



Restoration of threatened metallophyte populations in Katanga (D.R. Congo): lessons learnt

Soizig Le Stradic, Maxime Séleck, Julie Lebrun, Sylvain Boisson, Handjila Guylain & Grégory Mahy

SER Europe – Oulu – August 2014





Context

mines occupied less than 1% of
the world's terrestrial land
surface





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mining modifies ecological
processes at broad geographical
scales





Context

mines occupy less than 1% of the world's terrestrial land surface



mining modifies ecological processes at broad geographical scales



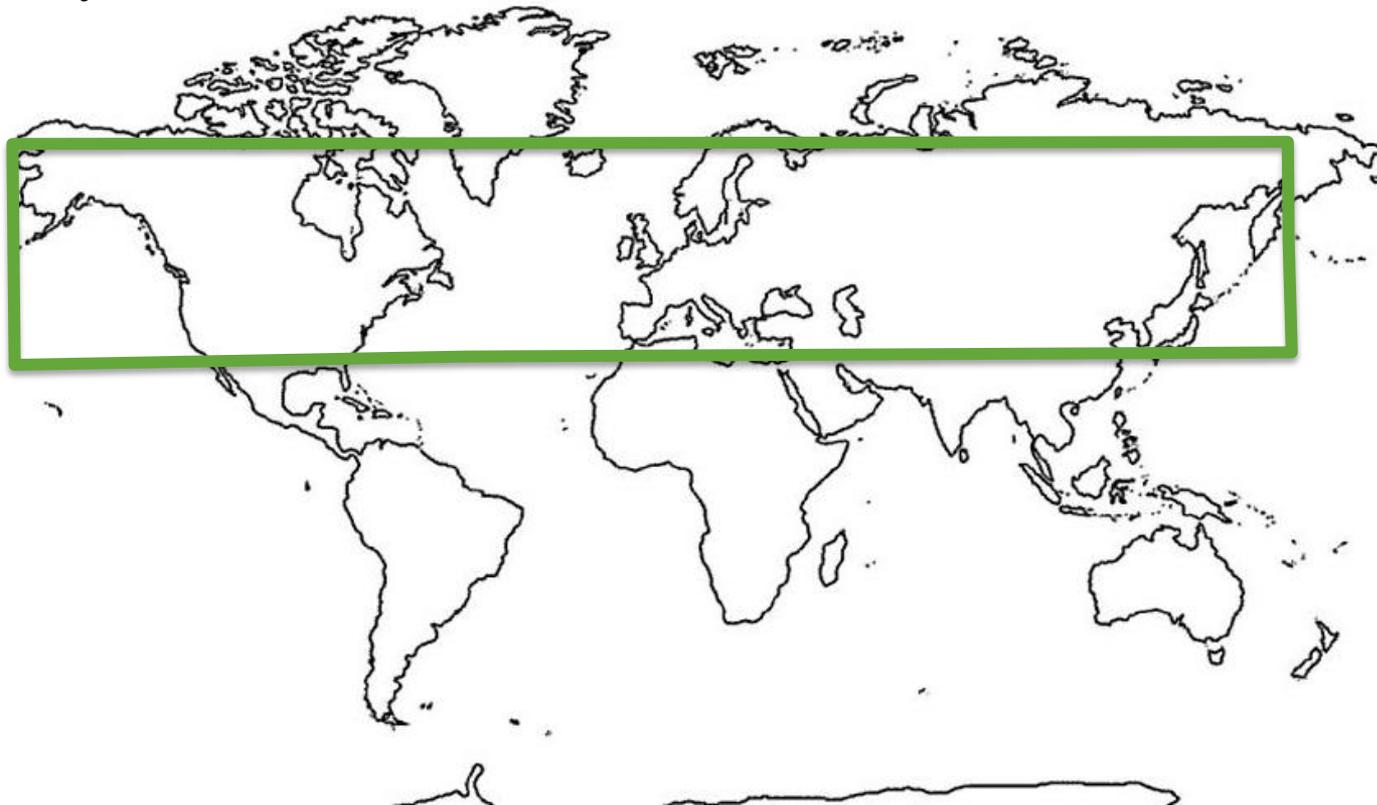
Heavy impacts

Restoration is necessary



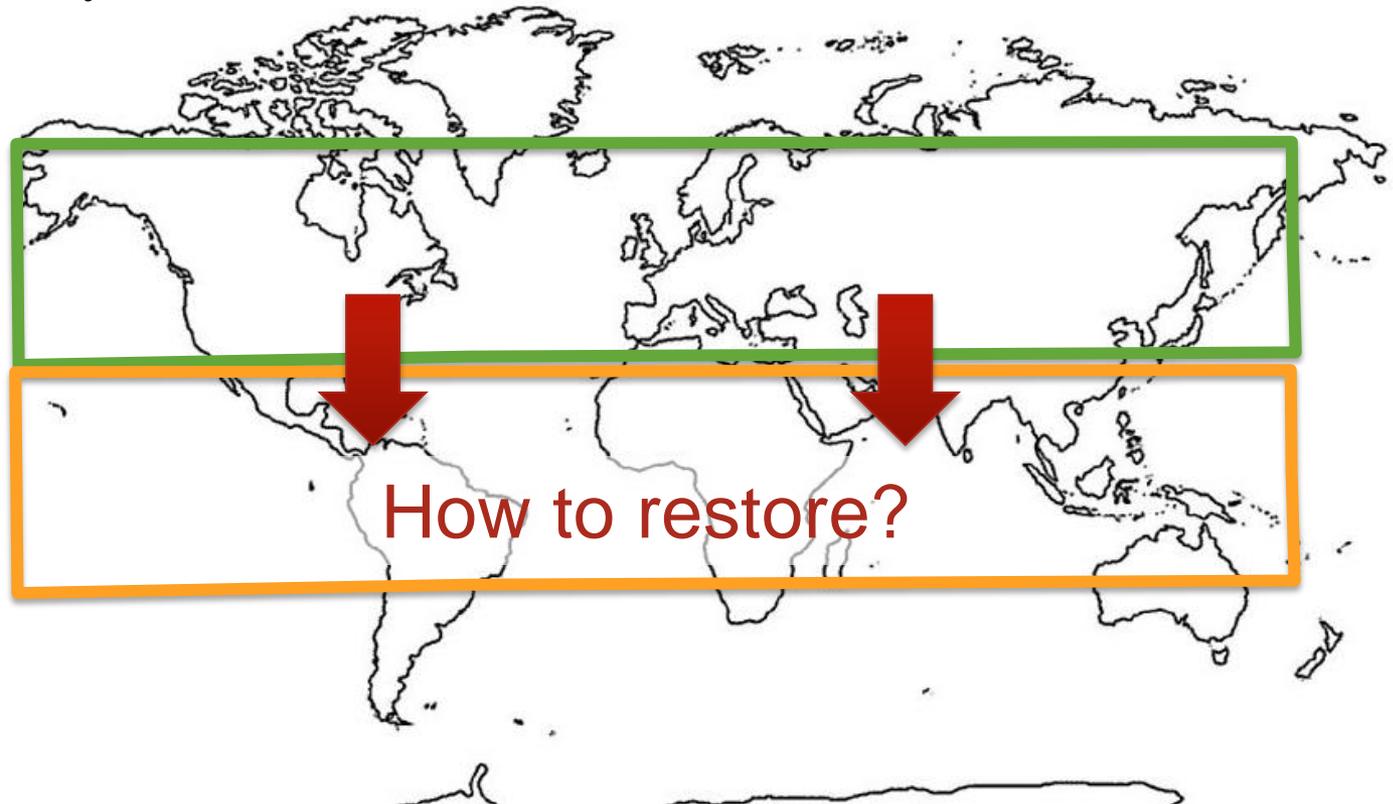
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Restoration is necessary, but.....



