FOR THE WIN ROBOTICS

ROTATIONAL GRAZING

LESSON PLAN | VERSION 2

LESSON OVERVIEW

Prerequisite Knowledge

- Build Essentials
- Fly Essentials

Materials Needed

- Hopper(s)
- safety glasses
- controller(s) **or** FTW Fly device(s) with Bluetooth capabilities (such as iPads or smart phones)
- FTW Fly device(s) with Wifi capabilities (such as iPads or laptops)
- tape (for the floor)
- measuring tape (up to 15')
- landing pads
- writing utensils

Time Allotment

Lesson: 1 hour (or 1 – 2 class periods), Setup: 20 minutes

Documents

- Agriculture Slide Deck II
- Agriculture Student Workbook

Vocabulary

- Remote Pilot in Command (RPIC) – the person flying the drone
- Visual Observer (VO) – the person maintaining visual contact with the drone and in communication with the RPIC
- Navigator – the person responsible for giving the RPIC directions on where to fly
- Rotational Grazing – a system where a pasture is divided into smaller sections, called paddocks, and a herd of cattle is rotated through the paddocks to allow the vegetation to regrow

In this Lesson...

Students learn about and discuss livestock management in agriculture. Then, they fly and land Hopper in each of six paddocks in a pasture to simulate collecting data on the vegetation height. They will create a rotational grazing plan for cattle based off of the vegetation heights.

Learning Objectives

- Participate in a group discussion about livestock management in agriculture and its current technologies.
- Understand the system of rotational grazing and create grazing plan in a chart.
- Work as a VO, navigator, or RPIC with teammate(s) to navigate Hopper together and practice drone flying skills.

LESSON STRUCTURE

Read through the following table before starting the lesson. Approximate times have been given for each section to help with scheduling and time management.

