

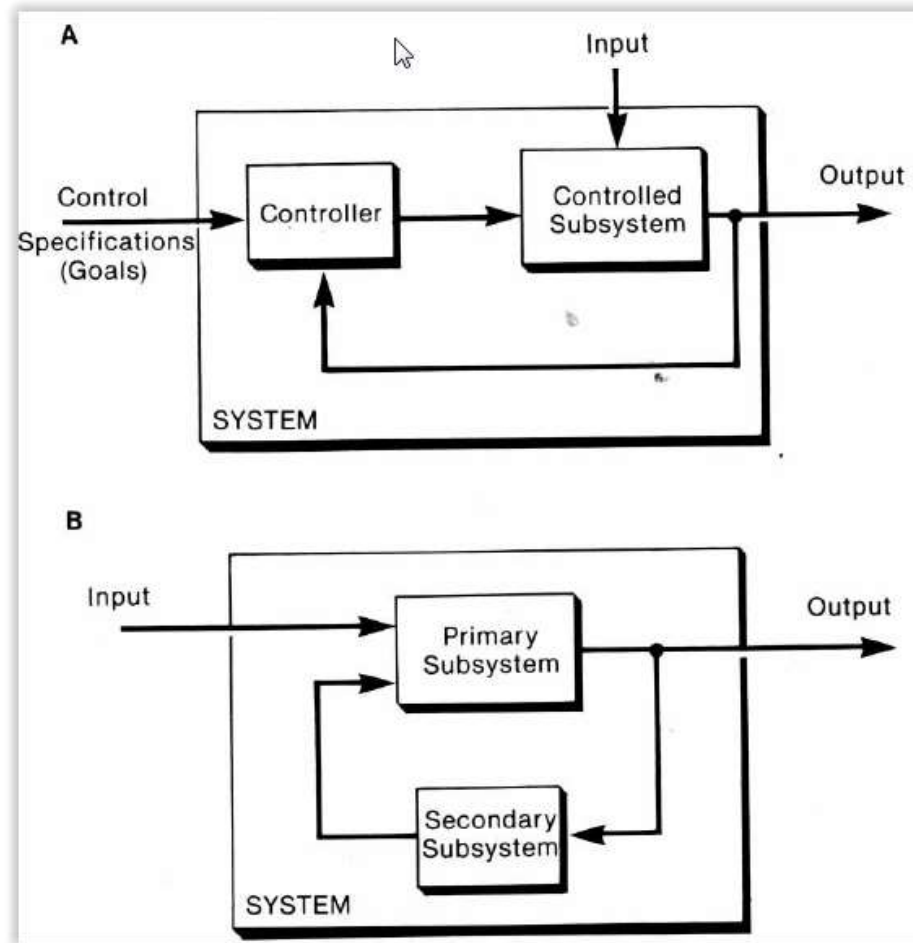
**Cybernetic nature of ecosystem,
stability through feedback control
and through redundancy of
components;
resistance and resilience stability**

The Cybernetic Nature & Stability of Ecosystems

- Besides energy flows and material cycles, ecosystems are rich in **information networks** comprising physical and chemical **communication flows** that connect all parts and steer or regulate the system as a whole.
- Accordingly, ecosystems can be considered cybernetic (from Gk. *kybernetes* = pilot or governor) in nature
- But control functions are internal and diffuse rather than external and specified as in human engineered cybernetic devices

The Cybernetic Nature & Stability of Ecosystems

- The elementary principles of cybernetics are modeled in Figure, which compares:
- A goal-seeking automatic control system with specified external control as in a **mechanical device (A)** with
- A diffuse subsystem regulation as in **ecosystems (B)** – where control mechanisms are internal & diffuse; involving interactions between primary and secondary subsystems



The Cybernetic Nature & Stability of Ecosystems

- In any case, control depends on **feedback**, which occurs when part of the output feeds back as input.
- When this feedback input is positive (like compound interest, which is allowed to become part of the principal), the quantity grows – **positive feedback**
- **Positive feedback** is **deviation- accelerating** & necessary for growth and survival of organisms

