INTRODUCTION TO CAUSAL LOOP DIAGRAMS

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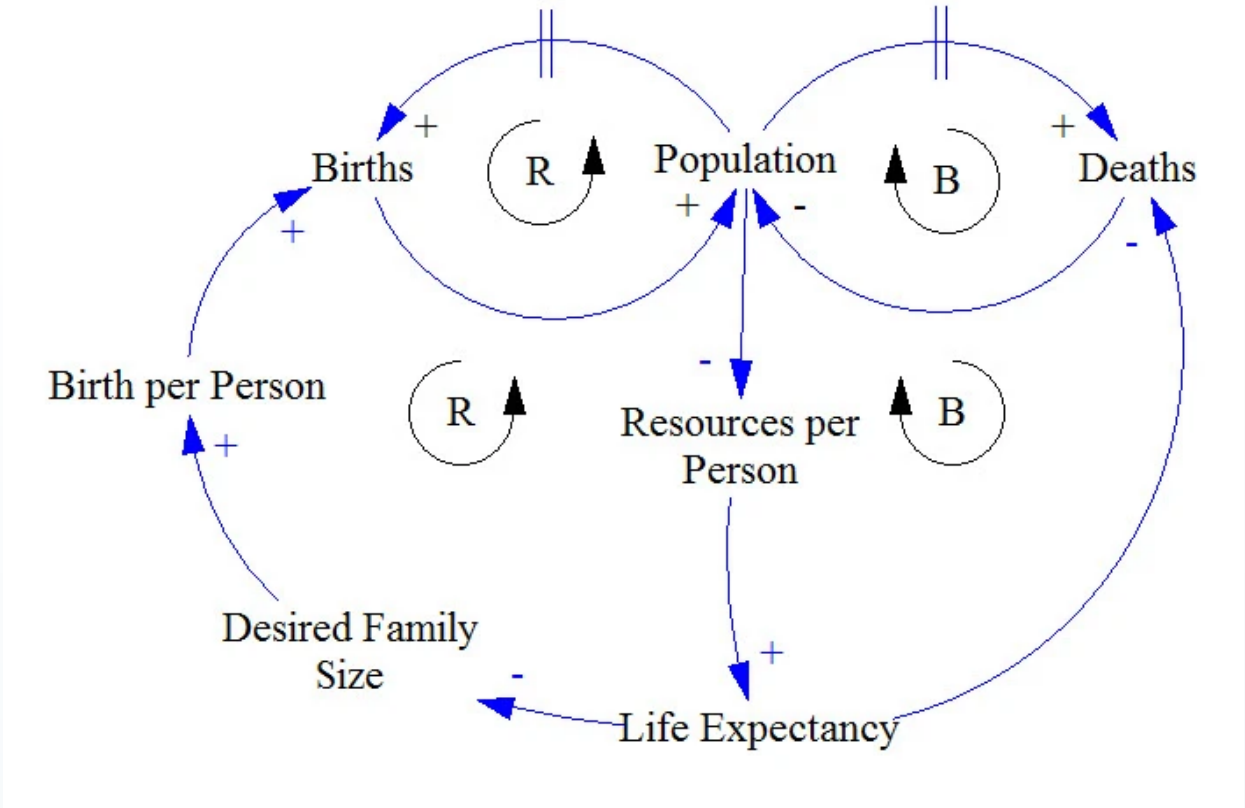
Excerpts from slides prepared for Water, Peace and Security tailor-made capacity development activities in Iraq. Please attribute authors when using materials.

