



香港開放教科書
Open Textbooks
for Hong Kong

- *Free to use.*
自由編輯運用
- *Free to change.*
共享優質課本
- *Free to share.*

BIOL S301 Conservation and Biodiversity (Free courseware)



香港公開大學
THE OPEN UNIVERSITY
OF HONG KONG



© The Open University of Hong Kong, 2009, 2011



[This work is licensed under a Creative Commons-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/)

Contents

Chapter 1 Hong Kong biodiversity: Case studies	1
1.1 About this module	1
1.2 Introduction	1
1.3 Country park management strategies	2
1.3.1 Activity 1.1	3
1.3.2 Defining the country park management challenge	3
1.3.2.1 Activity 1.2	4
1.3.3 The country park management challenge: a case study	5
Video tour	6
1.3.3.1 Activity 1.3	7
1.3.3.1.1 Activity feedback	7
1.3.4 Hong Kong's country park management challenge in a global context	9
1.3.4.1 Reading 1.1	9
1.3.5 The response: management strategies	10
AFCD management principle 1	10
AFCD management principle 2	11
AFCD management principle 3	12
1.3.5.1 Activity 1.4	13
1.3.5.1.1 Activity feedback	13
1.3.6 The result: Improved countryside ecology?	16
Features and achievements of the AFCT in country park management	16
1.4 Marine park management.....	18
Marine park management	18
Virtual tour: Tung Ping Chau and Hoi Ha Wan	19
1.4.1 Readings in marine ecology	21
1.4.1.1 Reading 1.2	21
1.4.1.2 Reading 1.3	25
1.4.1.3 Reading 1.4	25
1.4.1.4 Activity 1.5	26
1.4.1.4.1 Activity feedback	27
1.4.2 Geological diversity in Hong Kong.....	28
1.4.2.1 Natural geological resources of Tung Ping Chau	28
1.4.2.2 Geo-attractions at Hoi Ha Wan.....	30
1.4.2.3 Geological conservation	31
1.4.2.4 Activity 1.6	31
1.4.2.4.1 Activity feedback	31
1.5 References.....	33
1.6 Conclusion	35

Chapter 1 Hong Kong biodiversity: Case studies

1.1 About this module



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Welcome to this free courseware module 'Hong Kong biodiversity: Case studies'!

This module is taken from the OUHK course [BIOL S301 Conservation and Biodiversity](http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcGenericPage2010&c=C_ETPU&cid=191149104400&BODY=tcGenericPage), (http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcGenericPage2010&c=C_ETPU&cid=191149104400&BODY=tcGenericPage) a five-credit, higher level course that is part of the BSc /BSc (Hons) in Environmental Studies programme and the BSc in Applied Science programme, both offered by the [School of Science and Technology](http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcSubWeb&l=C_ST&lid=191133000200&lang=eng) (http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcSubWeb&l=C_ST&lid=191133000200&lang=eng) of the OUHK. This course helps you to expand the much-needed minority of citizens who know what conservation and biodiversity are.

BIOL S301 is delivered via a blended approach to learners and comprises five study units. Each unit contains study content, activities, self-tests, assigned readings, etc for students' self-learning. **This module (The materials for this module, taken from the print-based course BIOL S301, have been specially adapted to make them more suitable for studying online, and multimedia elements have been added where appropriate. In addition to this topic on 'Hong Kong biodiversity: Case studies', which is an extract from Unit 4 of the course, the original Unit 4 also includes the topics 'Urban parks and conservation', and 'Biodiversity and ecotourism'.) retains most of these elements, so you can have a taste of what an OUHK course is like. Please note that no credits can be earned on completion of this module. If you would like to pursue it further, you are welcome to enrol in [BIOL S301 Conservation and Biodiversity](http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcGenericPage2010&c=C_ETPU&cid=191149104400&BODY=tcGenericPage) (http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcGenericPage2010&c=C_ETPU&cid=191149104400&BODY=tcGenericPage)**

This module will take you about **eight hours** to complete, including the time for completing the activities and self-tests (but not including the time for assigned readings). Owing to copyright issues, textbook and assigned readings are not included in the free courseware.

Good luck, and enjoy your study!

1.2 Introduction



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

In this module, we will examine the following themes:

1. Country park management strategies, with particular attention to the huge Sai Kung East Country Park.
2. Marine park management situations, challenges and opportunities, with case studies of:
 - a. Tung Ping Chau; and
 - b. Hoi Ha Wan.

Biodiversity is perhaps the hottest topic in ecology textbooks and courses worldwide today. One very basic (core) objective of country park management is to conserve biodiversity.

1.3 Country park management strategies



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

The HKSAR is blessed with 41,000 hectares of country parks. This translates to Hong Kong having 63.7m² of country park per person. Of course, the people of Hong Kong and its numerous visitors will not go into a country park and occupy 'their' 63.7 m². This park area per person idea was presented to underscore one of the outstanding ecological services performed by plants which are essential parts of the vegetated ecosystems which make up and maintain the extensive country park system. As you can easily imagine, 41,000 ha is a huge area to manage. A typical small Hong Kong apartment with one kitchen area, a living room, toilet/bathroom and two small bedrooms is about 620 ft², which is only 57.6m², or therefore 0.576% of one hectare: very, very small. It takes some regular and well-planned effort to manage (to look after) a small apartment. To look after 41,000 ha or 410 square kilometers is no easy task.

Park managers are charged with the stewardship of 41,000 ha of varied landscape, dynamic geomorphology, many different types of habitat, 1,920 species of native flowering plants, 360 bryophytes ([mosses](http://en.wikipedia.org/wiki/Moss) (<http://en.wikipedia.org/wiki/Moss>) and liverworts), 215 [ferns](http://en.wikipedia.org/wiki/Fern) (<http://en.wikipedia.org/wiki/Fern>), 450 birds and 50 mammals and many other [vertebrates](http://en.wikipedia.org/wiki/Vertebrate) (<http://en.wikipedia.org/wiki/Vertebrate>), numerous [invertebrates](http://en.wikipedia.org/wiki/Invertebrate) (<http://en.wikipedia.org/wiki/Invertebrate>) (30,000+) all distributed within a whole range of ecosystems at many stages of ecological succession, rehabilitation and health. To this known biodiversity we can add the inadequately studied, the ignored and the unknown. Included in this latter category are the decomposers: those ecologically vital organisms described as [bacteria](http://en.wikipedia.org/wiki/Bacteria) (<http://en.wikipedia.org/wiki/Bacteria>) and [fungi](http://en.wikipedia.org/wiki/Fungi) (<http://en.wikipedia.org/wiki/Fungi>) and studied by microbiologists and mycologists. There are substantial numbers of macro and microscopic fungi in Hong Kong but only a minority have been studied. Likewise, very few bacteria (and most are not pathogenic i.e. harmful disease-causing) have been studied in ecological terms where they, with the fungi, perform essential functions as decomposers in biogeochemical cycles. This lack of study is evident in the currently available data from the biodiversity survey of Hong Kong as even a quick inspection of this data in this [Activity 1.1 \(Page 3\)](#) will reveal.

1.3.1 Activity 1.1



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Visit the webpage provided by the [University of Hong Kong's Biodiversity Survey \(http://www.biosch.hku.hk/ecology/bs/\)](http://www.biosch.hku.hk/ecology/bs/) .

Inspect [Table 2 \(http://www.biosch.hku.hk/ecology/bs/pages/html/table2.html\)](http://www.biosch.hku.hk/ecology/bs/pages/html/table2.html) , and see that fungi and bacteria do not get a mention.

The biodiversity database is good as far as it goes, but you will find that the database lacks a stand-alone quality and you will be deflected to other sources e.g. PhD or MPhil thesis or papers in journals such as the Memoirs of the Hong Kong Natural History Society. The latter is a very good source of local biodiversity studies, but may not be easy to access. We have some editions in the OUHK library.

The table does, however, give you a summary of some of Hong Kong's quite impressive biodiversity. Take care to note, too, that this table records the non-marine species. I do not know why the rather outstanding marine macro-algae of Hong Kong's coasts are left out, and find this surprising as the seasonality and interesting combinations of temperate and tropical algae are an outstanding part of the biodiversity of the HKSAR. We will look at marine algae again in this module when we visit Tung Ping Chau and this will help to rectify these shortcomings. I am surprised, too, that those important bio-indicators of air pollution, the [lichens \(http://en.wikipedia.org/wiki/Lichen\)](http://en.wikipedia.org/wiki/Lichen) are neglected in this HKU biodiversity survey. Professor K C Ho has conducted lichen surveys from OUHK; there is an attractive book on Hong Kong lichens ([Thrower 1988 \(Thrower, S L \(1988\) Hong Kong Lichens, Urban Council.\)](#)) which recorded 200 species twenty years ago; this was extended to 261 in 1999 ([Aptroot and Seaward 1999 \(Aptroot, A and Seaward, M R D \(1999\) 'Annotated checklist of Hong Kong lichens', Tropical Bryology, 17: 57-101.\)](#)). All this work on lichens has been done and should therefore appear in a biodiversity data bank such as that provided by HKU.

1.3.2 Defining the country park management challenge



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Clearly, even from the uncompleted biodiversity survey (such as the one you surveyed in the [Activity 1.1 \(Page 3\)](#)) you can see that the management challenge facing park managers in Hong Kong is huge. They need your participation and contribution because, as you will observe as these last two units unfold, management strategies in the 21st century are moving towards cooperation and participation between both public (government) and private (non-government) sectors throughout the region.

