Exercise walk-through

5.2
Agriculture and food

International Baccalaureate · IB Diploma · Environmental Systems and Societies · HL

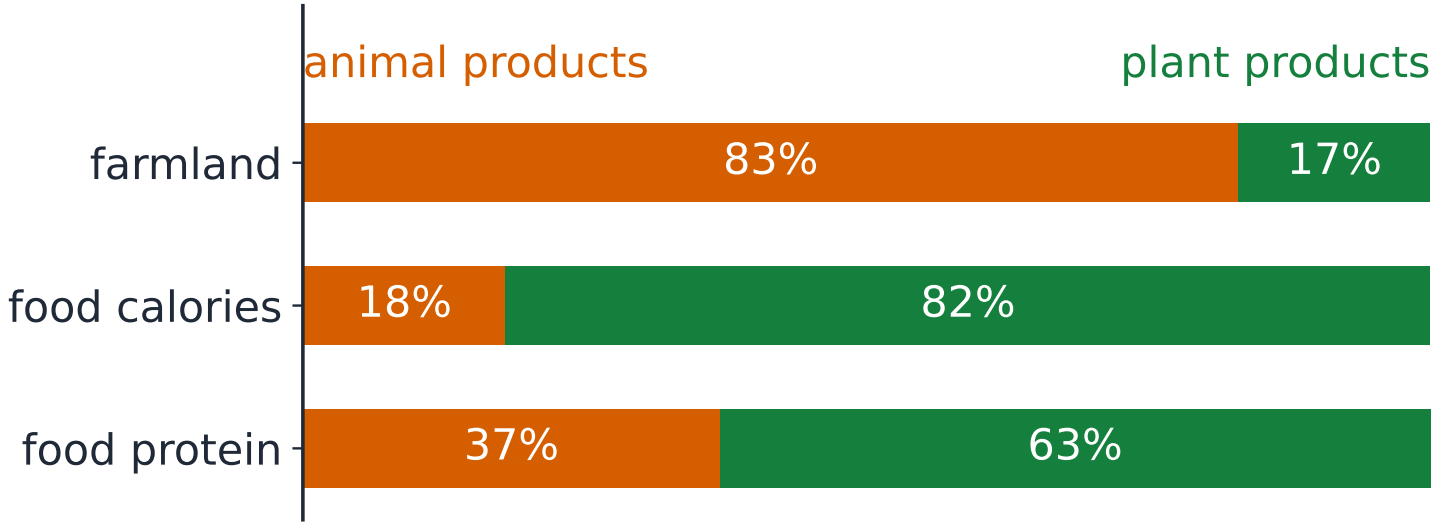
Energy output divided by counted input

1. **Invented givens.** A: food 45000 MJ, counted non-solar input 3000 MJ per ha. B: food 50000 MJ, input 20000 MJ per ha.
2. **Ratios.** A: 45000/3000=15. B: 50000/20000=2.5.
3. **Boundary.** Solar energy is excluded; count labour, fuel, fertiliser and machinery consistently.

Decision

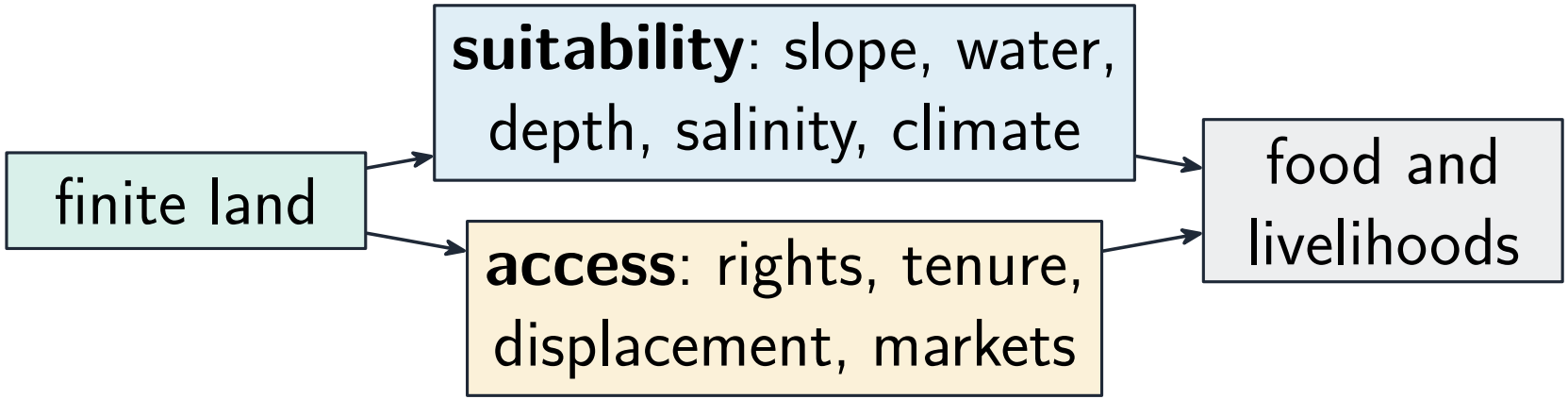
A ratio above 1 does not violate conservation; this is not a complete thermodynamic efficiency.