Causal loop diagrams (CLD)

- A visualization of the system's interconnections
- A tool that facilitates system thinking and captures complex inter-dependent issues within diverse groups
- By representing an issue from a causal perspective, you can become more aware of the structural forces that produce complex outcomes
- Verbalizing a narrative through the loops to confirm the system behavior is being described. This story telling makes an understanding of the system more explicit.
- Includes 4 basic elements: variables, the links between them, the signs of the links and the sign of the loop

Qualitative model: causal loop diagram

A set of factors and arrows

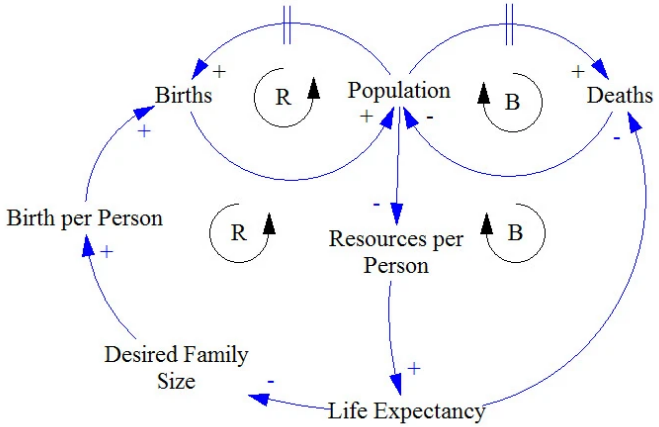


Qualitative model: causal loop diagram

Factors (= words linked by incoming or outgoing arrows and representing variables or quantities whose value changes over time).

- are neutral: <population> is better than <increase in population>, because the changes follow from the signs of the arrows
- are preferably concisely formulated
- and specific: a chain must be divided into several factors and arrows
- may be part of the socio-economic, environmental or institutional system
- may increase or decrease: <precipitation> is better than <climate>, because we can say <more precipitation>.

  <agricultural subsidy> is better than <policy>.

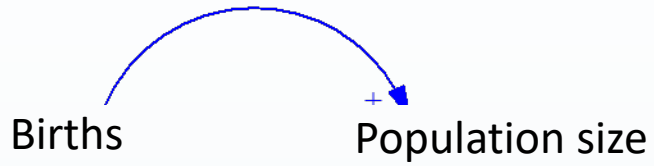


System dynamics - polarity

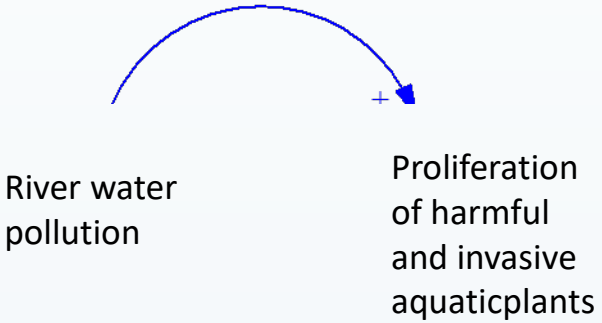
When 'factor x' increases, 'factor y' increases => positive arrow (polarity +)

When 'factor x' increases, 'factor y' decreases => negative arrow (polarity -)

