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HAVE MENTORED MORE THAN 10 LAKH STUDENTS (OFFLINE & ONLINE CLASSES) FOR UPSC CIVIL SERVICES EXAMINATION & OTHER UPSC EXAMS FOR MORE THAN 18 YEARS.

AJIT TIWARI

- ✓ Have worked as Senior Faculty in various prestigious institutes in India.
- ✓ Lectures are fused with memory tricks for long term retention.
- ✓ Interactive teaching based on question answer approach
- ✓ Well known faculty for General studies- Environment & Ecology, Complete Geography (Physical, Indian, World, & Economic Geography), Disaster Management & Complete Geography Optional.

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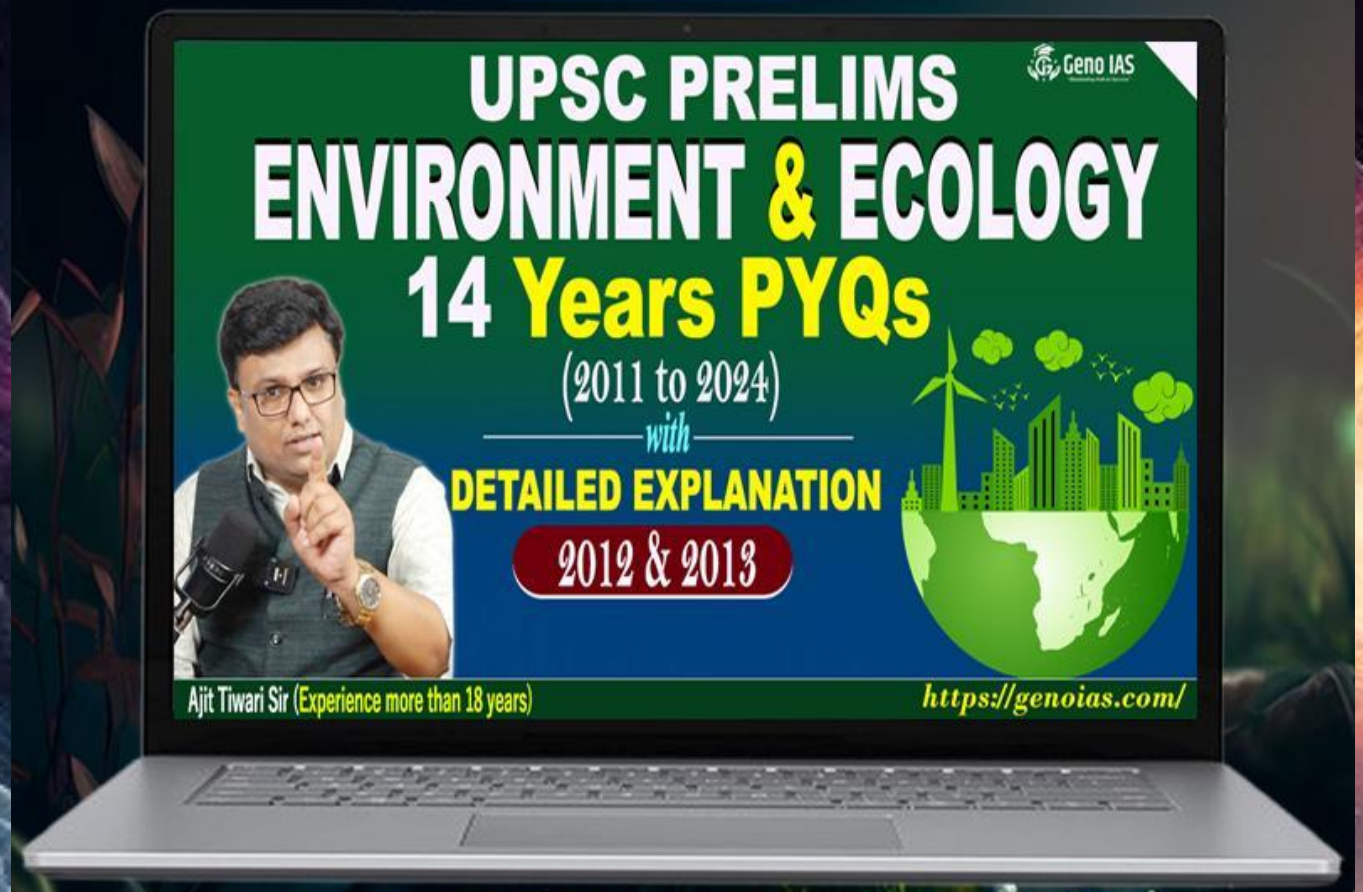

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Assam -Mehgalaya cadre.

MR. SUSHIL SINGHAL
Retd. IFS,
Former High Commissioner of India in Papua New Guinea

MR. HARDEEP SINGH
Former Director General Agriculture Haryana Former HPSC Chairman

MR. SANJAY SINHA
Retd. IPS, Former DGP, Tripura, Former UPSC Board Member

MR. NAVNEET WASAN
Retd. IPS, Former Special Director General, National Investigation Agency (NIA), Former UPSC Board Member

MR. ROHIT NANDAN
Retd. IAS, Former Secretary, Skill Development & Enterpreneurship, Former UPSC & UPPSC Board Member

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Retd. IFS,
Former Ambassador, Ministry of External Affairs

MR.GAURISHANKAR GUPTA
Retd. IFS, Former Higher Commissioner of India to Trinidad and Tobago Former UPSC Interview Panelist

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UPSC CSE PRELIMS 2012

Q21. Consider the following kinds of organisms:

1. Bat
2. Bee
3. Bird

Which of the above is/are pollinating agents/agents?

a) 1 and 2 only
b) 2 only
c) 1 and 3 only
d) 1, 2 and 3

Wind
Water
Ants
Insects
Animal
Elephant
Man

Expected Questions

Pollen grains
Self pollination
Cross pollination
Anther
Unisexual
Bisexual
Stigma
Geitonogamy
Xenogamy
Cleistogamous

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Bat

Bee

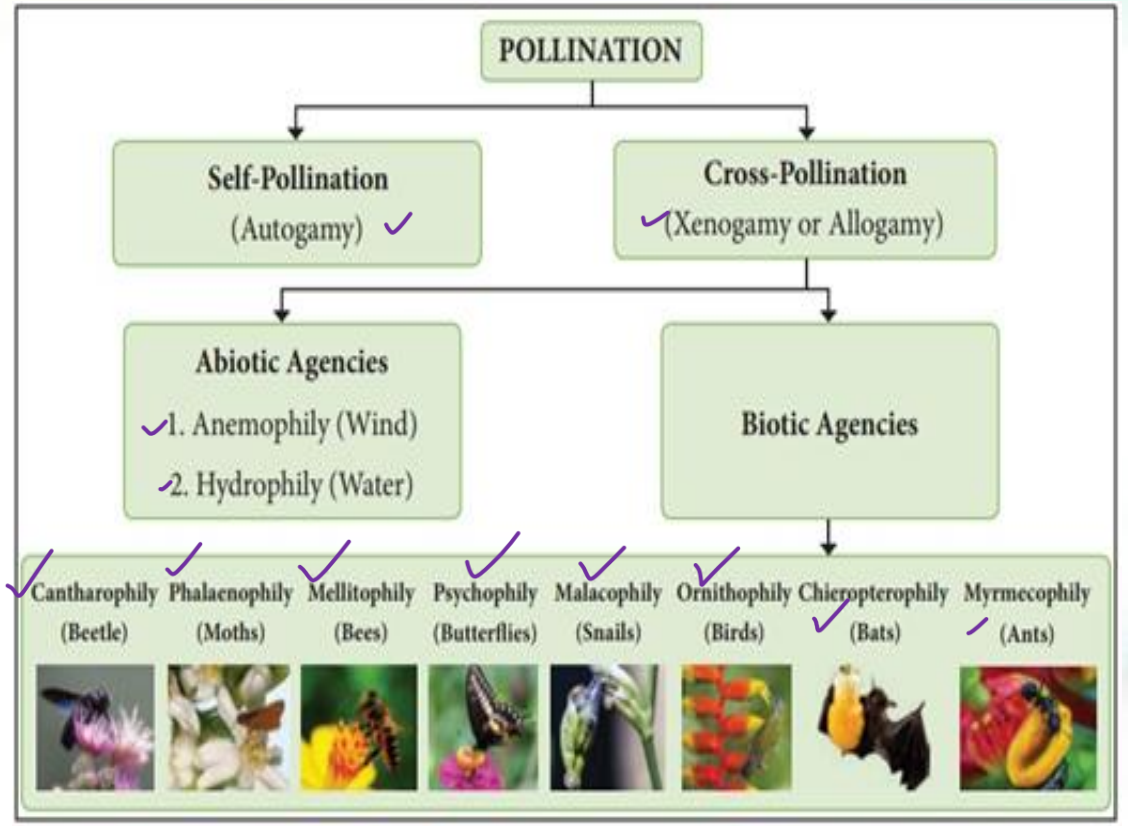
Bird

21. Solution (d)

- In flowering plants, pollination refers to transferring pollen grains from the male anther of a flower to the female stigma.
- Pollination taking place in a single flower is called self pollination, while pollination taking place between two flowers is called cross pollination.
- If the cross pollination is between flowers of the same plant, it will be called Geitonogamy, while if it takes place between two separate plants, it will be called Xenogamy.
- In some plants, the flowers are bisexual and closed called Cleistogamous. Here only self pollination takes place.

POLLINATORS

- Insect pollinators include bees, (honey bees, solitary species, bumblebees); pollen wasps (Masarinae); ants; a variety of flies including bee flies and hoverflies; lepidopterans, both butterflies and moths; and flower beetles.



- Vertebrates, mainly bats and birds, but also some non-bat mammals (monkeys, lemurs, possums, rodents) and some reptiles (lizards and snakes) pollinate certain plants.
- Among the pollinating birds are hummingbirds, honeyeaters and sunbirds with long beaks; they pollinate a number of deep-throated flowers.

Q22. Which of the following can be threats to the biodiversity of a geographical area?

1. Global warming
2. Fragmentation of habitat
3. Invasion of alien species
4. Promotion of vegetarianism

Arthur & Wilson biogeographic Principle

$\frac{1}{10^{th}}$ loss of Habitat → $\frac{1}{2}$ loss of bio.

Select the correct answer using the codes given below :

a) 1, 2 and 3 only

b) 2 and 3 only

c) 1 and 4 only

d) 1, 2, 3 and 4

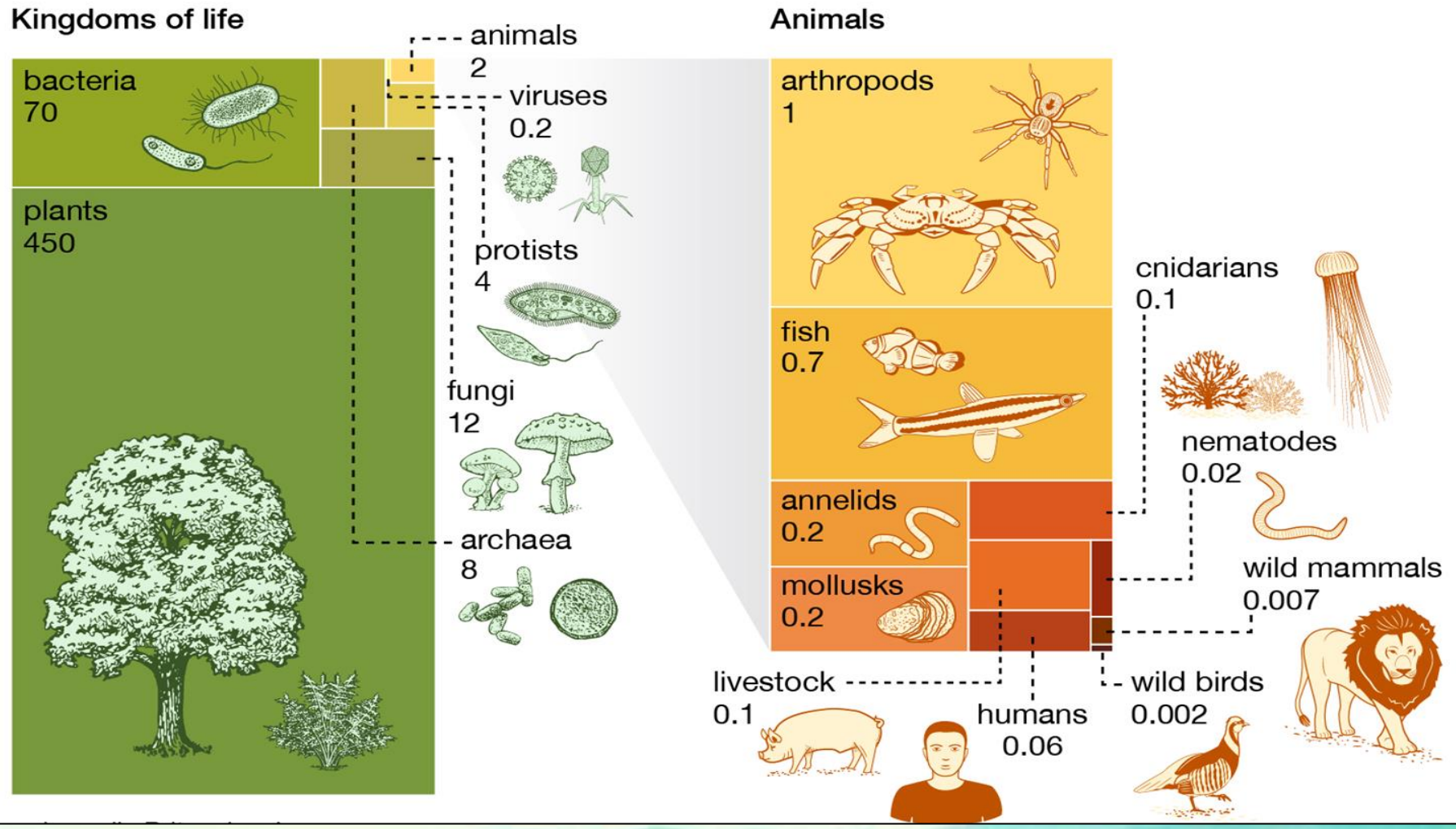
22. Solution (a)

- The global warming, fragmentation of habitat and invasion of alien species either alone or together can lead to loss of biodiversity of a region.

