

Working Papers

Worm Works Release

"Resource Sustainability: a local perspective"

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at

Outpost Natural Foods

The School of Freshwater Sciences at the University of Wisconsin-Milwaukee promises exploration, discovery, and analysis in the integrated fields of science, economics, and policy. It addresses current issues related to water resources and supports major initiatives by advancing knowledge relevant to today's society. The School is a graduate degree only program granting M.S. Professional, M.S. Thesis, and Ph.D. degrees. **Worm Works** is a working group that publishes timely narrative on current issues.

River Kaster has been an aquatic ecologist at the School for 33 years. He has spearheaded numerous scientific explorations, provided the foundation for the scientific outlet, Journal of the North American Benthological Society, now in its 30 year, and in 2007 founded the Laguna Bacalar Institute, dedicated to conserving pristine Laguna Bacalar in the southern Yucatan Peninsula. He was a SoTL Scholar in 2009-2010, his title: "Bridging the Gap Between Knowledge and Creativity". River currently studies issues of sustainability and the growth and collapse of hierarchies. He teaches the graduate course: "Coupling Science and Business Ingenuity".

An aerial, black and white photograph of a massive crowd of people, densely packed and filling the entire frame. The perspective is from directly above, showing the heads and shoulders of the individuals. The crowd is diverse in age and appearance, and the overall impression is one of a very large gathering.

**By mid-century,
there will be an additional
3 billion people.**



**Most will be born in countries
already experiencing
water shortages.**



**The Los Angeles basin
can support about
1 million people
with its own water.**



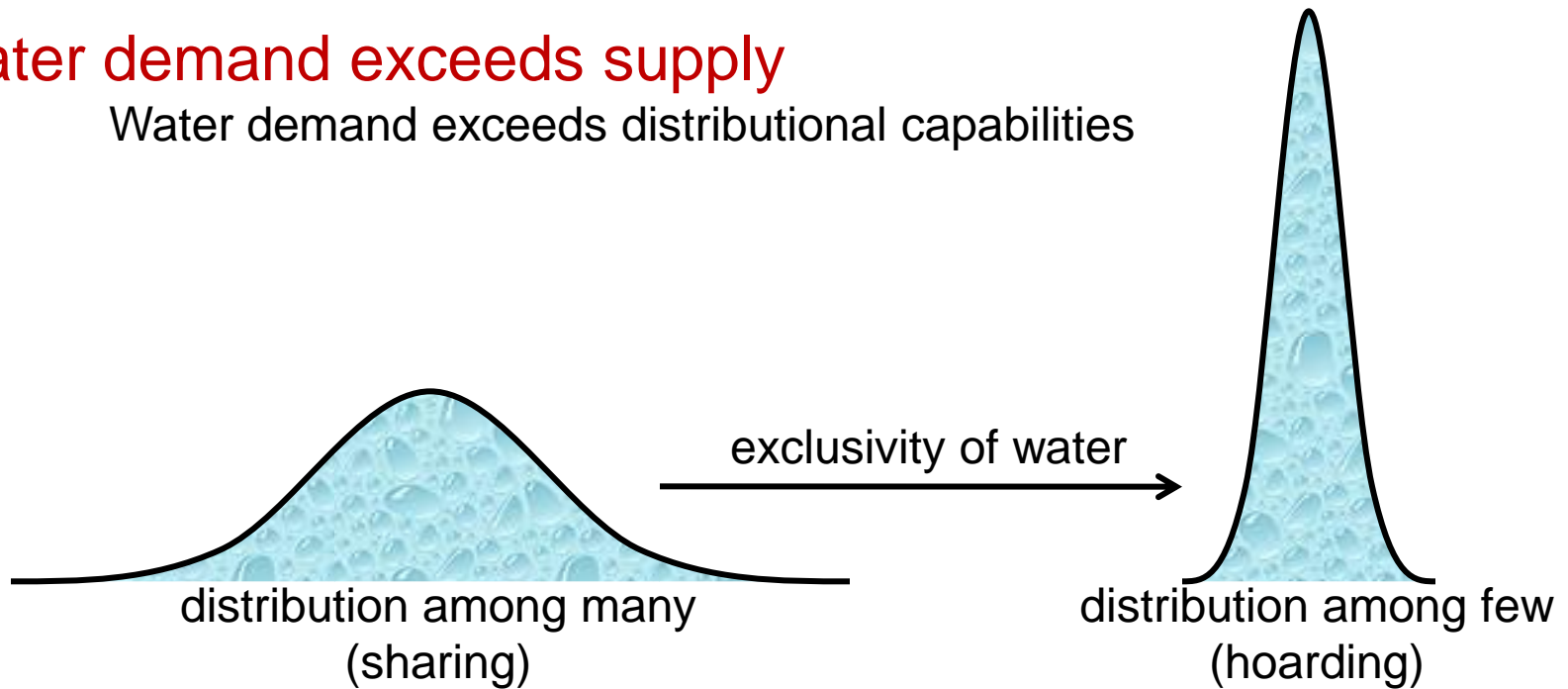
**By the year 2020,
the population is
expected to reach
22 million.**





