Challenges for the copper flora

Pr. François Malaisse
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"Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Biodiversity associated to extreme ecological conditions

Soils with high levels of toxic elements

- Heavy Metals (Ni, Zn, Cu, Co, ...)
- Gypsum (CaSO$_4$)
Metallophytes

Metallophytes
Plant that tolerates high concentrations of heavy metals in soils

Soils with high concentration of heavy metals

Ore body with high concentration of heavy metals
A diversity of metal ecosystems

Serpentine ecosystems

> Fe, Mg, Ni, Cr, Co

< Ca, P, K

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A diversity of metal ecosystems

Calamine ecosystems
> Zn, Pb, Cd
A diversity of metal ecosystems

Copper Cobalt Ecosystems

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Zambebian regional centre of endemism

8,500 spp.
54% endemics

4,600 endemic species

source: van Wyk & Smith [2001]
The Zambezian regional centre of endemism

Upper Katanga

Bemba domain (Katanga - Zambia domain)
The Katangan Copperbelt
Transect of copper outcrops in the Katangan Copper Arc
> 600 species, with:

- 32 strict metallophytes endemics
- 23 broad metallophytes endemics

= conservation challenges

- Hyperaccumulator and tolerant species

= biotechnological resources
“panarc” distribution

Acalypha cupricola (Euphorbiaceae)
“north-west” distribution

Haumaniastrum robertii (Lamiaceae)
south-east distribution

Faroa chalcophila (Gentianaceae)
New species for science

Unexplored biodiversity
Precolonial copper metallurgy
5th century AC
Copper and Biodiversity

Biodiversity conservation challenges
Anthropogenic metalliferous soils
Anthropogenic metalliferous soils

Copper and Biodiversity

Rehabilitation challenges
Guidance Note 6
Biodiversity Conservation and Sustainable Natural Resource Management

Code minier - RDC
Guidance Note 6
Biodiversity Conservation and Sustainable Natural Resource Management
April 30, 2006

G18. Critical habitat is a subset of both natural and modified habitat and is determined by the presence of high biodiversity value based on one or more of the following criteria:

i) large numbers of endemic or restricted-range species found only in a specific area
ii) the presence of known critically endangered or endangered species
iii) habitat that is required for the survival of particular migratory species or to support globally significant concentrations or numbers of individuals of congregatory species
iv) unique assemblages of species that cannot be found anywhere else
v) areas that have key scientific value due to the evolutionary or ecological attributes present
vi) areas that include biodiversity that has significant social, cultural or economic importance to local communities
vii) areas recognized as particularly important for the protection of ecosystem services (such as aquifer protection).
Copper endemism in the Congolese flora: a database of copper affinity and conservational value of cuprophytes

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Table 1 – Plant taxa strictly endemic of Cu-rich soil in Katanga, D.R.Congo (absolute metallophytes), with their IUCN status, habitat and number of sites.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Family</th>
<th>Sites</th>
<th>IUCN red list status</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>\textit{Acalypa cupricola} W.Robyns ex G.A.Levin</td>
<td>Euphorbiaceae</td>
<td>51</td>
<td>(EN B2a + 3d)</td>
<td>P, S1</td>
</tr>
<tr>
<td>\textit{Acalypa dikuluwensis} P.A.Duign. &amp; Dewit</td>
<td>Euphorbiaceae</td>
<td>1</td>
<td>EX</td>
<td>P</td>
</tr>
<tr>
<td>\textit{Actiniopteris kornsai} Medwecka-Kornas</td>
<td>Pteridaceae</td>
<td>4</td>
<td>(CR B2a+(b(i,ii,iii,iv)))</td>
<td>P</td>
</tr>
<tr>
<td>\textit{Aeollanthus saxatilis} P.A.Duign. &amp; Denaeyer</td>
<td>Lamiaceae</td>
<td>4</td>
<td>(CR B2a+(b(i,ii,iii,iv)))</td>
<td>P</td>
</tr>
<tr>
<td>\textit{Basananthe cupricola} A.Robyns</td>
<td>Passifloraceae</td>
<td>1</td>
<td>EX</td>
<td>P</td>
</tr>
<tr>
<td>\textit{Batopedina pulvinellata} Robbr. subsp. glabrifolia Robbr.</td>
<td>Rubiaceae</td>
<td>4</td>
<td>(CR B2a+(b(i,ii,iii,iv)))</td>
<td>P</td>
</tr>
<tr>
<td>\textit{Bulbostylis fusiformis} Goetch.</td>
<td>Cyperaceae</td>
<td>3</td>
<td>(CR B2a+(b(i,ii,iii,iv)+(c(iii))))</td>
<td>P, S1</td>
</tr>
<tr>
<td>\textit{Cheilanthes inaequalis} (Kunze) Mett. var. lanopetiolata P.A.Duign. (\textit{Notolaena inaequalis} Kunze var. lanopetiolata P.A.Duign.)</td>
<td>Pteridaceae</td>
<td>1</td>
<td>(CR B1a+(b(i,ii,iii,iv)))</td>
<td>P</td>
</tr>
<tr>
<td>\textit{Commelinga mwatavanyaoanga} P.A.Duign. &amp; Dewit</td>
<td>Commelinaceae</td>
<td>2</td>
<td>(CR B2a+(b(i,ii,iii,iv)))</td>
<td>P</td>
</tr>
</tbody>
</table>