

**Bird Survey of Selected Farmlands in the
Proposed Northern Metropolis, Hong Kong SAR:
Interim Report**



Little Bunting *Emberiza pusilla*, Tai Po Tin, Ping Che

Published: 11 July 2022

Kadoorie Farm and Botanic Garden Publication Series No. 18

Bird Survey of Selected Farmlands in the Proposed Northern Metropolis, Hong Kong SAR:

Interim Report

Published: 11 July 2022

Authored by

Xi ZHENG, Bosco Pui Lok CHAN and Tsz Kin AU

Contents

Summary	2
Introduction	2
Study Areas and Methods	3
Summary of Findings	5
Threats and Recommendations	6
Acknowledgments	7
References	8
Appendices	10
Plates	17

Copyright

© 2022, Kadoorie Farm and Botanic Garden Corporation, all rights reserved

For enquiries about this report, please contact:
Kadoorie Conservation China Department,
Kadoorie Farm and Botanic Garden Corporation
Lam Kam Road, Tai Po, N.T.
Hong Kong Special Administrative Region
kcc@kfbg.org

Document Citation

Kadoorie Farm and Botanic Garden (2022) Bird Survey of Selected Farmlands in the Proposed Northern Metropolis, Hong Kong SAR: Interim Report. Kadoorie Farm and Botanic Garden Publication Series No. 18. Kadoorie Farm and Botanic Garden, Hong Kong SAR. 24pp.

SUMMARY

Kadoorie Farm and Botanic Garden (KFBG) conducted bird surveys at nine selected farmlands in the proposed Northern Metropolis from January 2021 to May 2022. A total of 151 bird species were recorded during the study period, 29 of which are species of conservation concern. These farmlands were interspersed with brownfields, villages, infrastructures and other anthropogenic land uses, and were susceptible to disturbances and future degradation. Based on an analysis of habitat and species characteristics, the three most important sites for farmland biodiversity conservation were Tai Po Tin, Sandy Ridge Wetland Mosaic and Chow Tin - Lei Uk. It is suggested that future development plans should incorporate a farmland conservation strategy to safeguard these farmlands of conservation as well as agricultural significance, preferably with the concepts of “Nature Park” and “Urban-Rural Greenway”.

INTRODUCTION

On 6 Oct 2021, the HKSAR Government announced in the Policy Address a mega plan entitled the Northern Metropolis Development Strategy (NMDS), which includes many development proposals and some conservation measures, but an overwhelming emphasis on fishponds and waterbirds. An extensive area of the northern New Territories is included under this plan, which supports substantial area of active as well as high value abandoned farmlands remaining in Hong Kong. While the ecological importance of fishponds and forests are widely recognized locally, regional ornithological studies have reported greater bird diversity in farmlands in comparison to fishponds or forests (Kwok & Dahmer 2001; Li *et al.* 2022). Although ecological data on farmlands in Hong Kong are scanty, their importance to local biodiversity conservation has been recognised for a number of sites and several farmland conservation projects are being implemented (e.g., Long Valley, Ho Sheung Heung and Lai Chi Wo).

Farmland birds are in steep decline globally as they are sensitive to changes in agricultural practices and land use. Farmland birds in Europe declined by 52% from 1980 to 2010 (BirdLife International 2013), and a staggering 74% of farmland bird species in North America experienced population decline from 1966 to 2013 (Stanton *et al.* 2018). In Hong Kong, the disappearance of local agriculture had a significant impact on farmland bird communities; many farmland birds declined dramatically since the 1960s following the abandonment of commercial rice farming (Allcock 2009; Carey *et al.* 2001; Leven 1998). A recent SAR-wide systematic bird census conducted by the Hong Kong Bird Watching Society (HKBWS) reported over 77% of bird species with a shrunken distribution were open country species; many of which depend on farmlands for survival (HKBWS 2020).

Many countries in Europe and North America are investing considerable conservation effort into farmland biodiversity conservation, with an increasing number of farmlands managed with innovative conservation initiatives such as land purchases, incentive schemes and private-public partnerships (Aebischer *et al.* 2016; Hardman *et al.* 2016; Heckert 2020).

