Human–Wildlife Interactions 12(2):259–271, Fall 2018 • digitalcommons.usu.edu/hwi

Engaging people in nature stewardship through Master Naturalist programs

Mark Larese-Casanova, Utah State University, 5210 Old Main Hill, Logan, UT 84322, USA
marklc@usu.edu
Michelle Prysby, Virginia Tech and Virginia Cooperative Extension, 460 Stagecoach Road, Charlottesville, VA 22902, USA

Abstract: Master Naturalist programs across the country have reconnected Americans with nature for >20 years. Research suggests that reconnecting humans with nature benefits personal health and wellness, educates stakeholders about the importance of conservation, and enhances individual participation in stewardship efforts. Nationally, the Alliance of Natural Resource Outreach and Service Programs coordinates and supports Master Naturalist programs through facilitating collaboration and sharing of resources, as well as organizing an annual conference. We explore the Virginia Master Naturalist and Utah Master Naturalist programs as 2 examples of different, but highly effective, statewide programs to highlight the diversity of Master Naturalist programs. The Virginia Master Naturalist was created in partnership with 5 state agencies. It is coordinated at a local chapter level, taught entirely in person, and has the primary purpose to train volunteers who support natural resource conservation in the state. The Utah Master Naturalist, in contrast, was created by Utah State University Cooperative Extension. Centrally coordinated at the state level, it is partially taught online and focuses more on connecting a highly urbanized population to the vast natural areas around the state. Master Naturalist programs provide unique opportunities for scientists and resource managers to engage the public and promote stewardship through education, volunteer opportunities, and citizen science. This mutualistic relationship benefits not only the public that learns from experts and participates in real-world management projects, but also the managers who achieve a broader impact of their work and receive valuable volunteer assistance in fulfilling their management goals.

Key words: citizen science, conservation, management, Master Naturalist, stewardship, Utah, Virginia, volunteers

Much thought and discussion has been dedicated over the past few decades to the emerging concept that humans rely on nature for much more than just the essential components of wildlife habitat. The public now recognizes that humans also depend on nature for many physical, emotional, and psychological benefits (Wilson 1984, Frumkin 2001). Wilson (1984) hypothesized that, as a process of biological evolution, humans have an innate connection to nature that presents itself as an emotional affinity to other organisms. Reinforcing this innate connection through interactions with nature is essential to maintaining a happy and healthy life (Heerwagen and Orians 1993, Frumkin 2001, White et al. 2013).

The personal benefits of spending time in nature, including improved health and emotional wellness, have been well-documented through research in recent years. For example, spending time in nature can increase cognition, from concentration to problem-solving, among urban adults (Herzog et al. 1997). Likewise, as the proportion of natural settings increases in children's lives, symptoms of attention-deficit/hyperactivity disorder (ADHD) decrease (Kuo and Taylor 2004, Taylor et al. 2001). Conversely, removal of nature from daily life increases the risks of negative health effects (Louv 2008).

As humans have migrated from rural to urban environments over time, they gradually become disengaged from the natural world. Leopold (1949) identified the challenge of "how to bring about a striving for harmony with land among a people many of whom have forgotten there is any such thing as land." Nearly half of the world's population now lives in cities, and as this transition continues, the minority of humans will maintain daily interaction with the natural world. In the United States, 62.7% of the population lives within cities that occupy only 3.5% of the land area (U.S. Census Bureau 2015). In addition to a physical removal from nature through urbanization, technological advances in entertainment have kept more people, children in particular,

indoors (Clements 2004, Karsten 2005). As a result, unstructured, direct contact with nature by children has declined dramatically over the past couple of decades (Kellert 2005, Taylor and Kuo 2006). It has been suggested that these factors have led to a "nature deficit disorder" among children, in which indoor entertainment provided largely by electronics has led to an increase in childhood obesity, impaired social skills, and ADHD symptoms (Louv 2008). A similar disconnect from nature has been documented in adults, for whom considerable gaps exist between interest in nature and direct engagement with nature (Kellert et al. 2017).

A disconnect from nature has consequences not just for personal well-being but also for conservation. A lack of interaction with nature discourages positive environmental behaviors (Soga and Gaston 2016) and thus should be of concern to conservation agencies and organizations. The proportion of American adults who participate in consumptive uses of wildlife, such as hunting and fishing, has been steadily declining (U.S. Department of the Interior et al. 2016), and the resulting reduced income from license sales and taxes strains the budgets of state wildlife agencies, making it more difficult to fulfill their missions. On the other hand, participation in nonconsumptive uses of wildlife, such as birdwatching and photography, are increasing as Americans' view of wildlife shifts.

Master Naturalist programs provide a means to counteract the growing disconnect with nature, to engage the growing nonconsumptive wildlife recreation audiences, and to address some of the identified barriers people face in pursuing their interests in nature (Alliance of Natural Resource Outreach and Service Programs [ANROSP] 2016*a*). These programs have the expressed goal of actively connecting people with nature. They provide in-depth, experiential training on natural resources to interested members of the public, preparing them to use their new nature-related skills and knowledge to benefit conservation efforts. Most Master Naturalist programs also require volunteer service in environmental education and outreach, citizen science, or stewardship. Although participants in Master Naturalist programs often are already nature enthusiasts (Larese-Casanova, in press), these programs provide a pathway to take the participants from being personally interested in nature to being active ambassadors for nature. Master Naturalist program participants become a corps of well-informed natural resource stewards who then provide service to their communities. This service frequently includes educational programming that reaches a much broader audience within the general public, helping those who may have had little knowledge of nature and few opportunities to experience it firsthand to develop stronger connections to the natural world around them.

