ENGINEERING MATERIALS FOR SUSTAINABILITY- CV0424

UNIT – 4

DEPARTMENT OF CIVIL ENGINEERING

ENERGY CONSERVATION BUILDING CODE

Purpose

The purpose of this codes is to provide minimum repurements for the energy- efficient design and construction of building .

It also takes cares of other supects such as lighting and others which reqires different source of energy

Scope

- The code is applicable to building that have connected load of 500 kW or greater or a contract demand of 600 kVA or greater .

- Generally buildings having conditioned area of 1000 sp.m or more will fall in this category .

Applicable Building System

- The code is apply to :

a. Buiding envolopes, except for unconditional storage spaces or warehouses .

b. Mechanical systems and equipments , including heating , ventilating and AC’s .

c. Service hot water heating .

d. Interior and exterior lighting .

e. Electrical power and moters .

ECBC

- With the backgroung of high energy saving potential and its benefits bridging the gap between demand and supply , reducing enviormental emissions through energy saving and to effectively over come the barrier the Govt. of India has enacted the energy concervation Act , 2001 .
- The act reqired much needed legal framework for embarking on an energy efficiency drive .
- This includes Energ y conservation code .

Mandatory Requirments

- Fenestration
- Solar heat gain coefficient
- Air leakage
- Opaque costruction
- Building envelope sealing

Perspective Requirement

- Roofs
- Opaque Wall
- Vertical fenestration

Roof assembly U-factor and insulation R-value requirements

Climate Zone	24-Hour use building		Day time use building	
	Hospitals , Hotels , Calls Centers e.t.c		Other Building Type	
	Maximum U-factor of the overall assembly ($W/m^2 – {}^oC$)	Minimun R-value of insulation alone ($m^{2-o}C/W$)	Maximum U-factor of the overall assembly ($W/m^{2-o}C$)	Maximum R-value of insulation alone ($m^{2-o}C/W$)
Composite	U-0.261	R-3.5	U-0.409	R-2.1
Hot and dry	U-0.261	R-3.5	U-0.409	R-2.1
Warm and humid	U-0.261	R-3.5	U-0.409	R-2.1
Modrate	U-0.409	R-2.1	U-0.409	R-2.1
Cold	U-0.261	R-3.5	U-0.409	R-2.1

Opaque wall assembly U-factor and insulation R-value requirements

Climate Zone	24-Hour use building		Day time use building	
	Hospitals , Hotels , Calls Centers e.t.c		Other Building Type	
	Maximum U-factor of the overall assembly ($W/m^2 – {}^oC$)	Minimun R-value of insulation alone ($m^2\text{-}{}^oC/W$)	Maximum U-factor of the overall assembly ($W/m^2\text{-}{}^oC$)	Maximum R-value of insulation alone ($m^2\text{-}{}^oC/W$)
Composite	U-0.440	R-2.10	U-0.440	R-2.10
Hot and dry	U-0.440	R-2.10	U-0.440	R-2.10
Warm and humid	U-0.440	R-2.10	U-0.440	R-2.10
Modrate	U-0.431	R-1.80	U-0.397	R-2.00
Cold	U-0.369	R-2.20	U-0.352	R-2.35

Vertical Fenestration U-factors and SHGC Requirements (U-factor in W/m^2-^oC)

		WWR ≤40%	40%<WWR≤60%
Climate	Maximum U-factor	Maximum SHGC	Maximum SHGC
Composite	3.30	0.25	0.20
Hot and Dry	3.30	0.25	0.20
Warm and Humid	3.30	0.25	0.20
Modrate	6.90	0.40	0.30
Cold	3.30	0.51	0.51

CONCLUSION

- This was the brief detail Information about **ENERGY CONSERVATION BUILDING CODE** .

SURFACE WATER BALANCE

Contents

- Evapotranspiration (ET)
- Difference between evaporation & transpiration
- Types of evapotranspiration
- Factors affecting evapotranspiration
- Method to determine evapotranspiration
- Significance of ET.

