Annex III Ecosystem Services Review Report

森林村落
Forest village
梅子林蛤塘永續鄉村計劃
Mui Tsz Lam Kop Tong sustainable village programme

Ecosystem Services Review

on the Changes and Values in Ecosystem Services brought by the Management Agreement project at Mui Tsz Lam and Kop Tong

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About Centre for Civil Society and Governance: Established in December 2002, the Centre for Civil Society and Governance was the first research centre in Hong Kong dedicated to enhancing our knowledge of civil society — its nature, constituents, dynamics, roles (in particular its contribution toward governance)—and to contributing to the attainment of a sustainable society through forging community-based, innovative solutions to inform policy deliberation and collective action.

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Introduction

In 2021, with support from the Countryside Conservation Funding Scheme, the Centre for Civil Society and Governance at The University of Hong Kong launched a three-year project "Forest Village: Mui Tsz Lam and Kop Tong Sustainable Village Programme (2021-2024)" with several partnering organisations. The objectives are to enhance the overall biodiversity and ecosystem services through restoring the mosaic of land uses and conserving upland forest, to formulate sustainable management strategies, and to foster community stewardship and collective actions among stakeholders in nature and culture conservation. This report focuses on the changes and values of ecosystem services provided by the natural environment as a result of this Management Agreement (MA) project.

Methodology

An inventory of the different ecosystem services spanning three periods: when the two villages were active farming communities, between 1970's/1980's to late 2010's when all villagers had moved out, and since village revitalisation initiative in 2019 have already been provided in another report. Based on the inventory, detailed comparisons were made of the services before the MA, i.e. **during the period when the two villages were unoccupied, and as a result of the project**. Efforts were also made to look into the value of the various ecosystem services in terms of benefits to the people. As this is not a research, information on the benefits and values have to be gathered from literature. There have been very few studies on ecosystem services in Hong Kong (Hopkinson & Stern, 2002; Lai *et al.*, 2022) and none specifically on forest village ecosystem. Hence relevant overseas studies were referred to whenever appropriate to gain a better understanding.

Ecosystem services cover the many benefits provided by the natural environment to humans. To provide a more systematic approach that can be compared with other studies, in this report they are grouped into the four broad categories: provisioning, regulating, supporting and cultural services following the Millennium Ecosystem Assessment (2005).

Changes in Ecosystem Services

Provisional Services

Much of the natural environment uphill of Mui Tsz Lam (MTL) and Kop Tong (KT) villages have been protected as Country Parks since 1978. There have not been major changes in the ecosystem functions or natural resources in recent years. When the two villages were unoccupied, no one live in the villages and the main group of people receiving the benefits provided by the natural environment would be the hikers passing through the area. It is highly unlikely that they would directly collect much food, water, medicine, fuel or other natural resources from the environment. Hence, the provisional services enjoyed by the visitors during this period would be minimal.

In contrast, as a result of the MA project, a diverse range of workshops, eco-tours and activities had been organized that attracted participants to stay longer in the villages. A total of 115 citizen scientists, 114 volunteers and over 800 campers joined these activities. More casual visitors also came to MTL and KT as there were more media coverage, social media posts and sharing. Moreover, attractions had been added or organised such as the MTL Story House,

mural art walls, outreach booths and festivals. More than 19,000 walk-in visitors to the MTL Story House were recorded during the project duration.

Portable water was not available in MTL and KP. Thus there had been a heavier reliance on the stream water for domestic use (drinking, cooking, washing etc.) because more people visited and stayed at the villages as a result of the MA project. Moreover, stream water was also used to support activities (e.g. dye workshops and camping use) and irrigation for agriculture and the butterfly gardens etc. *Strobilanthes cusia* and *Dioscorea cirrhosa* were collected as natural dye in workshops and other plants in making traditional Hakka food such as Chinese New Year glutinous rice cakes. Although the amount collected was very small, these were crucial for the workshops and activities because they are the media for the transmission of traditional knowledge and the cultural significance could not be replaced by other plants or products. Small quantities of fuel wood were also collected for cooking by the villager in Kop Tong to prepare food for visitors and in activities such as cooking the rice cakes . Hence there had been some increases in provisional services because of the MA project (Table 1).