Water demand exceeds supply

Water demand exceeds distributional capabilities



Unprecedented human death is linked to water borne disease: 5 million per year

Water will be the limiting resource that prompts the population crash

The population crash has already begun
and is expected to peak in 2075

(although it remains largely invisible to the resource wealthy)

Resource limitation is the earth's natural feedback response

Intra- and Intergenerational resource exploitation

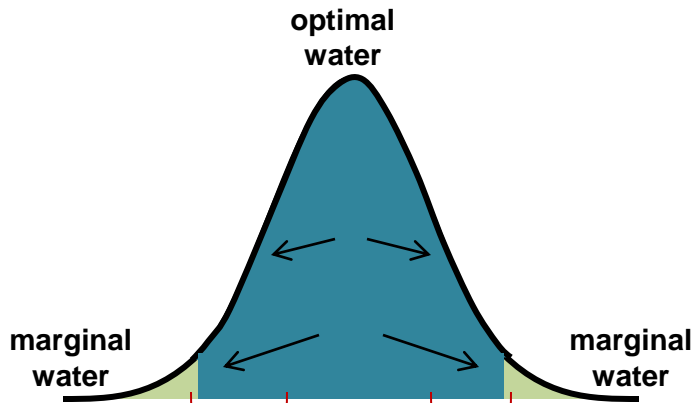
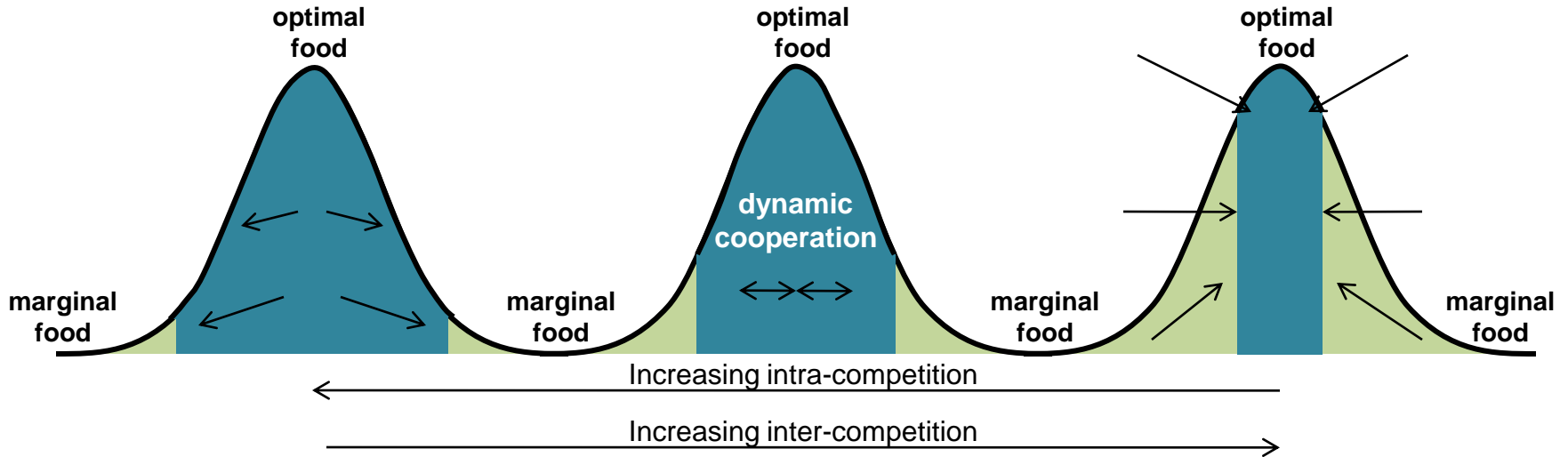
1. Each generation exploits available resources to the detriment of the next generation.
2. Technology facilitates the next generation's ability to better exploit their inherited, degraded resources.
3. Sustainability is a **Red Queen's Race**
--running faster and faster to keep in front of resource collapse

Technology disproportionately benefits the resource wealthy, while confiscating resources from the poor.



The balance between optimal and marginal existence

(Adaptation to the Red Queen's Race forces people to a marginal existence)



These are the population sectors that crash...

...as a result of marginal water, food, clothing, education, opportunity.



