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Understanding hydrocarbon fate and transport in peat soils using column experiments

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HS8.1.6 – Hydrogeophysics: a tool for hydrology, ecology, agronomy and beyond

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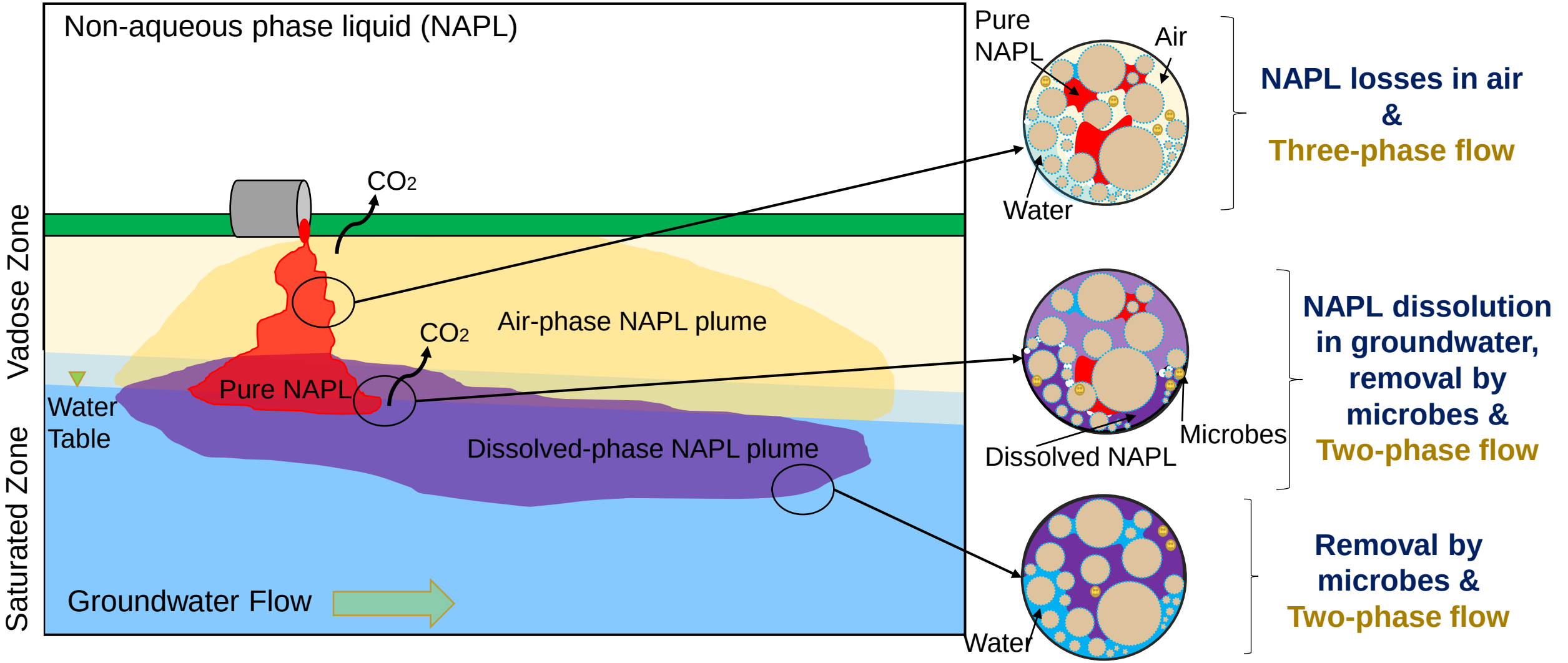
Our research work



- A better understanding of potential transport pathways, rates, and more efficient clean-up strategies is needed **to improve shallow groundwater quality.**

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Research questions our work can help to address

Use **physical** measurements and **computer**-based approaches to answer research questions:

- How do groundwater **rise and fall redistribute** organic **contaminants?**
- How do groundwater dynamics enhance the growth of soil **microbes** to **remove** organic **contaminants**?