In view of the mounting development pressures and existing gaps in our knowledge regarding farmland biodiversity in the proposed Northern Metropolis (NM), Kadoorie Farm and Botanic Garden (KFBG) initiated a systematic biodiversity study of selected farmlands in the proposed NM, aiming to understand the importance of farmland (both active and abandoned) for wildlife conservation and identify priority sites. Data from this study will be used to: (1) update the distribution and status of farmland-dependent species in NM; (2) identify the conservation value of selected farmlands in NM and propose priority sites for conservation; (3) assess the net loss in local biodiversity if farmland ecosystem protection was to be neglected in development plans.

Due to seasonality of the different taxon groups, this interim report focuses on results of our bird survey from January 2021 to May 2022. Ongoing surveys to cover the 2022 autumn migration season, as well as those targeting amphibians, reptiles, butterflies and odonates will yield further results and be documented in a future publication.

STUDY AREAS AND METHODS

Nine farmland areas, namely Heung Yuen Wai - Tsung Yuen Ha, Chuk Yuen, Chow Tin - Lei Uk, Sing Ping, Ping Yeung Old Village - Shui Lau Hang, Tai Po Tin, Sandy Ridge Wetland Mosaic, Lok Ma Chau Village and Shek Wu Wai, were selected for our biodiversity survey (Figure 1). These farmland sites varied greatly in habitat size and diversity, but were strategically selected for wider coverage of the NM and invariably have relatively intact cultivated fields, and were all located within or adjoining the proposed New Development Areas under the NMDS.

A total of 167 ha of farmlands were surveyed in the nine survey sites. Depending on the size of these sites, we selected 12 transects to cover a mosaic of active and abandoned farmland plots (Plate 1 to 5). Actively cultivated fields were categorised into dry and wet farmlands following literature on farmland birds of Hong Kong (Allcock 2009; Leven 1998). Dry farmland was characterised by vegetable and flower crops, while wet farmland contained flooded fields largely associated with the production of Water Spinach *Ipomoea aquatica* and Watercress *Rorippa nasturtium-aquaticum*; some sites contained deeper water wetlands such as fish- and/or lily-ponds as well as marshes formed by long-abandoned fishponds and choked waterways.

From Dec 2021 to May 2022, systematic bird surveys were conducted at dawn or dusk at least once per month at each survey site; birds observed were identified, counted and recorded along the designated transects. Additional night surveys were conducted intermittently to search for nocturnal avifauna, especially owls and nightjars. Significant records from our pre-visits, as well as verified birdwatchers' records between Jan-Nov 2021 were included in this interim report.

