Use of Systems Thinking to Combat Mosquito-borne Diseases

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Systems thinking is a way of

- **understanding reality** that
- **emphasizes the relationships among a system's parts** rather than the parts themselves
- recognizes the fact that our attempts to solve difficult problems sometimes make matters worse (or fail) due to the **tendency of dynamic systems** to "**delay, defeat or dilute the effects of planned interventions**".

In public health (**Mosquito-borne disease systems**) systems thinking involves understanding and learning

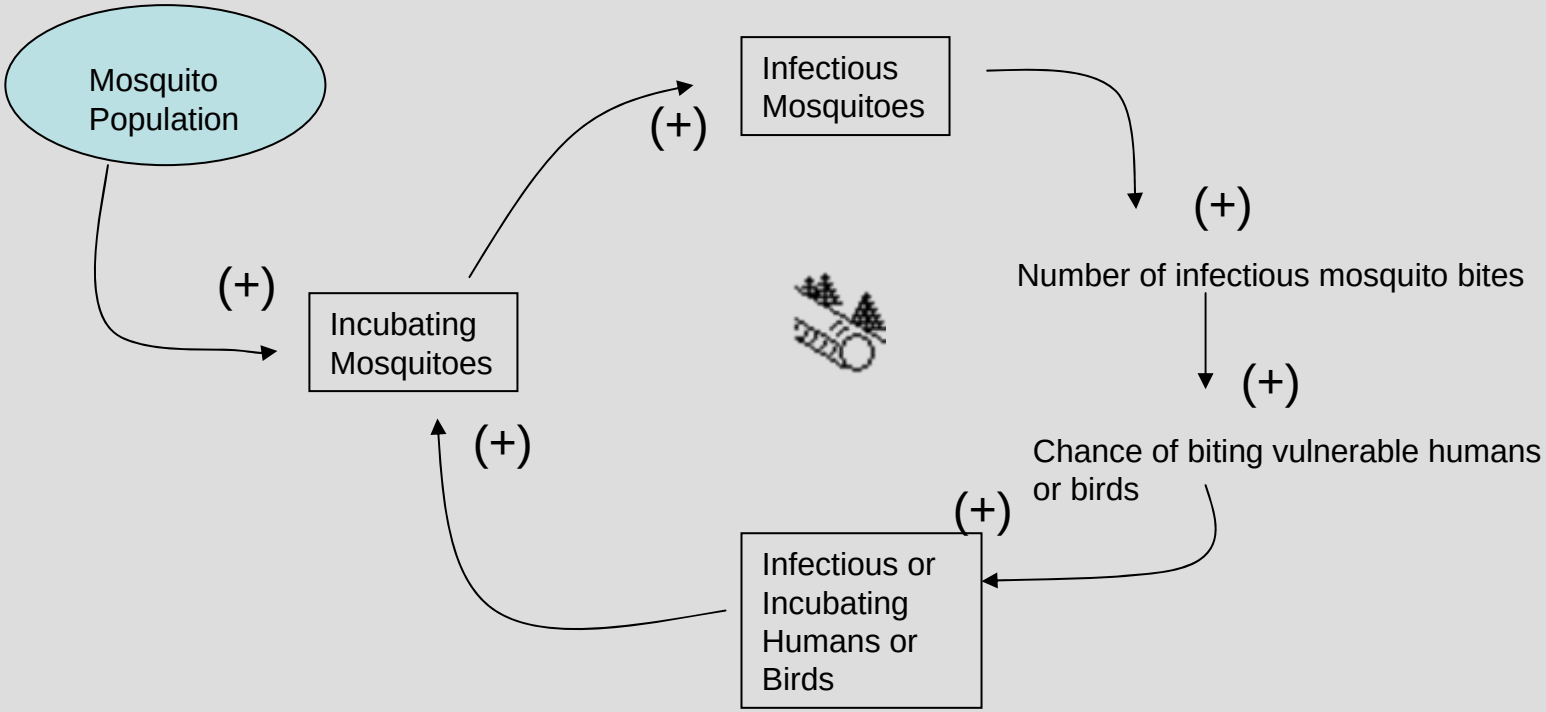
- **the environment in which the disease develops**
- the **complex interrelationships of the systems variables** and **their resulting behavior**
- the **ramifications and trade-offs of the actions** we choose**.**

Critical Tools Of Systems Thinking

- **Causal Loop Diagrams**
- **Archetypes**
- **Computer Models**

Causal Loop Diagrams – Basic Mechanisms

Mosquito-borne Disease System



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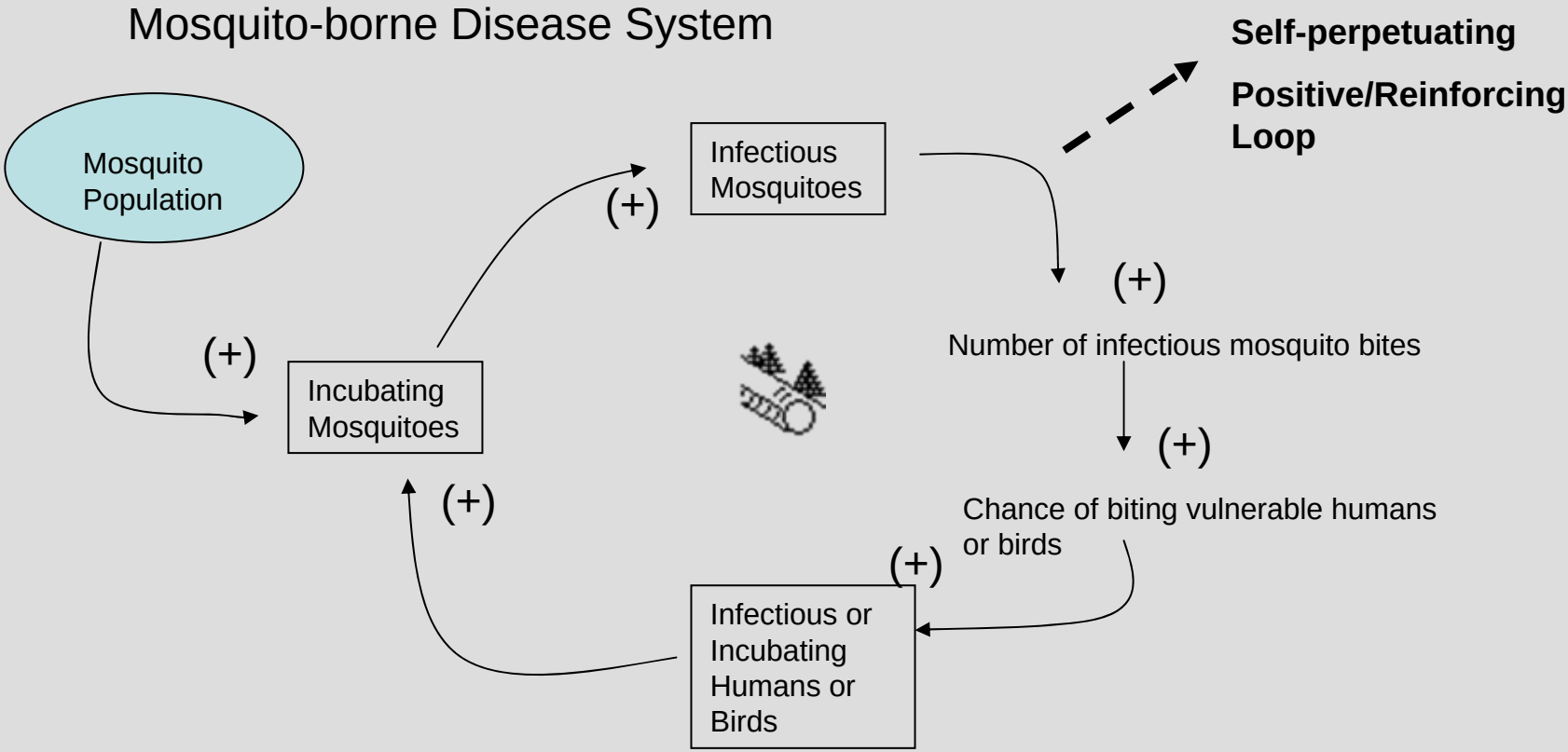

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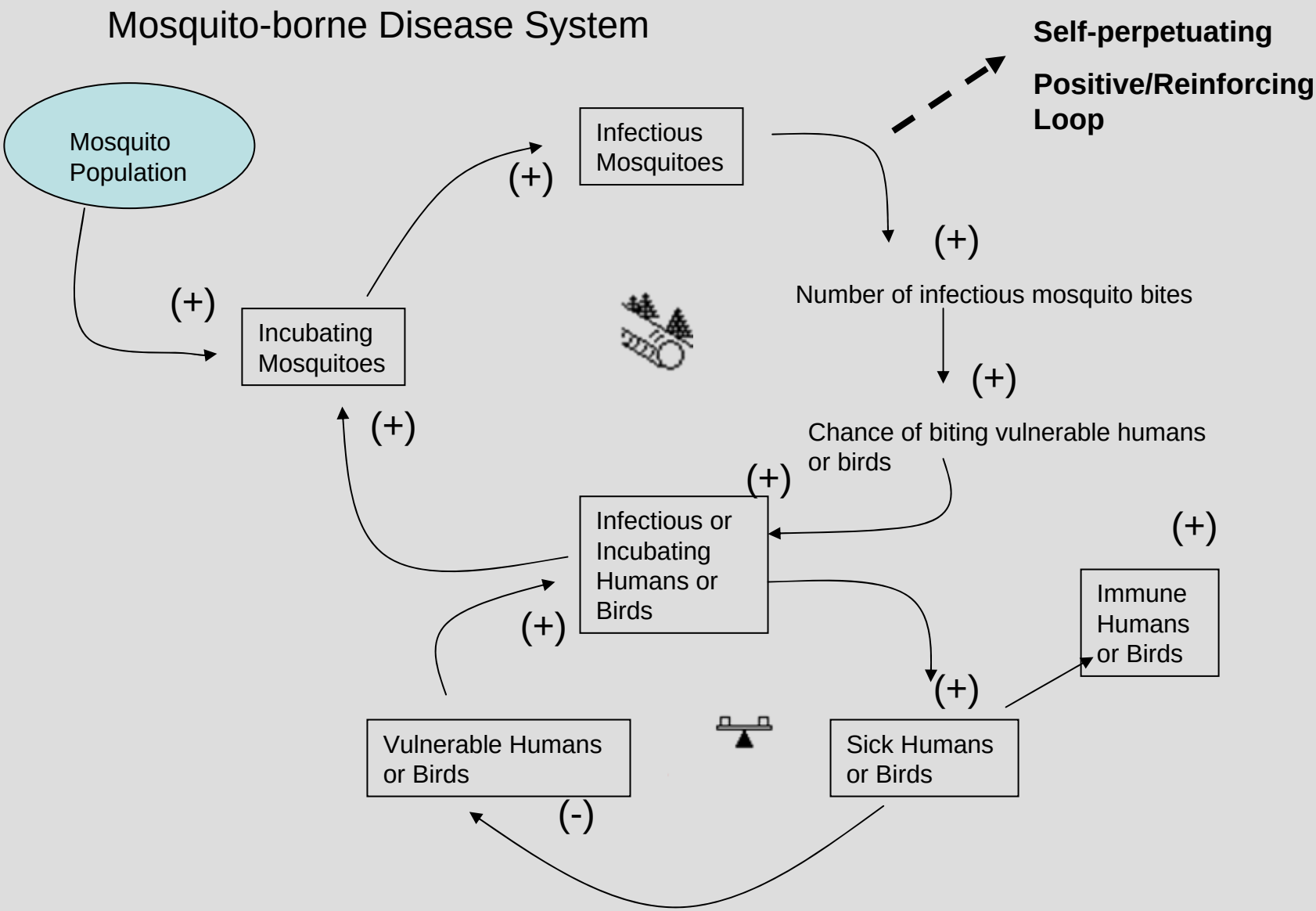

