GAME: SAY ONE RELATED WORD

Tree				

System Thinking 2

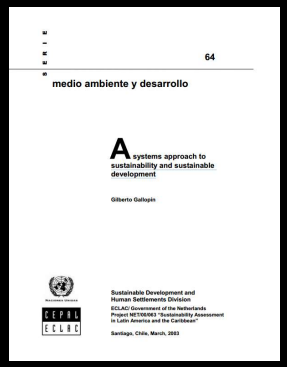
Socio-Ecological Systems and Regime Shifts

Summary

1) Socio-ecological system

2) Sustainable Development

3) Resilience and Regime Shifts



Gilberto Gallopín, A systems approach to sustainability And sustainable development (2003)

Hola, I am **Gilberto Gallopin** from Argentina

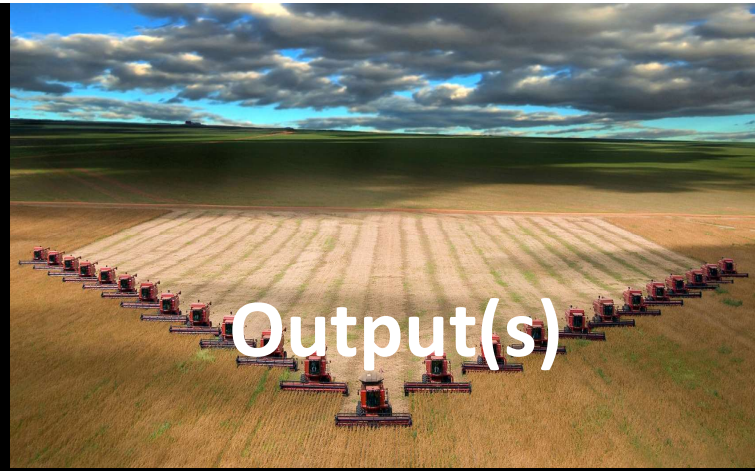
I am an Ecologist, ecosystems analyst and SD expert

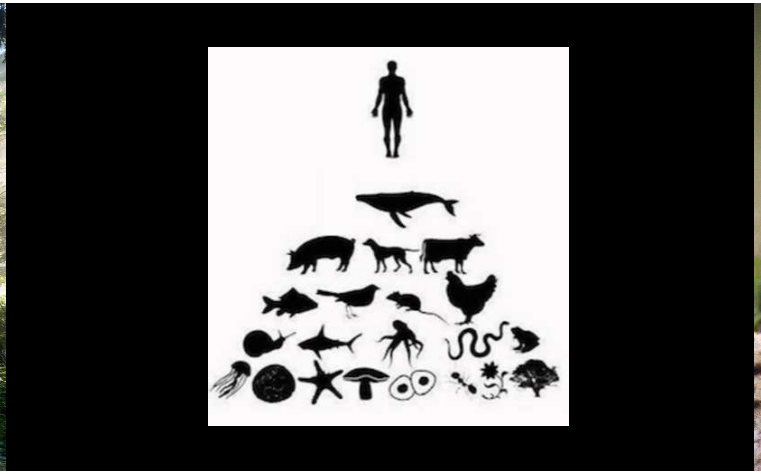
In few word, I am quiet a cool guy. Try enjoying my thoughts :)

You are also very welcome to challange them at the end of the class ;)

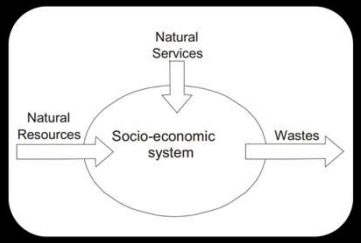
What do we want to **sustain**?

What do we want to **change**?





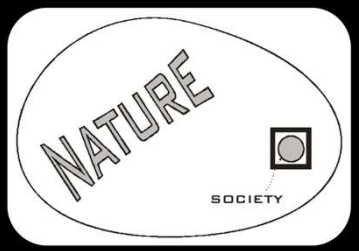

The War Has Only Vegan!



Anthropocentric Position

lance?

