

# Ecological Cribsheet *a few principles*

*taken from:*

**C.S. Holling**

**Donella Meadows**

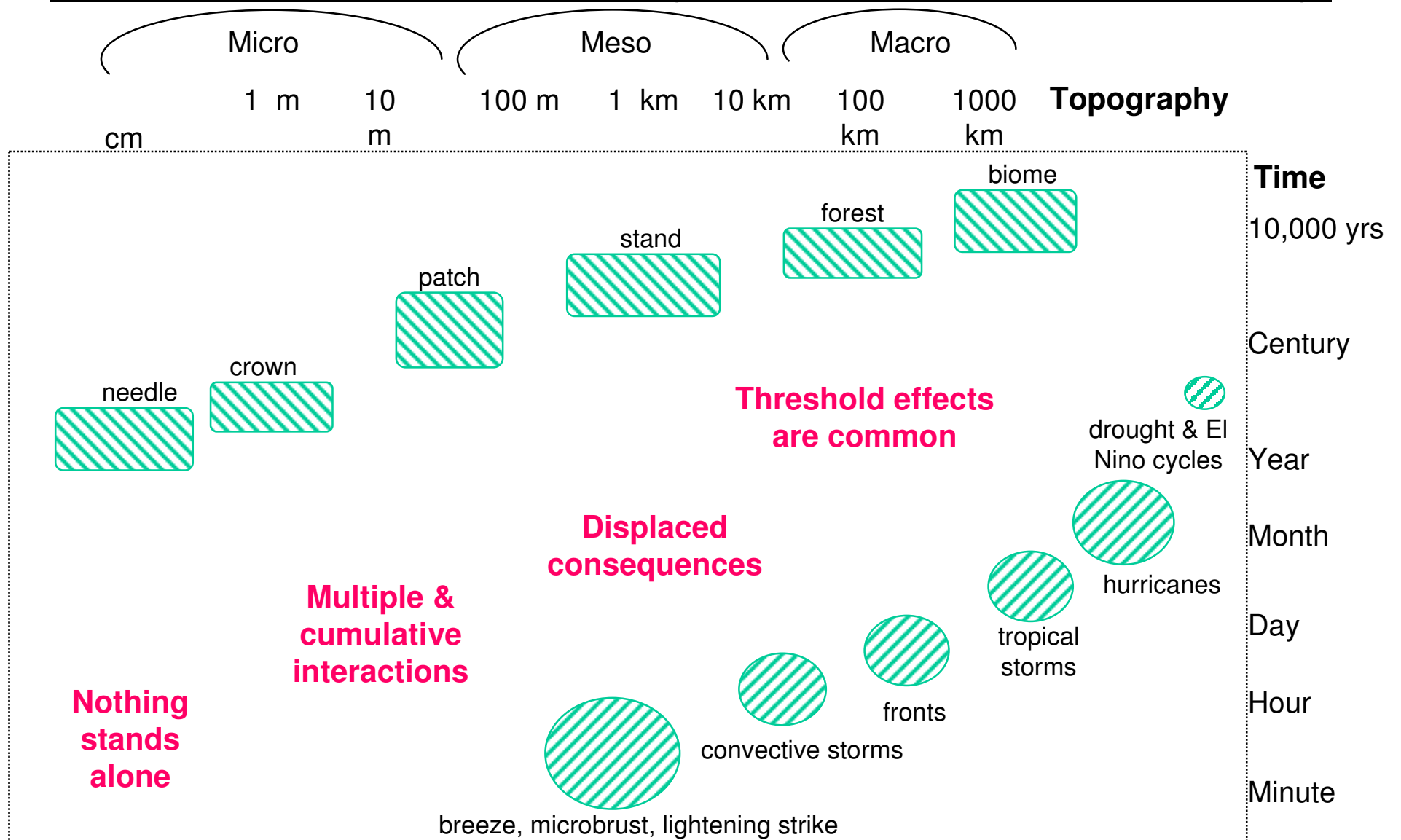
**Elinor Ostrom**

**Charles Southwick**

*by:*

*Barbara Heinzen, May 1998*

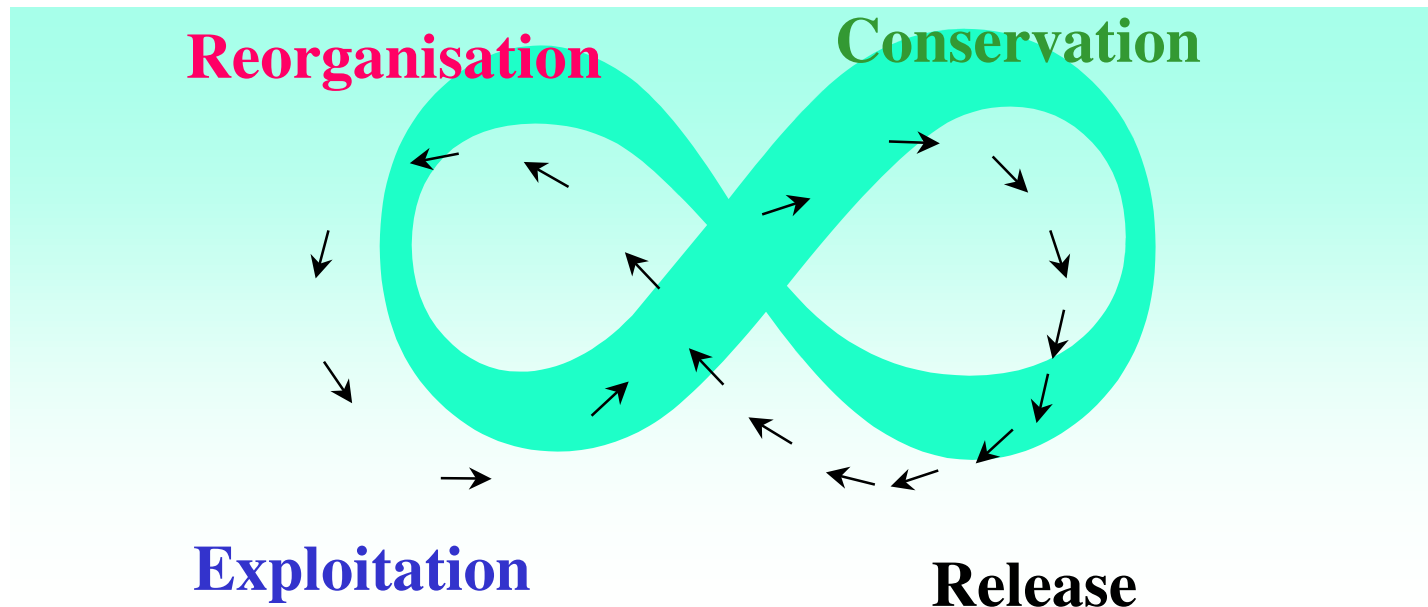
# Asynchronous & Asymmetrical Activity



# Ecosystem Cycle

- **Accessible carbon**
- **Nutrients & energy**

- **Consolidation**
- **Climax**



