

LANDSCAPE CONSERVATION PLANNING FOR SPRINGS MANAGEMENT AND RESTORATION

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Springs are places where groundwater discharges at or near the earth's surface under air, water or ice. Springs ecosystems support a wide diversity of species and cultures across all landscapes, some of which are dependent on the specific habitat conditions which occur at the point of emergence of the water. At least thirteen spheres of discharge have been proposed to classify springs ecosystems. Descriptive data exist to demonstrate that a few of these spheres of discharge are statistically significantly different, requiring specific management and restoration needs. Comprehensive inventory and assessment techniques have been developed and used to describe 1,000s of springs ecosystems across Western North America. Springs support the headwaters of most perennial streams, but the location and identification of springs continues to be limited by the adoption of a universal classification system and database. Less than 10 % of the springs on most landscapes have been identified and even fewer have been comprehensively inventoried and assessed. Recent nationwide surveys have estimated the non-market values of springs in wilderness in Grand Canyon National Park. Although springs occupy far less than one % of the area of most landscapes, inventories of springs across landscapes indicate that up to 45 % of all plant species are supported at springs. Common, comprehensive inventory and assessment data collected with multiple different protocols are accessible on the secure, cloud-sourced Springs Online database of the Springs Stewardship Institute. Inventory and assessment techniques have been adapted and adopted by many land and resource management organizations, including many indigenous nations. Techniques developed to assess the condition and risks of springs ecosystems can be used to prioritize stewardship action across landscapes. Stewardship prioritization is an essential component of successful landscape conservation design planning, especially when resources for stewardship are limited. When successfully implemented, landscape

conservation planning can assist with sustaining the important ecosystem services that springs support. Predictions of the responses of the ecosystem to climate change should be included in the planning and design process, so resource utilization is optimized. Examples of management and restoration actions based upon landscape level inventory and assessment will be provided for springs across the greater Grand Canyon Ecoregion.