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pour le Développement
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Effect of natural and assisted revegetation of an alluvial gold mine on the reduction of mercury remobilisation from soil and recovery of soil functions (French Guiana)

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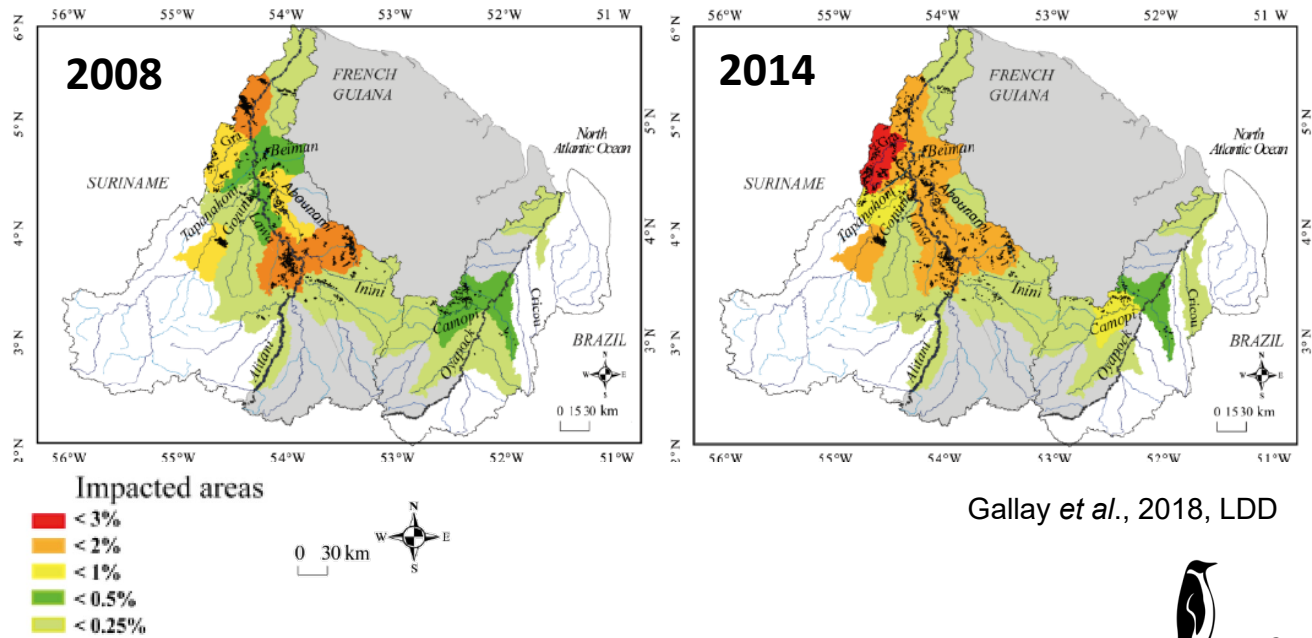
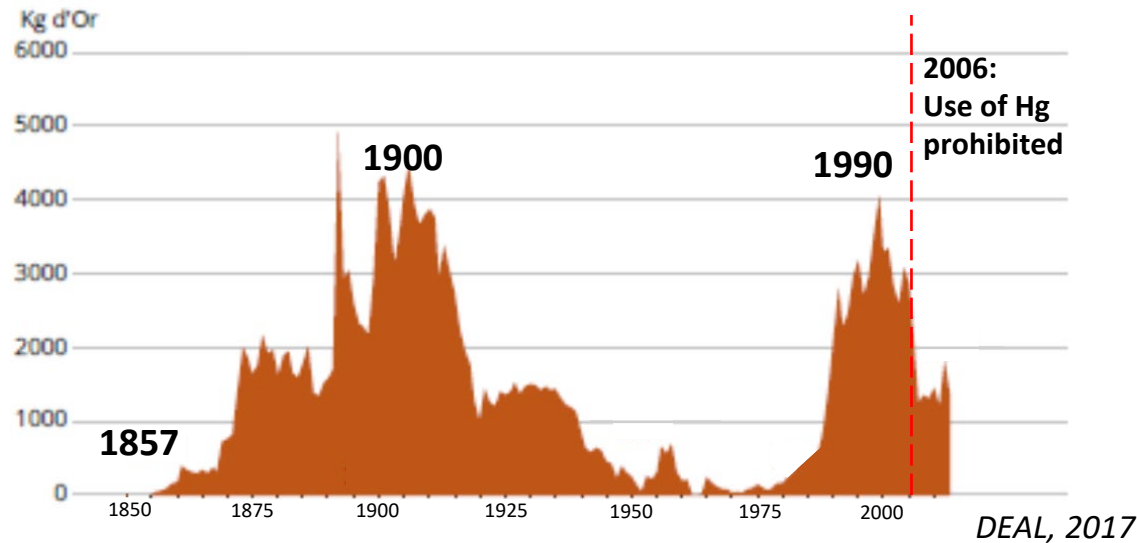