Socio-Ecological System



Extreme Biocentric Position

"A **socio-ecological system** is any system composed of a **human component** in interaction with an **ecological component**."

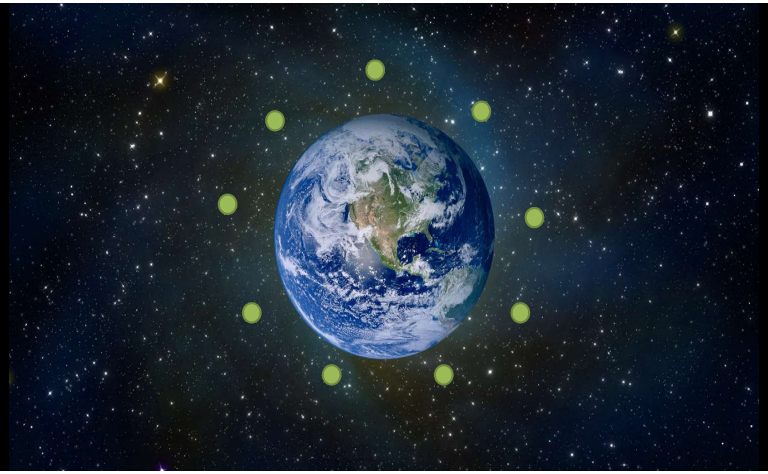
Thinking ourselves as in a socio-ecological system is the closest way to reality

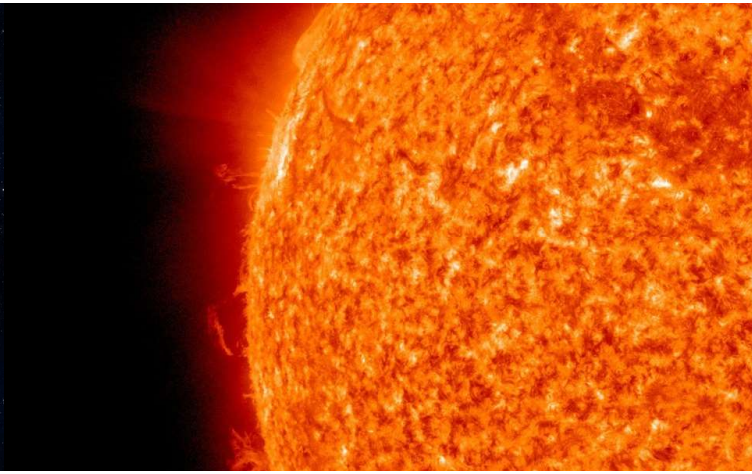
«When you watch at the infinite space, you understand that it is not an astronaut going into space, but are the astronaut and the whole Earth going <u>together</u> to explore the Universe»

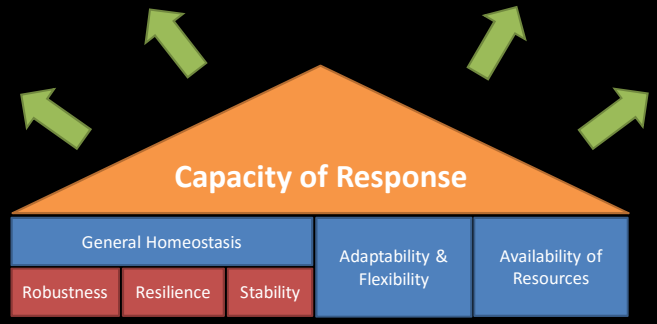
-Chris Hadfield Ted Talks 2014-

«Cool, so now we have this socio-ecological system…

And how do we sustain it?»

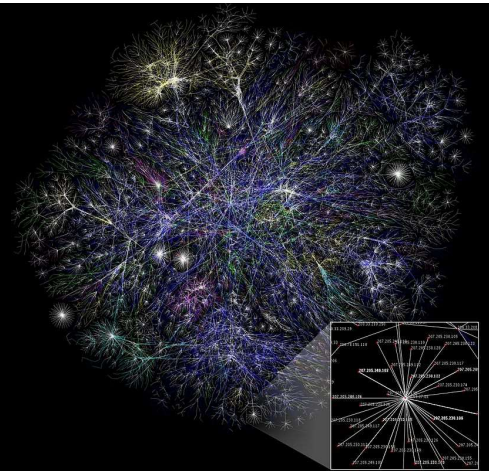





Capacity of Response
General Homeostasis
Robustness
Resilience
Stability
Adaptability & Flexibility
Availability of Resources

Sustainability and sustainable development.