- **Pioneer**
- **Opportunist**

- **Fire**
- **Storm**
- **Pest**

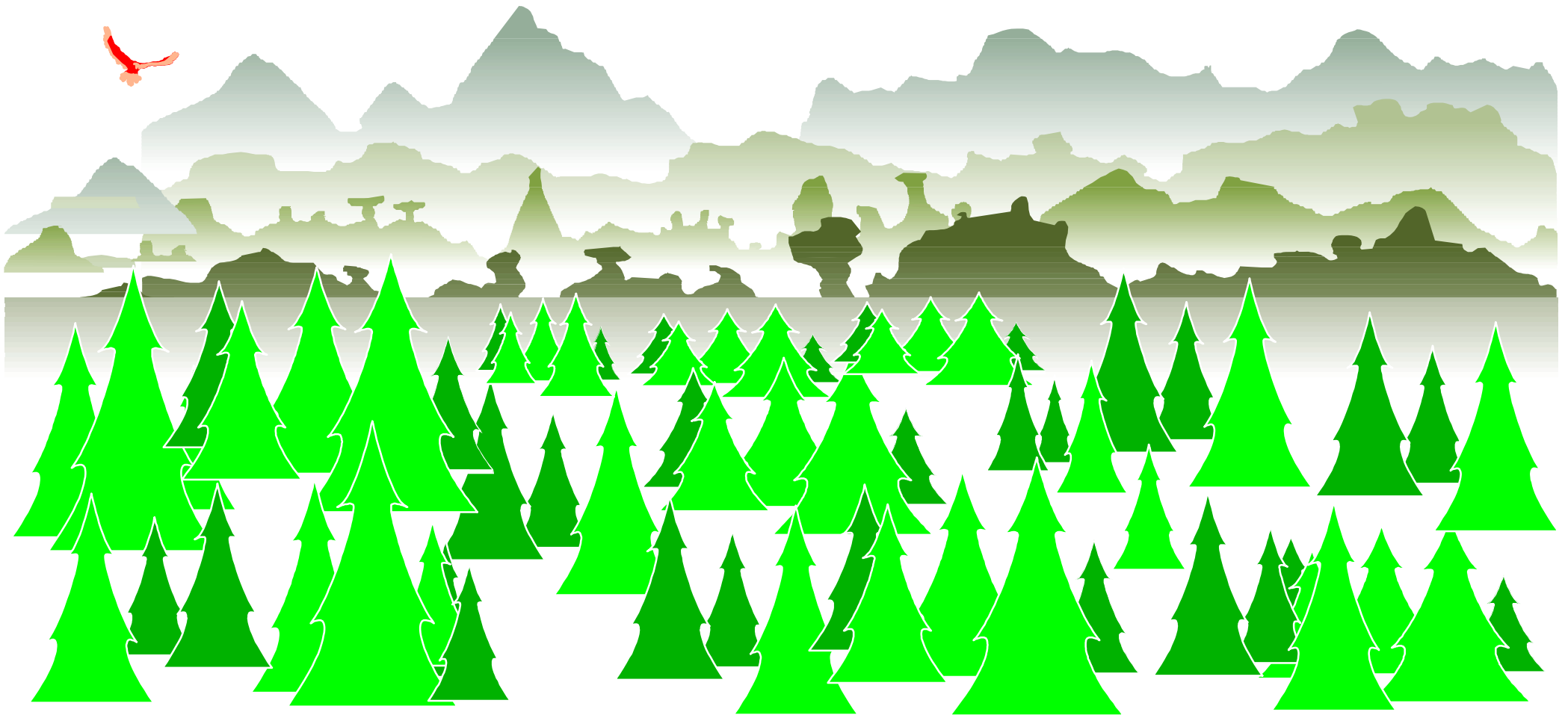
# Resilient Mosaic Landscapes

*created from asynchronous & asymmetrical activity*



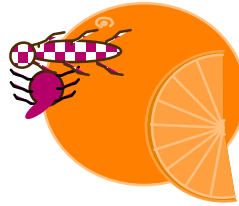
# Productivity of Homogeneous Landscapes

## *& the Paradox of Control\**



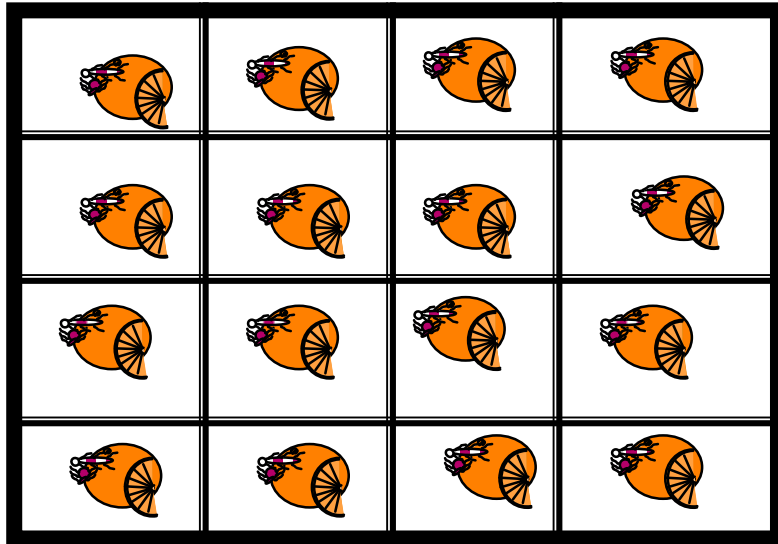
*\* The more we control, the more vulnerable we become.*

