

Opportunities to Design Biofuel Systems for Multiple Environmental Services and Socioeconomic Benefits

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April 2014
Krugar National Park





Consider bioenergy within system as an opportunity to design landscapes that add value



Landscape design is a plan for resource allocation

- Suggests a way to manage for more sustainable provisions of bioenergy and other services
- Takes context, trends and current conditions into consideration



Landscape design approach for bioenergy should be applied via five steps

- Set goals
 - Involve key stakeholders
 - Develop consensus approach
- Consider constraints
- Address wastes
- Evaluate and apply solutions
- Monitor and adaptive management



Recommended practices

- Stakeholder engagement throughout process
- Consider management options within the broader context
- Attention to site selection and environmental effects in the
 - location and selection of the feedstock
 - transport of feedstock to the refinery
 - refinery processing
 - final transport and dissemination of bioenergy.
- Monitoring and reporting of key measures of sustainability
- Attention to what is “doable”



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Pressures and incentives for landscape design

- Legal demands or regulations
- Customer requirements or specifications
- Stakeholder concerns
- Competitive advantage
- Environmental and social pressure groups
- Reputation loss



Obstacles to developing and deploying landscape design

- Landowner rights
- Traditional practices
- Up front planning required
- Coordination complexity/effort
- Higher initial costs



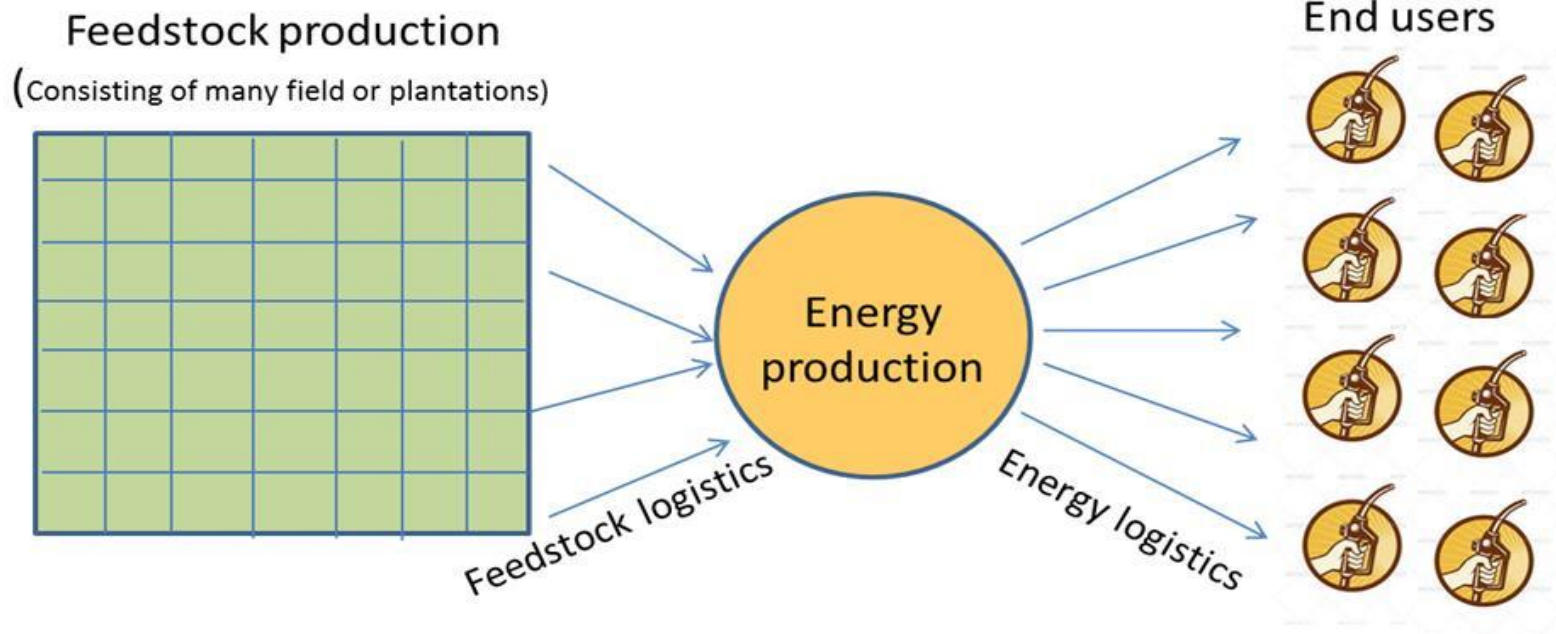
What enables landscape designs?

