Sagebrush Steppe Focused Condition Assessment

DOI Unified Regions 8,9,10 (Pacific West) – BIHO, CIRO, CRMO, GRBA, HAFO, JODA, LABE, LARO, PARA

Importance: Resilience of A Threatened Ecosystem

Sagebrush steppe is one of the most threatened ecosystems in the Intermountain West and not well represented within the parks and protected-area systems of the US. Substantial portions of sagebrush steppe have been converted to agriculture and heavily grazed rangeland, and remaining steppe is being invaded by weeds and altered by increasingly frequent large fires. This focused condition assessment supports strategic steppe conservation decision-making across NPS by assembling park geodatabases with the necessary information from previous park inventories, monitoring, and assessments for sagebrush steppe mapping. These maps are developed within the framework of ecosystem resilience to fire and resistance to annual grass invasion. Approaching park steppe conservation through the lens of resilience and resistance allows for intuitive prioritization of park landscapes and facilitates collaboration within NPS and among its partner organizations such as the Bureau of Land Management which manages sagebrush steppe adjacent to NPS lands.

View from Bath Rock-City of Rocks National Reserve, Idaho. Sagebrush steppe makes up about 70% of the land within City of Rocks National Reserve (CIRO) and plays a major ecological role in supporting native plant species diversity and providing habitat for wildlife and scenic vistas.

Assessment Objectives

Our goal is to facilitate collaborative sagebrush steppe conservation across park lands and with neighbors across larger steppe landscapes with geographic mapping tools and a supporting scientific framework that makes NPS decision-making easier and more effective.

Assessment Methods

We have drawn heavily on multiple past and ongoing efforts to synthesize existing information and tools into park geodatabases. A geodatabase is an organized database assemblage of geographic information and spatial data that supports easy mapping and access to information. For example, park soils are key resources for sagebrush steppe management and our geodatabases bring together park soil inventories with multiple kinds of attributes including ecological site descriptions, soil physical properties, and soil moisture and temperature regimes so that soil resources can be mapped with other park data. Soils are fundamental influences on resilience to fire and resistance to weed invasion and need to be examined for each park carefully when planning for park operations such as firefighting and revegetation.

We have integrated into our geodatabases the products from previous research, including park long-term vegetation monitoring and model predictions of high-quality steppe persistence and resilience and resistance changes under scenarios of climate change, fire histories, soils and vegetation inventories, and park administrative and management boundaries. We have also utilized support from the regional NPS Fire Reserve Fund to synthesize this information into updated park management plans for the John Day Fossil Beds National Monument (JODA). We plan to provide this level of support to each of the 9 parks in the region that steward sagebrush steppe ecosystems.

