

Waste 2 Gold

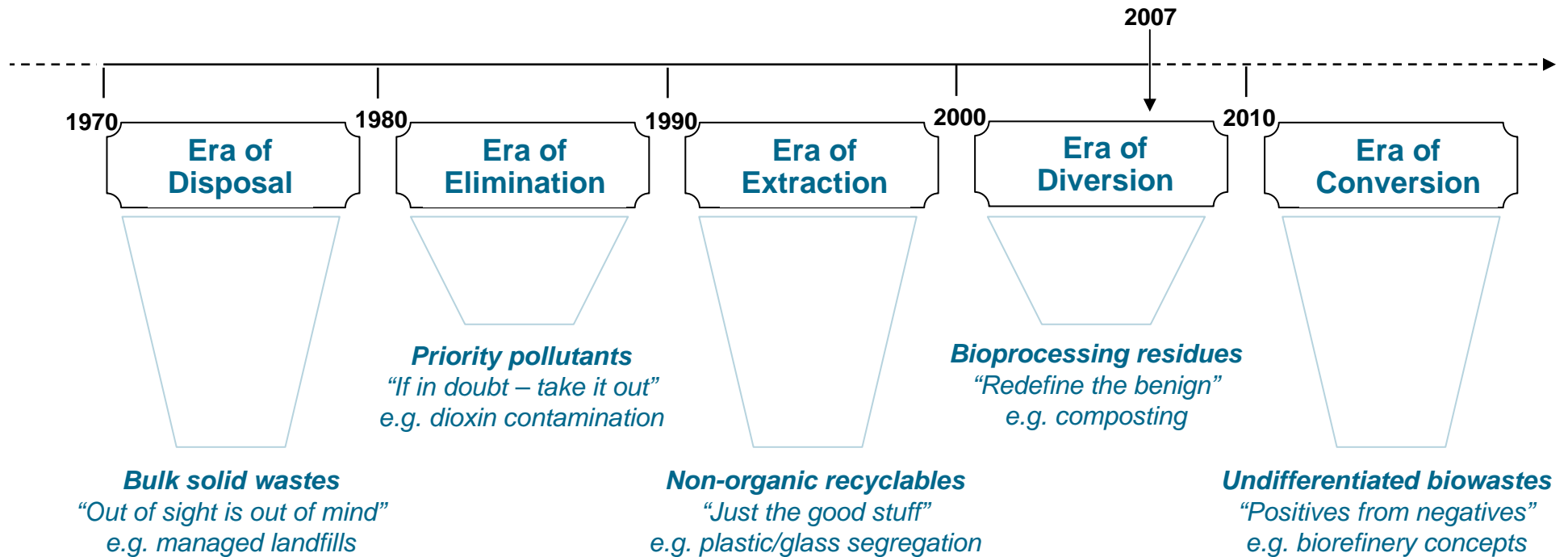
*Turning environmental
negatives into economic
positives*

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<http://www.scionresearch.com>

- Primary Industries
 - ▶ Striving for improved sustainability
 - Economic and regulatory drivers
 - Seeking proprietary value propositions
 - ▶ Waste management critical role
 - Distress spending
 - ◆ >\$1 billion per year in NZ alone
 - ◆ >\$ 500 billion per globally
 - NZ Waste Strategy
 - ◆ 95% diversion from landfills by 2010
 - Lost value, lost efficiencies

- Total 2006 industrial waste production: 1.9 MT/yr
- Total 2006 industrial organic waste production: 0.5 MT/yr
- Total landfill costs: \$14 – 69 M/yr
- Greenhouse gas emissions: 0.64 MT CO₂/yr
- Organic wastes currently diverted from landfill: 24.7%
- 2006 diversion rate required for 2010 goal: 57.2%



- Added value bioproduction from industrial wastes:
 - ▶ improve economic and environmental sustainability
 - Reduce waste treatment costs
 - Negative >>> Positive
 - New market opportunities