Knowledge Base:

- Biodiversity is under serious threat as a result of human activities. The main dangers worldwide are population growth and resource consumption, climate change and global warming, habitat conversion and urbanisation, invasive alien species, over-exploitation of natural resources and environmental degradation.

Relative biomass in gigatons (GT) of carbon (C)



Main threats	Some underlying causes
Threats in terrestrial areas	
Degradation, destruction and fragmentation of natural habitats	Spread of the urbanised areas, road network and industrial areas and associated problems (noise, pollution); abandon of former agricultural practices that were favourable to biodiversity
Decrease in the capacity of the agricultural areas to host wildlife	Intensification of agricultural practices (yielding pollution and disturbance) and disappearance of landscape elements that provide food and shelter that are exploitable by wildlife (such as hedges, trees, ponds, etc.)
Pollution of soils, air and water	Excess of heavy metals (industry, roads), manure and pesticides (agriculture) and other pollutants
Invasions by alien species	International trade and transport (roads, railways, rivers), gardening practices, exotic trees in forestry, exotic pests released in the wild, climate change, etc.

Main threats	Some underlying causes
Epidemics affecting wildlife	Arrivals of pathogens that are favoured by the introduction of exotic species, pollution and the destruction of habitats
Climate change	Carbon emissions, deforestation and other land use changes due to human activities
Dessication of soils and wetlands	Excess pumping of underground water tables
Recreation and leisure	Overuse of green open spaces and wild areas, little respect for nature, mountain biking and motor sports in fragile areas, dogs not on leash
Threats in marine areas	
Overfishing and decline of species	Industrial fishing, overexploitation of target species, by-catch species

Main threats	Some underlying causes
Pollution and eutrophication	Land-based activities (river run-off), atmospheric deposition, maritime traffic
Degradation and destruction of the sea floor	Beam trawling, dredging, sand and gravel extraction
Alien species introductions	Maritime trade (ballast waters, fouling), leisure navigation, mariculture, climate change
Leisure and tourism	Coastal development, water quality in summer (high population), mechanical beach cleaning, noise and other perturbations due to the high population

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Q23. Consider the following:

1. Black-necked crane
2. Cheetah
3. Flying squirrel
4. Snow leopard

Which of the above are naturally found in India?

a) 1, 2 and 3 only

b) 1, 3 and 4 only

c) 2 and 4 only

d) 1, 2, 3 and 4

Black-necked crane

IUCN Vu

Schedule I. WPA 1972

Cheetah

Oldest big cat

Miocene era

Flying squirrel

Snow leopard

23. Solution (b)

Black-necked Crane

- Black-necked cranes also known as 'Trung-Trung Karmo' migrate every winter from Tibet and China's Xinjiang province to Arunachal Pradesh in India.
- Sangti Valley in West Kameng district and Zemithang of Arunachal Pradesh are the only wintering sites of the bird in India.
- The crane also breeds in Ladakh and Bhutan.

- The bird is revered by the 1 lakh-strong community of Monpas (major Buddhist ethnic group of Arunachal Pradesh) as an embodiment of the sixth Dalai Lama (Tsangyang Gyatso).
- It is protected under Schedule I of Wildlife Protection Act, 1972 - the highest legal protection given to birds and wildlife.
- It has been classified as 'vulnerable' by the International Union for Conservation of Nature (IUCN) in its Red List of Threatened Species.

THE NAMDAPHA FLYING SQUIRREL

- The Namdapha flying squirrel (Biswamoyopterus biswasi) is an arboreal, nocturnal flying squirrel endemic to Arunachal Pradesh in northeast India, where it is known from a single specimen collected in Namdapha National Park in 1981.
- No population estimate is available for B. biswasi, but the known habitat is tall Mesua ferrea jungles, often on hill slopes in the catchment area of Na Dihing river (particularly on the western slope of Patkai range) in northeastern India.

- The Namdapha flying squirrel is listed as critically endangered by the IUCN.
- It is known from a single specimen collected in 1981 in Namdapha National Park.
- Its range of the Namdapha flying squirrel may be restricted to a single valley and it is threatened by poaching of animals for food from within the park, and possibly by habitat destruction.

SNOW LEOPARD

- The snow leopard inhabits the higher Himalayan and trans-Himalayan landscape in the five states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, and Arunachal Pradesh.
- This area contributes to about 5% of the global snow leopard range.
- Snow leopards are categorized as ‘Vulnerable’ by IUCN and in the Schedule I of the Indian Wildlife (Protection) Act 1972.

- They are listed in Appendix I of the Convention on International Trade in Endangered Species (CITES) and the Convention on Migratory Species (CMS), revealing the need for the highest conservation status to the species, both globally and in India.

CHEETAH

- Cheetah Acinonyx jubatus, is one of the oldest of the big cat species, with ancestors that can be traced back more than five million years to the Miocene era.
- The cheetah is also the world's fastest land mammal.
- According to the United Nations, Cheetahs are listed as "Vulnerable" by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, but a recent study revealed the decline in its significant population.

- Cheetahs are an endangered species, according to the Convention on International Trade in Endangered Species (Cites).
- Only 7,100 cheetahs are left in the wild, almost all of them in Africa.
- The Asiatic cheetah, which once roamed parts of India, is now only found in Iran, where there are thought to be about 50 left.

- Hence, scientists are demanding for cheetahs to be uplisted to the “Endangered” category.
- In North Africa and Asia, they are considered to be “Critically Endangered.”

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Ajit Tiwari Sir (Founder & CEO Geno IAS)

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Q24. With reference to the wetlands of India, consider the following statements:

3 million hectares — 10 Million

Revised list

Current (2012)

1. The country's total geographical area under the category of wetlands is recorded more in Gujarat as compared to other States.

6750 km^2

2. In India, the total geographical area of coastal wetlands is larger than that of wetlands.

Which of the statements given above is/are correct?

a) 1 only

b) 2 only

c) Both 1 and 2

d) Neither 1 nor 2

24. Solution (c)

Expected questions

- Gujarat has the highest percentage of total wetlands in the country with paddy fields also being considered as wetlands.

What are Wetlands:

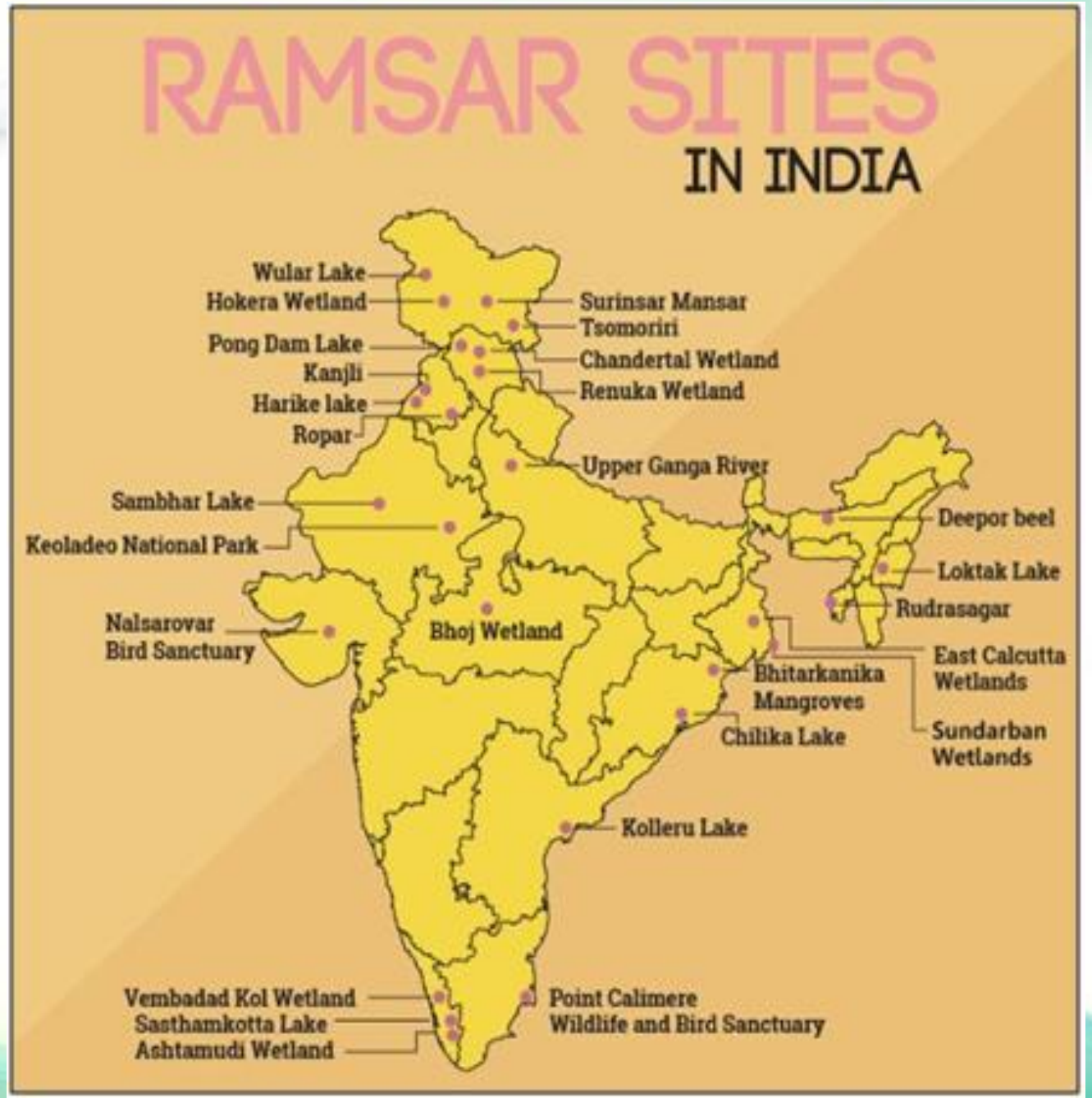
- Defined as – “Areas of marshes, fen, peat-land or water whether natural or artificial, permanent or temporary with water, that is static or flowing, fresh, brackish or salt including areas of marine water, the depth of which does not exceed six metres”.
- Gujarat occupies around 3 million hectares of wetlands out of India's total 10 million hectares of wetland area

- India has total 27,403 wetlands, of which 23,444 are inland wetlands and 3,959 are coastal wetlands but the coastal wetlands occupy an estimated 6,750 sq km, which is more than the inland wetlands
- Wetlands provide a wide range of important resources and ecosystem services such as food, water, fiber, groundwater recharge, water purification, flood moderation, erosion control and climate regulation.
- They are, in fact, a major source of water and our main supply of freshwater comes from an array of wetlands which help soak rainfall and recharge groundwater.

Five major wetland types are generally recognized:

- **Marine -** Coastal wetlands including coastal lagoons, rocky shores, and coral reefs.
- **Estuarine -** Including deltas, tidal marshes, and mangrove swamps.
- **Lacustrine -** Wetlands associated with lakes.
- **Riverine -** Wetlands along rivers and streams.

- Palustrine - Meaning “marshy” - marshes, swamps and bogs.
- Human-made wetlands - such as fish and shrimp ponds, farm ponds, irrigated agricultural land, saltpans, reservoirs, gravel pits, sewage farms and canals.


RAMSAR SITES
IN INDIA
Wular Lake
Hokera Wetland
Pong Dam Lake
Kanjli
Harike lake
Ropar
Surinsar Mansar
Tsomoriri
Chandertal Wetland
Renuka Wetland
Upper Ganga River
Sambhar Lake
Keoladeo National Park
Nalsarovar
Bird Sanctuary
Bhoj Wetland
Deepor beel
Loktak Lake
Rudrasagar
East Calcutta
Wetlands
Bhitarkanika
Mangroves
Chilika Lake
Sundarban
Wetlands
Kolleru Lake
Vembadad Kol Wetland
Sasthamkotta Lake
Ashtamudi Wetland
Point Calimere
Wildlife and Bird Sanctuary

State-wise List of Ramsar Sites of India

S.No.	Ramsar Site	State	Designated Year	Area (km^2)
1	**Kolleru Lake**	**Andhra Pradesh**	2002	**901**
2	**Deepor Beel**	**Assam**	2002	40
3	Kanwar (Kabar) Taal	Bihar	2020	26.2
4	**Nagi Bird Sanctuary**	Bihar	2023	2
5	**Nakti Bird Sanctuary**	Bihar	2023	3.3
6	Nanda Lake	Goa	2022	0.42
7	Khijadia WLS	Gujarat	2021	6
8	**Nalsarovar BS**	**Gujarat**	2012	123
9	Thol Lake	Gujarat	2021	6.99
10	Wadhvana Wetland	Gujarat	2021	10.38

11	Bhindawas WLS	Haryana	2021	4.11
12	**Sultanpur NP**	**Haryana**	2021	142.5
13	**Chandra Taal**	**Himachal Pradesh**	2005	0.49
14	**Pong Dam Lake**	**Himachal Pradesh**	2002	156.62
15	Renuka Lake	Himachal Pradesh	2005	0.2
16	**Ranganathituu BS**	**Karnataka**	2022	5.18
17	Magadi Kere Conservation Reserve	**Karnataka**	**2024**	0.5
18	Ankasamudra Bird Conservation Reserve	**Karnataka**	**2024**	0.98
19	Aghanashini Estuary	**Karnataka**	**2024**	4.8
20	**Ashtamudi Wetland**	**Kerala**	2002	614

21	**Sasthamkotta Lake**	**Kerala**	2002	3.73
22	**Vembanad-Kol Wetland (Longest Lake in India)**	**Kerala**	1905	**1,512.5**
23	Bhoj Wetland	Madhya Pradesh	2002	32
24	Sakhya Sagar	Madhya Pradesh	2022	2.48
25	Sirpur wetland	Madhya Pradesh	2022	1.61
26	Yashwant Sagar	Madhya Pradesh	2022	8.22
27	**Tawa Reservoir**	Madhya Pradesh	2024	200
28	**Lonar Lake (Impact Crater Lake)**	**Maharashtra**	2020	4.27
29	**Nandur Madhameshwar**	**Maharashtra**	2019	14
30	**Thane Creek**	**Maharashtra**	2022	65.21
31	**Loktak Lake**	**Manipur**	1990	266
32	Pala Wetland	Mizoram	2021	18.5