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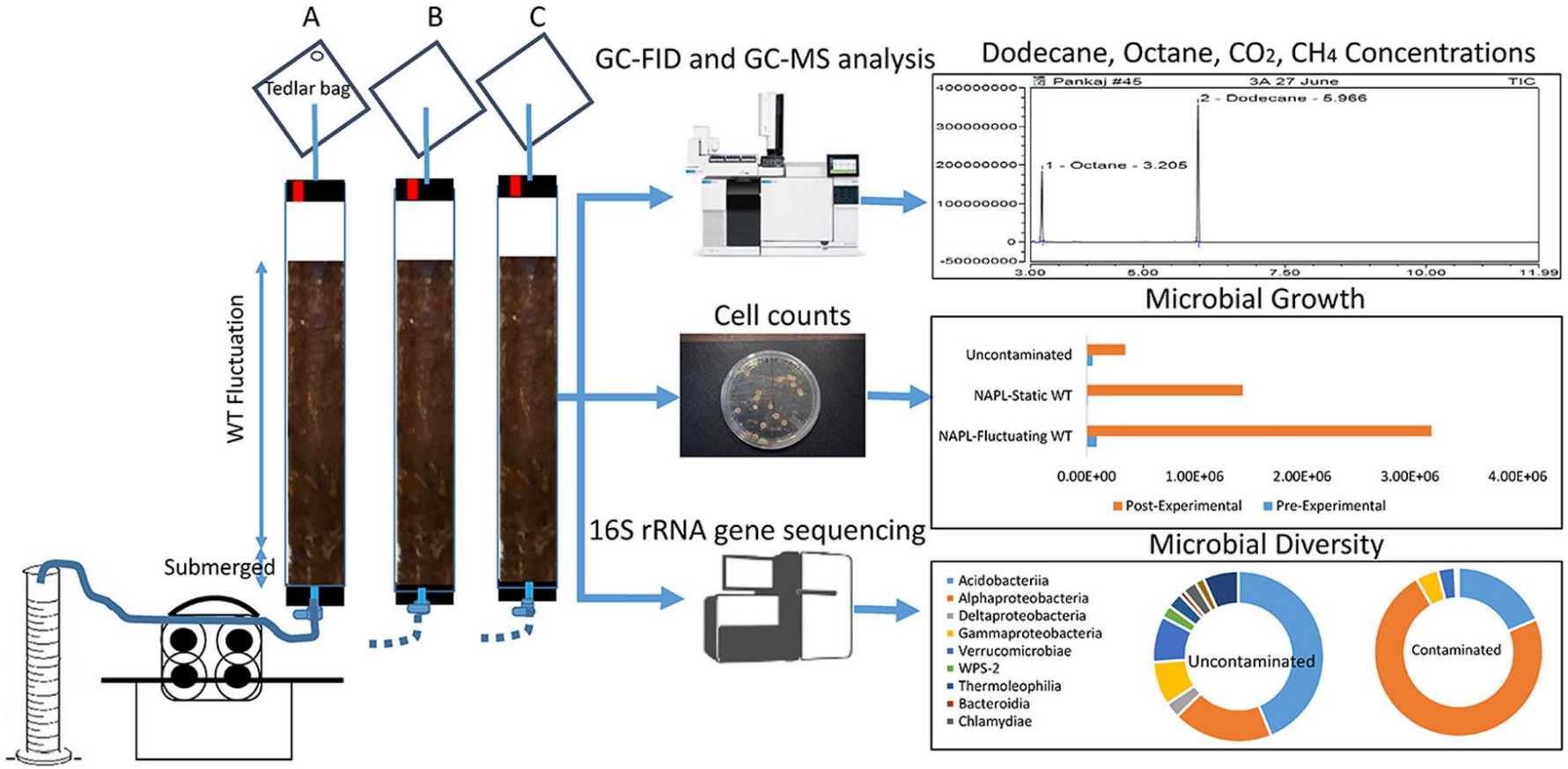
Our Experiments

- Controlled laboratory experiments to simulate the movement and fate of NAPL contaminants in undisturbed peat soil (0-35cm depth) columns.