- Carbohydrate-based industrial sectors
 - ▶ Nitrogen deficient waste streams
 - low cost source of carbon
 - low cost source of biomaterial residues
- Protein-based industrial sectors
 - ▶ Nitrogen rich waste streams
 - low cost source of nutrients and carbon
- Municipal waste sector
 - ▶ Organic rich waste streams
 - low cost source of feedstocks



Pulp and Paper

100 billion L/yr wastewater

150,000 t/yr solid wastes

30% total NZ IOW

Focus on:

Compliance/Value recovery



Horticultural Processing

Low volume wastewater

59,000 t/yr solid wastes

19% production discards

Focus on:

Value recovery

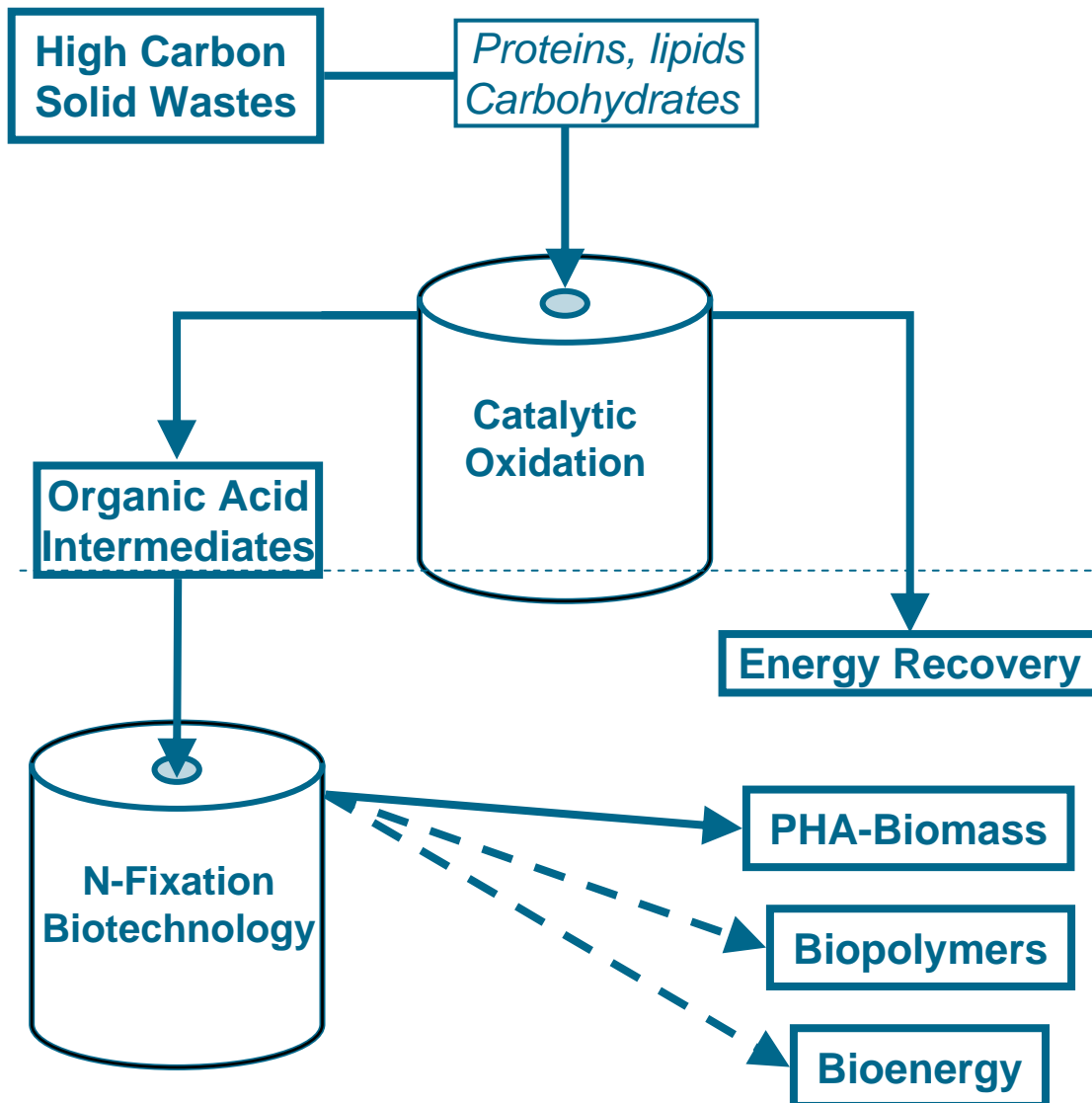
These types of conversion wastes typically:

