29 Reducing Risks Through Emissions Mitigation

Jasper, New York

Key Message 1

Mitigation-Related Activities Within the United States

Mitigation-related activities are taking place across the United States at the federal, state, and local levels as well as in the private sector. Since the Third National Climate Assessment, a growing number of states, cities, and businesses have pursued or deepened initiatives aimed at reducing emissions.

Key Message 2

The Risks of Inaction

In the absence of more significant global mitigation efforts, climate change is projected to impose substantial damages on the U.S. economy, human health, and the environment. Under scenarios with high emissions and limited or no adaptation, annual losses in some sectors are estimated to grow to hundreds of billions of dollars by the end of the century. It is very likely that some physical and ecological impacts will be irreversible for thousands of years, while others will be permanent.

Key Message 3

Avoided or Reduced Impacts Due to Mitigation

Many climate change impacts and associated economic damages in the United States can be substantially reduced over the course of the 21st century through global-scale reductions in greenhouse gas emissions, though the magnitude and timing of avoided risks vary by sector and region. The effect of near-term emissions mitigation on reducing risks is expected to become apparent by mid-century and grow substantially thereafter.

Key Message 4

Interactions Between Mitigation and Adaptation

Interactions between mitigation and adaptation are complex and can lead to benefits, but they also have the potential for adverse consequences. Adaptation can complement mitigation to substantially reduce exposure and vulnerability to climate change in some sectors. This complementarity is especially important given that a certain degree of climate change due to past and present emissions is unavoidable.

Current and future emissions of greenhouse gases, and thus emission mitigation actions, are crucial for determining future risks and impacts of climate change to society. The scale of risks that can be avoided through mitigation actions is influenced by the magnitude of emissions reductions, the timing of those reductions, and the relative mix of mitigation strategies for emissions of long-lived greenhouse gases (namely, carbon dioxide), short-lived greenhouse gases (such as methane), and land-based biologic carbon. Many actions at national, regional, and local scales are underway to reduce greenhouse gas emissions, including efforts in the private sector.

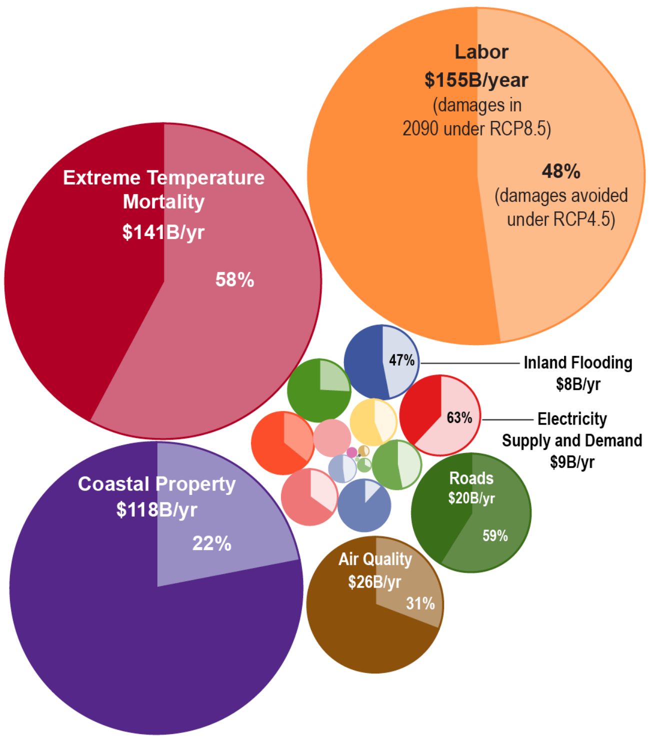
Climate change is projected to significantly damage human health, the economy, and the environment in the United States, particularly under a future with high greenhouse gas emissions. A collection of frontier research initiatives is underway to improve understanding and quantification of climate impacts. These studies have been designed across a variety of sectoral and spatial scales and feature the use of internally consistent climate and socioeconomic scenarios. Recent findings from these multisector modeling frameworks demonstrate substantial and far-reaching changes over the course of the 21st century—and particularly at the end of the century—with negative consequences for a large majority of sectors, including infrastructure and human health. For sectors where positive effects are observed in some regions or for specific time periods, the effects are typically dwarfed by changes happening overall within the sector or at broader scales.