Positive arrow

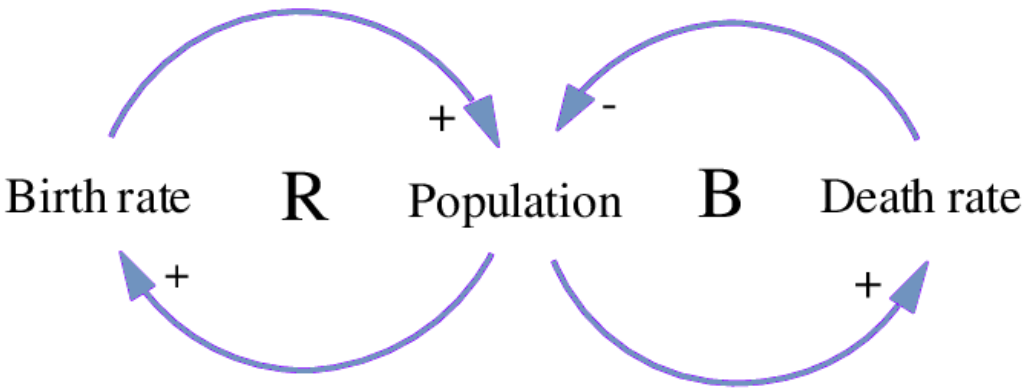


when the number of births increases, the size of the population increases



System dynamics

Negative arrow and balancing loop



R = reinforcing
B = balancing

when the number of births increases, the size of the population increases

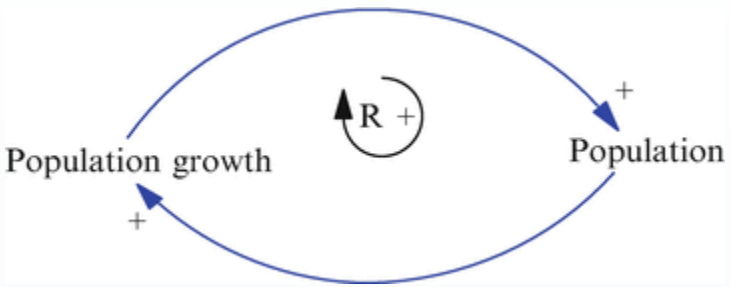
when the size of the population increases, the number of births increases

when the size of the population increases, the number of deaths increases

when the number of deaths increases, the size of the population decreases

System dynamics

Positive causal loop: reinforcement loop



when the number of births increases, the size of the population increases

when the size of the population increases, the number of births increases

Objective to develop a causal loop diagram on the links between natural resources and safety

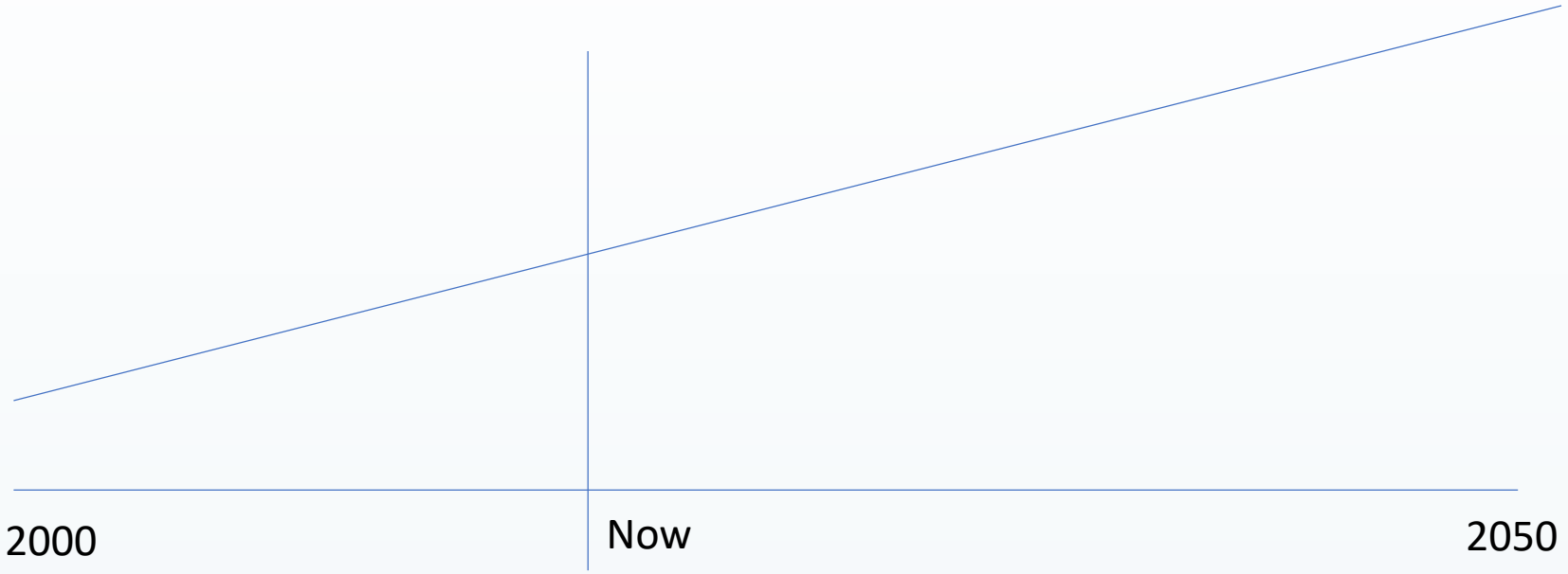
- clarify perceptions of causal links
- find links between the knowledge of different participants
- develop a shared understanding of the links between natural resources and security
- as a basis for identifying questions about the system that further research can help to answer

