

A dark blue silhouette of a world map is centered in the background of the slide. The map shows the outlines of the continents in a slightly lighter shade of blue against the darker blue background.

Resource Allocation and Problem Prioritization for Sustainable Facilities & Infrastructure

Annie R. Pearce

Rita A. Gregory

Jorge A. Vanegas

Georgia Institute of Technology

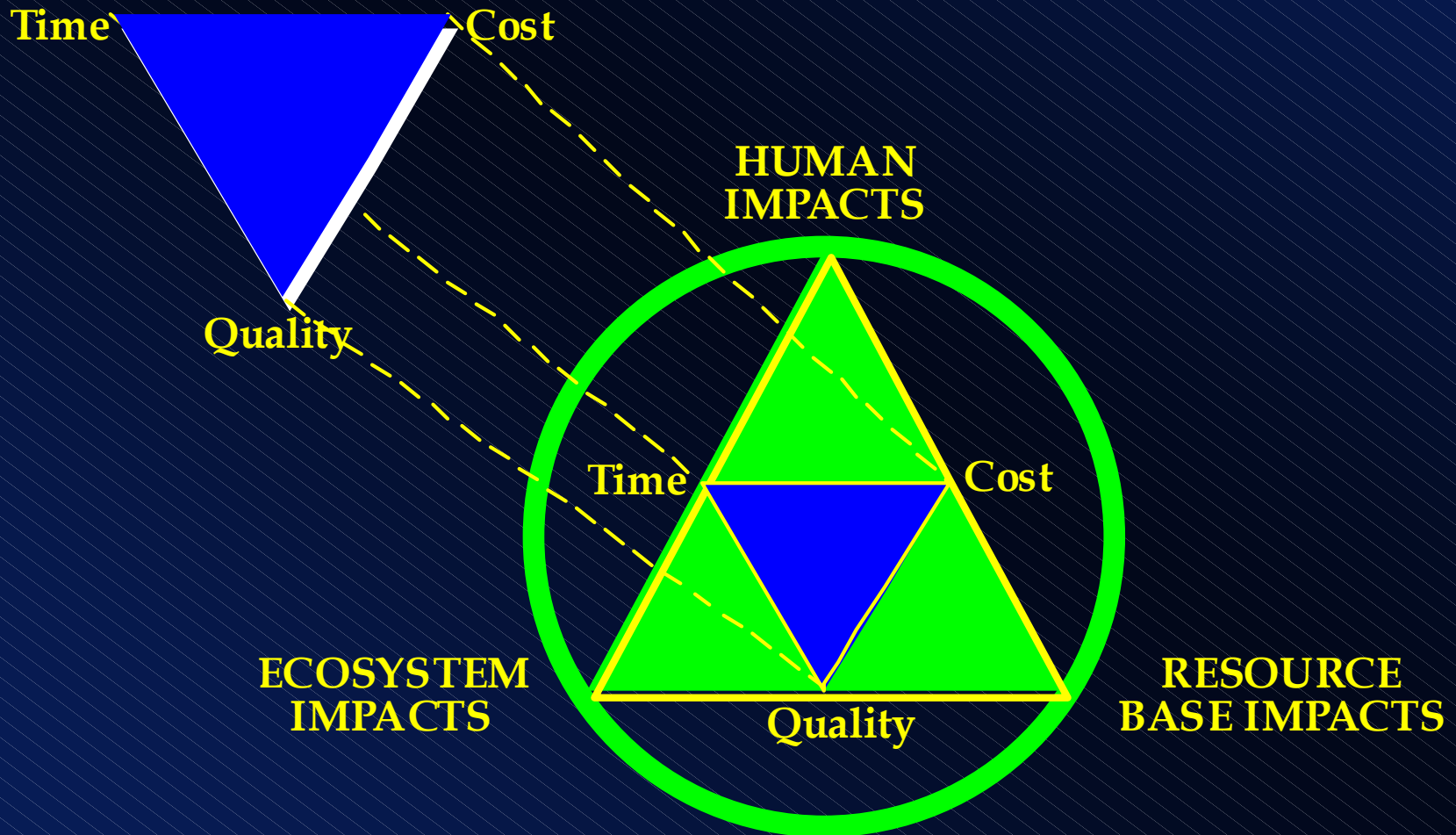
If you're a decision maker...

- ◆ 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?!??

