Sludge Application Rate Advisor for Sustainable Agricultural Use of Municipal Wastewater Sludge

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Sustainability

- Linear economy

Natural resources and resources industries	Industrial processes, distribution and product use	Waste and pollution
• Air • Water Land and minerals • Energy • biological		

From Eugene Odum, Ecology, 1963 and www.Ecocycle.org, 2008

Circular economy

Design for the environment

Cleaner production & distribution

Empowered consumer

Resource recovery

Natural resources & resource industries
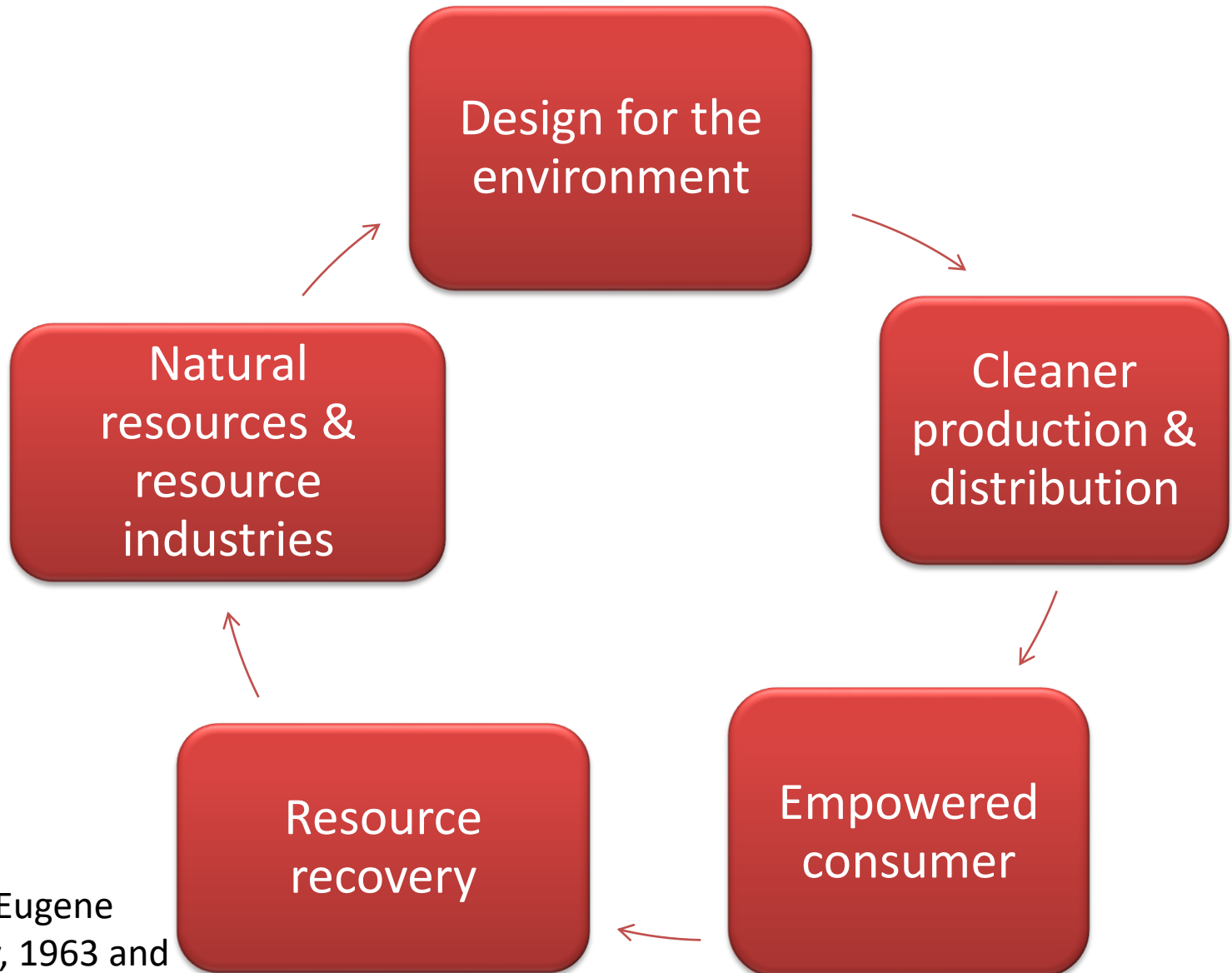
Adapted from Eugene Odum, Ecology, 1963 and www.Ecocycle.org. 2008

Sludge as a resource

K

P

N

Non renewable nutrients

Renewable resources

Residue

Crop production

Energy generation

Bricks etc...

