

Please do not
write anything
except the
question number
in this space.
कृपया इस स्थान
में प्रश्न संख्या के
अतिरिक्त कुछ
न लिखें।

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को
इस हाशिए में
नहीं लिखना
चाहिए
Candidates
must not
write on this
margin

SHASHANK BHARDWAJ

Email ID - shashankbhardwaj1195@gmail.com

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को
इस हाशिए में
नहीं लिखना
चाहिए
Candidates
must not
write on this
margin

(Please do not
write anything
except the
question number
in this space)
कृपया इस स्थान
में प्रश्न संख्या के
अतिरिक्त कुछ
न लिखें।

1. (a)

Yield regulation means the determination of yield and its expression in a management plan prescription.

Periodic Block Method

Here, the compartment is divided into a number of periodic blocks of equal size on the basis of condition and maturity of crops.

$$\text{Area of each Periodic Block} = \frac{\text{Area of felling series}}{\text{Rotation period of crop}} \times \text{regeneration Period}$$

Ⓔ.g. Chir pine plantation with rotation period, 120 years & regeneration period, 30 years, would have 4 periodic blocks.

Different types of Periodic Block method

① Permanent periodic block allotment method

Here all periodic blocks have been fixed and allocated.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

(Please do not write anything except the question number in this space)
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

उम्मीदवारों को इस दफ्तियर में नहीं लिखना चाहिए।
Candidate must not write on the margin

② Revocable periodic block allotment method -

Only regeneration block is assigned. For remaining periodic blocks, area has been allocated but not fixed. Their boundaries may alter in future.

③ Single periodic block allotment method - Only regeneration block is assigned (and not the others).

④ Floating periodic block allotment method -
Periodic block is determined according to the prevailing situations and requirements.

⑤ Judich's stand selection method - developed in Germany. Crop is treated and selected for felling and regeneration according to the requirements.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को
इस हाशिए में
नहीं लिखना
चाहिए
Candidates
must not
write on this
margin

(b) Tactical harvest planning is a short term harvest planning. It deals with how the harvest will be done, who will accomplish the operations and when it will be done.

Recommended Practices

- ① Harvesting equipment should be efficient enough to minimise losses and wastes in the forest.
- ② Harvesting schedule should consider the convenience of logging and transportation.
- ③ Consideration of silvicultural system and number of trees to be retained during harvesting operations.
- ④ Stakeholder engagement, considering tribal

economy and forest rights Act in mind.

- ⑤ Inventory and data assessment is necessary to plan sequence of felling operation.
- ⑥ Use of Geographic Information System and Remote sensing in the planning.
- ⑦ Growth and yield modelling should be done to supply as per market requirements.
- ⑧ Further, protected areas and local watershed must be considered to ensure minimum or no disturbance is done to associated biodiversity.

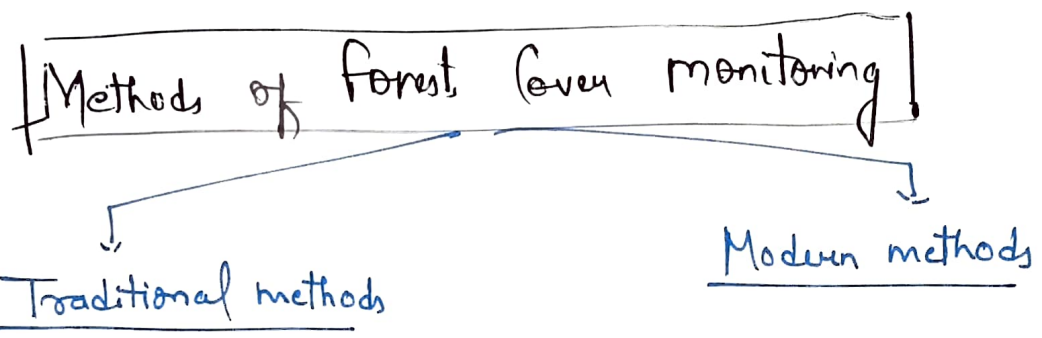
Please do not write anything except the question number in this space. कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

उम्मीदवारों को इस हाशिए में नहीं लिखना चाहिए। Candidates must not write on this margin.

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis. (Specimen Answer Booklet - For Practice Purpose Only)

(c) Currently, forest cover monitoring in India is done by forest survey of India (FSI).



① Traditional methods were prominently practiced till 1980s.

- Data collection and assessment is done manually.
- Collection of data happens through inventory, sample plots or aerial survey.

- However there are challenges associated with it:
 - ✓ time consuming
 - ✓ too expensive to cover large area
 - ✓ not applicable to remote, inaccessible area.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

(Please do not write anything except the question number in this space)
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

उम्मीदवारों को इस हाशिये में नहीं लिखना चाहिए।
Candidates must not write on this margin

II Modern methods

- Unmanned aerial vehicles like drones
- Satellite based remote sensing with

④.g) FSI uses IRS resourcesat-2, LISS-III sensor to monitor forest cover.

- However, modern methods require skilled workforce, satellite development support etc.



UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को इस हाशिए में नहीं लिखना चाहिए।
Candidates must not write on this margin.