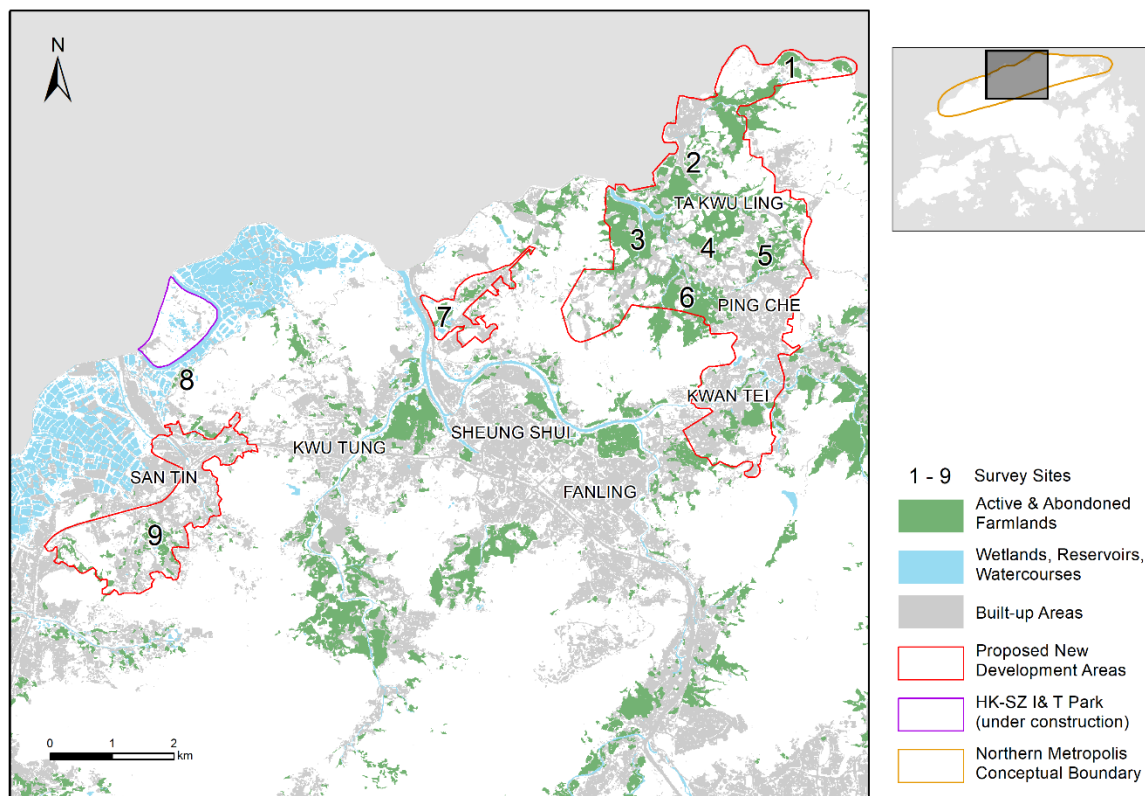


Figure 1. Location of survey sites (1 = Heung Yuen Wai - Tsung Yuen Ha, 2 = Chuk Yuen, 3 = Chow Tin - Lei Uk, 4 = Sing Ping, 5 = Ping Yeung Old Village - Shui Lau Hang, 6 = Tai Po Tin, 7 = Sandy Ridge Wetland Mosaic, 8 = Lok Ma Chau Village, 9 = Shek Wu Wai)

The classification system of birds followed the *List of Hong Kong Birds* (HKBWS 2021). Species listed as Near Threatened, Vulnerable, Endangered and Critically Endangered in the *IUCN Red List of Threatened Species* (HBW and BirdLife International 2021) and the *Red List of China's Vertebrates* (Jiang *et al.* 2016), and/or listed in the *State Key Protected Wild Animals List*, were considered of conservation concern.

As the survey sites had different habitat size and diversity, a direct comparison of species richness would be inconclusive in drawing conservation importance. In an attempt to offer a comprehensive assessment of the conservation value for these sites, a scoring matrix has been constructed to ensure different biotic and abiotic factors are taken into consideration: (1) habitat size; (2) habitat diversity; (3) bird species richness; (4) number of bird species of conservation concern.

SUMMARY OF FINDINGS

A total of 151 bird species were recorded during the study period (Appendix 1), representing 27% of the 564 bird species reported for Hong Kong.

We recorded 29 species of conservation concern: the globally “Critically Endangered” Yellow-breasted Bunting *Emberiza aureola* was observed in Heung Yuen Wai - Tsung Yuen Ha (Plate 6), Tai Po Tin and Lok Ma Chau Village. The Lok Ma Chau Village farmland also yielded sightings of the “Vulnerable” Japanese Yellow Bunting *Emberiza sulphurata* (Plate 7). Little Bunting *Emberiza pusilla* and Black-faced Bunting *Emberiza spodocephala* were consistently recorded at various survey sites, sometimes in significant numbers (more than 50 Little Buntings were recorded in a single survey at Tai Po Tin). Species dependent on wet farmland recorded included the Greater Painted-snipe *Rostratula benghalensis* and two *Gallinago* snipes from Lok Ma Chau Village; Swinhoe's / Pintail Snipe *Gallinago megala/stenura* at Tai Po Tin, and Slaty-legged Crake *Rallina eurizonoides* in Heung Yuen Wai - Tsung Yuen Ha. Eastern Yellow Wagtail *Motacilla tschutschensis* and Red-throated Pipit *Anthus cervinus* were also regularly recorded at various sites. Active-abandoned farmland mosaic proved to support some rare species: locally rare Black-winged Kite *Elanus caeruleus*, Ashy Woodswallow *Artamus fuscus* (Plate 8) and Crested Bunting *Emberiza lathami* (Plate 9) were recorded at Ping Yeung Old Village - Shui Lau Hang; Bonelli's Eagle *Aquila fasciata*, Northern Goshawk *Accipiter gentilis* and Bull-headed Shrike *Lanius bucephalus* at Tai Po Tin; the “Vulnerable” Eastern Imperial Eagle *Aquila heliaca*, Bonelli's Eagle and Cinnamon Bittern *Ixobrychus cinnamomeus* were recorded at the Sandy Ridge Wetland Mosaic.

