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Zhu, Jinlei, et al. "Improving Measurements of the Falling Trajectory and Terminal Velocity of Wind dispersed Seeds." *Ecology and Evolution*, vol. 12, no. 8, 2022, p. e9183–n/a, https://doi.org/10.1002/ece3.9183.

Physics Report - Major Connection
10/24/22

Paper: Improving Measurement of the Falling Trajectory and Terminal Velocity of Wind Dispersed Seeds

Summary:

The article I chose to read was titled "Improving Measurements of the Falling Trajectory and Terminal Velocity of wind-dispersed Seeds by Jinlei Zhu,Carsten M. Buchmann, and Frank M. Schurr for *Ecology and Evolution* 12(8). The purpose of this article was to determine if a new experimental design to measure the falling trajectory and terminal velocity of wind-dispersed seeds was accurate and reliable. As we all know plants produce seeds to reproduce, and one of the many dispersal methods plants use to spread out their seeds is by using the wind. Scientists believe that the key component in determining the success of seed dispersal is the seed's effective terminal velocity. Accurate estimations of terminal velocity are very important for determining or predicting the variation in dispersal ability. Seeds with a lower terminal velocity are often seen being transported further horizontally than those with a higher terminal velocity. This is because the lower terminal velocity increases the chances that turbulent airflows can uplift the seed, thus moving the seed more horizontally. Existing experiments used to test v_t fall into 3 categories. The first Lets seeds accelerate over certain distance then estimates v_t as vertical seed velocity but yields biased v_t values for seeds that continue accelerating past the allotted space. The second measures the air speed needed to suspend the seed in the air but difficulties arise when trying to measure that air speed. Vertical air flows can also damage smaller seeds and seeds with a complex

falling pattern. The third uses cameras to estimate v_t but only from one angle. The experimental design being evaluated uses a high resolution camera and mirror to record the falling seed from 2 different angles. Using "automated image analysis" a 3D seed trajectory is determined and a physical model of freefall is fitted to those trajectories with air resistance to estimate the terminal velocity of the seed (Jinlei et al. 2022).

Upon reading this article I did not realize that something I thought was so simple could be extremely hard to analyze in a laboratory setting. The concept of wind dispersed seeds is an integral part of understanding the ecology and diversity of an ecosystem. This also ties into the idea of competition between different species of plants who primarily compete for space and resources. For example plants that are able to produce seeds with low terminal velocities are able to very effectively expand their range and outcompete other plants in the same area. On the other hand if a species of plant relies on a high density of individuals in a small area for survival, heavy seeds that do not travel far before hitting the ground is a good adaptation for them to have. This concept of how terminal velocity affects the range of plants is very fascinating in that this information could be used to naturally repopulate an area of land that had its plants wiped out from either clear cutting or an naturally occurring event (forest fires, flooding, etc.). Some of the concepts from class that are directly related to this article is the idea of velocity in 2 dimensions (terminal velocity), projectile motion (a seed falling from a tree and the wind carrying it horizontally from a certain height), and even forces (wind and gravity).

In conclusion, I think this article gives great insight into how physics and ecology are intertwined. The concepts that are presented in this article are very interesting and I

believe with greater understanding of how the environment around us works, comes a greater appreciation for the natural world.

Reference:

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excellent job.
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