# Malthus Revisited

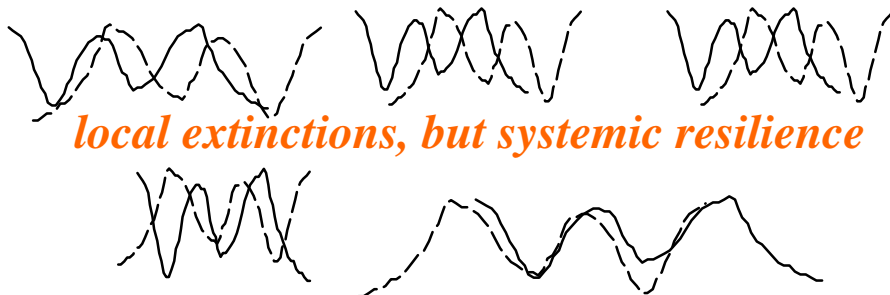


1958 Carl Huffaker, UC Berkeley experiment: populations of spider mites eat oranges & predators eat spider mites. What happens when supply of oranges varies & boundaries are removed?

## Spatial Variability



## Spatial Homogeneity



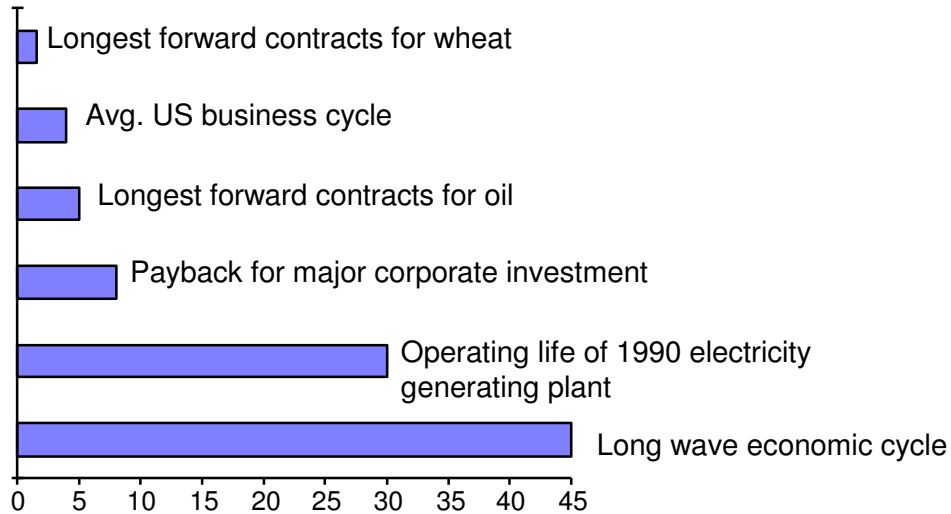
*boom-bust of both populations to extinction*