As we write, the story of biodiversity in the HKSAR continues to grow: new lists are compiled and new species are added. [The Agriculture, Fisheries and Conservation Department \(AFCD\) \(http://www.afcd.gov.hk/\)](http://www.afcd.gov.hk/) is especially active and has created some excellent publications to keep the people of Hong Kong and beyond informed,

as new pages in the expanding story of biodiversity unfold. We invite you to visit the AFCD's colourful and inspiring newsletters entitled Hong Kong Biodiversity as often as you like from now on.

Let try [Activity 1.2 \(Page 4\)](#).

1.3.2.1 Activity 1.2



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Please make a visit (your first perhaps of many) to the [AFCD's Hong Kong Biodiversity site \(http://www.afcd.gov.hk/tc_chi/conservation/hkbiodiversity/hkbiodiversity.html\)](http://www.afcd.gov.hk/tc_chi/conservation/hkbiodiversity/hkbiodiversity.html).

Take a look at [Hong Kong Biodiversity AFCD Newsletter Issue No. 16 December 2008 \(http://www.afcd.gov.hk/english/conservation/hkbiodiversity/newsletters/files/IssueNo16.pdf\)](http://www.afcd.gov.hk/english/conservation/hkbiodiversity/newsletters/files/IssueNo16.pdf) and inspect the feature article entitled 'Current status of dragonflies (Odonata) and their representation in protected areas in Hong Kong' by the Dragonfly Working Group.

This article displays beautiful dragonflies and in Table 1 lists eight new species recorded in Hong Kong since 2003. Now isn't that impressive! I recall an incident once at an EIA presentation on Kau Sai Chau related to the Public Golf Course Development (1994–1995) when a businessman scoffed at ecologists worried about insect surveys, including dragonflies. The businessman thought that dragonflies were of no importance to golf courses or to ecology. But he was very wrong! Not only is Hong Kong famous for its dragonfly diversity, these large, attractive insects play important roles in ecosystems. Dragonflies matter! [Primack \(2000\) \(Primack, R B \(2000\) A Primer of Conservation Biology, 2nd edn, Sinauer Assoc. Inc.\)](#) reminds us (if we need reminding, as the Kau Sai Chau businessman did) that these large, aquatic insects are so important to wetlands that in Japan teams of teachers, children and parents have built over 500 dragonfly ponds next to schools and parks to provide habitat (and, we should add, enhance ecological health) for these and associated species. Some recent, rather subtle ecological research with tree frogs in Pennsylvania (USA) demonstrated how dragonfly larvae (acting as predators) influenced ecology and natural selection (micro-evolution) in tree frog tadpoles ([Relyea 2002 \(Relyea, R \(2002\) 'Local population differences in phenotypic plasticity: Predator induced changes in wood frog tadpoles', Ecological Monographs,72: 77–93.\)](#)).

So, the message here is that our AFCD in Hong Kong are 100% correct in showing concern for and conducting active research on our dragonfly biodiversity and the many other taxonomic groups that contribute to our regional biodiversity.

If you are still near your computer and have Newsletter Issue No. 16 close at hand, scroll down to Table 2. Take a look at the far right hand column, 'No. of sites within protected areas / total no. of sites recorded.' This column illustrates very strongly how important our protected areas (country parks + special areas + sites of special scientific interest) are to biodiversity conservation. You will notice too, I'm sure, that many dragonflies have a local status of UC or R i.e. uncommon or rare.

Please visit www.hkbiodiversity.net (http://www.afcd.gov.hk/tc_chi/conservation/hkbiodiversity/hkbiodiversity.html) at any time you like.

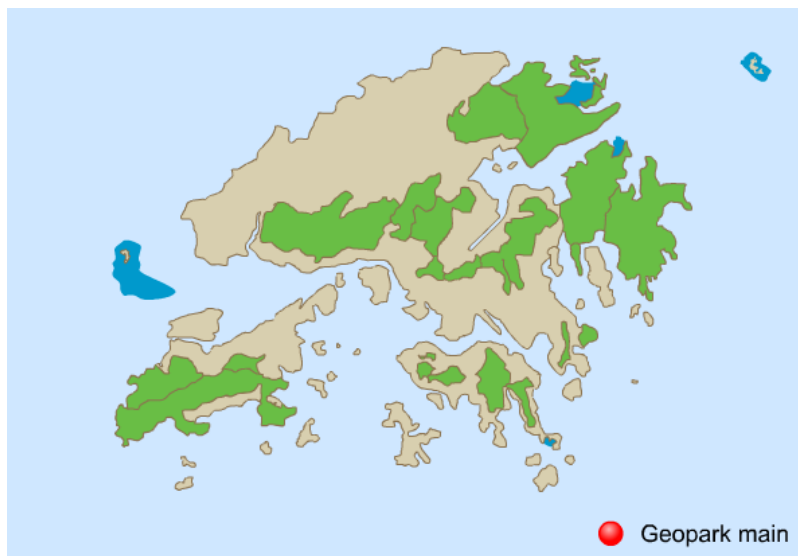
Hint: As you study this module, you may want to keep one browser window or tab open to this module and the other to the AFCD Biodiversity Newsletter Issue site.

1.3.3 The country park management challenge: a case study



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Now it's time to return to the park management challenge and in more detail. For this study we choose one of the biggest country parks in Hong Kong, Sai Kung East Country Park which is 4,477 ha in size. To give you perspective and some comparisons, the map in the following video shows the locations of Hong Kong's country parks, marine parks and the new geopark, and their sizes in ha.



Click this link to watch the video:

http://www.opentextbooks.org.hk/system/files/resource/1/1518/1526/media/biols301-01-The_country_park_management_challenge_a_case_study.mp4

Now just before we develop the scope of the management strategies of these big pieces of real estate called country parks, perhaps you would like to take a tour and 'visit' some of Sai Kung East Country Park. You can! We have uploaded a segment of the OUHK TV broadcast video entitled 'Hills, coasts and streams' which features some of the landscape, habitats and biodiversity present. Take a look now.

Video tour

The following video segment introduces you to the landscape of Sai Kung East Country Park, with a special feature on the appearance of a rare and special flower.



Click this link to watch the video:

http://www.opentextbooks.org.hk/system/files/resource/1/1518/1526/media/FormatFactoryu4_video1~2.mp4

I will assume that you have accepted this 'on tour' opportunity and would like therefore to invite you to attempt an activity based on this tour. To further enhance this activity we will also supply you with access to the reading entitled, 'The geological and geomorphological attractions of High Island.'

Attachment: [The geological and geomorphological attractions of High Island. \(http://www.opentextbooks.org.hk/system/files/resource/1/1518/1526/media/The%20geological%20and%20geomorphological%20attractions%20of%20High%20Island.pdf\)](http://www.opentextbooks.org.hk/system/files/resource/1/1518/1526/media/The%20geological%20and%20geomorphological%20attractions%20of%20High%20Island.pdf)

You can now try [Activity 1.3 \(Page 7\)](#) and check the [Activity feedback \(Page 7\)](#) afterward.

Let's now move on to an appreciation of the challenges posed Sai Kung East Country Park. To appreciate this fully, and to approach it scientifically as a well trained AFCD officer, we need to call up our holistic perspective. How could we do this? One way, and a good way, would be to keep a comparative and at least partly worldwide view in mind. Can you now guess what sort of ideas should be in our mind at this point?



1.3.3.1 Activity 1.3



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Identify the ecological and biodiversity challenges and opportunities of Sai Kung East Country Park.

1. Imagine that you are an officer with the AFCD and that your boss, the Senior Conservation Officer in charge of the huge Sai Kung East Country Park, has asked you to devise a list of:
 1. ecological
 2. geomorphological (landscape), and
 3. biodiversity 'hot species' resources for this park. The list is to be given to a post-graduate student (perhaps like you in the near future) to help him/her conduct a conservation and biodiversity update/reassessment of Sai Kung East Country Park.
2. The list need not be too detailed. (It is a list after all) but you should try to put some reasons or short explanations and comments in parenthesis () as you think fit.

There is feedback for this activity, but please make *your* own effort before you check it.

1.3.3.1.1 Activity feedback



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

1. Ecological resource list
 - a. Habitat and geomorphological diversity

- steep slopes vegetated (expect species differences; some may be useful in eco-restoration of eroded slopes)
 - steep slopes eroded (with landslides/slips)
 - unweathered rock faces (pioneer species)
 - weathered rock faces (early succession species)
 - plants on tuff (geochemical differences)
 - plants on basalt (geochemical differences may indicate biological differences)
 - steep grade streams (fast flowing, less stable; see video clip from Hong Kong Habitats 'Hills, coasts and streams')
 - boulder-dominated stream beds
 - fine, sediment-dominated stream beds (as above for gentle-grade streams)
 - sunny hillside habitats (high light/photon tolerant)
 - shaded hillsides (leaf size ecotypes)
 - estuarine streams (saline influence; mangroves and halophytes)
 - disused paddy fields
 - tree trunks as microhabitats (bracket fungi and epiphytes)
- b. biodiversity 'hot species'
- Bryophyte societies on moist, sheltered sites (TCM and 'lower plants' – non-vascular)
 - fallen trees from Typhoon York (Sept 1999) and their own microhabitat diversity combinations (ecorecovery indicators)
 - Chinese New Year Shrub (CNYS) societies on shallow, acidic soils of upper exposed, wind-swept slopes (culturally important plant species) (The CNYS is a protected species under Forestry Regulations)
 - (CNYS is *Enkianthus quinqueflorus*); recall the video clip of CNYS from Hong Kong Habitats 'Hills, coasts and streams')
 - Chinese Lily (*Lilium brownii*) micro-habitats (precious rare species)
 - *Bruguiera gymnorrhiza*, a mangrove that featured in Jenny Lee's BSc (Hons) thesis in Unit 3 near the Sai Wan village (rare in Hong Kong – at the edge of tropics)

These are a sample of 'hot species.' I am sure that your visits to the AFCD Biodiversity Newsletters and other resources could add to these.

