Human responsibilities for environmental conservation

Syllabus:
- the concept of sustainable development and the need for the conservation of natural resources.
- afforestation in Hong Kong as a means of restoring degraded or devegetated land.
- the management of natural resources (e.g. fish, timber).
- the recycling of wastes (e.g. paper, aluminium).
- the need to maintain biodiversity: conservation of wildlife and their habitats; ecological, aesthetic and moral considerations.
- the protection of endangered species in Hong Kong with reference to at least two of the following examples: Chinese White Dolphin, Romer’s Tree Frog, Black-faced Spoonbill, and Pitcher-plants.
- the pollution control measures: sewage treatment, the control of agricultural wastes and industrial effluents.
- the relationship between economic development and conservation of the environment.
- the importance of environmental education and legislation.

Introduction:
Conservation does not just mean retaining things as they are in nature; but it means careful management of our environments to provide conditions needed for the good quality of life in our generation as well as in future generations. By means of careful control on the balance between harvest and renewal, conservation ensures a continuous yielding of natural resources which include many useful plants, animals, materials, water and land.

The management of natural resources:
A. Fishery:
- Fisheries, especially marine fisheries, are an important source of human food.
- Unlike most other food species, fish have not been domesticated nor owned by individuals.
- Modern fishing still depends on hunter-gathering techniques and fishermen compete for stock.
- Biological, economic, social and political factors complexly interact in the modern fishing and quota system.
- Over the last century, technological advances have greatly improved human hunting ability.
- Furthermore, developments in refrigeration and freezing methods have meant that vessels can fish to greater capacity.

i/ Underfishing:
- under condition of light fishing of a fish population that grows to the limits of food supply, the carrying capacity.
  - competition for food restricts the numbers surviving and the size to which individuals grow.
  - slow-growing older fish compete successfully with smaller ones for food.
  - fish catches show a predominance of older fish.
  - the population could sustain a larger more profitable fishery of better quality fish if more fish were caught by removing the excess older fish would achieve a better growth rate through the remaining stock.
ii/ Overfishing: it is the state of heavy fishing that generates a population of mainly young small specimens, since fish are caught as soon as they reach a catchtable size; these young fish would make rapid growth if left longer in the sea and would soon reach a more valuable size; individual fishermen are tempted to improve immediate income by catching more fish; if fish are caught before spawning so that the reproductive capacity of the stock is seriously affected then a rapid reduction in numbers occurs and local extinction may result.

- Ways to avoid overfishing:
  - limit the total permitted annual catch of fish
  - limit the size of the fishing fleet
  - limit the length of the fishing season
  - limit the fishing area
  - forbid the landing of under-sized fish
  - forbid fishing in nursery area
  - forbid using small mesh and hook sizes

B. Forestry:
- Forests are the natural climax vegetation of many parts of the world covering

  - In recent years, tropical rainforest are declining at a rate that will decrease their 1950 extent (15% of global land surface) to 300 million hectares (7% global land surface), so tropical rainforest are in urgent need of conservation.

i/ Reasons for the decline of tropical rainforest:

  (1) Unwise management: deforestation due to logging, especially clear cutting, merely for timber but without due regard for selective, phased and sustainable logging; deforestation for low-density cattle ranching and for highway development, a special problem in South America, or for rubber and oil palm production in Malaysia; trade in endangered plant and animal species.

  (2) Unlimited human population increase: increased need of agricultural land and residential, recreational area. Increased demand for forest products and growing disposable habit of wealthy societies.

  (3) Technological change: climatic change caused by the greenhouse effect and global warming, acid rain and drought; oil prospecting and oil spillage as well as other forms of pollution; hydroelectric projects and their effects on aquatic populations as well as habitat destruction through flooding; pesticide accumulation and the effects of fertilizers.

ii/ Effects of deforestation:

  1. there is a loss of traditionally harvested products such as timber, honey, fruit, game animals and herbs
  2. deforestation of uplands cause soil erosion and cause floods in the plains below (This is one of the main cause of flooding problem of East of China)
in the last 10 years. Details please refer to web site below:
http://ihouse.hkedcity.net/%7Ehm1203/hazard/flood%2Dchina.htm

3. silting problem of reservoirs reduces their useful life, whilst harbours and
estuaries must be continually dredged to keep them open
4. increase global carbon dioxide, this change may have long term effects on
the global climate, the amount and frequency of rainfall may be altered too
5. forests have the most species-rich and diverse wildlife communities, their
destruction will lead to innumerable extinction of little-known forms of life
with the consequent loss of genetic variety and potential resources
6. loss of soil fertility by leaching, as most of the richness in forest is locked
up in its trees
7. finally cause desertification
- Therefore, afforestation is an urgent project to conserve our living area. Since
1870 afforestation was carried out. Details please refer to the web site below:
http://parks.afcd.gov.hk/newparks/chi/education/afforest_history.htm
- On the other hand, China Government is also carrying out many projects about
afforestation to prevent soil erosion or desertification. Details please refer to
the web site below:

The recycling of wastes:
‘Wise use of the environment’ means dealing with the wastes to provide the
greatest good for a number of recycle processes which may provide energy or
usable substances. For recycling purposes, the wastes must be collected and sorted
so that the different materials are separated.

