USDA Forest Service Pacific Northwest Research Station
Starkey Experimental Forest and Range, Northeast Oregon

Long-Term Studies of Ungulates, Wildlife, Biodiversity, Disturbance Ecology, Hydrology, and Land Uses in Managed Forests and Rangelands

The Starkey Experimental Forest and Range (Starkey) is the site of long-term studies to evaluate effects of human activities, land uses, disturbance regimes, and restoration practices common to public and private lands in the western U.S. Over 80 federal, state, private, tribal and university partners have collaborated in Starkey research and management applications. **Over 80 studies and 400 publications have been completed during the past 30 years, informing land use decisions across the western U.S. on both public and private lands.**




Unique Assets of Starkey:

- The **world's largest ungulate research enclosure** (25,000 acres), allowing cause-effect landscape studies to be conducted that are essential to credible use of results in management decisions.
- **Continuous coverage telemetry systems**, generating over 40 million deer, elk, and cattle over 35 years, the largest telemetry data set on ungulates ever collected to evaluate land use activities.
- An **automated system of traffic counters** on roads and trails to evaluate traffic and human activities.
- One of the **largest, long-term data sets** of environmental variables collected for long-term research.
- Over **30 years of research on effects of major land uses, human activities, and restoration practices**.
- A state-of-the art **winter feeding and animal handling facility** for ungulate care to meet research goals.
- **Tractable ("tame") elk, mule deer, and cattle** have been used for nutrition and herbivory studies essential to address critical management questions not possible to address with wild ungulates.
- **Dedicated sharing of over 20 scientists and science support staff** among 15 partners (federal, private, state, Tribal, university), with partner leveraging of >3 million dollars annually for shared research.

Example Accomplishments with National Implications:

- **Hunting research** has dramatically improved harvest designs for elk by wildlife agencies throughout North America, enhancing diverse hunting opportunities.
- **Timber harvest and thermal cover studies** have resolved national controversies on these issues, resolving litigation that saved the FS multi-millions of dollars in land use planning.
- **Motorized traffic and off-road recreation research** was used by the FS in developing national roadless policy, national OHV policy, and travel management plans across U.S.
- **Elk-deer-cattle grazing interactions studies** resulted in new methods of allotment management planning for cattle grazing on FS rangeland allotments in the western U.S.
- **Elk nutrition and habitat use models** have guided new silvicultural, fuels, and travel management strategies on public and private lands across the western U.S.
- **Fuels reduction research** provided key information about management designs to benefit ungulate habitat use and performance and to reduce fire risk in forest ecosystems.
- **Stream-riparian restoration and riparian grazing research** has evaluated effects on vegetation, salmonids, beaver, small mammals, native bees, and hydrologic regimes under Northwest Water Initiative.
- **Carnivore research on cougars, black bears, bobcats, and coyotes** documented their ecosystem effects.
- **Native bee research** has documented high diversity and pollinator roles in riparian and forest ecosystems.

Examples of On-Going Research with National Implications:

- **Stream-riparian restoration to evaluate recovery of threatened salmonids and biodiversity and hydrologic responses** at Meadow Creek. Research started in 2012 in collaboration with over 20 partners. This work is the first to evaluate vegetation recovery for threatened salmonids and additional biodiversity responses under varying levels of cattle, elk, mule deer, and beaver herbivory. Results inform best management practices for stream and riparian restoration and ungulate management in riparian systems.
- **Effectiveness of novel Stage 0 stream-riparian restoration under the PNW Research Station's Northwest Water Initiative.** This new research builds on stream-riparian research at Starkey and additional tribal, private, and federal lands in the Meadow Creek Watershed to further evaluate a wide range of biodiversity and hydrologic responses to these innovative restoration practices. Research builds on long-term data streams continuing to be collected on multi-disciplinary responses to valley floor restoration, which include Tribal First Foods, vegetation, threatened salmonids, native bees, wildlife, beaver recolonization, virtual fence cattle grazing, and desired hydrologic regimes to improve late-summer water storage and availability to serve a wide range of ecosystem services.
- **Accelerated upland forest restoration effects on multi-resource management**. This research evaluates the benefits and effects of landscape-scale thinning and fuels management prescriptions on Tribal First Foods, forest health, ungulate nutrition, wildlife habitat and use, native bees, and hydrologic regimes while reducing fuel loading and fire risk in fire-suppressed forest conditions typical of National Forests in the western U.S. Results inform multiple use management related to fuels reduction.
- **Landscape effects of climate change, fuels treatments, and ungulate herbivory.** This project evaluates long-term effects of climate change, fuels reduction, fire management, and ungulate herbivory on forest vegetation and associated ecosystems and services, with management implications for western U.S forests.
- **Upland and riparian use models by cattle to improve grazing management practices and beef production.** This study uses long-term Starkey data to develop decision tools cattle grazing and beef production, for benefit of both public and private land grazing systems and allotment management planning.
- **Hunter access effects on hunt designs and harvest objectives.** This long-term study is the first to provide knowledge about "habitat choices" that hunters make under varying levels of motorized access, and to documents effects of these choices on hunter success, elk and mule deer habitat use and productivity.
- **Elk nutrition and habitat use models to improve management on public lands.** Elk distributions have increasingly shifted from public to private lands across the western U.S., particularly before and during hunting seasons. Models are helping managers assess current conditions and implement effective habitat restoration practices to maintain desired elk distributions on public lands for public viewing and hunting.
- **Ecological factors limiting mule deer productivity.** Mule deer continue to decline across the species' range, and many factors have been identified but not evaluated. Starkey Research began in 2014 to evaluate effects of habitat and elk density manipulations on mule deer population recovery.
- **Climate change effects on ungulate forage and animal performance.** Elk and cattle compose multi-million-dollar economies that depend on forage production during summer and fall on public lands, but these ranges are prone to prolonged drought, causing sharp declines in production. Effects of climate change on ungulate forage and animal condition are being evaluated with over 20 years of animal and climate data, with direct implications on beef cattle production and elk productivity on western grazing lands.

Opportunities for Use of Long-Term Data Sets:

- **Long-term research at Starkey has generated one of the largest, most diverse data sets** on ungulates, spatial data, animal performance, carnivores, native bees, vegetation climate, human activities, and traffic data that have been collected at landscape scales. Data sets provide diverse, compelling opportunities to test a broad range of hypotheses for management and to address variety of major ecological theories by interested scientists and graduate students. Data documentation and archiving is a continual process designed to facilitate efficient and effective research uses for all interested scientists and students.

Contact: Dr. Michael Wisdom, Research Wildlife Biologist, michael.wisdom@usda.gov