?

Loss of non-renewable resources

Non agricultural beneficial use

?

Environmental pollution

Landfills, Incineration, Disposal (land and marine)
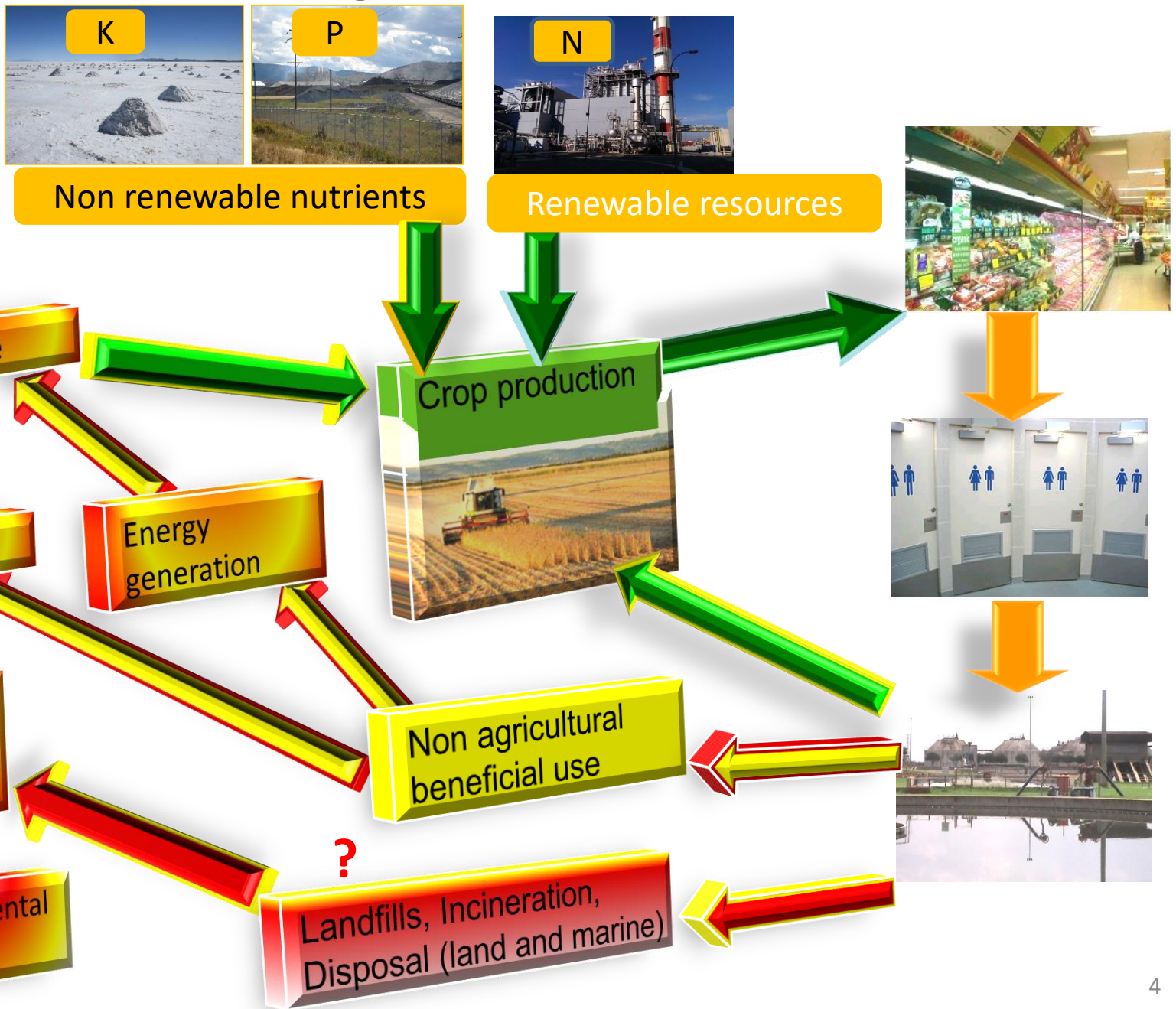
The role of recycling sludge in agricultural lands in fulfilling the UN SDG
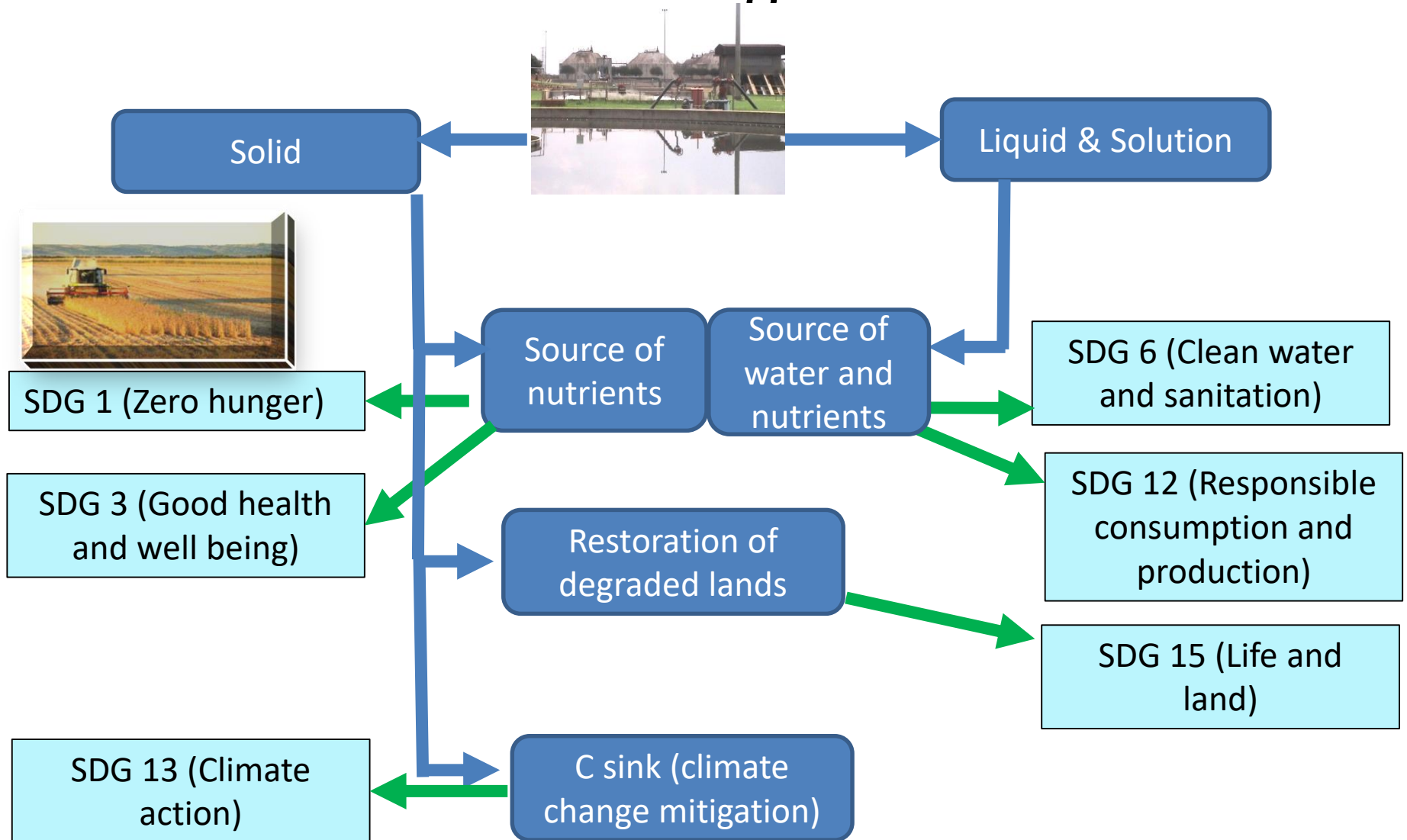
Beneficial agricultural use of wastewater sludge in South Africa

- According to the South African sludge guideline,
  - Sludge may be used in agricultural lands if the:
    - Microbial content,
    - Stability, and
    - Pollutant concentration fell within acceptable ranges.

- Sludge which qualify for agricultural use:
  - Should be applied according to crop nutrient requirement
    - Maximum application rate set at 10 t ha^{-1} yr^{-1}.

