An ecosystem approach

Bio-physical sustainability

What have we talked about?

- **Theoretical framework**
- **Systems Thinking**
  - Flow descriptions
  - Boundaries, environment
  - Scale + type, nesting: hierarchy
- **Production consumption models**
  - Laws of thermodynamics
  - Energy, exergy; quantity/quality
  - Efficiency, effectiveness
  - Life cycles, total cost etc.

What have we talked about?

- **Resources (empirical)**
  - Water
  - Waste management
  - Energy
- **Complexity (more theory)**
  - Attractors and flips
  - Chaos
  - Self-organization
  - SOHO model (eco-eco model)

What is the goal? Sustainability

- **History**
  - Early 70s, Awareness:
    - **Club of Rome: Limits to Growth (D. Meadows)**
    - **Stockholm meeting on the Environment**
    - **First energy crisis due to oil embargo**
    - **Intermediate Technology: Small is Beautiful**
    - **First warnings about Ozone hole and CFCs**
    - **Air and Water pollution concerns**
    - **Environment and Resource Studies founded**
  - Mid 70s to late 80s: Response
    - **1977: Canada as a Conserver Society (SC # 27)**
    - **1987: Bruntland Commission: Sustainable Development**

What is the goal? Sustainability

- **90s: Here to Stay?**
  - Global Climate Change, Ozone hole, famine, AIDS and other "new" diseases, water crisis
  - Rio Conference, multiple international agreements: Agenda 21, CFCs, etc.
  - Local initiatives, International Council for Local Environmental Initiatives etc.
  - After 1993, multiple environmental education programmes.
  - The emergence of *Ecological Economics* and *Ecosystem Approach* and *Sustainable Livelihoods*

What is the goal? Sustainability

- **Sustainable livelihoods**
- **Ecological integrity**

Promoting sustainability

- **The relationship between ecological and socio - economic systems and their properties. Jane Jacobs…….**
- **Ecological footprint (evaluation and measurement)**
  - A way of measuring and communicating our relationship with the planet.
- **Industrial ecology (How to change what we do)**
  - An approach to integrating the eco-eco system using an ecosystem approach.
  - Life cycle analysis as an example
  - An experience in an Indian village

How do we develop a sustainable future?

- **An ecosystem approach**
  - **Understanding the world from a nested complex system perspective.**
  - **Designing human production-consumption systems as ecosystems.**
  - **Applying the ideas of systems thinking to the design of a sustainable (i.e. symbiotic) relationship between natural ecological systems and human (i.e. socio-economic) ecological (i.e. production-consumption) systems.**

