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Authors: Kaye, Thomas N., Bush, Kelli, Naugle, Chad, and LeRoy, Carri J.

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CONSERVATION ISSUES

Conservation Projects in Prison: The Case for Engaging Incarcerated Populations in Conservation and Science

Thomas N. Kaye[1,5]

[1]Institute for Applied Ecology
PO Box 2855
Corvallis, OR 97339-2855

Kelli Bush[2]

Chad Naugle[3]

Carri J. LeRoy[4]

[2]Sustainability in Prisons Project
2700 Evergreen Parkway NW
Olympia, WA 98505

[3]Oregon Department of Corrections
3601 State St.
Salem, OR 97301

[4]The Evergreen State College
2700 Evergreen Parkway NW
Olympia, WA 98505

[5] Corresponding author:
tom@appliedeco.org; 541-753-3099

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ABSTRACT: The pace of habitat destruction and loss of biological diversity globally exceeds the current capacity of societies to restore functioning ecosystems. Working with prison systems to engage inmates in habitat conservation and ecological science is an innovative approach to increase our ability to reestablish habitat and at-risk species, while simultaneously providing people in custody with opportunities for reciprocal restoration, education, therapeutic activities, safer conditions, and lower costs of imprisonment. We present the benefits of working with prisons to conduct habitat conservation through nursery production of plants and captive rearing of animals, combined with educational experiences, and provide an overview of the Sustainability in Prisons Project Network. Examples of projects with prisons in Washington and Oregon include nursery production of Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis*) for restoring habitat of the greater sage-grouse (*Centrocercus urophasianus*), nursery production of early blue violet (*Viola adunca*) to support conservation of threatened Oregon silverspot butterflies (*Speyeria zerene hippolyta*), captive rearing programs for Oregon spotted frogs (*Rana pretiosa*) and endangered Taylor's checkerspot butterflies (*Euphydryas editha taylori*), and nursery production of over 60 plant species for restoration of native prairies. Including incarcerated people in conservation and science could tap into the positive potential of over 2 million inmates at over 4000 prisons and jails in the United States and create new partnerships to support large-scale habitat restoration and ecological research.

Index terms: captive rearing, sagebrush, sage-grouse, sustainability in prisons project, Taylor's checkerspot

INTRODUCTION

Habitat loss is a major driver of declines in biodiversity (Ehrlich 1988). Many ecosystems in the United States have declined by 70% or more, especially forests, grasslands and savannas (Noss et al. 1995), and over 1500 species are listed by the US Fish and Wildlife Service as threatened or endangered (US Fish and Wildlife Service 2013d). Habitat restoration (e.g., Hobbs and Harris 2001) and active reintroduction of declining species (Seddon et al. 2007; Seddon 2010) are, therefore, important tools for conservation. However, the sheer magnitude of the work needed to address habitat and species losses is so high that conservationists face financial and capacity restraints on what they can accomplish (Miller and Hobbs 2007). Add to these problems the stress of global climate change on habitats and species, and the need for a rise in our social capability to intervene becomes even more urgent (McClanahan et al. 2008). Innovative methods for implementing actions like habitat restoration and species reintroductions may improve the ability of land managers to reach their conservation targets. One method may be to reach out to new groups of people to help achieve larger goals.

Over 2.2 million adults are incarcerated in prisons and jails in the United States (Glaze and Herberman 2013). Some states mandate that prisoners contribute in positive ways as part of their rehabilitation treatment; for example, Oregon's Inmate Work Act requires correctional institutions to engage inmates in full-time work or on-the-job training. Over 96% of incarcerated men and women will be released back to their communities (Nellis 2013). Engaging this large and severely underserved population in conservation practice and science education creates a win-win situation with high potential for positive impacts on the environment, inmates, and social communities. In this paper we report that collaborations between natural area managers, scientists, and correctional facilities can contribute to conservation, as well as benefit researchers and prison inmates. To illustrate this potential, we describe the Sustainability in Prisons Project (SPP) model. We provide case studies of how this innovative collaboration benefits a variety of species and habitats through nursery production of native plants and captive rearing of rare animals, explain how these partnerships result in transformative educational opportunities, and argue that such collaborations can enhance conservation science.