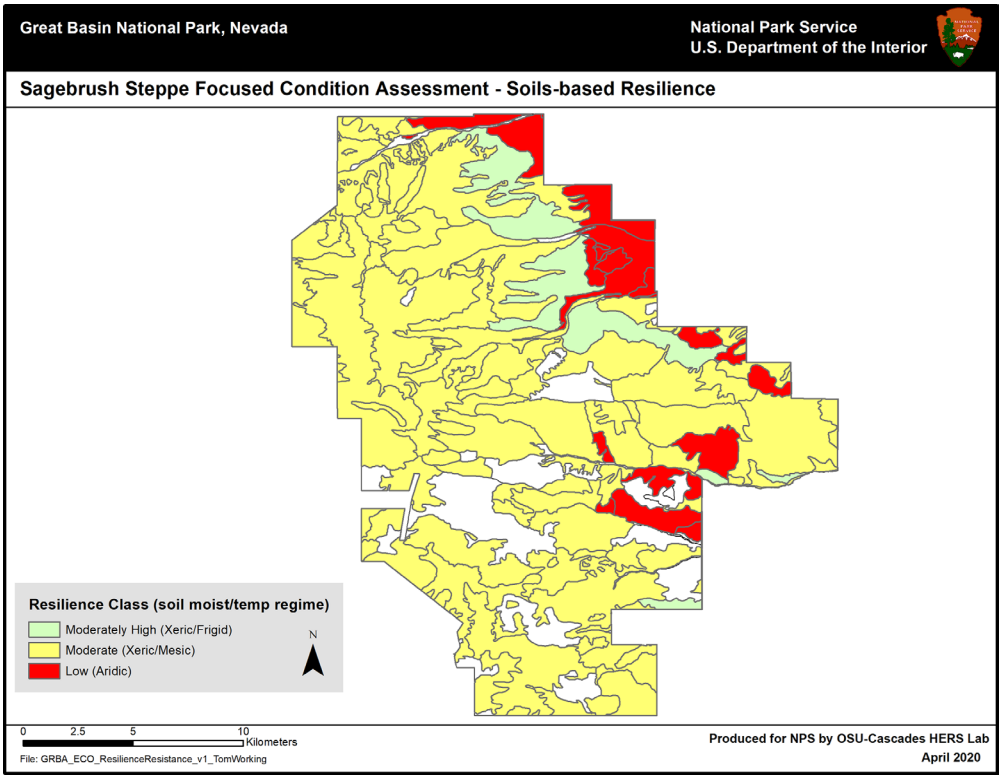
Assessment Results

Individual park geodatabases have been assembled and are available online. The management synthesis for the John Day Fossil Beds (JODA) is available here. A seven-year analysis of variation in post-fire vegetation response in JODA steppe among mapped ecological sites is under review and available here. The majority of park steppe examined was mapped as low resilience and resistance. Some areas may increase to moderate resilience under some scenarios of changing precipitation patterns. Fires have become increasingly frequent and are trending larger in size as well. Cheatgrass and at least two

other invasive annual grasses, medusahead and ventenata, have heavily infested many park lands in predicable patterns along gradients of resilience, topography, and burn severity. We use an "alluvial diagram" to illustrate these results on page 3. These findings underscore the precarious conservation setting of NPS steppe lands. However, numerous opportunities exist to aggressively protect remaining steppe landscapes where native vegetation has not yet been lost, especially in areas of moderate and high resilience, and on cool north-facing slopes in low-resilient areas. Restorations are possible but costly and logistically challenging, especially across large rugged and low-resistance park landscapes. Our geodatabases can help guide strategic prioritizations and scenario planning, staging of fire operations, and fire suppression. Paleontological, cultural, and infrastructure resources can be included in these planning exercises, as can viewsheds, trails, and education and interpretation opportunities so that visitors can experience and participate in sagebrush steppe conservation.

Next Steps

Park burned area emergency stabilization and rehabilitation plans (BAER/BAR) are being informed by the geodatabases. Analyses of post-fire recovery and restoration effectiveness are ongoing. Outstanding needs include acquisition of high-resolution imagery and data gaps in some parks. Structured decision support tools that allow park managers to grapple with choices, outcomes, and uncertainties are in development. The important opportunity is to integrate park fire operations planning with resource protection strategies and this can now be done with the geodatabases.



A geodatabase view of soils in Great Basin National Park. Relative resilience and resistance, influenced by soil temperature and moisture regimes, vary predictably along the elevational and topographic gradients, with cooler, wetter sites exhibiting higher resilience than hotter, drier sites.

Assessment Products

Shinderman, M., M. Hovland, C. Oedekerk, A.J. Lamet, and T.J. Rodhouse. 2020. Managing for resilience to fire and resistance to annual grass invasion in upland sagebrush steppe: John Day Fossil Beds National Monument. Natural Resource Report NPS/UCBN/NRR—2020/2144. National Park Service, Fort Collins, Colorado. Available online at: https://irma.nps.gov/DataStore/Reference/Profile/2275579

Assemblage of geodatabases to inform sagebrush steppe resilience to fire and resistance to weed invasion and support conservation planning in Pacific West Region parks. Available online at: https://irma.nps.gov/DataStore/Reference/Profile/2272485

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Rodhouse, T.J., K.M. Irvine, L. Bowersock. *In review*. Post-fire response of native and non-native grasses in a repeatedly-burned low-elevation sagebrush steppe protected area provides insights about resilience to fire and resistance to annual grass invasion. *Frontiers in Ecology and Evolution*. Submitted July 20, 2020. Available online at: https://irma.nps.gov/DataStore/Reference/Profile/2278547

