Climate Change

Part 1: Why Does Climate Change Matter?
Temperature is a critical environmental variable that profoundly affects life processes.

- Temperature is Critical
- Temperature Drives Performance Across Biological Scales
- Summary of Part 1
- Quiz Questions

Part 2: Detecting Climate Change
Detecting trends in noisy data. Climate versus weather. Recent data including increased surface temperature, decreased extent of snow and ice, and sea-level rise all indicate that the Earth's climate is warming.

- Earth's Dynamic Climate
- Climate vs. Weather
- Detecting a Trend: A Signal-to-Noise Problem
- Is Earth's Climate Warming?
- Best Evidence of Change: Surface Temperature
- More Evidence of Change from Proxies
- What Do Other Components of the Climate System Show?
- A Coherent Picture of Climate Change
- Summary of Part 2
- Quiz Questions

Part 3: Earth's Climate and Climate Models
A simple model can predict a planet's mean surface temperature using solar output, distance from the Sun, planetary albedo, and greenhouse gases. More sophisticated models are needed to predict regional climate patterns.

- Climate Models: Why and How
- Modeling Temperature: Irradiation
- Modeling Temperature: Albedo
- Modeling Temperature: Atmosphere
- Feedbacks to the Climate System
- Earth's Energy Budget
- Sophisticated Climate Models (GCMs)
- Recreating Historic Climate
- Summary of Part 3
- Quiz Questions

Part 4: Humans and Climate Change
Humans and Climate Change. Attribution. Available evidence indicates greenhouse gas emission and other human actions have altered Earth's climate. Climate change will affect people directly and indirectly.

- Attribution of Recent Climate Change
- How Do Natural Forcings Affect Climate?
- How Do Anthropogenic Forcings Affect Climate?
- Why Is Earth's Climate Warming?
- Projecting Future Changes
- Cascading Effects of Climate Change
- Summary of Part 4
- Quiz Questions

Part 5: Biological Consequences of Climate Change
Warmer temperatures can affect a species' phenology, growth rate, performance, and overall fitness. While some species can tolerate these impacts, many species will respond to climate change by shifting their ranges poleward or uphill, by evolving adaptations to the altered climate, or by going extinct.

- Climate Change Poses Grave Threats for Many Species
- Direct and Indirect Effects of Climate Change
- How Can Life Respond?
- Individuals May Acclimate
- Species Ranges May Shift
- Who Can "Keep Up" With Climate Change?
- Populations May Evolve
- Which Populations Can Evolve Fast Enough?
- The Changes To Come
- Summary of Part 5
- Quiz Questions