# Foundation

## Topic 1 · SL and HL

# 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.

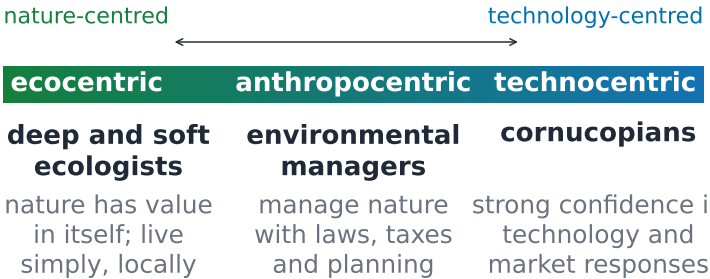
Fukushima 2011.

## Books and agreements

Silent Spring 1962, Brundtland 1987.

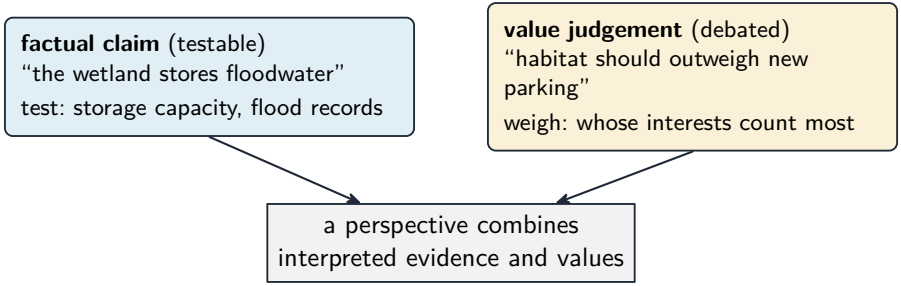
Rio 1992, Paris 2015.

# 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.

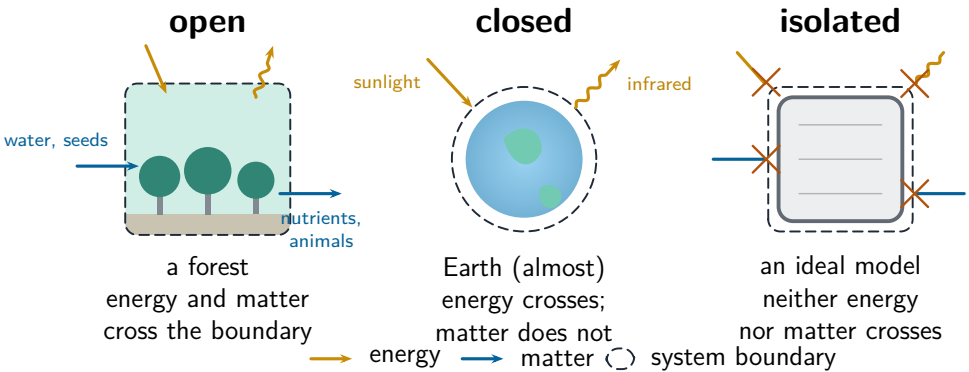
# An interval budget

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

## Decision

Final storage is 890 $\mathrm{m}^3$ under the stated **model**.

# Types of system




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

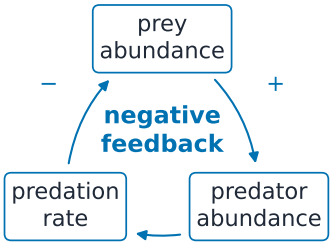
# Energy in systems

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

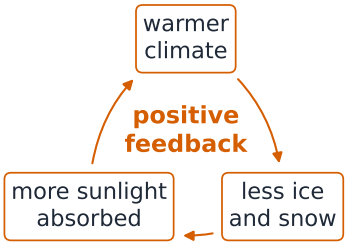
$$\text{efficiency} = \frac{\text{useful energy out}}{\text{energy in}} \times 100\,\%$$

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.

