

Chapter 7: Impact of Nitrogen and Climate Change Interactions on Ambient Air Pollution and Human Health

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ABSTRACT

Nitrogen oxides (NO_x) are important components of ambient and indoor air pollution and are emitted from a range of combustion sources, including on-road mobile sources, electric power generators, and non-road mobile sources. While anthropogenic sources dominate, NO_x is also formed by lightning and wild-land fires and is also emitted by soil. Reduced nitrogen (e.g., ammonia, NH₃) is also emitted by various sources, including fertilizer application and animal waste decomposition. Nitrogen oxides, ozone (O₃) and fine particulate matter (PM_{2.5}) pollution related to atmospheric emissions of nitrogen (N) and other pollutants can cause premature death and a variety of serious health effects. Climate change is expected to impact how N-related pollutants affect human health. For example, changes in temperature and precipitation patterns are projected to both lengthen the O₃ season and intensify high O₃ episodes in some areas. Other climate-related changes may increase the atmospheric release of N compounds through impacts on wildfire regimes, soil emissions, and biogenic emissions from terrestrial ecosystems. This chapter examines the potential human health implications of climate change and N cycle interactions related to ambient air pollution.

7.0 INTRODUCTION

Reactive nitrogen (Nr), including both anthropogenic and natural nitrogen (N) emissions, plays an important role in ambient air quality and subsequent impacts on human health. Here we describe the interactions of Nr and global climate change on ambient air quality and subsequent human health impacts, as displayed in Figure 7.1 We describe the role of Nr in ambient air pollution formation, including nitrogen oxides (NO_x), O₃, and particulate matter (PM). We summarize the evidence regarding the human health effects of these ambient pollutants. Finally, we discuss implications for policy and provide recommendations and key research needs.

Global climate change is predicted to have adverse consequences to human health through many pathways outside of the those described within this chapter; these additional pathways have been previously described (see Confalonieri et al. 2007; Haines and Patz 2004; Houghton et al. 2001; Institute of Medicine 2011). Examples of these predicted adverse health consequences include the following: increased illnesses and deaths due to an increased frequency of heat waves, particularly in traditionally cooler climates; physical injury, infectious disease, malnutrition, and psychiatric disorders due to flooding; malnutrition due to drought; increased pollen concentration leading to increased allergic rhinitis; changes in the geographic patterns of vector-borne diseases; increased indoor allergens and pests due to increased indoor dampness; and reduced indoor air quality due to reduced natural ventilation. Pathways not directly related to ambient air pollution are not discussed further in this chapter.