**Stable & Unstable Equilibria**

* Stable Equilibrium: system returns to same equilibrium after disturbance
* Unstable Equilibrium: system returns to new equilibrium after disturbance

*Feedback*

* Systems affected by outside & inside of system
* Change system to a new state/return to original state
* **Negative Feedback:** damps down, neutralize or counteract any deviation from an equilibrium
	+ Stabilizes system
	+ Results: Steady-state equilibrium
* **Positive Feedback:** further increase/decrease in the output
	+ Enhances the change in the system
	+ Destabilized and push to new equilibrium
	+ System may collapse (may be stopped by external force)
* **Ecosystem in state of flux:** it changes constantly

**Transfers & transformations**

* **Transfer:** matter and energy move or flow through ecosystems without changing forms or state
	+ Movement of material through living org
	+ Movement of energy
* **Transformations:** when a flow involved a change of form or state
	+ Matter to matter
	+ Energy to energy
	+ Matter to energy
	+ Energy to matter

**Flow & Storages**

* **Energy Flow:**
	+ From one compartments to another
	+ When org. eats another org. (stored chemical energy)
	+ Carbon bonds are broken during respiration 🡪 energy released 🡪 used by org. of lost as hear
* **Matter Flow**
	+ It’s as minerals
	+ Absorbed by plants 🡪 turn into cell 🡪 eaten by human 🡪 decomposers break dead organic matter 🡪 return to soil
* **Geochemical cycles:** shows flow and storage of energy and matter
* **Nitrogen/Carbon cycle:** show only the flow and storage of matter

**Complexity & Stability**

* **Complexity:** feedback links, flows & storages
	+ High complex 🡪more stable system
	+ Withstand stress & change
	+ Path can takeover if one is removed
	+ If lots of predators 🡪 one is wiped out 🡪 others increase by more preys
* **Monocultures:** farming system in which there is only one major crop 🡪 vulnerable to disease

**Models of system**

* Help predicts changes in the system by modeling reality
* Physical & software models, mathematical equations, data flow diagrams

*Climate models*

* Predict changes with a range of emissions of greenhouse gases
* Omit complexities of the real system
* Allow us to look ahead & predict effects of a change to an input to a system

**Test yourself**

1. Energy flows but nutrients cycle
2. Describe the transfers & transformation involved when light energy strikes a leaf-

The energy of the light has been transformed to the leave without changing the form yet as it is ‘absorbed’ by the plant, it changes from energy of the light to energy for the leaf to be used in her process of photosynthesis.

3. State the first law of thermodynamics. How does it apply to ecosystems?