



South China Botanical Garden
Chinese Academy of Sciences



Université Fédérale
Toulouse Midi-Pyrénées



ENSAT



How to reconcile quality of crops for human consumption and pollutions of anthropogenic soils commonly observed?



Amaranthus tricolor L.



Wollastonite



Food without Cd !

▫ Case study inspired by « Synergistic improvement of crop physiological status by combination of cadmium immobilization and micronutrient fertilization. » Wu et al. 2015. *Env. Sc. Pollution Research*.

Authors of the resource :

Jingtao Wu

wujingtao@scbg.ac.cn



Camille DUMAT

camille.dumat@ensat.fr

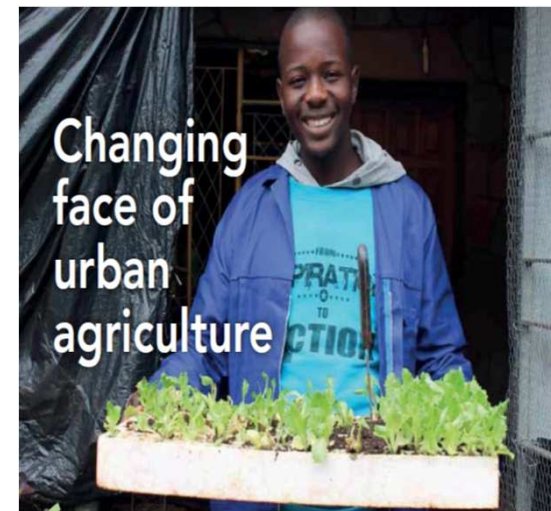


To quote this reference:

**Wu J. & Dumat C. 2016. How to reconcile quality of crops for human consumption and pollutions of anthropogenic soils commonly observed? Réseau Agriville.
Copyright, 22 mars 2016.**

Context

- ❑ At the global scale, soil pollutions (induced by industries, transports, intensive agriculture...) particularly by persistent metals are observed.
- ❑ The growth of cities in the world is straining urban food systems. Urban agriculture provides fresh food, creates jobs, recycles municipal waste, creates green belts, and strengthens the resilience of cities to climate change. **Pollutions need to be managed!**



Organisation des Nations Unies
pour l'alimentation et l'agriculture

<http://www.ruaf.org/publications/magazines>

Urban agriculture is booming



(<http://ensia.com/>; <http://www.stockholmresilience.org>)

- ❑ It's obviously preferable to cultivate edible plants on uncontaminated soils !
- ❑ But [↑ world population + ↓ arable land] ► **Cultivation of food plants on low/medium polluted soil while reducing phytoavailability of pollutants is a proposed track.**

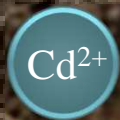
In situ cadmium immobilization technique



Amendment :
Phosphates; Liming materials;
Organic matters; Metal oxides

Soil amendment :
Wollastonite (**W**)

Raw material



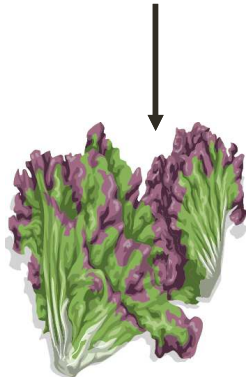
Cd IMMOBILIZATION :
Adsorption - Complexation
Precipitation (pH, redox...)
[Speciation change]

↓ **Cd**
BIOAVAILABILITY

Deficiency of immobilization technique

Control plant :

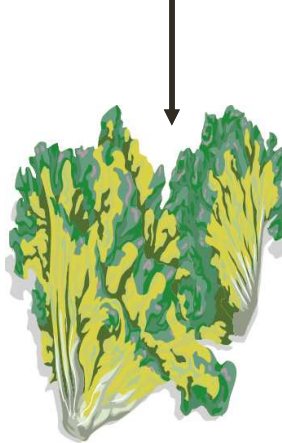
- Low growth rate,
- High Cd uptake
(CK condition)



Amaranthus tricolor L.

with immobilization amendment :

