Environmental Behaviourism Humanism, Slope development, - Channel Morphology

Behaviourism

subjective (cognitive)

decision making behaviour mediates the spatial relationship b/w environment and man.

Geography ⇒ same
↓subjective knowledge of man;
but different for different persons

eg:- Pygmies in equatorial forest ⇒ believes that environment is supreme

Europeans ⇒ believe that man is supreme

Image of the environment depends on the view point of the observer.

Major points

1) Alternative model for quantitative revolution. To define cognitive (subjective) environ, which determines the [illegible] process

2) To unfold the spatial dimension of psychological & social theories of human behaviour.

3) To generate primary data to study human beh

4) To analyse the spatial variation in the decision making process.

Assumptions

1) Ppl have an environmental image - This image can be identified by the researcher.

2) There is a strong relationship b/w environ image & decision-making

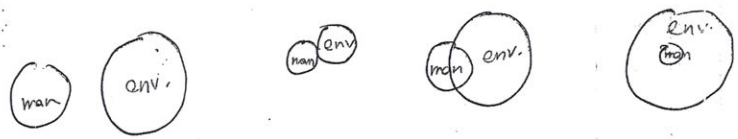
So, rather than a universal generalization using quantitative method, an individual-level approach using qualitative methods to include human behaviour, social & psychological dimensions.

Humanism

Man is the centre of the environment. humanism gives a central & active role to human awareness, conscience.

- To study earth as home of the man
- Gives methodology to study human experience.
- Provides a historical perspective of man.
- It recommends participatory approach.
  - To live with the community as a member, without revealing the identity of the research.
  - to get the actual meaning behind man's behaviour.

Radicalism Behaviourism Humanism



Applicability of humanistic approach

1. Geographical knowledge
2. Territory & place
3. Crowding & privacy
4. Livelihood & economics
5. Religion.

Basis of humanism

1- Every human has an inherent geographical knowledge. (even a migratory bird has its own geo knowledge ⇒ tracks route from Siberia to Rajasthan). So, try to study this geo. knowledge of man, rather than imposing external knowledge

2. Every human has his own territorial consciousness
eg:- even a dog has its own territory. Does NOT cross

3. Every human wants his own sphere of privacy.

4. ~~Good~~ Livelihood determines man's relationship with environment.
eg:- Poverty ⇒ man resorts to exploitation of nature.

08/12/12

5) Religion determines man's behaviour w.r.t environment, since religion itself originated initially as a faith of nature.

eg:- eating mutton (goat) is accepted in Hinduism. Killing cows is considered unholy.

Hinduism bars cutting down of banyan tree.

Protestant religion ⇒ advocates economic growth. allows exploitation of nature.

Slope

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Hill sh

Summt

~~Rectilinea~~

Rectilinea

Concave

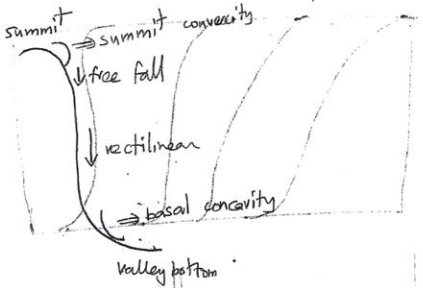
Get notes for 'Gene pool', 'Vitteday classification'. from sir)

08/12/12

Slope Development

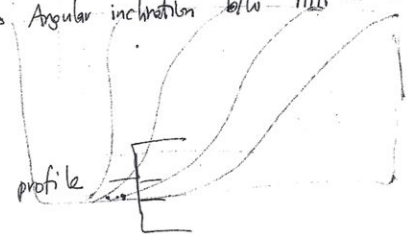
Slope

Angle between summit & valley bottom.



Slope → Angular inclination b/w hill top and

Hill slop profile

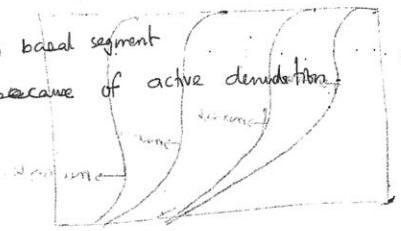


Summit convexity

~~Rectilinear~~ free face ⇒ wall-like slope;

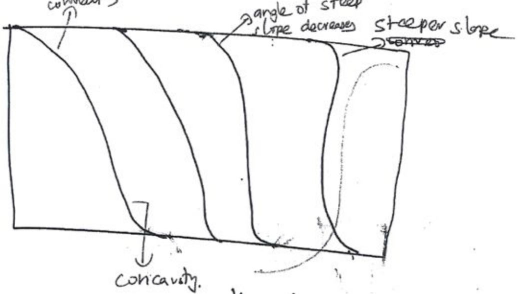
Rectilinear ⇒ linear segment b/w upper free face & basal concavity.

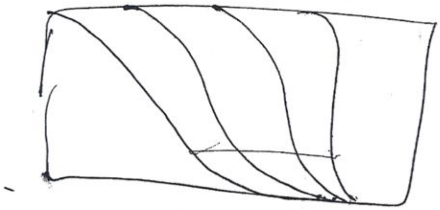
Concave ⇒ basal segment
↳ because of active denudation



Slope decline

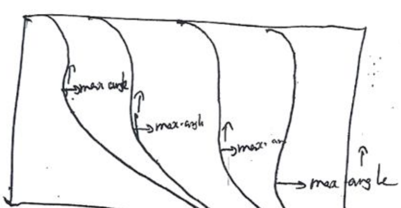
Steepest part of the slope progressively decreases in angle accompanied by development of convexity & concavity.





Slope replacement

Maximum angle decrease through replacement from below by gentle slope



Parallel

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length d

remains cr

place

Parallel retreat

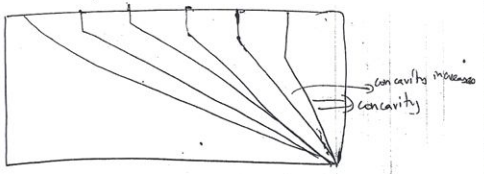
- with free face
- without free face

Maximum angle remains constant. The absolute length of all parts of the slope except the concavity remains constant. Concavity increases in length and it takes place always.

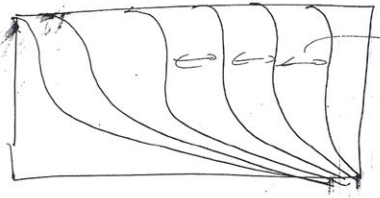
∴ Overall length increases

But abs. height remains constant.

i) With free face



ii) Without free space



Waste sheet ⇒ weathered materials existing on slope profile.

Davis ⇒ slope decline.

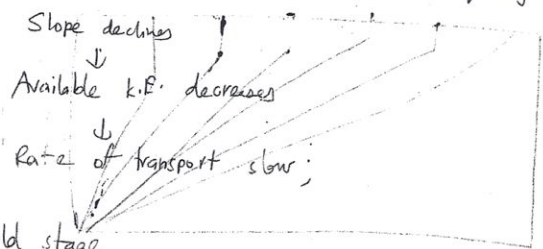
Youth state ⇒ high slope

⇓

Available kinetic energy > work to be done

⇓

Debris transported & removed quickly.

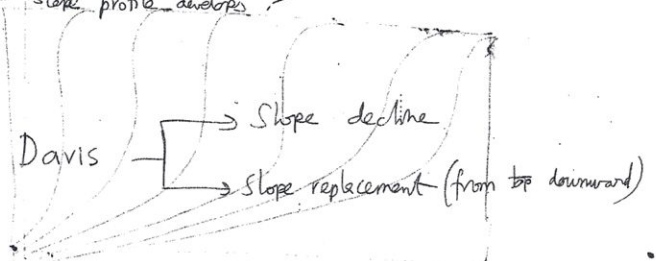


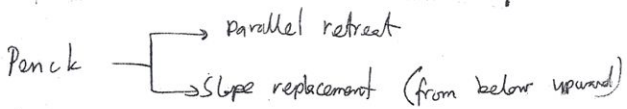
⇓

balance b/w supply & removal of debris

⇓

Graded slope profile develops.





Penck

include

Processes

1. Reduction

2. Denudatio

fa

3. Renew

L.C.K

process

1. F

2.

Factors

Pedi plana

Twin pr

Penck's

include parallel retreat drag.

Processes

1. Reduction ⇒ breaking regolith (O, A, E, B, C (includes solumn parent rock)) into finer particles by weathering.

2. Denudation ⇒ removal of regolith material down-slope.
   Factors:- Rate of weathering, mobility & climate.

3. Renewal of exposure ⇒ uncovering of parent rock material.

L.C. King

Processes

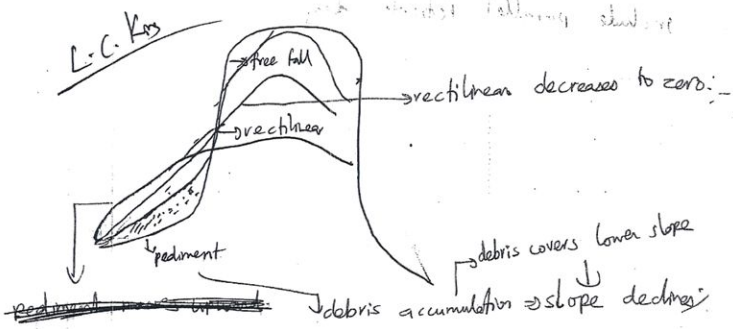
1. Fluvial process (water erosion) :-
2. Mass movement (due to gravity)

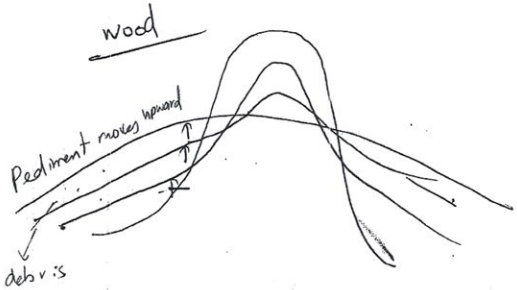
Factors ⇒ local conditions
resistant & strong bedrock
bold, sufficient relief.

Pediplanation Cycle

Twin process of SCRAP retreat & Redimentation;

Pediplanation





- Debris deposits on foot. ~~Pediment~~
- debris removal < debris accumulation
- Pediment moves upward at the cost of free face & rectilinear.
- Free face & rectilinear disappears.

↓

Debris covers the whole mountain

↓

creates a plain-like structure

Concept

↓

NOT

eg:

remain

Gentle Slope

16/12/12 1st test

23/12/12 2nd t

30/12/12 3rd t

6/01/12 4th t

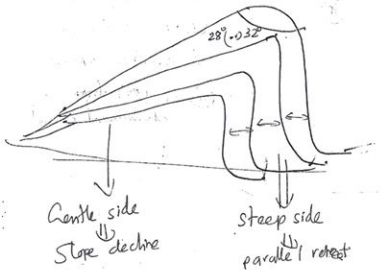
Concept of Savinye

NOT theory; based on practical field observation.

eg:- Why is the steep cliffs on Australian coast remain steep for more than 100 yrs?

Why no slope degradation?

Savinye
- slope retreat decline on gentle side
- parallel retreat on steep slope



16/12/12 1st test → Physical setting, agri & resources

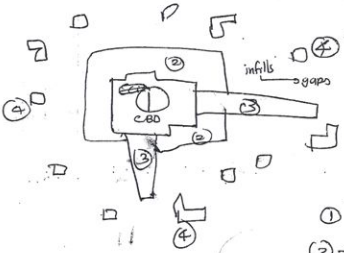
23/12/12 2nd test → Industry, transport, cultural setting

30/12/12 3rd test ⇒ Population, settlement

6/01/12 4th test ⇒ Soil science, environ, contemporary issues.

Urban Sprawl

- Areal expansion of rapidly growing cities
  ↓ either due to low class SQUATTER SETTLEMENTS (push factor: no space in city, no land rights) or HIGHER CLASS SETTLEMENTS (pull factor: for big gen mansions, noise free environment)
- Usually, expands linearly outward, along the roadways



① → city core
② → continuous sprawl
③ → ribbon sprawl
④ → leap frog or checkerboard sprawl.

- Also, leads to scattered peri-urbanization ⇒ dispersive urban growth ⇒ creates hybrid landscape ⇒ rural-urban fringes.
- Also leads to suburbs, conurbation & formation of megalopolis.
- It usually causes
  1) Dispersion (lesser population density : eg:- higher classes build homes with lawns etc. on huge tracts of land)
  2) Discontinuity (leap-frog sprawl, as shown in fig.)
  3) Segregation of land-zones (a residential area, separated from the CBD : single use zoning) ↓ the places where ppl live, work, shop are all far from one another

-This encourages car-dependency → more emissions
(for higher classes) → more obesity & NCDs.
→ leads to fatal accidents.

