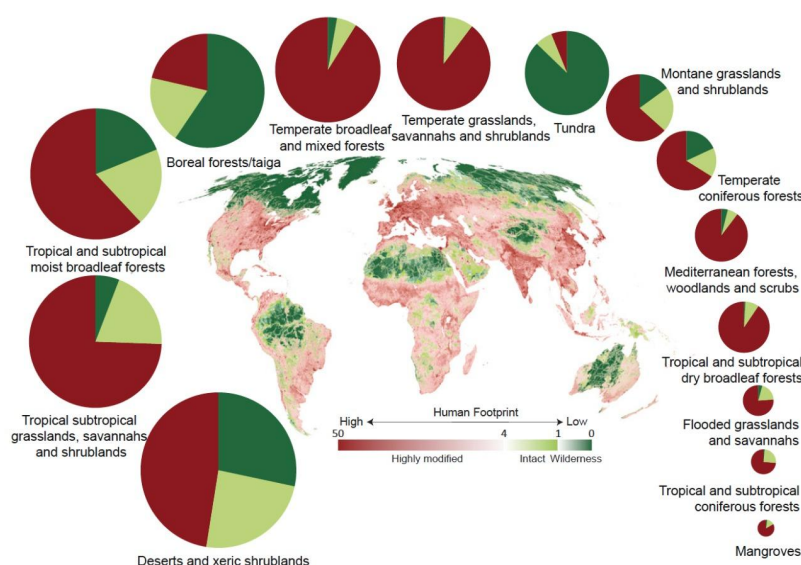
➔ *Publicising Nature* - by becoming cheerleaders and champions for nature, encouraging others to celebrate it as it is; unaltered, we can multiply our positive impact enormously. We can also help to shift perspectives by changing the way we use the word "nature" by making it clear that we're all part of it.

➔ *Thinker Role Models* - as the landscape of societal role models shifts towards celebrities, we all have a crucial role to play in becoming and uplifting thinker role models, and inspiring those around us to want to be scientists, explorers, inventors, conservationists and changemakers, and helping people to value things that protect all life on Earth.
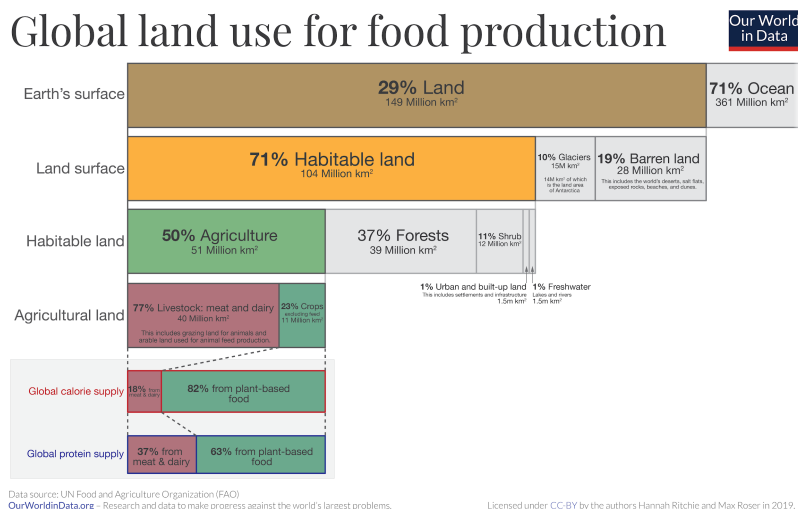
Useful Diagrams

Land Change

Humans have now significantly altered the surface of the Earth. This diagram shows the extent of our modification of the land as a map, and different types of regions as pie charts. Notice how the less modified (more green) regions are mostly inhospitable deserts, mountains and tundra.

([Change in Terrestrial Human Footprint…](#))

Global Land Use

Most of the land we've modified, we've converted to farmland. This chart shows how the land on the Earth is used, and how this farmland contributes to our food supply.

