Operationalising One Health

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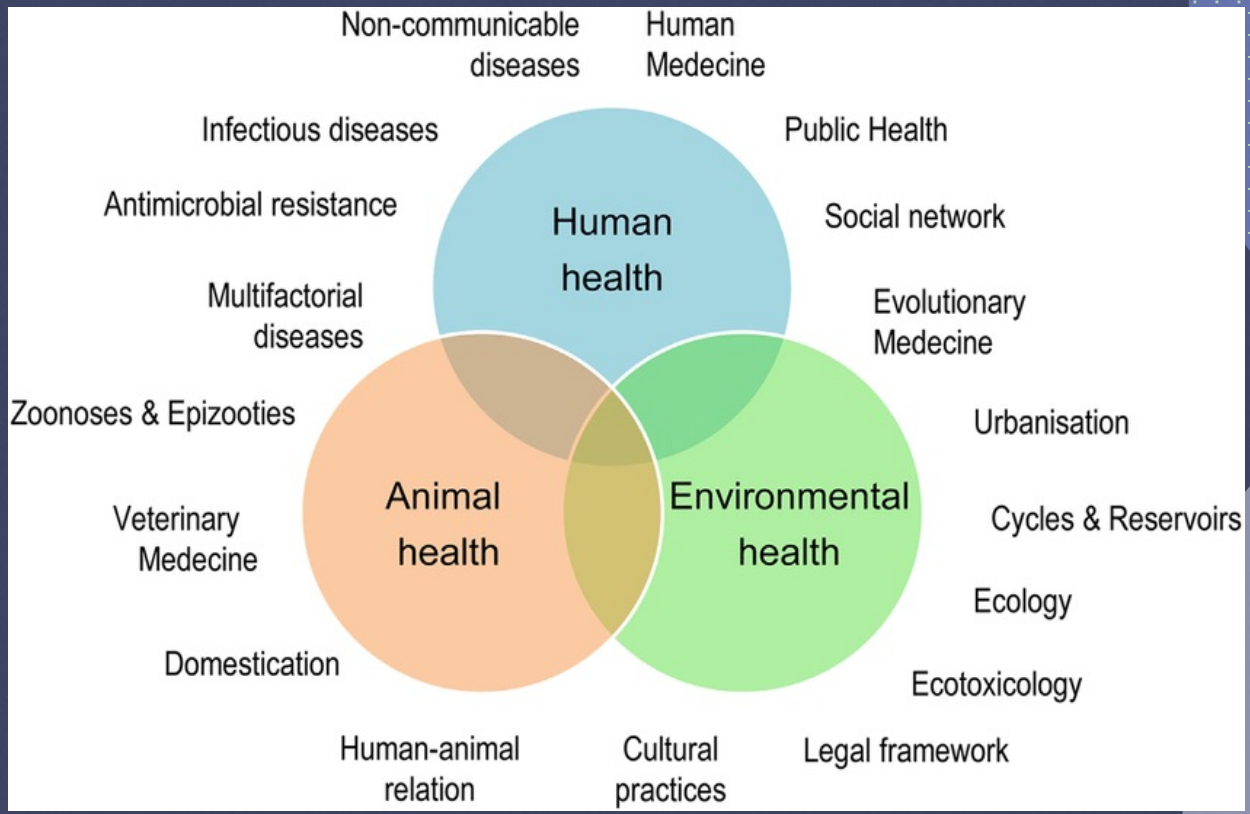
DIMES - Università di Bologna

One Health promotes multi-system perspective on health



Independent disciplines

Involves sequenced and focused content with discipline-based correlated ideas

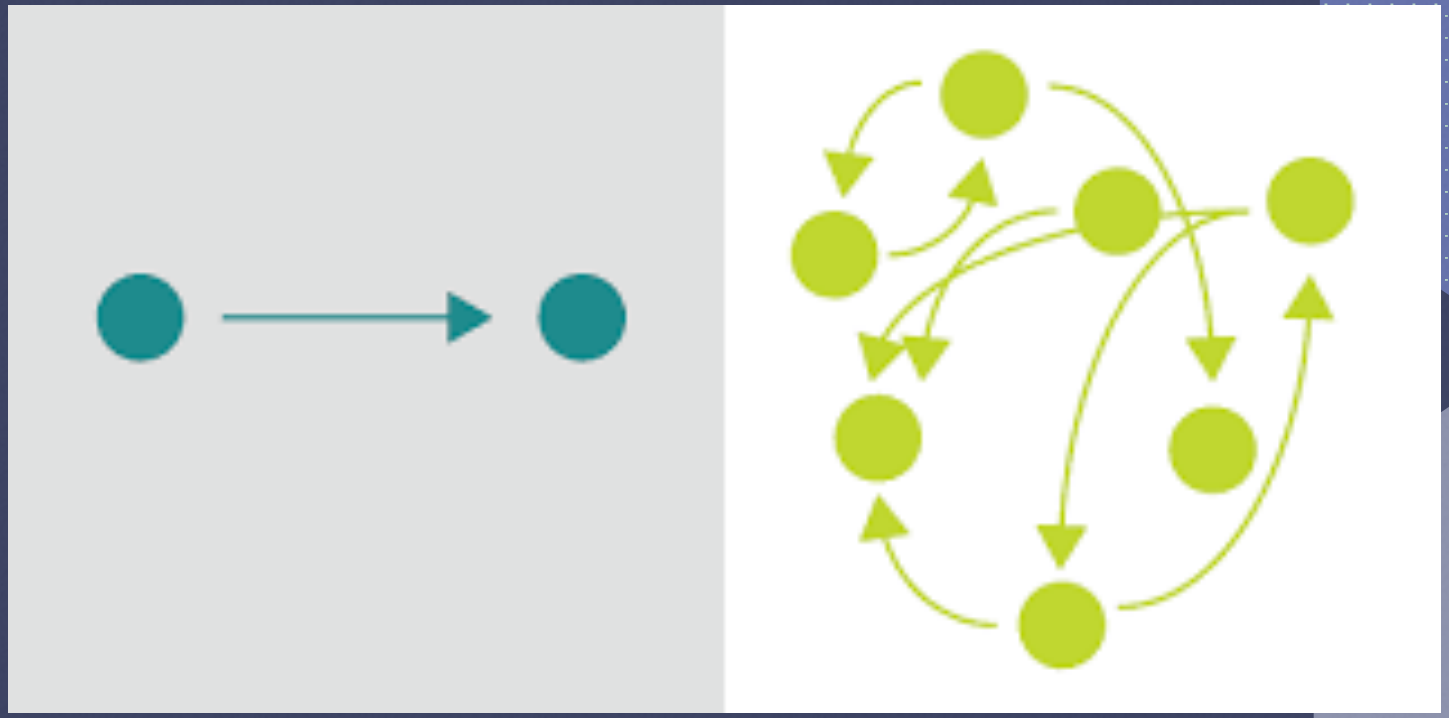
Multidisciplinarity

Contrasts disciplinarity perspectives in an additive manner, involving little interaction between disciplines

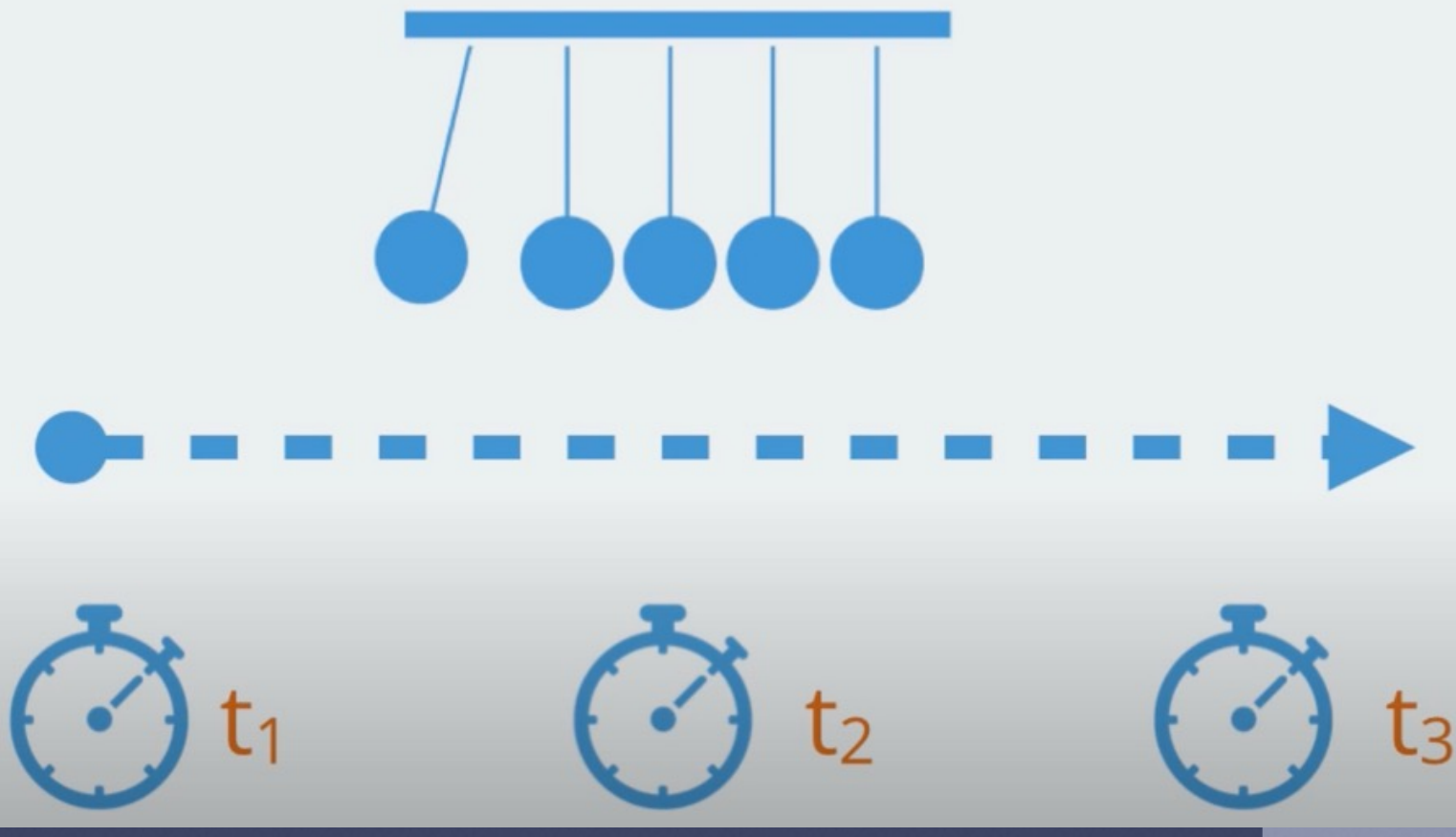
Interdisciplinarity

Combines two or more disciplines to a new level of integration, beginning to break boundaries

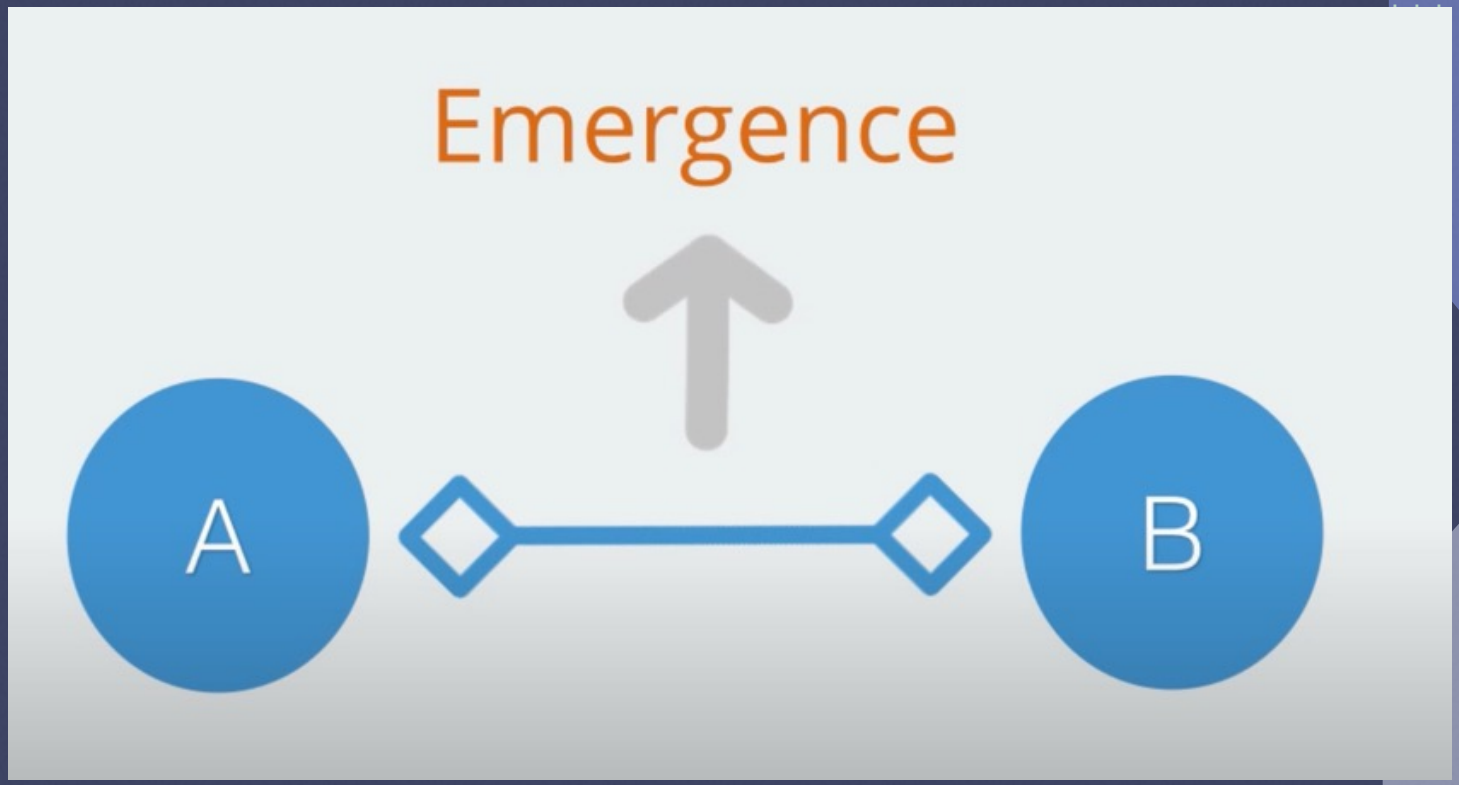
Linear thinking vs System Thinking

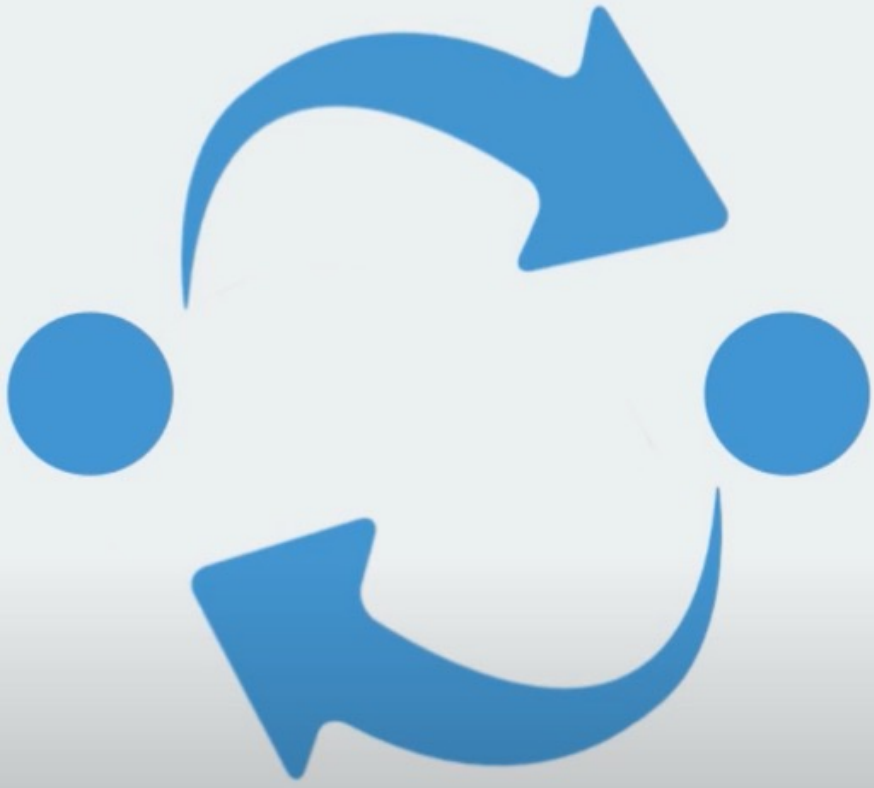


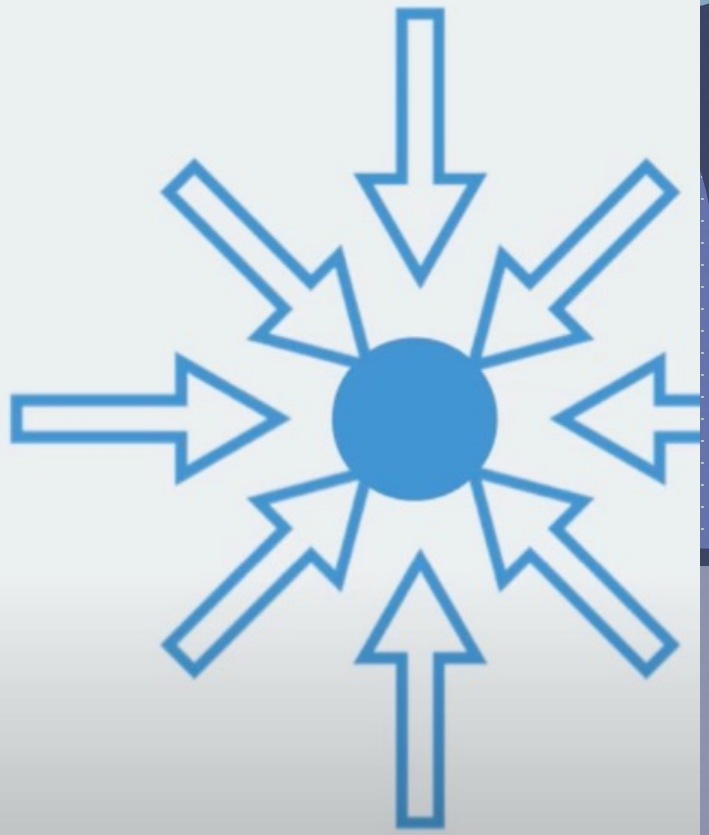
Linear causality (linear reductionist thinking)

