

Phytomanagement at Bordes site

Toward a rehabilitation of ecological functions and associated ecosystem services

January 2020

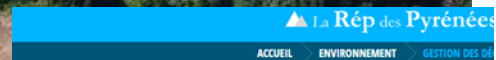
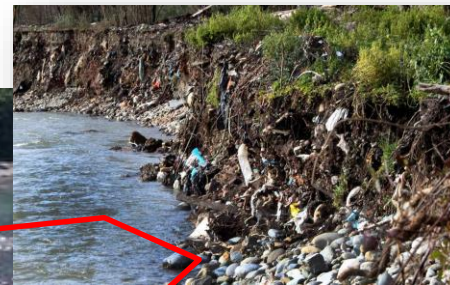
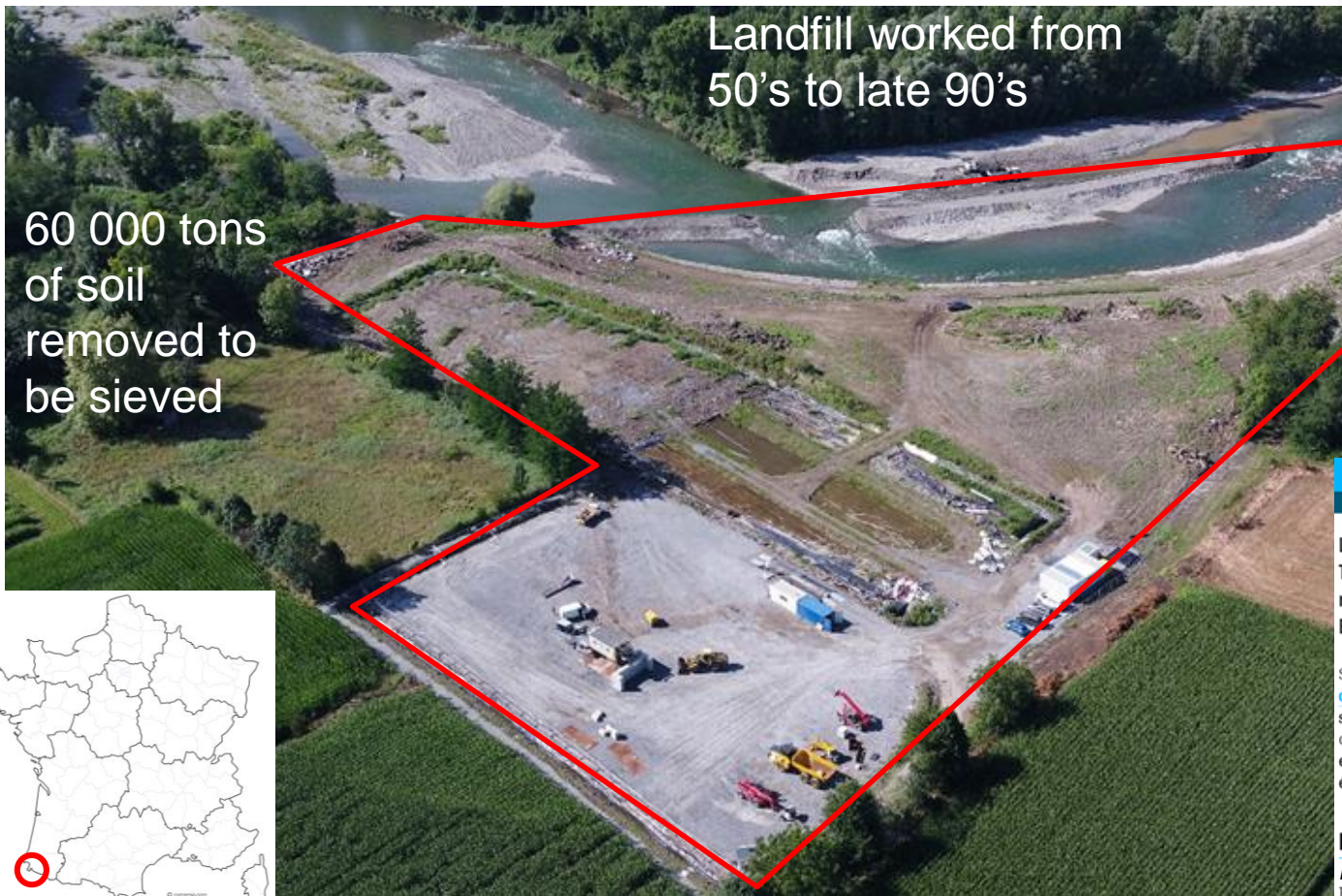
Bordes (64)



prêts pour la révolution de la ressource



Bordes?



