The Circular Economy

INNOVATION FOR CHANGE

New drivers for tomorrow's forestry

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Industrialised bio-based systems (agricultural, fibre and food) are linear and extractive

Current industrial agricultural/food design is based on *a linear* approach:

Take-Make-Dispose

§ **Depleting planetary sources**, i.e., running out of materials, clean water and non-renewable energy sources

§ **Running out of planetary sinks** for emissions and pollution (which adversely affects human health and causes degradation and destruction of natural habitat for other species)

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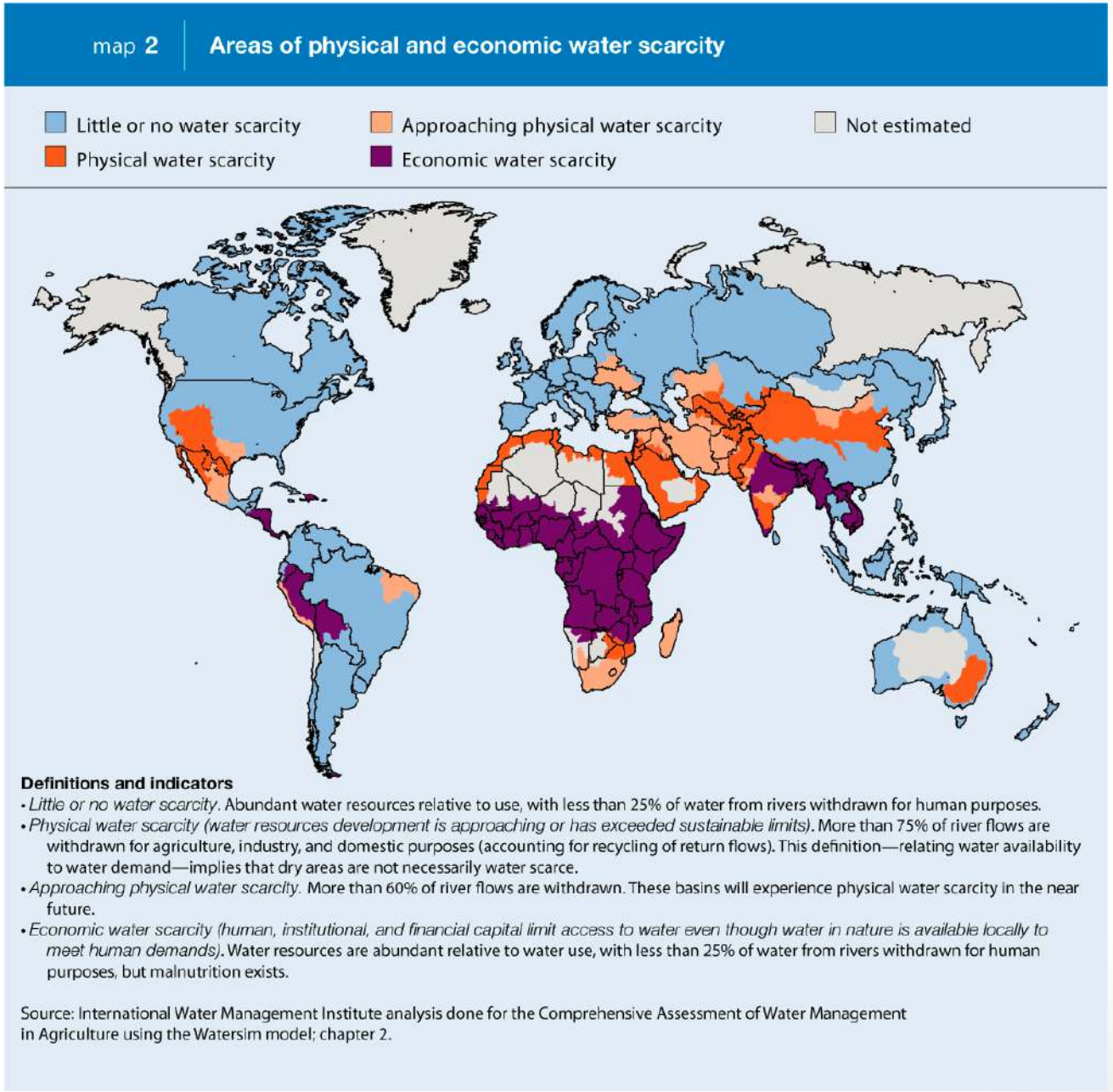
Water is also a material: often scarce