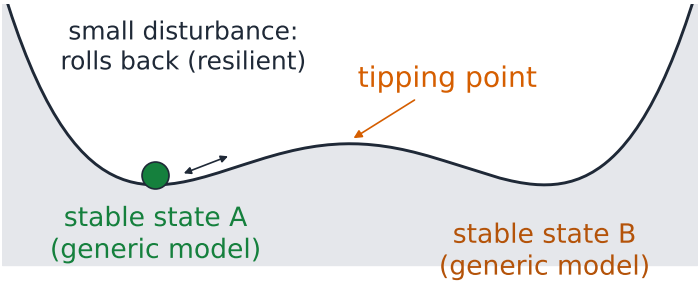
Temperature changes growth and coverage, which can oppose changes in input.

## 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**.

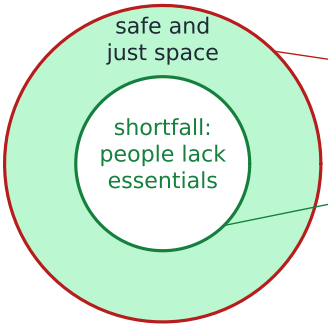
# Ecological footprint

1. **Footprint per person.** Invented data: 50 million people; footprint $2.0 \times 10^8$ gha. Divide by $5.0 \times 10^7$ to get 4.0 gha/person.
2. **Biocapacity per person. Biocapacity** $1.2 \times 10^8$ gha divided by $5.0 \times 10^7$ 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




**ecological ceiling**
overshoot beyond it: climate change, biodiversity loss, pollution

**social foundation**
food, water, health, education, housing, energy, a voice

Meet social needs while respecting ecological limits.

# Environmental impact assessments

## Strengths

Effects considered before deciding.

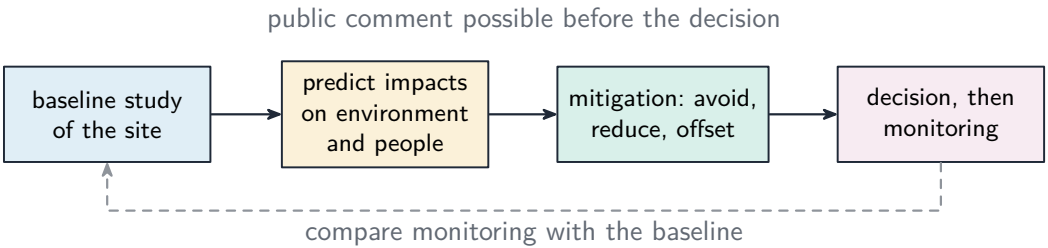
The public can comment.

## Limitations

Predictions are uncertain.

The project may go ahead anyway.

# An environmental impact assessment




Monitoring compares back to the baseline

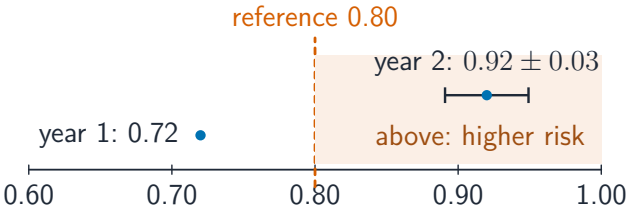
# AHL: Compare a threshold

1. **Given.** Illustrative upper reference 0.80; observation $0.92 \pm 0.03$.
2. **Compare.** Observed interval 0.89–0.95 lies above a fixed 0.80.
3. **Exceedance.** $100(0.92 - 0.80)/0.80 = 15\%$; an uncertain reference 0.70–0.95 instead overlaps the observation.

## Decision

A threshold comparison alone does not decide law, costs or fairness.

# Has the boundary been crossed?




whole interval 0.89–0.95 lies above: $(0.92 - 0.80)/0.80 = 15\%$ above (invented index)

> Only a whole interval above the line shows a crossing

# 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.