Defense Energy Security from a Social-Ecological Systems Perspective

Or:

How to do the long trip

when you can't read the fuel gauge

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Agenda

- Energy resource concerns
- Context within natural resource management theory
- Systems perspective for understanding the uncertainties and mission vulnerabilities
- Adapting to stay resilient

Bottom Line Up Front

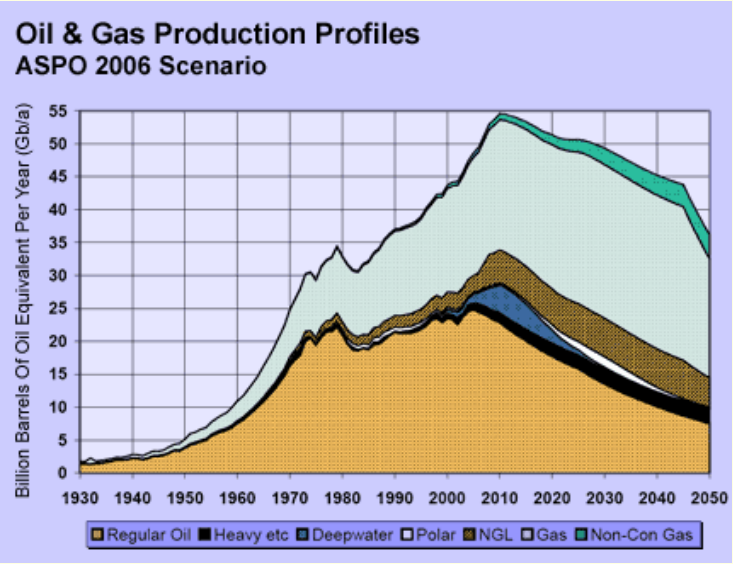
- The most important factor in energy security is RESILIENCE
  - Vulnerability in narrow resource dependency
- We can learn from nature: Resilient ecosystems are sustainable
- We need adaptive strategies to achieve defense energy resilience
- If we only plan for new energy sources, we are not addressing the underlying problem

Energy Resource Concerns

- Below ground
- Above ground
- Systemic over-reliance
  - Nationwide
  - Military

Energy Resource Concerns: Below Ground

- Hubbert‟s Peak
- National Petroleum Council meta-study on outlook to 2030
  - Enough “molecules in the ground,” BUT
  - US cannot rely on Saudi Arabia to make up shortfalls
- Numerous studies projecting peak within 10-20 years



Energy Resource Concerns: Above Ground

- Even “adequate” supplies not sufficient: **Many threats to access**
- NPC study sites “accumulating risks”
  - Political
  - Economic
  - Environmental
  - Military
  - Infrastructure
- Takes decades to adjust resource base

Energy Resource Concerns: Systemic Over-Reliance - Nationwide

All public sectors…

- Agriculture
- Industry/manufacturing
- Transportation
- Health
- Safety
- Etc.

…rely on very few energy resources

- Oil
- Coal
- Natural gas

Even minor shortfalls quickly cause big problems, price swings, and anxiety

Energy Resource Concerns: Systemic Over-Reliance - Military

- Oil is a GREAT fuel
  - Great energy density, transportability, store-ability
  - Enables power, agility, & lethality
  - Easy to get hooked!

Energy Resource Concerns: Systemic Over-Reliance - Military

- "Just a logistics problem"
  - Assumed to be available anywhere, any time, in whatever form and quantity is needed
  - Military purchasing power relies on suppliers worldwide
  - What were once "wants" are now "needs"
- Missions planned, equipment acquired, force structured & trained based on assumed supply
- Without energy resilience, missions unsustainable

Understanding the Mission Vulnerabilities

- Thought experiment:
  What happens if we start turning off the tap?
- Consider changes in resource availability
  - Slow or rapid onset?
  - Short-lived or permanent?
  - Affecting quantity, type, quality, and reliability
- What mission capabilities suffer?
- What are secondary and cascading effects?
  - Less energy available to address the problem
- Does effect on nation distract or alter military missions?
- Can effects be mitigated?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The Ecological Example: Understanding the System