The social component of Master Naturalist programs may help make them effective. Kellert et al. (2017) found that strategies to address the gap between Americans' interest in nature and their pursuit of those interests must recognize that connections to nature have an important social component and usually occur in the company of friends or family. Master Naturalist programs typically bring people together to learn about and experience nature as a group of adults with diverse backgrounds and levels of experience, but similar interests in nature. Additionally, Master Naturalist programs are an ideal venue for conservation agencies to connect with nature enthusiasts, many of whom are nonconsumptive users, to convey the importance of their conservation work and recruit volunteers to help fulfill their management goals.

A national network of Master Naturalist programs

The earliest Master Naturalist programs were formed in the 1990s with the purpose of promoting conservation education and, in some cases, training new volunteers and engaging them in projects to benefit local natural resources. One of the first statewide Master Naturalist programs began in Texas in 1997 through a cooperation between the state's Cooperative Extension program (now called Texas A&M AgriLife Extension) and the Texas Parks and Wildlife Department (Bonneau et al. 2009). A statewide Master Naturalist program began in Florida shortly thereafter (Main 2004). Through a series of grant-funded workshops and conferences in 2004–2005, these statewide programs and several long-running local Master Naturalist programs shared their

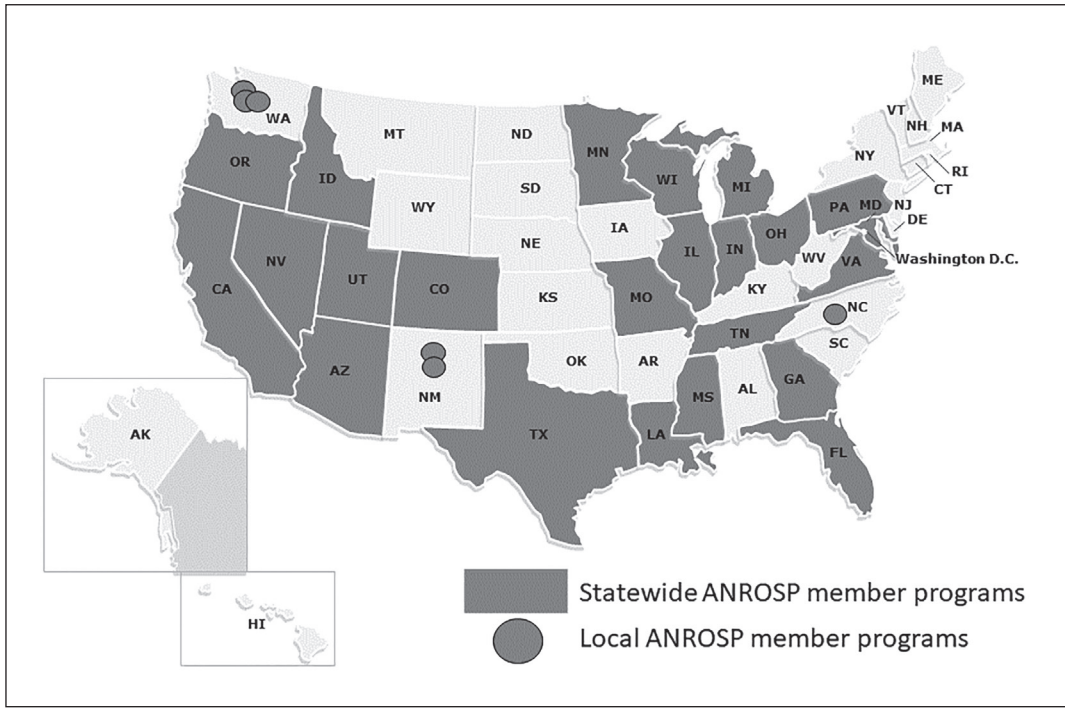

Figure 1. Map of Alliance of Natural Resource Outreach and Service Programs member programs in 2017.

program models with representatives from other states, resulting in a rapid growth in new Master Naturalist programs across the nation (Texas Parks and Wildlife Department 2004).

The workshops set the stage for continued sharing and cooperation among Master Naturalist programs, and in 2005, leaders from a dozen different programs convened to form a national alliance, the Alliance of Natural Resource Outreach and Service Programs (ANROSP). The ANROSP provides leadership, information, and resources to support the establishment and expansion of natural resource outreach and service programs such as Master Naturalists and similar programs with varying names such as Conservation Stewards, Volunteer Naturalists, Master Watershed Stewards, and Coverts Projects. For the purposes of this article, we refer to all of these programs collectively as Master Naturalist programs. The ANROSP member programs train conservation volunteers to enhance and expand natural resource conservation and education across the nation (ANROSP 2016*b*).

The ANROSP has played a significant role in supporting Master Naturalist programs and helping new programs develop. Member programs routinely share their program documents, such as logic models, volunteer handbooks, budgets, business plans, timelines, volunteer training materials, project examples, and marketing materials with each other. Member programs are encouraged to use these materials freely and tailor them for their own needs. In addition, ANROSP facilitates monthly mentor conference calls, during which representatives of any program can call in to discuss a challenge they are facing and gather ideas and solutions from other programs. Representatives of the ANROSP have traveled to states considering developing Master Naturalist programs to give presentations on program models and benefits. Additionally, ANROSP activities include annual conferences to share best practices of natural resource outreach and stewardship programs, information sharing across its member programs through member listservs, and connecting member programs for multistate projects and grants.

