

Artisanal and Small-scale Gold Mining

Phytoextraction to promote sustainable development

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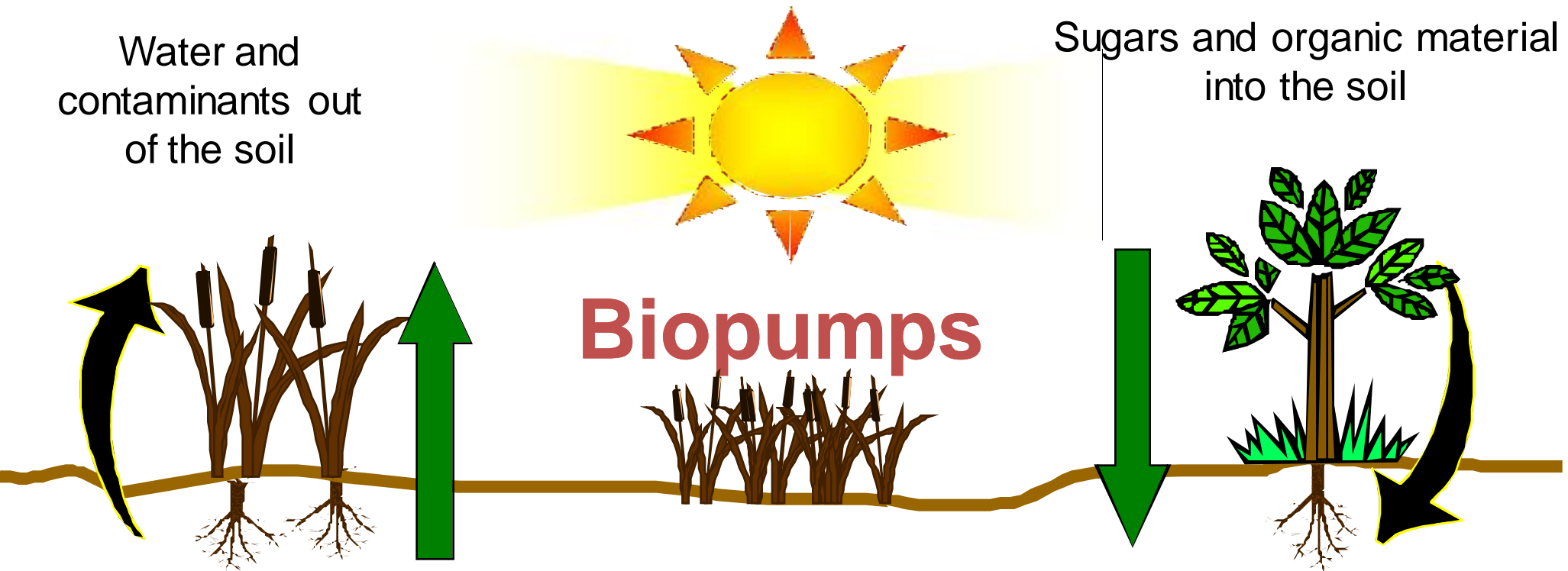
Phytoremediation

The use of plants to improve the environment

Water and
contaminants out
of the soil

Sugars and organic material
into the soil

Biopumps



So what is Phytomining?

- Use of plants to extract valuable metals from soil
- Environmental benefits; contaminants removed from soil
- But a revenue source is recovered from the plants
THIS IS THE DEFINING POINT
- Reported for gold and nickel



Gold phytomining working targets

- Gold concentration of 100 g/t in a crop with harvested biomass of 10 t/ha
- Yield 1 kg of gold per hectare from 1 t of ash
- Other metals will also be recovered
 - Some valuable (Ag, Pt)
 - Others less valuable or toxic (Hg, Cu)



Can this really make money?



Estimated \$ scenario. 10 t of biomass @ 100 mg/kg incinerated then solvent extraction of 1 t of ash. Gold @ US\$1000 / oz

Item	cost	revenue
Agricultural and labour costs	\$ 3,327	
Irrigation and chemical costs	\$ 2,975	
Processing costs	\$ 7,657	
Sub total	\$ 13,959	
Gold recovered	1 kg @ US\$1000 / oz	\$ 32,155
Gross margin		\$ 18,196

This is for each crop. Up to 10 crops could be realistic



Phytomining for sustainable development in ASGM areas



New strategy for ASGM management

- Our position is that ASGM is good
- The problem is not elemental Hg, but the transformation of Hg when released into the environment
- We must stop the uncontrolled discharge of Hg-contaminated waste
- Create an **incentive** for miners to contain amalgamation and cyanidation tailings



The *incentive* is gold from
phytoextraction

Revenue pays for remediation and
tailings management



How would we run gold phytomining?

- Collect tailings (amalgamation or cyanide) in a 'farming' area
- This could be designed with a liner to stop leaching



- Grow a suitable plant species (cassava?)
- Allow plant to reach maximum biomass then apply cyanide to the tailings
- Gold (and mercury) is made soluble, plant takes up the gold (and mercury)
- Then harvest and process the plant material
- This removes a portion of the gold in the ground
- Will also remove or stabilise mercury in the root zone
- Repeat the process



Is cyanide dangerous?

Not to plants.
And not to us if
safely used

And it is already being used.
Through partnership, safety and
efficacy could be improved

This represents a business opportunity

- Collect the Hg contaminated waste and 'farm' it
- Build a 1 ha containment area
- This will yield several crops per year, for several years, each yielding 0.5-1 kg of gold
- This assumes a certain amount of gold in the rock
- Long term..... Maybe the technique can be used instead of amalgamation?



What will phytoextraction achieve?

- **Incentive** to contain amalgamation and cyanidation waste
- Employment, training and education for local communities
- Alternative livelihood / new business
- It would stop uncontrolled release of Hg
- Gold value of the crop pays for these benefits
- Gold is the economic **incentive** behind the system



IRC-MEDMIND vision for artisanal communities

- 'Farming' system for gold
- Value of the gold pays for environmental protection and education
- Subsidise the development of sustainable agriculture
- A viable alternative technology to support ASGM

