

Peter D. WARWICK and ZHU Zhiliang, 2013. Assessment of Carbon Sequestration Capacities in Biologic and Geologic Reservoirs in the United States. *Acta Geologica Sinica* (English Edition), 87(supp.): 956-957.

Assessment of Carbon Sequestration Capacities in Biologic and Geologic Reservoirs in the United States

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Carbon sequestration is a method of securing carbon dioxide (CO₂) to prevent its release into the atmosphere where it would contribute to global warming as a greenhouse gas. Geologic storage of CO₂ involves injecting high-pressure liquid CO₂ into subsurface porous and permeable rocks that have an overlying geologic seal. Biologic carbon sequestration refers both to natural and to anthropogenic processes by which CO₂ is removed from the atmosphere and stored as carbon in vegetation, soils, and sediments.

The U.S. Geological Survey (USGS) is conducting two separate national assessments to estimate the potential capacity of carbon sequestration in biologic and geologic reservoirs in the United States. The biologic assessment covers above-ground, surface, and below-ground carbon pools of all major terrestrial and aquatic ecosystems, and is based on an integrated use of resource inventory data, land use, climate, soils, and statistical or simulation models (Zhu et al., 2010). The geologic assessment focuses on subsurface formations within major sedimentary basins, where storage assessment units (SAUs) are defined on the basis of their geologic and hydrologic characteristics, and relies on a probability-based assessment methodology (Burruss et al., 2009; Brennan et al., 2010; Blondes et al., 2013). Each SAU has well-defined reservoirs and an overlying, regionally extensive geologic seal of low permeability.

To date, the biologic and geologic assessments have yielded regional-scale and spatially explicit results that suggest significant carbon sequestration capacities may be available. For example, the biologic assessment showed an estimated mean annual rate of carbon sink at 151 (or range of 34-262) teragrams of carbon per year (TgC/yr) for all major ecosystems in the central plains and western mountains of the United States. It considered major biologic controlling processes such as land use and wildfires (Zhu et al., 2011, 2012). Over a 50-year

performance period, this translates into a biologic sequestration capacity of up to 13 petagrams of carbon (PgC). For the geologic assessment, models have been developed to estimate CO₂ storage capacity in 36 basins within the United States. A total of 202 SAUs were identified within these basins. During 2013, the USGS plans to prepare reports that contain the data used in the assessment, the assessment results, and an executive summary for on-line publication at <http://energy.usgs.gov>. Geologic CO₂ storage capacity may be much larger than biologic capacities, and likely ranges from hundreds to thousands of PgC in the geologic formations of the United States (Warwick and Zhu, 2012). The biologic and geologic national-scale assessments, when complete, will provide the most comprehensive accounting of the carbon storage potential in the United States. (For more information, see http://www.usgs.gov/climate_landuse/carbon_seq/.)

Key words: biologic sequestration, geologic sequestration, carbon dioxide, storage capacities

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