Our findings demonstrate that the remaining farmlands in NM support a rich avifauna and are providing critical habitats for a significant number of globally-/locally-threatened species. With farmland loss and intensification of farming practices, bunting populations have been in steep decline worldwide including Hong Kong, the predominantly dry farmlands of NM appear to be important stopover and/or wintering grounds for migrating/wintering buntings, including the Yellow-breasted Bunting. Greater Painted-snipe is an iconic wetland-dependent species and has experienced drastic decline in Hong Kong since the 1960s (Carey *et al.* 2001). The remaining wet farmlands in NM could provide vital foraging and breeding grounds for this locally endangered species. Additionally, wet agriculture is thought to support a greater diversity and abundance of birds than dry farmland (Allcock 2009).

Habitat characteristics and bird species richness of the nine survey sites is summarised in Appendix 2. The overall conservation values of the sites were calculated based on the assessment of farmland habitat and bird diversity; a detailed ranking matrix will be presented in a future publication. While a final priority site listing cannot be drawn from preliminary data in this interim report, it is apparent the conservation value of Tai Po Tin, Sandy Ridge Wetland Mosaic and Chow Tin - Lei Uk (Location 6, 7 and 3 in Figure 1) are amongst the highest in the NM based on our results.

THREATS AND RECOMMENDATIONS

A number of threats were observed from our survey sites during the study period. Mist nets were found at Chuk Yuen (Plate 10) and Ping Yeung Old Village - Shui Lau Hang, presumably erected to protect crops from birds. The nets will also cross the flight paths for birds and bats not preying on the crops so can be considered indiscriminate in targeting a number of different fauna species. Although an uncommon practice in Hong Kong, mist nets could be deadly to wildlife, it is suggested that conservation awareness activities targeting farmers should be organized to promote wildlife-friendly farming practices in NM.

Many watercourses, large and small, in the study area were suffering from varying degrees of pollution (Plate 11). The Ping Yuen River drainage basin was particularly affected with stream courses giving off pungent smells, but birds were seen foraging/bathing in these foul watercourses (Plate 12). As the current land use of these largely private lands within the NM is a mixture of farmlands, livestock farms, villages and brownfield sites (Plate 13); industrial, livestock and domestic waste continues to contaminate the alluvial lowland rivers of NM, which by themselves are a very rare freshwater habitat type in the SAR. Local studies have suggested that changes of agricultural land use to other purposes could lead to a surge of toxic chemicals in soil, which is harmful not only to wildlife, but also to humans, especially children (Lopez *et al.* 2011; Man *et al.* 2010). Stricter regulations for waste/sewage management and appropriate land use planning should be prioritized by the relevant government authorities.

The loss of farmlands to development is considered as the major threat to farmland birds in Hong Kong (Allcock 2009). Farmlands are often treated as land banks for development, and the staggering number of brownfield sites scattered throughout the study area reflects the substantial scale of this issue in Hong Kong. According to the latest government report, there are 7,373 active brownfield sites with an area of ca. 1,414 ha in the New Territories, with 98% of these located in the northern New Territories (PlanD 2019). The decline of agriculture and subsequent conversion of abandoned farmland has greatly reduced farmland coverage in Hong Kong (Jim 1997). Currently, there is only 4,023 ha of agricultural land left in Hong Kong, accounting for merely 3.57% of Hong Kong's land area (Kwong *et al.* 2022). Farmland habitat is usually considered to be of low ecological value, especially sites scattered amongst brownfields and villages, due to the high level of human disturbance, such as those in the Ta Kwu Ling and San Tin areas. Contrary to this common perception, our survey results clearly demonstrate that farmlands in NM support a thriving bird community, and many are heavily dependent on farmlands for their survival in Hong Kong. Further degradation and/or loss of these fragmented farmlands could be detrimental to these farmland-dependent birds. Preventing further loss of this vanishing wildlife habitat should be considered a priority in making Hong Kong a truly sustainable city.