WWW.MERCURYPAPETOWN.COM

History of goldmining in French Guiana



- Two Gold Rushes in the 1900s and 1990s
- Gold mining still present and expanding



Mercury sources in French Guiana

Hg in soils in temperate regions : 20-50 ng/g

Hg in soils F. Guiana : 200-800 ng/g in oxisols



Laffont *et al.*, 2011

Mercurial impregnation among pregnant women from Guiana (Haut Maroni): Study and prevention

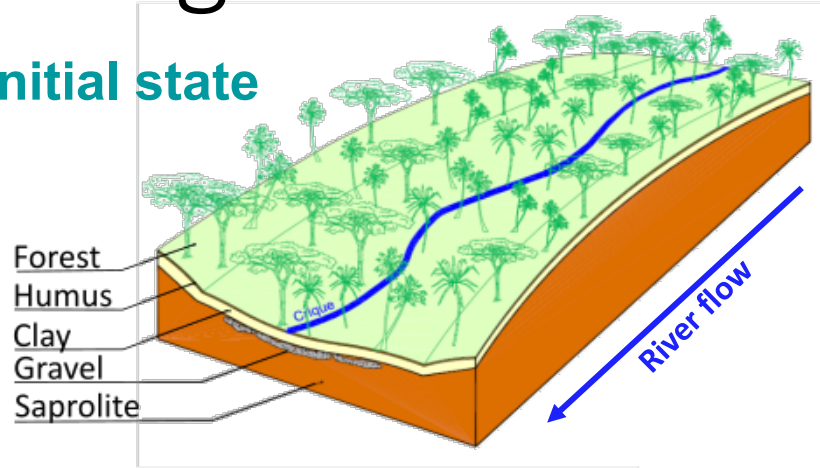
Rémy Pignoux^a, Pierre-Yves Gourves^b,
Mohamedou Sow^b, Régine Maury-Brachet^{b,*}

- **Naturally high Hg geochemical background in soils**
- **Impact of Illegal gold mining (ASGM)**
 - Hg amalgamation (elemental Hg)
 - Mining = remobilisation of geogenic Hg(II)
- **Health concerns in native populations**

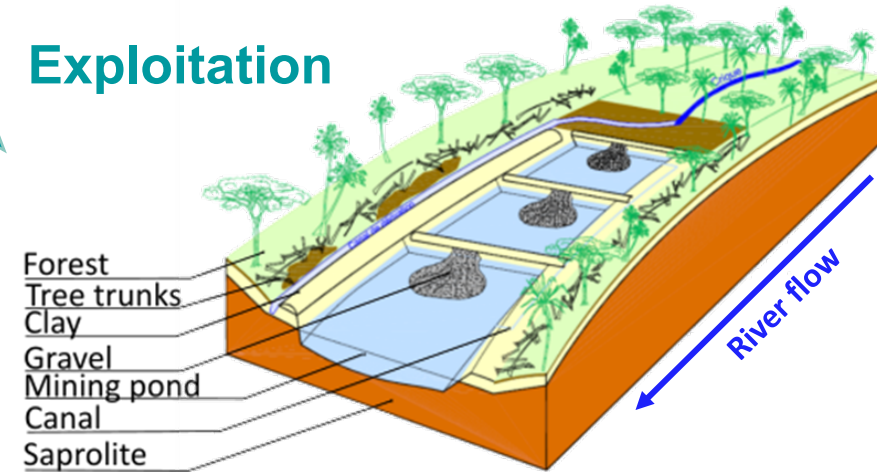


Legal Alluvial Gold Mining (no Hg use)

