ASSISES NATIONALES DES BIOCHARS

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Atelier Biochar & Cycle de l'eau

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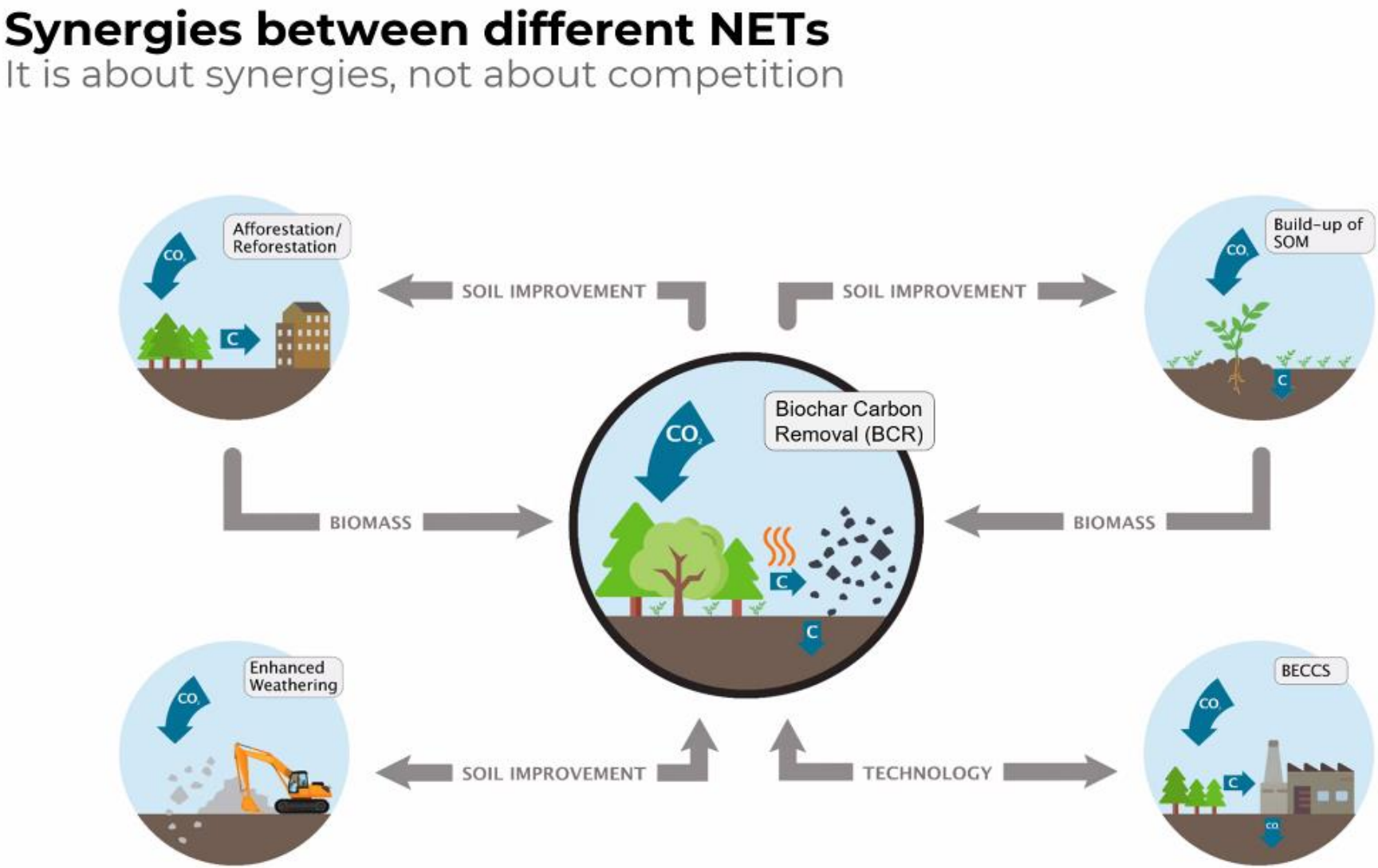
Programme de l'Atelier

- Introduction aux enjeux
  - Rappel du contexte climat / gestion du carbone / GES
  - Propriétés des biochar(s)
  - Potentiel d'application dans le cycle de l'eau
- Questions / Echanges
- Conclusion

Rappel du contexte et des éléments de base entre biochar / climat / gestion du carbone / émission de gaz à effet de serre

1 De quoi parlons-nous ?



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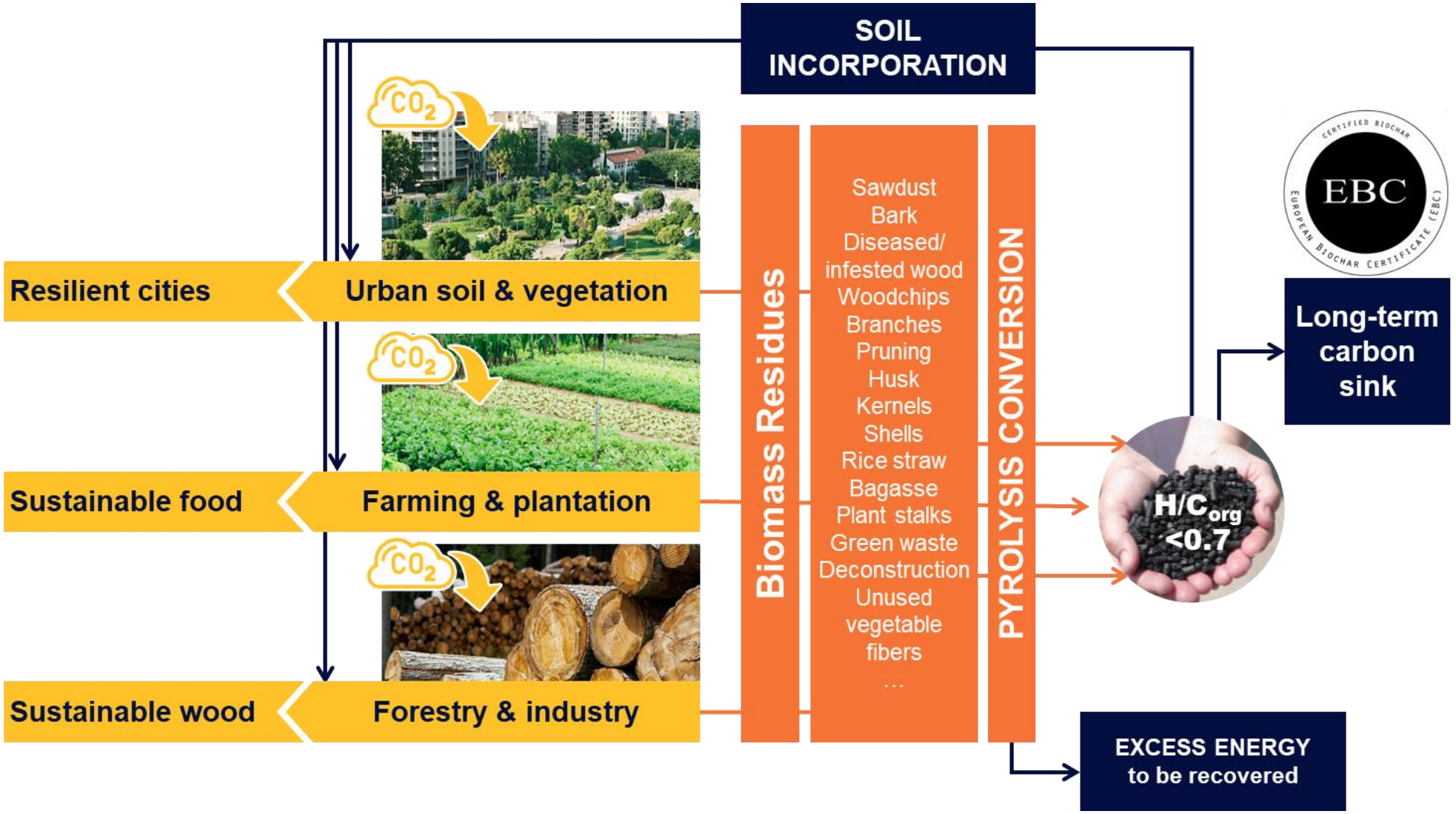