Problem faced:
- it is troublesome to separate the different wastes materials.
- on the other hand it is cheaper for a soft drink manufacturer to put his drinks into
  non-returnable aluminium cans
- cooperation of people in the city is needed.
- new facilities are needed / developed for the collection of different types of waste
  materials.

Environmental benefit of recycling:
Information taken from http://www.umass.edu/recycle/environmental_benefits.html

<table>
<thead>
<tr>
<th>Material</th>
<th>Energy Savings</th>
<th>Pollution Reduction</th>
<th>Resource Savings</th>
<th>Miscellaneous</th>
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<tbody>
<tr>
<td>Aluminum</td>
<td>95% energy</td>
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<td>4 lbs. saved</td>
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<td>Material</td>
<td>Energy Savings</td>
<td>Environmental Impact</td>
<td>Natural Resource Savings</td>
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<td>Glass</td>
<td>50%</td>
<td>20% less air pollution; 50% less water pollution</td>
<td>1 ton of glass made from 50% recycled materials saves 250 lbs. of mining waste</td>
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<td>Glass can be reused an infinite number of times; over 41 billion glass containers are made each year</td>
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<td>Paper</td>
<td>60%</td>
<td>95% less air pollution; each ton saves 60 lbs. of air pollution</td>
<td>Recycling of each ton of paper saves 17 trees and 7000 gallons of water</td>
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<td>Every year enough paper is thrown away to make a 12' wall from New York to California</td>
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<td>Plastic</td>
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<td>Plastic milk containers are now only half the weight that they were in 1960</td>
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<td>If we recycled every plastic bottle we used, we would keep 2 billion tons of plastic out of landfills</td>
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<td>We use enough plastic wrap to wrap all of Texas every year</td>
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<td>Steel</td>
<td>74%</td>
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<td>74% energy savings; every pound of steel being recycled saves enough energy to light a 60-watt bulb for 24 hours</td>
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<td>Every year we create 11.5 million tons of ferrous wastes</td>
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<td>One ton of recycled steel saves 2,500 lbs. of ore, 1000 lbs. coal, and 40 lbs. limestone</td>
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<td>Enough iron &amp; steel is discarded in the US to continually supply the nation's automakers</td>
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Conservation of wildlife and their habitat:

There is an accelerating rate of extinction. Nowadays, it is about one species is lost per day. There is a considerable extinction of valuable alleles if an existing species’ gene pool becomes too reduced, this is happening with crop plants and domesticated animals. It is common in developed countries for a very few varieties of these species to be grown.

For details of maintaining biodiversity in HK can refer to the web site below:
http://resources.ed.gov.hk/envir%2Ded/text/hkissue/e%5Fm1%5F7%5F5.htm

A. Reasons why organisms become endangered:
(1) Natural selection
(2) Habitat destruction
(3) Competition
(4) Hunting and collecting
(5) Destroyed by man: many species may carry diseases of man’s domesticated species, e.g. badgers (獾), they cause tuberculosis of cattle.
(6) Pollution

B. Techniques used to conserve the wildlife and their habitat:
(1) Development of National parks and nature reserves:
    they can preserve a vulnerable food source, e.g. in China areas of bamboo forest are protected to help conserve the giant panda
(2) Planned land use
    specific areas of land may be set aside for a designated use
    the type of activities permitted on the land are carefully controlled by legislation
(3) Legal protection
(4) Commercial farming:
    development of farms which produce sough-after goods, e.g. mink farming, deer farming, may produce enough material to satisfy the market and so remove the necessity to kill these animals in the wild
(5) Breeding by zoos
    when numbers have been sufficiently increased they may be reintroduced into the wild
(6) Removal of animals from threatened areas
    organisms threatened by man, or natural disasters such as floods, may be removed and resettled in more secure habitats
(7) Control of introduced species
    organisms introduced into a country by man require strict control if they are not to out-compete the endemic species
    feral animals (domesticated individuals which escape into the wild) must be similarly controlled
(8) Ecological study
    careful analysis of all natural habitats is essential if they are to be managed in a way that permits conservation of a maximum number of species
(9) Education to the public