Problematique of Complexity

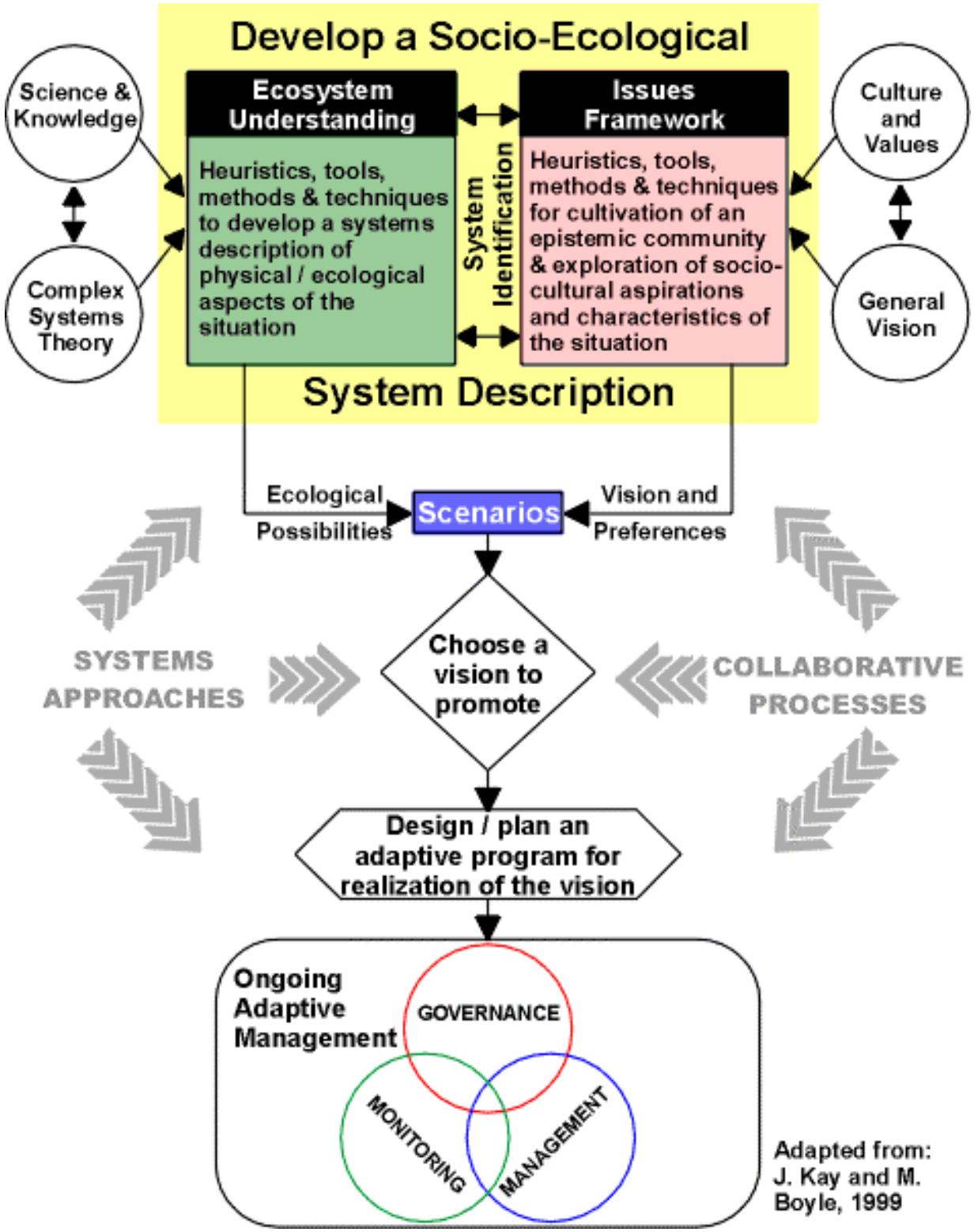
- **Irreducible uncertainty**
- **Multiple attractors**
- **Hierarchical (scale and type)**
  - Multi scale
  - Multiple perspectives
  - Nested