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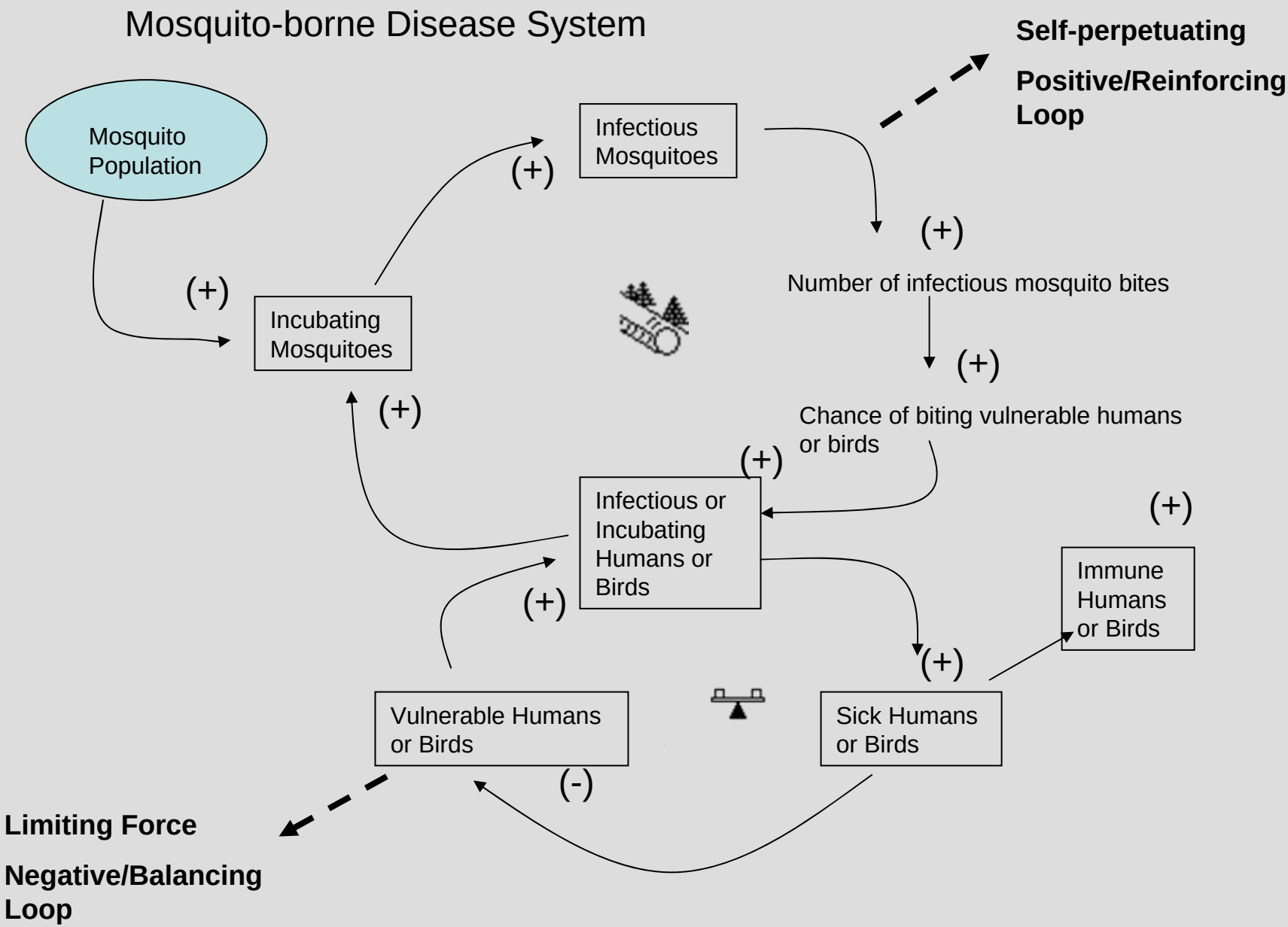

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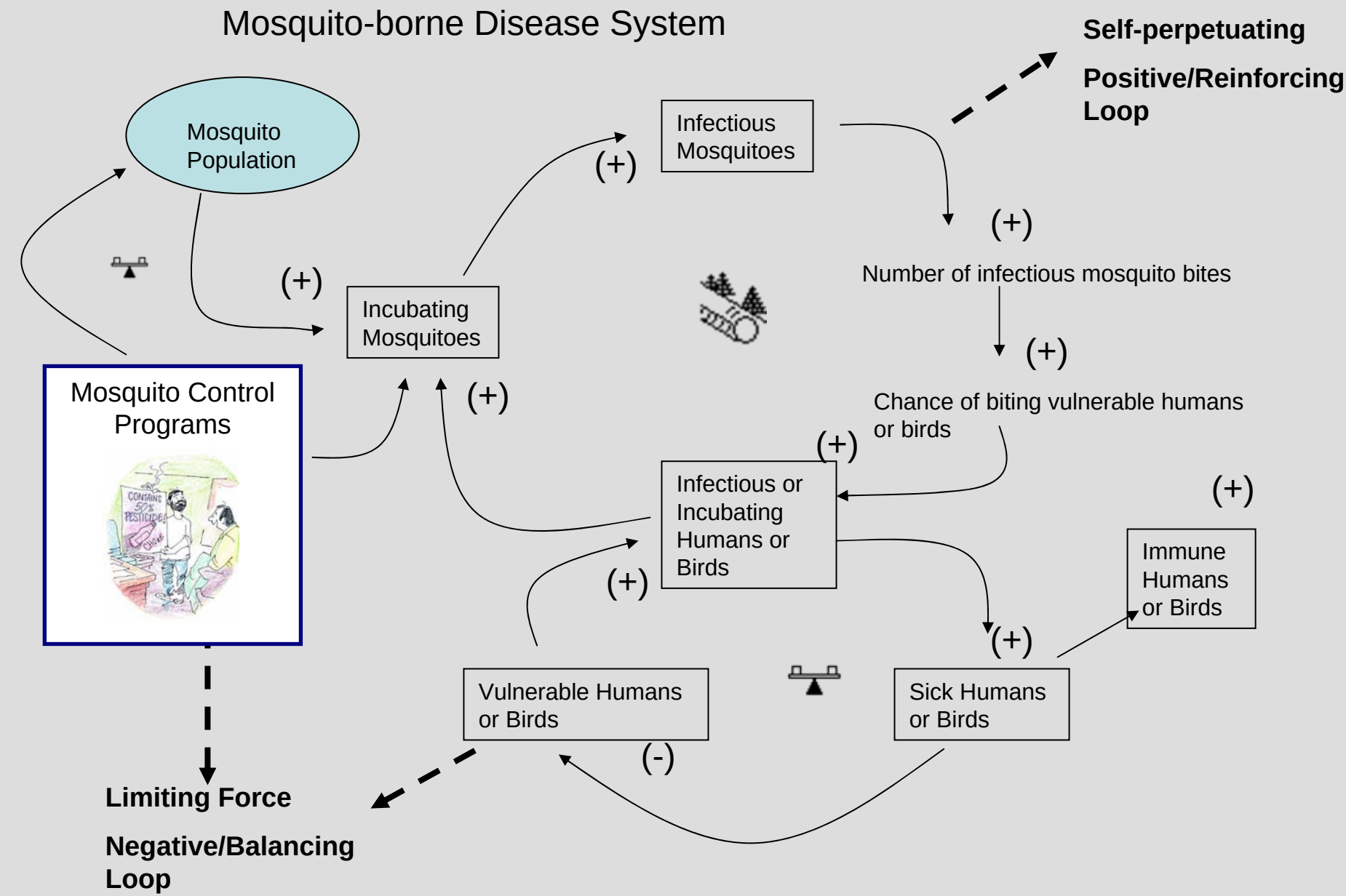

Archetypes – Tools with which one can construct credible and consistent hypotheses about the governing forces (political, environmental, social and structural variables) of their SYSTEM