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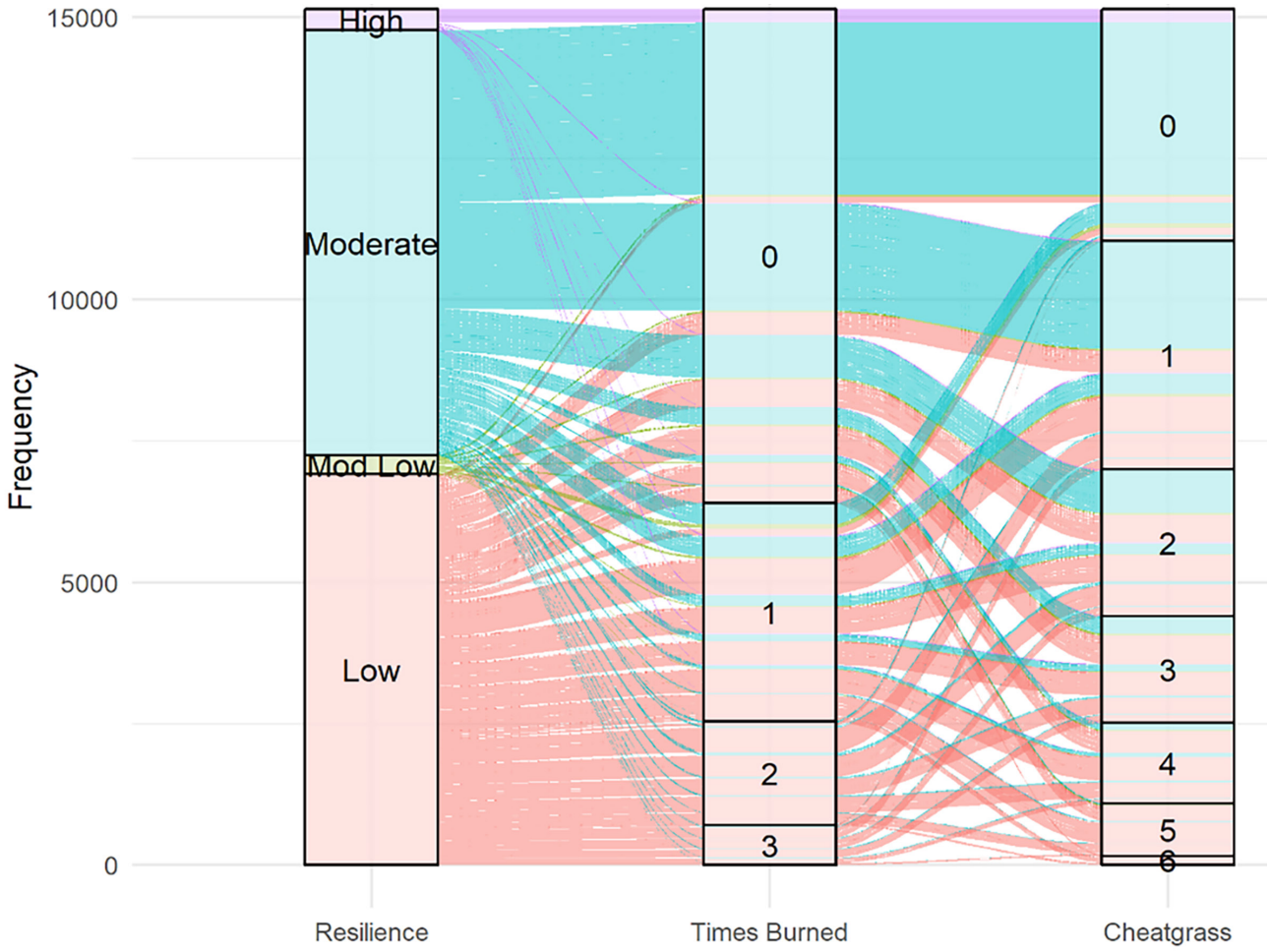
Supporting Information

Chambers, J.C., J.L. Beck, J.B. Bradford, and others. 2017. Science framework for conservation and restoration of the sagebrush biome: linking the Department of the Interior's Integrated Rangeland Fire Management Strategy to long-term strategic conservation actions. Part 1. Science basis and applications. RMRS-GTR-360. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Available online at: https://www.fs.fed.us/rm/pubs_series/rmrs/gtr/rmrs_gtr360.pdf

Bradford J.B., D.R. Schlaepfer, W.K. Lauenroth, K.A. Palmquist, J.C. Chambers, J.D. Maestas, and S.B. Campbell. 2019. Climate-driven shifts in soil temperature and moisture regimes suggest opportunities to enhance assessments of dryland resilience and resistance. *Frontiers in Ecology and Evolution* 7:358. Available online at: https://www.frontiersin.org/articles/10.3389/fevo.2019.00358/full

Chambers, J.C., M.L. Brooks, M.J. Germino, J.D. Maestas, D.I. Board, M.O. Jones, and B.W. Allred. 2019. Operationalizing resilience and resistance concepts to address invasive grass-fire cycles. *Frontiers in Ecology and Evolution* 7:185. Available online at: https://www.frontiersin.org/articles/10.3389/fevo.2019.00185/full



An alluvial diagram for plot-based (n=15,144) sagebrush steppe vegetation monitoring data from five NPS units (CIRO, CRMO, JODA, HAFO, LARO). This analytical diagram demonstrates how resilience in plots has been mapped from soil inventory attributes as low (red) and moderate (blue), and very little as high (purple), and with a substantial proportion invaded by cheatgrass (cover classes 0-6 correspond to % cheatgrass cover in monitoring plots). Note that almost all low resilience plots (red) "flow" through at least one burn and at least some (cover class >0) cheatgrass. This diagram clarifies that low-resilient areas in these parks are heavily invaded, exacerbated by repeated fires, but that even moderately-resilient areas are very vulnerable to cheatgrass invasion especially after multiple fires, underscoring the need for aggressive fire prevention in areas where native steppe vegetation is still intact. High resilience areas are few, but rarely burn and remain free of cheatgrass where it occurs.

More Information

Tom Rodhouse
Email: Tom_Rodhouse@nps.gov