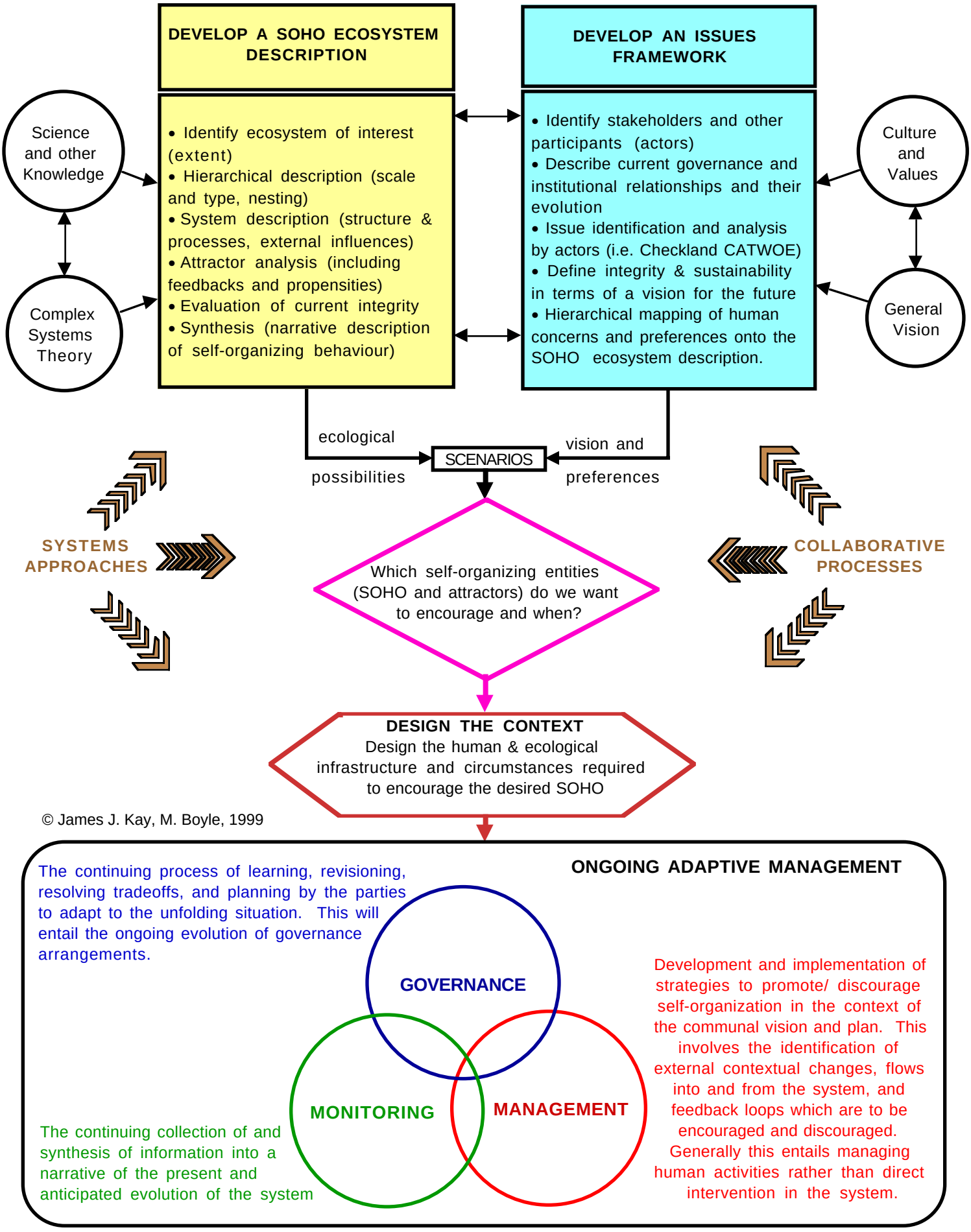
Realities of Complexity

- **We must deal with irreducible uncertainty, emergence and surprise, the lack of a preferential perspective, and the reality that life is a tradeoff.**
- **We no longer have the luxury of dealing with problems for which reductionist "scientific method" approaches are sufficient, and predictability and the ability to anticipate are the hallmark of success.**
- **Possibilities not predictions**
- **Adapt as the situation unfolds instead of anticipate and control**

The challenge

- **Bring together all the players (scientist and non-scientist alike).**
- **Deal with irreducible uncertainty and unavoidable surprise.**
- **Synthesize different viewpoints and types of understanding at different scales.**
- **Produce narratives about how the future ought and might unfold.**
- **There is no right answer, no solution, just resolution of tradeoffs through negotiation…adaptive management…….**