- ▶ Non-homogenous
- ▶ High water content
- ▶ May contain toxicants

>>> Destruction best option, but:

- ▶ Energy intensive
- ▶ High Capex
- ▶ Generate high CO₂ emissions
- ▶ Secondary waste streams





Disassembly:

- Reduce volume
- Eliminate risk
- Recover embodied energy
- Capture carbon
- Simplify feedstock

Reassembly:

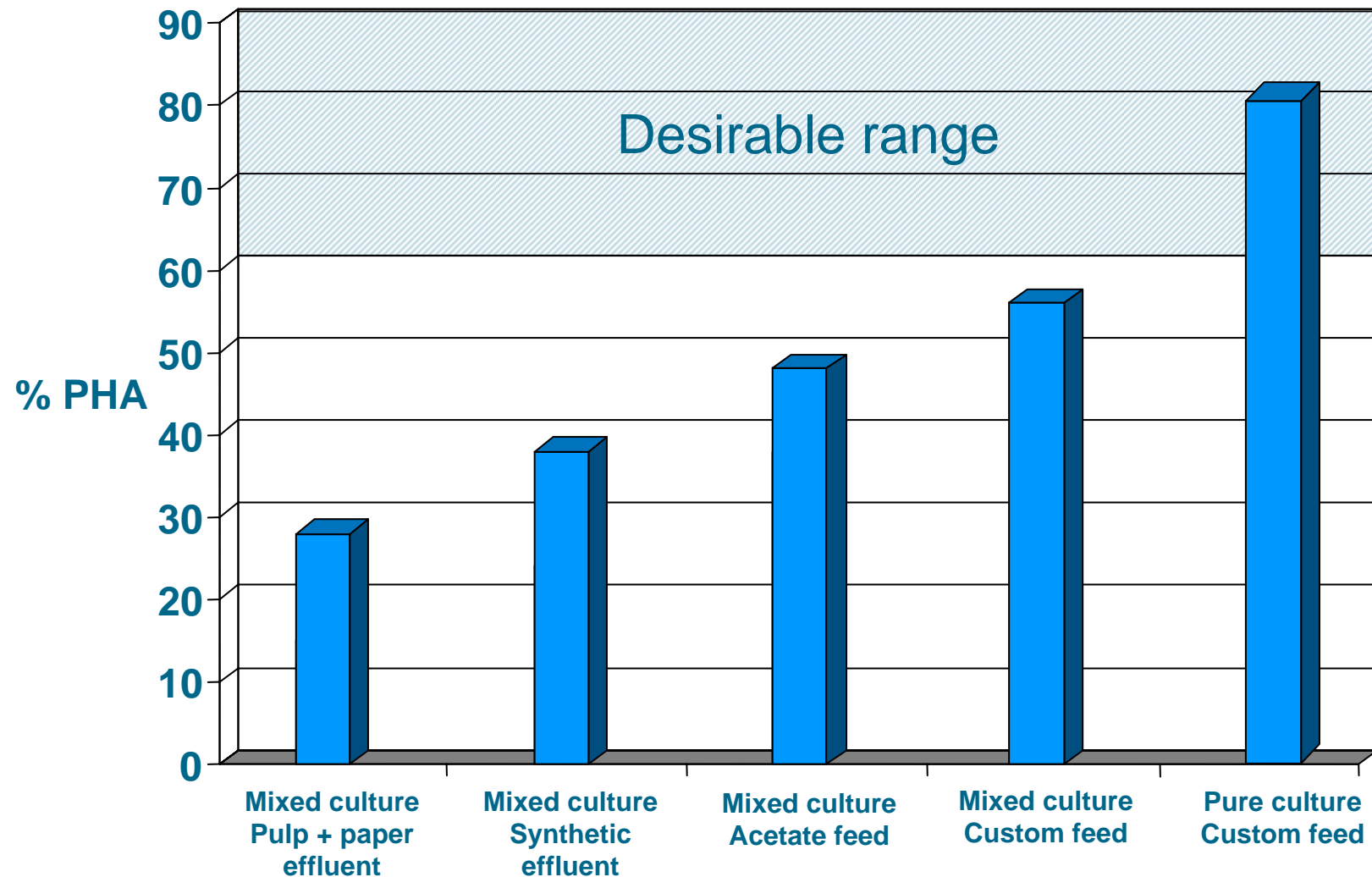
- Create value
- Exploit embodied carbon
- Minimise energy input
- Maximise selective output
- Link to broader Scion IP



