



## Wild Women of Reclamation Newsletter

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American Society of Reclamation Sciences  
ASRS



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Greetings to all our fellow Wild Women of Reclamation!

It has been almost four years since I compiled a newsletter (Summer 2019) and a lot has happened. A worldwide pandemic, I retired, ASMR, American Society of Mining and Reclamation, did a rebranding and changed their name to the American Society of Reclamation Sciences, ASRS, to better reflect that not all reclamation has to do with mining, and I became President of ASRS.

It is finally Spring in New Brunswick, Canada, so I posted a jack-in-the-pulpit that I photographed while picking fiddleheads. A true Maritime Spring pastime.

Now that life is returning to a new normal, let us rekindle our social connection of women doing reclamation. Here is an article that arrived from Gina Clingerman, which arrived in my inbox in September 2020, about three weeks before I retired. The topic is still extremely relevant, both in terms that many women and girls are featured as part of the work, but also because the outcome of the project was enhanced by a group of sometimes marginalized people. So Gina updated her original work. The article illustrates just how inclusion and improved self-worth can lead to much better life outcomes, and in this case, expanded reclamation outcomes. I think we can all use some increased social connection right about now and we should be cognizant that we can also extend that connection to others to include them in working in reclamation. Maybe I am just too sensitive, but I found myself getting misty eyed when I read Gina's work.

But before we get into the science, I hope to see many of you at the 8<sup>th</sup> gathering of the Wild Women of Reclamation in Boise, Idaho on June 6 at 7 am in the conference center. Dr. Jenise Bauman will be speaking about fungi and inspiration. Breakfast will be provided. Please bring a friend or two. Let's rekindle friendships and make a few more!

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And now on to an introduction to Gina Clingerman and her heartwarming article.



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Gina received a Bachelor of Arts and Science in Anthropology and a Bachelor of Arts in English from the University of Wyoming. She has been a professional archaeologist in Wyoming for the last twenty years. Gina has spent the last thirteen years in Lander, WY working for the Bureau of Land Management as the Abandoned Mine Lands (AML) Archaeologist and most recently as an AML Project Manager. In this capacity Gina tracks mine sites through the entire process from identification and characterization to final closure. Her current project, the Wyoming AML Native Plants Project, consists of restoring previously reclaimed abandoned mine lands to suitable habitat for sagebrush obligate species using a suite of planting and seeding techniques.

## **Abandoned Mine Lands Native Plants Project**

By Gina Clingerman

The Abandoned Mine Lands (AML) Native Plants Project was created in 2016 by the Bureau of Land Management (BLM) Abandoned Mine Lands (AML) Program, the Wyoming Department of Environmental Quality – Abandoned Mine Lands (WDEQ-AML) Division, and the Office of Surface Mining Reclamation and Enforcement (OSMRE). The project aims to restore sagebrush steppe habitat for the health and survival of sagebrush obligate species in Wyoming.

At the start we were preoccupied with how reclamation efforts of the involved agencies at abandoned mine lands could support or help restore sage-grouse populations in the state of Wyoming. Greater sage-grouse populations have been dwindling across the west. A USGS publication shows that sage-grouse populations have declined 80 percent range wide since 1965 and 40 percent since 2002 (Coates et al 2001). Looking at the sage-grouse was a starting point for our project, but we soon came to understand that sage-grouse population declines are only the beginning.

The problem of dwindling sage-grouse populations is a conglomeration of habitat loss by human encroachment, noise from oil and gas production, wildfires, and the scarring legacy

they leave behind, the spread of invasive plant species, and human indifference. The problem is not just affecting sage-grouse populations– it is touching all non-human beings who rely on the sagebrush steppe ecosystem for habitat, food, breeding grounds, and summering or wintering grounds.

