Conservation Corner

The Conflict between Rare Plant Conservation and Extractive Industries

By Josh Carrell

As discussed in the Conservation Corner of the Fall 2022 issue of *Aquilegia*, rare plants of Colorado are under threat from the oil and gas industry (1). Threats manifest in a variety of forms and levels of severity. Unpaved road usage, common at oil and gas sites, contributes to habitat fragmentation, dispersal barriers, and increasing dust loads, which can diminish plant growth and reproductive potential (2). In turn, noise, dust, and turbulence influence the distribution and density of pollinators, which indirectly impact plant health (3,4).

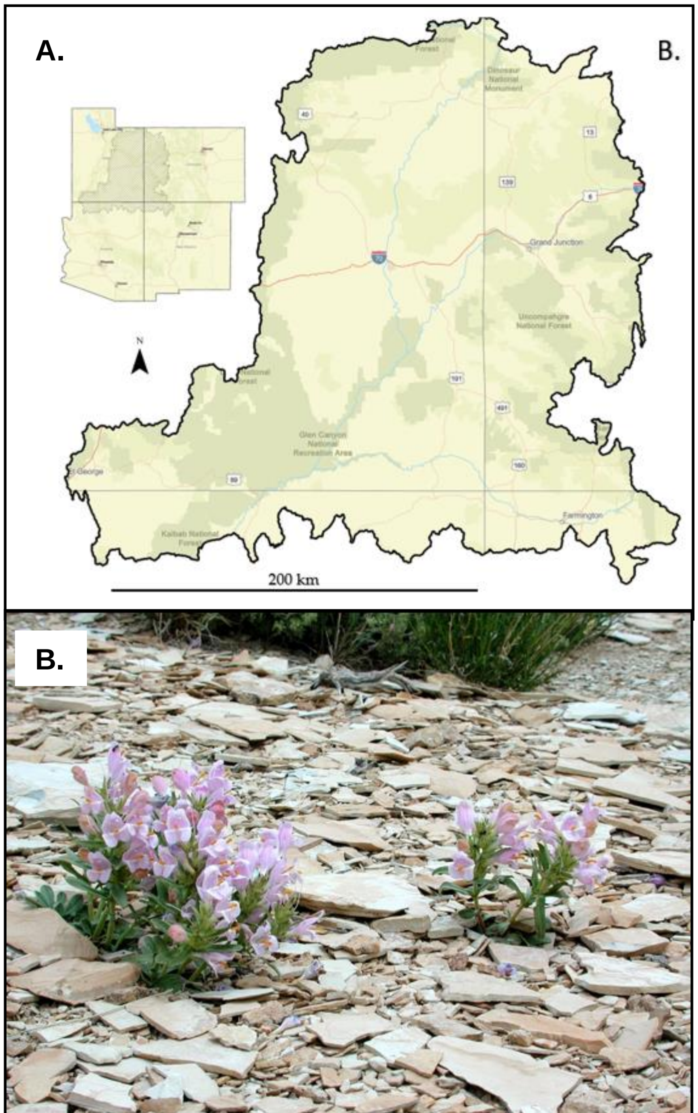

Figure 1. A. The Colorado Plateau. B. Graham's beardtongue (*Penstemon grahamii*) situated among loose oil shale. © Robert Fitts, UNHP

Lastly, oil and gas infrastructure development destroys oil shale, a sensitive habitat for the plants that occupy it.

These developments threaten rare plants far beyond the Centennial State. Our borders overlap with an ecoregion of intensifying conservation conflict: the Colorado Plateau, a biodiverse and energy-rich ecoregion located in the Intermountain West (Figure 1A). The Colorado Plateau boasts profuse oil and gas resources. Due to underlying geological and edaphic (soil) conditions, plant biodiversity hotspots occur but are severely limited in their distribution to small, discrete ranges (Figure 1B). As a result, many plant species are placed under federal and state management plans due to their rarity. In addition to limited range size, plant-species endemism and oil and gas development potential significantly overlap in geographic distribution (5).

