

Sustainability, Resilience, and the Prelude to Modern China

Stevan Harrell

Environment and Society in China

10 January 2014



Deforestation 1700-1937

% of Forest lost, 1700-1937

< 25%



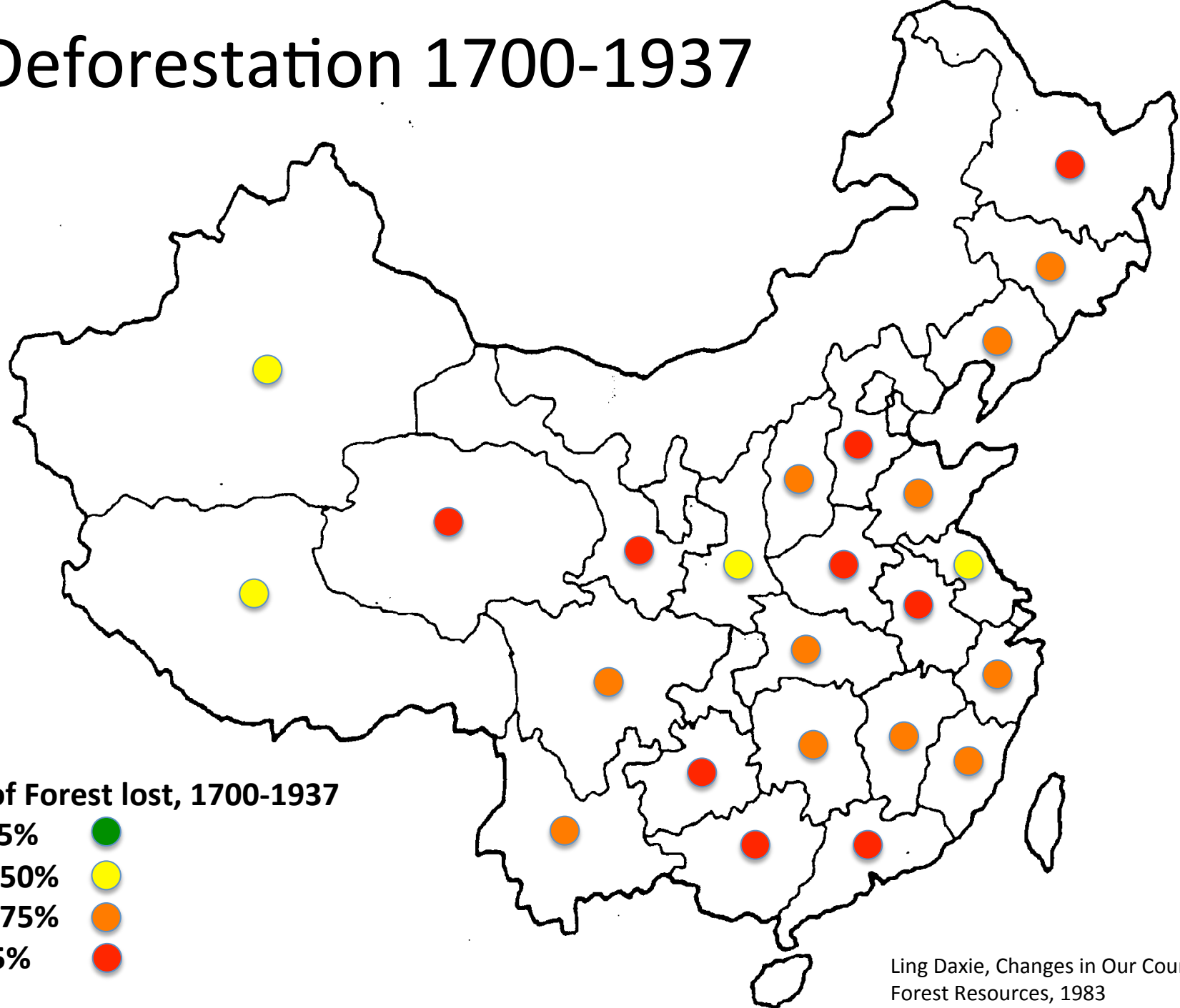
25-50%



50-75%



>75%

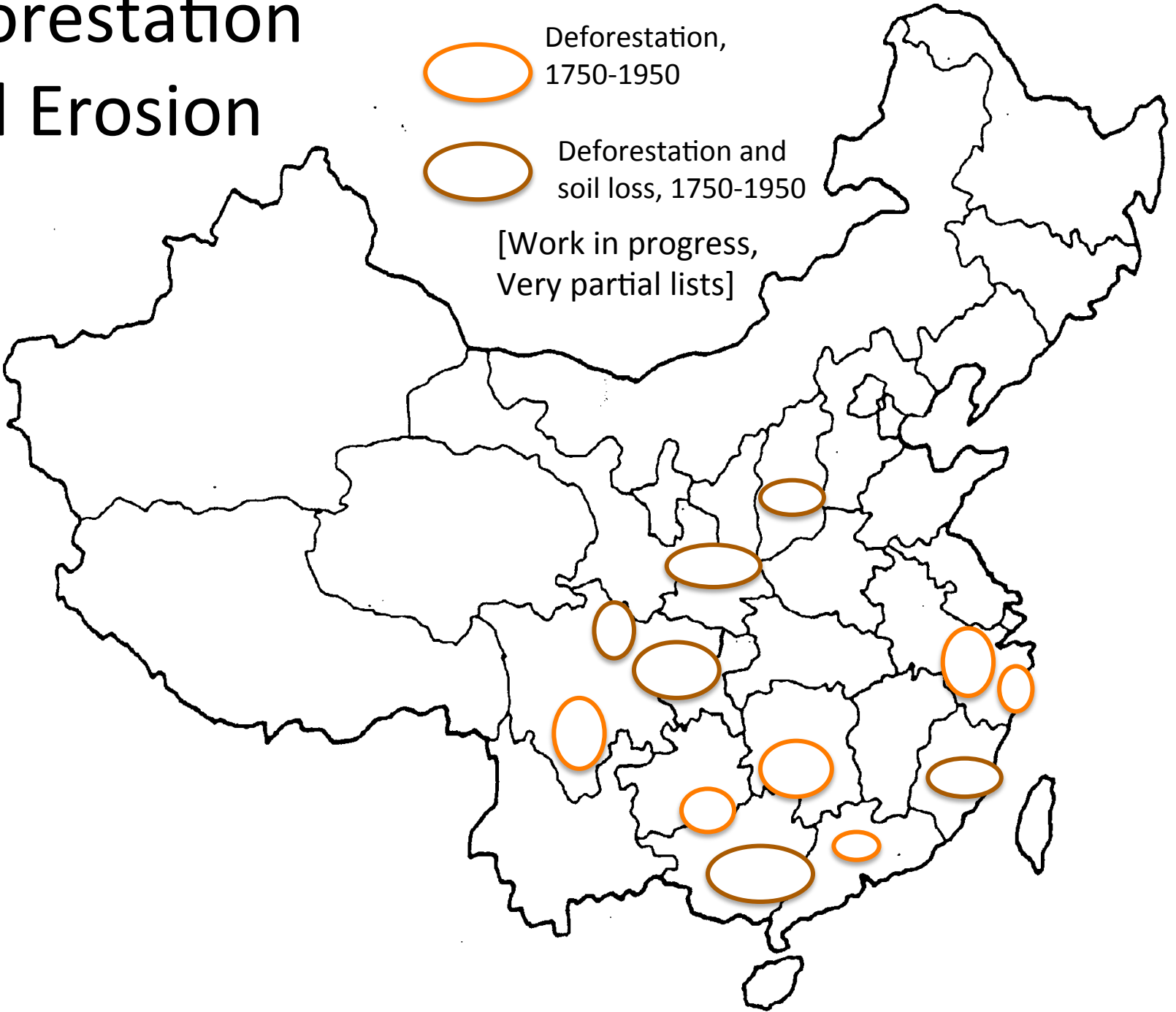


Ling Daxie, Changes in Our Country's Forest Resources, 1983

Deforestation and Erosion

- Deforestation, 1750-1950
- Deforestation and soil loss, 1750-1950

[Work in progress,
Very partial lists]



Historical Frequency of Floods and Droughts in the Wei River Plain



Figure 4 The contrast of frequency statistics of drought and water disasters with population changes in the Weihe Plain (370 BC-2000 AD)
(X-coordinate 2000 is corresponded to a 50-year disaster frequency (1950 to 2000 AD), others are deduced similarly.)



Deforestation

虞衡斤斧罗千山，工命采斫杙与椽。
深林土剪十取一，百牛连鞅摧双辕。
万围千寻妨道路，东西蹶倒山火焚。
遗馀毫末不见保，躡蹠涧壑何当存。
群材未成质已天，突兀哮豁空岩峦。
柏梁天灾武库火，匠石狼顾相愁冤。
君不见南山栋梁益稀少，爱材养育谁复论。

柳宗元，行南路，**Translated by Mark Elvin and Stevan Harrell**

The official guardians' axes have spread through a thousand hills,
At the Works Department's order hacking beams and billets.
Of ten trunks cut in the woodlands' depths, only one gets hauled away.
Ox-teams strain at their traces—till the paired yoke-shafts break.
Great-girthed trees of towering height lie blocking the forest tracks,
A tumbled confusion of lumber, as flames on the hillside crackle.
Not even the last remaining shrubs are safeguarded from destruction;
Where once mountain torrents leapt—nothing but rutted gullies.
Timbers, not yet seasoned or used, left immature to rot;
Proud summits and deep gorges now—hummocks of naked rock.
Disasters destroy the cedar bridges; there is fire in the armory;
Artisans regard each other with looks of anxious enmity.
Do you not see that it would be better to have fewer bridges in the southern mountains?
Who will speak again of the loving cultivation of forests?

Simple definitions I like to use

- Sustainability is preserving the resilience of a socio-ecosystem
- Resilience is the ability of a system to absorb disturbance and continue functioning

Sustainability is Like God

- We can't really know what it is
- If it didn't exist, we would have to invent it
- People worship it



Sustainability is Like God

- We can't really know what it is—Apophatic theology. Sustainability is *not*:
 - Using resources at a rate faster than we can replenish
 - Rendering things unusable by poisoning and polluting
 - Extinguishing species
- But what sustainability *is* is hard to say.