Western states' wildlife agencies have documented a steady decline in pronghorn populations throughout the west over the last decade (<https://www.gohunt.com/content/the-life/antelope-numbers-across-6-states>). Sharply declining mule deer populations led to the Wyoming Mule Deer Initiative which states that the population has declined 31 percent since 1991 (Mule Deer Working Group 2018). Other species that rely on the sagebrush steppe ecosystem that are now in decline include the pygmy rabbit, western burrowing owl, American badger, loggerhead shrike, sage thrasher, greater short-horned lizard, sagebrush lizard, Townsend's big-eared bat, and many more. As we learned more about the decline in populations of sagebrush dependent species our mission broadened to include improving wildlife habitat for sagebrush obligate species, including the greater sage-grouse, at previously reclaimed mines by re-establishing sagebrush and native plant communities through various means such as sagebrush seedling plantings and innovative seed technologies.

To achieve this mission, we began connecting with nonprofit groups and local agencies that have similar mission statements including The Nature Conservancy (TNC), Wyoming Wildlife Federation, The Wyoming Outdoor Council, Popo Agie Conservation District, Fremont County Weed and Pest, and Wyoming Mining Natural Resource Foundation. Our combined funding and resources make the project goals more achievable and our plantings more sustainable.

Initially, we developed the project as a sagebrush seedling planting effort using locally available sagebrush seed collected by the Seeds of Success (SOS)<sup>1</sup> that was grown in prison facilities through the Sagebrush in Prisons Project (SPP), part of an ecological education project created by the Institute for Applied Ecology (IAE)<sup>2</sup>. Later, it would grow into our own sagebrush growing facility at the Wyoming Honor Farm and it would include research and design studies with habitat restoration specialists from TNC and a cofounded seed laboratory.

### **Sagebrush Seedling Student Plantings**

In 2017 we began a partnership with Lander Middle School science teachers to offer a unique field trip to science fair students interested in ecology. We provide the students with sagebrush steppe ecological education as part of the BLM's National Strategy on

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<sup>1</sup> For more information about SOS - <https://www.blm.gov/programs/natural-resources/native-plant-communities/native-plant-and-seed-material-development/collection>.

<sup>2</sup> For more information about IAE - <https://appliedeco.org/education/sagebrush-in-prisons-project/>.

Education, Interpretation, and Youth Engagement<sup>3</sup> policy. Through this partnership, we teach students the importance of preserving and restoring the sagebrush steppe ecosystem and the impacts of fracturing the ecosystem, and we give them a broad overview of the animals that depend on the ecosystem for survival.

Our first planting took place in 2017. We have planted every subsequent year except for 2020 and 2021 due to COVID-19. In 2017, 45 students and 44 volunteers planted 900 seedlings. In 2018, 48 students and 40 volunteers planted 1,200 seedlings. In 2019, 45 students and 38 volunteers planted 1,490 seedlings (Figure 1). We planted 729 seedlings in 2022 with 105 students and 19 volunteers. To date we have planted 4,319 sagebrush seedlings and reclaimed approximately 10.5 acres. Our educational planting has had a positive impact on the lives of these budding scientists and the sagebrush survival rate is between 85-90 percent as confirmed by yearly monitoring. We are currently planning our fifth year of planting.



*Figure 1 Lander Middle School science student sagebrush planting group photo. Photo by IAE 2019.*

This project is a good opportunity for young science students to better understand applied sciences such as ecology, botany, reclamation, and many others. It also shows them that there are science careers in the place they live. Over the years, volunteers who are wildlife biologists, archaeologists, wildland firefighters, botanists, restorations scientists, and conservationists work directly with the students (Figure 2). It is this aspect of the project that keeps the students and the volunteers engaged in the reclamation.

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<sup>3</sup> For more information on BLM Youth Engagement - <https://www.blm.gov/documents/national-office/public-room/strategic-plan/education-interpretation-and-youth-engagement>



Figure 2 BLM Archaeologist and Wildland Firefighter Krystal Hazen McCreary helps Lander Middle School science students plant sagebrush seedlings. Photo by BLM 2017

### **IAE Sagebrush in Prisons Project and Inmate Plantings**

In 2018, a lapse in funding for the SPP jeopardized federal agencies' access to sagebrush seedlings for habitat restoration. In response, we connected with IAE with the hope of setting up a direct partnership to continue the SPP. We met with the Wyoming Department of Corrections (WDOC) and IAE personnel with the intent to bring the SPP to the Honor Farm, a minimal security prison, in Riverton, Wyoming. The interest from WDOC was overwhelming and in 2019 we procured plans and materials to build a greenhouse. Inmates lent their expertise and erected the greenhouse that May.

