Prioritizing Improvement Options for Built Environment Sustainability:

The Sustainable Facilities & Infrastructure Program

Annie R. Pearce

Research Engineer

Georgia Tech Research Institute

SFI Program Goals

- Understand how professional practice must be shifted to achieve sustainability
- Identify knowledge gaps & opportunities
- Fill gaps via basic & applied research
- Facilitate dissemination of knowledge
- Monitor the integration and impacts of new knowledge

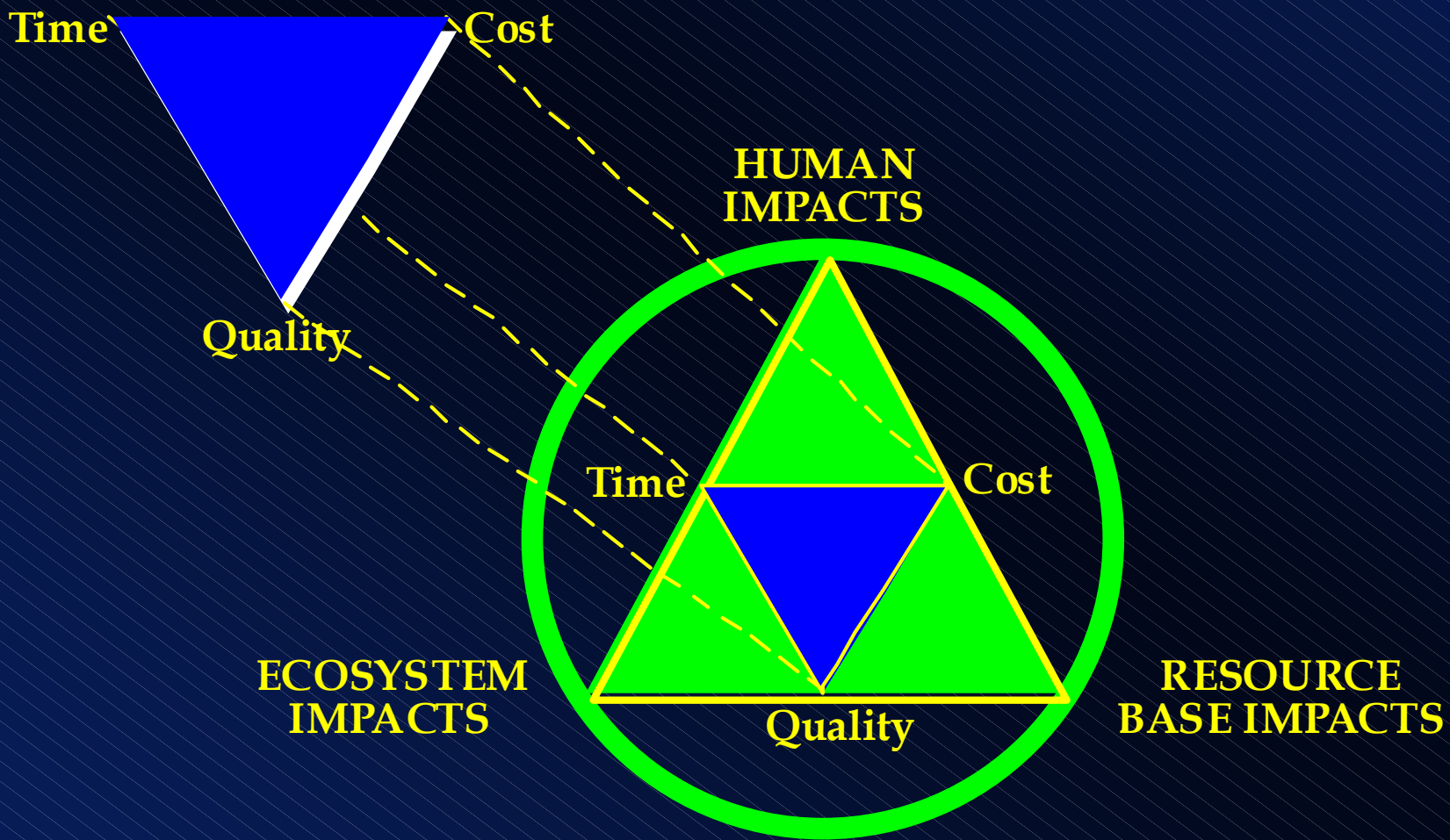
If you're a decision maker...

