Emergy signature as a basis for sustainability valuation of agro-ecosystems

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1. Background
- Humans depend on the ecological resources for the inevitable needs of food, feed and energy
- Human engineered ecosystems have resulted in adverse impacts on the ecosystems
- Agro-ecosystems constitute over 37% of the earth’s surface (Porter et al., 2009)
- Agro-ecosystems are biggest contributor to the worsening ecosystem service provision
- Reduction in the capacity of the ecosystems for provision of ecosystem services (MEA, 2005)

2. Problem formulation
- Ecosystem services are integral to the ecological sustainability and the economic prosperity
- A renewed perspective towards a sustainable society (Ryden & Haden, 2006)
- Need for holistic accounting procedures to account for economic, social and ecological costs
- Emery analysis (Odum & Odum, 2006) takes account of the environment and the economic inputs

3. Objective
- Assess emery in input of a novel food and energy production (CFE) system compared with conventional wheat production system in Denmark
- To evaluate the sustainability of the two production systems based on emery indices

4. Materials and methods
- Emery analysis steps (Odum & Odum, 2000; Brown et al, 2004)
  - Setting up system boundary after which inputs and outputs crossing the boundary are quantified
  - Inputs are converted into a common currency of solar joules based on transformity coefficients
  - Assessment of the fraction of renewable, non-renewable, purchased resources
  - Use of emery indices (EYR, ELR, ESI, EFR) for sustainability valuation

5. Results

Table 1: Comparative emery indices in conventional wheat and combined food and energy production system (CFE) in Taastrup in Denmark