Initial state

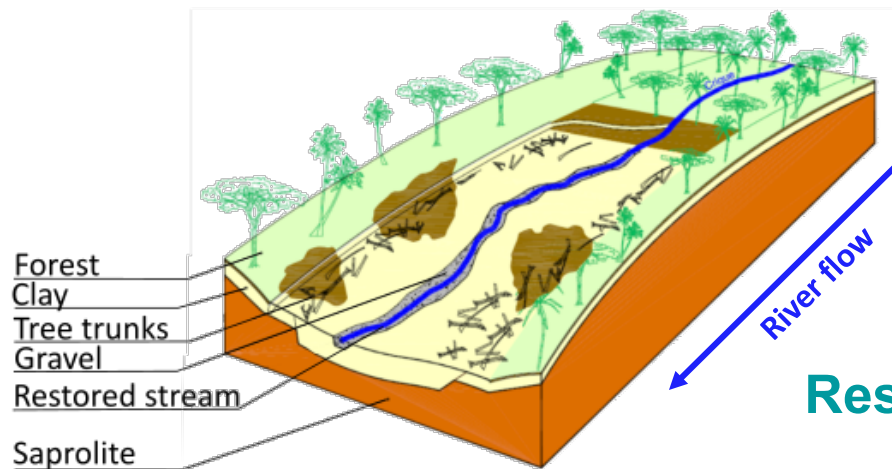


Exploitation

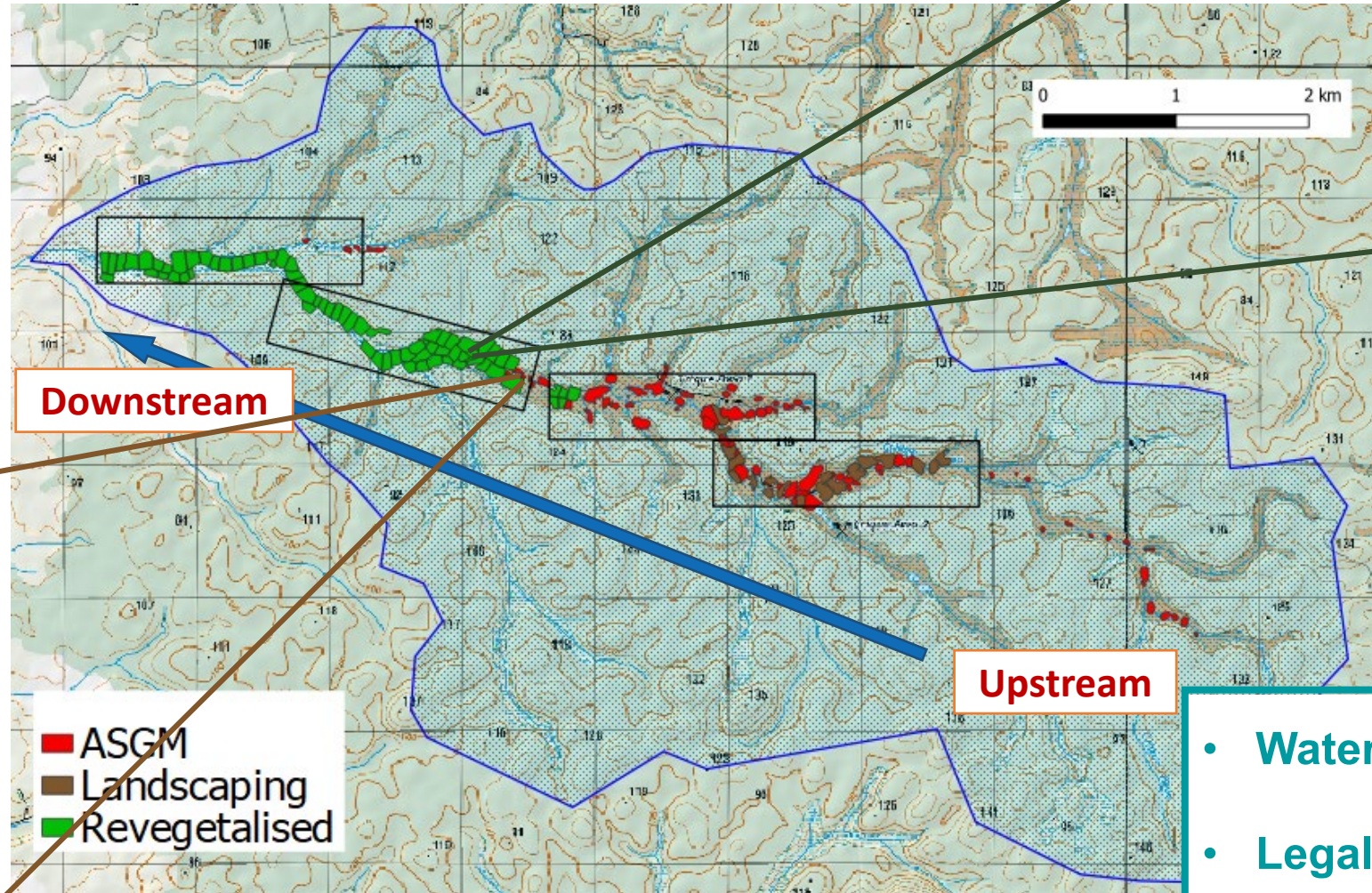


- Influence of restoration + timespan for :**
- Reduction of contaminant (Hg) fluxes
 - Recovery of soil functions

Restoration



Study site: AWA Gold Mine



- Watershed area: 32.3 km²
- Legal mining site downstream of ASGM