- Communication across the supply chain
- Management systems
- Agreement among key stakeholders: people, government & business
- Training and education
- Integration into corporate policy
- Regulations and standards

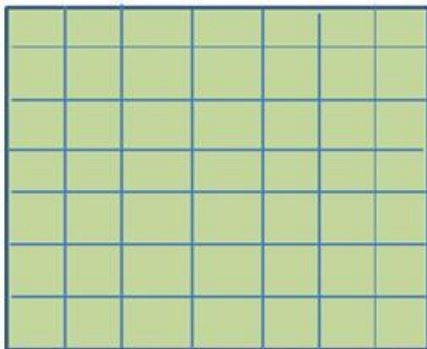


The scale of the bioenergy production system may be

(A) The entire supply system



(B) Just one part of the supply system: e.g., feedstock production



(C) A set from one part of the supply system: e.g., a few fields where energy crops are produced or residues are collected

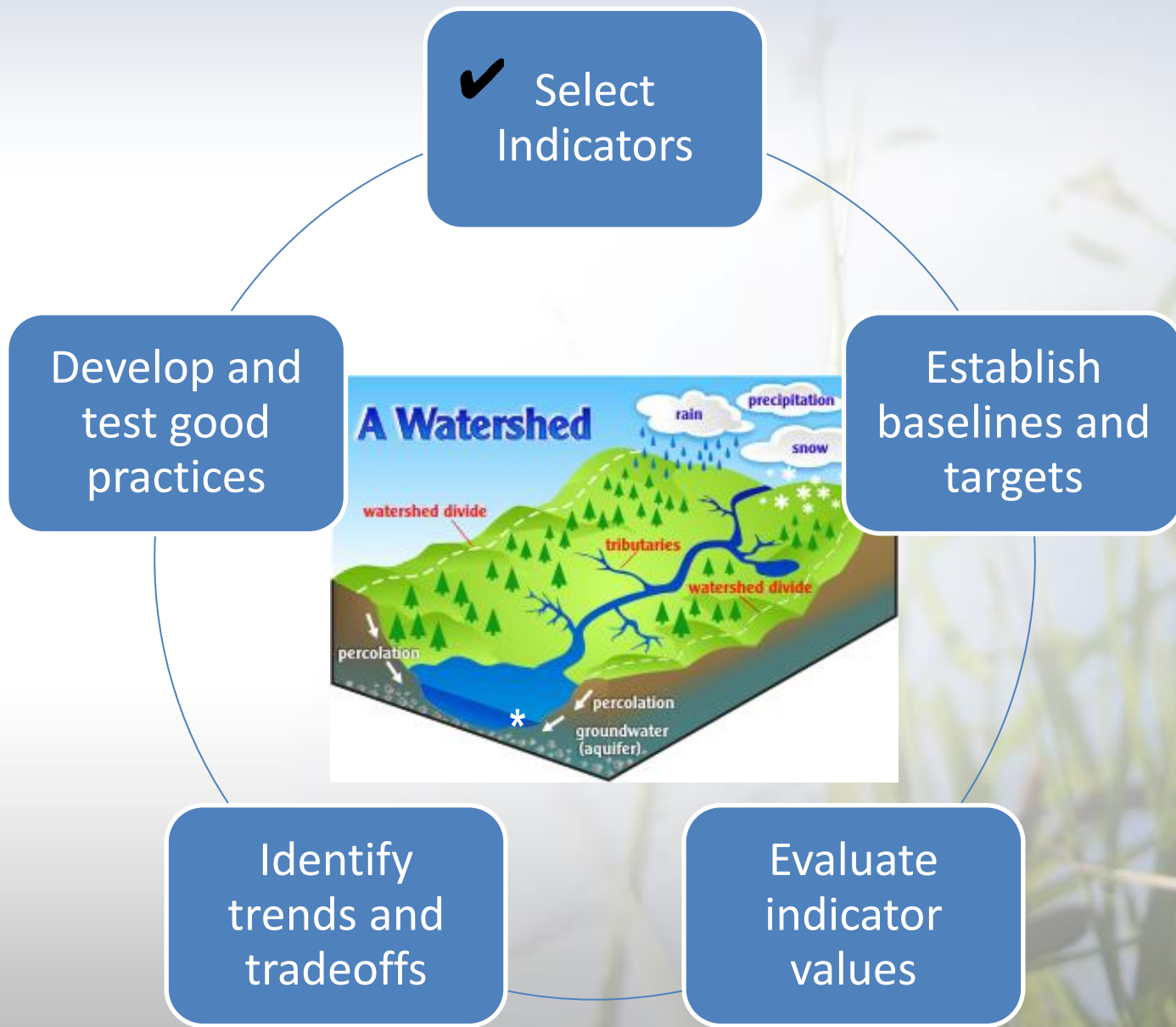