Sustainability is not the same as constancy



Gallopin 5 Points of SD

The ethical foundations of sustainable development

Dynamism

Concept

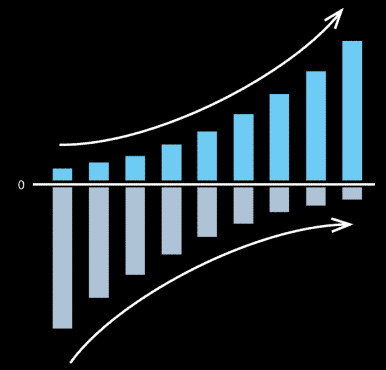
Implementation

A variety of perspectives

Sustainable development

'The end goal of conventional sustainable strategies is to be carbon neutral. But you can only have zero carbon emissions when you do not exist. So is this our biggest goal? Instead of not existing, lets create a big positive footprint'.

Professor Dr. Michael Braungart
System Thinker – Professor of Chemistry in Erasmus University in Rotterdam



Optimization - Integration of eco-efficiency and eco -effectiveness, to support the increase in value . Ambition to leave a positive environmental footprint.

Gallopin 5 Points of SD

The ethical foundations of sustainable development

Dynamism

Concept

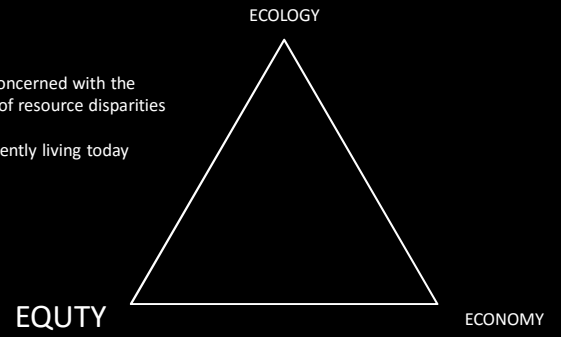
Implementation

A variety of perspectives

Intergenerational justice

Future generations should be taken on account when deciding for resource depletion or allocation.

Equity is concerned with the reduction of resource disparities among
those presently living today



Gallopin 5 Points of SD

The ethical foundations of sustainable development

Dynamism

Concept

Implementation

A variety of perspectives

Fox → Rabbit

Sustainable development cannot exist as some static equilibrium state (Brooks, 1992).

Gallopin 5 Points of SD

The ethical foundations of sustainable development

Dynamism

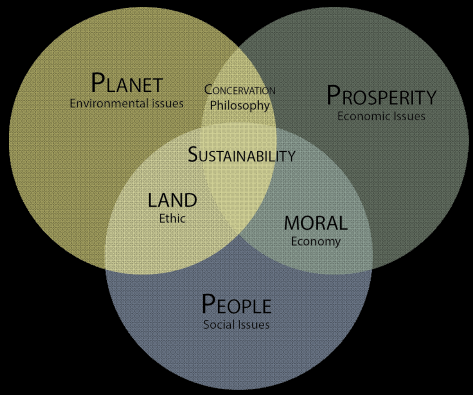
Concept

Implementation

A variety of perspectives

Competing objectives

Approach, which focuses on reconciling social, economic and ecological goals (Peterson, 1997*)*



Gallopin 5 Points of SD

The ethical foundations of sustainable development

Dynamism

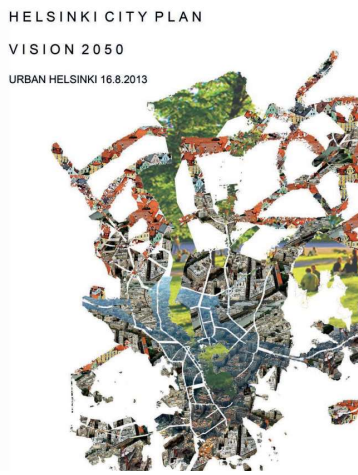
Concept

Implementation

A variety of perspectives

City Planning

Implementing a sustainable concept requires achievable goals, consensus building and perspectives. (Peterson, 1997*)*.