Can we use constant application rates regardless of the source of sludge?

- Sludge nutrient release rate varies:
  - Among wastewater treatment processes, and
  - agro-ecological zones.

- Hence sludge application rates should be adjusted accordingly.

Sludge N release rate varies between wastewater treatment methods
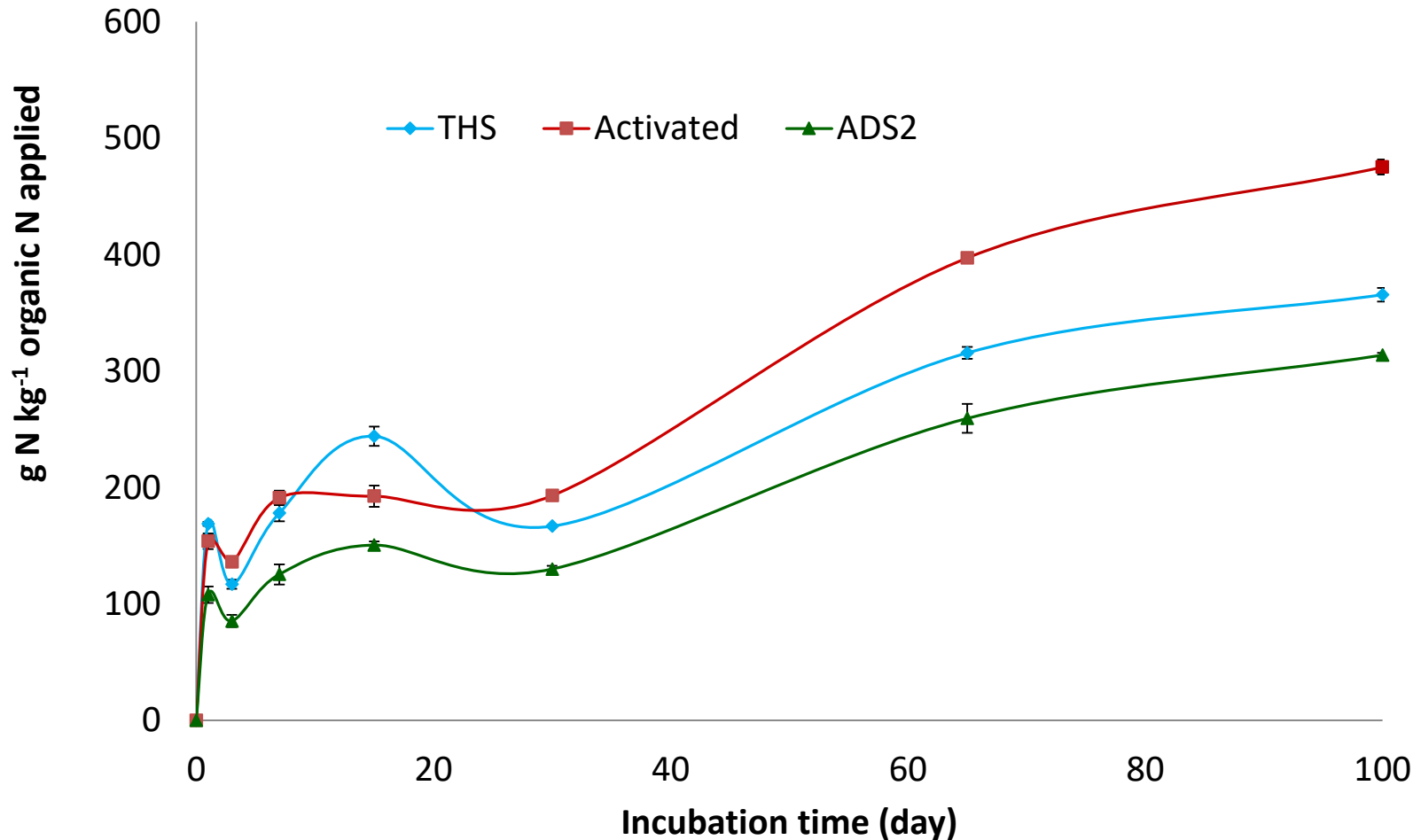
Sludge N release rate varies between agro-ecologicl zones