99% pure polyester granule

Bacterial polyesters

- Readily degradable
- Behave like polyethylene
- Sustainable replacement for petrochemical plastics

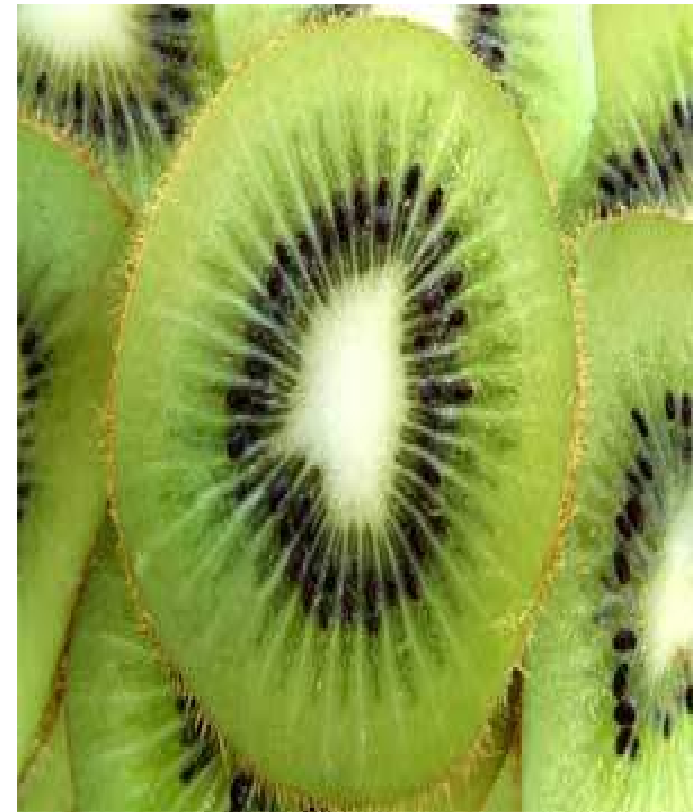


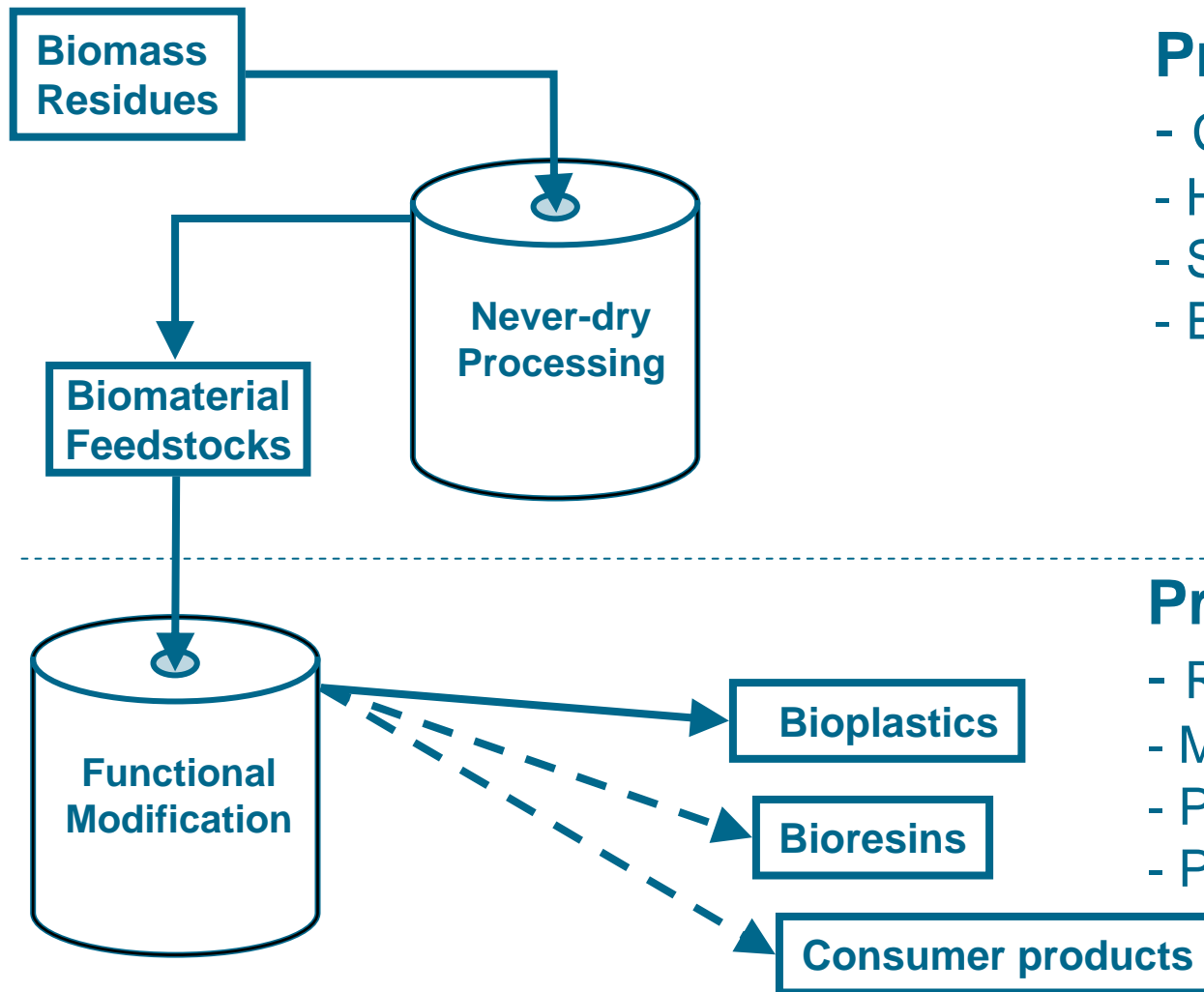
These types of conversion wastes typically:

- ▶ Homogenous
