Durango Nature Studies Habitat Assessment

2013

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Executive Summary

The Durango Nature Center, near Bondad, Colorado, was acquired by Durango Nature Studies (DNS) in June of 1998. As part of the negotiations to acquire the land, as well as the goals of DNS to "inspire a positive personal relationship with our natural world through non-profit outdoor education promoting an enhanced respect for nature," all 142 acres of land was placed under a conservation easement. The Florida River runs through the DNS property and, along with a pond, provides a habitat for fish, frogs, and macroinvertebrates.

In 2008, bullfrogs began to be reported on the DNS property by visitors and employees. Because bullfrogs are considered an invasive species and will naturally out-compete the native leopard frogs on the DNS property, DNS wanted Animas High School (AHS) to conduct annual surveys of these species. They want to keep tabs on the leopard frog and bullfrog populations and assess the health of the DNS ecosystem.

To accurately assess ecosystem health, the 10th grade AHS biology students made four separate trips to DNS property to collect a variety of field data. Water quality tests were done to gauge coliform bacteria, nitrates, pH (measure of acidity or alkalinity), dissolved oxygen, and phosphates. The students also made multiple vegetation plot surveys and captured and counted aquatic macroinvertebrates in both the Florida River and the pond on the DNS property. To estimate frog populations, students conducted visual encounter surveys and collected mark-recapture data.

DNS is a non-profit organization and as of 2007, the annual budget is $147,300. AHS students must make recommendations for moderation and management based on their collection data, but they must also keep the DNS budget in mind to ensure that their recommendations can be performed.

Species Overview

Rana pipiens

The northern leopard frog (Rana pipiens) is a formerly abundant frog that has experienced significant declines in population due to various factors and is recognized by its prominent lateral dorsal ridges. Rana pipiens ranges in size from 3 to 5 in (7.6 to 12.7 cm) and is found in most of northern North America and Canada, except on the Pacific Coast. They generally live near ponds and marshes and occasionally venture into well-covered grasslands. Northern leopard frogs are considered opportunistic eaters and will consume any form of nutrition that can fit in their mouths, mostly beetles, ants, flies, worms, smaller frogs (including their own species), birds, and garter snakes. They breed and overwinter (hibernate) in water bodies due to their intolerance towards freezing conditions, but the adults spend the entire post-breeding summer period (that is, July, August, and early September) in grassy meadows, open shrub areas, or damp woods, often far from any water. Female leopard frogs lay egg clutches that contain 2,000 to 6,500 eggs and are laid in shallow water either singularly or in communal masses of 25 to 40 clutches (Smith 2004 and Northern 2013).

Rana pipiens is considered a species of “State Special Concern” in Colorado according to Colorado Parks and Wildlife due to the modern threats of habitat destruction, diseases, chemical contamination, acidification, increased ultraviolet light due to loss of the ozone layer, introduced predators, over collecting, climatic changes, and general environmental degradation against the species (Smith 2004).

Rana catesbeiana

The bullfrog (Rana catesbeiana) is the largest of all North American frogs. Bullfrogs are typically green or gray-brown with brown spots and have easily identifiable circular eardrums, or

tympanum, on either side of their heads. Bullfrogs have been recorded to grow up to a length of 8 inches and weigh up to 1.5 pounds, but are more commonly found in the range between 3.5 to 6 inches long and weigh 1.1 pounds. The bullfrog is a native of eastern North America but has been introduced in areas ranging from southern Ontario to southern Mexico, as well as various locations in Europe, Asia, and South America. Rana catesbeiana is a generalist predator. This means that they will consume any form of nutrition that will fit into their mouths, including insects, mice, fish, birds, snakes, and other frogs. Bullfrogs spend the winter months (starting in October) hibernating at the bottom of breeding ponds until mid-April or early May when they emerge from their slumber and begin mating. If during any point in hibernation the temperature rises adequately, hibernation will be interrupted. Female bullfrogs produce up to 20,000 eggs. Males are highly territorial and will aggressively guard their land (Spitzen 2010).