33	Ansupa Lake	Odisha	2021	2.31
34	**Bhitarkanika Mangroves**	**Odisha**	2002	**650**
35	**Chilika Lake (Oldest Ramsar Site in India)**	**Odisha**	**1981**	**1,165**
36	**Hirakud Reservoir**	**Odisha**	2021	654
37	**Satkosia Gorge**	**Odisha**	2021	981.97
38	Tampara Lake	Odisha	2021	3
39	**Beas CnR**	**Punjab**	2019	64
40	**Harike Wetland**	**Punjab**	1990	41
41	Kanjli Wetland	Punjab	2002	1.83
42	Keshopur-Miani CmR	Punjab	2019	34
43	**Nangal WLS**	**Punjab**	2019	1
44	Ropar Wetland	Punjab	2002	13.65

45	**Keoladeo National Park**	**Rajasthan**	**1981**	28.73
46	**Sambhar Lake**	**Rajasthan**	1990	240
47	Chitrangudi BS	Tamil Nadu	2021	2.6
48	**Gulf of Mannar Marine BR**	**Tamil Nadu**	2022	526.72
49	Kanjirankulam BS	Tamil Nadu	2022	0.96
50	Karikili BS	Tamil Nadu	2022	0.584
51	Koonthankulam BS	Tamil Nadu	2021	0.72
52	Pallikaranai Marsh Reserve Forest	Tamil Nadu	2022 ✓	12.475
53	**Pichavaram Mangrove**	**Tamil Nadu**	2022 ✓	14.786
54	Point Calimere WLS & BS	Tamil Nadu	2002	389
55	Suchindram Theroor Wetland Complex	Tamil Nadu	2022	0.94
56	Udhayamarthandapuram BS	Tamil Nadu	2022	0.44
57	Vaduvur BS	Tamil Nadu	2022	1.12

58	Vedanthangal BS	Tamil Nadu	2022	0.4
59	Vellode BS	Tamil Nadu	2022	0.77
60	Vembannur Wetland Complex	Tamil Nadu	2022	0.2
61	Karaivetti Bird Sanctuary	Tamil Nadu	**2024**	4.5
62	Longwood Shola Reserve Forest	Tamil Nadu	**2024**	1.16
63	**Nanjarayan Bird Sanctuary**	Tamil Nadu	2024	1.3
64	**Kazhuveli Bird Sanctuary**	Tamil Nadu	2024	**1,513**
65	Rudrasagar Lake	Tripura	2005	2.4
66	**Hokera Wetland**	**UT of JK**	2005	13.75
67	Hygam Wetland CnR	UT of JK	2022	8.02
68	Shallbugh Wetland CnR	UT of JK	2022	16.75
69	Surinsar-Mansar Lakes	UT of JK	2005	3.5
70	**Wular Lake**	**UT of JK**	1990	189

71	**Tso Kar (High Altitude Ramsar Site)**	**UT of Ladakh**	2020	95.77
72	**Tsomoriri (High Altitude Ramsar Site)**	**UT of Ladakh**	2002	120
73	Bakhira WLS	Uttar Pradesh	2021	28.94
74	Haiderpur Wetland	Uttar Pradesh	2021	69
75	Nawabganj BS	Uttar Pradesh	2019	2
76	Parvati Arga BS	Uttar Pradesh	2019	7
77	Saman BS	Uttar Pradesh	2019	5
78	Samaspur BS	Uttar Pradesh	2019	8
79	Sandi BS	Uttar Pradesh	2019	3
80	Sarsai Nawar Jheel	Uttar Pradesh	2019	2
81	Sur Sarovar (Keetham Lake)	Uttar Pradesh	2020	4.31
82	Upper Ganga River (Brijghat to Narora)	Uttar Pradesh	2005	265.9
83	Asan Barrage	Uttarakhand	2020	4.44
84	East Kolkata Wetlands	West Bengal	2002	125

77	Saman BS	Uttar Pradesh	2019	5
78	Samaspur BS	Uttar Pradesh	2019	8
79	Sandi BS	Uttar Pradesh	2019	3
80	Sarsai Nawar Jheel	Uttar Pradesh	2019	2
81	Sur Sarovar (Keetham Lake)	Uttar Pradesh	2020	4.31
82	Upper Ganga River (Brijghat to Narora)	Uttar Pradesh	2005	265.9
83	Asan Barrage	Uttarakhand	2020	4.44
84	East Kolkata Wetlands	West Bengal	2002	125
89	**Sundarban Wetland (Largest Ramsar Site in India)**	**West Bengal**	**2019**	**4,230**

State-wise Number of Ramsar Sites

Rank	State	No. of Ramsar Sites
1	Tamil Nadu	18
2	Uttar Pradesh	10
3	Odisha	6
4	Punjab	6
5	UT of JK	5
6	Madhya Pradesh	5
7	Gujarat	4
8	Karnataka	4
9	Bihar	3
10	Kerala	3
11	Himachal Pradesh	3

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Arrange the following states in dec. no of Ramsar sites?

12	Maharashtra	3
13	West Bengal	2
14	Rajasthan	2
15	UT of Ladakh	2
16	Haryana	2
17	Andhra Pradesh	1
18	Manipur	1
19	Assam	1
20	Mizoram	1
21	Uttarakhand	1
22	Tripura	1
23	Goa	1
89 Ramsar Sites in total		

State-wise Area of Ramsar Sites

Rank	State	Area Under Ramsar Sites (km^2)
1	West Bengal	4,355
2	Odisha	3,456
3	Tamil Nadu	2,469
4	Kerala	2,130
5	Andhra Pradesh	901
6	Uttar Pradesh	395
7	Rajasthan	269
8	Manipur	266
9	Madhya Pradesh	244
10	UT of JK	231
11	UT of Ladakh	216

Kidney of Nature
1971, 2nd Feb
Ramsar Convention
Iran

Top 5 Ramsar Sites in India

S. No.	Ramsar site	State	Designation year	Area (in sq. km.)
1.	Sunderbans Wetland	West Bengal	2019	4230
2.	Vembanad Kol Wetland	Kerala	2002	1512.5
3.	Chilka Lake	Odisha	1981	1165
4.	Kolleru Lake	Andhra Pradesh	2002	901
5.	Bhitarkanika Mangroves	Odisha	2002	650

Q25. The acidification of oceans is increasing. Why is this phenomenon a cause of concern?

1. The growth and survival of calcareous phytoplankton will be adversely affected.
2. The growth and survival of coral reefs will be adversely affected.
3. The survival of some animals that have phytoplanktonic larvae will be adversely affected.
4. The cloud seeding and formation of clouds will be adversely affected.

Which of the statements given above is /are correct?

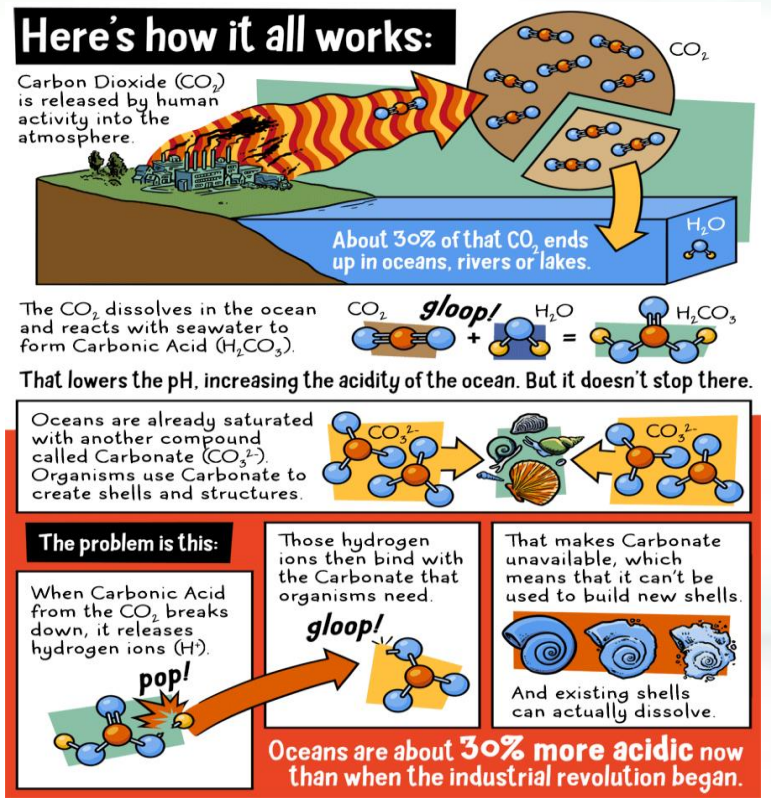
a) 1, 2 and 3 only
b) 2 only
c) 1 and 3 only
d) 1, 2, 3 and 4

25. Solution (a)

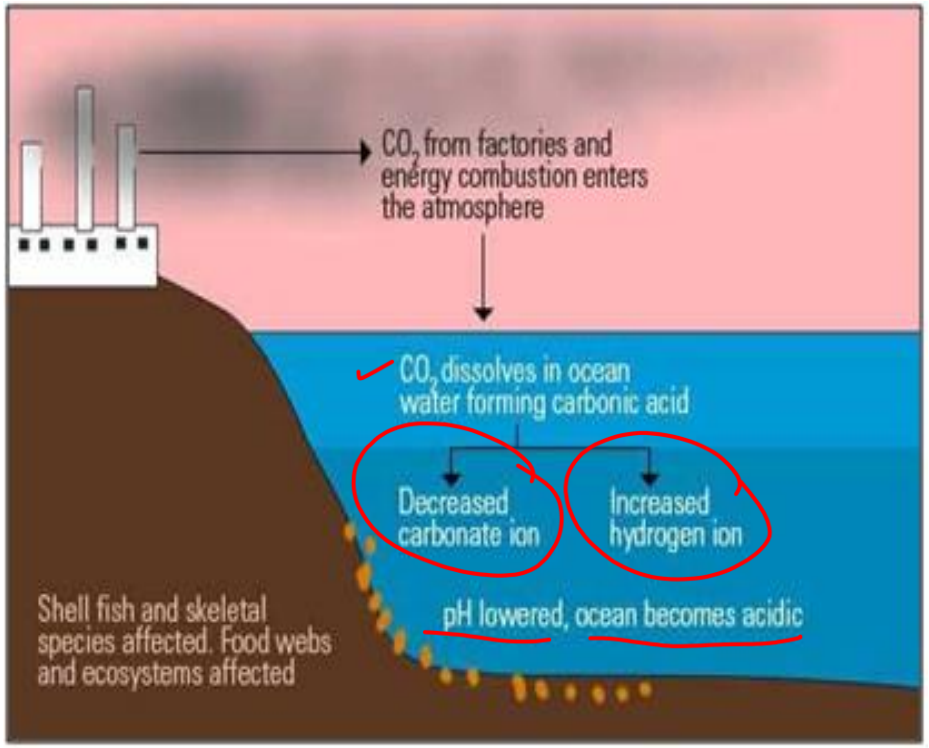
- Ocean Acidification can be defined as the ongoing, consistent decrease in the pH of the Ocean water.
- When carbon dioxide dissolves in the Ocean water, it creates Carbonic (H_2CO_3) and increases the Hydrogen Ion (H+) concentration in the Ocean.
- The absorption of the Carbon dioxide by Ocean helps in mitigating the climatic effects of Carbon dioxide emissions, but at the same time it also has negatively impacted the pH value of Ocean water such as Calcifying animals.

CAUSES FOR OCEAN ACIDIFICATION

- In the past, ocean acidification occurred naturally but over much longer periods of time.
- However the Industrial Revolution of the 1800s triggered an escalation of carbon dioxide levels in the atmosphere, which has continued to climb ever since.
- The gas is being produced faster than nature can remove it, meaning increasing amounts are being absorbed by the ocean.



- Ocean acidification is now thought to occur faster than it has been in the last 20 million years.
- Main culprit is the burning of fossil fuels such as coal, oil and gas.
- Deforestation results in fewer trees to absorb the gas.
- Also, when plants are cut down and burnt or left to rot, the carbon that makes up their organic tissue is released as carbon dioxide.
- Some parts of the ocean are naturally acidic, such as at underwater hydrothermal vents and cold seeps.
- These openings occur on the seafloor and are caused by underground volcanic activity.



- Other industrial processes also contribute to atmospheric carbon dioxide levels. Eg. Cement production accounted for around 8% of the gas released globally in 2015.
- In coastal areas, logging can also displace acidic soil into waterways, gradually contributing to the lowering pH in the ocean.