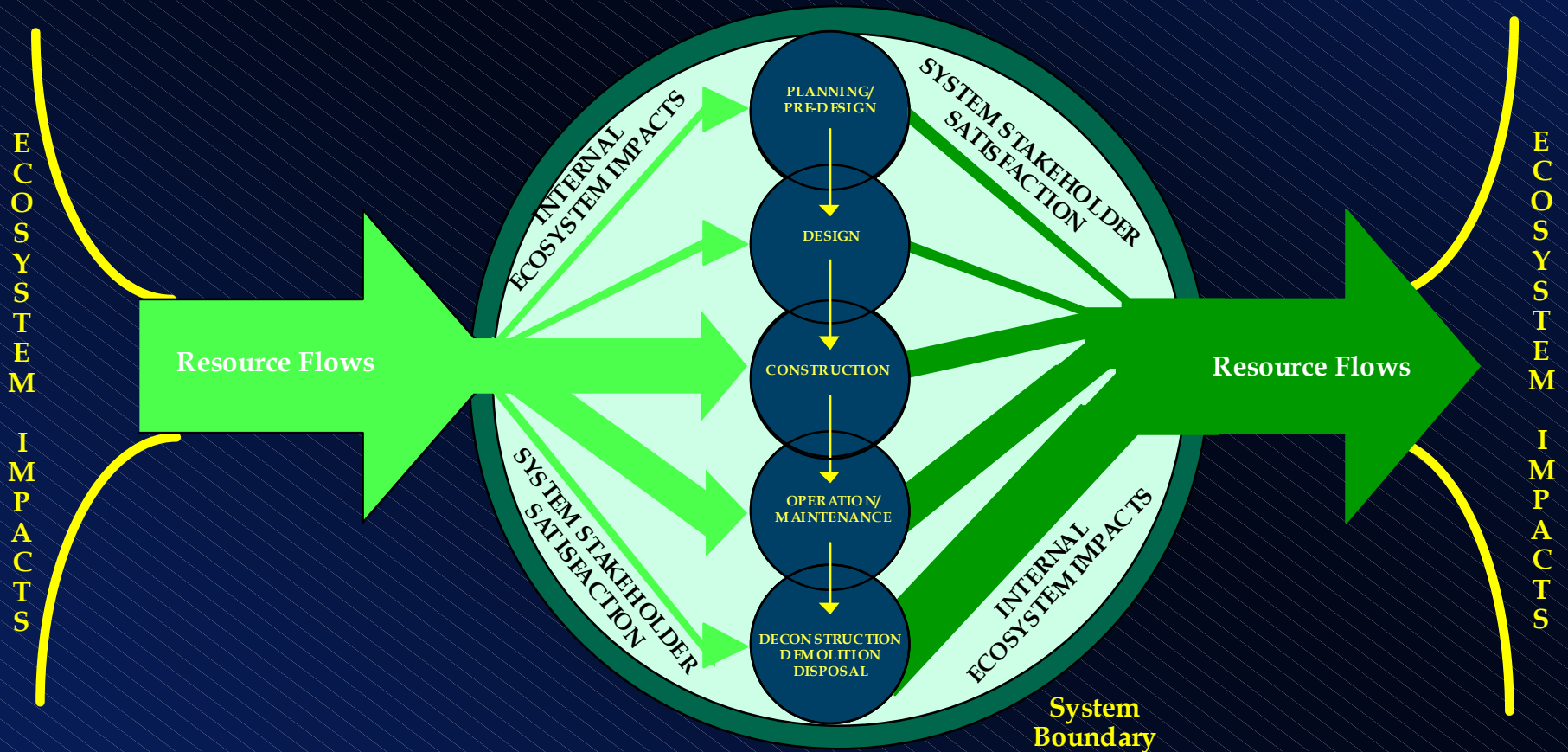
Why is prioritization a challenge?