- Less Cd uptake,
- But, chlorotic disorder

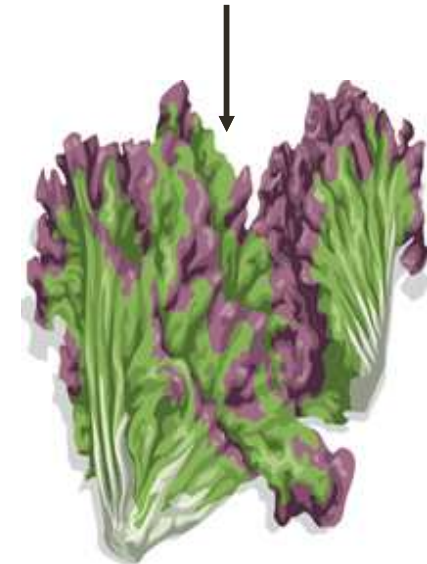


Micronutrient (Zn, Mn),
synchronous immobilization with Cd (by W)



Objective :

- Higher growth rate,
- Less Cd uptake,
- Stronger photosynthetic ability



(W+Zn+Mn condition)



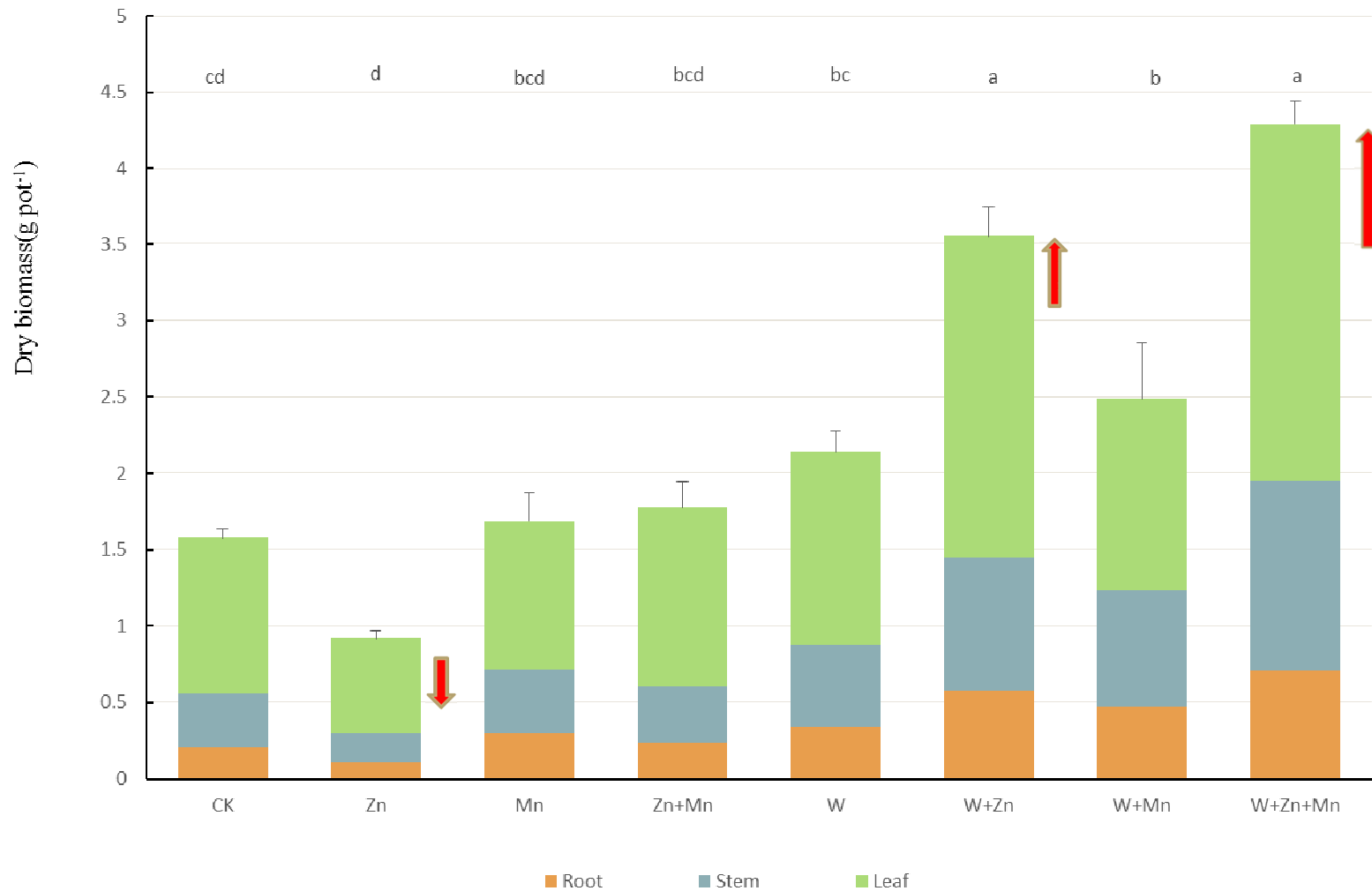
(1) Wollastonite to immobilize Cd.
+
(2) Micronutrient fertilization to favor plant biomass.

