Stocks and flows

A **stock** is the foundation of any system. Stocks are the elements of a system that you can see, feel, count or measure at any given time. A stock is a store, a quantity or an accumulation of material or information that has built up over time. It may be the water in a bathtub, a population, books in a bookstore, trees in a forest, the money in a bank or the motivation of your co-workers. A stock does not have to be physical.

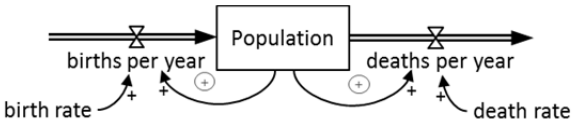
Stocks change over time through the actions of a flow. **Flows** are filling and draining, births and deaths, purchases and sales, growth and decay, deposits and withdrawals, successes and failures.

A stock can have multiple **inflows** and **outflows**. For example, a water reservoir (stock) can be filled (inflows) through river inflow or rain and can be emptied (outflows) through evaporation or discharge.

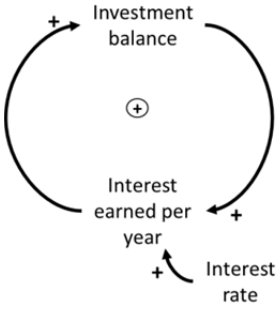
A stock and flow diagram is made up of several parts. A box is used for the stock and the flows are shown as a pipe and tap.

How to identify stocks and flows: Imagine that time is suddenly frozen. Flows are variables that you can no longer measure because they are expressed as a flow over time (ex. euros per year, lollies per hour). The variables that you can still measure are stocks. Stocks can be measured at an instant in time.

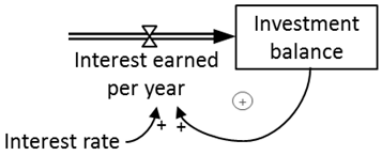
We can add feedback loops to show how changes in stocks feed back into the system. Feedback loops can cause stocks to maintain their level within a range (balancing) or grow or decline (reinforcing). In this example, the flows into and out of the stock change with the level of the stock.



Example: You recently won the lottery and decided to invest your winnings. Interest compounds on your investment according to the causal loop diagram to the left. In order to further study this structure, we need to transform the causal loop diagram into a stock and flow diagram. We can measure the investment balance at a point in time which means that it is a stock. Interest earned is a flow. The interest rate is an "auxiliary" variable. **Auxiliary variables** directly or indirectly influence the rate of a flow. As they are not the focus of our model they are simply shown in text form.



A stock and flow diagram shows the investment (a stock) growing as it accumulates the interest earned (a flow). The amount of interest earned depends on the size of the stock (via the feedback loop) and the interest rate (auxiliary variable).



Moving from a causal loop diagram to a stock and flow diagram

Three steps are required to move from a causal loop diagram to a stock and flow diagram :

1. Identify the key stocks in the system;
2. Identify the flows that modify the levels of the stocks;
3. Add the remaining variables and relationships including the feedback loops.