David Little Livestock
Range Management Endowment
AT THE UNIVERSITY OF IDAHO

2023 Project Progress Report:

Virtual fence technology used to manage cattle in riparian habitats and wildfire burn areas

By Melinda Ellison

PRELIMINARY RESULTS for (2023):

TITLE: Virtual fence technology used to manage cattle in riparian habitats and wildfire burn areas

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BACKGROUND: Proper distribution of livestock across the landscape allows for uniform and sustainable use of rangeland resources. Overuse of critical riparian and upland habitats by livestock can have negative effects on stream bank erosion, water quality, overuse of critical forage resources for wildlife, and damage to critical habitats for fish, wildlife, and other terrestrial species. Livestock can be excluded from critical riparian areas with traditional fencing, which can be expensive to build, require extensive approval procedures on public lands, yearly maintenance cost, and logistically unattainable in some topographies. Increased wildfire frequency on public lands has also created economic challenges for livestock producers, including loss of fences and post-fire grazing management guidelines imposed by public land agencies, often limiting livestock grazing for two growing seasons postfire to allow for plant recovery. Wildfires typically result in unburned, lightly burned, and heavily burned areas within wildfire burn areas. Herding of livestock and/or use of temporary fences could be used to graze cattle in these mosaic burns; however, these methods can be labor intensive and expensive. A new technology that could be used in place of traditional fencing is Virtual Fencing (VF), which relies on GPS generated geospatial fence coordinates and collars attached to a cow's neck that provide either a sound, shock, or both, to either contain or exclude cattle from specified GPS zones. The use of VF technologies could provide a more flexible method of containing cattle movement across the landscape and assist to exclude cattle from burn areas, and critical riparian and upland grazing areas, while allowing for unrestricted movement of wildlife across these areas.

HYPOTHESIS or OBJECTIVES:

We hypothesize that virtual fence technologies used with cattle will effectively exclude > 90% of the cattle from critical riparian areas and wildfire burn areas in upland and forested grazing areas.
Specific objectives of the project include:

1) Evaluate the effectiveness of VF geospatial boundaries to exclude cattle from grazing critical riparian/upland habitats and wildfire burn areas based on a percentage of cattle that breach VF boundaries, locations/duration of breaches, and repeatability of breaches by individual animals within the cattle population.
2) Evaluate forage utilization of riparian/upland habitats and wildfire burn areas pre- and post-grazing both within and outside VF boundaries based on a spatial balance of monitoring sites across VF grazing polygons.

3) Evaluate cattle distribution across the VF grazing polygons based on GPS data in relation to VF boundaries and the relationship of livestock distribution with forage utilization based on forage monitoring sites in objective 2.

PROCEDURES: The VF collars funded by this proposal are being used on cows enrolled in an existing 2-year funded upland grazing project as well as a multi-year grazing project on post-wildfire burn areas (2022 "Moose" Wildfire). The VF system designed by Vence Inc. along with their proprietary Herd Manager Software will be used for both projects. The software allows for design of geospatial inclusion and exclusion boundaries, real-time animal tracking, and animal location data transmitted to and from collared cows to mobile, solar powered base stations that further communicate via cellular link to Vence's cloud-based storage for data download.