Remember, the aim of this activity is not so much to get the perfect or even near complete answer. The aim is, rather, to enable you to experience the process of being a scientist working under some on-the-job pressure.

You may well be able to expand on the ecological points given in parenthesis.

1.3.4 Hong Kong's country park management challenge in a global context



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Hong Kong is far more than a small southern coastal corner of China. Hong Kong has the eyes of the world upon it. Increasingly, world bodies such as [UNESCO](http://en.unesco.org/) (<http://en.unesco.org/>) also look to Hong Kong for models that could be used to guide the very highly populated Asia tropics in their efforts to use the environment in an ecologically sustainable way as the demands of the 21st century intensify. This idea is expressed in various ways in some recent publications about the conservation of Hong Kong (e.g. [Maxwell and Hung 2008](#) (Maxwell, G S and Hung, C L (2008) 'Diversity in cultural perceptions of ecological resources: Lessons from New Zealand and Hong Kong, China', Proceedings of the UNESCO, Joint Reg. Sem. and CBRN, Jakarta MAB:121–31.); [Yip et al. 2006](#) (Yip, J J, Corlett, R T and Dudgeon, D (2006) 'Selecting small reserves in a human- dominated landscape: Hong Kong, China', Journal of Environmental Mangement, 78: 86–96.); and [Corlett 2009](#) (Corlett, R T (2009) The Ecology of Tropical East Asia, Oxford University Press.)). A particularly good article on this topic is [Yip, J J](#) (Corlett, R T and Dudgeon, D (2006) Yip, J J, Corlett, R T and Dudgeon, D (2006) 'Selecting small reserves in a human- dominated landscape: Hong Kong, China', Journal of Environmental Mangement, 78: 86–96.), 'Selecting small reserves in a human-dominated landscape: Hong Kong, China', Journal of Environmental Management, 78: 86–96. We won't require you to read it for this course, but it's a good resource to look up if you are interested.

Let's now visit and use an earlier resource about cultural perceptions of ecological resources.

1.3.4.1 Reading 1.1



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

'[Maxwell, G S and Hung, C L \(2008\) 'Diversity in cultural perceptions of ecological resources: Lessons from New Zealand and Hong Kong, China](#) (<http://unesdoc.unesco.org/images/0018/001829/182996E.pdf>)', Proc. UNESCO, Joint Reg. Sem. and CBRN, Jakarta MAB:121–31. This reading is presented on pages 121–31 of the UNESCO document, but note that in your .pdf reader, the reading appears on pages 131–141. You are invited to 'tour' any other pages as you wish. As you examine this paper from the point of view of appreciating the nature and scale of the management challenge presented by our huge Sai Kung East Country Park, perhaps give attention to some key points:

- Defining sustainability is not an easy task scientifically.
- EIA is an immature discipline and often not done to acceptable scientific standards.
- Ecology as a science must not be over-pressured by 'Green groups' who can have, as do some developers, rather limited or narrow agendas.

- Hong Kong is not always behind and in need of following so-called 'developed countries.'
- Both Hong Kong and New Zealand have shown clear developmental stages and phases in environmental management.
- Hong Kong today looks upon its country parks as locations which enhance the quality of life. This view is a paradigm shift from the earlier, post-World War Two view of country parks as sites requiring slope and soil erosion control and or as catchment landscapes for water supplies.
- Management today involves re-vegetation of degraded slopes and habitats with species native to Hong Kong and southern China in tune with the regional biogeography and ecology.

1.3.5 The response: management strategies



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

AFCD responds to the challenge of country park management by approaching it in a systematic and scientific manner.

This management strategy is based on a number of management principles. These include:

AFCD management principle 1

A comprehensive understanding of Hong Kong's natural environment

Having a good picture and comprehensive understanding of the Hong Kong natural environment, which means the landscapes beyond the urban area. It has been said that the Chinese expression for landscape is *shan shui*. Translated this means 'mountains water.' The AFCD strives to maintain its knowledge of 23 country parks. The landscapes are diverse and involve the interactions between mountains and water. *Shan shui* is a phrase that captures this idea beautifully. The climate which helps to modify the underlying geology that characterize the rocks of Hong Kong is a mixture of tropical extremes and subtropical influences e.g. we experience typhoons in summer and cold snaps in winter. Hills dominate much of the countryside managed by the AFCD; yet these hills are dissected by valleys, steep and gentle slopes, permanent and seasonal streams and flood plains. Collectively, these diverse landscapes provide diverse habitats; which in turn help to provide and sustain our impressive biodiversity. AFCD's management strategy is mindful of this principle of landscape diversity.

The following video clip illustrates how crucial slope maintenance is in Hong Kong's country parks.

Click this link to watch the video:

http://www.opentextbooks.org.hk/system/files/resource/1/1518/1530/media/u4_video2.mp4

AFCD management principle 2

Strategically-located management centres supported by an 'army' of conservation managers and specialists

Having management centres dispersed at strategic locations within or close to country parks, e.g. [The Sai Kung East Country Park \(http://www.afcd.gov.hk/english/country/cou_vis/cou_vis_cou/cou_vis_cou_ske/cou_vis_cou_ske.html\)](http://www.afcd.gov.hk/english/country/cou_vis/cou_vis_cou/cou_vis_cou_ske/cou_vis_cou_ske.html) has the Pak Tam Chung Management Centre (PTCMC) right beside the road entrance to this huge park, on Tai Mong Tsai Road, Sai Kung. The PTCMC is managed by a Senior Field Officer of the AFCD. Nearby, there is a well-designed and usefully resourced visitor centre staffed by uniformed AFCD officers who provide advice and information to any people who may wish to visit some of the open-air attractions available in the 4,477 ha of the scenic Sai Kung East Country Park. Perhaps you would enjoy and benefit from a review of the country park landscapes by looking at Reading 5.5 in Unit 5 of S122. You may recall that Dr Wong Fook-ye outlined and described the many geomorphological features that can be seen in country parks. This he did in a style of using our country parks as a teaching laboratory – an outdoor, real, dynamic 'lab'; not a virtual lab inside a computer!

These AFCD management centres are not only led by trained conservation and park officers these teams are supported by an 'army' of conservation managers and specialists back in the AFCD Head Office at Cheung Sha Wan Government Offices, Cheung Sha Wan Road, Kowloon. The following list will give you a good idea of the sort of roles played and jobs done by AFCD in country park management:

- Assistant Director (Country and Marine Parks)
- Assistant Director (Conservation)
- Senior Country Parks Officers (SCPO) (North West)
- SCPO (Wetland and Fauna Conservation)
- Senior Conservation Officer (SCO)
- Conservation Officer (CO)
- Country Parks Management Officer (CPMO)
- Country Parks Ranger Officer (CPRO)
- Senior Field Officer / Field Officer (SFO/FO)
- Nature Education Officer (NEO)
- Nature Education Assistant (NEA)

Some of these positions may have specialist designations, e.g. CO (Flora) would be a Conservation Officer who specializes in plants, especially trees and shrubs, that are native to the HKSAR.

From this list alone, you can deduce some of the strategies and functions of AFCD. There are those which focus on conservation management and there are those which focus on education, and those concerned with research such as herbarium and nursery based activities. All posts and roles are integrated into the holistic aim of conserving our natural resources and managing them in a way that facilitates long term conservation, recreation and education in all areas related to biodiversity conservation. Such management needs to respond to region-wide social and economic considerations for the benefit and enjoyment of the present and future generations of the Hong Kong communities (Jim and Wong 2006 (Jim, C Y and Wong, F Y (2006) 'An evaluation of the country parks system in Hong Kong since its establishment in 1976', chapter 4 in Jim, C Y and Corlett, R T (2006) Sustainable Management of Protected Areas for Future Generations, IUCN, WCPA, FOCP, Hong Kong.)).

The following video clip gives you an example of one way the AFCD tries to educate the people who use Hong Kong's Country Parks – and consider how they might do even better.

Click this link to watch the video:

http://www.opentextbooks.org.hk/system/files/resource/1/1518/1530/media/u4_video3.mp4

AFCD management principle 3

An effective infrastructure

Maintaining an infrastructure which enables AFCD to do their many jobs and the people of Hong Kong to access the parks for recreation, education and, increasingly, for quality of life and health enhancement reasons. Recent studies have shown that Hong Kong country parks are amongst the most often visited in East Asia (Southeast Asia, China and Japan) (Jim and Wong 2006 (Jim, C Y and Wong, F Y (2006) 'An evaluation of the country parks system in Hong Kong since its establishment in 1976', chapter 4 in Jim, C Y and Corlett, R T (2006) Sustainable Management of Protected Areas for Future Generations, IUCN, WCPA, FOCP, Hong Kong.)) and perhaps in the Asia Pacific (Maxwell and Hung 2008 (Maxwell, G S and Hung, C L (2008) 'Diversity in cultural perceptions of ecological resources: Lessons from New Zealand and Hong Kong, China', Proceedings of the UNESCO, Joint Reg. Sem. and CBRN, Jakarta MAB:121–31.)). In the two years 2004–2005 over 12 million visitations were recorded for

HKSAR country parks. This represents a six-fold increase since 1976/77. Between 1994/95 and 2002/03, the numbers have been close to 10.5 million per year (Jim and Wong 2006 (Jim, C Y and Wong, F Y (2006) 'An evaluation of the country parks system in Hong Kong since its establishment in 1976', chapter 4 in Jim, C Y and Corlett, R T (2006) Sustainable Management of Protected Areas for Future Generations, IUCN, WCPA, FOCP, Hong Kong.)). This trend is likely to increase as even without the unwelcome SARS episode, more and more people of all ages stages and socio-economic levels are coming to value the green, 'lungs of Hong Kong,' which are the country parks. What sort of infrastructure would you expect to be held responsible for if you were, say, a SCO (services) within the AFCD?