Sustainability is Like God

- To paraphrase Voltaire:
- Si la durabilité n'existait pas, il faudrait l'inventer



Sustainability is Like God

- People worship it

- School of Sustainability, Arizona State
- Program on Sustainable Development, Columbia
- Inclusion of Sustainable Development in the Policy documents of governments



Sustainability is like a Water Weenie



Buzzword

- Robert Solow: “It is very hard to be against sustainability. In fact, the less you know about it, the better it sounds. The questions that come to be connected with sustainable development or sustainable growth or just sustainability are genuine and deeply felt and very complex. The combination of deep feeling and complexity breeds buzzwords.”

A New Word

- 1611: “Sustainable” meaning “bearable, endurable”
- 1845: “Sustainable” meaning “able to be upheld as a point of law,” as when the defense attorney shouts “objection” and the judge says “sustained”
- 1972: First use of “sustainability”
- 1972: First use of “sustainable development” but seems to be used in the sense of sustaining the development, rather than conserving the natural resources as one develops.

Oxford English Dictionary

Some Current Definitions

- OED: “Of, relating to, or designating forms of human economic activity and culture that do not lead to environmental degradation, esp. avoiding the long-term depletion of natural resources.” Notice: “environmental degradation,” “long-term depletion of natural resources.” *What sustainable is not, apophatic theology.*
- Brundtland Report, Sustainable development; “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”
- Solow: sustainability is “An obligation to conduct ourselves so that we leave to the future the option or the capacity to be as well off as we are.”
- Ismail Serageldin: Sustainability is the maintenance of stocks of capital: natural, human, social, and human-made. Strong sustainability is the maintenance of stocks of natural capital; weak sustainability, or “sensible sustainability” allows the possibility of human-made (technological) capital for natural capital. Another list gives natural, economic, human, physical, and social capital.

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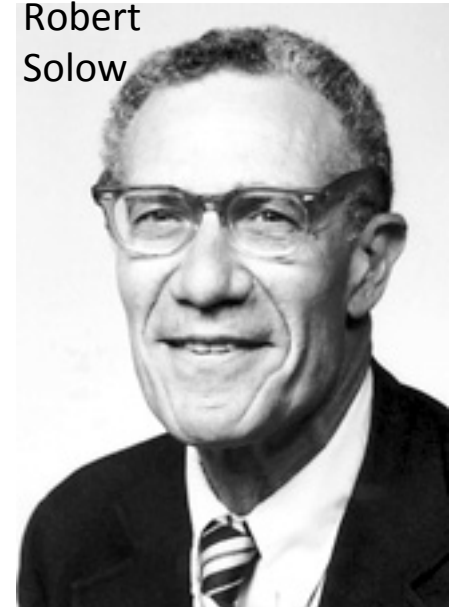
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Robert
Solow



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David Orr's Challenges: More Thinking About What is not Sustainable

David
Orr

- Ongoing militarization of the planet
- A world with large numbers of desperately poor people
- The perpetual enlargement of the human estate
- Unrestricted development of any and all new technology
- A world divided by narrow, exclusive, and intense allegiances to ideology or ethnicity
- Unrestrained automobility, hedonism, individualism, and conspicuous consumption
- A spiritually impoverished world



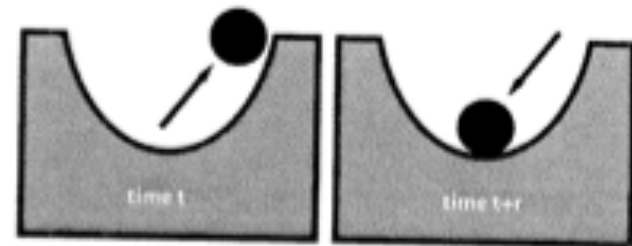
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Some definitions--Resilience

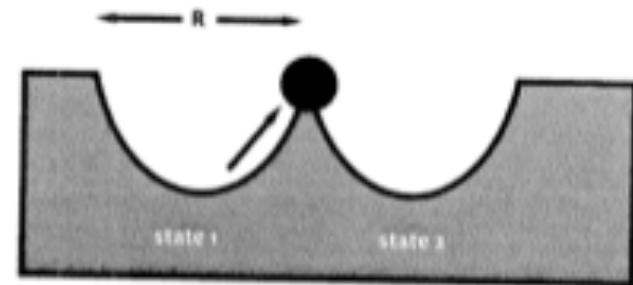
1. Engineering resilience: [In a system assumed to be in equilibrium] Return time to a steady state, following perturbation