1 Quels moyens d'action sur le Climat et ses impacts

Mitigate climate change

All actions reducing the global concentration of green house gases in the atmosphere in order to limit the impact of climate change

PILLAR A
Reduce emissions

Reduce the quantity of GHG emissions from our activities and the **ones we are accountable for**

Mandatory carbon market (ETS, …)

PILLAR B
Avoid emissions

Help others reducing their GHG emissions through services and products and **contribute to reduction carbon finance projects**

Mandatory market (ETS) or Voluntary carbon market

PILLAR C
Develop carbon sinks

Remove GHG emissions from the atmosphere and **contribute to removal carbon finance projects**

Biochar

Voluntary carbon market

Adapt to climate change

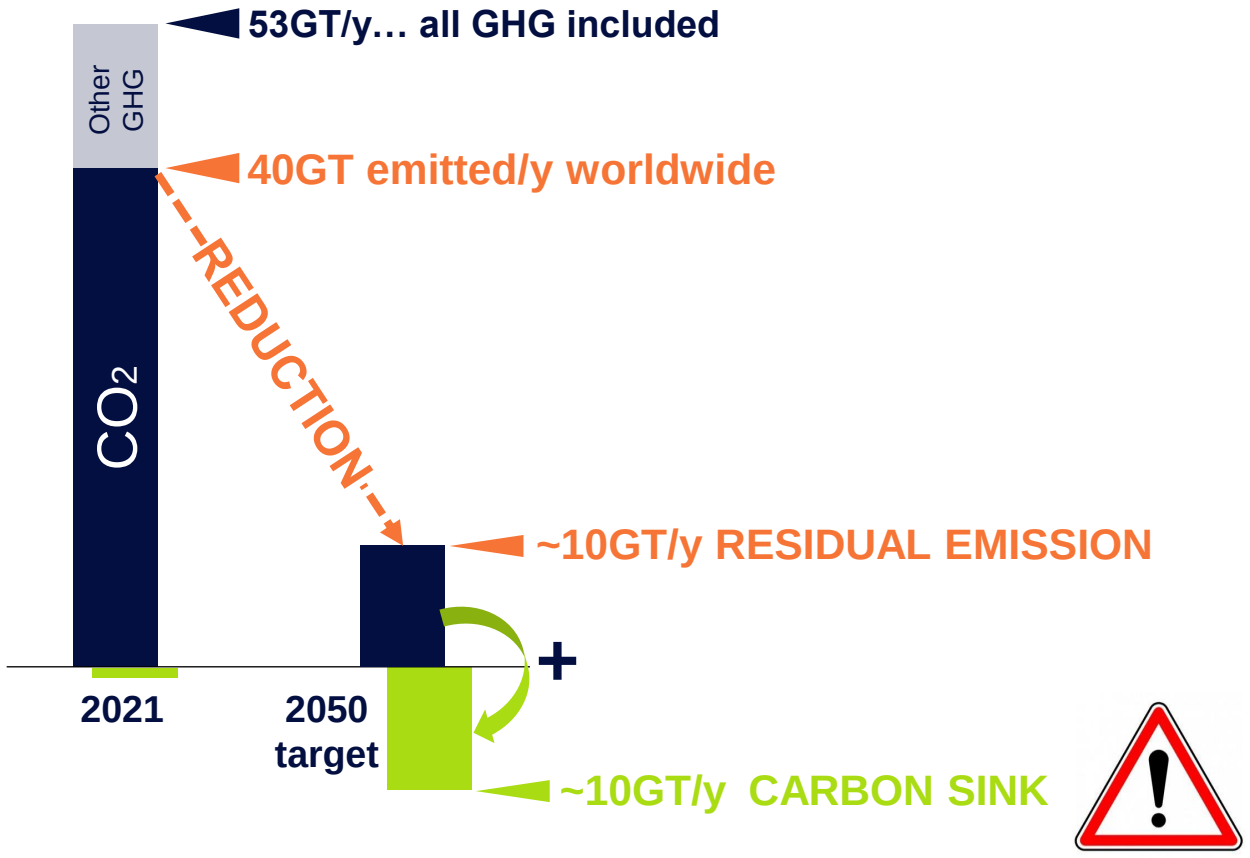
All actions that anticipate or adjust to both current and predicted effects of climate change

1 Les Accords de Paris en bref !

2 GOALS DEFINED BY IPCC/PARIS AGREEMENT:

- Reduce drastically **CO_2 world emission**
- Develop a 10GT **CO_2 sequestration** annual capacity by 2050

+ PREFERENCE FOR SOLUTIONS HAVING CO-BENEFITS ATTACHED (SDGs)