Mosquito-borne Disease System

Mosquito Control Programs

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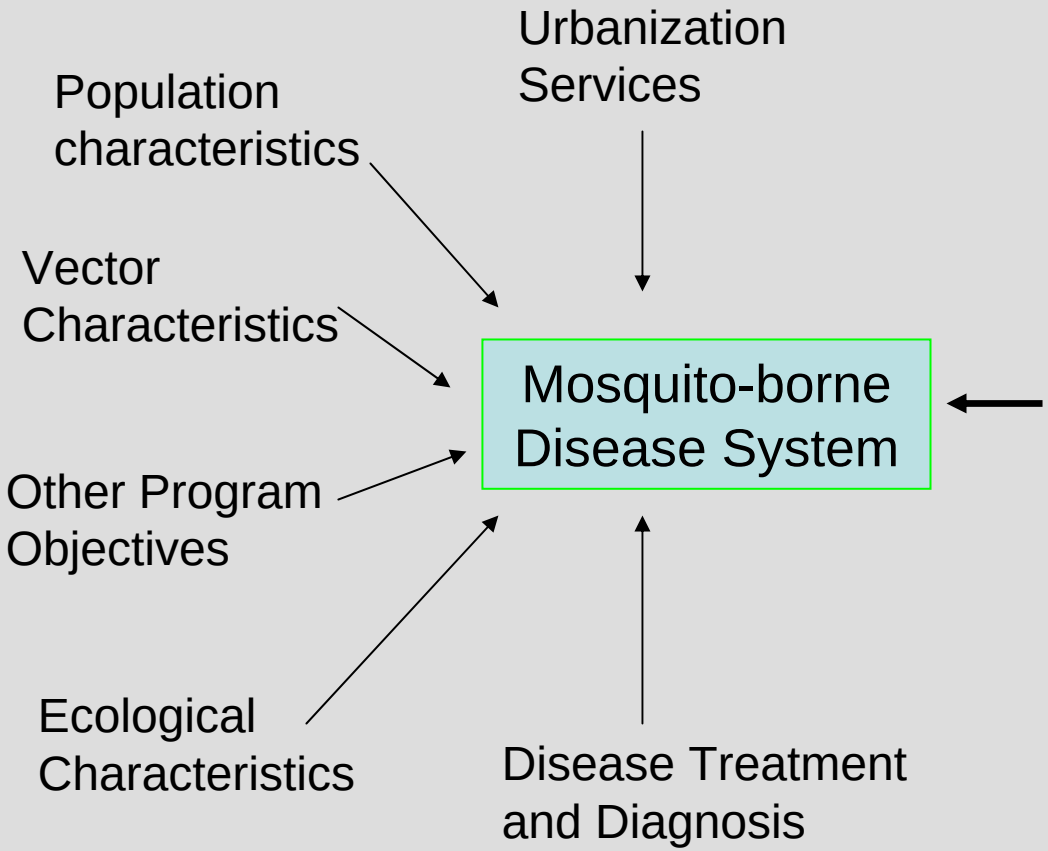

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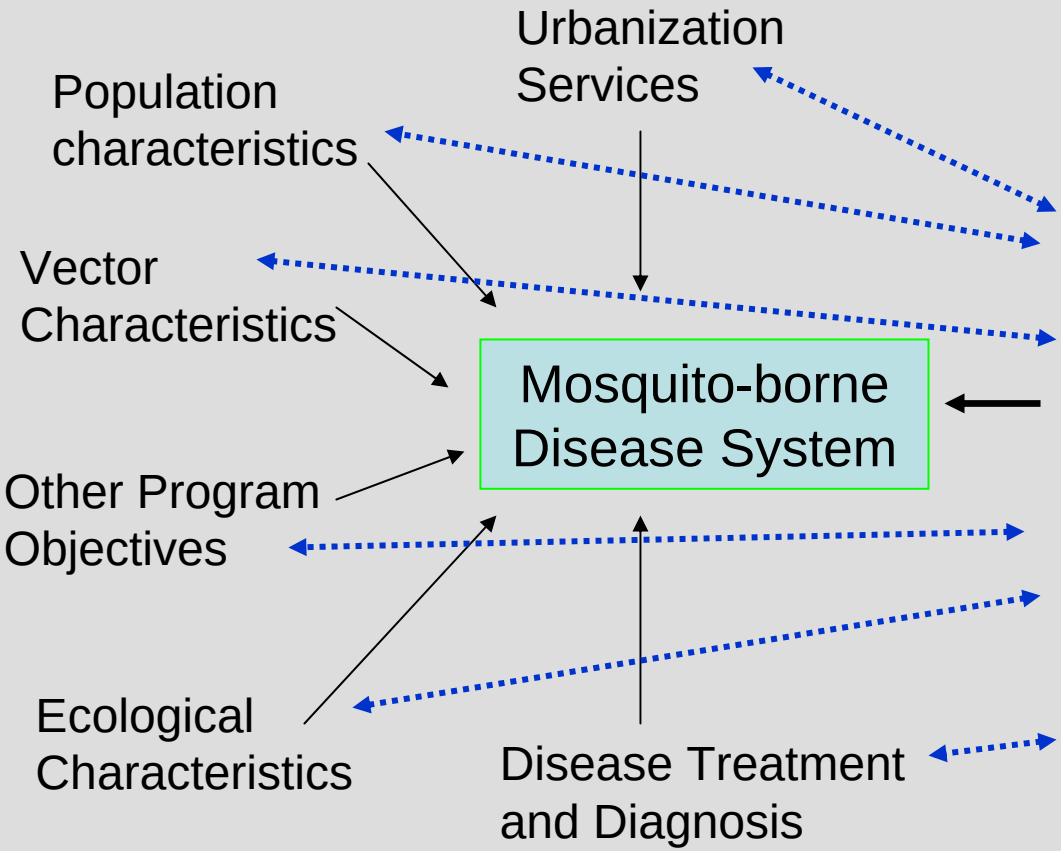
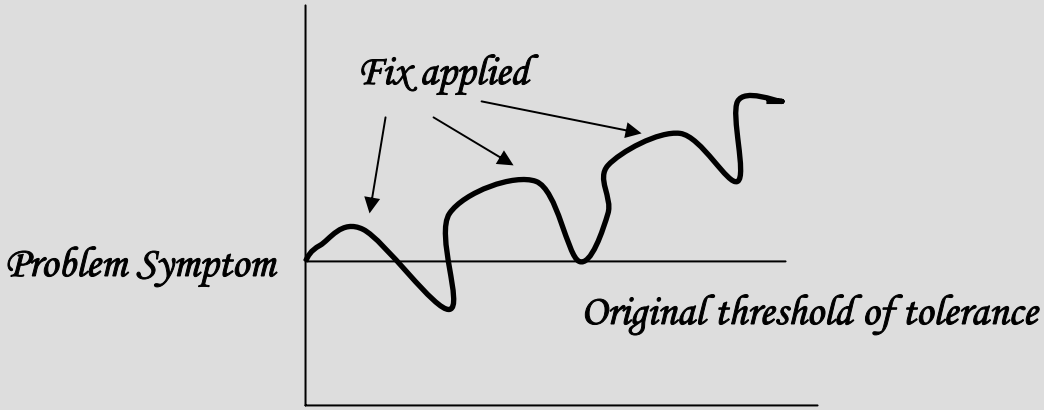


Mosquito Control Programs

Fixes that Backfire



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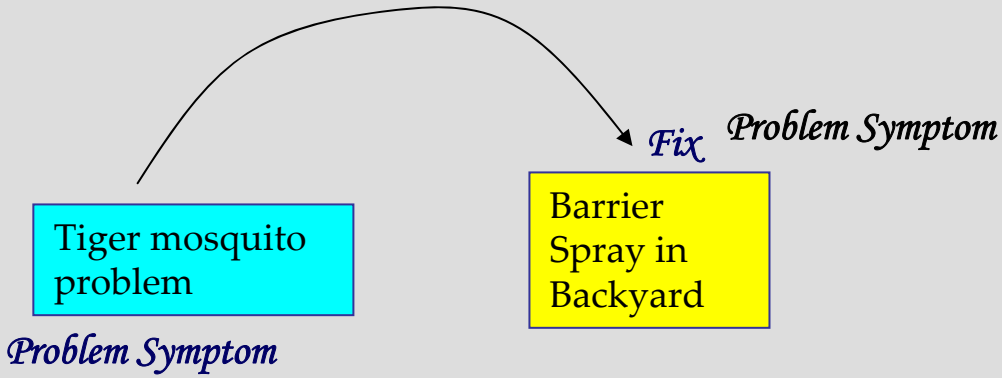

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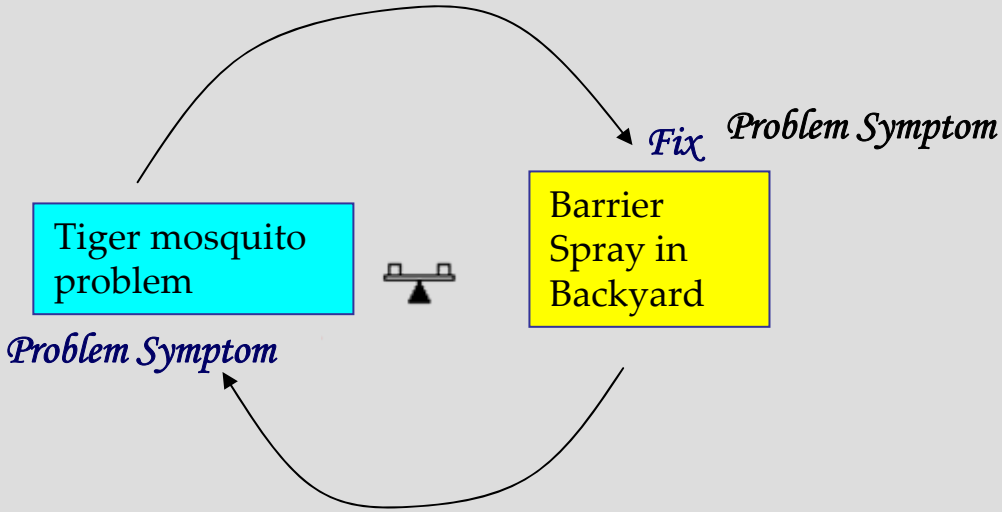