Example: 1. What are the causes and consequences of an increase in traffic jams

Severity of traffic jams

2. Pattern over time

- Traffic jams are currently posing a problem for society
- In the year 2000 the level was still acceptable, but since then increased steadily
- Fear is that traffic jam intensity will continue to increase and pose huge problems



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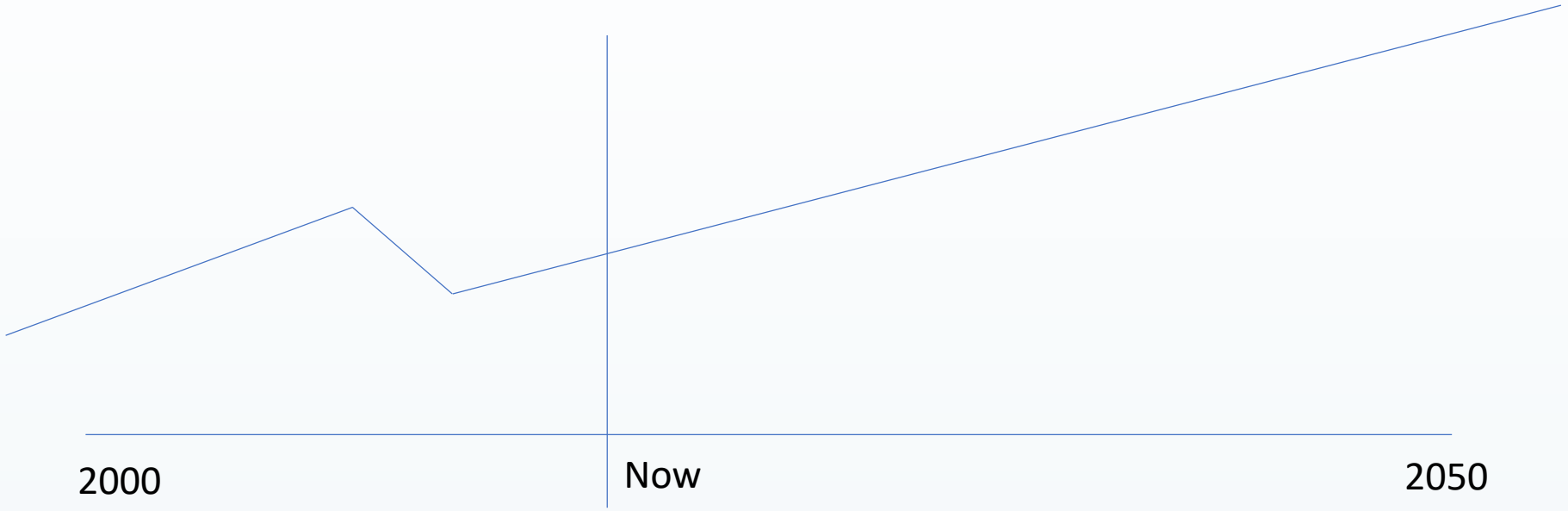
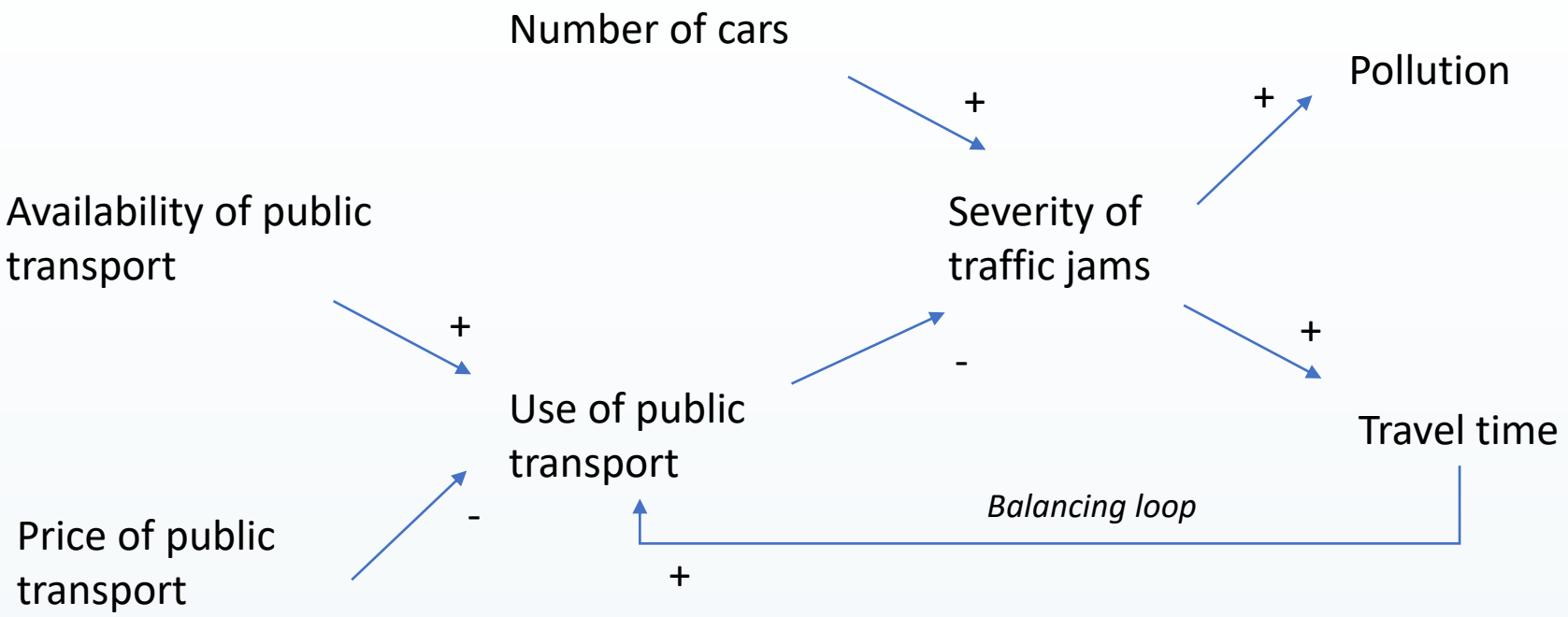