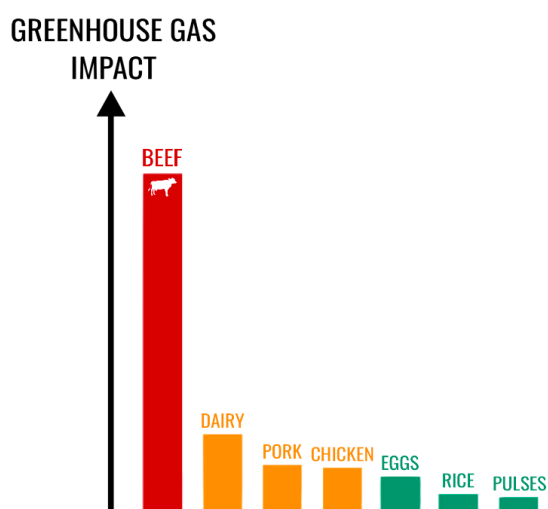

([Our World In Data](#))

Earth's Land Mammals

If you were to put all of the world's land mammals into a pile, then this chart shows approximately how the total weight of that pile would split up. This chart is based on slightly old data, but it's still close to the reality. We used the most up to date numbers in the lesson and the Key Points above.

(XKCD, using data from Vaclav Smil)

Greenhouse Gas Emissions From Foods

This is a simple chart created by AimHi's Matthew Shribman to show the *relative* greenhouse gas emissions of certain foods per unit of protein.
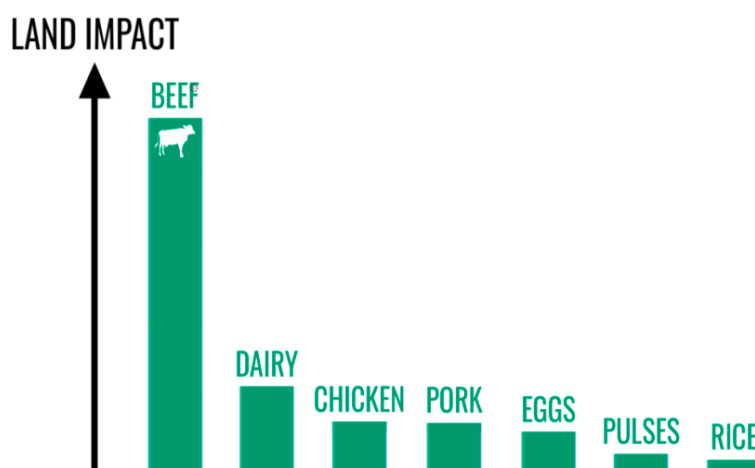

(Matthew Shribman, based on data from WRI, Shifting Diets)

Land Impact of Foods

This is another simple chart created by AimHi's Matthew Shribman to show the *relative* land requirements of certain foods per unit of protein. Notice how closely this chart matches the previous one. The reason they match so closely is explained in the Key Points above.
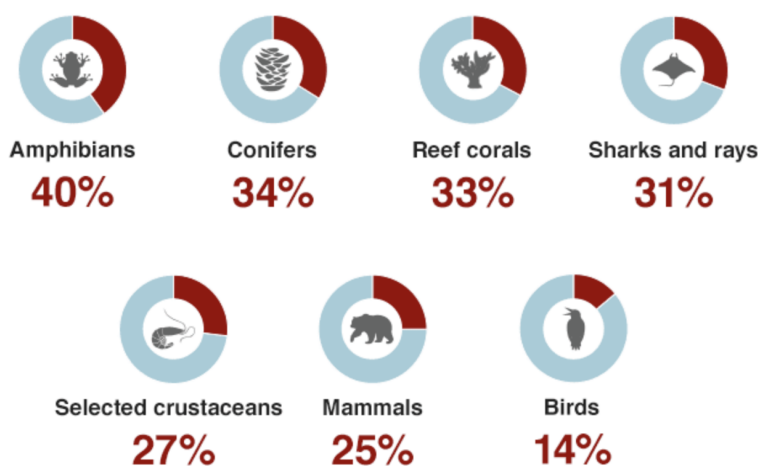

(Matthew Shribman, based on data from WRI, Shifting Diets)

Extinctions

We are entering a period that many are calling the "sixth mass extinction". Living things have only disappeared in such great numbers 5 times before in the history of the Earth. This chart shows the percentage of amphibians, mammals, birds and more currently at risk of extinction.