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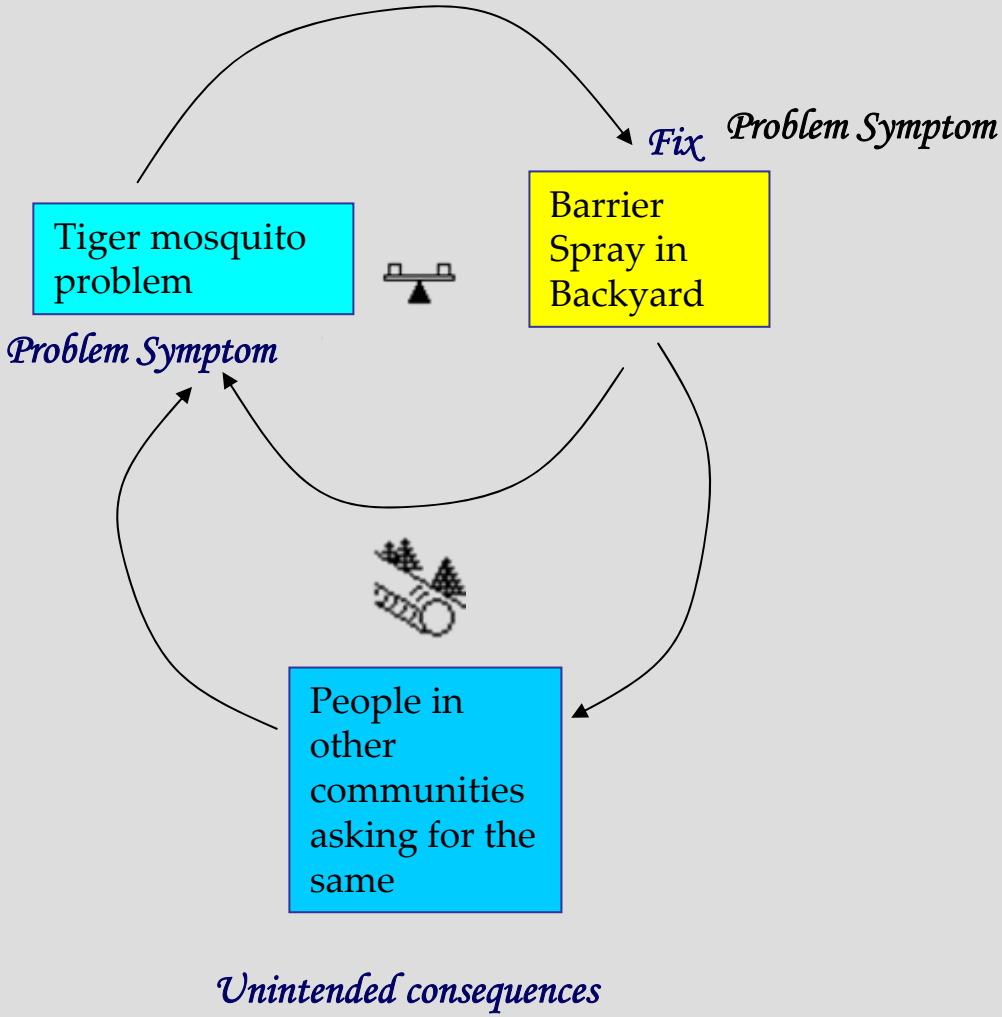

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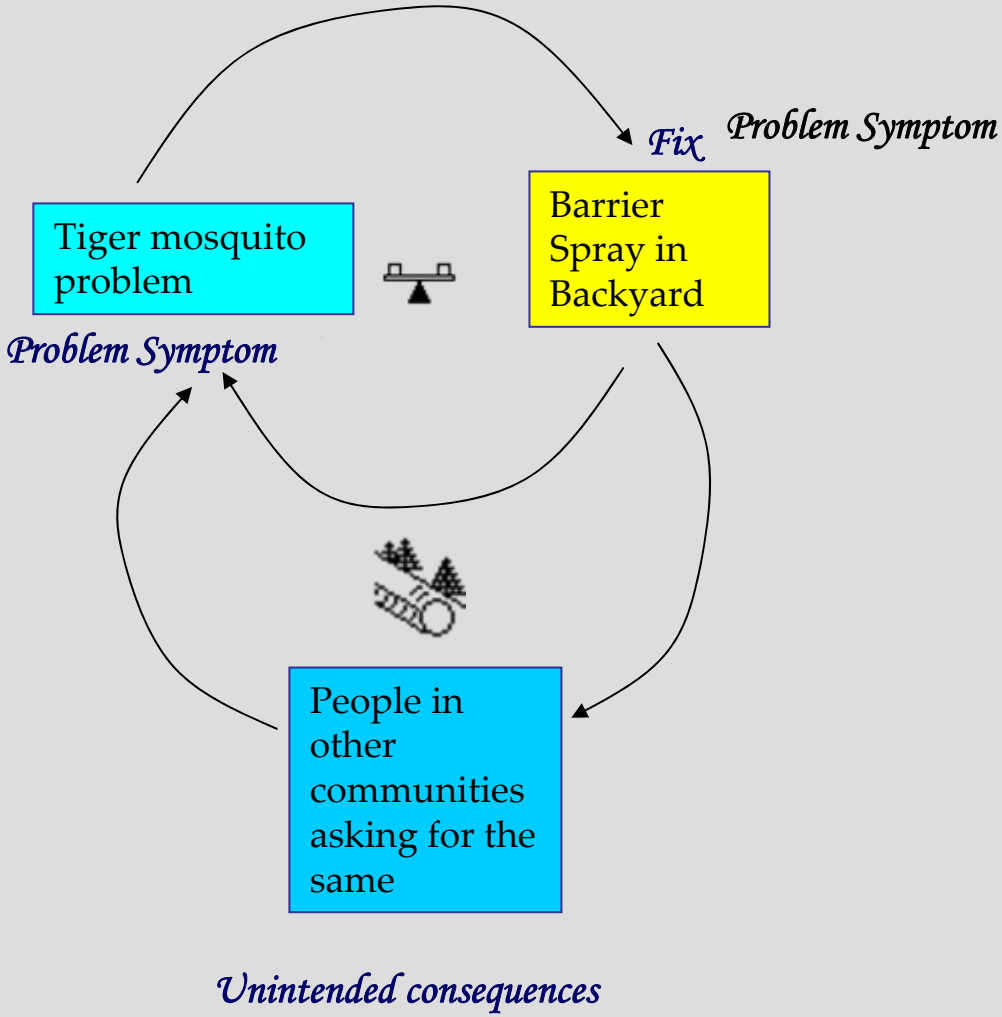

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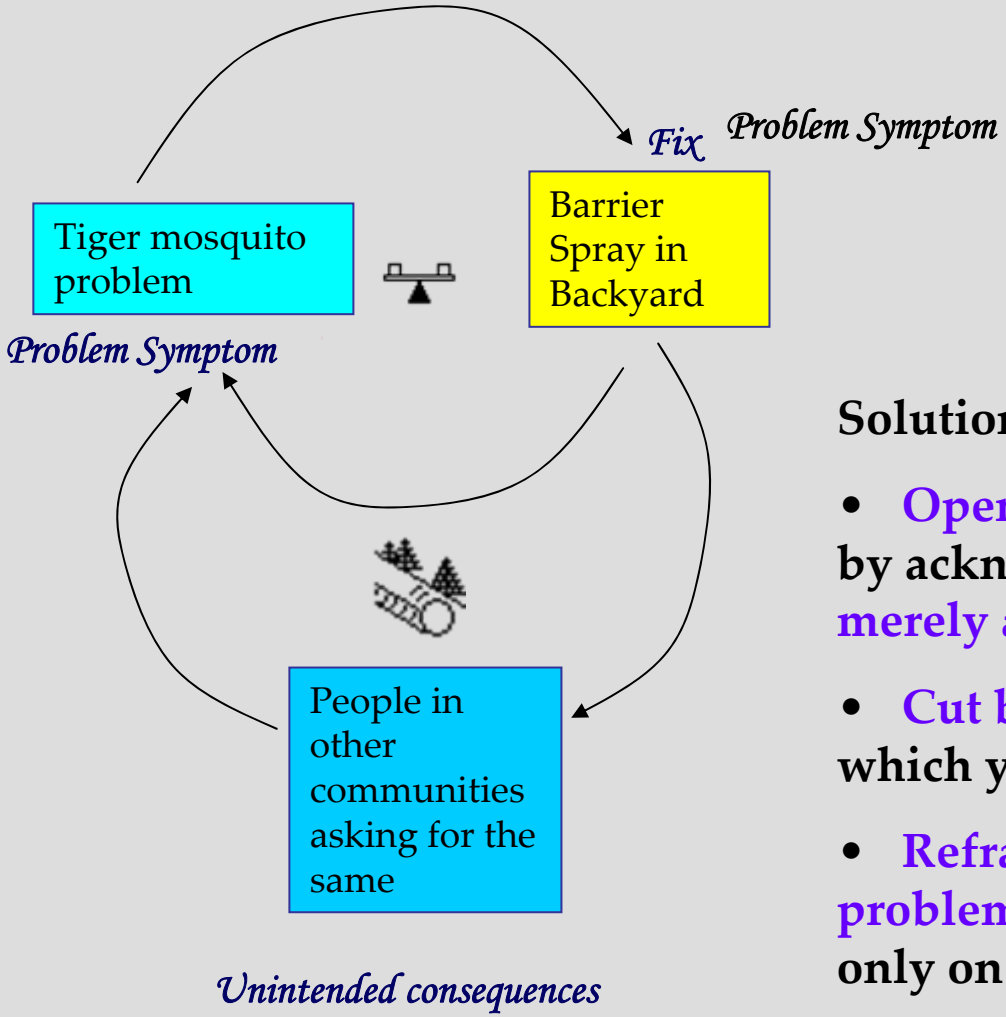
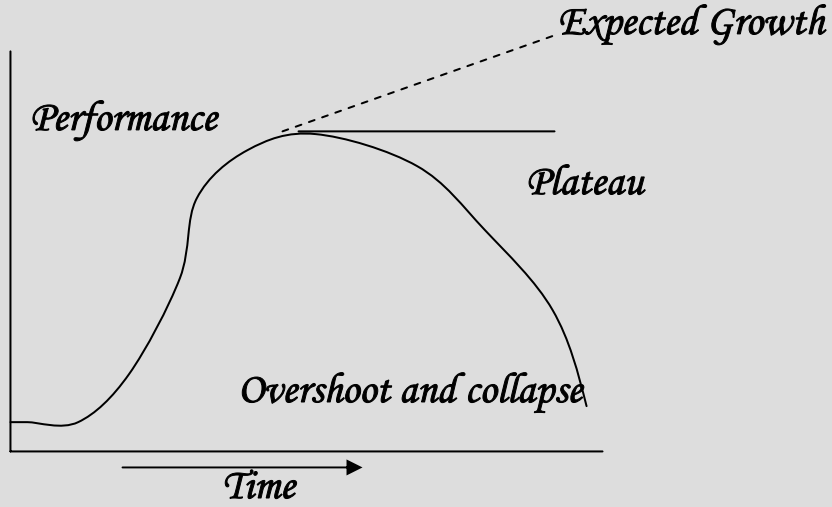


Solutions:

- **Open up people's mental models by acknowledging that the "fix" is merely alleviating a symptom.**
- **Cut back on the frequency with which you apply the "fix".**
- **Reframe and address the root problem, give up the fix that works only on the symptom.**

