

Springs Ecosystem Ecology and Stewardship: History and Future

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Springs are places where groundwater is exposed at, and usually flows from the Earth's surface, with both subaqueous and subaerial expression. Springs are the most productive, biologically diverse, socio-culturally and economically important, and evolutionarily intriguing features of many landscapes, particularly in arid regions. However, they also are among the most threatened ecosystems, being subject to an ever-increasing array of anthropogenic impacts on groundwater and poorly-informed surface land management practices. Springs are geomorphically and ecologically diverse, with 13 identified spheres of emergence (types), each of which may contain a wide array of microhabitats and species assemblages. While springs are generally small ecosystems, springs are likely the most sustainable ecosystems, and can readily be rehabilitated if the supporting aquifer is relatively intact. Our springs symposium in 2000 produced recommendations to improve springs ecosystem science and stewardship. Here I summarize progress over the past two decades in understanding springs ecosystem ecology and biodiversity, and indicate potentially fruitful directions for future research and management. I also review progress in codifying comprehensive springs inventory and assessment protocols and information management, subjects that will be described in more detail in other talks in this symposium. I describe an approach to springs ecosystem stewardship planning, and review and describe restoration and feed-back monitoring approaches. The MNA Springs Stewardship Institute has developed its secure, relational Springs Online database (SpringsData.org) to provide springs stewards with enhanced ability to archive, analyze, report upon, and share information and assess the status and functionality of aquifers and springs across private property, agency, Tribal, interstate, and international boundaries. Despite improving reception of these issues, there remains limited agreement on the scientific lexicon, best science and management practices, and the urgency of conservation facing these remarkable ecosystems. In reviewing these challenges, I recommend that renewed vigor and attention be directed towards resolution of scientific and management conflicts to help society move towards a sustainable future of springs stewardship across local, state/provincial, national, and global scales.