The *Ph-UEL* project: a circular system-thinking for water hyacinth biomass transformation and valorization

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Invasive plants pose a growing global challenge due to their damaging effects on ecosystems, biodiversity, and infrastructure such as dams and bridges. Among them, water hyacinth (WH) stands out as a prolific and problematic species. Controlling invasive plants represents a major financial burden, with European control efforts alone reaching €116 billion over the past 60 years. The *Ph-UEL* project has attempted to understand the potential of WH as a phosphorus-rich agricultural enhancer through its structural, biological, and chemical characteristics, aligned with a strong field component. Alongside, the *Ph-UEL* project recognizes the role of public engagement in environmental stewardship, prioritizing also raising awareness about the broader impacts of invasive species through its Instagram page *NOVOJACINTO*.

Preliminary analyses of WH biomass collected from four urban and agricultural areas revealed location-dependent accumulation patterns. Roots accumulated more heavy metals (As, Fe, Cd, Ni, Mn, Pb), while aerial parts concentrated essential nutrients (P, Ca, K, Mg, B). WH samples from intensively farmed areas showed elevated phosphorus content – alongside potentially toxic elements – highlighting the need for site-specific risk assessment. Additionally, structural analysis indicated high levels of recalcitrant biomass (48–63% lignin, hemicellulose, and cellulose), reinforcing WH's potential as a stable soil input. These findings suggest WH could serve as a sustainable phosphorus source in agriculture, provided its safe use is ensured through foundational studies like this one. As for the public engagement, *NOVOJACINTO* accounts with 107 followers, and more than 1,000 visualizations in which usuaries access to fact sheets about this invasive species, reinforcing the role of Ph-UEL in educational and outreach efforts to raise awareness about biological invasions.

FIGURE 1
Ph-UEL project's scientific and public outreach: showcase of water hyacinth research, educational facts, and the @novojacinto Instagram initiative.