After exploring the key links related to the AFCD's strategy, it's time for Activity.

1.3.5.1 Activity 1.4



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Think about what you would expect to have as a park visitor interested in access to scenic vistas, fresh air, stands of vegetation and picnic or BBQ sites in a big country park such as Sai Kung East.

You may want to take a look back at the [AFCD's information on this park](http://www.afcd.gov.hk/english/country/cou_vis/cou_vis_cou/cou_vis_cou_ske/cou_vis_cou_ske.html) (http://www.afcd.gov.hk/english/country/cou_vis/cou_vis_cou/cou_vis_cou_ske/cou_vis_cou_ske.html) to see what is currently available.

Now make a checklist of ideal infrastructure/facilities under any set of sub-headings you think suitable. Try to think like a strategic (and generous) SCO. As usual, there is feedback for the activity, but the value of the feedback grows if you do your thinking, brainstorming, writing and emailing (some classmates) first.

1.3.5.1.1 Activity feedback



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Towards an ideal country park infrastructure: Assets, facilities and services

Physical infrastructure

1. Paths: footpath network for all seasons and all weather = an access system + a safety back-up network (There are at least 615 km of foot paths in country parks).
2. Hiking, tramping, cross-country walking trails: most appear on topographic maps and several excellent books e.g. Yang et al. (2002) (Yang, K Y, Ngar, Y N and Lock, N Y (2002) *New Viewpoints – Country Parks in Focus*, FOCP.) (<http://www.opentextbooks.org.hk/ditatopic/1535#>); Owen and Shaw (2001) (Owen, B and Shaw, R (2001) *Hong Kong Landscapes: Along the MacLehose Trail*, Geotrails Society.) (<http://www.opentextbooks.org.hk/ditatopic/1535#>), Owen and Shaw (2007) (Owen, B and Shaw, R (2007) *Hong Kong Landscapes*, HKU Press.) ([http://](http://www.opentextbooks.org.hk/ditatopic/1535#)

www.opentextbooks.org.hk/ditatopic/1535#); Stokes (2000) (Stokes, E (2000) Exploring Hong Kong's Countryside, AFCD, Hong Kong Tourist Association, HKJC Charities Trust, Exon & ESSO Co.) (<http://www.opentextbooks.org.hk/ditatopic/1535#>) give trail details and lots of environmental information and instructions on how to travel to and from these country parks. In my assessment the best book for biodiversity or natural infrastructural assets, is the colourful, photogenic New Viewpoints, Country Parks in Focus book by Yang, Ngar and Lock – all are (or were) officers of the AFCD.

3. Nature trails: these are walks with a purpose. The purpose is varied reflecting the landscape and nature diversity we have mentioned earlier. These trails are decorated with stations where site interpretation and explanation plates are installed. These plates provide information on flora, fauna, landforms and, where relevant, cultural or historic features in country parks. Here are some examples:
 - In Sai Kung East Country Park a detailed metal plate illustrates the panorama of hills and islands looking south west from High Island Dam towards Pak A and Pak Lap and Town, Bluff and Basalt Islands in the sparkling coastal waters near the entrance to Port Shelter.
 - Pak Sin Leng Nature Trail is 44 km long and allows you to appreciate a spectacular escarpment, dynamic landscapes (landslides and nature repairing landslides with vegetation), Plover Cover Reservoir, sedimentary rocks and active conservation or afforestation.
4. Country Park Visitor Centre (CPVC): We have mentioned the Pak Tam Chung VC and its informative displays of geological history, coastal features, rock types and conservation activities. There are many others such as Tai Mo Shan VC and Tai Mei Tuk VC.
5. Nature education, organic farming, plant displays and combined eco-geo centres. Yes this sounds too good to be true. But there is one; the Lions Nature Education Centre (LNEC). Located at Tsui Hang, Sai Kung this centre occupies 16.5 ha and provides an excellent menu of natural assets all designed with enjoyment and outdoors education in mind. The LNEC has:
 - exhibition halls
 - field displays
 - herbal gardens
 - vegetable demonstration gardens.

(Many young Hong Kongers, especially primary school age pupils, do not have a clear concept of where vegetables come from. They will say 'supermarket' or wet market' if you ask some of them. This LNEC can teach them that even bak choi and choi sum need soil, sun and rain to grow and cultivation by expert gardeners!)

- an arboretum
- fruit trees
- dragonfly ponds
- a bamboo grove
- a nature trail
- a rock and mineral corner with quartzite, granite, chlorite, fluorite, muscovite, feldspar, marble, magnetite and serpentine.

6. Conduct afforestation programmes to repair eroded slopes and prevent further erosion (a result of extreme weather events such as typhoon loads of heavy rain over short time periods.) Use appropriate exotic and where possible native tree and shrub species to re-vegetate degraded sites.
7. Mitigate and prevent unwanted fires. Fire has been one of the worst threats to ecological habitats in country parks (Jim and Wong 2006 (Jim, C Y and Wong, F Y (2006) 'An evaluation of the country parks system in Hong Kong since its establishment in 1976', chapter 4 in Jim, C Y and Corlett, R T (2006) *Sustainable Management of Protected Areas for Future Generations*, IUCN, WCPA, FOCP, Hong Kong.) (<http://www.opentextbooks.org.hk/ditatic/1535#>)). Fire-fighting teams on short stand-by duties are essential infrastructural items. In the longer term, education of park users (the public mostly) to avoid unwanted fires associated with sensitive cultural activities (grave site visits) and behaviour at BBQ sites can bring success and has: before 1985 there were ~300 hill fires per year. Recently (e.g. 2003) the number has been reduced to less than 70 (Jim and Wong 2006 (Jim, C Y and Wong, F Y (2006) 'An evaluation of the country parks system in Hong Kong since its establishment in 1976', chapter 4 in Jim, C Y and Corlett, R T (2006) *Sustainable Management of Protected Areas for Future Generations*, IUCN, WCPA, FOCP, Hong Kong.) (<http://www.opentextbooks.org.hk/ditatic/1535#>)).
8. Control of invasive species The biggest concerns come from plants and one of the worst invaders – enemies of country parks – is the aggressive, exotic, climbing weed, *Mikania micrantha*. (Please visit the AFCD website and look for AFCON 21/2 which is Nature Conservation Practice Note aimed to help you (and any other keen conservation action person!) to clear and control *Mikania*.) Recently, an unwanted animal invader has won AFCD attention. It is the red fire ant; this ant is an aggressive eco-warrior of the nasty kind.

Intellectual infrastructure

1. As you have seen already, the AFCD has published many informative and attractive books about the countryside.
2. Numerous excellent [maps](http://www.afcd.gov.hk/english/country/cou_who/cou_who_map.html) (http://www.afcd.gov.hk/english/country/cou_who/cou_who_map.html) are available. Those in the countryside series using a scale of 1:25,000 (i.e. 1cm on the map = 25,000 cm on the countryside) are ideal for countryside tourism.
3. AFCD [webpages](http://www.afcd.gov.hk/) (<http://www.afcd.gov.hk/>) are extensive and impressive which has several cross-links to publications and other pools of information).

Dream list (wish list)

1. AFCD ecotour leaders available on a 'dial-a-guide' service, with one ecotour leader (ETL) available for every group of 10 tourists.
2. AFCD holiday homes – some government managed and locally owned or village owned holiday retreats, all managed using alternative energy sources and environmentally friendly waste disposal/re-cycling infrastructures.
3. *Outdoor-education* centres in former, now empty remote schools e.g. there is a disused former village primary school at a prime tourist location near Sha Kiu Village, Leung Shuen Wan (High Island), Sai Kung. This would be an ideal outdoor-education centre or outdoor conservation research centre. You could visit this

and make a proposal to the government to invite OUHK to manage an outdoor conservation research centre here: good idea?!

1.3.6 The result: Improved countryside ecology?



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Let's now consider the important question of progress in conservation. We ask, has the challenge presented by managing 41,000 ha of rural landscape been fully appreciated and appropriately responded to? In other words, have the management strategies adopted by the AFCD over the past three decades produced good results? How could these good results be measured? It is very tempting to invite you to attempt an activity here. If this were a lecture, I would pause and ask the class for ideas: How could we assess (or grade) the success of AFCD country park management methods over the past 30 years? What would you say? Well, here is a sample of what I would be very impressed to hear you say. A good, well-executed and scientific country park management strategy would demonstrate many (or all) of many following features and achievements.

