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WATER QUALITY MANAGEMENT AND ASSESSMENT

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01

Water Quality Management and Assessment

BY

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02

SYNOPSIS

This course is designed to expose students to current trends and various aspects of water quality assessment and management for river catchments, lakes, reservoirs, wetlands, and marine ecosystems.

It tackles problems involving water pollution and its impacts on the environment and legislation. Water quality monitoring projects carried out by students will enable the application of proper sampling and monitoring methods.

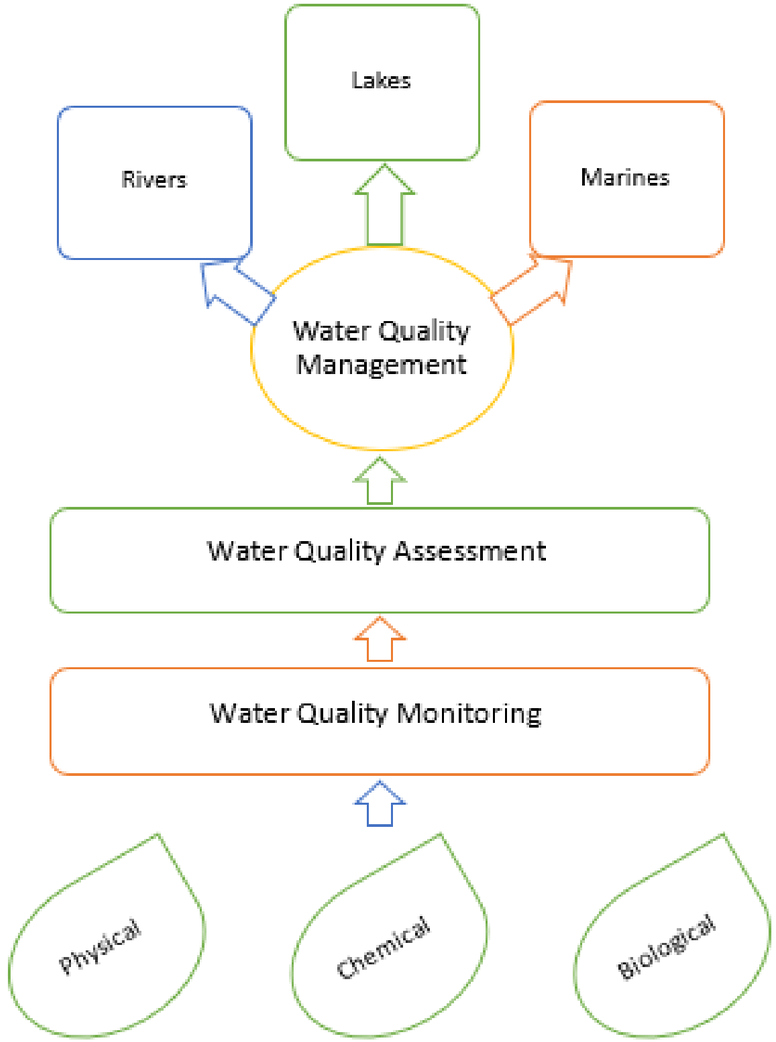
At the end of the course, students will then be able to assess water quality problems and plan mitigation and control measures for water pollution.

LESSON PLAN

01 WEEK	02 WEEK	03 WEEK	04 WEEK	05 WEEK
Introduction	*Water Quality Assessment*	*Biological Assessment*	*Water Quality Index*	*River*
06 WEEK	07 WEEK	08 WEEK	09 WEEK	10 WEEK
Integrated River Basin Managemenr	*River Restoration*	*Mid Semeter Break*	*Wetland*	*Constructed Wetland*
11 WEEK	12 WEEK	13 WEEK	14 WEEK	15 WEEK
Field Work Assigment	*Lake and Reservoir Part 1*	*Lake and Reservoir Part 2*	*Lake Monitoring*	*Coastal Water Management*
16 WEEK				
Marine Resources				

Water Quality Management

Water Quality Management



Water Quality Management

WATER QUALITY ASSESSMENT

evaluation of the physical, chemical, and biological nature of water in relation to the natural quality, human effects, and intended uses which may affect human health and the health of the aquatic environment

WATER QUALITY MONITORING

the collection of information at set locations and at regular intervals in order to provide data that may be used to define current conditions, establish trends, etc

Purpose

Water Quality Assessment

To verify whether the obeserved water quality is suitable for intended uses

To determine trends in the quality of the aquatic environment and how it is affected by the release of containment

Determining the impacts of specific activites

Setting quality criteria and standards

To check any unexpected/unwanted changes

Water Quality Monitoring

To characterize waters and identify changes or trends in water quality over time

To identify specific existing or emerging water quality problems

To determine whether program goals - such as compliance with pollution regulation