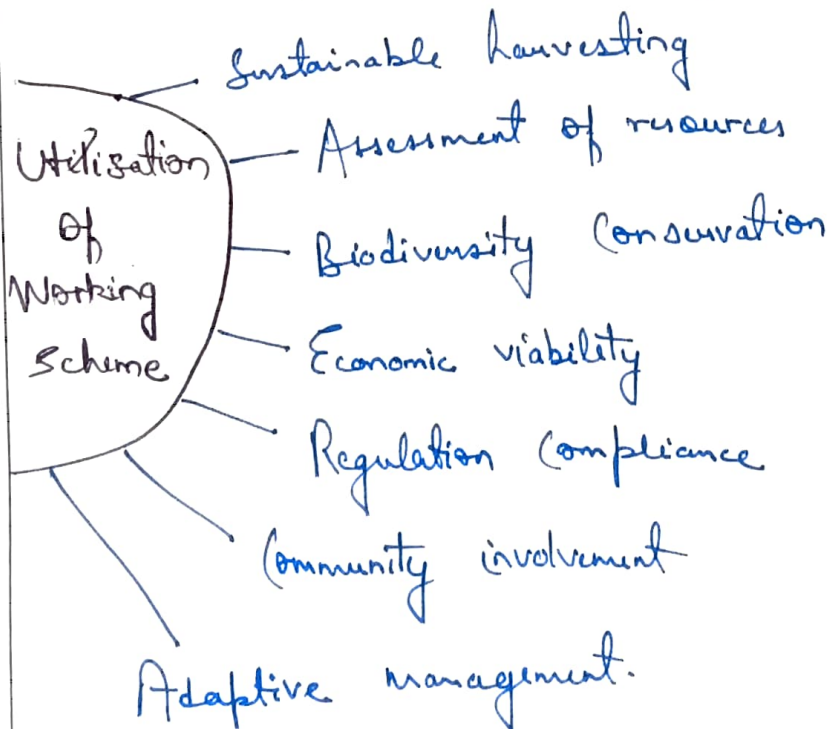
(d)

Working Scheme is a written scheme of management of forest area that is outside the forest department's ^{direct} control.

o p.g. - forest area owned by local bodies, Cantonment etc.

o It provides set of prescriptions that are necessary to ensure sustainable development.

o Generally, the term of working scheme is shorter than that of working plan.



UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को
इस हाशिए में
नहीं लिखना
चाहिए।
Candidates
must not
write on this
margin

(e)

According to British Commonwealth forest terminology, forest working plan is a written scheme of management, aiming at continuity of Policy and action in controlling treatment of a forest.

Divisional working plan is helpful in the scientific management of a forest in the following ways:-

- ① Sustainable utilisation of forest resources
△ e.g. utilisation according to carrying capacity of forest ecosystem.
- ② Resource allocation - Working plan helps in increasing efficiency by optimising resource allocation.
- ③ Conservation planning according to locality factors.

△ e.g. Chapter 7 of Part I of National working plan

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

④ Code 2023 envisages conservation and maintenance of soil and water resources.

④ Application of silvicultural treatments as advised in working plan code.

④ Tending operations like weeding, cleaning etc.

⑤ Forest inventory, survey and mapping to assess and analyse the status of forests

⑥ Estimation of Grazing Stock and Carbon Stock of forests is also recommended in the divisional working plan.

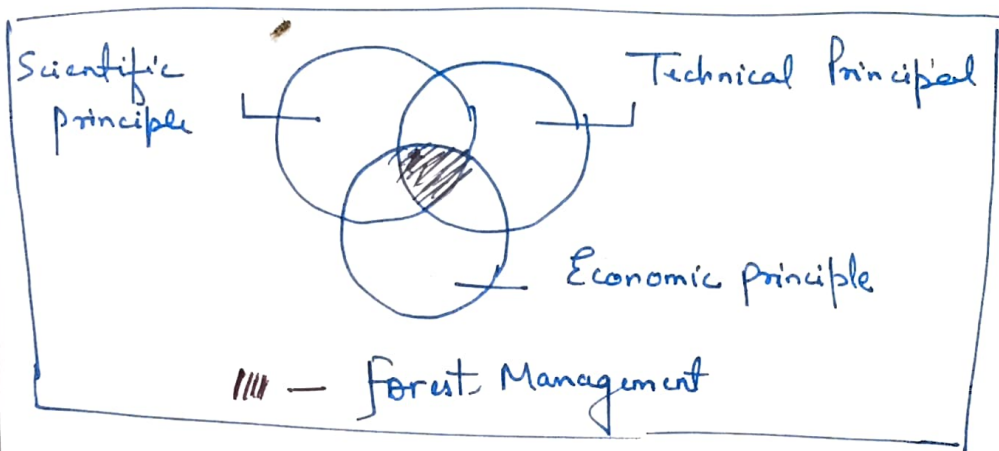
UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को इस हाशिए में नहीं लिखना चाहिए
Candidates must not write on this margin

2.(a)

Forest management is the practical application of scientific, technical and economic principles of forestry.



(OBJECTIVES)

- ① maintaining productive capacity of forest stands
△ e.g. Ensuring healthy Poplar plantation in Terai region for Paper industry.
- ② Promoting protective role of forests
△ e.g. Aravalli Green wall project to combat desertification
- ③ Fulfillment of international obligations - △ e.g.

India's Commitment at UNCCD's COP14: to restore 26 million hectare of land by 2030.

- ① Soil conservation - \triangle e.g. Soil conservation through forestry interventions in Chambal ravines.
- ② Attainment of normal forest, that serves as a standard for comparison for sustained yield management.
- ③ Urban forestry promotion - \triangle e.g. micro-carbon sink creation to combat air pollution in Delhi.