THE CASE FOR CONDUCTING CONSERVATION PROGRAMS WITH CORRECTIONAL FACILITIES

Inmate participation in habitat conserva-

tion results in a substantial increase in the capacity of land managers and scientists to restore landscapes, conduct research, and work toward recovery of threatened and endangered species. For example, restoration ecologists partnering with SPP-Washington have worked with local correctional facilities to raise endangered species and native plants for release into, and restoration of, natural areas (LeRoy et al. 2012). SPP-Washington's first conservation program was initiated by researchers at The Evergreen State College partnering with Washington Department of Corrections to involve inmates in a study of how to sustainably cultivate moss for use in the horticulture trade, while also broadening the social effects of their research (Nadkarni 2006). This work in turn benefited the incarcerated and nearby social communities.

Caring for living organisms provides significant therapeutic value to inmates, whether they are caring for animals (Strimple 2003; Ormerod 2008) or plants (Relf and Dorn 1995; Relf 2006; Clarke 2011; Lindemuth 2014), which can result in calmer, safer prison settings. Providing inmates with an opportunity to give back to their communities through conservation projects strengthens their sense of accountability and pro-social behavior, resulting in improved attitudes about the environment (Gallagher 2013), as well as creating a form of reciprocal restoration in which inmates make tangible contributions to the natural world and develop a positive sense of connection to the environment. Similarly, the Great Plains Restoration Council's Restoration Not Incarceration model, an environmentally based program for formerly incarcerated youth, has yielded positive outcomes for participants, Gulf Coast habitats, and local communities (Norton and Holguin 2011; Norton et al. 2013).

Adults in custody are hungry for intellectual stimulation and participation in scientific research. Receiving scientific lectures and presentations by professionals helps meet this need while providing exposure to positive role models (Ulrich and Nadkarni 2009; Weber 2012). Work and vocational training programs reduce rates of recidivism after inmates are released into their communities (Bouffard et al. 2000; Wilson et al. 2000), and educational opportunities improve postrelease employment rates and earnings (Tyler and Kling 2006; Cho and Tyler 2013). Incorporating concepts of natural resource conservation into correctional facilities is part of the "greening of corrections" (Thigpen et al. 2011) movement, which promotes sustainability in prisons with benefits to the environment, inmates, and communities (LeRoy et al. 2012).

THE SUSTAINABILITY IN PRISONS PROJECT NETWORK

The Sustainability in Prisons Project (SPP) model was cofounded by the Washington State Department of Corrections and The Evergreen State College in 2003 (LeRoy et al. 2012). Pilot activities were initiated at Cedar Creek Corrections Center, a minimum-security prison for men in Little Rock, Washington (Nadkarni and Pacholke 2013). The outcomes of the first programs were overwhelmingly positive and resulted in inmate participation in conservation research and science, sustainability education for both staff and inmates, and reduced prison operating costs. The SPP partnership grew to include natural resource agencies, conservation and community organizations, and land management agencies such as the US Department of Defense. With increased partners, resources, and corrections' staff interest, science and sustainability programs have expanded to all prisons across Washington State. These successful programs drew the attention of the media and word spread throughout the world. The SPP model has generated interest from countries such as France, Moldova, and Australia. Over 20 states in the United States have expressed an interest in developing SPP programs in their prisons or jails. In 2011, the Institute for Applied Ecology partnered with the Oregon Department of Corrections to initiate an SPP program in Oregon. In response to the overwhelming interest in the SPP model, the SPP Network was founded in 2012. Currently there are nine SPP programs operating in prisons or jails in Washington, Oregon, Utah, California, Maryland, Ohio, and New York. The SPP Network allows participants to share successes and seek support for challenges; collaborate on funding opportunities; standardize program evaluation, data tracking, and analysis; and share resources such as curricula, protocols, and outreach documents.