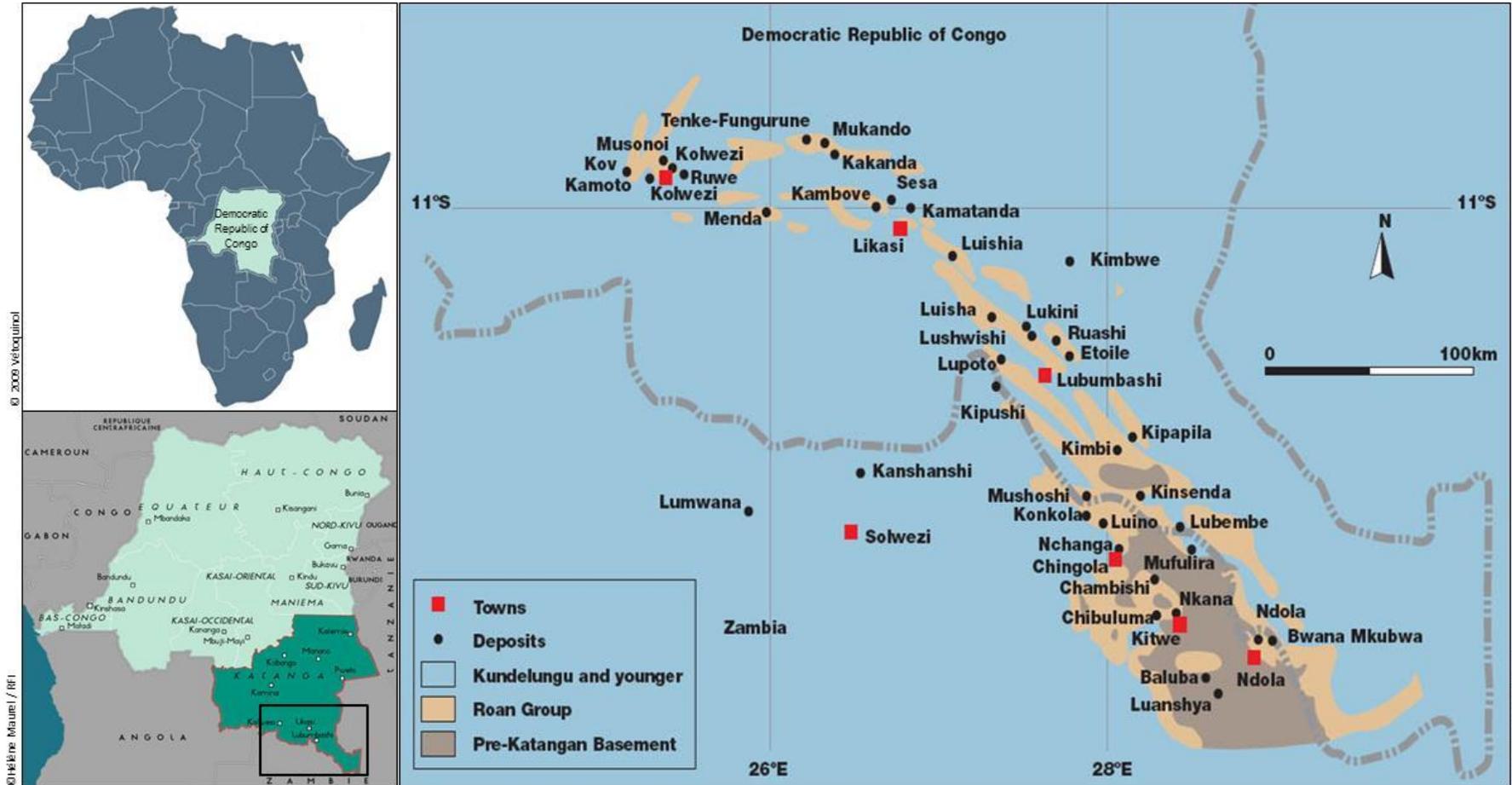
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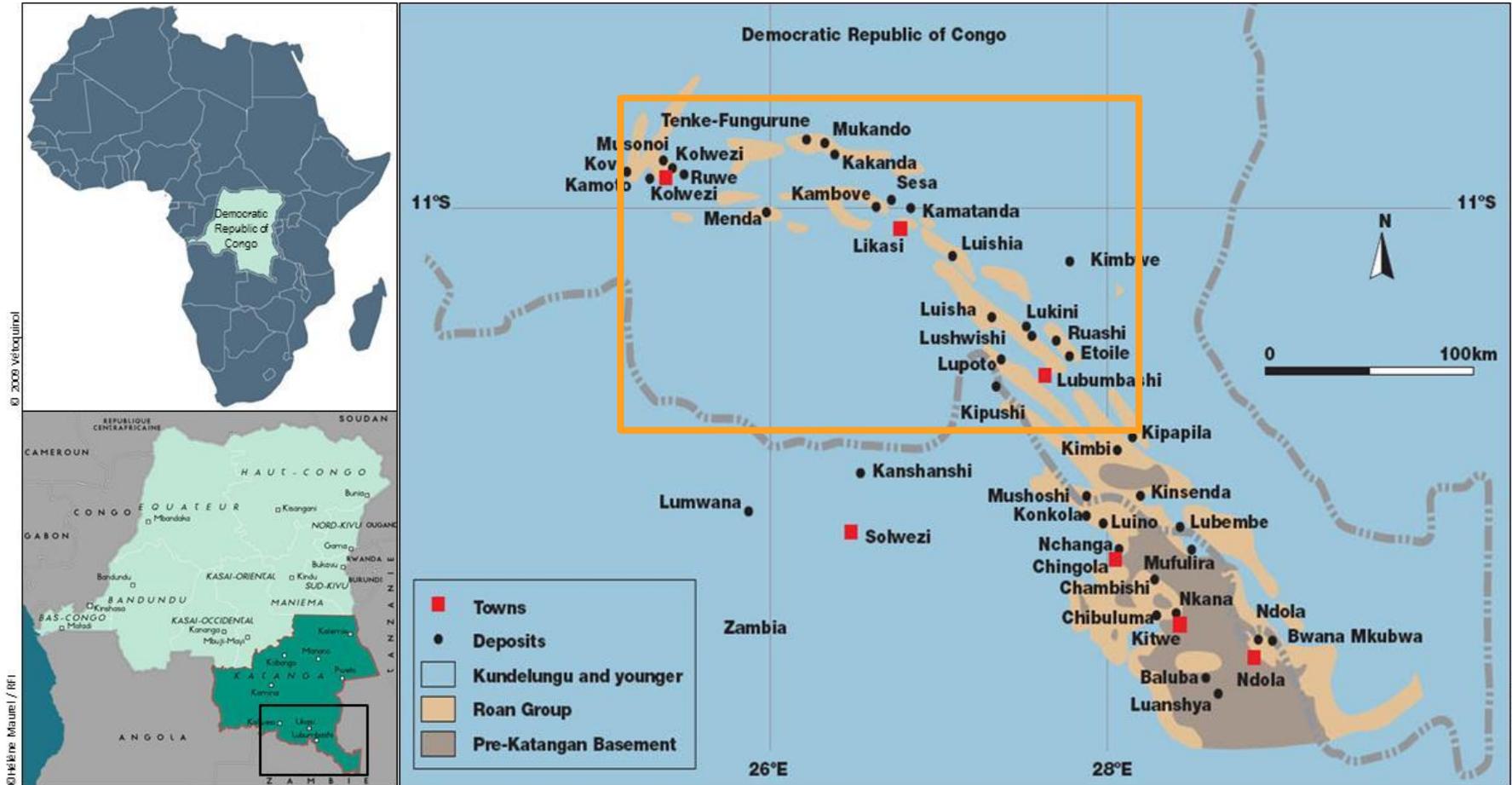
Context

The geological katangan « scandal »: +/- 160 « copper hills »