PECULIARITIES

- ① Forest management requires long-term investment and maintenance. This often results in lack of private sector participation.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

- ② Here, benefits are both tangible as well as intangible. Intangible benefits are often not recognised by locals. e.g. social forestry programme
- ③ less research and development in yield regulation mechanism
- ④ large number of stakeholders - e.g. forest department, civil society organisation, locals
- ⑤ susceptible to external threats - e.g. In Madhya Pradesh, sal heartwood borer killed 8 million sal trees in 1998.
- ⑥ vulnerable to climate change and global warming - e.g. forest survey of India in collaboration with BITS Pilani has shown climate change hotspots in forest areas of India.

(b)

Working circle is area of forest that is organised and managed as a unit of working plan, with some particular objectives and goals.

- Working plan officer determines the constitution of working circle at time of working plan preparation.
- Its constitution requires detailed information about forest division and considers different factors like :-
 - ✓ Objectives of forest management
 - ✓ Crop composition
 - ✓ site condition
 - ✓ wildlife etc.
- Kinds of working circle differ from division to division based on above factors.

TYPES

- ① Biodiversity conservation working circle -
Protects & preserves species richness within forest ecosystem.
- ② Chir working circle ensures establishment of chir regeneration within shortest possible time.
- ③ Improvement working circle aims to improve status of forest crop in an area.
- ④ Joint forest management working circle ensures cooperative effort between forest department and locals.
- ⑤ Wildlife management working circle aims to preserve favourable habitat conditions for wildlife.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

⑥ Grazing working circle is constituted to facilitate and allot an area for grazing.

⑦ Minor forest produce working circle ensures continuous supply of non-timber forest products like Tendu leaves of Diospyros melanoxylon.

⑧ Industrial timber working circle ensures supply of timber to wood based industries.

(Please do not write anything except the question number in this space)
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

उम्मीदवारों को इस हाशिये में लिखने की आवश्यकता नहीं है।
Candidates must not write on the margin.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को
इस हाशिए में
नहीं लिखना
चाहिए
Candidates
must not
write on this
margin

(C) Rotation is the planned number of years between formation (or regeneration) of a crop and its final felling.

Physical rotation

① It is the age upto which tree remains sound.

② It is generally determined by production of viable seed (high forest) or Coppice vigorously.

③ It is generally practiced in protection forest, amenity forest etc.

Rotation of maximum Volume production

① It is the age at which mean annual increment (MAI) culminates.

② It is determined by age of intesection of MAI & CAI (current annual increment).

③ It is practiced where total quantity is important.
e.g. - Paper and pulp industry, Particle board industry etc.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को इस हाशिए में नहीं लिखना चाहिए।
Candidates must not write on this margin

Please do not write anything except the question number in this space.
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

3.(a)

Increment is the increase in diameter, height, volume and quality of a tree in a given period.

- It helps in yield sustainability, forest survey, inventory etc.
- Ideal increment is one of the important aspects of Normal Growing Stock.

Relationship between MAI and CAI

- MAI stands for mean annual increment. It means average increment over life of a tree.
- CAI stands for current annual increment. It means increment of dimensions of a tree over a year.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

(Please do not write anything except the question number in this space)
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

उम्मीदवारों को इस स्थान पर केवल प्रश्न संख्या लिखनी चाहिए।
Candidates must not write on this margin.

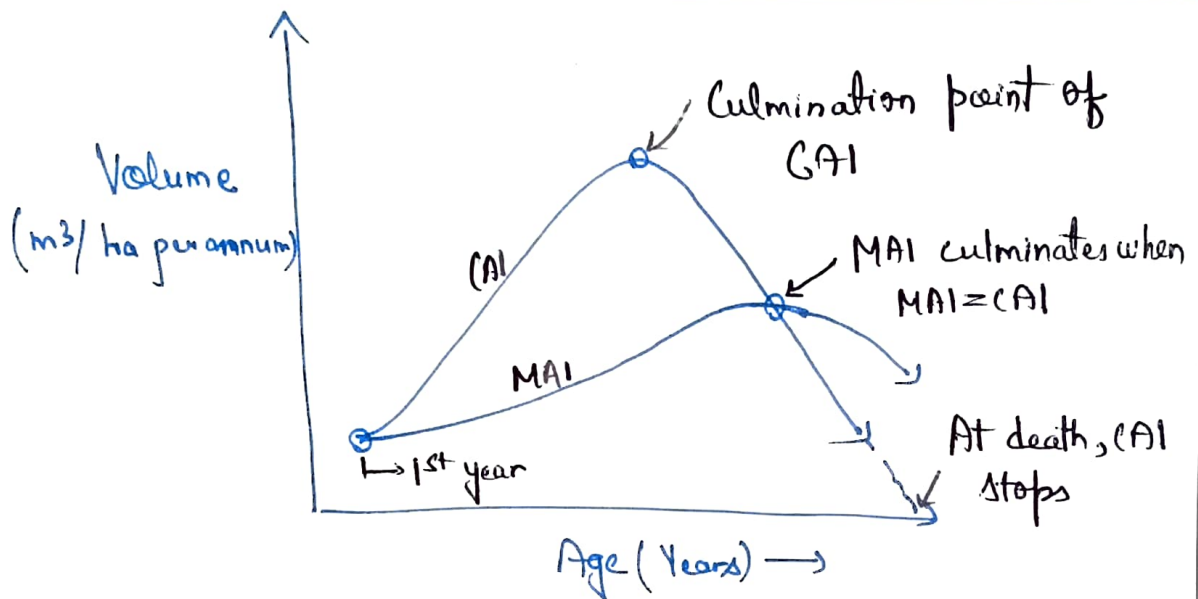


Figure: relationship between MAI & CAI

Infer from above graph:

- ① Both MAI & CAI is equal at the beginning.
- ② During initial phase, CAI is more than MAI.
- ③ Culmination point of CAI comes earlier as comparison to that of MAI.
- ④ MAI culminates when MAI=CAI.
At this point, rotation of maximum volume production takes place.
- ⑤ Then both, MAI & CAI, starts falling. However, CAI falls more rapidly and becomes zero at harvesting.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

(Please do not write anything except the question number in this space) कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

उम्मीदवार
इस हाथि
नहीं लिख
चाहिए
Candidate
must not
write on t
margin

(b) Yield regulation is the determination of yield and its expression in management plan prescription.