DEVELOP A SOHO ECOSYSTEM DESCRIPTION
DEVELOP AN ISSUES FRAMEWORK
Science and other Knowledge
Complex Systems Theory
• Identify ecosystem of interest (extent)
• Hierarchical description (scale and type, nesting)
• System description (structure & processes, external influences)
• Attractor analysis (including feedbacks and propensities)
• Evaluation of current integrity
• Synthesis (narrative description of self-organizing behaviour)
• Identify stakeholders and other participants (actors)
• Describe current governance and institutional relationships and their evolution
• Issue identification and analysis by actors (i.e. Checkland CATWOE)
• Define integrity & sustainability in terms of a vision for the future
• Hierarchical mapping of human concerns and preferences onto the SOHO ecosystem description.
Culture and Values
General Vision
ecological possibilities
SCENARIOS
vision and preferences
SYSTEMS APPROACHES
COLLABORATIVE PROCESSES
Which self-organizing entities (SOHO and attractors) do we want to encourage and when?
DESIGN THE CONTEXT
Design the human & ecological infrastructure and circumstances required to encourage the desired SOHO
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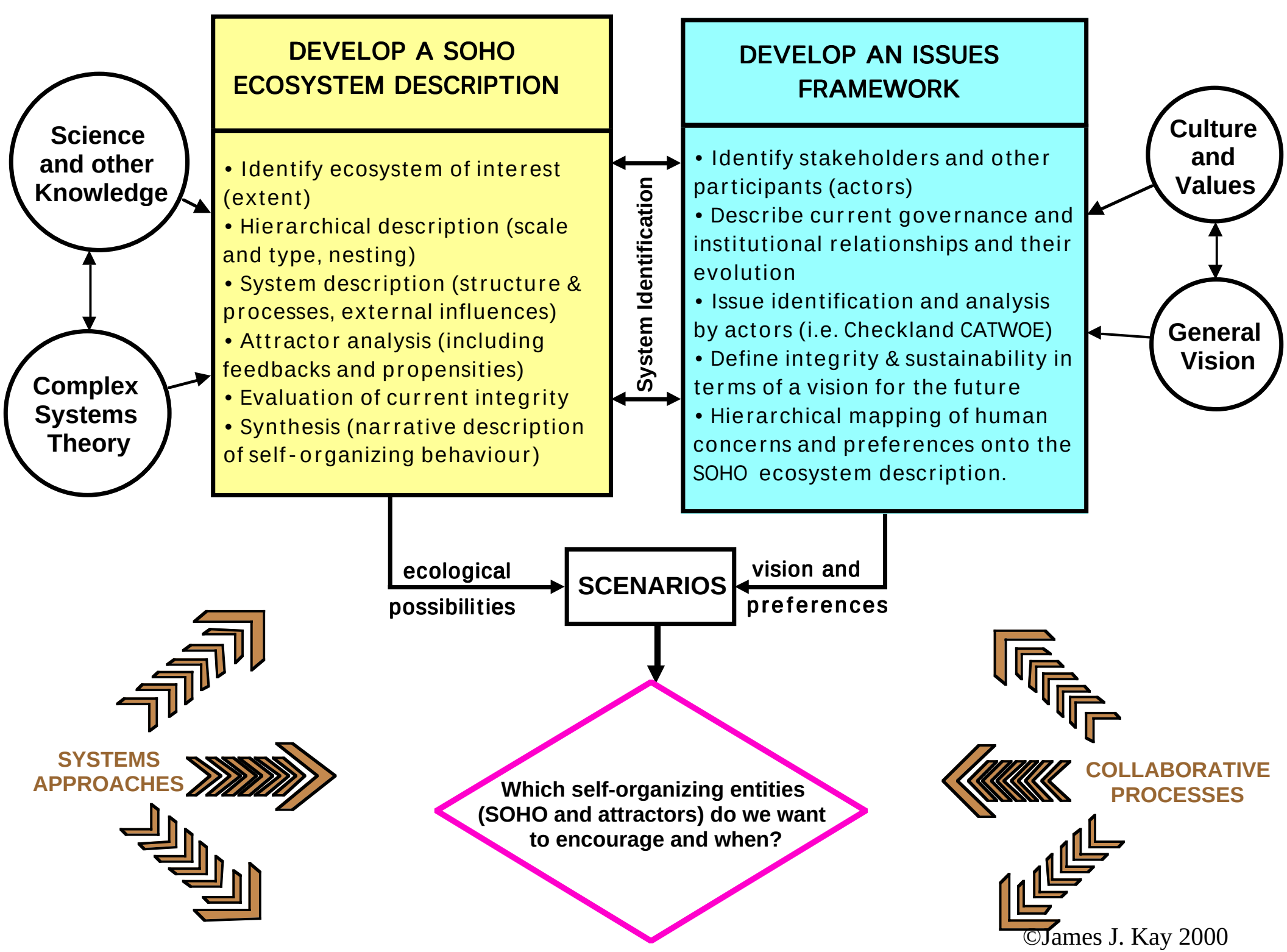
ONGOING ADAPTIVE MANAGEMENT
The continuing process of learning, revisioning, resolving tradeoffs, and planning by the parties to adapt to the unfolding situation. This will entail the ongoing evolution of governance arrangements.
GOVERNANCE
MONITORING
MANAGEMENT
The continuing collection of and synthesis of information into a narrative of the present and anticipated evolution of the system
Development and implementation of strategies to promote/ discourage self-organization in the context of the communal vision and plan. This involves the identification of external contextual changes, flows into and from the system, and feedback loops which are to be encouraged and discouraged. Generally this entails managing human activities rather than direct intervention in the system.



SYSTEMS APPROACHES

COLLABORATIVE PROCESSES

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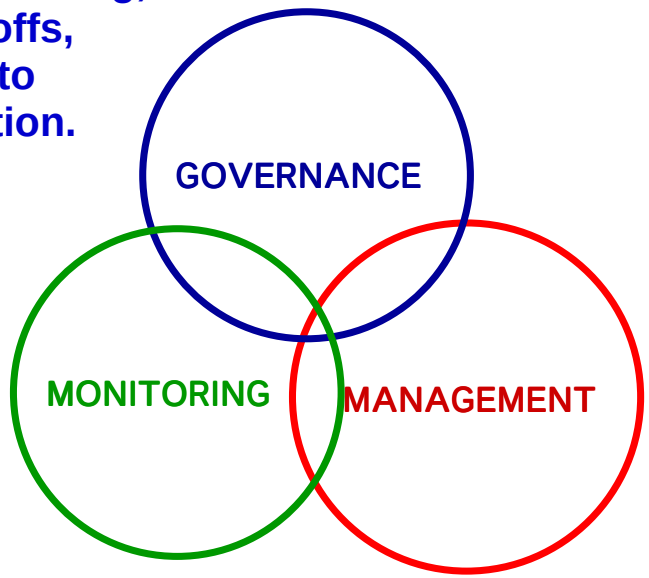