Results & Discussion

➤ Changes of biomass for *Amaranthus tricolor* L.

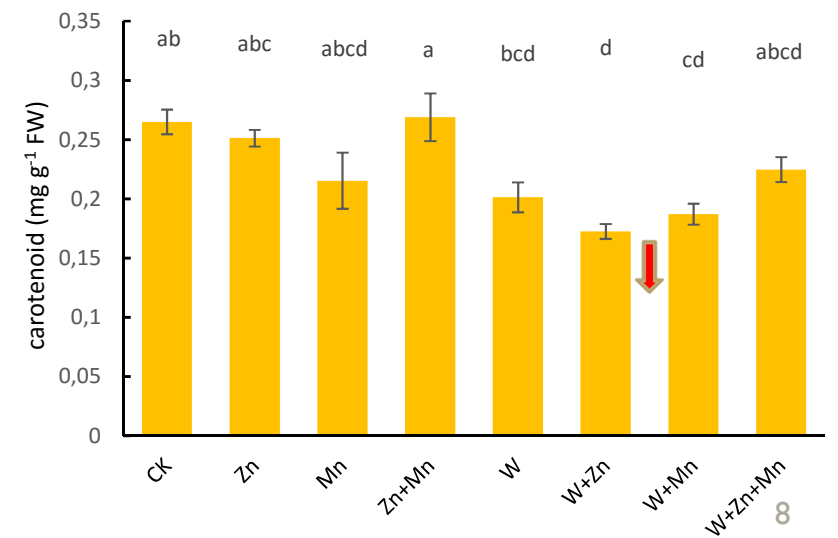
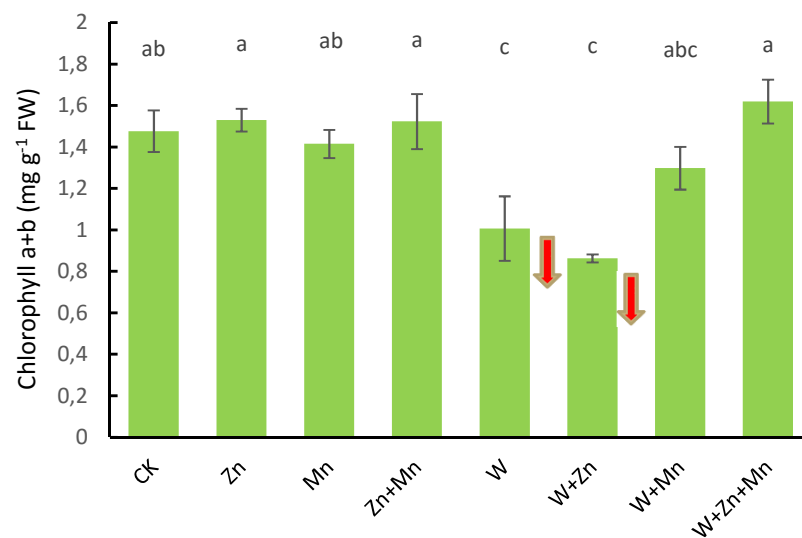
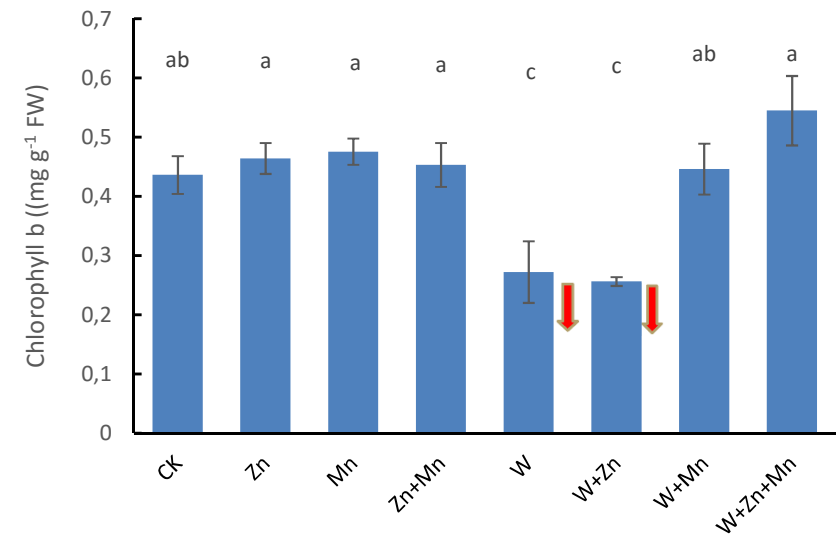
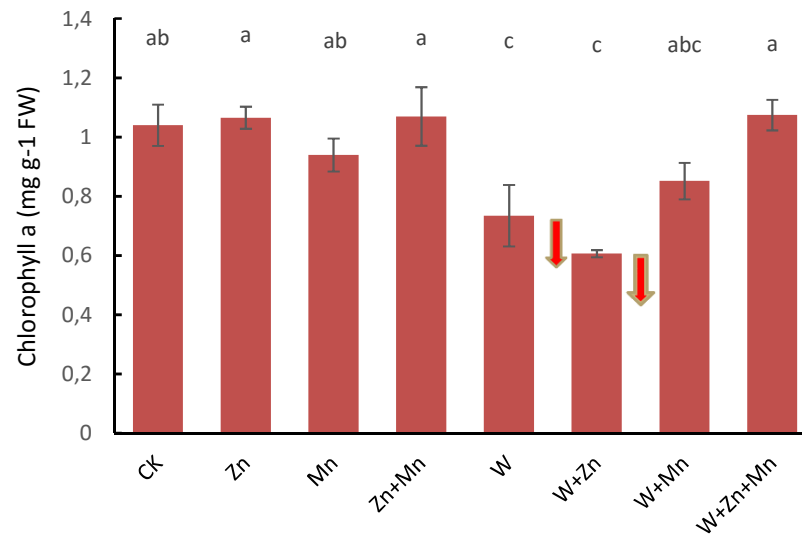
The best way is (W+Zn+Mn).