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Q26. The Millennium Ecosystem Assessment describes the following major categories of ecosystem services- provisioning, supporting, regulating, preserving and cultural. Which one of the following is supporting service?

a) Production of food and water

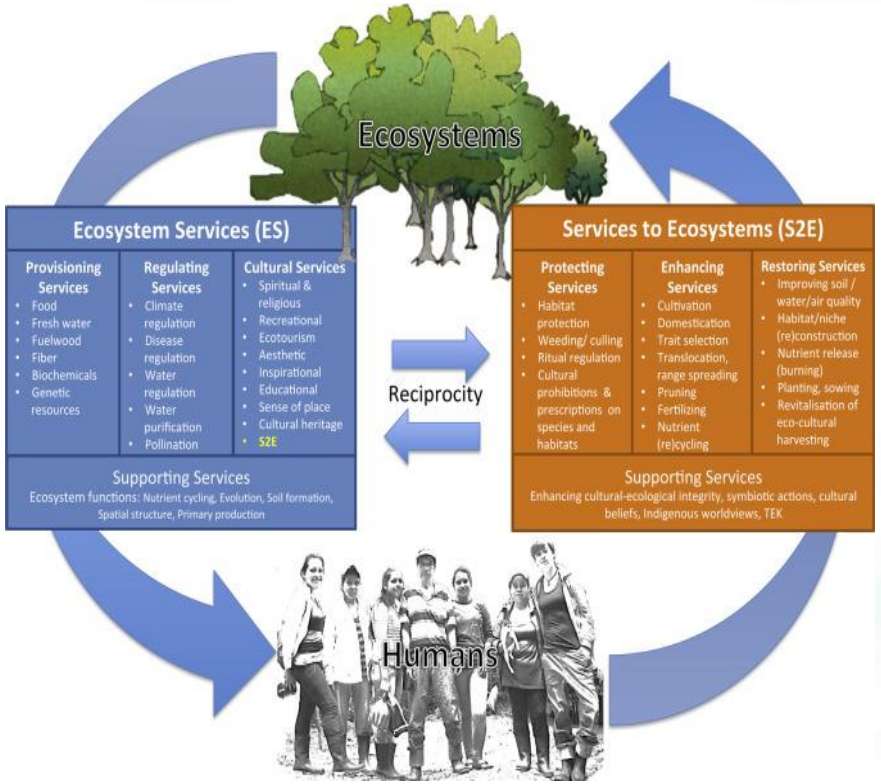
b) Control of climate and disease

c) Nutrient cycling and crop pollination

d) Maintenance of diversity

26. Solution (c)

- Supporting services of an ecosystem are those which are not directly and exclusively produced by that ecosystem for that matter.
- Among given options, nutrient cycling and crop pollination services are not directly and exclusively rendered by an ecosystem and thus, could be classified as-Supporting Services.



MILLENNIUM ECOSYSTEM ASSESSMENT

- The Millennium Ecosystem Assessment (MA) was called for by the United Nations Secretary-General Kofi Annan in 2000.
- Initiated in 2001, the objective of the MA was to assess the consequences of ecosystem change for human well-being and the scientific basis for action needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being.

SUPPORTING SERVICES:

(Ecosystem functions)

nutrient cycling, evolution, soil formation, spatial structure, primary production

PROVISIONING SERVICES:

food, fresh water, fuel, wood, fiber, biochemicals, genetic resources

REGULATING SERVICES:

climate, flood, disease & water regulation, water purification, pollination

CULTURAL SERVICES:

spiritual, religious, recreation, ecotourism, aesthetic, inspirational, educational, sense of place, cultural heritige

- Their findings, contained in five technical volumes and six synthesis reports, provide a state-of-the-art scientific appraisal of the condition and trends in the world's ecosystems and the services they provide (such as clean water, food, forest products, flood control, and natural resources) and the options to restore, conserve or enhance the sustainable use of ecosystems.
- Out of the various services supporting services are those that are necessary for the production of all other ecosystem services.

- They differ from provisioning, regulating, and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people.
- Some services, like erosion regulation, can be categorized as both a supporting and a regulating service, depending on the time scale and immediacy of their impact on people. While maintenance of diversity is regarded as supporting services.

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Q27. What would happen if phytoplankton of an ocean is completely destroyed for some reason?

1. The ocean as a carbon sink would be adversely affected.
2. The food chains in the ocean would be adversely affected.
3. The density of ocean water would drastically decrease.

Select the correct answer using the codes given below :

a) 1 and 2 only

b) 2 only

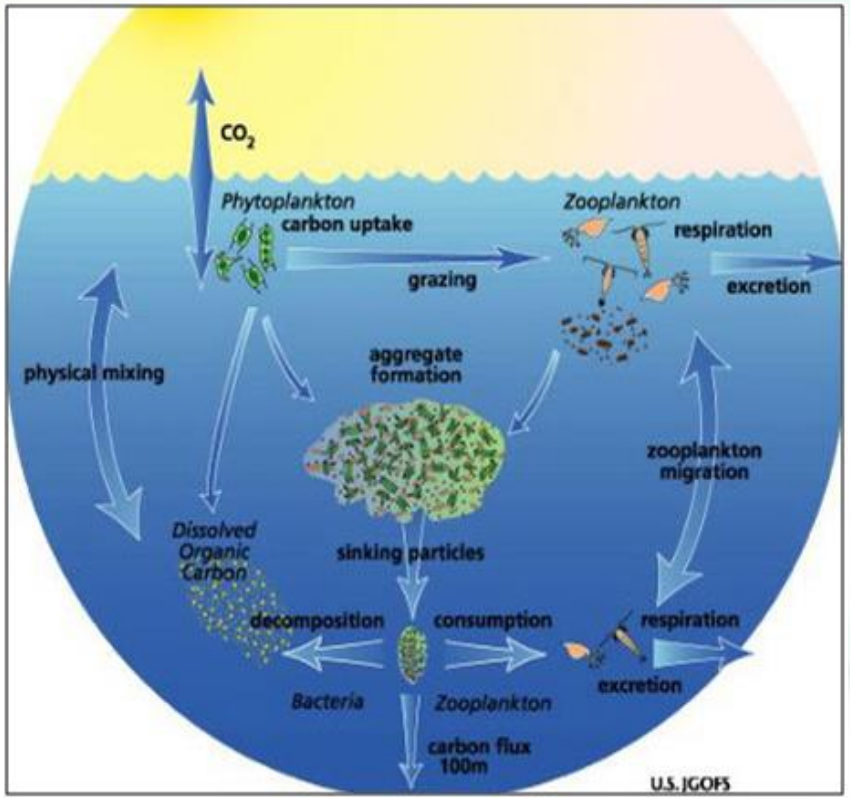
c) 3 only

d) 1, 2 and 3

27 (a) Phytoplanktons:

- They are the producers present in the aquatic ecosystem. Phytoplankton is the plant-like organisms of the water that carry out photosynthesis and float in the upper areas of the world's ocean.
- Phytoplankton, also known as microalgae, are similar to terrestrial plants in that they contain chlorophyll to capture sunlight, and they use photosynthesis to turn it into chemical energy in order to live and grow.
- Phytoplankton is responsible for most of the transfer of carbon in the carbon dioxide from the atmosphere to the ocean.

- Worldwide, this biological carbon pump transfers about 10 gigatonnes of carbon from the atmosphere to the deep ocean each year.
- Even small changes in the growth of phytoplankton may affect atmospheric carbon dioxide concentrations, which would feed back to global surface temperatures.



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UPSC CSE PRELIMS 2013

Q28. Which of the following can be found as pollutants in the drinking water in some parts of India?

1. Arsenic
2. Sorbitol
3. Fluoride
4. Formaldehyde
5. Uranium

Select the correct answer using the codes given below.

a) 1 and 3 only

b) 2, 4 and 5 only

c) 1, 3 and 5 only

d) 1, 2, 3, 4 and 5

Arsenic

Fluoride vs Fluorine

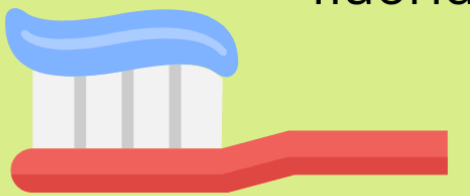
Fluoride is either the fluorine ion or a compound containing fluorine.

F^-

fluoride ion

NaF

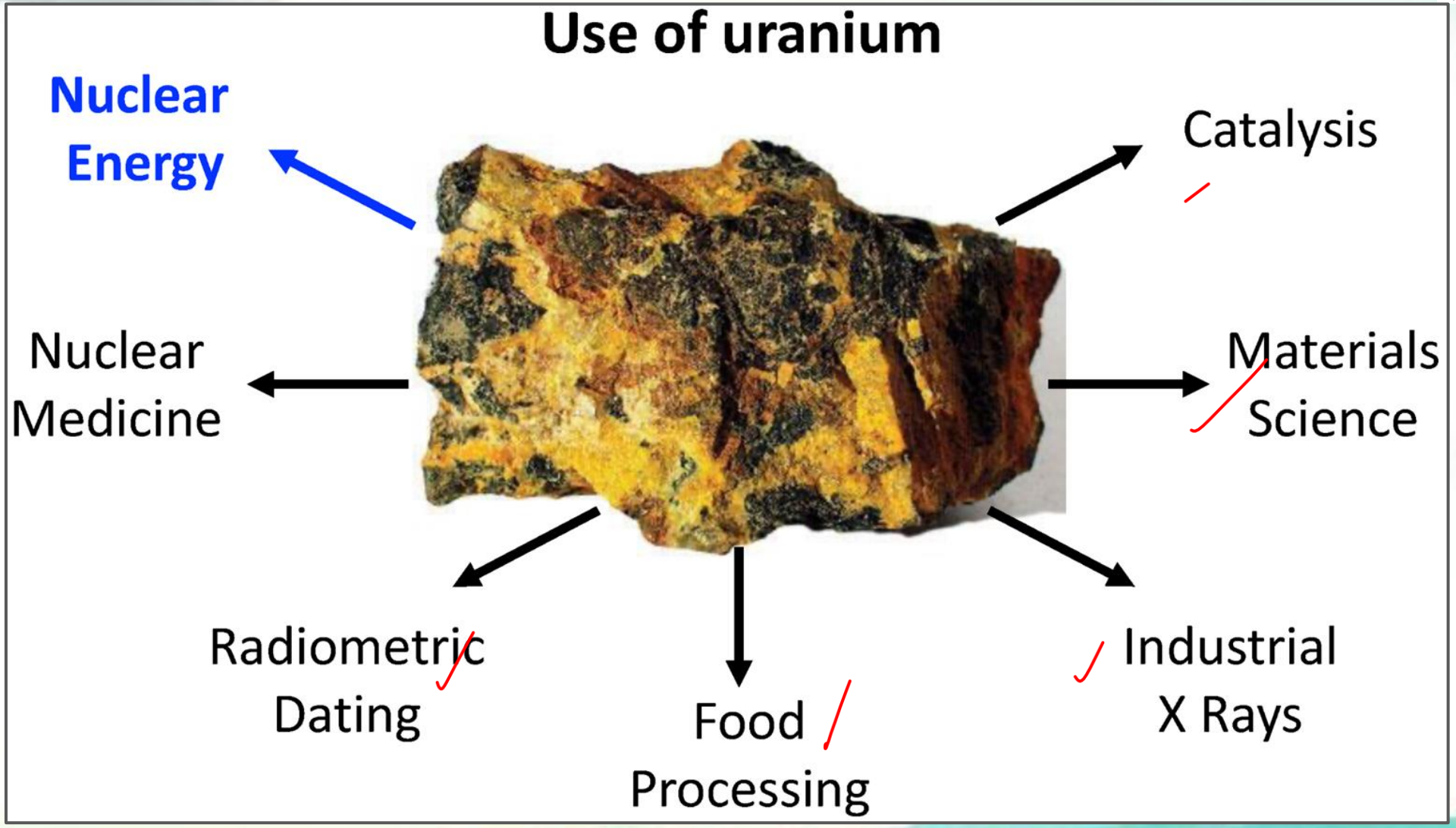
sodium fluoride



Fluorine is an element on the periodic table.

sciencenotes.org

Use of uranium



28. Solution (c)

- Formaldehyde is a colorless, strong-smelling, flammable chemical that is produced industrially and used in building materials such as particleboard, plywood, and other pressed-wood products
- Formaldehyde is more known than sorbitol.
- No authentic source that called formaldehyde a water pollutant.
- It is used as a preservative to preserve human organs.
- It finds some application in textile, resigns and wood industry.
- Sorbitol (glucitol) is a sugar alcohol with a sweet taste which the human body metabolises slowly.

- Formaldehyde is used in many industries.
- It's used in glues and resins, dyes, textiles, disinfectants, building materials, automobile parts, embalming, and laboratories.

KNOWLEDGE BASE

- Sorbitol, less commonly known as glucitol, is a sugar alcohol with a sweet taste which the human body metabolizes slowly. It can be obtained by reduction of glucose, which changes the converted aldehyde group to a primary alcohol group
- The quality of drinking-water is a powerful environmental determinant of health.
- Water pollution has reached an alarming level in India and has contributed to water scarcity by polluting freshwater resources, thereby limiting options.
- Despite Namami Gange, water quality of Ganga continues to worsen.

NATURAL SOLUTIONS TO WATER SECURITY – FROM SOURCE TO CITY

In many cities worldwide, drinking water supplies are greatly affected by how land is managed. Improving the health of the lands around water sources improves water quality, restores reliable water flows and brings numerous other benefits, both upstream and downstream.

DEFORESTATION

Clearing forests increases the erosion of soil. The sediment pollutes nearby waterways and makes filtration more difficult and expensive.

AGRICULTURAL RUNOFF

Rain washes fertilizers into nearby water sources, polluting the city's drinking water supply.

SOIL EROSION

Livestock entering waterways trample the riverbank, contributing to sedimentation. Fecal waste in the water increases risk of disease.

POLLUTION

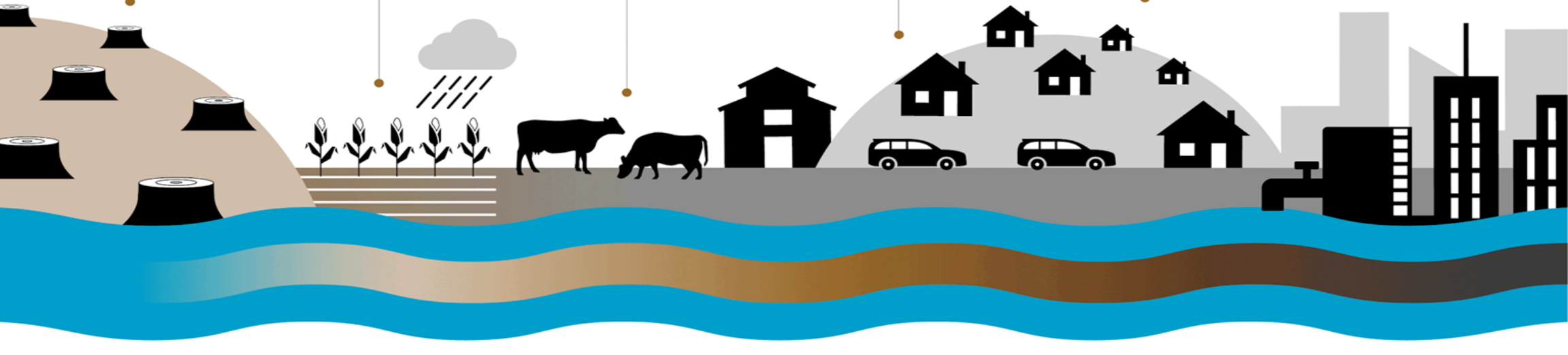
Some agricultural runoff drains through pipes directly into waterways. Oil and rubbish from roads washes into rivers.