Table 1. Comparison of provisional services at Mui Tsz Lam and Kop Tong when the villages were unoccupied and during the Management Agreement project

Types of ecosystem services		**Period**	
		Village Unoccupied	Management Agreement
Provisional Services	Food, Drinks and Medicine	-	-
	Water	-	++
	Raw Materials	-	+
	Entertainment Materials	-	-
	Fuel	-	+
	Food for Farm Animals	-	-

Significance level: - minimal, + low, ++ medium, +++ high

Regulating Services

The overall regulating services during the two periods were summarised in Table 2. Although no one lived in the two villages during the unoccupied period, there were still some wider, more generic regulating services benefiting the hikers such as local air purification, cooling effect in summer and protection from wind chill in winter through local climate regulation by the surrounding forests. The forests and other vegetation in the catchment would also protect the two villages and the farmland from floods and landslides, i.e. the erosion and flood control services. During the MA project, more people visited the two villages and spending more time in the area. Hence, the regulating services mentioned above that are relevant to the casual visitors and the project participants became more significant. The forests and trees would also provide a local climate regulation service in maintaining a shady and humid conditions favourable for the growth of mushrooms, shade coffee, cacao and bitter ginger in the MA project.

Moreover, the remaining fruit trees in the villages had been managed for production again using an environmentally-friendly approach with minimal use of chemicals. Some 300kg of fruits and bitter ginger were harvested, generating an income of over HK$ 12,000 via sales of farm products for the MA project (see Completion Report). Therefore, the pollination and pest control services by the surrounding natural environment had become important for the production of these agricultural products.

There is a strong linkage between effective pollination systems and biodiversity. Studies have indicated that pollen limitation as a cause of fruiting failure (Johnson and Bond 1994). For example, larger fruits of more uniform shape and better seed production generally correlate with a greater number of visits from pollinators (Alderz 1966). Since changing weather conditions may favour some pollinators over others, having a large and diverse suite of potential pollinators is the best insurance policy for fruiting (Kremen et al. 2002). On the other hand, pollinators need local floral diversity to provide sufficient nectar, pollens and shelter throughout the seasons. A rich mixture of nesting sites are also favourable to a diverse mix of pollinators. Large monocultures fail to provide these. In forest villages like MTL and KP where a matrix of healthy natural ecosystems are adjacent to orchards/fields, there is a good assurance that pollination services remain intact. In contrast, large monoculture orchards often rely on the domesticated honey bee and is faced with disease and parasite challenges.

Biodiversity may also enhance pest resistance in agriculture through predation and parasitism (Millennium Ecosystem Assessment, 2005). For example, there appears to be complementarity of function among spider species in which they use different methods to catch prey, occupy different microhabitats, and/or are active at different times or seasons. Therefore, a high spider species richness leads to higher and less variable predation rates (Marc and Canard 1997; Riechert et al. 1999). In fact a rich mixture of spider species were observed in MTL and KP. This pest control service could increase the agriculture productivity when compared to those without natural predators. On the contrary, the use of pesticides would likely wipe out the natural predators than the pests themselves and the resurgence of pests can cause considerable damage to the crops (Naylor and Ehrlich 1997).

Under the MA project, butterfly gardens and insect hotels had been established close to the village area. These were successful in attracting more butterflies and parasitic wasps, thus likely enhancing the pollination and pest control Regilating Services. New crops such as coffee, cacao had been planted in the agroforest plot for future production. The services provided by the natural pollinators and enemies of pests would be expected to gain importance.