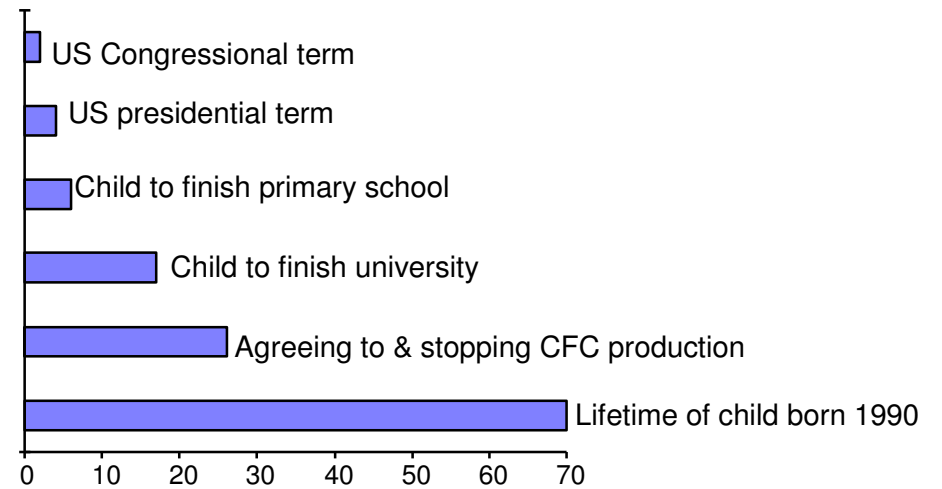
**Conclusion: boundaries create variability & variability creates resilience**