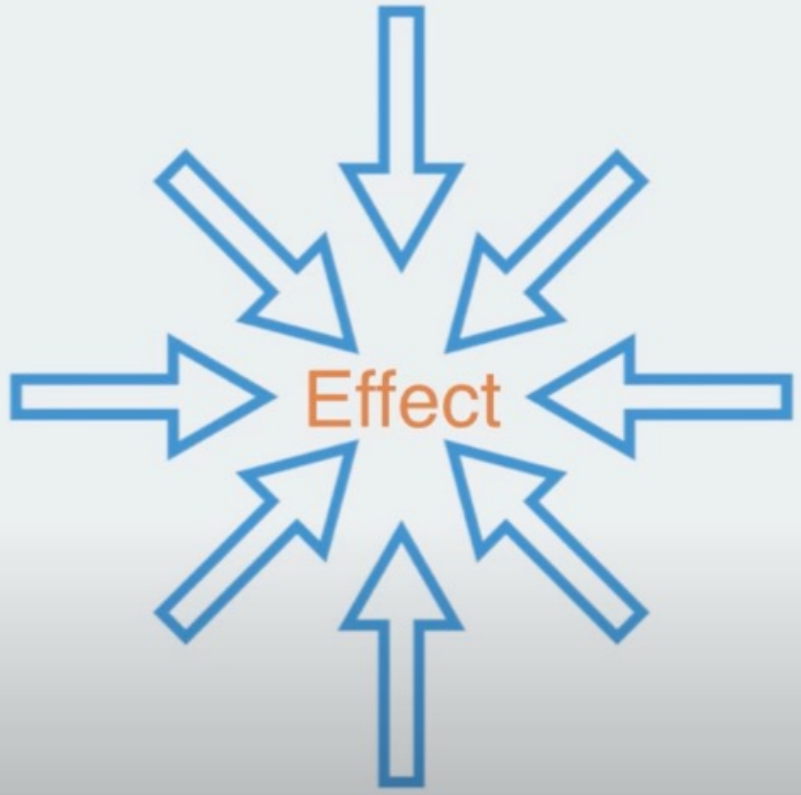

t1
t2
t3

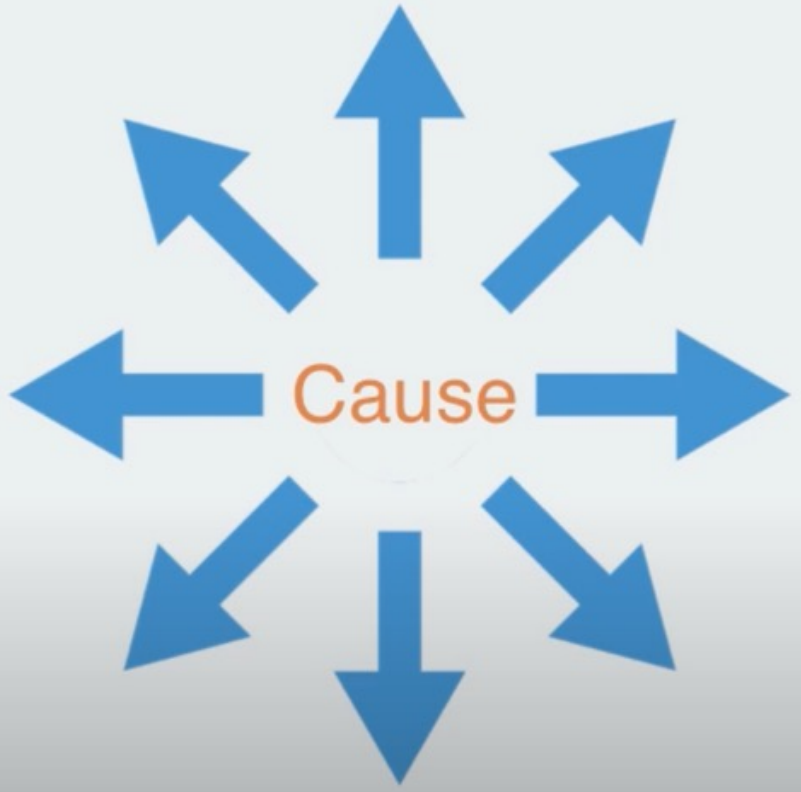
Non Linear causality (Systems thinking)





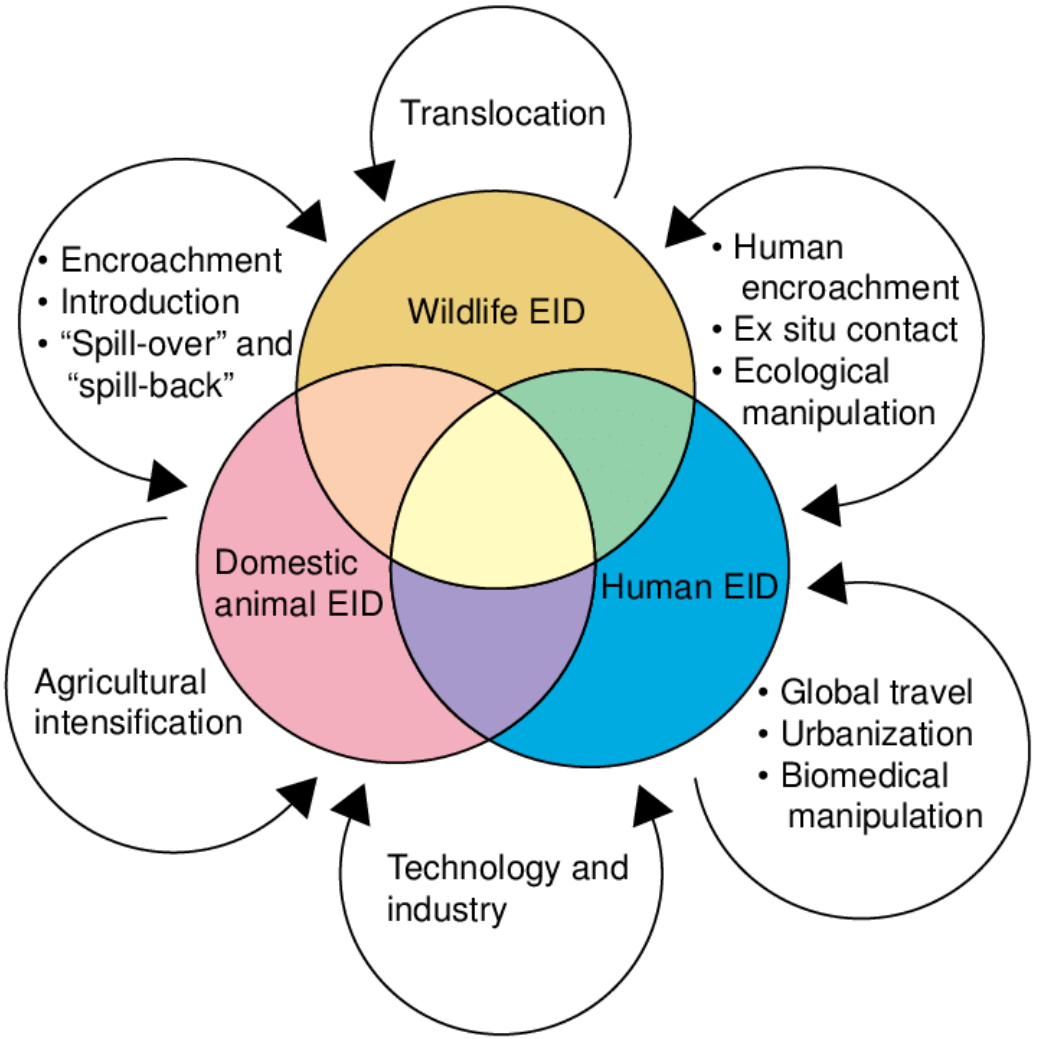



Effect


Cause

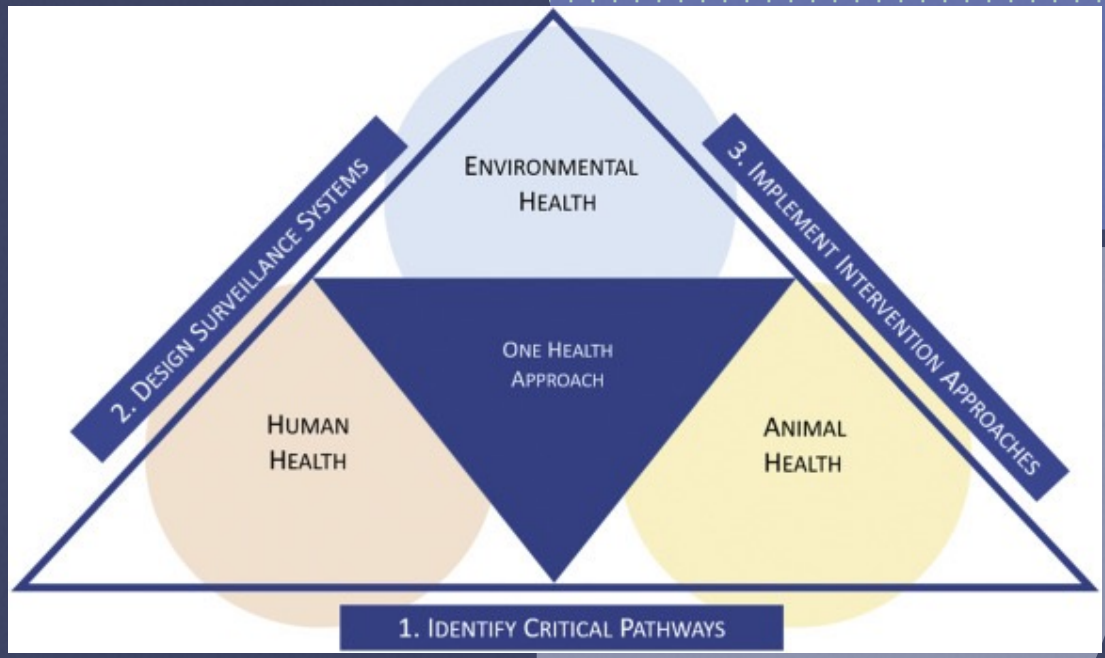
Determinism

Indeterminism

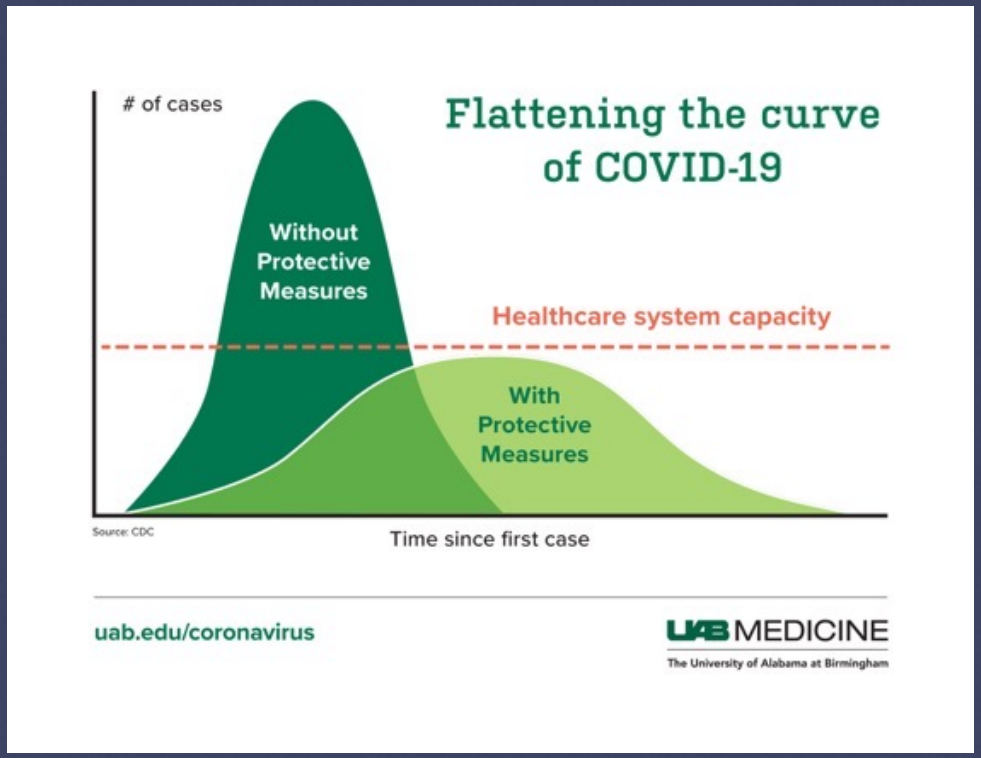

Translocation
• Encroachment
• Introduction
• "Spill-over" and "spill-back"
Wildlife EID
• Human encroachment
• Ex situ contact
• Ecological manipulation
Domestic animal EID
Human EID
Agricultural intensification
• Global travel
• Urbanization
• Biomedical manipulation
Technology and industry

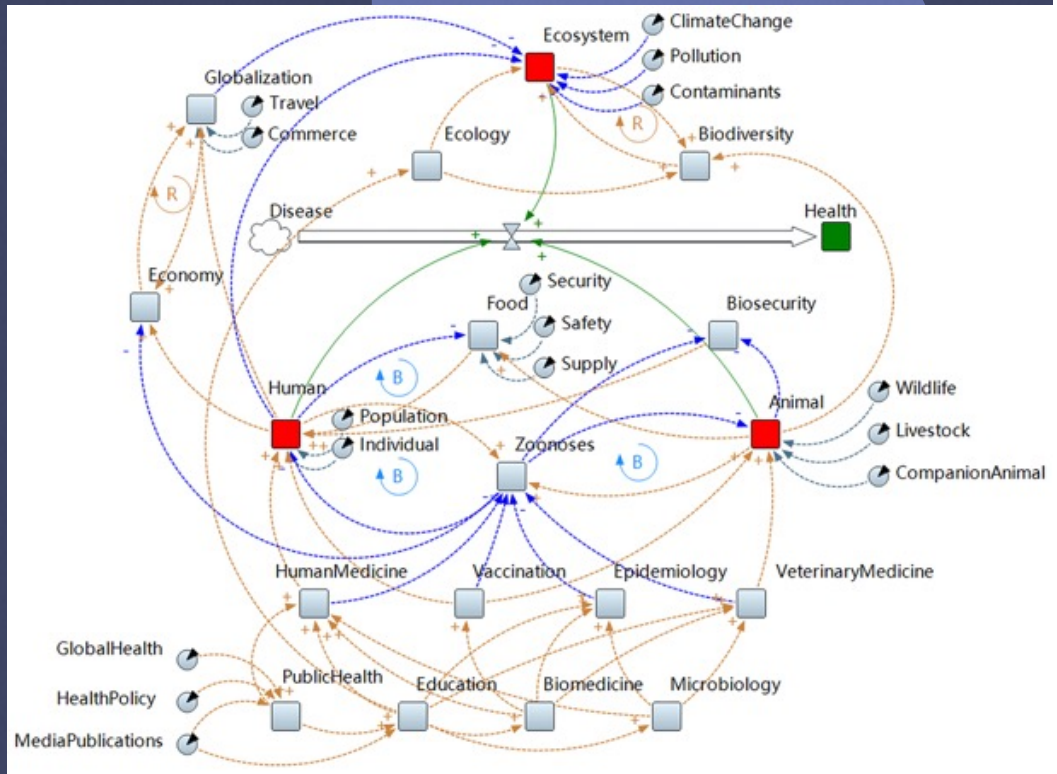
One Health paradigm shift

- From individual-diseased centred approach
- to integrated systems or community-based approach