Population Growth Drives Inefficiency and Chaos

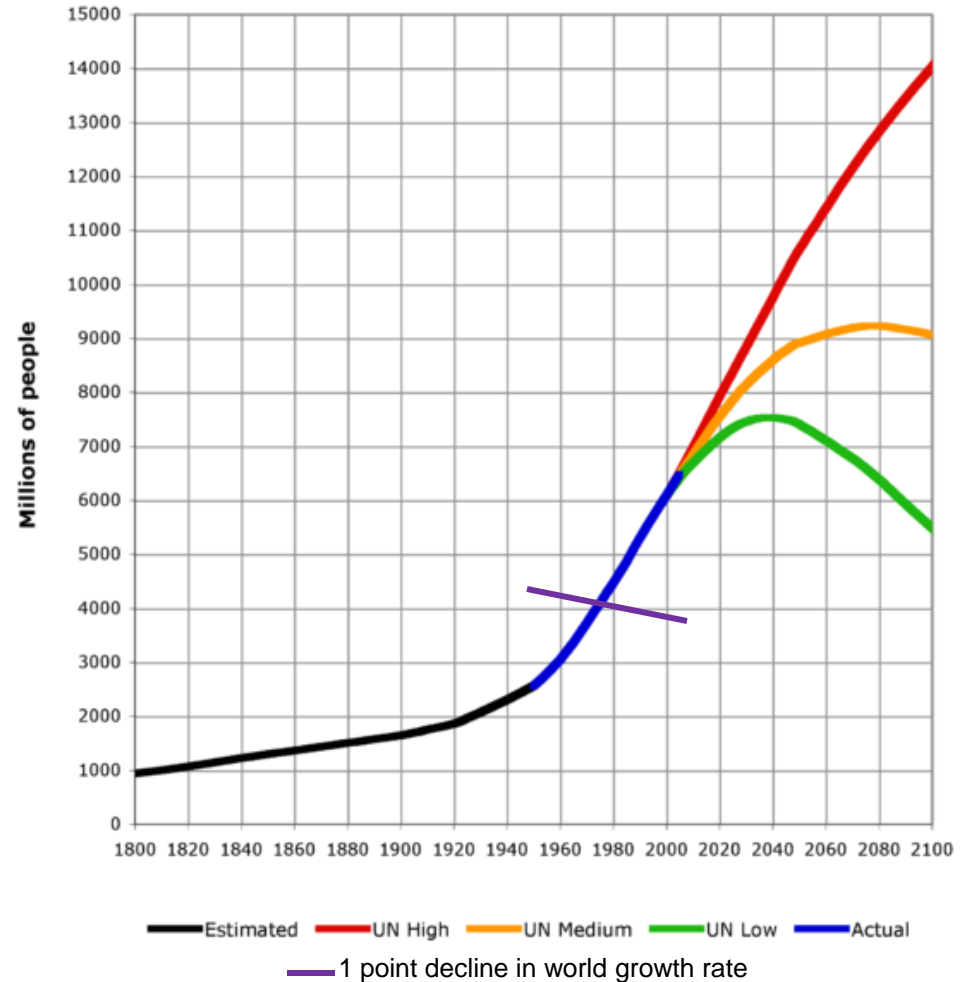
Population momentum insures future resource degradation for the next 100 years.