Recently, I partnered with researchers in the Quinney College of Natural Resources at Utah State University, examining the conflicts between rare flowering plant conservation and the oil and gas industry of the Colorado Plateau. This resulted in the publication of a manuscript, *Balancing Rare Species Conservation with Extractive Industries,* from which excerpts of this article are drawn. We found that societal interests regarding biodiversity conservation and natural resource extraction are diverse and often conflicting. We all rely on oil and gas products as a society, the development of which isn't inherently "evil," though we often feel that way when it conflicts with other interests such as plant conservation. In fact, the prospect of maximizing oil and gas development and extraction while simultaneously conserving the total landscape of rare species may be desirable to the general population. However, that outcome is simply not possible. Regardless of wants or desires, there are two truths regarding the oil and gas industry of the Colorado Plateau—energy development and extraction will continue to grow; and rare plants will continue to be at risk. With the understanding that we cannot choose only one or the other, we questioned: "With the high number of flowering plant species qualifying for listed status under the Endangered Species Act or being considered of concern by Non-Governmental Organizations (NGOs) like NatureServe, and the increasing global demand ►

◄ for oil and gas resources, how can conflicting conservation and energy demand objectives be mutually satisfied?”

To assess options, we used a combination of methods in Species Distribution Modeling (SDM) and Spatial Conservation Prioritization (SCP). SDM is the process of using species occurrence records and environmental predictors (e.g., climate, soil type, slope, etc.) to generate spatially explicit maps of habitat suitability of a given species across a given geographic boundary. SCP is the process of systematically selecting potential locations for conservation action at an optimal financial cost, while simultaneously considering external risks or restrictions. To make these calculations, we used Marxan conservation-planning software.

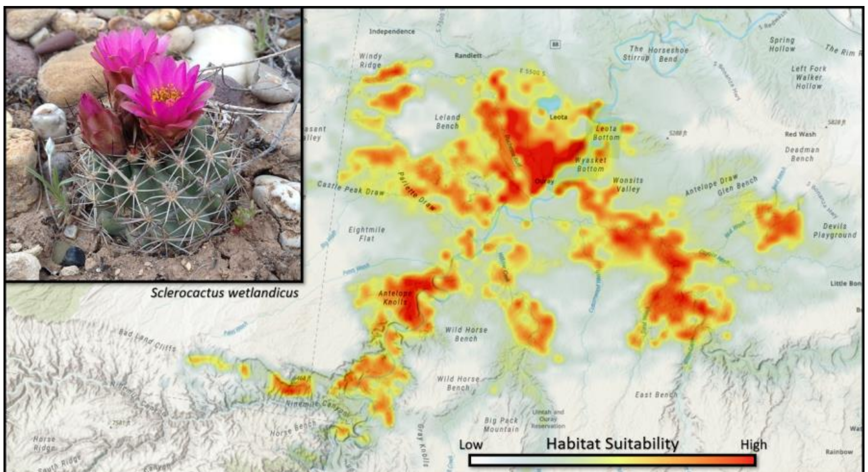

Figure 2. An example of SDM output for The Uinta Basin Hookless Cactus (*Sclerocactus wetlandicus*). Photograph © Grant Young, USFWS

To begin, we developed habitat suitability models for 29 rare flowering plant species (Figure 2). Then we examined the distribution of current oil and gas infrastructure, oil and gas development potential, and land ownership associated with predicted plant habitat suitability. We also included the financial cost tied to both wellhead restoration and land ownership as a function of optimization. We developed various scenarios to identify the optimal locations for conservation action. Our approach optimized conservation of 29 flowering plant species by selecting the minimum number of planning units required to cover 30 percent (a common conservation objective) of each species’ distribution and habitat at the lowest financial cost (6-8). By minimizing the number of units selected for conservation action, we not only minimize financial cost but also reduce areas of high energy development and potential from conservation efforts. These results provide not only options for land managers in areas with extractive industries but identify specific spatial zones for conservation action.