Limits to Growth



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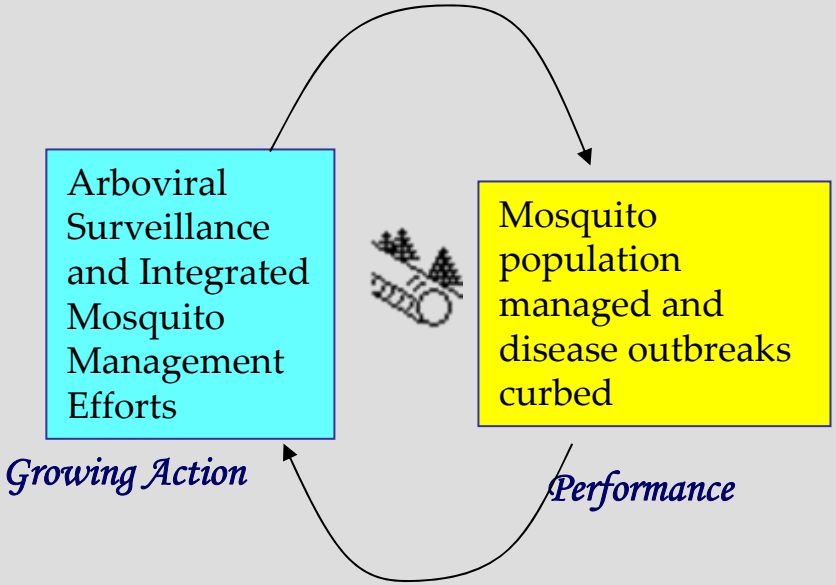

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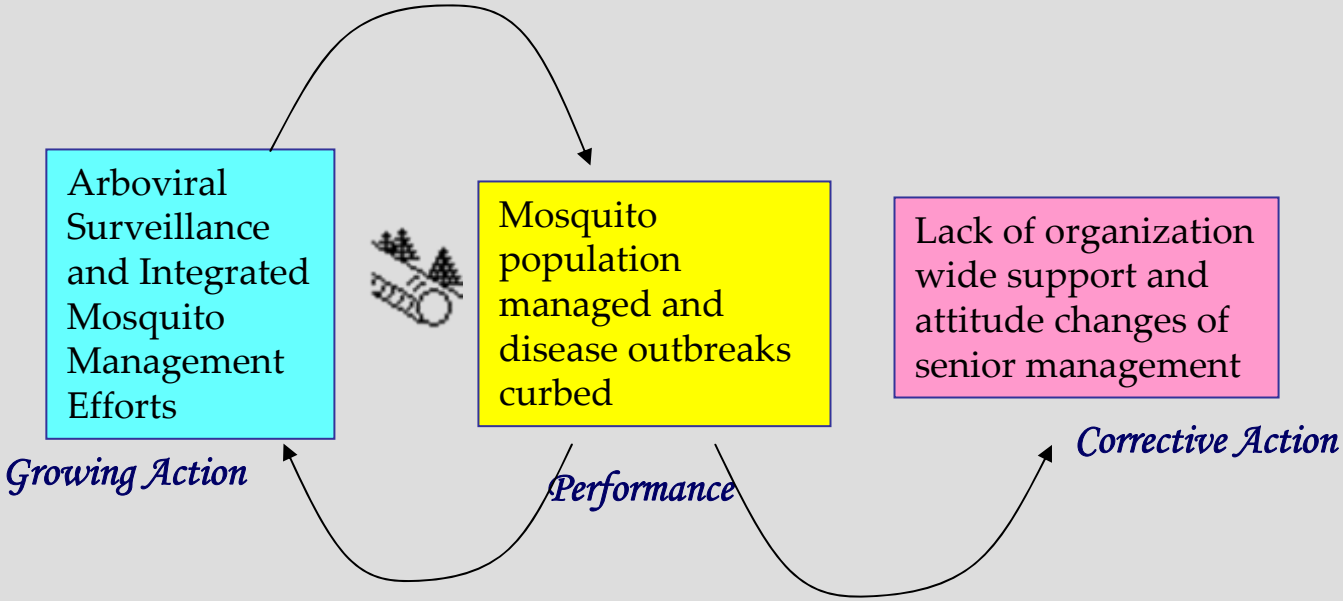

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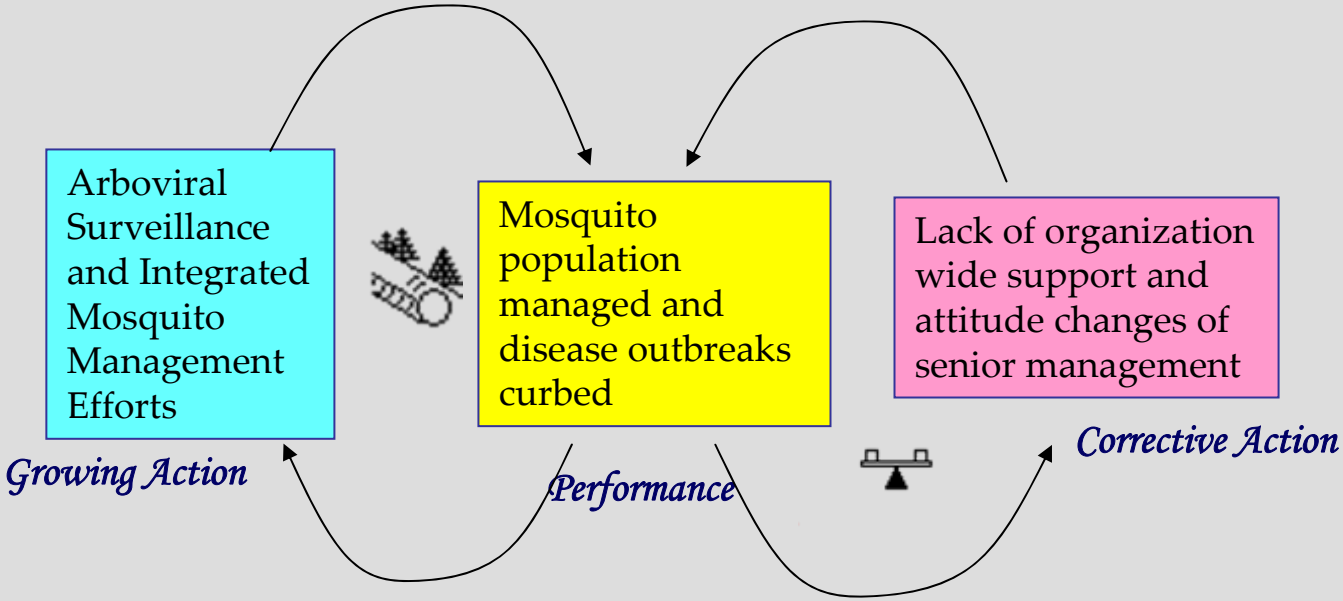

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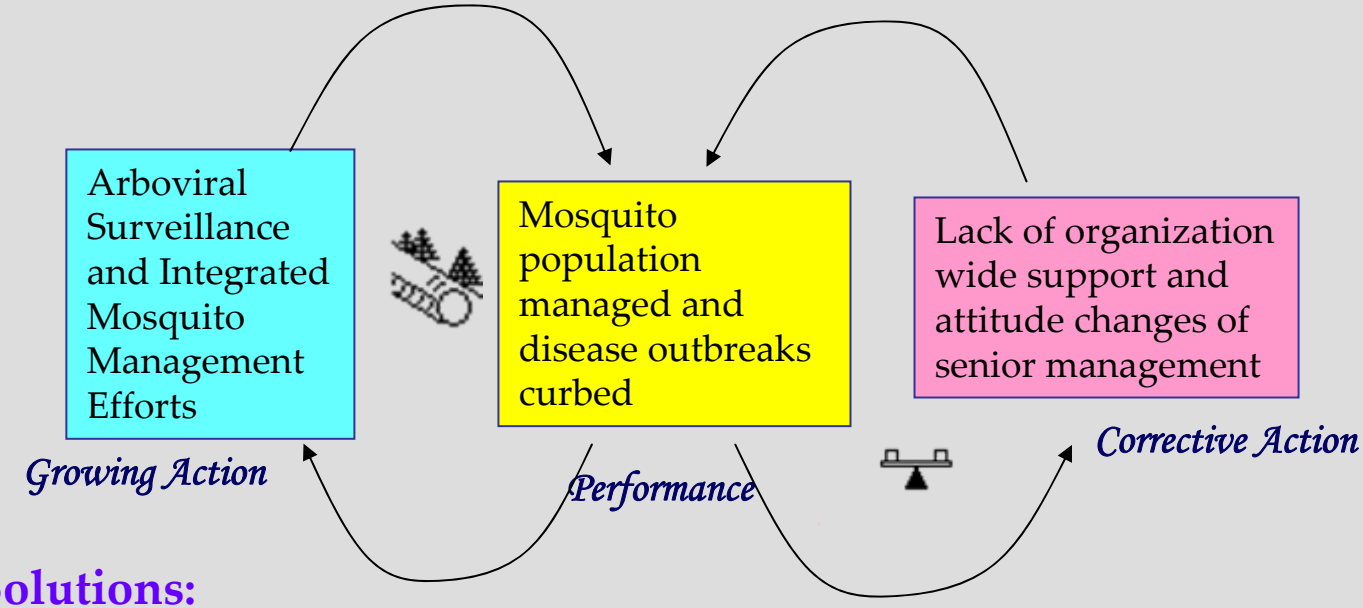
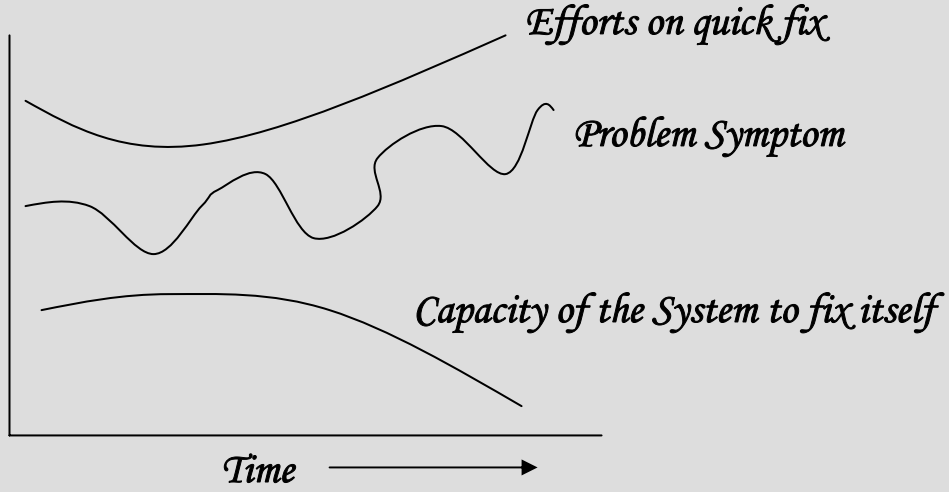