What are the causes and consequences of an increase in traffic jams?



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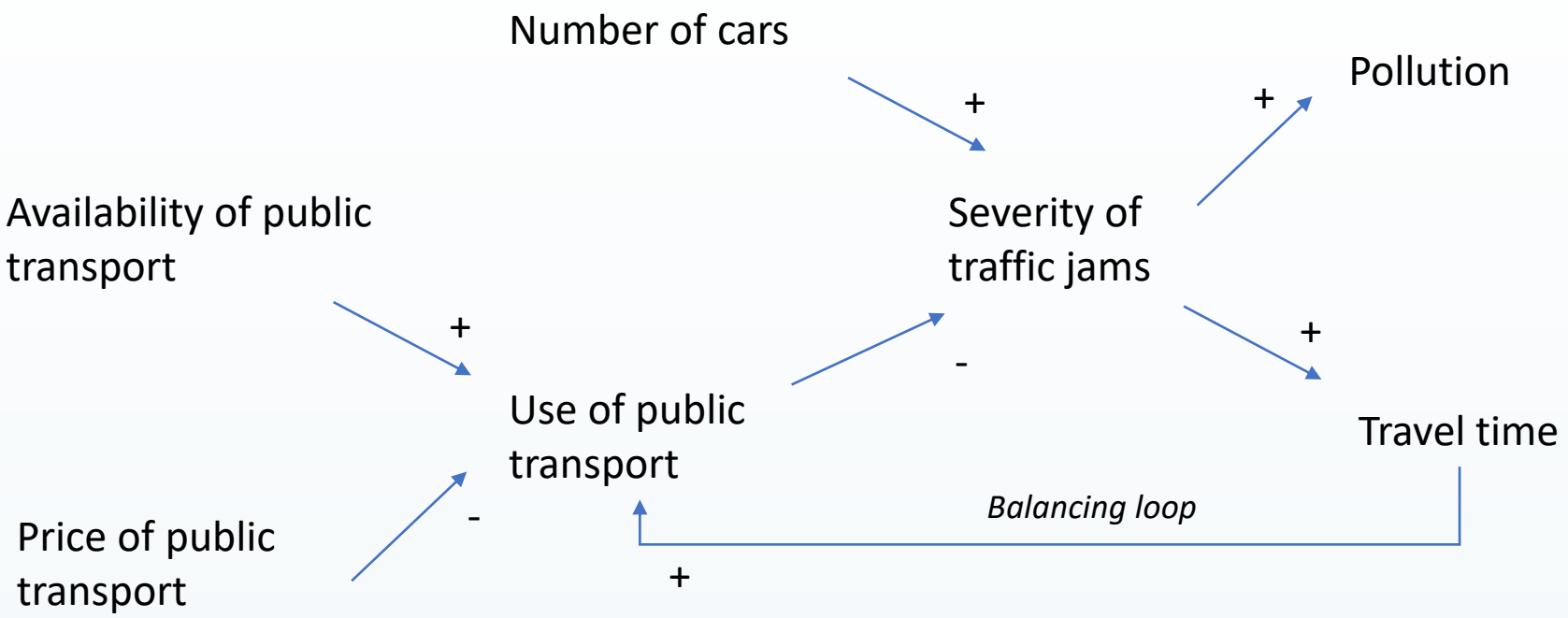


Causal loop diagram

To facilitate discussions

Helps to identify 'leverage points' and solutions

What are the issues?

- Outcomes of interest
- Causes
- 'issues' often linked

Approach to developing a causal loop diagram

How do stakeholders understand the links between natural resources and safety?

- Information gathered through conversations and workshops
- Identification of key issues as perceived by different participants
- Identification of the causes and consequences of these problems
- Integration into a single causal loop diagram by linking the factors raised in various activities
- There is an opportunity in this process to build a shared understanding of the water-conflict dynamic and therefore can be a tool of dialogue

Exercise Option 1: Causal loop diagram from daily life

- Choose a partner (your neighbor?)
- Choose a problem/issue: e.g. quality of a football team (choose your team), car accidents, number of stray dogs, bureaucracy, unemployment, informal economy, COVID, gender equality, urbanization, or an issue of your own choice. Write the identified issue on a piece of paper.
- Agree on at least one factor that influences the identified issue. Write that factor also on the piece of paper and draw an arrow from the causing factor to the identified issue.
- How does that cause influence the identified problem? Positively (+) or negatively (-)? Write the sign (+ or -) next to the arrow on the paper.
- Make a picture of the paper and put it in the chat of the training session.