- ◆ 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

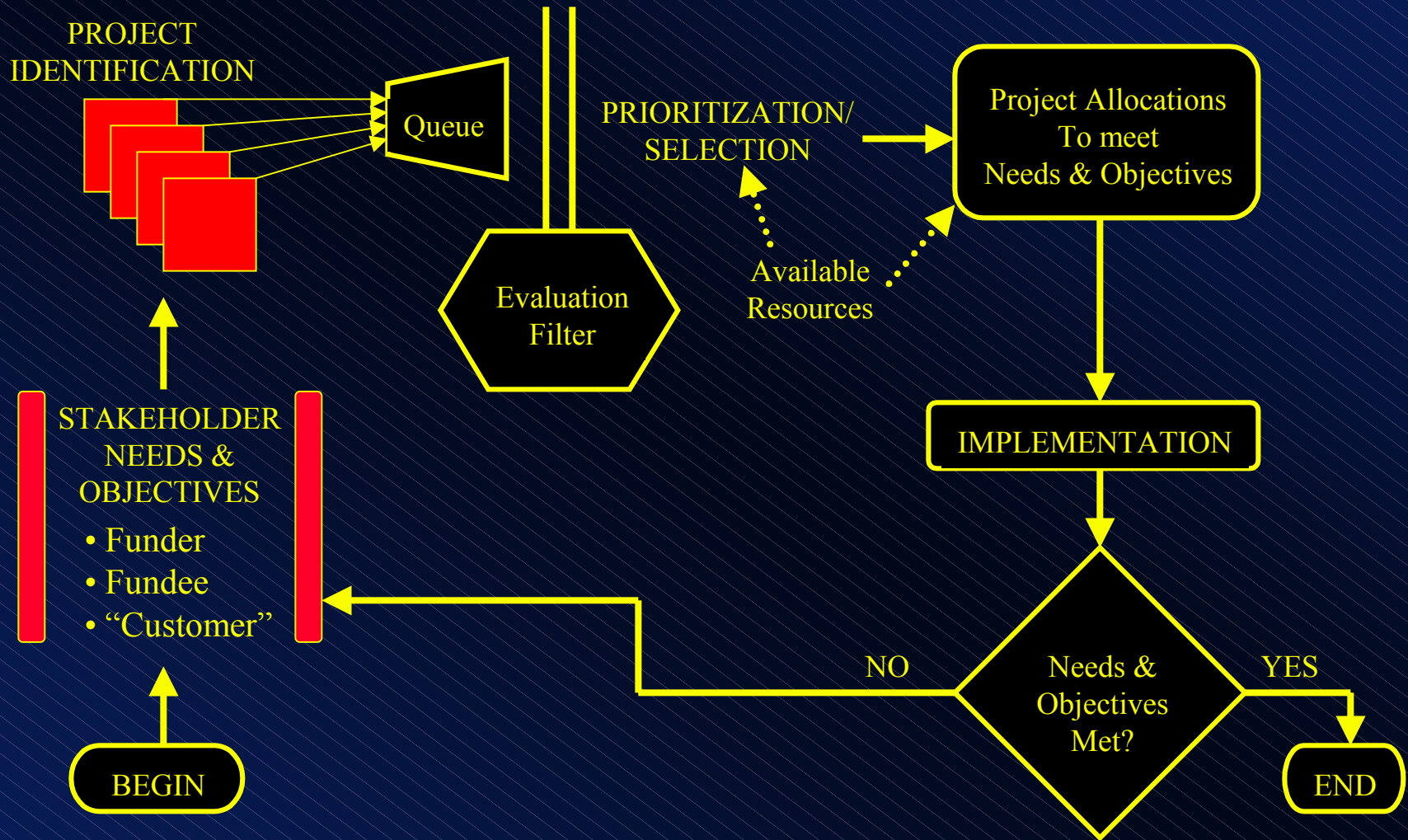
What is Sustainability?