Evolution of Vegetation cover

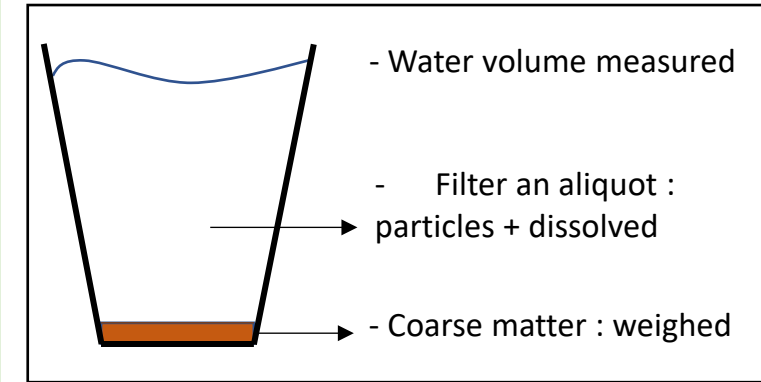
- 2x2 m plots
- triplicates on 2 sites : No vegetation vs vegetation cover
- Recover eroded matter

T = 0 months (april 2022)

T = 8 months (dec 2022)

T = 13 months (may 2023)

Spontaneous



T = 24 months (april 2022)

T = 32 months (dec 2022)

T = 37 months (may 2023)