In addition to local studies and our latest findings, the biodiversity and conservation values of the region's farmland are increasingly being highlighted by conservation researchers (Li *et al.* 2020, 2022; Zhang *et al.* 2022), a shift of mindset regarding the conservation importance of farmlands

should be promoted among stakeholders, including the general public as well as policy makers. It is also imperative that future development plans should incorporate a farmland conservation strategy to safeguard what is remaining in Hong Kong.

The Sandy Ridge Wetland Mosaic yielded the highest bird richness and ranked second for conservation value based on our interim results. It is worth noting that the Eurasian Otter *Lutra lutra*, a species of high conservation concern in both Hong Kong and mainland China, as well as a Class II protected animal in State Key Protected Wild Animals List, was recorded in this study site in 2009 (PlanD 2010). Preliminary results of our ongoing otter survey suggest that otter continues to visit this site in recent years. Previous studies also suggested that the Greater Painted-snipe is likely to breed in the agricultural area of this site (CEDD 2016; PlanD 2010). We also recorded a number of locally-rare wetland/open country species here during our survey, such as Eastern Imperial Eagle, Bonelli's Eagle, Cinnamon Bittern, Grey-capped Greenfinch *Chloris sinica* and Chinese Grosbeak *Eophona migratoria*. To preserve this unique wetland-farmland mosaic, it is recommended to incorporate this site into the proposed Sha Ling/Nam Hang Nature Park.

A study conducted on urban farmlands of Guangzhou, another megacity in the Pearl River Delta, has indicated that the degree of farmland fragmentation in landscape scale could affect bird diversity (Lee *et al.* 2022). High quality farmland areas with high conservation value within the NM (i.e. Tai Po Tin, Sandy Ridge Wetland Mosaic and Chow Tin - Lei Uk) should be preserved and enhanced for agriculture, biodiversity conservation as well as recreation purposes in future development plans. By adopting the concept of the proposed New Territories North Urban-Rural Greenway to link up the natural, agricultural and cultural resources within the NMDS, a "Greenway Network" could be designed to preserve and enhance these ecologically-sensitive areas in the proposed NM. The "Greenway Network" could act as an eco-corridor to connect these farmland areas with high conservation value and greatly enhance the biodiversity value of the region.

ACKNOWLEDGEMENTS

John Allcock, Abdelhamid Bizid, Benjiman Li, and Tim Woodward kindly contributed their interesting bird records from the study area. We would also like to thank John Allcock, J. W. Duckworth, James Eaton, Michael Leven and Yu Yat Tung for their valuable comments on the definition of farmland-dependent bird species. This work was funded by the Kadoorie Farm and Botanic Garden.