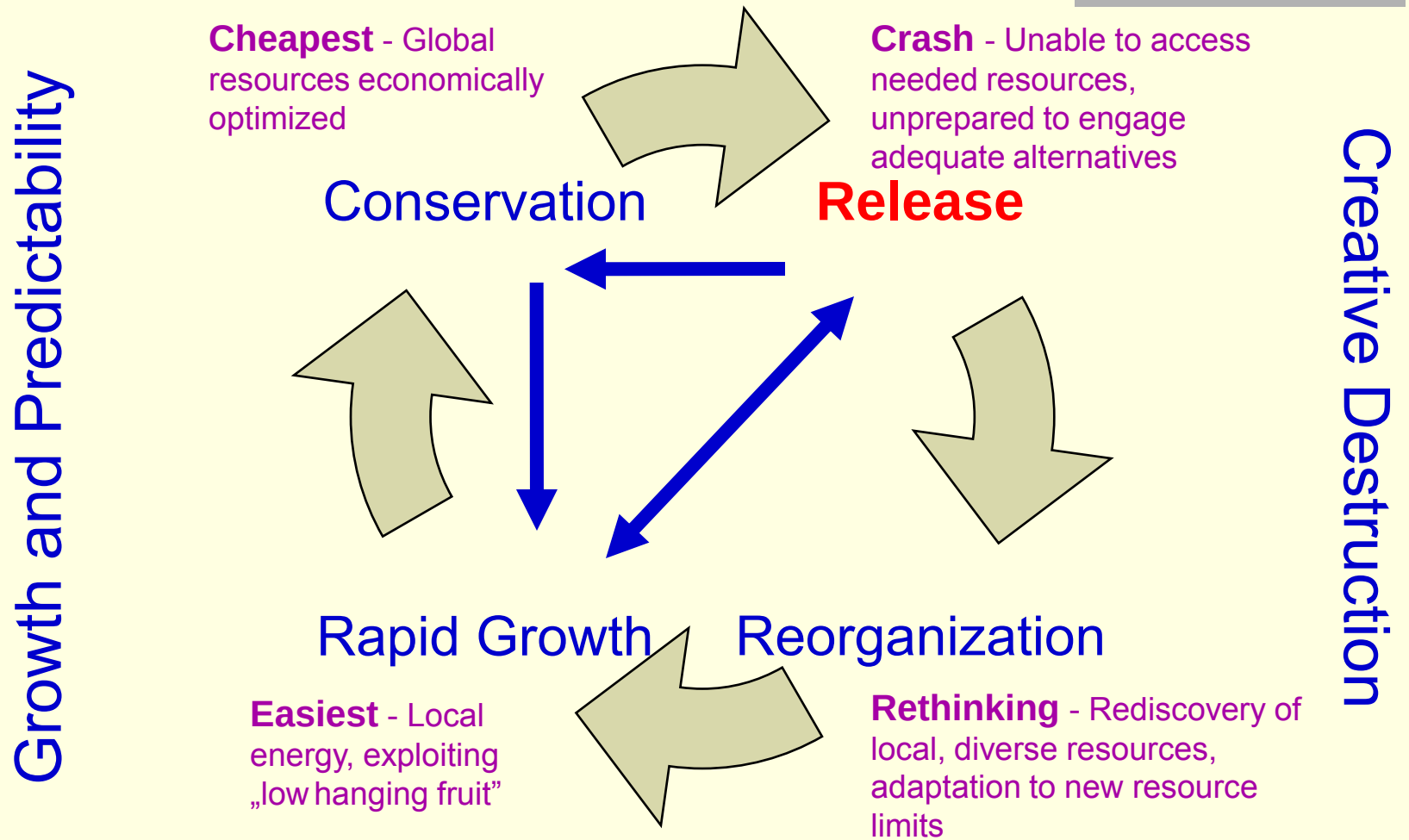
- Resilience Theory
  - Amount of disturbance that system can absorb without changing structure, feedbacks, function, overall ID
    - "Things are pretty much status quo," versus
    - "The world no longer looks familiar"
  - Stability regimes driven by "slow variables"
    - E.g., energy resource supplies
  - Bounded by thresholds
    - Can resource keep up with demands?