Features and achievements of the AFCT in country park management

1. The size of the country parks has increased since the enactment of the Country Park Ordinance (law) in March 1976 when 38,850 ha existed, to just over 41,000 (actually 41,583 ha) ha in 2005 (Jim and Wong 2006 (Jim, C Y and Wong, F Y (2006) 'An evaluation of the country parks system in Hong Kong since its establishment in 1976', chapter 4 in Jim, C Y and Corlett, R T (2006) Sustainable Management of Protected Areas for Future Generations, IUCN, WCPA, FOCP, Hong Kong.)).
2. The diversity of habitats has improved.
3. Sites of special scientific interest (SSSIs) have been promoted. There are at least 41 SSSIs today. Some of these are SSSIs set aside for particular species, e.g. egrets (*Egretta* spp.).
4. Go back and revisit the AFCD newsletter, [Hong Kong Biodiversity \(http://www.afcd.gov.hk/english/publications/publications_con/pub_con_hkbio.html\)](http://www.afcd.gov.hk/english/publications/publications_con/pub_con_hkbio.html)
5. Look for some articles on this topic. They come with excellent photographs.
6. Some very small but outstandingly eco-cultural-historical sites have appeared. The best (in my view) example here is that of Lai Chi Wo which is less than 2 ha in size, but still a precious and famous fung shui wood.
7. Land is precious and scarce in HKSAR, and the AFCD have done well to retain so much of these country parks despite the demand for more land by more people and more industrial development.
8. The biodiversity gap between inside and outside country parks. Many win-win cases fit into this ecologically important group:

- a. Ninety-eight per cent of the montane (upper mountain habitat) forests which are now known to contain rare plant species still awaiting study are inside country parks.
- b. Ninety-four per cent of plantation or mixed forest lies within country parks.
- c. Almost thirty per cent (to date) of the fung shui woodland is in country parks.
- d. Fifty-six per cent of the shrubland lies within country parks. Some of this shrubland occurs on remote uplands on which societies of the culturally important and botanically interesting Chinese New Year shrub grow and decorate these hills with beautiful red and white bell shaped flowers during Chinese New Year (Maxwell 1997 (Maxwell, G S (1997) 'Large flowers in *Enkianthus quinqueflorus* from the hills of Sai Kung East Country Park', *Memoirs of the Hong Kong Natural History Society*, 21: 217-20.)).
- e. The recent joint biodiversity surveys of the HKSAR by South China Botanical Garden (<http://scib.ac.cn/english/index.htm>) , AFCD (Hong Kong Herbarium (<http://www.hkherbarium.net/Herbarium/index.html>)) and HKU have discovered over 100 plant species new to Hong Kong. Most of these were in the country parks of Tai Mo Shan, Pat Sin Leng, Ma On Shan and Lantau.
- f. Non-domesticated mammals are very rare near urban areas or housing estates but they can be seen occasionally in country parks. I have seen the leopard cat and Country Park Officers (park wardens) have regular reports of Chinese porcupines, ferret badgers, small Indian civets, leopard cats, wild boars and muntjacs (*Muntiacus* spp; small deer-like mammals better known perhaps as barking deer). These sightings are most encouraging because mammals like leopard cats are well up the food chain, and they are therefore good indicators of ecological function and ecosystem health.
- g. At Tai Po Kau Nature Reserve (http://www.afcd.gov.hk/english/country/cou_vis/cou_vis_cou/cou_vis_tpk/cou_vis_cou_tpk.html) (only 460 ha in size) there are recorded sightings of 166 different bird species: outstanding for a relatively small nature reserve when the total for all of the HKSAR is 450!

There are more measures of success and to further develop this list, I invite you to seek for some more if you have the time by visiting the AFCD websites with this question clearly in focus in your mind.

We could now go on to ask about the future plans of AFCD. What is the vision that AFCD has for the future? Right now it's appropriate to give our country park a rest and move away from the countryside to the sea. Let's now consider marine parks.

1.4 Marine park management



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

The concept of a marine park is relatively new in Hong Kong, but most welcome and much needed. The core aims of **marine park management** are essentially the same as those designated for country parks, and are designed by the AFCD to promote nature conservation and facilitate outdoor recreation at sites of natural value.

Marine park management

The focus of marine park management is on extending the concepts of country park management into the coastal and immediate offshore marine environments. On a practical, regular basis AFCD officers strive to maintain basic facilities and infrastructure to enable safe, enjoyable park appreciation in as natural ecological setting as possible.

These maintenance activities include both land and marine aspects. In both of the case studies you will encounter in this topic, Tung Ping Chau and Hoi Ha, the marine parks adjoin and merge with country parks. This, beautifully, makes a gentle transition between terrestrial intertidal and maritime ecosystems.

Happily, the closeness of these splendid marine parks of Tung Ping Chau and Hoi Ha to country parks can give the many mainly urban people of Hong Kong genuine access to an interconnected series of excellent ecosystems: terrestrial, littoral and submarine. Thus in one day a keen, active person can embrace vegetated landscapes, intertidal seashore habitats and the world beneath the mean low-tide mark which include corals, spectacular seafishes and sublittoral macroalgae. Together, Tung Ping Chau and Hoi Ha offer an interesting contrast between a rocky underwater seascape (Tung Ping Chau) and a quiet sandy seabed. This choice of contrasting ecosystems is excellent and does much to foster both appreciation of marine life and ecological understanding of the importance of habitat diversity within the coastal waters of the HKSAR.

We shall now look at both Tung Ping Chau and Hoi Ha in some detail and, as we do, the full range of natural resources will be identified. Broadly, these resources of nature include:

- biological diversity;
- ecological diversity, and

- geological diversity.

Some interrelationships between the ecological and the geological will be emphasized. These have recently emerged as a trend in conservation within Hong Kong and the links between eco and geo dimensions of nature can be spectacular.

Virtual tour: Tung Ping Chau and Hoi Ha Wan

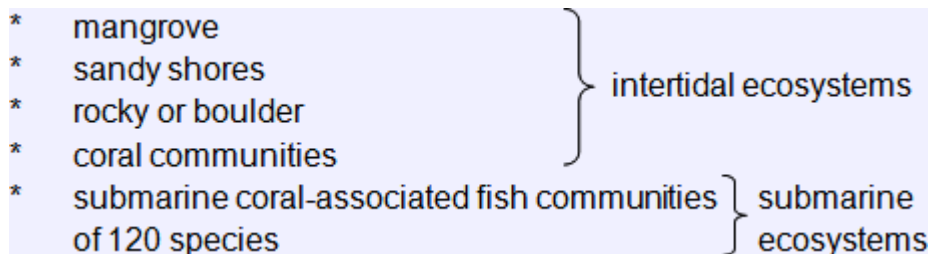
Please now log onto the [AFCD website \(http://www.afcd.gov.hk/eindex.html\)](http://www.afcd.gov.hk/eindex.html).

Click the red flower entitled Country and Marine Parks, see the heading 'Visiting Country and Marine Parks,' select Marine Parks then Designated Marine Parks and Marine Reserve. Now you can see the Tung Ping Chau and Hoi Ha Wan sites. Tour both. I suggest that you visit both parks before you continue with a rather scientific exercise (in the next activity) based mainly on Tung Ping Chau, which will follow your tour and some reading.

As you participate in this virtual tour please notice these points in particular:

- The sizes (in ha) of Tung Ping Chau and Hoi Ha Wan.
- The geographic locations which are exposed to the more saline (salinities > 30ppt or parts per thousand or > 3.0% salt) and good quality waters away from the western influence of diluted sea water and pollutants from the Pearl River estuarine zone.
- Ecosystem diversities: Tung Ping Chau has submarine corals, spectacular algal beds (especially during winter) of around 65 species of green, red and brown algae (see Hodgkiss 1984 and Kong and Ang 2004) in rocky shore ecosystems, and 130 reef-associated fish species.

Hoi Ha Wan has five marine ecosystems. These are:



The biodiversity of Hoi Ha Wan Marine Park is impressive for its 260 ha. Mangroves, corals and a diverse range of marine invertebrates such as sponges, tubeworms, sea urchins and sea cumpers can be found, but (and this is potentially a big but) the conservation status of being only a marine park rather than a marine reserve may make biodiversity conservation at Tung Ping Chau and Hoi Ha Wan difficult

to achieve. Can you suggest why? The fundamental reason is that some recreational fishing permits have been given for people to fish (take top or upper food chain predators from marine ecosystems) at Hoi Ha Wan. Furthermore, it is not always easy to control collecting of living things by children and ecologically-uneducated adults in marine parks.

The following video clip takes you to Hoi Ha Wan itself so that you can see how these principles are being applied, and how some graduates of the OUHK Environmental Studies programme are working to preserve this Park.



Click this link to watch the video:

http://www.opentextbooks.org.hk/system/files/resource/1/1518/1538/media/u4_video4.mp4

The next video takes you 'under the surface' at Hoi Ha Wan; you'll see how efforts are being made to enhance the marine environment with the aim of increasing the Park's biodiversity.



Click this link to watch the video:

http://www.opentextbooks.org.hk/system/files/resource/1/1518/1538/media/u4_video5.mp4

We shall return later to this important conservation question. In the meantime, as a student of environmental studies, please keep this park vs reserve issue in your mind.

With this short virtual tour done, let's now take our conservation to a higher level and consider in depth some of the ecology that lies behind and may be needed to scientifically manage resources like Tung Ping Chau and Hoi Ha Wan marine *parks*, or, in the future, we hope, as marine *reserves*. The higher level work will involve some set reading of three papers in marine ecology followed by a demanding but rewarding activity based on these readings.

1.4.1 Readings in marine ecology



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Please now study each of the following papers about Hong Kong marine ecology. They are arranged in a logical and educationally appropriate sequence

You may panic a bit at your first sight of these three readings, and feel that it will be too much. Don't – you will be given guidance in getting through them.

[Reading 1.2 \(Page 21\)](#) is a nice clear introduction to all the big ideas – it's an exercise in connecting ideas and critical thinking.

[Reading 1.3 \(Page 25\)](#) is solid science about a fantastic place in Hong Kong. The research was done by a former tutor in ecology at the OUHK; she was also awarded an MPhil degree from Chinese University for her excellent study of a red algal species on Tung Ping Chau. This paper may attract you to follow in their footsteps and visit Tung Ping Chau!