Gallopin 5 Points of SD

The ethical foundations of sustainable development

Dynamism

Concept

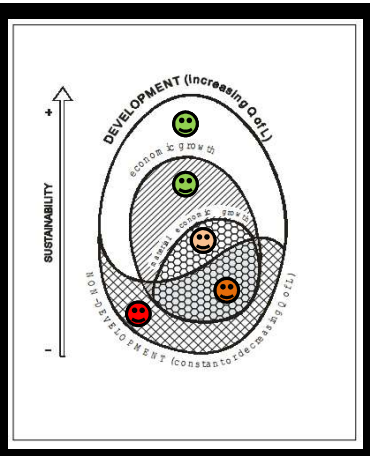
Implementation

A variety of perspectives

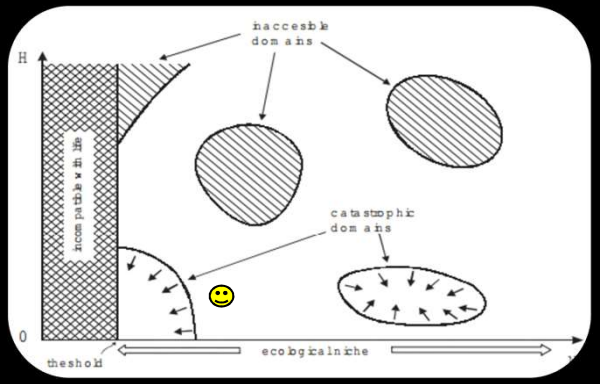
Biomimicry

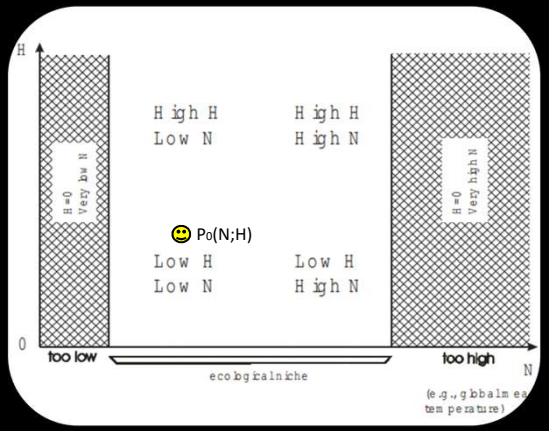
No single group has authority to define sustainable development(Peterson, 1997*)*.

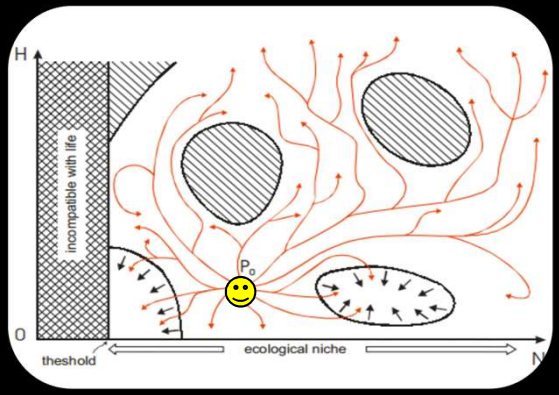
How can a society develop?