# Interlocking Timescales - in Years

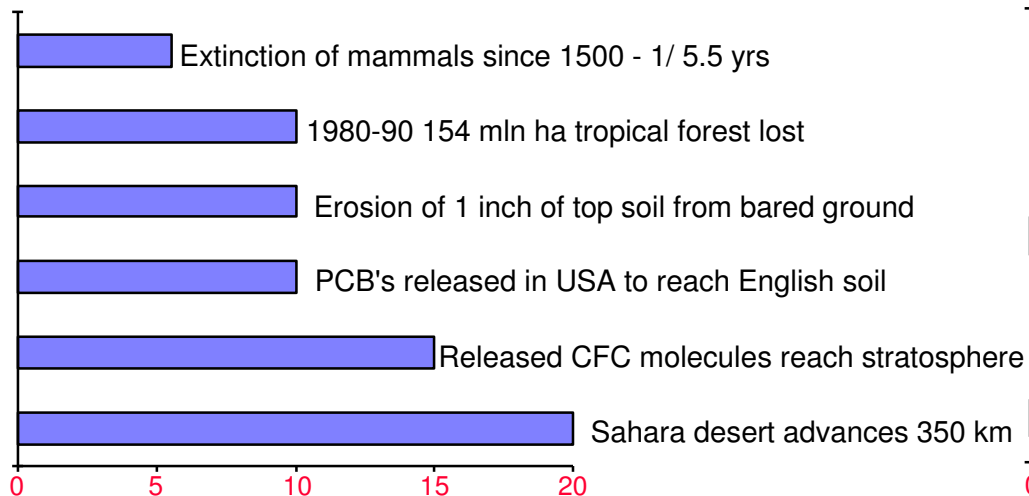
## Economic Timescales



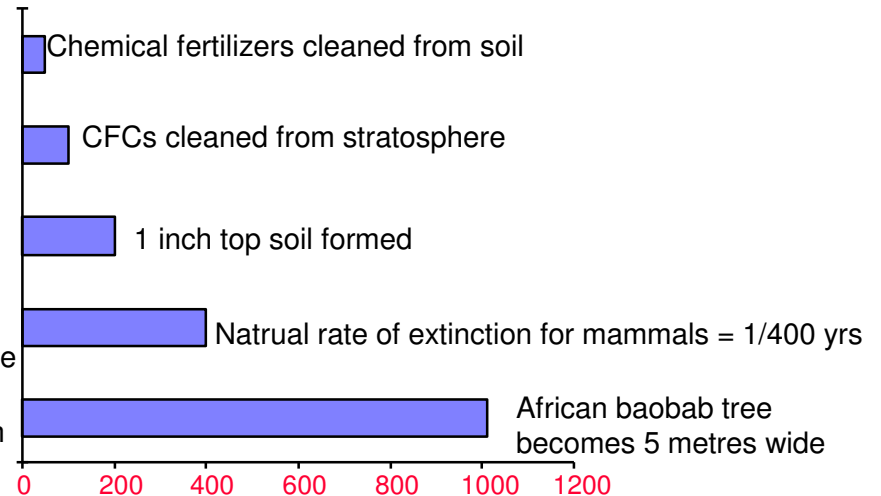
## Social & Political Timescales



## Timescales of Destruction



## Timescales of Creation & Restoration

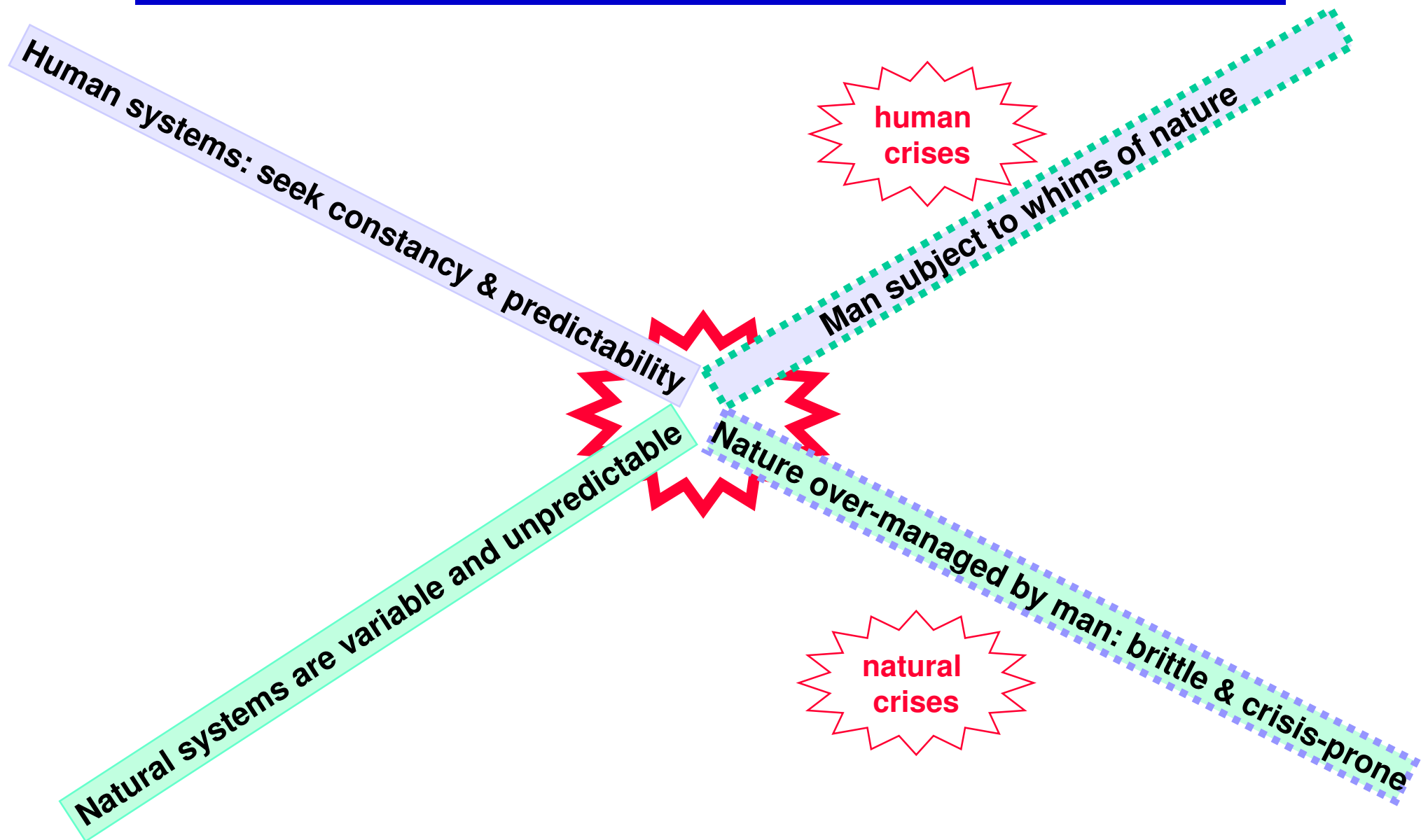


# Places to Intervene in a Human System





# Mismatched Human & Natural Systems



# Basic Ecological Principles

1. Nothing stands alone.
2. Mutual influences exist among individuals.
3. Limiting factors play a dominant role.
4. Biotic communities differ.
5. Species form networks of relationships.
6. Complete eco-systems have producers, consumers & decomposers.
7. Biological interactions are usually multiple & cumulative.
8. There are frequent synergisms -- greater than the sum of their parts.
9. Ecological reactions or interactions are often delayed.
10. Threshold effects are common.
11. Human populations are subject to ecological principles.
12. Planet earth is a finite and closed ecological system.