The project is being conducted on two separate public land grazing allotments near Carmen, ID. Location one is the Bureau of Land Management (BLM) Badger Springs allotment (~10,000 acres; See Figure 1) divided into three equal sized grazing units either by physical fence on two boundaries and no fences on the remaining boundaries. Two units are grazed in alternate years in the spring and fall and one grazed each year in the summer and fall. Four exclusion areas around critical upland grazing habitats were designed to exclude cattle from grazing in these areas. Additional boundaries were developed to exclude cattle from adjacent private and United States Forest Service (USFS) lands. Grazing periods included May to July (n =160 cow/calf pairs; collars funded for 2-years; USDA-NRCS-CIG) and Oct to Nov (n=160 dry cows from USDA-NRCS-CIG; additional 220 collared dry cows funded by this proposal). Location two is the Diamond Creek/Moose allotment (~70,000 acres; See Figure 2) consisting of BLM and USFS grazing allotments impacted by the 2022 "Moose" fire. With approval by USFS in Spring 2023, 400 cow/calf pairs out of the original pre-fire allotment numbers of 700 cow/calf pairs were allowed to graze approximately ~39,000 acres of the allotment in the first-year post fire from May 15 to October 10, 2023. Only one side of the allotment is physically fenced adjacent to private lands with no fencing used on the remainder of the allotment. Grazing was initiated with three herds of each permittee's cattle (130, 100, 170 cow/calf pairs per herd, respectively). Grazing polygons were on BLM allotments (May 15 to June 15), lower USFS (June 15 to July 15), and upper USFS (July 15 to Oct 15). Additional GPS based exclusion polygons (n =12) were developed where cattle were not allowed to graze within the BLM and USFS lands. These exclusion areas primarily included high and moderate intensity burn areas (n=12), a riparian area (n=1), and the Salmon Municipal Watershed area (n=1).

Daily summarization of GPS tracking and VF activation data (cows entering and exiting the sound and electric zones of the VF) will allow us to determine the effectiveness of the VF technology to exclude cattle from critical riparian and wildfire zones by evaluating the absence vs. presence of cattle in VF exclusion zones. Overall VF effectiveness will be determined by total cattle numbers inside and outside riparian and wildfire areas and how those occurrences change daily during the grazing period within each grazing polygon. The GPS locations of each animal will also be plotted on virtual maps to determine location intensity of livestock grazing to calculate grazing intensity per acre based on number of GPS points counted in each map pixel and number of animal units in each group. Within years, locations, and seasons, forage utilization in uplands and riparian areas will occur prior to and at the end of each grazing period within each grazing polygon. Monitoring sites will be spatially selected across allotments to evaluate how cattle distribution may affect resources utilization. Number and locations of monitoring sites will be based on how VF boundaries are organized relative to the fire burn exclusion zones, riparian areas, and(or) stock watering areas within each pasture.

ACCOMPLISHMENTS or RESULTS: For the initial grazing period from May 15 to July 15 on the BLM Badger Springs allotment, collar GPS tracking data has been collected for further analysis. Initial estimates indicate that animal containment within the virtual fence boundaries of suckled cows was approximately 90%. Six VF collars either broke or fell off cows during the grazing period. For almost every cow that breached the virtual fence boundaries, we were able to "virtually" herd cows back to the

primary containment areas with additional VF polygons. The permittee did not have to spend any labor days to herd cattle back into the confinement areas. According to the permittee, they had to move cows back into the allotment 7 times in 2022 when no virtual fence was used. Forage production across the allotment on June 15 was 1,418 lbs./acre. Forage utilization was evaluated with landscape appearance at 11 locations after across the two grazing periods. Mean utilization was 9.1 ± 6.0 % SD with a range of 6.2 to 25.6. Four upland VF exclusion areas of 3.1, 3.0, < 1.0, < 1.0 hectares had utilization of 4, 14, 4, 16% respectively. During the initial fall grazing (Oct. 5 -31) with non-lactating cows without calves (n =403), daily containment within the grazing area has been between 99-100%.