(Wu et al., 2016)



Results & Discussion

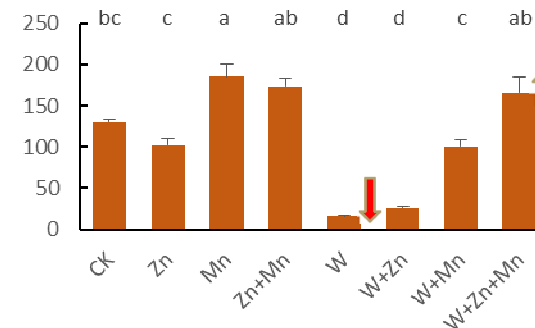
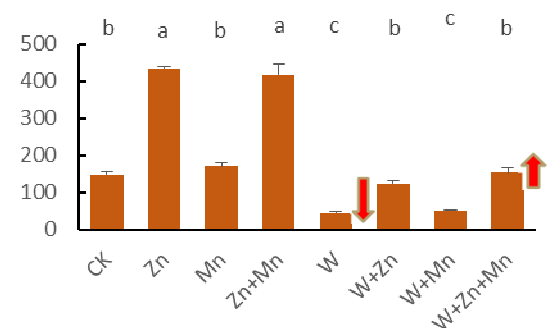
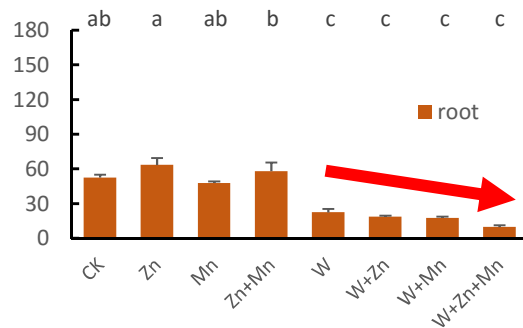
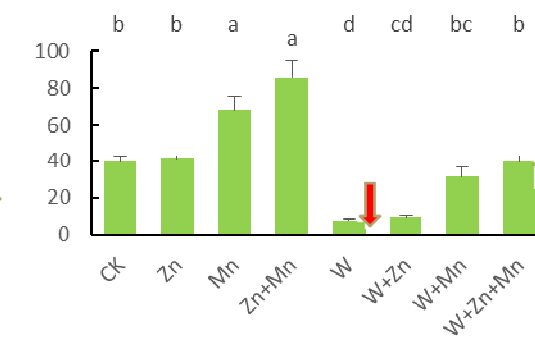
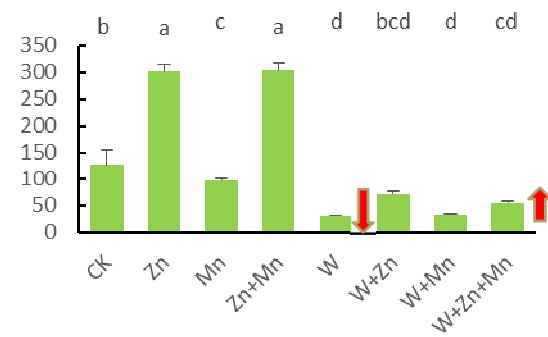
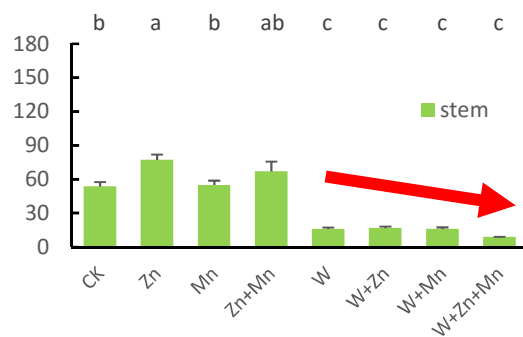
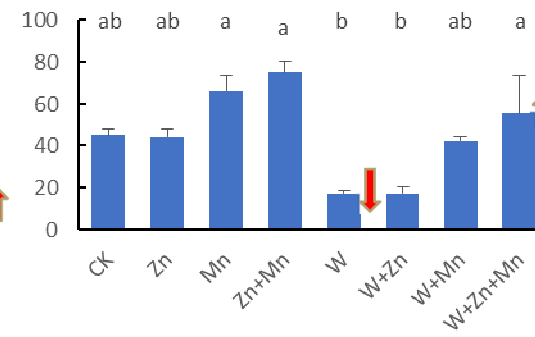
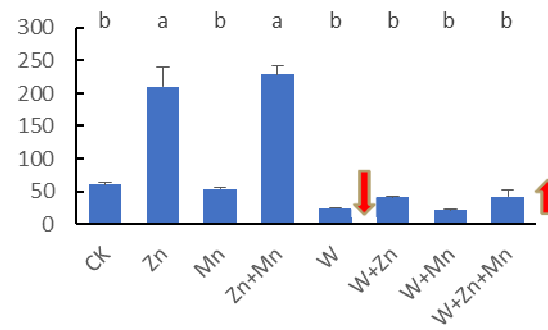
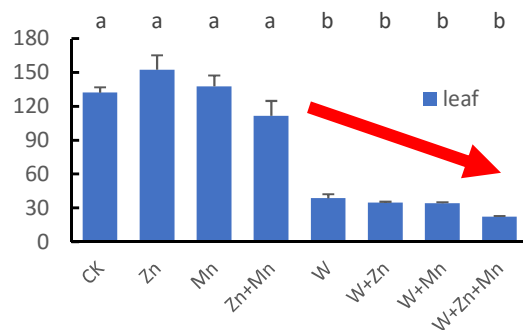
➤ Changes of photosynthetic pigment content (Wu et al., 2016)



Results & Discussion

➤ Changes of metal concentrations in plant

(Wu et al., 2016)



Cd concentration (mg/kg)

Zn concentration (mg/kg)

Mn concentration (mg/kg)

↓ Cd phytoavailability permits to cultivate healthy plants :

- Addition of amendments such as wollastonite (W).
- pH increase favors Cd precipitation.
- In addition to Cd immobilization, it's crucial to improve general soil fertility (organic matters, nutrients...) and favor ecosystem services.



In recent years, **urban agriculture in Lisbon** has become more widespread. Expansion of agriculture within the city and its suburban areas and on the urban poor who grow vegetables in response to the current crisis.

In this way, society has been contributing to the city's resilience.