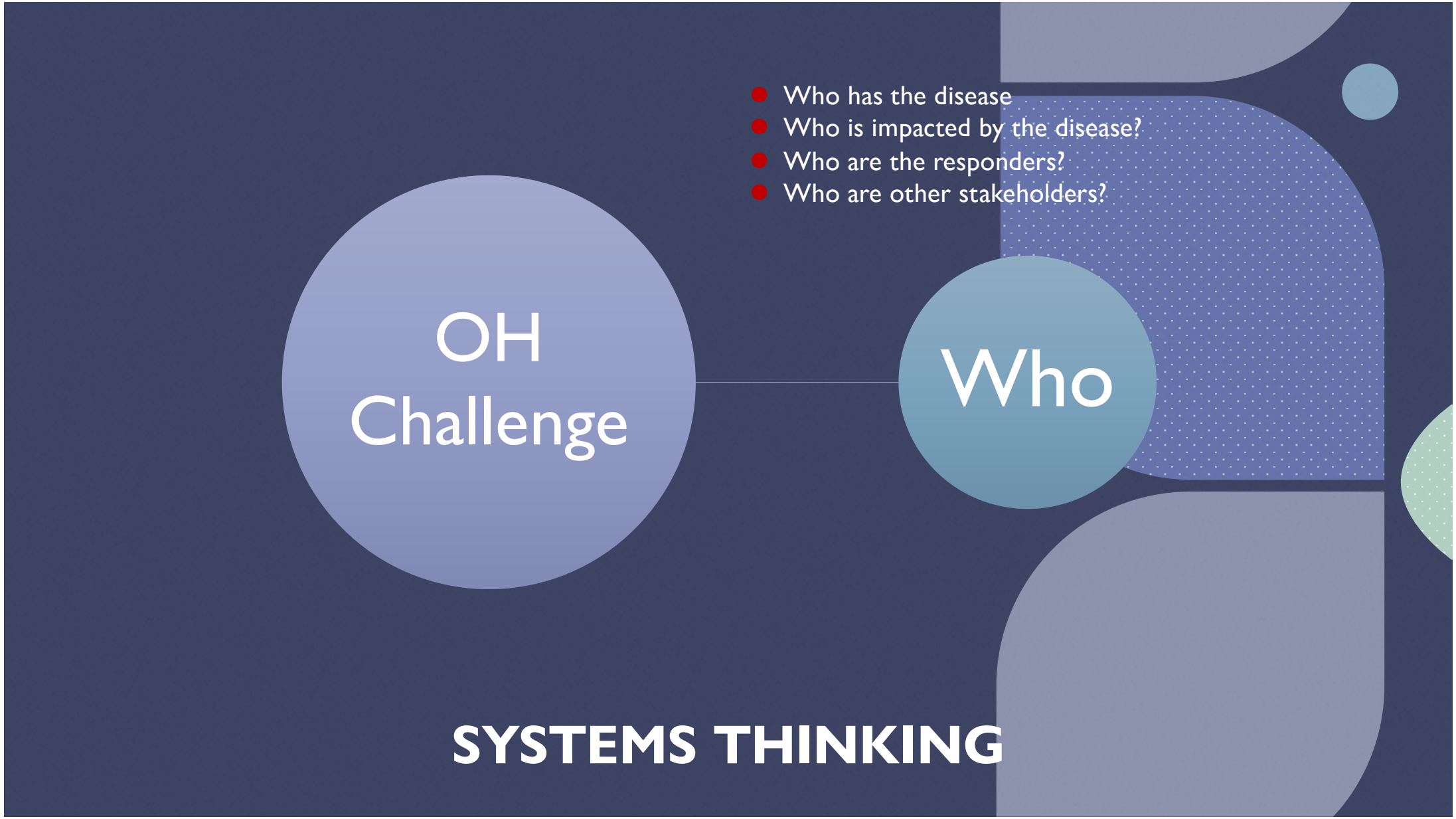
A systems Dynamic approach

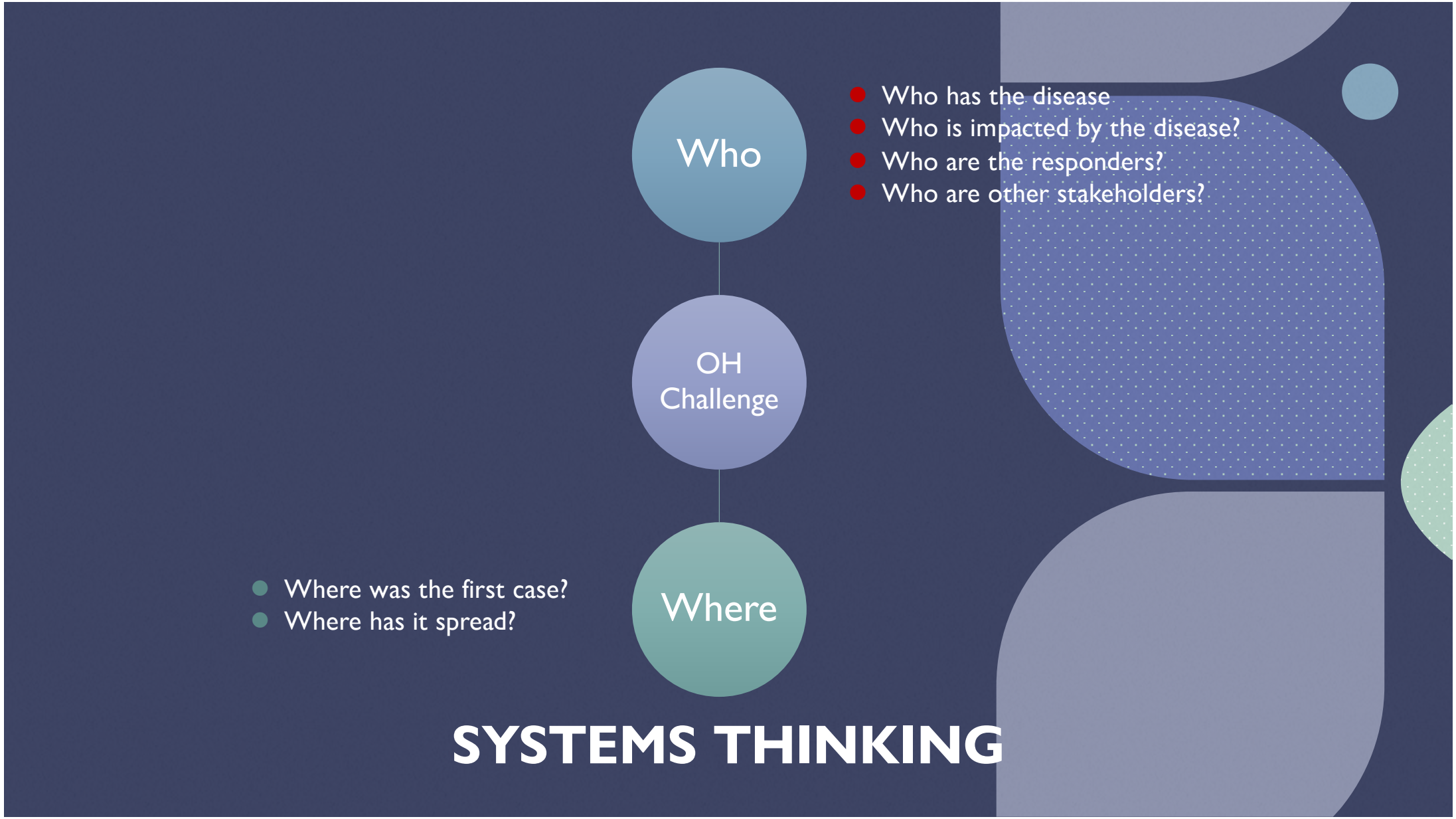


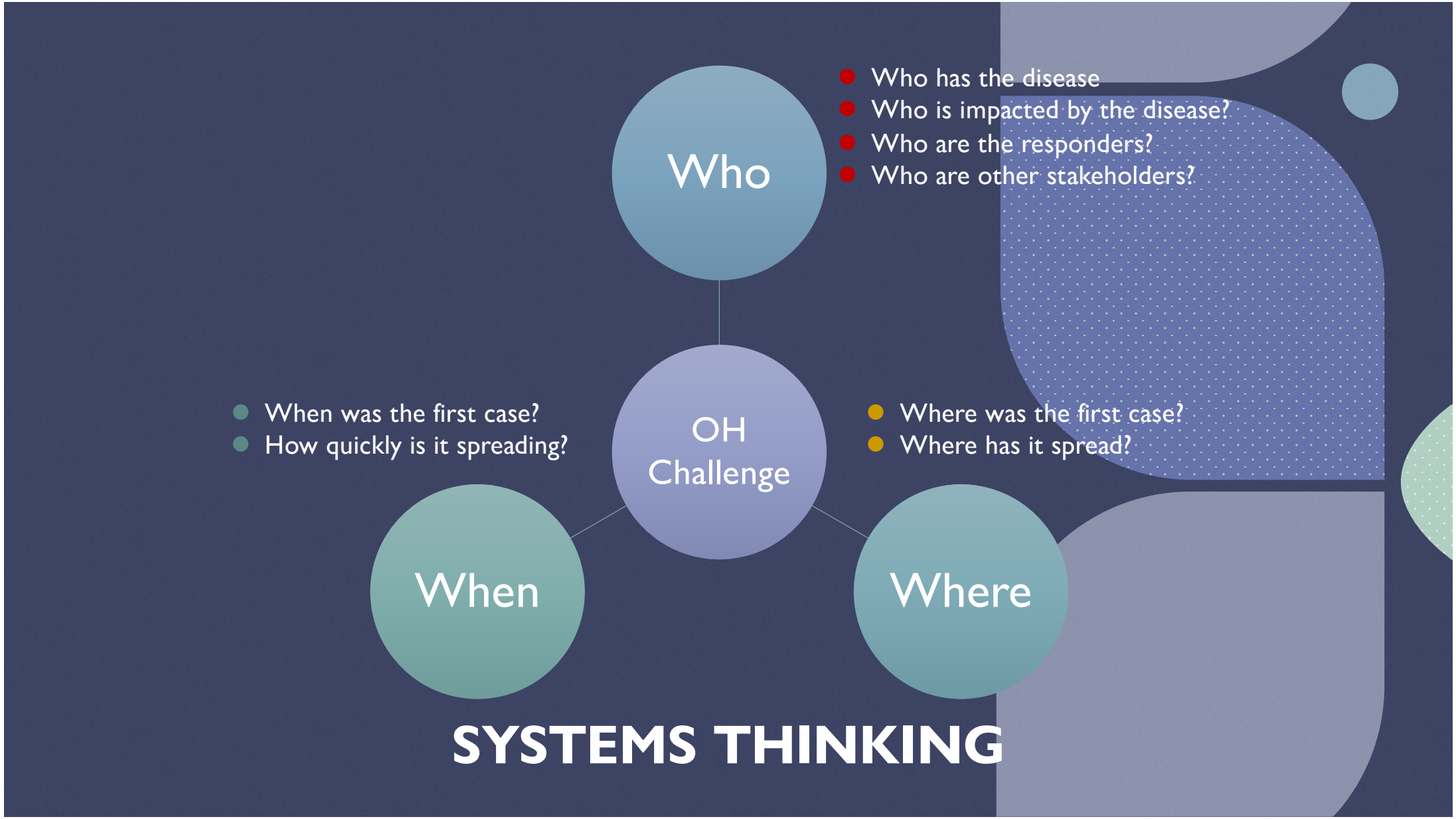


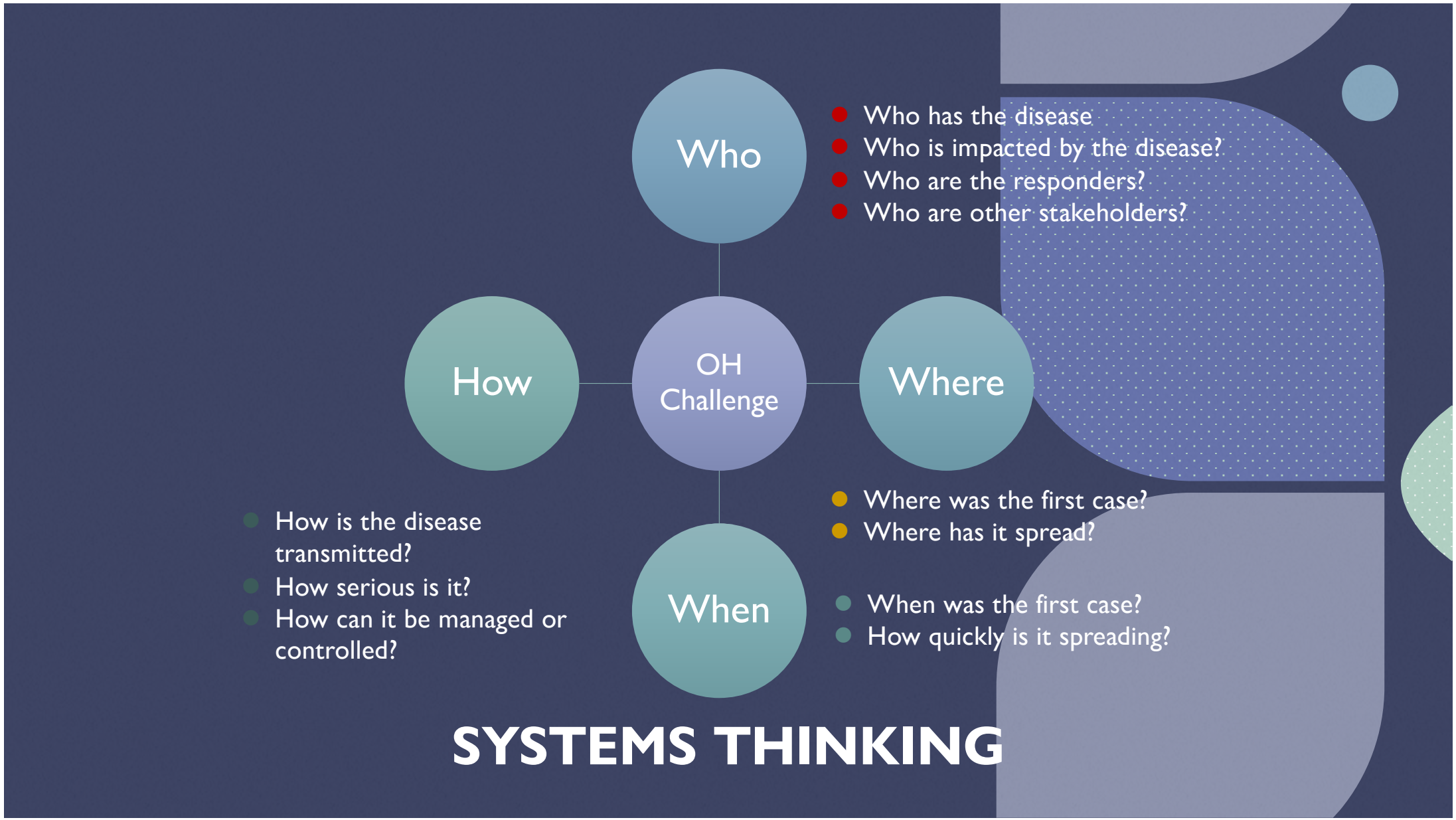
OH Challenge: EID

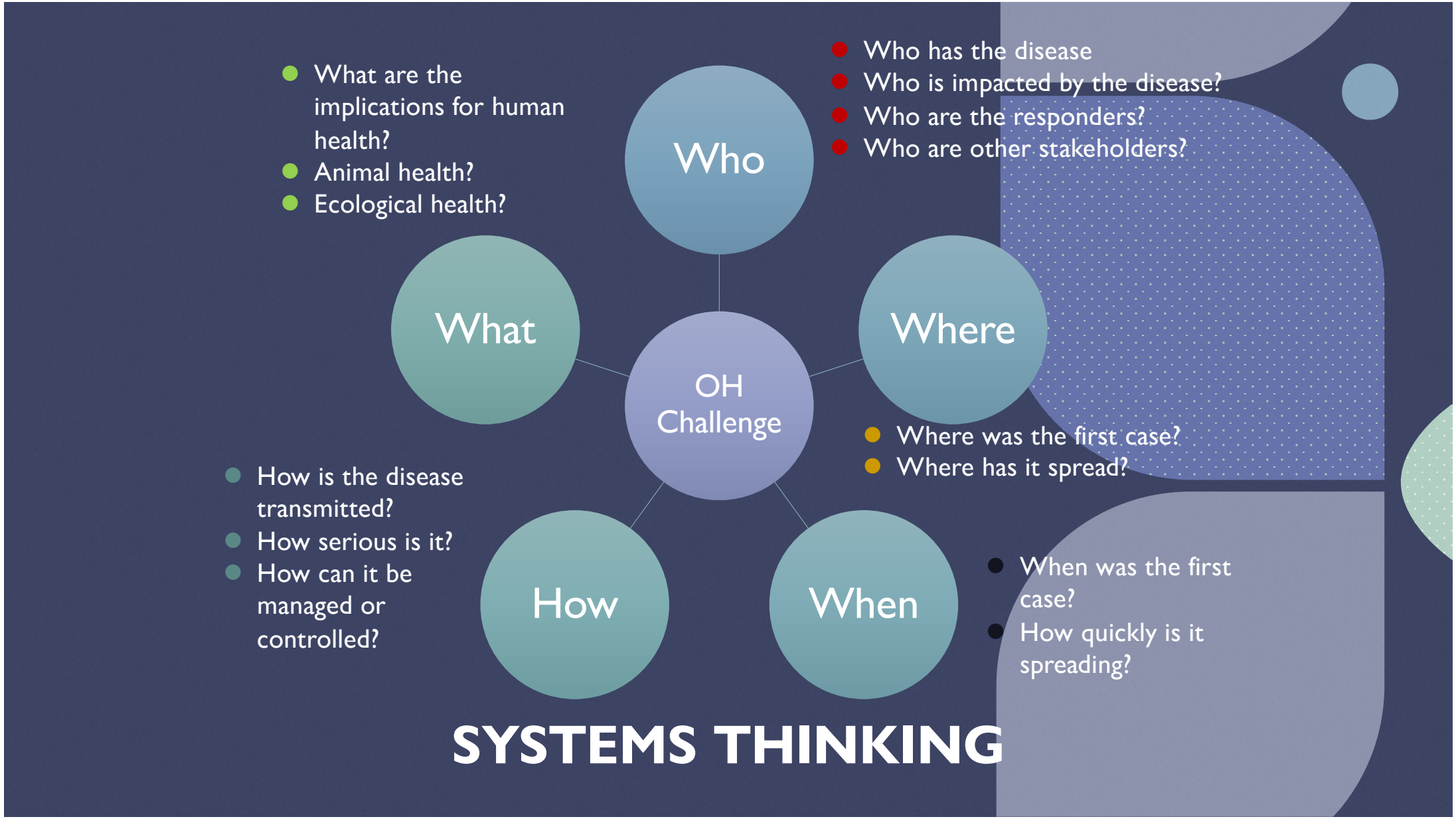
SYSTEMS THINKING

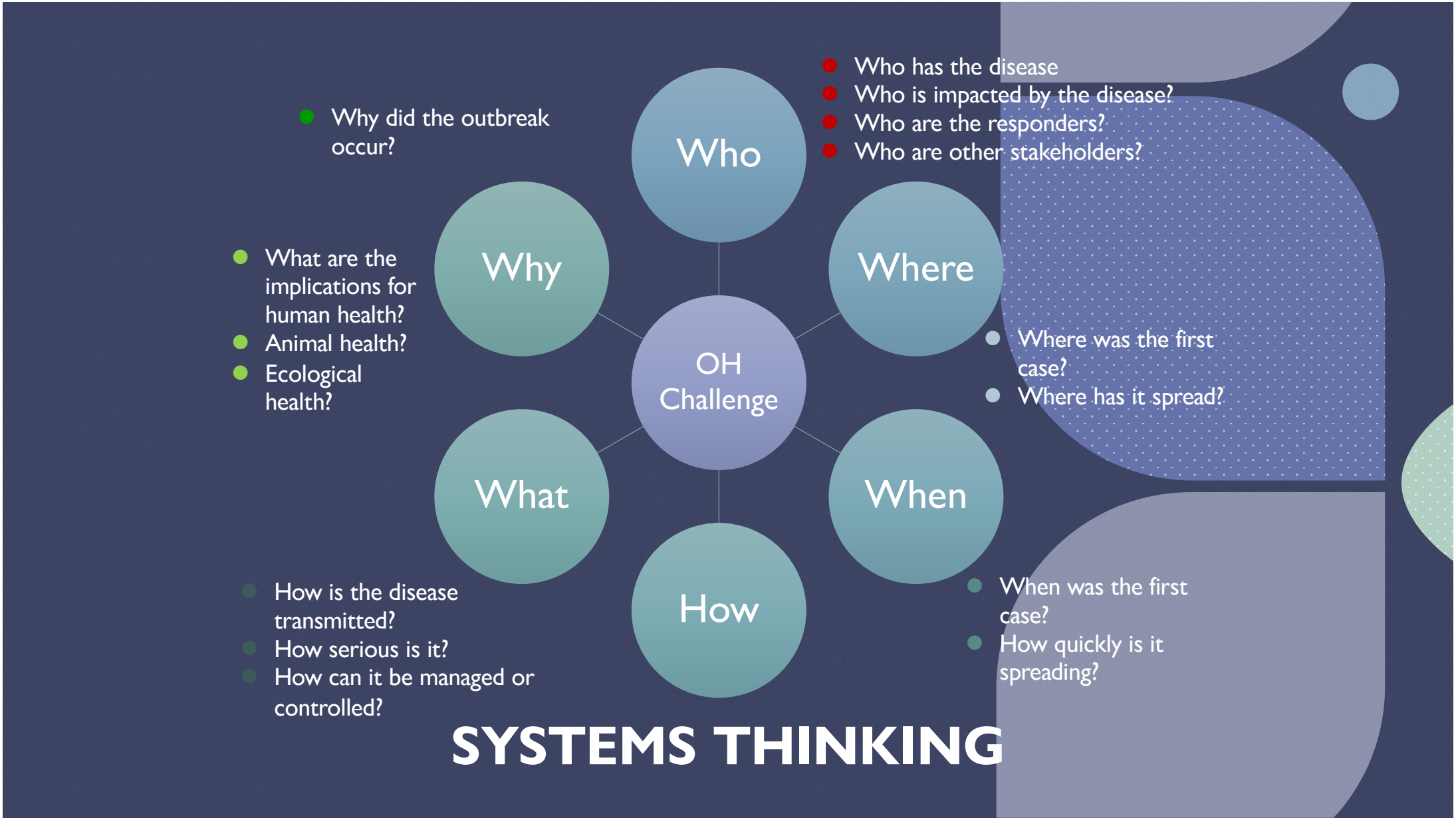

OH Challenge
Who
Who has the disease
Who is impacted by the disease?
Who are the responders?
Who are other stakeholders?
SYSTEMS THINKING

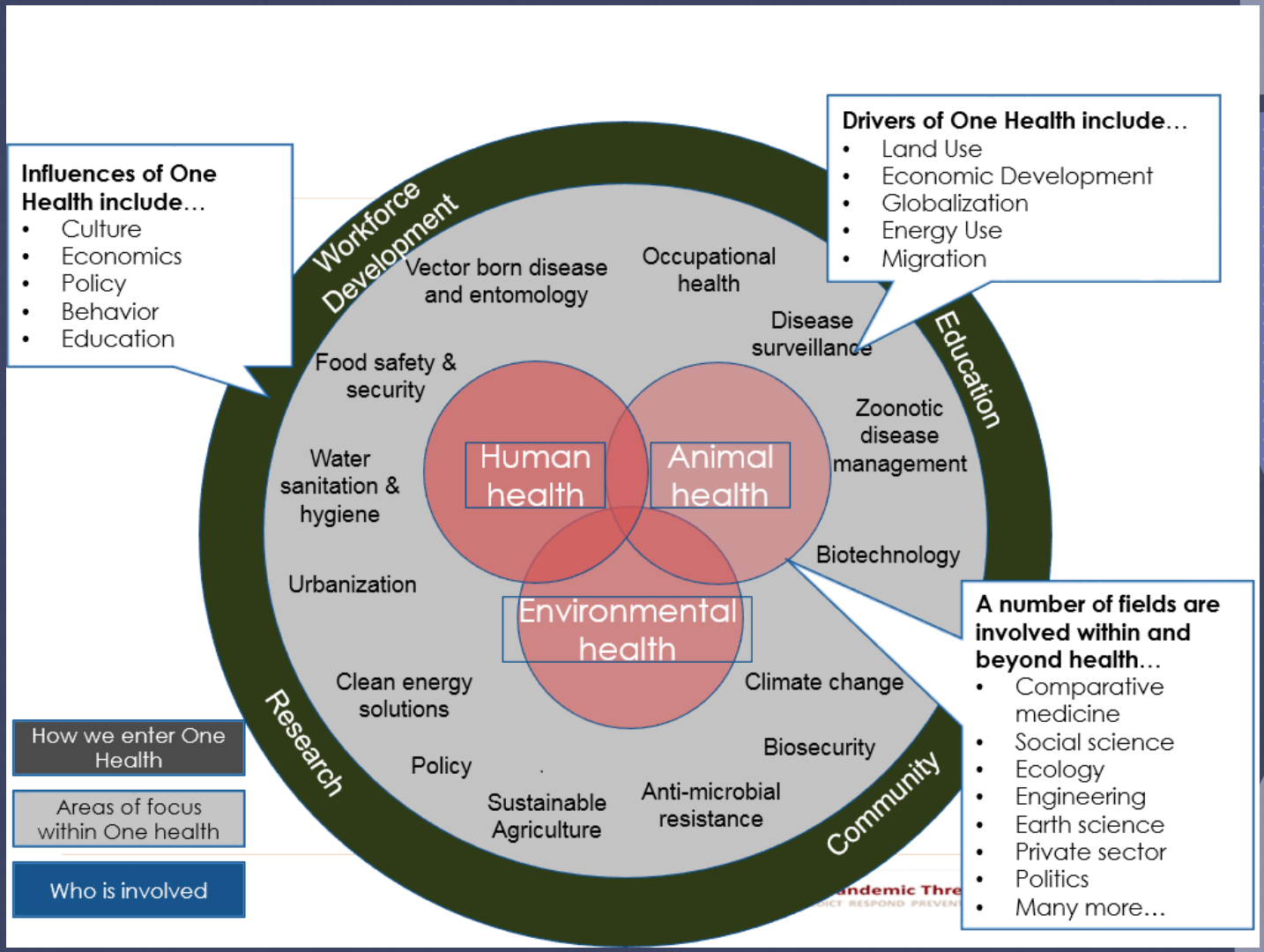

Who
Who has the disease
Who is impacted by the disease?
Who are the responders?
Who are other stakeholders?
OH Challenge
Where
Where was the first case?
Where has it spread?
SYSTEMS THINKING


Who
Who has the disease
Who is impacted by the disease?
Who are the responders?
Who are other stakeholders?
When was the first case?
How quickly is it spreading?
OH Challenge
Where was the first case?
Where has it spread?
When
Where
SYSTEMS THINKING


Who
Who has the disease
Who is impacted by the disease?
Who are the responders?
Who are other stakeholders?
How
OH Challenge
Where
How is the disease transmitted?
How serious is it?
How can it be managed or controlled?
Where was the first case?
Where has it spread?
When
When was the first case?
How quickly is it spreading?
SYSTEMS THINKING


Who
What
Where
OH Challenge
How
When
Who has the disease
Who is impacted by the disease?
Who are the responders?
Who are other stakeholders?
What are the implications for human health?
Animal health?
Ecological health?
Where was the first case?
Where has it spread?
How is the disease transmitted?
How serious is it?
How can it be managed or controlled?
When was the first case?
How quickly is it spreading?
SYSTEMS THINKING


Who has the disease
Who is impacted by the disease?
Who are the responders?
Who are other stakeholders?
Who
Why did the outbreak occur?
Why
What are the implications for human health?
Animal health?
Ecological health?
Where