- Many improvement options exist
- Which ones do you apply, if you can't apply ***all*** of them?
  - Financial and resource constraints
  - Performance and other constraints
- Which ones are most critical or effective for your particular facility?
- Where do you start?!??

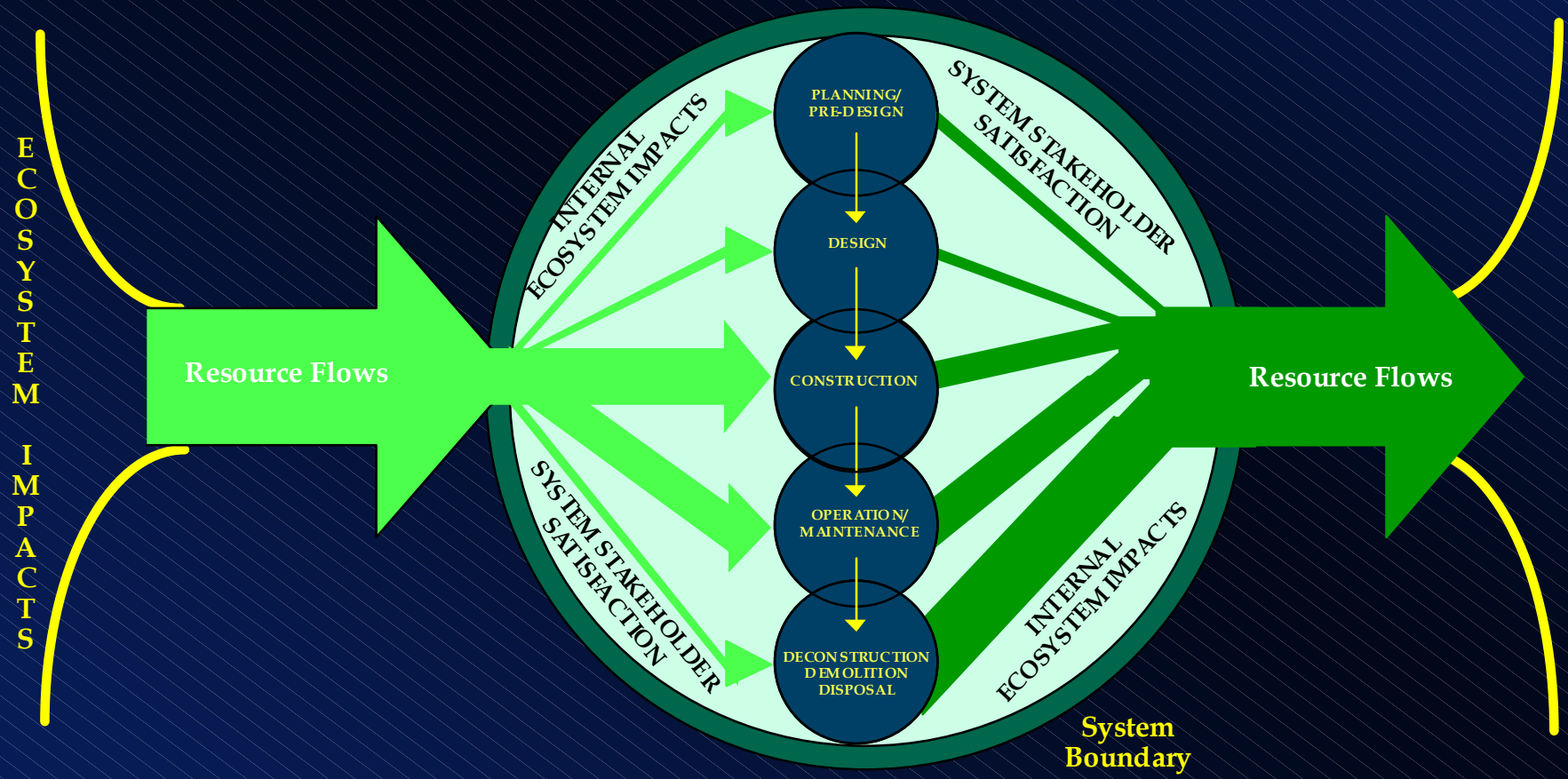
Why is prioritization a challenge?