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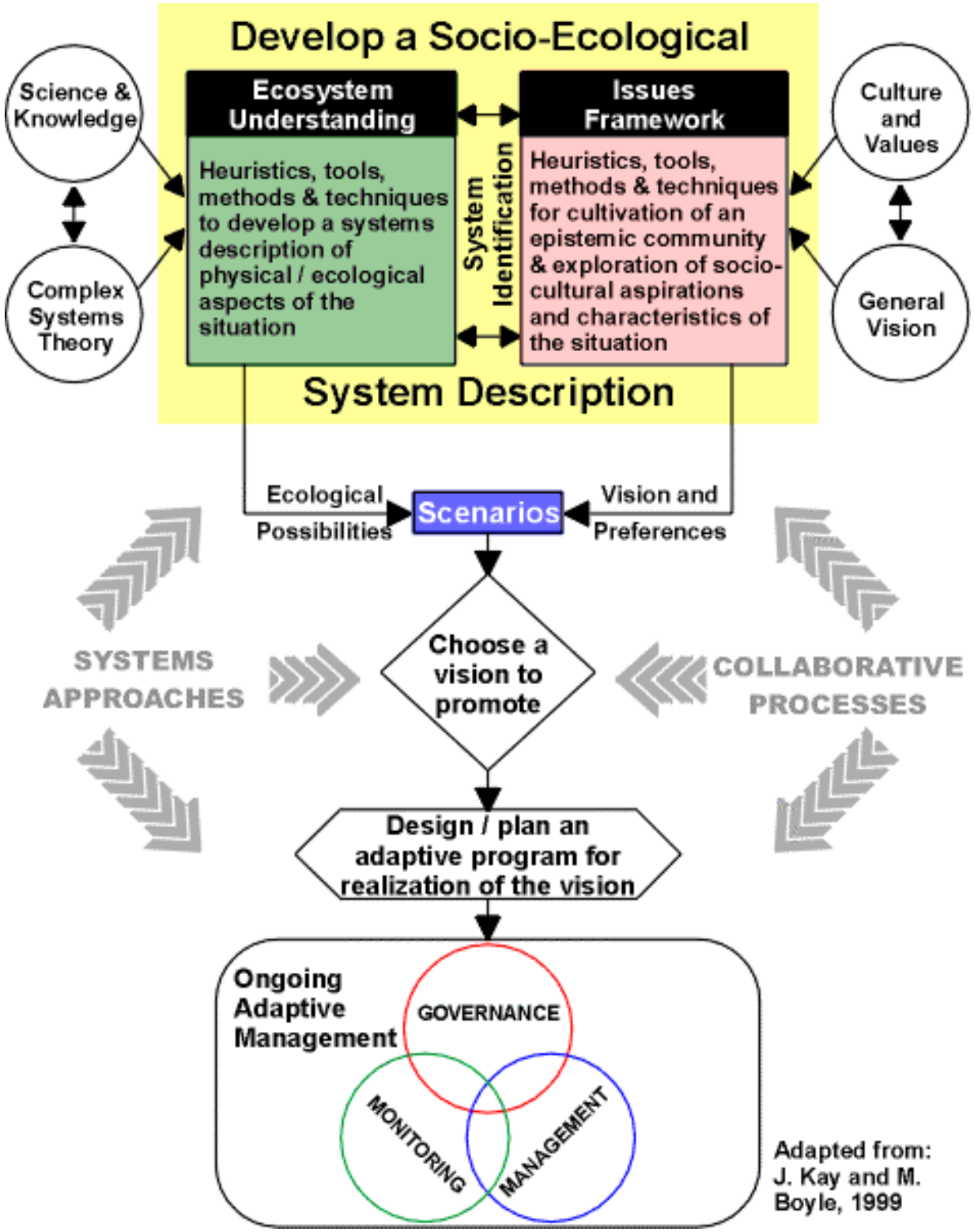