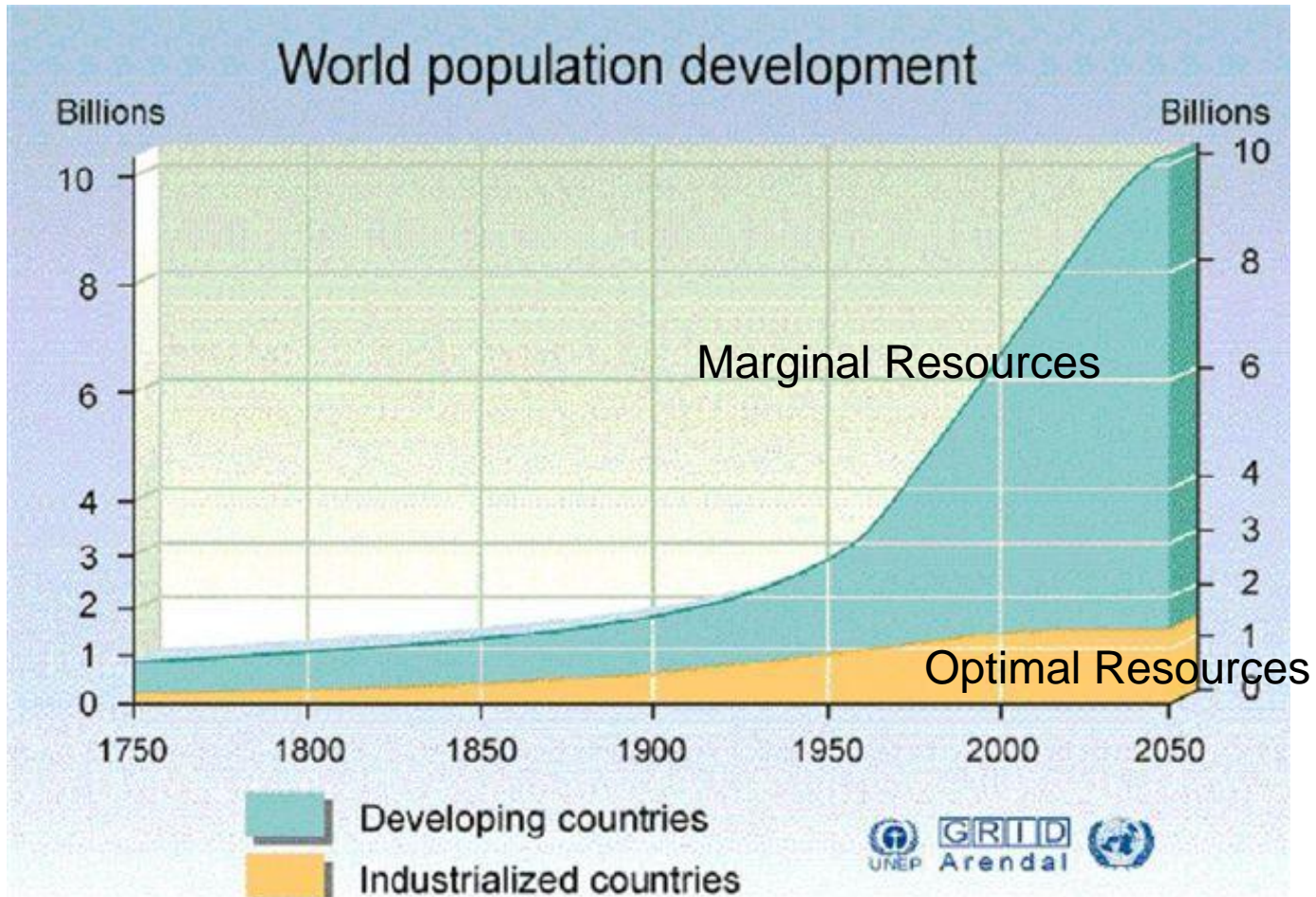
The question that must be answered ***now*** is what does the post-collapse world look like?

Enormous lag-times make it necessary to predict the future of the human condition.

“The best way to predict the future,
is to create it”

Peter Drucker

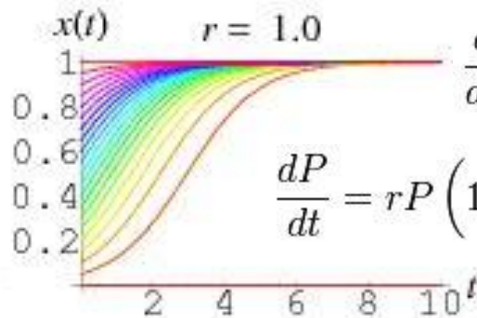




Sustainability: oxymoron or measurable goal

Jerry Kaster
 School of Freshwater Sciences
 Great Lakes WATER Institute

What does sustainability look like?



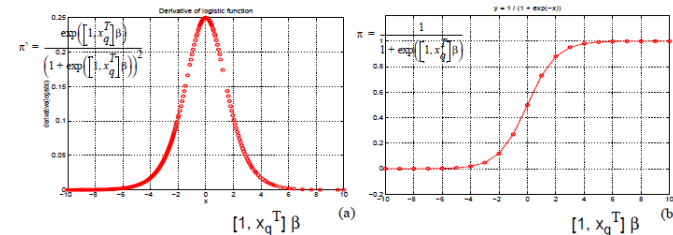
$$\frac{dP}{dt} = rP \left(1 - \frac{P}{K}\right) \quad \frac{dx}{dt} = rx(1-x)$$

$$\frac{dP}{dt} = rP \left(1 - \frac{P}{K}\right)$$

$$P(t) = \frac{KP_0 e^{rt}}{K + P_0(e^{rt} - 1)}$$

where

$$\lim_{t \rightarrow \infty} P(t) = K.$$



$$H' = -\sum_{i=1}^S \frac{n_i}{N} \ln \frac{n_i}{N} \quad k \sum_i P_i \ln(P_i)$$

$$f(x) = e^{-x^2}$$

$$f'(x) = -2xe^{-x^2}$$

$$f''(x) = (-2x)^2 e^{-x^2} - 2e^{-x^2}$$

$$= 2(2x^2 - 1)e^{-x^2} \quad 12$$

Defining Sustainability

“Sustainability is the long-term perpetuation of well being, which has environmental, economic, and social dimensions.”

