Wastewater treatment trees: can forest filters help solve our wastewater crisis?

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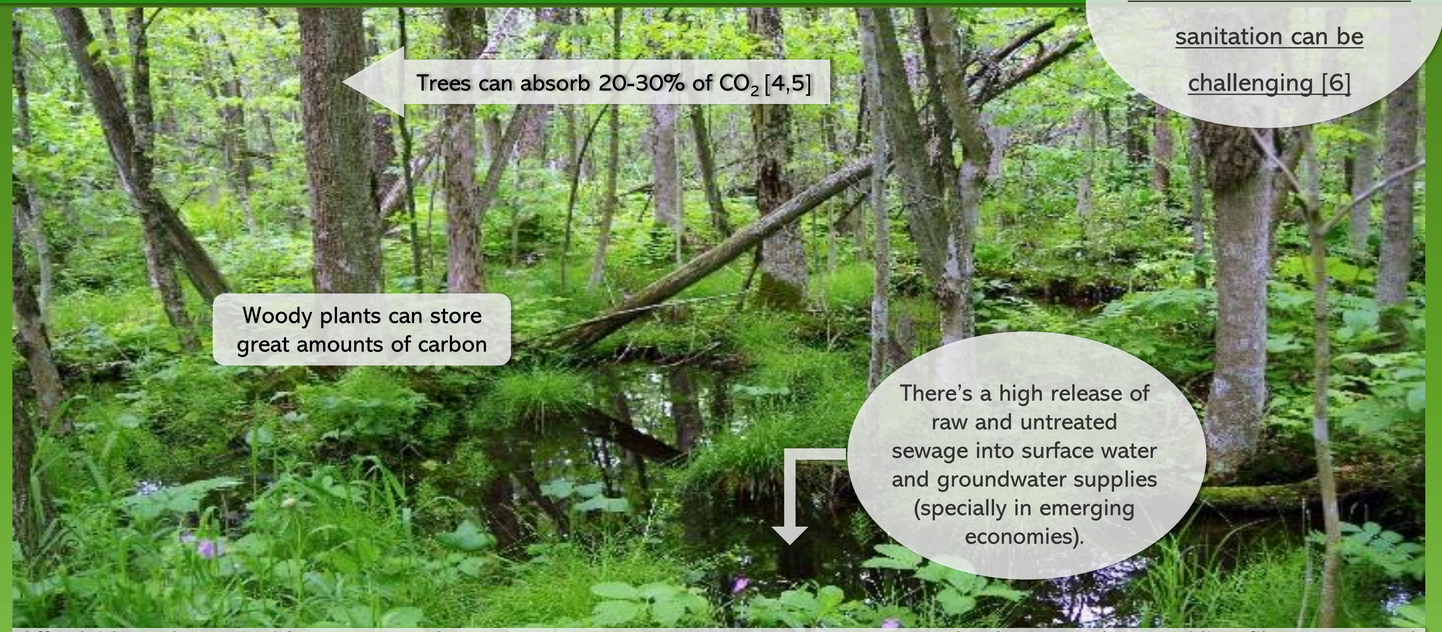
Develop models for the movement and fate of pollutants in relation to the quantity and quality of tree growth, and the soil and light conditions.

Understand the changing limits to tree growth under nutrient and water availability through the monitoring of changing tree biomass allocation and water use efficiency.

Understand how irrigation by wastewater can support and maintain forested landscapes, how human beings will interact with the forest, and what the consequences will be over different time scales.

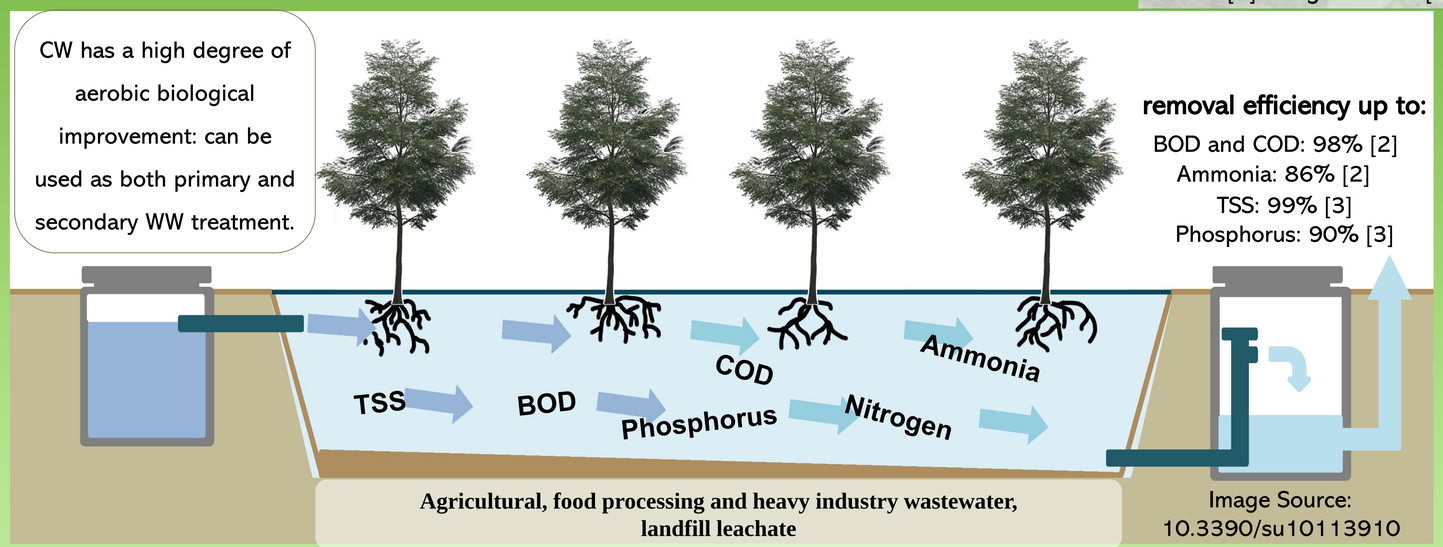
Understand and quantify the economic value of increased forestry products yield, in comparison to conventional rain-fed irrigation.