C. The protection of endangered species in Hong Kong:
   ✓ develop marine park provide area for dolphin to live
   ✓ forbid fishing boat entering the area dolphin live
   ✓ forbidding catching of dolphin
2. Romer’s Tree Frog (盧氏樹蛙）
   (http://www.wwf.org.hk/eng/conservation/spe_cons/tree_frog.html)
   - educate the public
   - study the ecology and the conservation of this species
   - capture them from the endangered area, breeding in laboratory and then re-introduce them into a new, similar habitat natural habitat

3. Black-faced Spoonbill (黑面琵鷺)
   (http://www.wwf.org.hk/eng/maipo/wildlife/black_faced.html)
   - develop Mai Po as a protected area for birds and many other lives to live
   - forbidding catching of them

4. Pitcher plants (豬籠草)
   - legislation to prohibit destruction of the endangered plants
   - develop of country parks
   - seed collection and bred in the laboratory
   - legislation to restrict the import of export of the endangered species

D. Countryside conservation (Country Park Programme) :-
- In 1976 the Country Parks Ordinance came into effect. This provided legislation for the outline, control and management of the Country Parks
- Good progress was made and by the end of 1980, 40% of the hilly areas of Hong Kong had been designated as Country Parks
- In addition, a number of Special Area have been set aside for additional protection, e.g. Mai Po Marshes and Hoi Ha Wan. In theses areas rare plants or organisms threatened with extinction are protected
- The use of the countryside is regulated that making them remain as a renewable resources
- The management plan including the followings :
  a/ protection of wildlife and their habitat is often incompatible with unlimited public access so some zoning is often necessary
  - zones for intensive public use will contain barbecue and picnic facilities
  - protected areas will require a permit for entry so that vulnerable sites or species may be protected
  - in-between areas may be scheduled for light public use e.g. walking tracks are provided but intensive use for picnics is discourage
  b/ nature trails may be constructed to help fulfil educational aims
  c/ the continuous supervision of these country parks by the park wardens help to prevent littering, water pollution and illegal wood cutting
  d/ barbecue stoves are built in certain sites where the hill fire hazard is lowest
- For the details about country parks of Hong Kong, fleas refer to the web site : http://parks.afcd.gov.hk/newparks/eng/index.htm
Pollution control measures:

A. City planning:
1. Zonation of residential and industrial area
2. Relocation of heavy pollutant sources, e.g. the power plant was removed from urban area to the west (from Hung Hom to Tsing Yi and Tuen Mun, from North Point to Lamma Island)
3. Improve the mass transport system to reduce the number of automobiles
4. Sewage treatment plants were built in new towns
5. Green zones were established to separate residential areas and industrial areas

B. Sewage treatment:

Domestic sewage is purified in a sewage treatment plant before it is discharged into rivers or seas to reduce water pollution and the hazard on health. In 1975 there was only one full scale sewage treatment plant at Shek Wu Hui in Sheung Shui. Afterwards, large scale sewage treatment plants was built in other new towns in N.T. For details refer to the following web site:

Sewage is treated in different stages:

1. Primary treatment: the primary treatment can reduce the BOD (biochemical oxygen demand) of the sewage by about 40% during this treatment the solid matter and suspended particles are removed away.
   Processes included:
   i/ screening = sewage passes through a sieve which screens out bulky solid matter such as bottles, paper, sticks and plastic bags
   ii/ removing grit = the ‘filtered’ sewage flows along a grit chamber to allow heavy particles settle out at the bottom as grit which is then removed away
   iii/ sedimentation = the suspension flows from the grit chamber into the sedimentation tank where the large particles of organic matter settle down at the bottom as primary sludge, the supernatant liquid is called effluent

2. Secondary treatment: during this treatment, the organic matter in effluent is oxidized to harmless inorganic matter.
   the effluent introduced into the aeration tank is aerated by the bubbling of compressed air through the fluid:
   this encourages the growth of bacteria and protozoa in a thin layer of sludge which consume much of the organic matter of the sewage.

3. Tertiary treatment: in some countries, chlorine was added into the effluent before discharged into the river.

4. Sludge digestion chamber: also called fermentation tank:
   the sludge rich in organic matter and very bulky, they undergoes anaerobic decomposition here and produces methane:
   methane can be used as fuel for power generation in some countries.
of the remains of sludge can be dried to reduce the transportation cost, and may use as fertilizer or soil conditioner but for those containing pathogens, toxic industrial wastes or heavy metals are better used for reclamation of land.

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**Fig. 2** Simplified flow diagram of a sewage treatment plant.

**C. Control of agricultural and industrial effluent :-**
Laws are set up to restrict the sewage discharged from farms and industries and also move the farms and factories away from the town centre. So that the disturbance from them to the citizens can be minimized.