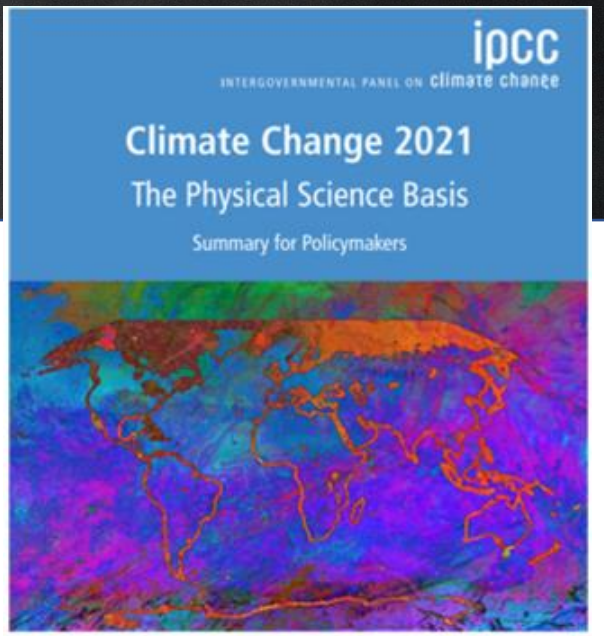


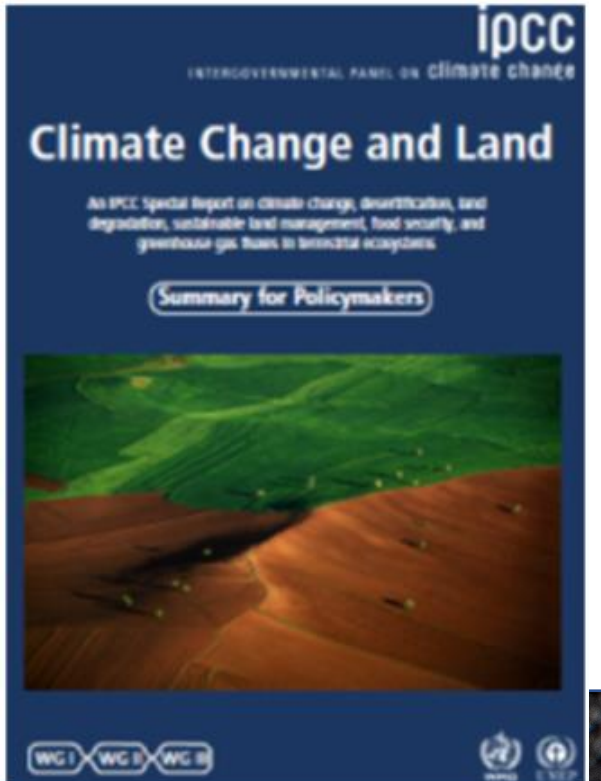
1 Inventaires des solutions

BIOCHAR

Solutions:	Nature-Based Solutions (NBS)					Technology-Based Solutions (TBS)					
	Afforestation	Agro-forestry	Soil Carbon	Peatland Rewetting	Forest management	Biochar	Biomass in buildings	Terrestrial Enhanced Weathering	BECCS	DACCS	CCU
Solution maturity											
Costs (current)											
Removal potential											
Permanence / reversibility risk											
Robust MRV											
Co-benefits potential											
Negative externalities/ leakage risks											