The Colorado Division of Wildlife categorizes the bullfrog as an invasive species and states, “The introduction of the bullfrog is believed to be a major factor in the decline of native leopard frogs, as it outcompetes and preys on the native frogs.” The bullfrog is a threat to native amphibian and fish species due to its aggression towards other species and the harmful fungus that is carried on the bullfrog. Rana catesbeiana has a natural resistance to the disease chytridiomycosis, which is caused by the fungus batrachochytrium dendrobatidis, and is a means for the infection to spread. Chytridiomycosis is an emerging infectious disease that is considered one of the main causes of global amphibian declines and extinctions. Unlike most species, frogs absorb nutrients and water through their skin, but chytridiomycosis causes a microscopic change in the skin that prevents the infected frog from absorbing required nutrients. Another reason why bullfrogs are considered invasive is that they out-compete other species for resources and directly predate on other amphibians. Further more, they use their aggression to drive tadpoles out of safe regions of water into the open water where they are vulnerable to be

preyed upon by non-native bluegill fish (Spitzen 2010).

Results

During the Durango Nature Studies survey, water chemistry tests, vegetation plots, macroinvertebrate collection, and visual encounter data was collected. Based on macroinvertebrate data, the DNS pond yielded a total diversity index of 1.27 while the river provided a total of 1.41. (See Tables 4 and 5.) The vegetation plot data collected in Table 3 resulted in an average total diversity index of 1.16. The water chemistry tests conducted (in Table 2) presented pH level of 8 for both the Florida River and the DNS pond: this result means the water is considered alkaline. The dissolved oxygen test resulted in a level of 7.5 mg/L, which is considered normal in the pond. Due to a high concentration of sediments in the Florida River, the test for dissolved oxygen was inconclusive. The Florida River presented phosphate at a level of 4 ppm and 5 ppm for the pond, which is considered high and can contribute to excessive plant grow. The test for nitrogen levels came up as 1 ppm for the pond and 2 ppm for the Florida River. (Thus it is stable The coliform test for both the river and the pond yield a positive result. During the visual encounter survey (Table 1), a total of 37 person hours were conducted in surveying and resulted in an average of 6.25 leopard frogs and 0 bullfrogs being observed.

Habitat Assessment:

The Average Shannon-Weiner result of 1.16 (out of 5) for vegetation plot data, 1.27 for the pond, and 1.41 for the Florida River indicates that the Durango Nature Studies ecosystem is stable for the surrounding area. Shannon-Weiner is based on a scale of 1 to 5, and one would only find a result of 4 in a highly diverse rainforest near the equator (Shannon 2013).

During Animas High School's survey, no stoneflies were observed in either the pond or the Florida River. Out of all known macroinvertebrates, stoneflies have the lowest tolerance of

pollution and can't survive in moderate water quality (Pollution 2013). With this knowledge in hand, it can be assumed that both the Durango Nature Studies pond and the Florida River is polluted in some way, but due to the fact that other macroinvertebrates were collected, those waters can at least provide habitat for other macroinvertebrates that are not as sensitive to pollution.

The conducted survey yielded an elevated level of phosphorus found in the water. Phosphorus, found in the form of phosphates, is a nutrient required for plant growth and is a fundamental element in the metabolic reactions of plants and animals. Sources of phosphorus include human and animal wastes and decay, industrial wastes, runoff, fertilizers, and detergents that are near sources of water and can easily be washed or dropped into the water (Managing 2012).

Excess amounts of phosphorus cause extensive algae growth, called blooms, which lead to decreased oxygen levels in the water. When there is a spike in algae growth, excessive amounts of plant matter dies and is decomposed by animals. As the animal population increases, the biological oxygen demand (that is, how much oxygen animals in an environment need to survive) also increases, which creates unsustainable levels of dissolved oxygen in the water.

Students also performed a test for coliform, which yielded a positive result, but it is recommended that Animas High School students modify their testing methods to determine the exact level of coliform present in the water. Coliform is a common bacteria found in the intestinal tracts of all animals and in fecal matter. Coliform serves as an indicator for water quality and suggests the presence of other harmful protozoa and viruses. High levels of coliform may cause deformity in a developing *Rana pipiens*, as well as skin irritation.