A. Engineering resilience (r).

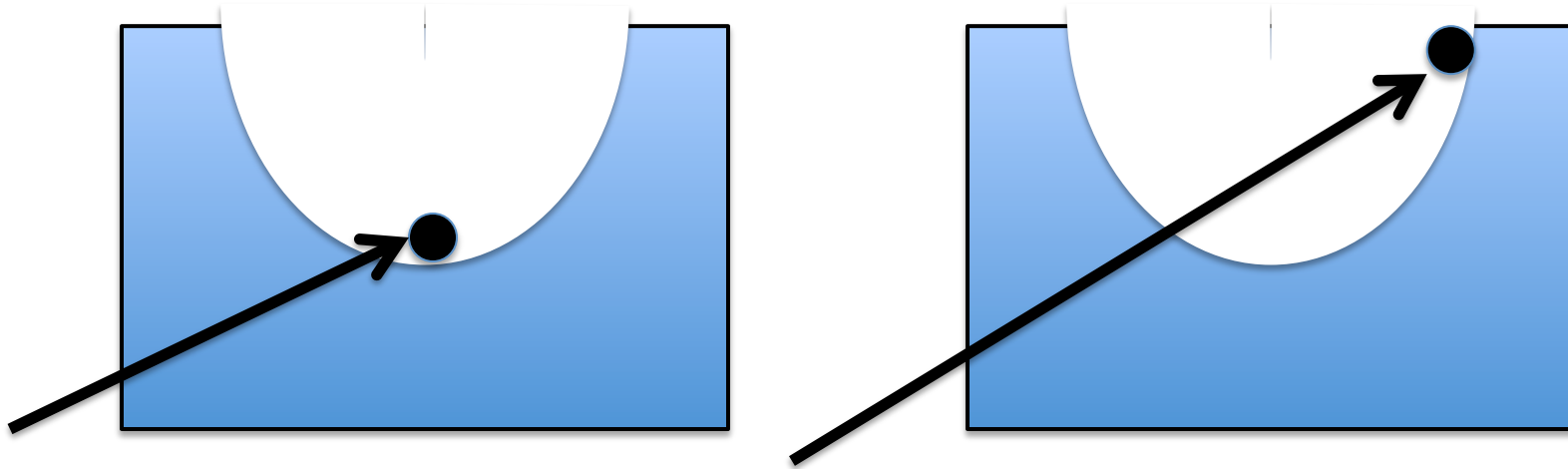


2. Ecosystem resilience: [In a system where no equilibrium is assumed] The magnitude of disturbance that can be absorbed before the system redefines its structure by changing the variables and processes that control the system.

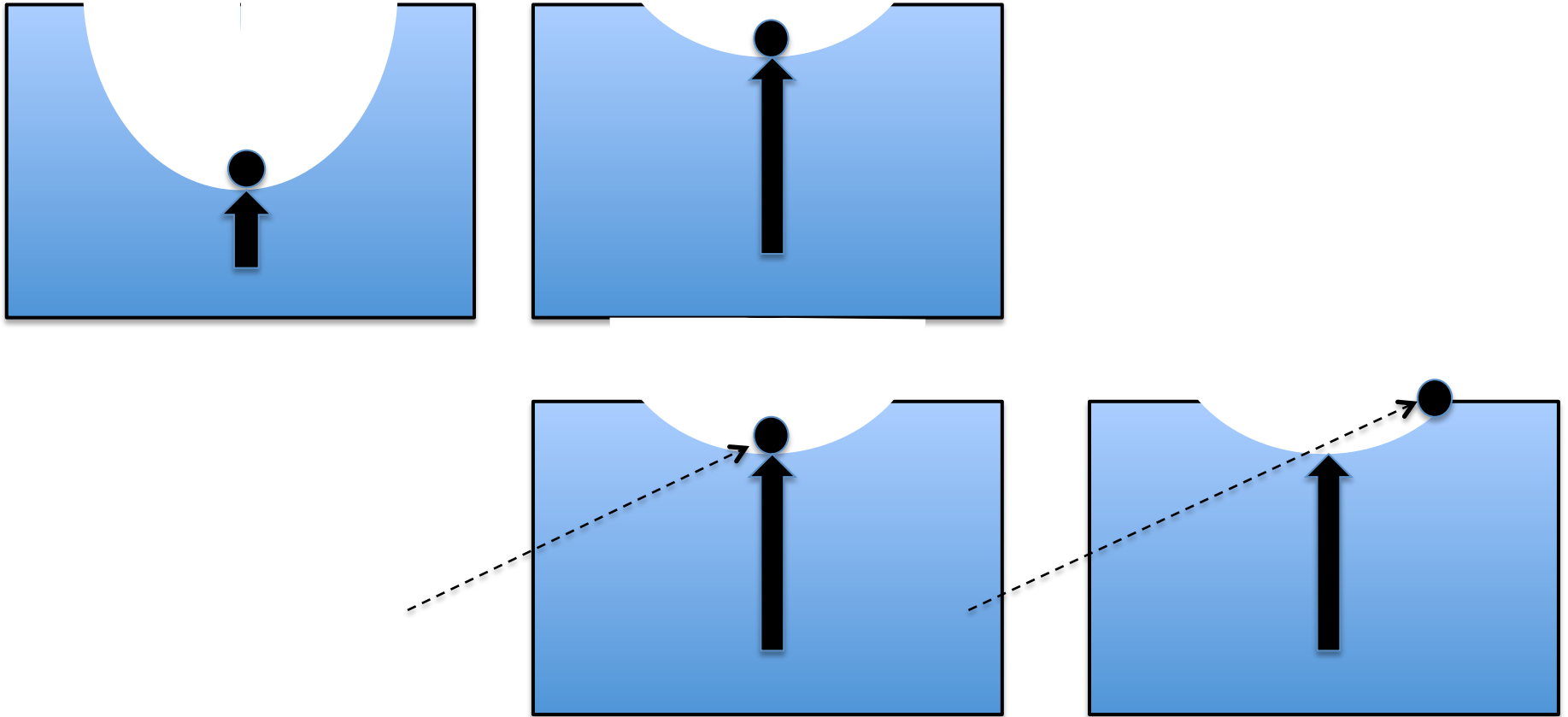
B. Ecological resilience (R).