CASE STUDIES

The SPP Network has developed several successful projects. The following examples illustrate some of the projects in Oregon and Washington that are based on plant production in prison-based nurseries or captive rearing of animals. These collaborations among conservationists, scientists, students, and correctional facilities are making tangible contributions to natural area and rare species management.

Sage Brush and Greater Sage-grouse

The greater sage-grouse (*Centrocercus urophasianus* (Bonaparte)) is a candidate for listing by the US Fish and Wildlife Service as a threatened or endangered species that is found in Washington, Oregon, Idaho, Montana, North Dakota, eastern California, Nevada, Utah, western Colorado, South Dakota and Wyoming and the Canadian provinces of Alberta and Saskatchewan (US Fish and Wildlife Service 2013b; Figure 1). Habitat fragmentation and destruction across much of the species' range have contributed to significant population declines over the past century. Loss of sagebrush (*Artemisia* spp.) habitat, primarily due to wildfire, is the main driver of the decline of this species in the western United States (Connelly and Braun 1997; Miller and Eddleman 2001) because sagebrush provides crucial food and cover for these birds at multiple stages of their lifecycle. Greater sage-grouse require large areas of contiguous sagebrush, which is typically killed by wildfire and regenerates slowly from seed in the wild. Planting container grown sagebrush is an ecologically and economically sound technique of reestablishing these shrubs (Dettweiler-Robinson et al. 2013), even on depleted sites (McAdoo et al. 2013). Production of sagebrush plants for habitat restoration within state prison systems (Figure 2A) represents an opportunity to provide urgently needed

plant materials for greater sage-grouse conservation projects.

Biologists from the Institute for Applied Ecology (IAE) have partnered with the Oregon Department of Corrections as SPP-Oregon and have been working with the Snake River Correctional Institution, a medium- and minimum-security men's facility in Ontario, Oregon, and the Bureau of Land Management to produce genetically appropriate Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle and Young) for planting at nearby restoration sites. Since 2013, IAE staff have visited the facility regularly to interact with prison staff and inmates, provide training in horticultural practices, and review propagation procedures. The facility is currently producing at least 10,000 container plants annually, with capacity of up to 80,000. A lecture series on sagebrush ecosystems and greater sage-grouse conservation is included in this program. Because sagebrush appears to be locally adapted to environmental factors like day length and temperature, we carefully match the seed source of propagated material to specific restoration sites. This program is being developed as a model with protocols that can be used at many correctional facilities in and near the remaining range of the greater sage-grouse (Figure 1) to contribute local-source plant materials for the species' recovery.

Violets for Oregon Silverspot Butterflies

Oregon silverspot butterflies (*Speyeria zerene hippolyta* (W.H. Edwards)) were once common in coastal grasslands from northern California to southern Washington, but have declined to a handful of remaining populations. The species is now listed as threatened (US Fish and Wildlife Service 2001). Habitat management is a key need for the species, including enhancement of its native larval food source, early blue violet (*Viola adunca* Sm.) (New et al. 1995). The Oregon Zoo manages a captive rearing program for these silverspots that involves releasing them into sites with appropriate habitat in Oregon (Schultz et al. 2011), but few sites possess the numbers or densities of early blue violets necessary to support new populations. Therefore, management to increase violet populations, including planting large numbers of container grown plants, is underway at multiple restoration sites.