To decrease the levels of both coliform and phosphorus contamination, it is suggested

that DNS ask owners of farmland and domestic animals upstream from the property to restrain their livestock to a specific area (around ¼ mile from the Florida river or any possible sources), preventing their feces from contaminating the water through runoff, wind, or other forces. Unfortunately there is no feasible way to control wild animals, such as deer, from stepping in waste and then carrying it to the water to be washed off (Managing 2013).

In the future it is recommended that for better data to be collected, Animas High School students should conduct surveys during the different life cycles of the leopard frog and during different hours of the day. It might be that during the breeding season, a smaller quantity of leopard frogs are seen, and the bullfrogs are more prominent. Water quality evaluations should also be conducted once every month to see the difference in nitrate, phosphate, and dissolved oxygen levels to determine when the water is most polluted and what surrounding areas could be contributing to the pollution (if any).

In three years of surveying, Animas High School students have never captured a bullfrog but have viewed and monitored them as well as received reports from DNS employees that they are present on the property. Thus students suggest that the capture methods be enhanced so that bullfrogs may be counted, collected, and examined.

One suggestion would be to use a pitfall trap. A pitfall trap is a trapping pit system for small animals. When an animal enters the trap, they are unable to escape and either die or remain unscathed. The Animas High School survey currently uses active collection methods, such as butterfly nets rather than pitfall traps, which are passive.

Animas High School students and DNS employees have come to the conclusion that active collection is difficult and time consuming, especially in the Durango Nature Studies habitat where it is hard to see the bull frogs in the thick grass and other vegetation shelters that are present throughout the property. Thus the current approach results in unreliable data. As

suggested above, bullfrogs should be trapped using pitfall traps. Next spring (year of of 2014), Durango Nature Studies employees should install the traps on the property around suspected bullfrog areas (that is, around the pond and in the bushes in the surrounding areas). The pitfall traps will contain sources of food ideal for a bullfrog (such as fake tadpoles, frogs, and so on.) Animas High School students, in alternation with DNS employees, could then check and monitor the traps periodically throughout the year including during the breeding season and the summer when they are at large. When bullfrogs are captured, they will be counted and disposed of. If a leopard frog or other small animal is mistakenly snared, it could be released (Use 2013).

To better monitor leopard frog populations, DNS could implement an ID tag system. Currently when a leopard frog is captured, it is marked and counted but there is no way to differentiate one marked leopard frog from another, and this results in the counting of the same frog (a double count). If Animas High School students began installing microchips in leopard frogs, they would be able to monitor the same frog throughout multiple years and have the ability to differentiate one leopard frog from another when conducting population surveys (Microchip 2013).

One modification to the Durango Nature Studies property to promote leopard frog population is to continue removing the invasive bullfrog species through the utilization of pitfall traps as stated above. With the bullfrogs gone, there will be minimal threat to the leopard frog's home range, which in turn will increase the leopard frog population (Home 2013).

To estimate populations, Animas High School students used two methods, mark-recapture and visual encounter surveys. Mark-recapture is when a portion of a population is captured, marked (with elastomer), and released. Later, another portion is captured and the number of marked individuals within the sample is counted. Because the number of marked individuals within the second sample should be proportional to the number of marked individuals

in the whole population, an estimate of the total population size can be obtained by dividing the number of marked individuals by the proportion of marked individuals in the second sample. This method is most useful when it is not practical to count all of the individuals in the population and is more reliable than a visual encounter survey (Kasmer 2013).

A visual encounter survey (VES) is a scan search to determine species diversity and population density. The VES works on four assumptions: 1) Every individual has an equal chance of being counted during the survey, 2) Each species is equally likely to be observed during each sampling session, 3) Each individual is only counted once, and 4) Results from two or more observers surveying the same area simultaneously are identical. This form of surveying is somewhat problematic when it comes to accuracy due to the fact that not all of the necessary assumptions will be met in any given situation (Haupt 2008). It is recommended that next year if a VES is conducted, Animas High School students set up transects to satisfy VES assumptions more accurately. (Students will walk in a straight line in a given direction and will count how many frogs they capture or observe.)

The most reliable form of surveying is mark-recapture and although it takes longer to execute the method, should always be referenced due to its low margin for error compared to a visual encounter survey and provides a better understanding of the size of a species population.

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