REDUCED FLOW

Agricultural soils and industrial surfaces have less ability to absorb and slowly release rain than naturally vegetated soils do. This results in less water during dry times and more flooding when it rains.

WATER TREATMENT

Urban centers receive dirty water that often can be unsafe for human consumption. Water users pay a significant cost for industrial treatment of water when it reaches the city.



UPSTREAM — **DOWNSTREAM**

- The waters of the Yamuna, Ganga and Sabarmati flow the dirtiest with a deadly mix of pollutants both hazardous and organic.
- India’s rivers have high fluoride content and are also contaminated by antibiotics, beyond the permissible limit of 1.5 ppm, which affects 66 million people nationwide.
- The Ganga river basin that covers 26.3% of India’s Geographic area cannot be used for any purpose, including drinking, cooking or bathing.

URANIUM

- Generally, the highest potential radiation-related health risk for uranium mining or processing facility workers is lung cancer associated with inhaling uranium decay products (more specifically, radon decay products), as well as other non-lung-cancer risks associated with gamma radiation exposure on-site.

- As per the World Water Development Report, 2019, it has been revealed that coliform bacteria and biochemical oxygen demand (BOD) have increased significantly in the Ganga river Because the rivers are too polluted to drink and the government is unable to deliver freshwater, many urban dwellers are turning to groundwater, leading to its rapid depletion.

UNDERGROUND WATER POLLUTION

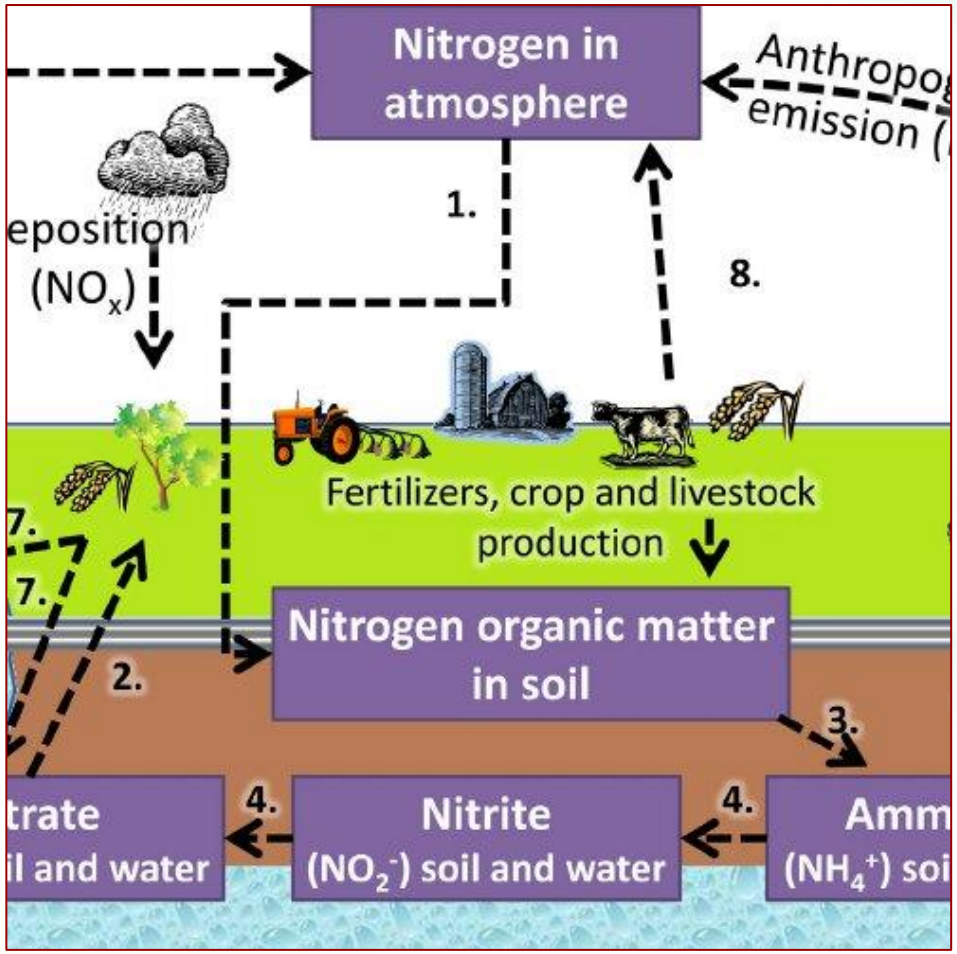
- In India at many places, the groundwater is threatened with contamination due to seepage from industrial and municipal wastes and effluents, sewage channels and agricultural runoff.
- Pollutants like fluorides, uranium, heavy metals and nutrients like nitrates and phosphates are common in many parts of India.

POLLUTANTS

1. NITRATES

- Dissolved nitrates commonly contaminate groundwater.
- Excess nitrate in drinking water reacts with haemoglobin to form non-functional methaemoglobin and impairs oxygen transport.
- This condition is called methemoglobinemia or blue baby syndrome.
- Methaemoglobin is a form of the oxygen-carrying metalloprotein haemoglobin.

- Methaemoglobin cannot bind oxygen, unlike oxyhaemoglobin.
- High levels of nitrates may form carcinogens and can accelerate eutrophication in surface waters.



2. TRACE METALS

- Include lead, mercury, cadmium, copper, chromium and nickel.
- These metals can be toxic and carcinogenic.

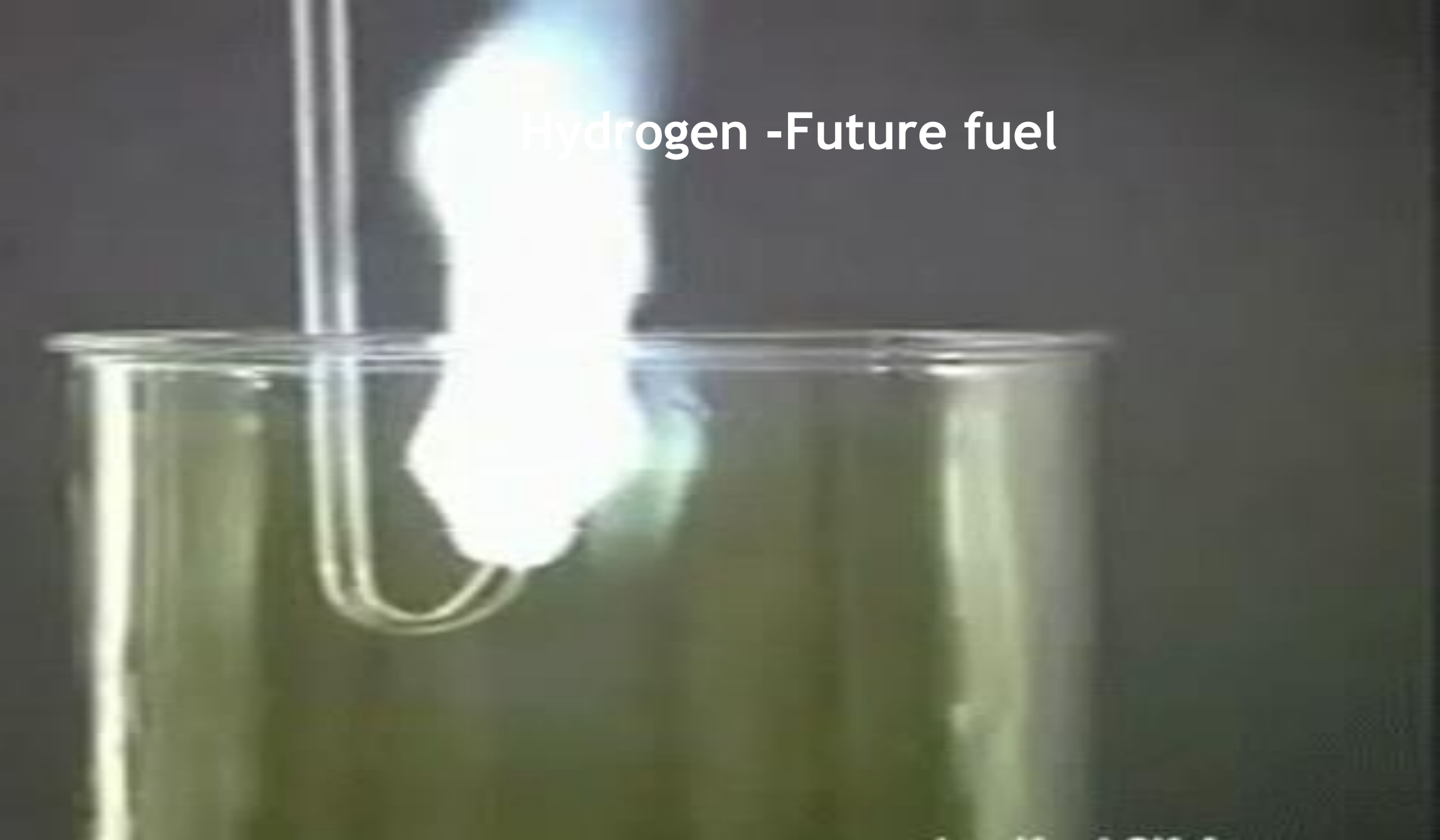
3. ARSENIC

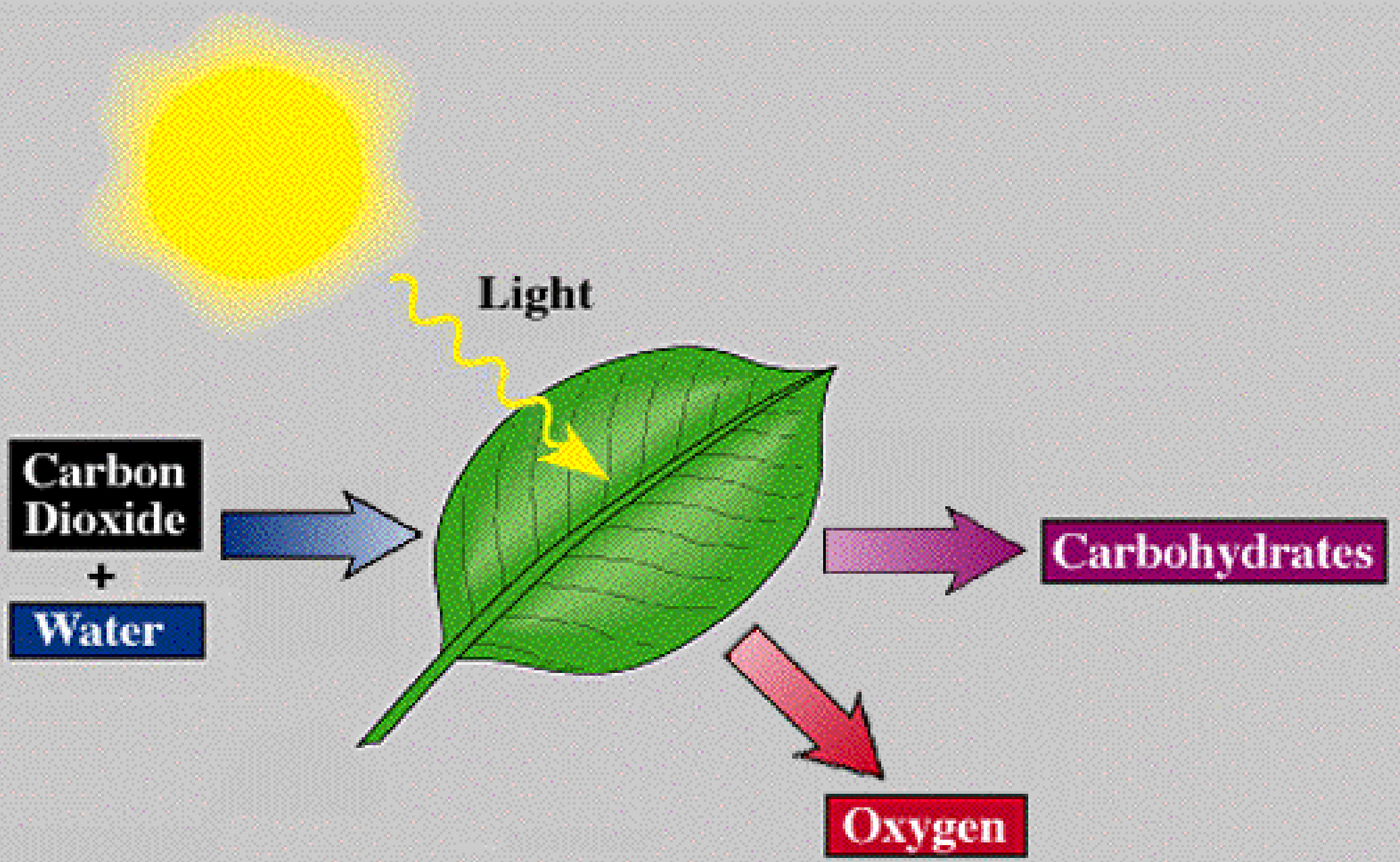
- Seepage of industrial and mine discharges, fly ash ponds of thermal power plants can lead to arsenic in groundwater.
- In India and Bangladesh (Ganges Delta), millions of people are exposed to groundwater contaminated with high levels of arsenic, a highly toxic and dangerous pollutant.
- Chronic exposure to arsenic causes black foot disease.
- It also causes diarrhoea and also lung and skin cancer.