Le député Jean-Paul Mattéi en appelle au ministre de la Transition écologique et solidaire Nicolas Hulot pour répondre à la situation d'urgence de la pollution du Gave à Bordes.

Suite aux crues récentes, [le déversement de plusieurs tonnes de déchets sur les berges du Gave à Bordes](#) n'en finit pas de susciter des réactions. Au point que le député MoDem de la 2e circonscription Jean-Paul Mattéi a demandé d'urgence une entrevue avec Nicolas Hulot, ministre de la Transition écologique et solidaire.

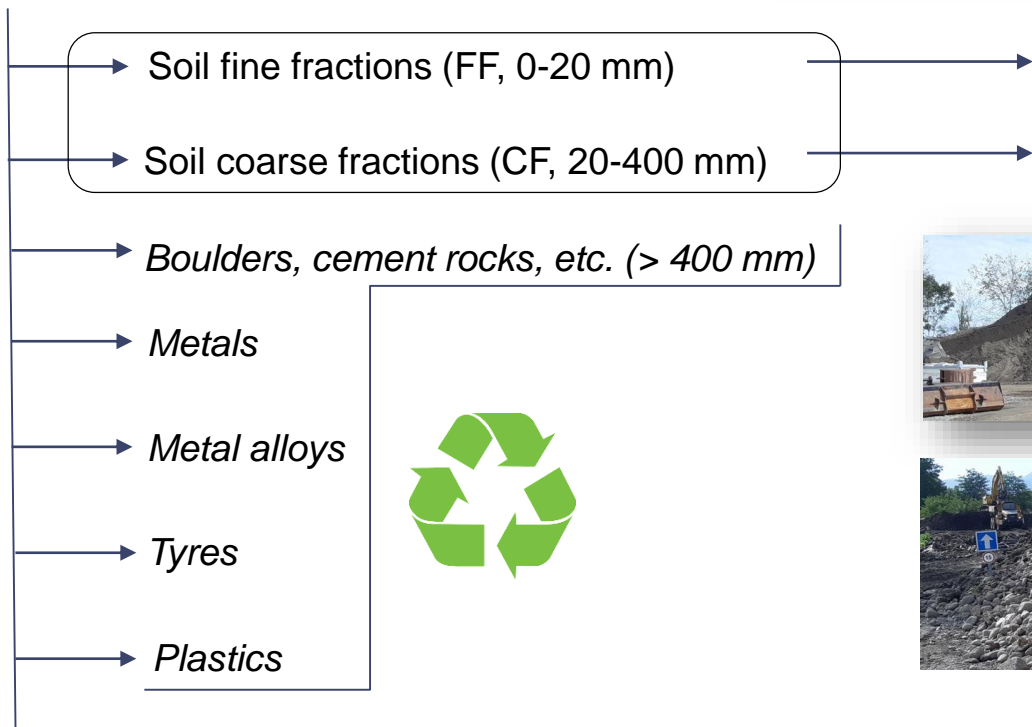
Deux ministres saisis

La république des Pyrénées, 09.08.18
Pour autant, le député réaffirme son soutien vis à vis des

Landfill mining operations started in September 2019



Excavated
soils
(60 000 T)



Reused on site as upper layer (FF) and downer layer (CF) for land reclamation



Bordes now.....Bordes then ?



Fully restored ecosystem

- Ecosystem processes are recovered
- Ecosystem complexity (biodiversity, ecological functions) is recovered

Before



After



Partially restored (rehabilitated) ecosystem

- Ecosystem processes are partially recovered
- Ecosystem complexity (biodiversity, ecological functions) is partially recovered

Before



After



Novel ecosystem ?

- Ecosystem processes are in the process of being recovered
- But loss of complexity (biodiversity, ecological functions, etc.)