Source: Comprehensive Assessment of Water Management in Agriculture, 2007.
Summary available at:
http://www.fao.org/nr/water/docs/Summary_SynthesisBook.pdf

Fossil water

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Fossil water

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Fossil phosphate

Societe Nouvelle des Phosphates de Togo, 2007-12-02

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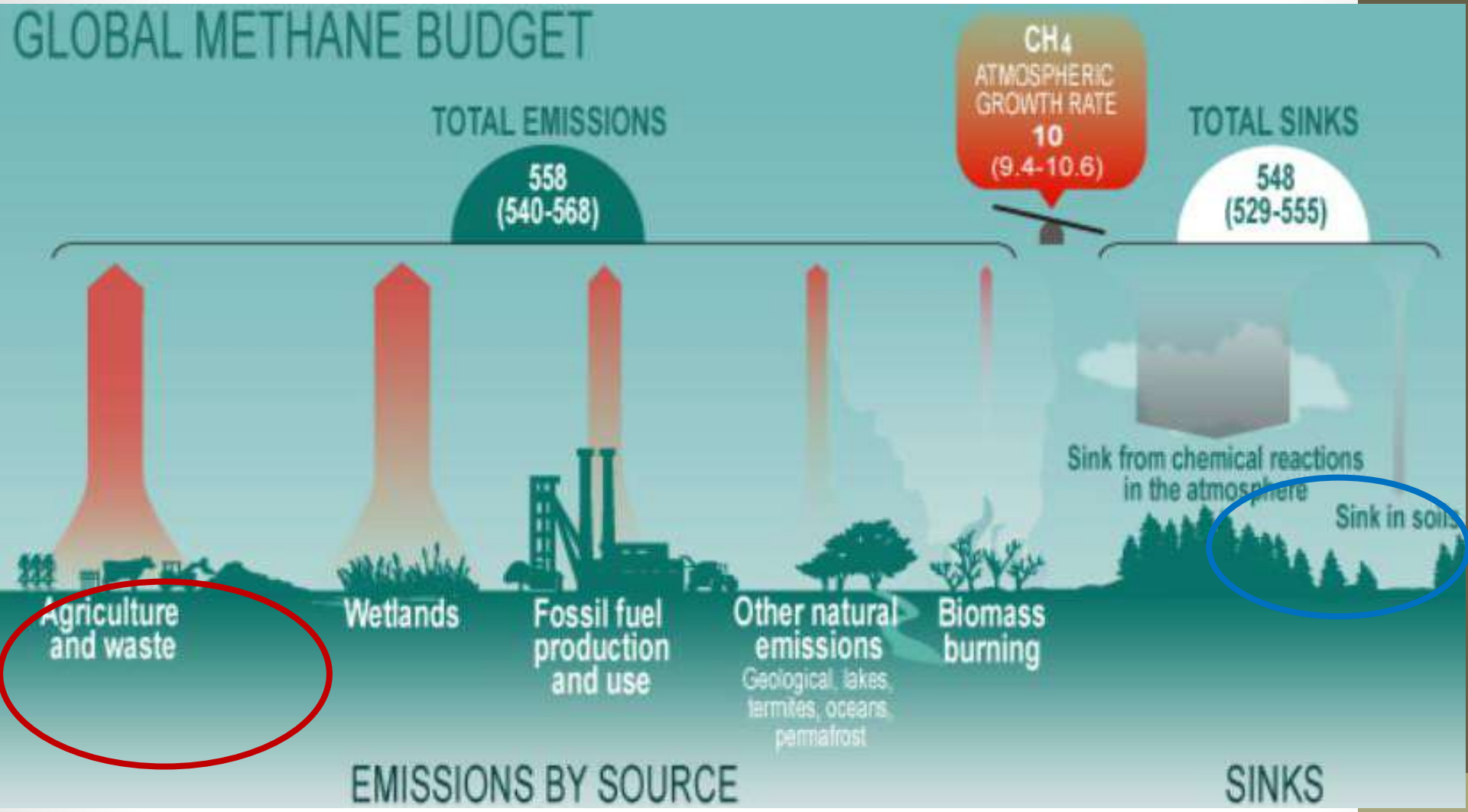
The problem of sinks