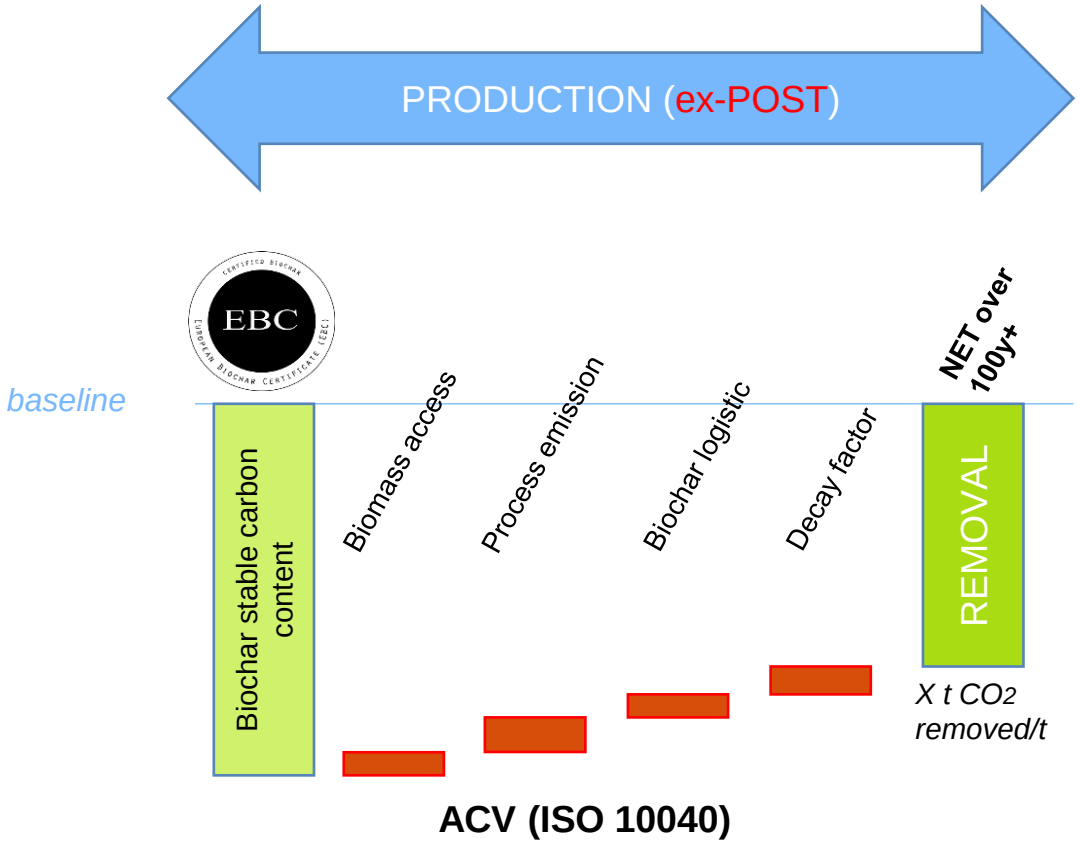
Inconclusive



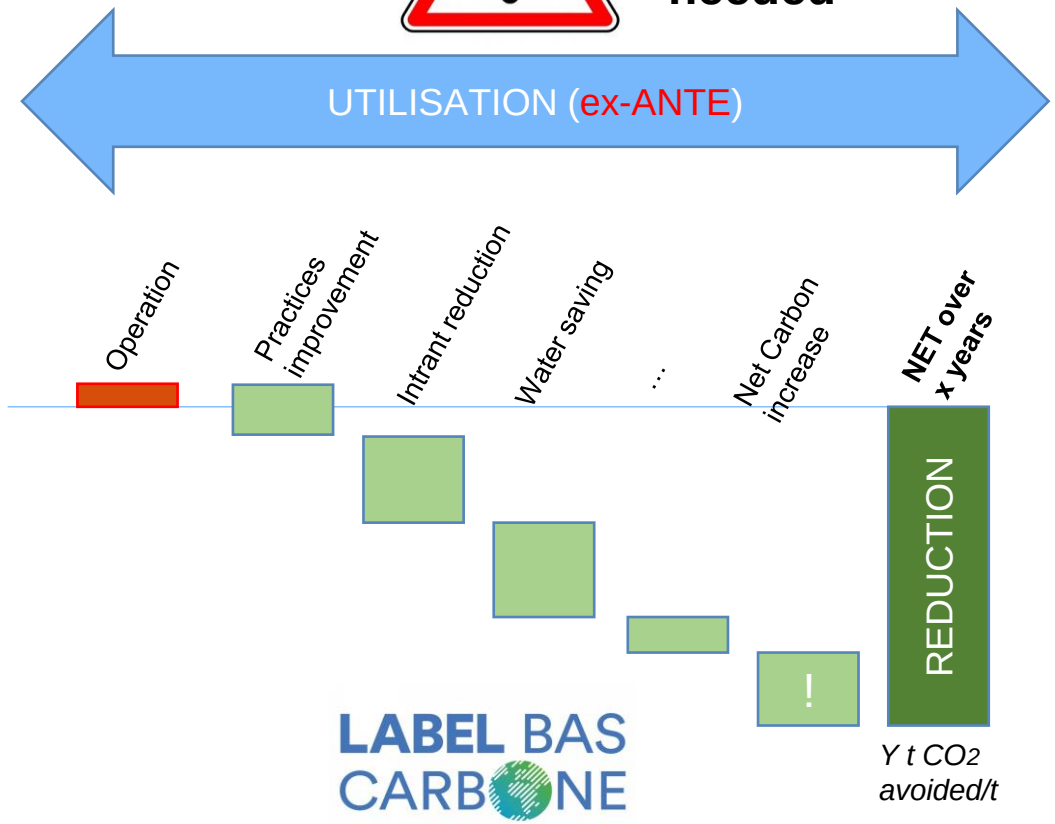


1 Comptabilité des impacts carbone

2 mandatory principles ➔ be additional & avoid double-counting



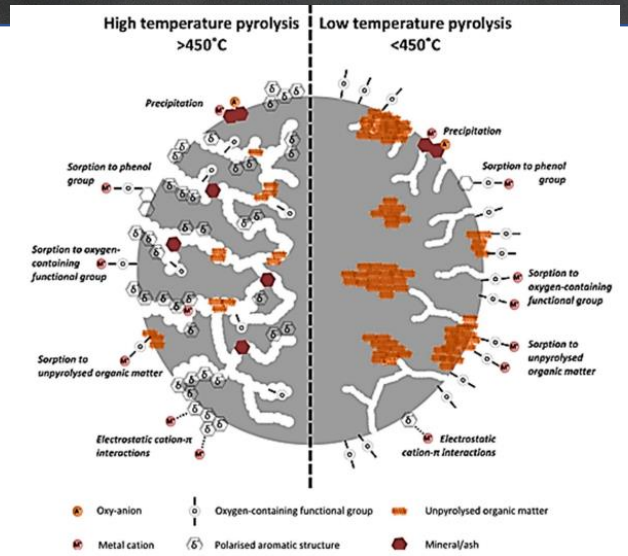
Methodology needed



Usage	End of Life of the used biochar	Removal carbon impact
Effluent “epuration” through a dedicate processing (filtration, contactor, …)	Incineration / Combustion	NO
	Thermal regeneration	depends on carbon actual losses
	Inclusion in construction material	YES
	Inclusion in compost/AD	YES
	Spreading on land	YES
	Landfilling	YES
Contaminated soil (i.e. water table/ surface water protection)	Extraction and thermal desorption	NO
	Soil kept in place	YES

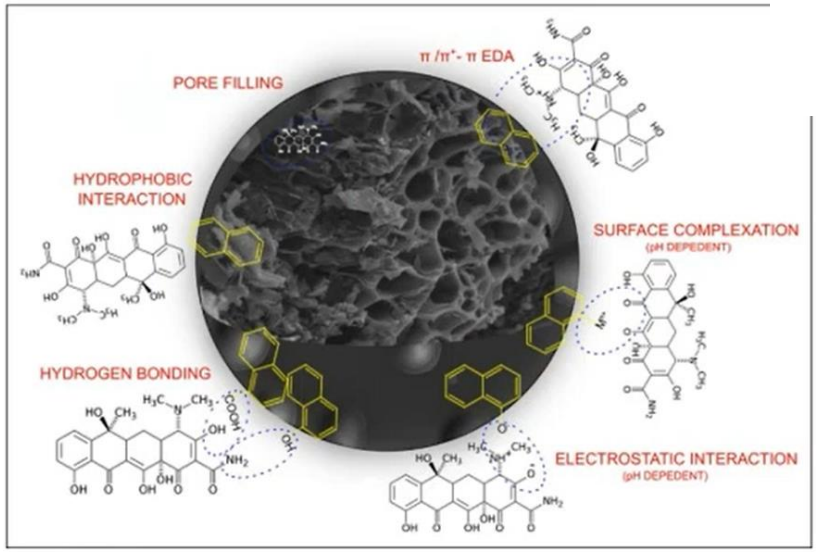
Propriétés des biochar(s)

Biochar … matrice finalement complexe



Source : 2020, Ambaye TG. et al. Mechanisms and adsorption capacities of biochar for the removal of organic and inorganic pollutants from industrial wastewater

Fig. 2 Mechanisms of metal cations (e.g. Cd^{2+}, Cu^{2+}, Hg^{2+}, Pb^{2+}, Zn^{2+}) and oxyanions (e.g. PO_4^{3-}, AsO_4^{3-}) sorption to biochar prepared by pyrolysis at high temperature (>450 °C) and low temperature (<450 °C) (Reproduced with permission from Sizmur et al. (2017), Bioresource Technology 246 (2017) 34–47)