What is evapotranspiration?

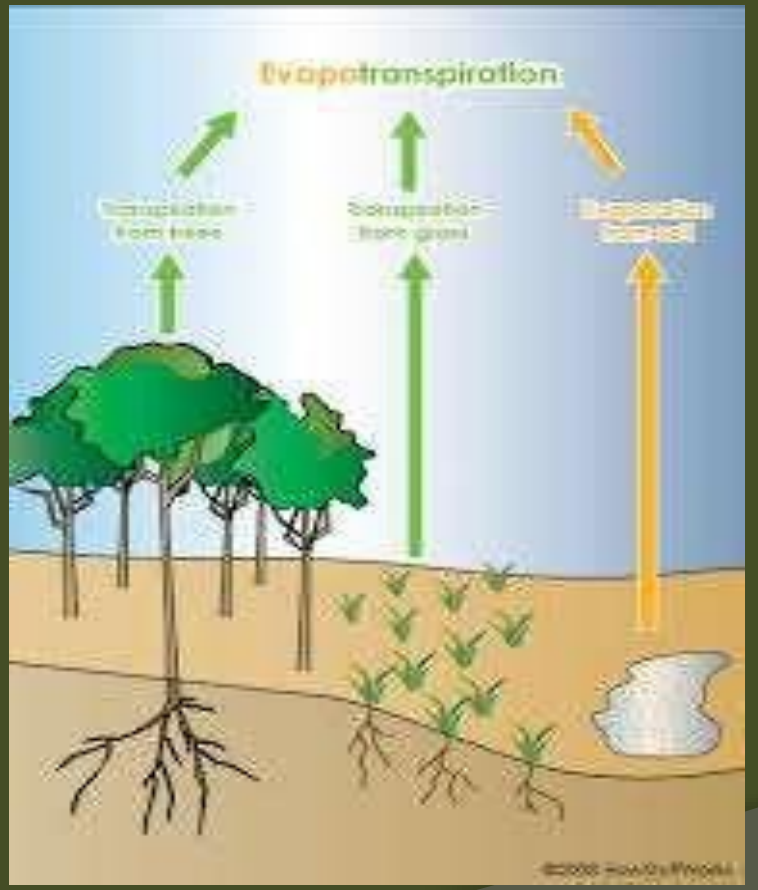
- It is a combination of two separate processes