Where was the first case?
Where has it spread?
OH Challenge
What
How is the disease transmitted?
How serious is it?
How can it be managed or controlled?
When
When was the first case?
How quickly is it spreading?
How
SYSTEMS THINKING



understanding the component elements of a system and how they are connected

to predict the way the system might behave in a given situation

Community based approach

Involving social scientists
Community members
Policy makers

To establish socially, economically, and environmentally sustainable and effective interventions

“If everyone is thinking alike, then somebody isn't thinking.”

Gen. George S. Patton

Ecosystems

- conventionally defined as distinct from human systems
- can be **viewed as coupled human-natural systems**
- **Can be described as Complex Adaptive Systems (CAS)**

Complex systems characteristics

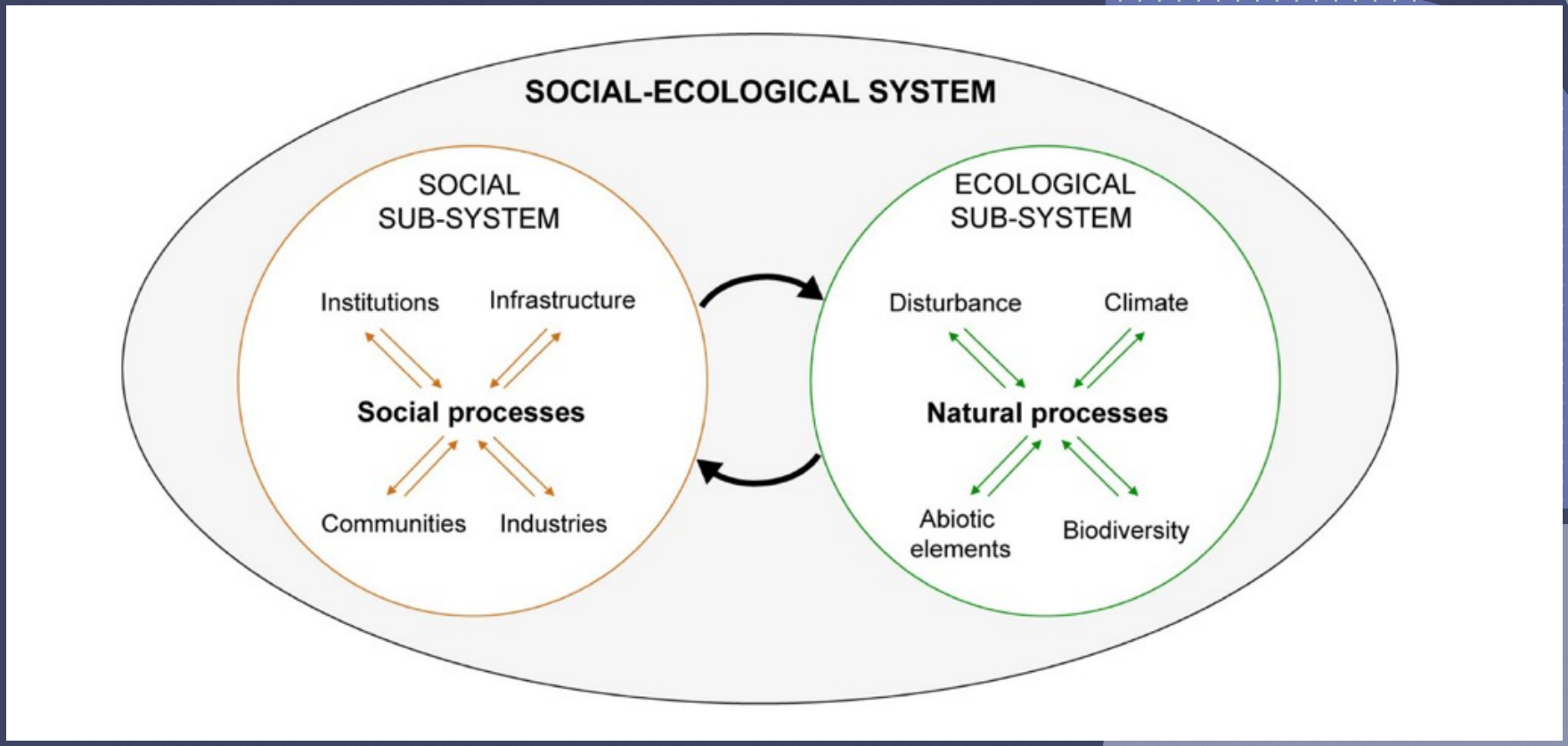
- complex processes often show **unpredictable behavior** since **synergistic effects** emerge by the **nonlinear combination of multiple inputs** in a system
- presence of multiple causality
- **Multiple inputs** are confluent in a **single output**.
- Need for System thinking

Complex behaviors

- Societies are paradigmatic examples as well as of and organizations such as health systems are no exception
- **Multiple causality** is often reinforced by phenomena related to **circular causality**
- **“effects” are fed back to modify “causes”** and information flow amongst different hierarchical levels on the system
-

its unique conception of resilience (SESR)

Social-Ecological Systems Theory

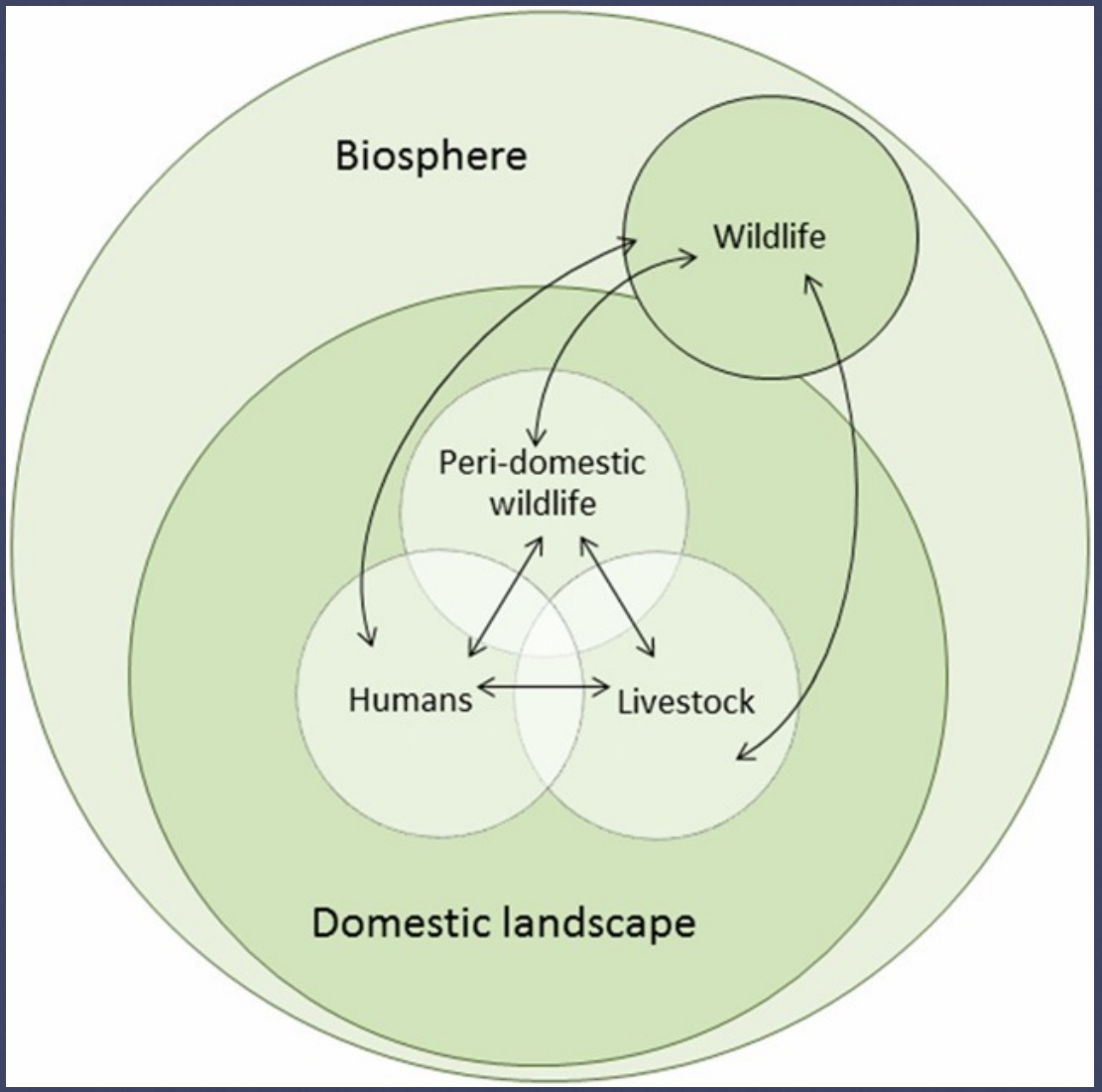


Social-Ecological Systems Resilience (SESR) for operationalising One Health

- SESR derives from **studies of ecosystem functioning** applied to environmental and sustainable resources management
- One Health focuses on problems at the human-animal-environment interface
- SESR is applicable to operationalize OH