The large number of trees in the dense forests would also play a significant role in carbon capture and storage. In the study of above-ground carbon stored by trees in this MA project, a total of 16.33 tonnes of carbon were estimated in the 2,400 m^2 of forests measured. A repeated survey in 2024 showed there was an increase of 1.18 tonnes of stored carbon (see Third Year Biodiversity Monitoring Report). The figures did not include carbon stored below ground and in the soil which could be more than the above-ground carbon in tropical forests (Dantas *et al.*, 2020). The results showed that the forests in MTL and KT continue the service of capturing and storing carbon.

Although the forests surrounding MTL and KT would have gradually expanded in area and in maturity over the years, during the MA, some of the trees in the agroforest plots and tent camping site had been cleared. These would have a countering effect on carbon storage. For this review, carbon storage during the MA was deemed to be largely similar to that during the village unoccupied period.

Table 2. Comparison of regulating services at Mui Tsz Lam and Kop Tong when the villages were unoccupied and during the Management Agreement project

Types of ecosystem services		**Period**	
		Village Unoccupied	Management Agreement
Regulating Services	Pollination and Pest Control	-	++
	Water Purification, Erosion and Flood Control	+	++

	Local Air Purification	+	++
	Carbon Storage	++	++
	Local Climate Regulation	+	++

Significance level: - minimal, + low, ++ medium, +++ high

Supporting Services

The supporting services that are necessary for the ecosystems to function and allow the other services present at Mui Tsz Lam and Kop Tong during the two periods being reviewed are summarised in Table 3. The ecological processes and functions of the natural environment were expected to be largely the same as there were no major changes between the two periods. However, the actual benefits during the MA period were higher because agricultural production had resumed and benefited from the various contributions from the natural environment. In addition, there were more people visiting the areas and spending longer time taking part in various activities.

Biodiversity conservation is the primary objective of the MA project and some rare and/or restricted species have been recorded in MTL and KP. Biodiversity was the central theme in many of the activities and workshops (such as eco-tours, insect hotel workshops, InsectBlitz citizen science camp), thus making 'Habitat for Species' supporting service of high significance. Genetic diversity is the biological variation that occurs within species and is one of the three levels of biodiversity. It is crucial for the plant and animal species to continue to evolve and enable the ecosystem to adapt to changes. Hence, the 'Maintenance of Genetic Diversity' supporting service is also of high significance during the MA. In addition, enhancement measures by the MA project such as butterfly gardens, insect hotels, and, propagation and planting of rare plants would also contribute to these Supporting Servies. Therefore, the overall supporting services were a lot more significant during Management Agreement than those during the village unoccupied period.

Table 3. Comparison of supporting services at Mui Tsz Lam and Kop Tong when the villages were unoccupied and during the Management Agreement project

Types of ecosystem services		**Time Periods**	
		Village Unoccupied	Management Agreement
Supporting Services	Nutrient Cycling, Primary Production, Soil Formation and Retention	+	++
	Habitat for Species	+	+++
	Maintenance of Genetic Diversity	+	+++

Significance level: - minimal, + low, ++ medium, +++ high

Cultural Services

Cultural services are entirely determined by human perceptions of their environment. When the two villages were unoccupied, the vast majority of the people receiving these services were hikers passing through the area. They chose the North-eastern N.T. probably because of the beautiful scenery. Aesthetic enjoyment and recreational/leisure services were the main benefits received (Table 4) and it would be difficult to separate the two. On the other hand, some villagers returned to the villages during big festivals and carried out ceremony at the shrine next to the feng shui wood. The cultural identify and heritage were strong.

While no statistics is available on the number of casual visitors to MTL/KP, it is believed that considerably more people visited the NENT countryside including the MTL/KP area in recent years as a result of the revitalisation initiatives by the Hong Kong Government, the enhanced

transportation provided by the regular kaito service and increased publicity. That is, more people enjoyed 'Aesthetic Enjoyment' and 'Recreational and Leisure Services'. As part of the MA project, the MTL Story House with displays on the cultural heritage was established and received 19,000 casual visitors. Mural art walls were also created in the two villages. These added a cultural element into the visitors' experience and increase the 'Cognitive and Educational Services'.