Source : 2021, Krasucka et al. Chemical Engineering Journal, 405:126926

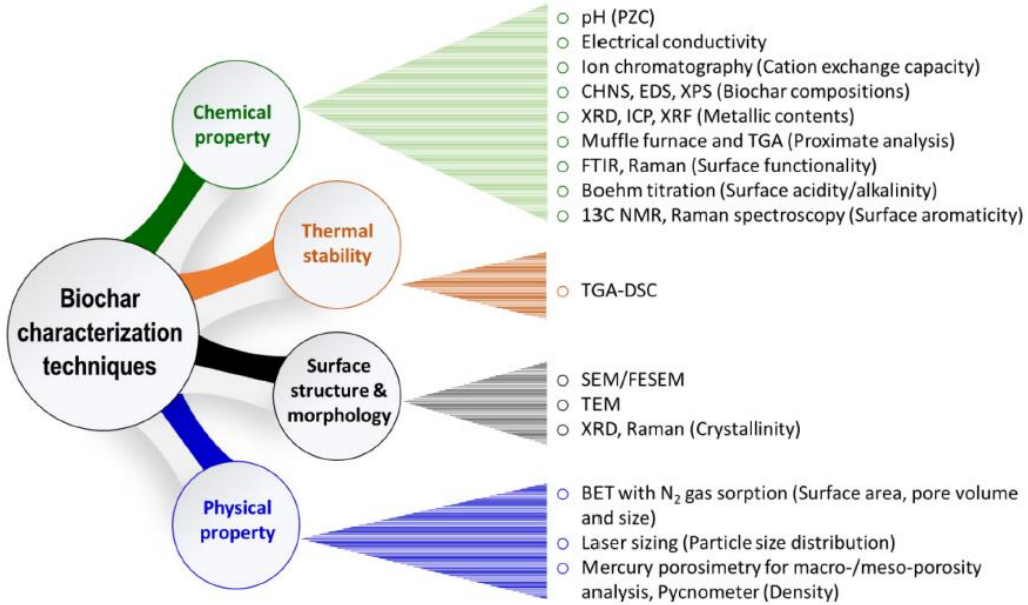


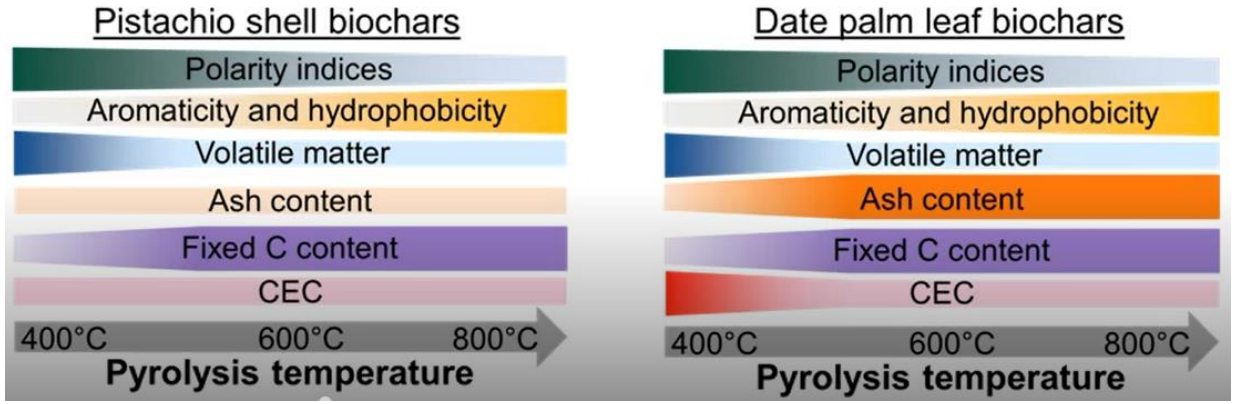
Fig. 1. Classification of characterization techniques versus biochar properties reported in biochar literature.

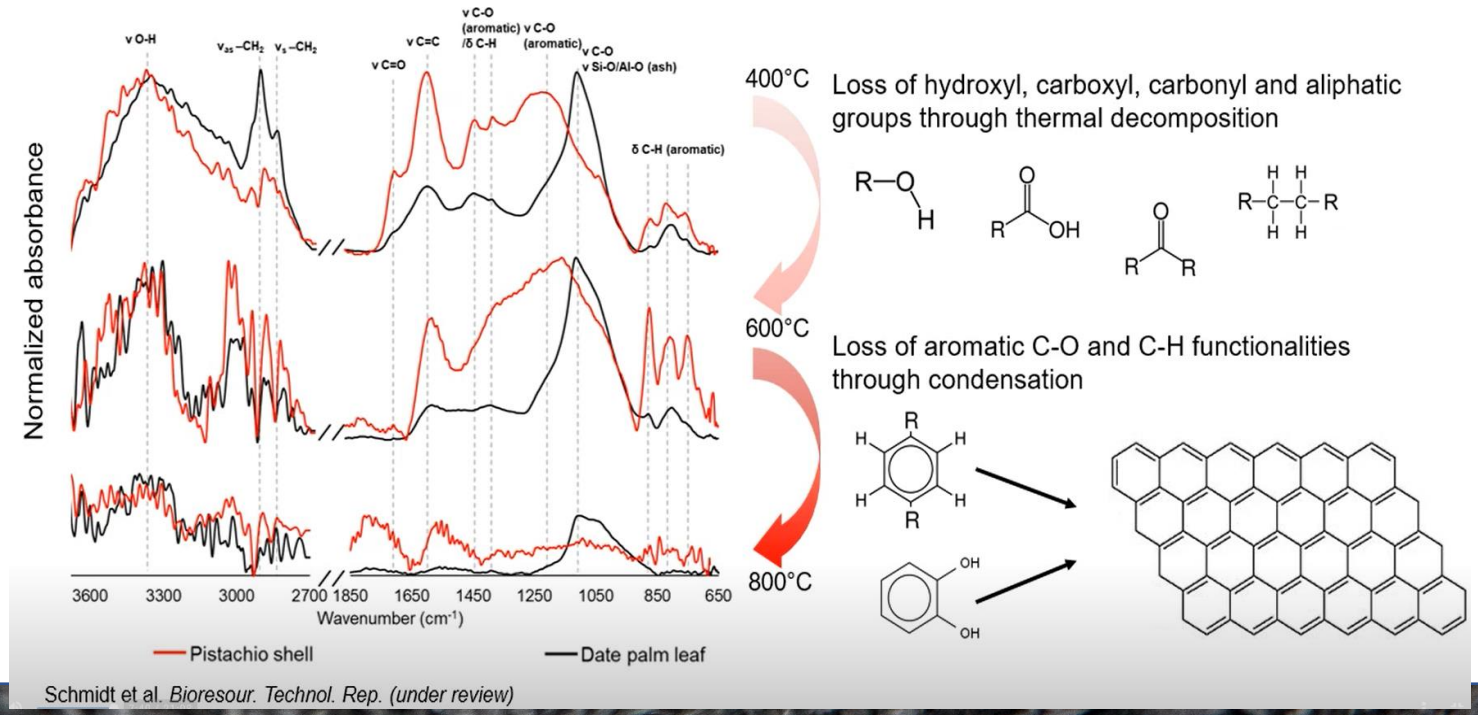
Sources : 2022, Zeghioud et al. A comprehensive review of biochar in removal of organic pollutants from wastewater

Quel biochar pour quel usage ?