As of 2018, ANROSP consisted of 29 program members from 26 states (Figure 1). Statewide Master Naturalist programs are thought to exist or be in development in at least 13 additional states. All ANROSP member programs have

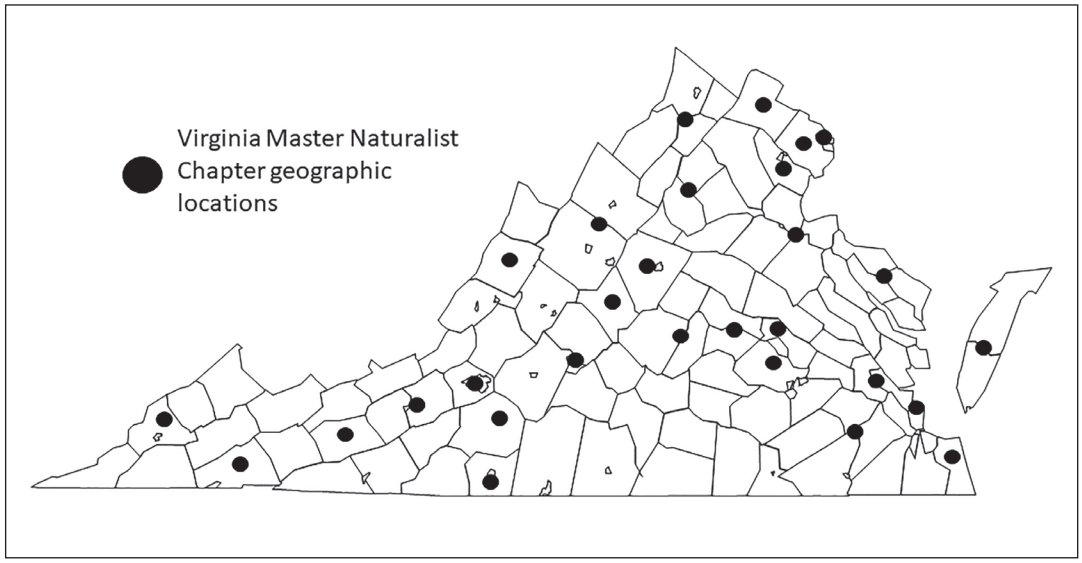

Figure 2. Geographic distribution of Virginia Master Naturalist chapters overlaid on map of counties and independent cities in Virginia, USA. The figure shows the core area of activity for the chapter, but most chapters have volunteers from and are active in a multi-county area around the core location.

a natural resource focus, are community-based, offer a minimum of 20 hours of service-oriented education and training, include a field component in the training, and are coordinated by nonprofit organizations, state or local government agencies, or universities. Beyond those commonalities exists much diversity in program focus. Some programs focus on the training aspect, providing in-depth continuing education intended to promote learning about natural resources. Other programs focus more on the volunteer aspect, still providing training, but then focusing on engaging the volunteers in education, citizen science, and stewardship projects. A few programs specifically target K-12 teachers or ecotourism staff.

Master Naturalist programs are also diverse in terms of the training and curriculum they provide to participants, as well as the instructors used to deliver the program. Master Naturalist programs in Minnesota, Florida, and Maryland, for example, provide a centralized training for instructors and core curriculum materials. The trained instructors, often staff of nature centers or parks, then deliver the training at their local sites. In contrast, chapter-based programs in Texas, Virginia, and Missouri allow local chapters to design their own training courses to meet state standards. Instructors for these programs are more often guest speakers who teach just 1 topic. In Oregon and Utah, participants complete an online training module that is the same statewide, and then complete field training modules tailored to their local environments.

Master Naturalist programs frequently involve collaborations between Cooperative Extension within state land-grant universities and at least 1 state natural resource agency, including forestry, wildlife, parks, natural heritage, and environmental quality agencies. Approximately two-thirds of ANROSP member programs are led or co-led by their state's Cooperative Extension agency, and one-fourth are led or co-led by a natural resource agency in their state. The remaining programs are primarily independent nonprofit organizations or programs within local parks and recreation departments (ANROSP 2016*b*).

Virginia Master Naturalist

The Virginia Master Naturalist (VMN) program was created by 5 of Virginia's state agencies to connect with new audiences and constituencies and to fill a need for natural resource volunteers. Existing natural resource education programs in Virginia Cooperative Extension and Virginia's natural resource agencies reached forest landowners, hunters, and anglers, but few targeted Virginians living in urban environments or nonconsumptive users of natural resources, such as recreational

wildlife watchers. Most of Virginia's population (>8 million; >75%) lives in urban areas (U.S. Census Bureau 2012), and this trend is increasing (Sen 2017). The VMN program is an outlet for Virginia's natural resource agencies to connect with these audiences who otherwise might be unfamiliar with the missions and activities of the agencies. As agencies attempt to address natural resource issues such as the health of the Chesapeake Bay, the nation's largest estuary, they also saw a need for additional trained volunteers who could contribute to their management and education goals.

Because of its focus on volunteerism, much of the VMN program's design was geared toward quickly getting volunteer "boots on the ground" statewide. To accomplish this goal, program sponsors chose a chapter-based model for the program. In a chapter-based model, local Master Naturalist groups operate semi-autonomously under the guidelines and oversight of the statewide sponsors. Each local group, or chapter, is run by a volunteer board of directors. They lead all program activities at the local level, including recruiting new volunteers, planning and conducting the training courses, managing and tracking volunteer activities, developing local partnerships and projects, and reporting their impacts. Because this model does not require a uniform set of curriculum materials, nor does it require significant staffing at the local level, new chapters were created quickly and the program had nearly 600 trained volunteers within 2 years of its launch. The chapter model works well in Virginia because it has many population centers distributed throughout the state, even in rural areas. Thus, it is relatively easy for the VMN program to reach a broad audience across the state (Figure 2).

In the VMN program model, volunteers enter the program by enrolling in a basic training course at least 40 hours in length, with at least 10 hours in the field, that is offered by a local chapter. Upon graduation from the course, which includes completing written and practical assessments, the trainee becomes a Virginia Master Naturalist member. To achieve and maintain the title of Certified Virginia Master Naturalist, the volunteer must complete 8 hours of continuing education and 40 hours of approved volunteer service each year after graduation.

Since its inception in 2005, the VMN program has grown to 29 local chapters with activities or volunteers in >80% of Virginia's counties and independent cities. Chapters exist in the most urbanized areas of the state, such as Fairfax County in northern Virginia, and the most rural areas, such as Wise County in far southwestern Virginia's coal country. Over the lifetime of the program, nearly 5,000 individuals have completed the basic training course. Approximately 50% of those graduates also completed all of the requirements to become a Certified Virginia Master Naturalist volunteer, and many more actively volunteered at a lesser level.

