

An Overview of the GDE Method with Case Studies in Utah, Wyoming, and Colorado

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Inventories of groundwater-dependent ecosystems (GDEs), primarily springs and wetlands, are being conducted on National Forests and Grasslands throughout the USA to determine the distribution and characteristics of these critical natural areas. In 2012, the US Forest Service (USFS) published the Groundwater-Dependent Ecosystems (GDEs) Level 1 Inventory Field Guide, which provided standardized protocols to evaluate a core set of ecological parameters and management indicators at each GDE site, resulting in consistent assessment and characterization of GDEs on public lands administered by the agency. Inventory efforts are frequently collaborative projects among the USFS, state agencies and heritage programs, academic institutions, and non-profit organizations, including the Springs Stewardship Institute (SSI). Data entry into Springs Online, an established database maintained by the SSI, has facilitated the secure archival of the valuable inventory information. The consistent collection of on-site field data, coupled with systematic information management, provides a valuable baseline for effective management, and allows for comparisons of GDE features among different Forest Service units, ecoregions, and climatic regimes. In 2012, the USFS also released the revised Planning Rule, with direction for Forest Plan revision that requires consideration of groundwater resources, indicating the increased recognition of both the ecological importance of GDEs and the pressures on groundwater on public lands.

Here, we present recent findings from inventories conducted on National Forests in Utah, Wyoming, and Colorado, particularly GDE distribution and characteristics relative to elevation, hydrogeology, precipitation regime, geomorphic land forms, and past glaciation activity. We also provide examples of the utility of GDE inventories nationwide in: (1) regional and forest-level assessments of climate change vulnerability; (2) multiscale assessments of carbon storage, instream flow support, and other ecosystem services; (3) locating populations of rare biota that are partially or wholly dependent on GDE wetland and/or spring habitats; (4) identifying the need and options for improved management, with recommended actions specified in revised forest plans; (5) improving capability to assess and predict threats to groundwater resources. The stewardship of GDEs is improved through increased understanding of their landscape-level distribution and condition, which is best achieved through collaborative inventories using consistent methods and systematic data management.