For the Diamond Moose allotment, there were three herds of cattle. Collar GPS data for the entire grazing period (May 15 to Oct 15) has been collected for further analysis. There were three distinct grazing periods including the BLM (May 15 to June 1; 4,000 acres), lower USFS (June 1 to July 15, 5,000 acres), and the upper USFS (July 15 to October 10, 30,000 acres). Elevation changes are from 4,200 ft to 8,000 ft. Initial observations on cattle containment were highly variable across the three herds. One herd had a minimal number of cattle breaches during the BLM and lower USFS grazing periods with an estimated daily containment between 95 and 100%, with only one large breach of 10 cows that were virtually herded back within several days. Containment with the other two herds was highly variable with considerably more breaches ranging from 1 to 15 cows with a daily containment between 75 to 85%. With that said, a major challenge faced by permittees on this allotment is the premature movement of cattle "over the top" to the upper USFS where 25% of the cows typically move into before the July 15 move date. Consequently, these extra cows can alter forage biomass availability on the upper forest with cattle grazing additional early summer growth. Even with all the breaches on the lower USFS, the VF kept cattle off the upper forest until they were moved by permittees on July 15, which certainly allowed for additional forage growth on the upper USFS than in previous years. Forage utilization across the BLM grazing allotments ranged from 9 to 40%; whereas, the lower USFS had utilization of 30-40%. Lastly, the upper USFS had a 35% utilization and one of the critical riparian areas that was excluded from grazing had zero utilization. Once cows were moved to the upper USFS, they were able to spread out and containment within the boundaries increased to an estimate of 75 to 90%, depending on the herd of cattle. For the 15 fire exclusion areas, there negligible breaches with animal numbers ranging between 1-8 animals per breach. Further data analysis will include animal containment within virtual fence boundaries and livestock distribution across the grazing allotment. Moving cattle from the allotment was made more efficient because permittees new where to find the cattle and their labor times were considerably decreased compared to previous years.

In conclusion, these results provide preliminary evidence that virtual fence could allow for sustainable management of cattle across large scale private acreages and public grazing allotments as well as riparian and post fire burn areas. Producers were able to experience both the positive and negatives of the new technology, and they have committed to use it for next year (2024). The most frequent comments by permittees were the significant decrease in labor/time in keeping cows contained in their allotments, knowing where cattle were in the grazing allotments which makes it easier to locate cattle when they need to be moved, and the potential for improved and more sustainable forage utilization by improved distribution of cattle across the landscape during the grazing season.

PUBLICATIONS or OUTPUTS:

Ellison. M. and J. V. Yelich. 2024. Use of virtual fence on a public grazing allotment in upland western sagebrush steppe. University of Idaho. Society for Range Management Meeting. Sparks, NV

Yelich, J. V and M. Ellison. 2023. Where the Forest Meets the Range: Connecting the Dots – Virtual Fence on the Diamond Moose Project. University of Idaho Extension, Carmen, ID. Sept. 6.

Figure 1. BLM Badger Springs Allotment "Heat Map" representative of cattle locations from Oct. 15 to Oct. 22, 2023 for 400 non-lactating grazing cows. Green color represents high cattle intensity, blue represents low cattle intensity, no color represents minimal to no cattle activity. Line legend: red designates pasture units, yellow are virtual fences, red/yellow areas are virtual fence exclusion zones.