In 2017, nearly 2,000 VMN volunteers reported 128,000 hours of service on education, citizen science, and stewardship projects in their communities. In addition, they contributed another 28,000 hours to chapter administration, including recruiting and training new volunteers, managing volunteers, coordinating chapter events, and conducting the general day-to-day business to keep the chapters thriving. On average, each active volunteer contributed >80 hours of service in 2017. When totaled, their service is equivalent to 61 full-time equivalents, with a monetary value of $4.1 million (Independent Sector 2016).

Each year, approximately 500 new people complete the Virginia Master Naturalist basic training with a local chapter. Trainings address statewide learning objectives on a wide variety of topics, including the ecology and management of systems (e.g., forest ecology and management, aquatic ecology and management), natural history topics (e.g., botany, ornithology), and naturalist skills (e.g., interpretation and teaching, citizen science.) The classes are taught by local guest instructors, who may be state agency personnel, university professors, local natural resource professionals, or even experienced Master Naturalist volunteers. Typically, a different instructor teaches each class session within a course, providing an opportunity for the trainees to meet and learn from many local experts. Those initial interactions are often a springboard to further learning and engagement in volunteer projects.

To meet the field time requirements, VMN basic training courses have several field trips,

often to parks and natural areas where the chapter has volunteer projects. The field time is an opportunity for VMN participants to explore the special natural areas in their communities and to see real-life examples of concepts and organisms they have learned about in the classroom. The field trips are also an opportunity to practice naturalist skills, such as using keys and field guides to identify organisms, keeping field notes, and using sampling techniques to study wildlife populations.

The continuing education requirement for Certified Virginia Master Naturalist status promotes learning and development of natural resource skills and knowledge, and it provides the experienced Master Naturalist with tools to be a more effective volunteer. Continuing education opportunities are offered frequently by program partners and by program staff, and they may include workshops on specialized topics, conferences, and webinars.

As volunteerism is the primary focus of the VMN program, volunteers connect with wildlife and other natural resources through service in stewardship, citizen science, and education. Their stewardship work typically happens on public property, such as local, state, and national parks. It often includes invasive plant removal efforts, restoration of native habitats, installation and maintenance of small demonstration habitats such as pollinator gardens, stream and trail clean-ups, and trail building. In a 2013 needs assessment study, VMN volunteers, agency staff, and partnering organization staff all ranked "participating in environmental stewardship projects" first among the ways that VMN volunteers are making a difference in their communities (Merenlender et al. 2016). In Arlington County, among Virginia's most populated areas, VMN volunteers adopt >20 neighborhood parks to manage invasive species. They lead a routine schedule of work days, sometimes involving other members of the neighborhood alongside the VMN volunteers, to remove invasive plants and promote native species. Volunteers and park managers report that, as a result of VMN volunteers' persistence, sites are showing significant improvement in terms of reduction of invasive species and increase in native plant abundance and diversity (M. Jordan, VMN-Arlington Regional Chapter volunteer, personal communication).

Citizen science is the most popular area of service for VMN volunteers, garnering the most volunteer hours each year since 2012. Studies of birds and other wildlife comprise the majority of these citizen science efforts (Merenlender et al. 2016). Citizen science efforts are often part of large-scale contributory projects such as the Audubon Christmas Bird Count and the Cornell Lab of Ornithology's Feeder Watch, but also include locally focused collaborative and co-created projects designed specifically for, and sometimes by, VMN volunteers (Shirk et al. 2012). For example, VMN volunteers have collaborated with a university researcher and the Virginia Department of Game and Inland Fisheries on a long-term study to document and monitor vernal pool habitats and their associated obligate amphibian species.

Program volunteers play a valuable role in connecting other people, particularly youth, to nature and natural resources. Each year, VMN volunteers make >100,000 contacts through their educational programs. These programs include afterschool and summer nature clubs for K-12 youth, booths with hands-on educational activities at community events, and nature walks for the public at local parks and trails. In just 1 example, VMN volunteers conducted a Kids Count day in association with an annual butterfly count. Volunteers taught youth how to identify common butterflies, facilitated their observation of butterflies in a natural setting, and led games to illustrate the ecological roles of butterflies. Reaching the other end of the age spectrum is a project created by VMN volunteers called Reconnect with Nature Project: Bringing Nature Home to Long-term Care. In this project, volunteers conducted various programs to bring nature to long-term care residents who otherwise had little access to the natural world. Programs include monitoring of bluebird (*Sialia* sp.) boxes installed on the nursing home grounds, presentations on nature topics, and small-group sessions in which volunteers use photographs and hands-on resources to facilitate storytelling and informal learning about nature among the residents (Connelly and Roth 2015).

The VMN program serves as a conduit for resource managers and local citizens to connect with each other for mutual benefit. For example,

VMN volunteers collaborated with the manager of a longleaf pine (*Pinus palustris*) ecosystem on a 3-year research study to identify the most effective strategies to control an invasive plant that is spreading in the natural area (Jordan et al. 2016). The volunteers were able to investigate an issue of importance to the land manager and provide data to inform the resource management decisions. The land manager assisted the volunteers in research design and in some treatments, such as prescribed burning, that required specialized skills. They are now working together to write a research paper to share their findings with a broader audience (G. Payne, VMN volunteer, Historic Southside Chapter, personal communication). Another group of VMN volunteers has worked closely with managers to designate an area of a nearby state park to serve as an outdoor laboratory for the chapter. The volunteers serve as stewards for the outdoor laboratory, improving it with pollinator gardens and educational resources such as a children's discovery area and a trail for individuals with visual or hearing impairment—projects the park would have been unlikely to accomplish without the leadership and work of the VMN volunteers. The chapter also uses the area for training new volunteers and conducting citizen science projects such as biodiversity inventories and vernal pool monitoring (T. Skinner, personal communication).