“Sustainability is living off the natural income replenished by natural resources and not depleting earth’s endowment of natural capital that supplies this income.”

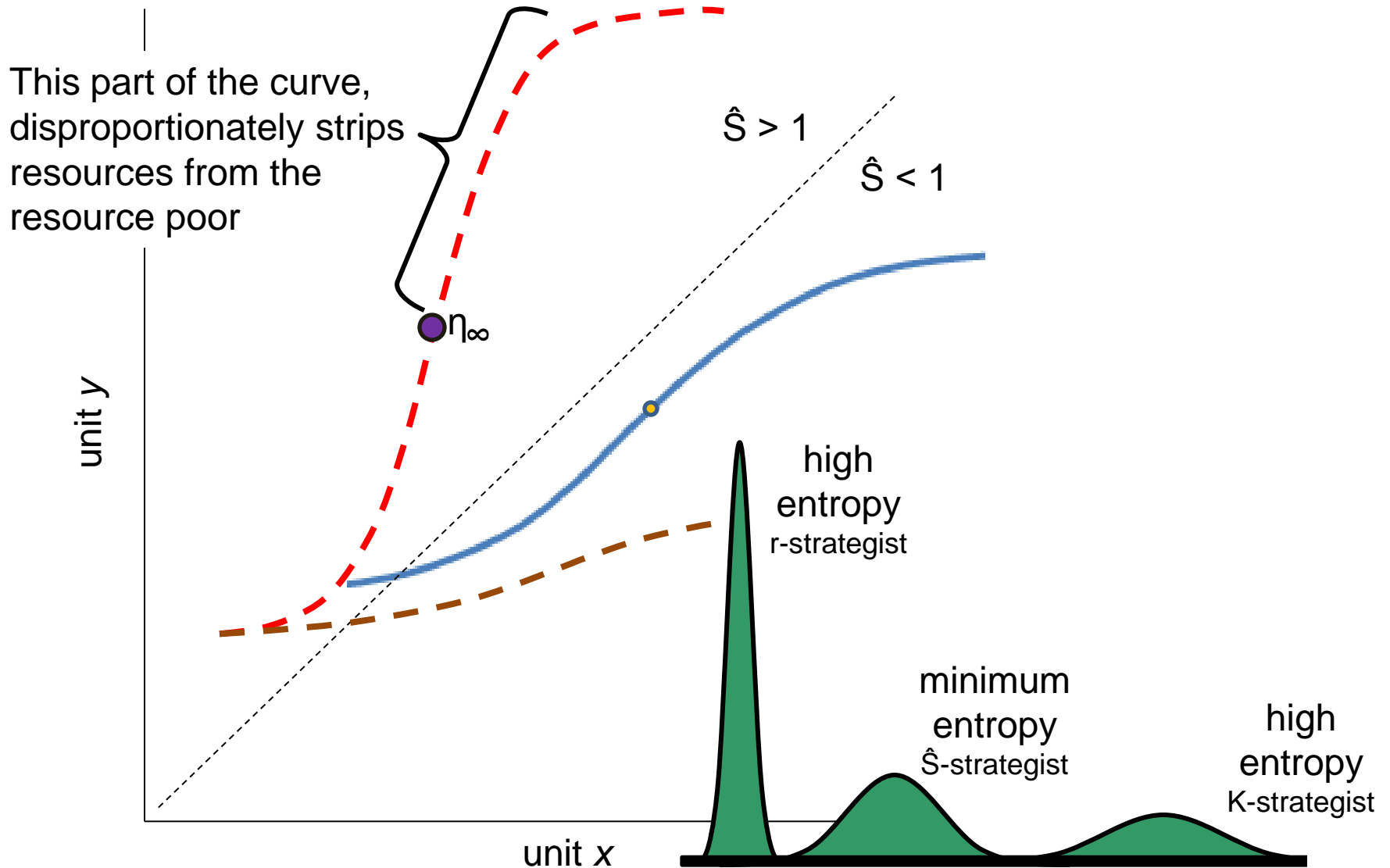
“Sustainability is doing no harm for seven generations.” Iroquois League

“Sustainable development ... meets the needs of the present without compromising the ability of future generations to meet their own needs.”
(WCED, 1987)

“Sustainability is the likelihood that a system or system component will not experience a decreasing trajectory of well-being over time.” (Stanford University)

“Sustainability uses resources at maximum efficiency and minimum entropy within the confines of locality.” (SFS Kaster)

What is the tradeoff between vertical and horizontal flow (information theory)?