- N mineralization varies significantly across agro-ecological zones (sludge application rate 10 t ha^{-1})
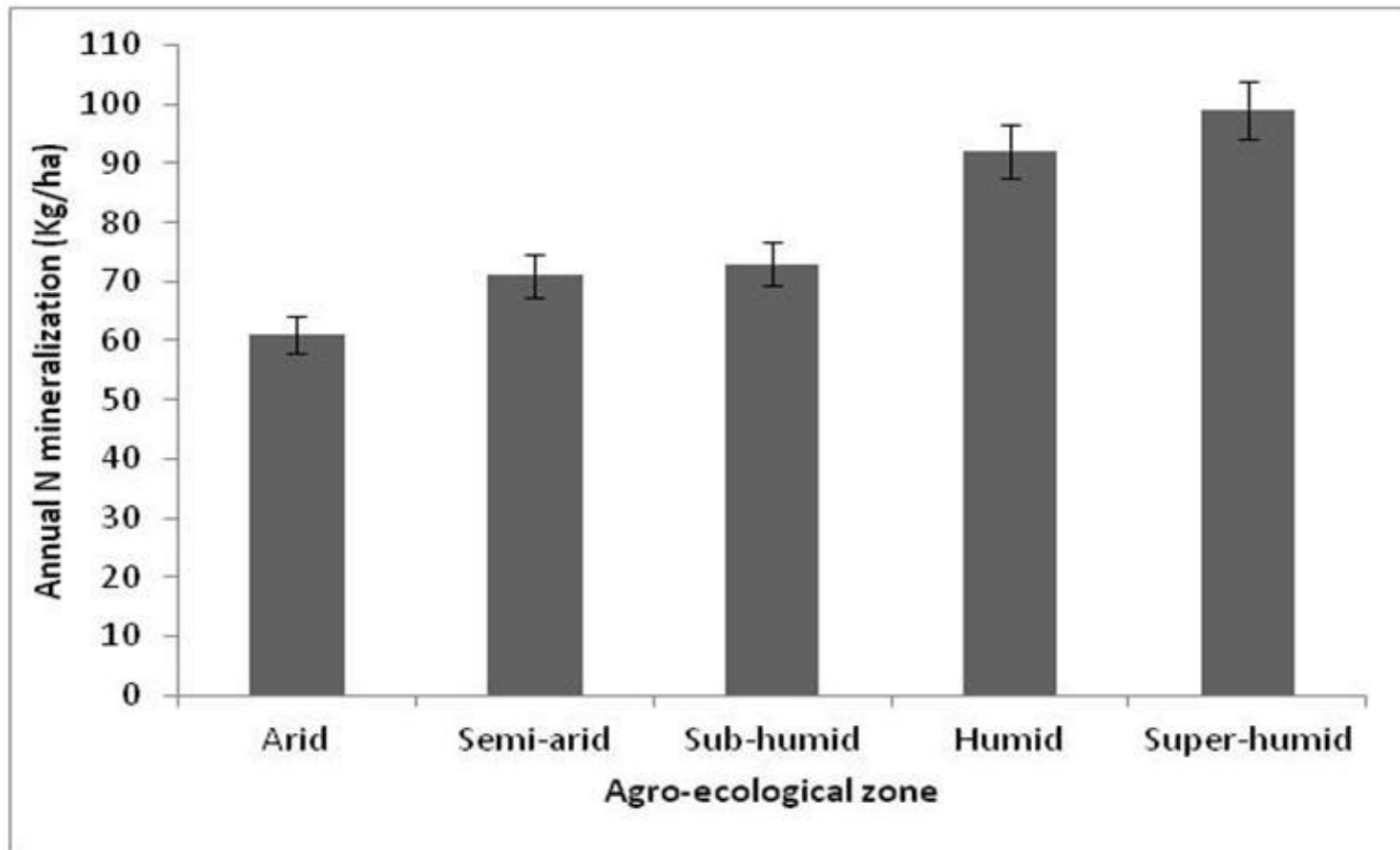
SARA model development

- SARA model was developed to assist the implementation of site and crop specific sludge recommendation:

  – Across SA agro-ecological zones,

  – Cropping systems,

  – Soil types, and

  – Sludge types.