Slow Variables and Thresholds

- Clear Lake ⟶ Cloudy, eutrophic lake
  - Variable - phosphorus accumulation in sediment
  - Threshold – low dissolved oxygen levels causing P release into water column
- Norse Settlements in Greenland*
  - Variable - climate - temperature
  - Threshold – level at which unable to raise crops and maintain livestock
- Energy Security
  - Variable – regional fuel availability
  - Threshold – level at which missions compromised

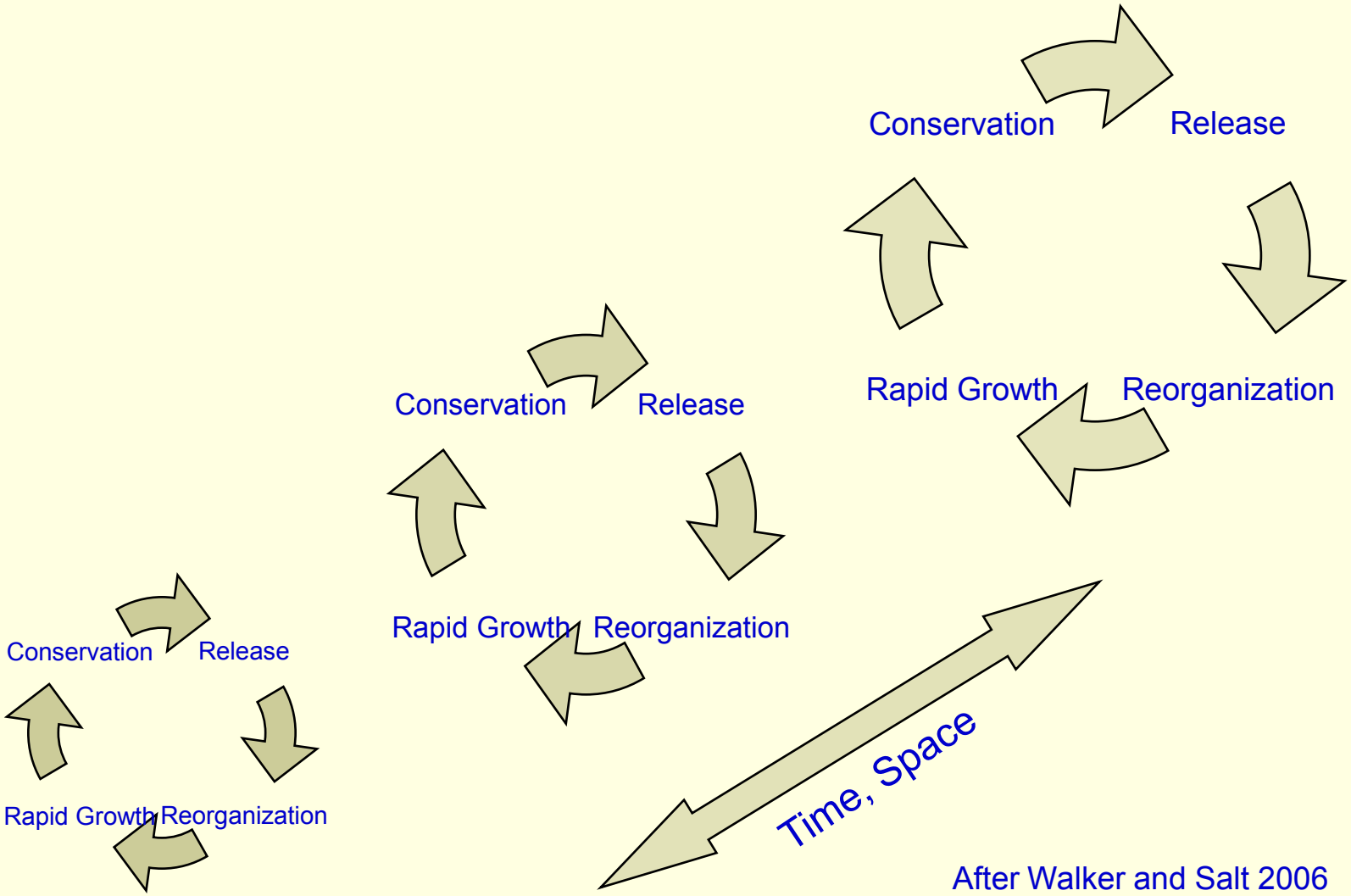
*From Diamond 2004

Adaptive Cycle



After Walker and Salt 2006

Adaptive Cycles at Multiple Scales



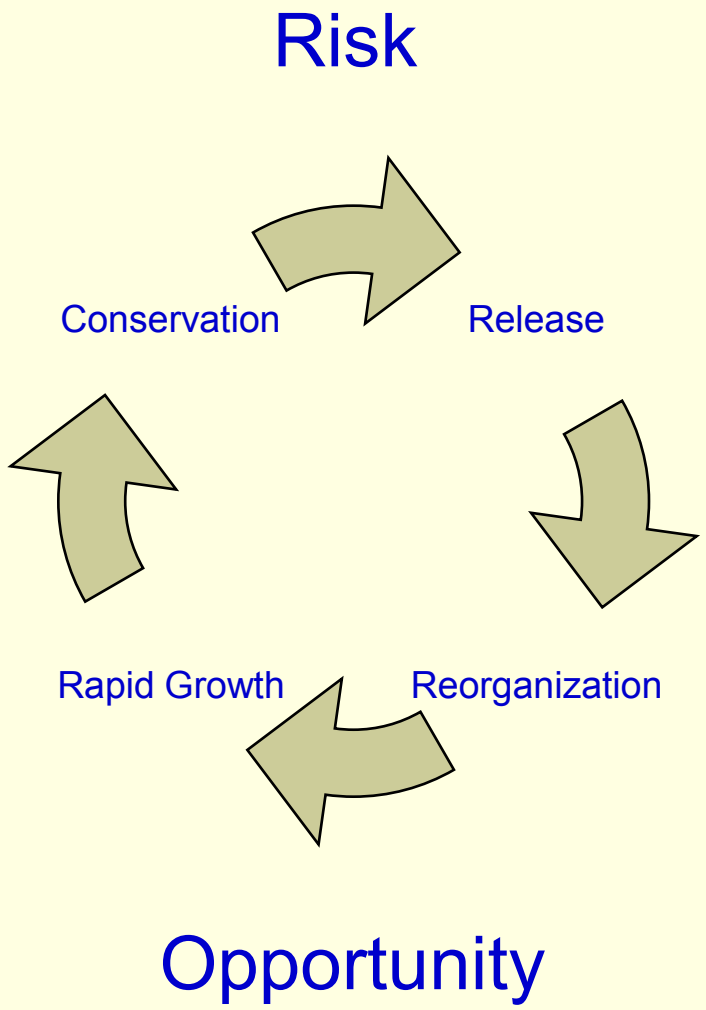
After Walker and Salt 2006

Addressing Uncertainties

- Adaptive Management
  - Policy as experiment
    - Premise – systems are dynamic!
    - Seek resilience in face of surprise
  - Test hypotheses about system behavior
  - Adjust policies and try again
  - "*Learning is a long term proposition that requires ballast against short-term policies and objectives*" (Lee 1993).

Adapting to Stay Resilient

- Understand location within Adaptive Cycle
  - *Risk* - greatest in Conservation & Release phases
  - *Opportunity* - greatest in Reorganization & Rapid Growth



Adapting to Stay Resilient

- Use adaptive management to explore
  - Cross-scale effects
  - Key variables at higher & lower scales
  - Thresholds
    - Anticipate breaches
- Avoid “mono-culture” mentality
  - Less resilient – less “response diversity”
  - Optimization for 1 resource or condition lowers overall resilience
  - Tight control can hasten collapse

Resilience Management Questions

- What linkages between scales drive system?
  - Are we monitoring the right variables?
- Do our policies explore system bounds (thresholds)?
- How should system be managed to avoid breaching thresholds?
  - Do we avoid perverse subsidies? Do incentives promote inflexible or counterproductive behavior?
  - Can Conservation Phase be perturbed to move back into Rapid Growth Phase (avoiding Release)?

Resilience Management Questions (cont.)

- Can thresholds be elevated or moved?
- Can energy source diversity be increased?
- How do we build institutional capital to increase resilience?
  - Financial capital
  - Capacity to innovate
  - Adaptive management approach to learning
  - Organizational memory
  - Response diversity

Conclusions

- We can enhance security by increasing the resilience of our energy programs
- We can gain useful perspective from natural resource management theory to assist in this task
- Resilience Theory provides the context
- Adaptive Management provides the framework

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Questions?