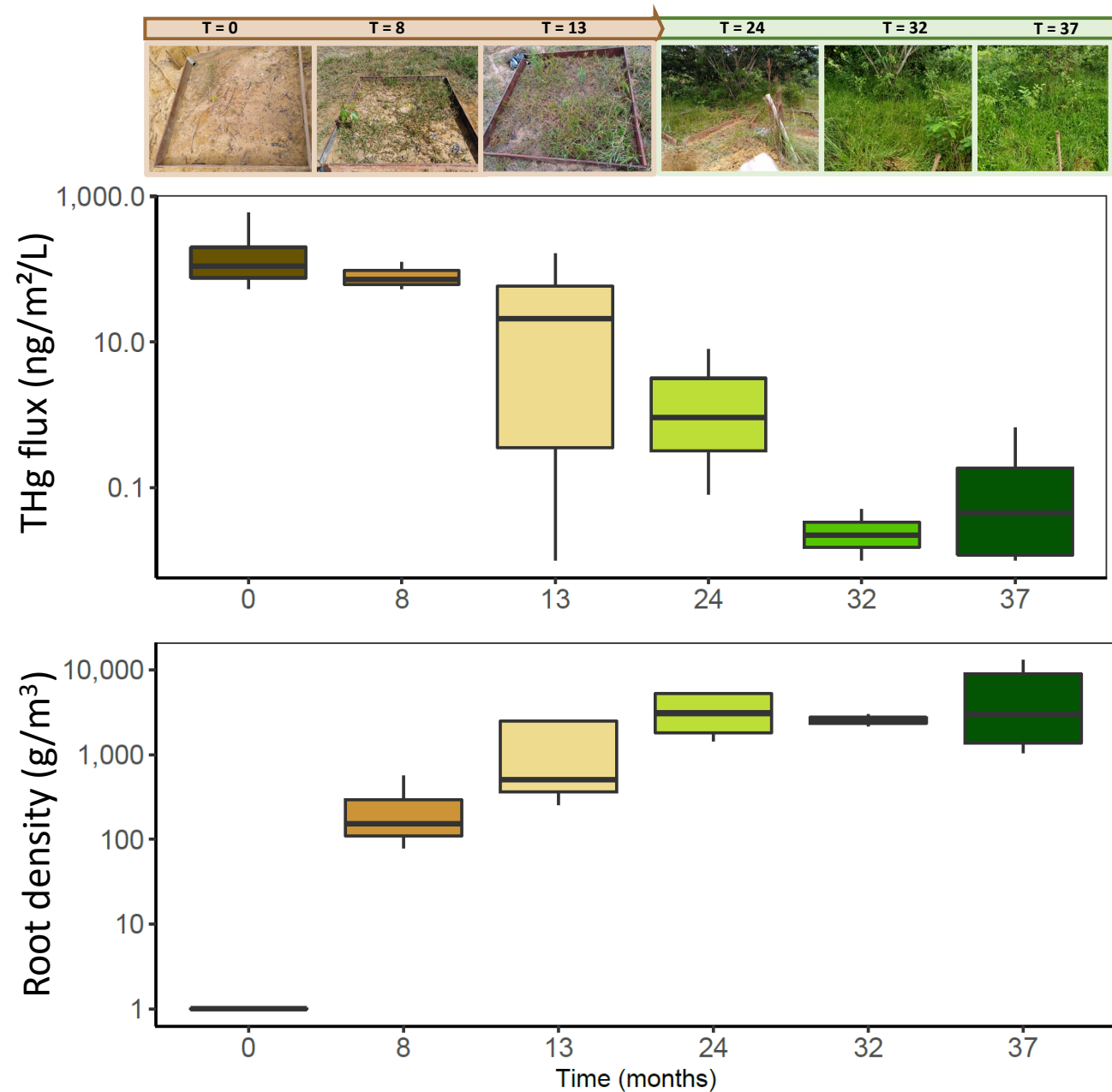
Revegetation



⇒ iHg and MeHg measured in the particulate and filtered fractions