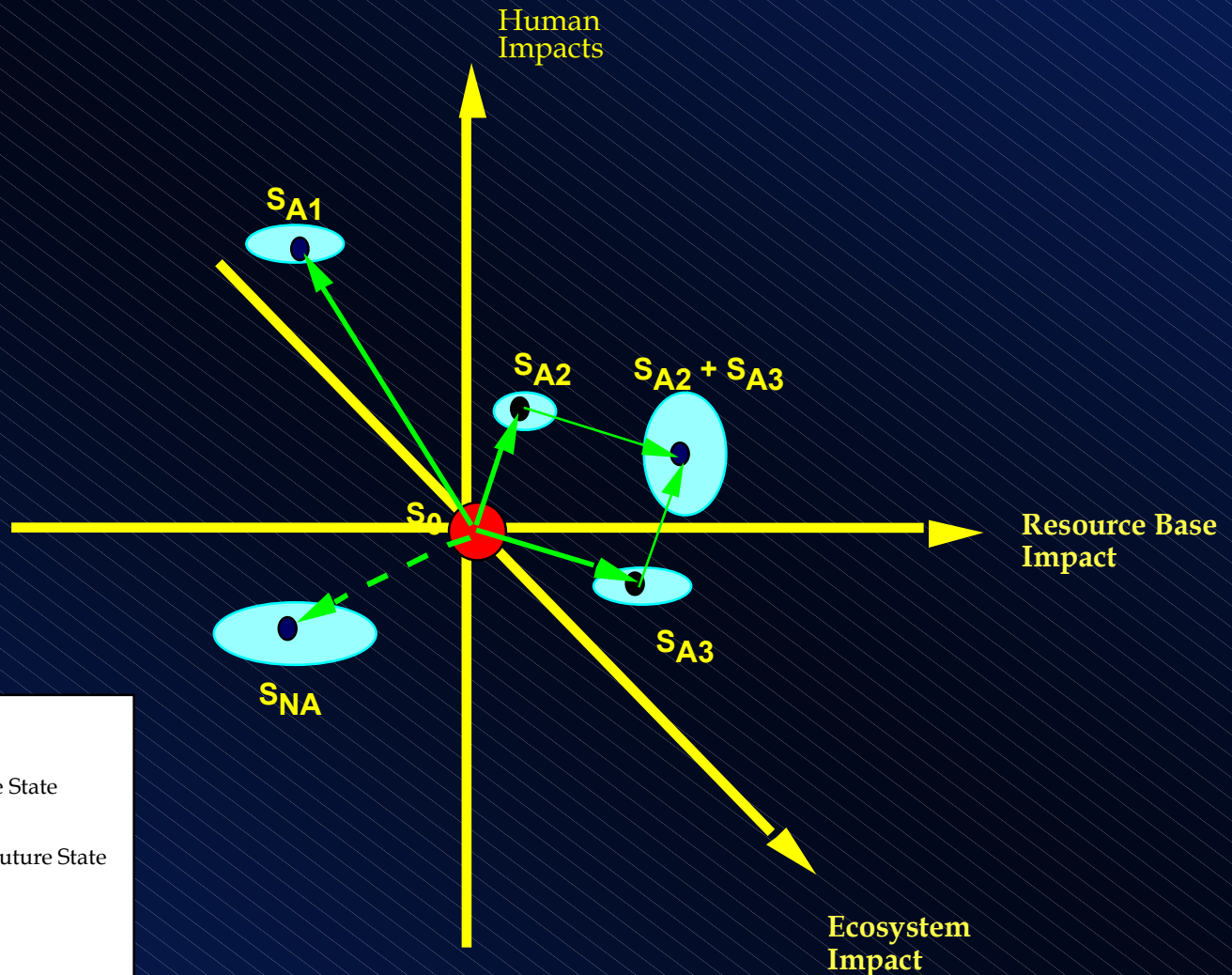
System Representation: Built Environment Sustainability Factors