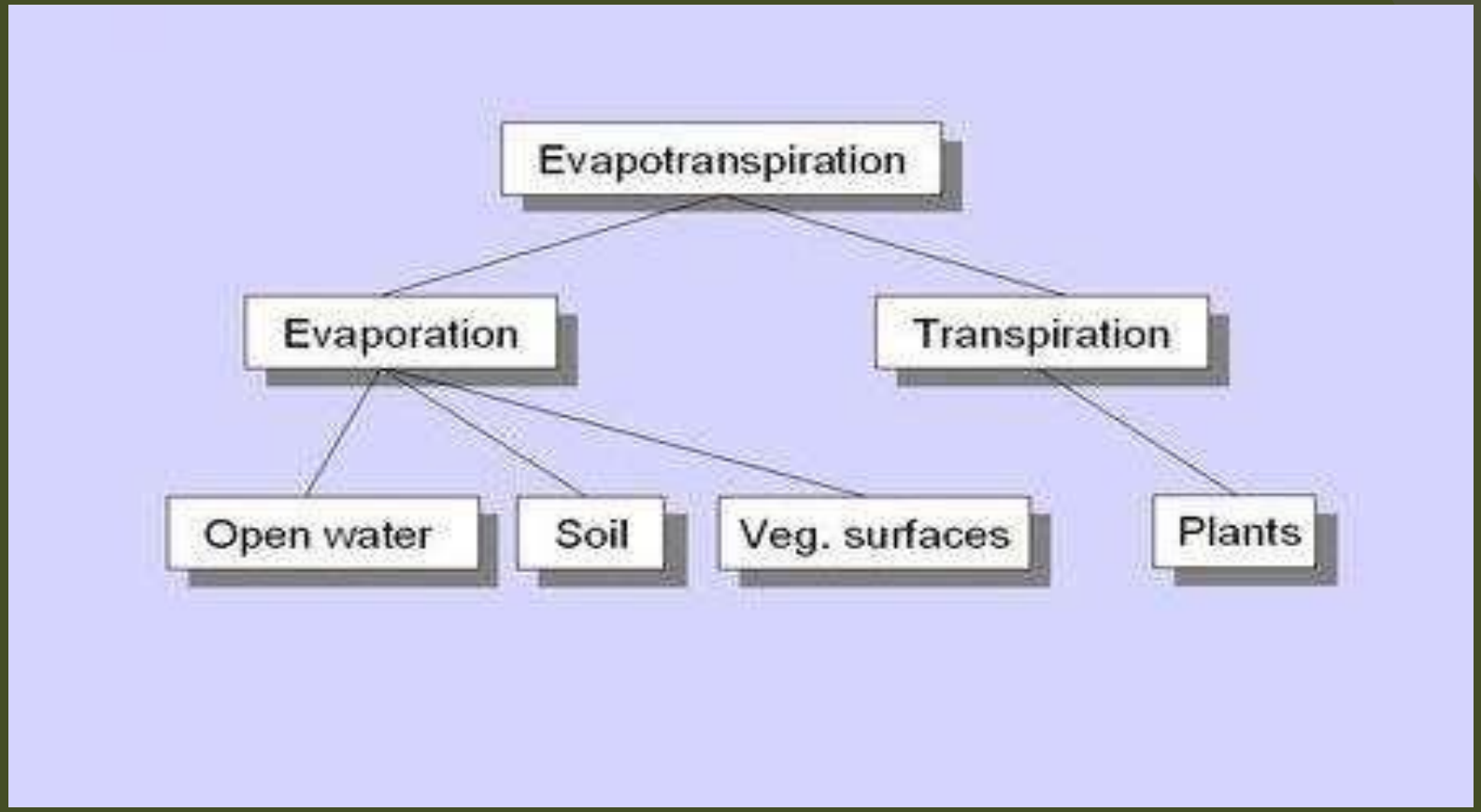
Evaporation:-

- Loss of water from the soil surface or any other open water body

Transpiration:-

- Loss of water vapour from plant stomata.





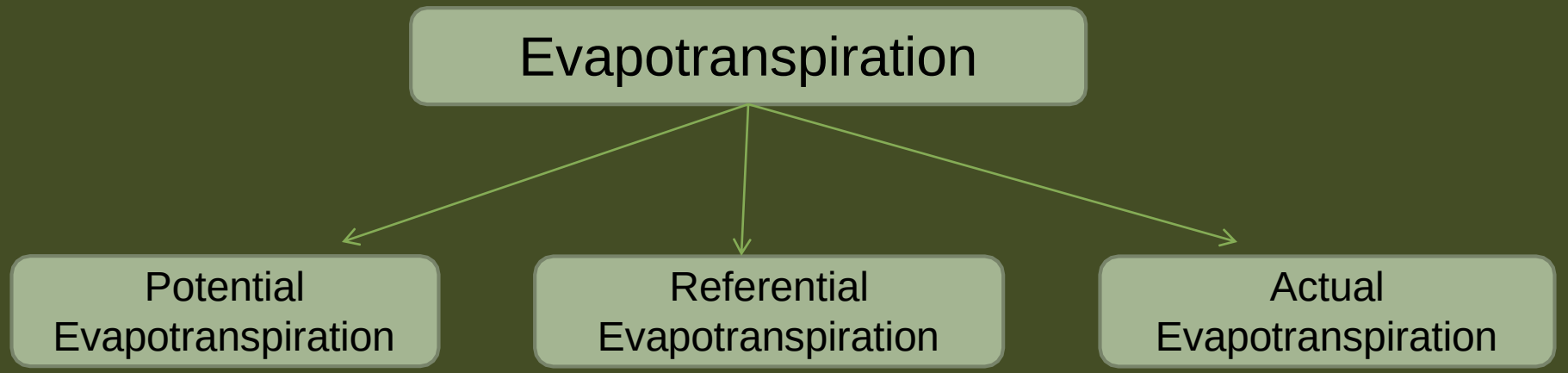
Evapotranspiration divided into subprocesses