REFERENCES

- Aebischer, N.J., Bailey, C.M., Gibbons, D.W., Morris, A.J., Peach, W.J. & Stoate, C. (2016) Twenty years of local farmland bird conservation: The effects of management on avian abundance at two UK demonstration sites. *Bird Study* 63, 10–30.
<https://doi.org/10.1080/00063657.2015.1090391>
- Allcock, J.A. (2009) Farmland Birds. In: C. L. C. Wong, V. W. Y. Lam, and G. W. J. Ades (Eds), *Ecology of the Birds of Hong Kong*. Kadoorie Farm & Botanic Garden, Hong Kong, pp. 87–104.
- BirdLife International (2013) Europe-wide monitoring schemes highlight declines in widespread farmland birds. *BirdLife International*. Available from:
<http://datazone.birdlife.org/sowb/casestudy/europe-wide-monitoring-schemes-highlight-declines-in-widespread-farmland-birds> (June 2, 2022)
- Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M. & Young, L. (2001) *The avifauna of Hong Kong*. Hong Kong Bird Watching Society, Hong Kong, 564 pp.
- CEDD (2016) Site Formation and Associated Infrastructural Works for Development of Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery. Available from:
https://www.epd.gov.hk/eia/register/report/eiareport/eia_2362016/EIA_HTML/index.htm (July 5, 2022)
- Hardman, C.J., Harrison, D.P.G., Shaw, P.J., Nevard, T.D., Hughes, B., Potts, S.G. & Norris, K. (2016) Supporting local diversity of habitats and species on farmland: A comparison of three wildlife-friendly schemes. *Journal of Applied Ecology* 53, 171–180. <https://doi.org/10.1111/1365-2664.12557>
- HBW and BirdLife International (2021) Handbook of the Birds of the World and BirdLife International digital checklist of the birds of the world. Version 6. Available from:
http://datazone.birdlife.org/userfiles/file/Species/Taxonomy/HBW-BirdLife_Checklist_v6_Dec21.zip (June 6, 2022)
- Heckert, K. (2020) American Farmland Trust, USDA NRCS and Others Partner on \$24.2 Million Collaboration to Protect California's San Joaquin Valley. *American Farmland Trust*. Available from: <https://farmland.org/american-farmland-trust-usda-nrcs-and-others-partner-on-24-2-million-collaboration-to-protect-californias-san-joaquin-valley/> (June 16, 2022)
- Jiang, Z., Jiang, J., Wang, Y., Zhang, E., Zhang, Y., Li, L., Xie, F., Cai, B., Cao, L., Zheng, G., Dong, L., Zhang, Z., Ding, P., Luo, Z., Ding, C., Ma, Z., Tang, S., Cao, W., Li, C., Hu, H., Ma, Y., Wu, Y., Wang, Y., Zhou, K., Liu, S., Chen, Y., Li, J., Feng, Z., Wang, Y., Wang, B., Li, C., Song, X., Cai, L., Zang, C., Zeng, Y., Meng, Z., Fang, H. & Ping, X. (2016) Red List of China's Vertebrates. *Biodiversity Science* 24, 500–551.
- Jim, C.Y. (1997) Land Use Problems with Associated Farmland Abandonment. *Geography* 82, 277–280.
- Kwok, H. & Dahmer, T.D. (2001) Birds Communities on Cultivated Lands in Hong Kong. *Memoirs of Hong Kong Natural History Society* 24, 181–188.
- Kwong, I.H.Y., Wong, F.K.K., Fung, T., Liu, E.K.Y., Lee, R.H. & Ng, T.P.T. (2022) A multi-stage approach combining very high-resolution satellite image, gis database and post-classification

- modification rules for habitat mapping in Hong Kong. *Remote Sensing* 14.
<https://doi.org/10.3390/rs14010067>
- Lee, M., Chen, D. & Zou, F. (2022) Winter Bird Diversity and Abundance in Small Farmlands in a Megacity of Southern China. *Frontiers in Ecology and Evolution* 10, 1–13.
<https://doi.org/10.3389/fevo.2022.859199>
- Leven, M.R. (1998) Focus on Farmland. *Porcupine!* 18, 19–23.
- Li, J., Mammides, C., Zhou, L., Sun, J., Tan, X. & Jiang, A. (2022) Bird diversity in different habitats under agriculturalization in Guangxi, China. *Biodiversity Science* 30, 21515.
- Li, L., Hu, R., Huang, J., Bürgi, M., Zhu, Z., Zhong, J. & Lü, Z. (2020) A farmland biodiversity strategy is needed for China. *Nature Ecology and Evolution* 4, 772–774. <https://doi.org/10.1038/s41559-020-1161-2>
- Lopez, B.N., Man, Y.B., Zhao, Y.G., Zheng, J.S., Leung, A.O.W., Yao, J. & Wong, M.H. (2011) Major pollutants in soils of abandoned agricultural land contaminated by e-waste activities in Hong Kong. *Archives of Environmental Contamination and Toxicology* 61, 101–114.
<https://doi.org/10.1007/s00244-010-9590-6>
- Man, Y.B., Sun, X.L., Zhao, Y.G., Lopez, B.N., Chung, S.S., Wu, S.C., Cheung, K.C. & Wong, M.H. (2010) Health risk assessment of abandoned agricultural soils based on heavy metal contents in Hong Kong, the world's most populated city. *Environment International* 36, 570–576.
<https://doi.org/10.1016/j.envint.2010.04.014>
- PlanD (2010) Land Use Planning for the Closed Area - Feasibility Study Final Report. Available from: [https://www.pland.gov.hk/pland_en/misc/FCA/files_072010/Final_Report/041-02 Final Report \(Chapter 7\).pdf](https://www.pland.gov.hk/pland_en/misc/FCA/files_072010/Final_Report/041-02_Final_Report_(Chapter_7).pdf) (June 2, 2022)
- PlanD (2019) Study on Existing Profile and Operation of Brownfield Sites in the New Territories - Feasibility Study. , 90. Available from: [https://www.pland.gov.hk/pland_en/p_study/comp_s/Brownfield/Report/Brownfield Study_FR_ENG.pdf](https://www.pland.gov.hk/pland_en/p_study/comp_s/Brownfield/Report/Brownfield_Study_FR_ENG.pdf) (June 14, 2022)
- Stanton, R.L., Morrissey, C.A. & Clark, R.G. (2018) Analysis of trends and agricultural drivers of farmland bird declines in North America: A review. *Agriculture, Ecosystems and Environment* 254, 244–254. <https://doi.org/10.1016/j.agee.2017.11.028>
- The Hong Kong Bird Watching Society (2020) The Only Hong Kong Bird Atlas Showed Birds from Open Country Accounted for 70% of Species with Shrunk Distribution, Calls for Immediate Actions for Conserving Open Country. *The Hong Kong Bird Watching Society*. Available from: <https://cms.hkbws.org.hk/cms/en/hkbws/work/resarch/hk-bird-atlas-2020-en> (June 2, 2022)
- The Hong Kong Bird Watching Society (2021) List of Hong Kong Birds. *The Hong Kong Bird Watching Society*. Available from: <https://cms.hkbws.org.hk/cms/en/resource/bird-list> (June 2, 2022)
- Zhang, M., Tian, C., Che, X., Zhao, Y., Chen, S., Zhou, X. & Zou, F. (2022) New bird records in Guangdong Province and their correlation with natural and social-economic factors. *Biodiversity Science* 30, 21396.