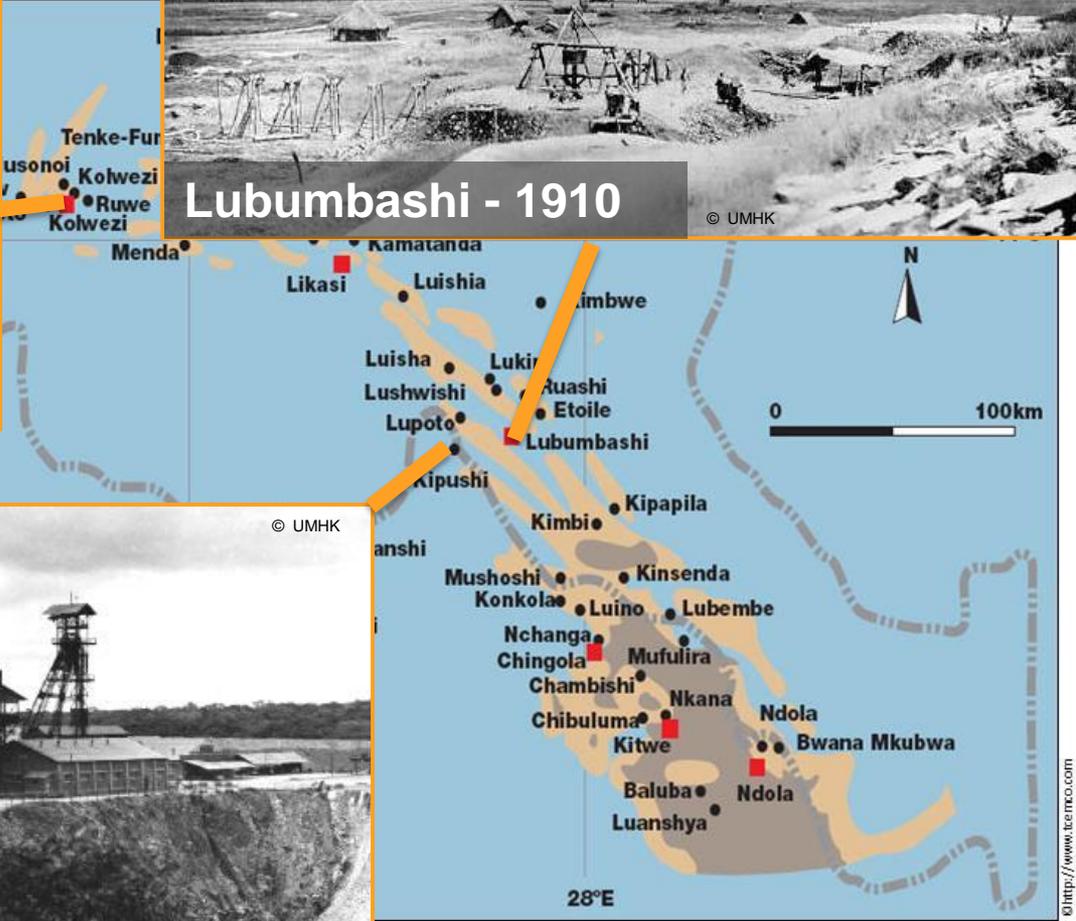


Context

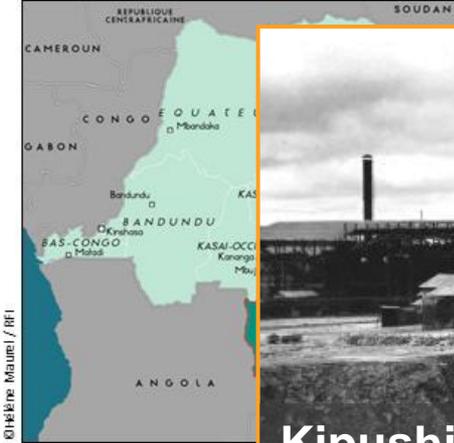
The geological katangan « scandal »: +/- 160 « copper hills »



Context



© 2000 Vektorprint



Cu-Co communities



Extreme [Cu] & [Co] in soil



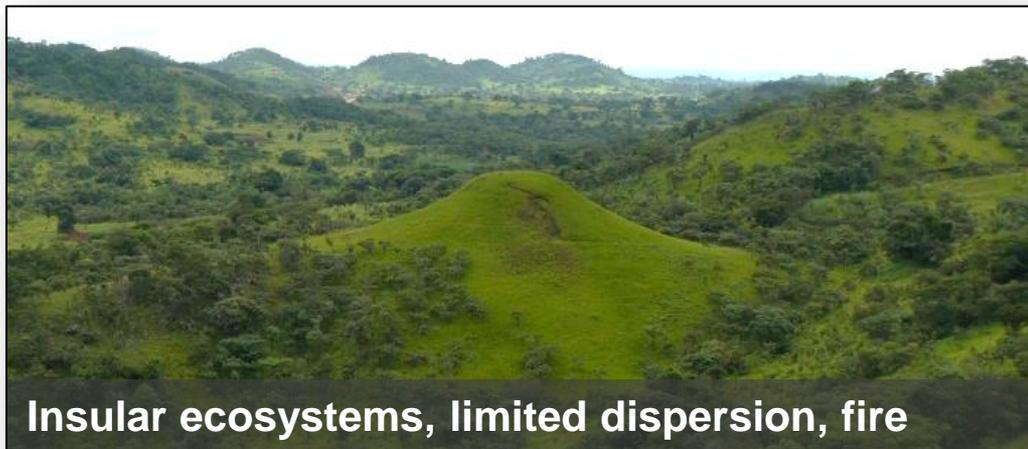
Insular ecosystems, limited dispersion, fire



Cu-Co communities

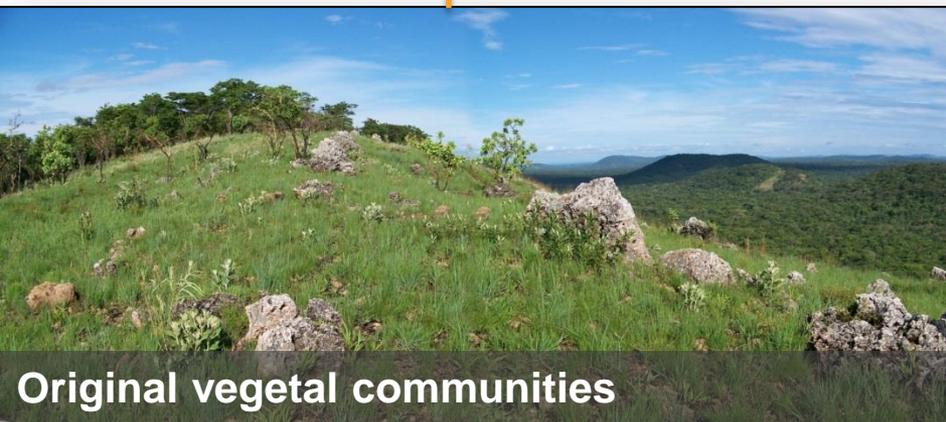


Extreme [Cu] & [Co] in soil



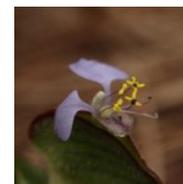
Insular ecosystems, limited dispersion, fire

High selective pressure



Original vegetal communities

Specialized metallophytes, endemic species



Cu-Co communities

Plant Ecology and Evolution 143 (1): 5–18, 2010
doi:10.5091/plecevo.2010.411



Copper endemism in the Congolese flora: a database of copper affinity and conservational value of cuprophytes

Michel-Pierre Faucon^{1,2,6,7}, Arthur Meersseman^{1,7}, Mylor Ngoy Shutcha³, Grégory Mahy⁴,
Michel Ngongo Luhembwe³, François Malaisse⁴ & Pierre Meerts^{1,5}

24 broad endemics



Dissotis derriksiana P.A.Duvign.