Since then, SPP crews have grown a total of 84,541 seedlings for habitat restoration across the west. Inmates have learned about and propagated Wyoming big sage (*Artemisia tridentata ssp. wyomingensis* = 51,344), mountain big sage (*Artemisia tridentata spp vaseyana* = 16,733), and silver sage (*Artemisia cana* = 4,508). Our growing plans for this year include approximately 20,000 mountain big sage, 10,200 Wyoming big sage, and 100 silver sage seedlings for a total of 30,300 seedlings.

SPP crew inmates are paid through the program and are responsible for sowing seeds, watering and tending seedlings, checking for pests weekly, and learning about the ecology of native ecosystems and growing native plants. Each participant receives a certificate of completion detailing the skills they learned as part of the project. In addition to sowing, tending, and growing the seedlings, we have organized three inmate plantings since 2019. A total of 39 inmates have planted 13,064 sagebrush seedlings at two different planting areas in the Gas Hills in central Wyoming (Figures 3 and 4). Additionally, ten inmates collected almost four pounds of sagebrush seed over two days last year. It was a successful and educational field trip with lasting effects as those seeds will be grown into seedlings for continued habitat restoration in the coming years.



*Figure 3 Wyoming Honor Farm inmate planting sagebrush seedlings. Photo by IAE 2019*



*Figure 4 Wyoming Honor Farm inmate sagebrush planting group photo. Photo by IAE 2019.*

To those of us outside the prison system this might seem like a quaint story but green programs like the SPP have meaningful impacts on inmate populations. Bureau of Justice statistics reveal that 68% of inmates are re-arrested within 3 years of their release and 77% are re-arrested within 5 years of release with little change in these rates over the last 30 years (van der Linden 2015). Research done by Sander van der Linden Ph.D. on inmate populations participating in the Greenhouse/GreenTeam Program in Riker's Island, NYC, demonstrates a 10% drop in recidivism (re-arrest) rates.

It is hard to determine what is driving the success of green prison programs and the reduction in recidivism rates but "some experiments have shown that when randomly assigned to either a "green" or "other" rehabilitation programs, the green program was significantly better for reducing risk-taking behavior, cultivating better decision-making skills and improving overall psychosocial functioning" (van der Linden 2015). The literature on the benefits of nature is increasing daily and we believe this project helps inmates learn new and employable skills, develop confidence in themselves, and learn how to cooperate with each other while producing a valuable restoration product.

The SPP is a two-fold reclamation project – not only are we using the seedlings to reclaim sage-grouse habitat, but the act of growing those seedlings is reclaiming the hearts and minds of the inmates who participate in the project. We continue to work to grow the program at the Honor Farm. We completed the construction of the polycarbonate greenhouse, installed permanent metal growing tables in the greenhouse, and last year erected a shadehouse for hardening the seedlings in the fall before planting (Figure 5). We have expanded our field trips to include seed collection and last spring we planted a native area around the greenhouse with native seed and later seedlings in the hopes of having a seed nursery for drought years. We hope to keep expanding our educational offerings as well.



*Figure 5 Sagebrush Canopy Cover: Wyoming Honor Farm inmates installing the shade canopy cover on the erected greenhouse structure. Photo by WY DOC 2019.*

### **Habitat Restoration Through Developed Seed Enhancement Technologies (SET)**

Before our partnership with TNC, they were in the early phases of developing and testing SETs for sagebrush steppe restoration after large-scale wildfires. Sagebrush seed has a traditionally low germination rate and is slow to be established, making large-scale habitat restoration difficult. We were keen to promote the research and work with TNC to develop SETs that were less time consuming than hand planting thousands of sagebrush seedlings and could be widely shared with restoration industries across the west. In 2019 we completed construction on a seed laboratory where research could be designed, and trials tested as our work evolved.

