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Counting land carbon storage in Guizhou Province, southwestern China

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In mountainous area of southwestern China, especially Guizhou Province, karst landscapes (a special geomorphology mainly consisting of limestone and dolomite) are continuously, broadly distributed with harsh and fragile habitats. The dissolutional landforms, caves, and aquifers on soluble rocks create the most beautiful landscapes and tourist resorts. They also result in many environmental disasters, such as water pollution, drought, and rocky desertification, thereby creating many severe social problems. Research indicates that forests and shrublands located in karst terrains have low aboveground biomass, but high belowground biomass. However the harsh habitats with many rock outcrops make the biomass observation difficult. The commonly used forest inventory data cannot fully account for the carbon storage in such habitats. The carbon from carbonate rocks is always neglected.

Here we present a framework of full account of carbon storage in Guizhou using data from multiple sources and based on five combined methods. The simple way is to calculate carbon storage using carbon density directly measured from field vegetation and soil samplings plus vegetation and soil area information derived from their atlases. The second method is to consider temperature-dependent carbon turnover and net primary production of different vegetation and soil types. The third is using time series forest inventory data and regional volume-biomass transfer functions. Simulations of carbon storage using remote sensing driven ecosystem model (e.g. CASA), and climate driven equilibrium and dynamic vegetation models (e.g. BIOME4 and LPJ) are the fourth and fifth selections, respectively. Karst and non-karst vegetation located in morphologically different terrains are carefully, separately treated. Carbon stored in carbonate rocks and water bodies (lakes, reservoirs and rivers) is considered too.

A preliminary result shows that the province stores 176 to 554 Tg C with large uncertainty in Guizhou Province. Carbon storage of karst vegetation is significantly lower than that of non-karst vegetation, due to the commonly accepted reason that karst habitats are not suitable to plant growth. This research provides a basic understanding of carbon storage at a regional scale for further fully counting the carbon budget in karst mountainous area of southwestern China.