The next activity is based on Readings 1.2–1.4 (especially [Reading 1.4 \(Page 25\)](#)). You will find it very rewarding because it provides deep training for you as a conservation biologist/ecologist. Please do your best, and then you will gain much from the detailed feedback.

1.4.1.1 Reading 1.2



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Summary of key ideas and findings from Hodgkiss (1984) 'Seasonal patterns of intertidal algal distribution in Hong Kong'

The condensation of this paper was prepared by the course developer for *BIO S301*. I am sure that you won't mind, as this summary shortens your reading by about eight pages!

Introduction

The paper by Hodgkiss is very good; it's a pioneering paper on intertidal macroalgae

of Hong Kong that demonstrates that although Hong Kong is technically in the tropics, its climate is *not* tropical.

Some biologists seem unsure about what label to give Hong Kong's climate and while happy to describe it as monsoonal in one sentence, they feel they should also acknowledge that 'many, climatologists classify Hong Kong's climate as subtropical' and state this on the same page as they mention monsoonal climate. Some also offer the suggestion that the terms 'wet season' and 'dry season' might be more appropriate for a biologist (Dudgeon and Corlett 2004, 20). This can be confusing for readers. Other biologists are less unsure, and are confident to describe Hong Kong as having a subtropical, highly seasonal monsoonal climate (e.g. Kong and Ang 2004 (Kong, S L and Ang, P O (2004) 'Seasonal occurrence and reproduction of *Hypnea charoides* (Rhodophyta) in Tung Ping Chau, NT, HKSAR, China', *Hydrobiologia*, 512: 63–78.)). Geographers and geomorphologists are also inclined to emphasize the subtropical nature of the local climate (Owen and Shaw 2001 (Owen, B and Shaw, R (2001) *Hong Kong Landscapes: Along the MacLehose Trail*, Geotrails Society).).

The paper from Hodgkiss (1984) (Hodgkiss (1984) 'Seasonal patterns of intertidal algal distribution in Hong Kong', *Asian Marine Biology*, 1: 49–57.) as summarized here gives a very clear set of biological evidence that the seasonality displayed by most intertidal algae supports the notion that Hong Kong's climate is *subtropical*; a point again dramatically demonstrated by winter chill shock events which killed tropical ecotypes of *Avicenniamarina* mangroves (Maxwell 2001 (Maxwell, G S (2001) 'Chill shock tolerance differentials local and Thai ecotypes of *Avicennia marina*', *Memoirs of the Hong Kong Natural History Society*, 24: 205–06.)) and *Sonneratia* spp, another tropical mangrove (Kwok et al. 2008 (Kwok, P W, Tang, W S and Wong, S W (2008) 'The frosting impact on *Sonneratia* in Hong Kong', *Hong Kong Biodiversity, AFCD Newsletter*, 16: 7–9.)). **Main findings**

- Intertidal algal distribution on Hong Kong shores shows that exposure to strong sunlight is the major factor responsible for a clear pattern of seasonality in which most species disappear during the summer (late May, June, July, August);
- Daily duration of bright sunshine varies from 1.4 hours in March to 7.4 hours in July;
- The tides in the South China Sea are mainly diurnal.
- Hodgkiss's data pool is set out in two tables you should examine closely:

Type (division)	Total for year	Summer spp: all summer (1-3 months)	# absent during summer (%)
Green algae (Chlorophyta)	17	3(2)	12(70.5)
Brown algae (Phaeophyta)	20	1(3)	16(80)
Red algae (Rhodophyta)	19	5(1)	13(68)
Blue-green algae (Cyanophyta)	2	0(2)	0(0)
All species total	58	9(8)	41(70.6)

Table 1.1: Algal species numbers recorded and % absent during summer months

Habitat type, within hard shore (not sandy or muddy)	No. of spp		
	Oct-May	June-Sept	% decrease in summer
Exposed	51	12	76
Sheltered	30	7	76
Estuarine	20	8	60
Oceanic	54	13	76
Exposed/estuarine	13	5	62
Exposed/oceanic	48	11	77
Sheltered/estuarine	12	3	75
Sheltered/oceanic	26	4	85

Table 1.2: Number of algal species at different habitats in relation to season (mouth of the year)

Points for thought

- Summer tides and sun: illumination and desiccation on the seashore. During summer in Hong Kong the lowest ebbs of the tide (low tide times) occur between 2 pm and 6 pm. During the cooler weather between November and April the ebbs tend to be between 2 am and 6 am, i.e. when it is cool and approaching sunset. (You might be interested in tides and these can be easily accessed by visiting the tide tables provided by the Hong Kong Observatory. Visit: www.hko.gov.hk or

www.weather.gov.hk . Or, if you prefer, you can purchase a booklet (bilingual) showing tide tables for seven different coastal locations around Hong Kong.) Thus, in summer, the intertidal algae experiences strong afternoon sun for a significant period of time. The temperature and drying (desiccation) effect can be severe. Only nine out of the fifty-eight algae survived for the entire summer! Those on the lower shore experienced less sunset (as you would expect from the daily tidal dynamics) but even short periods of extreme illumination, desiccation and 'slow cooking' at summer temperatures on exposed rocky shore surfaces can cause algal mortality. This has been known for a long time in algal biology (Chapman 1962 (Chapman, V J (1962) *The Algae*, Macmillan and Company, London.); Hock 1982 (Hock, C (1982) 'The distribution of marine algal in relation to temperature regulation of their life histories', *Biological Journal of the Linnean Society*, 18: 81–144.)).

- We may need more studies to distinguish the slight survival differences due to the relative importance of salinity (oceanic saline waters vs estuarine less saline waters), desiccation vs temperature effects and illumination vs temperature effects.

Perhaps you might like to do some follow up research on intertidal algae of Hong Kong. You will have the opportunity to examine this paper as Reading 4.3 soon.

1.4.1.2 Reading 1.3



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Kong, S L and Ang, P O (2004) 'Seasonal occurrence and reproduction of *Hypnea charoides* (Rhodophyta) in Tung Ping Chau, NT, HKSAR, China', *Hydrobiologia*, 512: 63–78.

Attachment: [Seasonal occurrence and reproduction of *Hypnea charoides* \(Rhodophyta\) in Tung Ping Chau, NT, HKSAR, China](http://www.opentextbooks.org.hk/system/files/resource/1/1518/2412/media/Seasonal%20occurrence%20and%20reproduction%20of%20Hypnea%20charoides.pdf) (<http://www.opentextbooks.org.hk/system/files/resource/1/1518/2412/media/Seasonal%20occurrence%20and%20reproduction%20of%20Hypnea%20charoides.pdf>)

Note that annotations from the course developer are provided to help guide your interaction with this paper.

1.4.1.3 Reading 1.4



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Kennish, R, Williams, G A and Lee, S Y (1996) 'Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*', *Marine Biology*, 125: 55–64.

Attachment: [Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*](http://www.) (<http://www.>

opentextbooks.org.hk/system/files/resource/1/1518/2413/media/Algal%20seasonality%20on%20an%20exposed%20rocky%20shore%20in%20Hong%20Kong.pdf.pdf

We've provided a clean copy so that you can read it first and do your own mark-up.

1.4.1.4 Activity 1.5



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Connecting marine biology to the management of Tung Ping Chau's rocky shores

1. The *aim* of this activity is to get you to connect some existing knowledge about rocky shore ecology in Hong Kong to the management and educational value of a particular ecological asset provided by Tung Ping Chau, as a marine park.
2. The *management situation* - Imagine that you are a field studies or Nature Education Officer employed by the AFCD and your boss (an assistant director) has asked you to read the scientific paper provided (Kennish et al. 1996 (Kennish, R, Williams, G A and Lee, S Y (1996) 'Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*', *Marine Biology*, 125: 55–64.)) and then *devise*:
 - a. A *research plan* to compare the findings of Kennish et al. (1996) (Kennish, R, Williams, G A and Lee, S Y (1996) 'Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*', *Marine Biology*, 125: 55–64.) to the comparable situation, which has never been researched, on Tung Ping Chau. *Note*: that the assistant director has put you in charge of Tung Ping Chau's intertidal habitats for two years.
 - b. A simple *field trip guide* that would help middle school (age 12–15) children and senior citizens who wish to visit Tung Ping Chau to learn about rocky shore ecology.
 - c. A *short report* which is a critical analysis of the Kennish et al. (1996) (Kennish, R, Williams, G A and Lee, S Y (1996) 'Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*', *Marine Biology*, 125: 55–64.) paper, pointing out any aspects which could be improved upon if the study was repeated, say, at Tung Ping Chau.

Yes, there is (as promised) very detailed feedback to support your efforts made with this Activity. It is strongly recommended that you do attempt this activity before you read on.

1.4.1.4.1 Activity feedback



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Responding to the paper on Hong Kong rocky shore ecology by Kennish et al. (1996) (Kennish, R, Williams, G A and Lee, S Y (1996) 'Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*', *Marine Biology*, 125: 55–64.).

Your research plan: Considerations!