(IUCN)

Legality Isn't A Guide For Morality

Just because something is legal doesn't mean it's reasonable. We need the law to catch up with the scientific reality. It'd make sense for actions that put humanity at risk to be illegal.
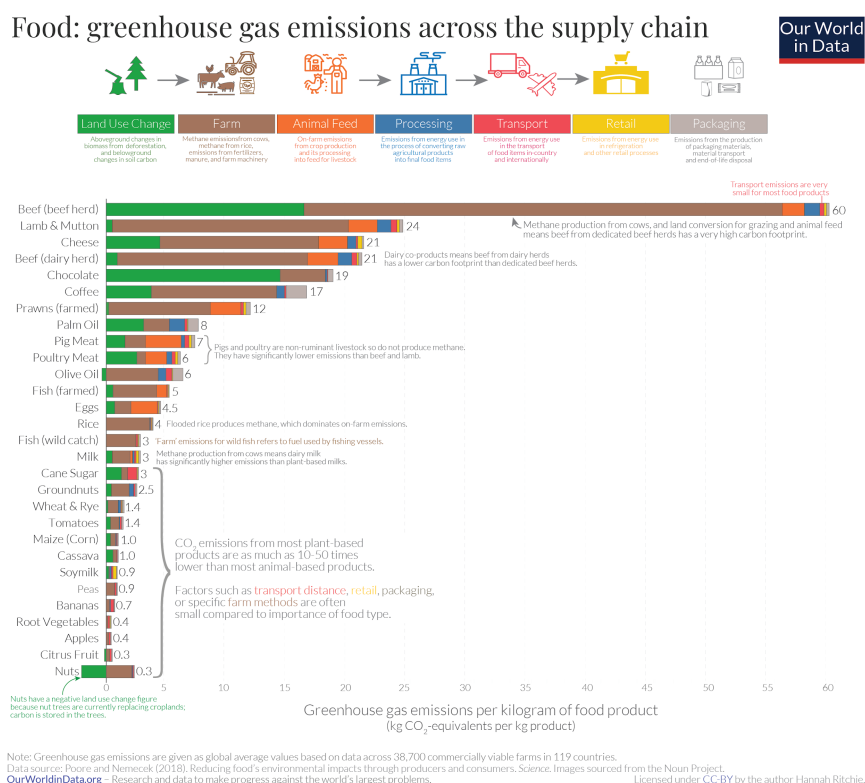

([The Mind Unleashed](#))

Appendix

Here are some bonus diagrams and images that you might find useful or interesting.

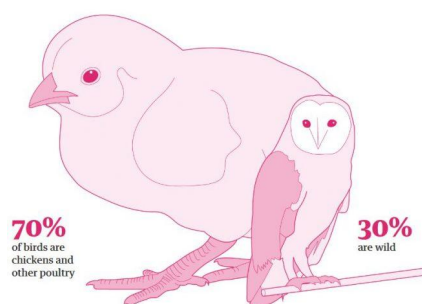## Greenhouse Gas Emissions From More Foods

The greenhouse gas emissions from farming and food production, and which part of the process causes them, can be complicated. This chart makes it simple for multiple foods.

([Our World In Data](#))

Chickens On Earth

Most of the birds on Earth these days are chickens.
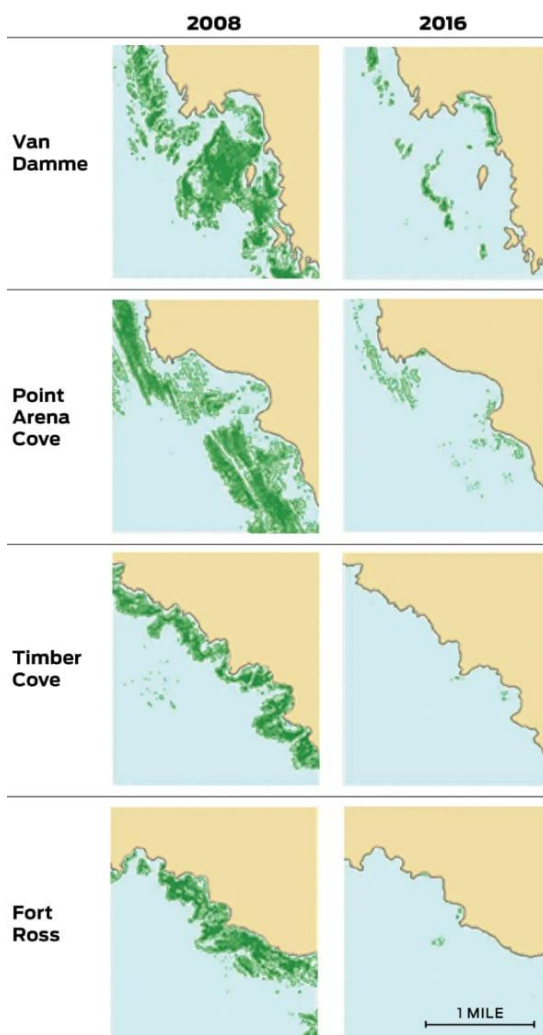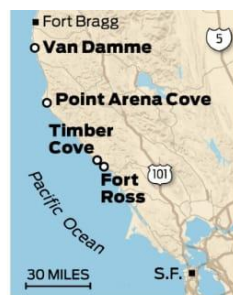

([The Guardian](#))

Kelp In Decline

Kelp forests are disappearing around the world. It's a process that we need to reverse, because their death releases huge amounts of greenhouse gases, and shrinks vital habitats. Restoring them has the opposite effect: locking up carbon and helping biodiversity to flourish.