- No one can agree what sustainability means
- Existing indicator-based metrics are either
  - Too general to incorporate contextual features
  - Too specific to be useful in multiple contexts
- Little or no justification for choice of indicators
- Incommensurability
- Difficult to incorporate human needs and aspirations in a way that satisfies everyone

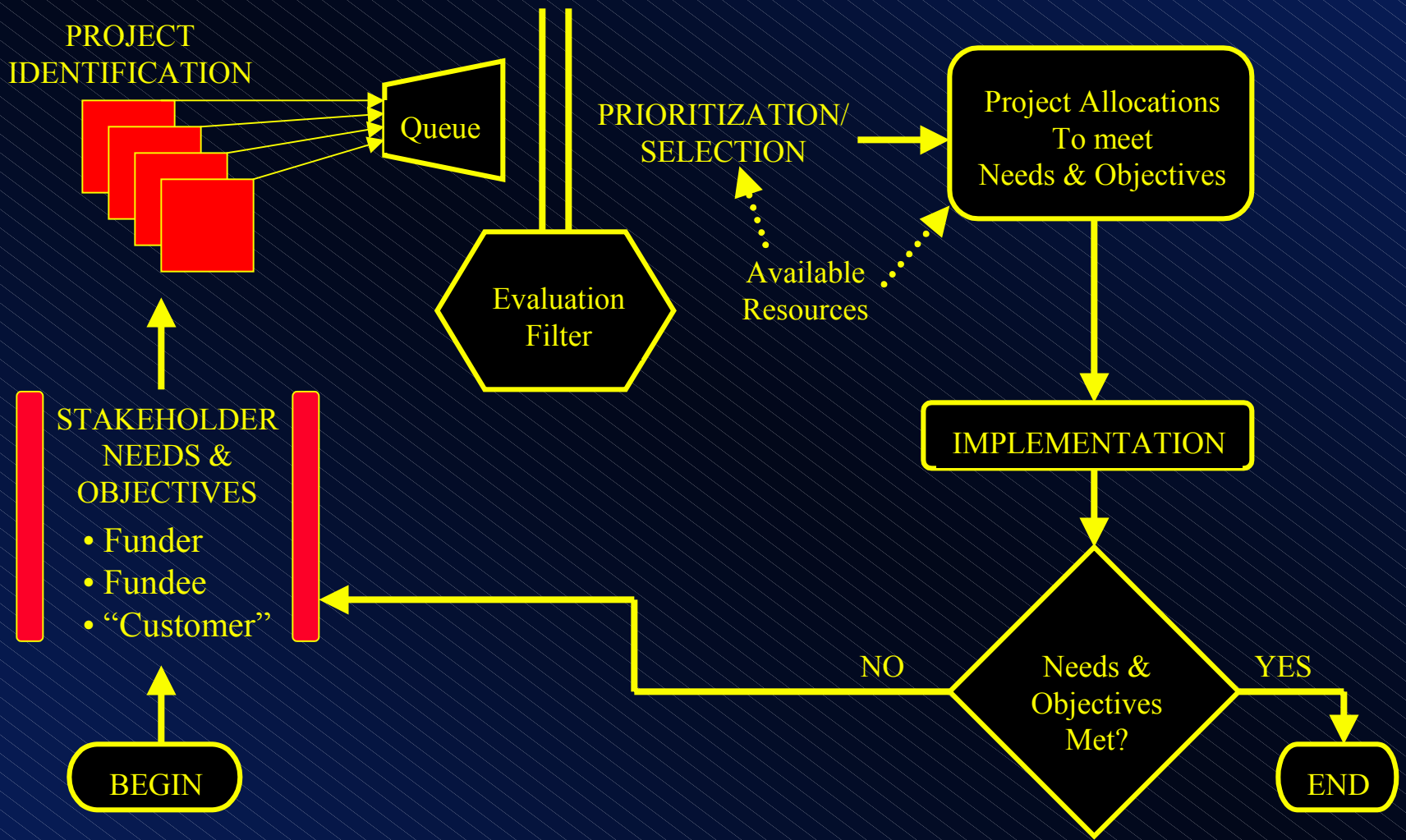
What is Sustainability?



