

**Sustainability as a Criterion for
Problem Identification,
Prioritization, and Decision Making**

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Overview

- What is Sustainability?
- Why Should We Care about Sustainability?
- How Can We Implement Sustainability?
- Sustainability and Built Facilities
- Opportunities for Collaboration
- Conclusions



What is Sustainability?

- **Sustain:**
 - “to keep in existence; to maintain” (AHCD 1993)
- **Sustainability:**
 - “...a system state marked by stability, where changes to the system remain constrained so as to maintain the stability of the system into the foreseeable future.” (Pearce 1995)



What is Sustainability?

- What are we trying to sustain?
- Sustainable Technology?
- Sustainable Development:
 - “...development which meets the needs [and aspirations] of present generations without compromising the ability of future generations to meet their own needs.” (World Commission on Environment & Development 1987)



What is Sustainability?

- Sustainability of Humans & Human Race
- Objectives:
 - Meeting human needs and aspirations now
 - System stability over time
- What are the important factors?



What is Sustainability?

- **Thermodynamic Foundations:**
 - System: $\text{Earth} + \text{Solar Input} - \text{Heat Output}$
 - Consumption Increases Entropy and Decreases Utility
 - Ecosystems are the Primary Mechanism for Regeneration of Resources



What is Sustainability?

- **Thermodynamic Objectives:**
 - Minimize negative impacts on natural ecosystems (since they are the primary mechanism for capturing solar energy in the form of photosynthesis)
 - Minimize the gain in entropy of matter as a result of consumption-related processes



What is Sustainability?

- **The Anthropocentric Component:**
 - Intragenerational Equity: meet the requirements for human survival in the present
 - Intergenerational Equity: leave the Earth in at least as good a condition as we found it
 - Motivation for Initiators: maintain standards of living at least as good as the ones which currently exist



What is Sustainability?

- **Dimensions and Objectives:**
 - Resource Consumption: minimize the consumption of matter and energy
 - Ecosystem Impacts: minimize negative environmental impacts
 - Human Satisfaction: satisfy human needs and aspirations



Why Should We Care About Sustainability?

- Growing Recognition of the Global Environmental Impacts of Development:
 - Global Warming
 - Species Extinction
 - Ozone Depletion
- Difficulty Sustaining Current Development:
 - Deteriorating Infrastructure
 - Maintenance Backlogs



How Can We Implement Sustainability?

- **Problem Characterization:**
 - Lack of consensus on the challenges - Problem reframing is needed!
 - Disagreement on objectives - Unification and consensus are needed!
 - Many opportunities, finite resources - Prioritization is needed!



How Can We Implement Sustainability?

- **Steps in Problem Solving:**
 - Problem Definition/Framing
 - Objectives Setting
 - Generation of Alternatives
 - Analysis/Recommendation of Solutions
 - Implementation of Solutions
 - Feedback, Maintenance, and Learning



Problem Definition and Framing

- Paper or plastic?
- A Coke is a Coke is a Coke....



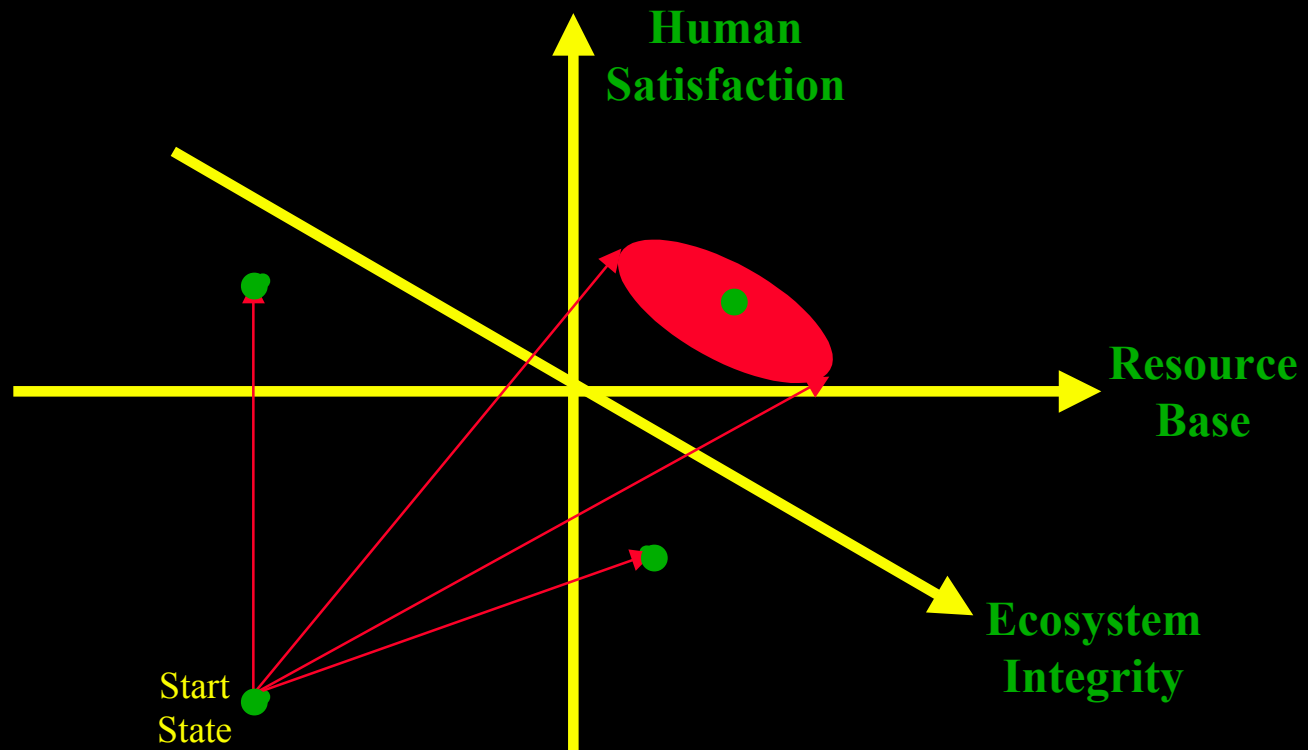
Sustainability and Technological Systems

- **Critical Dimensions and Limit States:**
 - Resource Consumption \leq Sustainable Yield of Resource Base
 - Human Satisfaction \geq Basic Biological Survival
 - Ecosystem Integrity \geq Carrying Capacity for Humans



Sustainability and Technological Systems

- Representation of System Sustainability:





Conclusions

- We should care about sustainability!
- Sustainability is about system stability
- Sustainable problem solving requires:
 - Looking at problems in new ways
 - Considering solutions “outside the box”
 - Dynamic approaches to implementation and feedback