Moreover, over 110 citizen scientists and 110 volunteers were recruited and participated in the many activities, workshops and eco-tours during the MA project. The experience enhanced knowledge on nature and/or culture of the forest villages among many of the participants. In the feedback after the activities, over 40% agreed or strongly agreed they had acquired new knowledge in depth across various aspects. (see Designing rural steward incubation report in Annex V), suggesting the activities and programme under the MA project had facilitated the "Cognitive and Educational Services" of MTL and KT.

Such deeper experience also fostered connections with the natural environment and the cultural heritage and resulted in a significant 'Spiritual Services'. Indeed, in the successfully matched pre- and post- questionnaire surveys undertaken by over 80 participants, significant changes were observed regarding the question "I feel connected with my ancestors/history of rural Hong Kong". Villagers also increasingly returned and actively took part in the festivals and some of activities. Thus, the MA project also contributed to an increase in 'Spiritual Fulfilment' services for the villagers.

It is worth mentioning that the forest villages provided inspirations for the project team in creating the mural art wall and in developing the use of natural dye in fabrics. That is, they also benefited from the "Cognitive and Educational Services".

Table 4. Comparison of supporting services at Mui Tsz Lam and Kop Tong when the villages were unoccupied and during the Management Agreement project

Types of ecosystem services		**Time Periods**	
		Village Unoccupied	Management Agreement
Cultural Services	Aesthetic Enjoyment	+++	+++
	Recreational and Leisure Services	+++	+++
	Spiritual Fulfilment	+	+++
	Cognitive and Educational Services	-	+++

Significance level: - minimal, + low, ++ medium, +++ high

Values in Ecosystem Services brought by the MA project

Ecosystem services are the many benefits to humans provided by the natural environment and they are essential not only for the well-being but also the quality of life (Millennium Ecosystem Assessment, 2005). The natural environment and the associated ecological processes and functions around MTL and KT remain more or less the same since the MA project started. Through active management during the MA project, the pollination and pest control services had been enhanced and agroforest plots established for production. The habitat for species and maintenance of genetic diversity Supporting Services had also been enhanced. Arguably though, the most significant change in terms of ecosystem services is how people use the area and what they get from the activities.

Return of Agriculture

One big change is the return of agriculture in the MTL and KT villages. The original fruit trees have been managed to make them productive again, agroforest plots have been established to plant shade coffee, cocoa, bitter ginger and mushrooms, and new fruit trees have been planted in some formerly abandoned terraced farmland. The provision of water from the streams has become important again for irrigating the fruit trees and crop plants (Table 1). An environment-friendly agricultural practice has been adopted and chemicals are not or only minimally applied. In return, there is likely a greater reliance on the pollination and pest control regulating services (Table 2). The broader supporting services of nutrient cycling, primary production, soil retention, habitat for species and maintenance of genetic diversity (Table 3) also became more significant.

The actual amount of agricultural produce of around 300kg and the corresponding monetary value of over HK$ 12,000 is small when compared with the scale of the MA project. In fact, the cultural significance of reviving traditional agriculture and the amenity value of having forest villages with active farmland in the green hills is much more important. Natural environments are of high aesthetic value to people all over the world. Nature is beautiful is obvious to most people (Millennium Ecosystem Assessment, 2005) and there is a general preference for natural over built environments (Ulrich 1983; Kaplan and Kaplan 1989; Lai *et al*., 2022). Researchers have even proposed that people's preference for nature may be the result of an ancient evolutionary history in which evolution has made contact with natural environments a source of restoration and well-being (Ulrich 1983; Kaplan 1987). There is also a preference for park-like settings by Asian populations (Kellert, 1993), probably because they imply the offer of food, water and security (Heerwagen and Orians 1993). A landscape of green hills with terraced agriculture and forest villages like those of MTL and KT would score highly in aesthetic value. Aesthetic pleasure has consistently been found to be one of the most important motivations for outdoor recreation which brings much value. This would be discussed in more details in the following section.