TNC's research began with seed pods/pellets and then grew to include herbicide resistant seed pellets, seed coatings, and dust treatments. The seed pod/pellet consists of ingredients that have the potential to enhance and nourish seeds during germination (Figures 6 and 7) . Native seed, including sagebrush, grasses, and forbs, were evaluated in seed pellets and herbicide resistant seed pellets. Success has been limited with sagebrush seeds but other native seeds, particularly grasses, have done well in seed pellet trials.

The research is ongoing, but TNC has recently published their research in the journal *Rangeland Ecology & Management* (see references). Seed technologies can play an important part in enhancing habitat restoration in sagebrush steppe ecosystems, but more research is needed to study what kinds of specific seed technologies will benefit a variety of

native seed. Currently, we have funding for the next three to four years to continue this research both in the lab and in the field at AML sites.



*Figure 6 Seed lab grand opening with pasta machine which forms the seed pods. Pictured left to right: Gina Clingerman (BLM), Johanna Blanchard (BLM), Emma Freeland (BLM), Maggie Eschleman (TNC), Don Newton (WDEQ-AML), Corinna Riginos (TNC). Photo by WDEQ-AML 2019.*

*Figure 7 Seed Pods 1: Depositing activated charcoal herbicide protective pods in furrowed test plot. Photo by TNC 2019*

### **The Future of Sagebrush Habitat Restoration**

Currently, the future of sagebrush habitat restoration is uncertain, but not for a lack of devoted sagebrush restorationists. It is uncertain because repairing a fragmented habitat takes time and effort. Our project and our partners are trying to figure out how to complete this work efficiently and with the resources that we have, knowing that ecosystems are complex and varied, and disruptions are long lasting.

We have seen that getting people involved in the work, showing them the beauty of this vast landscape, and helping them to understand the connections from the sagebrush through the vast web of living organisms that depend on it, makes a difference. We hope that our work with young scientists will inspire them to choose careers in restoration, habitat management, and ecology. We hope that our work with inmates will show them that they are valuable members of this restoration community and society at large. We hope that our curiosity and wonder will eventually lead us to develop sustainable SETs that can be useful to restorationists in all ecological settings.

The future of sagebrush habitat restoration probably will not be resolved by a single grand action but most likely by the small, seemingly simple ones like planting a seedling and



caring what happens in the world around us. To this end, we are committed to helping others establish similar projects by sharing our successes and our failures. If you have any questions about this project or would like to be involved, please contact Gina Clinger at [gclinger@blm.gov](mailto:gclinger@blm.gov).

**References:**

Coates, P.S., Prochazka, B.G., O'Donnell, M.S., Aldridge, C.L., Edmunds, D.R., Monroe, A.P., Ricca, M.A., Wann, G.T., Hanser, S.E., Wiechman, L.A., and Chenaille, M.P., 2021, Range-wide greater sage-grouse hierarchical monitoring framework—Implications for defining population boundaries, trend estimation, and a targeted annual warning system: U.S. Geological Survey Open-File Report 2020-1154, 243 p., <https://doi.org/10.3133/ofr20201154>.

Eshleman, Magdalena M., and Corinna Riginos, 2023, Potential to Improve Wyoming Big Sagebrush Establishment with a Root-Enhancement Seed Technology. *Rangeland Ecology & Management* 88 (2023) 143-151p.

van der Linden, Sander, 2015, The Rise of Green Prison Programs: How Exposure to Nature is Reducing Crime. *Psychology Today*. <https://www.psychologytoday.com/sg/blog/socially-relevant/201508/the-rise-green-prison-programs?collection=1078088>.

Mule Deer Working Group and Wyoming Game and Fish Department, 2018, The Wyoming Mule Deer Initiative. <https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Mule%20Deer%20Initiative/Mule-Deer-Initiative.pdf>.