The plan would include:

1. A field visit at low tide to examine the broad patterns of plant and animal (algal and invertebrate) composition and distribution on the more sheltered A Man Wan coast and the more exposed Lung Lok Shui coast of Tung Ping Chau. Did the zonation pattern described by Kennish et al. (1996) (Kennish, R, Williams, G A and Lee, S Y (1996) 'Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*', *Marine Biology*, 125: 55–64.) for Cape d'Aguilar, Hong Kong Island appear at Tung Ping Chau?
2. Measurement of the shore length at low tide.
3. Drawings/photographs of the shoreline structure, e.g. wave-cut platform, dissected irregular rocky shorescape.
4. Suitability of quadrat sizes: would 50 × 50 cm be adequate at Tung Ping Chau?
5. Abundance of grapsid crab species *Grapsus albolineatus*, if not so abundant then do we have an alternative crab species on Tung Ping Chau?
6. Should we scale down the number of crabs taken, e.g. would the removal of ~10 crabs/sampling visit be biologically bad and harm the ecology of Tung Ping Chau's rocky shore?
7. Describe fully how algal fragments in crab guts were to be identified.
8. Improve on the method/research plan used by Kennish et al. (1996) (Kennish, R, Williams, G A and Lee, S Y (1996) 'Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*', *Marine Biology*, 125: 55–64.) but completing a comparable study over *two* sets of seasons rather than 18 months and conduct the survey on *both* sides of Tung Ping Chau to fully address the possible influences of exposure vs shelter.
9. Take into account that Tung Ping Chau is a marine *park* and, unlike, Cape d'Aguilar on Hong Kong Island which is, today, a marine *reserve*.
10. The findings from such a Tung Ping Chau study may contribute to a move by the government to *change* the conservation status of Tung Ping Chau from marine *park* to marine *reserve*!

Points to improve upon: Critical evaluation for any future work

1. Macroalgal survey used a 'stratified random sampling method' but the details of this were absent. How can sampling really be stratified and random at the same time?

2. How, exactly, were the 15 quadrats (50 cm × 50 cm) randomly located? Were random numbers used?
3. How many substrate types of each kind (rock, pool, crevice, etc.) were studied? Why were these details absent from the research paper?
4. How was the percentage cover calculated? Details please!
5. No mention of conservation of crab numbers, e.g. taking 10 crabs (5 males + 5 females) every month for 7 months may well influence crab population ecology. From a conservation view point, this crab removal action may have a negative impact on crab numbers and the ecology crabs influence. Why did Kennish et al. (1996) (Kennish, R, Williams, G A and Lee, S Y (1996) 'Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*', *Marine Biology*, 125: 55–64.) neglect to address this potential problem?
6. It was not at all clear how the authors of Kennish et al. (1996) paper actually identified the algal fragments from crab gut contents!
7. The details of dietary selectivity were not given. The scientific (not statistical) basis of Vanderploeg and Scavia's (1979) selectivity coefficient were not given. The paper should have a stand alone quality and enable the reader/reviewer to fully appreciate the method, especially one as important as diet selection by the target organism, the crab!
8. More work needed to be done on the taxonomy of the algal species: far too many species were *not* identified, e.g. *Cladophora* spp, *Enteromorpha* spp, *Polysiphonia* spp and some alga were only described as a growth from e.g. crustose corallines.

Finally, even if you thought of just 3–5 of these points, that would be evidence of good thinking. You were not expected to get all of these. The points given in this feedback can be looked upon as a brainstorming conducted session by two or three ecologists.

1.4.2 Geological diversity in Hong Kong



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Earlier in this unit a mention was made of *geological diversity* as well as ecological diversity. Before we leave the marine parks, their rocky shores and island habitats, a brief consideration of another natural resource for which Hong Kong is famous: the geology! Some of my friends and colleagues in the Geotechnical Engineering Office were attracted to Hong Kong *because* of its geological diversity. This diversity can make for substantial town planning challenges. Happily, it also contributes, in some spectacular and beautiful ways, to another type of environmental appreciation known as *geotourism*: welcome to the geo-delights of Tung Ping Chau and Hoi Ha Wan.

1.4.2.1 Natural geological resources of Tung Ping Chau



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Tung Ping Chau is a flat, crescent-shaped island located in Mirs Bay the north-eastern waters of Hong Kong. On Tung Ping Chau a visitor can combine ecological, cultural

(historical) *and* geotourism and enjoy all of this on *one* small island in one inspiring day.

Tung Ping Chau is only about 1 sq. km in area, and nowhere is more than 50 m above sea level. Today 0.83 km² are protected on the land portion of this island (it is an extension of Plover Cove Country Park) and in November 2001 another 2.7 km² surrounding Tung Ping Chau became a marine park. For years, Tung Ping Chau was protected by its remoteness. Today, it has the added protective status of being part of a country park plus a marine park. Geologically, it is made from dolomite siltstone with chert of the Ping Chau Formation. Such rock is not common in Hong Kong, which is typified by volcanic rocks, created by violent eruptions that took place mostly between 165–140 million years ago (Owen and Shaw 2007) rather than rocks like siltstone.

Photo tour

Here is a slideshow of images from Tung Ping Chau.



Click this link to watch the video:

<http://www.opentextbooks.org.hk/system/files/resource/1/1518/2415/media/Biols301%20-%20Geological%20Resources%20At%20Tung%20Ping%20Chau.mp4>

What do *geotourists* come to see and enjoy on Tung Ping Chau? The AFCD have maintained a nice country trail circuit hike around the coastline of Tung Ping Chau. Perhaps the most photogenic and eco-geo feature is the wave-cut platform at Kang Lau Shek on the north-eastern tip of the island. Here you can see, measure, admire and photograph two honey-coloured sea-stacks each about 8 m above sea level (Choi and Stokes 2005 (Choi, N Y K and Stokes, E (2005) 88 Hong Kong Natural Wonders, Pub. FOCP.)). These geomorphological formations are, in effect, monuments to nature's forces of coastal erosion. Here is a thought for you. How do you think that the beautiful platforms were built; what natural forces were creating the geomorphological features and, at times, exposing magnificent rock displays that almost look man-made (e.g. rock fragments that look like cakes from a giant's cake shop in Mong Kok)? Yes, you are correct, it was exposure to strong waves and their ability, overtime, to make world class geo-attractions crafted from these, essentially, sedimentary rocks of dolomite and calcitic shales, marls and siltstones.

1.4.2.2 Geo-attractions at Hoi Ha Wan



Available under [Creative Commons-ShareAlike 4.0 International License \(http://creativecommons.org/licenses/by-sa/4.0/\)](http://creativecommons.org/licenses/by-sa/4.0/).

Hoi Ha Wan has geo-attractions too. These are not as unusual or spectacular as Tung Ping Chau but they are impressive in their own way.

Geologically, Hoi Ha Wan is built upon a very different rock from which Tung Ping Chau was carved. Here, tuffs rule the rocks. Around Hoi Ha they are Rhyolitic crystal tuff. South-east from Hoi Ha near High Island another tuff appears. This is vitric tuff. Tuff is a volcanic rock composed of compacted, medium to fine-grained pyroclastic material which was, in days lost deep in geological history, ejected by volcanic explosion. The term pyroclastic has its linguistic origins in classical terms (Greek meaning 'broken by fine' (Whittow 2000 (Whittow, J (2000) *Physical Geography, Penguin.*)).

However these volcanic explosions last took place ~150+ million years ago. Today, the slow, steady processes of weathering and erosion have given us a landscape made of rocky outcrops visible even on the mostly quiet, peaceful, sandy shores at the landward end of Hoi Ha Wan. The surrounding hills of Hoi Ha Wan also display attractive rocks which sit like monuments to the past giving us confidence for the future as well as links with the geological history of Hong Kong.

Photo tour

Here is a slideshow of images from Hoi Ha Wan.



Click this link to watch the video:

<http://www.opentextbooks.org.hk/system/files/resource/1/1518/2416/media/Biols301%20-%20Geo-attraction%20At%20Hoi%20Ha%20Wan.mp4>

The ambiance created by the landscape surrounding Hoi Ha Wan provide aesthetic power to the presence of a marine park. Ecologically, the stability bestowed by these solid tuffaceous rocks helps to sustain the landscape on which a vegetated ecosystem which covers the hills of Hoi Ha can develop.

1.4.2.3 Geological conservation



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

From our brief mention of the geological aspects of both Tung Ping Chau and Hoi Ha Wan we can appreciate the interconnections of *geo* and *eco* components of natural resources which are the basis of the holistic conservation concerns in the country and marine parks of Hong Kong. There is a movement today in Hong Kong to promote geological conservation. [The Association for Geoconservation Hong Kong](http://www.rocks.org.hk/en/index.php) (<http://www.rocks.org.hk/en/index.php>) writes letters to the papers on this topic. A number have been published in the *South China Morning Post*, e.g. on 24 August 2009 a letter by Cindy Choi called for the government to halt its plans for a wind farm at sea in the waters beyond the eastern coastline. What are your views on the idea of:

- separate, specialist conservation groups like geoconservation, and
- the desirability of a wind farm within eye sight of the Hong Kong coastline, in the Sai Kung region?

A recent trend in *nature tourism* in Hong Kong has been called geotourism to which mention was made earlier. Let's conclude our short geo resources account by presenting you with a thought for the future: are *geo*-resources equal in importance to *eco*-resources?

It is time to leave the countryside and look at how conservation, perhaps surprisingly, does also operate in the urban environment of Hong Kong.

Let try Activity and see the feedback followed.

1.4.2.4 Activity 1.6



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Wind farms at sea and geoconservation

Consider the two ideas for discussion and the debate highlighted above and share your views via a face to face, or on-line conversation or even during a tutorial session. As usual, there is feedback but, be warned, this feedback will be expressed in a way that should encourage even more dialogue and argument. This is good too and is the sort of exchange of ideas that can contribute to good decision making as, we hope, may happen in the Legislative Council of the Hong Kong Government.