Regulation of the yield of a forest

The yield is regulated based on different parameters such as area, volume, area and volume, increment and volume and increment.

Basis

Yield regulation method

1. Area ———— Annual coupe by gross area
Annual coupe by reduced area

2. Volume ———— 1. Von Mantel's formula
2. Howard's modification
3. Simmon's modification
4. Smythies' modification
5. Burma modification

3. Increment ———— Increment method
Swiss method
Biolley's check method

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को
इस हाशिए में
नहीं लिखना
चाहिए
Candidates
must not
write on this
margin

4. Area and volume
- Permanent Periodic block method
 - Single periodic block method
 - Retrievable periodic block method
 - Floating periodic block method
 - Judeich's stand selection method

5. Volume and increment of whole Growing stock

↳ french method

↳ Brandis' diameter class method

↳ Hufnagl's diameter class method

etc.

Formula of glorious simplicity

Von-Mantel's formula for yield regulation in forests is also known as formula of glorious simplicity. This can be deduced as follows:

We know that $NGS = I \times \frac{r}{2}$ where, $r =$ rotation period of crop
 $NGS =$ Normal growing stock
 $I =$ Normal yield.

$\Rightarrow \frac{\text{Normal yield}}{NGS} = \frac{2}{r}$ ①



(Please do not write anything except the question number in this space)
 कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

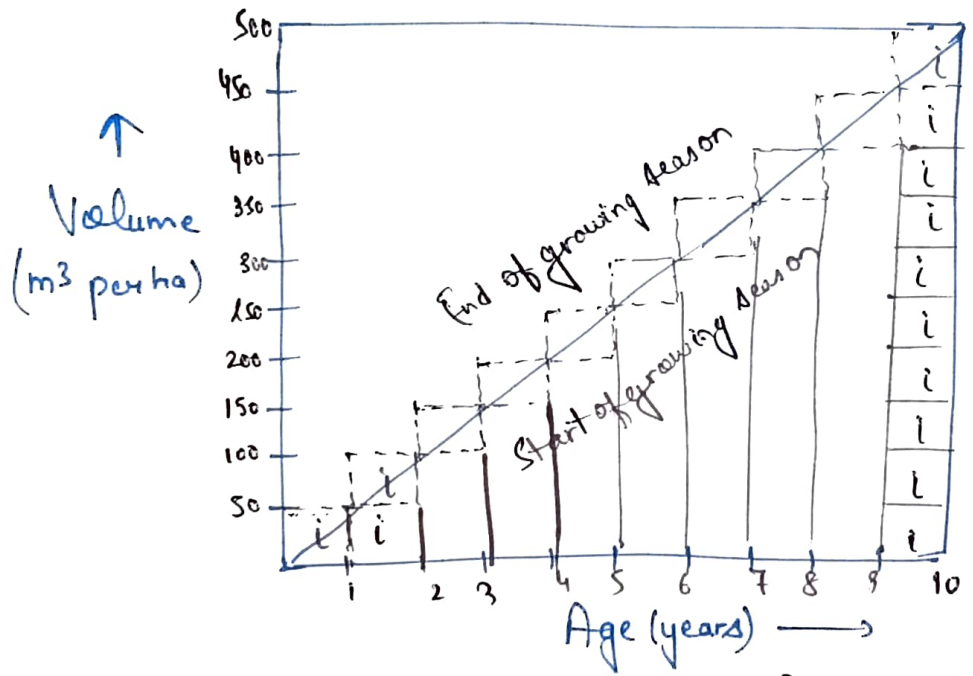
Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
 (Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को इस भाग में नहीं लिखना चाहिए।
 Candidates must not write on this margin

According to Von-Mantel,

$$\frac{\text{Yield}}{\text{Growing stock}} = \frac{\text{Normal yield}}{\text{Normal Growing Stock}}$$

$$\Rightarrow \boxed{\text{Yield} = \left(\frac{2}{8}\right) GS = \frac{2GS}{8}}$$



Advantages

- 1) Easy to apply
- 2) Works well in normal, even-aged and regular forest
- 3) Close to attainment of normality.

Disadvantages

- 1) difficult to measure entire growing stock
- 2) Not suitable for irregular forests
- 3) requires more labour to measure and assess whole forest area.