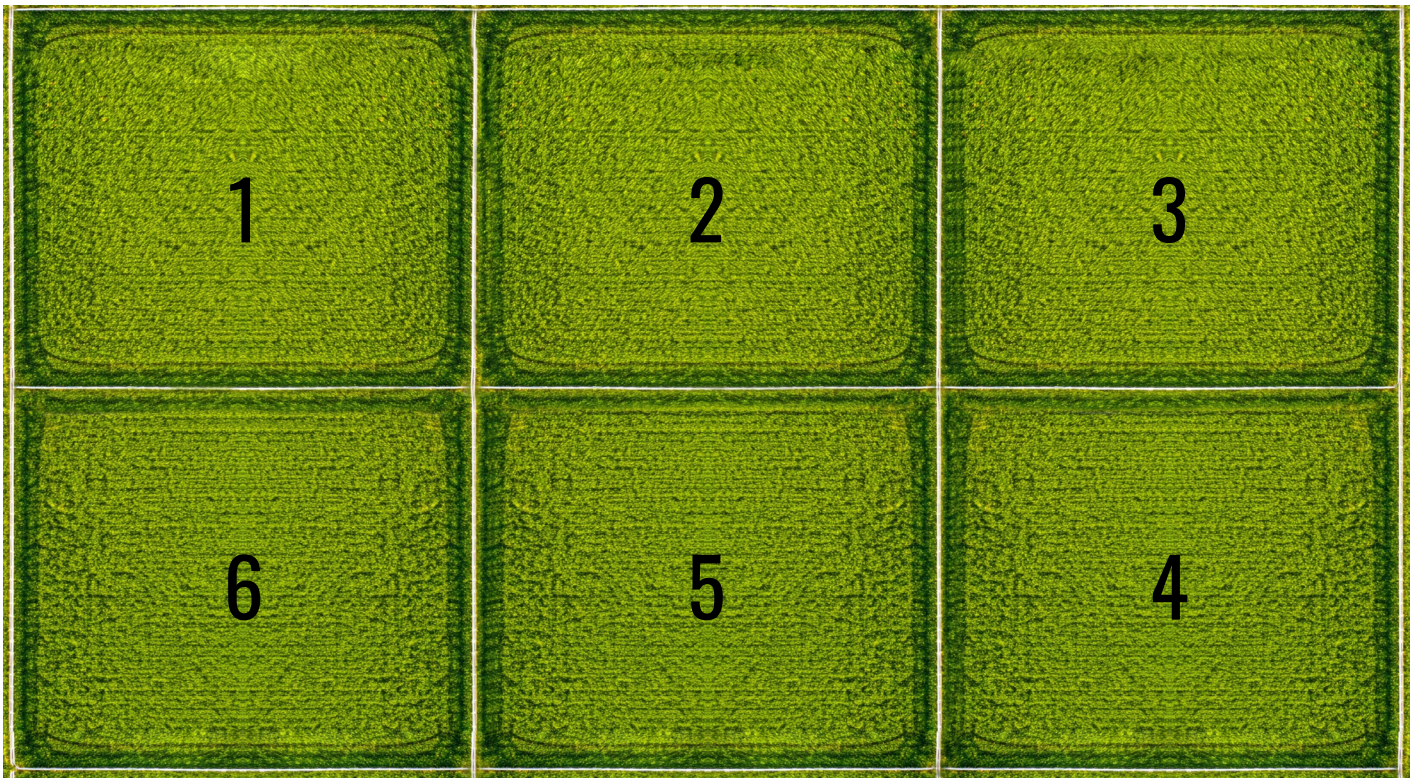
Lesson Section	Description	Approximate Time
Direct Teaching	Open the slide deck titled Firefighting Slide Deck I and have the first slide up as the students walk in. Encourage students to think about the bell ringer question: "What are some foods you like to eat that come from animals?" Go through the rest of the slides of the slide deck with the students. Play any videos directly from the slides if possible (as opposed to going to the external website). Reference any presenter's notes as needed for each slide. The last slide presents the scenario of the Rotational Grazing activity to the students.	15 minutes
Discussion & Activity	Ensure the activity is set up prior to the beginning of the lesson. Allow for up to 20 minutes to set up. Separate students into small teams. Choose team sizes based on how many students there are and how many drones are available. Ideally, there would be no more than 3 – 4 students per team. Encourage the use of aviation terms such as roll, yaw, pitch, and altitude in the communication between the RPIC, navigator, and VO(s). Implement the extension if time permits. Use the questions provided on page 6 to lead a group discussion with the students. Have them fill out a row in their flight log in their Agriculture Student Workbook. See pages 7 & 8 of this guide for an example of what the Agriculture Student Workbook pages could look like filled out.	45 minutes

ACTIVITY SCENARIO

You have a 400-acre pasture of switchgrass for cattle grazing that you have separated into six equal paddocks labeled 1 through 6. You decide to use a rotational grazing system with your cattle.

You and a navigator will work together to hover Hopper over each paddock to measure the switchgrass height. Then, you will create a chart outlining your rotational grazing plan based on the recorded switchgrass heights starting at the month of April 2025.

The switchgrass heights are based on the color of the landing pad in each paddock.