System Representation:
Built Environment Sustainability Factors

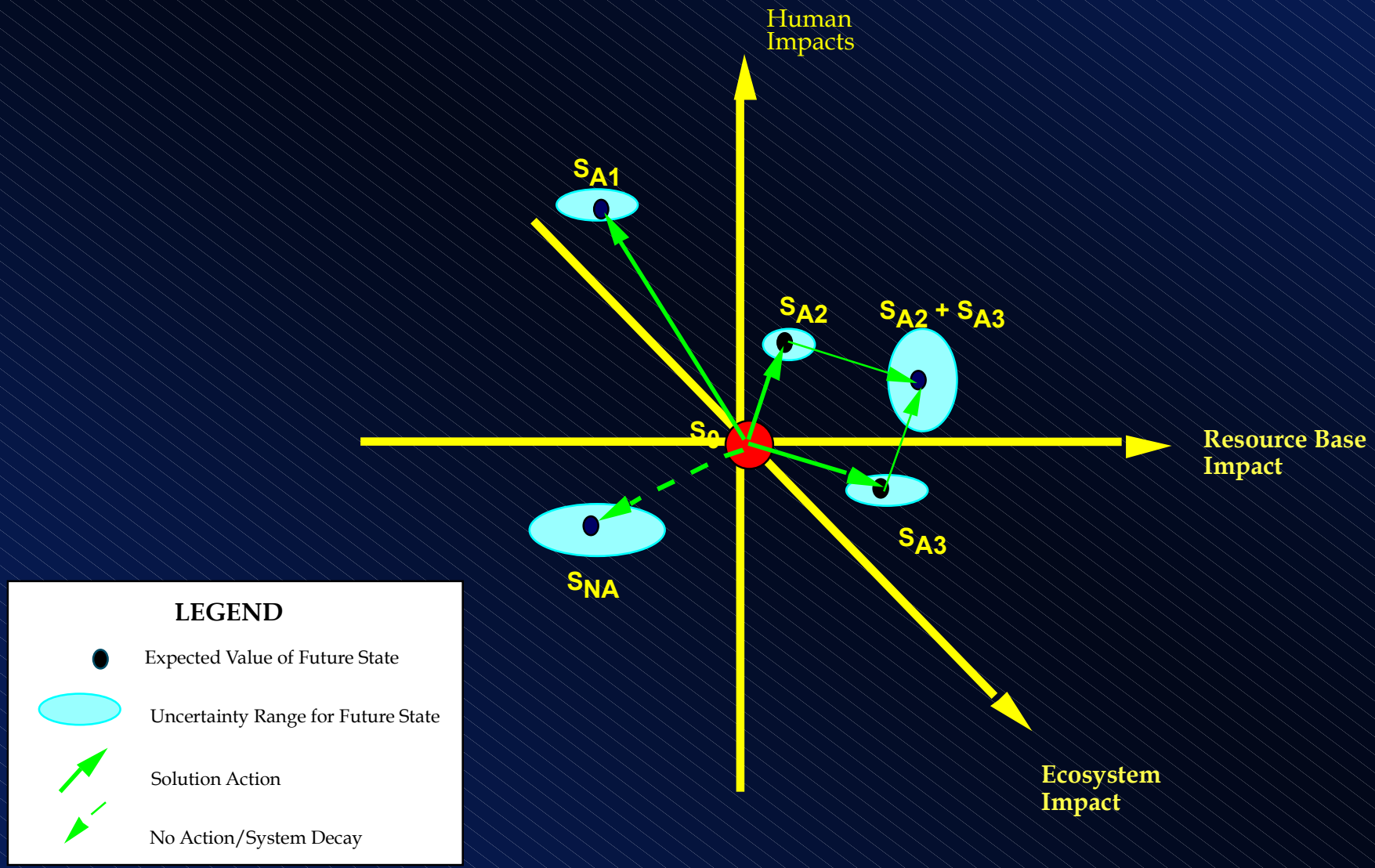


The Resource Allocation Process



