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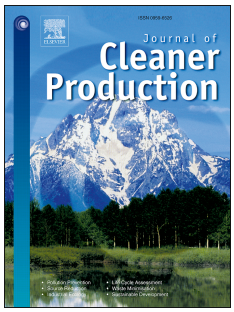

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Carbon sources/sinks analysis of land use changes in China based on data envelopment analysis

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Abstract: China's recent rapid socioeconomic development has caused its land use patterns to evolve rapidly. Land use changes are significantly influencing carbon emissions in China. Thus, assessing carbon emissions from land use change patterns is significant for sustainable socioeconomic and ecological development. This study applied a geographic information system and data envelopment analysis (DEA) to estimate provincial-level carbon emission efficiency in China during 1999–2014. The results indicate that China's total carbon emissions and carbon sequestration from land use showed annual rising trends but with an increasing difference in growth. At provincial level, the highest provincial emissions were 3–4 times greater than the lowest. In addition, carbon sources increased 20 times faster than carbon sinks. The contribution of carbon emissions from construction land to total carbon emissions was greater than 90%, also, the contribution of carbon sinks from forest land to total carbon sinks was greater than 90%; Carbon emissions were most intensive in Northeast China, and they gradually decreased in a radiating pattern to the north, west, and south. Among 31 provinces, only Qinghai, Inner Mongolia, Yunnan, Guangxi, and Heilongjiang showed effective reductions in carbon emissions. The spatial disparities in carbon emissions were likely due to differences in technological efficiency and scale of operation.

Key words: carbon emission efficiency; land use changes; DEA; China

1 Introduction

Intensified human activities and continued exploitation of natural resources have caused considerable changes in the morphology of Earth's surface, which have led to imbalance of the existing CO_2 cycle (Gattusoetal., 2015; Liska et al., 2014). As one the consequences, the average global temperature has been increased by 0.74°C during the past 100 years (IPCC. 2007; Alexander et al., 2006). Reducing CO_2 emissions and practicing low-carbon economies is a global unanimous consensus in tackling the global warming (Considine, 2000; Matthews et al., 2009; Rahman et al., 2010). Rapid economic growth and increasing population have increased energy consumption (Yau and Hasbi, 2013; Azadeh et al., 2008; Uyterlinde et al., 2007; Ahmad et al., 2014). The overuse of fossil energy is considered the primary reason for excessive greenhouse gas emissions, which have amplified the phenomenon of global warming (Wang et al., 2014; Liu et al., 2015; Schirrmeister et al., 2011; Nejat et al., 2015; McGlade And Ekins, 2014; Marland et al., 2009). In addition, the alternations from natural

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