The Resource Allocation Process



Problem Identification: Prediction of Future Sustainability States



LEGEND

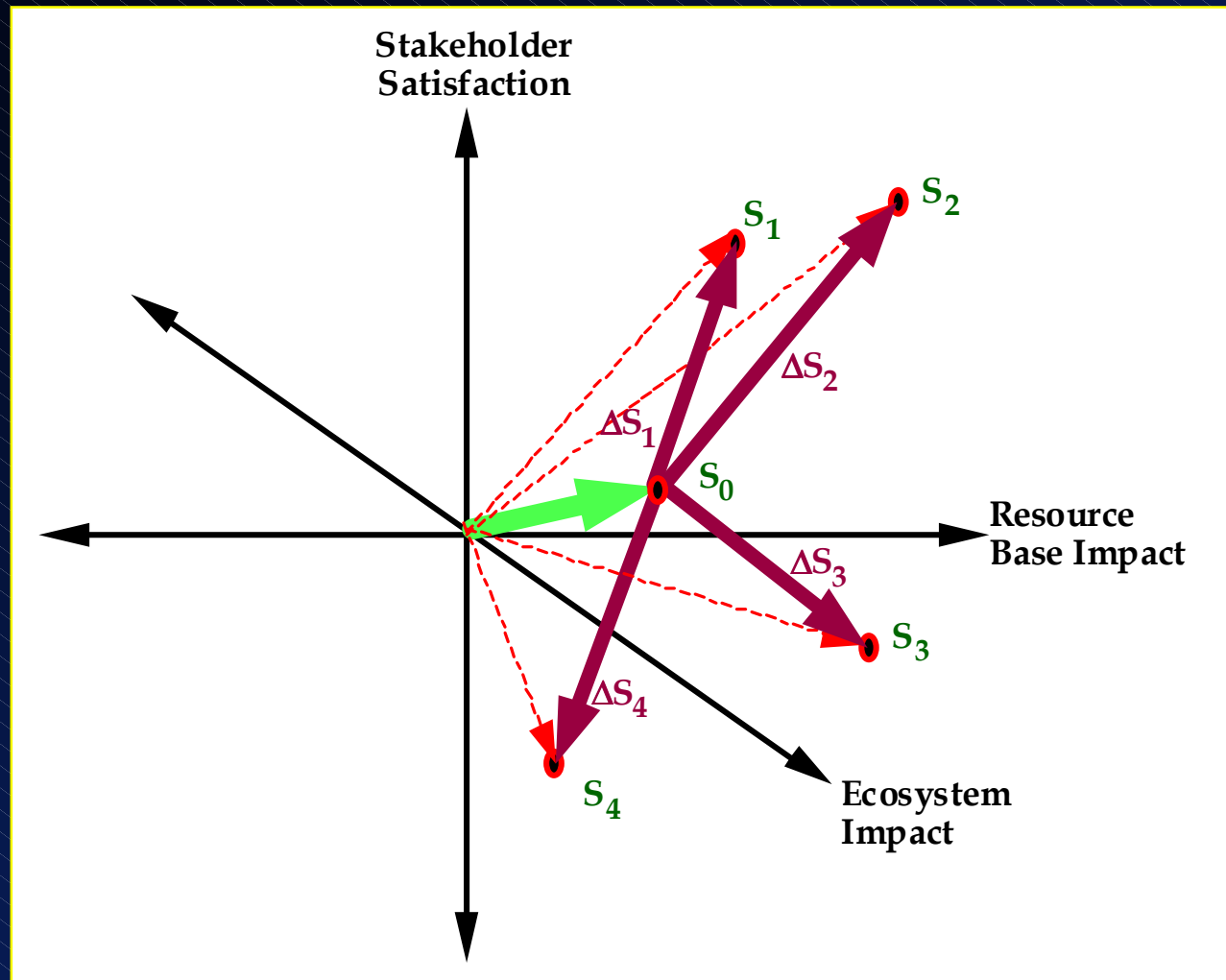
- Expected Value of Future State
- Uncertainty Range for Future State
- ➔ Solution Action
- ➔ No Action/System Decay

