Exploring the Use of *Eleocharis palustris* and *Phyleum pratense* to Filter out Cu and Pb in Stormwater Runoff Entering The Laramie River, Wyoming

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Exploring the Use of *Eleocharis palustris* and *Phleum pratense* to Filter Out Cu and Pb In Stormwater Runoff Entering the Laramie River

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Pollutants from urban stormwater are a threat to the water quality of the receiving waters (Fulcher, 1994). In many places vegetation has been used to filter out contaminants from sewage treatment plants, mine effluent and agricultural effluent. Native and non-native species of vegetation can also be used to help filter out heavy metal contaminants entering the fluvial environment through storm sewer outflows (Ellis, J.B. *et al.* 1994 and Startin, 1994). The objectives of this study are (1) to determine the dominant native and non-native herbaceous riparian species growing in storm water gullies which discharge into the Laramie River (2) to compare the uptake of Cu (Copper) and Pb (Lead) between two species in a greenhouse experiment (3) compare how the metals are partitioned between roots and shoots (4) to determine if the two species are suitable for revegetation of disturbed areas within the storm sewer gullies. The study area consisted of two stormwater outflow gullies which discharge into the Laramie River at Laramie, Wyoming. The greenhouse experiment was conducted at the University of Wyoming Plant Soil and Insect Sciences 30th Street Greenhouse in Laramie.

To determine the dominant native and non-native herbaceous riparian species a vegetation survey was conducted along the Steele Street and Harney Street storm sewer outflow (SSO) gullies during July, 1995. This survey was conducted using the transect method. Selection of these two gullies was based on a study by Parker which identified these two gullies as having the highest storm water effluent heavy metal concentrations (Parker, 1994). Selection of Cu and Pb for the experiment was based on the above noted data as well as on sediment samples which were collected at the mouth of the SSO in July, 1995.

Results of the vegetation survey identified *Eloecharis palustris* as the dominant native herbaceous species. *Phalaris arundinacea* was found to be the dominant non-native however, given the invasive nature of this species and the objectives of this study it was determined to be unsuitable. *Phleum pratense*, the second dominant herbaceous non-native species, was selected.

To compare the uptake of Cu and Pb between the two species a greenhouse study was conducted over an eight week period. The greenhouse experiment consisted of a randomized complete block design with a three replications and a 4x2x2 factorial treatment structure of 4 metal concentrations, 2 metals, and 2 species. Cu and Pb concentrations of 1, 10 and 100 mg/kg as well as a control were used. Plants were grown from seed in a 1:1:1 mixture of sand, peat and vermiculite in aerated undrained tanks. After it was determined that enough plant material was available for analysis plants were dosed twice a week with either the Cu or Pb solution. Deionized water was added to the control. Nutrients were supplied weekly in the form of Hoagland's Nutrient Solution. After eight weeks the plants were harvested and roots and shoots were separated and oven dried. Plant roots, shoots, soil and interstitial water were analyzed on a per gram basis for either Cu or Pb using Atomic Absorption Spectroscopy. Results will be analyzed using ANOVA.

Data summaries have been conducted for roots and shoots. Cu and Pb concentrations for roots and shoots are noted below in Table 1 and Table 2, respectively. For both species root and shoot Cu levels increased with increasing treatment concentrations. Copper concentrations in both species were higher in the roots than the shoots. Concentrations of Cu were greater in the roots of the *Phleum pratense* than in the roots of the *Eleocharis palustris* for all treatment levels. Copper levels within the shoots were higher in the Phleum pratense with the exception of the control and 10 mg/kg treatment.

Table 1: Available Cu in roots and shoots.

	Roots	**Shoot**
***Eleocharis palustris*:**		
0 mg/kg (control)	58.0721	14.1066
1 mg/kg	78.3318	16.3396
10 mg/kg	161.0902	65.9037
100 mg/kg	310.5149	216.2892
***Phleum pratense*:**		
0 mg/kg (control)	98.2765	10.8812
1 mg/kg	139.8818	18.4441
10 mg/kg	584.7205	64.5027
100 mg/kg	615.3996	244.5433

As with Cu, Pb levels detected in root and shoot tissue increased with increasing treatment levels. Lead concentrations were higher in the shoots than the roots of *Eloecharis palustris* for all treatment levels. For *Phleum pratense*, lead root/shoot partitioning with respect to treatment concentrations were more variable. Lead levels found in root tissues were similar between the two species. *Eleocharis palustris* shoots contained more lead than the *Phleum pratense* for three out of the four treatment levels.

Table 2: Available lead in roots and shoots.

	Roots	**Shoot**
***Eleocharis palustris*:**		
0 mg/kg (control)	4.7267	4.9732
1 mg/kg	9.9116	24.4386
10 mg/kg	17.7580	36.0467
100 mg/kg	127.7549	229.7526
***Phleum pratense*:**		
0 mg/kg (control)	8.5403	4.5565
1 mg/kg	11.3292	10.1052
10 mg/kg	17.6599	48.4900
100 mg/kg	144.3461	149.7566

Preliminary data analysis indicates that with an increase in Pb and Cu treatment levels, bioaccumulation of the metal in the plant tissues increased. Uptake of the two metals is variable between the two species as is the partitioning of the metals within the roots and shoots. Partitioning of the metals occurred in below and aboveground tissues suggesting the two species can potentially be used to filter Cu and Pb from stormwater.

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