

Review

Land cover changes and their biogeophysical effects on climate

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ABSTRACT: Land cover changes (LCCs) play an important role in the climate system. Research over recent decades highlights the impacts of these changes on atmospheric temperature, humidity, cloud cover, circulation, and precipitation. These impacts range from the local- and regional-scale to sub-continental and global-scale. It has been found that the impacts of regional-scale LCC in one area may also be manifested in other parts of the world as a climatic teleconnection. In light of these findings, this article provides an overview and synthesis of some of the most notable types of LCC and their impacts on climate. These LCC types include agriculture, deforestation and afforestation, desertification, and urbanization. In addition, this article provides a discussion on challenges to, and future research directions in, assessing the climatic impacts of LCC.

KEY WORDS land cover change; climate; biogeophysical impacts

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1. Introduction

Land cover change (LCC) has significant impacts on the earth's climate, hydrology, water resources, soils, and biota (Foley *et al.*, 2003b; Lambin *et al.*, 2003; DeFries

et al., 2004; Twine *et al.*, 2004; Scanlon *et al.*, 2005, 2007; Zhang and Schilling, 2006; Cotton and Pielke, 2007; Pereira *et al.*, 2010). Despite some uncertainties in the magnitude of the impacts, it is increasingly recognized as an important forcing of local (Landsberg, 1970; Balling, 1988; Segal *et al.*, 1989b; Rabin *et al.*, 1990; Balling *et al.*, 1998; Arnfield, 2003; Campra *et al.*, 2008; NRC, 2012), regional (Barnston and Schickedanz, 1984; Zheng *et al.*, 2002; Foley *et al.*, 2003a; Mohr *et al.*, 2003; Oleson *et al.*, 2004; Voltaire and Royer,

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