Please do not write anything except the question number in this space
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

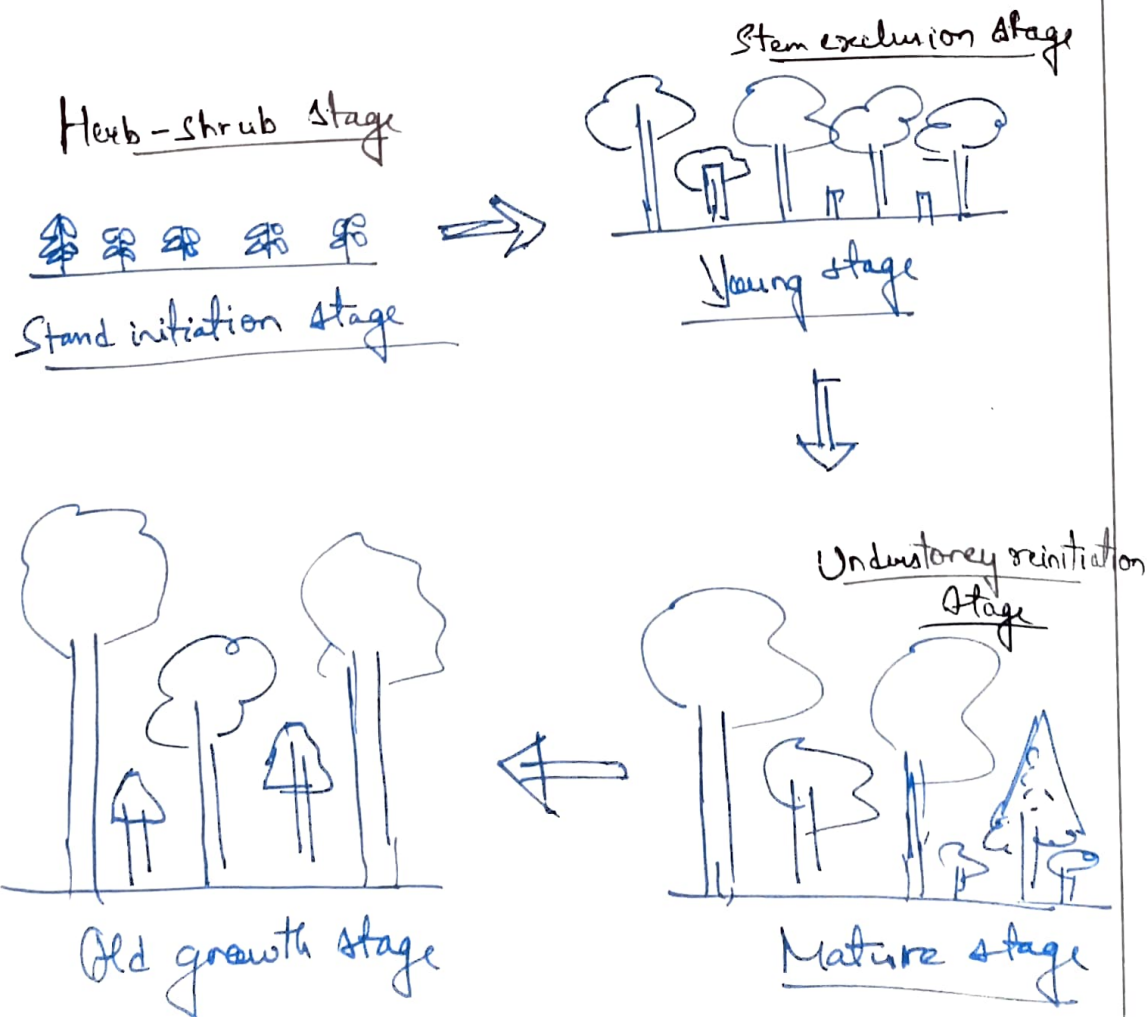
Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को इस हाथिए में नहीं लिखना चाहिए।
Candidates must not write on this margin

(C) Stand is a contiguous area that contains a number of trees that are relatively homogeneous or have a common set of characteristics.

• It talks about crop composition, age, size and distribution of trees.

Stages of stand development



UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को
इस हाशिये में
नहीं लिखना
चाहिए।
Candidates
must not
write on this
margin

5(a)

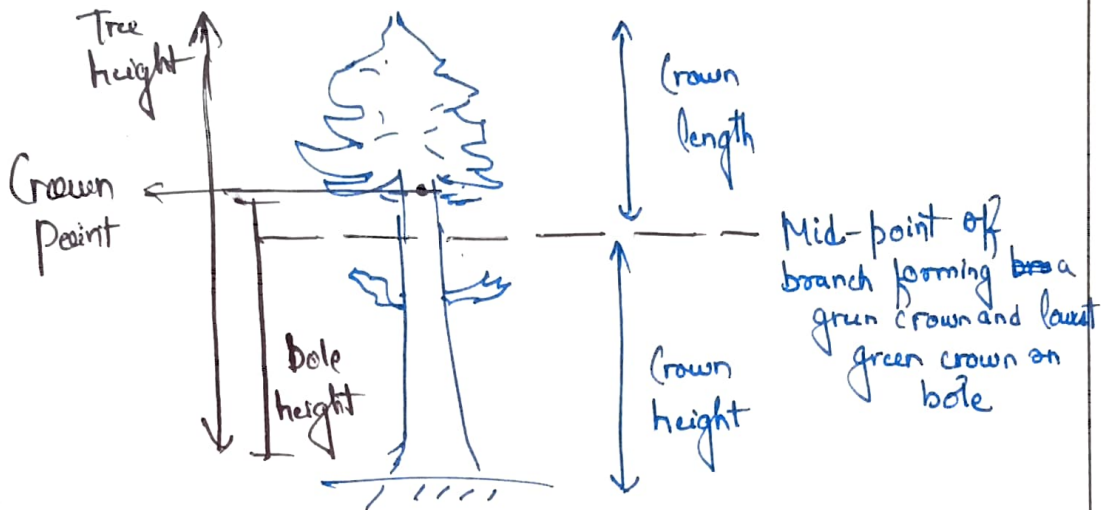


Fig. Tree and its nomenclature.