Sustainability is a local phenomenon

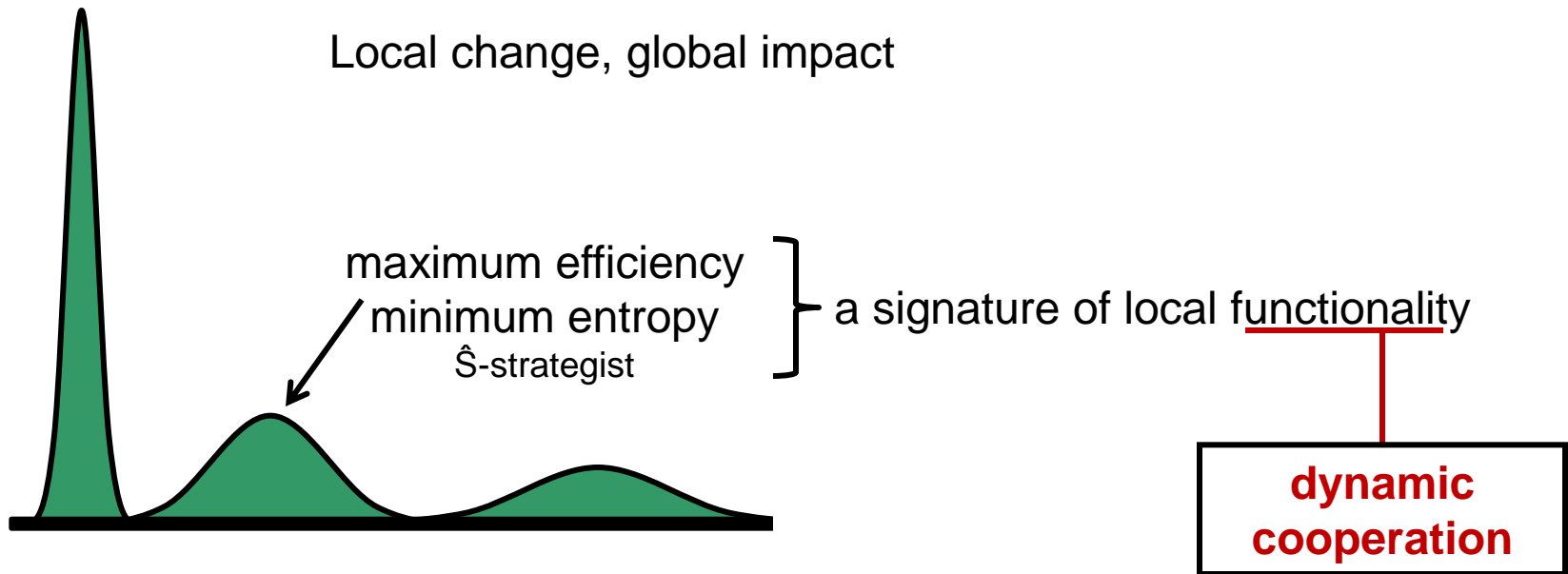
Locality: maximum efficiency at minimum entropy

Sustainability can be managed at the local level and expand to broader levels,
(e.g., state, national, global)