§ Many materials that we use to produce food contain chemical substances that are hazardous (dangerous) to human health and the environment.

§ Unfortunately, these substances get released into the environmental compartments (soil, water and air).

§ The releases occur deliberately and accidentally, in production, during use, or from waste disposal sites.

Agri-food systems are source of GHG emissions



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A lot of food is thrown away uneaten

Into the Trash It Goes

A federal study found that 96.4 billion pounds of edible food was wasted by U.S. retailers, food service businesses and consumers in 1995 — about **1 pound of waste per day** for every adult and child in the nation at that time. That doesn't count food lost on farms and by processors and wholesalers.

For a family of four people, that amounted to about **122 pounds of food thrown out each month** in grocery stores, restaurants, cafeterias and homes. Here is a depiction of that family's monthly share, the sum of waste in eight different food groups as detailed in the study.

Source: United States Department of Agriculture; Census Bureau

BILL MARSH AND KARI HASKELL/THE NEW YORK TIMES; PHOTOGRAPH BY TONY CENICOLA/THE NEW YORK TIMES

Almost 45 million tonnes of food is thrown away uneaten in USA annually. Source: Martin, A., Into the Trash It Goes, *New York Times*, 18 May 2008

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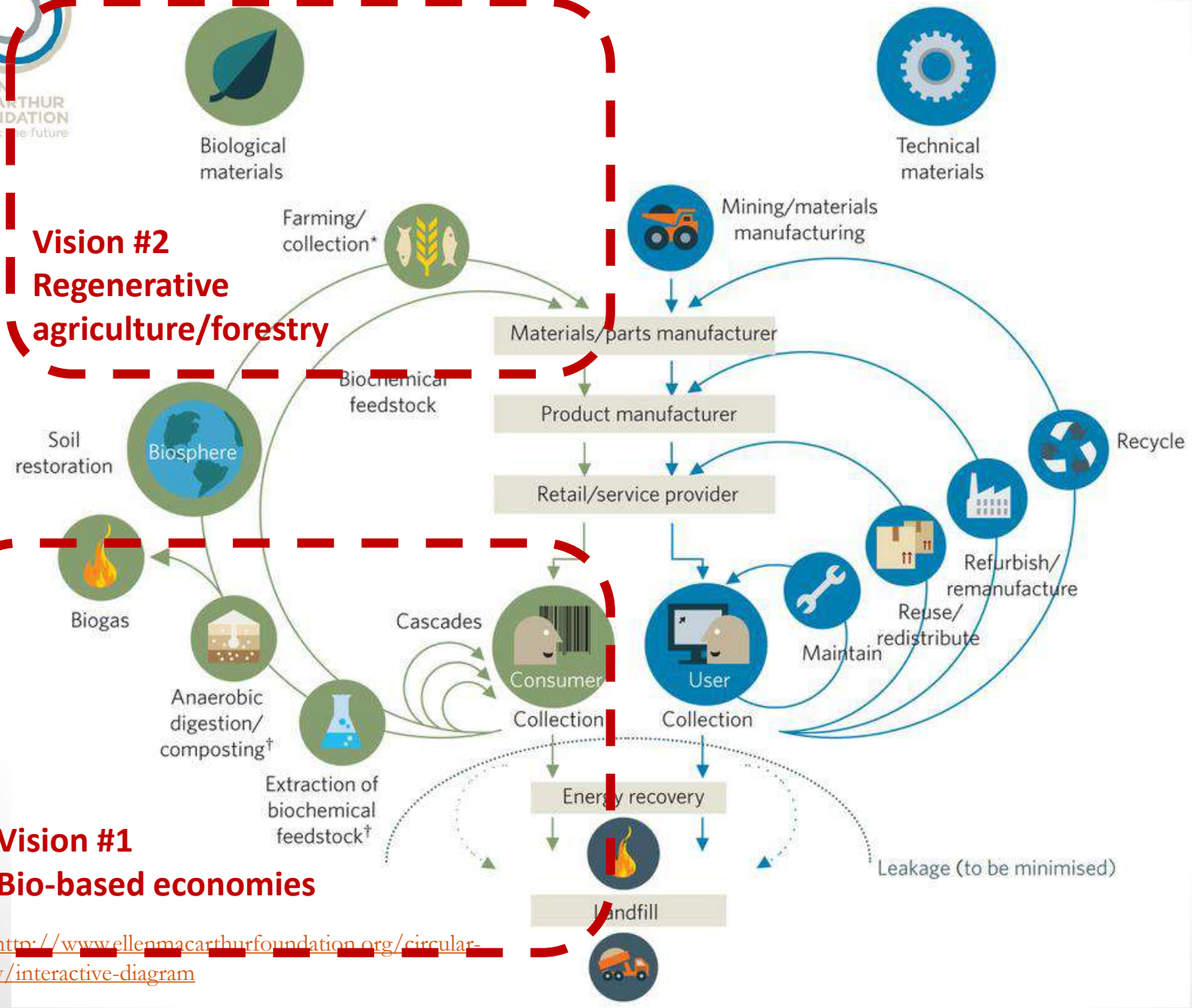