Early blue violets are in production at the

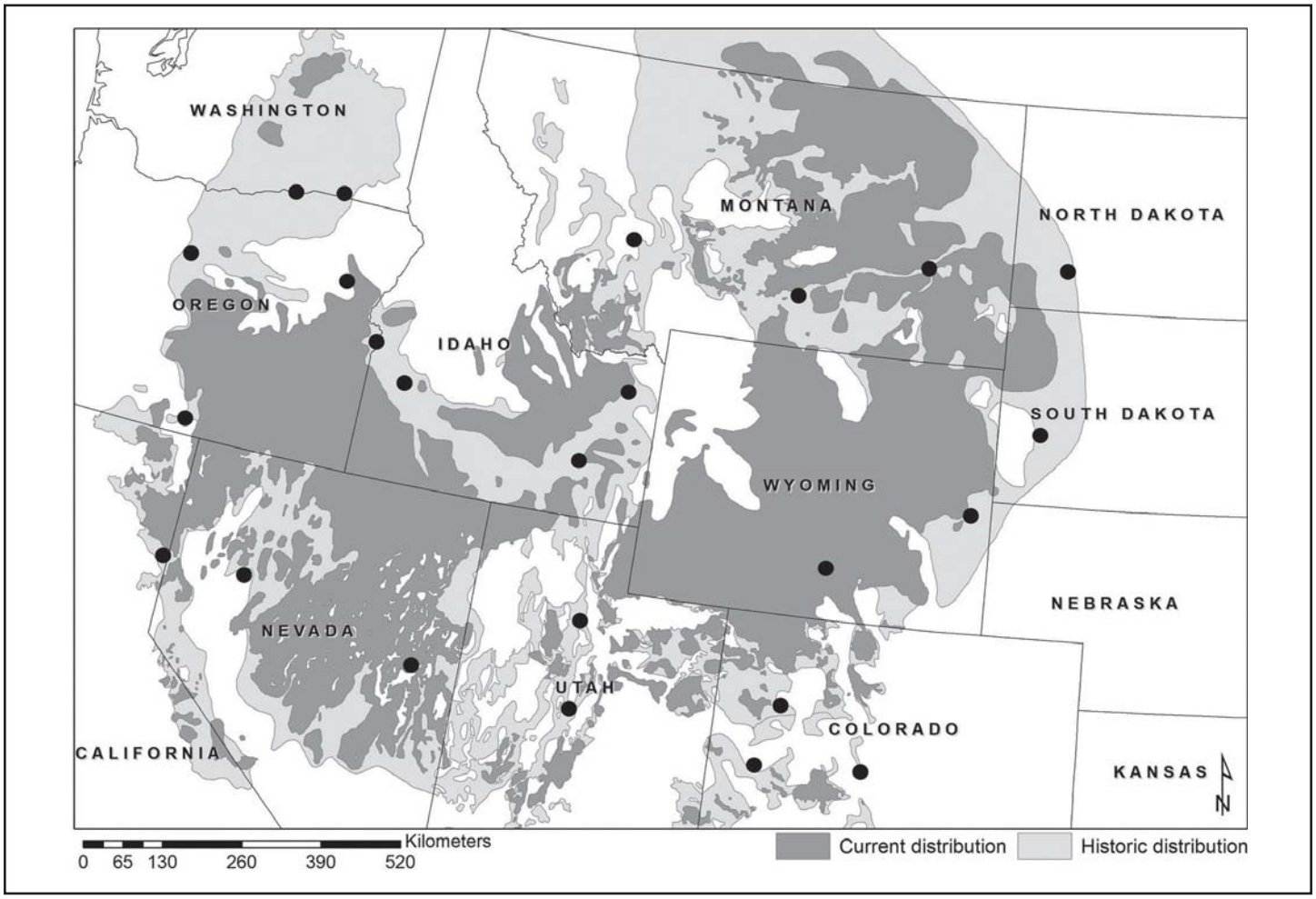

Figure 1. Current (2013) and historical distribution of greater sage-grouse, with locations of state and federal correctional facilities as dark circles. Greater sage-grouse distribution from US Geological Survey (http://sagemap.wr.usgs.gov/).