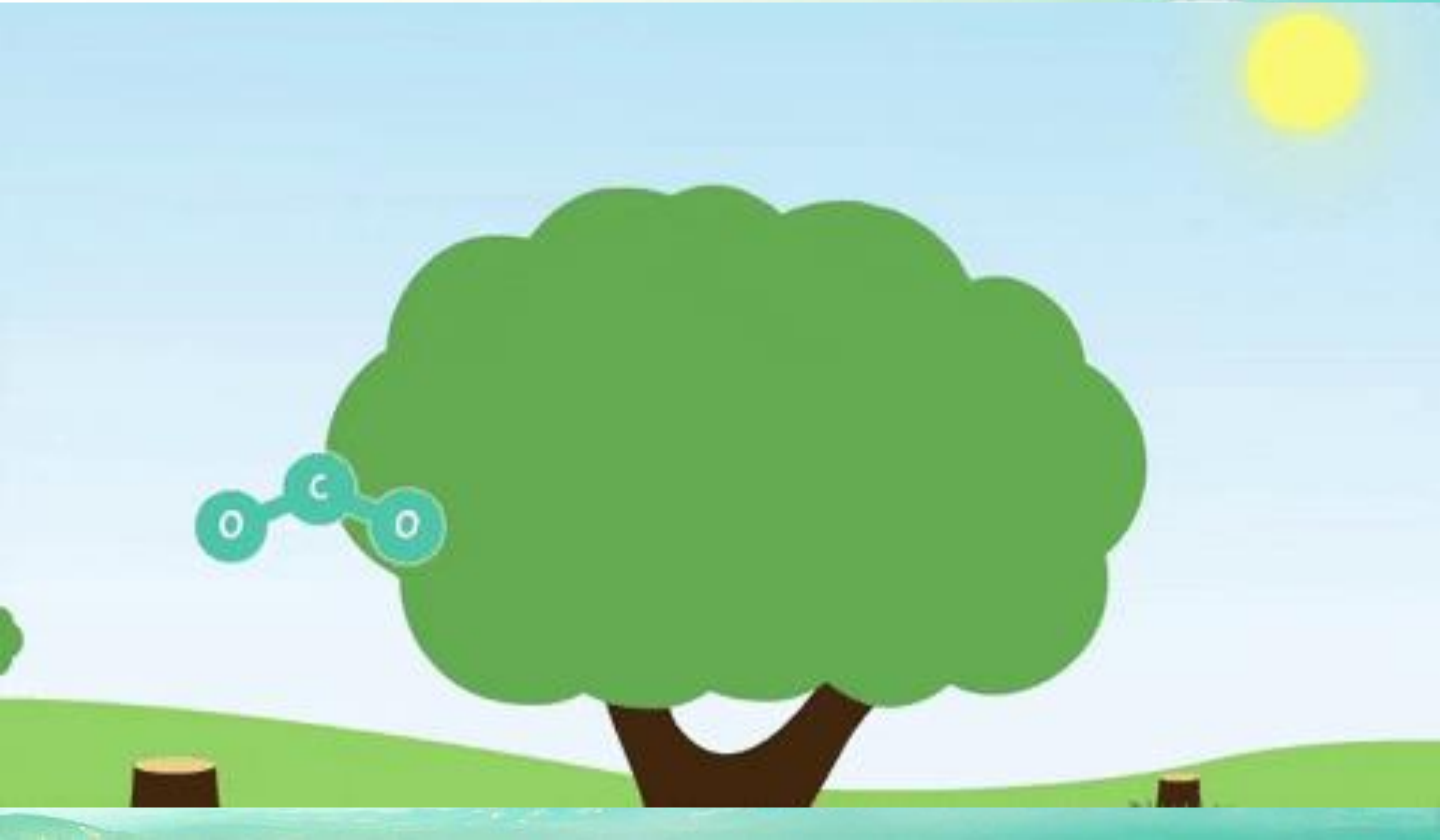
4. FLUORIDE

- Excess fluoride in drinking water causes neuromuscular disorders, gastrointestinal problems, teeth deformity, hardening of bones and stiff and painful joints (skeletal fluorosis).
- Pain in bones and joint and outward bending of legs from the knees is called Knock-Knee syndrome.
- Fluorosis is a common problem in several states of the country due to the intake of high fluoride content water.

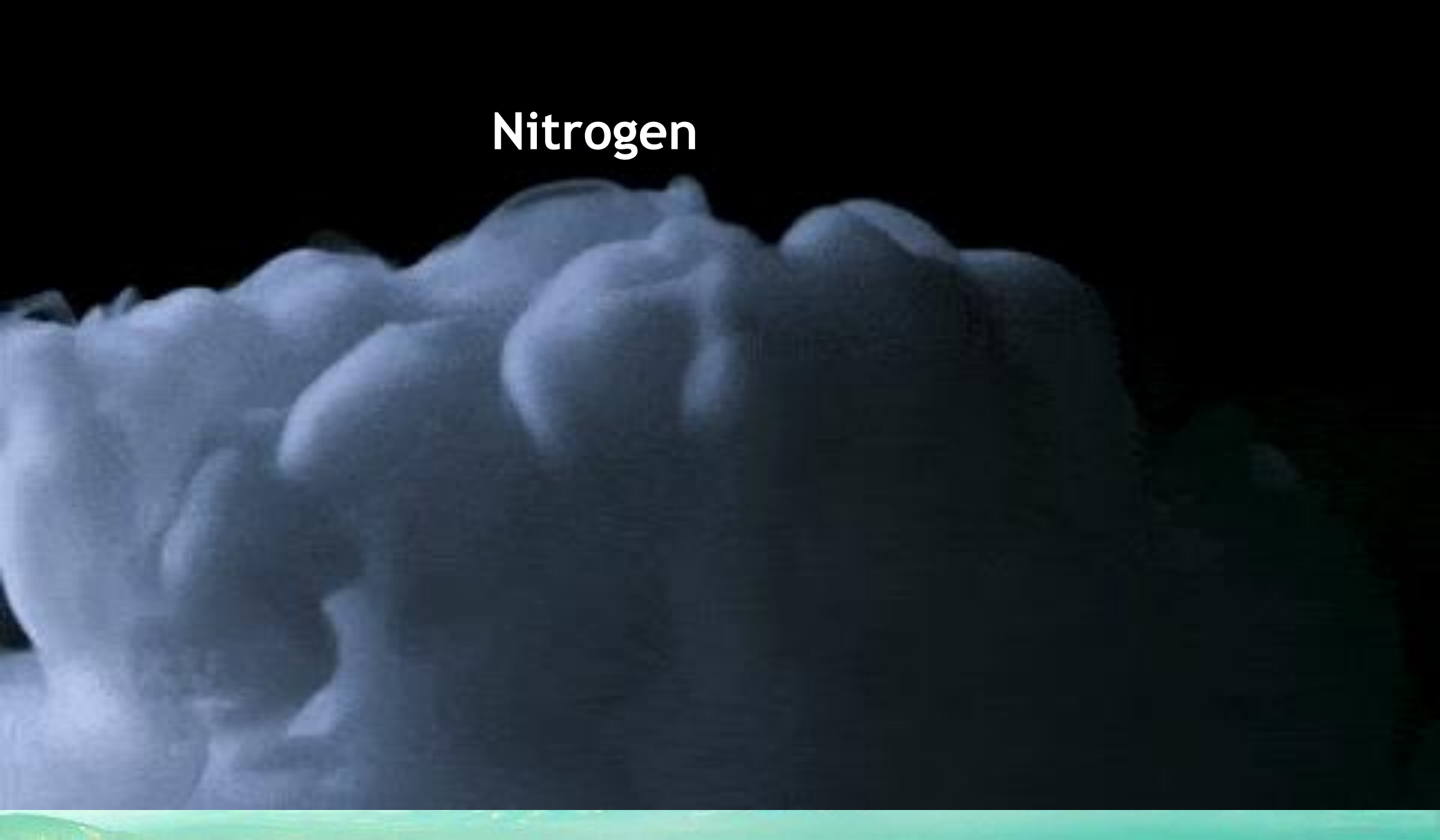
Hydrogen -Future fuel




Light
Carbon Dioxide
+
Water
Carbohydrates
Oxygen


O
C
O

Nitrogen



Q29. In the grasslands, trees do not replace the grasses as a part of an ecological succession because of :

(a) Insects and Fungi

(b) Limited sunlight and paucity of nutrients

(c) Water limits and fire

(d) None of the above

Insects and Fungi

29. Solution (c)

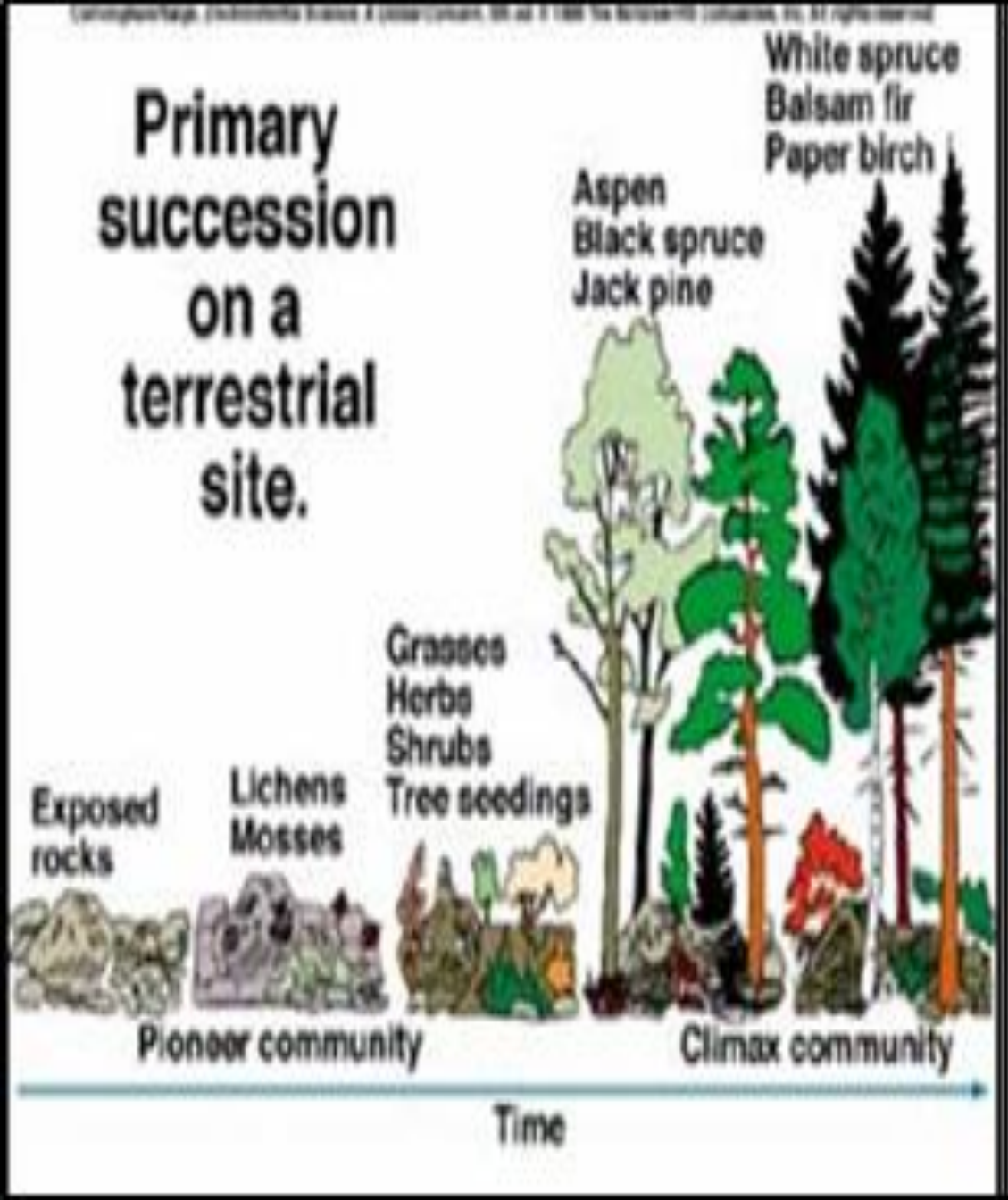
Explanation:

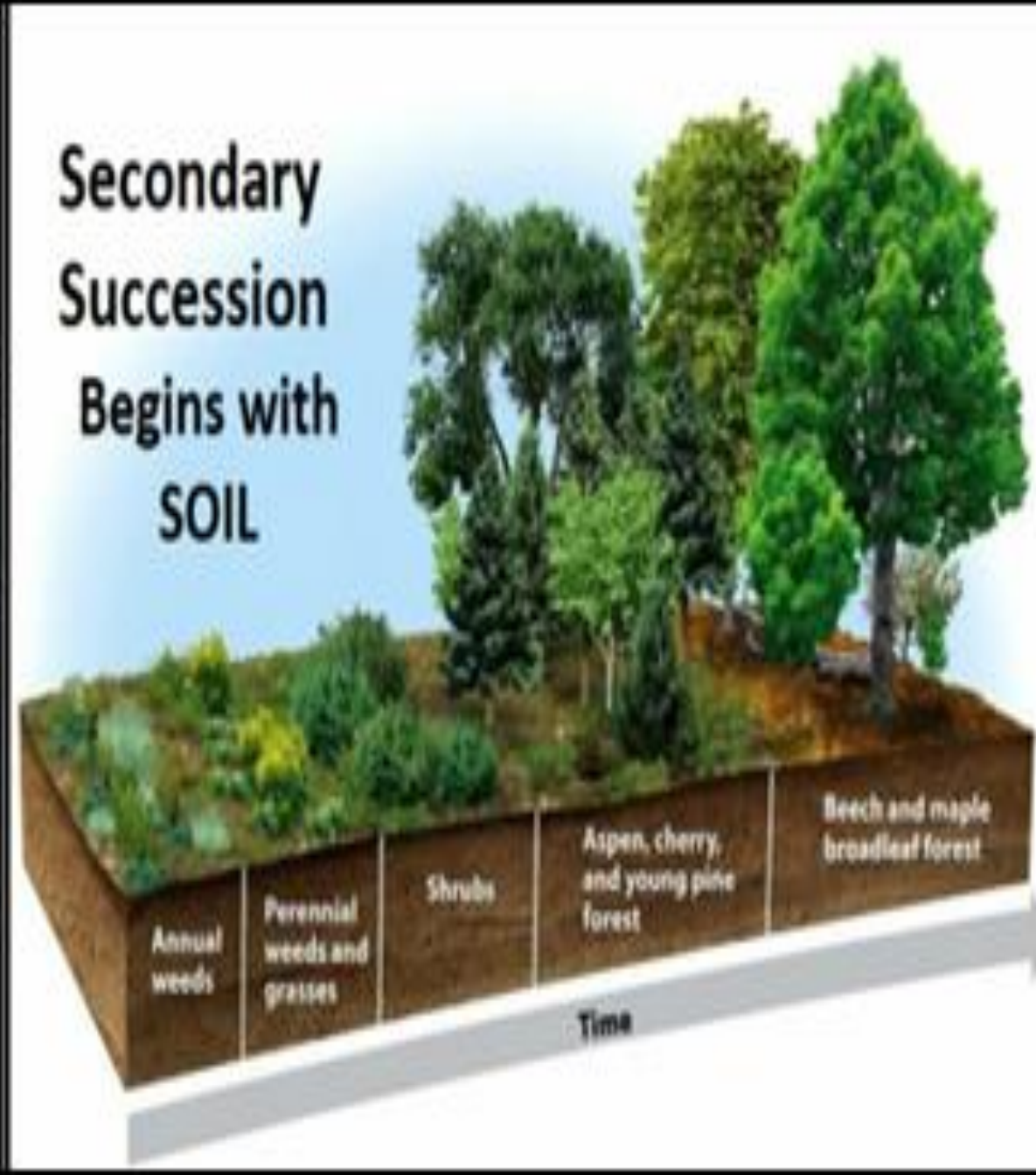
- Grasses have one good trick to monopolise a place.
- In the dry season the grasses dry up and cause fires which destroy other plant species and their seeds.
- Also, grasslands develop in regions with scanty rainfall where plant growth cannot be achieved.