Negative impacts of bioenergy can be avoided or reduced by attention to three principles

1. Conserve other ecosystem and social services (e.g., food, feed, fiber, or areas of high biodiversity).
2. Consider local context (effects of bioenergy on social and ecosystem services are context specific so recommended practices should also be location-specific).
3. Monitor effects of concern and adjust plans to improve performance over time.

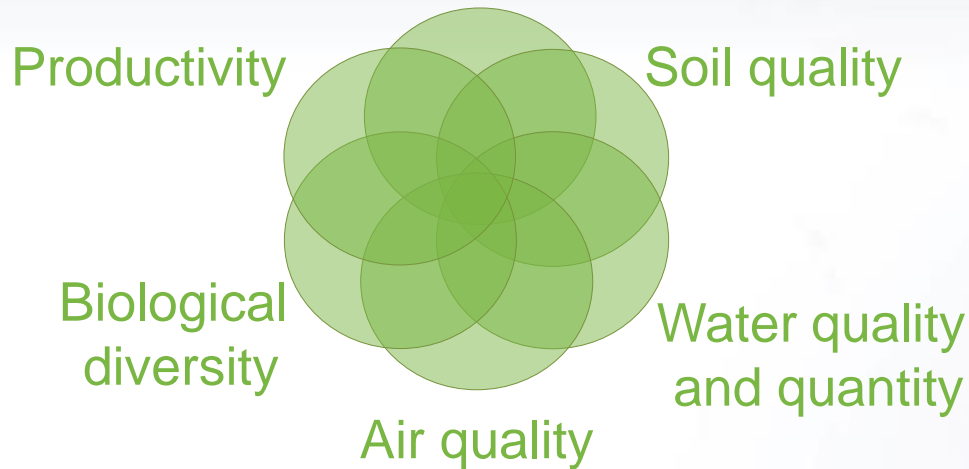


Approach to Assessing Bioenergy Sustainability



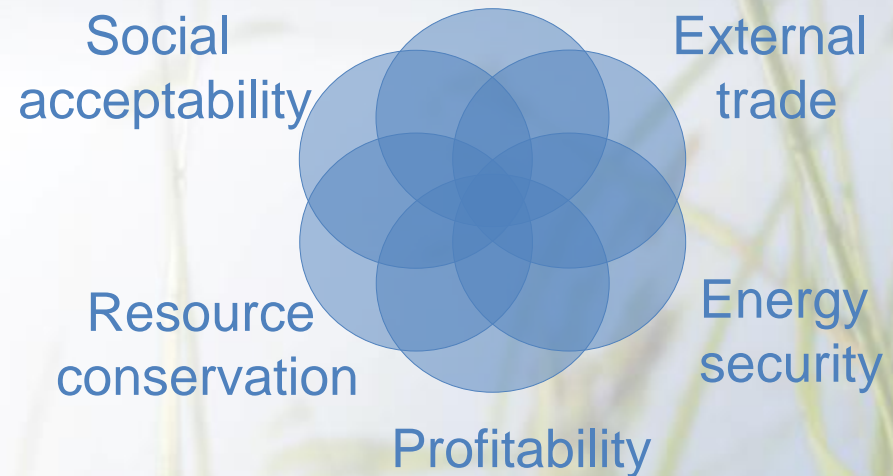
Categories for indicators of environmental and socioeconomic sustainability