25 Cu Hyperaccumulators



Anisopappus davayi S.Moore

34 strict endemics



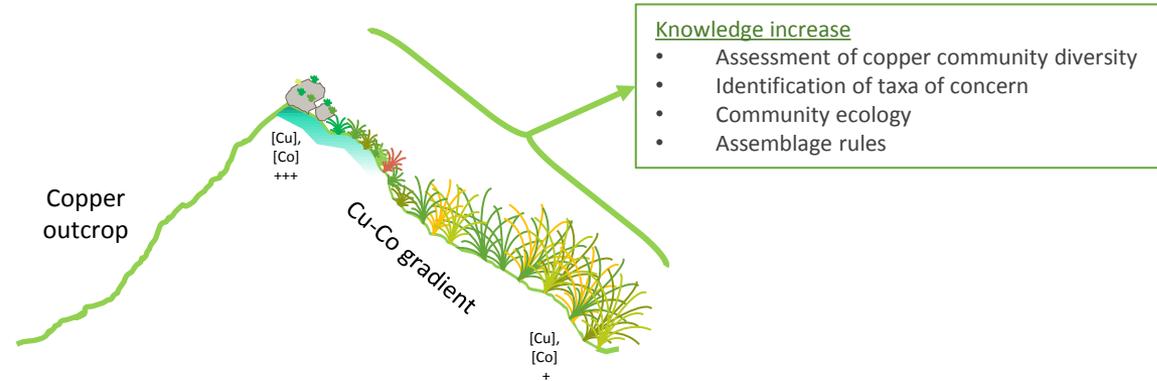
Lopholaena deltombei P.A.Duvign.

Specialized metallophytes,
endemic species



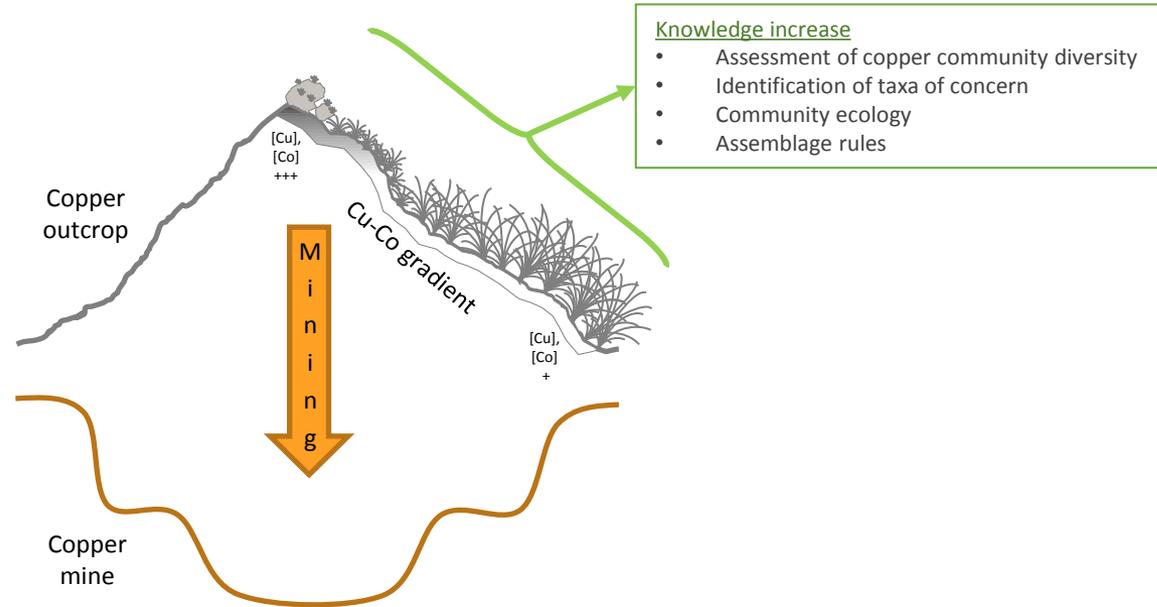
Global strategy

Global biodiversity conservation strategy developed with a mining company:



