

Carbon Emissions and Sequestrations in Urban Landscapes and their Various and Changing Land and Water Covers

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In order to meet the dual challenges of providing for a growing global population and mitigating climate change effects, it is necessary to consider how urban areas can grow with a minimum impact on the environment. Achievement of carbon neutrality in urban systems is complex and difficult. It requires increased understanding of carbon dynamics in urban ecosystems, including process-level understanding and distinction of natural and human-perturbed carbon exchanges and their interactions. This paper addresses part of this challenge, aiming to further understanding of the complex interactions between land use changes associated with urban growth and greenhouse gas (GHG) emissions.

The study involves a comprehensive analysis of the land-use related GHG emissions and removals (through carbon sequestration) in the urban region of Stockholm County in Sweden, which is currently experiencing large urban growth and rapid population growth. Stockholm County includes large urban areas, forested areas (both old and young preserved natural forests and managed forestry), farmlands, some wetlands, and a number of smaller towns and semi-urban areas. Geographically, much of the county is located on the Stockholm Archipelago – a series of islands in the Baltic Sea – and the remainder is dominated by many lakes, including Lake Mälaren, which is Sweden's third largest lake and the main water supply for the capital city Stockholm. The water coverage prevailing in the county along with urban and other land covers allows for investigation of the effects of variable and changing land cover distribution on regional GHG emissions and sequestrations, which may be considerable and are addressed in this study.

Results include an inventory of existing and planned land uses in Stockholm County, and the GHG emissions or sequestration potentials associated with each of these. The land uses include various urban and semi-urban areas, different types of natural and cultivated vegetation, agriculture, forestry, various water bodies and wetlands, and soil carbon storage. The study provides a GHG emission and sequestration-potential map of Stockholm County, which is further analysed to advance our understanding of how future development in the county can be shaped to effectively minimize urban GHG emissions and maximize carbon sequestrations.

Keywords: Climate Change; Land-use; Water Cover; Greenhouse Gas Emissions; Urban Planning; Stockholm Region