Greenhouse gas emissions



McBride et al. (2011)
Ecological Indicators
11:1277-1289

Social well being

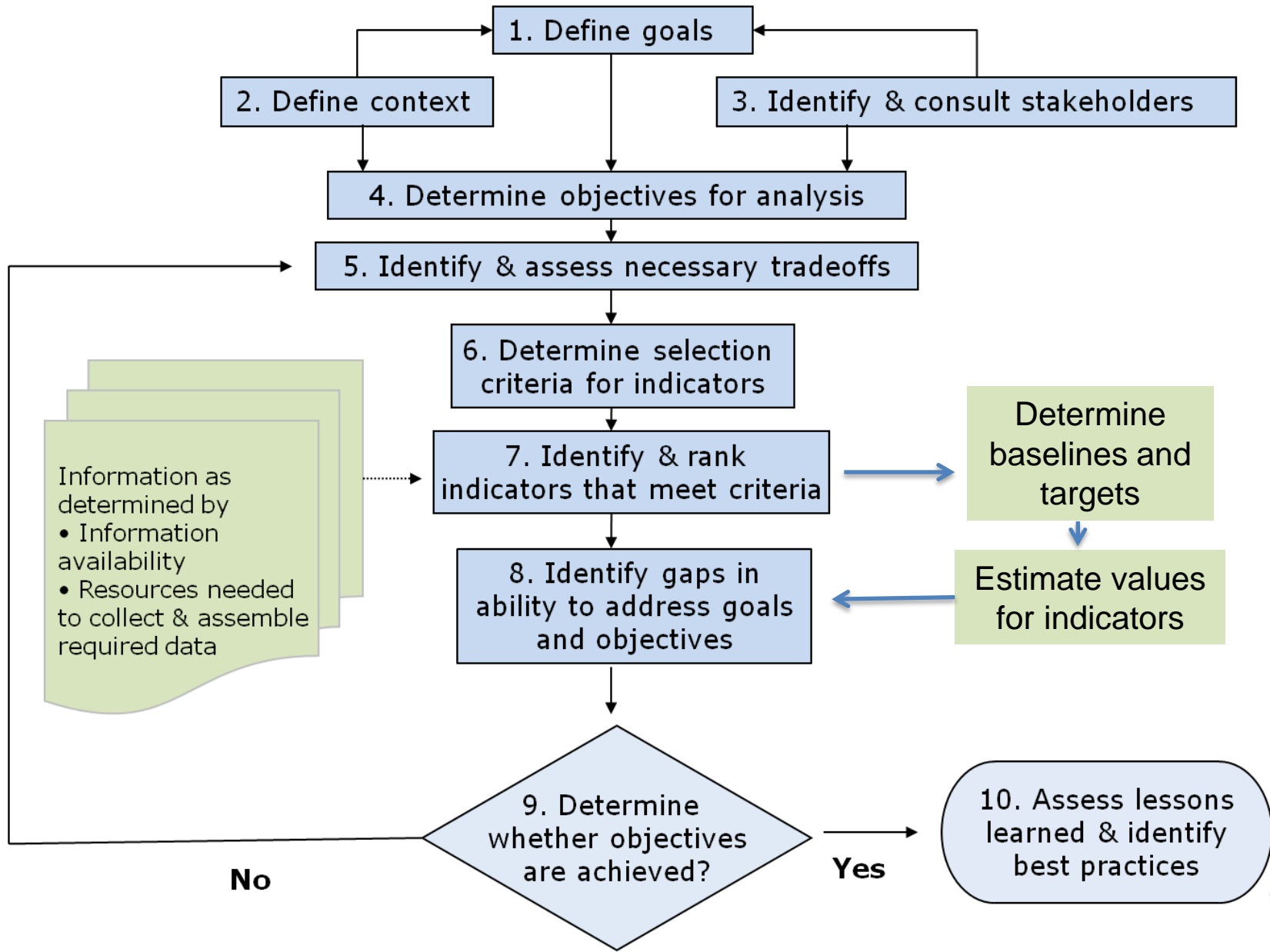


Dale et al. (2013)
Ecological Indicators
26:87-102.

Recognize that measures and interpretations are context specific

Efroymsen et al. (2013) *Environmental Management* 51:291-306.