	Happiness	Material Growth	Growth	Sustainable
Under-development	NO	NO	NO	NO
Mal-development	NO	YES	YES	NO
Material Economic Development	YES	YES	YES	NO
Non-Material Economic Development	YES	NO	YES	YES
No Growth Development	YES	NO	NO	YES


inaccesible
domains
H
incompatible with life
catastrophic
domains
0
theshold
ecological niche


H
High H
Low N
High H
High N
H=0
Very low N
P0(N;H)
H=0
Very high N
Low H
Low N
Low H
High N
0
too low
too high
N
ecological niche
(e.g., global mean
temperature)


H
incompatible with life
P0
0
theshold
ecological niche
N

Five Coevolution Attitudes in SE Systems

Paradigm 1. Standardization
Paradigm 2. Optimization
Paradigm 3. Pessimization
Paradigm 4. Equitization
Paradigm 5. Stabilization

"Establishment of absolute normas, environment and development standards"

*"some management strategies which satisfies all desired standards over the short term can lead nevertheless to an **irreversible development** which destroys the long-term feasibility of the paradigm"*

https://www.ted.com/talks/kent_larson_brilliant_designs_to_fit_more_people_in_every_city?language=en#t-119876

Five Coevolution Attitudes in SE Systems

Paradigm 1. Standardization
Paradigm 2. Optimization
Paradigm 3. Pessimization
Paradigm 4. Equitization
Paradigm 5. Stabilization

"Search for the best bundle"

(Assumption of perfect control over the socio-ecological system, but if that is not true → risk of system falling in one of the catastrophic domains)

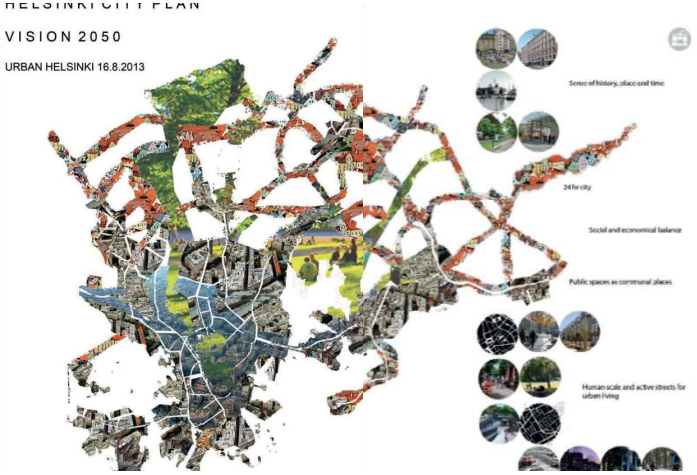
Five Coevolution Attitudes in SE Systems

Paradigm 1. Standardization
Paradigm 2. Optimization
Paradigm 3. Pessimization
Paradigm 4. Equitization
Paradigm 5. Stabilization

"Preventing the worst"

"Looking for the smallest possible amount of damage instead of the greatest possible benefit"

http://www.hel.fi/hel2/ksv/julkaisut/yos_2013-23_en.pdf



Five Coevolution Attitudes in SE Systems

Paradigm 1. Standardization
Paradigm 2. Optimization
Paradigm 3. Pessimization
Paradigm 4. Equitization
Paradigm 5. Stabilization

"Preserving the options for future generations"

"not contracting the "accessible universe" over time"

Five Coevolution Attitudes in SE Systems

Paradigm 1. Standardization
Paradigm 2. Optimization
Paradigm 3. Pessimization
Paradigm 4. Equitization
Paradigm 5. Stabilization

"Bringing the socio-ecological system into a desirable state in the coevolution"

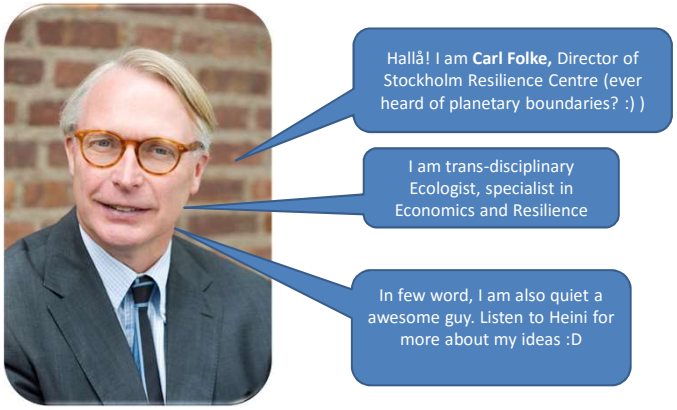
"Reach a desirable coevolution point and try to maintain it through good management"

