# Data Management and Local Knowledge: Building a Network to Support The Art and Science of Multi-Scale Citizen Science Support

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Citizen science and community-based monitoring programs are increasing in number and breadth, generating volumes of scientific data. Many programs are ill-equipped to effectively manage these data. We examined the art and science of multi-scale citizen science support, focusing on issues of integration and flexibility that arise for data management when programs span multiple spatial, temporal, and social scales across many domains. Our objectives were to: (1) briefly review existing citizen science approaches and data management needs; (2) propose a framework for multi-scale citizen science support; (3) develop a cyber-infrastructure designed to support citizen science program needs; and (4) describe lessons learned. We find that approaches differ in scope, scale, and activities and that the proposed framework situates programs while guiding cyber-infrastructure development. We built a cyber-infrastructure support system for citizen science programs (www.citsci.org) and show that carefully designed systems can be adept enough to support programs at multiple spatial and temporal scales across many domains when built with a standards-based flexible architecture. The advantage of a flexible, yet controlled, cyber-infrastructure system lies in the ability of users with different levels of permission to easily customize features themselves, while adhering to controlled vocabularies necessary for cross-discipline comparisons and meta-analyses. Program evaluation tied to this framework and integrated into cyber-infrastructure support systems will improve our ability to track effectiveness. We compare existing systems and discuss the importance of standards for interoperability and the challenges associated with system maintenance and long-term support. We conclude by offering a vision of the future of citizen science data management and cyber-infrastructure support.

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