Utah Master Naturalist

The Utah Master Naturalist program (UMN) emerged to fulfill a mission to educate the public and assist them in making informed decisions about their own personal use of natural resources. The concentrated population distribution and high growth rates in Utah have the potential to exacerbate a growing disconnect from nature. Utah has an abundance of beautiful natural areas including national parks, monuments, and forests, as well as state parks, with the mission of connecting people to nature. However, Utah also has the highest level of urbanization in the United States, with 88.4% of residents living in incorporated cities (U.S. Census Bureau 2015). A combination of a scarcity of available water and 65% of Utah as federal land contribute to the concentration of most of the state's population along a 150-mile stretch of the Wasatch Front. Despite a relatively small portion of the state being inhabited by people, Utah has the fastest-growing population in the country, increasing at a rate almost 3 times the national average (U.S. Census Bureau 2016). As a result, the population of Utah is expected to double by the year 2050.

A rapidly growing urbanized population in Utah creates a high demand for natural resources, challenging managers trying to meet those needs. Utah is the second driest state in the nation, receiving an average of 20–50 cm of precipitation each year (National Oceanic and Atmospheric Administration 2017). Utah also has the second highest per capita consumption of water in the United States at nearly 1,000 liters per person per day, 81% of which is used for irrigation (Utah Division of Water Resources 2010). Due to factors including increased temperatures and less snowpack due to climate change, as well as a growing population, it is projected that the Wasatch Front and St. George areas of Utah may not have enough water to meet their needs by 2025. The demand for potable water will only increase while the ability to store and deliver water will become more difficult, and resource conservation will be increasingly important.

Promoting conservation of water resources, for example, requires understanding the concept of a watershed, and the aquatic ecosystems, plants, and animals that live within a watershed. As participants see the interrelatedness and interdependence of these ecosystems on the scarce water resources, the importance of conservation of water resources becomes obvious. For instance, a UMN Watershed Investigations course usually explores how water resources are managed, from water treatment to wastewater treatment and monitoring water quality, with an emphasis on how participants can actively participate in conservation.

The UMN was also developed in large part to train volunteer naturalist educators who engaged the public across the state. A 2005 survey of 26 Utah organizations (e.g., nature centers, zoos, state parks) that use volunteer naturalists indicated a clear need for the UMN program to provide the knowledge and skills necessary for delivering education programs

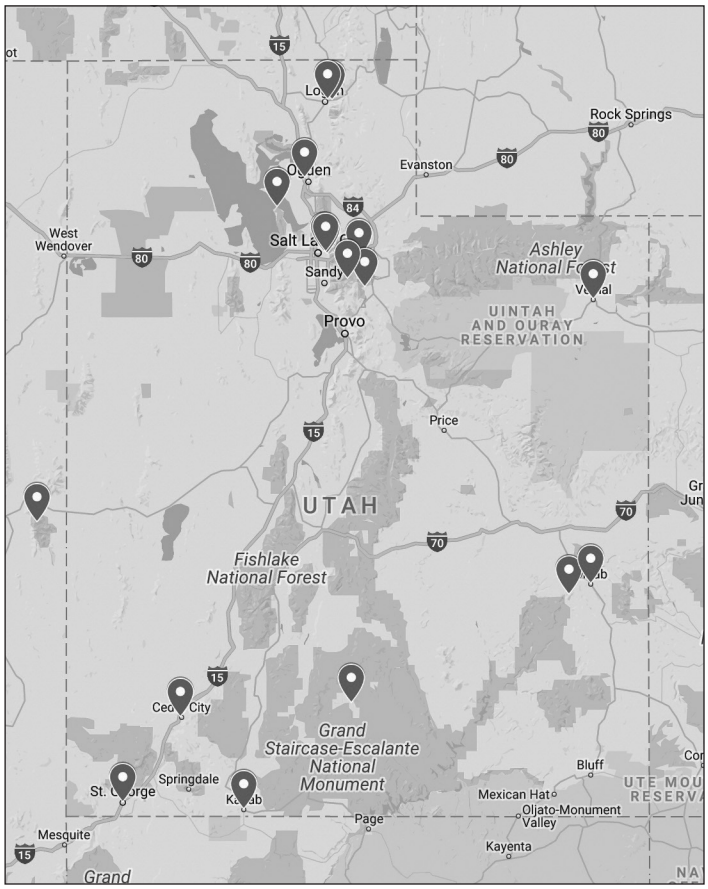

Figure 3. Geographic distribution of Utah Master Naturalist field courses.

to the public. Over half of responding organizations currently trained their volunteer naturalists, but for half of those organizations, training was only 1–5 hours in duration. Nearly all organizations (i.e., 95%) thought that the Utah Master Naturalist program would be valuable training for their volunteers and that their volunteers would be interested in the program.

While UMN set out to address the need for volunteer training, it became apparent that the program was also highly valuable in training professional educators and managers, including state park naturalists, backcountry rangers, environmental educators, and K-12 teachers. While accommodating such a diverse audience can sometimes be challenging, the UMN curricula are flexible enough to tailor field courses to meet the needs of all audiences. For instance, naturalists from the general public are usually interested in learning more about nature in Utah and connecting to environmental organizations and natural resource agencies, K-12 teachers often require a broad understanding of Utah's major ecosystems and techniques for sharing nature with their students, environmental educators desire to gain a deeper knowledge and discover the secrets of nature to share with others, and Utah State University (USU) graduate students, most of whom are enrolled in USU's online Master of Natural Resources degree, appreciate an in-person field experience to help them learn about natural resource ecology and management in Utah.