Resilience and Regime Shifts

1 Minute stretching before continuation ;)

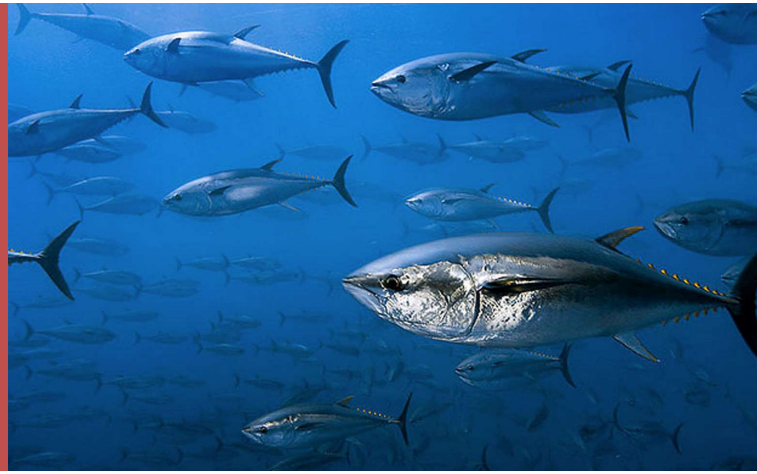
Understandings of Resilience

1) Engineering Resilience
2) Ecosystem Resilience
3) Socio-Ecological Resilience



Engineering resilience

system	simple
focus behaviour	near equilibrium
measurement	return time, efficiency
concepts	recovery, stable state, equilibrium



Ecosystem/ecological resilience
(=social resilience)

system	complex
focus behaviour	
measurement	
concepts	

Regime shifts - Intro

Reviewing the evidence of *regime shifts* in our environments in relation to ***resilience*** of adaptive ecosystems, social development and roles of biological ***diversity*** in that context.

Definition of resilience:

Here we define resilience as the capacity of a system to absorb disturbance and reorganize while undergoing change so as to retain essentially the same function, structure, identity, and feedbacks (Walker et al. 2004).

Resilience and regime shifts:

Resilience has a direct effect on regime shift.

- Removing whole functional groups of species or trophic levels.
- Direct impact on ecosystem.

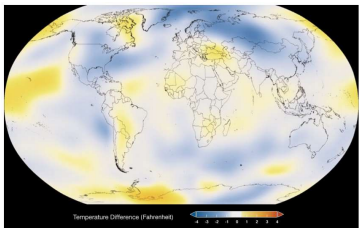
Regime shifts

Regime shifts imply shifts in ecosystem services and consequent impacts on human societies.

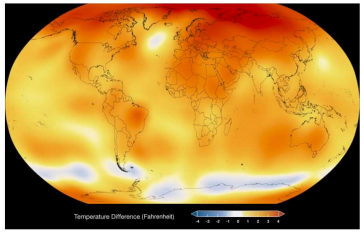
Old Perspective vs New Perspective

- Stable and infinitely resilient environment,
- Global steady state.

- Resilience can be been eroded
- self-repairing capacity of ecosystems should no longer be taken for granted