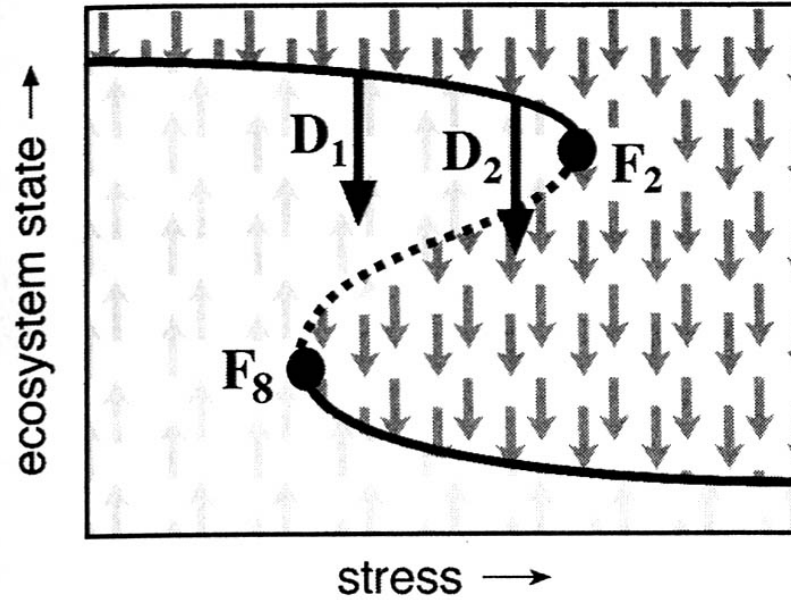
Some definitions—Disturbance and slow variables



