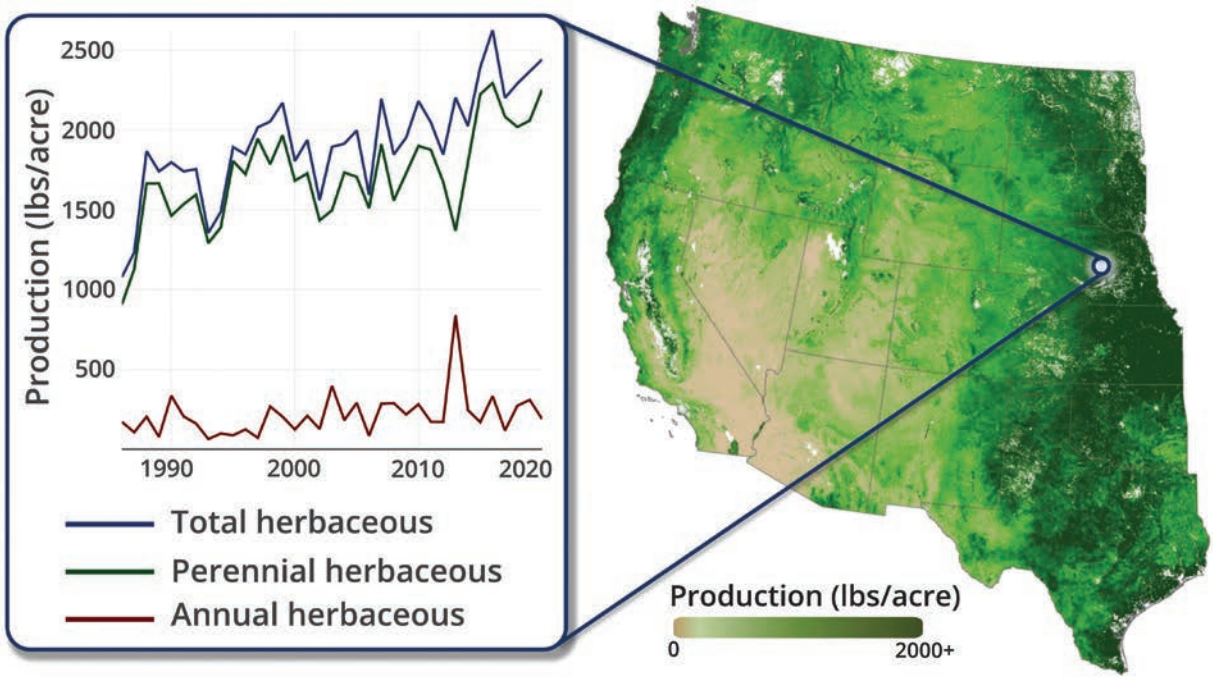
Advances in Rangeland Mapping Technology

Photo: Jeremy Roberts/Conservation Media

Strategic early investments by WLFW in remote sensing and mapping technologies continue to bolster conservation across western rangelands and have spurred the creation of cutting–edge geospatial data and tools that make conservation efforts more efficient and effective. Innovations in early online mapping tools spurred the creation of the Rangeland Analysis Platform (RAP)—a free online application that provides an unprecedented ability to monitor rangelands across space and time and serves as a primary mechanism to deliver rangeland conservation at landscape scales.

In Brief: Early WLFW investments in mapping technologies via the Rangeland Analysis Platform (RAP) provide spatial context for conservation actions and usher in a new era in rangeland monitoring and evaluation.



RAP–based estimates of herbaceous production put change–detection tools at the fingertips of land managers and other decision–makers.

WLFW developed annual, 30–meter, percent cover maps for U.S. rangeland vegetation from 1984 to the present.[1] Plant types mapped are those used for rangeland monitoring and evaluation including annual forbs and grasses, perennial forbs and grasses, shrubs, trees, and bare ground. These land cover data were improved using fresh field plot data and the latest machine learning techniques.[2]

In parallel, cutting–edge vegetation productivity maps that quantified plant carbon uptake were being produced at ever finer spatial and temporal resolutions;[3,4] providing a detailed view of vegetation productivity with cascading implications for conservation and management.[5] WLFW then combined the land cover data with productivity computations to create first–ever rangeland herbaceous production data that has been split into separate estimates for perennials and annuals.[6,7] Together, these cutting–edge data provide views of cover, carbon, and production at temporal and spatial resolutions never seen before.

Using these data, WLFW and partners developed the Rangeland Analysis Platform (RAP). This web application allows anyone to view and analyze land cover and vegetation production through time—from ranch to watershed scales.[8] The RAP and its data serve as a primary component in WLFW's strategic spatial approach to address rangeland threats across the West, embedded in the Sagebrush Biome Framework for Conservation Action.

RAP data are also a critical component in Idaho's Cheatgrass Challenge, where NRCS leaders and partners launched a statewide effort to fight invasive annual grasses. This effort highlights the role of the RAP in WLFW's spatial–based conservation strategy—Defend the Core, Grow the Core, Mitigate Impact—which focuses proactive conservation efforts where they are most likely to be successful and cost–effective. The Cheatgrass Challenge is using RAP to identify core intact areas, defending and growing those cores through conservation actions and

Rangeland Analysis Platform (RAP)

partnerships, and mitigating impacts in areas where annual grasses have a strong foothold.