Respond to emergiences such as spills and floods

Water Quality Management

RIVERS

01

SIMPLE MOLECULE H20

Total storage: River = 0.000021%
Lake: 0.0081%

02

PURE WATER

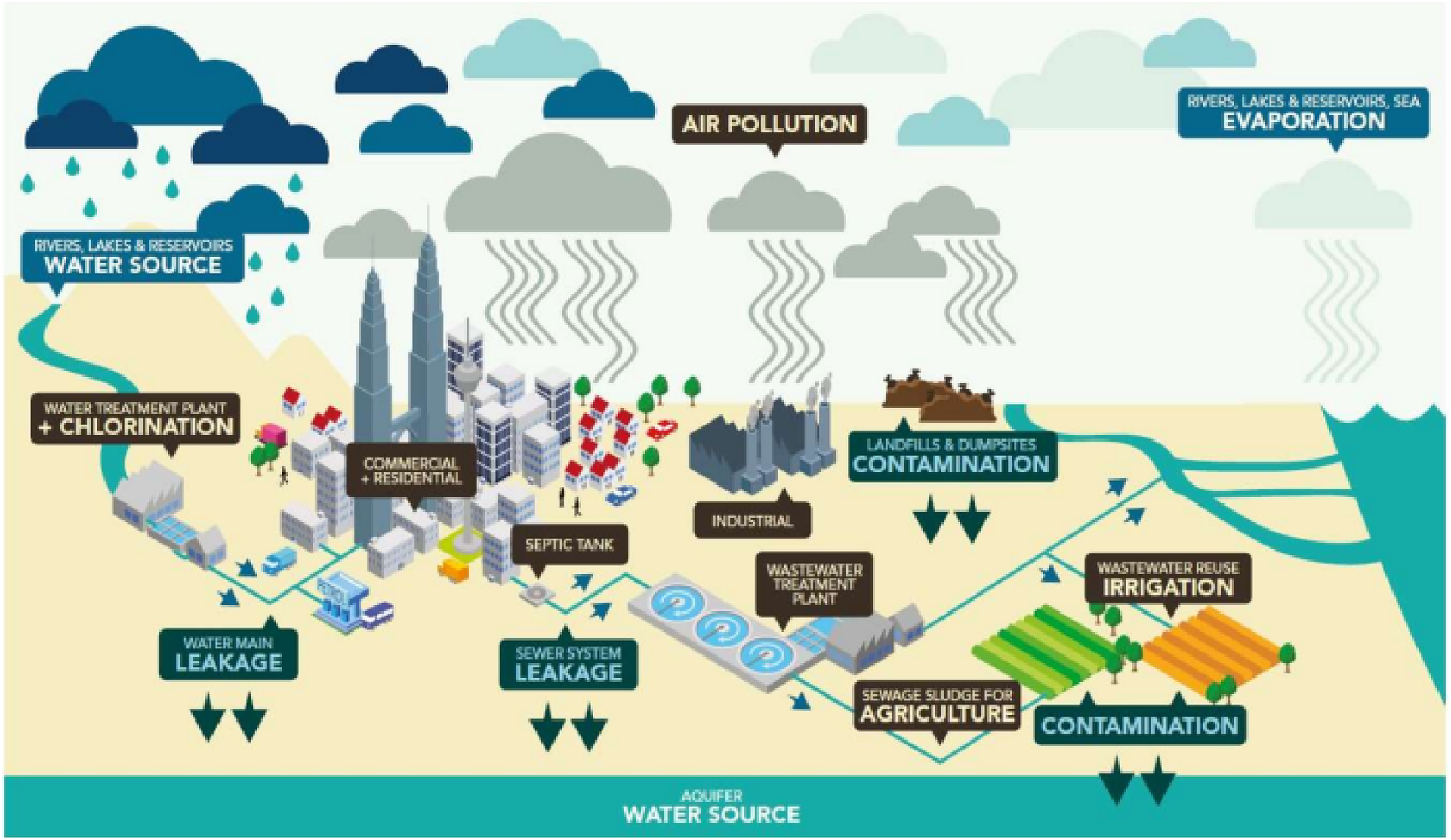
no taste, odour, color

03

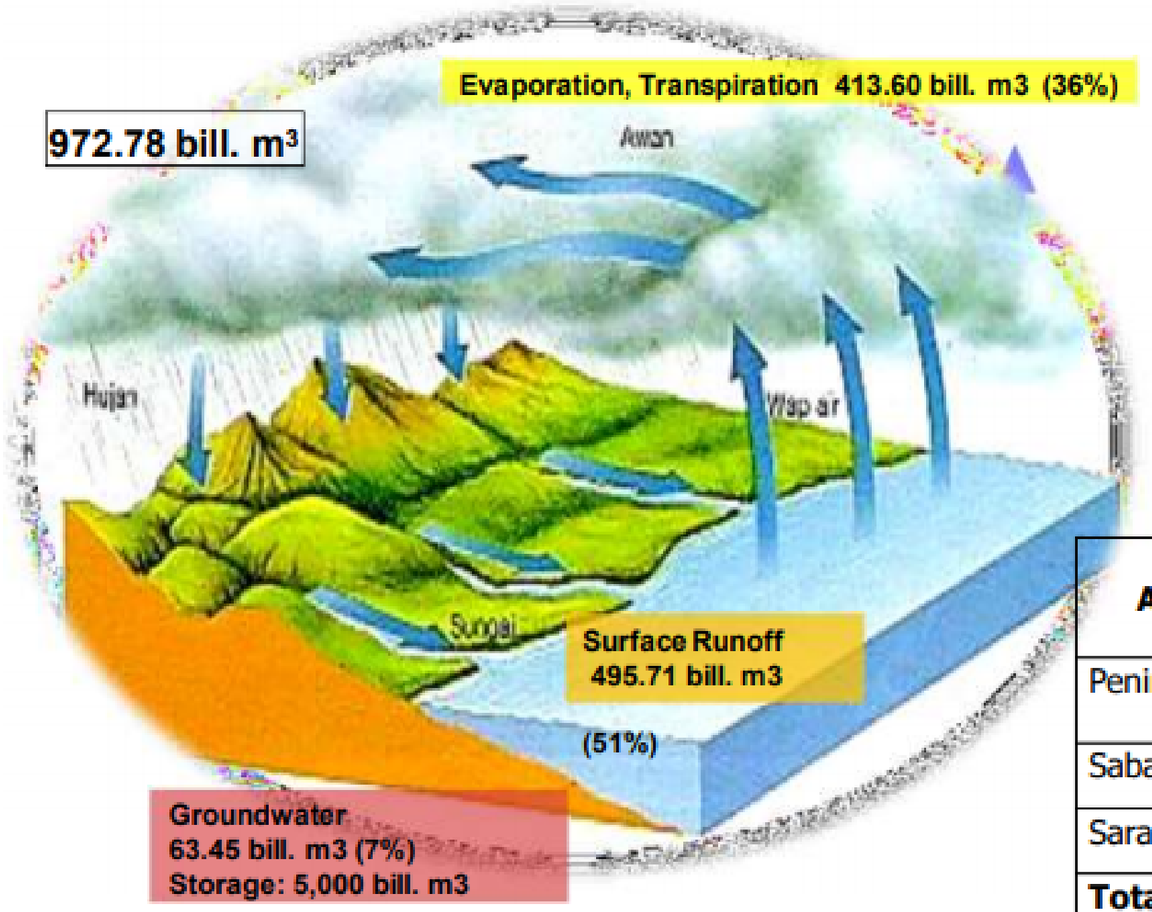
80% OF EARTH IS WATER

water is life, important for all living entity