Figure 2. Prison inmate technicians participating in conservation projects. (A) Adults in custody cultivating sagebrush (*Artemisia tridentata*) at Snake River Correctional Institution near Ontario, Oregon. Plants produced at this facility are planted by inmate work crews at restoration sites to improve habitat for greater sage-grouse (*Centrocercus urophasianus*) (photo by Stacy Moore). (B) Production of early blue violet (*Viola adunca*) at the Coffee Creek Correctional Facility to support habitat restoration and feeding of captively reared Oregon silverspot butterflies (*Speyeria zerene hippolyta*) (photo by Thomas Kaye). (C) An inmate with SPP-Washington Taylor's Checkerspot Captive Rearing Program at Mission Creek Corrections Center for Women holds an endangered Taylor's checkerspot butterfly (*Euphydryas editha taylori*) next to golden paintbrush (*Castilleja levisecta*) during a study of the butterfly's oviposition preferences (photo by Benj Drummond). (D) An inmate technician labels native prairie plants for the SPP-Washington Conservation Nursery Program at Washington Corrections Center for Women (photo by Benj Drummond).

Coffee Creek Correctional Facility for women, a medium- and minimum-security prison in Wilsonville, Oregon (Figure 2B). Violet plants are also grown at the Oak Creek Correctional Facility for young women in Oregon, a facility managed by the Oregon Youth Authority. This project is a partnership between the Oregon Department of Corrections, Institute for Applied Ecology, Oregon Youth Authority, and the Oregon Zoo. A lecture series on habitat and animal conservation is provided to inmates in the women's prison and young women receiving high school science classes at the youth facility. Biologists from the Institute for Applied Ecology work closely with the staff and offenders at both correctional facilities to ensure proper cultivation practices for the violet and provide training in horticultural techniques. The plants produced—up to 60,000 per year—are planted at restoration sites in Oregon, aided by inmate work crews, and used as a food source for captively reared larvae at the Oregon Zoo.

Oregon Spotted Frogs

The Oregon spotted frog (*Rana pretiosa* (Baird and Girard)) is a Washington state-listed endangered species and has been proposed for federal listing as threatened. The frog has vanished from at least 78% of its historic range (US Fish and Wildlife Service 2013c). Decline of this warm-water marsh species can be attributed to habitat loss, nonnative plant invasions, and predation by exotic bull frogs (*Lithobates catesbeianus* (Shaw)).

In 2009, SPP-Washington began a five year pilot program rearing Oregon spotted frogs at Cedar Creek Corrections Center for men. This novel approach was the first conservation program in a corrections center working with threatened or endangered species. The success of the frog program demonstrated multidimensional benefits and the potential for replication of similar conservation programs in new locations. While the concept of captive-rearing in a prison was new, programs rearing Oregon spotted frogs were already well-established in four area zoos. The zoos and scientists with the Washington Department of Fish and Wildlife provide technical assistance

and help with research design, funding proposals, and monitoring.

From 2009–2012, SPP-Washington released over 550 captive-reared frogs and achieved egg-to-adult survivorship rates that averaged over 77%. The program won the North American Conservation Award for Best Rearing Facility from the Association of Zoos and Aquariums three years in a row. All frog rearing operations were temporarily ceased during the 2013 season at the conclusion of the initial five year pilot program. The Oregon Spotted Frog Working Group utilized the time without active rearing programs to draft a recovery plan, analyze data, and consider next steps. While there are still many unanswered questions surrounding the recovery of this species, inmates began raising frogs again in 2014. Inmate technicians have received over four years of herpetological training as participants in the program. In addition, inmates have worked with scientists on several research projects, including studies on predator evasion, chytrid fungus (Conlon et al. 2013), and growth comparisons between two populations.

Taylor's Checkerspot Butterflies

Taylor's checkerspot butterfly (*Euphydryas editha taylori* (W.H. Edwards)) is a federally listed endangered species (US Fish and Wildlife Service 2013a). This butterfly once thrived from southern British Columbia to western Oregon in prairies maintained by fire. Currently there are only a few small, isolated populations remaining, the largest of which is on the Artillery Impact Area at Joint Base Lewis-McChord. In advance of listing, recovery team partners identified the need to establish a second butterfly rearing facility to add capacity and resiliency to the well-established rearing operation at the Oregon Zoo.