Locality provides the foundation for expansion

No local sustainability, no global sustainability

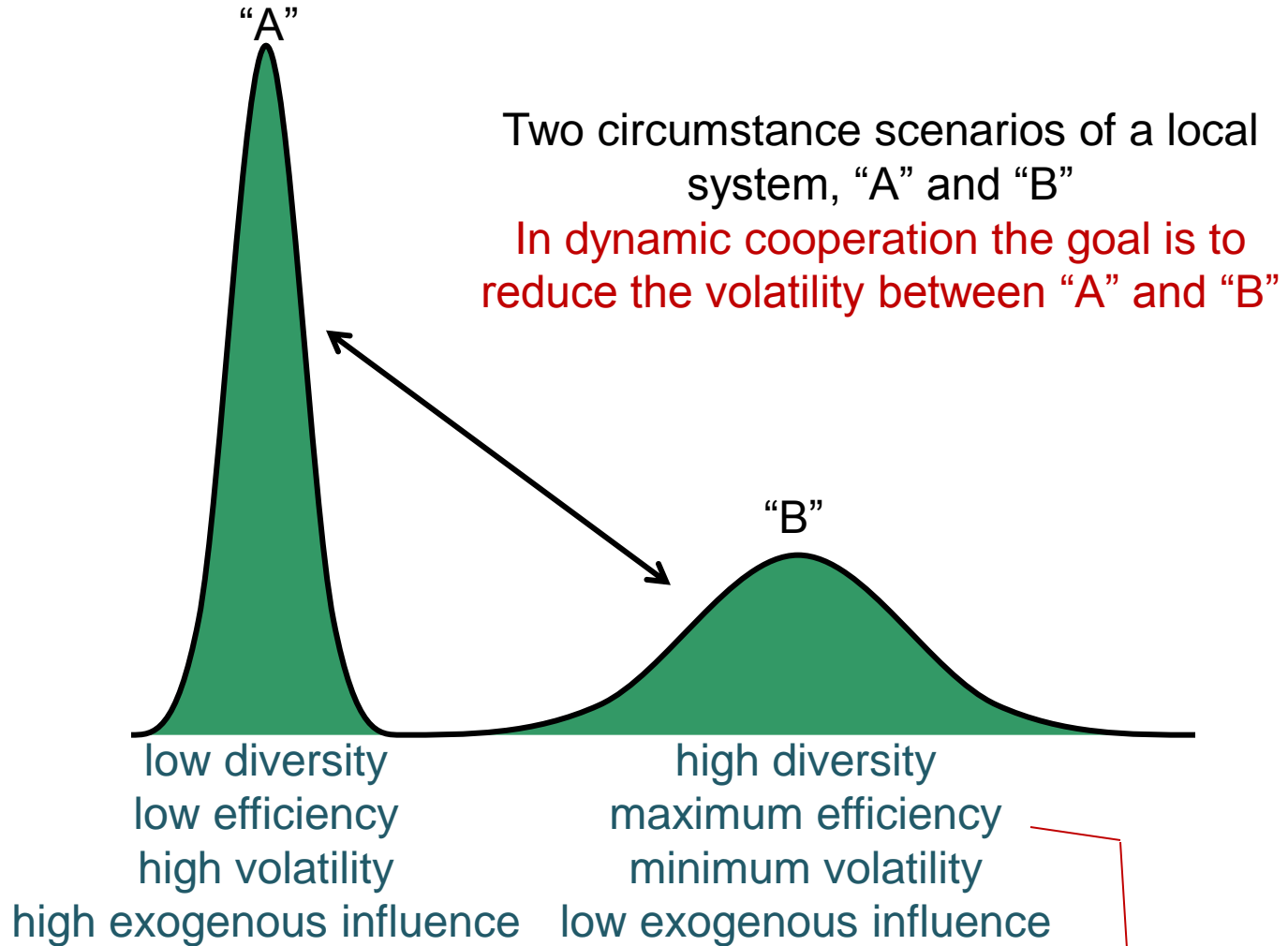
Local change, global impact



Hierarchy Growth and Collapse:

A dynamic process of nature

Locality reduces the volatility associated with flux



These are why locality works!

‘Success’ should not be measured by the traditional
profit standard.

‘Success’ should be measured by the
local standard
(your activities promote energy and material flow within a community)

“If it can be measured, it can be managed”

Peter Drucker

How can local sustainability be accomplished?

✿ You have to create locality ✿

Locality is an ecosystem that has certain characteristics

Buying Local

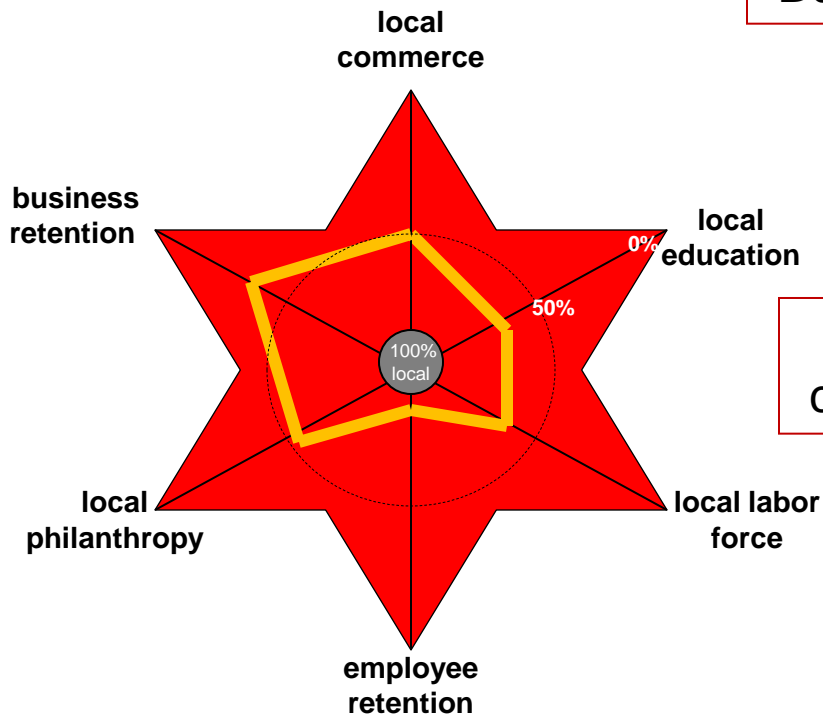
\$100 spent non-local = \$14 in local benefit
\$100 spent locally = \$45 in local benefit