(**Source:** Gregory & Pearce 1998, after Jones-Crabtree 1998)

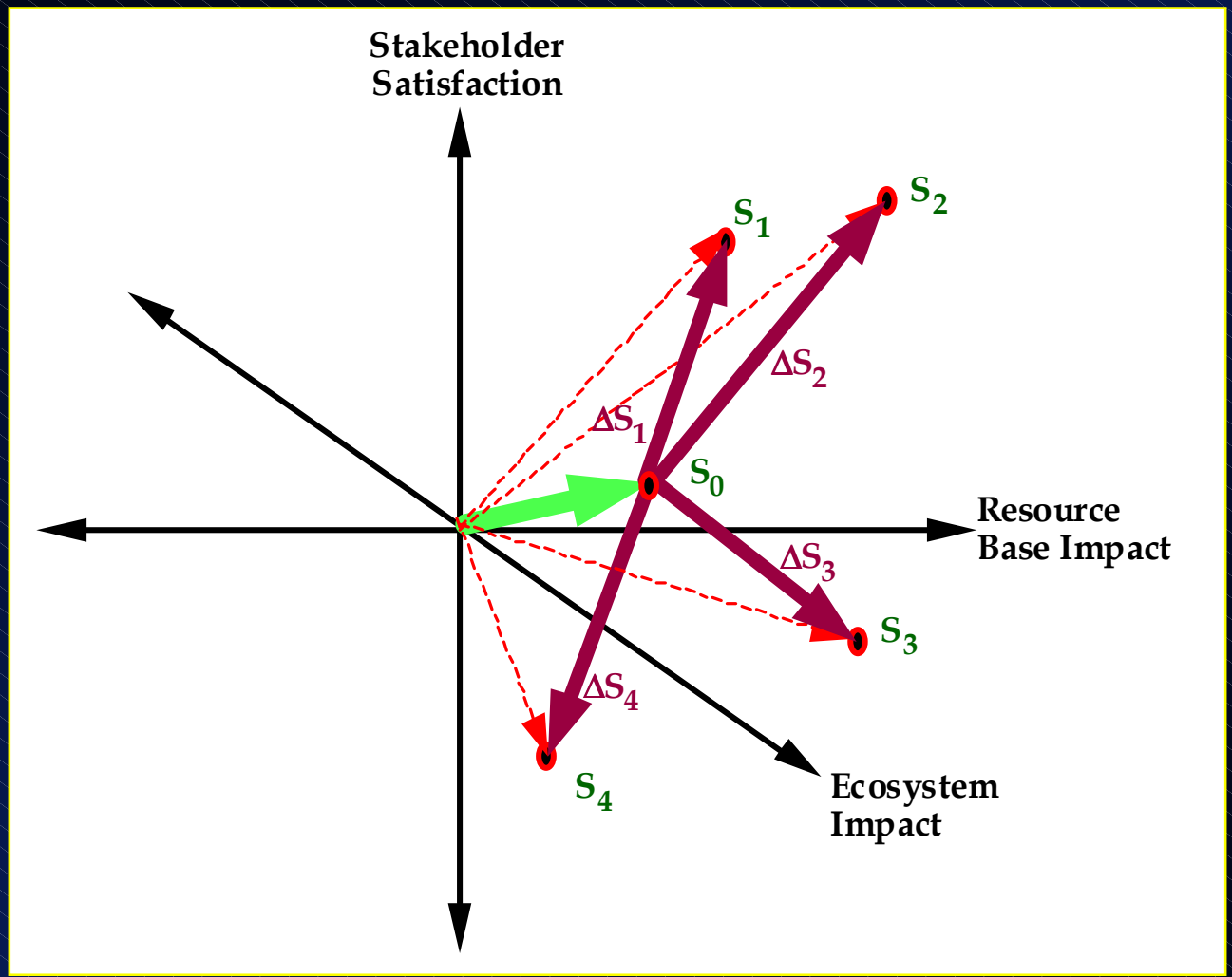
Problem Identification:
Prediction of Future Sustainability States