(i) Bole height is the height ^{of tree} upto crown point from ground.

(ii) Crown length is the distance of crown from tip of crown to mid-point between lowest green branches forming a green crown and lowest green branch on bole.



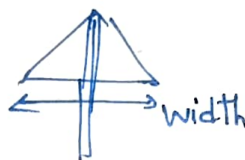
(Please do not write anything except the question number in this space)
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को
इस दृष्टिकोण से
नदी लिखने
चाहिए।
Candidates
must not
write on the
margin

(c) Crown width is ~~is~~ the length of
width of crown.



(d) Crown point is the lowest green branches
forming a green crown all round.

(Please do not write anything except the question number in this space कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।)

UPSC

उम्मीदवारों को इस हाशिए में नहीं लिखना चाहिए। Candidates must not write on this margin

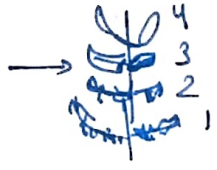
Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis. (Specimen Answer Booklet - For Practice Purpose Only)

(b) The Age of a standing Coniferous trees can be determined in following ways :-

(1) Age by general appearance of trees -

△ e.g. In Pinus roxburghii, crown shape is conical in early stage and becomes rounded as trees grow older.

(2) Age determination by mathematical relationship - regression or age versus diameter curve.

(3) Counting number of whorls or annual shoots
↳ Conifers produce whorls of branches annually → 

(4) Increment boring - boring of stem with Pender's increment borer.

↳ Age can be known through three periodic measurements.

(c) Volume table is a table showing average volume of tree logs or sawn timber of a given species based on different variables like diameter, height and form.

TYPES

(I) Classification based on number of variables

(1) One variable volume table - It is based on Diameter at breast height (DBH)
↳ used for local area.

(2) Two variable volume table - DBH and height
↳ Applicable to large areas.

(3) Three variable volume table - It is based

DBH, height and form.

II Classification based on scope of application

① local volume table - for use in restricted locality

② Regional volume table - applied to site-specific region

③ General volume table - used for large areas.

III Classification based on cuttun:

① Standard volume table - gives estimated cuttun in form of standard timber.

② Commercial volume table - excludes stump volume

③ Sawn cuttun table - info of sawn timber.

④ Assortment table - volume of various thin diameter

⑤ Sawn cuttun assortment table

(Please do not write anything except the question number in this space) कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

उम्मीदवारों को इस हाशिए में नहीं लिखना चाहिए
Candidates must not write on this margin

d) Remote sensing is the science of acquiring information about earth's surface without actually being in contact with it.

Uses in forest management

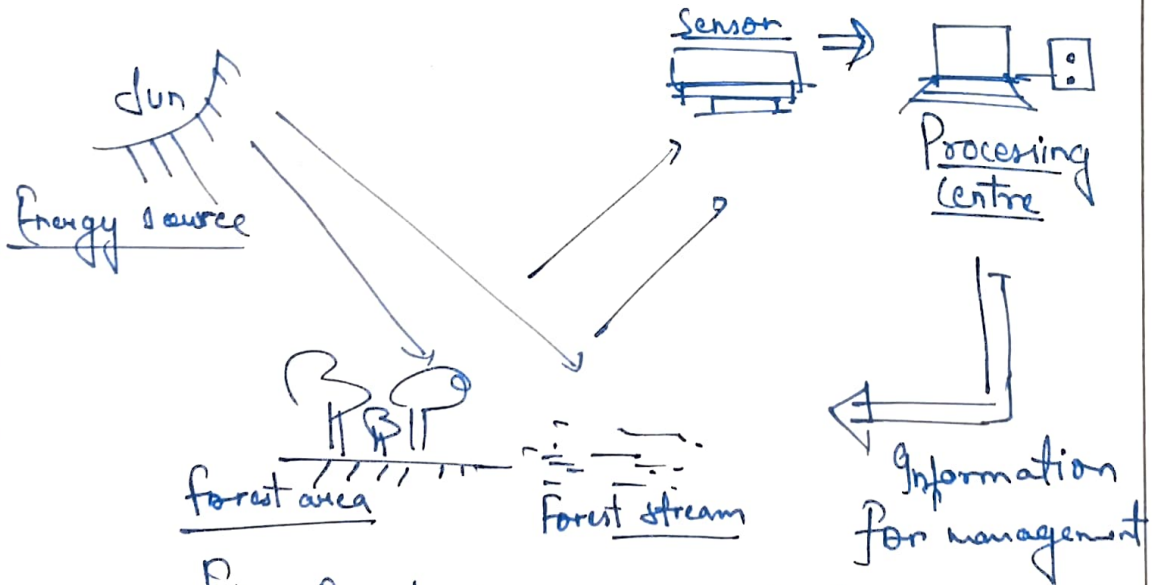


Fig: Remote sensing and forest management.

- ① forest fire monitoring - (e.g.) MODIS-SNPP sensors providing information regarding fires
- ② ecosystem and landscape modelling
- ③ Growing stock estimation

④ forest cover monitoring - eg LISS-III

sensor fitted in Resourcesat-II satellite, utilised by forest survey of India.

⑤ Monitoring abundance, distribution and impact of Invasive alien species

Such as Prosopis juliflora, Senna spectabilis.