Eg. of a megalopolis formed by URBAN SPRAWL.

WORLD

1) Eastern Seaboard of USA

INDIA

1) NCR Delhi

2) Tokyo, Nagoya, Osaka

3) Black country of UK → Birmingham, Wolverhampton, Bromwich, Walsall (Can area of industrial heritage dept).

Negative effects

1) Sprawl is essentially a 'low density zone' ⇒ consumes more land per capita

2) Agri. lands are converted for urban use → threat to food security

3) Car-dependent communities → obesity, emissions, accidents -

4) JOB SPRAWL & SPATIAL MISMATCH

Many factories & malls which require huge land move out of the city & locate themselves in the sprawl. This adversely affects the workers close, who live close to the CBD in the city-slums. They now have to REVERSE ~~TRANSIT~~ COMMUTE, spending more on transport.

Eg:- 50% Black Americans in US slums suffer from SPATIAL MISMATCH (b/w CBD & new factories) ↓ close to slums

5) Lack of public goods & service access to those in sprawl.

6) Speculative builders are willing to build profit-maker high class buildings, but not for low class affordable houses.

How to control?

1) Smart growth → urban planning & transport theory that concentrates growth in compact WALKABLE ↳ → USA → Kentucky, Portland... centres to prevent sprawl.

2) Compact city (or) Urban intensification → UK ⇒

a GREEN BELT policy, that restricts new buildings outside cities

Some facts on cities — UNEP (Rio summit — 'Future we want')

- 50% of humanity (3.5 b ppl) live in cities.
- By 2030, 60% of humanity will live in cities.
- In the next decade, 95% of urban expansion will take place in developing countries.
- 800 m ppl live in city slums today (MDG 7 :- Rehabilitate at least 200 m slum ppl).
- Cities occupy just 2% of earth's land, but support 50% of population, account for 70% energy consumption & 75% carbon emissions.
- High density cities can bring efficiency gains & tech. innovation while reducing energy & resource consumption.

SUSTAINABLE CITIES

UN habitat ⇒ Prosperous cities, 2012

New Delhi → 53rd rank
Mumbai → 58th rank
} Medium performance.

Dimensions taken

1) Productivity → job creation
2) Quality of life → clean drinking water, health, edn.
3) Infrastructure → transport, comm
4) Equity → Gini coefficient
5) Environmental sustainability → emission

What all makes a city sustainable?

1) Accessible public goods & services to all.
2) Cultural & social amenities are accessible to all.
3) Low cost, affordable houses.
4) Community links are strong & work together to deal with issues such as crime & security. (VIBRANT & COHESIVE CITY)
5) Areas of open space (parks, etc.) are safe, accessible & enjoyable.
6) Energy efficient homes.

7) Waste
8) Walka
9) Safe &
10) Public
11) Inwarded
12) Limiting
13) Infra (
14) Renewa
15) Safel
16) Xeriscap
eg:- Masde Whitefi
17) Green
eg:- Awa

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CITY)

& enjoyable.

7) Waste is seen as a resource and is recycled. (15)

8) Walkability & cyclability.

9) Safe & reliable public transport.

10) Public transport is seen as a viable alternative to cars.

11) Inward investment is made to the CBD

12) Limiting the city size, increasing its density, prevents sprawl.

13) Infra (roads, telecom, power

14) Renewable energy.

15) Safe & clean drinking water.

16) Xeriscaping → garden & landscape design for water conservation.

eg:- Masdar City in Abu Dhabi;
~~Whitehill~~ Bordon in U.K.

17) Green buildings (LEED → leadership in Energy & Envi design certification)

eg:- Auroville in India

FUNCTIONAL CLASSIFICATION of CITIES

based on CITY-FORMING & CITY SERVING FUNCTIONS (economic activities)

→ Ashok Mitra, Registrar of Census of India.

1) Manufacturing towns → near raw material sites; on transport lines.
   - segregation of business est. & houses.
   - officers quarters & labourers' dwellings are separate.

eg:- Jamshedpur, Bhilai, Rourkela, Bokaro, Durgapur, Chittaranjan, Coimbatore, Modinagar, Papernagar.

2) Admin towns:
   - national or provincial or district H.Q.
   - imp. political establishments (Supreme Court, Parliament) located here.

eg:- New Delhi, Mumbai, Patna, Kolkata, Bhopal

3) Collection centres:

ⓐ Mining towns: metallic, non-metallic, precious stones or energy resources
- Mining equipments & spl. clothes & accessories needed for miners.

eg:- Digboi, Bailadila, Kolvali (Gujarat), Jharia, Raniganj, Zawar (Rajasthan).

→ ⓑ fishing ports:
   - used as base for boats, ships
   - facilities for sorting, drying, freezing, canning fish.
   - boat building, repair of nets, fishing equipments.

→ ⓒ Lumbering towns:
   - collect & process wood.
   - have saw-mills & joinery,
   - paper mills.
   - tree/plant nurseries & research centres.

eg:- Kalpyadam, Kotdwar, Haldwani (Uttarakhand), Dimapur (Nagaland)

4.) Trade
.
.
.

eg:-
Dehradun(

5) Cultur

6) Resort

7) Financi

4.) Trade centres :-

- Historically imp. trading routes.
- Specialization in trade.
- esp. in desert crossings, mountain passes, river crossing
  silk road (longitudinal duires) Karakoram

eg :- Okha, Kandla (Gujarat), Kattihar (Bihar), Agartala (Tripura) Dehradun (Uttarkhand).

5) Cultural centre → education, religion
Shanti Niketan, Varanasi.

6) Resort town

7) Financial town

15/10/13.

ESSAY

→ Choose a topic which you understand deeply.

→ Do NOT choose a complicated topic, just for the sake of being different. ⇒ Spend 15 mins - for understanding it.

→ Once chosen, spend 1 hour for brainstorming.

① ⇒ Just jot down all points that comes to your mind. Context on (Don't keep any subheadings in mind) ⇒

② ⇒ Now write down subheadings & split the above pts - into the subheadings.

③ ⇒ Intro ; Conclusion → in Rough page ; clarify it, weed it, clean it & prepare an attractive note.

④ Don't quote too many examples.

⑤ The no. of pages you write does NOT matter. Do NOT stretch the essay, without points.

⑥ Do NOT restrict to a particular subject.
- Write broadly.

⑦ You can start with a story, depending on the topic.

⑧ Engage in course correction as & when you write the say... Try to see if you go in the right direction.

I expect these essays
- → Ethics
- → Globalisation & homogenization;
- → FDI → threat to the local industry.
- → New media & national security.
- → Unsafe women in globalised era.
- → Disaster is man-made.

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↔ Religi
→ Reform
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'Whither Indian democracy'?
Where is Indian democracy upto?
→ Read every word carefully.

→ Don't choose a topic by your emotional attraction to it. Choose a topic based on your familiarity.

→ Try to see everything from a Mohen jo Daro perspective (earliest history).

→ Try to have a panoramic view (a global view).

→ Preamble → geographically, historically, socially, politically, economically, environmentally.
worldwide view

→ Indian political parties don't have ideology.
↔ Religion & communalism are not same.
→ Rationalism & religion.
→ New World Economic order (NIEO)
↔ Your vision of India in 2100.
↔ We have literates, but not educated.

→ Globalisation has destroyed Indian traditional society.

→ If I am the God.

→ Media activism.

→ Advancement of Science & human values have negative correlation.

Globalisation → NOT a new phenomenon; Age old.

No! It has NOT destroyed.

- Globalisation → people, culture, knowledge, finance, labours, ...
- Glocalisation → adapted to own culture → for eg: veg KFC; KFC in diff. states no beef;
- Homogenisation → Mcdonaldisation.
- IVC times → ancient silk road
  - Chinese, Mesopotamian, Persian civilisations., Indo-Greeks, Parthians, Satavahanas
- ~~Before our colonial rule~~
  - Assimilation → Mughals, Akbar, Babar → Indianised
  - Islam, Birjyani, Chudidhar
  - family system sustains.
  - Resilient kinship & community life.
  - Globalisation & religion → worship has increased & diversified.
    - Pittsburg Venkateswara Vishnu temple.
    - Theosophical society: Malaysia Murugan
  - Globalisation of Music → A.R.R., Pandit Ravi Shankar
    - Indian music thrives.

- Globalisation → global citizen at physique, Indian citizen at heart.

- Social phones / Iphones / KFC chicken
  - families dining together
  - keeps far beings close at heart.

- Globalisation of religion
  - Hindus, Muslims, Christians → but, still the same Indian culture; no much variation except the place of worship (only in the sphere of sacred)

- Some aspects which have been destroyed
  - traditional attire / varying tastes.
- Globalisation of business
  - The craze for Indian cotton, tea.
- Globalisation of ppl → Indian diaspora ⇒ more Indian even more than natives
  - ↓ remittances;
  - ↓ spread of culture.
- Globalisation of cinema → fans for SRK, AB abroad
- Globalisation vs. Americanisation;
  - ↓ homogenous; westn;
- Religion & Caste still predominant
  - globalisation of caste & oppression ⇒ eg:- UK Race Equality act.
  - Globalisation & violence against women; remain conserved even today...
  - ~~If Indian trad~~ . Marriages → endogamy;

No!

Intro

1) Globalisation vs. Americanisation
2) Mcdonaldization & homogenization
3) Indian society → Globalised since 3000 BC.
4) Glocalisation → Global + local → KFC chicken;
5) Indigenisation → Akbar, Indo Greek, Parthians.
"hand of an Indian Ghent of Greek"
6) Globalisation of ppl → diaspora → Indian culture spreads abroad
food, festivals.
7) Global citizen @ physique, Indian @ heart.
8) Globalisation of Music → dress colour, food
P. Ravishankar, AR Rehman
sitar
9) Religion
- more attendance @ temples
2. style culture, rules Gods are diff.
10) ~~Globalisation~~ Globalisation of caste
11) Family institutes & resistance.
12) Globalisation of media.

Traditional society

- family;

Yes!

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Polity

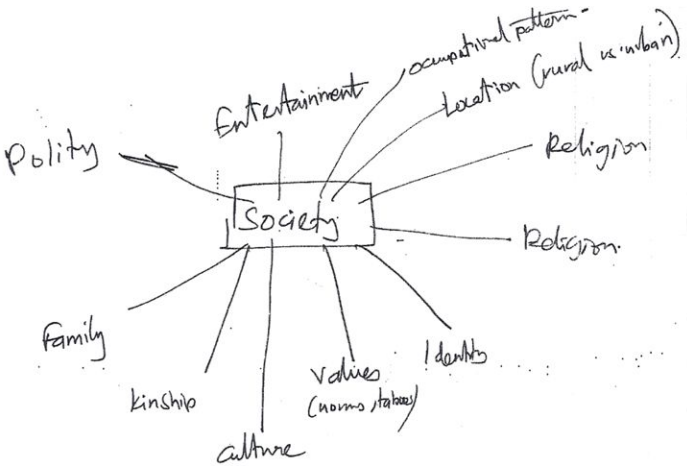
Family

- Individual
- Skills
- Knowledge
- Attitude
- Adaptab
- Emotion

Yes!

Coca colonisation

- Consumerism
- Identity crisis
- Homogenization
- Pop culture
- Individualism
- Minimal role of state
- Food, dress.
- Community life
- Bilingualism (languages)



- Individualism (Relation b/ individual & society).
- Skills
- Knowledge
- Attitude
- Adaptability
- Emotional attachment

Yes!

. Crimes against women.

. Joint family → nuke. family (lack of adaptability - adjustability)
eg: ~~[illegible]~~ increasing rate of divorces.

- Values → ancestor worship → respect for elderly → old age homes
- Time → children scarcity → creches.
- Religion → self-styled Godmen; Religion as a business tactic
  → eg: - Akshaya Tritya.
- Family → marriage system, gay marriage, live-in relationships
- Knowledge, info.; but NO values.

If I

TV, print, social

Media

. Peopl
. Bene
. Public
. Busi
. Politi
. Secu
. Priva
. Sove
. Judi
. Busi
. Me

If I am God

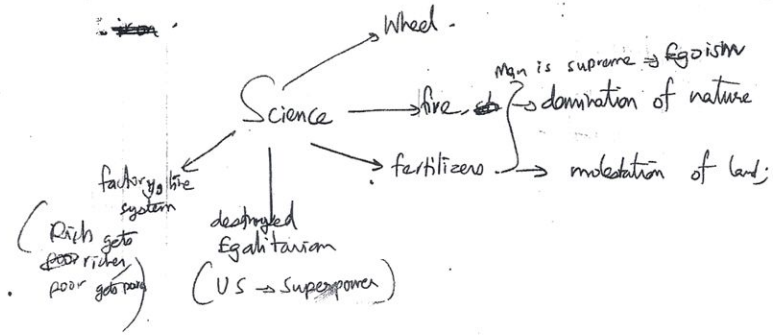
- Interesting, undiscovered
  1) Babies' thought process
  2) ~~Boo~~ Mind vs. heart.