WATER CYCLE: REALITY



MALAYSIA WATER RESOURCES

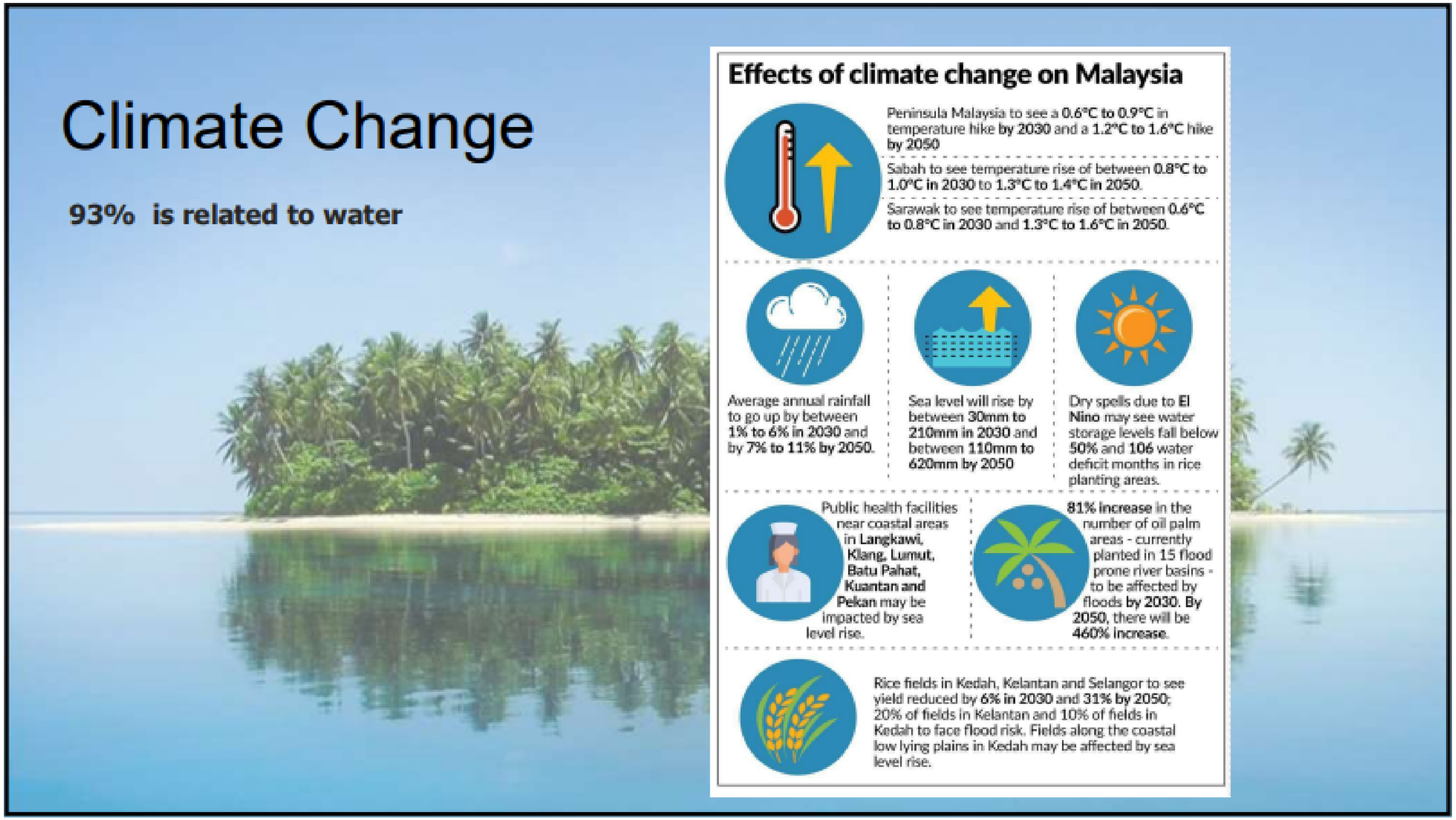


- **Malaysia Avg Rainfall 2,940 mm**
  - ❑ **Peninsular = 2495.5 mm**
  - ❑ **Sabah = 2560 mm**
  - ❑ **Sarawak = 3640 mm**
  - ❑ **Labuan = 3100 mm**

Area	No.	Main River Basin (>80km²)
Peninsular	1,235	74
Sabah	1,468	75
Sarawak	283	40
Total	**2,986**	**189** (95% landuse)