Dated land and nutritional shares



Oxford's 2018 research summary: attributed farmland, calorie and protein shares have distinct denominators.

Two filters on land for food



> Land must pass both to feed people

Exercises 2.1·2.2

2.1 Distinguish between intensive and extensive farming. [2]



2.2 Explain **three** ways food production adds greenhouse gases to the atmosphere. [3]



Exercises 2.1·2.2

2.1 Distinguish between intensive and extensive farming. [2]



2.1

intensive: large inputs of labour, capital, fertilizer per unit area, giving a high yield per area; extensive: few inputs spread over a large area, giving a low yield per area

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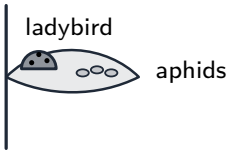
2.2

cattle digestion and flooded rice paddies release methane; nitrogen fertilizer releases nitrous oxide from soil; clearing forests for farmland, and fuel for machines and transport, release CO_2

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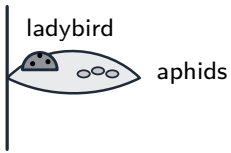
Exercise 2.3

2.3 Explain how integrated pest management (IPM) can reduce the environmental impact of farming. [3]



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uses natural predators (e.g. ladybirds eat aphids) and crop rotation to keep pests low; pesticides are sprayed only when pests pass a threshold, so less is used; fewer non-target species are harmed, less pesticide runs into water, and resistance develops more slowly

Exercise 3.1 (a)

3.1 The table shows the land needed to produce 100 g of protein (approximate global averages).

food	**land (m^2)**
beef (beef herd)	160
cheese	40
pork	11
tofu	2

(a) Calculate how many times more land beef needs than tofu for the same protein. [1]

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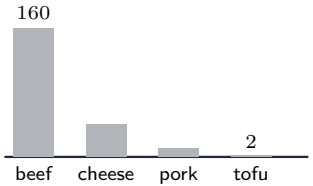
(a) $160 \div 2 = \mathbf{80}$ times

Exercise 3.1 (b)

3.1 The table shows the land needed to produce 100 g of protein (approximate global averages).

food	land (m^2)
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(b) Explain why animal products need more land than plant products. [3]

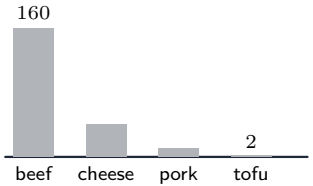


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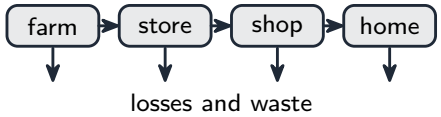


(b) animals are fed on plants (grazing or feed crops); energy is lost at each trophic level, mostly in respiration, so only about 10% is passed on; so far more plant food, and land, is needed for the same protein from animals

Exercise 3.2 (a)

3.2 About one-third of all food produced is lost or wasted.

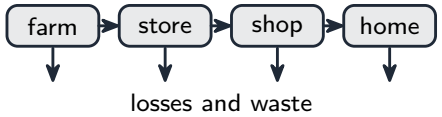
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(a) low-income: losses early, in harvest, storage and transport (poor storage, no cooling); high-income: waste at the end, in shops and homes (buying too much, strict “best before” dates, cosmetic standards)

Exercise 3.2 (b)

3.2 About one-third of all food produced is lost or wasted.

(b) Evaluate **one** strategy to reduce food waste. [3]

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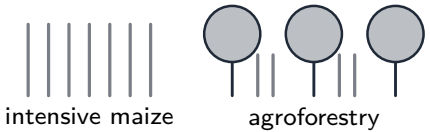
(b) Evaluate **one** strategy to reduce food waste. [3]

(b) e.g. better storage and cold chains: cuts losses where most food is lost in poorer countries; costs money and energy; judgement: high benefit for small cost when supported by government or aid

Exercise 3.3

3.3 A government must choose between expanding intensive farming and supporting agroforestry to feed a growing population.

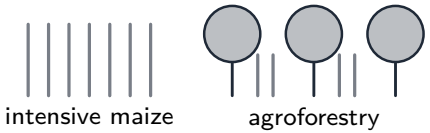
Discuss the two options. [8]



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award up to [8]: intensive: high yields per area, so less new land is cleared; feeds cities and earns exports; but high fertilizer, pesticide and water use; eutrophication, soil degradation, greenhouse gases; dependence on bought inputs; agroforestry: trees hold soil, add organic matter and nitrogen (legume trees), store carbon and support biodiversity; but lower yields of the main crop, slower returns, needs knowledge and labour; conclusion: a mix, matched to land type and farmers' needs, with justification