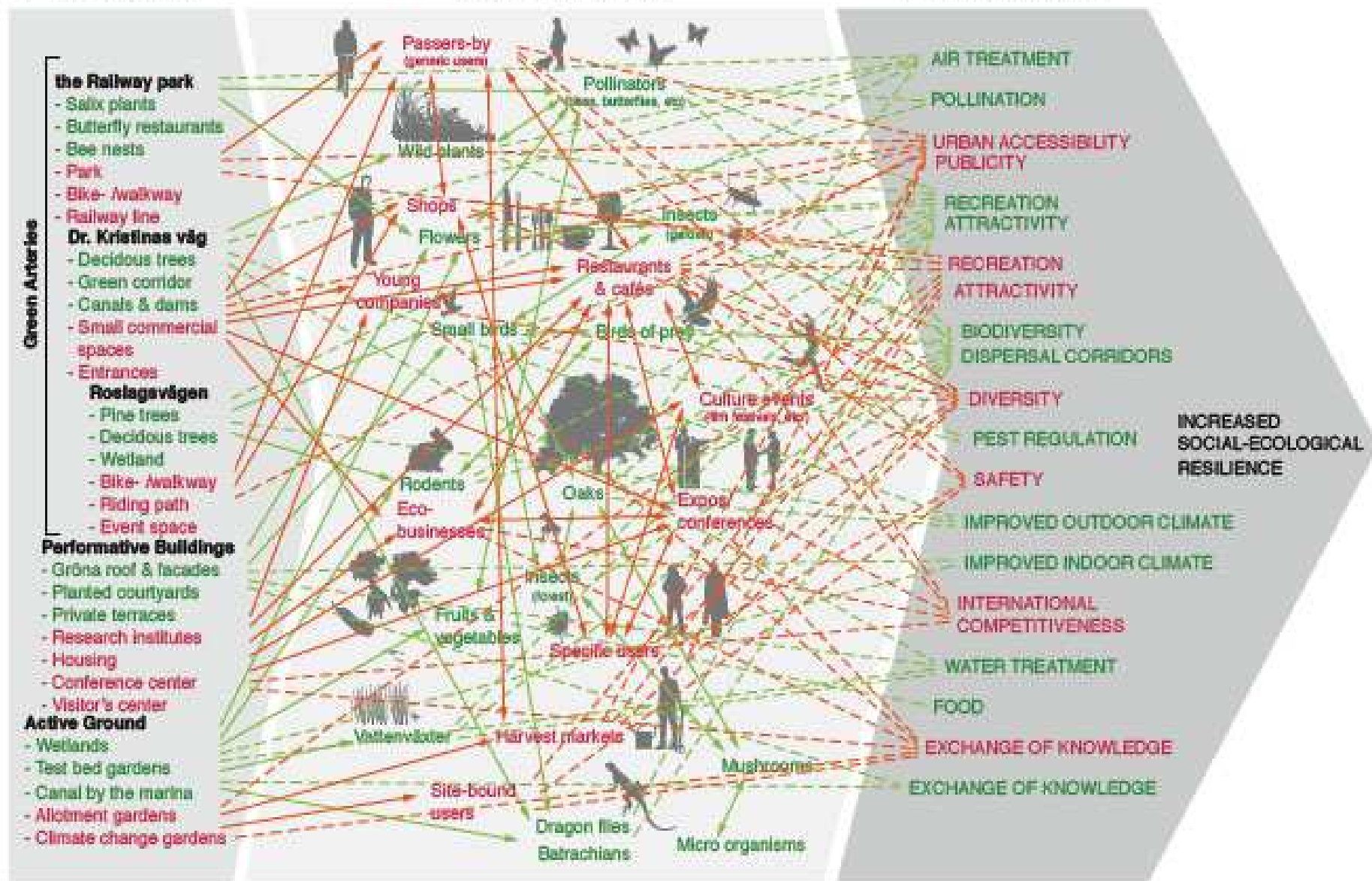


(Urban Agriculture magazine; w3.ruaf.org)

DESIGN COMPONENTS

ACTORS & PROCESSES

ECO SYSTEM SERVICES



<https://villepermaculturelle.wordpress.com/tag/permaculture-urbaine/>

For supplementary information



- Wu et al. 2015. Synergistic improvement of crop physiological status by combination of cadmium immobilization and micronutrient fertilization. Env. Sc. Pollution Research.
- <http://www.ruaf.org/urban-agriculture-what-and-why>
- <http://12.000.scripts.mit.edu/mission2014/solutions/urban-agriculture>
- <http://www.sustainabletable.org/251/innovative-agriculture>
- <http://www.who.int/ipcs/features/cadmium.pdf>
- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/313899/SCHO0709BQRO-e-e.pdf