Foundation

Topic 1 · SL

Leave the oil in the ground?

> Environmental decisions depend on evidence and on values.

- In 2023 Ecuador voted to stop drilling in part of Yasuní National Park.
- The same facts led different people to opposite answers.
- This unit: perspectives $\rightarrow$ systems $\rightarrow$ sustainability.

Environmental value systems

EVS	Central belief	Typical response
Ecocentric	Nature has **value** in itself	Consume less, live simply
Anthropocentric	Manage nature for people	Laws, taxes, planning
Technocentric	Strong confidence in technology	Desalination, carbon capture

Check: a technocentric response

Your turn

A city faces fresh-water shortage. Which proposed response most directly expresses technocentric confidence?

A. Use less water and protect wetlands
B. Build a desalination plant
C. Tax heavy water users
D. Move people to wetter regions

Values surveys

Your turn

Invented survey support rises from 30/50 to 40/50. What is the rise in percentage points?

A. 10
B. 20
C. 33
D. 40

How perspectives changed

Disasters

Minamata 1956, Chernobyl 1986.

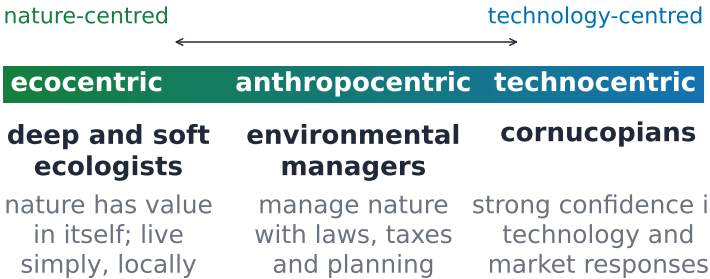
Fukushima 2011.

Books and agreements

Silent Spring 1962, Brundtland 1987.

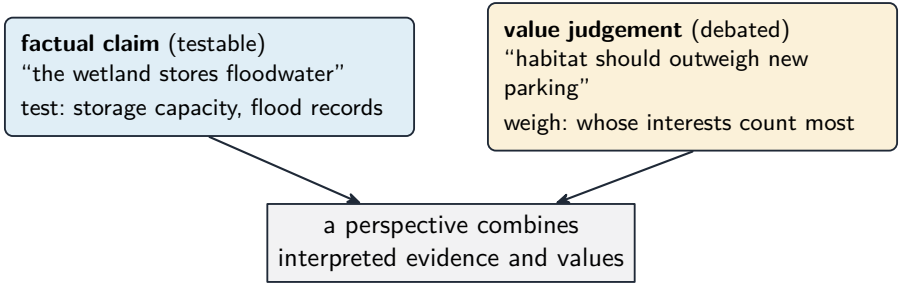
Rio 1992, Paris 2015.

The spectrum of value systems



Most people sit somewhere along the line

Fact or value judgement?



A **perspective** combines both

Storages and flows

Transfer

Water flowing down a river.

A fish eaten by a bird.

Transformation

Water evaporating.

Light energy to chemical energy in photosynthesis.

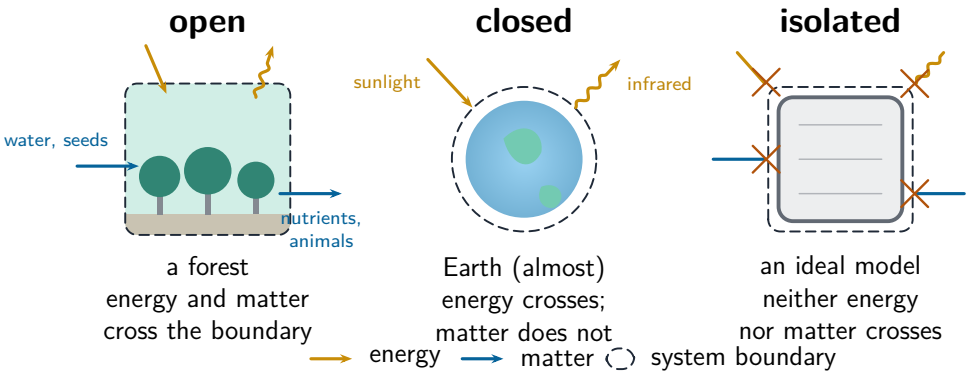
An interval budget

1. **Known.** Invented **storage** 800 m^3; mean rates in/out 120/90 m^3 per day; interval 3 days.
2. **Change.** $(120 - 90) \times 3 = 90$ m^3.
3. **Final.** $800 + 90 = 890$ m^3. A measured 875 m^3 leaves a 15 m^3 discrepancy to investigate.

Decision

Final storage is 890 m^3 under the stated **model**.

Types of system



Energy and matter crossing the **boundary** determine the **system** type.

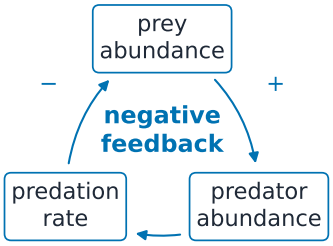
Energy in systems

- Energy input − output equals the change in **storage** over an interval.
- Respiration disperses energy; uneaten and unassimilated biomass also limit trophic **transfer**.