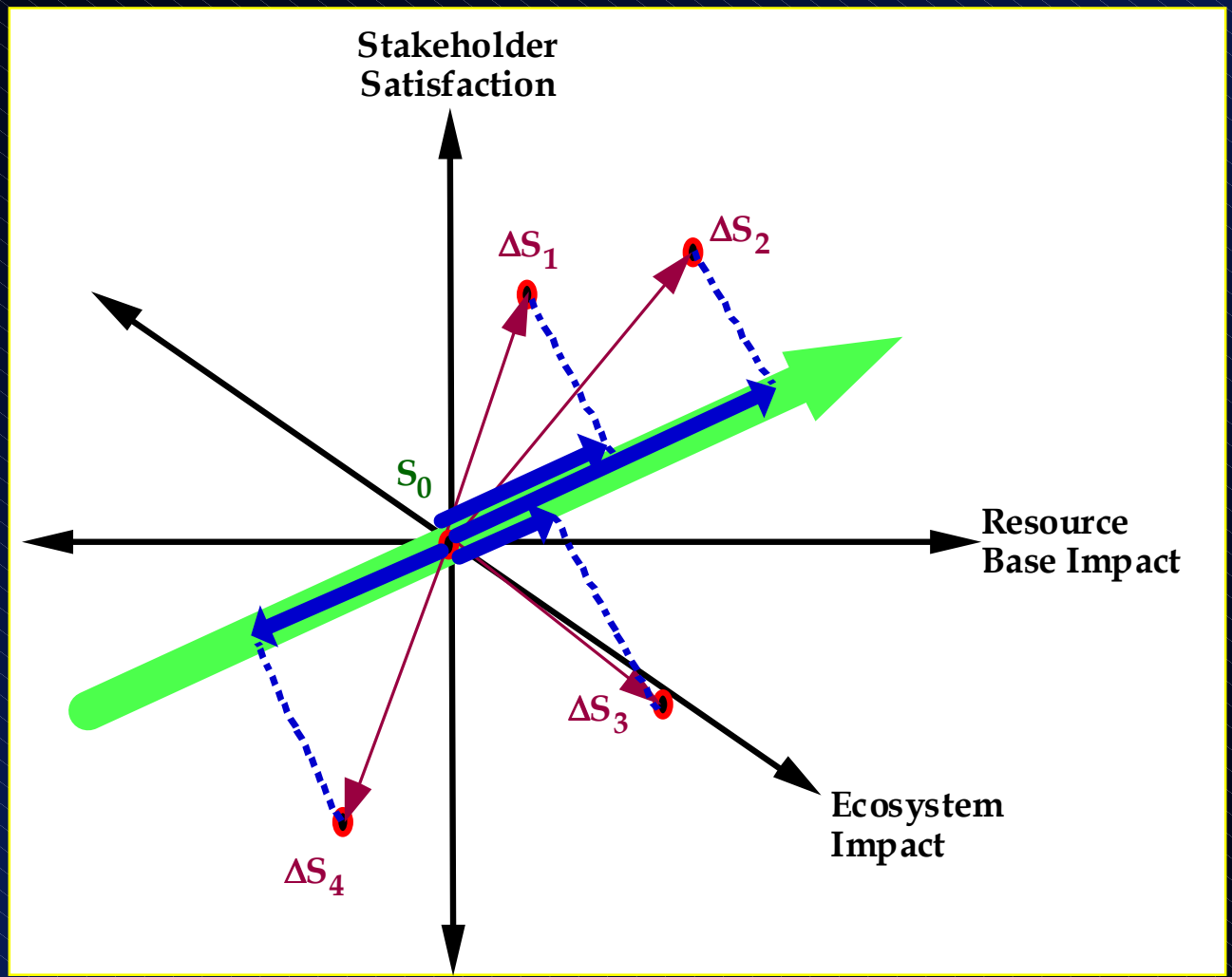
The Prioritization Process

- Establishes a baseline
- Forecasts changes in sustainability resulting from implementing improvement options
- Applies decision constraints to prune infeasible options
- Prioritizes remaining options according to most positive change in sustainability