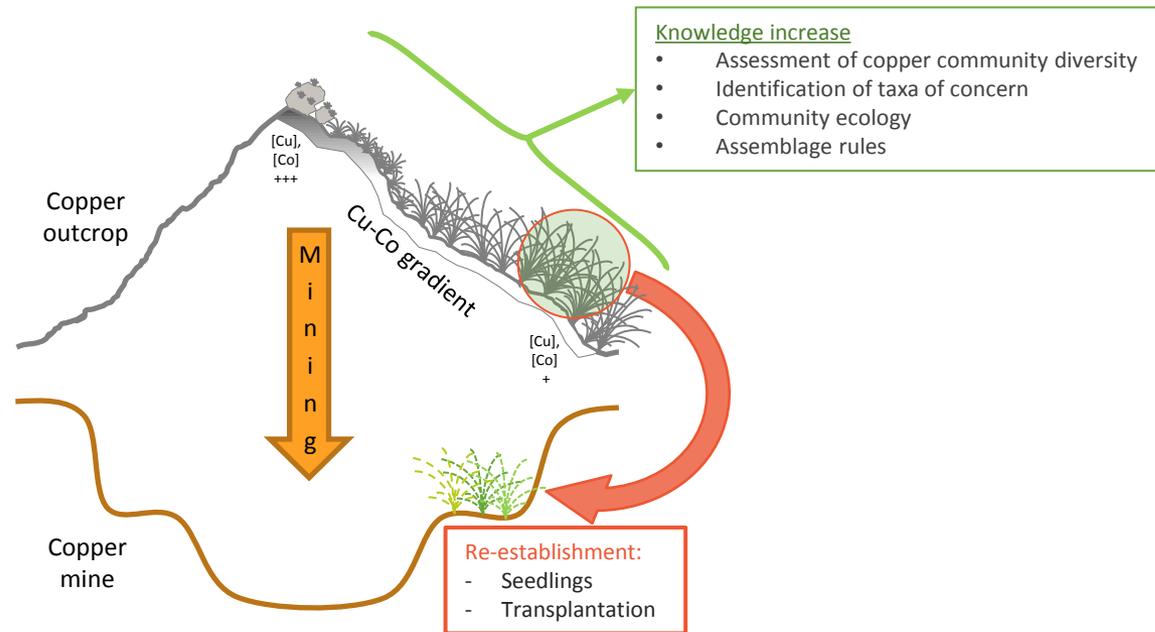
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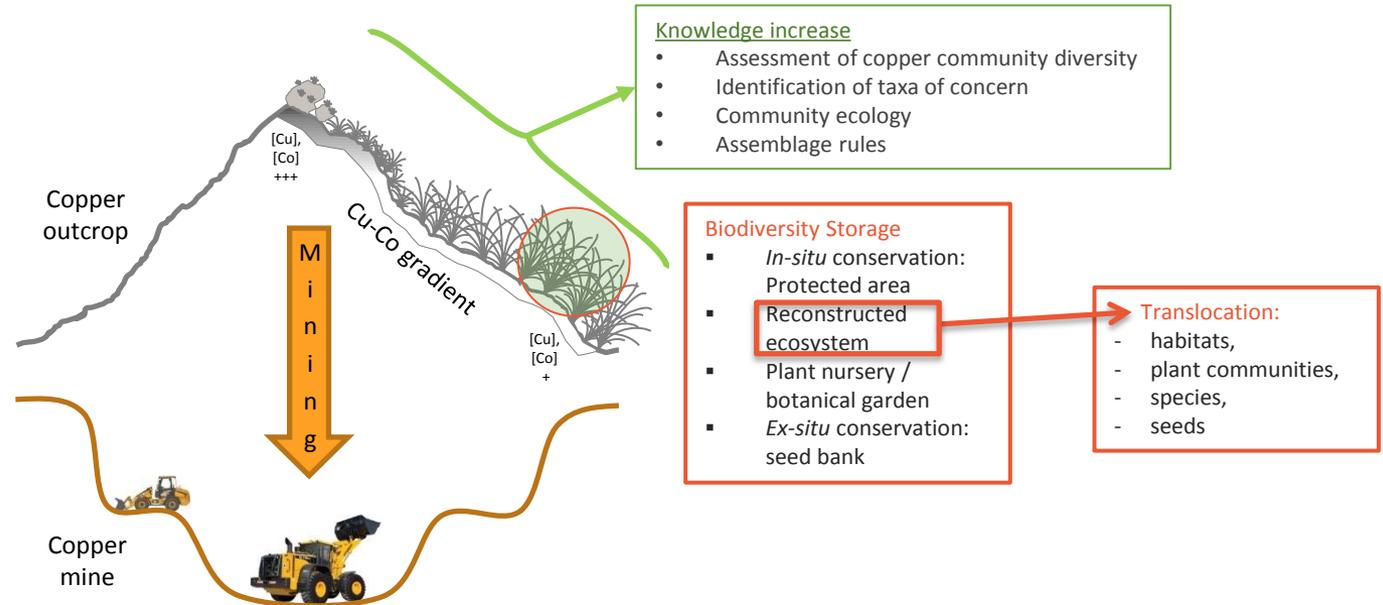
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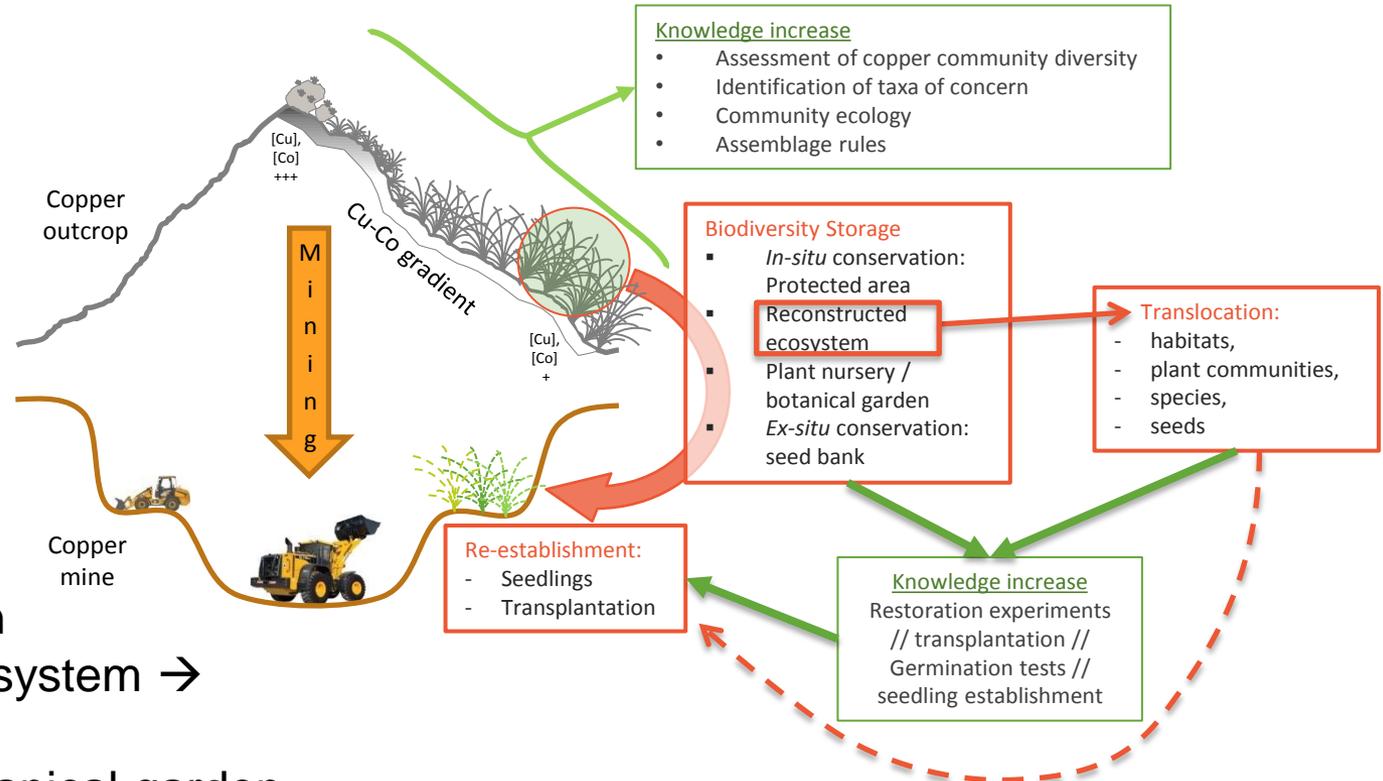
Biodiversity storage:

1. *In-situ* conservation
2. Reconstructed ecosystem → translocation
3. Plant nursery // botanical garden
4. *Ex-situ* conservation



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Biodiversity storage:

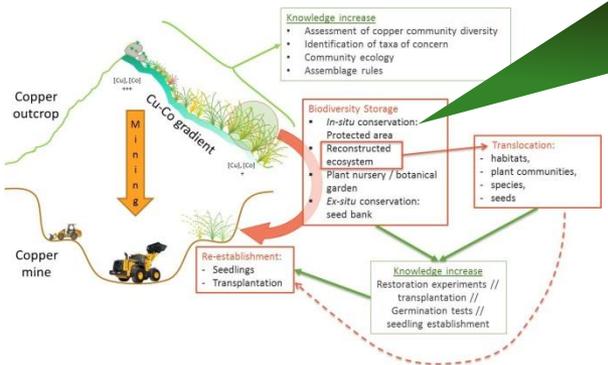
1. *In-situ* conservation
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4. *Ex-situ* conservation





In-situ

Protected areas



Kazinyanga



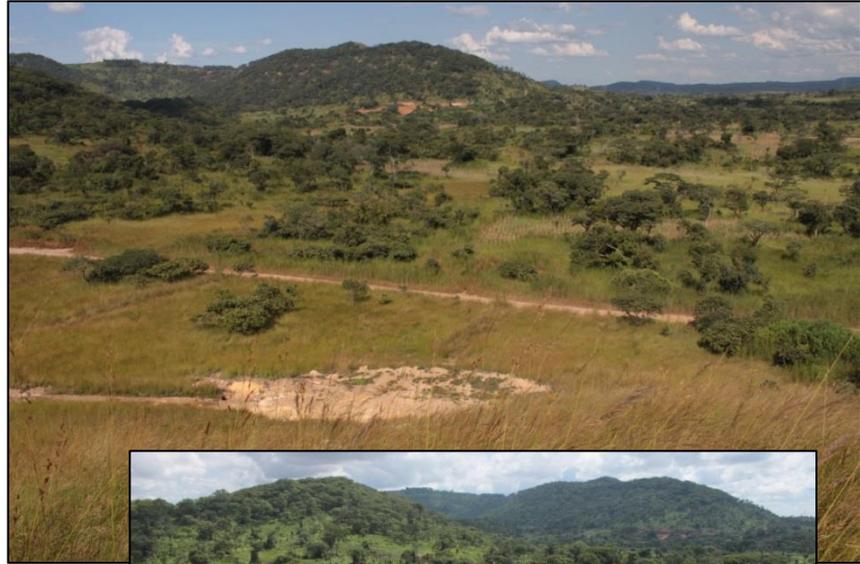
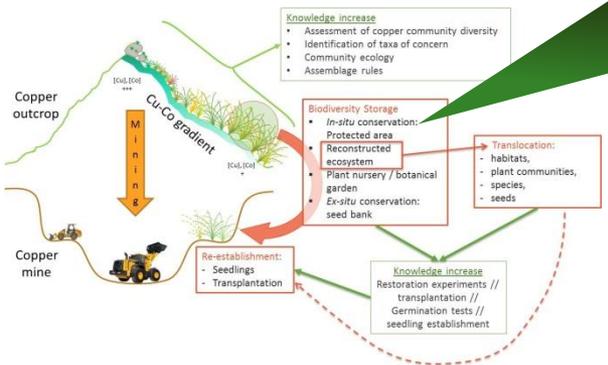
Shadirandzoro





