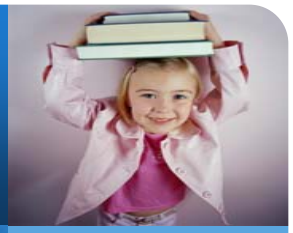
นิเวศวิทยา
Ecology





Dr. Boonsatien Boonsoong

Department of Zoology
Faculty of Science
Kasetsart University

Aims

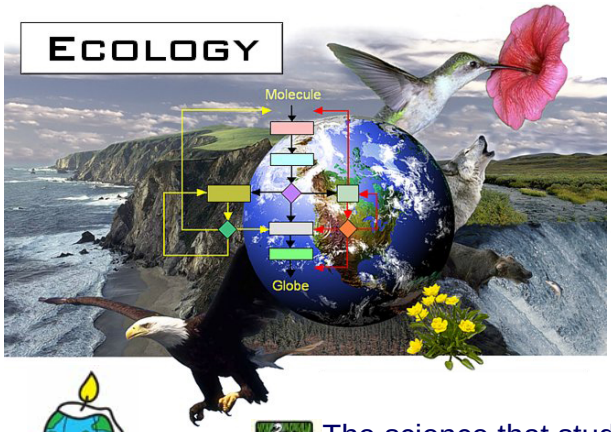


1. To explain structure and function of ecosystem
2. To analyse dissolved oxygen (DO)
3. To classify group of plankton
4. To calculate species diversity index



Ecology





The interactions that organisms have with other organisms and with their environment

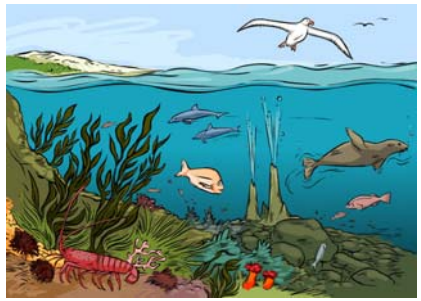
The science that studies these interactions

Ecosystem



'Any area of nature that includes living organisms and non-living substances that interact to produce an exchange of materials between the living and non-living parts is an ecological system or ecosystem.'
(E. P. Odum (1959) *Fundamentals of Ecology* W. B. Sanders, Philadelephia.)

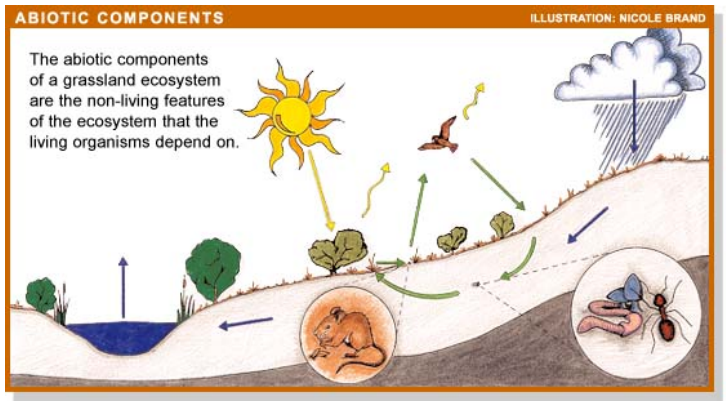
- aquatic ecosystems
- terrestrial ecosystems



- Structure
  - biotic components
  - abiotic components
- Function
  - nutrient cycle
  - energy flow

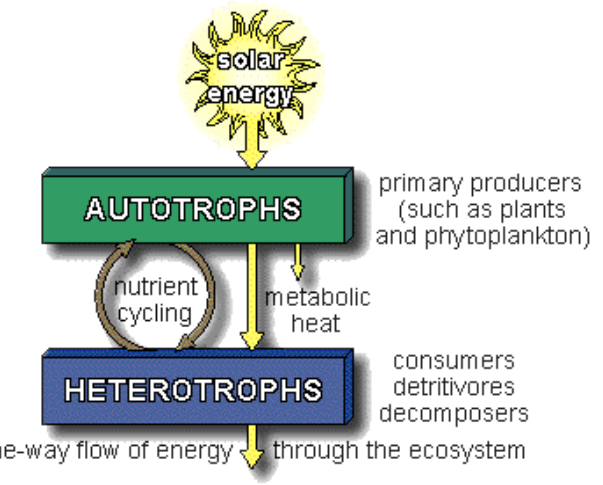
Abiotic components

- basic inorganic and organic compounds of the environment





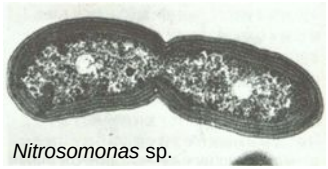
Biotic components



Biotic components

- **Producers** - autotrophic organisms manufacturing food from simple inorganic substances
  - photoautotroph
  - chemoautotroph




Nitrosomonas sp.