In 2011, SPP-Washington and faculty, staff, and students at The Evergreen State College collaborated with Washington Department of Corrections, Washington Department of Fish and Wildlife, and the Oregon Zoo to design and construct a new Taylor's checkerspot butterfly rearing facility at Mission Creek Corrections Center for Women, a minimum-security prison in Belfair, Washington. The program includes three to five inmate technicians, a graduate student coordinator, corrections staff, scientists, zoo partners, and SPP staff. Over the 2012 and 2013 seasons, more than 4000 Taylor's checkerspot butterflies were reared and released, with survivorship rates during rearing of over 95%. Through this program, inmates receive training, education, and they assist with critical research (Figure 2C). Inmates helped a graduate student at The Evergreen State College with an oviposition preference study to examine which host plants the butterflies select for egg laying (Aubrey 2013). The research findings have improved understanding of habitat needs and informed future restoration actions. Inmate technicians will receive credit as co-authors when the research is published.

Washington Conservation Nurseries

The prairie-oak landscapes in the Puget lowlands are one of the rarest ecosystems in the Pacific Northwest region (Floberg et al. 2004). Development and fire suppression have resulted in a dramatic decline in the acreage of prairie and associated plants and animals (Schultz et al. 2011). In 2009, SPP-Washington began a native plant nursery, cultivating 16 different species at Stafford Creek Corrections Center, a minimum-, medium-, and maximum-security prison for men in Aberdeen, Washington. Plant plugs generated by the program and its six to ten inmate technicians are installed on sites across the Puget Sound ecoregion for ecosystem restoration projects and for seed production. The success of the first nursery led to the development of inmate-assisted operations at a second prison, Washington Corrections Center for Women, a minimum-, medium-, and maximum-security prison in Gig Harbor, Washington, where four to six inmate technicians are engaged in nursery operations full-time (Figure 2D). Also, SPP-Washington began managing plug production at the Center for Natural Lands Management's Shotwell's Landing conservation nursery with the assistance of a ten-person prairie restoration crew from Cedar Creek Corrections Center for men.

Inmate technicians at all conservation nurseries are responsible for various tasks including seed-sowing, watering, pest and weed control, and data collection. Inmates receive training in native plant cultivation, integrated pest management, seed ecology, and fire ecology. As with other SPP-Washington programs, the conservation nurseries rely on a collaborative effort for success. Each nursery site relies on inmates, corrections staff, students, conservation partners, and SPP staff. Major conservation partners include restoration ecologists at the Center for Natural Lands Management, Department of Defense biologists at Joint Base Lewis-McChord, and scientists at the Washington Department of Fish and Wildlife.

From 2009 to 2013, SPP-Washington nurseries produced nearly one million native plant plugs and production included 63 different species. The assistance provided by inmate technicians more than tripled the number of plant plugs available annually for restoration sites on Puget lowland prairies. Inmates were also involved in important research, including the development of propagation protocols for rare plants and a study examining the effects of smoke-infused water on seed germination in various species.

OPPORTUNITIES FOR CONSERVATION RESEARCH

Conservation and science education activities in prisons represent a significant opportunity for small- and large-scale research on some of the significant challenges faced by natural area managers. For example, in the past 20 years, conservation biologists have realized the importance of genetics in both the rearing and restoration of species (Avise 1989; Reed and Frankham 2003) and in understanding their response to climate change, but also community and ecosystem ecologists have recognized the importance of genetic diversity for the structure and function of ecosystems (Whitham et al. 2006, 2010; Hughes et al. 2008; Bailey et al. 2009). For the most part, land managers realize that the genetics of organisms is important, but the ability to restore landscapes of known genetic makeup is beyond the scope of possibility for some conservation agencies. Just get-

ting native and at-risk organisms back into habitats is the main goal, but the ability to track genotypes or monitor the selective survival of certain genotypes is hampered by lack of time and resources. We suggest that large-scale genetic experiments could be installed and maintained by incarcerated technicians as common garden studies or restoration projects across a geographically distributed network of correctional facilities to answer cutting-edge genes-to-ecosystems questions.

