FACTORS INFLUENCING DENITRIFICATION IN AGRICULTRUALLY ADJACENT WETLANDS

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Project Background

- Wetlands are responsible for removing 50% of the terrestrial nitrogen.
- Denitrification is the main process that removes nitrate from the water in wetlands.
- The area surrounding our site is dominated by irrigated crops and pastures will often have excess nutrient run off, predominately during the irrigation season.
- Samples were obtained from the lakeshore wetland within Lake Lowell. Lake Lowell is located within Deerflat National Wildlife Refuge in Nampa, ID. It serves as an irrigation catchment, recreation area, and wildlife management area (Fig. 1).

Fig. 1: Lake shore wetland within Lake Lowell with our transect layout .

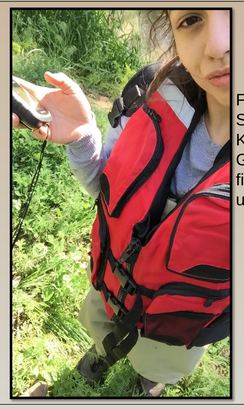

Fig. 2: Scientist Karina Gutierrez in field work uniform.

Project Objectives

- Evaluate the status of chemical nutrient levels in wetland soils subject to irrigation run off.
- Identify factors affecting the ability of the wetlands to provide the ecosystem service of denitrification.

Methods

- Soil core samples were taken from equal distances along a 800ft transect; five depths per site (Fig. 3).
- Nitrate and ammonia were extracted with KCl and quantified by flow injection analysis.
- Total carbon and nitrogen were analyzed by dry combustion (Fig. 9).
- Organic content was analyzed by loss on ignition.
- Field water quality tests were conducted throughout June and July (Fig. 4).

Fig. 3: Soil core samples taken from transect.

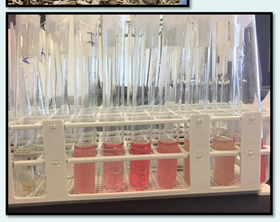

Fig. 4: (Below) Hach company nitrate water quality test.

Results

Nitrogen Accumulation:

- Total nitrogen and nitrate in soil samples was generally high throughout the transect (Fig. 5).
- Studies have shown that higher soil nitrogen and nitrate levels result in higher denitrification rates.
- Our analysis of the standing water in the wetlands indicated that the wetlands filtered more nitrates in the upland areas.

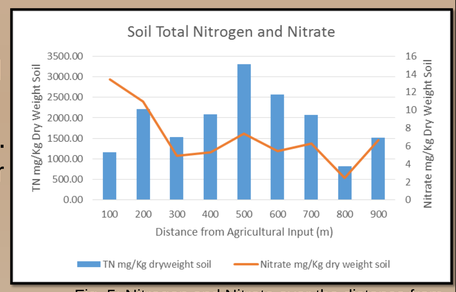

Fig. 5: Nitrogen and Nitrate over the distance from agricultural input to the lake.

Organic Matter:

- Total Carbon and Organic Matter was generally high throughout the transect (Fig. 6).
- Organic matter must be present for denitrification to occur.
- Organic carbon availability can come from plant material, soil matrix, and decomposable plant littler. Willow vegetation in the middle of our transect seems to supply the most soil organic matter.

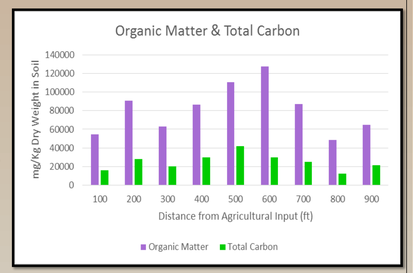

Fig. 6: Comparing organic matter and total carbon levels of dry soil weight in relation to the distance from the agricultural input.

Vegetation:

- Submergent and emergent plants have been shown to have a positive effect on denitrification levels.
- Canarygrass was the predominant vegetation found in the first 400ft of our transect (Fig. 7).
- Canarygrass is reported to produce denitrification rates at 70%.
- Towards the end that is closest to the lake, there is a vast abundance of smartweed, a plant known to accumulate nitrate in its tissues.

Fig. 7: The transect vegetation is characterized by 400ft of Canarygrass, followed by 200ft of willows, and more than 400ft of smartweed.

Land Use:

- The surrounding area is dominated by irrigated crops and pastures providing excess nitrate during the irrigation season.
- As a nitrate priority area, there is also elevated concentration of nitrate in the groundwater (Fig. 8).
- Nitrate inputs increased throughout the irrigation season.

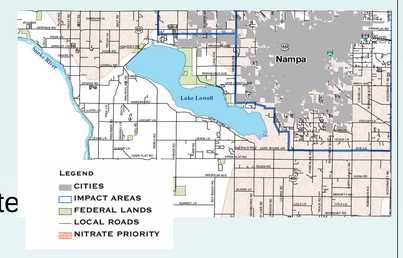

Fig. 8: Nitrate priority area surrounding Lake Lowell.

Fig. 9: Preparing soil samples for elemental analysis. (Left) Soil before Ball Mill instrument. (Right) Soil after Ball Mill instrument.

Conclusions/Discussion

- Our study indicates that the lakeshore wetland exhibits many of the factors necessary to provide the service of denitrification.
- The accumulated carbon and nitrogen in the soil can have had a positive effect on denitrification rates.
- The presence of Canarygrass represents a positive impact on denitrification potential. Some of the benefits were lost as the water level decreased because the grass was only in the uplands area.
- The denitrification service the wetland is providing could be supported by keeping the water level high, reducing the amount of runoff entering the area, and increasing biodiversity of the vegetation.

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