Money flow through the local community drives sustainability

Money residence time: how long does money flow locally before it leaks out

Buying non-local at cheap prices supports profit
but diminishes local money flow

(tragedy of the commons scenario)

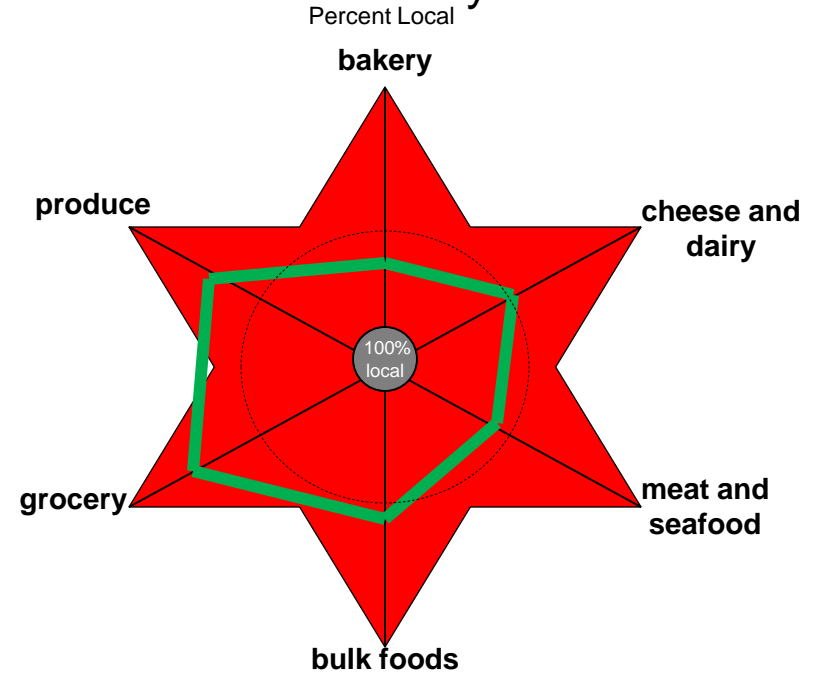


Creating & Measuring Locality

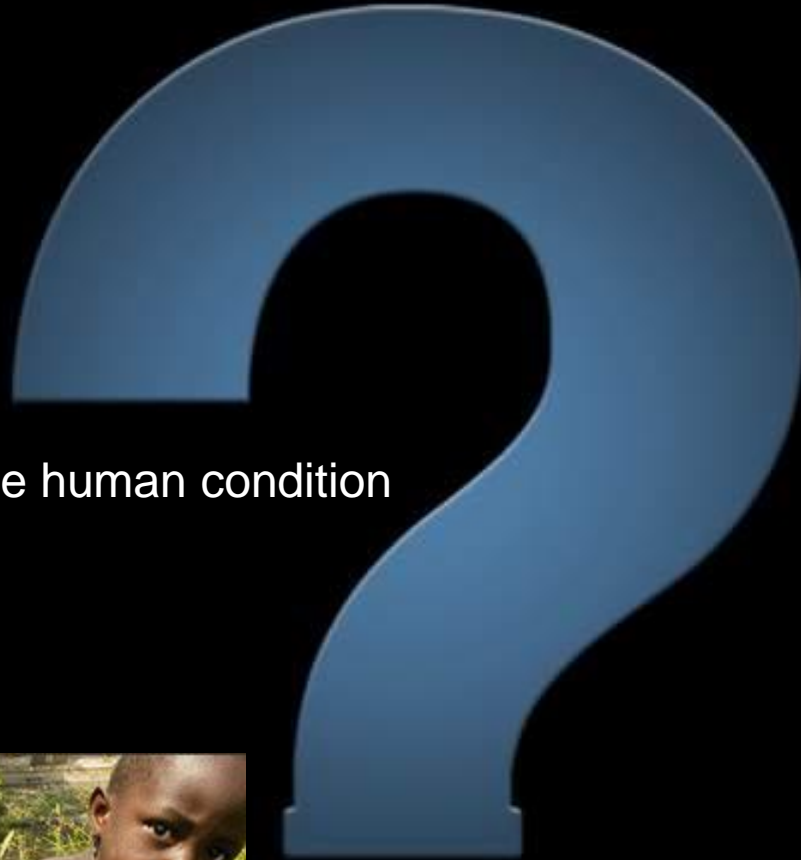
Customer Chart



Product Locality Chart



One of the reasons to measure:
self-perception is always different from reality



Locality will re-define the human condition



The **Outpost** *has to be* the future