- ▶ High water content
- ▶ Benign

>>> Re-direction best option, but:

- ▶ Processing demands
- ▶ Value proposition
- ▶ Seasonality
- ▶ Fit with business strategy





Preparation:

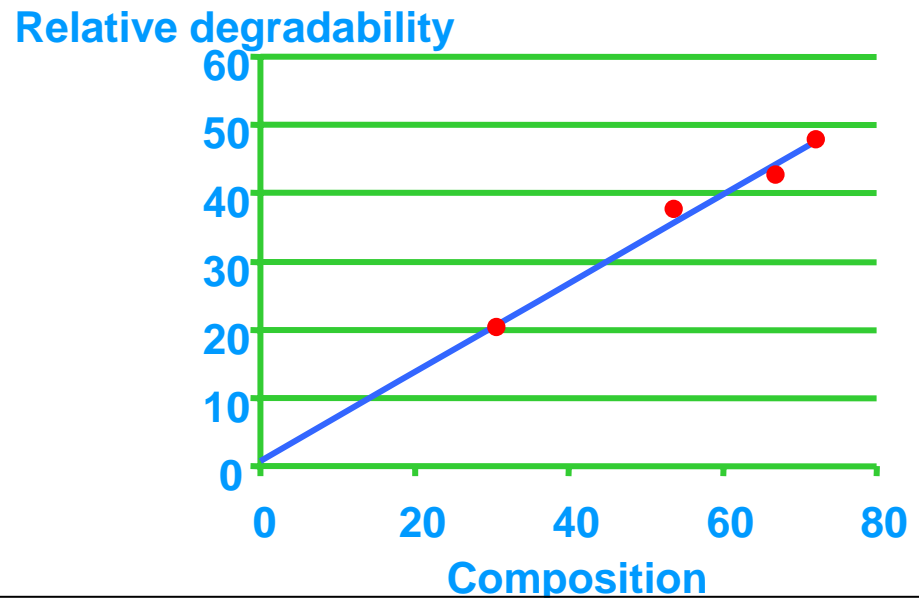
- Control moisture content
- Homogeneity
- Storage
- EIB database

