Predicting the long-term effects of iron addition on phosphorus dynamics in streams using modelling and high-resolution in-situ techniques

A Data Management Plan created using DMPonline.be

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Project abstract:

Excessive phosphorus (P) concentrations are the primary cause of eutrophication of freshwaters. To mitigate the negative ecological effects of eutrophication, P may be immobilised in the sediment. The chemical immobilisation of P by adding ferric iron (Fe(III))-based materials is the most widely adopted one. However, biogeochemical processes in sediment gradually lower the P trapping efficiency, e.g. Fe(III) reduction leading to Fe(II) solubilisation or sulfidation. The long-term effects of the Fe addition on the P dynamics at sediment-water interface are not well understood, likely because the sharp vertical gradients in the sediment are not well known. This proposal aims to develop new tools to measure the biogeochemical processes in sediments after adding Fe-based material. First, a novel DGT gel will be developed for 2-D imaging of P and its diagenetically relevant elements in sediment at a sub-millimetre scale. This combined high-resolution technique allows understanding where and how P is mobilized. Second, a microcosm and a flume experiment will be performed to investigate the role of organic matter and sulphate reduction on P biogeochemical cycles P and on the benthic microbial communities. Finally, a reactive transport model will be constructed to quantitatively analyse the P mass balance and predict the long-term efficiency of Fe addition in mitigating eutrophication. This research will broaden the application Fe(III)-based materials to mitigate eutrophication.

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FWO DMP (Flemish Standard DMP)

1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

Dataset Name	Description	New or reused	Digital or Physical	Only for digital data	Only for digital data	Only for digital data	Only for physical data
				Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)	Physical volume
		Please choose from the following options: • Generate new data • Reuse existing data	*Please choose from the following options:* • Digital • Physical	*Please choose from the following options:* • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA	*Please choose from the following options:* • .por, .xml, .tab, .csv,.pdf, .txt, .rtf, .dwg, .gml, … • NA	*Please choose from the following options:* • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA	
DGT gel	Gel performance data	new data	digital	experimental	.xml, .pdf, .xlsx, jpg,	< 1 GB	NA
LA-ICP-MS	Imaging	new data	digital	experimental	.csv, .jpg	< 1 GB	NA
WP2	Sediment incubation	new data	digital	experimental	.xlsx, .jmp, .jpg	< 1 GB	NA
WP3	Modelling	resue and new	digital	simulation data	.mlx, .jpg	<100 GB	NA

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

https://doi.org/10.1021/acs.est.6b04337; 10.1016/j.scitotenv.2022.160820

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

• No

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, …)? If so, please comment per dataset or data type where appropriate.

- No

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- No

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- No

2. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

All data and accompanying information will be stored exclusively on KU Leuven servers, One drive. All data will be accompanied by a README File or tab that outlines the exact data collection procedure, especially important for experimental data. All experiment work is prepared with good preparation. Standard operating procedures are noted down and stored in the lab shared drives and can be accessible to everyone. the lab manager will have access to all source data.

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- Yes

Yes, all metadata for experimental work is well maintained in the lab repository of procedures. They follow a standard format and vocabulary

3. Data storage & back-up during the research project

Where will the data be stored?

All data are stored at the KU Leuven One drive, the KU Leuven large storage L-drive. No data will be stored on local computers.

How will the data be backed up?

All data stored in the central KU Leuven facilities are backed up automatically with version control and logging

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.
If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

There is 20 GB of data capacity at KU Leuven OneDrive and 1 TB of data capacity at KU Leuven J-drive, which will be sufficient for the proposed project.

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

The data are stored on the KU Leuven servers, only accessible with double authentication.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

All costs are covered by KU Leuven or departmental group, or otherwise through existing grant funding

4. Data preservation after the end of the research project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

All data will be retained for at least 5 years. As data are stored digitally in secured servers of KU Leuven

Where will these data be archived (stored and curated for the long-term)?

The same repositories as mentioned above will be used for long-term storage

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

The same provisions are in place for long-term data preservation as for data storage in the shorter term. Smaller datasets are stored on the Onedrive, and larger datasets are on the KU Leuven L-drives.

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- Yes, in an Open Access repository

All data will remain available for other researchers at KU Leuven without restrictions

If access is restricted, please specify who will be able to access the data and under what conditions.

the project supervisor will be able to access the data

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.

- No

Where will the data be made available? If already known, please provide a repository per dataset or data type.

In Journal Publications

When will the data be made available?

The data newly generated in this project will be made available upon publication of research results.

Which data usage licenses are you going to provide? If none, please explain why.

Data usage will be open for public without any license in place

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- Yes

What are the expected costs for data sharing? How will these costs be covered?

Usually, there is no charge for sharing data with third parties

6. Responsibilities

Who will manage data documentation and metadata during the research project?

Lei Xia and The PI (Erik Smolders)

Who will manage data storage and backup during the research project?

Lei Xia and The PI (Erik Smolders)

Who will manage data preservation and sharing?

Lei Xia and The PI (Erik Smolders)

Who will update and implement this DMP?

Lei Xia