Humans derive many ecological, economical, water, and nutritional benefits from the critical zone (CZ), which is defined by the National Research Council (2001) as the area extending from the top of the vegetation canopy to the vertical depth of the freely moving groundwater. It is very important to note that soil in the CZ takes hundreds of thousands of years to form, whereas erosion or human disturbance can wash it away or otherwise reduce the productive nature of this important feature of the biosphere.

The January 2015 issue of Vadose Zone Journal includes an article introducing a vision of ecosystem services and its connection to CZ processes. The authors propose a new perspective that incorporates CZ processes to expand the traditional focus within the four categories of ecosystem services: (a) provisioning—outputs of food, water and energy; (b) regulating—water quality, floods, and disease; (c) supporting—helping animals and plants maintain genetic diversity; and (d) cultural—recreational, educational, and aesthetic services. This work helps to expand the role of these services and the constraints thereon by explicitly considering CZ processes under the categories of context, constraints, and currency.

Context describes the millions of years and the interaction of the physical, chemical, and biological processes that helped in the formation of the CZ. The time scale for CZ processes, such as formation of the soil, hydrologic partitioning, and landscape evolution is much longer than the conventional ecosystem services paradigm. Constraints describe physical processes that limit the delivery of goods and services. Examples include the rate of groundwater recharge and soil formation, both of which take place over centuries and millions of years, respectively. Currency is the valuation of the ecosystem service of the CZ for the ecological processes/services that are the output of the system. This could be the energy available to do work in the physical, chemical, and biological contexts.

The authors suggest incorporating CZ processes into the conventional definition of ecosystem services by considering the physical nature of the soil, processes that result in the formation of the soil that are on much longer time scales, and the interconnectedness of the physical, chemical, and biological processes. Incorporating CZ processes into the valuation of ecosystem services, which is receiving substantial attention by national and international bodies, provides a more thorough and effective framework by which policy makers can assess impacts from climate change and associated disturbances.

Reference


Critical zone services provide context, constraints, and currency that enable more effective management and valuation of ecosystem services (adapted from MEA, 2005).