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**Amphibian population estimates and ecosystem assessment on the Durango Nature Studies property**

Introduction:

The Durango Nature Studies (DNS) is a 140 acre nature preserve located in Durango, Colorado, near the New Mexico border on Bondad Hill. Durango Nature Studies offers school & summer workshops, hikes, normal visits and professional training. The property is also a place for a large amount of organizations to research, such as Fort Lewis College, Colorado State University and Animas High School. There are a variety of habitats on the DNS property including a pond, grassland and parts of Florida River.

*Rana catesbeiana*(Bullfrogs) are an invasive species in Colorado that out-compete and endanger native frog populations, for example the population of *Rana pipiens*(Northern Leopard Frog)that currently inhabit in the Durango Nature Studies pond.

The four Animas High School Sophomore Biology classes conducted field research to learn more about amphibian populations on the Durango Nature Studies Property each day throughout the week of September 17th. The Students conducted visual encounter surveys according frogs, did mark re-capture sections, water quality tests in the pond and in Florida River, and Wildlife inventories.

**Natural History**

Leopard Frogs´ diet consists of a variety of prey including insects, arachnids, worms, crustaceans, and other small vertebrate prey.Aquatic habitats are needed for breeding and overwintering. The Northern Leopard Frog breeds in a variety of temporary and permanent aquatic habitats. Shallow water depths, abundant emergent vegetation, quiet areas and absence of predatory fish species are important characteristics of most successful breeding sites.

Terrestrial habitats are important for foraging anddispersal. This species forages in moist terrestrialenvironments, typically riparian habitats, but maymove farther during wet periods. Although it mayforage in a variety of terrestrial habitats, habitatswith short (15–30 cm tall) vegetation appear to be preferred and grass areas taller than 1m are avoided, asare wooded areas, open areas, and heavily grazed or mowed areas.

Bullfrogs prefer larger, deep, permanent water bodies, swamps, ponds, and lakes which are densely vegetated, where bullfrogs are usually found along the water's edge. Permanent wetlands are required for breeding. Bullfrog stomachs have been found to contain rodents, small turtles, snakes, frogs (including bullfrogs), birds, and a bat, as well as the many invertebrates, such as insects, which are the usual food of frogs.

**Methods & Materials**

The Animas High School Biology Students set up Pitfall traps on the first day. The following days, the traps were checked every day to see if a frog was captured. If a frog was captured, it was marked, identified and brought back into the pond by the students.

Visual encounter surveys were conducted around the pond each day for four days. That means that the students went into the pond with nets to try to catch individuals of Bullfrogs and Leopard Frogs. The frogs were identified and marked so that the students can recognize if the caught frog was already caught by students on other days or if it was captured for the first time.

Water chemistry test were conducted in the pond and in Florida River on the property to determine the water quality for each water body. PH values were checked to see how acidic or basic the water is.

The Students checked the Dissolved Oxygen in the water to measure which amount of oxygen is available for chemical reactions and for organisms in the water.

The amount of Nitrates was checked, too to see if there is too much of it in the water which would cause water problems.

The Biology Students also checked if there are too many phosphates in the water. If so, it would cause plant growth and algae blooms which causes that less oxygen is available for other organisms.

Four random Vegetation Plot Surveys were conducted on the grassland on the DNS property by the students. That means that the students chose a random place in the grassland and counted the different plant species they can see in a square.

The students also collected Macro invertebratesin the River and the pond. The caught invertebrates were later counted and identified.

**Results**

Based on Macro invertebrate collection and the Shannon-Weiner Index, the Diversity is higher in the DNS pond in 2012 than in 2011. In 2011, more Invertebrates could have been found. In Florida River, more Invertebrates could have been found in 2012 than in 2011 and the Diversity is lower than in 2011. Based on the mark-recapture and the visual-encounter data 2012, the population of *Rana pipiens* on the DNS property is estimated to be 13.Based on the visual-encounter data, the population of *Rana catesbieana* is estimated to be 1. 2011, based on the DNS data, the population of *Rana pipiens* was estimated to be 1 and the population of *Rana catesbieana* was estimated to be 2. That means that there is a decrease of both populations, based on the data.Florida River and DNS pond water is alkaline. In both water bodies, the Nitrogen levels are higher than normal but have not reached a dangerous level. Phosphates levels in DNS pond and Florida River are both 4, the normal level is 0.03. Florida River contains more dissolved oxygen (3 like the normal level) than DNS pond (1). Coliform can be found in both water bodies on the DNS property.

**Discussion and Conclusion**

The diversity index in the DNS pond is higher in 2012 than in 2011 but less Macro invertebrates could be found in 2012 than in 2011. Since the diversity index in 2012 is higher than 1, the ecosystem is most likely to be stabile. But the ecosystem in the DNS pond in 2011 is estimated to be healthy, too because the diversity index is almost 1 (0,976). In Florida River, the stability of the ecosystem is higher in 2011 than in 2012 even though more Invertebrates could be found in 2012 than in 2011.

Phosphates levels of 4 could be found in Florida River and the DNS pond. The normal levels for Phosphates are 0.03. That means that there is a high risk of algae blooms in both water bodies on the DNS property. Algae blooms would cause immense problems for the Macro invertebrates, fishes, frogs, and other amphibians that current habituating in Florida River and in the DHS pond because the more algae are there, the more dissolved oxygen is used by them and the less oxygen is available for other organisms and for chemical reactions.