Solutions:

- **Real leverage in a "Limits to growth" scenario lies in its early phases. Anticipate upcoming limiting forces (which are small now, but will increase over time). What measures can you take so that, as you continue to grow, your capacity to handle your limits also grows?**

- **Look for other potential engines of growth – Can you strengthen the resources which are driving your own growth?**

Shifting the Burden



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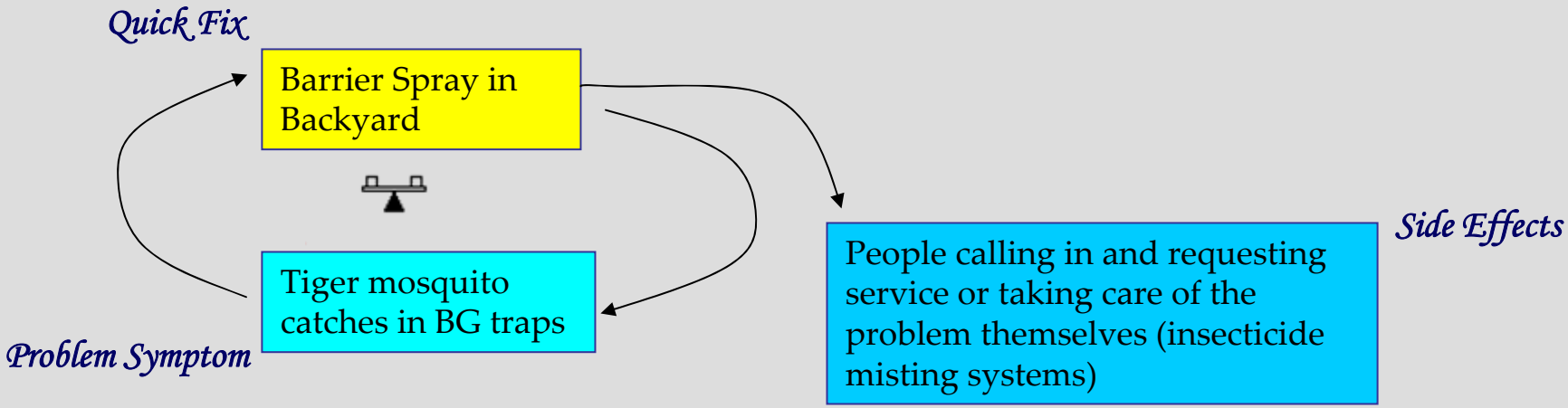

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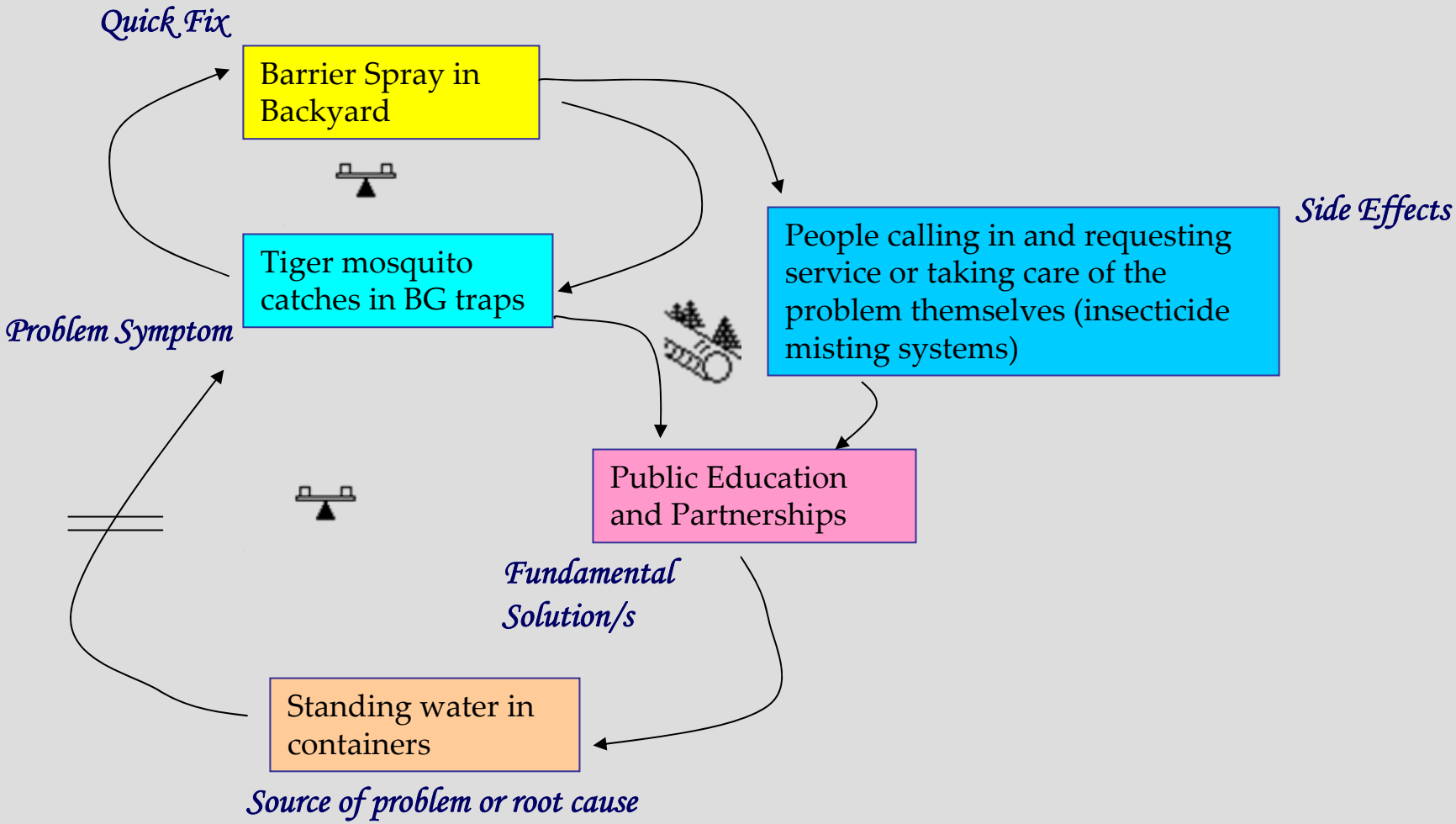

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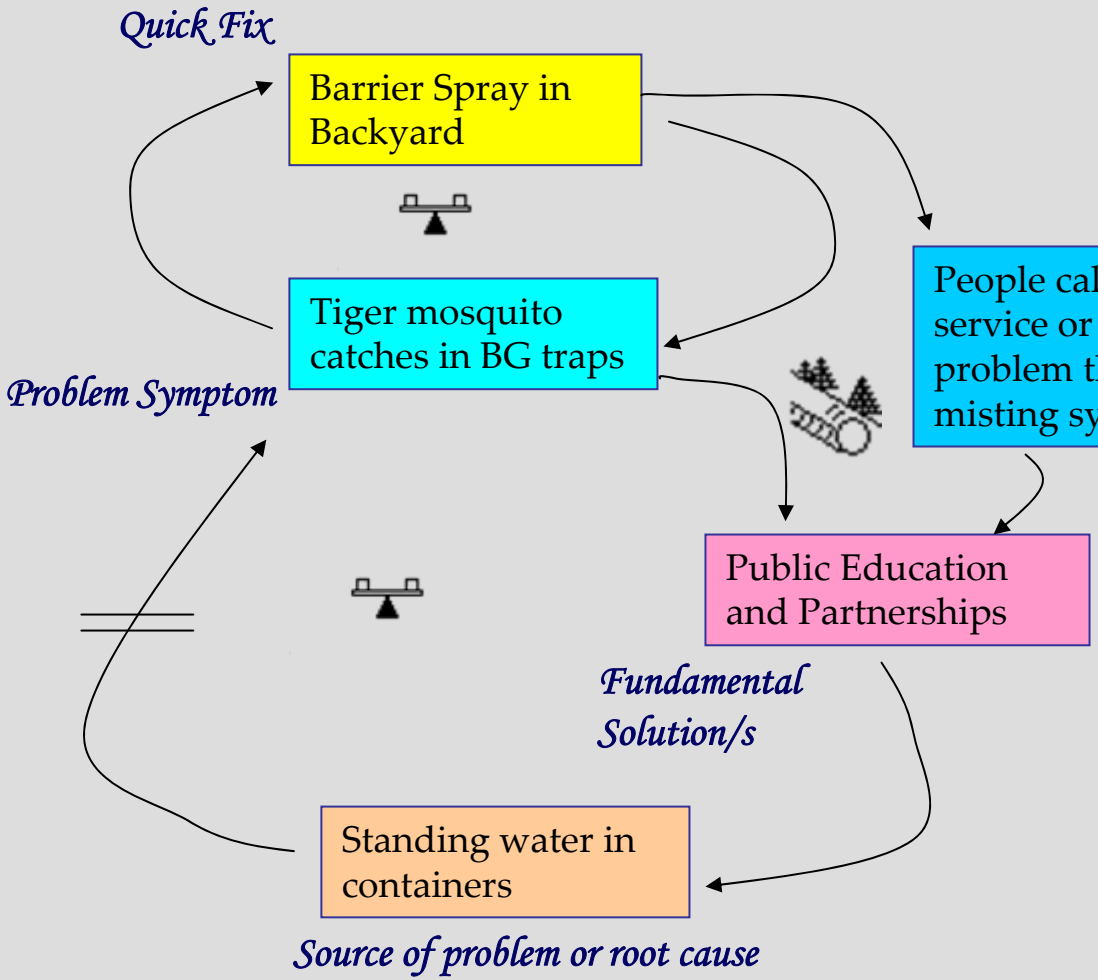
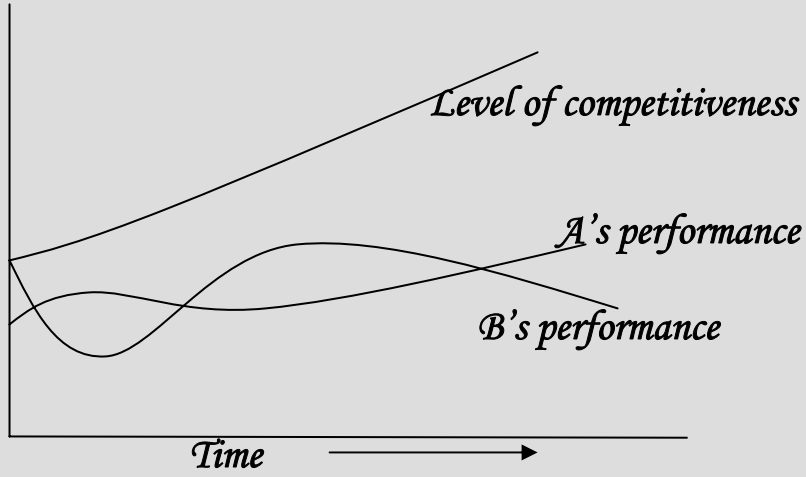