Difference between evaporation & transpiration

Transpiration	Evaporation
Transpiration is physiological process	Evaporation is physical process.
It is loss of water from the free surface of cells.	It is loss of water from the free surface of water.
Regulated process.	Non regulated process.
Guard cell involved.	No role of guard cell.
It is comparatively slow process.	It is faster process.
Influenced by anatomy of plants.	There is no such influence.

Types of evapotranspiration

- Evapotranspiration may be classified as:



Potential Evapotranspiration:-

- Concept given by Thornthwait.
- It is the highest rate of ET from an actively growing short height vegetation completely covering the ground with abundant water supply at a given climatic condition.

Referencial Evapotranspiration:-

- Concept given by Doorenboss and Pruit
- It is the rate of ET , not highest from an extended area completely covered by grasses of 12-15cm high completely covering the ground . It is the abundant soil moisture substance.

Actual Evapotranspiration:-

- It is the actual ET of a crop at particular locality and at particular time .It depends upon crop , soil , climate , and management factors.

Factors affecting Evapotranspiration:-

1. Environmental factors
2. Plant crop factor
3. Geographical factor
4. Soil factors

1. Environmental factors

Several factors affecting a plant's rate of transpiration and therefore evapotranspiration.

1. Air temperature, as temperatures increase, evapotranspiration also goes up.
2. Humidity, as the air becomes more and more saturated, less water is able to evaporate into that air.
3. Movement of wind and air increases, evaporation and transpiration does as well because moving air is less saturated than stagnant air.

4. Moisture/ water available, less water available means plants begin to transpire less water in an effort to survive. This in turn decreases evapotranspiration.
5. Solar radiations, more solar radiations more will be the rate of evapotranspiration.