In-situ

Protected areas



Kazinyanga



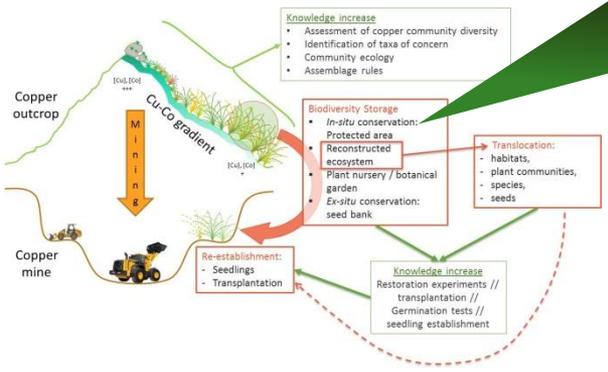
Shadirandzoro





In-situ

Plant Micro Reserves (PMR)



Biodiversity storage *via* plant micro reserves



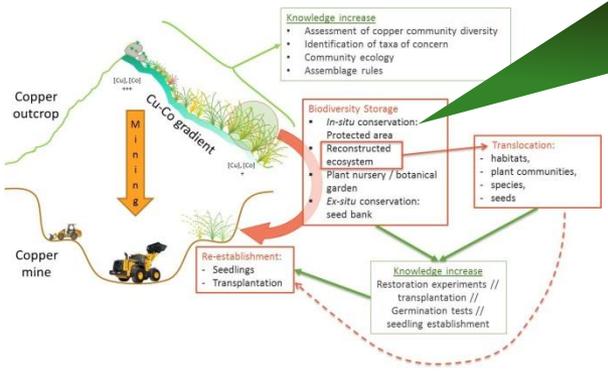
Kabwelunono PMR





In-situ

Plant Micro Reserves (PMR)



Kavifwafwaulu
PMR



→ Limited efficiency

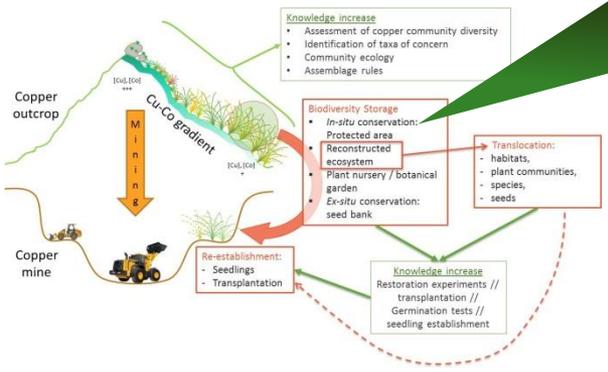
Original clearing	Initial surface of original clearing (ha)	Species Richness of original clearing Δ	Year of PMR creation	Initial PMR surface (ha) (% of initial surface)	PMR species richness *	PMR surface in Dec. 2013 (ha)	Lost surface percentage in 2013
Kavifwafwaulu [1]	11,95	149	2010	5,90 (49%)	136	2,20	62,71%
Shimbidi	13,67	165	2011	4,24 (31%)	159	2,60	38,68%
Kabwelunono	27,32	182	2012	5,70 (21%)	119	2,80	50,88%





In-situ

Plant Micro Reserves (PMR)



In situ conservation → **limitations**

- often destroyed or damaged
- Regularly decreased

+ some parts are in the mine footprint & can not be saved

→ 1 Alternative = **translocation of individuals**



Shadirandzoro



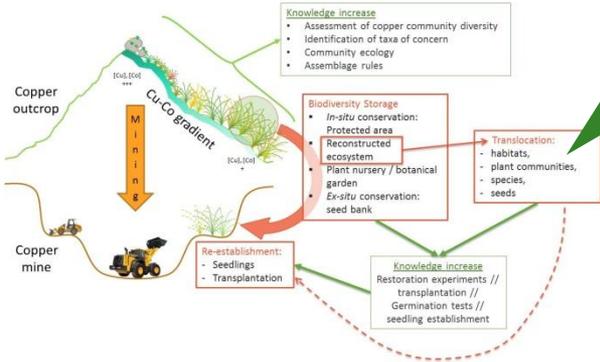
Kazinyanga



Ex-situ

Species translocation

First translocation from Kwatebela → Shadirandzoro



Kwatebala



Shadirandzoro



Species	Origin	Location	Date of transplantation	Initial number of individuals	% survival 2012 (nb of individuals)
<i>Basananthe kisiimbae</i>	Kwatebala	Shadiandzoro central	June 2007	84	5% (4)
<i>Cheilanthes perlanata</i>	Kwatebala	Shadirandzoro Central	April 2007	3107	25% (763)
<i>Chlorophytum subpetiolatum</i>	Kwatebala	Nursery	June 2007	284	82% (233)
<i>Chlorophytum subpetiolatum</i>	Kwatebala	Shadirandzoro Central	May 2007	235	63% (148)
<i>Lebedouria revoluta</i>	Kwatebala	Shadirandzoro Central	July 2007	57	89% (51)
<i>Wahlenbergia verbascoides</i>	Kwatebala	Shadirandzoro central	April 2008	200	7% (14)
<i>Xerophyta sp.</i>	Kwatebala	Shadirandzoro Central	April 2008	70	93% (65)

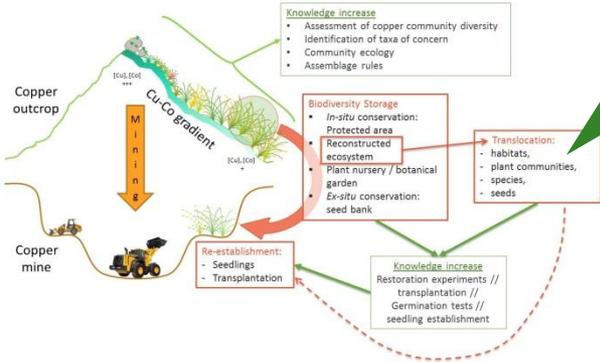
→ Endemic species



Ex-situ

Species translocation

First translocation from Kwatebela → Shadirandzoro



Kwatebala



Shadirandzoro

with 885 new individuals and 13014 prothalles

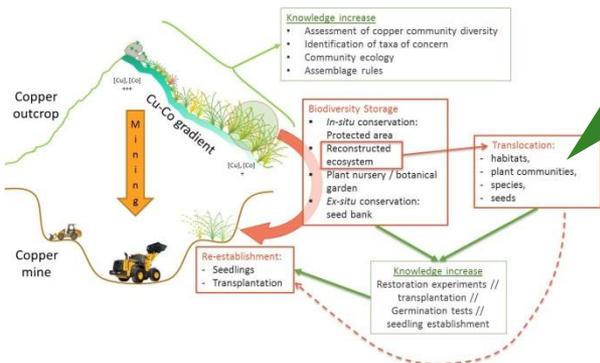
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Ex-situ

Species translocation

First translocation from Kwatebela → Shadirandzoro



Kwatebala



Shadirandzoro

Major issues with some critical species

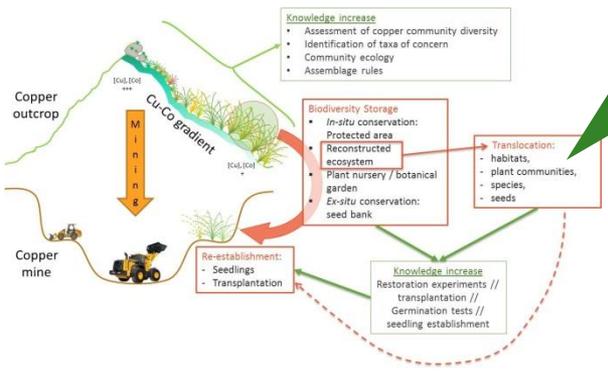
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Ex-situ