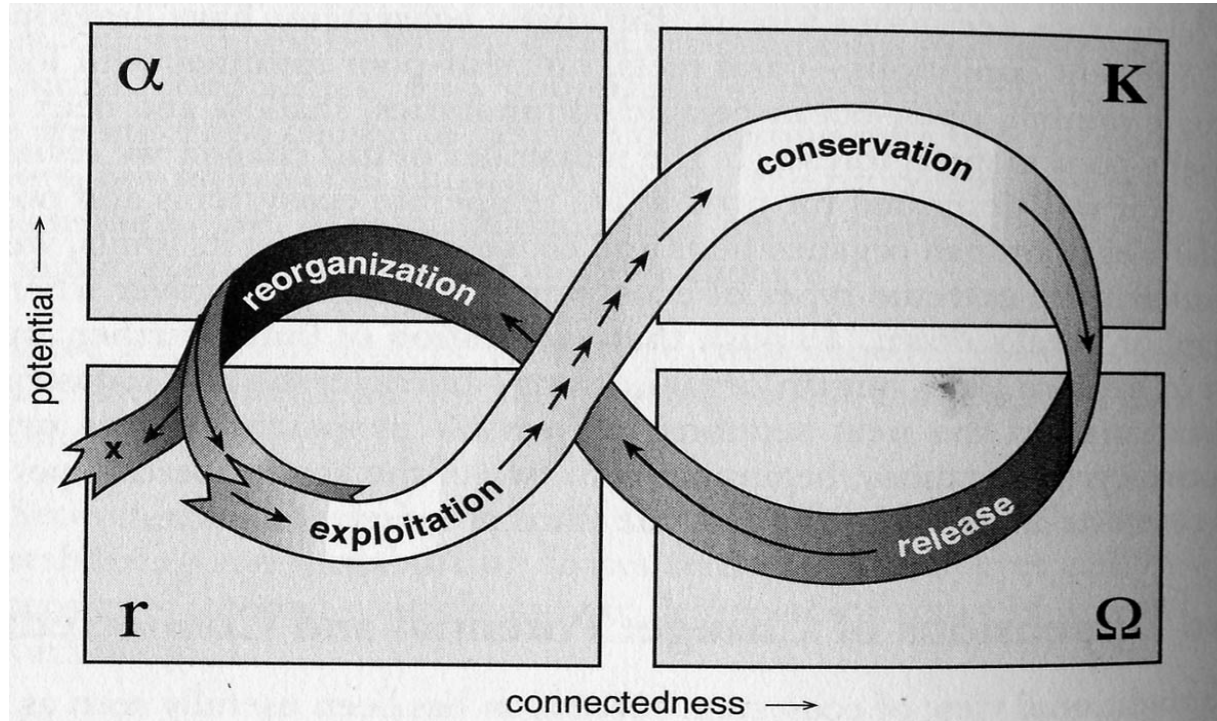
Qing Disturbance and slow variables



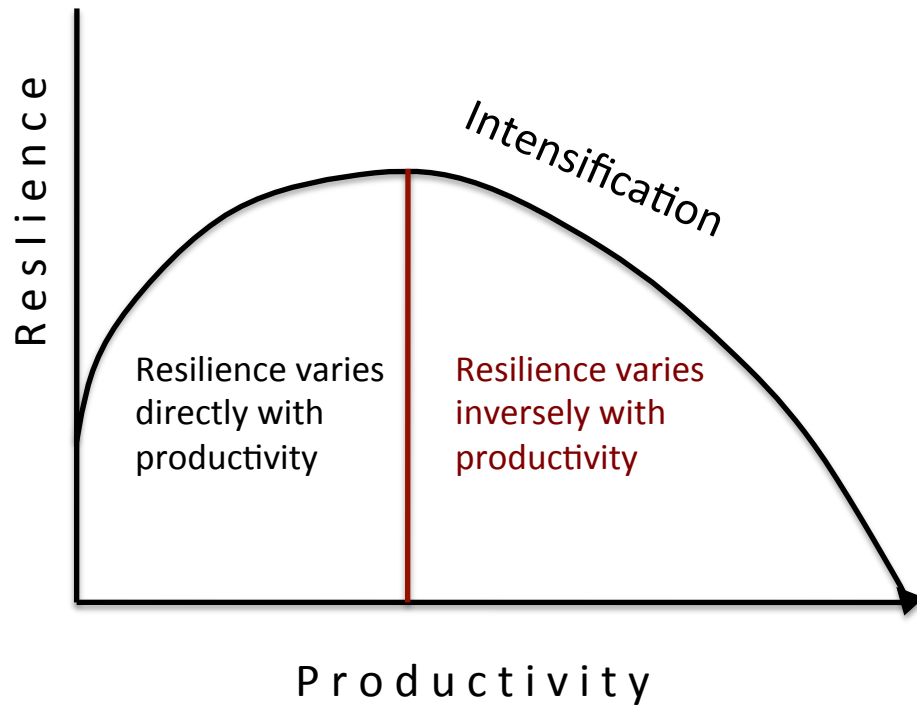
Some Definitions--Hysteresis



Some Definitions—Adaptive Cycle



Waterworks as illustration of the curvilinear relationship between productivity/intensification and resilience

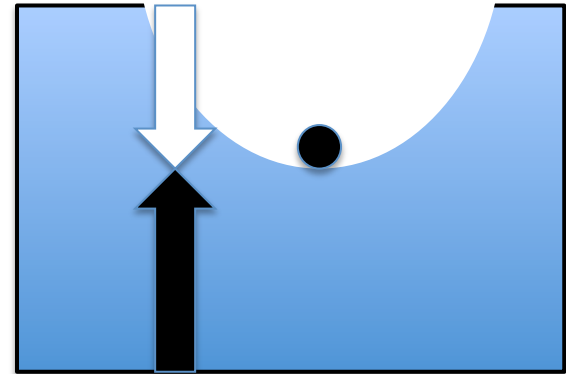


Start with irregular rainfall
Build a reservoir
Reservoir contains excess in big storms
Reservoir retains water in droughts
Natural events don't become disasters
Harvests become more reliable

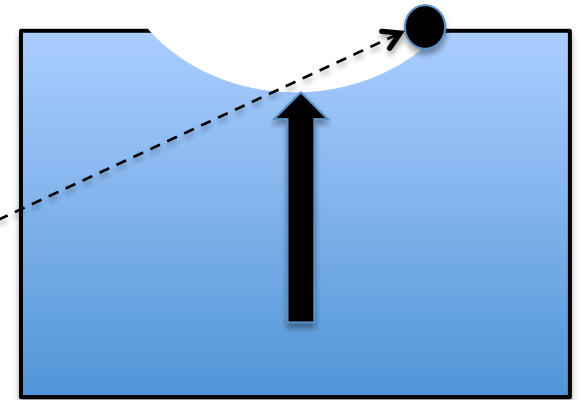
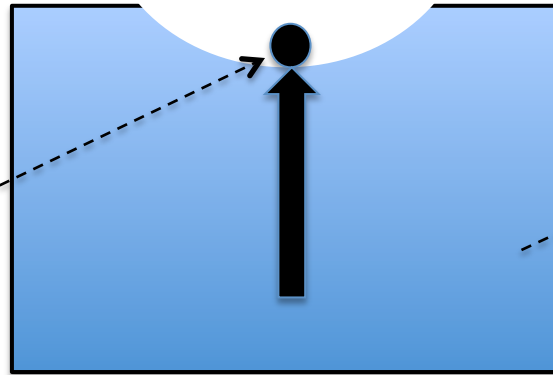
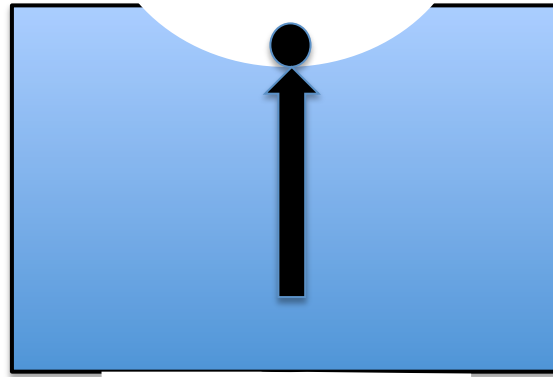
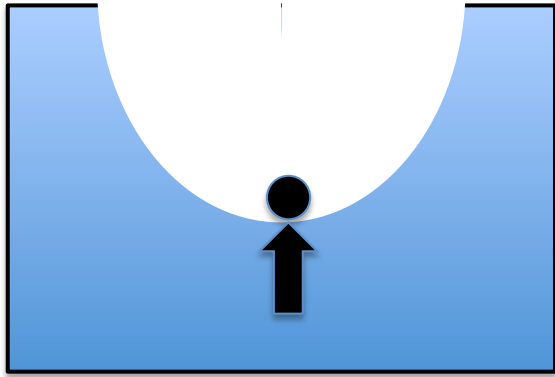
Reclaim more land
Reservoir can't release water, exceeds capacity
Community more dependent on lands that will flood
Natural events become disasters