Some basics:

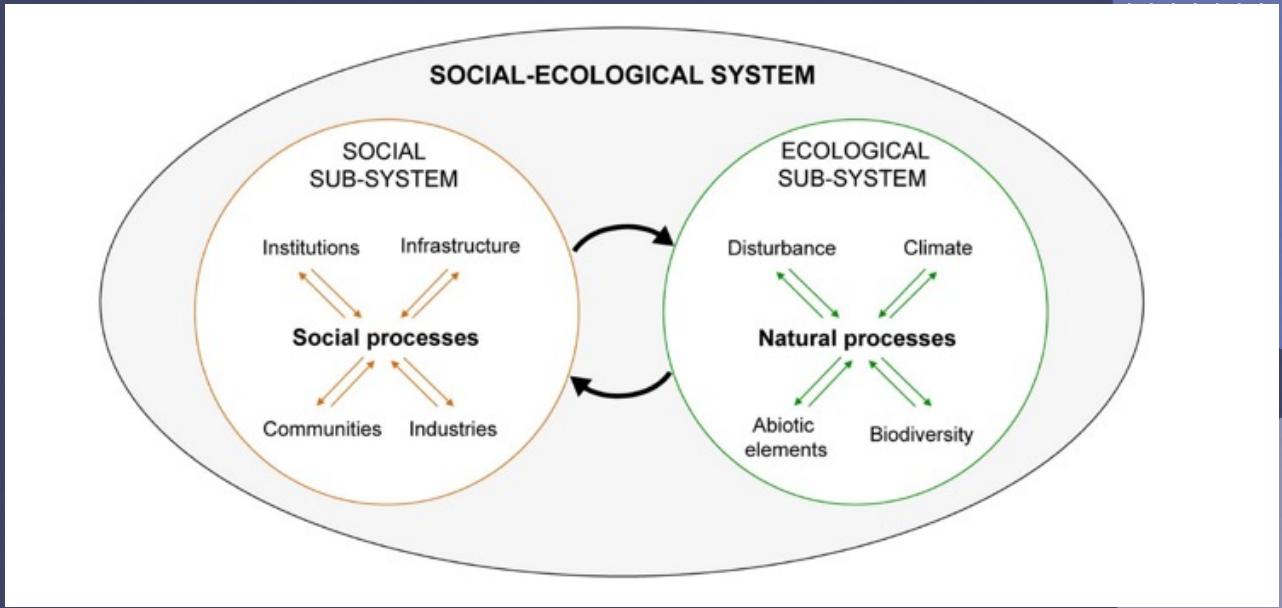
- CAS are far-from-equilibrium and exhibit non-linear dynamics and emergent properties (e.g., disease emergence).
- **They are predictably unpredictable**.....despite human intention
- intervention programs become part of the system further adding to their complexity and potential unpredictability



human—animal—environment CAS are always changing
(always have and always will)
they are effectively moving targets from a management standpoint

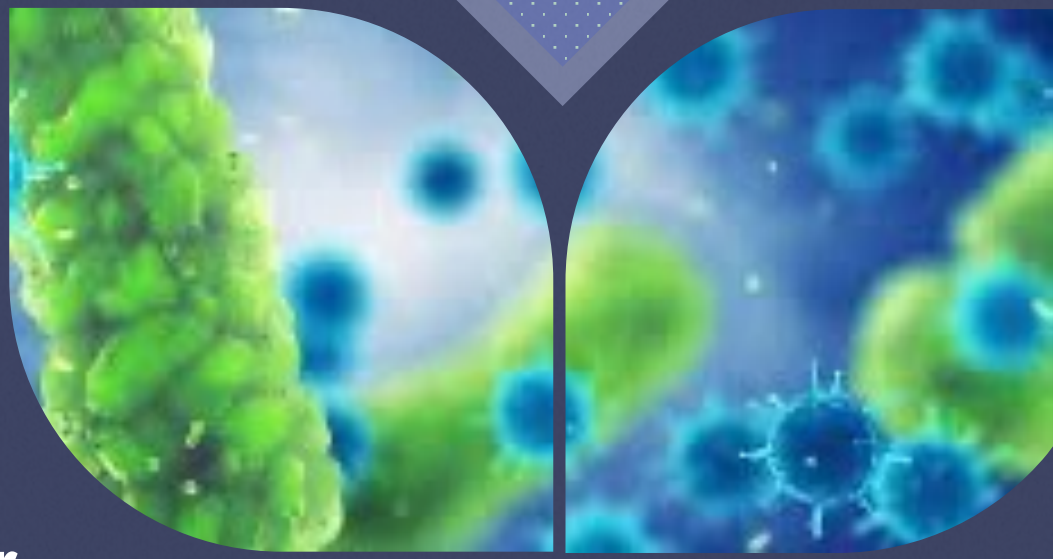
Social Ecological Systems conception

human nature relationship, is that **humans impacting nature or vice versa** not an ongoing **co-adaptive** (or maladaptive on the part of society) dynamic.



SESR views the ecological and social subsystems as reciprocally linked by numerous interacting components

- Parasites and pathogens are an integral but largely invisible component of social-ecological systems
- Their dynamics are undergoing dramatic due to human-induced changes.
- Visible alterations **in terms of landscape change**
- **less visible through pesticides and other chemicals e.g antimicrobials**



Core elements of SESR Theory

"resilience"

"adaptive management"

The policy and management responses typically are top-down and aimed at the control of ecosystem elements (e.g., vectors or parasites).

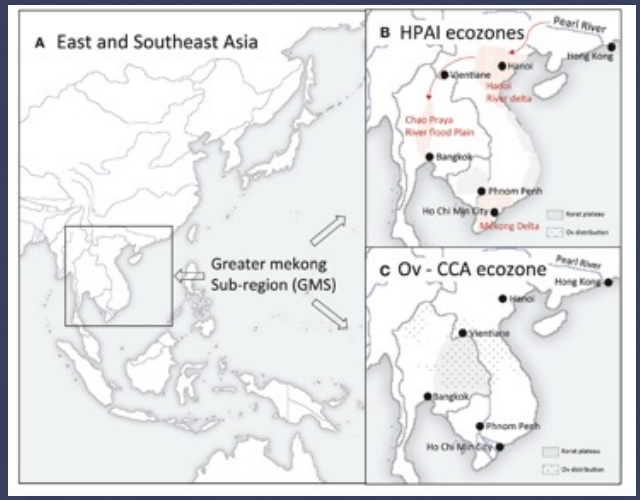
These can be beneficial in the short-term but may erode resilience in the long term.

Leading to social ecological system pathology with a loss of resilience and sustainability

Adaptive management

Ecosystem Management is SESR.

human-animal-environment
SESR management



E.g For zoonotic diseases

HUMAN-NATURAL SYSTEM'S HIERARCHICAL ORGANIZATION CONSIDERING CROSS-SCALE INTERACTIONS IN PLANNING AND MANAGEMENT

IDENTIFICATION OF **KEY SOCIAL (INSTITUTIONAL)** AND **RELEVANT NATURAL SYSTEM COMPONENTS** (E.G., VECTORS AND THEIR HABITATS),

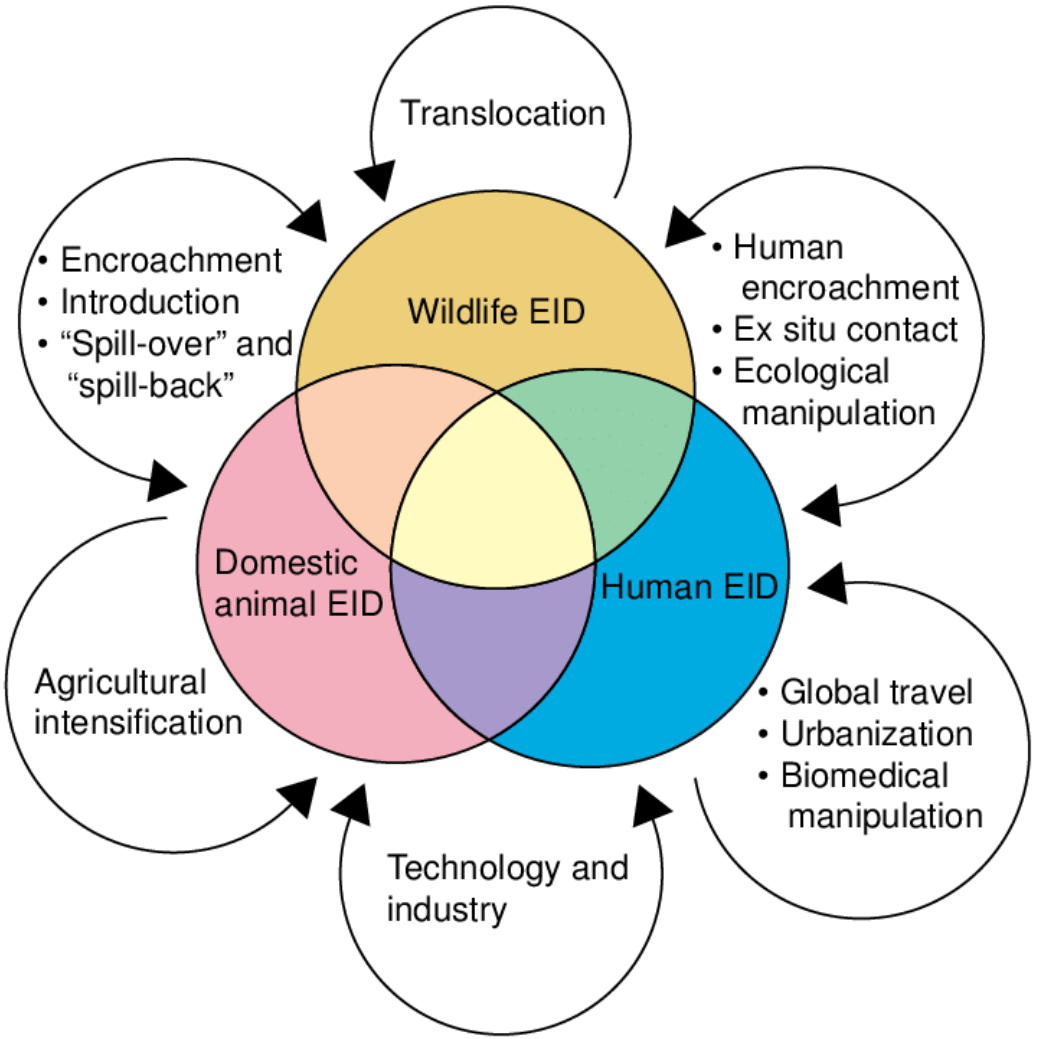
ECOLOGICAL INTERACTIONS

POSSIBLE OUTCOMES (E.G., THE RESPONSE OF HOST-PATHOGEN-ENVIRONMENT COMPLEXES TO INTERVENTIONS AND VICE VERSA)

Biomedical academic training and practice in clinical, laboratory, and even farm settings, tends to engrain a **linear, reductionist way of thinking**

This framework gives elegant mathematical explanations to several infectious disease dynamics and interventions es smallpox and rinderpest eradication