Need to understand
environmental filters on site

Before



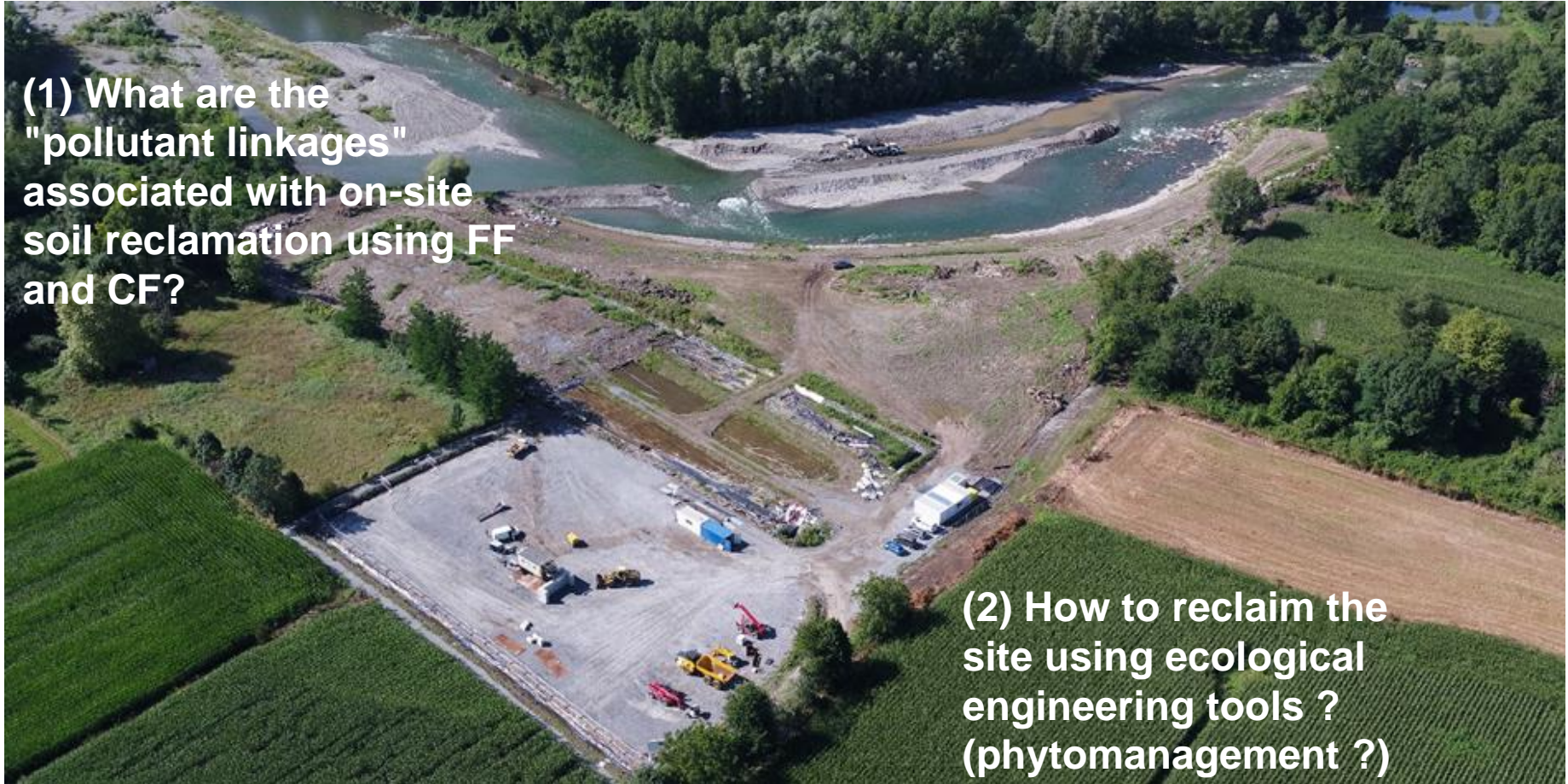
After



What is implemented and planned on site ?