1970 – global temperature

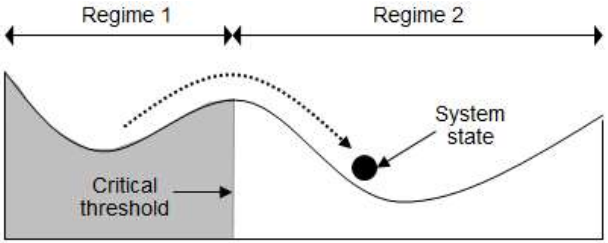


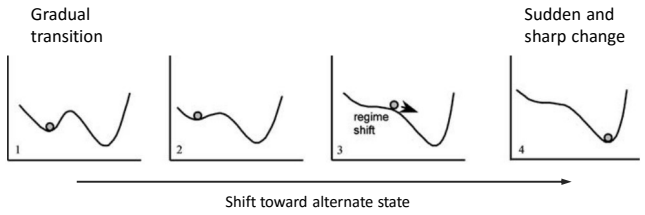
2015 – global temperature

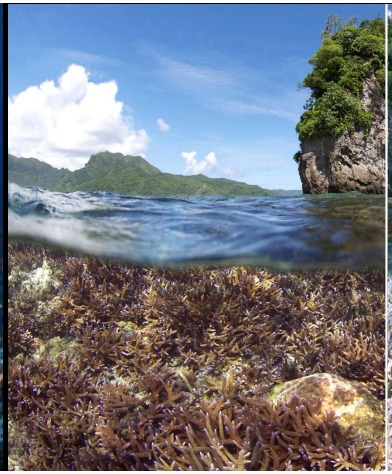
Data source: NASA/GISS

Regime shifts transition

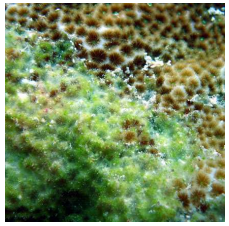
Ecosystems often do not respond to gradual change in a smooth way.





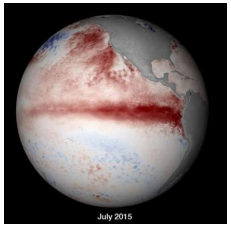



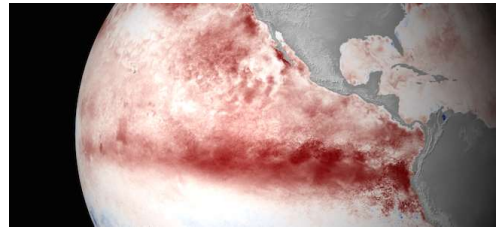
18.2.2016

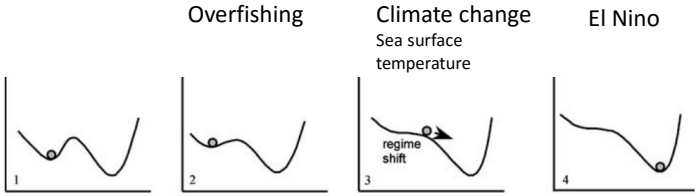


Algae-
dominating
reef

El Nino
Disease,
bleaching







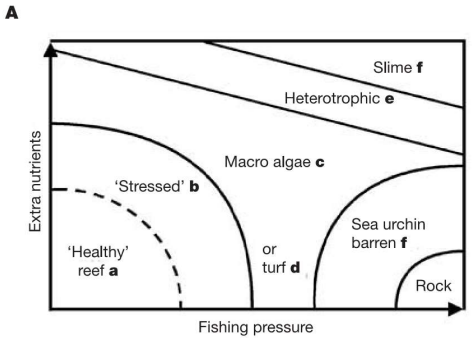
Coral-dominated reed

Coastal eutrophication

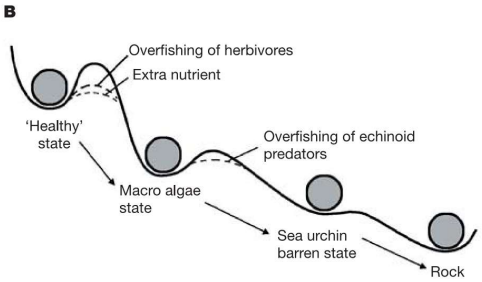
Disease, bleaching
80% of reef will not recover from this.

Algae-dominated reefs.
Increase in DOC and result in more coral breaching.

Carl Folke, Steve Carpenter, Brian Walker, Marten Scheffer, Thomas Elmqvist, Lance Gunderson and C.S. Holling7 (2004)



Bellwood et al. (2004)



Bellwood et al. (2004)


Healthy - Dec 2014
Dying - Feb 2015
Dead - Aug 2015

Causes of regime shifts

In context of eco-system human actions are first apparent reason; regime shifts may occur more easily if resilience has been reduced as a consequence of human actions.

Trophic cascade

Removal of functional groups of species and their response diversity, such as the loss of whole trophic levels (top-down effects)

Bellwood et al. (2004)

Alternation of disturbance regimes

Alteration of the magnitude, frequency, and duration of disturbance regimes to which the biota is adapted.