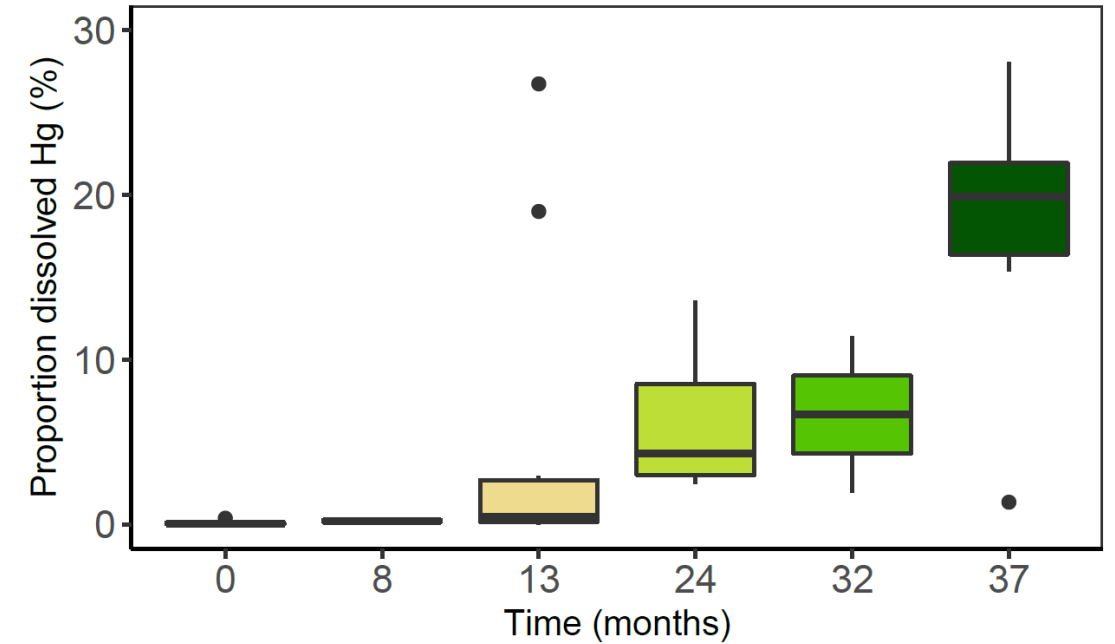
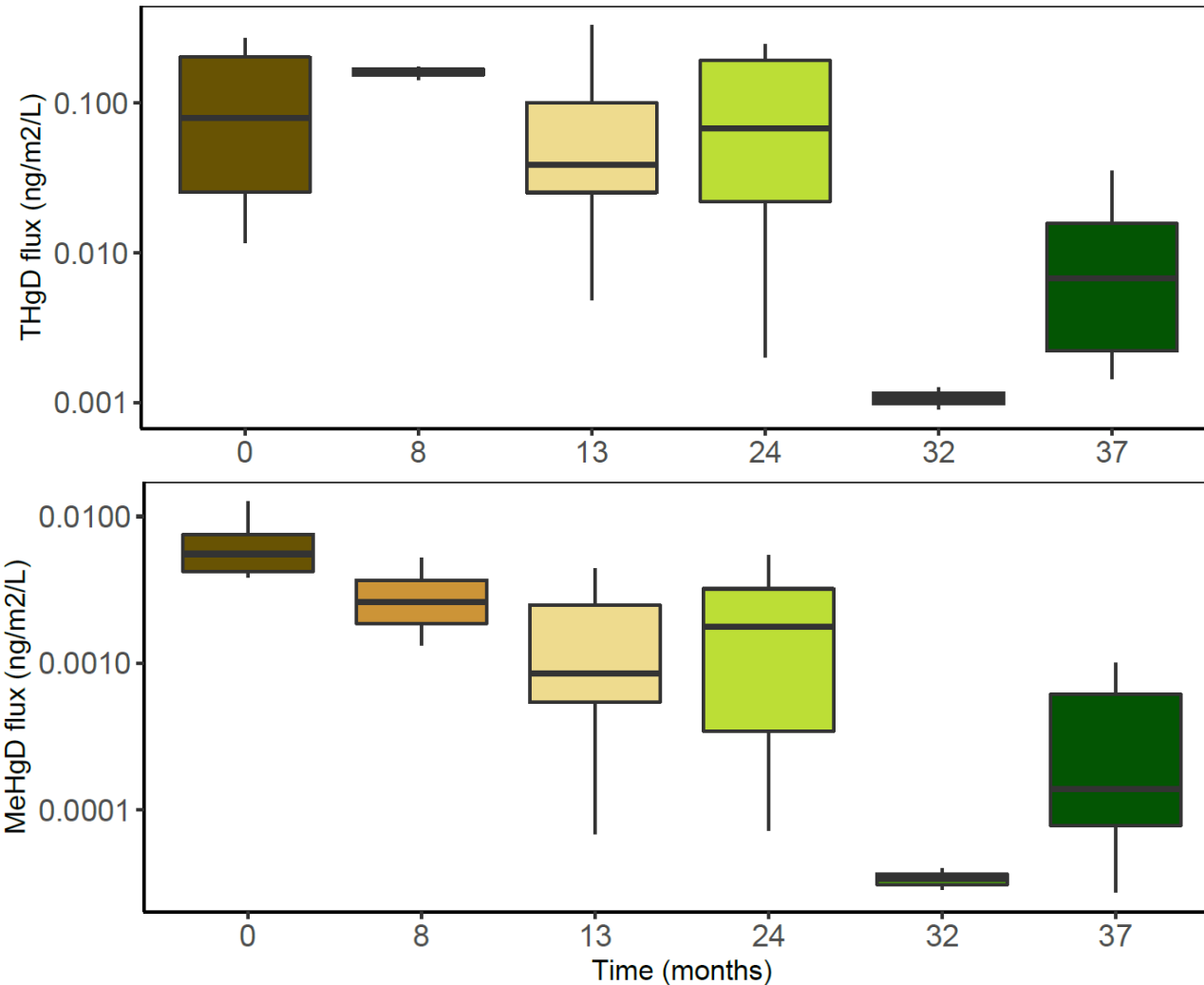
Vegetation cover = Reduction of THg fluxes