TOP parameters

1. Biomass sourcing
2. Production parameters & Technology
3. Activation/ Impregnation





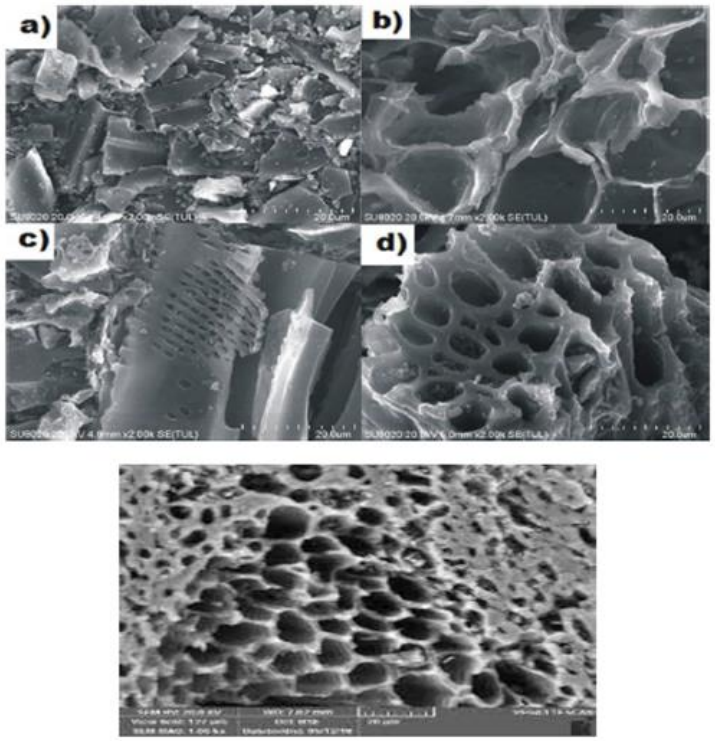
Schmidt et al. *Bioresour. Technol. Rep. (under review)*

Parallèle important entre biochars et charbons actifs

Key-concerns

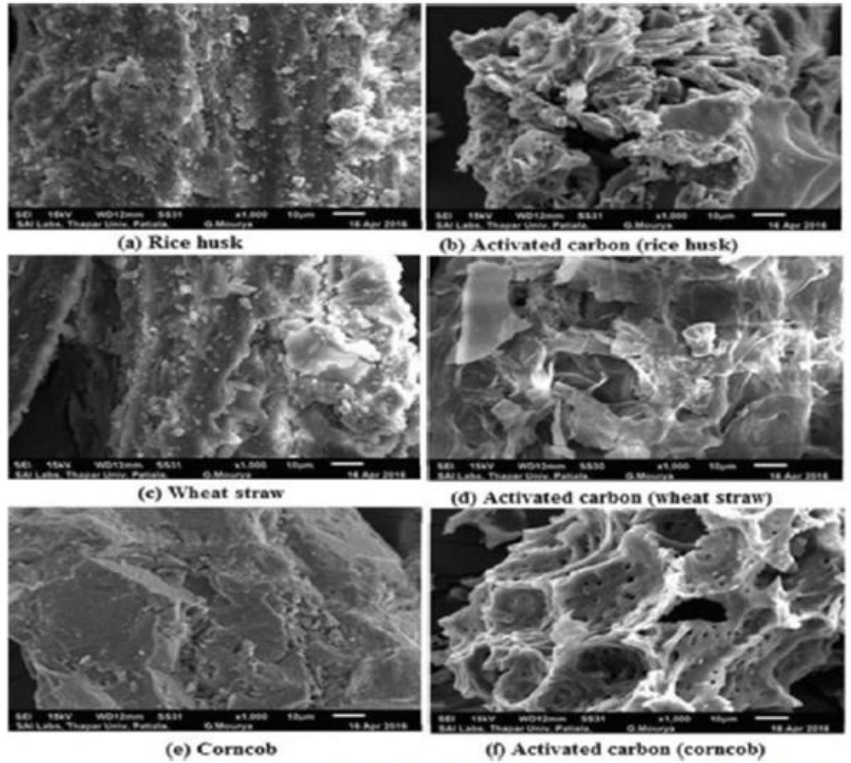
1. Fossil AC prices (powder, grain, …)
2. AC carbon footprint
3. AC/biochar … cost/benefit balance

Commercial Activated Chars



Sreńscek-Nazzal, J., Narkiewicz, U., Morawski, A.W., Wróbel, R.J. and Michalkiewicz, B., 2016. The increase of the micoporosity and CO2 adsorption capacity of the commercial activated carbon CWZ-22 by KOH treatment. *Microporous and mesoporous materials*.