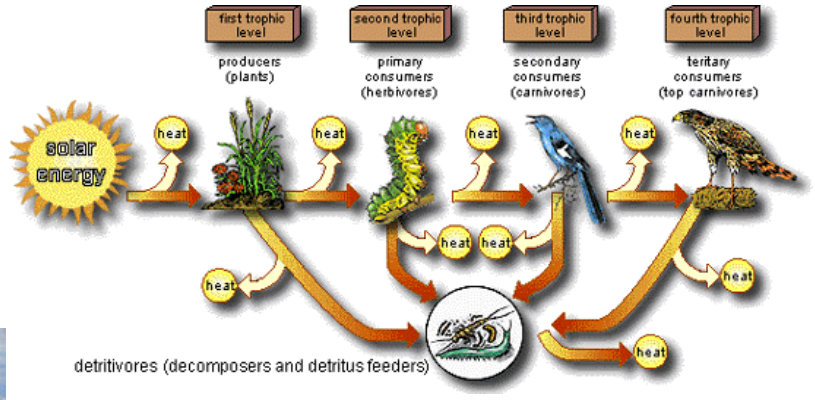
Planting to save our world

Biotic components

- **Consumers** - heterotrophic organisms consuming other organisms or particulate organic matter

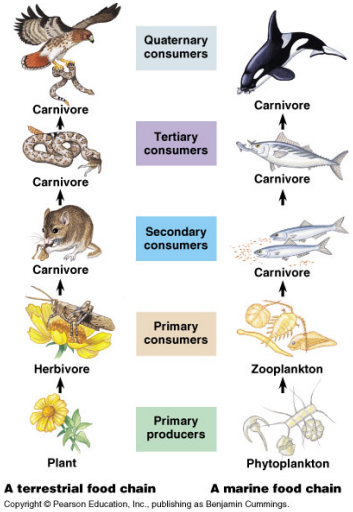
	Trophic level
Herbivores	Primary consumer
Carnivores	Secondary consumer
Omnivores	Tertiary consumer
Detritivores	Top consumer
- scavengers	
- decomposers	

Function: energy flow





Biotic components



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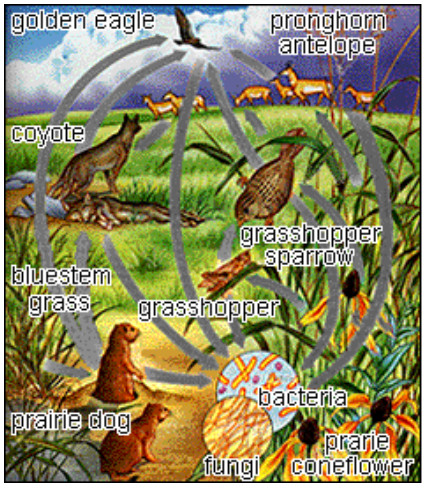


Biotic components

- **Decomposers** - heterotrophic organisms breaking down the complex compounds of dead protoplasm and releasing simple substances useable by the producers



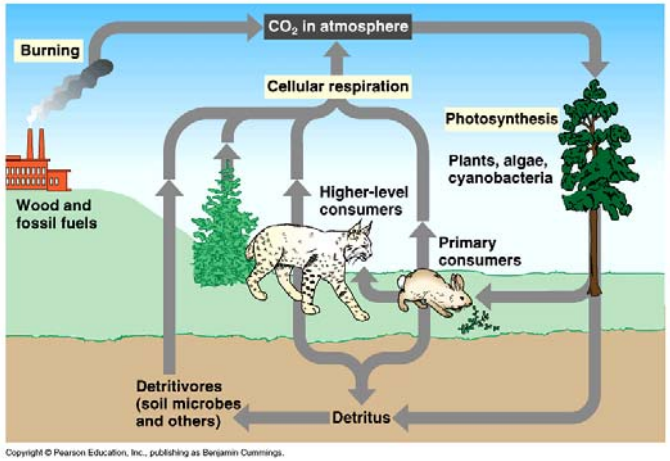


DECOMPOSERS BREAK DOWN MATERIALS AND RETURN NUTRIENTS TO THE SOIL.



