Unit 25 · Human Population

STUDY NOTES

WHAT NEB'S GRADE 12 EXAM ASKS

- **CDC's grid (2078):** Human Population and Health Disorders (Units 25–26 together): 4 of 75 marks; 1 short question (4 marks: understanding 1, application 1, higher ability 2)
- **The paper:** Botany 37 + Zoology 38; each part: MCQs × 1 (5 Botany, 6 Zoology) · 4 short × 4 · 2 long × 8; one OR in each short and long group; 3 hours; 1 mark per expected point
- **CDC's model paper:** short question on population (and, among the MCQs, amniocentesis)
- **Our model papers:** Paper 1 short question (why a young population keeps growing; a municipality's rate of natural increase per 1,000; Nepal's natural increase ~12 per 1,000 in 2025 but hardly any growth, and one effect); Paper 3 short question (Malthus's idea; doubling time ≈ 70 ÷ growth %; has his prediction come true? argue with the demographic transition)
- **MCQ (1 mark)**
  - demography; carrying capacity; natality = birth rate; mortality = death
  - S-shaped curve: humans; family planning, birth control control overpopulation
  - five stages in the demographic cycle; vasectomy: semen without sperms
- **Short and long (in parts)**
  - world population table and graph: estimate vs prediction, doubling times
  - draw growth curves; draw Malthus's theory
  - problems, causes, control of overpopulation; world's and Nepal's growth; pressure on human life
  - population, census, characteristics (long); World Population Day, census, dynamics (long)
  - growth curves (long); demography, causes, problems, control (long)
  - demographic transition and cycle (long); family planning in Nepal, FPAN, Nepal CRS (long)

Key terms

Demography: study of human populations: size, make-up (age, sex), where, how they change; a **demographer** studies them.

Population (*populus*, people): one species, one area, one time, working as a unit; interbreeding, sharing genes; a **self-regulating system**.

Community: all the populations living together (Chitwan's deer, tigers, grasses, trees).

Biotic potential: greatest possible growth, nothing holding it back.

Environmental resistance: what holds growth back (food, water, shelter, predators, disease, competition, disasters).

Carrying capacity (K): largest population an environment supports **indefinitely**; above it, it falls back.

Census: official count of every person at one time, usually every **10 years**.

Morbidity: how common disease is, not deaths.

Zero population growth: births = deaths, no migration.

Life expectancy: average years a person of a given age can expect to live (at birth unless said).

Population explosion / **crash**: rapid rise / rapid fall.

Population ecology: what decides a population's size, density, distribution, change.

- **World Population Day**: **11 July** (UN, 1989; 5 billion, 11 July 1987)
- three parts (CDC's 9.1.1–9.1.3): describing the population; its growth and control; the demographic cycle

Population characteristics

- natality, mortality, distribution, density, sex ratio, age structure, dispersal (everyday: also gender, ethnicity, education, income, poverty, life expectancy)

$\text{birth rate} = \frac{\text{live births}}{\text{population}} \times 1000$	per 1,000 a year **Use:** natality (CBR)
$\text{death rate} = \frac{\text{deaths}}{\text{population}} \times 1000$	per 1,000 a year **Use:** mortality (CDR)
$\text{natural increase} = \text{BR} - \text{DR}$	÷ 10 = % a year **Use:** Nepal: 19 − 7 = 12
$\text{vital index} = \frac{\text{births}}{\text{deaths}} \times 100$	over 100: growing **Use:** Nepal ≈ 270
$D = \frac{N}{S}$	per km^2 **Use:** density
$\text{doubling time} \approx \frac{70}{\text{growth \%}}$	years **Use:** 1% → 70