Biochars



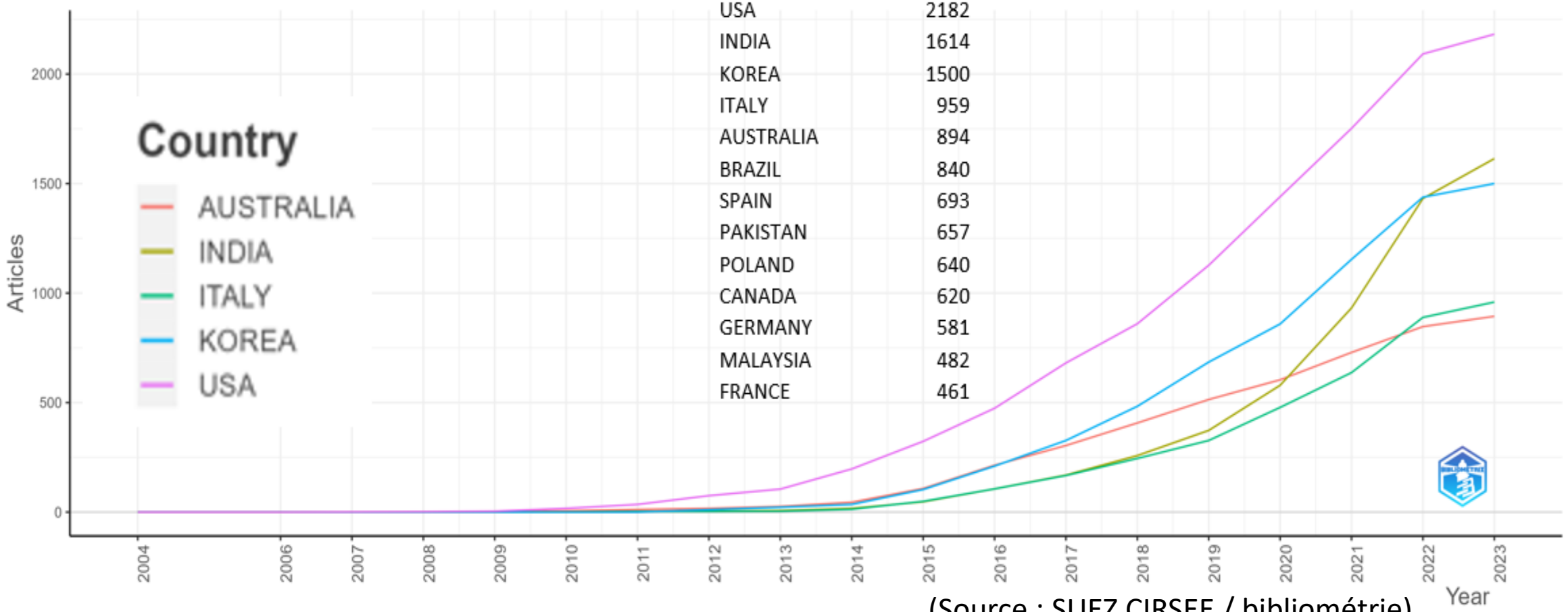
Januszewicz, K., Kazimierski, P., Klein, M., Kardaś, D. and Łuczak, J., 2020. Activated carbon produced by pyrolysis of waste wood and straw for potential wastewater adsorption. *Materials*, *13*(9), p.2047.

Potentiel d’application dans le cycle de l’eau

3 Activité R&D monde sur les biochars

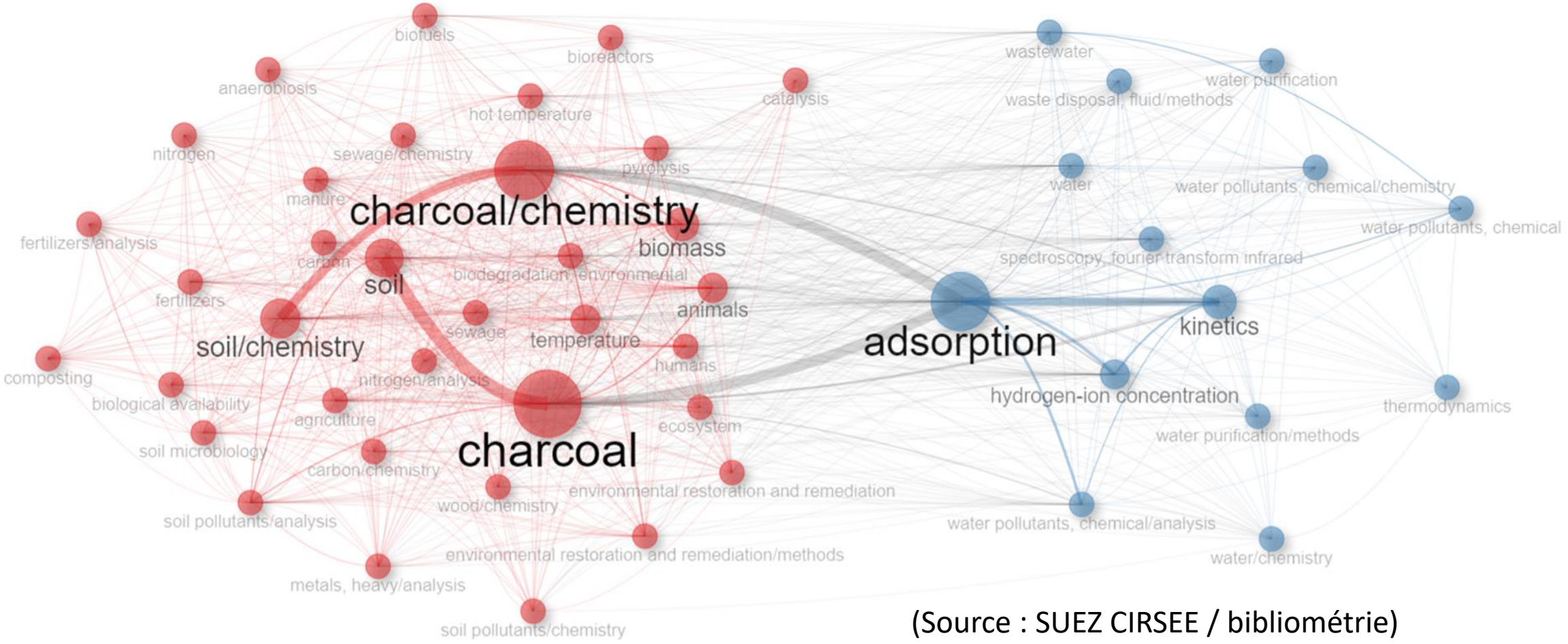
Nombre d'articles publiés en cumul / pays

Country	Articles
USA	2182
INDIA	1614
KOREA	1500
ITALY	959
AUSTRALIA	894
BRAZIL	840
SPAIN	693
PAKISTAN	657
POLAND	640
CANADA	620
GERMANY	581
MALAYSIA	482
FRANCE	461



(Source : SUEZ CIRSEE / bibliométrie)