TV, print, social media

Media → activism

- People
- Benefits to media
- Public opinion
- Business & media
- Politics & media
- Security
- Privacy
- Sovereignty
- Judiciary
- Business & politicians
- Media in Nationalism

→ Advancement of science & human values have negative correlation.



Human values

- Harmony with nature — fire, plough → Egoism
- Egalitarian (primitive communism) → domination of nature, domination of each

Boundaries	Frontiers
1. Lines demarcating the outer limits of territory under the sovereign jurisdiction of a nation-state.	Zones of varying width, separating the ecumens of a given pair of states. These are sparsely populated & of little utility, so the states on either side may not feel the need to define its limit precisely.
2. Inner oriented. The state tries to protect territory within its boundary.	Outer-oriented. The states try to expand outer into the frontier.
3. Centripetal 	Centrifugal 
4. Separating factor	Integrating factor (it is a zone which has a particular way of life.) eg:- Nagas communities in Indo-Myanmar frontier region.
5. Political.	Geographical.
6. Linear	Areal (these are zones).
7. Artificial (man-made)	Natural.
8. A phenomenon of the present (modern nation-states function on the basis of boundary)	A phenomenon of the past. (when there were ethnic communities who self-ruled).
9. It is artificial & hence can be moved (by a bilateral agreement)	It is natural — geographic, linguistic, cultural or religious — & cannot be moved.

Classification of boundaries

- Genetic or functional → 1) Antecedent 2) Subsequent 3) Superimposed 4) Relic or relict
- Morphological
  - ① Physiographic ② Geometric ③ Anthropogenic (or ethnic)

Genetic or functional

1- **Antecedent** → Boundaries predate (relat the time of exploration) the evolution of natural landscape.
eg:- USA & Canada (49th parallel); Africa → Berlin conf. (1884)

2. **Subsequent** → boundaries evolve with the society & cultural landscape.
eg:- nation-states in Europe, Indo-Pak;

3. **Superimposed** ⇒ a type of subsequent boundary (boundaries formed after evolution of cultural landscape), but cultural division does NOT coincide with the boundary. The boundary is imposed by an external power or by the dominant of the 2 states.
eg:- Ghana, Nigeria, Togo, Somalia ⇒ imposed by colonial powers

4. **Relic or Relict** ⇒ They have lost their political function, but it is still noticeable in the cultural landscape. It results from smaller states are subsumed by larger states, or when old boundaries are redrawn.
eg:- Spanish America & Anglo-America (Canada & US), East & West Germany.

Morphological

1) **Physiographic** → follows some feature of the landscape

ⓐ Mountain → eg:- Indo-China (Himalayas), Chile-Argentina (Andes)

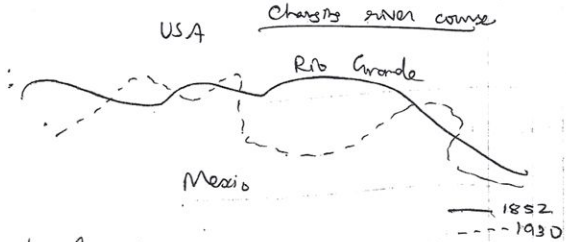
Adv:- 1) Stable 2) High & defensive 3) Firmly fixed

Disadv:- 1) No well defined crest (peak, which separates)
2) No coincidence b/w crestline & water divide.
3) Presence of transverse valleys & passes.
4) Dvpt. of sky as a highway (air transport)

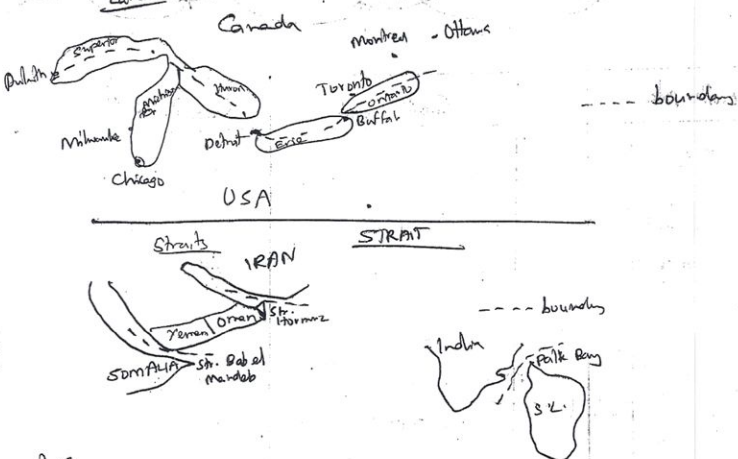
b) Rivers → eg:- Rio Grande (US-Mexico) ; Ghagra (UP - Bihar)

Adv:-
1) Clearly fixed on map.
2) More linear than mountain (which has a width)
3) Wide streams can act as effective buffers.

Disadv:-
1) Drainage basin act as unifying rather than separative factor.
eg:- Indo-Pak ; Indo-B'desh
2) Rivers shifting courses make admin & crime control difficult. eg:- Rio Grande



c) Lakes & Straits
- Divided exactly across the middle



2) GEOMETRIC
- straight line boundaries, following latitude & longitude.
eg:- 49th parallel → US-Canada ; 38th Parallel → N & S Korea

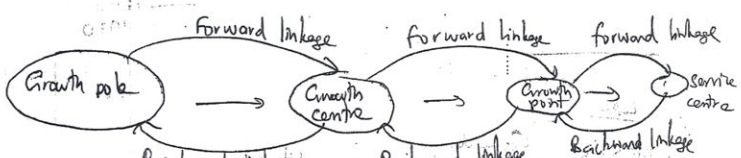
3) ANTHROPOGEOGRAPHIC
- Separates political communities, based on nationality.
eg:- most nation states in W-Europe.

Growth pole

- Growth is NOT ubiquitous, rather it occurs at poles centres & points with varying intensities and spreads through diverse channels and has varying terminal effects for the whole of the economy.

The variation in growth rate is due to variation in
1) Entrepreneurial innovations
2) Availability of resources.

The inter-regional disparities in growth are bridged by diffusion of growth to surrounding areas of growth poles, via forward & backward linkages.



Growth pole	Growth centre	Growth point
1) Population → 5-25 lakh	1 to 5 lakh (Tier-II)	<1 lakh (developing countries) <10,000 (dwpd.)
2) Has a BASIC industry (capital goods industry) initially.	No capital goods ind. only light goods (consumer goods) & services	FOOD PROCESSING & consumer goods)
3) Dominance of 2° & 3°. eg:- financial, edn, cultural, medical, industrial, technological sectors.	Dominance of 2° & 3°. • Grain, fruit & veg. markets, storage facilities for agri goods, agri. input like fertilizers, pesticide; edn, cultural, medical facilities.	TV station, financial servic
eg:- Bokaro, Bhilai Jamshedpur.	eg:- Faridabad, Gurgaon, Sonepat Panipat.	

Criticism

1) Difficult
2) Growth by arbitr
3) Politically
4) Growth p
eg "Islands
5) Each
6) Threshol
7) Sectoral
8) Problem

RURA

- Zone
suburban a
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- Area
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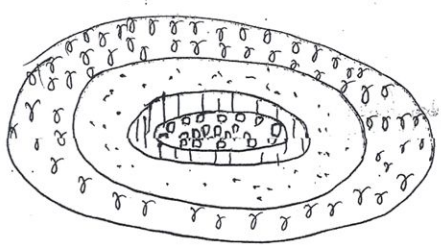
Criticism

1) Difficult to identify a growth pole
2) Growth poles develop due to some geographical advan, not by arbitrary govt. selection.
3) Politically motivated selection → failure
   eg:- Borgaigaon & Barauni.
4) Growth poles may not diffuse growth to surrounding areas.
   eg:- Bhilai > Rourkela ⇒ no growth to Chattis & Orissa.
   ∴ "Islands of prosperity amidst oceans of poverty".
5) Each growth pole has a unique socio-economic-ecological problem.
6) Threshold overlapped (more than one growth pole serves area).
7) Sectoral composition of a growth pole differs.
8) Problem of social acceptability.

RURAL – URBAN FRINGE

- Zone of transition between the continuously built-up urban & suburban areas of the central city and the rural hinterland.
- Area of mixed urban & rural land use between the point where full city services cease to be available and the point where agri. land use predominate.



Characteristics of rural urban fringe

1) Mix of land use.
2) Neither truly urban nor truly rural.
3) Mixed social & demographic characters.
4) Land use → airports, golf course, horse-race course, sewage treatment plants, large-sized godowns, farm house.
5) Agri. → INTENSIVE, and mainly grows PERISHABLE commodities. eg:- fruits, vegetables, flowers, dairy products.
6) Encroachment by residential & industrial estates.
7) Size of landholdings is small. (due to Von Thunen's high rent)
8) Social amenities & public utility facilities are inadequate.
9) Constant change in land use. The land shifts from agri. to 2° & 3° activities.
10) It is also called GREEN BELT.
11) Ppl living in the fringe areas commute daily to their place of work in the city.
12) It is a problem area, from the point of view of ADMINISTRATION, due to overlapping of juris (b/w Panchayats & Municipalities). The criminals escape the admin. boundaries after committing a crime in the neighbouring admin. areas.
13) Attracts middle class urban ppl for residential purpose.

Advantages of rural urban fringes

1) Creation of jobs in 2° & 3° industry for rural ppl, due to relocating industry.
2) Better market for agri. produce (dairy products, horticulture).
3) Greater interaction b/w rural & urban ppl bridges rural-urban divide.

Problems o

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7) Slums
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8) Lack of
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9) Crime rate
Cr
the police

Problems of urban-rural fringes

1) Obnoxious land use

- Serves as GARBAGE & SEWAGE dump of the city.
- All obnoxious land uses of the city are pushed to the urban-rural fringes. eg:- sewage disposal tanks, garbage dumps, burial & cremation grounds, brick kilns.

This generates poisonous gases (by incineration) & generates chemical effluents.

2) Diversion of ~~agri~~ agri. land for non-agri. use:

- Threatens food security.

3) Exploitation of rural ppl.

Encroachment by urbanites — both poor & elite, as the villages do NOT have any admin. or political or economic clout to resist this oppression.

4) Land degradation.

- Mixed land use → industries adjacent to agri fields degrade agri.

5) Social conflict

- Contradictory lifestyle ~~the~~ of urbanites & villagers leads to a degradation of community feelings.

6) Real estate & land speculation.

- Conc. of ownership (by illegal acquisition & encroachment).
- speculation & rising land values.

7) Slums

- Slums, which are uprooted from the city, relocate to the fringes. (Eg:- Jhuggi Jopra in Delhi).

8) Lack of social amenities

- Piped water, drainage, garbage dumps
- due to ~~lack of~~ overlap of admin. juris.

9) Crime rate

Criminals perpetrating crime here can escape by crossing the police dist. boundaries.

National Urbanization Policy

- Main objective: To Develop a rural-urban continuum rather than a rural urban dichotomy.
  - First priority to LOW COST URBAN HOUSING → both pvt. & public sector participation.
  - Improvement of slums, rather than their removal or demolition.
    eg:- Slum beautification programmes.
  - Urban Land Ceiling Act, 1976 → state govt. & local bodies given the right to acquire any private property for public use.
- SMALL & MEDIUM SIZED TOWNS
  a) development of infrastructure.
  b) incentives to entrepreneurs to set industries.
     ↓ tax rebates, low cost lands, infra-facilities free of cost.
  c) obligatory even for small/medium towns to prepare their master plans.
- Management of all cities/towns is given to the resp. state govt.
- Research & urban policy formulation on urban dept.