Natality: new individuals by birth

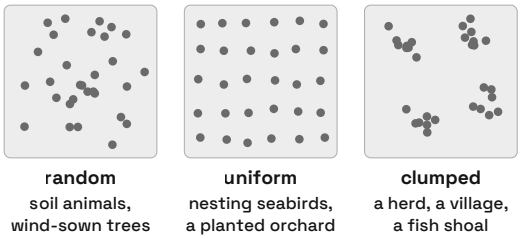
- **total fertility rate (TFR)**: children a woman would have at today's rates; **~2.1** replaces the parents (some die young; more boys born)
- Nepal: birth rate **~19 per 1,000** (2025), TFR **~1.9**; 1950: ~47, ~6 children
- **ecological (realized) natality** (actual) < **potential (maximum) natality** (ideal conditions)

Mortality: loss by death

- Nepal **~7 per 1,000** (2025), ~26 in 1950
- depends on crowding, competition, predators, parasites, **antibiosis**, disease, environment; tied to natality
- **ecological mortality** (actual) > **potential (minimum) mortality** (old age only)

Distribution (dispersion)

- **random**: by chance, no effect on one another; rare, even habitat
- **uniform**: evenly spaced; competition, **territories** (seabirds), planting
- **clumped**: groups round water, food, shelter, or social (herd, shoal, towns); **commonest**



The same 30 individuals spread in three ways.

Density: Nepal 29,164,578 on 147,516 km^2 = **~198 per km^2** (2021); Kathmandu District ~5,000, Dolpa ~5, Manang ~3

Sex ratio: Nepal: **males per 100 females**: 14,253,551 males, 14,911,027 females → **~96** (men abroad); India: females per 1,000 males; at birth ~105 boys per 100 girls

Age structure: **pre-reproductive** (under ~15) · **reproductive** (women 15–49) · **post-reproductive** (after ~45–50, menopause)

- many young → grows even with small families; many old → more deaths soon
- drawn as an **age pyramid** (men one side, women the other)

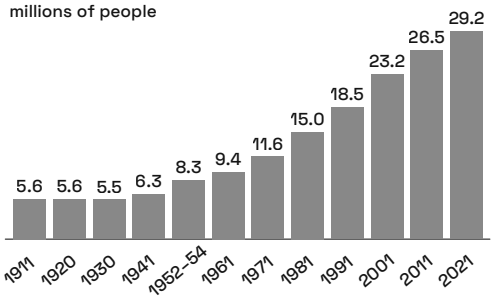
Dispersal

- **emigration**: one way out (decreases) · **immigration**: one way in (increases)
- **migration**: animals: regular two-way mass movement (Arctic terns, salmon, bar-headed geese over the Himalaya); people: any move to live elsewhere
- population changes by four: **births + immigration** add; **deaths + emigration** take away

- Nepal 2021: **2,190,592** living abroad (~7%, four in five men); UN: emigration ≈ natural increase → total growth ~0 (2025)

Population census

- records sex, age, education, household, work, industry; characteristics and dynamics worked out from it
- Nepal: first **1911**; since 1952–54 every year ending in 1; **National Statistics Office** (Central Bureau of Statistics until 2022); 12th in November **2021**

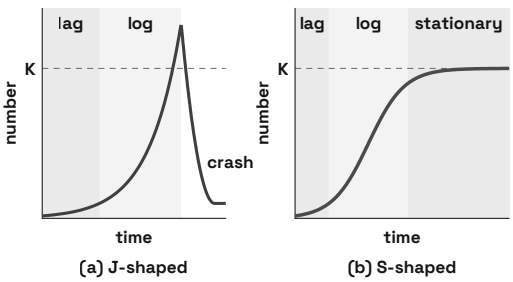


Nepal's twelve censuses, 1911–2021.