Steep decline in kelp population

Ravaged by sea urchins, kelp populations (shown in green) along the North Coast of California are down to only about 10% of historic levels.

Source: "Marine heat wave and multiple stressors tip bull kelp forest to sea urchin barrens" by L. Rogers-Bennett and C.A. Catton
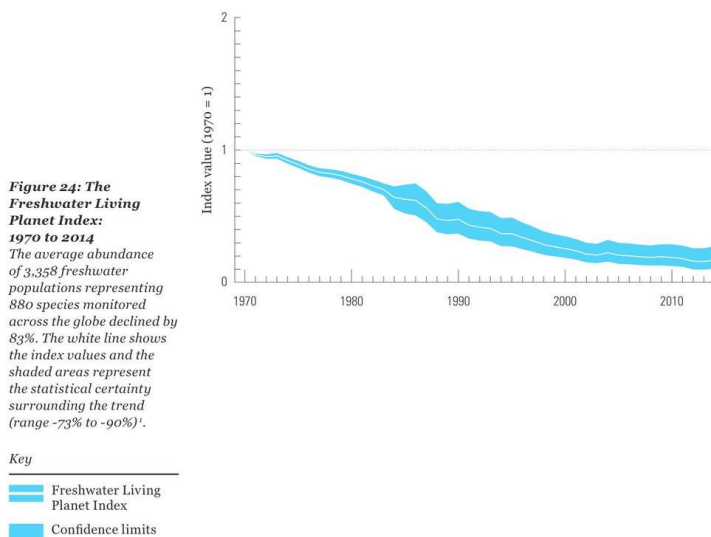
Todd Trumbull / The Chronicle

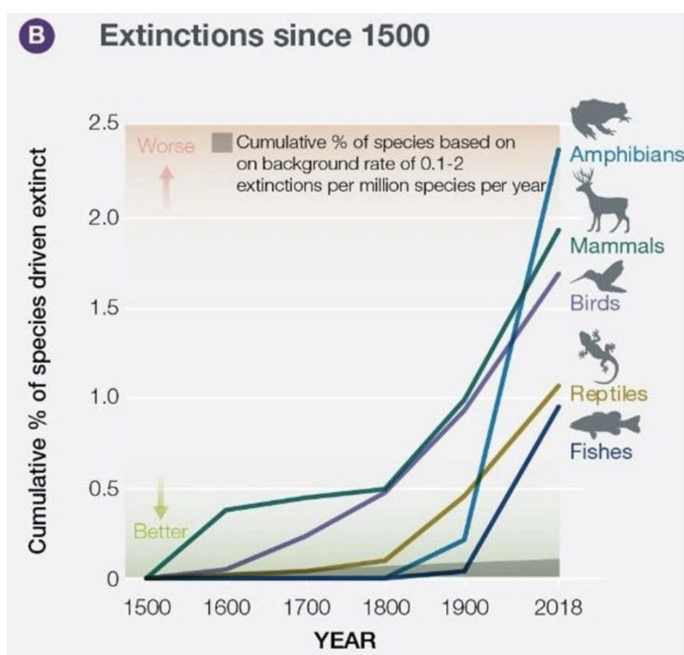([Nature](#))

Freshwater Life Disappearing

The Freshwater Living Planet Index shows a steady decline of wildlife in the world's freshwater.

Figure 24: The Freshwater Living Planet Index: 1970 to 2014
The average abundance of 3,358 freshwater populations representing 880 species monitored across the globe declined by 83%. The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (range -73% to -90%)[1].

Key

— Freshwater Living Planet Index

■ Confidence limits

([Living Planet Index](#))

Accelerating Extinctions

This chart shows the extent to which extinctions of different types of animals have been accelerating over the past few centuries.