1.4.2.4.1 Activity feedback



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Wind farms at sea and geoconservation

- Separate, specialist conservation groups like geoconservation associations

In my experience, the 'big eye' or 'big picture' viewpoint is of outstanding importance in conservation. The EIA process has suffered since it was born 40 years ago from problems associated with narrow, sectional and sometimes one-issue viewpoints presented either by developers or, worse, by their opponents, the extreme and narrow so-called conservation groups. In Hong Kong, as is the case in many places overseas, we have specialist conservation groups that like to focus on, say, birds, frogs, pandas, butterflies, dragonflies or one species of tree, e.g. California redwoods in the USA. I was once at an environmental hearing before a judge in New Zealand and debating an issue on forest conservation with some 'green groups' who were trying to save just a few species of trees which, in their opinion, were of 'special cultural significance.' When I remind them that forest fungi were also important too (e.g. bracket fungi on tree trunks in the New Zealand native forest), they were very annoyed and tried to shout me down. Amazingly narrow, sectional agendas were being advocated by this 'green group.' Fortunately, the judge on this occasion was fascinated by fungi and invited me to give scientific reasons for arguing in favour of fungi. The proceedings resulted in a more balanced, ecologically sound decision.

Your course S122 A Foundation Course in Biology and Earth Science was developed in a way that demonstrated the connections between biological, climatological and geological aspects of our total natural environment.

So, in my view, we should take a 'big eye' view of conservation and aim to focus on nature in her totality. To isolate single issues or emphasize, say, geology or landscape at the expense of ecology or biodiversity, is not a good modus operandi, i.e. way of doing things.

I would prefer if the Association for Geoconservation was integrated into a holistic Nature Conservation Movement or a society with a catchy logo like SOUL, or:

<p>Save Our Unified Legacy</p>	}	<p>Legacy meaning what we have inherited from our ancestors who left us the beautiful Hong Kong we have today</p>
---	---	--

- Should the wind-farm at sea idea be 'blown away'?

The Association for Geoconservation appears to dislike the wind farm at sea plan. Their reasons for rejecting the plan seems to focus on what they perceive as a natural seascape: one with islands, coastlines, distant hills and an uncluttered sea. I like this view too. But should our like for such a vista be more important than taking a big, bold step towards creating a renewable energy wind farm? The technology is available and the more big power companies like China Light and Power (CLP) get involved in renewable energy generation the less coal we will need to burn to make electricity. This is good, but something much greater and of longer term value may arise from a development like a marine wind farm. This something is enhanced and better technology for wind power. Technology thus improved may one day mean that we can have our own mini-wind farm near our

apartments in Hong Kong. What a fantastically exciting, futuristic and environmentally welcome idea.

In terms of spoiling the scenic seascape views, this is a very debatable idea too. Many Hong Kongers may, in fact, like to see a wind farm at sea. The sight might inspire the school children and university students of Hong Kong to invent new technologies of alternative power and lead us towards a genuine eco-future.

Clearly, we can't always have what one pressure group want, especially in a small place with a big population of which the Hong Kong SAR is a very good example.

Why can't we have a wind farm at sea? This is one environmentally friendly idea that should not be blown away!

1.5 References



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

Below are the resources referred to or cited by the developer(s) of the **original unit**:

- Aptroot, A and Seaward, M R D (1999) 'Annotated checklist of Hong Kong lichens', *Tropical Bryology*, 17: 57–101.
- Bush, M B (2003) *Ecology of a Changing Planet*, 3rd edn, Prentice Hall, Inc.
- Cater, E (2007) 'Ecotourism as a Western construct', chapter 3 in Higham, J, *Issues in Ecotourism*, Elsevier.
- Chapman, V J (1962) *The Algae*, Macmillan and Company, London.
- Choi, N Y K and Stokes, E (2005) *88 Hong Kong Natural Wonders*, Pub. FOCP.
- Corlett, R T (2009) *The Ecology of Tropical East Asia*, Oxford University Press.
- Hock, C (1982) 'The distribution of marine algal in relation to temperature regulation of their life histories', *Biological Journal of the Linnean Society*, 18: 81–144.
- Hodgkiss (1984) 'Seasonal patterns of intertidal algal distribution in Hong Kong', *Asian Marine Biology*, 1: 49–57.
- [Hong Kong 2030 Planning Vision and Strategy](http://www.pland.gov.hk/pland_en/p_study/comp_s/hk2030/eng/home) (http://www.pland.gov.hk/pland_en/p_study/comp_s/hk2030/eng/home).
- Higham, J (ed.) (2007) *Critical Issues in Ecotourism*, Butterworth-Heinemann (Elsevier).
- Jim, C Y and Wong, F Y (2006) 'An evaluation of the country parks system in Hong Kong since its establishment in 1976', chapter 4 in Jim, C Y and Corlett, R T (2006) *Sustainable Management of Protected Areas for Future Generations*, IUCN, WCPA, FOCP, Hong Kong.
- Kennish, R, Williams, G A and Lee, S Y (1996) 'Algal seasonality on an exposed rocky shore in Hong Kong and the dietary implications for the herbivorous crab *Grapsus albolineatus*', *Marine Biology*, 125: 55–64.

- Kong, S L and Ang, P O (2004) 'Seasonal occurrence and reproduction of *Hypneacharoides* (Rhodophyta) in Tung Ping Chau, NT, HKSAR, China', *Hydrobiologia*, 512: 63–78.
- Kwok, P W, Tang, W S and Wong, S W (2008) 'The frosting impact on *Sonneratia* in Hong Kong', *Hong Kong Biodiversity*, AFCD Newsletter, 16: 7–9.
- Maxwell, G S (1997) 'Large flowers of *Enkianthus quinqueflorus* from the hills of Sai Kung East Country Park', *Memoirs of the Hong Kong Natural History Society*, 21: 217–20.
- Maxwell, G S (2001) 'Chill shock tolerance differentials local and Thai ecotypes of *Avicennia marina*', *Memoirs of the Hong Kong Natural History Society*, 24: 205–06.
- Maxwell, G S (2002) 'Maximizing mangroves as resources for ecotourism, research tourism and teaching', *ASPACO, UNESCO & MAB Proceedings*, University of Ryukyus, Okinawa, 57–63.
- Maxwell, G S and Hung, C L (2006) 'Ecotourists as Eco restoration volunteers: Dream or Idea waiting to happen!' *Proceedings of the UNESCO Conference, Lao P.D.R.*: 125–33.
- Maxwell, G S and Hung, C L (2008) 'Diversity in cultural perceptions of ecological resources: Lessons from New Zealand and Hong Kong, China', *Proceedings of the UNESCO, Joint Reg. Sem. and CBRN*, Jakarta MAB:121–31.
- Owen, B and Shaw, R (2001) *Hong Kong Landscapes: Along the MacLehose Trail*, Geotrails Society.
- Owen, B and Shaw, R (2007) *Hong Kong Landscapes*, HKU Press.
- Primack, R B (2000) *A Primer of Conservation Biology*, 2nd edn, Sinauer Assoc. Inc.
- Relyea, R (2002) 'Local population differences in phenotypic plasticity: Predator induced changes in wood frog tadpoles', *Ecological Monographs*, 72: 77–93.
- Smith, T M and Smith, R L (2009) *Elements of Ecology*, 7th edn, Benjamin Cummings publisher.
- Stokes, E (2000) *Exploring Hong Kong's Countryside*, AFCD, Hong Kong Tourist Association, HKJC Charities Trust, Exxon & ESSO Co.
- Stokes, E (2007) *Sai Kung Islands*, FOCP.
- Swanson, M (1992) *Ecotourism: Embracing the New Environmental paradigm*, papers at IUCN, 4th World Congress on National Parks and Areas, Caracas, Venezuela.
- Thrower, S L (1988) *Hong Kong Lichens*, Urban Council.
- Wordie, J (2007) *Streets Exploring Kowloon*, HKU Press.
- Wearing, S and Neil, J (2009) *Ecotourism: Impacts, Potentials and Possibilities*, Elsevier.
- Weaver, D (2006) *Sustainable Tourism*, Elsevier.
- Whittow, J (2000) *Physical Geography*, Penguin.
- Yang, K Y, Ngar, Y N and Lock, N Y (2002) *New Viewpoints – Country Parks in Focus*, FOCP.

Yip, J J, Corlett, R T and Dudgeon, D (2006) 'Selecting small reserves in a human-dominated landscape: Hong Kong, China', *Journal of Environmental Mangement*, 78: 86–96.

1.6 Conclusion



Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) (<http://creativecommons.org/licenses/by-sa/4.0/>).

The big ideas of this module included:

1. Hong Kong parks are protected areas and the country and marine parks contribute most to sustaining our natural biodiversity. Although relatively small and inbuilt-up areas, even urban parks contribute to biodiversity conservation (e.g. Kowloon Park).
2. The comparatively huge area set aside by the HKSAR Government as country parks and other protected areas (~41,000 ha) presents a very considerable conservation challenge.
3. The responses to the conservation challenge have resulted in a management strategy in the hands of a large department of professionals, the AFCD.
4. Since the formal launch of the country parks programme in Hong Kong in 1976, there has been a net improvement in countryside ecology.
5. Marine park management presents special challenges to the conservation of biodiversity and there is growing evidence that marine parks may benefit ecologically from the status of marine reserve within the near future.

If you would like to learn more on this subject, you are welcome to enrol in [BIOL S301 Conservation and Biodiversity](http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcGenericPage2010&c=C_ETPU&cid=191149104400&BODY=tcGenericPage) (http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcGenericPage2010&c=C_ETPU&cid=191149104400&BODY=tcGenericPage) offered by the [School of Science and Technology](http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcSchool2014&sch=ST&lang=eng) (<http://www.ouhk.edu.hk/wcsprd/Satellite?pagename=OUHK/tcSchool2014&sch=ST&lang=eng>) of the OUHK.