Principles of urban planning

1) Urban decentralisation (to bring down overcrowdedness by developing new suburbs).
2) Green belts, open spaces, garden suburbs.
3) New towns → satellite towns → well planned. eg:- Noida, Ghaziabad.
4) Expanded towns → rural-urban continuum.
5) Urban Renewal
6) Slum ~~improvement~~ improvement
7) Rehab & Redevelopment
8) Traffic segregation
9) City centric redevelopment
10) Planning for future cities

Vertical Mechanisms

1. Incoming solar (insolation) ↓ UV
2. Long wave ↓ Infra-red
3. Sensible h (by conductio
4. Latent h (by evapo

conduction (sensible heat transfer)

- 4000 J
- Oceans

Factors

1) Insolation –
2) Long wave IR radiation
3) Latent heat
4) Sensible/h

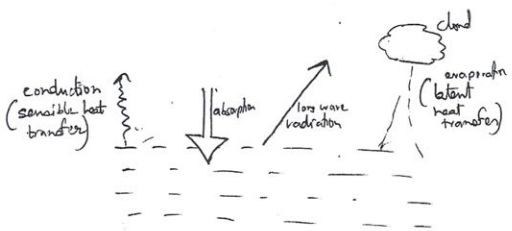
Ocean Heat Budget

Vertical Mechanisms

1. Incoming solar radiation (51%)
   (insolation → UV) absorbed by ocean surface
2. Long wave ocean surface re-radiation
   Infra-red reflection ⇒ 21%.
3. Sensible heat transfer ⇒ 7%.
   (by conduction to atmosphere)
4. Latent heat transfer
   (by evaporation) ⇒ 23%

Horizontal

1. Advection (by winds)
   - piling up the warm water;
   - upswelling of cold water.
2. Ocean currents
3. Gyral formations



- 4000 Joules of energy is reqd. to heat 1 kg of seawater by 1°C.
- Oceans store & release much more heat than the land.

$$\Delta E_{ocean} = 100 \times \Delta E_{land}$$

Factors

1) Insolation → latitude, time of day, clouds, aerosols, dust, reflectivity → roughness of sea surface

2) Long wave IR radiation → Cloud → lesser IR; Atmospheric humidity → less IR; Water temp → high IR; ice cover on sea → high IR.

3) Latent heat transfer → wind speed (high latent heat trans), humidity (dry → high heat trans)

4) Sensible heat → heat diff. b/w sea & atmos

CONTRACT FARMING

Defn:-

Agricultural production carried out according to an agreement between a buyer & farmers, which establishes conditions for the production and marketing ~~for~~ of farm products.

Typical clauses in a contract

1) General reciprocal obligations: the overall responsibilities of the contracting partners.

2) Specification of the agri. product to be produced, production technology to be used, plant/animal disease controls, transportation procedures, storage & quality standards.

3) Conditions for purchase, payment obligations, timing & modality of delivery.

4) Choice of jurisdiction to govern the contract.

5) Reference to a dispute settlement mechanism

6) The buyer ~~co~~may also commit to ~~provide~~ support production through supply of farm inputs, land preparation, provide technical advice & arrange transport of produce to the buyer's premises.

Benefits.

1) Assured markets & prices.

2) Enhanced farmer access to production inputs, mechanisation, transport services & extension advice.

3) Assured quality & timeliness in delivery of farmer's produce.

4) Improved local infra., such as roads & irrigation facilities in Sugar OUTGROWER areas, tea roads, dairy coolers/collection centres

(5) → Access to credit (contract can be ~~kept~~ as collateral)

Types of

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3) Mult
4) Infor
5) Inter

Problems i

1) Side
2) Input
3) Exclu farmers

4) Lack
5) Probc
6) Reduc
7) Over-
8) Soci

a) Uncerta
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Benefits

5) Est. bc
6) Assure
7) Only reas as MNCs
8) Skill impa fixed schedu

Types of contract farmes

1) Centralized model
2) Nucleus estate model
3) Multipartite model
4) Informal model
5) Intermediary model

Problems in contract farming

1) Side selling or extra-contractional marketing by farmers (in case of price rise)
2) Input diversion by farmers. (if excess inputs are provided)
3) Exclusion of small-scale farmers (80% of Indian farmers have less than 2 acres; 66% have less than 1 acre). Most cos. go for land of at least 5 acres, to attain a standardisation of product.
4) Lack of an exclusive legislation for agri. contracts.
5) Probability of monopoly of cos.
6) Reduced payments by cos, citing lack of quality.
7) Over-pricing for inputs & transport provided by the co.
8) Social & cultural constraints ⇒ schedule of harvest coincides with festive season or non-traditional seasons.
a) Unsuitable technology & crop incompatibility (The crop should in the farmers' traditional farming cropping regime).

Benefits

5) Est. backward & forward linkage b/w farmer & the market. eg:- Philippines → farm feed cos; pigs, poultry contract → farm feed as input.
6) Assure full capacity utilisation for processing cos.
7) Only resort for MNCs which require assured & timely supply as MNCs are NOT allowed to own land due to LAND TENANCY ACT.
8) Skill imparted :- improves the efficiency of the farmers, by giving a fix [illegible] advice easy to use inputs effectively; give knowledge about quality, export mark

Types of products under contract farming

- Non-traditional products.
- Those prone to market fluctuations (eg:- sugar)
- Those not covered by MSP (unlike rice, wheat)
- perishable products (dairy, eggs, vegetables, fruits).
- Tree crops

Evolution of contract farming

- Colonial period → indigo plantations
- 1960s → seed production cos.
- 1990 → Pepsi co. → tomato growing in Punjab → for tomato paste.
- Virginia tobacco → Andhra.
- Sugar (outgrowers).

Suggestions

1) Collectivisation of farmers → 10 to 15 small farmers coming together and signing group contract with cos. (eg:- Thailand)
2) A strong legal framework to govern agri. contracts.
3) More transparent contracts.
4) Compulsory provisions of insurance/ risk cover for crops

Growth path

Temporal

Growth

Natural

birth death

- 10,000 y
- 2000
- upto
- 1750 → ob
- After

1)

3

- 1808
- 192
- 1961
- 1974
- 1988
- 200

5m-10m

8000 BC

settled agri-

Spatial

1750 → 1

1930s

1950

Developed

6

175

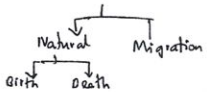
Developing

Population

Growth patterns

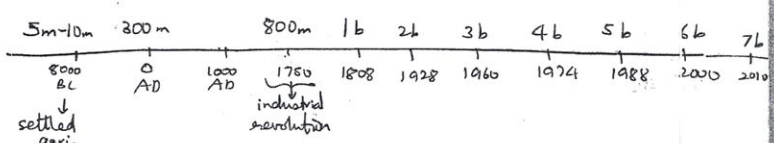
Temporal

Growth → increase in population b/w 2 diff. points in time.



- 10,000 yrs ago (before settled agr.) → 5 m to 10m
- 2000 yrs ago → 300 m
- upto 1000 AD → not much growth, due to epidemics, disasters, mortality famine
- 1750 → beginning of indus. revolution → 800m;
- After 1750 → high growth in western countries b.co.z
  1) Improved std. of living 2) Improved transport (to escape from famine, disasters, epidemics)
  ↓
  (~~Percent~~ less epidemics).
  3) Health advancement → decline in mortality rate.
  4) Increase in agri.-productivity
- 1808 → 1 b population.
- 1928 → 2 b
- 1960 → 3 b
- 1974 → 4 b
- 1988 → 5 b
- 2000 → 6 b

Timeline



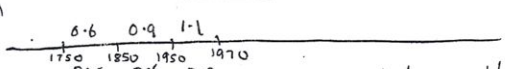
Spatial

1750 → 1900 → rapid growth in western countries.

1930s → intro. of health tech. in Asia, Africa, Latin America; growth in population in South.

1950 → population stabilizes in western countries.

Growth rates



Growth rate in various ~~regions~~ continents

- Europe → only continent with a negative annual growth of population.
- Africa → highest annual growth → 2% (eg:- Nigeria → 2.7%) most populous in Africa.
- S. America, Asia, Oceania, N. America ⇒ 1–2%

Growth rate in specific ~~countries~~ regions

- Europe (almost 0%.)
  - W. Europe → 0%.
  - Eastern & southern Europe → 0.6%.
- Asia
  - highest W. Asia (2.9%) → religious reasons
  - lowest E. Asia (1.1%) → economic growth, authoritarian imposition of ~~the~~ population control measures.

Population distribution

Spatial

Hemispherical
- 90% → northern hemi (bcoz more land area is in N. hemi.)
- 10% → S. hemi

Latitudinal
- 0° – 20° N → 10% (S.E. Asia)
- 20° N – 40° N → 50% (S. Asia & Central Asia, ~~eg~~ intensive cultivation, fertile deltas, Sun throughout → agri-throughout)
- 40° N – 60° N → 30% (W. Europe, US; industrial region, employment, extensive farming, ranching, moderate climate)
- > 60° N → 1%.

Altitude → 80% population live within 500 m above sea level.
- highest S. America (> 644 m sea level)
- lowest Aus (< 95 msl)

High density regions
- riverine areas, intensive cultivation → compact settlements ⇒ Indo-Gangetic plains → S. Asia, Egypt
- industrialised → urban → compact settlement ⇒ W. Europe (Belgium, Holland), E. America (N.Y, Philad, Boston, Richmond)

Low density

Factors
1) Climate
4) Mineral

Resource

Resource

Hig

Lo

Low density
- dry lands → lack of irrigation ⇒ sub-Saharan Africa (Sahel), Rajasthan
- cold lands @ high latitudes → Siberia, Greenland, Kashmir
- ~~reason~~ rugged terrain (mountainous areas) → N.E. India, Ural region, Himalayas
- wet tropics → equatorial Africa, Amazon forests, Brazil; Chattisgarh (India)
  - infertile soil (due to leaching)
  - dense canopy → diff. to exploit

Factors influencing population

1) Climate 2) Topography 3) Agri. land
4) Mineral resources 5) Industry 6) Transport.

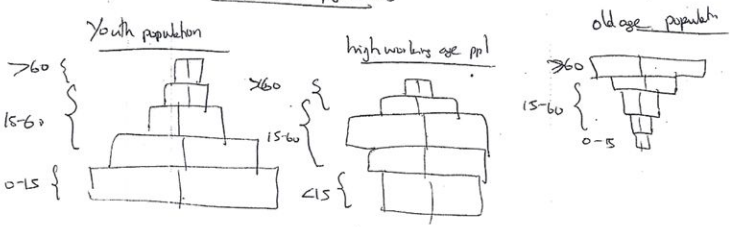
Resource & population ⇒ correlation

Resource \ Population	High	Low
High	Cratonic plains (fertile soil) N.E. America (Appalachian coal fields) W. Europe (Ruhr coal fields)	Equatorial Africa E. Russia Alaska
Low	Japan Singapore T.N. S.E. Asia	C. Australia Sahara Rajasthan

Demographic attributes (Structural features of population)

1) Age structure

Population pyramids



Age structure → no. of ppl in diff. age groups.

15–59 yrs → working age population

<15 ; >60 → dependent population.

more ↑ of ppl <15 ⇒ demographic dividend (profit)

↓

They'll constitute a huge workforce in the future.

Types of Age structure	children (<15)	old age (>60)
West Euro type	< 30%.	15%.
N. American type	35–40%.	10%.
Brazilian type (developing countries)	45%–55%.	4–8%.

Age composition → fn (fertility rate, death rate).

high TFR → ~~high~~ broad base in population pyramid.

low death rate / low TFR → broad apex in the pyramid.

TFR → Total Fertility Rate ⇒

TFR distribution

TFR → Avg. no. of children that would be born to a woman over her lifetime

i) if she were to experience the exact current ASFR (Age Specific fertility Rate) through her lifetime.

ii) if she were to survive from birth through the end of her reproductive life

TFR → 2.1 → Replacement level of fertility

- 2 → to replace the 2 parents
- 0.1 → to account for unforeseen mortality.

2) Sex composition

- Sex ratio = $\frac{\text{No. of females}}{1000 \text{ males}}$

↓

important indicator of gender equality.

Factors influencing sex ratio → high MMR:

1) Differentials in mortality.
2) Sex ratio at birth (usually given by Child Sex Ratio (0-6 yrs)) → female foeticide
3) Sex selective migration.
   - developing countries → 50% of agri. labour are women. → males migrate to urban areas (CSR, sex ratio in cities is low)
   - dvpd countries & Brazil → females migrate to urban areas. → not much female participation in agri.
4) Latitude → countries near equator produce more females than those near poles.

- Typical sex ratio @ birth ⇒ 105 males / 100 females (more males are born than women).
  Child sex ratio ⇒ male > female
- However, male experience higher mortality (due to less immunity, unsafe workplace, crime) than female.

Sex ratio ⇒ female > male : 1055 / 1000 males ⇒ avg. sex ratio in the world.

5) Paternal & maternal age
6) Order of birth.