Function: nutrient cycle

Carbon cycle



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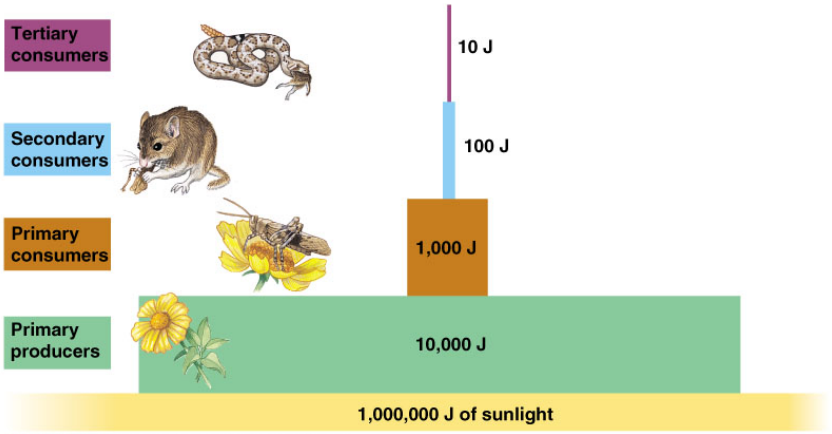
Function: energy flow



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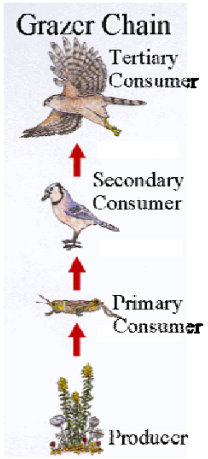
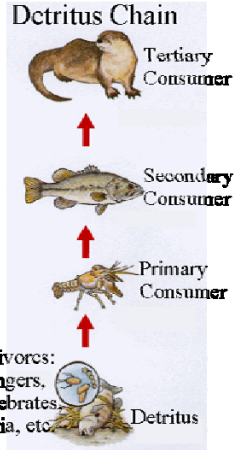
Food chain

- the specific sequence in which organisms obtain energy within an ecosystem

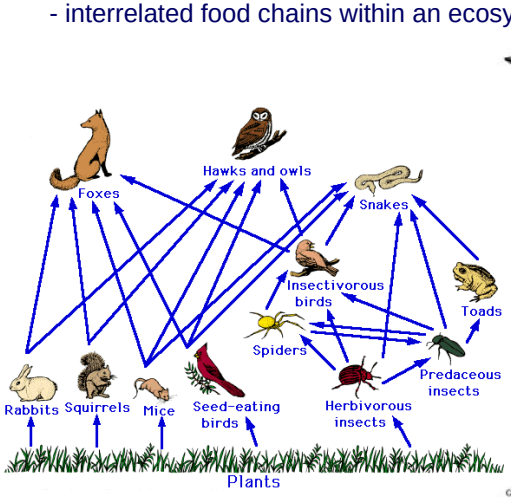


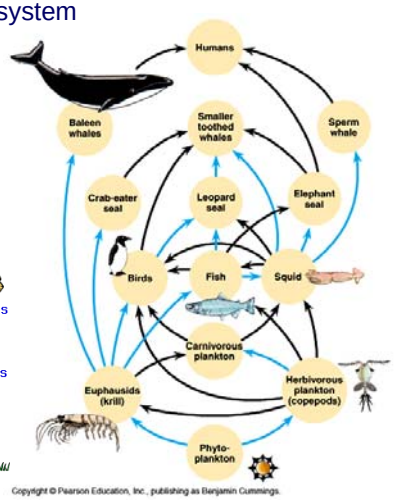




Food web

- interrelated food chains within an ecosystem





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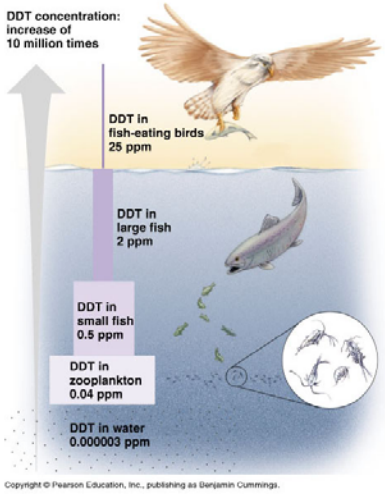
Bioaccumulation



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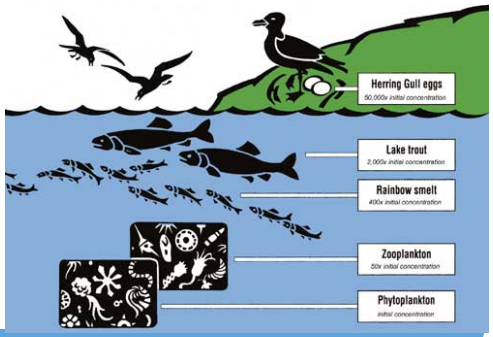
- the accumulation of contaminants by species in concentrations that are orders of magnitude higher than in the surrounding environment