- Though forests form the climax community in most of the ecosystems, in the grassland ecosystem grasses form the climax community.
- Thanks to fire and lack of water.
- Grasslands are almost irreversible once deforestation in water-scarce areas gives way to grasslands.

KNOWLEDGE BASE

- Ecological succession is a series of progressive changes in the species that make up a community over time.
- It is a predictable change and is an inevitable process of nature as all the biotic components have to keep up with the changes in our environment.
- The ultimate aim of this process is to reach equilibrium in the ecosystem.
- The community that achieves this aim is called a climax community.
- In an attempt to reach this equilibrium, some species increase in number while some other decreases.

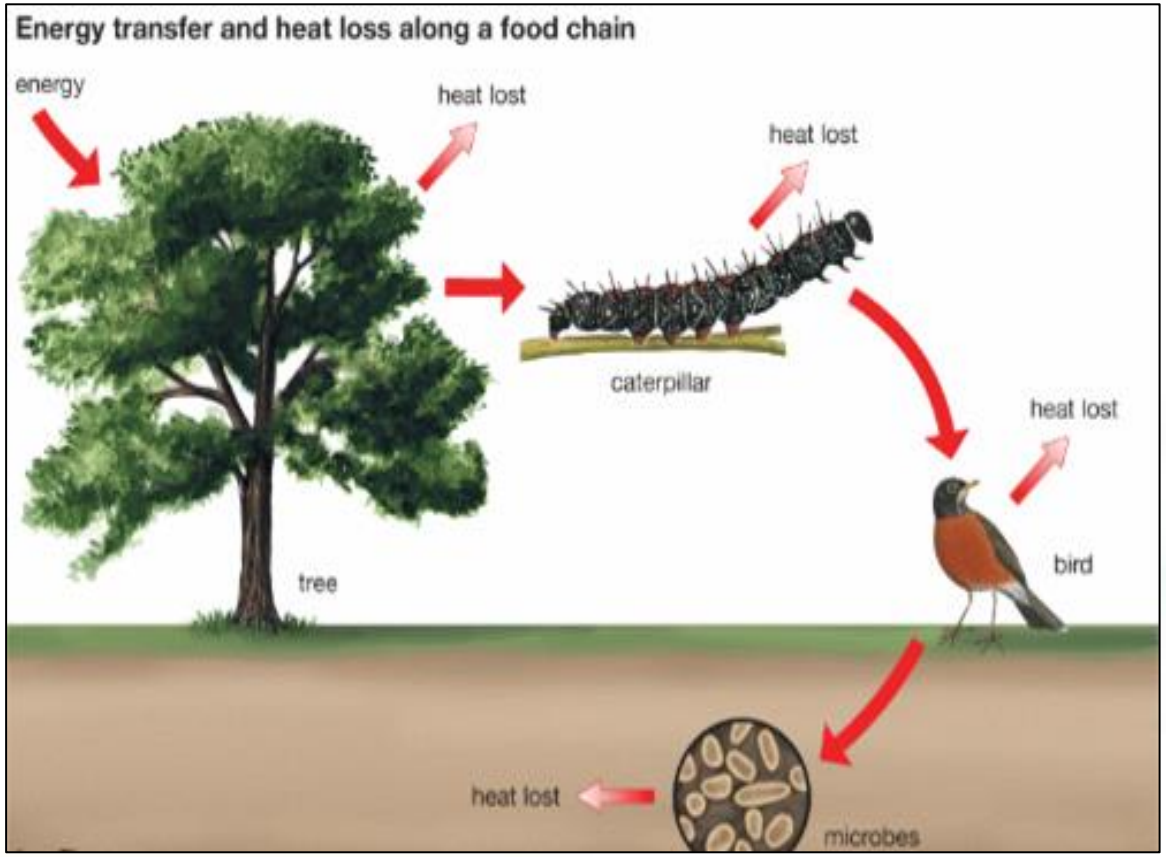

Primary succession on a terrestrial site.
White spruce
Balsam fir
Paper birch
Aspen
Black spruce
Jack pine
Grasses
Herbs
Shrubs
Tree seedings
Exposed rocks
Lichens
Mosses
Pioneer community
Climax community
Time


Secondary Succession Begins with SOIL
Annual weeds
Perennial weeds and grasses
Shrubs
Aspen, cherry, and young pine forest
Beech and maple broadleaf forest
Time

Ecologists usually identify two types of succession, which differ in their starting points:

- **Primary succession** primary succession, newly exposed or newly formed rock is colonized by living things for the first time.
- When the planet was first formed there was no soil on earth.
- The earth was only made up of rocks.
- These rocks were broken down by microorganisms and eroded to form soil.
- The soil then becomes the foundation of plant life.

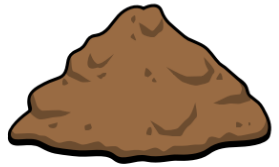
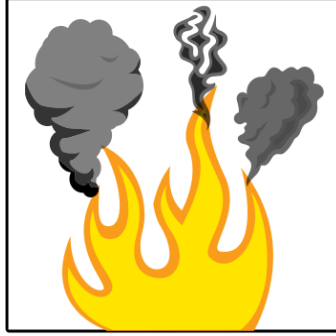
- These plants help in the survival of different animals and progress from primary succession to the climax community.
- If this primary ecosystem is destroyed, secondary succession takes place.



SECONDARY SUCCESSION

- In secondary succession, an area that was previously occupied by living things is disturbed, then re-colonized following the disturbance.
- Secondary succession occurs when the primary ecosystem gets destroyed.
- For eg., a climax community gets destroyed by fire.
- It gets recolonized after the destruction.
- This is known as secondary ecological succession.

- Small plants emerge first, followed by larger plants.
- The tall trees block the sunlight and change the structure of the organisms below the canopy.
- Finally, the climax community arrives.

What is secondary succession?	How does it Occur?	What is a pioneer species?
		
Secondary succession is succession where the environment already has soil to start with and doesn't need to create it.	Secondary succession usually occurs after a disaster like a forest fire destroys an environment and leaves it with only soil.	A pioneer species is the first species to move into an area and kicks off the process of ecological succession.
Step 1.	**Step 2.**	**Step 3.**
		
Grasses and weeds grow in the environment.	Wildflowers and shrubs begin to grow.	Small and large trees begin to grow.

CYCLIC SUCCESSION

- This is only the change in the structure of an ecosystem on a cyclic basis.
- Some plants remain dormant for the rest of the year and emerge all at once.
- This drastically changes the structure of an ecosystem.

SERAL COMMUNITY

- A seral community is an intermediate stage of ecological succession advancing towards the climax community."
- A seral community is replaced by the subsequent community. It consists of simple food webs and food chains.
- It exhibits a very low degree of diversity.
- The individuals are less in number and the nutrients are also less.

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Q30. Which one of the following is the correct sequence of ecosystems in the order of decreasing productivity?

Production = Total value
rate of photosynthesis / Vol^m / time
" Area

a) Oceans, lakes, grasslands, mangroves

b) Mangroves, oceans, grasslands, lakes

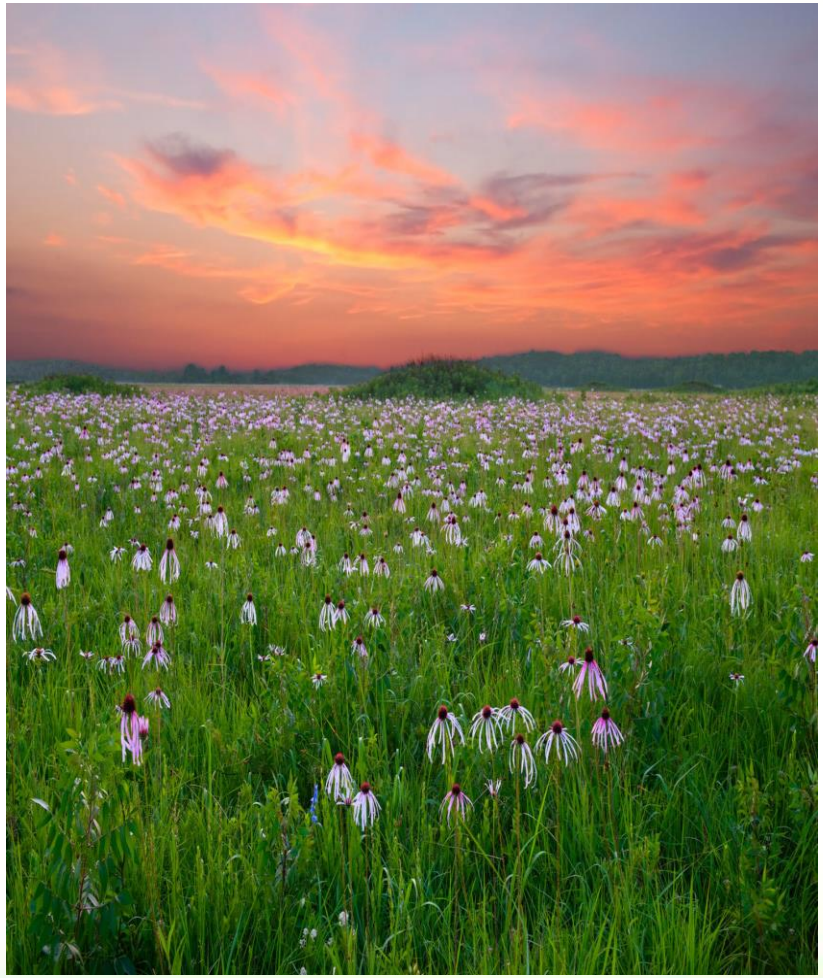
c) Mangroves, grasslands, lakes, oceans

d) Oceans, mangroves, lakes, grasslands

Oceans

Lakes

Grasslands



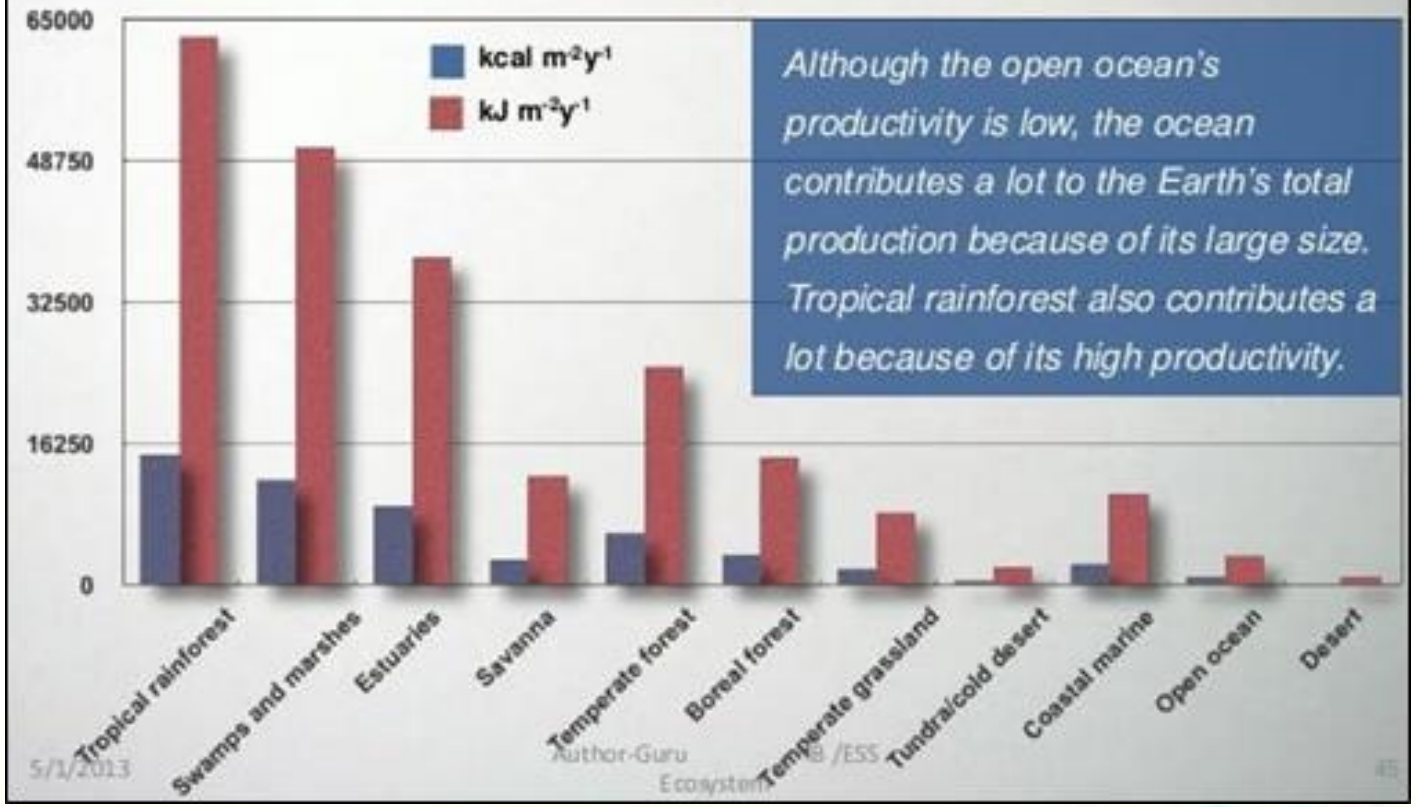
Mangroves

30. Solution: (c)

- Mangroves have the highest and deep oceans and have the least ecological productivity among all ecosystems.
- Ecotones have greater productivity compared to the surrounding ecosystems.
- Mangroves and grasslands are ecotones. (Tropical Rainforests is an exception as it has productivity comparable to wetlands because of its rich diversity of primary producers).
- Grasslands are not transitional all the time. E.g. Steppe. Non-transitional grasslands have very low productivity because of very limited diversity of primary producers. (Grasslands become transitional only when they are narrow).