To inform our modeling process, we used spatial data linked to oil and gas development and potential, oil and gas well pad location, and land ownership. There is considerable oil and gas development potential within the northern sections of the Colorado Plateau (9), primarily in Utah and Colorado (Figure 3A). Stunningly, there are approximately 63,000 active and 26,000 abandoned oil and gas well pads in the Colorado Plateau (Figure 3.B), distributed across public and private lands (Figure 3.D).

Our study concluded that there is no feasible solution that allows for conserving 100 percent of the rare plants and continuing with oil and gas development at current standards. However, we did achieve a spatially optimized solution by selecting specific locations that may conserve 30 percent of suitable habitat on public lands for the 29 plant species examined, while accounting for oil and gas development risk. This is a success given the complex nature of the land use of the Colorado Plateau. However, financial costs associated with the solution are at a staggering $14.72 million, far beyond the financial capabilities of most organizations hoping to conserve rare flowering plants.

Additionally, we found there are a variety of barriers to rare plant species conservation when examining the roles of extractive industry, land ownership, and social tendencies. Regarding the oil and gas industry, we found it was impossible to use well pad royalty costs to inform our study and provide a more accurate assessment, as they are proprietary information. Our study, which used estimated restoration costs tied to well pad reclamation, found that it costs approximately $24,500 to restore a single well pad (10). This cost is known among oil and gas infrastructure owners, who often abandon sites and declare bankruptcy once a well is depleted. Though arguably irresponsible, this is a common practice.

Regarding land ownership, we argue that public lands are more suitable than private land for the conservation of rare plants. There are options that provide incentives for private and tribal landowners to cooperate with species conservation policy; for example, conservation easements or conservation banking (11,12); however, these too often result in inefficient species conservation (13). Additionally, the Endangered Species Act of 1973 Section 7, requires federal agencies to consult with the US Fish and Wildlife Service (FWS) or National Oceanic and Atmospheric Administration (NOAA) to ensure that any proposed activity on public lands will not ►

◄ adversely modify or destroy critical habitat of a listed species (14). Private lands, however, may compromise habitat through incidental take permits that allow for land modification under a personal habitat-conservation plan submitted by the property landowner, even while under the same obligations of the ESA (15).

Additionally, plant species conservation, which may be best assessed at large ecoregional scales, is subject to geopolitical boundaries, which overlap natural processes with societal and political beliefs. The 29 species observed in our study represent approximately 63 percent of the rare flowering plant species found in the Colorado Plateau, many of which are found in Colorado (Figure 3D). However, political governance often inhibits conservation efficacy in transboundary regions (16,17). This can be due to restrictions on data availability and public data sharing designated by state, regional, or federal organizations, which impacted outcomes found in this research. Lastly, and most shockingly, surveys suggest ecologists limit data sharing ranges from insufficient data management, concerns for data misinterpretation, and jealousy (18).

The issues addressed regarding rare flowering plant species in the Colorado Plateau mirror those found throughout any locale undergoing energy development and extraction. There are options that may lead to the long-term conservation of species, but due to resource demand, geopolitical boundaries and agendas, and social inclinations, we are unable to meet them. Protecting rare plants in landscapes of energy extraction will require mutual coordination among diverse stakeholders, unlike any we have ever seen before. Although observations suggest otherwise, we can hope!

Josh Carrell is a PhD student of Forest Sciences at Colorado State University. He currently studies high elevation forests and climate variability in the Colorado Front Range. He's the lucky husband of April, a dessert connoisseur, and owner of two rowdy pups. He can be contacted at jcarrell@colostate.edu To view the full article, Carrell et. al, Balancing Rare Species Conservation with Extractive Industries. Land. 2022. visit: https://www.researchgate.net/publication/365298563_Balancing_Rare_Species_Conservation_with_Extractive_Industries