Exercise Option 2: Comprehensive causal loop diagram analysis

- **Decide upon an issue as a starting point (WPS related) 10 min.**
  - Each think of an issue that can be a key issue
  - Discuss together and decide on one
- **Draw how the issue developed over time 10 min.**
  - Talk about the current state/level (as precise as possible) in the past 5, 10, 25, 50 years ago. And, draw how you hope for it to develop in the coming 5, 10, 25, 50 years or more.
- **Draw the causal loop diagram 45 min.**
  - 5 minutes for everyone to identify and write down factors, that are causes or consequences of the evolution of the key issue
  - 10 minutes to make a round and collect the factors one by one. Adapt them if necessary (neutral etc.) and group them
  - 45 min: start building the diagram by identifying links between the factors and the key issue. Sometimes the links are not direct, but via other factors.
  - Choose who will do the plenary feedbakc on your results.

wps

Exercise Option 3: Integrating causal loop diagrams into dialogue processes

Step 1 (10 minutes)

- Divide into two (diverse) groups
- Each group is assigned one of these water-related issues:
  - Water pollution
  - Water availability
- Assign two people responsible to lead the group session. Think about diversity when assigning these persons, take age, gender, cultural background and profession into account.
- The two leaders should make a session plan (i.e., divide responsibilities, identify an opening question)
- The remaining team members can identify which stakeholder perspective they will represent in this activity (e.g., provincial authority)

Step 2 (20 minutes)

- Copy the table below with only the words in the upper row. (rows and colums can be added if needed).
- Discuss factors and fill in the table below with factors causing and caused by the central issue assigned to your group. Remember factors are neutral, consise, specific, can increase or decrease and are part of the natural, socioeconomic and institutional system.
- Identifed facilitators will lead the discussion

Underlying causes	cause	issue	Immediate effect	Secondary effect
	Release of pesticides			Lack of food
		pollution	Fish mortality	Health issues

Step 3 (20 minutes)

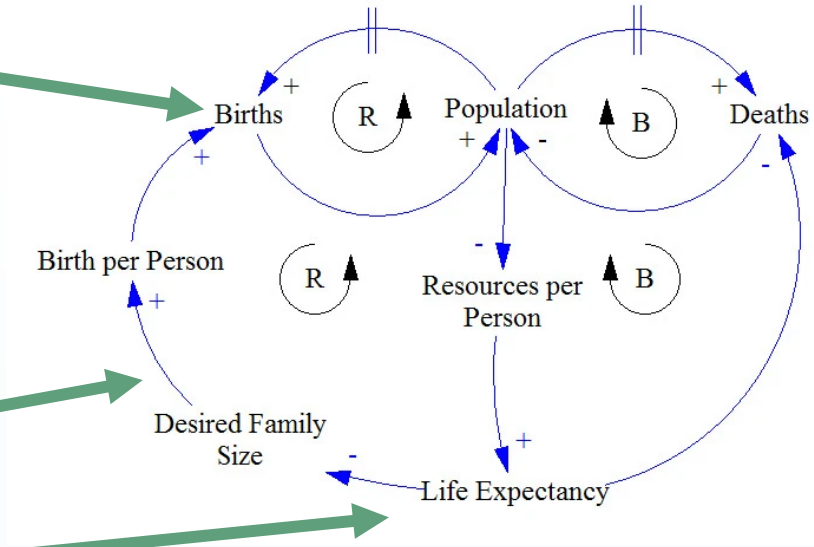
- Jointly place the factors of your table in a Causal Loop Diagram. Connect the factors with arrows with the correct polarity (- or +)
- Discuss the links and try to consider different possible connections between factors
- Focus on a dialogue, perceptions and experiences may be new or vary between people, take time for dialogue and come to a joint understanding of the system. Let people tell their ‘stories’).

Step 4 (10 minutes)

- Share with the whole group about your experience in the process and the results of this exercise.

Summary: Causal loop diagram elements

- **Factors** are neutral. They represent variables or quantities that change value over time and are linked by incoming or outgoing arrows (e.g., population or births).



- **Arrows** represent the system dynamics and polarity
  - When 'factor x' increases, 'factor y' increases -> positive arrow (+)
  - When 'factor x' increases, 'factor y' decreases -> negative arrow (-)

- **Loops** can reinforce or balance trends
  - R is “reinforcing”
  - B is “balancing”