Tucker Hartlaub
GEOG 270

Drones in Forestry

Drones are being expanded into many different industries as they get cheaper and more advanced. As we find more and more uses for UAS we are finding new applications where that could benefit different industries. When people think of drones or UAS many pay most of their attention to the vehicle itself. However, the real innovation comes from the different payloads that are developed. The new development of these new and better sensors allows for more diverse and accurate applications. The development of airborne sensors such as LiDAR, multispectral, and thermal sensors has opened many applications in the agriculture and forestry industries. Apart from sensors, larger drones with higher lifting capacity and advanced robotics allow for specialty payloads to help with different applications in both agriculture and forestry.

There is an extraordinary amount of uses and applications in which UAS can be used in forestry. However, for a use to be viable it has to meet a certain criterion to determine if it is beneficial to replace the current practice. The use of a UAS in forestry must be better in one or more of the following ways; less expensive, lower human life risk, faster, more accurate, and easier to use. If a UAV can improve one or multiple of these factors it can be a viable option to implement in forestry and most other industries. There are two subsets of the forestry industry that use UAS and they use them for different purposes and in different ways. The private industry focuses mostly on stand health and counts to determine health and estimate yields. The US Forest Service also uses UAS for this purpose but also uses drones to manage forests and forest fires. Stand count and yield are determined through the use of LiDAR technology that is able to measure the height and density of forest stands much faster than from the ground. There are also companies such as Treeswift who are developing AI UAS that can measure DBH (Diameter at Breast Height) of trees using LiDAR in order to get a more accurate understanding of the yield and health of a stand. Multispectral sensors allow foresters to measure the health and stress of stands through the use of mathematical indexes based of light reflecting off the foliage of the trees. One of the most common indexes is NDVI which takes values from reflected near-infrared light and red light. A healthy plant will reflect a large percentage of near-infrared light and will absorb a large percentage of red light, and vice versa for unhealthy or stressed plants. The values are then plugged into the following formula: NIR-Red/NIR+Red = NDVI. This formula will give you a value of -1 to 1, -1 to 0 being a dead plant or inanimate objects such as the ground, and .65 to 1 being a healthy plant. This can help see drought stress, disease or pest pressure, and other factors affecting a forest stand's health. The US Forest Service also uses these tools to measure their stand health, but they also have been using UAS to combat forest fires and protect firefighters better. One of the ways the US Forest Service uses drones is to scout forest fires and decide where to deploy firefighters to hold lines. This was typically done by manned helicopters and was expensive and sometimes impossible due to smoke levels. This allows for quicker engagement of fires with better placement and allows firefighters to have more information making the job slightly safer. Another way drones help the USFS is by allowing for faster-controlled burns. They do this with a hopper filled with small fire-starting balls connected to a UAS. This allows them to implement controlled burns faster and cover more ground. Controlled burns are essential to maintaining forest healthy by burning ground cover which serves as fuel if larger fires break out making it more difficult to stop these fires and

making them more extreme. The development and use of proprietary UAS and UAS attachments are key to the advancement of UAS technology. 3D printing is one of the technologies that is helping develop these proprietary uses as it allows a lower cost of entry and allows users to make multiple versions or change parts quickly. Once a payload is developed there can also be other uses for it in other industries with little to no changes.

There are many advantages and disadvantages to using a UAS, but each mission will vary on which ones apply and which ones don't. Advantages and disadvantages of a UAS also depend on what you are comparing it to, some missions might be using manned aircraft, and some might use simple ground workers or ground technology. Compared to manned aircraft UAS are cheaper, easier to fly, and safer. However, they also might be less accurate, not as reliable, and have much shorter flight times. Compared to simple groundwork a UAS is usually faster, more accurate, and can mitigate the risk to human life. Some disadvantages compared to groundwork are they are more expensive, have a higher barrier of entry, and added training needed for flying and software. The result of these different advantages and disadvantages means we must take each scenario on a case-to-case basis. Sometimes a UAS makes sense to replace the current technology being used and sometimes the disadvantages outweigh the advantages. There are many scenarios where it would be beneficial to use a UAS and they will become more prominent as the technology improves and costs lower.

In conclusion, UAS are still a young and emerging technology that can be used in many areas to help make the forestry industry safer, more informed, and lower costs. There are many uses being used in both the government and private sectors with more being developed for more efficient use and brand-new uses. While there can be some disadvantages to UAS there are also many advantages. These must be weighed on a case-by-case basis to determine whether the transition to a UAS will benefit the user. As UAS and sensor technology improve, and the cost is lowered they will become more prominent, and more companies/agencies will implement them. There will also be more proprietary uses for UAS as users get more comfortable and creative with different payloads and applications.

Resources

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