India → an anomaly

Sex ratio: 940/1000
Child sex ratio ⇒ 914/1000

Reasons
1) High MMR
2) Female foeticide (due to sex ultrasound scan)
3) Preference to male child
4) Patriarchy, patrilineal, patrilocal
5) Neglect of girl child → malnourishment
6) Child marriage → high MMR
7) Dowry

Highest sex ratios → Russia (1162/1000), USA (1030), UK (1020), Brazil (1020), Bdesh (1075), SL (1030)

Lowest sex ratios → UAE (456/1000), Kuwait (649/1000), India (940/1000), China (959/1000), Pak (917/1000), Bahrain (806/1000), Saudi (847/1000)

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Urban growth pa
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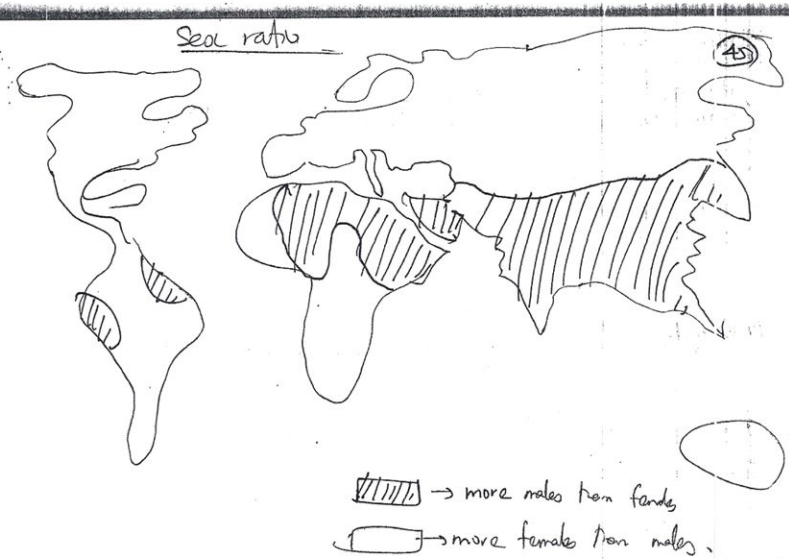
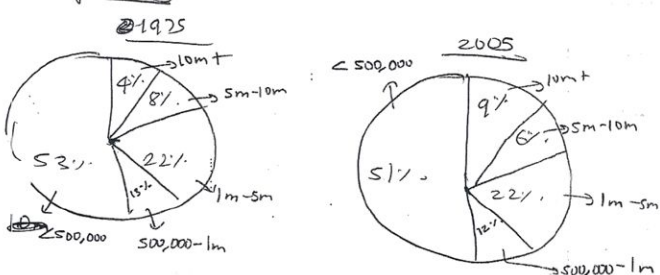
Sex ratio



Rural-urban composition

- 50% of world's population live in cities.
- There will be 8b city dwellers by 2030.
- 80% of city dwellers will be in developing countries, by 2030.

Urban growth pattern
Hierarchy of cities



- Not all cities are become big.
- The distribution of world's urban population is characterized by continuity rather than a pattern of change.
- Every second, 2 ppl are added to urban population.

Urban change

Developed (N. Ameri, W. Europe)	Developing (Asia, Latin America)	Africa
• Half of cities witnessed decline in population (−1% growth)	• Pace of urbanization decreases. 4% (1950) → 38% (1980) → 2% (2015)	• Highest growth → 3-3%. • More primate cities.

New cycle starts to unfold in the South (Developing countries)?

- There is an assumption that all cities can achieve growth. This is wrong. Urban growth & decay are two sides of the same coin of urban change.

Region	Declining cities
Africa	11
Latin America	46
Asia	87
India	11
China	50

- Smart planning for cities should include smart planning for growth as well as decline.

Reasons for decline of cities

1) Sub-urbanization → movement of population to neighbouring cities with diff. politico-admin. structures
eg:- Jakarta, La Paz, Seoul.

2) Economic Decline → due to structural crisis, recession, single industrial base, poor recovering capacity.
↓
Detroit (USA)

3) Reclassification of cities
~~Selective decline~~ → new admin. changes & settlement definitions
cities divided into smaller urban areas, reducing their physical space & no. of inhabitants

4) Selective
a) Loss
b) Loca
c) Poor

Drivers of

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4) Selective decline (local reasons)

a) Loss of political importance

b) Local conflicts → Aleppo (Syria)

c) Poor envi conditions → Singrauli (India).

Drivers of city growth

1) Designation of economic zones.

- custom warehouses, EPZ, SEZ, FTA.

eg:- Shenzen (China), Nashik, Hyderabad (IT friendly policy), S. Korea → corporate city concept

2) Investment in transport infra

↓

roads, rail, ports, airports.

China → growth of eastern & central cities.

3) Investment in communication service & trade

- Financial trade → Hong Kong, Singapore, Kuala Lampur.
- Real estate → Dubai, Doha
- IT cities → Hyderabad, Bangalore, Gunni (Korean silicon valley)

4) Change in city status

(size of city, boundary, legal status).

Transfer of capital city → Ankara (Turkey), Dodoma, Brasilia (Tanzania)

- Growth in urbanization = Growth in slum population

Cities & natural hazards

- Most common natural hazards in cities (by decreasing prevalence)

1) Flood → infra to prevent ⇒ dams, dikes, flood retention area, drain facilities.
   ↳ 30/63 cities
2) Cyclones → 2/3 of cities are located on coast
   ↳ 10/63 cities
3) Drought → 9/63 cities
4) Earthquakes → 6/63 cities
5) Volcano
6) Landslides.

1 disaster
- Tokyo → cyclone, earthquake, flood
- Delhi → drought, flood.
- New York → cyclone (hurricane), flood.
- Rio → floods
- Shanghai → floods.

3 risks (multiple hazard)

Philippines = Manila → flood, cyclone, earthquake. (on border Ring of Fire / Pacific plate)

Chile = Guayaquil, Santiago, Quito. (Ecuador) → drought, earthquake, flood
→ also volcano & landslide.
Pacific – Atlantic.

Regional disparity → adopt & planning

- Regional disparity → disunity → disintegration

Regional disparity in selected countries

Country	weighted cov index
USA	0.089
Canada	0.067
India	0.227
China	0.250
Russia	0.280
Brazil	0.267
Mexico	0.301

(increasing regional disparity)

Trends in disparity

- India → dramatic rise in inequality post 1992 (liberalization)
- USA's inequality is declining.
- Russia's inequality dramatically rising after 1991 (collapse of USSR)

Why regional disparity?

1) Differences in infra. & institutions (financial, political)
   port, road, rail, airport, highways.

Measures to reduce inequality

1) Central intervention (CSS, Fin. Commission (Hodgil-Musgrave formula) transfers, Planning Commission transfers)
2) Common market
   (economic union; greater inter-state flow of goods services capital & investment)
3) Fiscal equalization

Approaches to equality
- → Outcome → CSS, grant-in-aid.
- → Opportunity → infra & institutions
- → Capacity → fiscal equalization (CSS)

Comparative ~~Advantage~~ Disparity → Comparative ~~Growth~~ Advantage following

Differences in Infra (12th F.C. Report)

High → Goa, MH, Punjab

High moderate → GJ, TN, Kerala, Haryana

Moderate → Andhra, Karnataka

Lower middle → HP, MP, WB, UP, Orissa

Low → N.E., J&K, Bihar, Rajasthan

Business climate ('Doing Business report' → WB)

- Time to start a business → 80 days in Orissa
  57 days in Karnataka & Punjab.
- Time to close a business → 15 yrs in UP
  8 yrs in Karnataka.
- Time to enforce a contract → 1000 days in UP
  500 days in MH
- Time to register a property → high in power states.

Backwardness index (Raghuram Rajan) → to distribute plan funds through CSS.

10 indicators → equal weightage

1) Monthly per capita expen. 2) Education 3) Health 4) Household amenities
5) Poverty rate 6) Female literacy 7) % of SC/ST 8) Urbanisation rate
9) Fin. inclusion 10) Physical connectivity.

out of 1

- > 0.6 ⇒ least dvpd. → Odisha, Bihar, MP, UP.
- 0.4–0.6 ⇒ less developed → Gujarat
- < 0.4 → relatively dvpd. → Goa, Kerala, TN

100% → 28 states × 0.3 = 8.4% → equally shared
→ remaining 91.6% → 3/4 → based on needs
→ 1/4 → based on performance

∴ No 'spl. category' state.

Deviation → 20%
Distance → 25%

Gadgil–Mukherjee formula: ① Population (60%) ② Per capita income (25%)
③ Performance (7.5%) (tax, fiscal discipline) ④ Spl. problems (2.5%)

Languages

1) Indo–Euro
- Hindi
Haryanvi
Kachhi

2) Dravidi
- 2
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3) Austr
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4) Sino–
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Languages of India

1) Indo-European (Aryan) → Gangetic plain
   - Hindi, Sanskrit, Bangali (eastern), Oriya, Assamese, Brajbasha, Marathi, Haryanvi, Awadhi, Bujpuri, Nepali, Maithili, Magadhi, Kacchi, Sindhi (western), Pahari, Dogri (Himalayan).
   - 73% of population.

2) Dravidian → peninsula.
   - 20% of population.
   - Telugu, Tamil, Malayalam, Kannada.
   - Tribal → Gond, Oraons.
   - minor languages → Tulu, Khond, Kui, Parji

3) Austric (Nishada)
   - 1.38% of population.
   - Tribals of C. India ⇒ esp. Santhals (50% of Austric language)
   - Khasi, Jhantia, Nicoban.

4) Sino-Tibetan (Kirata)
   - Himalayan → Tibetan, Ladakhi, Lahuli, Lepcha, Bhutia
   - Arunachal → Aka, Dafla, Abor, Miri, Mishmi.
   - Assam-Myanmar → Bodo, Naga, Garo, Manipuri, Lushai.

Unifying influences
   - Urdu → Sanskrit + Hindi
   - Sanskrit, Persian, English ⇒ unifying role.
     ancient, medieval, modern

Factors influencing rural settlements

1) Nature of topography → undulating (dispersed), plain (compact), hills (dispersed)

2) Local weather conditions → arid areas → cold deserts (dispersed), semi-arid (semi-dispersed), moderate (compact)

3) Quality of soil → very fertile (compact)

4) Nature of surface & ground water → compact settlements near oasis.

5) Pattern of Landholding → extensive (dispersed), intensive small farms (compact)

6) Social organisation ⇒ a strong community feeling → compact settlement (eg:- Red Indians - USA)
   - caste-based → upper caste near the temples, lower caste far away.

7) Economic conditions

Rural settlement types

1) Strong point settlements
   - Security concerns → on a hillock, island, meander, fortress

2) Spring line settlement → Natural springs → contact of permeable & impermeable rocks
   - eg:- Durham (England).
   - eg:- in J&K, in Dover (England)

3) Wet point settlements → around water bodies ; eg:- oases, lakes, ponds

4) Dry point settlements → to escape from floods (stilt house, highland areas)
   - Meghalaya
   - coastal areas of Kerala.

5) Pilgrim settlement → eg:- Thiruvorkadu (TN)

6) Market settlements → weekly, biweekly markets.

7) Foothill settlements → Himalayan foothills.

8) Transplanted settlements

9) Abandoned settlements

Rural
Pattern →
fn (re

Pattern

Cities
Class
Class I
Class III
Class IV
Class V
Class VI

Cities →
1)
2)

Cities
1) Industr
5) Defence
8) Transpo

Rural settlement patterns

Pattern → spatial arrangement of settlements in relation to one another

fn (relief, climate, social factors, water supply, fertility, land usage).

Patterns
- major → clustered, semi-dispersed, dispersed.
  - clustered: Gangetic plains
  - dispersed: Kerala, Himalayas
- minor → Linear, semi-circular, T-shaped, star shaped, ring shaped, star-shaped.

Cities → hierarchical classification

	Population	% of urban ppl
Class I	>1 lakh	58%
Class II	50,000–1 lakh	12%
Class III	20,000–49,999	15%
Class IV	10,000–19,999	8%
Class V	5000–9999	5%
Class VI	<5000	2%

Cities → morphological classification

1) Hindu town: Madurai
2) Islamic town: Hyderabad, Golconda, Aurangabad
3) British town: Chennai, Mumbai
4) Modern planned town: Noida, Chandigarh

Cities → ~~functional classification~~ (economic classification)

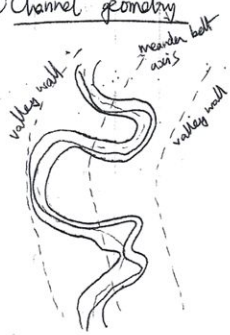
1) Industrial: Jharkhand, Jamshedpur, Bhilai
2) Commercial / Market: Ahmedabad
3) Cultural: Varanasi, Madurai, Haridwar
4) Resort: Shimla, Ooty
5) Defence: Mhow, Ambala, Vizag, Avadi, Arakkonam
6) Administrative: Bhopal, Chennai, Delhi
7) Collection centres
   - Mining → Thania, Udaipur
   - Fishing
   - Lumbering → Dimapur, Sibsagar
8) Transport towns → Mughalsarai, Kharagpur, Okha, Kandla.