Increased in visitors

Another significant change is the increased in the number of casual visitors to MTL/KP partly due to the MA project and partly due to the revitalisation initiative by the HK Government and the enhanced kaito service to the Northeast NT. As the number of visitors goes up, the benefits they received from the ecosystem services such as local air purification and local climate regulation also increase (Table 2).

People spending time outdoor doing exercise would improve the physical health (WYNG Foundation, 2019). While contacting with nature may enhance restoration from stress and increase mental health and social well-being (Ulrich 1983; Keniger et al., 2013; WYNG Foundation, 2019). These offer potential economic value for the society as a result of reduced medical costs, enhanced employability etc. (Russel *et al.*, 1998) and (Kuo and Sullivan 2001).

Biodiversity and Cultural Heritage themed Programme

The key ecosystem services change brought by the MA project is through the mixture of eco-tours, workshops, festivals, citizen scientist camps and other activities organised on the biodiversity and cultural aspect of MTL and KT. These have led to big increase in the significance of "Spiritual Fulfilment" and "Cognitive and Educational" cultural services (Table 4).

In addition to the physical, mental health and social well-being benefits described in the above section, participants also gained spiritual fulfilment and knowledge on biodiversity and/or cultural heritage (see Cultural Services section). There are potentially longer-term benefits to the participants as shown by the matched pre- and post- questionnaire surveys (see Annex V,

Designing Rural Steward Incubation Report). There were very strong increment in 'Change Advocacy' and 'Effective Decision Making' with respect to conservation, possibly making them more active in biodiversity and countryside conservation. According to the interviews conducted with the volunteers, some were naturally taking on leadership roles and sought further learning to deepen their knowledge on the natural and cultural resources of the area. Some of the interviewees were even proactive in suggesting further improvements for the programme and the village. There is a potentially wider value as more knowledgeable and dedicated people support biodiversity and countryside conservation in Hong Kong.

Discussions

Through active biodiversity management, re-establishing farming practices and organising a wide variety of activities and programmes on biodiversity and cultural heritage, the MTL and KT Forest Village MA project has significantly increased the benefits from the ecosystem services, in particular the cultural services.

Some of the abandoned terrace farmlands have been converted to orchards, agroforest plots and tent camping sites. There are also more people visiting and many spending longer time in the area. Nonetheless, biodiversity monitoring has not shown any negative impacts from the environmentally-sensitive change in land use and the increased human activities (see Third Year Biodiversity Monitoring Report). Rather, active enhancement measures such as the establishment of butterfly gardens have attracted more butterfly species.

Many ecosystems have important value as a place where people can go for relaxation, refreshment and recreation. Through the aesthetic qualities and rich cultural heritage, natural cum cultural environments can provide many opportunities for nature- and/or culture- based recreational activities. In many parts of the world, the increasing public demand for cultural landscape and associated amenity goods and services has caused greater land use diversification and more environmentally friendly land management. These multi-functional landscapes can provide food and raw materials, clean water, recreation opportunities, a sense of identity, and heritage values (Wascher 2000). There is also a potential to develop eco-tourism (including nature-based and cultural tourism) which is growing fast and constitutes about 30% of the world tourism revenue (Millennium Ecosystem Assessment, 2005).

As shown in the MTL and KP MA project, careful planning and diversify use in a mixed natural and agricultural landscape can bring both environmental and social benefits to the many visitors and programme participants. The application of ecosystem services as demonstrated by this report would provide a better informed planning and/or assessment of countryside conservation and revitalisation projects.

References

Alderz, W.C. (1966) Honeybee visit numbers and watermelon pollination. Jour- nal of Economic Entomology, 59, 28–30.

Dantas, D., Terra, M. D. C. N. S., Pinto, L. O. R., Calegario, N., and Maciel, S. M. (2020). Above and belowground carbon stock in a tropical forest in Brazil. Acta Scientiarum. Agronomy, 43, e48276.