WORLD'S RIVER CONDITION

CLIMATE CHANGE



River Features

LIVING ENTITY

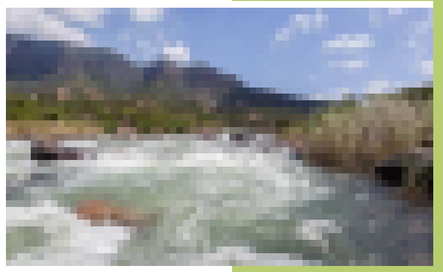
Sound and Self purification

SHAPE: S

Berliku-liku

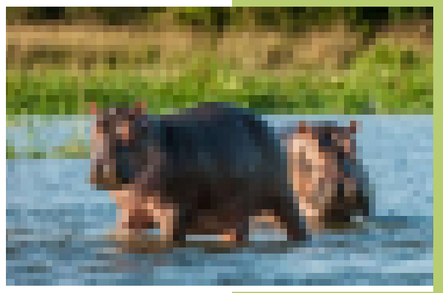
RAPID & SINKS

Jeram & lubuk



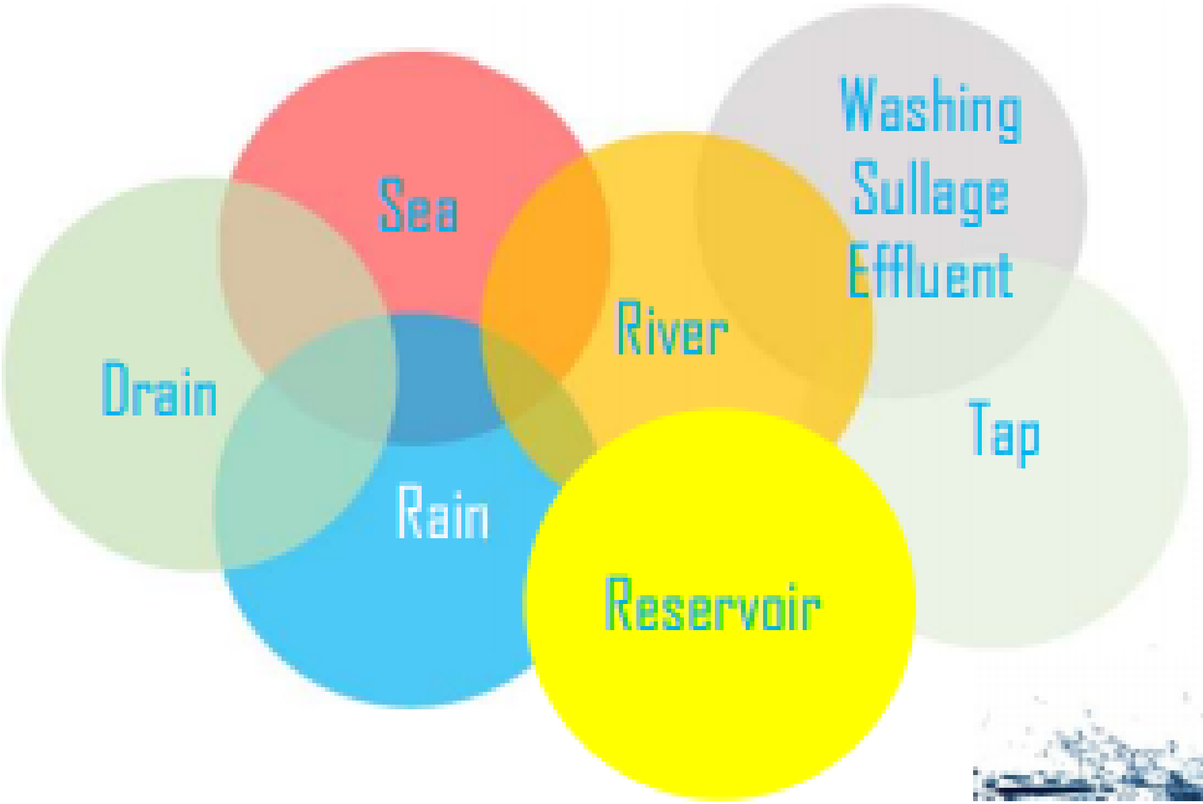
FLORA & FAUNA

Aquatic Life



WHERE DOES YOUR DRINKING WATER COME FROM

All are interconnected from source to sea



WATER CHALLENGES IN MALAYSIA

WATER QUANTITY

Water demand
Water constraints
Water usage

RIVER WATER QUALITY

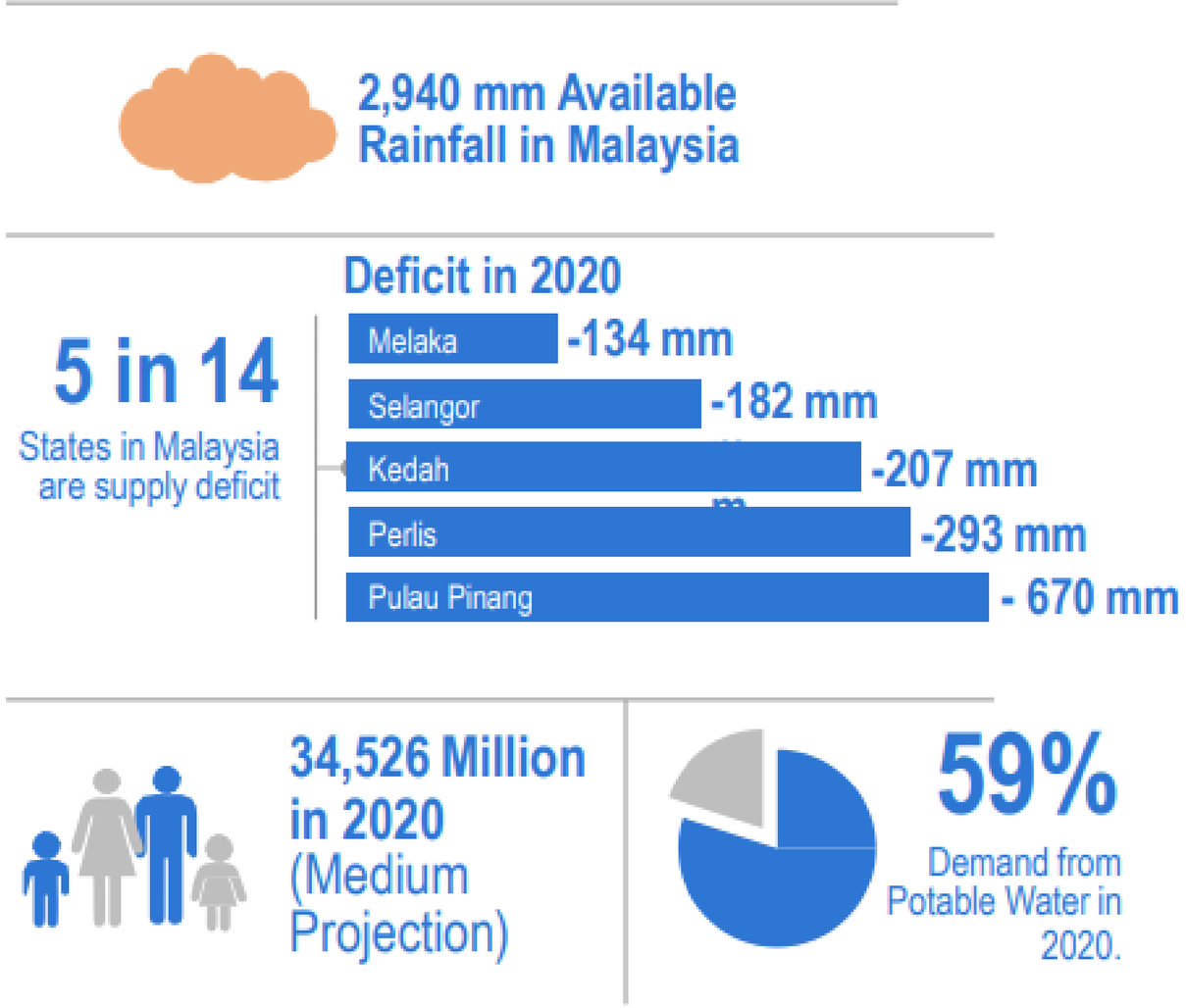
Raw water supply

CLIMATE CHANGE

Raw water supply


RIVER MANAGEMENT
WATER QUALITYMANAGEMENT

WATER SHORTAGE IN MALAYSIA



WATER CONSUMPTION

807 MM global precipitation

16,427 M3/year water per capita

2,940 MM Malaysia precipitation

83 M3/year water per capita

Water per capita per person

Malaysia **215**

Singapore **150**

NRW

56.3%

Perlis HIGHEST NRW among the states in Malaysia

34.1% National Average Value

WATER DEMAND IN MALAYSIA

2018

Population

32 Mil

Water Demand
16,700 MCM

Water Source Work

- Upstream
- Groundwater
- Rainwater harvesting
- Reclaimed effluent from STP

2050

Population

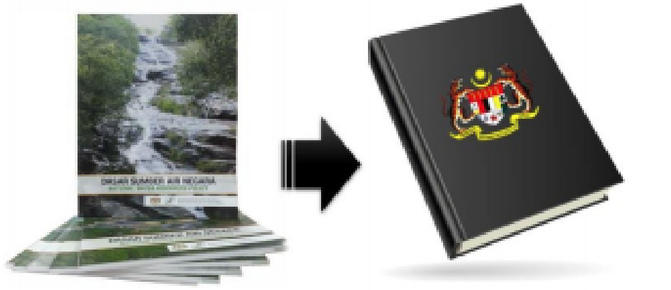
43 Mil

Water Demand
17,233 MCM

Water Source Work

- Upstream
- Groundwater
- Off-river Storage
- Multipurpose retention lakes/reservoir
- River bank filtration
- Rainwater Harvesting
- Reclaimed Effluent From STP

INTERGRATED WATER RESOURCES MANAGEMENT (IWRM)



National Water Resources Policy

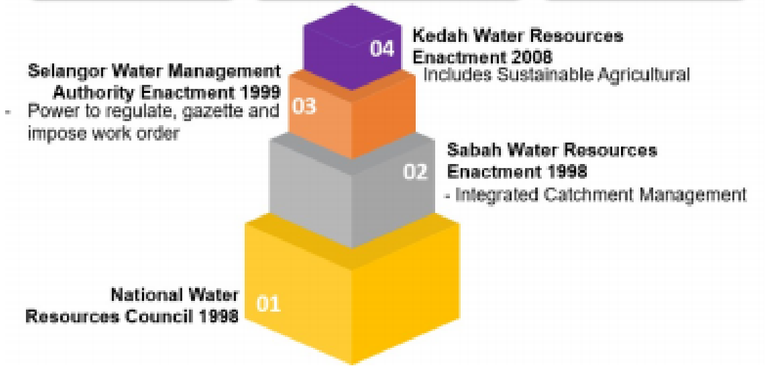
- Guidelines for federal and state
- Launched in 2012 after reviewing NWRS 2000-2050

