



Eco-Engineering Tailings and Soil-Systems

Game-changing technologies to transform practices in rehabilitating tailings and residues

Longbin Huang

Associate Professor / Principal Research Fellow

Program Leader – Ecological Engineering of Soil-Plant Systems

Some facts

Seeing is believing



Googling Mining Footprints – ALCOA Red Mud Ponds



Mount Polley Copper Tailings Disaster, Canada

**Releasing 10 million
cubic metres of water
and 4.5 million cubic
metres of slurry into
Polley Lake**



Metal Mine Tailings and Residues – *The Global Environmental Liability !*

- **Colossal environmental and economic liabilities**
 - > 7 GT tons of red mud already generated
 - > 30 GT of Cu-mine tailings already deposited
 - > Slow rates of successful rehabilitation
- **High pollution & contamination risks (e.g., sulfidic metal mine tailings & red mud)**
- **High costs of rehabilitation using conventional cover design: \$100,000 – 800,000 per ha x 500-1000 ha/mine**
 - Conventional technologies: Huge volumes of cover materials, huge financial costs, long-term environmental risks



New Technologies are urgently needed.....

The goals

- Significantly decreasing the volumes of soil & materials required
- Much lowered pollution risks via dusts and seepage

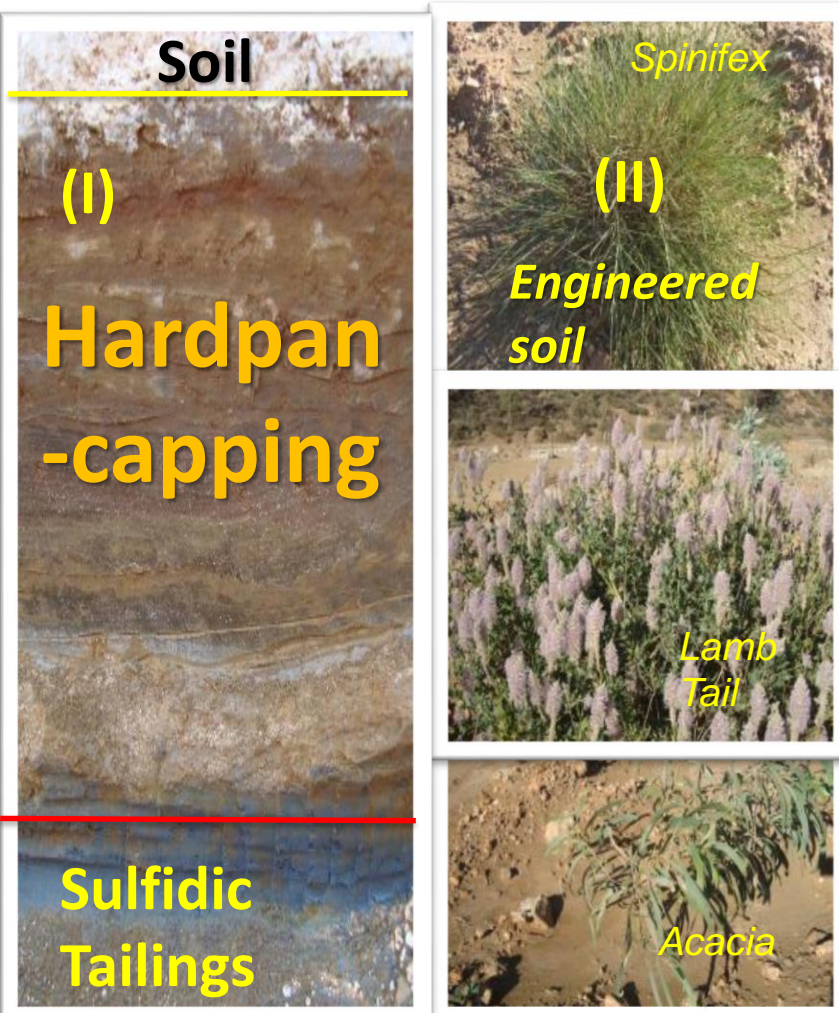
We need game-changing technologies:

- Eco-engineering tailings into soil (i.e. *technosols*)
- (Bio)-geochemical polymerization and hardpan formation



Eco-engineering soil formation & hardpan-based duplex soil systems

Old way \approx 1 m top soil + draining materials + capillary break (0.5 m rocks) + clay seal (0.5 m) \rightarrow **costly** + **seepage**



New way (I) =

‘stimulated bioweathering’