Census	Population	Yearly growth (%)	Doubling (y)
1911	5,638,749	–	–
1920	5,573,788	−0.13	–
1930	5,532,574	−0.07	–
1941	6,283,649	1.16	60
1952–54	8,256,625	2.30	30
1961	9,412,996	1.65	42
1971	11,555,983	2.07	34
1981	15,022,839	2.66	26
1991	18,491,097	2.10	33
2001	23,151,423	2.27	31
2011	26,494,504	1.36	51
2021	29,164,578	0.96 (NSO: **0.92**)	72

Growth curves

- two biggest threats: **environmental pollution** and **population growth**
- growth curve: number (y) against time (x)



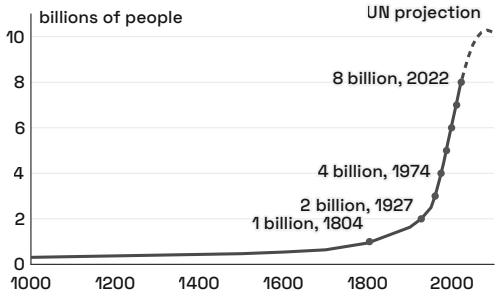
Growth curves: (a) J: lag, log, past K, crash; (b) S: lag, log (steepest at K/2), stationary at K.

	J-shaped	S-shaped
also	exponential	sigmoid, logistic
phases	two: **lag**, **log**	three: **lag**, **log**, **stationary**
lag	slow but steady	slow, settling in (positive acceleration)
log	geometric (2, 4, 8, 16…), faster and faster	fast, **fastest at half of K**, slowing near K
stationary	absent: sudden **crash**	births = deaths, stays near **K** (plateau, saturation, negative acceleration)
resistance	almost none until the crash	rises with the population
examples	insects in the rains, algal blooms, fruit flies in a jar	yeast, bacteria in culture, sheep in Tasmania, **humans** (expected)

- humans so far near a J; growth slowing since the 1960s; UN: levels off **~10.3 billion** in the 2080s → exam: humans follow the **S-curve**
- crash: 29 reindeer on St. Matthew Island (1944) → ~6,000 (1963) → nearly all died, winter 1963–64

Human population growth

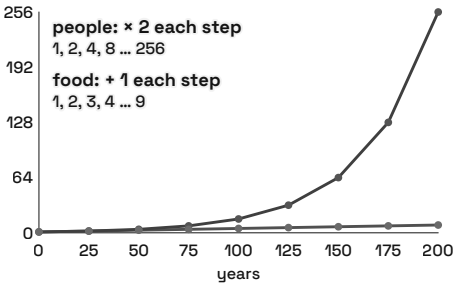
- **hunters and gatherers**: ~4 million around 10,000 BC
- **agriculture** (~8000 BC): raised carrying capacity; 200–300 million by AD 1; ~500 million by 1650
- **industry** (Britain from ~1750): with farming, transport, medicine → exponential phase
- what decides spread and growth: **geographical** (climate, water, soil, minerals, energy) · **social and economic** (education, income, ethnicity, beliefs) · **demographic** (stage of the transition)



The world's population, AD 1000–2100.

Malthus, *An Essay on the Principle of Population* (**1798**)

- population **geometric** (1, 2, 4, 8, 16… doubling every 25 years); food **arithmetic** (1, 2, 3, 4, 5…); after 200 years 256 people per 9 portions
- **positive checks** raise deaths: famine, disease, war, poverty
- **preventive checks** lower births: "moral restraint", later marriage, fewer children
- right: geometric growth possible; nothing grows forever on a finite Earth
- wrong: food grew faster (crops, fertilizers, irrigation, **Green Revolution**, 1960s); people chose fewer children as they grew richer, educated (**demographic transition**)
- read by Darwin and Wallace → natural selection



Malthus's two series.

The world

- 1750–1850: Europe grew faster than Asia; 1850: ~1.2 billion
- 1850–1950: Asia, Africa, Europe about doubled; North America ×6, Latin America ×5 (immigration)

Year	Millions	Year	Millions
1650	~500	1950	2,493
1700	~640	2000	6,172
1750	~790	2025	8,232
1800	~980	2050	9,664 (projected)
1850	~1,260	2100	10,180 (projected)
1900	~1,630		