Ecosystem Productivity

- The primary productivity of oceans is lower than that of terrestrial ecosystems because the water reflects (or absorbs) much of the light energy before it reaches and is utilized by the plant.

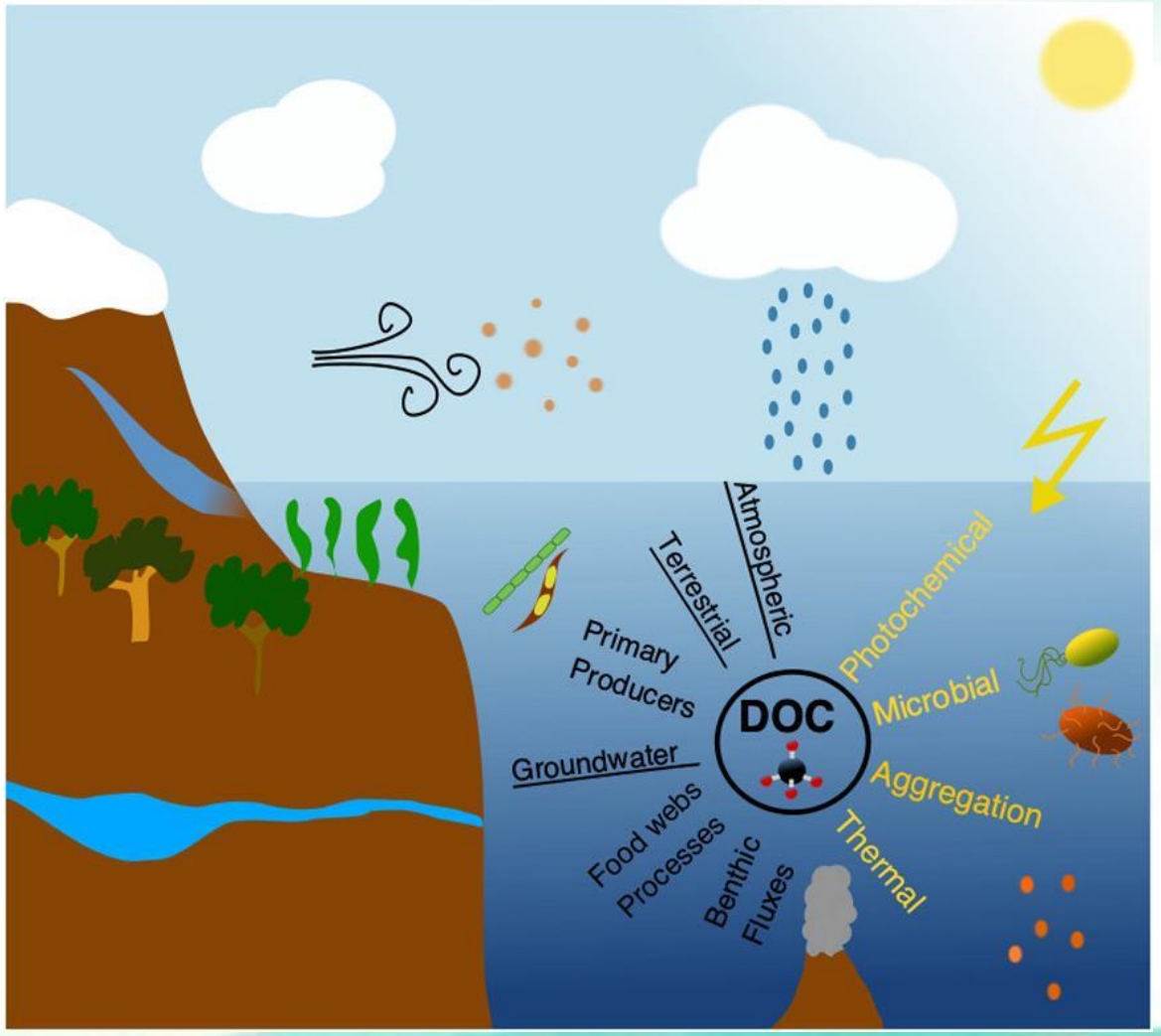


Although the open ocean's productivity is low, the ocean contributes a lot to the Earth's total production because of its large size. Tropical rainforest also contributes a lot because of its high productivity.

PRODUCTION & PRODUCTIVITY

- Oceans are very deep and hence productivity is limited to the surface only (Below in the aphotic zone productivity is negligible. Aphotic zone in oceans is few kilometres).
- Also, surface water in oceans is very poor in nutrients.
- Nutrient-rich cold water flows as a sub-surface flow lying in the aphotic zone.
- Sunlight and nutrients are far apart, and hence primary productivity is very low except in regions where there is an upwelling of nutrient-rich cold water (Cold and Warm current mixing zones).

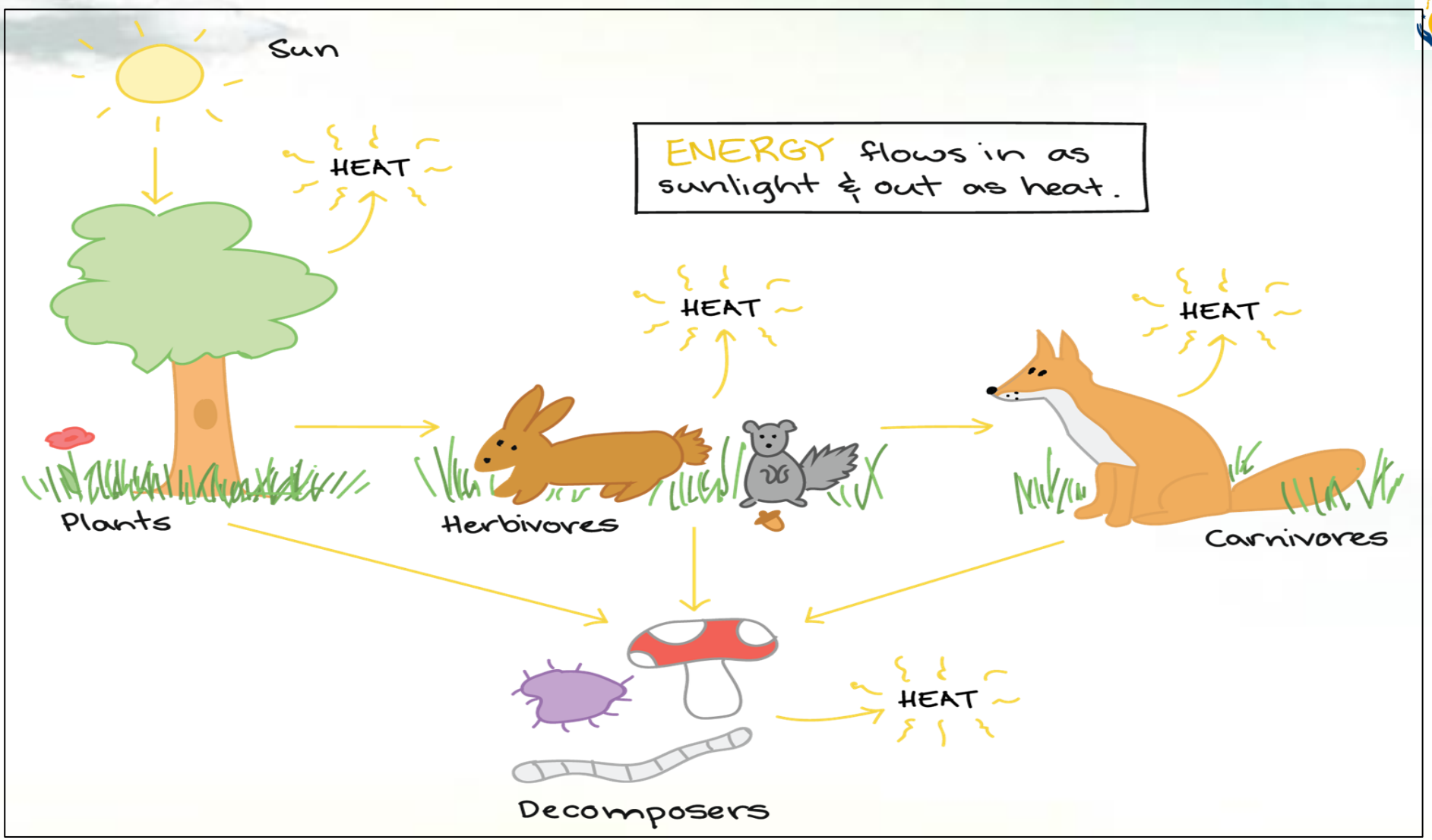
- So the open ocean ecosystem has the least productivity.
- Desert ecosystem also has very low productivity, less than oceans.



ECOLOGICAL PRODUCTIVITY

- Ecological productivity refers to the primary fixation of solar energy by plants and the subsequent use of that fixed energy by plant-eating herbivores, animal-eating carnivores, and the detritivores that feed upon dead biomass.
- This complex of energy fixation and utilization is called a food web.
- Ecologists refer to the productivity of green plants as primary productivity.

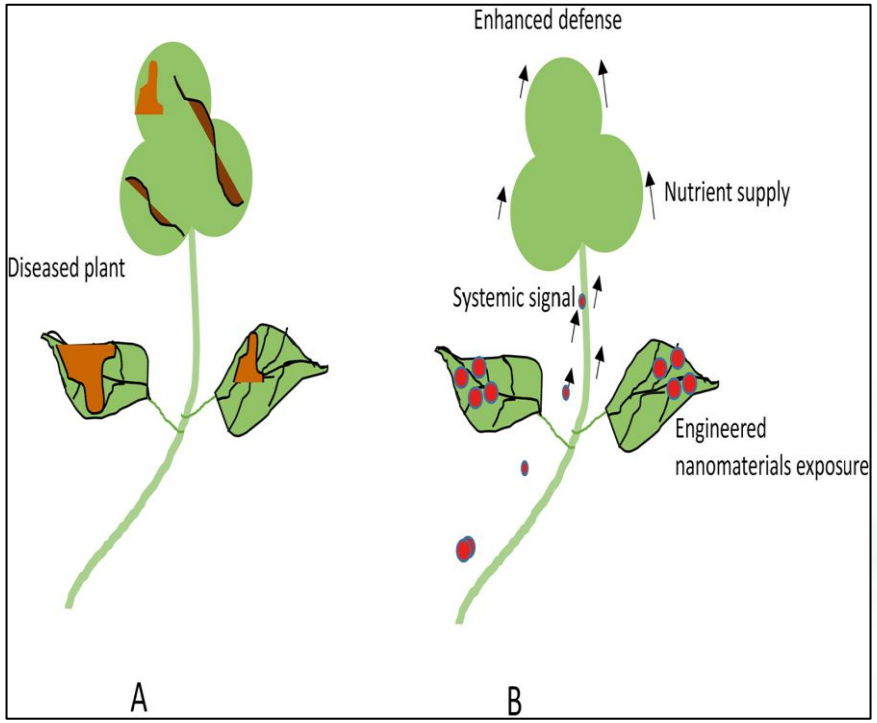
- Gross primary productivity is the total amount of energy that is fixed by plants, while net primary productivity is smaller because it is adjusted for energy losses required to support plant respiration.
- If the net primary productivity of green plants in an ecosystem is positive, then the biomass of vegetation is increasing over time.
- Gross and net secondary productivities refer to herbivorous animals, while tertiary productivities refer to carnivores.


Sun
HEAT
ENERGY flows in as sunlight & out as heat.
HEAT
HEAT
Plants
Herbivores
Carnivores
HEAT
Decomposers

- Within food webs, a pyramid-shaped structure characterizes ecological productivity. Herbivores typically account for about 10% of primary productivity, and carnivores less than 1%.
- Any dead plant or animal biomass is eventually consumed by decomposer organisms, unless ecological conditions do not allow this process to occur efficiently, in which case dead biomass will accumulate as peat or nonliving organic matter.
- Because of differences in the availability of solar radiation, water, and nutrients, the world’s ecosystems differ greatly in the amount of productivity that they sustain.

- Deserts, tundra, and the deep ocean are the least productive ecosystems, typically having an energy fixation of less than 0.5× 103 kilocalories per square meter per year (thousands of kcal/m2/yr; it takes one calorie to raise the temperature of one gram of water by 34°F [1°C] under standard conditions, and there are 1, 000 calories in a kcal).
- Grasslands, montane and boreal forests, waters of the continental shelf, and rough agriculture typically have productivities of 0.5-3.0× 103 kcal/m2/yr.

- Moist forests, moist prairies, shallow lakes, and typical agricultural systems have productivities of 3-10× 103kcal/m^2/yr.
- The most productive ecosystems are fertile estuaries and marshes, coral reefs, terrestrial vegetation on moist alluvial deposits, and intensive agriculture, which can have productivities of 10-2× 103kcal/m^2/yr.



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