Solutions:

- **What solutions can we come up with if the fix were not available?**
- **Strengthen the long-term solution.**
- **If you must address the problem symptoms right away, do so with restraint.**

Accidental Adversaries



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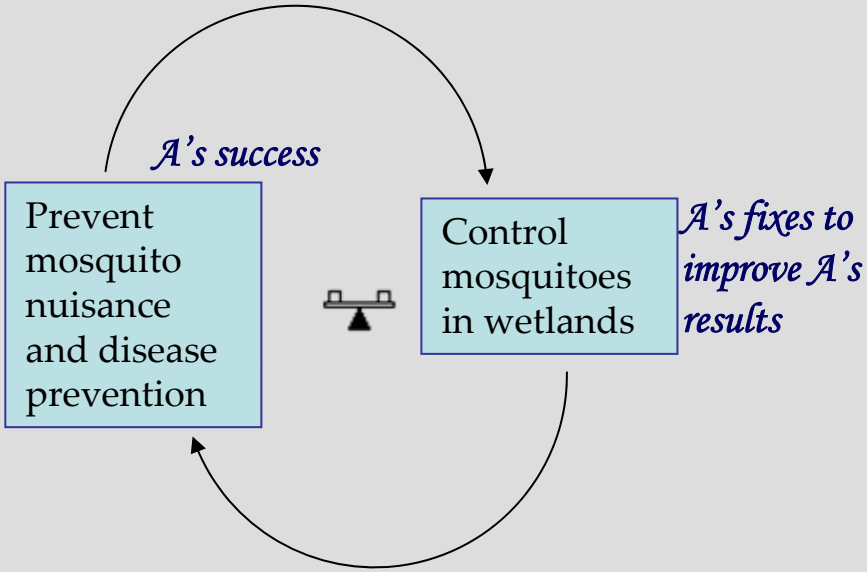

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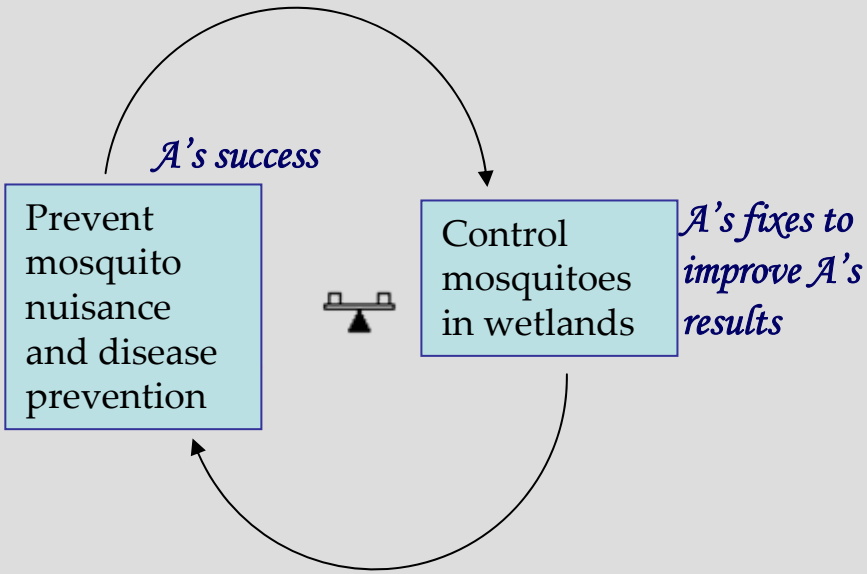

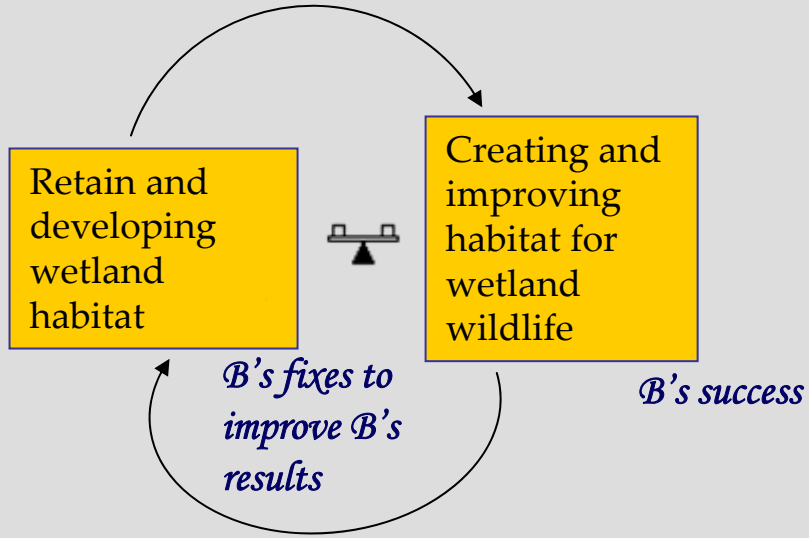

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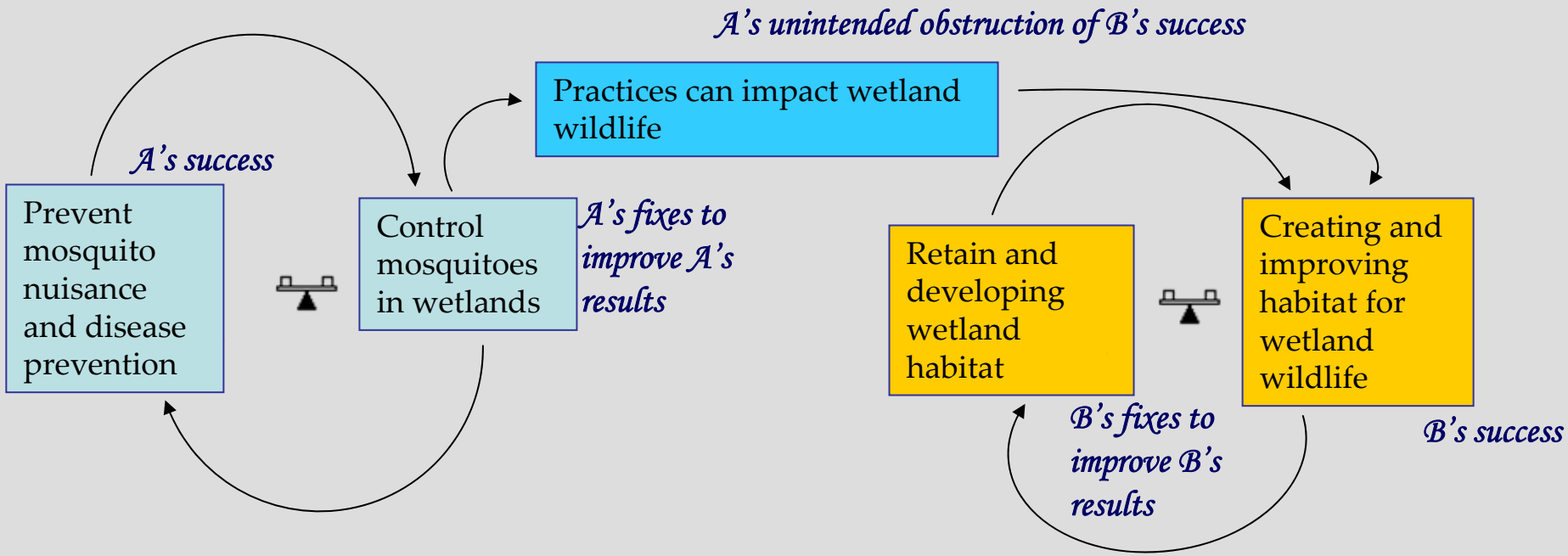

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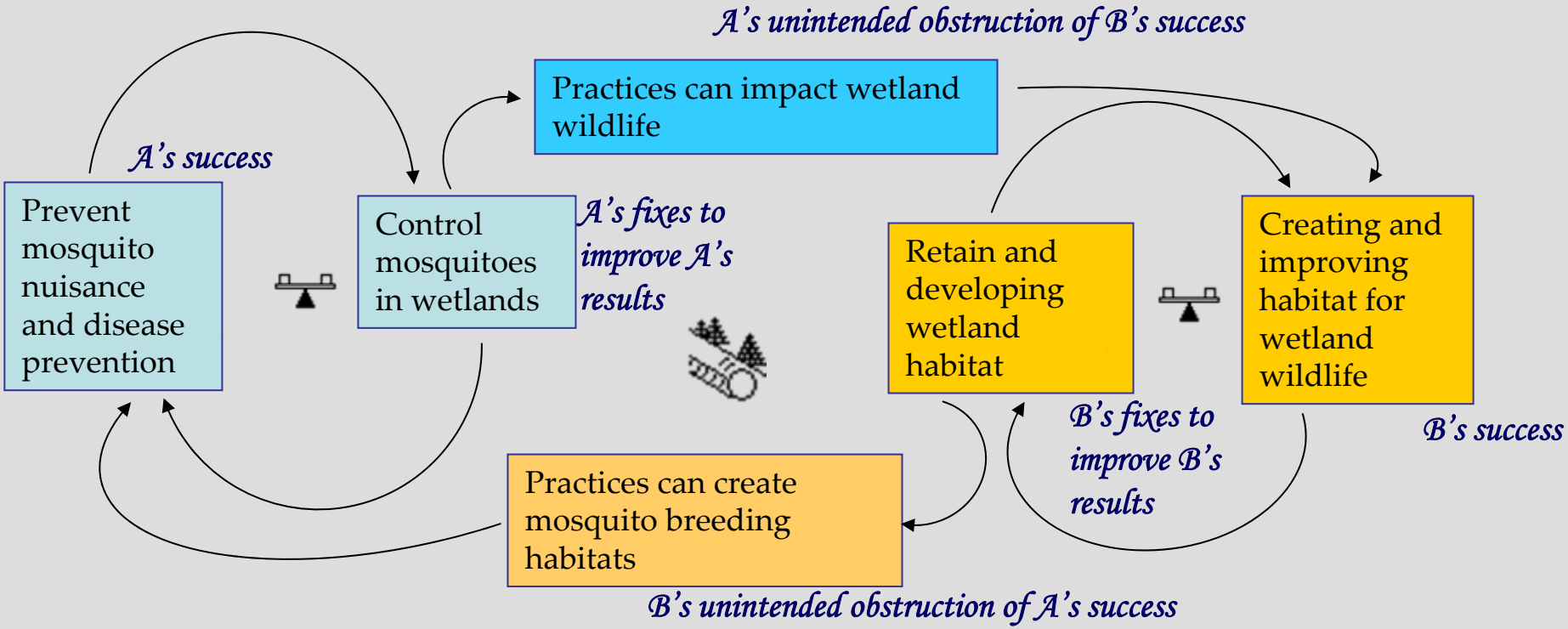