- 20th century ~45 million a year; peak ~94 million (~1990); now ~70 million (69 in 2025), falling; zero ~2084
- 2025: Asia 58.7%, Africa 18.8%, Europe 9.0%, Latin America 8.1%, North America 4.7%, Oceania 0.6%; growth now mostly Africa, South and West Asia
- largest 2025: **India** 1,464 million (passed China **2023**), China 1,416 (shrinking since 2022), USA 347, Indonesia 286, Pakistan 255

Population	Reached	Years since the last doubling
250 million	AD 1	–
500 million	1650	~1,650
1 billion	**1804**	~150
2 billion	**1927**	123
4 billion	**1974**	47
8 billion	**2022**	48

- no doubling to 16 billion expected

Nepal (2021: **29,164,578**, 0.92% a year, slowest since the 1930s)

- slow before 1950; 2–2.7% a year 1950s–2001; slowing since

- children per woman ~6 (1970) → ~2 now (at or below replacement)
- death rate fell first (~26 → 7) → more than tripled 1950–2021
- life expectancy ~38 (1950) → ~71 (2025); under-5 deaths ~340 → ~24 per 1,000 born
- more in the Tarai and cities; many young people abroad
- median age ~18 (2000) → ~25 (2025)
- UN: peak ~**36 million** around **2067**, then a slow fall

Pressure on human life

- **A** density · **B** resources (natural, man-made) shared thinly · **C** intensive agriculture (fertilizer, pesticide, irrigation; soil exhausted)
- **D** moving to cities (Kathmandu Valley ~0.6 million 1971 → ~3 million 2021) · **E** more waste (the Bagmati) · **F** over-consumption · **G** grabbing of resources (colonizing, force, purchase)

Causes of growth (mostly **deaths falling**, births high)

- **A** agriculture · **B** protection from disasters · **C** storage (fewer famines) · **D** disease control (smallpox gone 1980; cholera, measles, malaria)
- **E** health care · **F** infertility treatment (**IVF**; few births) · **G** polygamy (a crime in Nepal) · **H** marriage, divorce, remarriage
- **I** son preference (social, economic pressure) · **J** lack of education, awareness (girls) · **K** falling death rate · **L** fewer child deaths · **M** sanitation · **N** longer lives

Consequences of overpopulation

- **A** food, drinking water short · **B** resources over-exploited · **C** waste · **D** unplanned **urbanization**, slums
- **E** unemployment (young Nepalis abroad) · **F** pollution · **G** hazards become disasters (slopes cleared, people on slopes, river banks, weak buildings)
- **H** climate change · **I** deforestation

Controlling growth (lowering births, by choice)

- **A. later marriage**: Nepal **20 for both** (Muluki Civil Code 2017; below it a crime, Criminal Code)
- **B. education and awareness**: school, radio, TV, social media, street drama (sadak natak); **girls' education** above all
- **C. safe abortion** (**MTP**): legal since **2002**; Safe Motherhood and Reproductive Health Act **2075 (2018)**: consent up to **12 weeks**; up to **28 weeks** for rape, incest, danger to her life or health, serious fetal defect, HIV or other incurable disease; trained providers, approved centers
- **amniocentesis**: fluid round the fetus by needle, to test for genetic disease; finding the **sex** (or by ultrasound) and aborting for it is a **crime**
- **D. family planning**: couples decide how many and when, by **contraception**

Kind	Methods
natural (free, fail often)	**safe period** (calendar, rhythm: avoid ~days 10–17 of 28) · **coitus interruptus** (withdrawal) · **lactational amenorrhea** (full breastfeeding, baby < 6 months)
mechanical	**male condom** (only one also against STIs, HIV; Dhaal) · **female condom** · **diaphragm**, **cervical cap** (with spermicide) · **IUDs**: Lippes loop (inert), **Copper T** (copper harms sperms, eggs; 10–12 years), Progestasert, levonorgestrel IUD (hormone)
chemical	**spermicides**: creams, foams, jellies, tablets (fail often alone)
hormonal (synthetic estrogen, progestin: stop ovulation, thicken mucus)	**pills** daily (Nilocon White free; Sunaulo Gulaf); emergency pills · **injectables** every 3 months (Depo-Provera) · **implants** under the arm skin, 3–5 years (Norplant first; Jadelle, Implanon)
surgical (permanent)	**tubectomy** (tubes cut, tied, blocked; minilaparotomy, laparoscope) · **vasectomy** (vasa deferentia cut, tied; quicker, safer)