Vision #2
Regenerative agriculture/forestry

Vision #1
Bio-based economies

Source: http://www.ellenmacarthurfoundation.org/circular-economy/interactive-diagram

Two approaches to design metabolisms

Approach 1
Take back system (closed loops)

→ Research on business models, supply chain management/OR, and contractual design/theory, the theory of the firm

Approach 2
Networks in the metabolisms

→ Research on inter-firm collaborations (dynamic capabilities, knowledge governance)

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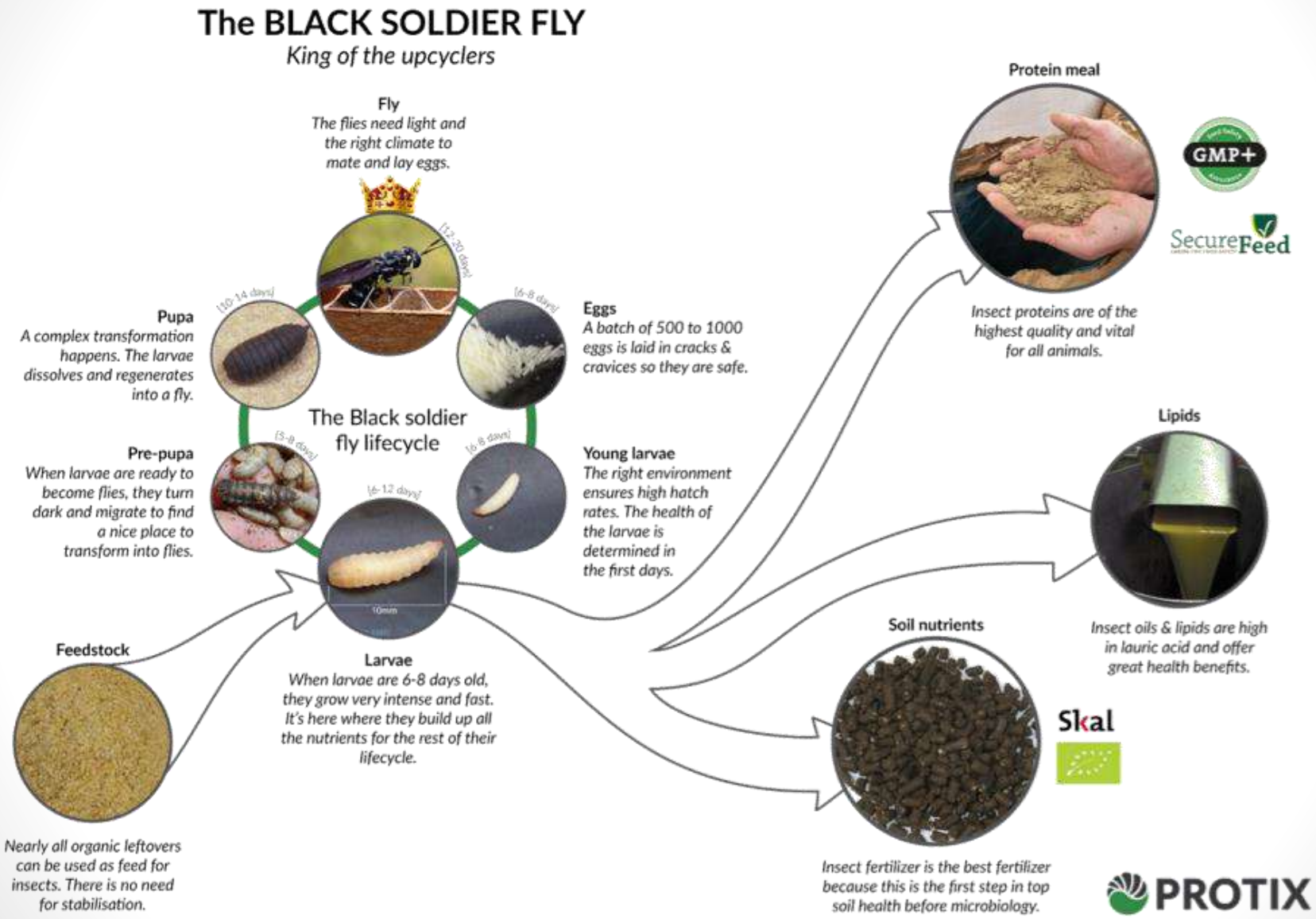
Approach 1: Closed loop/Closed circle

