Climate Change and Species Extinction



Australia's Great Barrier Reef has experienced four mass bleaching events in the last seven years, like this one in 2017. Scientists warn repeated bleaching makes it tough for corals to recover. Brett Monroe Garner/Getty Images

GLOBAL AVERAGE SURFACE TEMPERATURE



Rate of Change



Signs of Climate Change

Climate Change: Consequences

Delawareans are already experiencing the impacts of climate change, with more on the way.

Increased Temperatures

Delaware temperatures have risen 2°F since 1900.

PROJECTED:

Delaware temperatures are expected to increase another 2.5-4.5°F by 2050, with an up to 8°F increase by 2100.

Rising Sea Levels

Sea levels at the Lewes tide gate have risen more than a foot over the last century.

PROJECTED:

Sea levels at the Lewes tide gate are expected to rise an additional 9-23" by 2050.

Historically, days above 100°F in Delaware have occurred less than once per year.

PROJECTED:

Hotter, Longer Summers

By 2050, Delaware can expect 2-8 days per year to reach above 100°F.

Increased Precipitation

Delaware averages 45" of rain per year, typically evenly distributed among seasons. Rainfall in the autumn has been increasing 0.27" per decade.

PROJECTED:

Overall rainfall in Delaware is expected to increase by 10% by 2100. The number of very wet days (2" or more of rainfall) will also increase.

How Do Species Respond to **Climate Change?** Adapt? Die?

Nove?



Species Extinction

			Extinctio	n vs Extirpation
			Extinction	Extirpation
Extinct Extirp	on vs. ation	DEFINITION	Extinction is the termination of a species or a group of taxa	Extirpation is the situation in which a species or a population no longer exists in a specific region
		EXISTENCE	No longer exists	Exists in another region
		BIODIVERSITY	Extinction reduces biodiversity	Extirpation reduces genetic diversity

What is at Risk?



Vulnerability



Loss of Biodiversity

HABITAT LOSS Thinning, fragmenting, or outright destruction of an ecosystem's plant, soil, hydrologic, and nutrient resources

INVASIVE
SPECIESOSPECIESPrAny nonnative
species thattospecies thattesignificantly
modifies orwill
statedisrupts thespecies

ecosystems

it colonizes

OVEREXPLOITATION Process of harvesting too many aquatic or terrestrial animals, which depletes the stocks of some species while driving others to extinction

PRIMARY DRIVERS

POLLUTION

Addition of any substance or any form of energy to the environment at a rate faster than it can be rendered harmless

CLIMATE CHANGE ASSOCIATED WITH GLOBAL WARMING

Modification of Earth's climate associated with rising levels of greenhouse gases in the atmosphere over the past one to two centuries

-INFLUENCERS -

- Human population growth
- Increasing consumption
- Reduced resource efficiency

BIODIVERSITY LOSS

Reduction in the number of genes, individual organisms, species, and ecosystems in a given area

Encyclopædia Britannica, Inc.

Habitat Loss



Invasive Species Invasives emerge earlier and stay longer due to extended growing seasons

Climate extremes create new opportunities for invasion

Invasives shift their ranges into new ecosystems with warming

Herbicides are less effective with higher atmospheric CO₂ Invasives are introduced through new pathways due to sea ice melt

 $Q \rightarrow Q$ ves become

Invasives become more competitive with warming and higher

atmospheric CO₂

Parasites and Pathogens







Polar bears are categorized as VULNERABLE on the IUCN Red List and ENDANGERED in the US

They are top predators and critical to balancing the arctic food web When top predator populations go down, prey populations increase, while smaller prey and plant life decrease

Polar bears are strong swimmers, but they prefer to catch seals by waiting and grabbing seals from on the ice. The more ice that melts, the more difficult it gets for them to eat Seals are key to polar bears' diets to maintain fat and muscle throughout the year

THE ARCTIC IS LOSING 12.85% OF ITS SEA ICE EVERY DECADE



Melting sea ice means swimming faster, burning more calories, and losing muscle mass Polar bears burn calories quickly, about 12,325 a day



BLACK RAIL – Species on the Edge





What Does the Future Look Like?



More losers than winners: investigating Anthropocene defaunation through the diversity of population trends Biological Reviews, Volume: 98, Issue: 5, Pages: 1732-1748, First published: 15 May 2023, DOI: (10.1111/brv.12974)

How Can We Adapt?



Diagram modified from Climate Smart Conservation Cycle Framework in Climate-Smart Conservation: Putting Adaptation Principles into Practice and DPIPWE 2014 after Jones 2005, 2009.

Questions?

The climate uncertainty loop

How much greenhouse gas emissions will human activity produce through 2100?



How much will global average temperature rise in response to those greenhouse gases?



How will those effects translate into damage to human health and economies? How will natural systems (glaciers, ocean currents, etc.) respond to that rise in temperature?