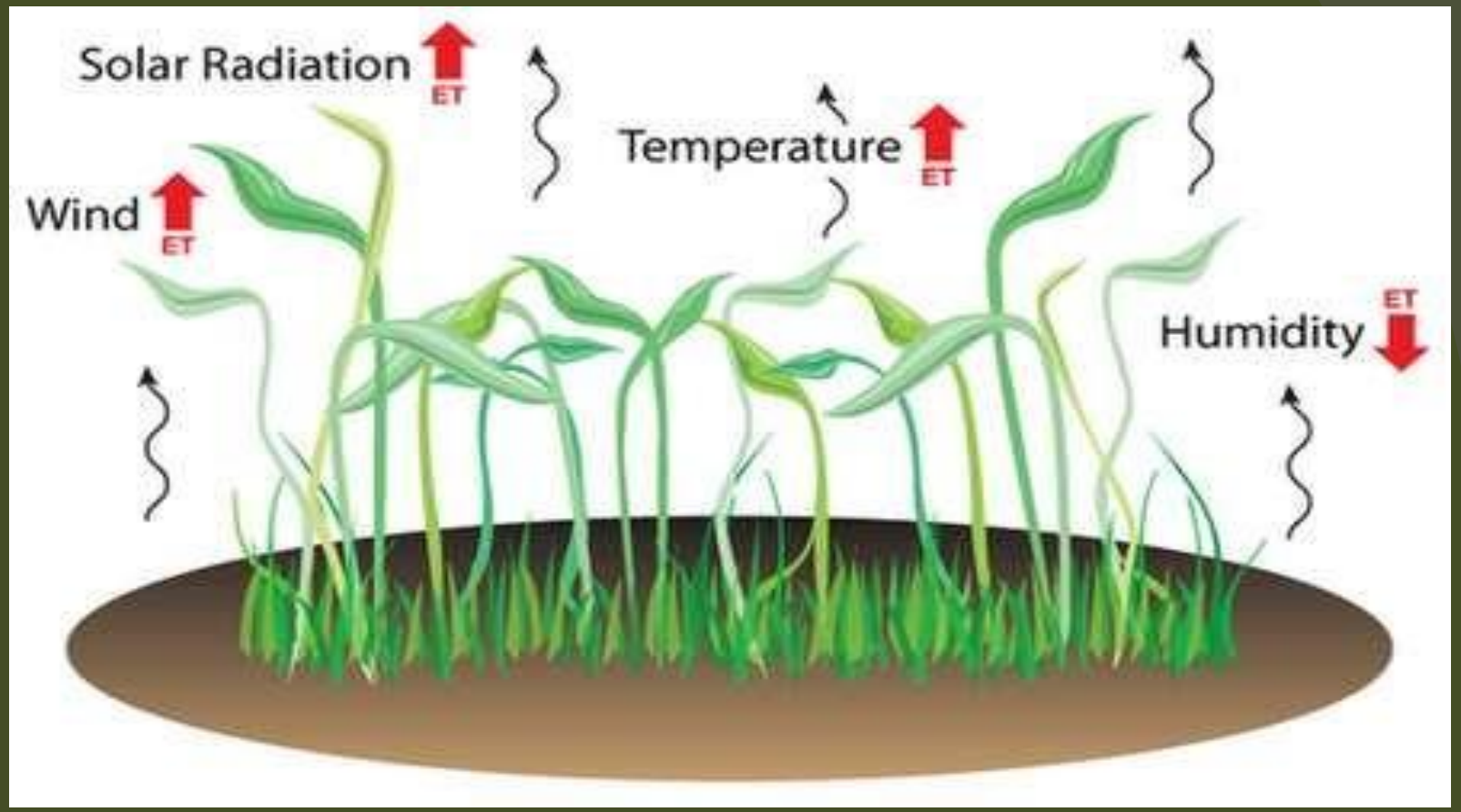