Some Definitions: Guarantors or Buffers

- Infrastructure: mostly waterworks
- Institutions
 - Kin groups
 - Irrigation Associations
 - Temples
- Beliefs and values
 - Frugality
 - Recycling
 - Generational Continuity
 - Within-community Reciprocity
- Ecological buffers
 - Wetlands
 - Forests
 - Fallow land
 - Ungrazed pasture



Qing—Disturbance and **slow variables**



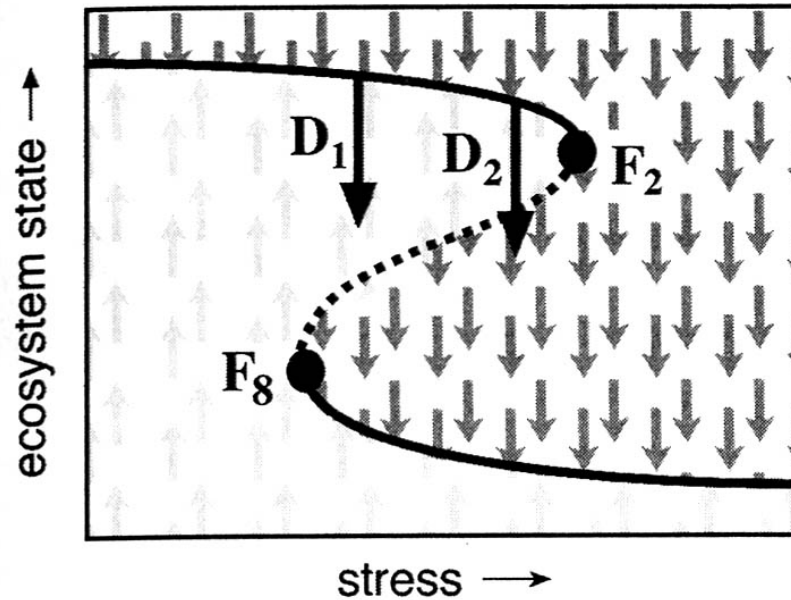
Qing slow variables:

Population growth (Jan 15)

Agricultural extension and
Intensification (Jan 17)

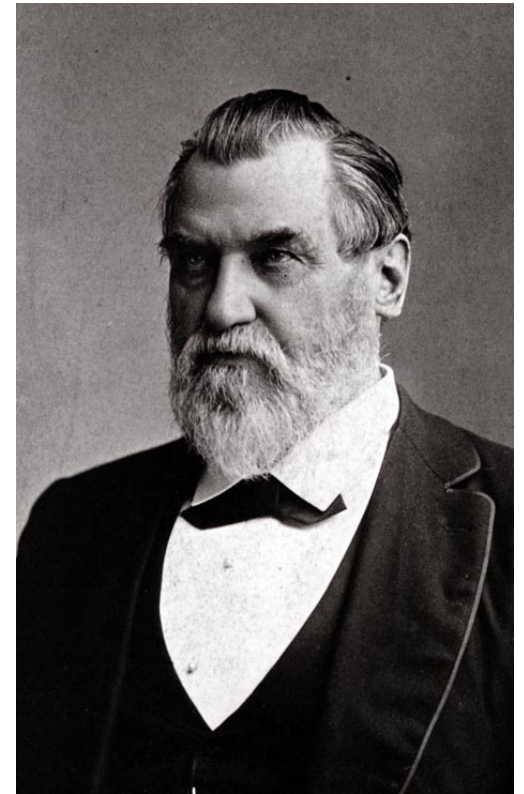
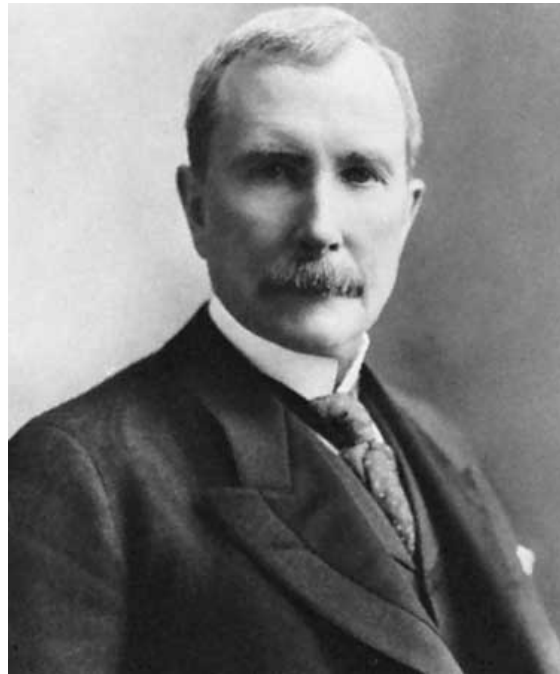
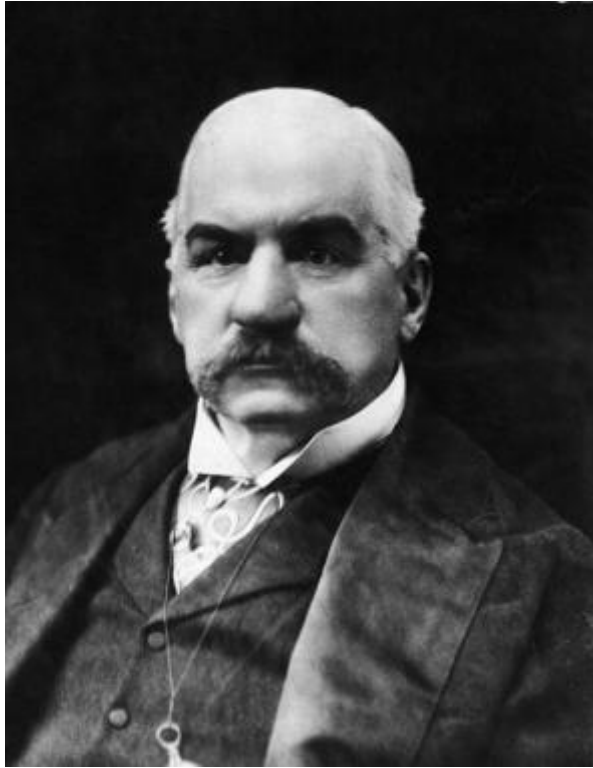
Increased water capture
(Jan 22)