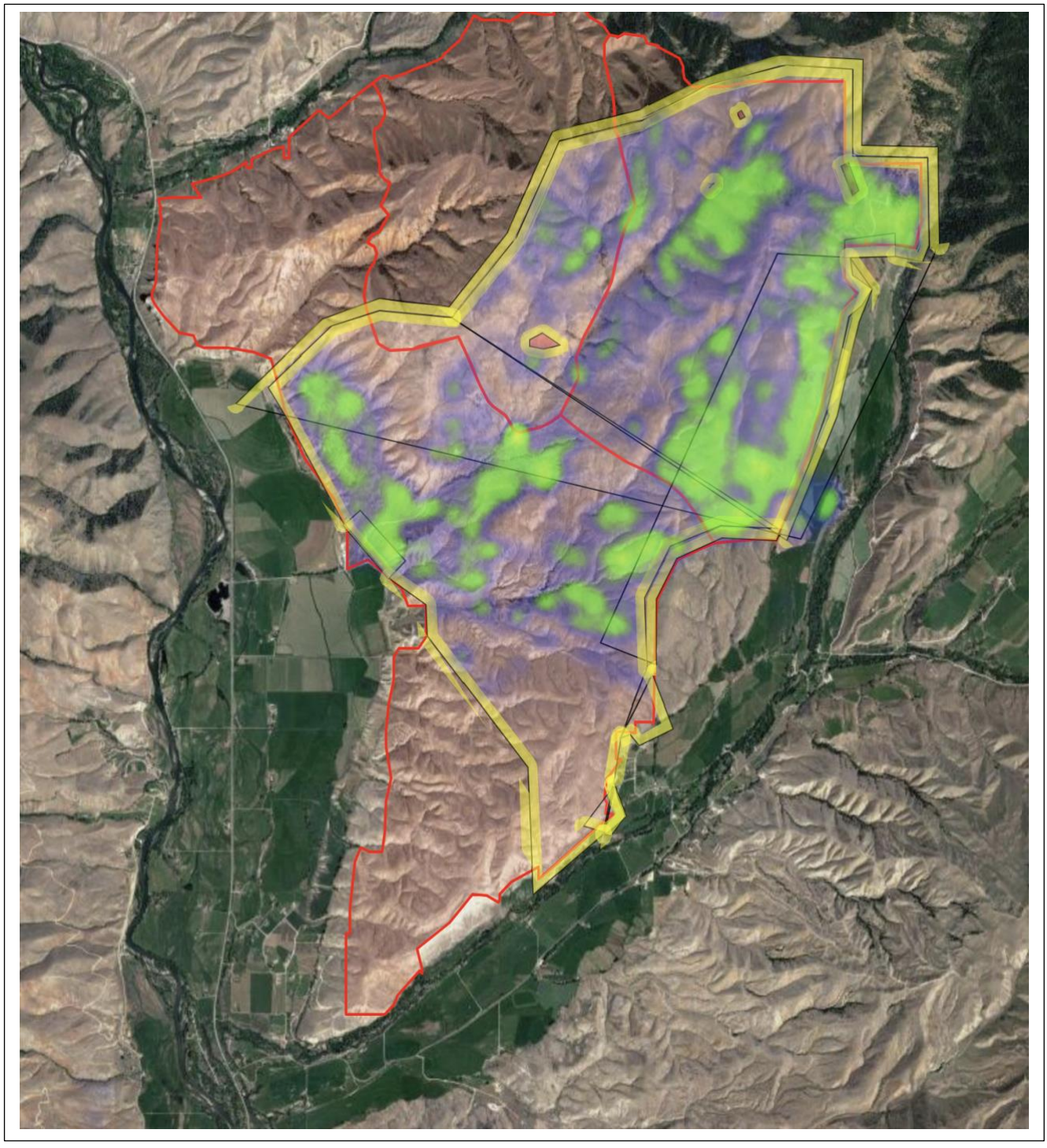

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Figure 2 Diamond Moose fire severity map (red = high, yellow=moderate, light green = low, dark green = absent) from which grazing areas were determined in spring 2023 based on USFS monitoring and University of Idaho forage biomass determination.