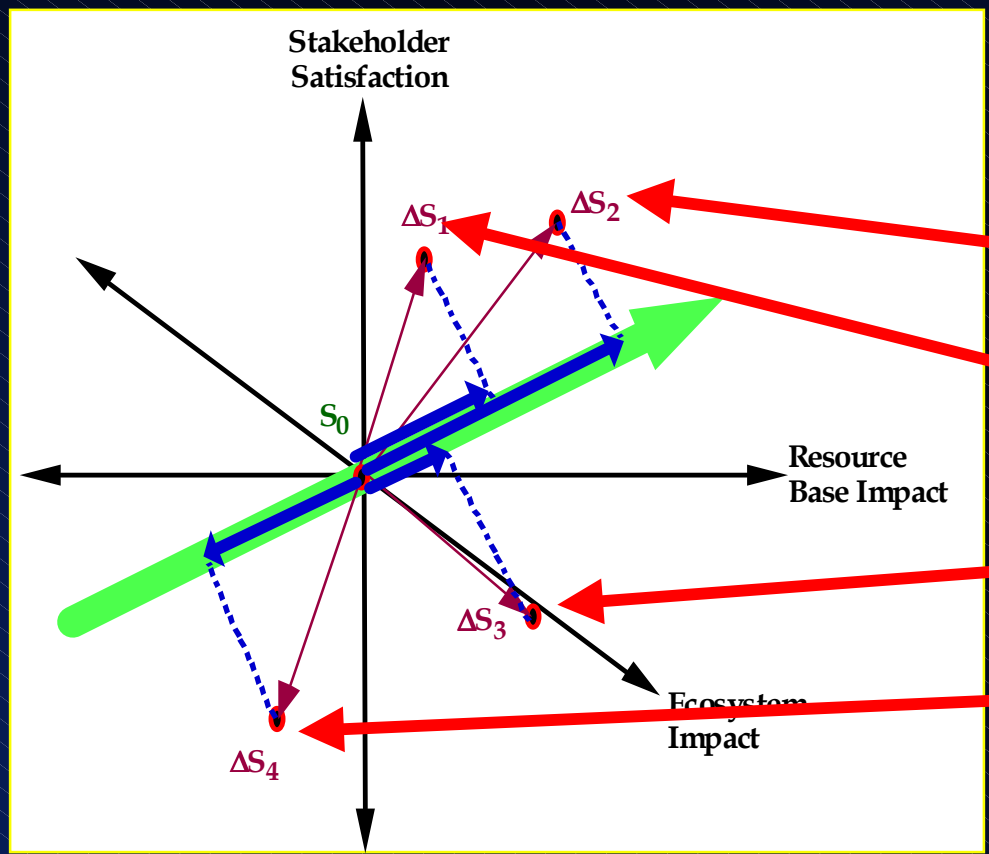
Representing Improvement Options



Comparing Improvement Options



Prioritizing Improvement Options



Priority:

- Option 2
- Option 1
- Option 3
- Option 4

Summary

- Operational definition of sustainability
- Mathematical model
- Tri-axial representation of parameters
- Prioritization of problems via prediction of future sustainability states

- Residential retrofit -> Commercial and industrial applications

Future Research Needs

- Range of sustainability improvement strategies and technologies
- Cost models for sustainability strategies
- Default data values and customization heuristics
- More accurate model of stakeholder satisfaction
- Temporal behavior of resource bases and ecosystems; life cycle amortization methods
- Marginal utility of more precise data; evaluation of existing data streams