This approach failed to manage recent global emerging zoonotic disease crisis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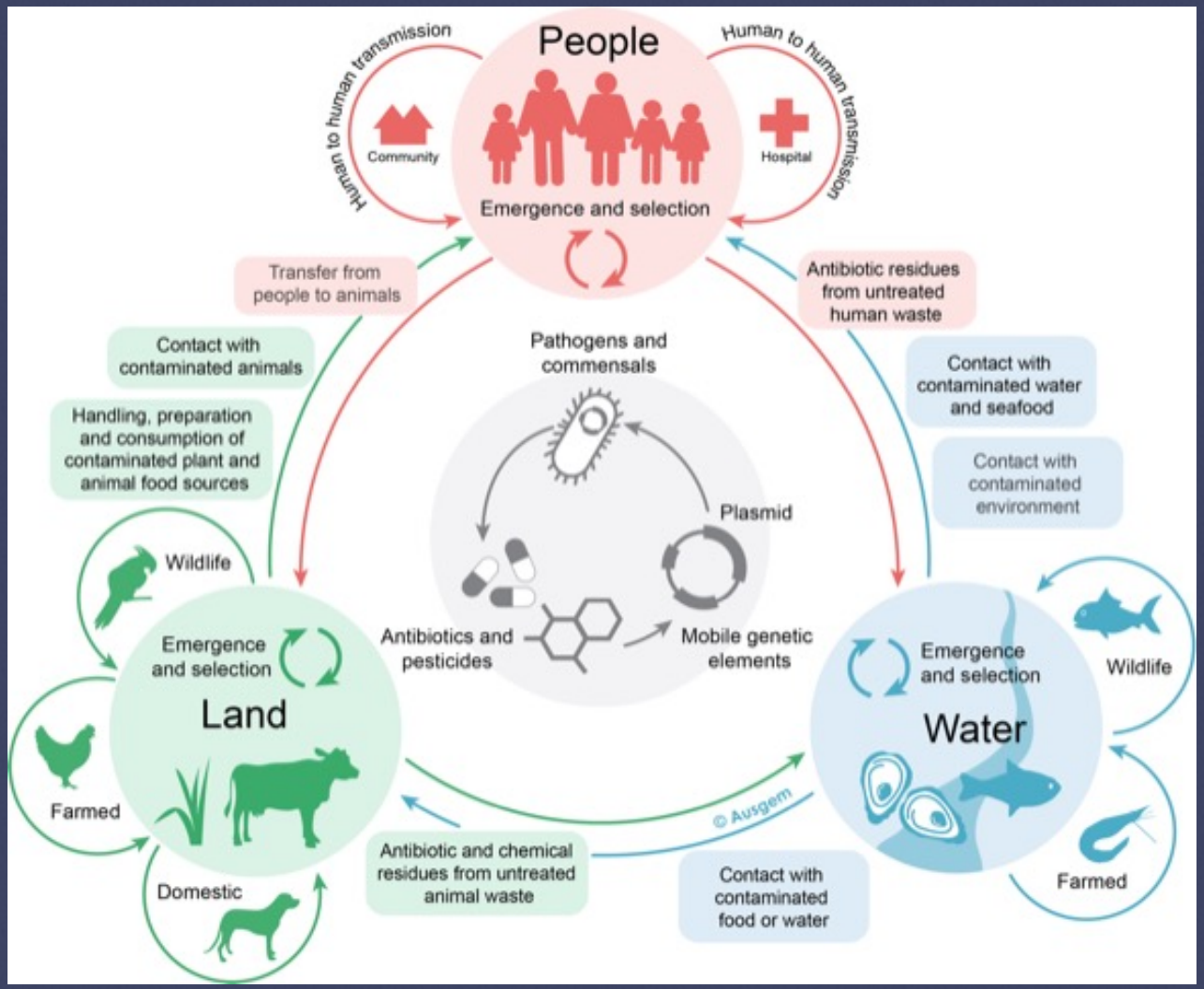
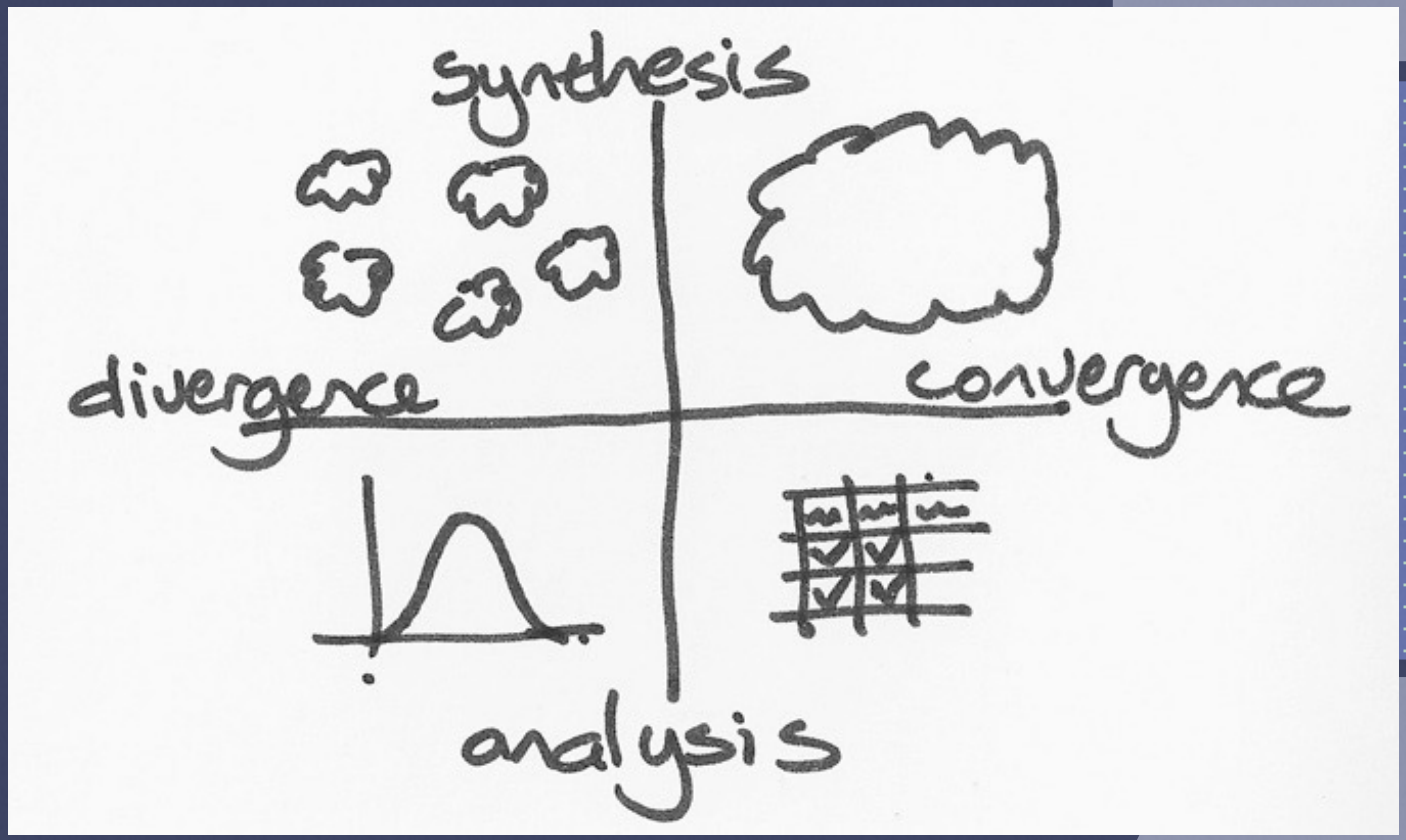
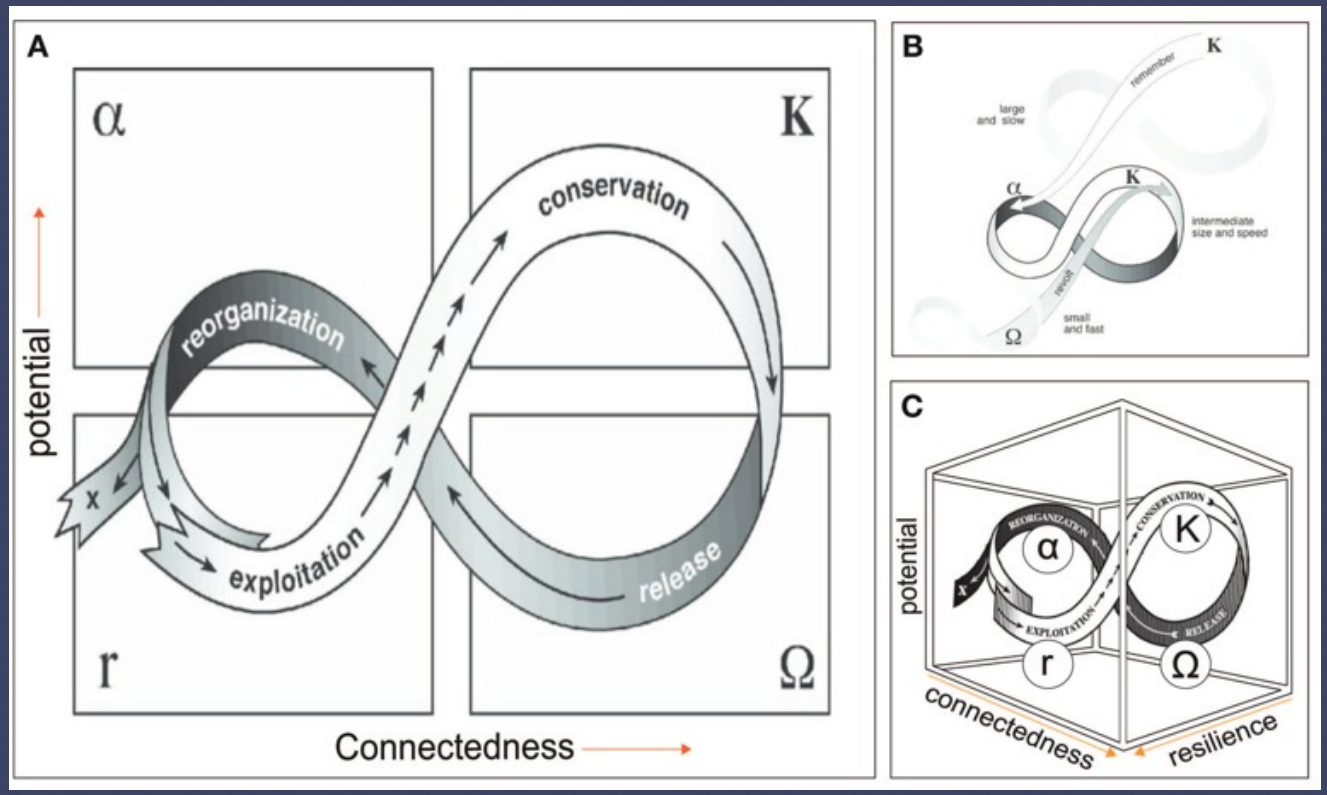

People
Human to human transmission
Community
Hospital
Human to human transmission
Emergence and selection
Transfer from people to animals
Antibiotic residues from untreated human waste
Contact with contaminated animals
Pathogens and commensals
Contact with contaminated water and seafood
Handling, preparation and consumption of contaminated plant and animal food sources
Contact with contaminated environment
Plasmid
Wildlife
Antibiotics and pesticides
Mobile genetic elements
Emergence and selection
Land
Emergence and selection
Water
Wildlife
Farmed
Farmed
Domestic
Antibiotic and chemical residues from untreated animal waste
Contact with contaminated food or water
© Ausgem

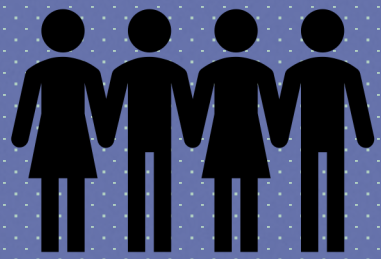


Wicked problems need multiple kinds of thinking.

http://world.edu/wp-content/uploads/2012/05/divergence.jpg

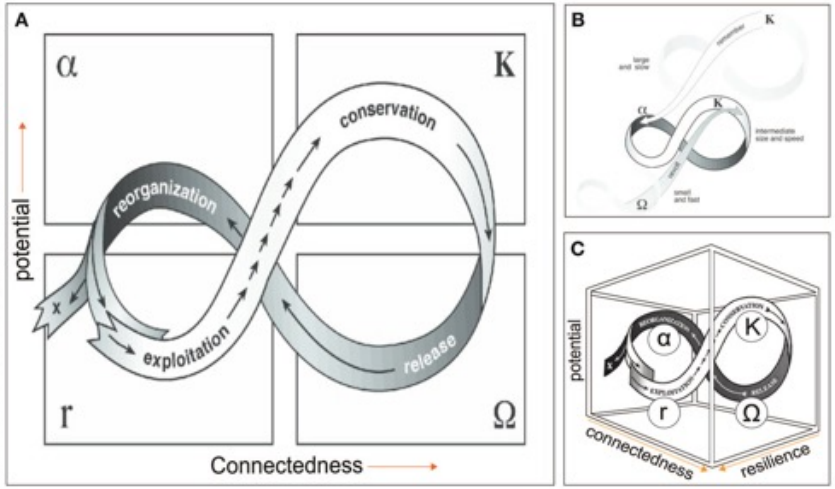
SESR's adaptive cycle metaphor





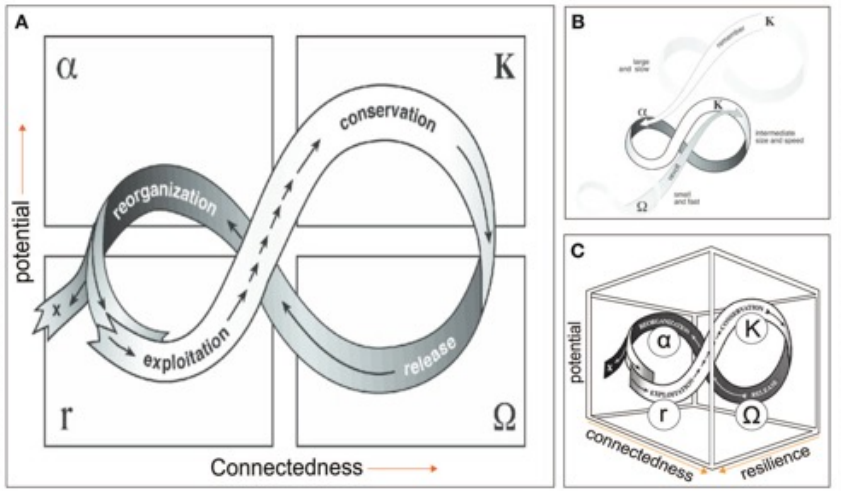
Human is a controller of natural system
Part of the system and problem
At the same time

- **natural rhythms of change**
- amplitude and frequency determined by **internal processes**
- rhythms alternate periods o organization and stasis and f reorganization and renewal
- **determining ecosystem productivity and resilience across scales**



2 major phases (or transitions)

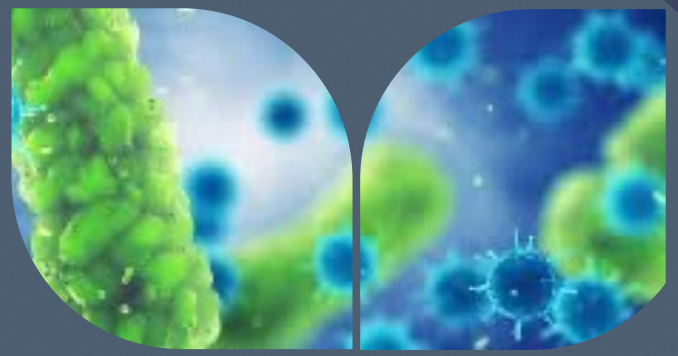
- Slow incremental phase of growth and accumulation
- Rapid phase of reorganization (the back loop) leading to the system's renewal, or possibly a "flip" to a new stability domain.
- **Regime Shift** mean that a threshold has been reached following which a social-ecological system "collapses"

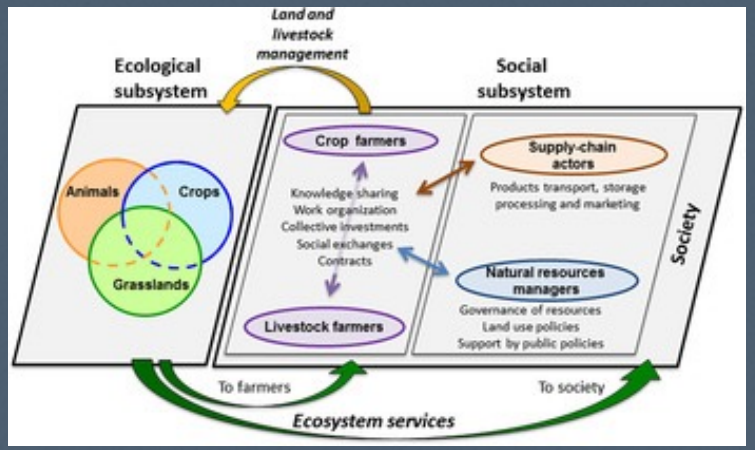


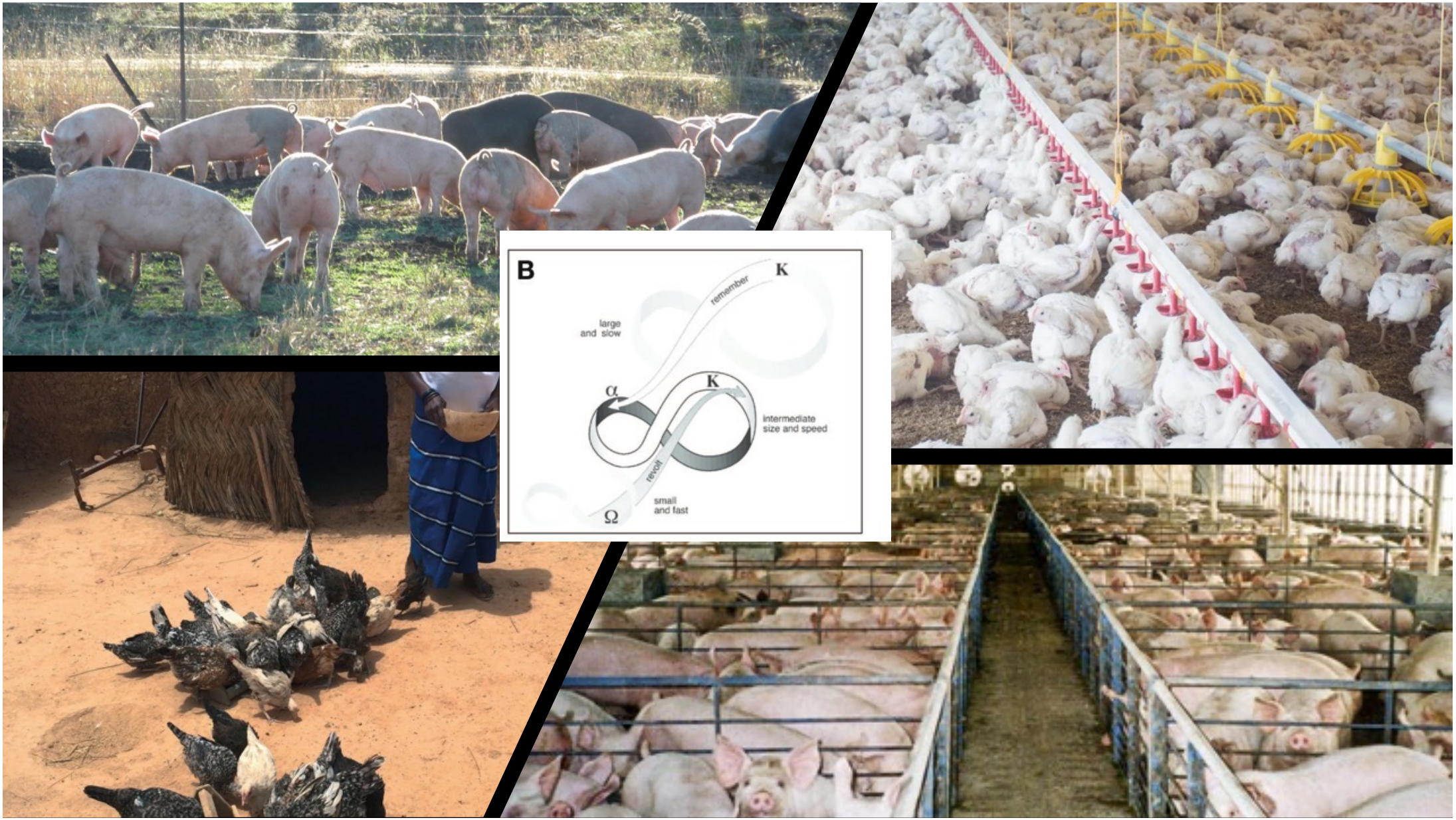
- E.g industrial intensification of agricultural production and food supply

this transformation involve:

- changing land use and land cover,
- **increased chemical inputs**

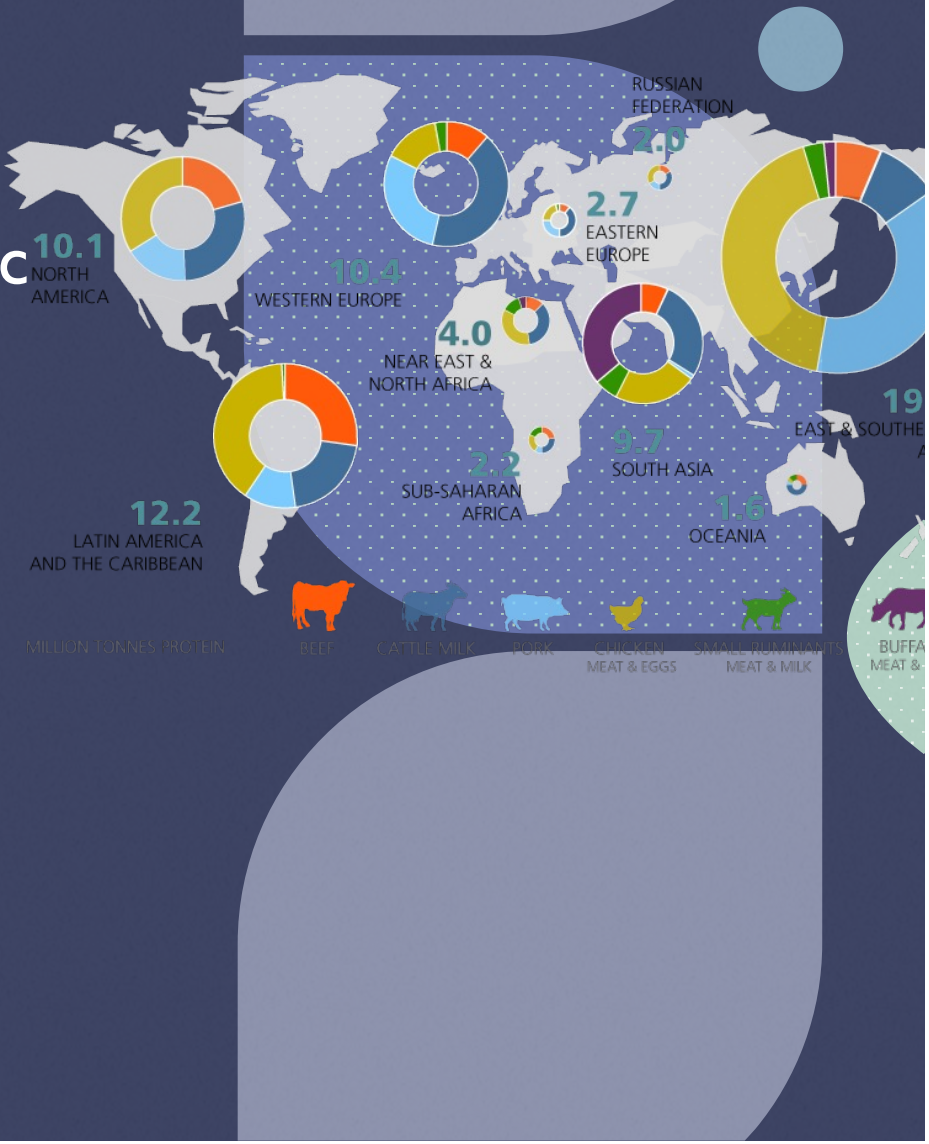


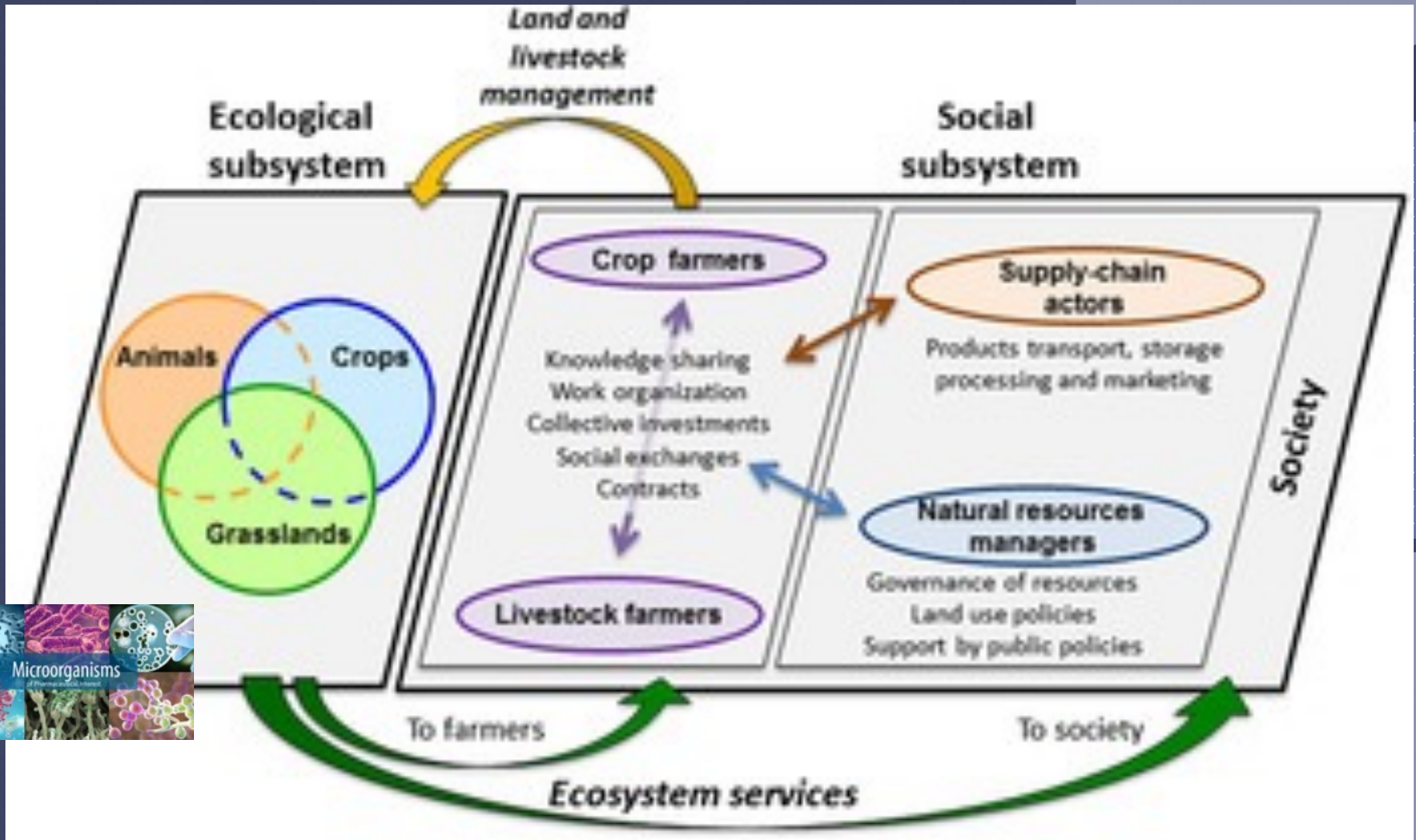



B
remember
K
large
and slow
α
K
intermediate
size and speed
revolt
small
and fast
Ω

- In these systems:

- Incremental phase: increased economic growth
- Exploitation phase **reinforce the belief in the intensification approaches**
- The success breeds confidence and continues even when effectiveness beg**ins to wane**

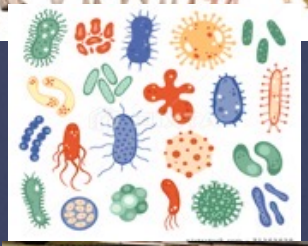



Land and livestock management
Ecological subsystem
Social subsystem
Animals
Crops
Grasslands
Crop farmers
Knowledge sharing
Work organization
Collective investments
Social exchanges
Contracts
Livestock farmers
Supply-chain actors
Products transport, storage processing and marketing
Natural resources managers
Governance of resources
Land use policies
Support by public policies
Society
To farmers
To society
Ecosystem services

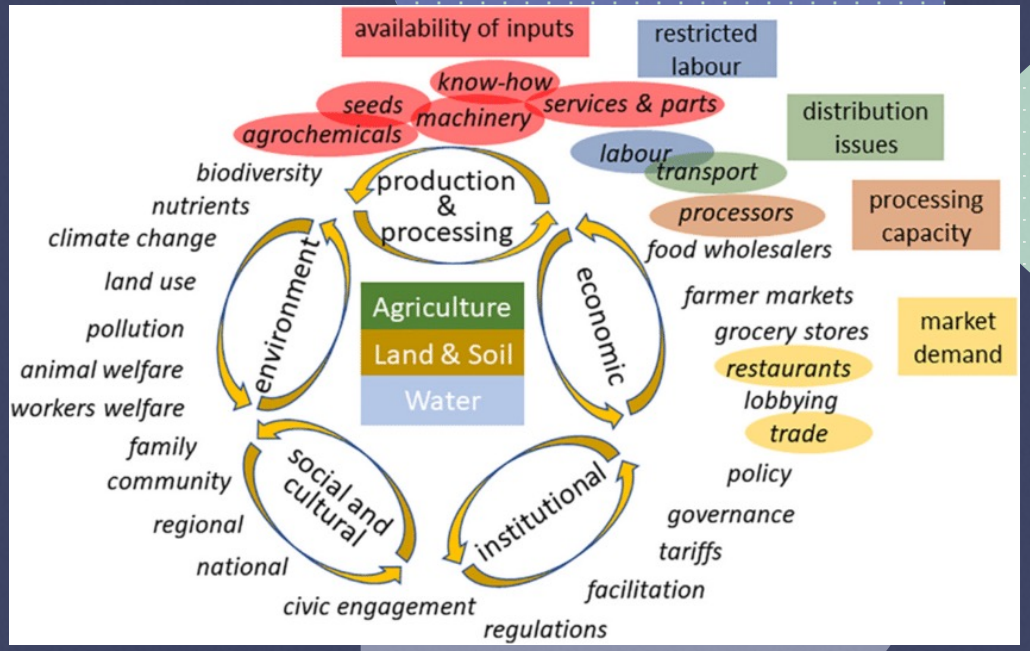
Microorganisms

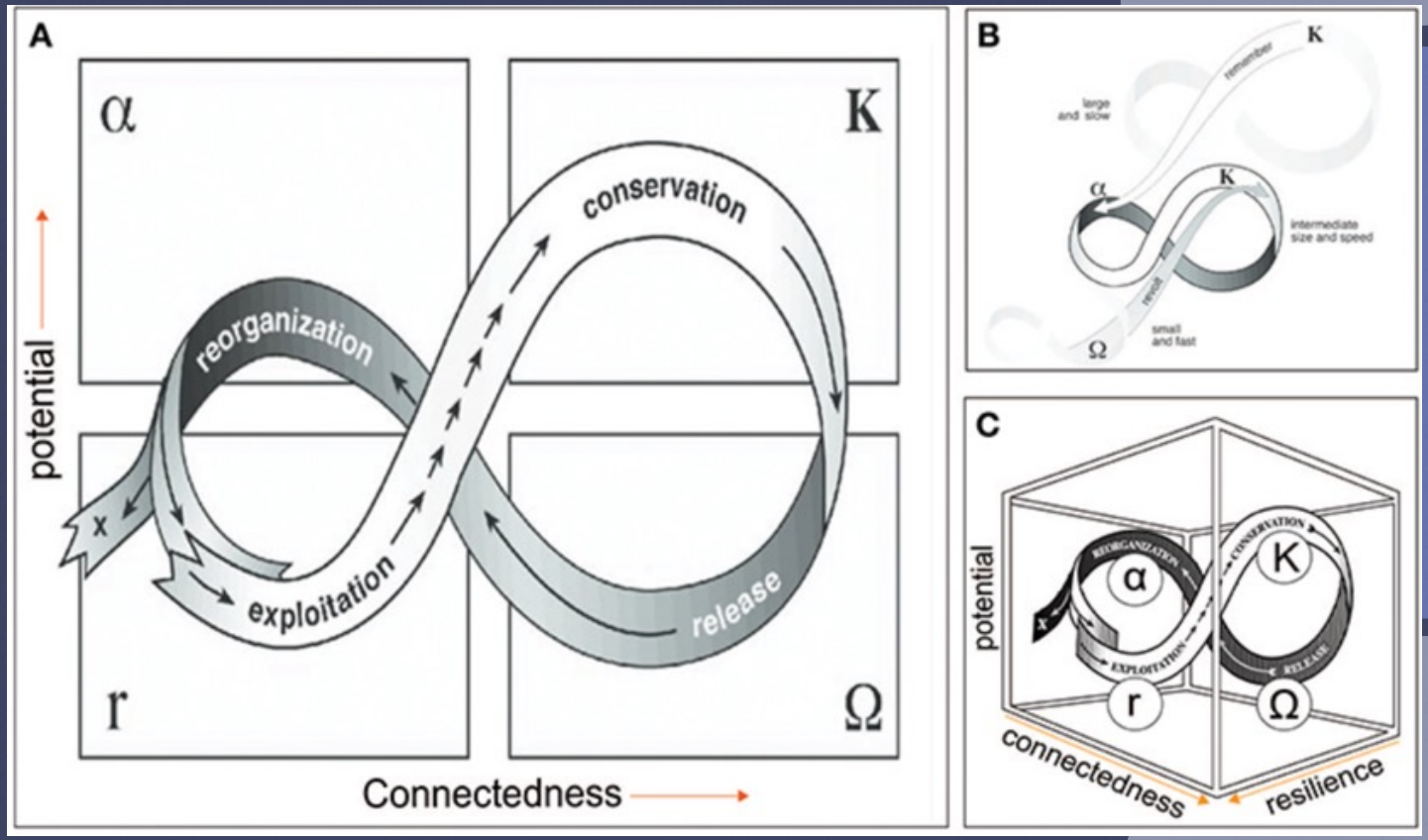
- Release phase represents the crisis stage is reached
- the system becomes unprofitable, as events e.g major disease outbreaks, become increasingly costly for the controlling institutions.

- IF RESILIENCE remains sufficient (**sufficient adaptive capacity remains**) and the system has not collapsed the opportunity to reconfigure may exist.
- The system enters the reorganization phase and the result leads to desirable outcomes



MARKET PRICES
LEGISLATION
CULTURE
TRADITIONS
STANDARDS
ETC





Wilcox et al., 2019

The Great Mekong Sub-region example a true story…….

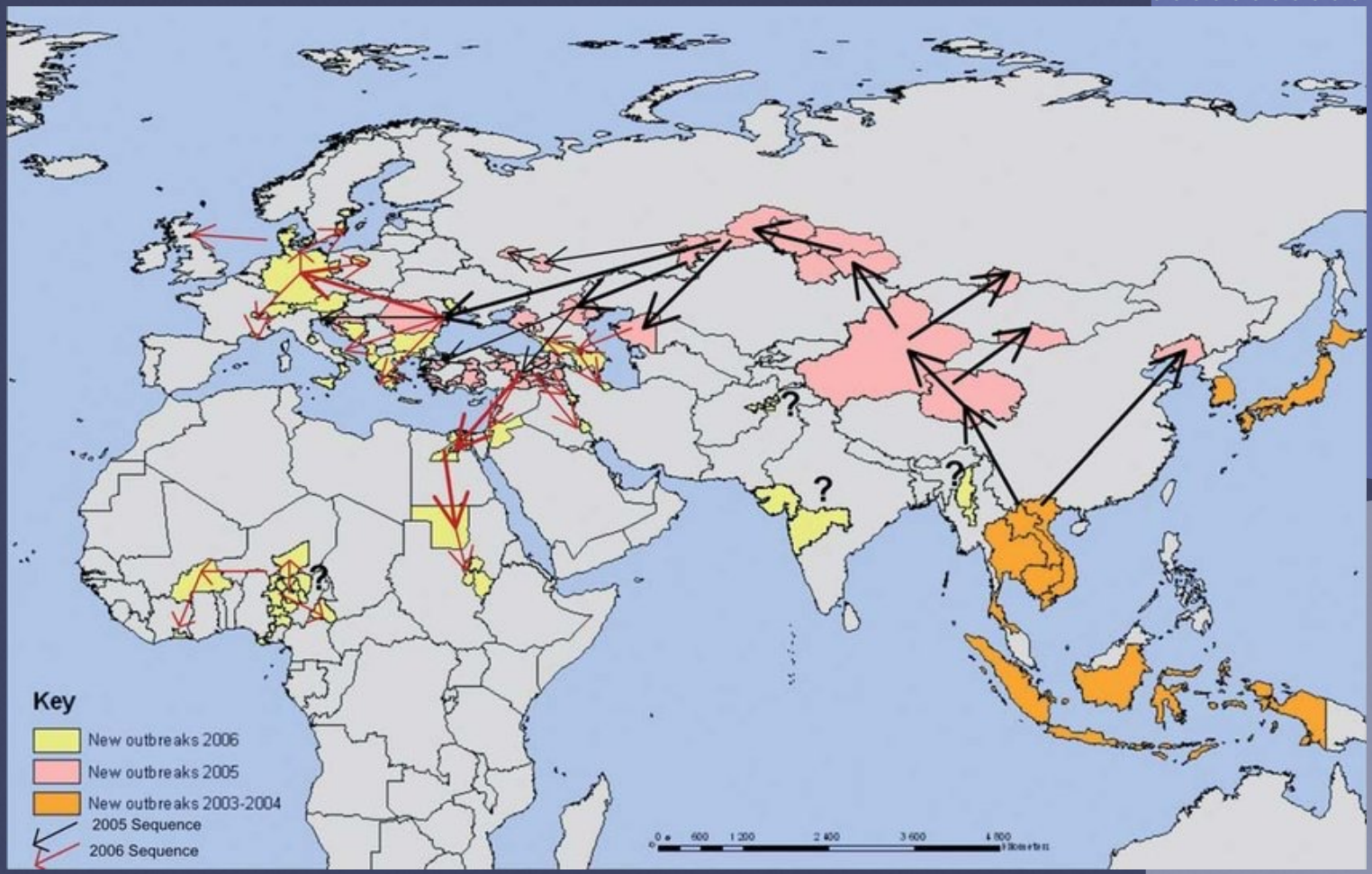
- 1998 H5N1 initial outbreak in Hong Kong, optimistically but mistakenly thought to have been successfully eliminated by massive poultry culling

- ……..BUT experts and government authorities either ignored the change taking place regionally

Economic opportunities

Production intensification not accompanied by increased biosecurity

“An accident waiting to happen”



"SURPRISE"