Unlike most other Master Naturalist programs that are a single course, UMN has consisted of 3 different ecosystem-based field courses—Watershed Investigations, Desert Explorations, and Mountain Adventures—that are each approximately 40 hours in length. The ecological diversity of Utah necessitates multiple field courses to explore unique ecosystems in depth. Three separate, focused field courses allow UMN to immerse participants in a particular ecosystem, connect participants to scientists and land managers who often lead educational field experiences, and experience public lands such as national and state parks and monuments. Each UMN field course is supported by a statewide curriculum including a course manual and plant and animal field guides (http://extension.usu.edu/utahmasternaturalist/coursematerials).

The number of UMN courses and participants continues to grow each year. A participant may choose to complete and become certified in 1, 2, or all 3 UMN field courses. The first UMN course was taught in 2007, and upwards of 13 courses are now taught each year. A total of 493 people have completed 695 Utah Master Naturalist certifications. Some participants choose to complete multiple courses, with 14% returning for a second field course, and 13% of participants are inspired to complete the full Utah Master Naturalist certification by

completing all 3 courses.

The UMN field courses are delivered across Utah, from Logan in the north to Kanab in the south (Figure 3). Locations for UMN field courses are based on the location of partner organizations, proximity to exemplary natural areas, and locations of underserved audiences. Most of the UMN field courses take place in the vicinity of the Wasatch Front where the majority of Utah residents live. Some UMN field courses are designed as learning vacations at places such as Dead Horse Point State Park near Moab, or Great Basin National Park, where residents from the Wasatch Front might attend to learn more about places where they spend leisure time. Many of the participants in these remote courses are not local residents. Occasionally, UMN field courses are offered in a more remote place like the town of Escalante adjacent to Grand Staircase-Escalante National Monument, where a clear audience of enthusiastic residents do not often have the opportunity to participate in adult education.

Utah's highly urbanized population limits the geographic reach of UMN and hinders the program from operating as a chapter-based model like many other Master Naturalist programs such as VMN. The relatively limited population and large amounts of public lands beyond the Wasatch Front drastically reduce the likelihood of UMN field courses and chapters engaging a local population of adequate size. Additionally, partner organizations and knowledgeable instructors are often unavailable in more remote areas of the state. As a result, the remoteness of many rural Utah towns is a barrier to residents traveling to participate in UMN field courses in more populated areas of the state. Beginning in 2018, 2-day online courses were implemented to teach the fundamental concepts of each field course prior to attending a shortened 3-day field course. This strategy was implemented to: 1) reach a broader audience across Utah, 2) provide an educational opportunity (i.e, online courses) to remote residents who may never be able to attend a UMN field course, and 3) to reduce the length of field courses in an effort to attract more partner organizations and increase the number and geographic reach of UMN field courses.

The UMN courses have demonstrated both immediate positive impacts and lasting benefits to participants' personal and professional lives over the past decade. The UMN participants tend to, on average, experience significant knowledge gain as measured by pre- and post-testing, especially among those who were amateur naturalists (Larese-Casanova 2011). Continued participant assessment using retrospective pre-post surveys confirms that knowledge gain related to the program objectives occurred for all responding UMN participants (n = 95). Additionally, UMN field courses are effective in connecting participants to nature and motivating them to continue participating in education and stewardship activities. Evaluation feedback from UMN participants has led to program improvements over the years, resulting in significantly higher participant satisfaction and stewardship motivations (Larese-Casanova 2015). Furthermore, increased stewardship motivations and behaviors were maintained on average 4 years, and upwards of 10 years, after participating in a UMN field course. The UMN field courses also assist managers in advancing in their careers and teachers in maintaining their teaching credentials (Larese-Casanova, in press). Even though UMN field courses attract highly engaged citizens, the program is effective in maintaining or increasing stewardship among its participants. As participants develop a holistic understanding of natural resources in Utah, they are inspired to thoroughly examine their own use and how they can be better stewards (Larese-Casanova 2015).

Service-learning and volunteerism are essential components of every UMN field course. Scientists and resource managers who lead UMN field course activities often integrate service opportunities, such as weed mapping and removal, bird and amphibian surveys, or water quality monitoring. Promoting service learning within each UMN field course helps reduce barriers to continued participation in volunteer service after a course. The UMN is atypical of Master Naturalist programs in that it encourages volunteer service, but does not require a specific amount of volunteer hours each year. The primary reasoning behind this decision is that many professionals, such as resource managers and K-12 teachers who have completed UMN field courses, use the

knowledge and skills in their work, and often do not have additional time to volunteer. As such, they should certainly be recognized as certified Utah Master Naturalists.

The UMN field courses often connect enthusiastic naturalists to agencies and organizations in need of dedicated volunteers. Integrating service-learning into a UMN course provides scientists and managers an opportunity to recruit knowledgeable and enthusiastic volunteers. Two UMN couples—Steve and Louise Brown and Ted and Carolyn McGrath—used their knowledge and skills gained in a Watershed Investigations field course to implement a water quality monitoring program at the U.S. Fish and Wildlife Service's Bear River Migratory Bird Refuge. Louise and Steve Brown also developed and received a state volunteerism award for their Nurture Nature program that provides monthly opportunities for senior citizens from their area to experience and connect to natural areas across Utah. Nurture Nature inspires seniors to have a healthy, active life that has a dramatic impact on their well-being at a time in their lives when they need it the most. Nancy O'Toole, a recently retired grant proposal writer, began volunteering at Wasatch Mountain State Park after attending a Mountain Adventures course taught there in 2012. Nancy volunteered 230 hours at Wasatch Mountain State Park in 2013 and raised tens of thousands of dollars for programs and infrastructure projects. While these Utah Master Naturalists are exceptional cases, many UMN participants learn about the program through their existing volunteer work at zoos, nature centers, and parks, using the knowledge and skills gained to become better informed and more highly trained docents.