Method	Pregnancies per 100 women a year (typical use)
implant, sterilization, IUD	under 1
injectable	~4
pills	~7
male condom	~13
withdrawal	~20
spermicide	~21
calendar	~15–24
none	~85

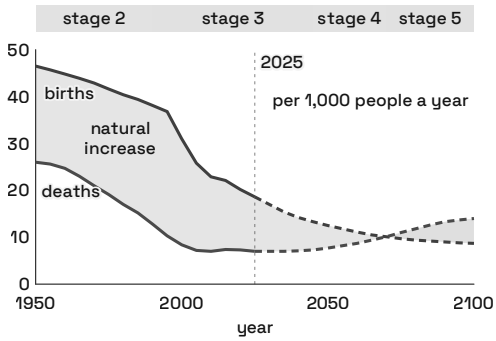
- **FPAN** (Family Planning Association of Nepal), **1959**: first; member of the IPPF; clinics
- government program from the 1960s: pills, condoms, injectables, IUDs, implants, sterilization **free** at health posts
- **Nepal CRS Company** (Contraceptive Retail Sales), **1978**: cheap condoms, pills, injectables in shops: **social marketing**
- 2022: ~43 in 100 married women on a modern method; female sterilization 13, injectables 9, implants 6 (NDHS)

Demographic transition and cycle

- **demographic transition**: **high births and deaths** → **low births and deaths** with technology, education, wealth; **deaths fall first**, births later (fewer child deaths, school, towns, women's work) → fast growth between
- **demographic cycle**: a population's course through it; **five stages**

Stage	Births	Deaths	Population	Examples
1. high stationary	high	high	steady	world before ~1750; India to ~1920; Nepal 1911–1930
2. early expanding	high	**falling fast**	grows fast	Niger, Chad (near its end)
3. late expanding	**falling**	low	still grows	India, Bangladesh, **Nepal**
4. low stationary	low	low	little growth, older	Sweden, Belgium, Denmark, Norway, Switzerland, USA
5. declining	**below deaths**	low	shrinks (unless immigrants)	Japan, Italy, Germany, Hungary, Bulgaria; China since 2022

- original theory had four stages; the fifth added when births fell below deaths



Nepal's birth and death rates since 1950, with the UN's projection.

- Nepal: UN expects deaths to outnumber births from ~2070 (natural decrease)

Paper questions

- young population: many about to reach the reproductive years → births stay many even with small families
- Nepal 2025: natural increase ~12 per 1,000, yet growth ~0: **emigration** about equals it; effect: young men away, villages short of workers, families on **remittances**
- doubling: 2.66% → ~26 years; 0.92% → ~76 years
- Malthus vs today: food per person rose; births fell in the transition; but no growth forever on a finite Earth

COMMON MISTAKES

✗ A population is all the species in an area
✓ that is a **community**; a population is **one species**.

✗ Morbidity is the death rate
✓ it is how common **disease** is; deaths are mortality.

✗ Carrying capacity is the greatest rate of growth
✓ that is **biotic potential**; K is the largest population kept **indefinitely**.

✗ The J-curve has a stationary phase
✓ it has only lag and log, then a **crash**.

✗ The S-curve grows fastest near K
✓ fastest at **half of K**.

✗ Nepal's sex ratio is females per 1,000 males
✓ Nepal counts **males per 100 females** (~96); India counts the other way.

✗ Growth came mainly from more births
✓ mainly from **deaths falling** while births stayed high.

✗ Malthus's prediction came true
✓ food grew faster than people; births fell with the **transition**.

✗ Nepal is in the fourth stage
✓ the **third**, late expanding.

✗ The demographic cycle has four stages
✓ **five**; the declining stage was added.