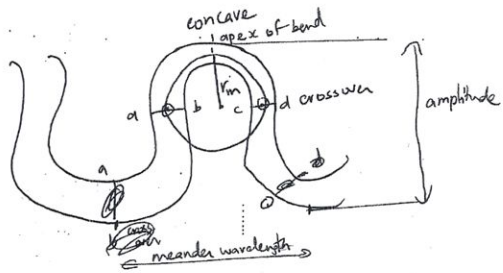
04/11/13

Channel morphology

1) Channel geometry 2) Channel fluid dynamics & Hydraulic Geometry
3) Channel bed topography 4) Channel types 5) Channel patterns -

① Channel geometry





—— ⇒ Thalweg

· Channel length, Channel depth, Thalweg ⇒ line joining points of max. depth.
line joining all midpoints across the channel, from source to mouth

- Sinuosity → deviation of actual channel path from theoretical (straight line) path.
- r_m → radius of curvature ⇒ radius of a circle drawn through the apex of the bend and the two cross-over midpoints.
- Cross-over → straight line joining two points across the channel.
- Channel gradient → gradient (slope) of channel in downstream direction.
- Channel width ⇒ straight cross-sectional distance of channel.

② Hydraulic geometry & channel fluid dynamics

① Fluid dynamics ② Bed & bank materials ③ Sediment load.

① FLUID DYNAMICS

Discharge, $Q = w \times d \times V$ (V → average velocity)

w → channel width; d → channel depth

Leopold & Maddock

$w = aQ^b$; $d = cQ^f$; $V = kQ^m$;

a, c, k ⇒ constants ; b, f, m ⇒ exponents

$a \times c \times k = 1$; $b + f + m = 1$

i) At-a-station relationships.

Relationship b/w discharge and channel variables (width, depth, velocity) at a particular point (gauging station) on channel.

$b = 0.26$; $f = 0.40$; $m = 0.34$

$b + f + m = 1.0$

$w = a Q^{0.26}$ ⇒ width $\propto$ (discharge)$^{1/4}$

$d = c Q^{0.40}$ ⇒ depth $\propto \sqrt{\text{discharge}}$

$v = k Q^{0.34}$ ⇒ velocity $\propto \sqrt[3]{\text{discharge}}$.

Q → discharge at gauging station.

~~width $\propto$ d~~

ii) Downstream variation in channel forms

$b = 0.5$; $f = 0.4$; $m = 0.1$

- relationship between discharge & channel variables in the downstream reaches of a channel (at successive gauging stations).

$V \propto Q^{0.1}$

As discharge increases, current velocity downstream also increases.

While the velocity in the upper reaches of mountains may seem wild, actual velocity there is low as the mountain torrent flows in circular eddies, with almost as much backward as forward motion.

~~(2) Bed~~ $b^{0.5} > f^{0.4} > m^{0.1}$ ~~⇒ w > d~~.

∴ With downstream increase in discharge, the channel width increases most rapidly downstream, ~~then~~ followed by depth & velocity.

(3) Bed & ~~bed~~ bank materials

- Resistant & cohesive bank ⇒ restricts corrosion & lateral erosion ⇒ increases velocity ⇒ no channel widening
- ~~coarse~~ coarse & cohesive bed ⇒ no bed erosion ⇒ no channel deepening

∴ lower 'w' & 'd', but high 'v'.

∴ b & f are low, while 'm' is high.

Erodibility of bank & bed ⇒ fn(cementation, packing of grains, vegetation, chemical bond).

(4) Sediment load

Sediment load →
- Suspended load sediment ⇒ narrow, deep channels (high velocity)
- bed-material load ⇒ wide, shallow channels (high turbulence ⇒ hydraulic lift - bed shear)

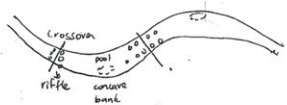
③ Channel bed topography → riffles, pools, shoals, sand bars.

Riffles

- water surface slope steeper than mean stream gradient.
- Coarse bed material.
- Present at crossovers
- cross-section is symmetrical

Pools

- water surface slope gentler than mean stream gradient.
- fine bed material.
- Present at concave banks
- Asymmetrical cross section.



5-stage model (Keller)

(1) channel is straight; no pools & riffles; sand is arranged as asymmetric shoals.

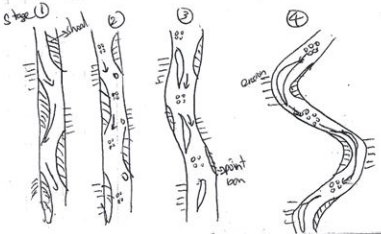
(2) small-sized pools & riffles; spacing = 3-5 times width; shoals still present.

(3) fully developed pools & riffles; spacing ≈ 5-7 x w; length of pool = 1-5 x length of riffle;

River banks develop a SINUOUS course; point bars develop.

(4) sinuous course; pool length > 1·5 riffle length; spacing ≈ 5-7 x width

(5) new sets of pools & riffles; modal spacing ≈ 3-7 x width.



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(1) Bedrock

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- Thick
- Degrade
- sinuo
- bed top
- deposit

① Transverse bar shift

⑤ Avulsion

Alluvial ch

(4) Channel types

(1) Bedrock channels (erosional channels or Rock channels) (2) Alluvial channels (sedimentation channels.

(1) Bedrock channels (erosional).

- Developed on well consolidated bedrocks; straight line, less sinuous; nick points → rapids.
- Rate of removal (erosion) exceeds sediment supply.

  eg:- Colorado river → Grand Canyon.

Types of erosion

→ Corrosion or solution → dissolution of soluble materials (carbonates).

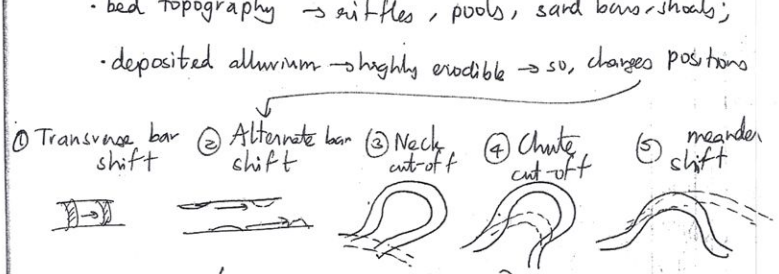
→ Corrasion or abrasion → removal of loosened materials using TOOLS OF EROSION (boulders, cobbles, pebbles).

→ Hydraulic action → breakdown of rocks by impact of water currents.

(2) ALLUVIAL CHANNELS (sedimentation)

eg:- Ganga - Yamuna plain;

- Thick sediments of mostly fluvial (river) origin are deposited.
- Degradation (erosion) → aggradation (deposition) → degradation.
- sinuous, meandering or braided.
- bed topography → riffles, pools, sand bars - shoals;
- deposited alluvium → highly erodible → so, changes positions



(3) Avulsion (rapid channel diversion)

Alluvial channels → stable → straight channels.

→ unstable → braided → frequent changes in positions of sand bars/islands and even disappearance.

Channel pattern

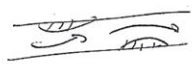
- usually associated with alluvial channels.
- based on i) Sinuosity & ii) channel multiplicity

Sinuosity Index (SI) $= \frac{L_c}{L_v} = \frac{\text{Channel Thalweg length}}{\text{Valley length}}$ or $\frac{\text{Channel length}}{\text{Length of meander belt axis}}$

Braided Parameter (BP) = No. of braids in one meander wavelength.

① Straight ② Meandering ③ Braided ④ Anastomozing ⑤ Anabranching

① STRAIGHT ⇒ S.I < 1.5

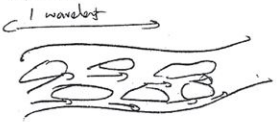


② MEANDERING ⇒ S I > 1.5 ; pools & riffles.

③ BRAIDED ⇒ BP > 1 ; multiple channels divided by bars / islands.

① longitudinal ② Transverse.

- frequent change in banks & Thalwegs.
- high W/d
- fluctuation in discharge
- erodible banks.



④ Anastomosing channel pattern

- ~~A special~~ Stable braided channel.
  - bars/islands do not shift
  - multiple channels

⑤ Anabranching ⇒ anabranches (offshoots) → rejoin the original trunk stream

Slope

- Slope & valley bo factors li ,
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① Slope

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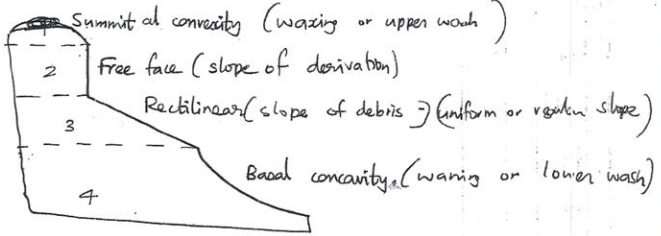
Slope development

· Slope → angular inclination of terrain between hill tops (crests) & valley bottoms, resulting from combinations of many causative factors like geological structure, climate, vegetation, drainage, etc.

Slope → angular inclination
Slope profile → inclined surface.

· Slope elements.



Genetic classification → based on origin & dupt.

1) Tectonic slope 2) Erosional slope 3) Slope of accumulation.

Quantitative classification

· Gentle slope ⇒ 0-5°; moderate slope ⇒ 5-10°; Steep ⇒ 10°-30°

Approaches to study of slope dupt.

1) Theoretical 2) Experimental (lab) 3) Field (empirical)

① Slope evolution approach (Davisian)

· study of historical dupt. of slope.

· uniformitarianism → processes operative today have operated in the past, throughout the geological time, but with varying intensity & direction.

· Time dependent model.

· Original form (structure) is assumed → speculative to be free face (cliff).

· Presupposes continuous, uninterrupted Slope decline.

· Rejuvenation or polycyclic landforms not considered.

· free face (steep) (youth) → moderate rectilinear (mature) → gentle slope concave (old)

2) Process – form approach

↓ denudation agent (rain, wind) — ~~creep or rainwash~~

→ slope type

Process		Form
· Fluvial (~~creep~~)	→	limestone — creep → convex slope
· Fluvial (~~rainwash~~)	→	clay — rainwash → concave slope.

· Time-independent.

Criticism

1) Slope dvpt. is not controlled by a unique factor (process) but also by climate, vegetation, etc.

2) Processes are slow and very difficult to observe & study.

3) All processes are not involved in slope dvpt. It is difficult to isolate such processes.

4) This approach says slope dvpt. is due to form & present day processes. But, The present day slopes are due to historical processes.

5) Climate controls slope forms & processes. (process / form)

Humid climate → fine debris. (chemical weathering)

Arid climate → coarse debris. (mechanical weathering)

But, L.C. King proposes 'climatic uniformitarianism' ↓ all slope forms are found in all climates.

Processes → soil creep, slide, flow
→ rainwash

i) Monoprocess concept

· A particular process only acts on the slope & produces a form.

eg:- creep → convex slope.
rainwash → concavity.

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· Base →
(ZONE OF AGGRADATION)

FENNMAN

- convexo-concave slopes are due to differential actions of rainwash. (surface run-off)

- Crest (peak) ⇒ limited amt. of water, limited erosion tools (less sedimentary load) ⇒ less erosion ⇒ only smoothens the slope ⇒ convex.

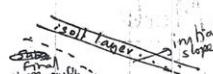
- Basal ⇒ huge volume of water, erosion tools (pebbles, cobbles) ⇒ maximum erosion ⇒ concave slope.

Criticism

1- Fennman does NOT accomodate 'Creep' (infiltration of water into permeable rock) process, which is dominant in humid areas.

- More infiltration → more creep
  - → reduced surface run-off → less rainwash.

GILBERT



- convexo-concave slopes are due to differential actions of CREEP (infiltration ⇒ water soaked soil flows downslope.

- He considers a slope covered with soils.

- Crest ⇒ infiltration ⇒ soils flow downslope → min. soil cover ⇒ convex ↓ to facilitate flow of soil.

- Base ⇒ huge soil flow from upslope ⇒ deposition → concave slope.

Criticism

i) Soil layer on hills is NOT always mobile.

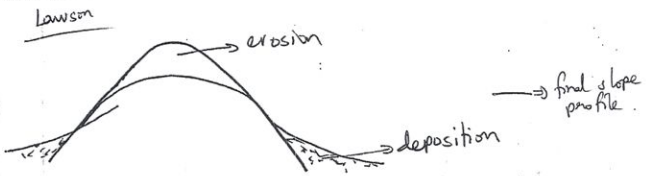
ii) Does NOT talk about rainwash.