Heerwagen, J.H. and Orians, G.H. (1993) Humans, habitats and aesthetics. In: The Biophilia Hypothesis, S.R. Kellert and E.O. Wilson (eds.), Island Press, Washington, DC.

Hopkinson, L. and Stern, R. (2002) Wild but not Free: an Economic Valuation of the Benefits of Nature Conservation in Hong Kong. Civic Exchange, Hong Kong.

Johnson, S.D. and Bond, W.J. (1994) Evidence for widespread pollen limitation of fruiting success in Cape wildflowers. Oecologia, 109, 530–534.

Kaplan, S. (1987) Aesthetics, affect and cognition: Environmental preference from an evolutionary perspective, Environment and Behavior, 19, pp. 3–32.

Kaplan, S. and Kaplan, R. (1989) The Experience of Nature: A Psychological Perspec- tive, Cambridge University Press, New York, NY.

Keniger, L. E., Gaston, K. J., Irvine, K. N., & Fuller, R. A. (2013). What are the benefits of interacting with nature?. International journal of environmental research and public health, 10(3), 913-935.

Kellert, S.R. (1993) The biological basis for human values of nature. In: The Biophilia Hyp

Kremen, C., Williams, N.M., Bugg, R.L., Fay, J.P. and Thorp, R.W. (2004) The area requirements of an ecosystem service: crop pollination by native bee communities in California. Ecology Letters, 7:1109–1119.

Kuo, F.E. and Sullivan, W.C. (2001) Aggression and violence in the inner city: Impacts of environment via mental fatigue, Environment & Behavior, 33(4), Special Issue on Restorative Environments, pp. 543–71.

Lai, D.Y.F., Tai, A.P.K., Ng, M.K. and Brander, L. (2022) Provision of Consultancy Service to Conduct a Study on Ecosystem Services in Hong Kong - Revised Final Report. Agriculture, Fisheries and Conservation Department, Hong Kong. (https://bih.gov.hk/filemanager/en/content_108/A_Study_on_Ecosystem_Services_in_Hong_Kong.pdf, assessed on 14 July 2024)

Marc, P. and Canard, A. (1997) Maintaining spider biodiversity in agroecosys- tems as a tool in pest control. Agriculture Ecosystems and Environment, 62, 229– 235.

Millennium Ecosystem Assessment (2005) Ecosystems and Human Well-Being: Synthesis
www.maweb.org/documents/document.354.aspx.pdf

Naylor, R.L. and Ehrlich, P.R. (1997) Natural pest control services and agricul- ture. In: Nature's Services: Societal Dependence on Natural Ecosystems, G.C. Daily (ed.), Island Press, Washington D.C., pp. 151–174.

Riechert, S.E., Provencher, L. and Lawrence, K. (1999) The potential of spiders to exhibit stable equilibrium point control of prey: Tests of two criteria. Eco- logical Applications, 9, 365–377.

Russell, K.C., Hendee, J.C., and Cooke, S. (1998) Social and economic benefits of a U.S. Wilderness Experience Program for Youth-at-Risk in the Federal Job Corps, International Journal of Wilderness, 4(3), pp. 32–8.

Ulrich, R.S., (1983) Aesthetic and affective response to natural environment. In: Human Behavior and Environment: Advances in Theory and Research, I. Altman and J.F. Wohlwill (eds.), Volume 6, Plenum Press, New York, NY, pp. 85– 125.

Wascher, D.M. (ed.), (2000) The Face of Europe: Policy Perspectives for European Landscapes, Report on the implementation of the PEBLDS (Pan-European Biological and Landscape Diversity Strategy) Action Theme 4 on European Landscapes, published under the auspice of the Council of Europe, ECNC European Center for Nature Conservation, Tilburg, The Netherlands.

WYNG Foundation (2019). Trailblazer project phase 1. Country parks usage and well-being. WYNG Foundation and and University of Hong Kong School of Public Health.