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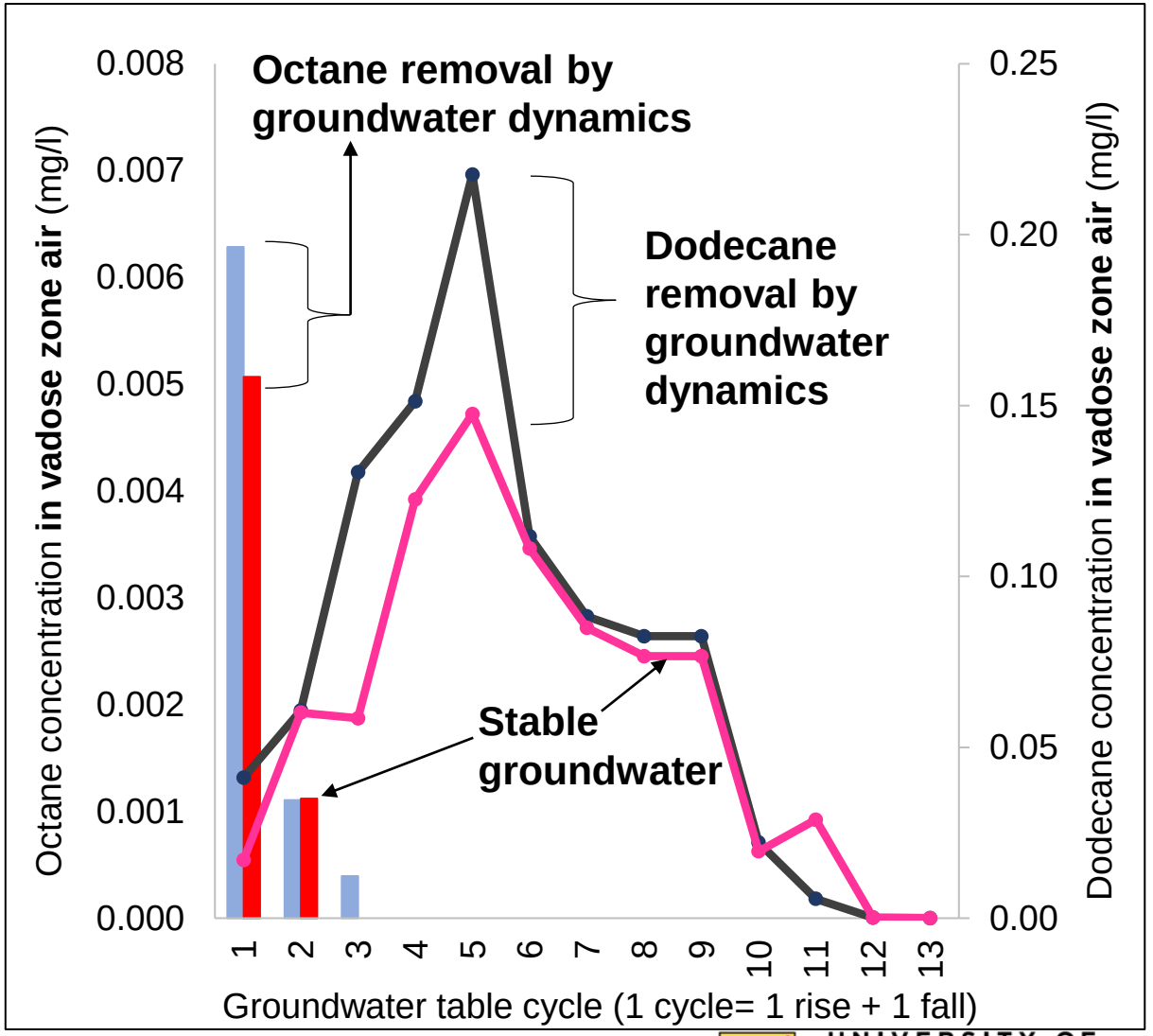
Key messages from our work

- Used mass characterization techniques to assess evaporation of organic contaminants over the time.

The water table dynamics reduces residual NAPL saturation from 8.1-11.3% to 7.7-9.5%.

Groundwater dynamics leads to more **evaporation of contaminants.**

Modified from Gupta et al. (2020)