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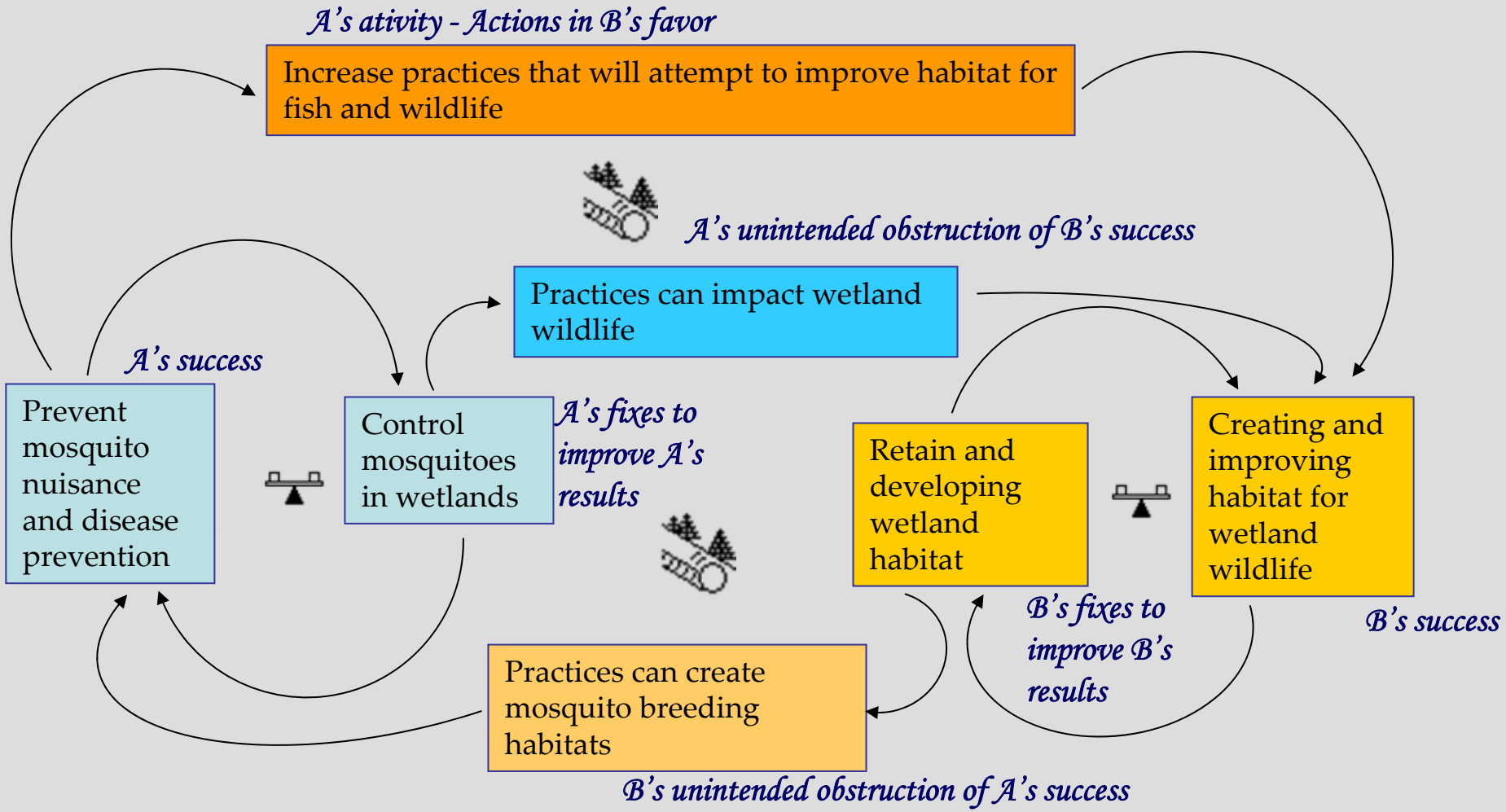

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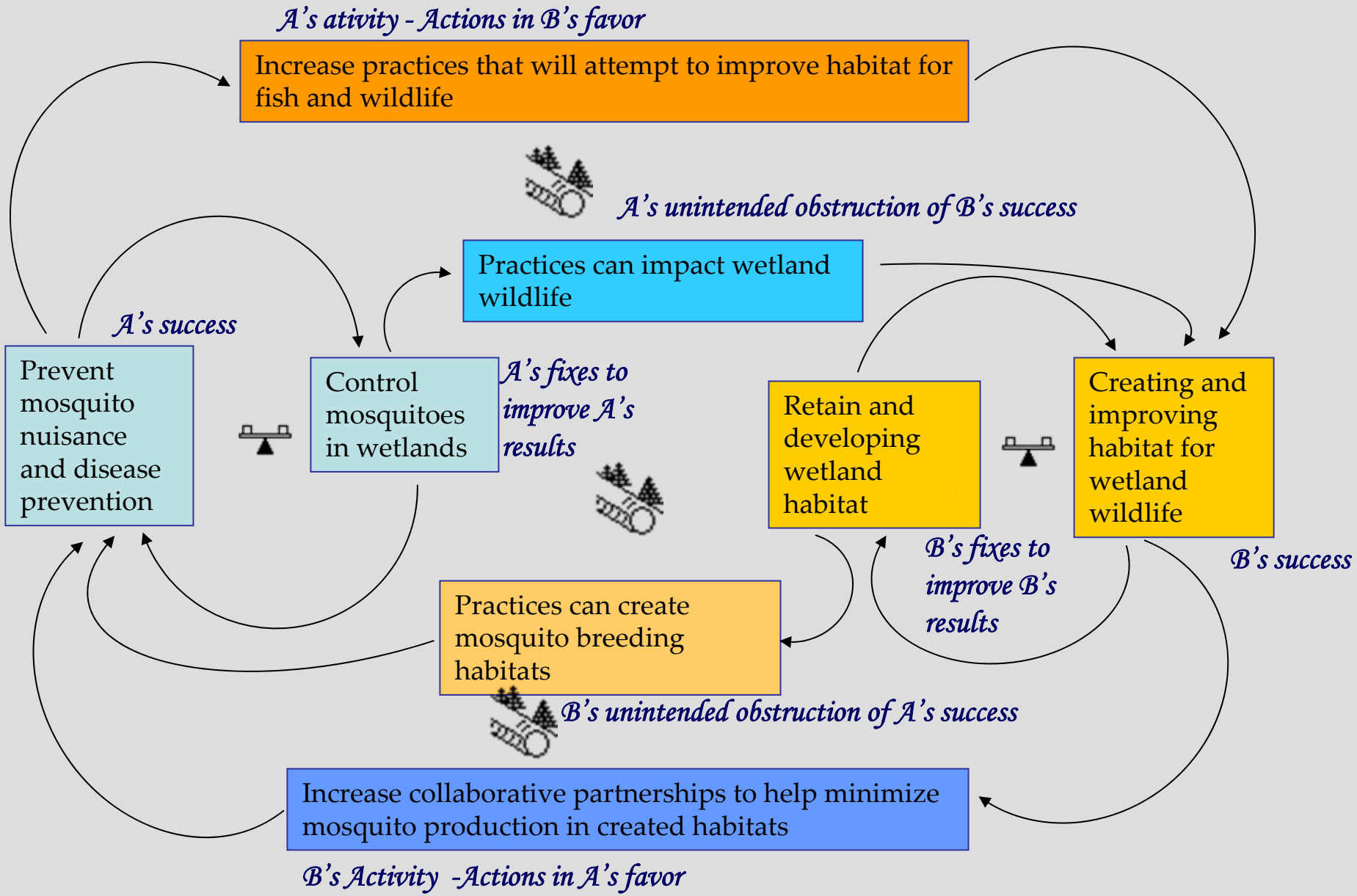

Accidental Adversaries

Solutions:

- **Don't push on the well-intended fix or solution that applies to your own part of the organization.**
- **Seek to strengthen your understanding of your partner's fundamental need, and how you could support each other instead. This may include helping to remove or weaken the constraints in your partner's system that resist your own solution.**

Computer Modeling

System Dynamics

- Mapping and modeling the forces of change in any dynamically complex system.
- Overcome the phenomenon of *policy resistance*
- Primary emphasis is on learning how our actions in the present can trigger plausible reactions both far away and over time. It does not forecast the future.

Commonly used software package – *iThink*

- Dynamic systems represented by the Malaria and Dengue
- To understand monitoring, evaluation and policy approaches that need to be considered
- Simulates our mental models to test a hypothesis and evaluate the likely effects of policies.

Why Bother with System Thinking???

(William O'Brien, Board of Governors – Center of Organizational Learning, MIT)

Success factors in organizations (1920 -1990)

- Efficiency
- Mass marketers
- Adoption of technology
- Financial Acumen

Success factors in organizations (1990 – the future)

- **Distributing power while increasing self-discipline**.
- Learning how to **understand systems and interrelationships**. We are good at the type of problem that lends itself to scientific solutions.
- **Improved conversation** – learn to overcome defense mechanisms that impede conversations and become good at conversation that isn't polite.
- **Voluntary followership** – do not think in terms of control.

References

1. Senge et al., 1994. The Fifth Discipline Field Book.
2. Benjamin, C. and Jones, A., 2006. Systems Thinking: A Practical Application. Participant Exercises. Division of Diabetes Translation, CDC
3. Forrester, J.W., 2000. A Guide to Learning System Dynamics. Sloan School of Management. Massachusetts Institute of Technology.
4. Newman, et al., 2003. A Systems Dynamics Approach To Monitoring and Evaluation At The Country Level: An application to the Evaluation of Malaria-Control Programs in Bolivia. Conference Paper.