# Investigating the Effect of Invasive Plants-Derived Biochar On Heavy Metal Adsorption

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## Introduction

Constructed wetlands, designed to mimic natural elements, provide essential functions like flood mitigation and water purification but face vulnerability to invasive plants and heavy metal influx from sources like road runoff.[1,2,3] Invasive plants disrupt water flow, accumulate biomass, and outcompete native plants. Incorporating biochar in wetland remediation is increasingly popular for its rapidity and strong pollutant affinity, presenting low-cost and diverse environmental benefits.[4,5] However, a knowledge gap exists in utilizing invasive plants for biochar production. **Our research addresses this by exploring biochar's heavy metal adsorption efficiency from three (3) distinct invasive plants and determining the optimum application rate.** This presents a potential solution to challenges related to wetland biomass and heavy metal accumulation**.**

**H1:** Biochar derived from *Typha* × *glauca* is anticipated to have superior heavy metal adsorption capacity, due to its large surface area and interaction with metallic cations.

## Methods

In Fall 2023, we conducted a 16 weeks greenhouse study simulating constructed wetlands with elevated Pb, Cr, and As levels. Biochar, produced through the distinct pyrolysis of *Typha* × *glauca* (hybrid cattail), *Phragmites australis* (common reed), and *Rhamnus cathartic*a (European buckthorn) at 500°C for 2 hours (Fig. 1,2) was applied at rates of 0, 10, and 25 t/ha. Midway through the study, live cattail rhizomes were introduced to assess their hyperaccumulation potential (Fig. 4.) Thorough data collection included analyses of soil, biochar, and T. × glauca tissues using techniques like ICP-MS, ion chromatography, and FTIR. Statistical analyses will be conducted using a Three-Way ANOVA in R.

## Research Question

**Q1**. How efficient is invasive plant-derived biochar in adsorbing heavy metals in constructed wetlands?

**Q2.** What is the optimal application rate for invasive plant-derived biochar in constructed wetlands?

**Figure.1**. Biochar production using the double barrel method

**Figure 2.** Resultant biochar after 2 hours of double barrel pyrolysis

**Figure 3.** Biochar from *Typha* × *glauca*

**Figure 4.** Experimental setup at Loyola University Experimental Greenhouse

## Results

Chemical and statistical results are forthcoming on the printed poster

## Looking Forward

Anticipated findings propose that invasive plant-derived biochar, serving as a removable filter for distressed constructed wetlands, mitigates heavy metal impacts, particularly from road runoff. Integrated into wetland management, this biochar fulfills a dual purpose by managing invasive plant biomass and sequestering harmful pollutants, contributing to the restoration of native vegetation, wetland function, hydrology, and biodiversity.

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