LAWSON

- convexo-concave slope is formed by erosion of rainwash.

- Crest → water carries less load ⇒ so, more energy ⇒ slope is eroded well & rounded ⇒ convex
  (ZONE OF EROSION)

- Base ⇒ eroded material from upslope is deposited ⇒ concave
  (ZONE OF AGGRADATION)



ii) POLYPROCESS

more than one process acts to give a convexo-concave slope.

- Crest → creep → summital convexity.
- Base → rainwash → concavity.

Overtime, creep becomes sluggish but rainwash continues. So, length of concave segment increases & spreads over entire hillslope.

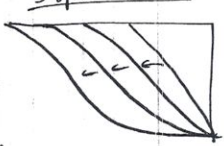
Models of slope evolution

1) Slope decline ⇒ steepest part of the slope progressively declines in angle, accompanied by development of convexity & concavity.

2) Slope replacement ⇒ The maximum angle decreases, as the steepest segment is replaced by gentle slopes from below. Finally, concavity spreads over the entire slope.

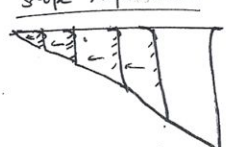
3) Parallel retreat ⇒ The maximum angle remains constant; absolute length of all slope segments except concavity remains constant. Concavity alone increases in length.

slope decline



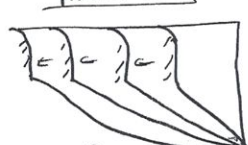
(Davis)

slope replacement



(Penck)

parallel retreat



(LC King)

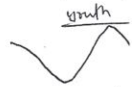
Theories o

i) Davis

(youth)

- Convex
- valley deepi
- ~~steep~~ increas slope angl
Csteep slope
V shaped v
- Creep domi

youth



Base level of erosion

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Youth stage

Old stage

ii) Penck

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Properties o

① ~~Eb~~ Texture

③ Thickness o

⑤ Climate

Theories of slope evolution

i) Davis → Slope decline.

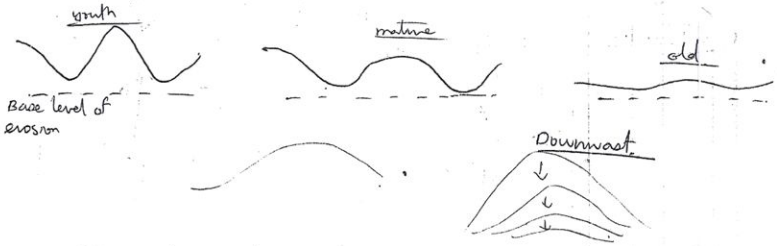
(youth) Convex → (mature) rectilinear → (old) concave

- valley deepening
- ~~base~~ increase in slope angle. (Steep slope) V shaped valley

- V-shaped valley.
- valley deepening & lateral erosion.

- lateral erosion
- Slope angle decreases.
- Rainwash dominates.

- Creep dominates



. Time-dependent model.

- weathered (debris) material on slope ⇒ waste sheet.
- Graded waste sheet ⇒ ~~when~~ the debris (weathered material) thickness on slope remains constant; this is because the transportive capacity of the transporting agent = energy reqd to move the debris.

∴ Debris supplied = Debris removed ⇒ equilibrium state.

Youth stage ⇒ Graded slope profile has steep gradient & debris is coarse

Old stage ⇒ Graded slope profile has gentle gradient & debris is fine.

ii) Penck → slope replacement.

. Morphological classification ⇒ based on present day form

. process – form.

Properties of forms

① ~~Se~~ Texture (degree of reduction) of regolith ② Mobility of regolith

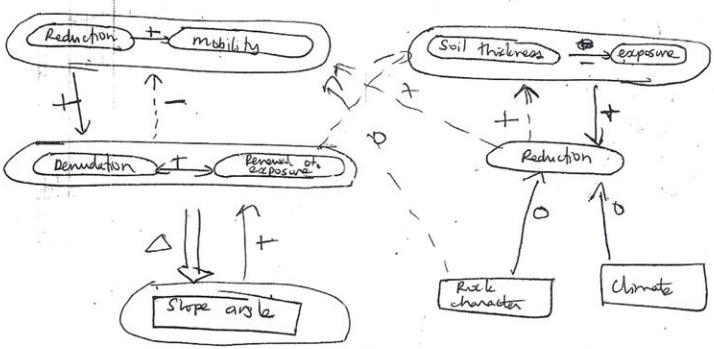
③ Thickness of regolith (wastesheet) ④ Exposure of slope surface

⑤ Climate ⑥ Slope angle ⑦ Rock property

Properties of processes

① Reduction (weathering) ② Denudation (transport) ③ Renewal of exposure.

Young's process-response model based on Penck's



Assumptions

1. Form ⇒ fn (rate of vertical erosion, rate of denudation (transport))
2. denudational process → transports debris & exposes slope for weathering.
3. Parallel retreat ∝ Slope.
4. Steep slope is replaced by gentle slope from below.
5. flattening of slope takes place from below upward.
6. 3 rates of erosion → Accelerated → convex (waxing)
   → constant → rectilinear
   → decelerating → concave (waning)
7. Rate of weathering is uniform.
8. When regd. mobility is attained, Rate of denudation = Rate of weathering.

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of weathering.

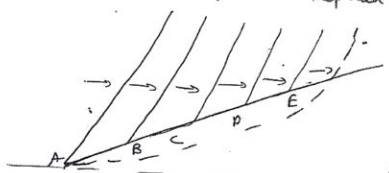
· Slope face except the lowest segment undergoes parallel retreat, since rate of weathering = rate of denudation.

· Lowest segment ⇒ not attained required mobility

so, rate of denudation < rate of weathering

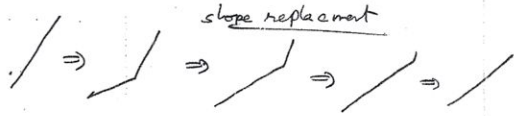
so, no parallel retreat

. So, the lowest segment is replaced by a gentle slope (slope replacement)



level of non-erodying river

slope replacement



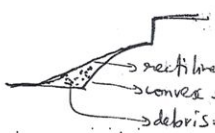
eg:- Bhander plateau (M.P.).

Wood's model

i) parallel retreat (slope replacement) ii) adjustment b/w rate of weathering & rate of transportation.

Initial ⇒ free face - convex

· weathered debris accumulation downslope ⇒ convex becomes rectilinear.



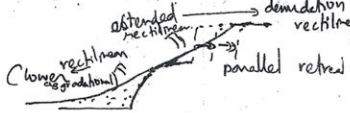
· free face undergoes parallel retreat

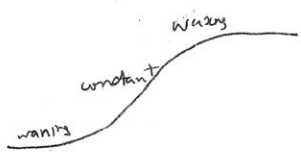
↓

replaced by rectilinear slope

⇓

extended rectilinear





L.C. King (True parallel retreat) Pediplanation.

· empirical study (based on field observation)

· 'Normal' hill → cliff → recessing → convex – rectilinear – concave

most 'Normal' climate → humid –

· Climatic uniformitarianism

PEDIPLANATION

i) Parallel retreat

. The free face undergoes retreat by backwast.

- cannot be replaced by debris from below (as rate of weathering = rate of transport).

ii) Pedimentation.

- concave, triangular sedimentation formed at base.

. This gradually extends upward at the cost of rectilinear (debris slope) & free face.

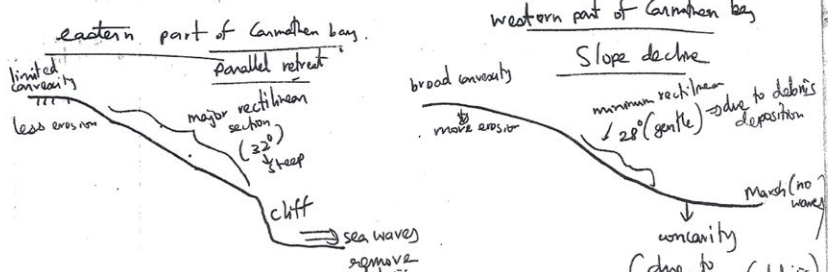
⇓

extensive concave slope → pediplan.

Savigear

· based on field evidence (Carmarthen Bay ⇒ South Wales).

. Both i) parallel retreat & ii) slope decline can occur together in a single region of uniform climatic condition.



eg:- Bhanda (parallel retreat).
Sharda pole hill (slope decline)

Strahler

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Strahler

-Parallel retreat.

. Field study (slope angle measurement:

. Carefully selected areas of uniform conditions in terms of geological structure, lithology, climate, vegetation, soil, etc.

. Max. slope angles of all such slopes in that area is measured and the Mean max. slope angle is taken.

. It is found that each max angle is almost equal to mean.

. So, i) in any one locality, all retreating slopes (steepest segments) have a similar max. slope angle.

ii) All these slopes, having max. slope angles, undergo parallel retreat, NOT slope decline.

iii) it is not necessary that all such slopes are of same age.

iv) The max. slope angle has developed such that the debris is transported easily (equilibrium slope ⇒ rate of weathering = rate of transport).

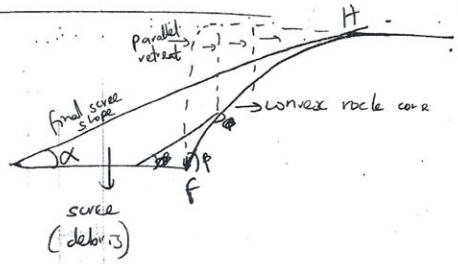
. Channel slope (hill slope) ∝ Valley slope (ground slope).

If valley is steep, debris accumulated at ground can be removed easily. So, there is parallel retreat and hill slope is steep, so as to equal the rate of removal.

. If valley is gentle, debris accumulates. So, slope of hill is gentle so as to maintain equilibrium ⇒ slope decline

Thus, it is similar to Savigear's theory.

Fisher – Lehmann model



- cliff face undergoes parallel retreat
  ↓
  (scree) is accumulated at the base
  ↓
  This scree buries the convex rock core.
- The lowest point of convex rock core is tangential to initial cliff angle (β).
- When parallel retreat is complete & the entire rock core is removed, the highest point of convex rock core H' becomes tangential to scree angle α'.

- Change in cliff angle (f) does not affect rock core.
- Change in scree angle (α) has a great effect on rock core.
  - Higher the scree slope angle, steepness of rock core increases.
  - Steepness of rock core depends on steepness of initial cliff angle (β).
    ↓
    Here β = 90° ⇒ so, convex rock core is very steep
    ↓
    initial cliff angle

Denudation chronology. (Upliftment, denudation, stream rejuvenation, glaciation, knick points, waterfalls)

Denudation chronology → construction of denudational history of a given region. It is a historical approach of landform study by "identifying, interpreting & dating the planation (erosion) surfaces developed in past cycles of erosion".

It is based i) on cyclic concept of Davis
2) uniformitarianism
3) present is key to the past

Palimpsest topography → A surface which bears the imprints of geomorphological processes during past geological periods.

It is based on evidences of

i) rejuvenation (knick points, incised meanders)
ii) preservation of past landforms by sedimentary deposits (unconformities)
iii) Glaciation (glacial tillites, glacial boulders) → Vindhyan, carboniferous, pleistocene
iv) Drainage patterns (fluvial processes) → denudation
v) Relic surfaces
vi) Faults → past tectonic events → upliftment
vii) Lava flows → pre-Dalma, Cretaceous (Gondwana), deccan trap

Criticism
This approach is highly deductive & speculative since
i) geological evidences are not available.
ii) past landforms are destroyed by recent erosion.

Erosion surface (planation surface)

- Plain topographic features having undulating ground surface and remnant low reliefs caused by denudational processes.
- They cut across various geological formations & structures.
- It is nearly flat, very close to base level and almost in old stage.
- Provide an important clue for reconstruction & denudation chronology.
- Types of erosion surfaces → peneplains, panplains, pediplains, etchplains, marineplains, cryoplains (by periglaciation)

• Erosion surfaces are formed due to erosion of different rock types (soft & hard) and different geological structures (folded, faulted, unclinal, etc.) alike.

• In simple words, all parts of land surface that are not directly depositional in origin are erosional surfaces.

Identification of erosion surfaces

• Since a long geological period is reqd. for complete denudation to base level, there are no post-Tertiary erosion surface.

• Erosion surfaces are not present near the theoretical base level (as they should have been), since they may have been uplifted (eg:- Chotanagpur). So, their identification becomes difficult.