The RAP has also provided critical data to identify the severity and extent of woodland expansion into sagebrush rangelands. This threat has detrimental effects on rangeland resiliency, hydrology, productivity, and wildlife. The RAP is being used to prioritize areas for conservation action and assess outcomes of past and future conservation efforts. Recent studies demonstrate the use of RAP data to assess outcomes of targeted conifer removal which increased sage grouse habitat,[9] resulting in a +12% increase in population growth rate.[10] Invasive annual grasses and expanding woodlands are pervasive across the West, and RAP data helps detect early warning signals before these threats result in irreversible shifts in vegetation assemblages.[11]

Rangeland monitoring is quickly evolving—with the RAP at the forefront—as WLFW is pioneering new approaches to rangeland conservation. WLFW has added the capacity to help train more ranchers and practitioners to apply this technology while continuing to innovate through new data and web applications to assist in managing and monitoring America's rangelands.

WLFW–SUPPORTED SCIENCE PUBLICATIONS:

1. Jones, M.O., B.W. Allred, D.E. Naugle, J.D. Maestas, P. Donnelly, L.J. Metz, J. Karl, R. Smith, B. Bestelmeyer, C. Boyd, J.D. Kerby, and J.D. McIver. 2018. Innovation in rangeland monitoring: Annual, 30 m, plant functional type percent cover maps for U.S. rangelands, 1984–2017. Ecosphere 9:e02430.

RAP provides spatial context to conservation strategies and makes it easy to quantify outcomes of management actions.

2. Allred, B.W., B.T. Bestelmeyer, C.S. Boyd, C. Brown, K.W. Davies, M.C. Duniway, L.M. Ellsworth, T.A. Erickson, S.D. Fuhlendorf, S.D., T.V. Griffiths, V. Jansen, M.O. Jones, J. Karl, A. Knight, J.D. Maestas, J.J. Maynard, S.E. McCord, D.E. Naugle, H.D. Starns, D. Twidwell, and D.R. Uden. 2021. Improving Landsat predictions of rangeland fractional cover with multitask learning and uncertainty. Methods in Ecology and Evolution 12:841–849.

3. Robinson, N.P., B.W. Allred, M.O. Jones, A. Moreno, J.S. Kimball, D.E. Naugle, T.A. Erickson, and A.D. Richardson. 2017. A dynamic Landsat derived normalized difference vegetation index (NDVI) product for the conterminous United States. Remote Sensing 9:863.

4. Robinson, N.P., B.W. Allred, W.K. Smith, M.O. Jones, A. Moreno, T.A. Erickson, D.E. Naugle, and S.W. Running. 2018. Terrestrial primary production for the conterminous United States derived from Landsat 30 m and MODIS 250 m. Remote Sensing in Ecology and Conservation 4:264–280.

5. Robinson, N.P., B.W. Allred, D.E. Naugle, and M.O. Jones. 2019. Patterns of rangeland productivity and land ownership: Implications for conservation and management. Ecological Applications 29:e01862.

6. Robinson, N.P., M.O. Jones, A. Moreno, T.A. Erickson, D.E. Naugle, and B.W. Allred. 2019. Rangeland productivity partitioned to sub–pixel plant functional types. Remote Sensing 11:1427.

7. Jones, M.O., N.P. Robinson, D.E. Naugle, J.D. Maestas, M.C. Reeves, R.W. Lankston, and B.W. Allred. 2021. Annual and 16–day rangeland production estimates for the western United States. Rangeland Ecology and Management 77:112–117.

8. Jones, M.O., D.E. Naugle, D. Twidwell, D.R. Uden, J.D. Maestas and B.W. Allred. 2020. Beyond inventories: Emergence of a new era in rangeland monitoring. Rangeland Ecology and Management 73:577–583.

9. Olsen, A.C., J.P. Severson, B.W. Allred, M.O. Jones, J.D. Maestas, D.E. Naugle, K.H. Yates and C.A. Hagen. 2021. Reversing tree encroachment increases usable space for sage–grouse during the breeding season. Wildlife Society Bulletin: In Press.

10. Olsen, A.C., J.P. Severson, J.D. Maestas, D.E. Naugle, J. Smith, J.D. Tack, K.H. Yates, and C.A. Hagen. 2021. Reversing tree expansion in sagebrush steppe yields population level benefit for imperiled grouse. Ecosphere 12:e03551.

11. Roberts, C.P., D. Twidwell, J.L. Burnett, V.M. Donovan, C.L. Wonkka, C.L. Bielski, A.S. Garmestani, D.G. Angeler, T. Eason, B.W. Allred, M.O. Jones, D.E. Naugle, S.M. Sundstrom, and C.R. Allen. 2018. Early warnings for state transitions. Rangeland Ecology and Management 71:659–670.

ADDITIONAL READINGS:

Uden, D.R., D. Twidwell, C.R. Allen, M.O. Jones, D.E. Naugle, J.D. Maestas, and B.W. Allred. 2019. Spatial imaging and screening and regime shifts. Frontiers Ecology and Evolution 7:e407.