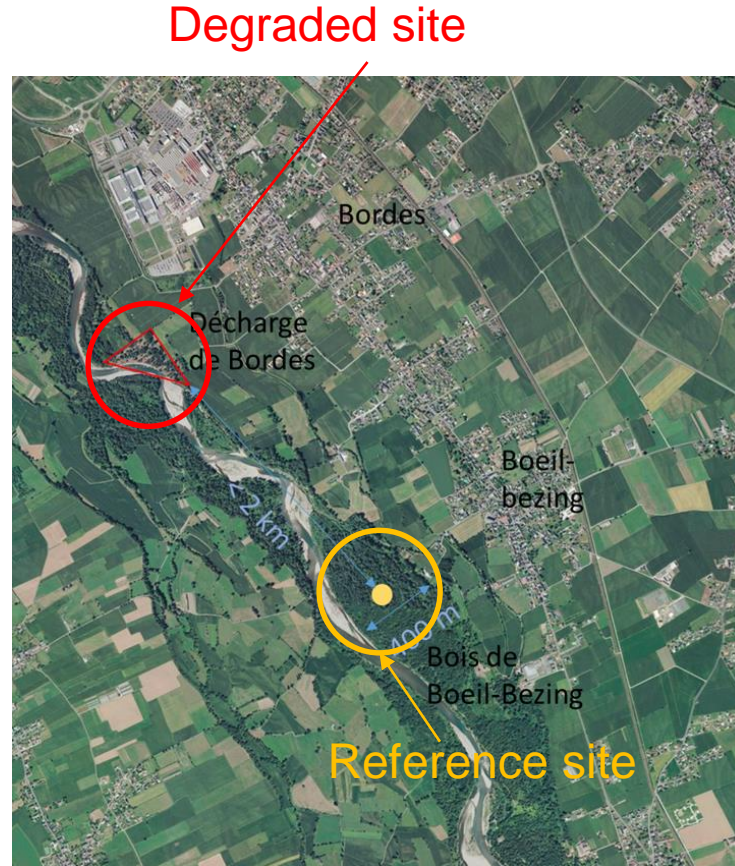
(1) What are the "pollutant linkages" associated with on-site soil reclamation using FF and CF?

(2) How to reclaim the site using ecological engineering tools ? (phytomanagement ?)



Pollutant linkages ? (*source, transfer, exposure*)

- Total contaminant concentrations (trace elements, PAH, BTEX, PCB)
- Agronomical characteristics
- Soluble contaminant concentrations in leachates
- Soil associated ecotoxicity (earthworms, dwarf beans)
- Leachate associated ecotoxicity (water fleas)
- Soil microbial activity (enzymes, respirometry)
- Soil DNA



Total xenobiotic concentrations

Soluble xenobiotic concentrations

(mg/kg)	Mean Bor	sd Bor	Mean ref	sd ref
As	55	35	29	0
Cd	7	2	3	1
Ca	34620	7141	23700	14001
Cr	146	60	26	0
Cu	422	121	36	3
Fe	48340	6948	38100	141
Mg	8148	1248	9130	2220
Mn	885	98	613	35
Mo	16	7	1	0
Ni	258	105	34	1
P	1146	84	534	290
Pb	259	70	373	227
K	1414	163	866	45
S	2004	330	677	154
Zn	943	335	1062	436
Hg	2	1	0	0
PAH (sum)	1	1	0	0
PCB (sum)	1	0	0	0
BTEX (sum)	0	0	0	0

NOTHING !



Ecotoxicity ?