Framework for Using Indicators to Assess Sustainability and Identify Best Practices



Conceptual Diagram of Effects of Bioenergy Choices

Societal conditions

- Agricultural subsidies & incentives
- Energy policies
- Market conditions
- Perception
- Technology



Individual land choices:

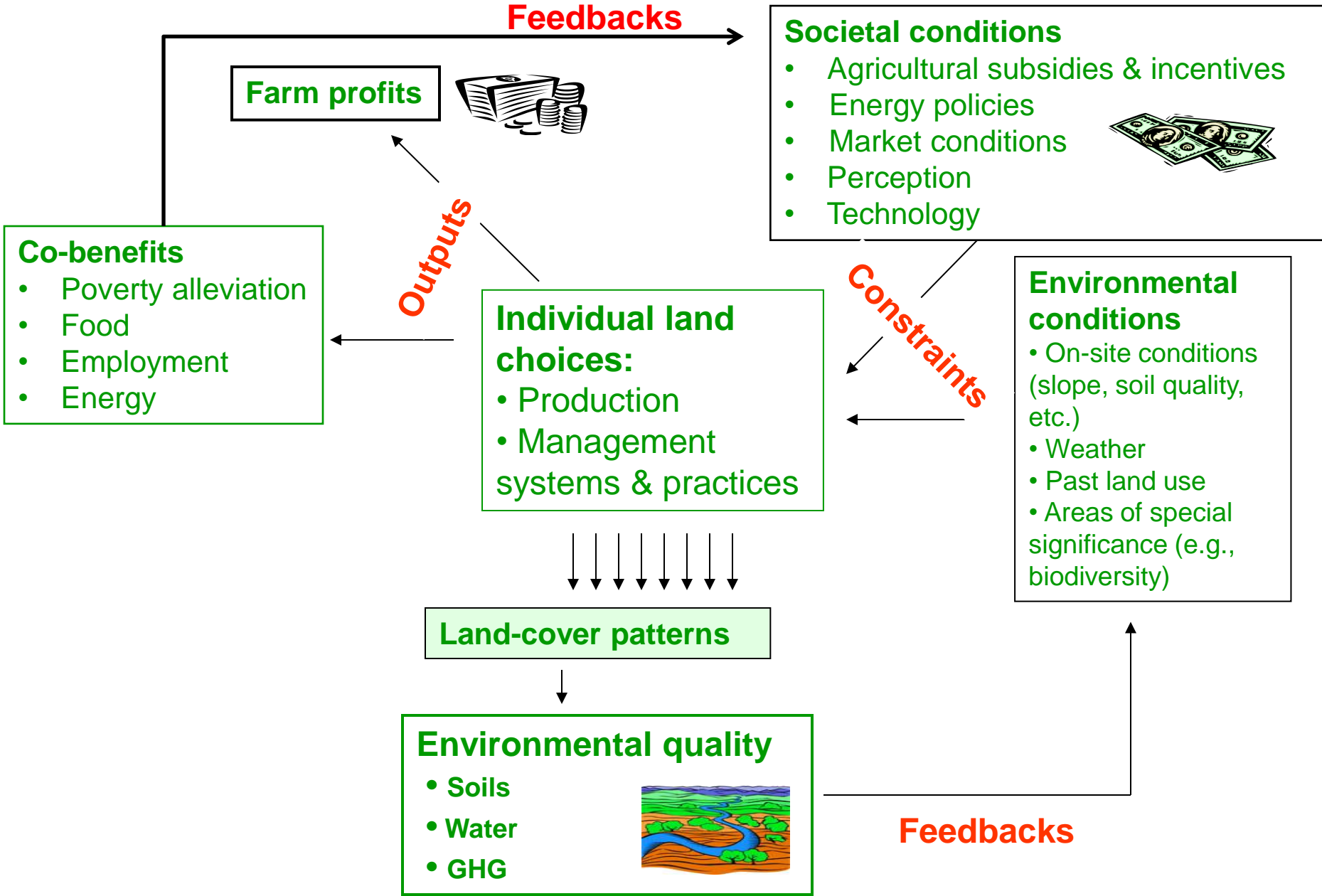
- Production
- Management systems & practices

Constraints

Environmental conditions

- On-site conditions (slope, soil quality, etc.)
- Weather
- Past land use
- Areas of special significance (e.g., biodiversity)

Conceptual Diagram of Effects of Bioenergy Choices



Thank you!

<http://www.ornl.gov/sci/ees/cbes/>



CBES
Center for BioEnergy
Sustainability