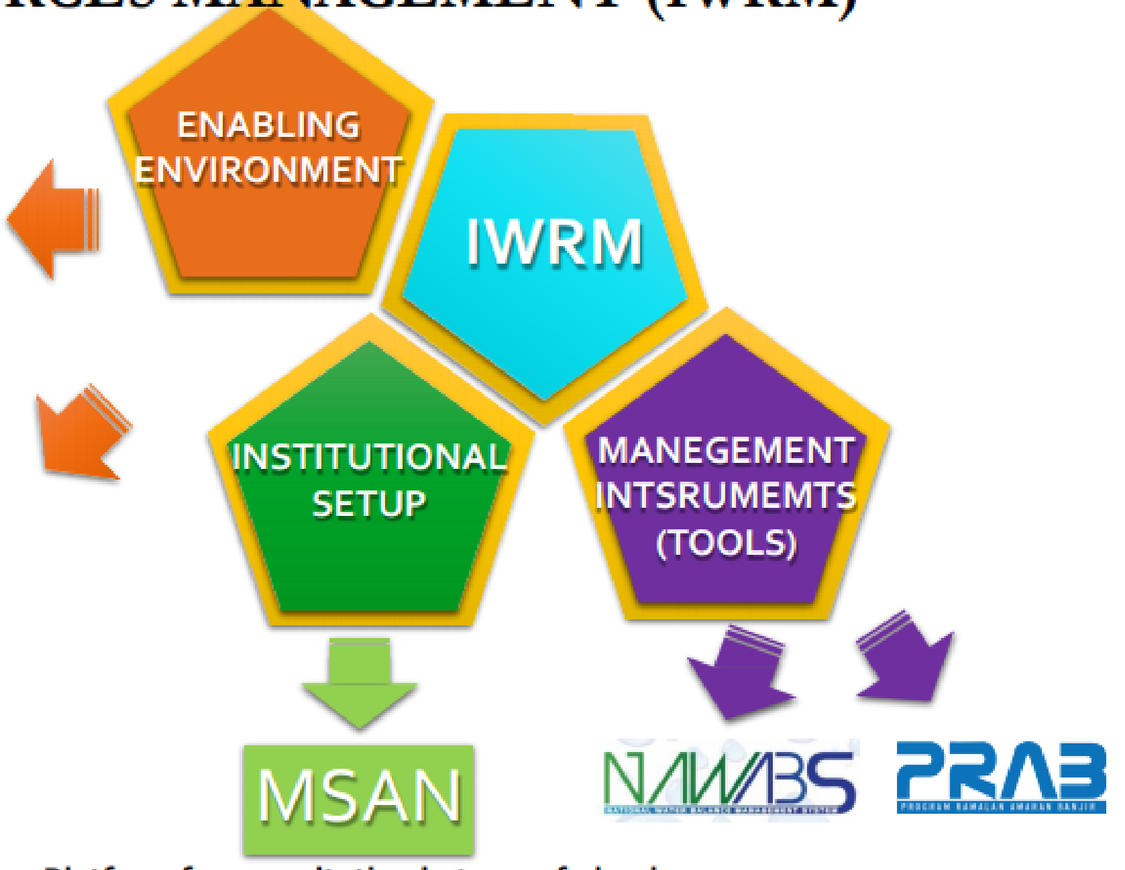
National Integrated Water Policy

- Integrated policy (water resources, supply and wastewater)
- Enhance partnership between government with NGO and private sector

Water Resources Act

Model Law	Holistic water law to implement IWRM & IRBM approaches	In consultation stage with stakeholders





Platform for consultation between federal and state govt.

THE NEED OF IRBM

IRBM DEFINED AS

The coordinated and sustainable use and management of land, water, vegetation, and other natural resources on a water catchment basis so as to balance resource utilization and conservation (Aust Catchment Management Act, 1999)_

WHAT IS IRBM

Process of guarding and coordinating the use of land and other resources in a sustainable manner to obtain products/goods or services

SUSTAINABLE RESOURCE MANAGEMENT

A process of managing resources to achieve/meet management objectives of producing good/product or services without affecting future values and productivity through conservation pf physical and environmental quality

WATER RESOURCES MANAGEMENT TOOLS

NATIONAL WATER BALANCE MANAGEMENT SYSTEM

WHOLE RIVER RESTORATION PLANNING

Vision
How restored river looks/behaves

Strategy
How to achieve vision- what to do where (broadly)

Reach specific
what to do where (detailed)

Idealised 'Vision' of the Avon Valley Landscape.
Note: not all features will be found on all river types.

Water Quality Management

WETLAND

RAMSAR CONVENTION 1971

Areas of marsh, peatland, 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 at low tide does not exceed 6 meters

BIOLOGICAL DEFINITION

Transition zone between terrestrial and aquatic environments

TYPE OF WETLANDS

- Coastal
- Inland
- Tundra
- Bogs and Fens
- Prairie
- Swamps
- Lakes and Ponds
- Rivers and Streams

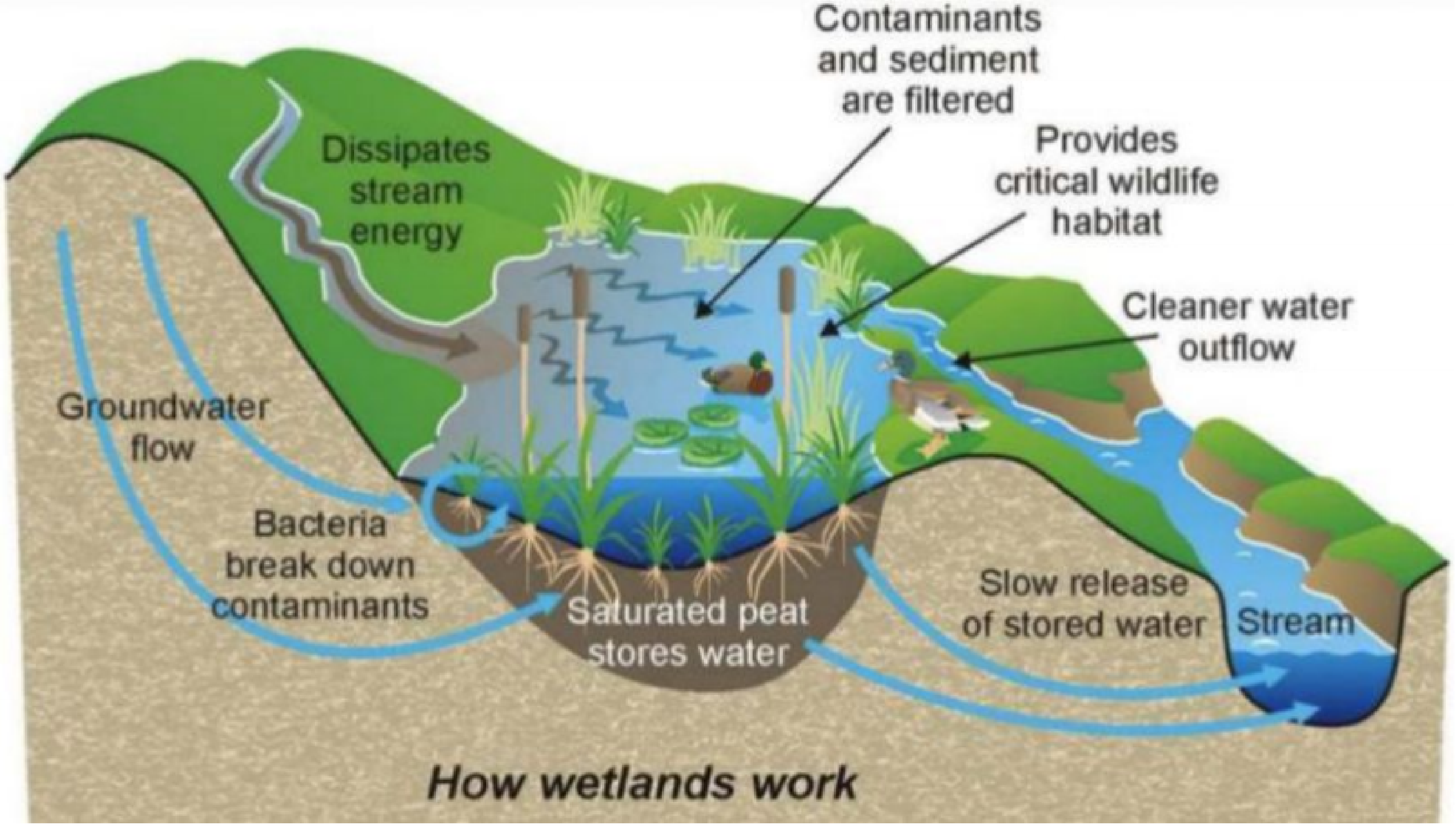
THE VALUE OF WETLANDS

- in the past, wetlands were mostly considered to be wasteland
- as people were settled, swamps ad marshes were obstructed along the way.
- many were drained to be replaced by farmland, railroads, and road construction.
- in recent decades, many people have come to recognize the value of wetlands