Earthworms

No toxicity



water fleas

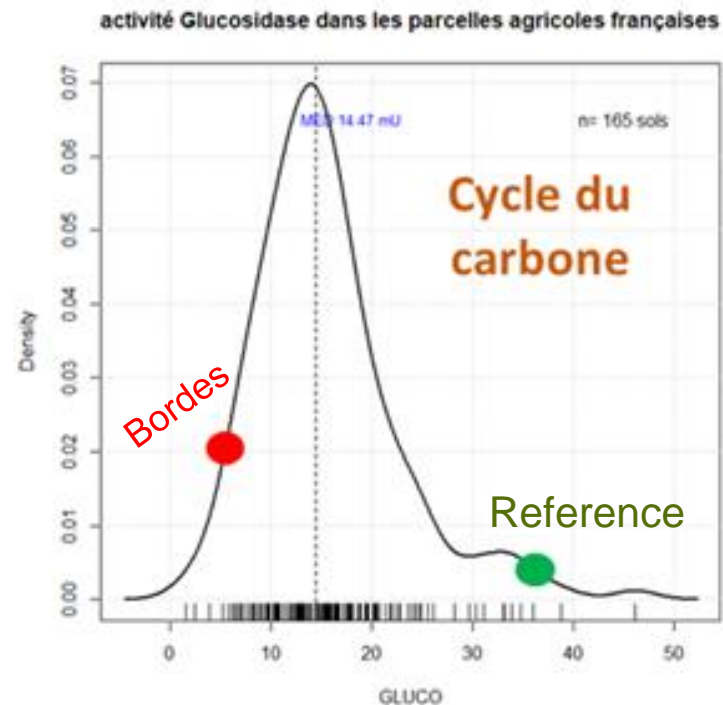
No toxicity



Dwarf beans

Not done yet

Soil microorganisms activity



Soil DNA

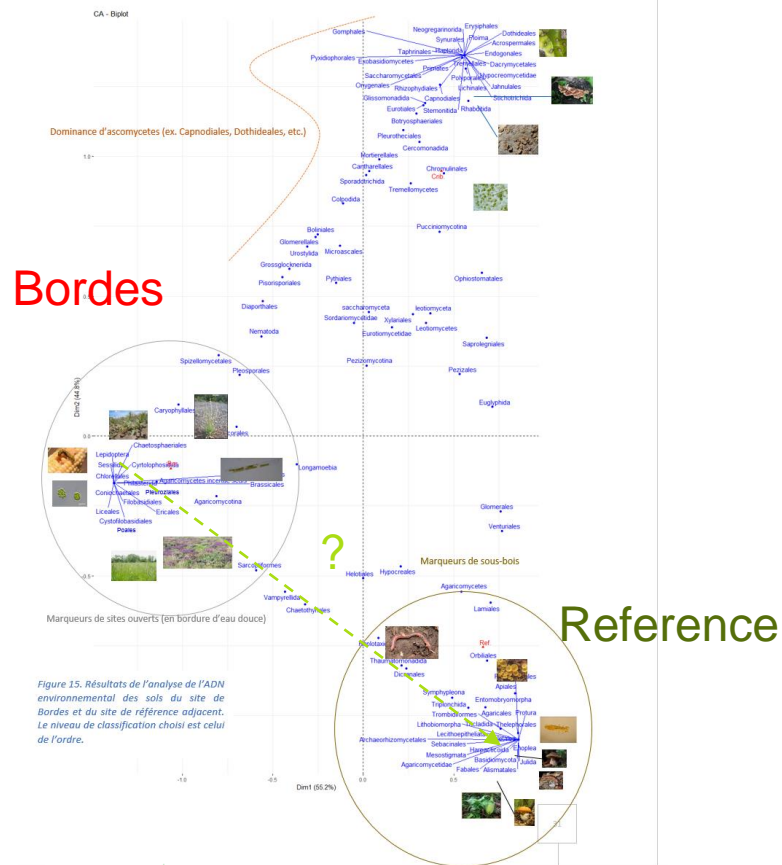


Figure 15. Résultats de l'analyse de l'ADN environnemental des sols du site de Bordes et du site de référence adjoint. Le niveau de classification choisi est celui de l'ordre.

First conclusions

- Sources -> Trace elements (HAP, PCB)
- Transfer path -> NO
- Exposure -> No current ecotoxicity BUT remnants of impact of anthropic activities (environmental DNA, μ organisms activity)

Contaminant linkages
Abiotic filter

- How to promote the return of a vegetation cover on site ?

Phytomanagement
Dispersal filter

- How to manage ecological interactions between species on site ?

Management
Biotic filter

Actions planned at Bordes site : How to *bypass* the dispersal filter ?

1. Hay transfer (*from nearby reference meadows*)



2. Tree planting
(local species)



*Speeding up of local
species installation*

2. *Soil transfer ?*



Bioaugmentation

March 2020



Hay transfer

Winter 19-20. Storage at Eco-altitude facilities



Where. Morlaas (Fr.)
When. August 2019
How. Hay harvest (brush tractor)



Where.
When.
How.
What.

Bordes restored landfill
Spring 2020
Hydroseeder
Mix of seeds (25% local species/ 75% rye grass/white clover) + **mulch** + hay covering



