

## 论文

### 土壤呼吸的温度敏感性和适应性研究进展

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#### 摘要:

土壤呼吸的温度敏感性和适应性是影响生态系统碳、氮循环的两个关键指标。论文综述了土壤呼吸对温度变化响应的最新研究进展和存在的问题,指出土壤有机质的质量和水溶性碳含量、土壤微生物种群结构和酶活性等因素是影响土壤呼吸的温度敏感性和适应性的主要因素。这些因素对土壤呼吸温度敏感性和适应性影响的机理不同,土壤呼吸的温度敏感性主要受上述因素的状态影响,而土壤呼吸的温度适应性则主要取决于上述因素的变化过程。例如平均温度、微生物生物量、呼吸底物质量和酶活性是影响土壤呼吸温度敏感性的重要因素,而温度的变化幅度、微生物种群结构变化、呼吸底物有效性和酶的最适温度的改变则影响土壤呼吸对温度的适应性。鉴于土壤呼吸的温度敏感性和适应性是两个密切相关的生物学过程指标,建议在陆地生态系统碳循环的研究中综合考虑这两个过程的交互作用。

**关键词:** 有机质分解 土壤微生物 有机质质量 土壤酶活性 温度

### The Interrelation between Temperature Sensitivity and Adaptability of Soil Respiration

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#### Abstract:

The temperature sensitivity and adaptability of soil respiration are the two key processes in the understanding of terrestrial ecosystem carbon and nitrogen cycle. Recently a growing body of literature sheds new light on the importance of the temperature sensitivity and adaptation of soil respiration in understanding terrestrial carbon cycling. It has been well known that small changes in  $Q_{10}$  value will have great influence on soil  $CO_2$  efflux, due to its nonlinear response to temperature, while the adaptation of soil biological processes could greatly reduce the extend of feedback between temperature and soil  $CO_2$  efflux. In this paper, we reviewed recent advances and hotspots in temperature sensitivity and adaptability of soil respiration and pointed out the limitations in previous studies. The overall studies showed that there are three types of adaptation mechanisms and two kinds of temperature sensitivity theory. The adaptation mechanisms can be defined by combine considering basal respiration and its temperature sensitivity. Soil organic matter, microorganisms and enzyme are factors that have great influence on the temperature sensitivity and adaptability of soil respiration; however, the mechanisms of these effects on the temperature sensitivity and adaptability of soil respiration are different. The temperature sensitivity of soil respiration is mainly related to the state of the above mentioned factors, while the adaptability soil respiration is largely determined by the biological process. For example, mean temperature, enzyme activity, substrate quality and the amount of microbes are the factors determining temperature sensitivity of soil respiration. Whereas, the amplitude of temperature changes, enzyme optimum temperature, substrate quantity, and diversity of microbes control the adaptability of soil respiration. Finally we pointed out that the temperature sensitivity and adaptability of soil respiration are closely related, and both the temperature sensitivity and adaptability of soil respiration are crucial in deeper our understanding on biology process. Both the two processes should be considered in the future research of terrestrial carbon cycle. In the end the future research hotspots are discussed.

**Keywords:** organic-matter decomposition soil microorganism quality of organic-matter soil enzyme activities temperature

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