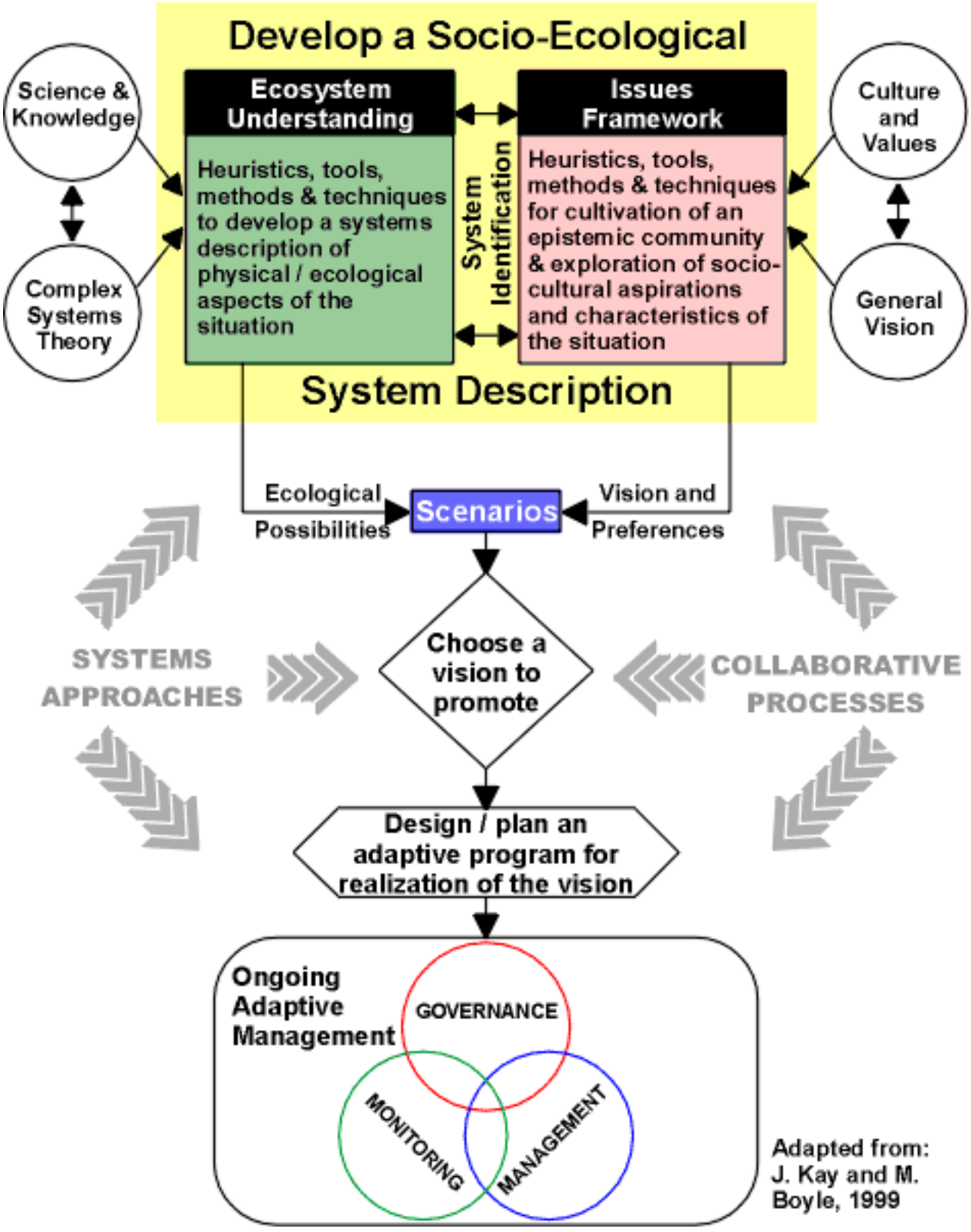
Develop a Socio-Ecological
Science & Knowledge
Ecosystem Understanding
Issues Framework
Culture and Values
Heuristics, tools, methods & techniques to develop a systems description of physical / ecological aspects of the situation
System Identification
Heuristics, tools, methods & techniques for cultivation of an epistemic community & exploration of socio-cultural aspirations and characteristics of the situation
Complex Systems Theory
General Vision
System Description
Ecological Possibilities
Scenarios
Vision and Preferences
SYSTEMS APPROACHES
Choose a vision to promote
COLLABORATIVE PROCESSES
Design / plan an adaptive program for realization of the vision
Ongoing Adaptive Management
GOVERNANCE
MONITORING
MANAGEMENT
Adapted from: J. Kay and M. Boyle, 1999