Citizen science is emerging as a valuable tool for scientists and resources managers to engage the public and recruit volunteers who help them meet their management goals (Bonney et al. 2016). Citizen Science is an essential component of service-learning in all UMN field courses. Recent collaboration with the Natural History Museum of Utah, which is emerging as the hub for citizen science in Utah, is aiding in the expansion of their Neighborhood Naturalists program across the state. The UMN online courses will now include tutorials on using iNaturalist as the primary tool for citizen science in Utah to encourage the creation of local naturalist events, including bioblitze. iNaturalist is an online tool for crowdsourcing nature observation and identifications, resulting in enormous datasets that are valuable to scientists and managers.

Over the past decade, several local national and state parks have conducted bioblitzes to better understand the plant and animal communities that they manage. Utah Master Naturalists are often integral in helping manage groups of volunteers, surveying areas, and identifying organisms during bioblitzes. The UMN also collaborates with specific research or management projects that need knowledgeable citizen scientists. For instance, UMN is helping to promote a long-term camera trapping research project to monitor large mammal populations in the central Wasatch mountains. Volunteers will help maintain and monitor motion-sensing camera traps, assist with identifying animal photos, and contribute to an online database to fill critical data gaps in the understanding of native wildlife populations along the wildland–urban interface.

Conclusions

State wildlife and natural resource agencies can play an important role in supporting Master Naturalist programs. First, they may provide basic funding for programs to support the personnel and infrastructure needed to train and coordinate program participants. The VMN program, for example, would not have started without the financial support from the state wildlife agency and several other agencies. Second, agency staff can assist these programs by providing subject matter expertise. Many Master Naturalist programs rely on scientists and managers to assist in writing course manuals and curricula as well as lead classroom presentations and field trips. Additionally, there is often a need for managers to lead advanced training opportunities at Master Naturalist program annual conferences. Third, agency staff can engage with programs to connect participants to volunteer service and outreach opportunities that relate to the agency's conservation mission.

Resource managers also benefit from connecting with Master Naturalists. Many of the program participants contribute to

projects through volunteering and citizen science. Vast amounts of reliable observational data are collected through volunteer citizen science programs, greatly contributing to understanding species ranges and ecological changes (Cohn 2008, Sullivan et al. 2009). From a financial perspective, time and resources invested by volunteers often provide a sizeable pool of in-kind donations that can serve as match on grant proposals. This mutually beneficial opportunity aids managers in fulfilling their management goals and supports Master Naturalist programs through educational support that focuses on current management issues.

Collaboration among Master Naturalist programs, resource managers, and highly engaged Master Naturalists provide a unique opportunity to fulfill conservation efforts. By engaging with Master Naturalist programs, resource managers invite the public to participate in natural resources science and real-world management issues, helping to create a more scientifically and environmentally literate citizenry. Wilson (1984) explained that "Humanity is exalted not because we are so far above other living creatures, but because knowing them well elevates the very concept of life."

Acknowledgments

We thank E. Harper, HWI associate editor, and 2 anonymous reviewers who provided valuable feedback on the manuscript.

Literature cited

Alliance of Natural Resource Outreach and Service Programs (ANROSP). 2016*a*. About us. Alliance of Natural Resource Outreach and Service Programs, USA, <https://anrosp.wildapricot.org/About>. Accessed July 13, 2018.

Alliance of Natural Resource Outreach and Service Programs (ANROSP). 2016*b*. Program directory. Alliance of Natural Resource Outreach and Service Programs, USA, <https://anrosp.wildapricot.org/directory>. Accessed December 1, 2017.

Bonneau, L., R. Darville, M. Legg, M. Haggerty, and R. N. Wilkins. 2009. Changes in volunteer knowledge and attitudes as a result of Texas Master Naturalist training. Human Dimensions of Wildlife 14:157–172.

Bonney, R., T. B. Phillips, H. L. Ballard, and J. W. Enck. 2016. Can citizen science enhance public understanding of science? Public Understanding of Science 25:2–16.

Clements, R. 2004. An investigation of the state of outdoor play. Contemporary Issues in Early Childhood 5:68–80.

Cohn, J. P. 2008. Citizen science: can volunteers do real research? BioScience 58:192–197.

Connelly, J. E., and S.A. Roth. 2015. Bringing nature home to long-term care residents. Virginia Master Naturalists, Charlottesville, Virginia, USA, <http://www.virginiamasternaturalist.org/home/bringing-nature-home-to-long-term-care-residents>. Accessed July 13, 2018.

Frumkin, H. 2001. Beyond toxicity: human health and the natural environment. American Journal of Preventative Medicine 20:234–240.

Heerwagen, J. H., and G. H. Orians. 1993. Humans, habitats, and aesthetics. Pages 138–172 *in* S. R. Kellert and E. O. Wilson, editors. The biophilia hypothesis. Shearwater Books/Island Press, Washington, D.C., USA.

Herzog, T. R., A. M. Black, K. A., Fountaine, and D. J. Knotts. 1997. Reflection and attentional recovery as distinctive benefits of restorative environments. Journal of Environmental Psychology 17:165–170.

Independent Sector. 2016. The value of volunteer time. Independent Sector, Washington, D.C., USA, <https://independentsector.org/resource/the-value-of-volunteer-time/>. Accessed March 3, 2018.

Jordan, R., S. Gray, A. Sorensen, G. Newman, D. Mellor, G. Newman, C. Hmelo-Silver, S. LaDeau, D. Biehler, and A. Crall. 2016. Studying citizen science through adaptive management and learning feedbacks as mechanisms for improving conservation. Conservation Biology 30:487–495.

Karsten, L. 2005. It all used to be better? Different generations on continuity and change in urban children's daily use of space. Children's Geographies 3:275–290.

Kellert, S. R. 2005. Building for life: designing and understanding the human-nature connection. Island Press, Washington, D.C., USA.

