

::: FIELD LOG • ADAPT OR DIE

Do or *Die*: Extinction in a Changing World

A Field Log activity bundle on why species go extinct in a changing world - the two outcomes of environmental change (adapt by natural selection, or die out), the beach-mouse mechanism, and a cactus-vs-Florida-torrey finish.

AGENT (STUDENT)

PERIOD

CASE DATE

:::01 The Assignment

OBJECTIVE

Earth's environment is constantly changing, and over 99% of species that ever existed have gone **extinct**. When conditions change, a population either adapts through natural selection or dies out. By the end of these notes you can explain how selection lets some populations adapt while others, unable to adapt in time, contribute to their own **extinction**.

A changing environment forces a choice biologists sum up as adapt or die. The population either evolves by **natural selection** - individuals with better-suited traits survive and reproduce more - or it fails to keep up and goes **extinct**. Natural selection has no goal and the population does not decide to change; it simply evolves because some traits survive better, and only when there is enough **variation** in those traits for selection to act on.

:::02 Vocab — The Detective's Toolkit

EXTINCTION

The dying out of a species - when its last members fail to survive or reproduce and the population drops to **zero**. More than **99%** of all species that ever lived are now extinct.

NATURAL SELECTION

Individuals with traits better suited to their **environment** survive and reproduce more, so those traits become more common over generations. It needs variation, survival differences, and **inheritance** of traits.

ADAPTATION

A heritable trait that improves survival and reproduction in a particular environment, spread through a population by **natural** selection. A cactus's water-storing stem is an adaptation to a **dry** climate.

VARIATION

The differences in traits among individuals in a population - the raw material natural selection acts on. Without variation there is nothing to **select**, so a population with no variation in a key trait cannot adapt and may go **extinct**.

:::03 The Investigation Flow

Why species go extinct - and how natural selection decides which populations adapt and which die out.

A CHANGING EARTH

over billions of years the atmosphere, climate, and continents change constantly; over 99% of species have gone extinct



ADAPT OR DIE

when the environment changes a population has two outcomes - adapt by natural selection, or fail and go extinct



HOW SELECTION WORKS — BEACH MICE

variation in coat color + a new predator removes the mice that stand out; survivors breed and pass on the trait, so the population evolves



WHY ADAPTATION FAILS

three limits block it: not enough time, the trait isn't possible, or too little variation to select from



TWO OUTCOMES, ONE LESSON

the cactus adapted to a drying climate and thrives; the Florida torrey could not adapt and is going extinct

::05 Field Log Spotlight - Natural Selection: The Beach Mice

Mice on a sandy beach vary in coat color. Selection needs variation, survival differences, and **inheritance** - all present once a new **predator** arrives.

- Variation: some mice are dark, some light - the differences exist before anything changes.
- Selection: a predatory bird arrives; dark mice stand out on the sand and are caught more, so light mice survive better.
- Inheritance: surviving light mice reproduce and pass coat color to offspring, so the next generation has more light mice.
- Evolution: over generations the population changes - it never 'decided'; it evolved because some traits survived better.

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::06 A Tale of Two Plants: Cactus vs. Florida Torreya

:: CACTUS (ADAPTED, THRIVING)

- Climate dried out long ago
- Tough skin + thick stems store water
- Spines deter animals; stores water
- Traits fit the dry climate; thrives today

:: FLORIDA TORREYA (FAILED, DYING)

- Seed-spreading animal went extinct
- Toxic fruit; no animal moves its seeds
- Stuck in one small area of north Florida
- Dying from fungal disease; can't adapt

:: THE RULE

Same world, two outcomes. The cactus had the variation selection needed to adapt to a drier climate, so it thrives. The Florida torreya could not adapt to its lost seed-disperser and new diseases, so it is dying out.

FIELD LOG COMPLETE

When the environment changes, a population either adapts through natural selection or goes extinct - and over 99% of all species have met the second fate. You saw the first outcome with the beach mice: existing variation in coat color, a new predator, and inheritance shifted the whole population toward light coats. Adaptation fails when there is not enough time, when the trait is not possible to build, or when there is not enough variation to select from. The cactus adapted to a drying climate and thrives; the Florida torreya, unable to adapt to its lost seed-disperser and new diseases, is dying out. Adapt or die is not a choice - it is what happens when a changing world meets the variation a population does, or does not, have.