Species translocation



Problems:

- these protected areas are out of the mine footprint ONLY on the short term
- protected areas regularly damaged by illegal miners

Destroyed this year

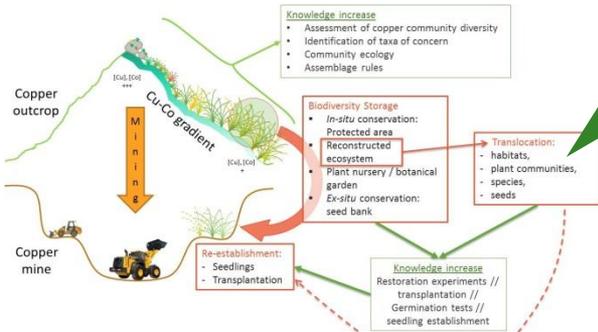


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Species translocation



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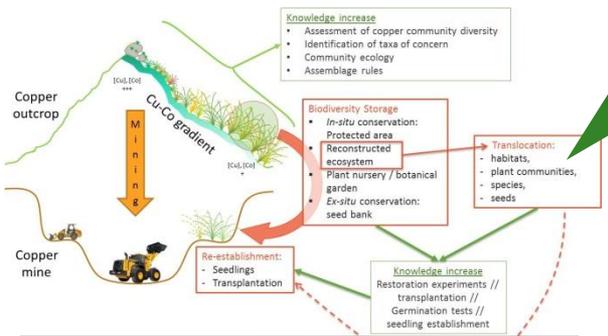
Solution → translocation in reconstructed ecosystems





Ex-situ

Species translocation



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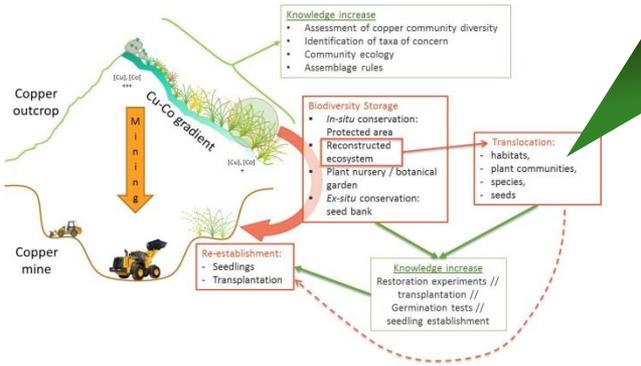
Solution → translocation in reconstructed ecosystems

- Out of the mine footprint
- No Cu-Co, not damaged by illegal miners
- Some species of Concerns are missing in ecosystems



Ex-situ

Species translocation



Translocation results at Shimbidi:

	Initial number	Survival (%) after 2 months	Survival (%) after 14 months
<i>Aeollanthus sabacaulis</i>	100	73	47
<i>Dissotis derriksiana</i>	50	54	8
<i>Tinnea coerulea var. obovata</i>	100	35	7
<i>Pandiaka carsonii</i>	100	77	41
<i>Barleria lobelioides</i>	50	10	4
<i>Triumfetta likasiensis</i>	50	54	14
<i>Ocimum vanderystii</i>	100	53	26
<i>Acalypha cupricola</i>	100	46	12

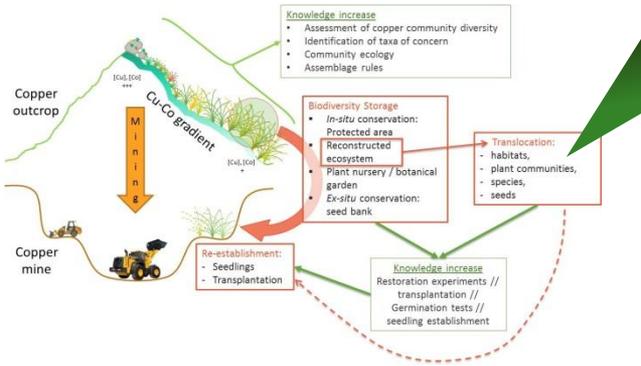


Pandiaka carsonii



Ex-situ

Species translocation



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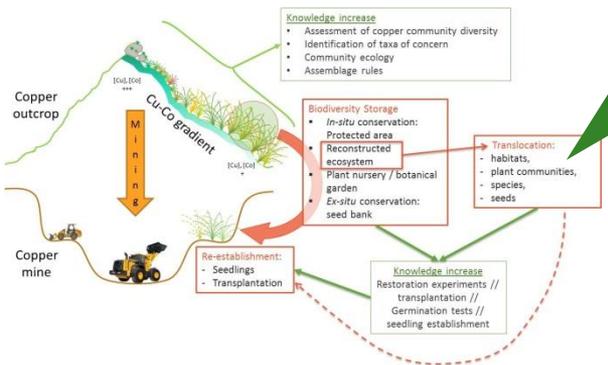
→ Translocation of species in another copper clearing seems more successful than the translocation in artificial ecosystem → edaphic conditions?? Competition??





Ex-situ

Species translocation



→ Damages to the root system



e.g. *Acalypha cupricola*



at Shimbidi:

Survival (%) after 2 months	Survival (%) after 14 months
73	47
54	8
35	7
77	41
10	4
54	14
53	26
46	12

→ These results are helpful for restoration programs → large root system is a major challenge when restoring these ecosystems.