+ **biogeopolymerisation** \rightarrow

hardpan-capping (*replacing clay-seal + capillary break layer*) + growth media

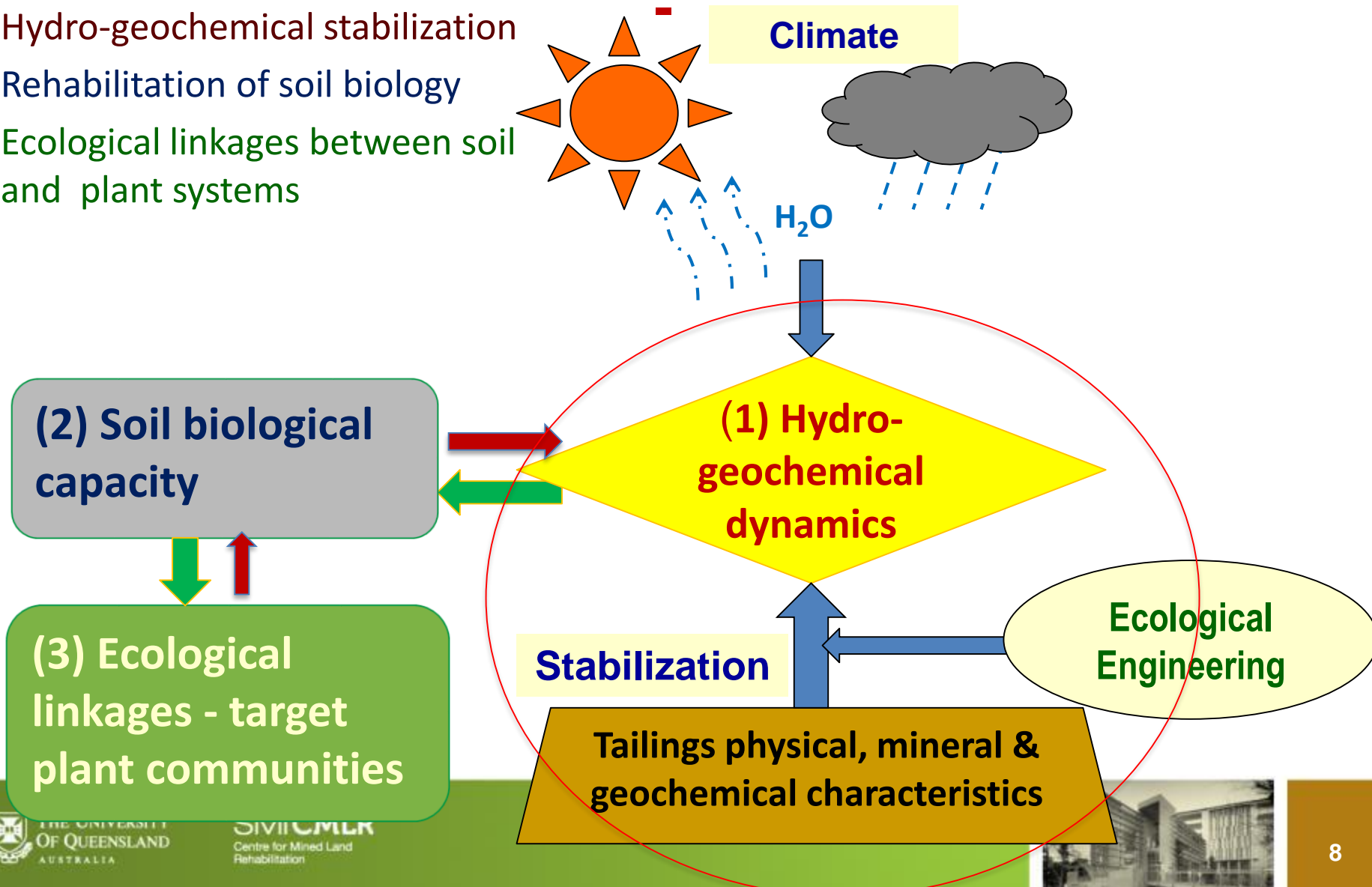
New way (II) =

‘stimulated bio-weathering’ +

soil formation \rightarrow **engineered soil**

Ecological Engineering of Total Soil-Plant Systems to rehabilitate tailings and residues

- ❖ Hydro-geochemical stabilization
- ❖ Rehabilitation of soil biology
- ❖ Ecological linkages between soil and plant systems



Impacts \$ \$ \$ \$ \$ \$ \$.....

Base metal tailings & red mud rehab

Conventional cover costs \approx \$100,000 – 800,000/ha

+ 100 years of seepage management

Impacts of new technologies:

\approx 30-70% savings + <20 years of seepage mgmt (due to sulfide depletion)

Savings per mine \sim \$\$\$\$...

(500-1000 ha tailings/mine

>300 x mines in next decade)