⑥ Soil and watershed management

⑦ Illegal logging detection

⑧ Above ground biomass estimation using

Synthetic aperture radar (SAR), as

evident in collaboration between FSI and ISRO.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

e

Wooden bridge is a bridge made of wood to cross natural obstacles like rivers, streams and valleys.

Structure

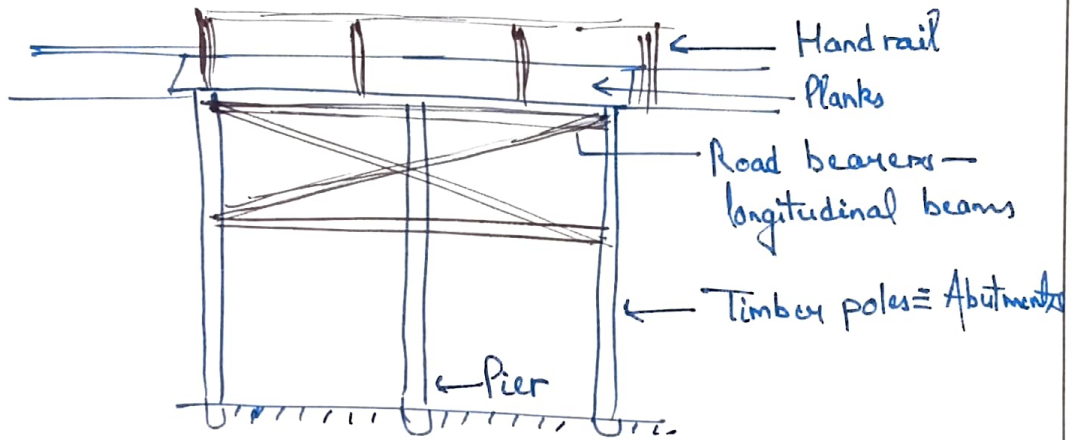


fig. Side view of Wooden bridge

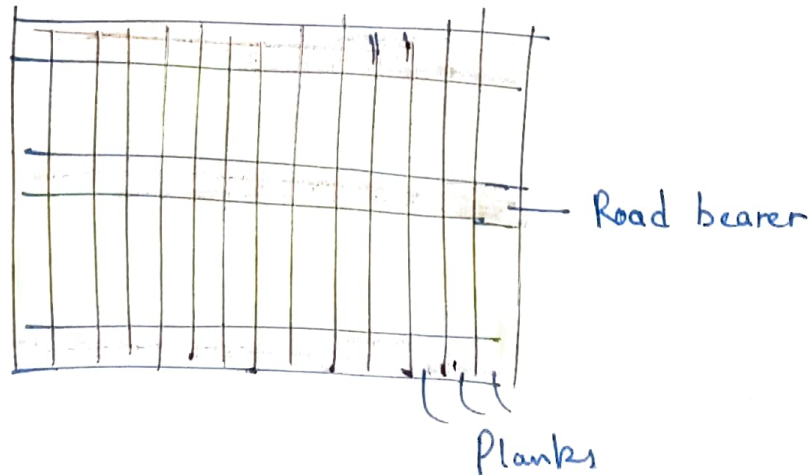


Fig: Top view

(Please do not write anything except the question number in this space)
कृपया इस स्थान में प्रश्न संख्या के अतिरिक्त कुछ न लिखें।

UPSC

उम्मीदवारों को इस हाशिए में नहीं लिखना चाहिए
Candidates must not write on this margin

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

8. a) Chain survey is the process of delineation of form, extent, position etc. of a tract of forest land by using linear measurements and, by applying principles of geometry

Principles

① Triangulation - Whole area is divided into right angled triangles.

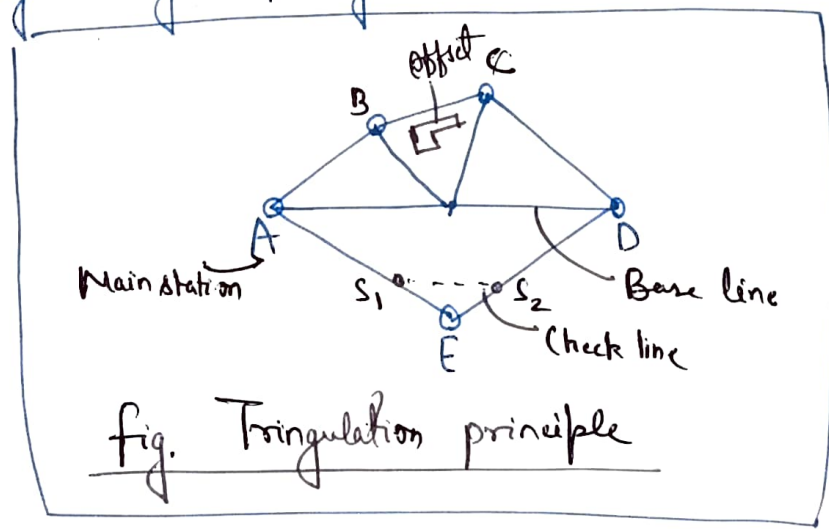


fig. Triangulation principle

② Traversing - straight lines connect a series of establishment stations along route of survey.

Advantages

- ① Easy to apply over small area
- ② plain area can be conveniently delineated.
- ③ Small scale map is prepared with precision and accuracy.

Disadvantages

- ① Crowded places can't be measured because of a lot of triangles would be drawn.
- ② large area requires different approach.
- ③ Can't apply over undulating and inclined area.