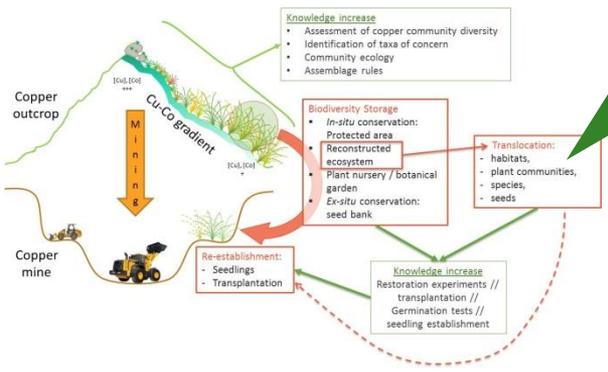




Ex-situ

Species sowing

Direct sowing of SoC and structuring species

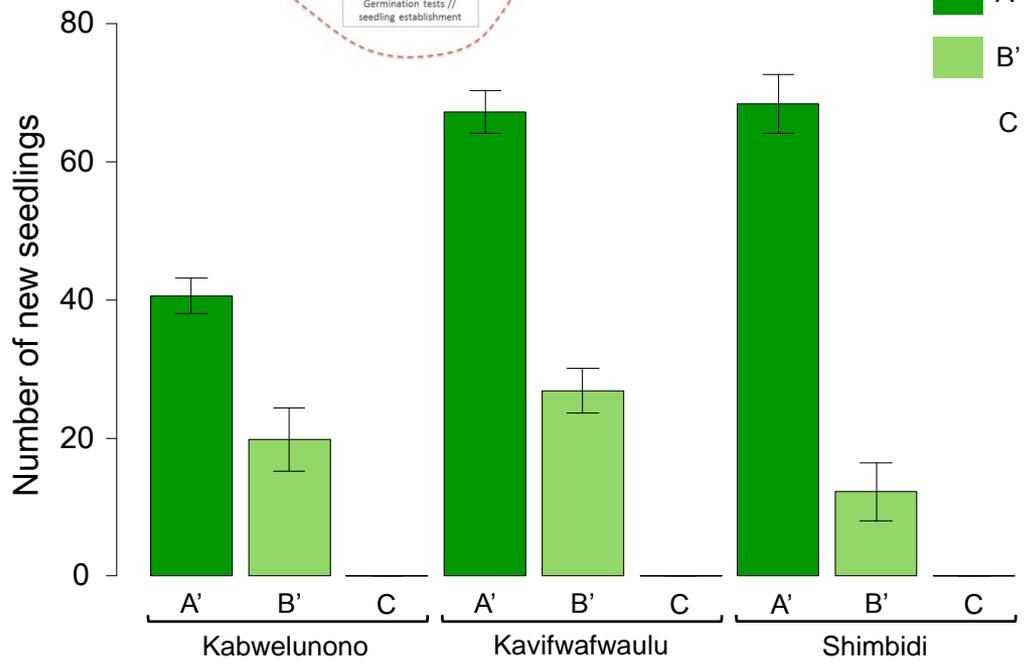
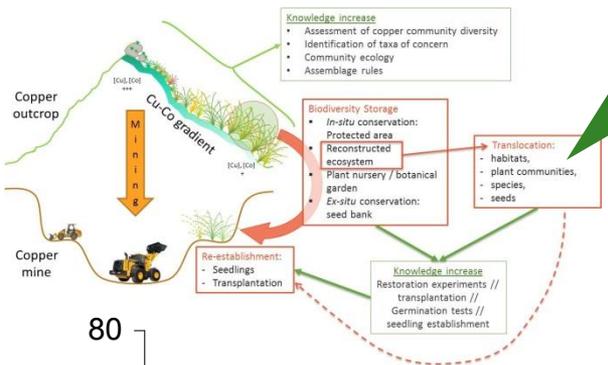




Ex-situ

Species sowing

Direct sowing of SoC and structuring species



- A' Mix with 10 species
- B' Mix with 5 species
- C Without sowing

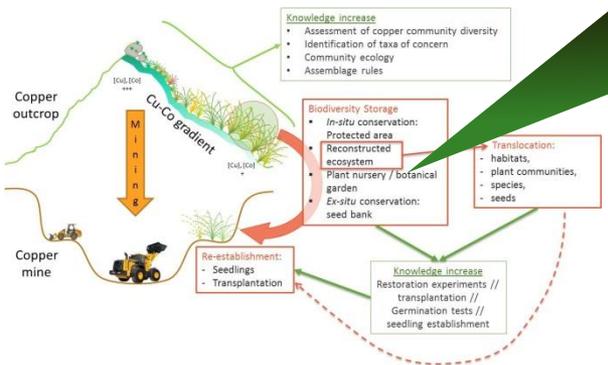




Ex-situ

Nursery / Botanical garden

Production of CuCo species seedlings in nursery



Cutting of *Commelina zigzag*



Seedling of *Aeschynomene pygmaea*



Seedling of *Triumfetta likasiensis*



Cuttings of *Euphorbia fanshawei*

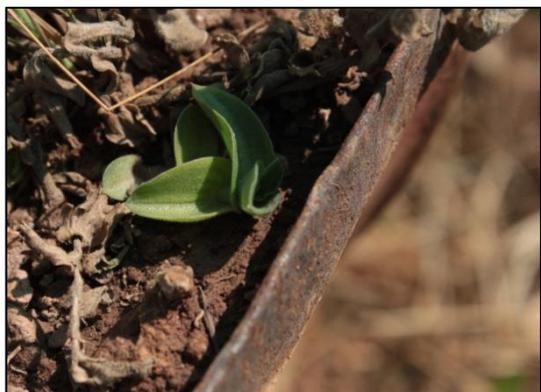
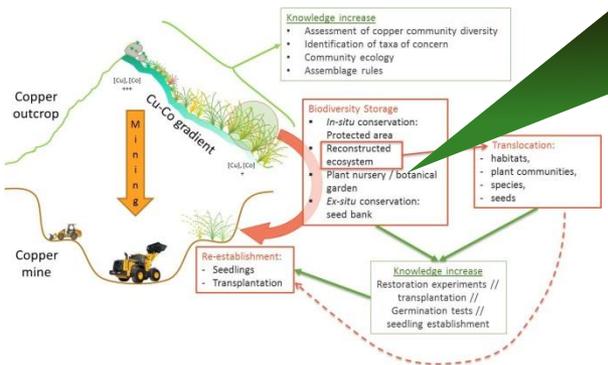




Ex-situ

Nursery / Botanical garden

Production of CuCo species seedlings in nursery



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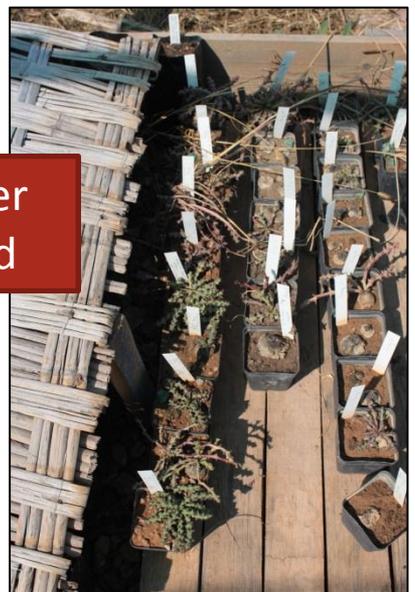
So far, the production of Copper species seedlings is very limited



Seedling of *Aeschynomene pygmaea*



Seedling of *Triumfetta likasiensis*



Cuttings of *Euphorbia fanshawei*

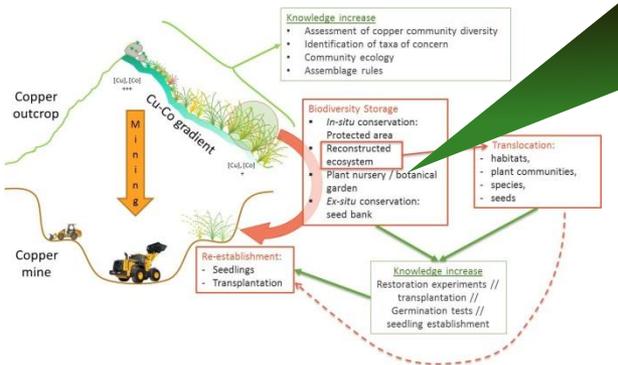




Ex-situ

Nursery / Botanical garden

Storage of the more critical species at the nursery



Transplantation of Species of Concern at the nursery in a Botanical garden



Conclusions

Increasing economic pressure → not compatible with old-growth grasslands

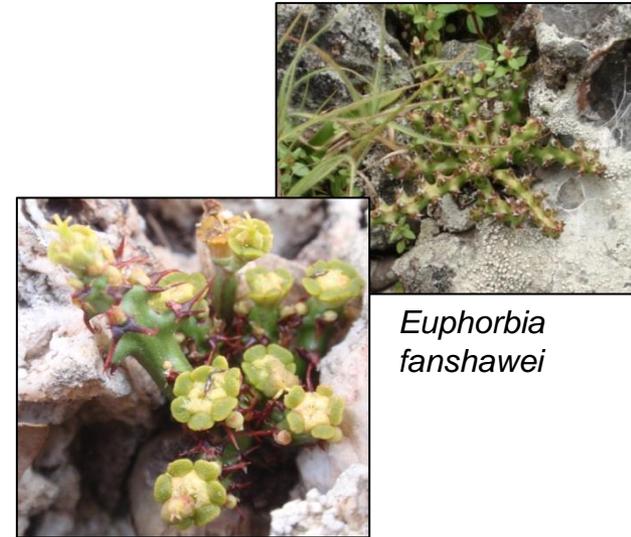


Conclusions

Increasing economic pressure → not compatible with old-growth grasslands

Major issues for the restoration of these degraded areas:

- 1) Limited availability of native seeds (empty seeds, few seeds, decrease of natural populations)
- 2) Low knowledge on species ecology (phenology, germination, etc.)



Thanks for your attention



More information: www.copperflora.org