# Exponential Growth

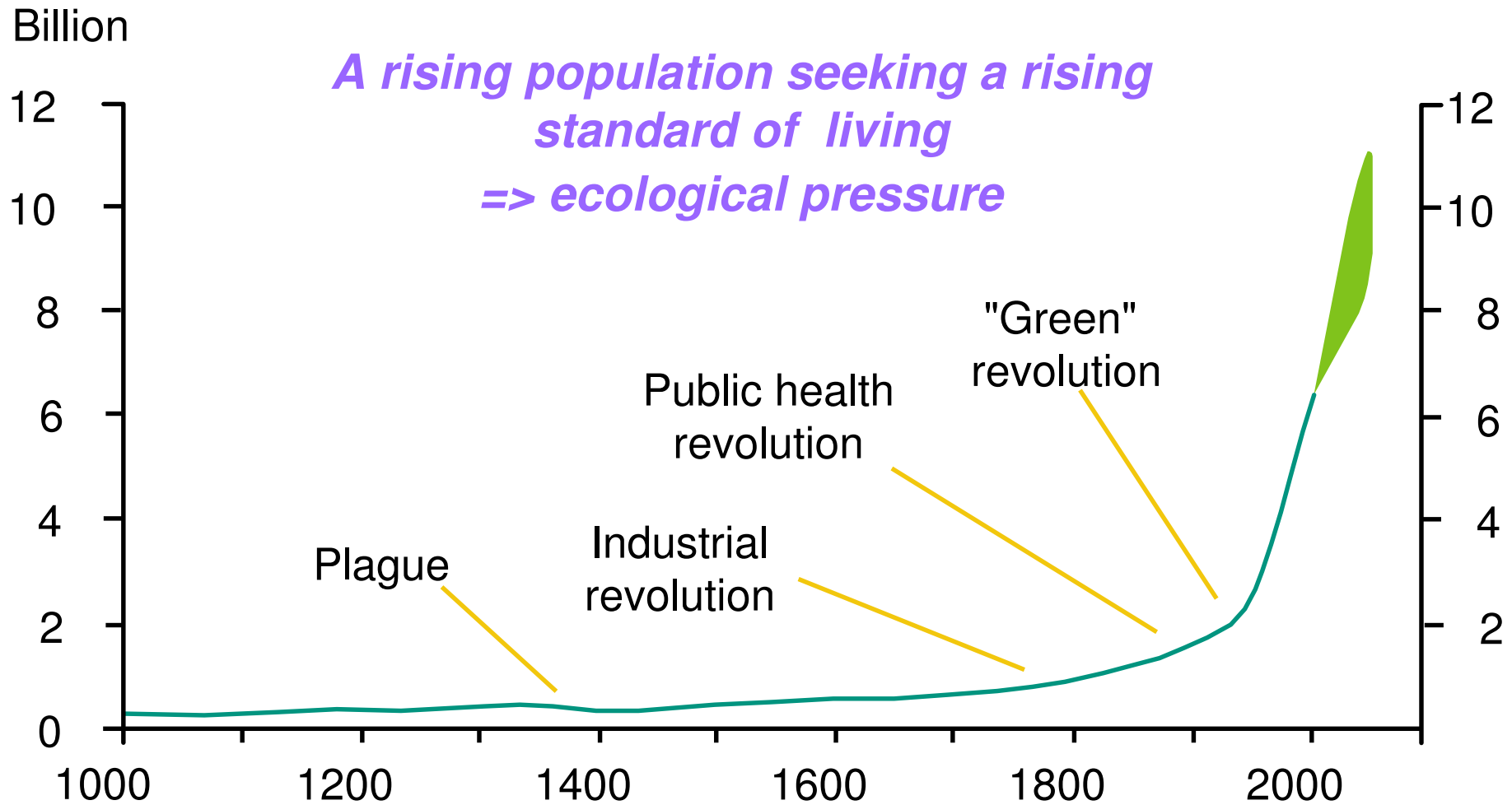
## DOUBLING TIMES

**Growth rates - %/yr**

**Doubling Time - yrs**

<b>0.1</b>	<b>700</b>
<b>0.5</b>	<b>140</b>
<b>1.0</b>	<b>70</b>
<b>2.0</b>	<b>35</b>
<b>3.0</b>	<b>23</b>
<b>4.0</b>	<b>18</b>
<b>5.0</b>	<b>14</b>
<b>7.0</b>	<b>10</b>
<b>10.1</b>	<b>7</b>