Bellwood et al. (2004)

Impacting via emmission

Impact on ecosystems via emissions of waste and pollutants (bottom-up effects) and climate change.

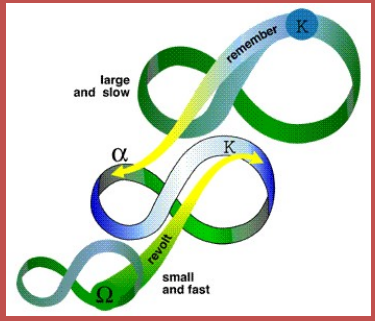
Ecosystem/ecological resilience
(=social resilience)

system	complex
focus behaviour	
measurement	
concepts	

Complex adaptive systems

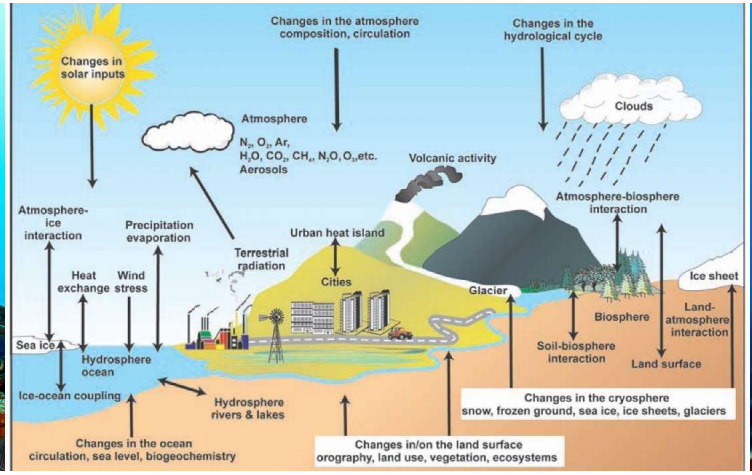
diversity and individuality
localised interactions
autonomous selection process
replication or enhancement

Levin (1998)



Ecosystem/ecological resilience
(=social resilience)

system	complex (adaptive)
focus behaviour	at stability boundaries
measurement	capacity to withstand shock while maintaining function
concepts	multiple equilibria, stability landscapes



Social-ecological resilience

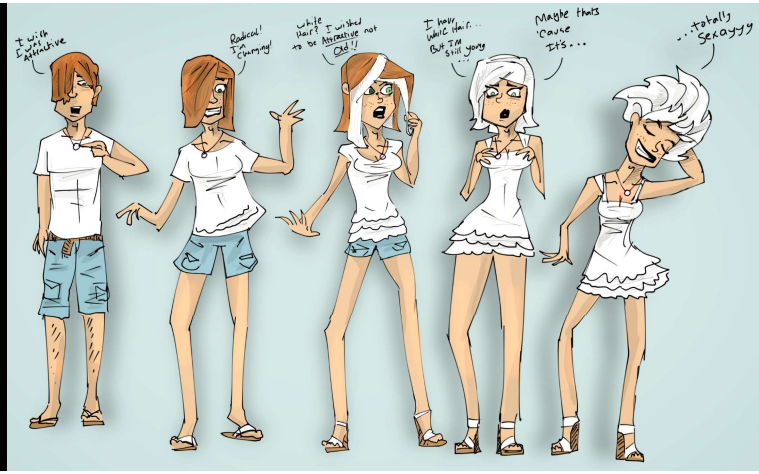
system	complex adaptive
focus behaviour	distrubance and reorganization, sustaining and developing
measurement	adaptability, transformability, learning, innovation
concepts	cross-scale dynamic interactions

Adaptability

is the capacity of the actors in a system to manage resilience.

Transformability

is the **capacity to create a fundamentally new system**
when the existing system is untenable
(Walker et al. 2004)



Social-ecological resilience

system	complex adaptive
focus behaviour	distrubance and reorganization sustaining and developing
measurement	adaptability, transformability, learning, innovation
concepts	cross-scale dynamic interactions


CHALLENGE ACCEPTED