Understand the safety aspects and perceptions by consumers related to water re-use following root-zone purification and possible supplementary treatments.



Affordable and sustainable treatment alternative to expensive wastewater treatment technologies such as trickling filters, activated sludge processes, waste stabilization pounds, up-flow anaerobic baffled reactor, moving bed biofilm reactor and sequential batch reactor [1]. Image Source: [7]

CW has a high degree of aerobic biological improvement: can be used as both primary and secondary WW treatment.



removal efficiency up to:

BOD and COD: 98% [2]
Ammonia: 86% [2]
TSS: 99% [3]
Phosphorus: 90% [3]

Agricultural, food processing and heavy industry wastewater, landfill leachate

Image Source: 10.3390/su10113910

Expected Results

- Removal efficiency of the main pollutants in the wastewater;
- Where the pollutants will accumulate in the woody vegetation (above- or belowground);
- Quantify and qualify the amount of biomass production due to CO_2 and wastewater fertilization.
- Discover the limitations and possibilities of CO_2 fertilization and nutrient uptake from wastewater.

Areas to be Developed

- The design type of the examined wetland;
- A deeper research in modelling Applied to wetlands;
- Type of woody vegetation;
- Analyse Carbon, Biomass, tree growth and CO2 assimilation relation.

[1] Parde, D., Patwa, A., Shukla, A., Vijay, R., Killedar, D., and Kumar, R. (2020). **A review of constructed wetland on type, treatment and technology of wastewater**. Environmental Technology & Innovation, 101261. **https://doi.org/10.1016/j.eti.2020.101261**; [2] Saeed, T., Afrin, R., Muyeed, A., and Sun, G. (2012**). Treatment of tannery wastewater in a pilot-scale hybrid constructed wetland system in Bangladesh**. *Chemosphere*, 88(9), 1065-1073. **https://doi.org/10.1016/j.chemosphere.2012.04.055**; [3] Bosak, V., VanderZaag, A., Crolla, A., Kinsley, C., and Gordon, R. (2016). **Performance of a Constructed Wetland and Pretreatment System Receiving Potato Farm Wash Water**. *Water*, 8(5), 183. **http://doi.org/10.3390/w8050183;** [4] Bonan, G. (2008). **Forests and Climate Change: Forcings, Feedbacks, and the Climate Benefits of Forests**. *Science*, 320(5882), 1444-1449. **http://doi.org/10.1126/science.1155121**; [5] Le Quéré, C., Andrew, R., Friedlingstein, P., Sitch, S., Pongratz, J., Manning, A., Korsbakken, J., Peters, G., Canadell, J., Jackson, R., Boden, T., Tans, P., Andrews, O., Arora, V., Bakker, D., Barbero, L., Becker, M., Betts, R., Bopp, L., Chevallier, F., Chini, L., Ciais, P., Cosca, C., Cross, J., Currie, K., Gasser, T., Harris, I., Hauck, J., Haverd, V., Houghton, R., Hunt, C., Hurtt, G., Ilyina, T., Jain, A., Kato, E., Kautz, M., Keeling, R., Klein Goldewijk, K., Körtzinger, A., Landschützer, P., Lefèvre, N., Lenton, A., Lienert, S., Lima, I., Lombardozzi, D., Metzl, N., Millero, F., Monteiro, P., Munro, D., Nabel, J., Nakaoka, S., Nojiri, Y., Padin, X., Peregon, A., Pfeil, B., Pierrot, D., Poulter, B., Rehder, G., Reimer, J., Rödenbeck, C., Schwinger, J., Séférian, R., Skjelvan, I., Stocker, B., Tian, H., Tilbrook, B., Tubiello, F., van der Laan-Luijkx, I., van der Werf, G., van Heuven, S., Viovy, N., Vuichard, N., Walker, A., Watson, A., Wiltshire, A., Zaehle, S., and Zhu, D. (2018). **Global Carbon Budget 2017**. *Earth System Science Data*, 10(1), 405-448. **https://doi.org/10.5194/essd-10-405-2018.** [6] World Health Organization. (2019). **Progress on household drinking water, sanitation and hygiene 2000-2017**. ISBN: 978-92-415-1623-5.[7] Wetlands Association, W. (2017) **Small wetlands make big impact** [online]. Available from: https://www.wisconsinwetlands.org/updates/small-wetlands-make-big-impact/ [Accessed 22 January 2021]. [8]

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