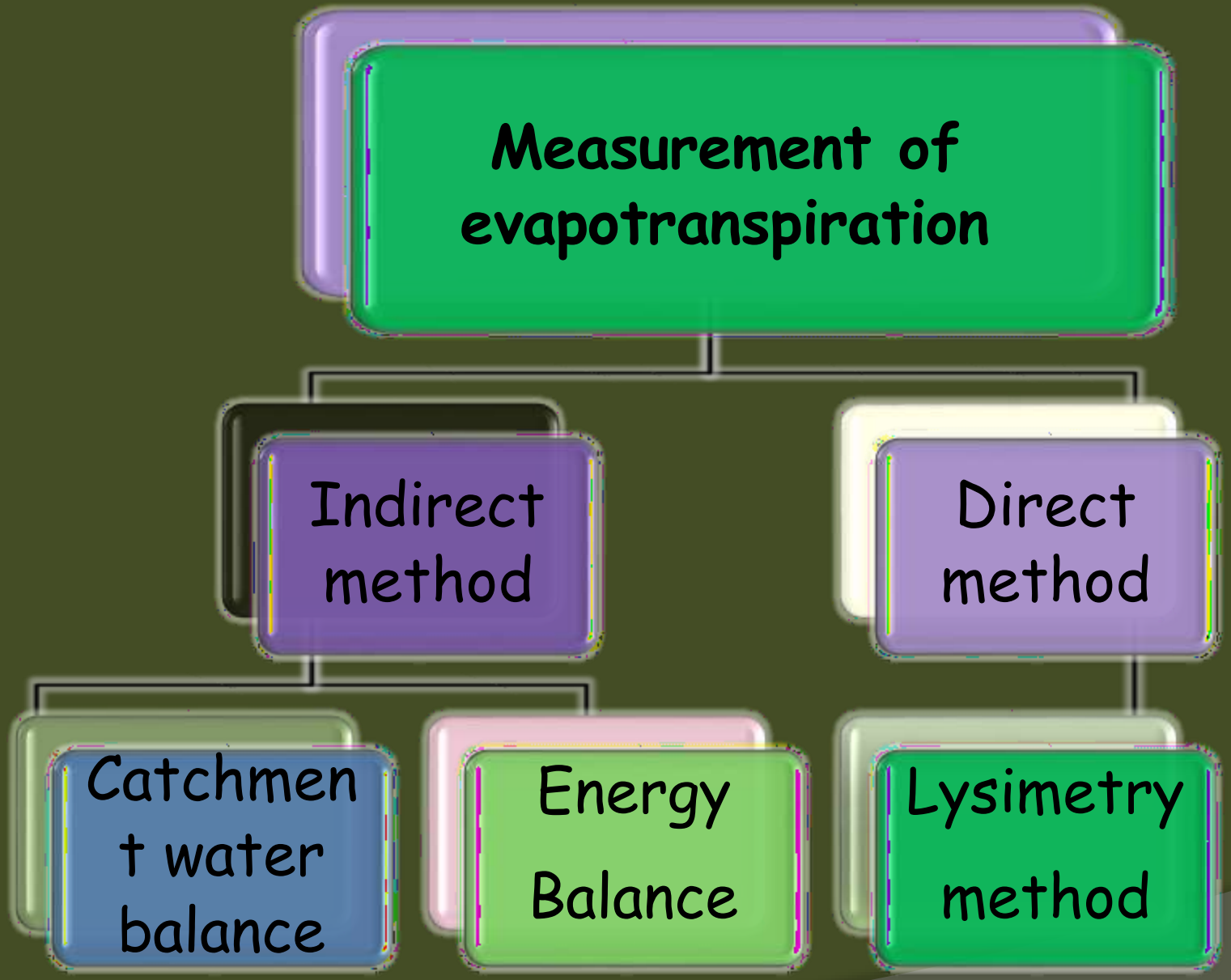