Occurrence des thématiques



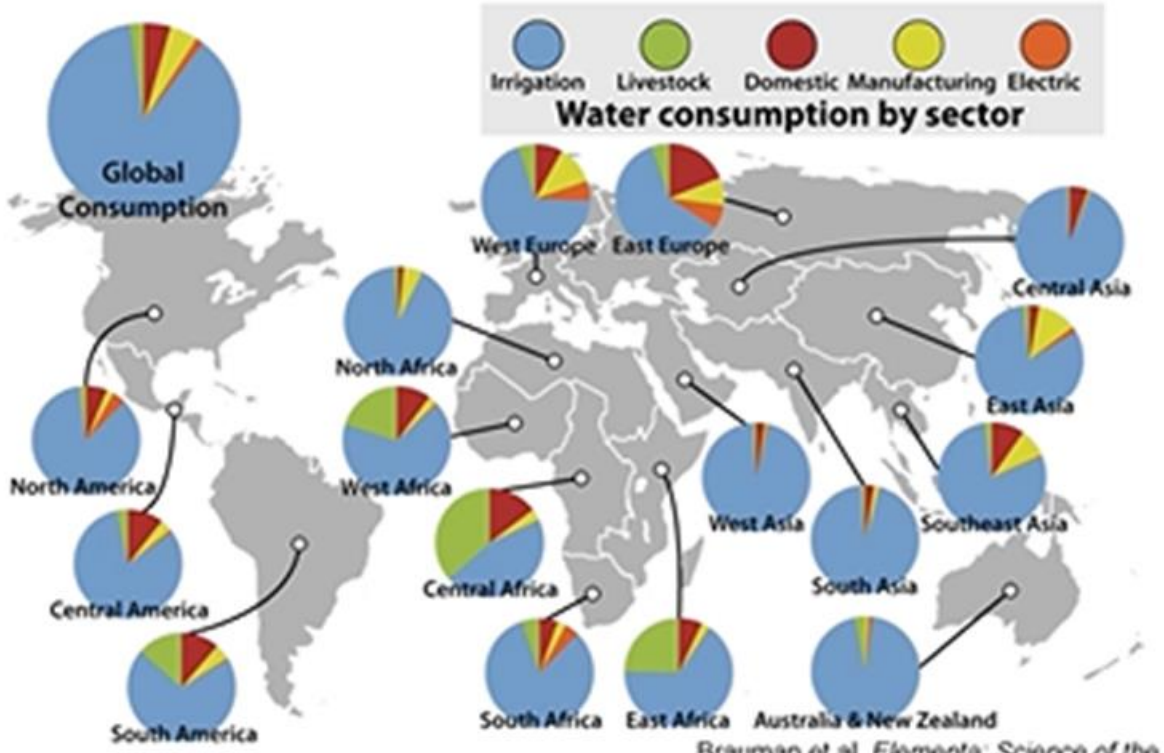
(Source : SUEZ CIRSEE / bibliométrie)

3 Intérêt fonctionnel des biochars

	Targeted Components as reported in the scientific publication
Minerals	Fertilizers, Ammonia, Ions (cations, anions)
Metals	Heavy metals : Pb(II), Cu(I), Cr(III), Cd(II), Ni(II), Zn(II), …
Organic	Petroleum hydrocarbons Polycyclic aromatic hydrocarbons (PAHs) Pharmaceuticals & human/veterinary antibiotics Phenols, pesticides Dyes … large spectrum of soluble organics
Micro-organisms	Pathogens Useful micro-organisms (mycorrhizes, …)
Particles	Mechanical filtration effect (depending on the size distribution)

Biochar … un élément de l'équilibre des usages de l'eau

Irrigation and global water use



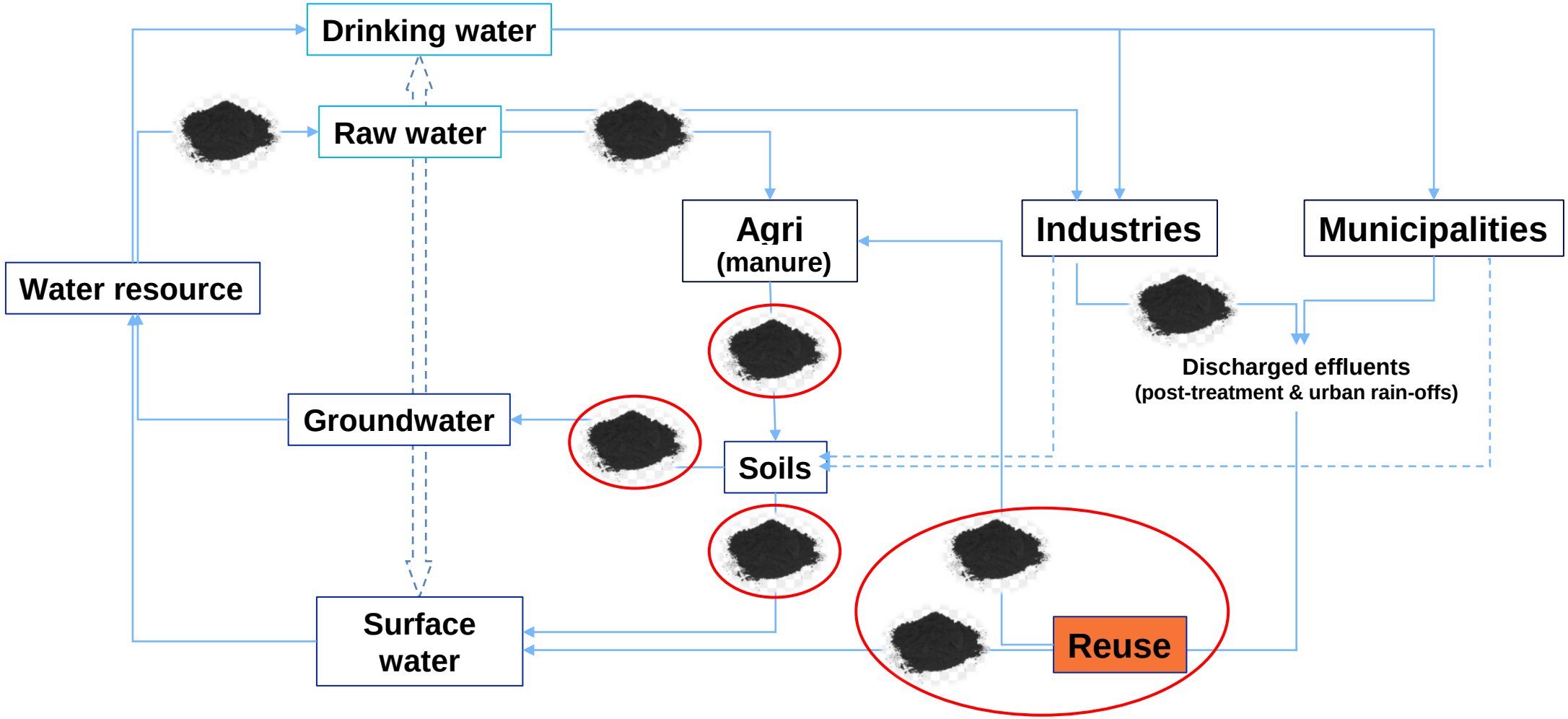
Brauman et al. *Elementa: Science of the Anthropocene* (**2016**) *4*. 000083.

- Irrigation accounts for >70% of freshwater consumption globally
- Estimated 71% of irrigated area experiences water shortages, expected to worsen
- Alternative water sources will be critical to meeting future water needs

Key-concerns

1. Quantity
2. Quality
3. Storability

3 Biochar … un réactif d'intérêt pour le grand cycle de l'eau



Questions / Echanges