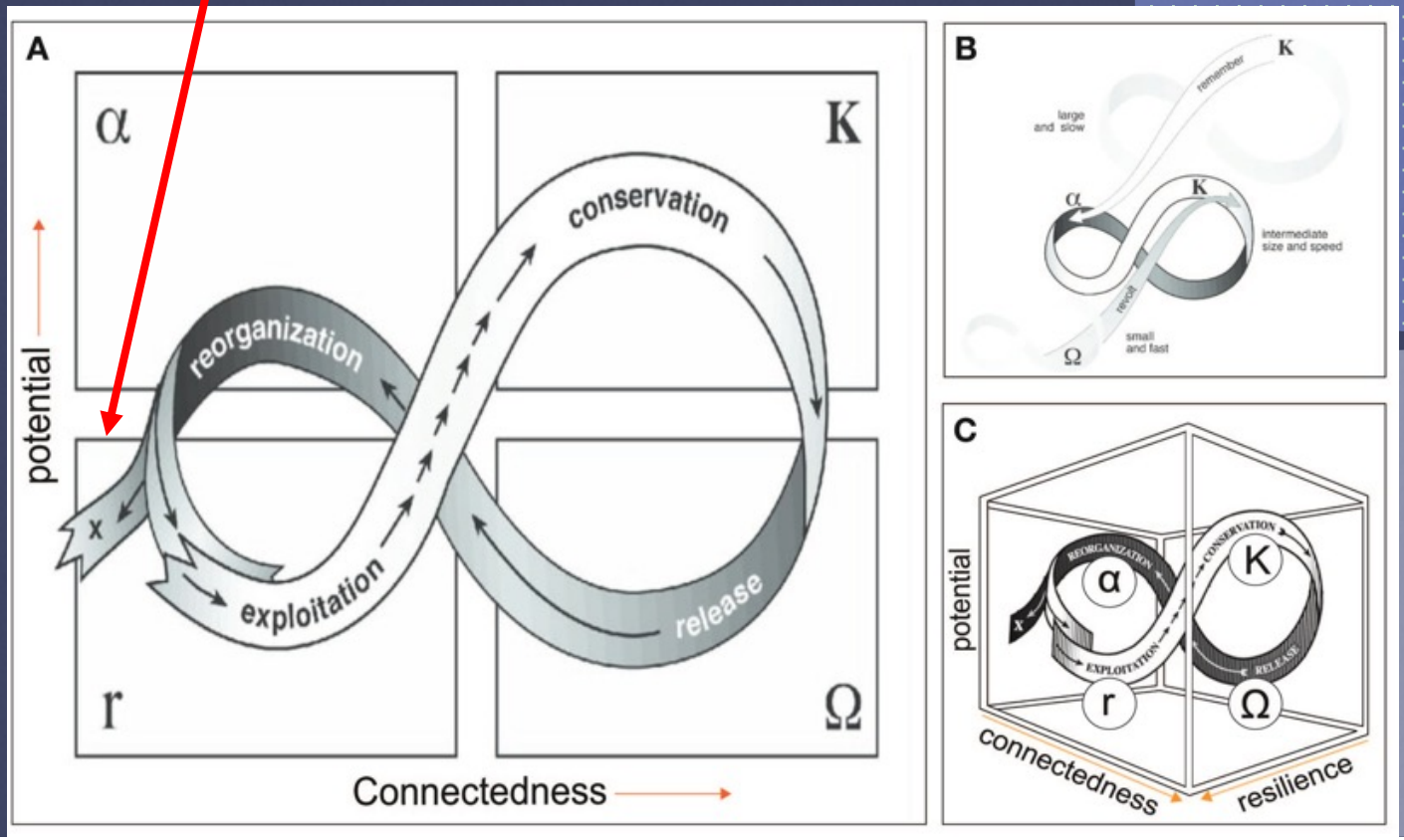
- In SESR jargon SURPRISE is defined as a **cognitive disagreement with expectations** based on the responsible **social institution's failure** to recognize signs indicating the system's increasing fragility

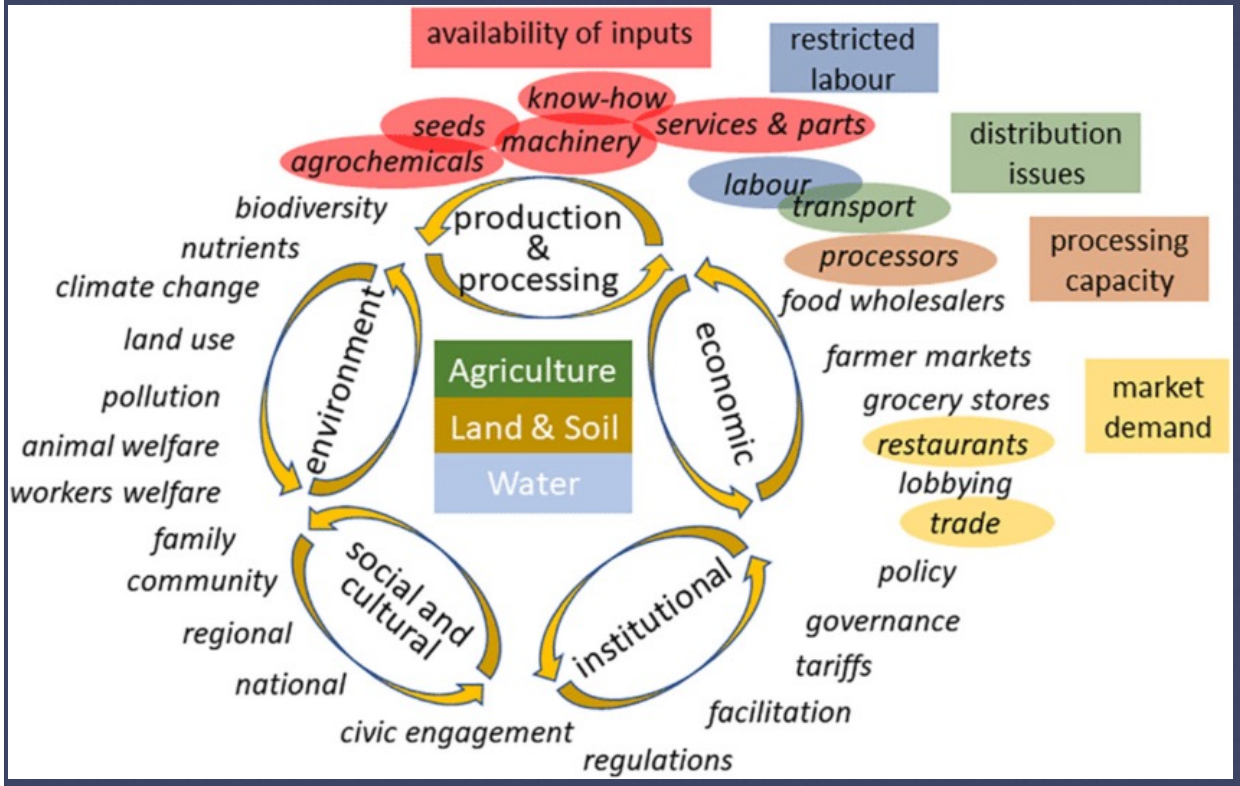
Consequences

1. Far **less diversified poultry production sector** now dominated by large agribusinesses
2. outbreaks threatening wildlife have been recurring
3. **Transboundary movements of Product supply chain linked to AI ecology**
4. HPAI a One Health problem

RESILIENCE

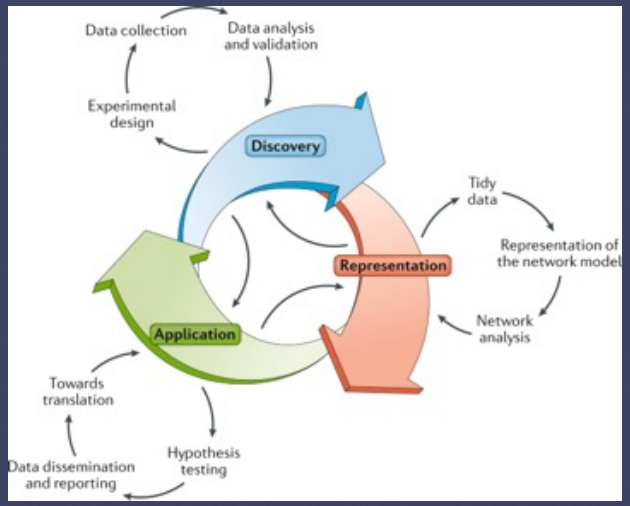
regime shift whereby the system "collapses becoming a new system, functionally and structurally




availability of inputs
restricted labour
know-how
seeds
machinery
services & parts
agrochemicals
distribution issues
labour
transport
biodiversity
nutrients
climate change
production & processing
processors
processing capacity
food wholesalers
land use
environment
economic
farmer markets
Agriculture
Land & Soil
Water
grocery stores
market demand
pollution
animal welfare
restaurants
lobbying
workers welfare
trade
family
community
social and cultural
institutional
policy
regional
governance
national
tariffs
facilitation
civic engagement
regulations

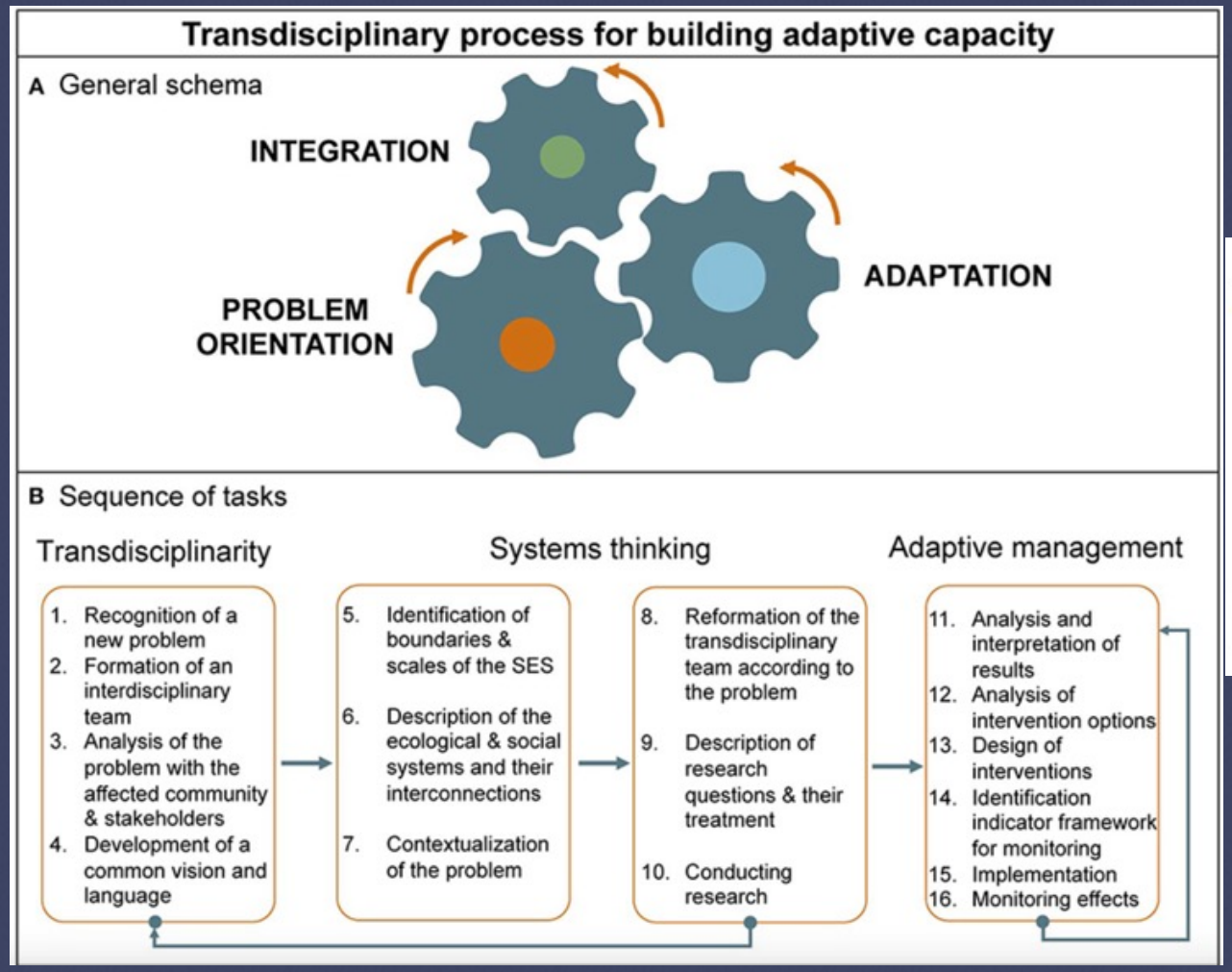

BIG DATA

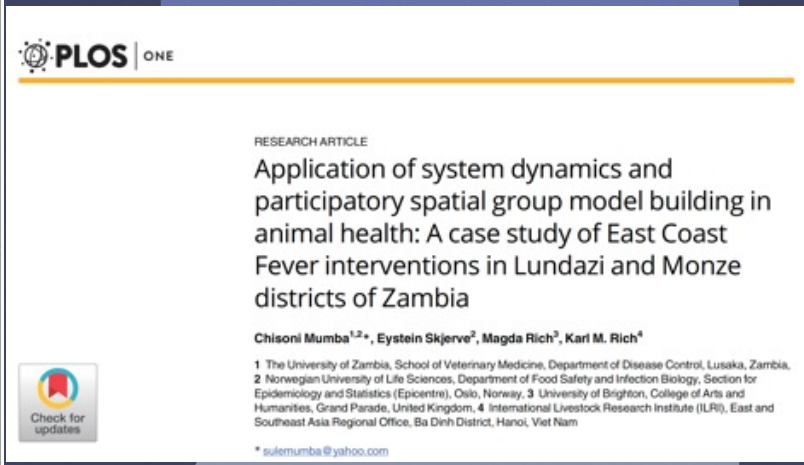

"Successful navigation"
1. indication of resilience
2. adaptive management.



ADAPTIVE MANAGEMENT

Adaptive Management/Adaptive Governance





PLOS ONE

RESEARCH ARTICLE

Application of system dynamics and participatory spatial group model building in animal health: A case study of East Coast Fever interventions in Lundazi and Monze districts of Zambia

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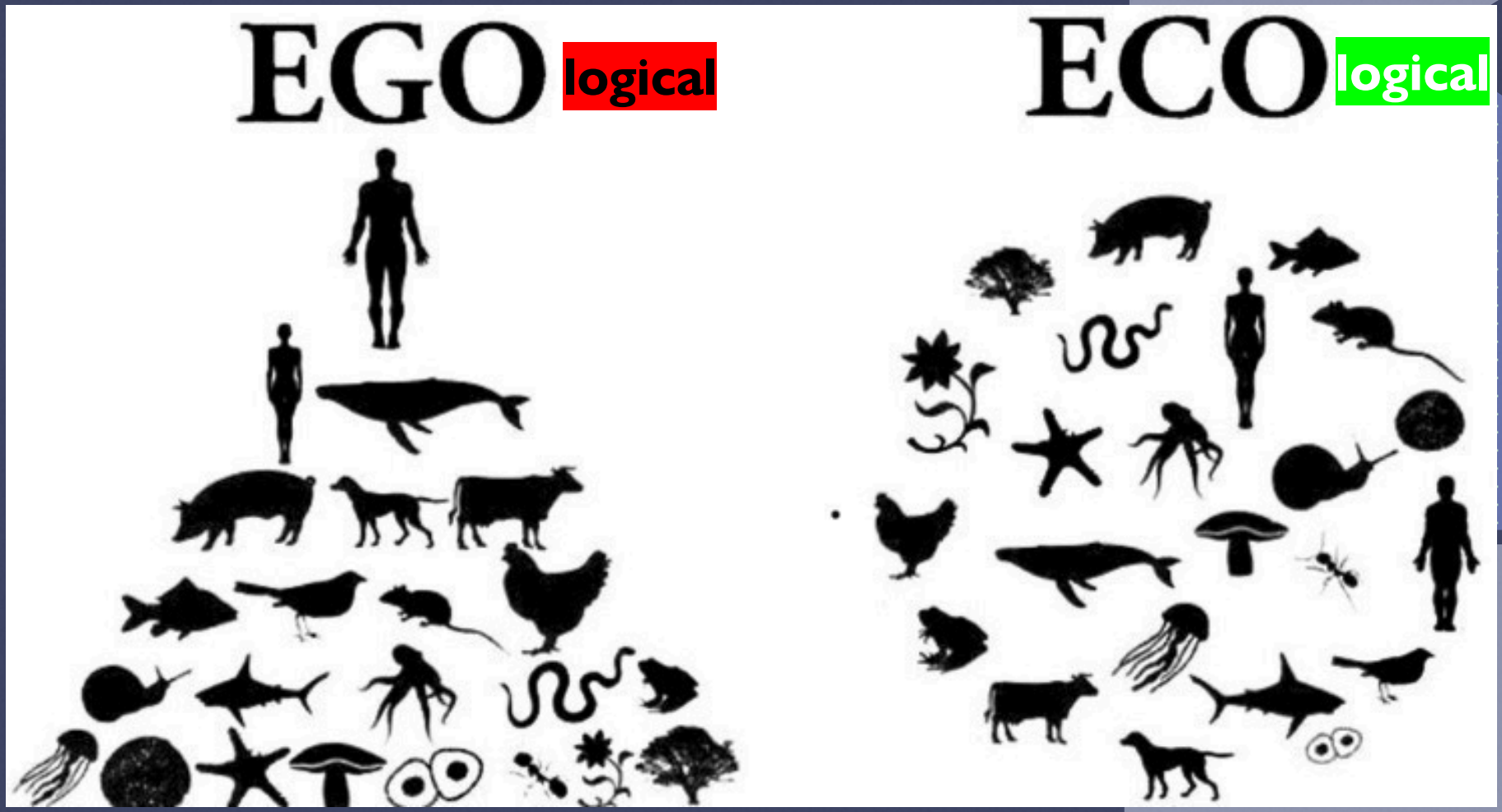
Check for updates



Anthropocentric Dualistic Unsustainable
Mechanistic self destructive

Ecocentric Holistic Sustainable
Compassionate Natural Regenerative

Watch the video “Beauty and the beef”

- Define the problem
- Identify the main stakeholders
- Describe perspectives and boundaries

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How to stay in touch

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