Applicant 4

GROUNDWATER ESSAY

The Impact of Water on the Arthropods of Bull Creek

In one of my high school classes, I was tasked with doing a biodiversity project. I decided to go in a different direction than most of the class by choosing to study arthropods over birds and woody plants. I wanted to determine the impact of water conditions on the ecosystem of arthropods, especially as you get closer to water. In Austin, the condition of the creek ecosystems are conditioned on the health of the groundwater systems. Not only did I find what I believed to be interesting results, but I also had a lot of fun going out to Bull Creek Park every Sunday to catch bugs and collect data.

My data showed a trend towards the distance from water affecting arthropod abundance. There was a minor difference in the value of average morphospecies caught per each distance, with values trended toward illustrating the distance from a water source on having an effect on the dispersal of arthropods, with the values at the far transects being less than those at the medium and close distance.

There are number of factors that affect the abundance of arthropods besides the distance to a standing water source. How the different organisms are able to get access to water is a big factor. Many organisms have developed adaptations in order to take in water without actually drinking it. Furthermore, water can be overabundant in some situations, or under abundant and arthropods have evolved to deal with this factor. (Edney 1977). Human interaction and control of the environment has a wide effect on the distribution of arthropods in a given area. A study of odonata species in South Africa illustrated the effects of humans on the order, with with odonata being very susceptible to the effects of human activity. (Samways 1996). Furthermore, a similar study on RIFA ants was conducted in California analyzing the abiotic factors on the distribution

on the insects. Factors such as elevation and distance to human disturbance were more of a factor on the ants, than distance to water. Argentine ants were more common in areas with more human contact, and in lower elevations, however factors such as distance from water were less important in predicting where the ants were. (Human 1998). This illustrates the view that distance to water only plays a minor role on the effects of distribution of arthropods in a given area, and any difference may not be significant in a numerical sense.

Improvements to our study would allow for clearer implications towards the effects of a water source on arthropod distribution. A larger data pool would decrease the chance of the difference between bug distribution to be left up to other biotic and abiotic factors, such as elevation and human activity. All transects had varying levels of human activity, weather, and elevation, so a larger data pool would help negate these other effects. Furthermore, Bull Creek District Park, the studied area, was quite narrow, so differences between distance from a water source were not that great. If transects were not so close together, then a greater variation between the number of arthropods found could be found.

Sally C. Levings and Donald M. Windsor researched the effect ground water moisture has on litter arthropods in Barro Colorado Island, Panama. The study was conducted in the dry season in artificially watered areas, compared to that of unmanipulated, dryer patches of ground. Levings and Windsor's data illustrated ants were more likely to migrate to wetter patches of ground, with there also being more arthropods collected in wetter areas than that of the drier ones. They concluded that in that more arthropods in general were more likely to migrate and be found in wetter patches of ground, and moisture of the ground plays a role in determining litter arthropod abundance. (Levings). For this reason, more arthropods could be expected to be found near water in Bull Creek because arthropods are more likely to migrate to wetter areas.

A similar study to the previously mentioned was conducted by researchers for Texas A&M University's Department of Entomology, comparing geological factors that affect red imported fire ant (RIFA) distribution and abundance in a Post Oak Savanna environment. Using many unconventional technologies, including aerial photography, videography, geographic information systems, and real-time differential global positioning, in order to map out the distribution and abundance of RIFA in the area. After collecting field data such as size of mounds, type of vegetation and dirt within the area, as well as genetic samples of the ants in order to get a reasonable idea of the geological factors in determining RIFA abundance and distribution. The researchers came to the conclusion that patch size, type, interference, and distance from water all affect RIFA community distribution and abundance. (Coulson). This supports the notion that the distance from water affects arthropod communities.

The book, *Food Webs at the Landscape Level,* Chapter 14, entitled Trophic Flows From Water to Land: Marine Input Affects Food Webs of Islands and Coastal Ecosystems Worldwide, discusses the role and relationship that organisms have between themselves, as well as the environment. The novel uses a multitude of scientific papers and studies to bolster its claims. This book presents data regarding the abundance of arthropods in and away from a large body of water. It illustrates the notion that arthropods are more abundant closer to larger bodies of water. For example, orb web spiders are six times more dense in regions near the coast of Baja California, instead of further inland where they are less common. (Power). This study also does support our hypothesis stating that arthropods and similar insects are affected by their distance to a standing water source.

This class research project inspired me to seek out other ways to learn about the animals and insects of the ecosystems of our central Texas creeks and streams. I was invited by Dr.

Suzanne Pierce to represent Pixel Profundo at the 2018 Annual Meeting of the American Association for the Advancement of Science. Pixel Profundo creates augmented reality education projects that combine augmented reality and 3D animations of animals and endangered species. I enjoyed presenting and explaining cutting edge technology to both children and adults. In college and beyond, I want to continue to learn and teach others about scientific themes critical to sustainable futures and natural systems.

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