Using Drones to Enhance Garden Projects

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Introduction

Drones (unmanned aircraft systems or UAS) are known for their ability to show and record a bird's eye view of landscapes and buildings. In science, researchers have used drones to monitor wildlife populations, track ecosystem changes, map vegetation health, and collect data in hard-to-reach areas, providing valuable insights into environmental and agricultural studies. Operators of drones fly the drone, look at images in real time, and download images for further analysis after the flight. Drones are even used to deliver seeds, fertilizer, or other supplies to where they are needed. When people, including scientists, fly a drone, they must follow federal and local rules and regulations. The Federal Aviation Administration (FAA) website offers information about how to register a drone and get appropriate licenses based on intended uses, state guidelines, and area of intended use. The Utah State University (USU) Extension fact sheet "Introduction to Drones" provides further information about certifications, and the USU Extension Aggie Drone Academy offers courses to help you get started in the exciting world of drone flight.

There are many different types of drones with various options, such as image quality, flight distance and time, and the ability to pre-plan flights. No matter what equipment you use, drones have taken us to new heights and helped us see our environments in new and different ways.

Choosing the Right Drone

If you are ready to buy a drone or just want to learn more about them, Penn State Extension provides a list of things to consider.

- **Cost -** Drones can do many things. To select a drone that fits your needs, determine how much money you are willing to spend on the drone, which can range in cost from a hundred dollars to tens of thousands of dollars. Find your price range based on how you plan to use the drone and the features you will need to accomplish your goals.
- **Battery life -** Consider how much battery life your drone will require to accomplish the intended tasks. The larger the area or the bigger the job, the more battery power the drone will require.
- **Camera quality -** A primary use of drones is to capture high-quality images and videos. When selecting a drone, it's crucial to evaluate the camera resolution and overall imaging capability to ensure it can accomplish your specific tasks, such as mapping, monitoring, or completing creative projects. Consider the importance of camera stability, which will ensure clearer and more reliable footage. Camera stability can often be achieved through a gimbal, a device that counteracts drone movement, especially in windy conditions or during dynamic flights.
- **Software -** Drones come with different kinds of software, such as obstacle avoidance to prevent collisions with objects, people, and other animals. Some drone software includes a return-to-home (RTH) function that allows the equipment to return to the user automatically when the dispenser is low, or the job is completed. GPS capabilities allow users to plan paths, and you can purchase other types of software to meet your specific needs.
- **Local regulations -** In addition to federal guidelines noted above, check your local and federal regulations to see if there are restrictions on the types and sizes of drones you plan to use in different areas. There may be state-specific regulations or local ordinances that will affect how and where you may use a drone.

Tips for Use

- Learn how to fly the drone in an unpopulated area like a park with minimal obstructions, such as trees, powerlines, and buildings. Be aware of roads and moving or parked vehicles.

- Check the weather; wind can affect your flight. Also, avoid rainy and foggy weather where visibility is low.
- Unless your drone has special features, fly it during the daytime.
- Ensure that the drone's battery is fully charged and properly secured. Check that the propellers are securely attached and in good condition. You may want extra propellers on hand as they are easily damaged and might need to be replaced.
- Take a preflight to practice and ensure that the equipment works properly. Keep your drone within your line of sight if possible.
- Be mindful of your battery life. Use built-in features such as georeferencing, altitude limits, or beginner settings.
- Practice using return-to-home functionality to bring the drone back safely in case of disorientation.

Drone Uses in Home and School Gardens

Figure 1. *Drone Spraying Fertilizer*

Photo credit: Michigan State University Ag and Natural Resources

- **Overall monitoring:** You can use drones to inspect gardens regularly, monitoring progress and changes and identifying areas that require attention (Figure 1). You can observe your garden's transformation over time, including dynamic seasonal changes!
- **Landscaping and planning:** Capture aerial photographs or videos to establish an overview of your garden's layout, which can help you plan new landscaping features or identify problem areas.
- **Crop and plant health monitoring:** Some drones can carry multispectral cameras or Normalized Difference Vegetation Index (NDVI) sensors to assess plant health, detect stress, and spot nutrient deficiencies or diseases. You can use thermal cameras to identify over- or under-watered areas or plants under heat stress.
- **Wildlife monitoring:** You can monitor wildlife as it comes and goes in your garden.
- **Seed planting:** Some drones can drop seeds into prepared soil for easier planting.

- **Garden maintenance:** Drones can identify weeds in your garden that might need attention, and some can be used to add mulch to needed areas.

Fun Facts About Drones

Figure 2. *"Drone" Originally Referred to Male Bees, Inspired by the Buzzing Sound*

Photo credit: Purdue Extension

- **Ancient beginnings:** The concept of unmanned aerial systems (UAS) dates back to 1849 when Austria used unpiloted balloons filled with explosives against Venice.
- **Bird impersonators:** Some drones are designed to look and fly like birds, helping scientists study wildlife without disturbing animals.
- **First commercial drone delivery:** In 2016, a Domino's Pizza in New Zealand was delivered by drone, making history in food delivery.
- **Drone swarms:** Large groups of drones can fly in coordinated formations, often used in light shows. Intel set a Guinness World Record with 2,066 drones flying simultaneously.
- **Life savers:** Drones are used for life-saving missions, such as delivering defibrillators, searching for missing persons, or providing medical supplies in remote areas.
- **Drones in sports:** Drone racing is now a professional sport, complete with leagues, prize money, and high-speed courses.
- **Underwater drones:** Not all drones can fly! Some operate underwater for marine exploration, shipwreck studies, and environmental monitoring.
- **Agriculture revolution:** Farmers use drones for crop monitoring, irrigation management, and planting seeds, boosting efficiency and sustainability.
- **Record-setting speed:** The world's fastest drone, the DRL RacerX, reached up to 179.6 mph (289 km/h).
- **Military origins:** Modern drones were initially developed for military use, but their uses have since expanded into countless civilian applications. The term "drone" originally referred to male bees, inspired by the buzzing sound (Figure 2). The first drones were used in World War I as an experimental

military tool but currently are an essential part of warfare.

- **AI-powered autonomy:** The next generation of advanced drones uses artificial intelligence to avoid obstacles, follow subjects, or execute complex flight patterns with minimal human intervention.

Resources

- Drones in the classroom: University Corporation for Atmospheric Research (UCAR) Center for Science Education.
- Drones for seeding: "Frost Seeding Native Grasses and Forbs With a Drone (UAV): Lessons Learned," Purdue University Extension.
- Drone guidelines, regulations, and licensing:
  - Federal Aviation Administration.
  - "Introduction to Drones," USU Extension.
- Drone course: USU Extension Aggie Drone Academy.

Acknowledgments

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