

Oklahoma Water Resources Center

Virtual fencing to control cattle for improved ecosystem services EPA Project No. MX – 02D00721

Quarter no. 2 From October 1, 2021 Through December 31, 2021.

I. Abstract

This quarter, VF collars and 1 base station were installed the week of October 18-22, 2021 at OSU's Research Range. This included installation of the new collar design (V3). V3 VF collars were evaluated the week of December 11, 2021 and confirmed to be compatible with the animals. Additional V3 collars were then deployed at OSU and an additional base station was installed the week of December 11, 2021 to cover the Lake Carl Blackwell (LCB) pasture site. Also, on December 15, 2021, 86 V3 VF collars and 1 base station were deployed at the cooperating ranch site and are tracking animal movement. A PhD student in AFS/NREM was recruited for the project and will be onboarded next quarter. Stream visual assessments were performed at all four watersheds on the OSU Research Ranges on October 13, 2021 and November 8, 2021. Automated Sampler enclosures and solar panel poles have been installed in the field for the four watersheds; however, we continue waiting on supplies from ISCO and the fabrication of the flumes to be completed to finalize installation. OSU Natural Resources Extension has had two social media posts to date which have been very impactful, resulting in 26,649 reach/impressions and 1,183 engagements. Additionally, our work was featured on SUNUP, a weekly agriculture TV show, further expanding our reach. Next quarter, work will focus on finishing installation of the automated samplers, conducting stream visual assessments, on-boarding a new PhD student, and expanding outreach.

II. Overall Progress and Results by Task

TASK 1: PROJECT ADMINISTRATION

Subtask 1.1: *OWRC will prepare electronic quarterly progress reports (QPRs) for submission to the EPA. QPRs shall document all activities performed within a quarter and shall be submitted by the 15th of October, January, April and July. QPRs shall be distributed to all Project Partners.*

The following actions have been completed during this reporting period:

- a. The 2nd quarterly report was prepared and submitted on January 14, 2022.

16% Complete

Subtask 1.2: *OWRC will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to EPA at least quarterly.*

The following actions have been completed during this reporting period:

- a. As of November 30th, \$2,410 project funds had been expended and \$65,452 encumbered.

1% Complete

Subtask 1.3: *OWRC will host coordination meetings, at least quarterly, with the project team to discuss project activities and schedule, communication needs, deliverables, and other requirements.*

The following actions have been completed during this reporting period:

- a. An EPA Virtual Fencing project team meeting was held with OSU researchers involved in the project on November 12, 2021.
- b. Additionally, OSU meets with industry partners biweekly to discuss the VF Project Status and coordinate activities. This quarter, meetings were held on October 12 & 26, November 9, and December 7 & 21.

16% Complete

Subtask 1.4: *OWRC will develop a Final Report that summarizes activities completed and conclusions reached during the project and discusses the extent to which project goals and measures of success have been achieved.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

TASK 2: QUALITY ASSURANCE

Subtask 2.1: *OWRC will develop a QAPP consistent with the most recent versions of EPA Requirements for Quality Assurance Project Plans (QA/R-5).*

The following actions have been completed during this reporting period:

- a. The project QAPP was submitted on September 2, 2021 and conditionally approved by EPA on September 24, 2021.

90% Complete

Subtask 2.2: *OWRC will implement the approved QAPP. OWRC will submit revisions and necessary amendments to the QAPP as needed.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

16% Complete

TASK 3: VIRTUAL FENCING DEMONSTRATIONS ON COOPERATING RANCHES

Subtask 3.1: *Identify cooperating ranch(es).*

The following actions have been completed during this reporting period:

- a. The first cooperating ranch was identified this quarter and an agreement put into place between OSU and the cooperating ranch.

35% Complete

Subtask 3.2: *Install VF system on cooperating ranch(es).*

The following actions have been completed during this reporting period:

- a. The VF system was installed on the first demonstration ranch on December 15, 2021.

35% Complete

Subtask 3.3: *Implement grazing management & riparian protection on demonstration ranch(es) using virtual fencing.*

The following actions have been completed during this reporting period:

- a. 86 V3 VF collars and 1 base station were deployed at one cooperating ranch site on December 15, 2021 and are tracking animal movement. Riparian protection is scheduled to be implemented with VF in 2022 after 1 year of baseline data is collected.

5% Complete

Subtask 3.4: *Perform Stream Visual Assessment.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter. Next quarter, the first stream visual assessment will be conducted at the demonstration ranch in January 2022.

0% Complete

Subtask 3.5: *Remote assessment of wildlife & pollinator habitat.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

TASK 4: VIRTUAL FENCING EVALUATION AT OSU RESEARCH RANGE(S)

Subtask 4.1: *Implement grazing mgt & riparian protection via VF*

The following actions have been completed during this reporting period:

- a. A PhD student in AFS/NREM was recruited for the project.
- b. VF collars and 1 base station were installed the week of October 18-22, 2021. This included installation of the new collar design (V3).
- c. V3 VF collars were evaluated the week of December 11, 2021 and confirmed to be compatible with the animals. Additional V3 collars were deployed at OSU.
- d. An additional base station was installed the week of December 11, 2021 to cover the Lake Carl Blackwell (LCB) pasture site.
- e. The first year of the project, all four watershed sites will be continuously grazed and cattle location will only be tracked.