SARA model – flow diagram
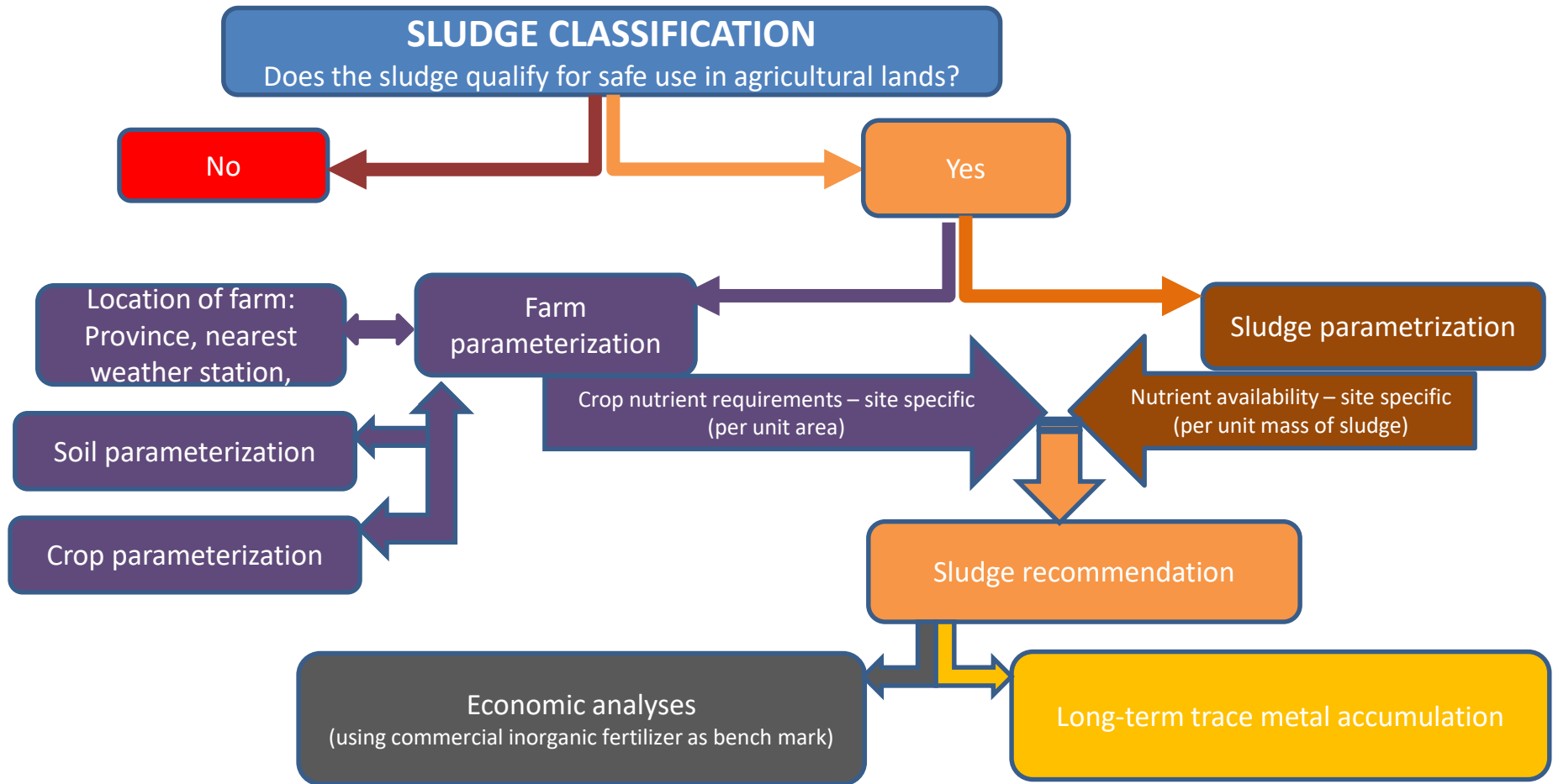
Sludge Classification Interface

SARA MODEL

SARA Model – sludge classification interface

Site, Crop And Soil Parameterization

SARA MODEL

SARA model – Site, Crop And Soil Parameterization

Sludge Parameterization

SARA MODEL

SARA model – sludge parameterization

Sludge Recommendation

SARA MODEL

SARA model – Sludge recommendation rate

Cost Benefit Analyzer

SARA MODEL

SARA model – Cost benefit analyser

Trace Metal Accumulation

SARA MODEL

SARA model – Trace metal accumulation

THANK YOU
ACKNOWLEDGMENTS