RAMSAR SITES IN MALAYSIA

1. Sungai Pulai, Johor
2. Tanjung Piai, Johor
3. Pulau Kukup, Johor
4. Tasik Bera, Pahang
5. Kuching Wetlands National Park, Sarawak
6. Lower Kinabatangan-Segama Wetlands, Sabah
7. Kota Kinabalu Wetlands, Sabah

HOW WETLANDS WORK



NATURAL FUNCTIONS OF WETLAND

CLIMATE EFFECTS

- Carbon fixation and CO2 balance (photosysnthesis)
- rainfall & humidity effects (evaporation & evotransportation)

BIODIVERSITY FUNCTION

- ecosystem diversity
- the link between terrestrial and aquatic ecosystem
- high species and population diversity
- highly diverse microbiological activity

TREATMENT PROCESS IN WETLAND SYSTEM

- Biodegradable organic matter removal
- solids removal
- Nitrogen removal
- Phosphorus removal
- Heavy metal removal

Water Quality Management

LAKES & RESERVOIRS

DEFINITION

A physical feature that is a considerable inland body of water, not part of the ocean, that is larger and deeper than a pond, and may or may not be moving slowly, and is localized to the bottom of basin (another type of landform or terrain feature) and is fed by a river

CHARACTERISTICS:

- Area of natural origin
- deeper waters are much colder than surface waters
- waves are common during storms

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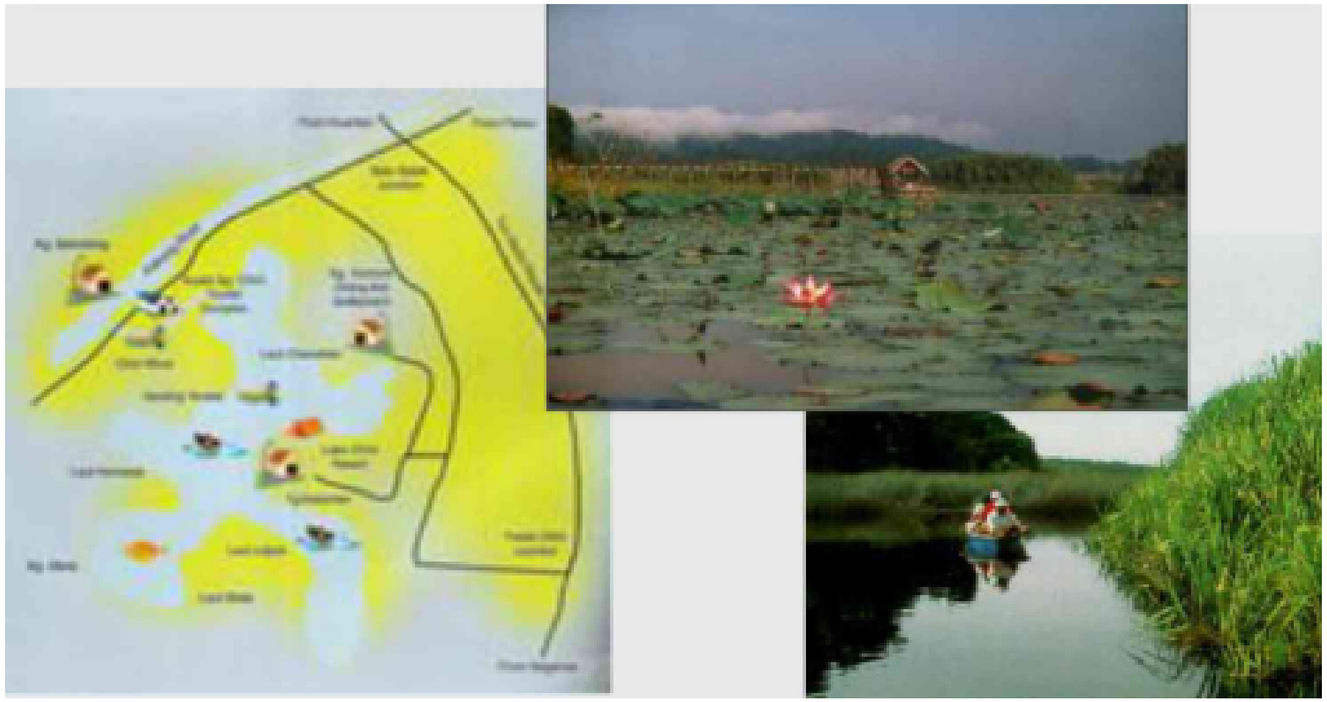
LAKES IN MALAYSIA

- Malaysia is not a lakeland country (no glacial & volcanic activity)
- natural lakes develop through many processes, but the main prerequisite for their existence is their ability of a land cavity to collect and retain water.
- Short liVed phenomena - evaporate, drain and water level fluctuates for both geological and climatic reasons.
- Follow a natural path whereby with time they silt up, colonized by plants, and eventually dry up (eutrophication)