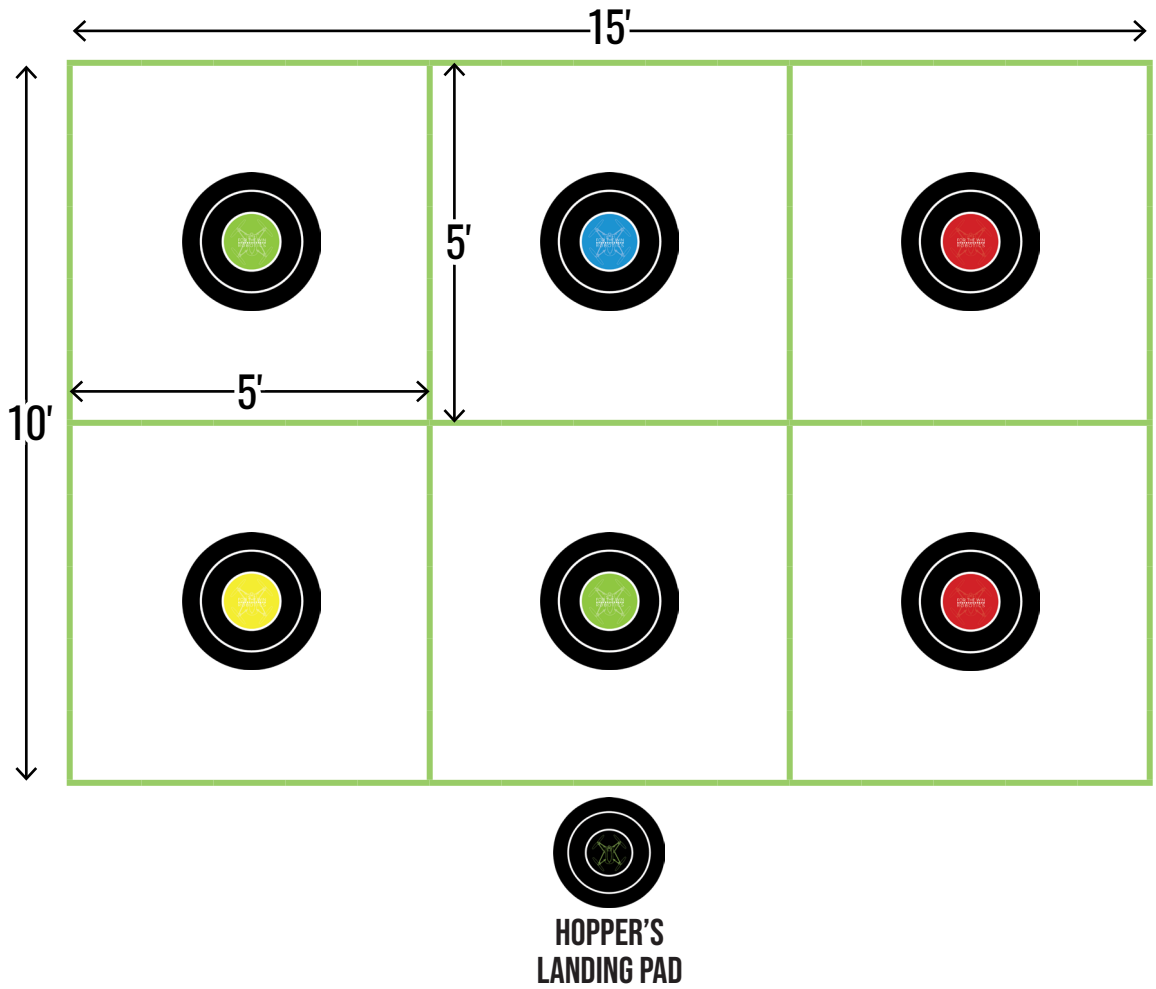
400 ACRES

ACTIVITY SETUP

Tape a 15' × 10' square on the ground which represents the pasture of switchgrass. Tape the rectangle into equal sixths, which represent the six paddocks, as shown in the graphic below. Each paddock is a 5' × 5' square.

Landing pads of various colors will be placed inside the paddocks. The landing pads will be selected and placed by either the facilitator or by another team. Place a landing pad for Hopper outside of the square.

An example of the setup is shown below.



ACTIVITY IMPLEMENTATION

Activity Facilitation

Go through the following steps with the students to facilitate the activity.

1. Assign one team member to be the RPIC (remote pilot in command) and another to be the navigator. The remaining team member(s) are the VOs (visual observers) who will monitor the setup for safety and accuracy.

2. Either the facilitator or the members of another team can select the landing pad color of each paddock. They can select from blue, green, yellow, and red depending on how many landing pads are available. At least three of these colors should be used.

3. Place Hopper on Hopper's landing pad facing toward the square/pasture.

4. Connect the controller or FTW Fly device to Hopper and have the RPIC turn away from the setup. Then, connect the Wifi enabled device to Hopper's camera and have the navigator turn away from the setup.