Chaining in case of dense forest area interrupts the chain line

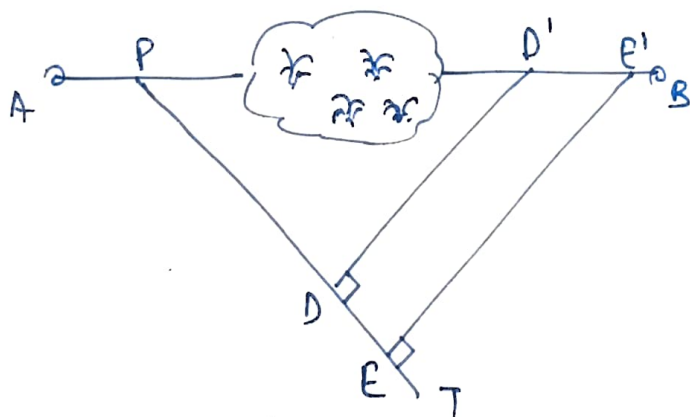


UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

◦ In this case, we draw a random line from Station A.

◦ Then, from this line, we draw two perpendicular offsets DD' & EE' so that D' and E' intersect the line joining AB .



◦ From Pythagoras theorem, we can measure PE' .

$$PE' = \sqrt{PE^2 + EE'^2}$$

$$\therefore \boxed{AB = AP + PE' + EB}$$

UPSC

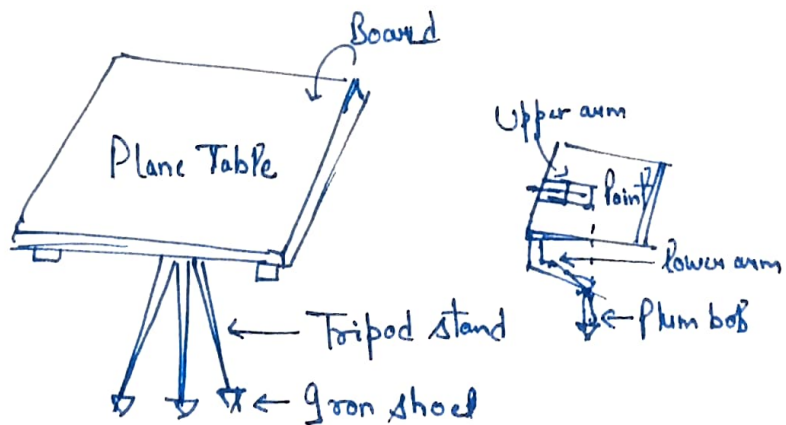
Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

(b)

Plane table survey is a method of survey where field observation, measurements and plotting are done simultaneously.

- It is based on the principle of parallelism, where rays drawn on paper, reflecting the stations, are parallel to lines joining stations on ground.

Tools utilised



further sheet of drawing paper, pencil, rubber, alidade is utilised.

UPSC

Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

Role in forest management

- ① To map out forest areas
- ② to map out fire burnt areas \rightarrow e.g. Survey after forest fire
- ③ to prepare plantation, stock and management maps.
- ④ Preparation of treatment maps in areas to be planted and conserved.
- ⑤ demarcate and delineate forest boundaries
- ⑥ detect encroachments on forest land.
- ⑦ prepare alignments of roads
- ⑧ layout of felling coupes.

- (c) Load is a force applied or exerted on an object like forest building.
- It may be due to force due to gravity or wind force etc.

TYPES

- ① Dead loads are relatively constant in magnitude as well as direction.
- ② Live load is variable or moving load.
- ③ Wind load is exerted due to lateral pressure.
- ④ Hydraulic load may be applied due to water stream.

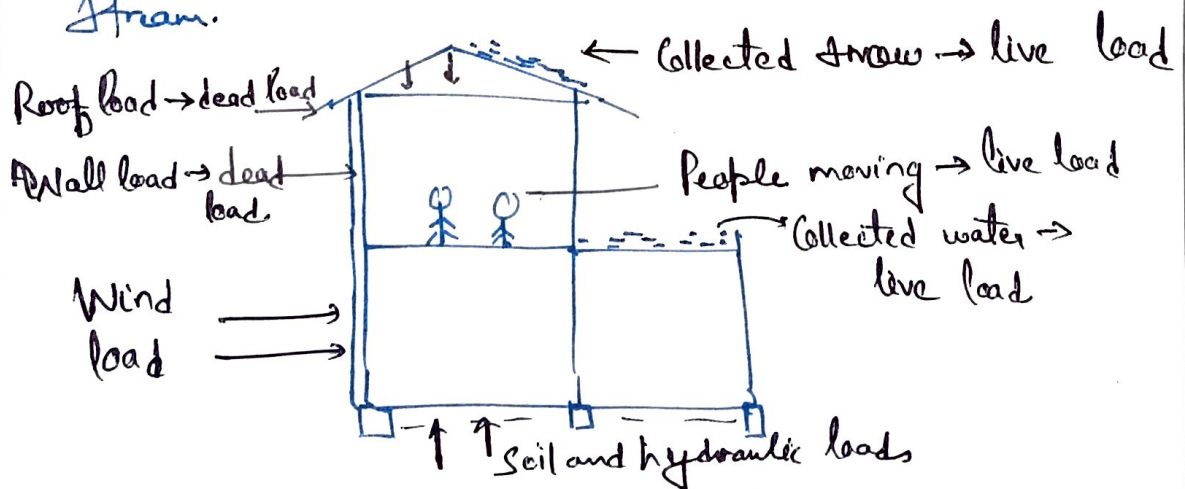


fig. Different loads