Kellert, S. R., D. J. Case, E. Escher, D. J. Witter, J. Mikels-Carrasco, and P. T. Seng. 2017. The nature of Americans: disconnection and recommendations for reconnection. The Nature of Americans National Report, D.J.

Case and Associates, Mishawaka, Indiana, USA, <https://lccnetwork.org/sites/default/files/Resources/Nature-of-Americans_National_Report_1.2_4-26-17.pdf>. Accessed July 11, 2018.

Kuo, F. E., and A. F. Taylor. 2004. A potential natural treatment for attention-deficit/hyperactivity disorder: evidence from a national study. American Journal of Public Health 94:1580–1586.

Larese-Casanova, M. 2011. Assessment and evaluation of the Utah Master Naturalist Program: implications for targeting audiences. Journal of Extension 49(5), Article 5RIB2.

Larese-Casanova, M. 2015. Using evaluation to guide and validate improvements to the Utah Master Naturalist Program. Journal of Extension, 53(3), Article 3IAW3.

Larese-Casanova, M. In press. The importance of evaluating long-term impacts: Utah Master Naturalist program as a case study. Journal of Extension.

Leopold, A. 1949. A Sand County almanac: with essays on conservation from Round River. Oxford University Press, Oxford, United Kingdom.

Louv, R. 2008. Last child in the woods: saving our children from nature-deficit disorder. Algonquin Books, Chapel Hill, North Carolina, USA.

Main, M. 2004. Mobilizing grass-roots conservation education: the Florida Master Naturalist program. Conservation Biology 18:11–16.

Merenlender, A. M., A.W. Crall, S. Drill, M. Prysby, and H. Ballard. 2016. Evaluating environmental education, citizen science, and stewardship through naturalist programs. Conservation Biology 30:1255–1265.

National Oceanic and Atmospheric Administration. 2017. State summaries: Utah. NOAA National Centers for Environmental Information, Ashville, North Carolina, USA, <https://statesummaries.ncics.org/sites/default/files/downloads/UT-screen-hi.pdf>. Accessed February 23, 2018.

Sen, S. 2017. Despite slowing growth rate, Virginia is projected to be the 10th largest state by 2040. Stat Chat, June 26, 2017. Demographics Research Group, University of Virginia, Charlottesville, Virginia, USA, <http://statchatva.org/2017/06/26/despite-slowing-growth-rate-virginia-is-projected-to-be-the-10th-largest-state-by-2040/>. Accessed July 13, 2018.

Shirk, J. L., H. L. Ballard, C. C. Wilderman, T. Phillips, A. Wiggins, R. Jordan, E. McCallie, M. Minarchek, B. V. Lewenstein, M. E. Krasny, and R. Bonney. 2012. Public participation in scientific research: a framework for deliberate design. Ecology and Society 17(2):29.

Soga, M., and K. J. Gaston. 2016. Extinction of experience: the loss of human-nature interactions. Frontiers in Ecology and the Environment 14:94–101.

Sullivan, B. L., C. L. Wood, M. I. Iliff, R. E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. Biological Conservation 142:2282–2292.

Taylor, A. F., F. E. Kuo, and W. C. Sulllivan. 2001. Coping with ADD: the surprising connection to green play settings. Environment and Behavior 33:54–77.

Taylor, A. F., and F. E. Kuo. 2006. Is contact with nature important for healthy child development? State of the evidence. Pages 124–139 *in* C. Spencer and M. Blades, editors. Children and their environments: learning, using and designing spaces. Cambridge University Press, Cambridge, United Kingdom.

Texas Parks and Wildlife Department. 2004. Texas Master Naturalist program spreads nationwide. Texas Parks and Wildlife, Austin, Texas, USA, <https://tpwd.texas.gov/newsmedia/releases/?req=20040726a>. Accessed [date].

U.S. Census Bureau. 2012. 2010 Census of population and housing, population and housing unit counts, CPH-2-48. U.S. Department of Commerce, Economics and Statistics Administration, Washington, D.C., USA, <https://www.census.gov/prod/cen2010/cph-2-48.pdf>. Accessed July 11, 2018.

U.S. Census Bureau. 2015. Population trends in incorporated places: 2000 to 2013. U.S. Department of Commerce, Economics and Statistics Administration, Washington, D.C., USA, <https://www.census.gov/content/dam/Census/library/publications/2015/demo/p25-1142.pdf>. Accessed February 27, 2018.

U.S. Census Bureau. 2016. Utah is nation's fastest-growing State, Census Bureau reports. U.S. Department of Commerce, Washington, D.C., USA, <https://www.census.gov/newsroom/press-releases/2016/cb16-214.html>. Accessed February 12, 2018.

U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2016. National survey of fishing, hunting, and wildlife-associ-

ated recreation. U.S. Department of the Interior, Washington, D.C., USA, <https://www2.census.gov/programs-surveys/fhwar/publications/2016/fhw16-nat.pdf>. Accessed July 13, 2018.

Utah Division of Water Resources. 2010. Municipal and industrial water use in Utah. Utah Division of Water Resources, Salt Lake City, Utah, USA, <https://water.utah.gov/OtherReports/MUNICIPAL%20AND%20INDUSTRIAL%20WATER%20USE%20in%20UTAH.pdf>. Accessed February 13, 2018.

White, M., I. Alcock, B. Wheeler, and M. H. Depledge. 2013. Would you be happier living in a greener urban area? A fixed-effects analysis of panel data. Psychological Science 24:920–928.

Wilson, E. O. 1984. Biophilia. Harvard University Press, Cambridge, Massachusetts, USA.

Associate Editor: Erin E. Harper

Mark Larese-Casanova is the Utah Master Naturalist program director and an extension assistant professor in the Department of Watershed Sciences at Utah State University. He is based in Logan, Utah.

Michelle Prysby is the state director for the Virginia Master Naturalist program and an extension faculty member in the Department of Forest Resources and Environmental Conservation at Virginia Tech. She is based in Charlottesville, Virginia.