Extinctions since 1500

Cumulative % of species based on on background rate of 0.1-2 extinctions per million species per year

Amphibians
Mammals
Birds
Reptiles
Fishes

([IUCN](#))

The Dwindling Amazon

Google's new Timelapse allows us to explore how much the Earth has changed since 1984. Below is the Amazon rainforest in 1984 (on the left) and 2020 (on the right). As you can see, it's rapidly being destroyed, especially from the south-east.

(Google Earth's Timelapse Project)

Crop Failures

Here's an image of a failing monoculture field. Images like this will become increasingly commonplace if we don't turn the global crisis around. We can and we will turn it around.
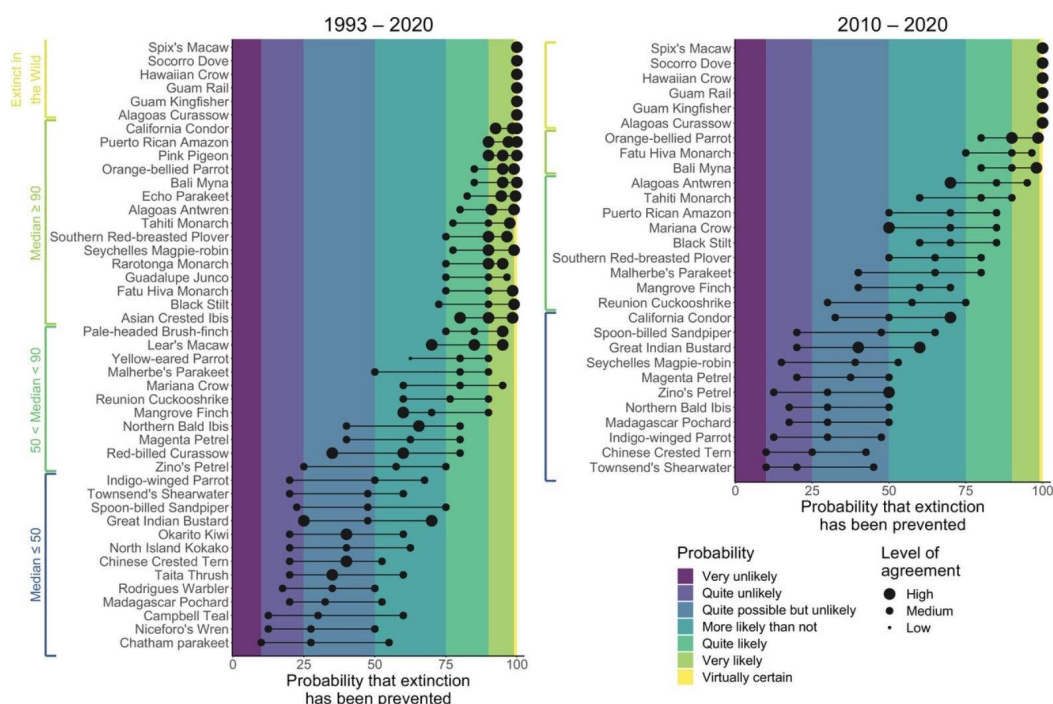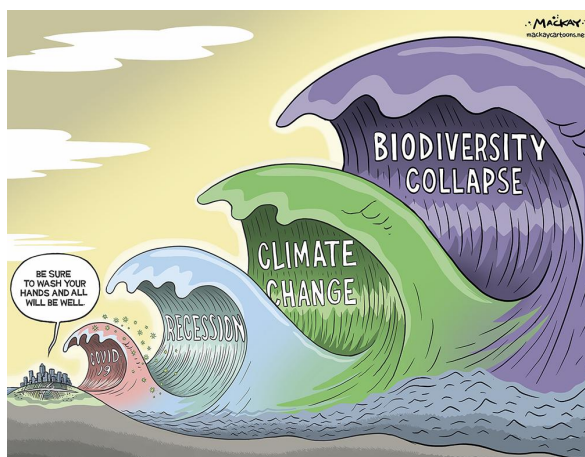

(ShareCast News)

Conservation Works

In the last few decades many more species would have become extinct without the efforts of conservationists. This chart shows the certainty that saving each species from extinction was due to conservation efforts. For the Spix's Macaw, it's certain. For the Mariana Crow, it's likely.

([Conservation Letters](#))

Biodiversity Collapse

Lastly, this cartoon by Graeme MacKay illustrates the relative urgency of what humanity faces, in the hope of helping people to understand that focussing entirely on the climate, without considering nature, is almost as absurd as treating COVID-19 as the world's greatest concern.

([Graeme MacKay](#))