BACKGROUND
Coral reefs have the greatest biodiversity (many species) of any ecosystem in the world. The building blocks of reefs are the over 700 species of coral (invertebrate marine animals) living in the oceans. Coral and coral reefs provide homes for millions of other marine species that contribute to the world’s water ecosystems. Each year, water ecosystems absorb about 30% of the Carbon Dioxide created from human activities. Additionally, reefs are home to many fish and other animals that over 500 million people depend on as food sources. Unfortunately, climate change, overfishing, and pollution are all human related influences posing serious threats to coral reefs.

One side effect of climate change is an increase in ocean temperatures, and even minor temperature changes affect coral. When ocean temperatures rise, algae that live on and protect corals leave the coral which makes it more susceptible to disease. This also removes the color from coral, so this process it called “coral bleaching.” Scientists are closely watching the widespread bleaching of coral reefs. There are corals that are resilient to these temperature changes which scientists see as a sign of potential adaptation and evolutionary processes that could save coral reefs. The concern is that this may not happen fast enough, and scientists are taking actions to speed it up. The urgency of coral reef adaptation and evolution is severe, but it is only one example of human related animal adaptations. For survival, animals need food, water, air and shelter. The natural environment in which an animal population lives—its habitat—contains these things that it needs to survive and reproduce. Natural and human-made changes to the environment result in changes to animal habitats. When these changes alter a habitat in a significant way, the animal population that lives there must adjust or adapt in order to survive. This can happen locally (for example, in a neighborhood or city) or on a much larger scale (such as in an ocean or arctic ecosystem, or even the world).

Natural selection is the process by which the genetic characteristics (and thus what traits are passed down to the next generation) of a population change over time (i.e. evolve) to become better suited to the environment. Such evolutionary changes are called adaptations. These adaptations can be structural (what the animal looks like), physiological (how its body chemistry works) or behavioral (how it acts). It is in this way that an environmental change can, over generations, lead to a significant change in the genetic makeup of a population as a whole. Sometimes, a new species is even created as a result.
There are many examples of animals changing how they live because of the proximity of people and the resulting changes to habitat—because of the structures we build, the things we remove, and the waste we leave behind. The rate of habitat change on Earth that many animal populations are experiencing is faster, and the changes more significant, than ever before. This can be caused by events such as large-scale deforestation, urbanization, and climate change. Sometimes, these environmental changes lead an animal population to thrive. There is even evidence of evolutionary change occurring in just a few generations in some animal populations—for example, adapting to live in higher elevations, migrate earlier, or change their camouflage. In other cases, adaptation does not happen fast enough and the environmental change leads an animal population to die, or a species to become endangered or even extinct.

It is important to understand that natural selection, evolution, endangerment, and extinction are natural and normal processes. The earth and its ecosystems are constantly changing and this occurs because of—and in spite of—the species that live on it. Still, by better understanding the impact of human actions on the environment and thus on animal habitats and the animals that live there, we have the potential to make informed choices that will have local and even global impacts in the future on the natural world, including the survival of the human species.

RESOURCES

Personal Stories
- Fisherman With No Fish - National Geographic
- Madjuri’s story in Karimun Jawa, Indonesia - Greenpeace
- A Return to the Reefs - Gordon Chaplin, Smithsonian

Articles
Coral Reefs
- * Coral reefs are sensitive to warming waters - Newsela

Other Animals
- * Coral reefs and climate change - IUCN
- * Report Finds Poor Outlook for Pacific Coral Reefs - IIID
- Some corals might adapt to climate changes - Science Daily
- * Scientists say they can grow coral in a nursery to help replenish the reefs - Newsela

Other Animals
- * What is biodiversity? - Newsela
- Animals affected by climate change – World Wildlife Magazine
- How a few species are hacking climate change – National Geographic
- The 10 species most at risk from climate change – The Guardian
- How the red fox adapted to life in our towns and cities – The Conversation
- 4 clever (and kind of sad) ways animals adapt to humans – National Geographic
- Natural selection in black and white: how industrial pollution changed moths – The Conversation
- Are humans driving evolution in animals? – BBC
- Unnatural selection: Humans are driving the evolution of new species – The Science Explorer
- In Cities, Wildlife Evolves Astonishingly Fast – National Geographic
- * The road to recovery. Closing roads counters effects of habitat loss for grizzly bears – University of Alberta
- * How food waste confuses wildlife – GreenBiz
- * As Earth’s climate changes, scientists try to make farm animals more hardy - Newsela
- Half of All Species Are on the Move—And We’re Feeling It - National Geographic

Data & Maps
Coral Reefs
- * Coral Reef Infographics - NOAA

Other Animals
- Climate change threatens one in six species with extinction, study finds - Carbon Brief
- The Second Global Assessment of Animal Genetic Resources - FAO
Videos and Audio

Coral Reefs
- The Crystal Reef: How Climate Change Affects the Oceans - TIME
- * Coral Life Viewed With New Underwater Microscope - LiveScience
- * Scientists Are Breeding Super Coral That Can Survive Climate Change - VICE

Other Animals
- Can wildlife adapt to climate change? – TEDEd
- Adapt or die: Can evolution outrun climate change? – CBS News
- How does climate change affect animals? – DW (German public broadcaster)
- Cities – Planet Earth, Season II, Episode 6 (available on Netflix)
- Famous peppered moth’s dark secret revealed – BBC News
- Adaptations of animals to mountain environments – Coursera
- * Light pollution effects on wildlife and ecosystems – International Dark Sky Association

Websites

Coral Reefs
- Chasing Coral

Art and Images

Coral Reefs
- Coral Reef Photo Gallery - UC San Diego

Other Animals
- * Jill Pelto Art
- * Nigerian artist Fred Martins uses posters to tackle issues of climate change- Design Indaba
- * Martin Wittfooth’s Futuristic Dystopia Comments on Climate Change - Art Sheep

* = resource includes one or more solutions