



Certainty and Uncertainty in Climate and Forest Response Part 1: The Climate System

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What We Know

The core phenomena underlying global climate change have been understood since the mid-1800's and the scientific study since that time has given us confidence in the following:

- Greenhouse gases (e.g. water vapor, carbon dioxide, methane, surface-level ozone, nitrous oxides and fluorinated gases) are warming the planet
- Other pollutants (i.e. aerosols, such as sulphur dioxide) are cooling the planet
- When all climate forcings are totaled (anthropogenic and natural) the total net effect is warming the planet
- The planet will continue to warm while this imbalance in the energy budget persists
- Significant regional differences in the rate of warming will continue, with areas near the poles generally warming more rapidly than lower latitudes
- Drought will be more impactful as temperatures increase
- Precipitation patterns are changing, with some regions getting wetter and some drier
- The probability of extreme heat and precipitation is increasing as the planet warms
- Sea levels will continue to rise for several centuries and beyond

Uncertainty about Future Climate

Uncertainty about global climate change lies in the details, especially in refining projections of how climate will change in the short-term and on a regional or local scale. Currently, the major areas of uncertainty include:

- Emissions
 - o Future emissions depend on how the world population grows, the nature of future economic development, and the technology we use to meet our energy needs – factors we can't predict with absolute certainty.
- Feedbacks
 - o The amount of warming caused by an increase in greenhouse gases depends on the impacts of positive (warming) and negative (cooling) feedbacks in the climate system – there is uncertainty in our understanding of these complex processes, how they are coupled, and our ability to simulate them. Examples of feedbacks include: snow/ice albedo (+), water vapor (+), clouds (+/-), and forests (+/-).
- Tipping Points
 - o There is evidence from the past that earth's climate can be pushed into an entirely new state when certain thresholds, or tipping points, are reached, such as the run-away loss of arctic sea ice or large-scale release of carbon from melting permafrost. It is uncertain exactly when we might reach one or more of these as a result of current climate change.
- Downscaling
 - o Downscaling is the process of extrapolating higher-resolution local or regional climate data from the results of global climate models, which adds a new layer of uncertainty to regional climate projections.

Click on the sub-headings above to go directly to the corresponding section of the full bulletin, or read the full-length bulletin online here: <http://climatesmartnetwork.org/2015/06/certainty-and-uncertainty-in-climate-change-and-forest-response-part-1-the-climate-system/>