- 80 – 90 % of THg in the particulate fraction
- Increase in vegetation (root density) = Reduction of erosion
= reduction of THg fluxes
- **3-fold** reduction of THg fluxes over 13 months due to spontaneous revegetation
- **900-fold** reduction after 3 years



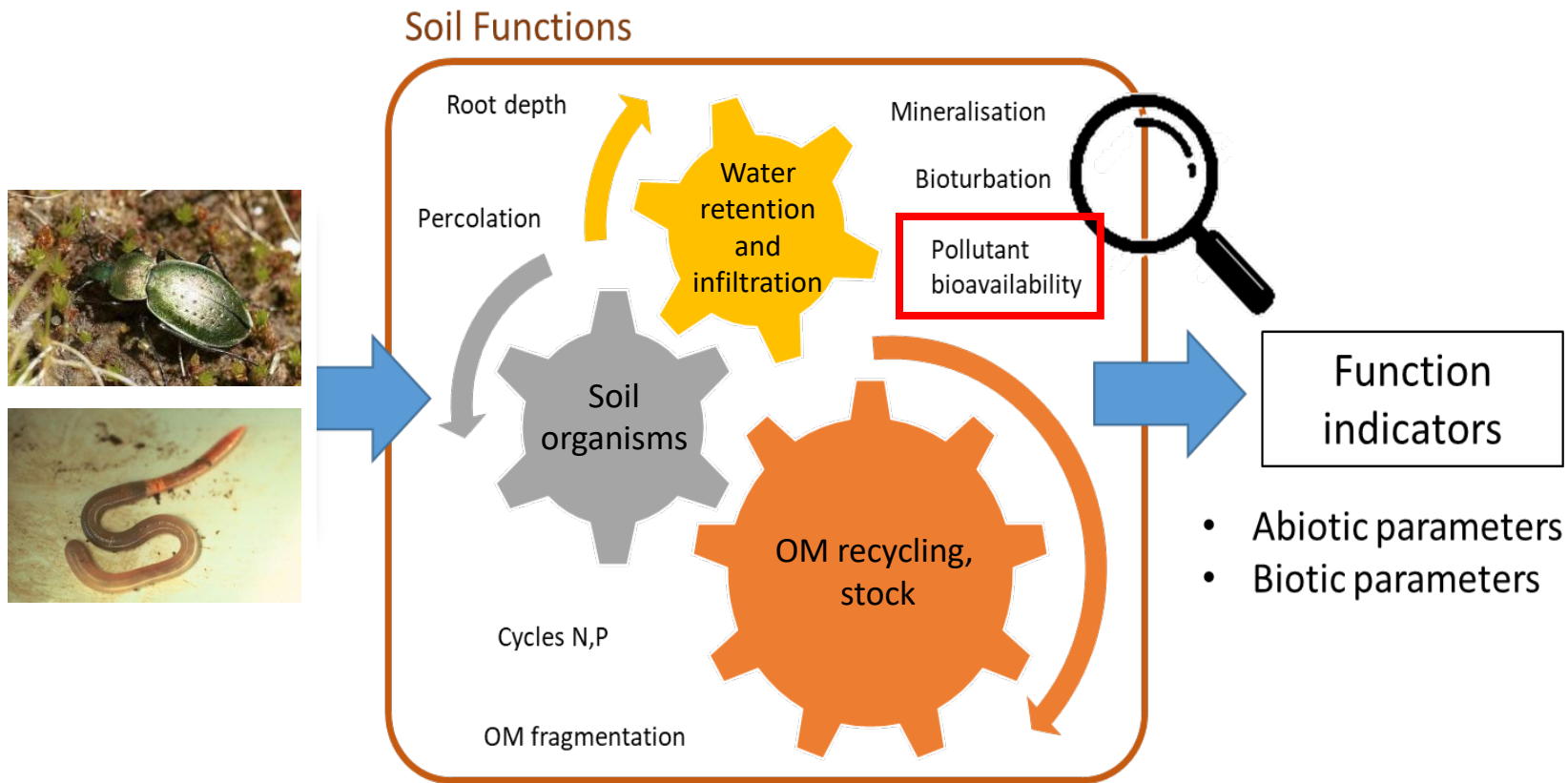
Dissolved Hg



- Dissolved Hg : Stability in fluxes and decrease after 32 months



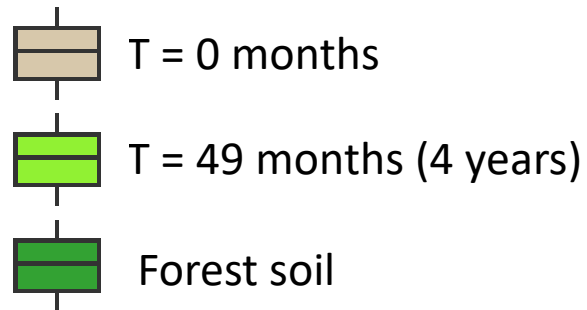
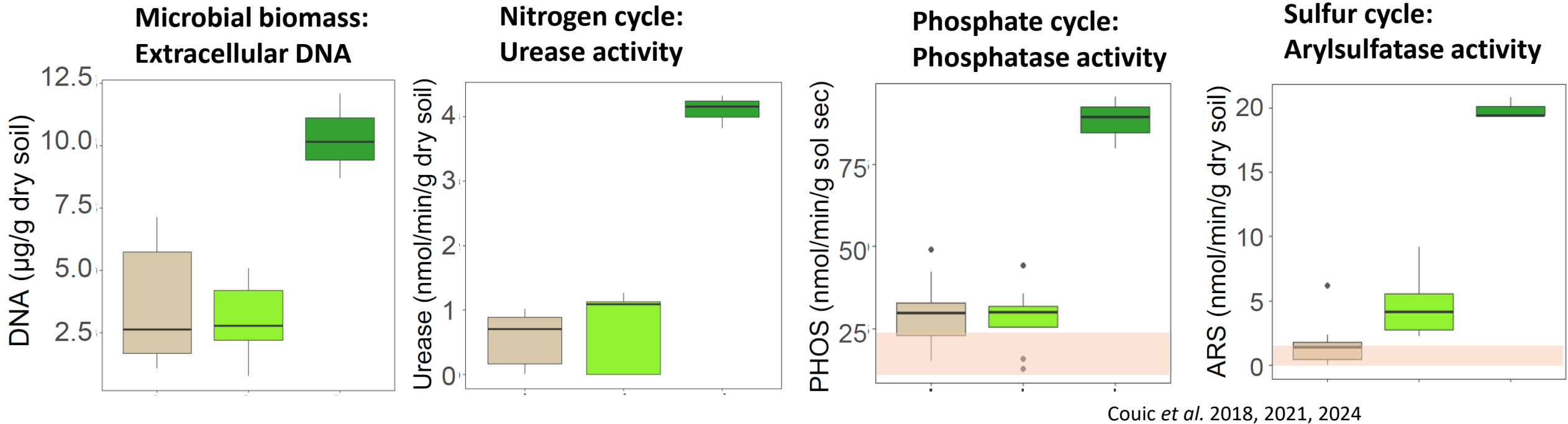
Soil restoration biological indicators



- Recovery of soil functions
- Soil Organic Matter = sink for (Me)Hg



Soil restoration biological indicators



- **No significant recovery of soil functions (C and N cycles) even 4 years after restoration**

Other indicators :

- Micro-respiration
- Denitrification
- qPCR (16S, 18S, functional genes N-cycle)



Evolution of a restored post-mining flat



	Bare Soil	Herbaceous	Tree plantation	Secondary forest
	T = 0	T = 6-12 months	T = 3 years	T = ?
Soil stabilisation	0	⊕ ⊕	⊕ ⊕ ⊕	⊕ ⊕ ⊕
Reduction of Hg fluxes	0	⊕ ⊕	⊕ ⊕ ⊕	⊕ ⊕ ⊕
Soil functions	0	⊕	⊕	???

Evolution of a restored post-mining flat

	Bare Soil	Herbaceous	Tree plantation	Secondary forest
	T = 0	T = 6-12 months	T = 3 years	T = ?
Soil stabilisation	0			
Reduction of Hg fluxes	0			
Soil functions	0			???

Recommendations :

- Landscape quickly after exploitation !
- Use nodulating plants (*Fabaceae*)
- Inoculate plant soils with N-fixating bacteria

**Check out
poster
n° 125**