NATURAL LAKES IN MALAYSIA

TASIK BERA

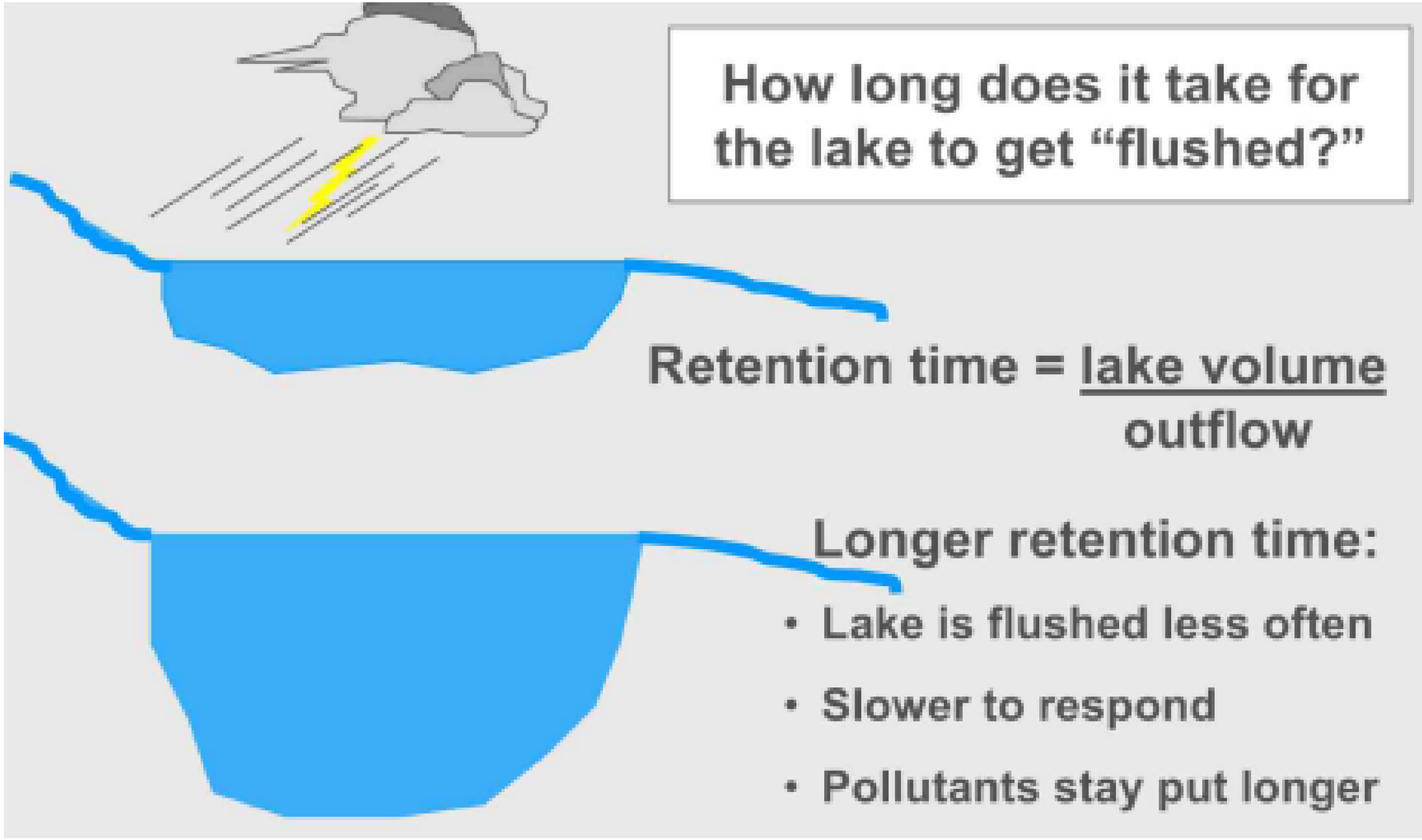
- 6150 Hectars



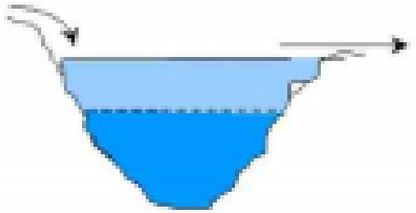
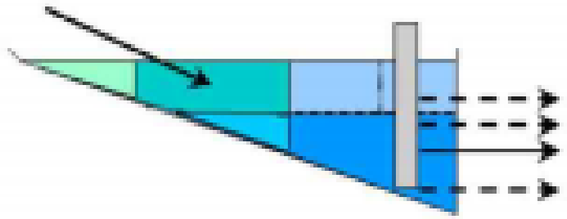
TASIK CHINI

- <1000 Hectars

WHAT IS RETENTION TIME



LAKE & RESERVOIR

Lake		Reservoir
		
long	Period of time the water remains	short
slight	Variation in level	large
Surface	Outflow	hypolimnic
vertical	Gradients	vertical and horizontal
hardly	Management of quality	comprehensive

LAKE

- open bodies of slow-moving water not in contact with the ocean

RESERVOIR

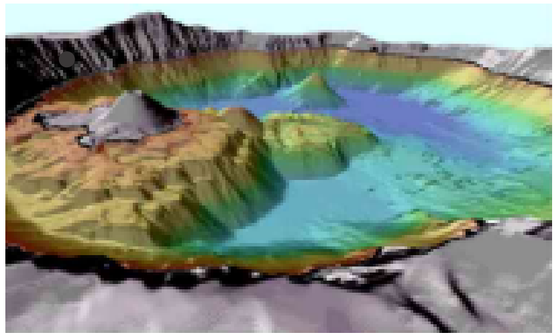
- Usually created for multiple uses and so result in multiple conflict

MAJOR LAKE TYPES

GLACIAL

TECTONIC

VOLCANIC



LANDSLIDE

OXBOW

RESERVOIR

LAKE ZONES

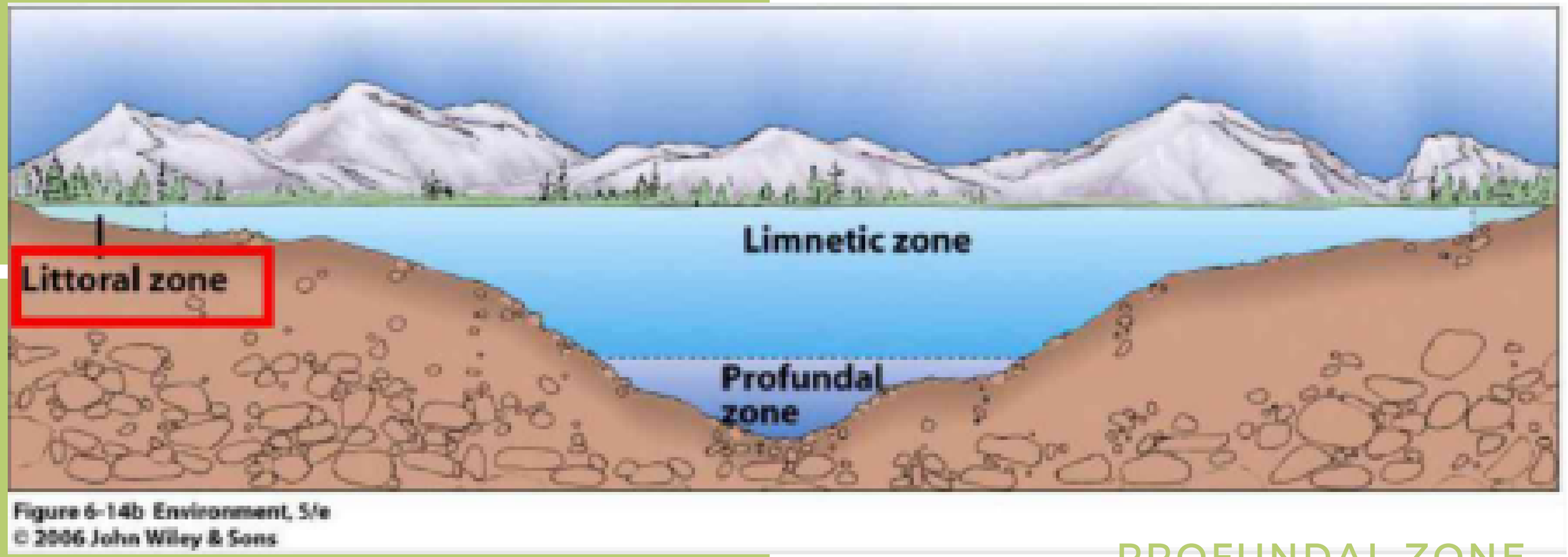


Figure 6-14b Environment, 5/e
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LITTORAL ZONE