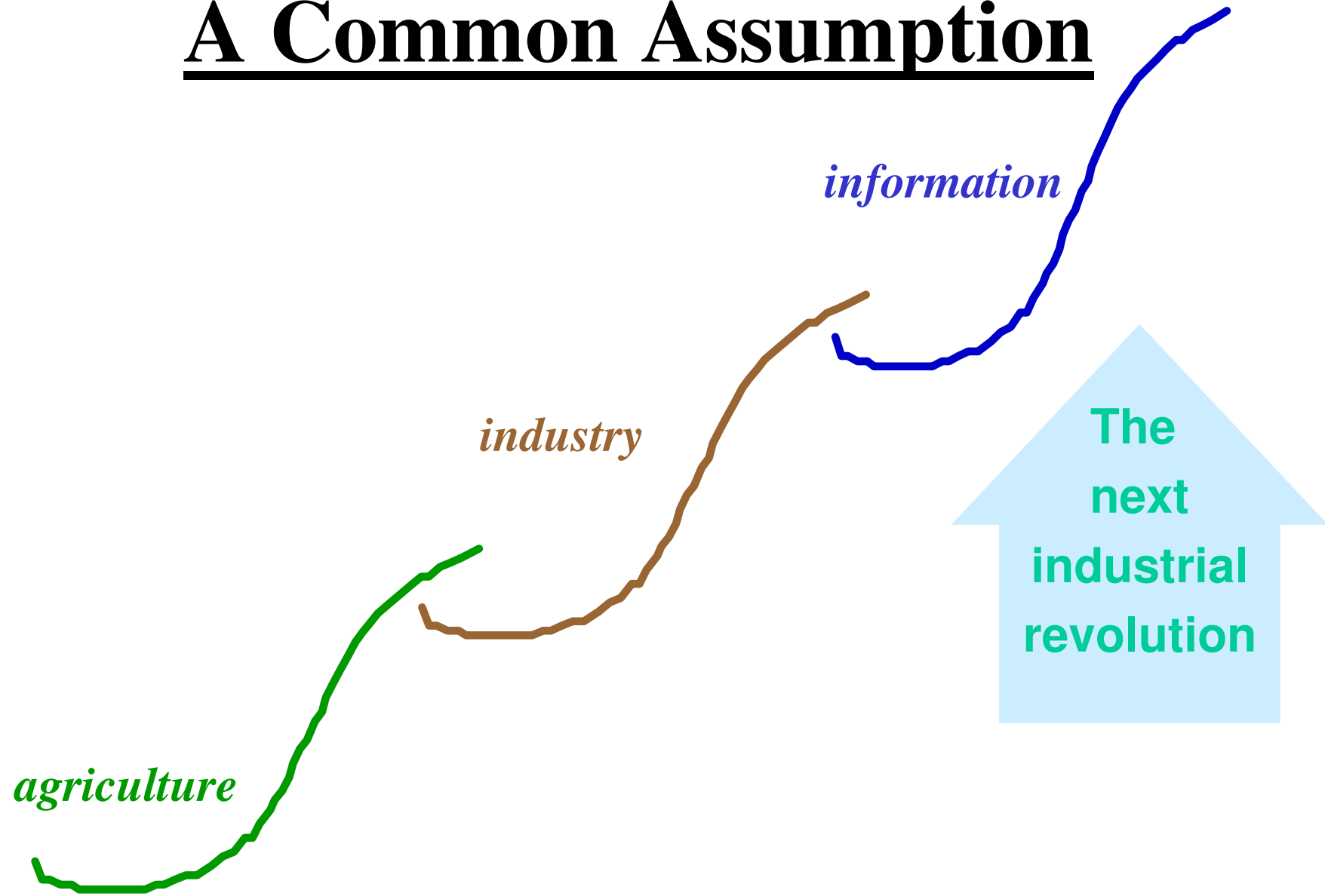
# World Population 1000-2050



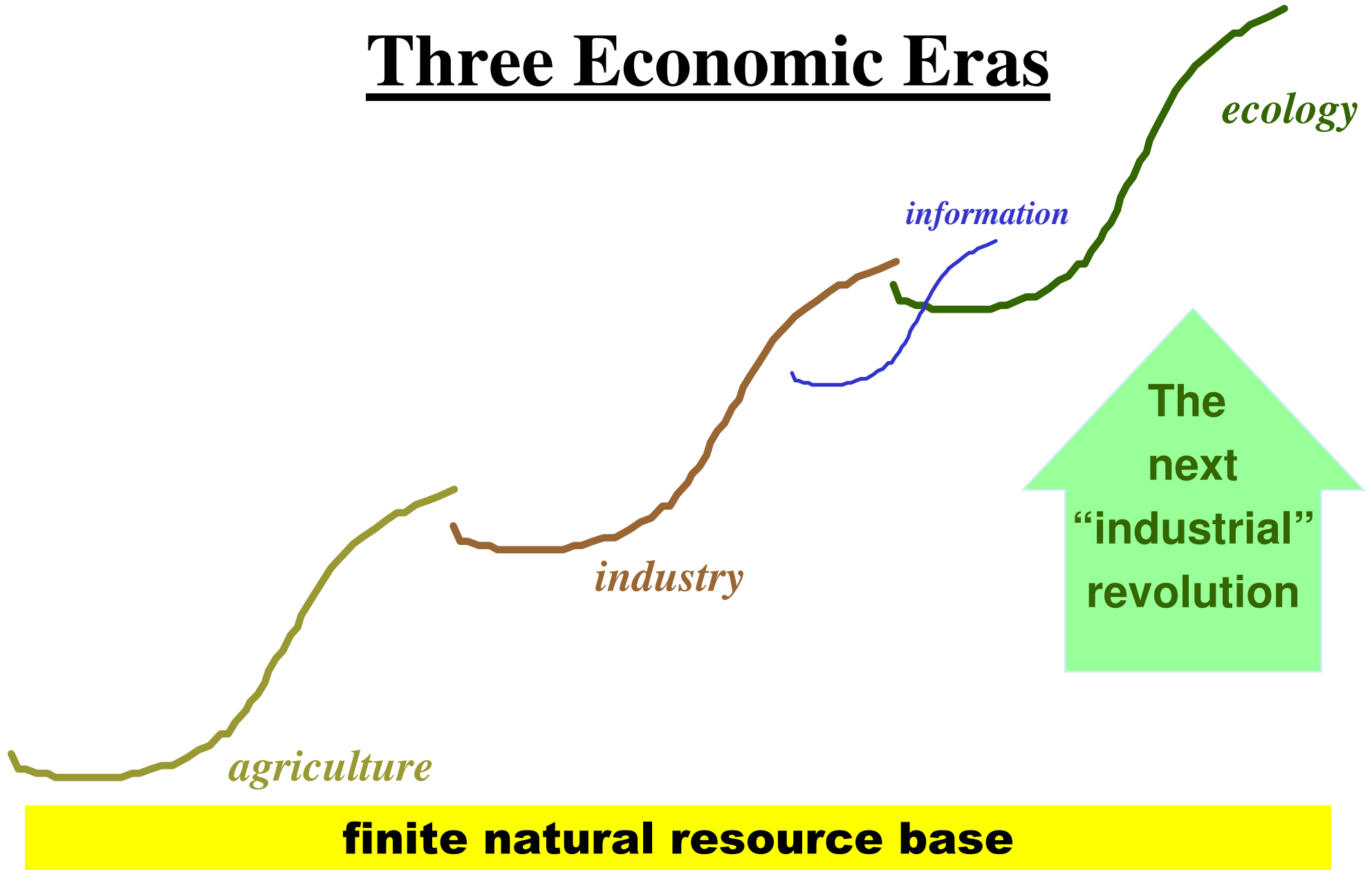
Source: United Nations

Cribsheet598, B.J. Heinzen 1998, p. 12

# A Common Assumption



# Three Economic Eras



**CHARACTERISTICS OF SYSTEMS SET UP TO 'GOVERN THE COMMONS'**

*taken from Governing the Commons: the evolution of institutions for collective action, passim  
by Elinor Ostrom, Cambridge University Press, 1990, reprinted 1996  
by B.J. Heinzen, 1997*

Common Problems	Design Principles of Successful Systems	Start-ups & How They Grow	Causes of Failure to Begin
<ul style="list-style-type: none"> <li>• Free-riding</li> <li>• Establishing the commitment to follow the rules</li> <li>• Creating new institutions</li> <li>• Monitoring use</li> </ul>	<ul style="list-style-type: none"> <li>• Clear boundaries defining ecosystems, number of users, fairness</li> <li>• Good fit between system rules &amp; ecosystem characteristics</li> <li>• Monitoring of use done by users</li> <li>• Graduated sanctions ensure compliance ("let the punishment fit the crime")</li> <li>• No interference from higher authorities</li> <li>• Nested enterprises (the principle of subsidiarity)</li> </ul>	<ul style="list-style-type: none"> <li>• Recognition/acceptance of the problem</li> <li>• Agreement to secure baseline data showing state of eco-system</li> <li>• Low cost way to work together is agreed (e.g. a forum for discussion); sometimes this is driven by the threat of others (e.g. courts) stepping in</li> <li>• A small number of key actors show progress is possible</li> <li>• Initial successful agreements are imitated by others</li> <li>• Ratification of agreements by courts or governments</li> </ul>	<ul style="list-style-type: none"> <li>• Too many actors involved</li> <li>• Too many actors are needed to show progress in starting</li> <li>• Short term discount rates of users</li> <li>• Dis-similarities of interests</li> <li>• Leadership qualities lacking in key individuals</li> <li>• Too big a job is attempted, too fast</li> <li>• External interference</li> <li>• High information &amp; transaction costs</li> </ul>