

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



Why Should We Care About Sustainability?

- Increasing Interest in Applying Sustainability:
 - Government, e.g., National Park Service, NSF
 - Private Industry, e.g., Interface Corporation, HOK, Monsanto
 - Grassroots, e.g., Sustainable Atlanta Initiative
 - Non-Profit, e.g., Orphanage Outreach
- Technical Assistance Opportunities!



Why Should We Care About Sustainability?

- Educational Initiatives:
 - Air Force Facilities Remediation Training
 - Potential ABET Accreditation Requirement
 - GE CST Curriculum at Georgia Tech
- Training and Education Opportunities!



How Can We Implement Sustainability?

- Problem Characterization:
 - Disagreement on objectives
 - Many potential opportunities, known and unknown
 - Finite resources to implement solutions
 - Prioritization is needed!



How Can We Implement Sustainability?

- **Steps in Problem Solving:**
 - Status Quo Assessment/Evaluation
 - Problem Identification
 - Consensus on Target State/Objectives
 - Prioritization of Problems
 - Modelling of Potential Solutions
 - Implementation and Reevaluation



Sustainability and Built Facilities

- Current Research:
 - Identification of Critical Dimensions
 - Definition of Limit States
 - Representation of Facility Sustainability
 - Selection of Assessment Tools to Locate Facilities in Sustainability Representation
 - Identification and Prioritization of Improvement Opportunities



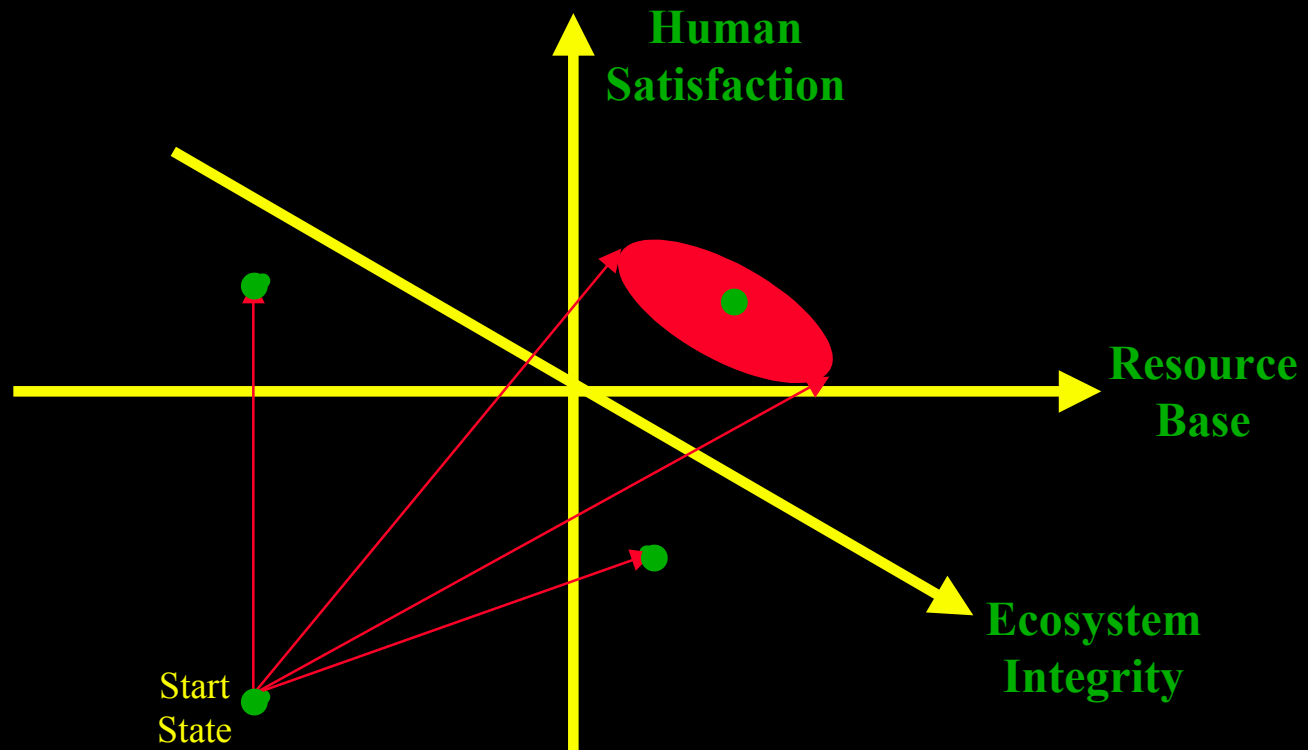
Sustainability and Built Facilities

- 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 Built Facilities

- Representation of Facility Sustainability:





Sustainability and Built Facilities

- Proposed Research:
 - Examine Economic Implications of Representation and Prioritization Schemes
 - Develop Computer-Based Tools for:
 - Facility Assessment and Modelling
 - Improvement Opportunity Identification
 - Sustainability Decision Support
 - Path Planning and Resource Allocation Applications



Opportunities for Collaboration

- **Air Force:**
 - Rehabilitation and Remediation Planning
 - Maintenance Decision Making
- **National Science Foundation:**
 - Infrastructure Rehabilitation Planning
 - Knowledge Transfer and Formalization
 - Educational Initiatives
- **ECDC Initiative at Georgia Tech**



Conclusions

- Sustainability is a strategy for addressing ever-increasing global problems
- There is increasing interest in sustainability in government, industry, academia, and society
- Implementing sustainability offers a host of opportunities for research, education, and technical assistance