Both, Florida River and DNS pond include coliform bacteria.When coliform bacteria can be found, there may have been recent fecal contamination, although not necessarily human in origin. This Coliform on its own may not be harmful but if the water contains fecal coliform it can be harmful for organisms in this habitat. Fecal coliform bacteria can, just like phosphates, reduce oxygen level and cause Eutrophication (algae blooms and less oxygen available for amphibians and invertebrates).

The Nitrogen levels in Florida River and DNS pond are higher than the normal levels (10 in Florida River, 6 in the DNS pond, 4 is a normal level) but it does not influence the organisms or the ecosystem because dangerous Nitrogen levels are 40.

The water in Florida River and in the DNS pond is alkaline. Water bodies can become alkaline by dissolve materials from rocks and soil. The pH value in the DNS pond is 10 which is pretty high and means that less acid-forming free hydrogen ions are available in the pond water. Organisms such as fishes in the pond are endangered when the pH value is higher than 9.

 I don´t think that Leopard Frogs (*Rana pipiens*) are endangered by Bullfrogs (*Rana catesbieana*) in the pond on the DNS property because based on Animas High School research data, the population of Leopard Frogs is estimated to be 13 and the population of Bullfrogs is estimated to 1. Only one bullfrog can´t kill a whole population of Leopard Frogs because it can´t reproduce.

**Charts and Tables**

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| **Florida River Water Quality** |  |  |  |
|  |  |  |  |
| Test Type | Levels | Normal Levels | Dangerous Levels |
| pH | 8 | 7 |  |
| Nitrogen | 10 | 4 | 40 |
| Phosphates | 4 | 0,03 |  |
| Dissolved Oxygen | 3 | 3 |  |
| Coliform | Positive |  |  |
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| **DNS Pond Water Quality** |  |  |  |
|  |  |  |  |
| Test Type | Levels | Normal Levels | Dangerous Levels |
| pH | 10 | 7 |  |
| Nitrogen | 6 | 4 | 40 |
| Phosphates | 4 | 0,03 |  |
| Dissolved Oxygen | 1 | 3 |  |
| Coliform | Positive |  |  |

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| Table 1: Macro invertebrate Data 2011 |  |  |  |  |  |  |  |
| **DNS Pond** |  |  |  | **Florida River 2011** |  |  |
| Invertebrate | Quantity | Pollution Tolerance |  | Invertebrate | Quantity | Pollution Tolerance |  |
| Damselfly | 53 | 5,20 | 0,34018 | Damselfly | 0 | 5,20 | 0 |
| Mayfly | 41 | 3,5 | 0,36635 | Mayfly | 125 | 3,5 | 0,35653158 |
| Midge | 5 | 7 | 0,14782 | Midge | 15 | 7 | 0,16057621 |
| Caddisfly | 2 | 2,8 | 0,07709 | Caddisfly | 120 | 2,8 | 0,36041343 |
| Dragonfly | 1 | 5,2 | 0,04534 | Dragonfly | 0 | 5,2 | 0 |
| Blackfly | 0 | 6 | 0 | Blackfly | 5 | 6 | 0,07387007 |
| Riffle Beetle | 0 | 4 | 0 | Riffle Beetle | 5 | 4 | 0,07387007 |
| Cranefly | 0 | 3 | 0 | Cranefly | 0 | 3 | 0 |
| Stonefly | 0 | 1,1 | 0 | Stonefly | 0 | 1,1 | 0 |
|  | 102 | Diversity Index | 0,97678 |  | 270 | Diversity Index | 1,02526137 |
|  |  |  |  |  |  |  |  |
| Table 2: MacroinvertebrateData 2012 |  |  |  |  |  |  |  |
| **DNS Pond** |  |  |  | **Florida River 2012** |  |  |
| Invertebrate | Quantity | Pollution Tolerance |  | Invertebrate | Quantity | Pollution Tolerance |  |
| Damselfly | 5 | 5,20 | 0,34657 | Damselfly | 0 | 5,20 | 0 |
| Mayfly | 10 | 3,5 | 0,34657 | Mayfly | 57 | 3,5 | 0,29034024 |
| Midge | 0 | 7 | 0 | Midge | 14 | 7 | 0,12531141 |
| Caddisfly | 0 | 2,8 | 0 | Caddisfly | 270 | 2,8 | 0,22158686 |
| Dragonfly | 2 | 5,2 | 0,23026 | Dragonfly | 2 | 5,2 | 0,02859344 |
| Blackfly | 0 | 6 | 0 | Blackfly | 1 | 6 | 0,01620097 |
| Riffle Beetle | 3 | 4 | 0,28457 | Riffle Beetle | 11 | 4 | 0,10574683 |
| Cranefly | 0 | 3 | 0 | Cranefly | 9 | 3 | 0,09148177 |
| Stonefly | 0 | 1,1 | 0 | Stonefly | 0 | 1,1 | 0 |
|  | 20 | Diversity Index | 1,20797 |  | 364 | Diversity Index | 0,87926151 |

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**Bibliography**

* Sources on Colleen Dunning´s DP (Resources Section)
* Wikipedia (Articles: Leopard Frog, Fecal coliform and Bullfrog)
* Research results of Biology classes of Animas High School
* Charts and data from class
* Class copies
* <http://www.waksmanfoundation.org/labs/rochester/coliform.htm>
* <http://www.ehow.com/about_6389345_pond-alkaline_.html#ixzz28xPko7hx>