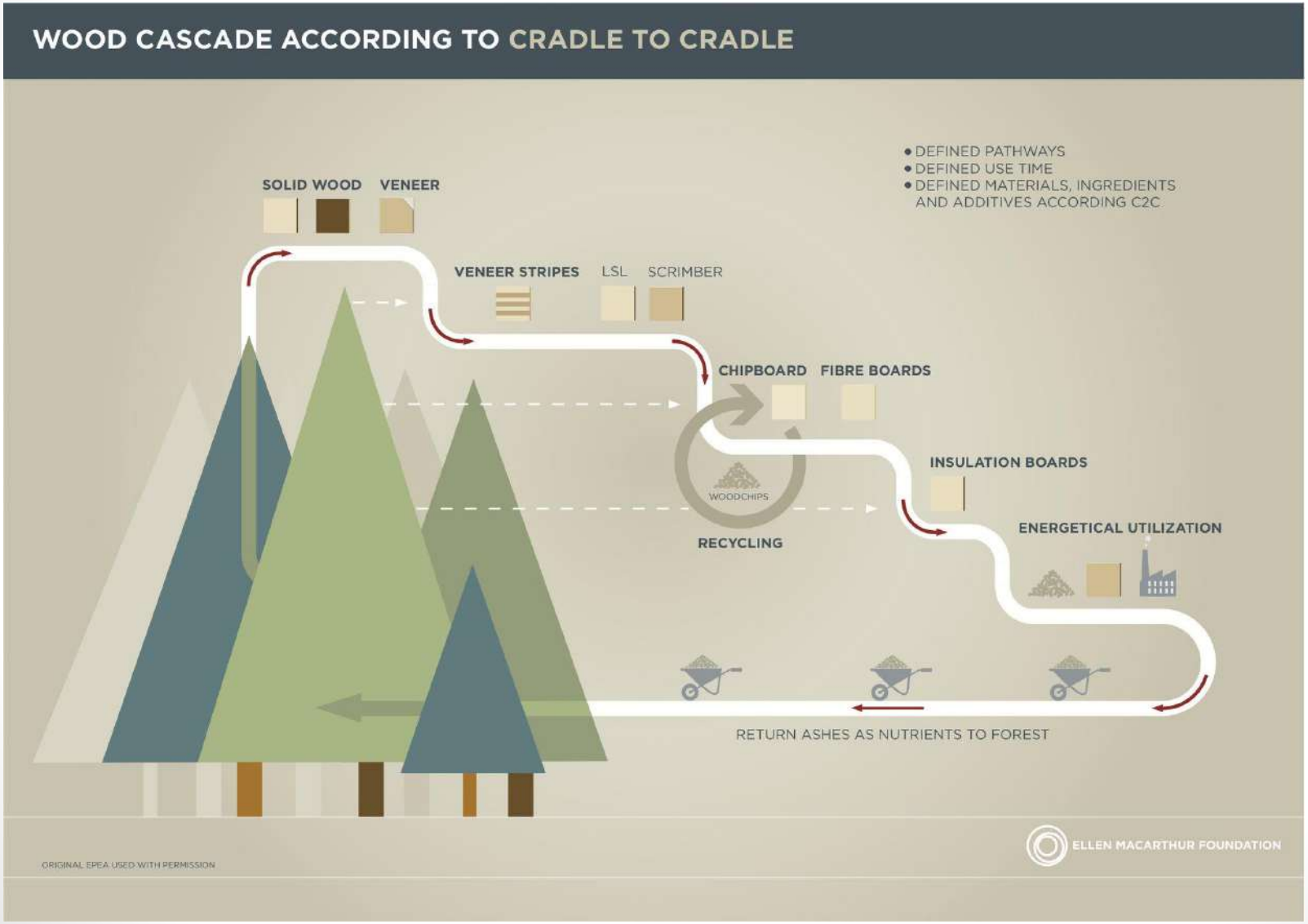
- Closed loop recovery
  - The reverse channel supplies high quality (recovered) products, components and materials to the forward channel thereby reducing the need for virgin sourcing and production. We refer to this as closed-loop recovery.
  - To maximize substitution, the recovered items must re-enter the original supply chain (Krikke 2011).

Krikke, H (2011). Impact of closed-loop network configurations on carbon footprints: A case study in copiers, *Resources, Conservation and Recycling.* 55, 1196-1205

Circular economy models in agribusiness (approach 1)



Circular economy models in forest management and timber/wood production (approach 1)



Approach 2: Metabolisms as Networks

- CE design enables the creation of wholly beneficial industrial systems driven by the synergistic pursuit of positive economic, environmental and social goals.

- CE defines a framework for designing products and industrial processes that turn materials into nutrients by enabling their perpetual flow within one of two distinct metabolisms: the biological metabolism and the technical metabolism (Braungart et. al 2007)

Braungart, M. McDonough, W. and Bollinger, A. (2007) 'Cradle-to-cradle design: creating healthy emissions – a strategy for eco-effective product and system design' *Journal of Cleaner Production*. 15, p.1337-1348

Circular economy models in agribusiness (approach 2)

Agripark metabolisms in Agriport A7 (The Netherlands)