Qing--Hysteresis



Qing Hystereses:
Eroded lands
Altered watercourses
Overtaxed institutions

Buying time: Increasing productivity; decreasing resilience: Capitalism



Buying time—Fossil Fuel



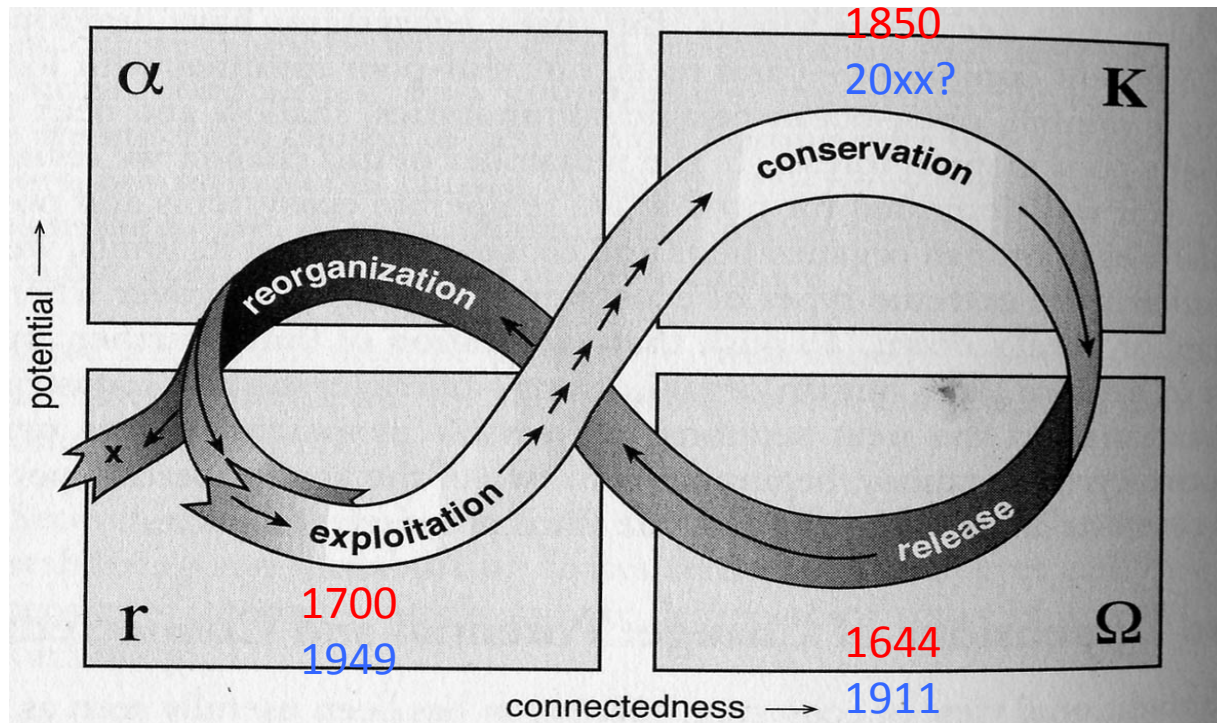
Buying time—Science



The Buying Time—Socialism



Two rounds of the Adaptive Cycle?



Qing Round: Population 200-450m, intensification without technology change

PRC Round: Population 500-1400M, intensification and technology change

Questions for us

- Is China doomed? To what?
- Is China more or less doomed than the rest of us?
- What buffers exist?
- What buffers can be strengthened?
- Does sustainability mean anything here?
- What are we trying to sustain?