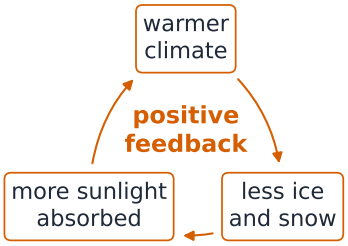
$$\text{efficiency} = \frac{\text{useful energy out}}{\text{energy in}} \times 100\,\%$$

Energy is conserved. There is no fixed maximum food-chain length.

Feedback



opposes the change;
delays can cause cycles



reinforces the change;
not a value judgement

Trace the complete loop; its sign does not judge whether the outcome is good.

Daisyworld

Mechanism

Dark daisies absorb and warm; light daisies reflect and cool.

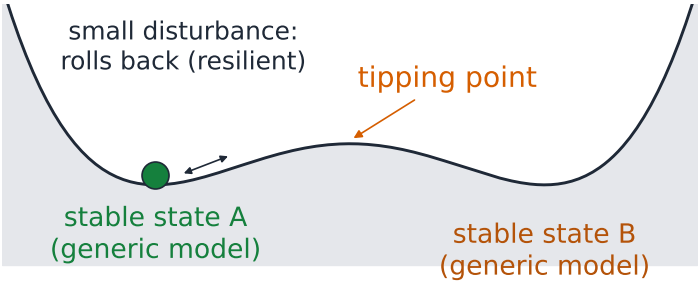
Temperature changes growth and coverage, which can oppose changes in input.

Limits

No conscious planetary planning is required.

Extreme conditions stop growth; the **model** does not guarantee real-Earth stability.

Tipping points and resilience



- Generic **model** of alternative states, not an exact Amazon clearing threshold.
- Functional diversity and suitable recovery traits can help; context matters.

Sustainability and justice

Ecological limits

Economy depends on society and environment.

Critical natural functions may not be replaceable by money.

Distribution

GDP is not a full environmental account.

Ask who benefits and who bears costs, locally and across borders.

Natural capital and income

Compare net regeneration with harvest, then also check ecosystem functions.

- Invented forest: 500000 m^3; net growth 2% per year gives 10000 m^3/year.
- Cutting 15 000 m^3 a year uses up the capital.

Ecosystem services

Provisioning and regulating

Food, water, timber.

Carbon **storage**, flood control.

Supporting and cultural

Soil formation, nutrient cycling.

Recreation, spiritual **value**.

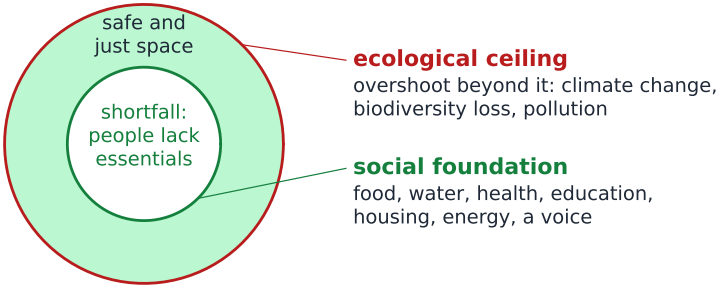
Ecological footprint

1. **Footprint per person.** Invented data: 50 million people; footprint 2.0×10^8 gha. Divide by 5.0×10^7 to get 4.0 gha/person.
2. **Biocapacity per person. Biocapacity** 1.2×10^8 gha divided by 5.0×10^7 people gives 2.4 gha/person.
3. **Deficit.** $4.0 - 2.4 = 1.6$ gha per person

Decision

Regional deficit $= 1.6$ gha/person; investigate trade, depletion and carbon.

Doughnut economics



- Meet essential needs while respecting ecological limits.
- Regenerative design restores functions; distributive design shares benefits and opportunities.

Environmental impact assessments

Strengths

Effects considered before deciding.

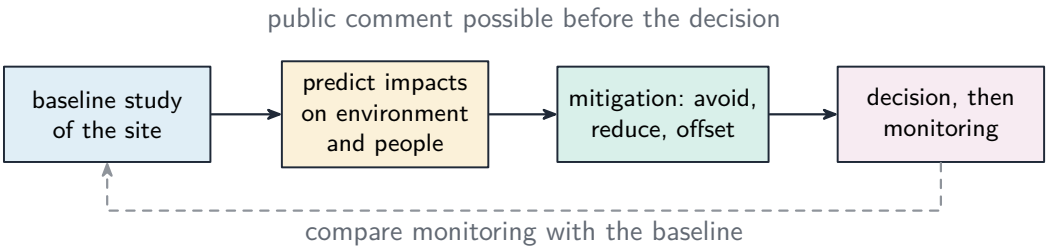
The public can comment.

Limitations

Predictions are uncertain.

The project may go ahead anyway.

An environmental impact assessment



Monitoring compares back to the baseline

Exam tips

> In evaluate questions, give strengths, limitations and a conclusion.

- Link each EVS to a specific action.
- A **storage** is an amount; a **flow** is a rate.
- Describe the whole **feedback** loop.

Check yourself

Try these

Classify photosynthesis and a fox eating a rabbit as transfer or transformation.

Explain why melting ice is an example of positive feedback.

A forest of 800 000 m^3 grows by 1.5 % a year. Find its natural income.