- Highly productive
- high species richness

LIMNETIC ZONE

- Photosynthetically productive
- large fish

PROFUNDAL ZONE

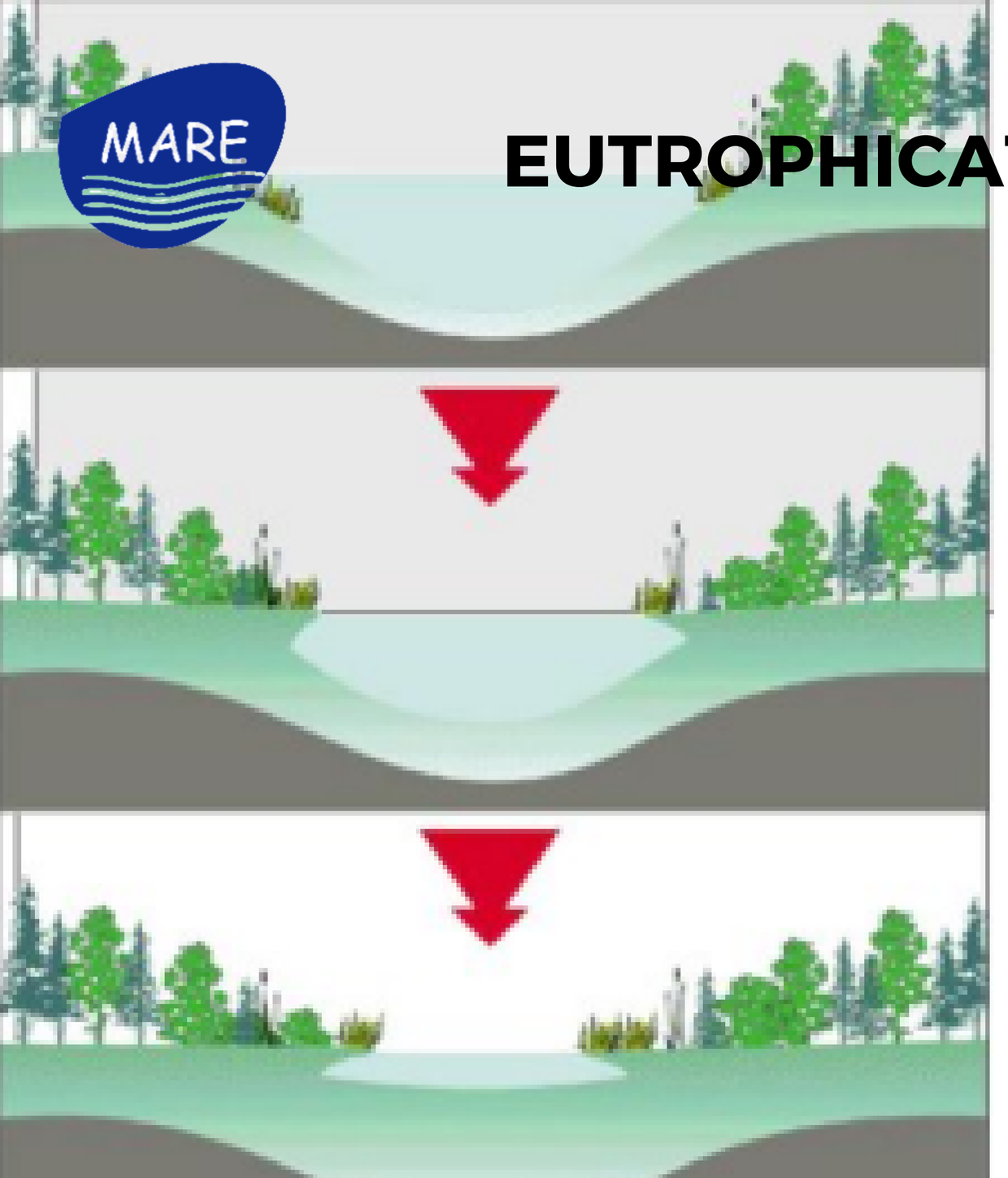
- Not always present
- anaerobic, dominated by decomposers

LAKE PRODUCTIVITY

PRODUCTION

- Closely related to the size of the watershed
- most productive lakes generally have a high ratio of watershed area to lake surface area
- lakes often classified on productivity (trophic state): Oligotrophic vs eutrophic

EUTROPHICATION

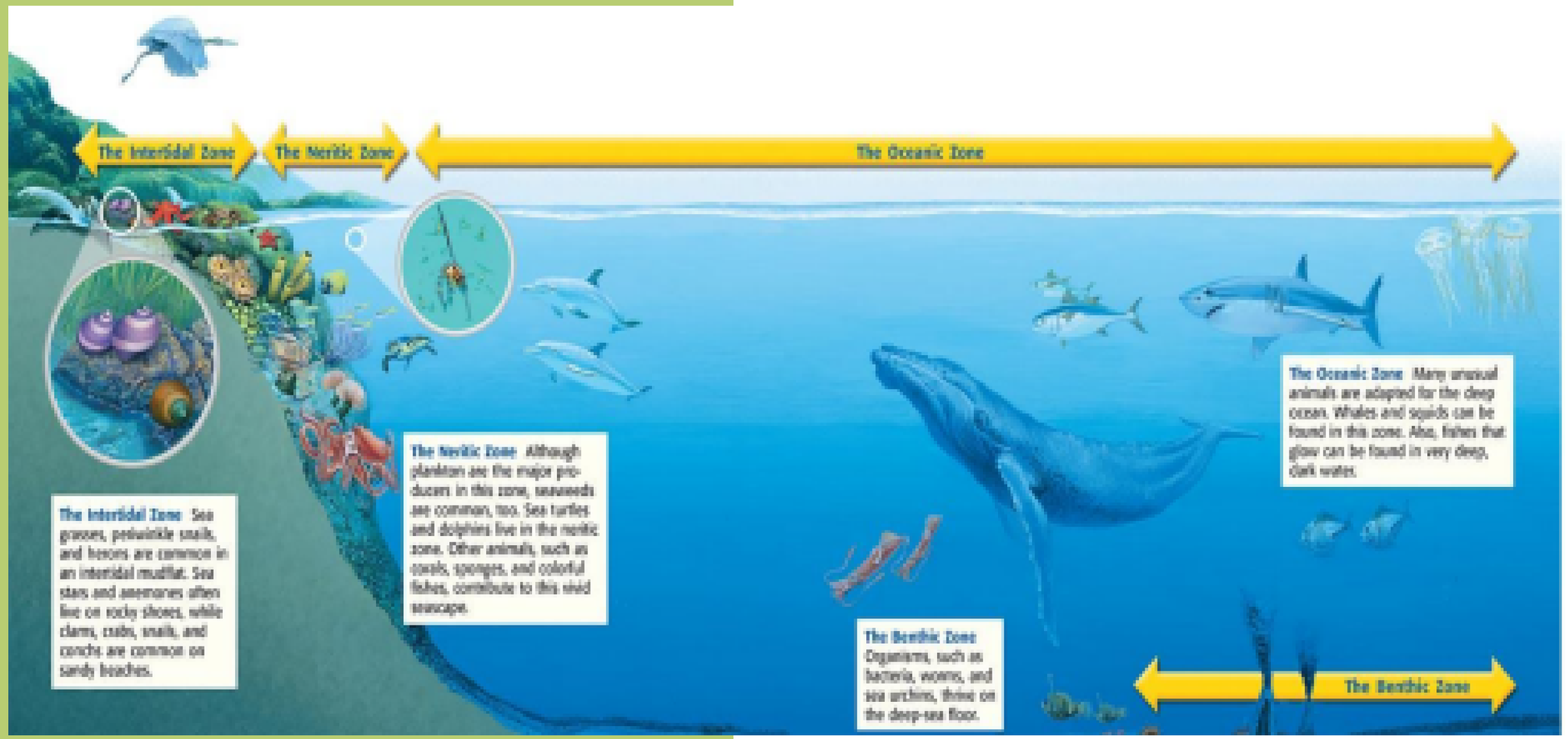


LAKE SUCCESSION

- As soon as a lake is formed it begins to "die"
- Lake succession = term used to describe changes in plant and animal populations

MARINE ZONES

- Life in a marine ecosystem depends on water temperature, water depth, and the amount of sunlight the area receives.



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