Public Abstract
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Greenhouse gas emissions (GHG) vary with the interactions among physical, chemical, and biological characteristics of soil and microclimate. Soil microorganisms are involved in almost all soil processes, mediating soil organic matter decomposition and nutrient cycling; and are also involved GHG dynamics between the soil and atmosphere. The objective of this study was to examine the relationship between GHG efflux and soil microbial community and activity across a forested landscape. We evaluated the influence of topography on enzyme activity, phospholipid lipid fatty acid profiles (PLFA), and soil microbial diversity, based on polymerase chain reaction (PCR), denaturing gradient gel electrophoresis (DGGE) and real-time PCR analysis. Soils from a secondary forest in central Missouri were collected July and November of 2008 and May of 2009 and incubated for 30 d at several air temperatures and soil moisture contents to determine the influence of landscape sampling position on soil GHG efflux and soil microbial communities. Our research revealed temporal differences in microbial population and GHG efflux, indicating that time of year when samples were collected is an important factor. Temperature also had a significant effect on soil microbial population and GHG efflux. Moisture also impacted some GHG measurements; however, the influence was not as great as the temperature effect. In addition, correlation between GHG and measured biological properties and GHG and soil temperature and moisture in the incubated soils implied that microbial properties as well as soil temperature and moisture may affect GHG efflux from these forest soils. However, the low correlation coefficient (r values) and the lack of correlation within some sampling periods indicated that the relationship among soil microorganisms, soil conditions and GHG efflux is highly complex and cannot be fully explained by direct correlations among the measured properties and GHG efflux.