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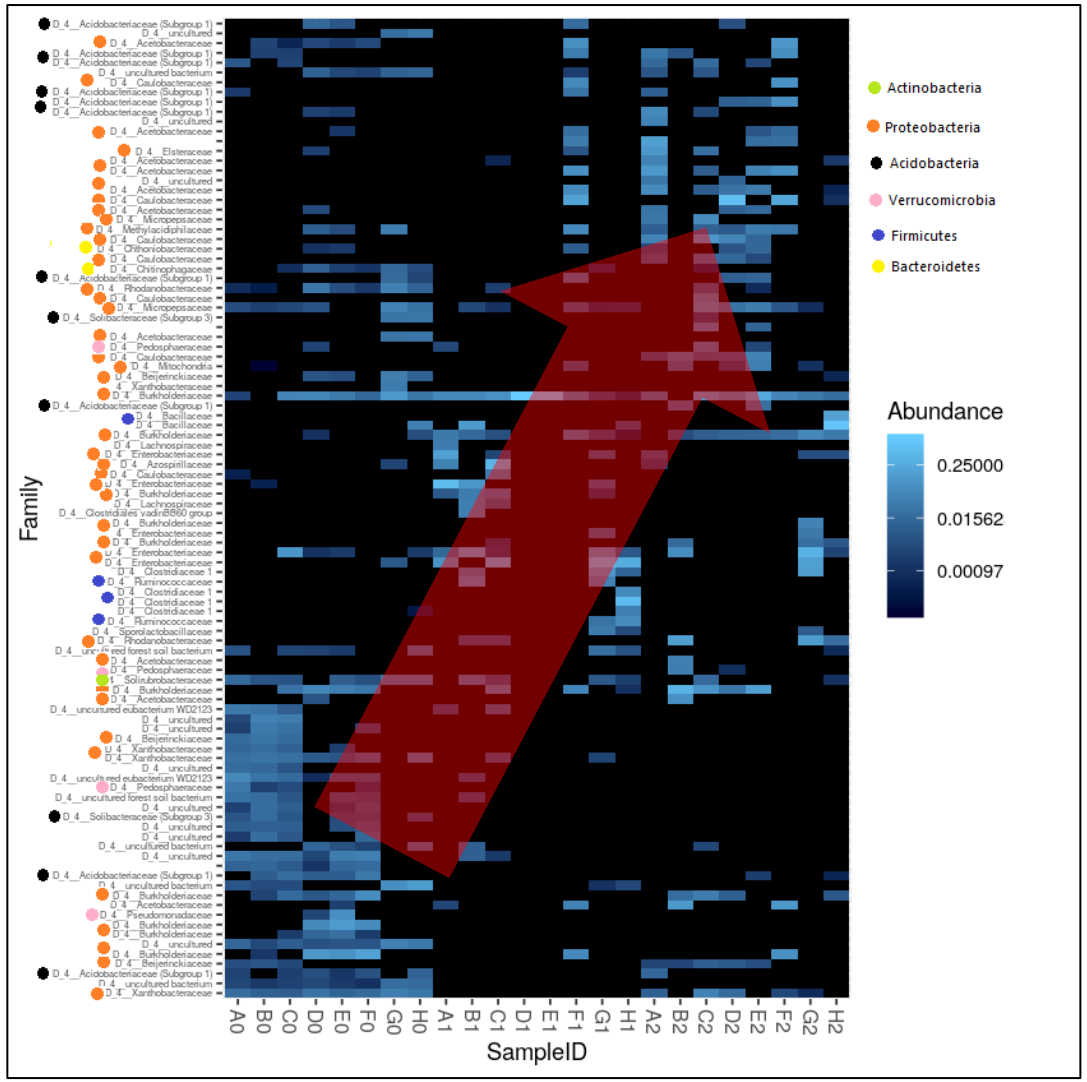
Key messages from our work (continued…)

(Gupta et al. 2020)

- Used 16S rRNA sequencing for the biomonitoring soil microbes.

WT dynamics accelerate hydrocarbon degraders, mainly species of phylum Proteobacteria.



By manipulating the groundwater, one can **enhance the microbial growths.**

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Conclusions

- Maintaining the hydraulic structure of the peat deposit (i.e., not excavating or burning), and allowing or promoting WT fluctuations, can be an effective tool to manage and remediate hydrocarbon polluted peatlands.

- Large-scale experimentation to measure dispersal of microbes and their role in **the reactive transport of NAPLs** may improve our current understanding of the ecological/evolutionary mechanisms that foster microbial diversity.

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- **Reference:** Gupta, P. K., Gharedaghloo, B., Lynch, M., Cheng, J., Strack, M., Charles, T. C., & Price, J. S. (2020). Dynamics of microbial populations and diversity in NAPL contaminated peat soil under varying water table conditions. Environmental Research, 191, 110167.

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Thank you very much

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