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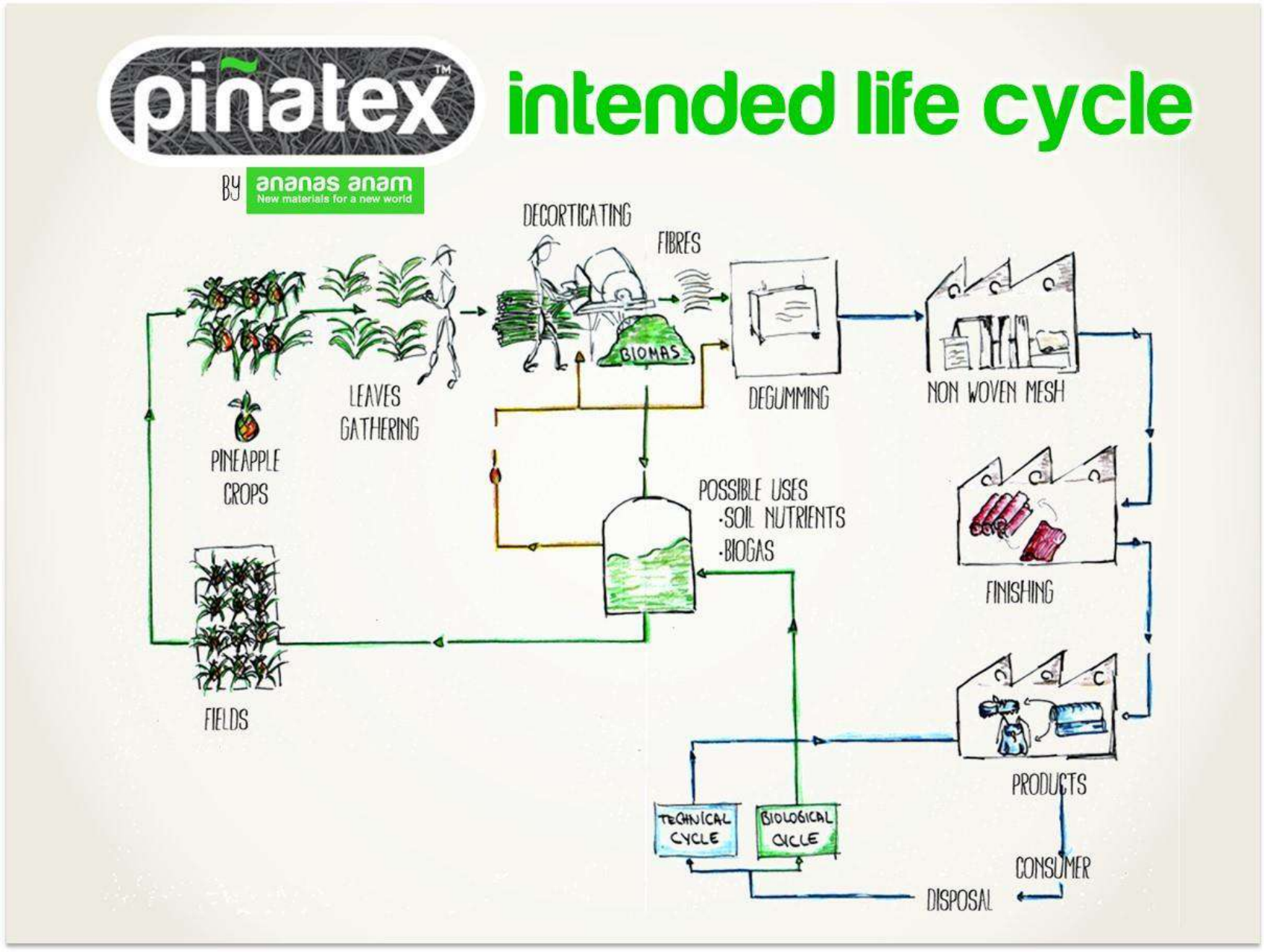
Circular economy models in fibre management (approach 2)



Regenerative agriculture/forestry

The current global practice of regenerative agriculture/forestry is based on applied and scientific research carried out by several international communities:

Scaled-up systems and practices:

- organic farming

Niches

- permaculture, agroecology, agroforestry, ecological intensification, restoration ecology.

www.regenerativeagriculturefoundation.org

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