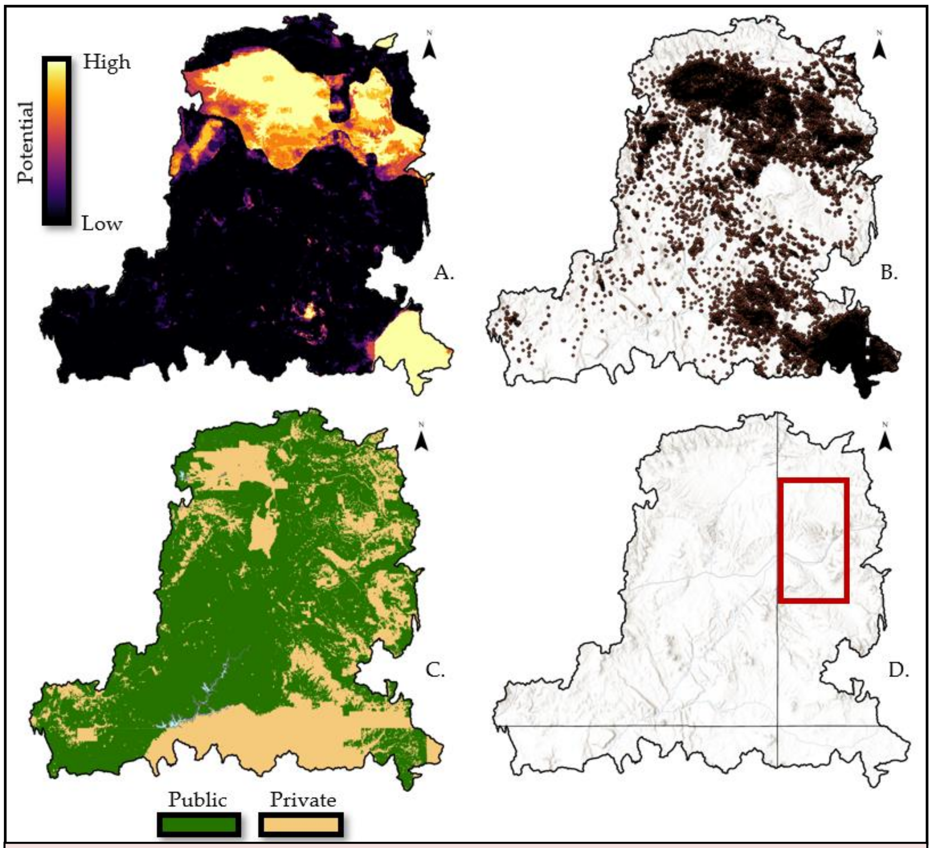

Figure 3. Spatial data examined during study optimization. A. Oil and gas development potential model from (19). B. Oil and gas well pad locations. C. Public and private land tenures. D. Generalized location of rare flowering plants at risk within Colorado, outlined in a red rectangle.

References

1. Klafhen B. 2022. Rare Plants Still Under Threat. *Aquilegia*. 46.4:24-25.

2. Lewis MB, Schupp EW, and Monaco TA. 2017. Road dust correlated with decreased reproduction of the endangered Utah shrub *Hesperidanthus suffrutescens*. *Western North American Naturalist* 77:430-439.

3. Althoff DM, Groman JD, Segraves KA, and Pellmyr O. 2001. Phylogeographic structure in the bogus yucca moth *Prodoxus quinquepunctellus* (Prodoxidae): comparisons with coexisting pollinator yucca moths. *Molecular Phylogenetics and Evolution.* 21:117-127.

4. Godsoe W, Strand E, Smith CI, Yoder JB, Esque TC, and Pellmyr O. 2009. Divergence in an obligate mutualism is not explained by divergent climatic factors. *New Phytologist.* 183:589-599.

5. Welsh SL. 1978. Problems in plant endemism on the Colorado Plateau. *Great Basin Naturalist Memoirs.* 191-195.

6. Betts, MG, Villard M-A. 2009. Landscape thresholds in species occurrence as quantitative targets in forest management: generality in space and time? In: *Setting Conservation Targets for Managed Forest Landscapes.* Betts, MG, Villard M-A, ed. Cambridge University Press. p.185-206.

7. Hammill E, Tulloch AIT, Possingham HP, Strange N, and Wilson KA. 2016. Factoring attitudes towards armed conflict risk into selection of protected areas for conservation. *Nature Communications.* 7:11042.

"**Rare Plants**…" *continued on page 19* ►