Study site: KU



- **KU1**
  สำนักส่งเสริมและฝึกอบรม
- **KU2**
  ศูนย์วนศาสตร์ชุมชน

Water Quality Assessment







- **Physical assessment**
  Chemical assessment
  Biological assessment



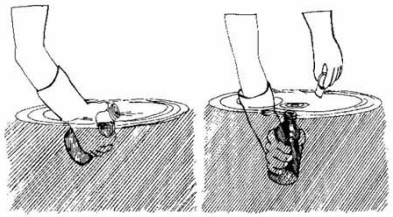
Azide Modification: Winkler method

Label for sample bottles



BOD bottle

wash



Fix

Add 1ml $MnSO_4$

1 ml NaOH + KI



An orange-brown flocculent precipitate will form if oxygen is present

Carefully

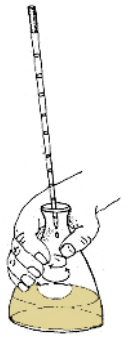
Add

1 ml H_2SO_4 (conc.) just above surface of sample



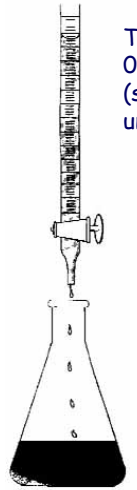
invert sample to mix

Azide Modification: Winkler method



200 ml of sample

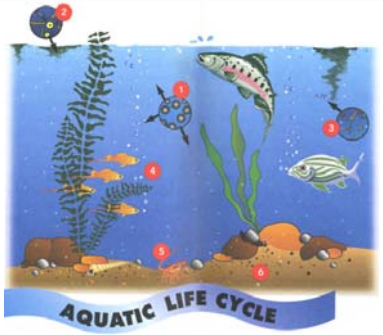
3 drops starch solution
blue color forms



Titrate with
0.025 N $Na_2S_2O_3$
(sodium thiosulfate)
until sample is clear

Calculate DO concentration
DO (mg/L) = # mL of titrant
x 1 mg DO/1 mL

Why is Dissolved Oxygen important?



Sensitive organism



Tolerant organism

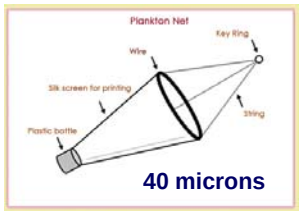


How much oxygen do aquatic organisms need ?

Acceptable of DO levels for aquatic animals > 5 mg/L

DO levels < 3 mg/L → stress

Species diversity index: Plankton







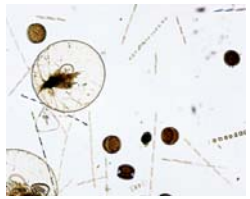


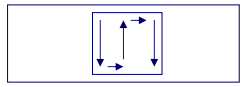
เก็บตัวอย่างแพลงก์ตอนในแนวดิ่ง

ใส่ขวดและดองด้วย 4% ฟอร์มาลิน

กระจายแล้วดูดใส่หลอดทดสอบ หลอดละ 1ml

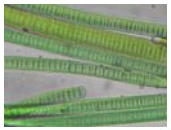
ตรวจดูชนิดและนับจำนวน
แล้วมาคำนวณหาค่าดรรชนีความหลากหลาย





Phytoplankton & Zooplankton

• **Blue-green algae**



• **Diatom**



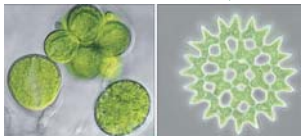
• **Protozoa**







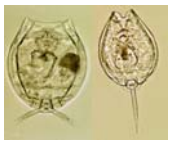
• **Green algae**



• **Rotifer**







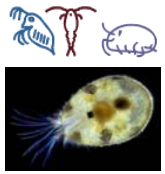
• **Crustaceans:** copepod, ostracod, cladoceran

• **Desmid**











Shannon index

$$H' = - \sum p_i \log p_i$$

$p_i = n_i / N$

n_i = จำนวนสิ่งมีชีวิตในแต่ละกลุ่มของสิ่งมีชีวิต

N = จำนวนสิ่งมีชีวิตทั้งหมดในพื้นที่นั้นๆ

Calculate Shannon index (H')



กลุ่มสิ่งมีชีวิต	แหล่งน้ำที่ศึกษา			
	1	2	3	4
1	10	29	91	20
2	11	19	1	20
3	12	14	1	0
รวม	33	62	93	40

$H' = - \sum pi \log pi$

$H'_1 = - (10/33 \log 10/33 + 11/33 \log 11/33 + 12/33 \log 12/33)$
$H'_1 = - (0.3 \log 0.3 + 0.33 \log 0.33 + 0.36 \log 0.36)$
$H'_1 = 0.475$

$H'_2 = 0.459$ $H'_3 = 0.4082$ $H'_4 = 0.302$

สรุป แหล่งน้ำ 1 มีค่าความหลากหลายสูงที่สุด