**D. Education :-**
The public should be educated through mass medium to arouse the public the sense of responsibilities and citizenship to maintain a clean environment which they are living and consume less resources.

**E. Legislation :-**
Air quality: designation of Air Control Zones (ACZ)
- control pollutant emissions from stationary sources within ACZ
- reduces sulphur dioxide emissions by prohibiting the use of liquid fuels containing more than 0.5% by weight of sulphur, or of solid fuel containing more than 1% by weight of sulphur
- restricts emission of dark smoke from stationary combustion sources and vehicles
- regulate certain specified industrial processes which may cause serious air pollution, e.g. the cement works on Lamma Island
- controls the production and supply of ozone depleting substances, such as CFCs, in order to minimize their use and release into the environment

Wildlife: protection of endangered animals and plant species
- regulates the import, export and possession of endangered species
Human Activities and the Environment

Water quality: designation of Water Control Zones (WCZ)
- prohibit discharge of poisonous materials into water anywhere in Hong Kong
- controls discharge of effluent other than domestic sewage in WCZ
- establishes the water quality objectives within Deep Bay, Junk Bay, Mirs Bay, Port Shelter, Tolo Harbour WCZs with respect to aesthetic appearance, bacteria colour, D.O., pH, temperature, salinity, suspended solids, ammonia, nutrients, BOD, dangerous substances, phenol and turbidity
- prohibits dumping of wastes at sea without a license
- prohibits livestock keeping in urban areas and provides for control over the discharge or deposit of livestock wastes in designated control areas

Noise control: restricts and reduces the annoyance caused by noises from construction sites, industrial and commercial premises
- When the sound is over 120dB, we feel pain of the ear, below is the table showing the sound level in different conditions

<table>
<thead>
<tr>
<th>Sound</th>
<th>Level dB</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jet take off at 30m</td>
<td>140</td>
<td>Temporary deafness</td>
</tr>
<tr>
<td>Screaming in someone’s ear</td>
<td>110</td>
<td>Unpleasant</td>
</tr>
<tr>
<td>Noisy machine in a factory</td>
<td>100</td>
<td>Uncomfortable</td>
</tr>
<tr>
<td>Telephone at 1m</td>
<td>80</td>
<td>Annoying</td>
</tr>
<tr>
<td>Normal conversation</td>
<td>60</td>
<td>Ordinary environment</td>
</tr>
<tr>
<td>Ideal library</td>
<td>30</td>
<td>Very quite</td>
</tr>
<tr>
<td>Total absence of sound</td>
<td>0</td>
<td>May cause hallucination due to sensory deprivation</td>
</tr>
</tbody>
</table>

Waste disposal: provides control and management of the collection, removal, treatment and disposal of wastes
- provides the control of chemical wastes; all chemical wastes must be collected and transported by licensed collectors, and required to be treated and disposed of at licensed facilities

F. Research:
- Doing researches to find out new conserving measures. Quite a number of researches is going on at the experimental farms e.g. Tai Lung Farm and Kadoorie Farm.

G. Population control:
- Since a larger population exerts a greater pressure on the environment, controlling the population is also an effective measure of conservation.
Suggested solution to the Exercise

(94 I 6a)
Non-renewable resources are resources of which their abundance is limited / finite [1/2] and which cannot be replaced / recycled. [1/2] Their continued use will result in exhaustion, [1/2] with harmful social and economic consequence [1/2].

(95 II 3a)
Soil texture [½] - determined by proportion of clay : silt : sand [1] which affects support a soil can offer to plants [½], porosity and capillarity [½], a loam soil is best for plant growth [½].


Capillarity [1/2] - affects the ease with which water is pulled to the roots for absorption [1]

Soil colour / temperature [1/2] - a dark soil keeps more heat than light soil [1/2].
Temperature directly affects root growth by its effect on metabolic rate [1/2] temperature also affects microbial activity [1/2] hence nutrient availability [1/2]

* Alternative headings are acceptable < max. 7 >

(95 I 4c)
Causes of greenhouse effect - accumulation of carbon dioxide and methane / hydrocarbon gases in the atmosphere [1/2] which traps heat reflected from the earth's surface [1/2].
Causes of ozone depletion - gases such as CFC / halons enter into the stratosphere [1/2] irreversibly react with ozone molecules breaking them to oxygen gas [1/2]

(94 I 6b)
Eutrophication is a process whereby a water body becomes enriched with nutrients [1/2] (inorganic and organic materials) at rates which cannot be assimilated. [1/2] This causes an increase in the growth of aquatic plants [1/2] which then results in unfavourable changes to water quality. [1/2]