5. The RPIC will fly and hover Hopper over all six paddocks while the navigator watches Hopper's live video feed and communicates to the RPIC.

6. Once the navigator identifies the color of the landing pad in each paddock, one of the team members (either the navigator or a VO) can label the paddocks on the first Rotational Grazing page in their Agriculture Workbook with the landing pad colors. The rest of the team can complete this page after all colors are identified and the RPIC lands Hopper on the starting landing pad outside the pasture.

   Hopper does not have to hover over the paddocks in numerical order although it can be recommended to the students to help them stay organized.

7. After successfully identifying the color in each paddock, students will return Hopper to Hopper's landing pad outside of the pasture.

8. Based off the data collected, students will fill out their rotational grazing plan in the chart provided in their Agriculture Workbook using the information provided. The switchgrass measurements are given in the table provided. Each student should create their rotational grazing plan on their own.

ACTIVITY IMPLEMENTATION

Extension

If time permits, challenge the students to continue their rotational grazing plan for the months of May 2025 and June 2025 on a scratch sheet of paper or in a digital chart.

Post-Activity Discussion Questions

Use the following questions to lead a group discussion after implementing the activity.

1. Was flying Hopper while viewing the camera stream easier or harder than flying Hopper while maintaining visual contact?
2. How did the RPIC and navigator in your group communicate with each other? What words did the navigator use to communicate where the RPIC should fly Hopper?
3. How was safety ensured? If Hopper flew out of the fly zone, how did the RPIC respond?
4. Compare your rotational grazing plan chart to those of your team member(s). Are they different? If so, how?

Flight Log

Have students fill out a row in their flight log in their Agriculture Student Workbook. An example of what it could look like is shown below.

Date	Drone Model	Location	Flight Time	Notes
04/01/2025	Hopper	Los Cerritos Middle School Soccer Fields	20 minutes	My partner Rob and I flew Hopper over a pasture with six paddocks to measure the grass length of each paddock. Then, we used this data to create a rotational grazing plan.

1. Write the color of the landing pad in each paddock below.

1 green	2 blue	3 red
6 yellow	5 green	4 red

Use the following table to find the range of the switchgrass height in each paddock.

Color	Switchgrass Height (as a range)
Blue	1 – 6 inches
Green	7 – 12 inches
Yellow	13 – 18 inches
Red	19 – 24 inches

2. Paddock 1: 7 – 12 inches

3. Paddock 2: 1 – 6 inches

4. Paddock 3: 19 – 24 inches

5. Paddock 4: 19 – 24 inches

6. Paddock 5: 7 – 12 inches

7. Paddock 6: 13 – 18 inches

Use the switchgrass height measurements you collected and the following information to create a rotational grazing plan in the chart below starting at the month of April 2025.

- A pasture with eight paddocks typically requires 3 − 6 grazing days per paddock.
- A paddock in this pasture typically requires 15 − 20 days of rest and no more than 20 days of rest.
- The target height of switchgrass to *start* grazing is 18 − 22 inches.
- The target height of switchgrass to *stop* grazing is 5 − 7 inches.
- Your herd of cattle is large enough to allow for *up to* two paddocks to be grazed at once.

Fill in the missing information. Draw x's in cells for the grazing days, and leave cells blank for the days of rest. The sizes of the paddocks are in acres.

Placement of x's will vary.

Paddocks		**April 2025**																													
Size	Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		T	W	Th	F	Sa	S	M	T	W	Th	F	Sa	S	M	T	W	Th	F	Sa	S	M	T	W	Th	F	Sa	S	M	T	W
50	**1**										x	x	x	x	x																
50	**2**																		x	x	x	x	x								
50	**3**	x	x	x	x	x																x	x	x	x	x					
50	**4**	x	x	x	x	x																		x	x	x	x	x	x		
50	**5**													x	x	x	x	x													
50	**6**						x	x	x	x																		x	x	x	x