Recent studies also show that many climate change impacts in the United States can be substantially reduced over the course of the 21st century through global-scale reductions in greenhouse gas emissions. While the difference in climate outcomes between scenarios is more modest through the first half of the century, the effect of mitigation in avoiding climate change impacts typically becomes clear by 2050 and increases substantially in magnitude thereafter. Research supports that early and substantial mitigation offers a greater chance of avoiding increasingly adverse impacts.

The reduction of climate change risk due to mitigation also depends on assumptions about how adaptation changes the exposure and vulnerability of the population. Physical damages to coastal property and transportation infrastructure are particularly sensitive to adaptation assumptions, with proactive measures estimated to be capable of reducing damages by large fractions. Because society is already committed to a certain amount of future climate change due to past and present emissions and because mitigation activities cannot avoid all climate-related risks, mitigation and adaptation activities can be considered complementary strategies. However, adaptation can require large up-front costs and long-term commitments for maintenance, and uncertainty exists in some sectors regarding the applicability and effectiveness of adaptation in reducing risk. Interactions between adaptation and mitigation strategies can result in benefits or adverse consequences. While uncertainties still remain, advancements in the modeling of climate and economic impacts, including current understanding of adaptation pathways, are increasingly providing new capabilities to understand and quantify future effects.

For full chapter, including references and Traceable Accounts, see https://nca2018.globalchange.gov/chapter/mitigation.

Projected Damages and Potential for Risk Reduction by Sector



Annual Economic Damages in 2090		
Sector	**Annual damages under RCP8.5**	**Damages avoided under RCP4.5**
Labor	$155B	48%
Extreme Temperature Mortality◊	$141B	58%
Coastal Property◊	$118B	22%
Air Quality	$26B	31%
Roads◊	$20B	59%
Electricity Supply and Demand	$9B	63%
Inland Flooding	$8B	47%
Urban Drainage	$6B	26%
Rail◊	$6B	36%
Water Quality	$5B	35%
Coral Reefs	$4B	12%
West Nile Virus	$3B	47%
Freshwater Fish	$3B	44%
Winter Recreation	$2B	107%
Bridges	$1B	48%
Munic. and Industrial Water Supply	$316M	33%
Harmful Algal Blooms	$199M	45%
Alaska Infrastructure◊	$174M	53%
Shellfish*	$23M	57%
Agriculture*	$12M	11%
Aeroallergens*	$1M	57%
Wildfire	−$106M	−134%

The total area of each circle represents the projected annual economic damages (in 2015 dollars) under a higher scenario (RCP8.5) in 2090 relative to a no-change scenario. The decrease in damages under a lower scenario (RCP4.5) compared to RCP8.5 is shown in the lighter-shaded area of each circle. Where applicable, sectoral results assume population change over time, which in the case of winter recreation leads to positive effects under RCP4.5, as increased visitors outweigh climate losses. Importantly, many sectoral damages from climate change are not included here, and many of the reported results represent only partial valuations of the total physical damages. See EPA 2017 for ranges surrounding the central estimates presented in the figure; results assume limited or no adaptation. Adaptation was shown to reduce overall damages in sectors identified with the diamond symbol but was not directly modeled in, or relevant to, all sectors. Asterisks denote sectors with annual damages that may not be visible at the given scale. Only one impact (wildfire) shows very small positive effects, owing to projected landscape-scale shifts to vegetation with longer fire return intervals (see Ch. 6: Forests for a discussion on the weight of evidence regarding projections of future wildfire activity). The online version of this figure includes value ranges for numbers in the table. Due to space constraints, the ranges are not included here. *From Figure 29.2 (Source: adapted from EPA 2017).*