The Prioritization Process

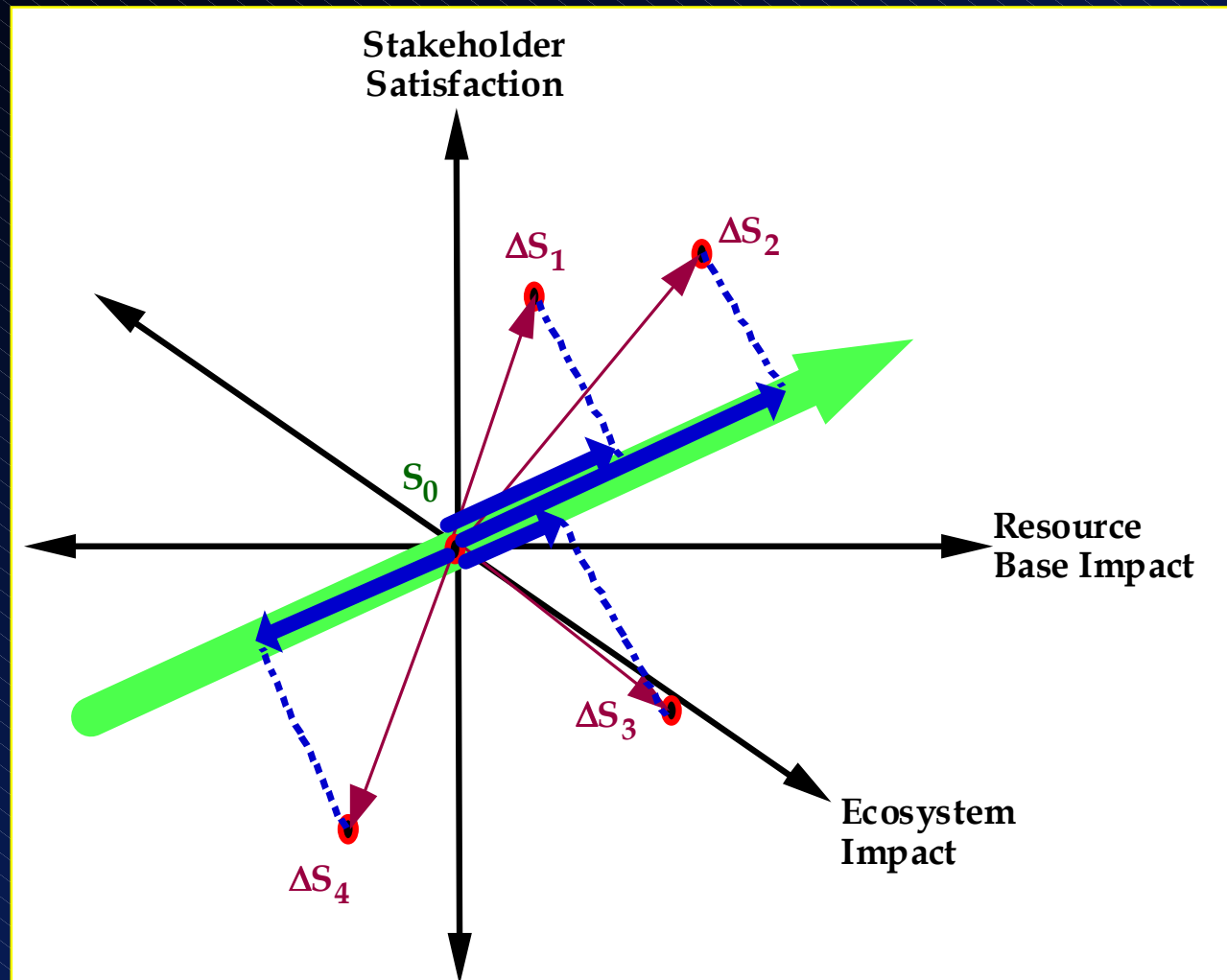


- ◆ Establishes a baseline
- ◆ Forecasts changes in sustainability resulting from implementing improvement options
- ◆ Applies decision constraints to prune infeasible options
- ◆ Prioritizes remaining options according to most positive change in sustainability

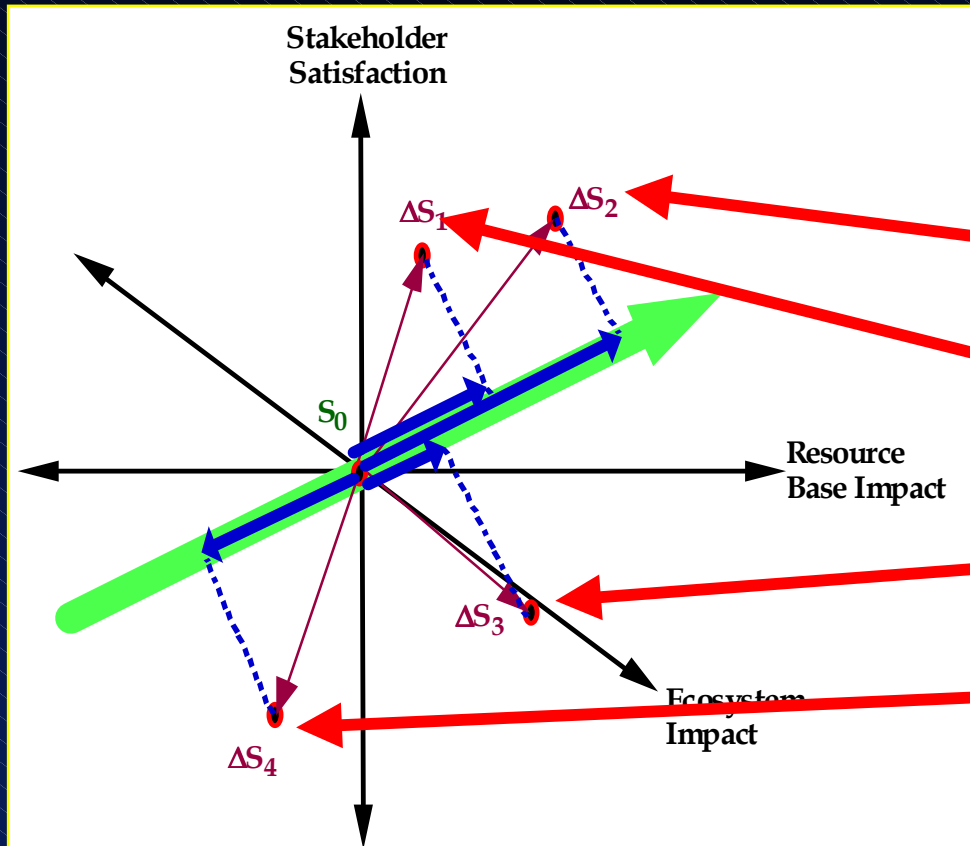
Representing Improvement Options



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