Figure: ET is an energy driven process, increases with temperature, solar radiation and wind speed. ET decreases with increasing humidity.

2. Plant and crop factors:-
   - Vegetative cover
   - Leaf shape and size
   - Type of plant
3. Geographical factors:-
   - ET is also dependent upon an area's geography,latitude and climate.
   - Regions on the globe with the most solar radiation experience more evapotranspiration.
   - Evapotranspiration rates are also highest in areas with a hot and dry climate.
   - Evapotranspiration is less in higher latitudes.

4. Soil factors-:
   - ET depend upon water table depth, soil moisture and capillary character.
     - When soil is lacking moisture, plants begin to transpire less water in an effort to survive, this in turn decreases evapotranspiration.

Measurement of evapotranspiration


Measurement of evapotranspiration
Indirect method
Direct method
Catchment water balance
Energy Balance
Lysimetry method

Direct method

A lysimeter is a measuring device which can be used to measure the amount of actual ET which is released by plants, usually crops or trees.

By recording the amount of precipitation that an area receives and the amount lost through the soil, the amount of water lost by evapotranspiration can be calculated.

$$ET = P + (I - D) + S$$

Where,

ET = Evapotranspiration

P = Precipitation

I = Irrigation water

D = Excess water drained from bottom

S = Increase or decrease in storage of soil moisture

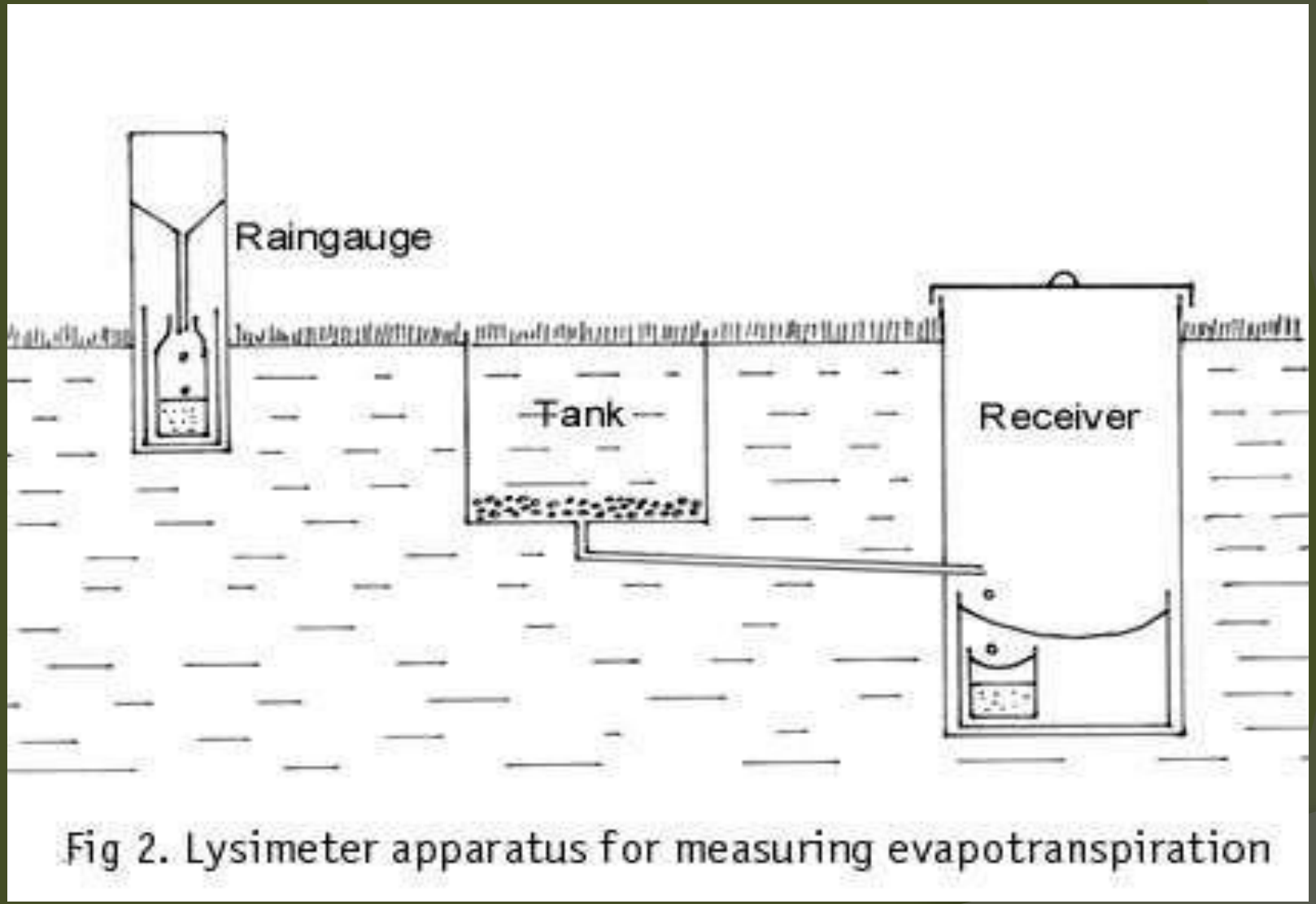


Fig 2. Lysimeter apparatus for measuring evapotranspiration

Indirect method

CATCHMENT WATER BALANCE

Evapotranspiration may be estimated by creating an equation of the water balance.

$$ET = P - \Delta S - Q - D$$

ET = Evapotranspiration

P = Precipitation

ΔS = Change in Storage

Q = Stream flow

D = Groundwater recharge

Significance of evapotranspiration

- It is an important process in water cycle as it responsible for 15% atmosphere water vapour.
- It maintains soil temperature.
- It helps in movement of nutrients in plant
- Optimizes temperature of plant.
- Make the plant cell turgid which provide a proper shape to plant.


THANK YOU