- f. In years 2-3, grazing management and riparian protection will be implemented at 2 sites (East Native 1 and 2) and continuous grazing will continue at the other 2 sites (LCB 1 and 2).

16% Complete

Subtask 4.2: *Perform Stream Visual Assessment at OSU Research Range(s).*

The following actions have been completed during this reporting period:

- a. Stream visual assessments were performed at all four watersheds on 10/13/2021 and 11/8/2021. Stream condition at LCB 1, LCB 2, and East Native 1 was good with these watersheds scoring 8.6, 8.52, and 8.1 respectively. East Native 2 was in fair condition, scoring a 6.04.
- b. Stream visual assessments will be conducted quarterly to capture seasonal variation and changes due to virtual fencing.

8% Complete

Subtask 4.3: *Install ISCO samplers at paired watersheds at OSU Research Range(s).*

The following actions have been completed during this reporting period:

- a. Sampler enclosures and solar panel poles have been installed in the field.
- b. We continue waiting on supplies from ISCO and the fabrication of the flumes to be complete.
- c. We expect to complete installation next quarter prior to spring rains.

8% Complete

Subtask 4.4: *Monitor water quality at OSU Research Range(s).*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter. Monitoring equipment has not yet been installed. However, drought conditions have prevented runoff from occurring thus far (i.e. we have not missed a runoff event yet since the project was launched).

0% Complete

Subtask 4.5: *Remote assessment of wildlife & pollinator habitat at OSU Research Range(s).*

The following actions have been completed during this reporting period:

- a. Pre-grazing imagery was collected with an Unoccupied Aerial Vehicle (UAV) at one OSU site on October 5, 2021.

8% Complete

TASK 5: WATERSHED MODELING

Subtask 5.1: *Gather input data*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter. We continue actively recruiting a PhD student to perform the modeling and expect to bring a student on by summer 2022.

0% Complete

Subtask 5.2: *Model development*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

Subtask 5.3: *Model calibration*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

Subtask 5.4: *Model validation*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

Subtask 5.5: *Perform long-term simulations*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

TASK 6: OUTREACH

Subtask 6.1: *Develop Extension programs and materials.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

Subtask 6.2: *Deliver Extension programs to producers.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

Subtask 6.3: *Develop standards, specifications, and guidance.*

The following actions have been completed during this reporting period:

- a. A rough outline for “Virtual Fencing: A Guide for Successful Implementation” has been drafted.

8% Complete

Subtask 6.4: *Deliver results to producers via Soil Health programs.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

Subtask 6.5: *Communicate results via social media, newsletter, webpage.*

The following actions have been completed during this reporting period:

- a. OSU Natural Resources Extension has had 2 posts to date (see links below) on:
 - [Announcement of the launch of the EPA grant](#) on September 2, 2021
 - [Installation of collars on the demonstration ranch](#) on December 19, 2021
 - Analytics for the 2 Natural Resources Extension social media posts are as follows.

	Posts	Reach/Impressions	Engagements
Facebook	2	24,626	1,080
Instagram	2	373	43
Twitter	2	1,650	60
Total	6	26,649	1,183

- b. Our VF work was also featured on [SUNUP](#) on December 13, 2021. SUNUP, a weekly TV show which airs Saturday mornings at 7:30am and Sunday mornings at 6:00am on OETA, is Oklahoma’s place for information on the latest agricultural research, updates for current crops, and other issues important to Oklahoma agriculture.
- c. Members of the team participate in the informal “VF Working Group” monthly web conference with approximately 10 other VF researchers from across the U.S.

16% Complete

Subtask 6.6: *Deliver presentations at conferences.*

The following actions have been completed during this reporting period:

- a. Presented on project at Extension Ag Coffee Shop on November 17.

16% Complete

Subtask 6.7: *Publish manuscripts in peer reviewed journals.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

0% Complete

III. Related Issues/Current Problems and Favorable or Unusual Developments

- Obtaining supplies and equipment for monitoring due to supply chain issues has been problematic.
- Obtaining graduate students, particularly for the modeling, due to tight job market and delays in obtaining visas for international students has been challenging as well.
- OSU has been donated a research ranch near Haskell, Oklahoma. This ranch appears to be an excellent ranch for demonstrating the benefits of virtual fencing as the ranch has an extensive stream network which is somewhat degraded. Integrating this new research ranch into the project would allow us to demonstrate how this technology can assist with range and stream restoration.

IV. Projected Work for Next Quarter

- Install 4' H-Flumes and ISCO automated samplers at research range watershed sites and initiate runoff collection and analysis
- Stream visual assessments will be conducted at all four research range watersheds and at the demonstration ranch
- Continue and expand outreach efforts on virtual fencing and the project
- On-board new PhD student in AFS/NREM