Production:

- Reactive extrusion
- Masterbatch formulation
- Prototyping
- Performance testing

- A 'dialer' is the substrate used to adjust biocomposite performance and improve cost envelope
- Broad range tested:
 - ▶ Lignocellulosics
 - ▶ Horticultural
 - ▶ Agricultural
 - ▶ Industrial





- Environmentally-intelligent biocomposites
 - Programmable degradation using waste-derived dialers
 - Eco-Pots - biodegradable planting system
 - EcoFert - controlled-release nutrients
 - BioFoam - post-consumer-compostable packaging
 - Low-grade panels and molded sheets

- Pulp and Paper Waste Minimisation Project Committee
- Bay of Plenty Waste 2 Gold Initiative
- EIB Industry Partnership
 - ▶ strategic input, leveraged investment
 - ▶ technology transfer via directed R&D programmes
 - ▶ conduit for identifying issues and implementing solutions
 - ▶ secure websites, newsletters and workshops
 - ▶ established model for other sectors

Zero Value



Waste Disposal

Current costs

-\$38M per year

Transformation



Value creation

Direct value gain
+ \$24M per year

Remediation



Waste levies
Greenhouse credits

Mitigation

Indirect value gain
+ \$58M per year

Waste 2 Gold

93% volume reduction
New products



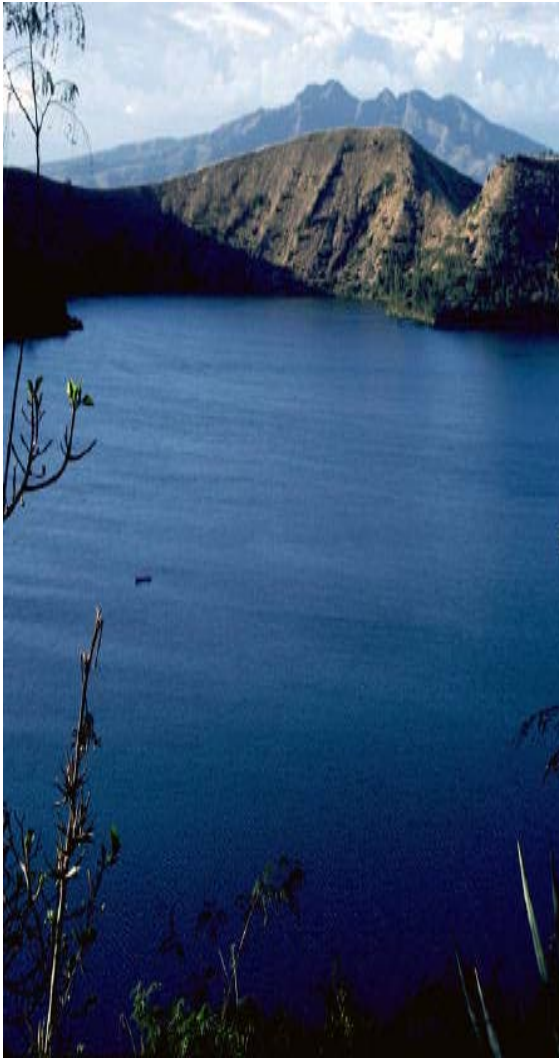
Waste Bioconversion

- Remediation
- Bioplastics
- Bioenergy
- Biofuels



Residue Modification

- Biocomposites
- Chemical extracts
- Enzymes
- Animal feedstocks



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