CONCLUSION

Repeatedly, incarcerated people have proven to be adept, meticulous, responsible, and innovative as conservation biology technicians. When properly supported by experts and engaged college students, and carefully monitored by corrections staff, inmates can manage complicated protocols, perform meticulous tasks, and keep detailed records. We partner with inmate technicians not only in the rearing and care of rare and endangered plants and animals, but also in the design and implementation of scientific research that benefits the conservation community. Research projects that involve extensive monitoring, many hours of hands-on care, or large-scale replication are ideal for in-prison environments.

The SPP model of conservation biology, scientific education, and research has been replicated in other states beyond its founding location in Washington State. As of 2013, SPP conservation biology programs exist in Oregon, Maryland, and Ohio, and SPP programs are being initiated in California and Utah, with more conservation projects coming online each year. In addition, many other countries have contacted us about our innovative methods and we hope to begin adding international SPP sites to our Network in the near future. To support this expansion, we wrote a handbook of protocols (LeRoy et al. 2013) and we provide consultations and tours of existing facilities. Bringing conservation projects into prisons reduces the demand on conservation organizations for space, resources, human-power, and funding. We envision an expansion of this model to further reduce the costs of restoration for environments across the United States and beyond.

Imagine the environmental good that could be done if each of the 186 federal and military prisons, 1200 state prisons, and 2800 county jails (Minton 2013) in the United States partnered with state, federal or nonprofit conservation organizations to rear and reintroduce just one species. Endangered species experts and zoo technicians could develop protocols to be implemented by incarcerated technicians, which would free time and resources for those same experts to create new protocols instead of spending valuable time on the daily care and feeding of these organisms. Working with just over 100 inmate participants in four prisons in Washington State, we have raised and released over 550 frogs, more than 4000 butterflies, and almost 1 million rare and endangered plants in only 5 years. Consider the good that could be done by the over 2.4 million incarcerated Americans in all 50 states in the United States.

We see no better use for time behind bars than the restoration of landscapes and the potential rehabilitation of incarcerated citizens. Although our evidence is mainly anecdotal to date, we have heard from many of our incarcerated technicians that their time on conservation projects is meaningful work and that they are proud of their contributions to restoration efforts and the persistence of these endangered organisms in the wild (http://sustainabilityinprisons.org/stories/). The SPP Network provides inmates an opportunity to contribute to something larger than themselves and to the world beyond the bars. If therapeutic work with living things while incarcerated can be transformative, bringing conservation projects into prisons may have the additional benefit of reducing recidivism and making all of our communities safer in the long run. Our collective mantra is "doing good while doing time."

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Thomas Kaye is Executive Director at the Institute for Applied Ecology as well as courtesy Associate Professor in the Department of Botany and Plant Pathology at Oregon State University. He focuses on habitat restoration techniques for prairie ecosystems, reintroduction methods for threatened and endangered species, modeling responses of plants to climate change, and bringing science and habitat conservation to underserved communities.

Kelli Bush is the Program Manager of the Sustainability in Prisons Project (SPP), a partnership founded by The Evergreen State College and the WA Department of Corrections. She manages SPP's Taylor's Checkerspot Butterfly, Oregon Spotted Frog, and Western Pond Turtle programs, and oversees all SPP program operations. She has degrees in horticulture and agriculture ecology, and two decades experience in policy and practice of restoration ecology, conservation biology, and horticulture.

Chad Naugle is the Sustainability Coordinator for the Oregon Department of Corrections. His interests are safe and sustainable operations and providing meaningful vocational training programs for adults in custody that deal with science, nature and ecosystem restoration.

Carri LeRoy is a member of the faculty at The Evergreen State College. She has a PhD in Biological Sciences, a Masters in Liberal Studies (focus in environmental education) and degrees in Environmental Science and International Studies. She is the Co-Director of the Sustainability in Prisons Project (SPP), a program that brings science and nature into prisons and hopes to reduce the environmental, economic, and human costs of prisons. SPP was founded as a partnership between The Evergreen State College and the WA Dept. of Corrections, and is now an international network of scientists, educators and prison administrators.

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