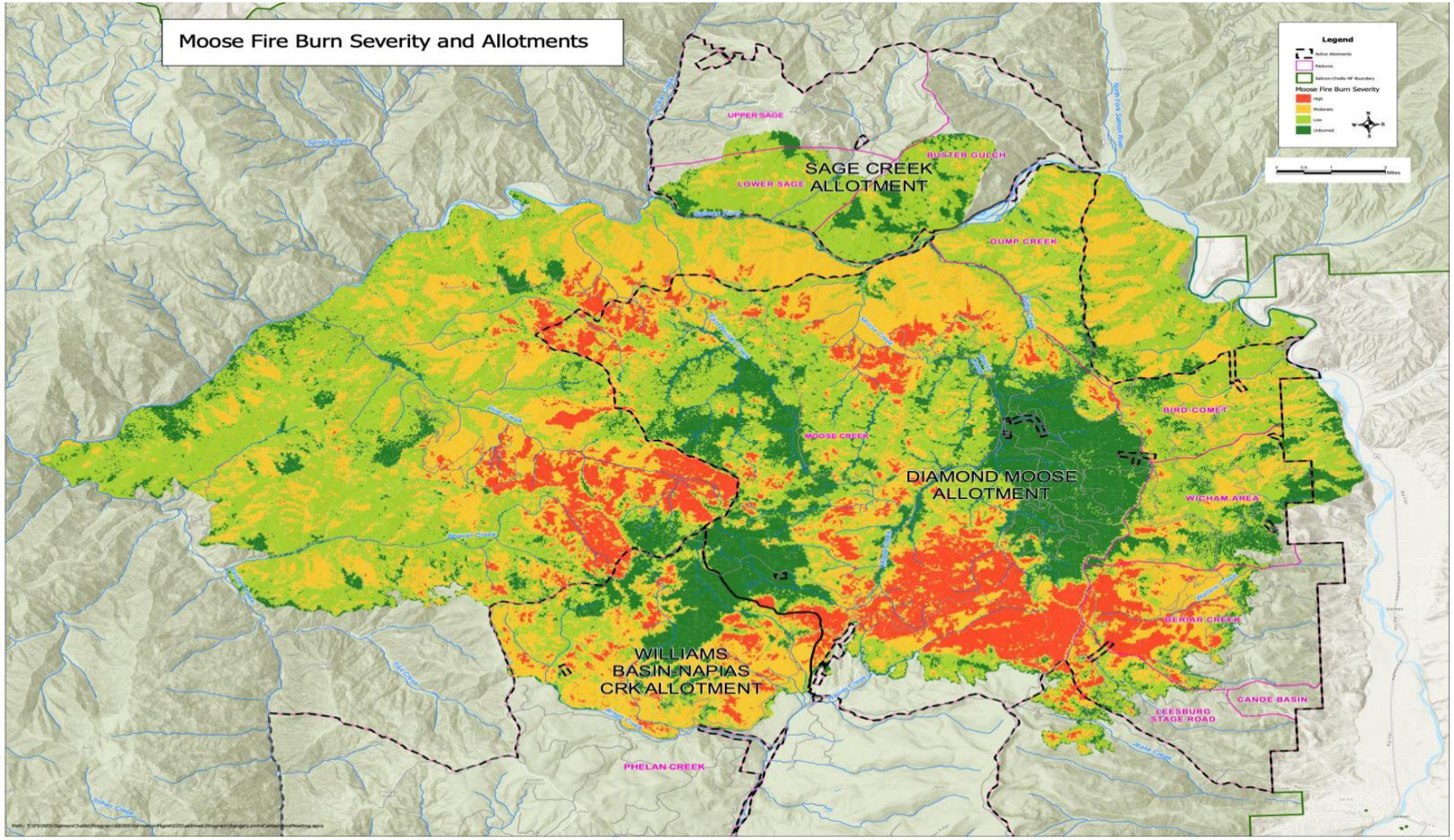

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Figure 3 Diamond Moose grazing allotment. Includes positioning of virtual Fences for defined grazing areas. Blue area represents Diamond Moose Grazing allotment. Double yellow lines represent virtual fences used where cattle grazed July 15 to Oct, 10, 2023. Yellow lines with red areas inside represent 15 post-fire exclusion zones designed to keep cattle from grazing inside the zones, which represented severe/moderate fire burn intensity areas plus the Salmon Municipal Water Management area (SMW). Most areas outside the double yellow virtual fences and within shaded blue were also severe/moderate fire burn areas where grazing was excluded with the exception of six yellow polygons at bottom right (USFS and BLM) that were not burned and cattle were allowed to graze them May 15 to July 15.