Identification techniques

1) Altimetric frequency histogram
2) Altimetric frequency curve
3) Superimposed profiles

⇒ frequency maxima are found

↓

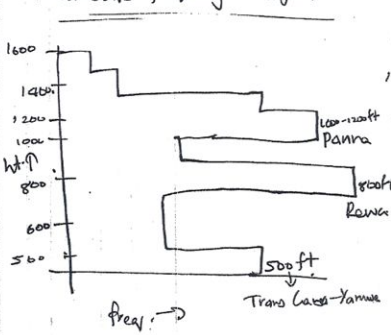
these frequency maxima indicate a 'surface'

↓

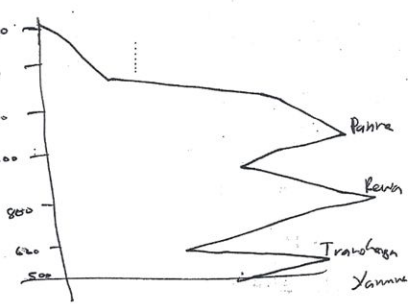
whether these surfaces are 'structural' or 'erosional' can be found using FIELD CHECKS.

Belan basin

Altimetric frequency histogram



Altimetric frequency curve



Factors which modify erosion surfaces.

i) Age → more age → more denudation.

ii) Thickness of deposits ⇒ Sedimentary deposits ⇒ protect the surface from changes.

iii) ~~Rock~~ Hardness of rock ⇒ hard rock → more resistant to erosion.

iv) Streams ⇒ high stream frequency & density ⇒ more changes

Dating of erosion surfaces

1) Height correlation 2) Geological unconformity 3) Radio-carbon dating.

1) HEIGHT CORRELATION → correlation of the concerned surface with another erosion surface at another place, the age of which is already known.

- It is believed that the entire erosion surface at the time of formation will be of uniform elevation everywhere & is continuous.

Disad :- The original surface might be deformed due to tectonic movements, folding eg:- Ranchi plateau warpings.

2) GEOLOGICAL UNCONFORMITY

- Erosion surfaces are protected by sedimentary cover; hence, they are preserved & their age can be estimated from age of deposit.

Disad.

i) There might be missing of old & new deposits.

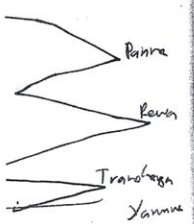
ii) The sedimentary cover may be removed & buried surface is resurrected & undergoes modification.

eg:- Gondwana Rediplain in S. Africa.
(wrongly predicted as Tertiary as it carried Miocene sediments)

3) Radio-carbon dating.

- Absolute age of erosion surface can be found.
- based on amount of C-14 isotope in fossils in the stratigraphy.

Disad. Not useful to predict surfaces formed before evolution of life.



Denudation chronology & erosion surfaces of Chotanagpur highlands

1) Pre-Dalma 2) Pre-cambrian 3) Carboniferous 4) Permian-Triassic
5) Gondwana 6) Tertiary

1) Pre-Dalma erosion surface

- uplift ment in Archean period.
- uplifted landmass was peneplained in this cycle of erosion.
- lava flow in Dalma period.
- Dalma lavasheet has preserved some erosional surfaces (unconformities)
  eg:- Dhanjori highlands (preserved by sandstone-conglomerate).

2) Pre-Cambrian erosion surface

- fluvial process → denudation → granite-gniss base exposed.
- Erosional unconformity → Kolhan highland (preserved by sandstone-conglomerate).

3) Carboniferous

- Carboniferous GLACIATION → entire Gondwanaland is covered by ice-sheet
  (S. Africa, peninsular India, Aus, S. America).
- evidence for glaciation → glacial boulders found in Talcher coal mines of Orissa. (Chotanagpur).
- interglacial period → ice sheets retreat ⇒ marshes, swamps, lakes formed.

4) Permian-Triassic

- carboniferous ice-sheet completely retreat.
- exposed highlands are denuded.
- rellplift ment in Triassic period.
- This reuplift ment is then completely denuded,

Geological time scale

Primary or 1° (Palaeozoic) — 2° (Mesozoic) — 3° (Tertiary)

Archaen → Dalma → Pre-Cambrian → Cambrian O S D C P → Triassic Jurassic Cretaceous → PEOMP

Carboniferous, Permian — 4° Quaternary: Pleistocene → Holocene

5) Gondwana
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6) Tertiary
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5) Gondwana surface.

. Permian–Triassic cycle of erosion is interrupted by Cretaceous volcanic flow.

. Cretaceous period → peninsular India is separated from Gondwanaland.

. Monsoon climate originates → heavy rain → rapid fluvial erosion. (Gondwana cycle)

↓ denudation

Gondwana surface.

. Such contemporary & identical Gondwana surfaces are found in other parts of Gondwanaland (S.America, Africa, Aus.) also.

. Gondwana cycle is also called Pre-tertiary cycle in India.

. This cycle of erosion is interrupted by Deccan lava flow.

. Gondwana surface → extensive, undulating & low in elevation, sloped eastward.

6) Tertiary period.

. 3 phases of upliftment in Chotanagpur (as a result of Himalayan orogeny).

. 1st upliftment → Miocene period ⇒ 305 m;

. 2nd upliftment → Pliocene → western part of Chotanagpur uplifted by 305 m;

. 3rd phase → 305 m.

Total upliftment of S.W. Chotanagpur ⇒ 305+305+305 = 915m (parkland).

Thus, Chotanagpur plateau is polycyclic in origin (multiple cycles of erosion) & is a true palimpsest topography.

Applied Geomorphology

1) Regional planning:

Planning objectives → 1) Achieving growth of society
→ 2) removing socio-economic disparities by exploiting natural / human resources.

· Spatial unit of planning ⇒ administrative unit ⇓ cross-cutting physiographic units; diff. resources, diff. problems. uniform planning not possible + to (DRAINAGE BASIN) watershed as an unit

DRAINAGE BASIN as a unit ⇒ an ideal geomorphological unit characterized by relationships b/w basin reliefs, fluvial processes & man.

· Geoenvironmental & human problems are almost the same throughout the basin bcoz of geomorphic and hydrologic uniformity.

eg:- Chambal drainage basin (MP & UP) ⇒ geoenvironmental problem: gravination, rill & gully erosion, land degradation
human problem: dacoity; ravines are hide-outs; degraded land → no agri → dacoity

Planning units drainage basin as a unit ⇒ Tennessee Valley Authority, Damodar Valley Corp.

⇓ understanding channel drainage, channel geometry & flow, sedimentation load

⇓ helps to control erosion

2) Hazard management

· Hazard (process) & disaster (end)

· Hazards (climate change, change in hydrology, change in vegetation cover, diastrophic earth movements (fault, fold))

· Disasters → sudden earth movements (volcano, earthquake)
- mass movements (landslide, avalanche)
· floods

. Geomorphic knowledge → identifying, prediction & management of hazards

VOLCANO → i) change in temp. of crater lakes, geysers, hot springs.
ii) monitoring gases from " " "
iii) histories of eruption → predicting future eruption
iv) path of lava flows (lahar) → by assessing topography & possible eruption points.

EARTHQUAKE → i) regular measurement of seismic movements & tremors.
ii) regular measurement of earth surface tilt by tiltmeters.
iii) measurement of local gravity & magnetic fields.
prevention iv) avoid construction on fault zones, fragile slopes,

FLOODS → by understanding channel geometry, morphology & pattern
bed sedimentary load, erodibility of banks
rate of erosion at upper catchment
prevention
i) divert flow of water (through diversion channels)
ii) hasten discharge of water (by straightening meanders).
iii) protective embankments & leaves.
iv) flood plain zoning

construction of leaves → confines flood water → high rate of erosion in catchment → sedimentation → river bed increases → leaves is breached

3) Urbanization

pre
- Field survey, terrain classification, selection of alternative location.
post
- effect of urban community on natural processes & vice versa.

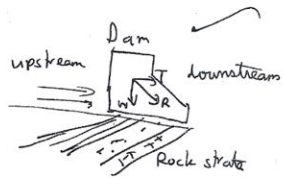
eg:- Allahabad (in the lap of Ganga & Yamuna).
urban expansion into the geomorphologically unsuitable lowland (KACHHARS)
waterlogging (no drainage), floods, weak foundation, house collapse.

Future physical growth should be oriented towards geomorphically sound areas of Jhusi & Phaphamau.

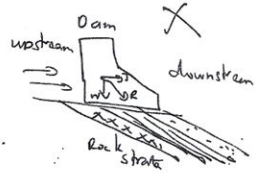
4) Engineering:-

Dams

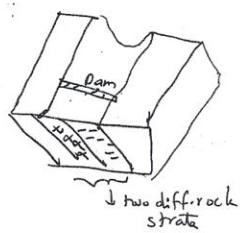
- Porous, permeable rocks → leakage of water → percolation & seepage.
  (eg:- limestone), ~~compaction~~
- Shale → cementation shale ✓
  → compaction shale ✗ (swells.)
- Strata dipping ~~downstream~~ upstream ✓
  i) prevents percolation
  ii) perpendicular to 'R' ⇒ good foundation



- Strata dipping downstream ✗
  i) allows water seepage
  ii) parallel to 'R' = cause dislocation



- Fault zones & fractures ✗
  esp across the length of the dam
- Dams across rock strata ✗
  diff. rocks
  diff. properties → unequal settlement



Bridges

i) Nature of rock ⇒ strong & durable ; no joint, fault, fracture;
ii) Structure of rock ⇒ along strike, strata dipping upstream.
iii) River channel → sedimentary load, channel pattern
bending river → max. velocity at concave bank.

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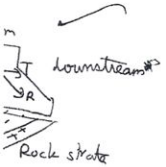
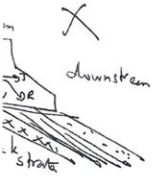




fracture;

upstream.

ern

neave bank.

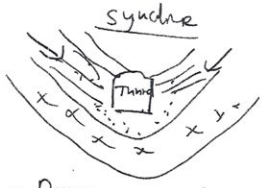
Tunnels

i) swelling rocks (shale) X ⇒ absorb moisture & swell ↓ displacement.

ii) Fault zones X ⇒ if it is not possible to avoid, tunnel should be driven at right angles to fault (minimum meetres).

iii) Waterbearing rock (aquifers) X ⇒ makes construction difficult (Causes floodes)

iv) Folded rocks: Anticline ✓
Syncline X



· Pressure on roof is more ⇒ collapse
· water may also percolate

· water drains away
- pressure is also less -

Roads

1) Presence of permafrost in periglacial region X → denudation chronology

· once vegetation is removed, permafrost melts (Thaws) and forms thermokarst lakes ⇒ collapse of surface

eg:- Trans-Siberian railway line.

2) Carbonate rocks & karst toro X
underground caverns, swallow holes ⇒ collapse.

3) Stratigraphy → buried lakes (paleo lakes), X
high water table aquifers X
} by denudation chronology

4) Steep slopes X, prone to slope failure X.

Air strips

i) flat terrain with resistant rock.
ii) level slope
iii) free from flood
iv) absence of fog-

(5) Hydrology

- porosity & permeability
- artesian wells.
- limestone capped by sandstone → filters (pure water)
  ↓ good porosity
- karst topo ⇒ swallow hole → no filtration → impure water.
- Buried periglacial & interglacial valleys ✓ (denudation chronologie)
- Alluvial sand ✓ (eg: Great Plains of N. India).

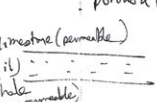
(6) Mineral exploration

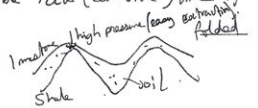
1) Ridges (positive topographic expression) ⇒ vein
   ↓
   quartz, lead, zinc

2) Weathering → Al, Mn, Ni → bauxite (weathered basaltic laterite)
   eg:- Ranchi, Palamau (pathards):
   elluviation of 'Al' due to rainfall;
   illuviation at bottom → forms bauxite

3) Placers → mixtures of heavy metals; aggregates of chemical weathering & erosion.
   Residual placer ✗
   Alluvial placer → Platinum
   Colluvium placer → gold

4) Mineral oil
   porous & permeable rock (sandstone, limestone) ✓





Age c

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Geosyncl

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Age of earth

1) Ocean salinity 2) Rate of sedimentation 3) Rate of erosion
4) Radioactivity 5) Tidal force 6)

Geosyncline → Hall & Dana (shallow); Haug (deep geosyncline)

1) Lithogenesis 2) Orogenesis 3) Cryptogenesis

Kober's theory → Geosyncline mountain building.

- contraction of earth → compressive force
- orogen → mobile water zone; kryptogen → nuclei (rigid continental mass)
- rennakatten → marginal mt.; median mass.

Drainage systems

- Sequent → consequent, subsequent, obsequent, resequent.
- Insequent → antecedent, superimposed.