**P1.3** INTERCOMPARISON OF ALTERNATIVE VEGETATION DATABASES FOR REGIONAL AIR QUALITY MODELING

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## 1. INTRODUCTION

Vegetation cover data are used to characterize many air quality model processes, including the calculation of heat, moisture, and momentum fluxes with the Penn State/NCAR Mesoscale Meteorological Model (MM5) and the estimate of biogenic emissions with the Biogenic Emissions Inventory System (BEIS) (Byun and Ching, 1999). This paper compares vegetation cover and isoprene emissions estimated from three contemporary databases: (1) the North American Land Cover Characteristics (NALCC) version 2 database, (2) the Biogenic Emissions Landcover Database (BELD3), and (3) the National Land Cover Database (NLCD). Each of these databases may be suitable for use with regional-scale air quality models.

## 2. DESCRIPTION AND ANALYSIS

The NALCC database, which is released by USGS and supported by the National Center for Atmospheric Research (NCAR) for use with MM5, consists of 1-km resolved land cover classes derived from Advanced Very-High Resolution Radiometer (AVHRR) satellite data (USGS, 2001). BELD3 provides vegetation data to the Biogenic Emissions Inventory System (EPA, 2001). It combines the NALCC data with U.S. Forest Service and U.S. Department of Agriculture databases so that tree and crop cover (by species) are resolved to 1-km. The NLCD was released by the Multi-Resolution Land Characteristics Consortium (USGS, 2002). It is based on Landsat-TM data and available at ~30-m resolution.

These databases were used to examine vegetation cover distributions across the contiguous United States and a $10^6$ $km^2$ domain centered over Nashville, Tennessee. To enable comparisons of vegetation cover and because of differences in vegetation classification systems, vegetation classes from each database were aggregated into seven broad categories: forests, agriculture, urban, grass/shrubland, water, wetlands, and barren.

The fractional cover of each of the seven categories is shown in Figure 1. For the Nashville domain, the focus of the remainder of this paper, agricultural area estimates range from 24 to 39%, while forested area estimates range from 52 to 72%.

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For the Nashville domain, the commonly-used NALCC database indicates more forest area and less crop area than the other two databases. This is somewhat surprising because the NALCC woodland/cropland class was mapped into the agriculture category. Overall, forest and crop cover percentages agree reasonably well between NLCD and BELD3.

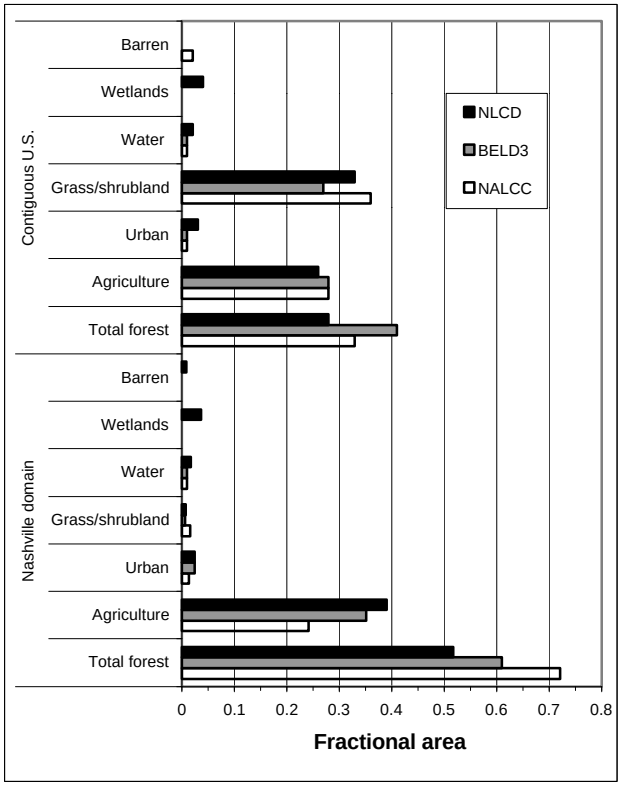


Figure 1. Fractional vegetation areas for the contiguous U.S. and for a model grid centered over Nashville, TN

## 3. INFLUENCE ON ISOPRENE EMISSSIONS

It is hypothesized that differences among the three vegetation databases will influence emission estimates of isoprene, an important hydrocarbon for tropospheric chemistry. Isoprene is emitted primarily from deciduous trees, especially oaks. Using emission factors from BEIS3 (Pierce et al., *this issue)*, normalized isoprene emissions were computed for each 1 km grid cell within a $10^6$ $km^2$ domain centered over Nashville, Tennessee. For the BELD3 and NLCD datasets, isoprene emission factors were multiplied by the areas of individual tree

species as derived from county-level tree species distributions from the US Forest Service and the forested fractions indicated with either the BELD3 or NLCD datasets. For the NALCC dataset, the BEIS3 isoprene emission factor was related to the USGS classification assigned to each 1 km grid cell.

Isoprene emissions computed along a transect extending from south-central Missouri to western North Carolina are shown in Figure 2. In general, estimates obtained with the BELD3 and NLCD databases closely agree (avg= 6349 vs. 6387, $r^2$= 0.62). Although the mean NALCC value is only slightly higher than these two values (avg=6517), the NALCC-derived estimates are not as closely correlated with the NLCD as BELD3 ($r^2$= 0.24). The lack of agreement is particularly noticeable in two areas: the Ozark Plateau (x=0-175 km) and east of Nashville (x=540-640 km). As shown in Figure 2, the isoprene emission estimates resulting from NALCC are at least 20% lower than the BELD3 and NLCD datasets in the Ozark Plateau, while they are ~100% larger along the 100-km transect east of Nashville.

## 4. FINAL THOUGHTS

The relative distribution of forest and agriculture cover contained in the popular NALCC database is shown here to differ from two other contemporary databases for the mixed agricultural/forested region of the Tennessee Valley. For estimating biogenic emissions, it is shown that isoprene emissions can vary by a factor of two depending on the source of vegetation data. We therefore urge caution if using broadly-defined vegetation classes (like those found in the NALCC data) to derive biogenic emissions, and we recommend that other databases, such as the NLCD, coupled with tree species distribution information be considered for simulating other meteorologically-related processes that depend on the characterization of vegetation data.

## 5. REFERENCES


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## 6. DISCLAIMER AND ACKNOWLEDGEMENTS


This paper has been reviewed in accordance with the U.S. Environmental Protection Agency's peer and administrative review policies. Mention of products or trade names does not constitute endorsement or recommendation of their use.

The authors appreciate the assistance of Chris Geron (EPA-NRMRL), Ross Lanetta (EPA-NERL-LCB), and Tanya Otte (NOAA-ARL-ASMD)


**FOR FURTHER INFORMATION**

*http://www.epa.gov/asmdnerl/biogen.html*