Appendix 1. Bird data collected from January 2021 to May 2022 from the nine survey sites in the proposed Northern Metropolis. Conservation Status: NT = Near Threatened, VU = Vulnerable, EN = Endangered and CR = Critically Endangered, I = Nationally Class I protected, II = Nationally Class II protected.
Species of conservation concern are bolded.

Common Name	Scientific Name	IUCN Red List of Threatened Species (2021)	Redlist of China's biodiversity (2015)	State Key Protected Wild Animals List (2021)	Tai Po Tin	Sandy Ridge Wetland Mosaic	Chow Tin - Lei Uk	Ping Yeung Old Village - Shui Lau Hang	Heung Yuen Wai - Tsung Yuen Ha	Lok Ma Chau Village	Shek Wu Wai	Chuk Yuen	Sing Ping
Chinese Spot-billed Duck	<i>Anas zonorhyncha</i>								✓				
Eurasian Teal	<i>Anas crecca</i>										✓		
Chinese Francolin	<i>Francolinus pintadeanus</i>		NT			✓		✓	✓	✓		✓	
Grey Nightjar	<i>Caprimulgus jotaka</i>									✓			
Savanna Nightjar	<i>Caprimulgus affinis</i>				✓	✓	✓	✓	✓				
Himalayan Swiftlet	<i>Aerodramus brevirostris</i>		NT							✓			
Pacific Swift	<i>Apus pacificus</i>							✓					
House Swift	<i>Apus nipalensis</i>				✓	✓	✓	✓	✓	✓	✓		✓
Greater Coucal	<i>Centropus sinensis</i>			II	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lesser Coucal	<i>Centropus bengalensis</i>			II	✓	✓	✓	✓	✓	✓		✓	
Chestnut-winged Cuckoo	<i>Clamator coromandus</i>							✓	✓				
Asian Koel	<i>Eudynamys scolopaceus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Plaintive Cuckoo	<i>Cacomantis merulinus</i>				✓	✓	✓	✓	✓	✓	✓		
Large Hawk-Cuckoo	<i>Hierococcyx sparveroides</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Indian Cuckoo	<i>Cuculus micropterus</i>				✓	✓		✓	✓	✓		✓	
Rock Dove	<i>Columba livia</i>					✓				✓			
Oriental Turtle Dove	<i>Streptopelia orientalis</i>					✓	✓	✓	✓				
Red Collared Dove	<i>Streptopelia tranquebarica</i>				✓								
Spotted Dove	<i>Spilopelia chinensis</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Common Emerald Dove	<i>Chalcophaps indica</i>						✓						
Common Moorhen	<i>Gallinula chloropus</i>					✓		✓					
Slaty-legged Crane	<i>Rallina eurizonoides</i>		VU						✓				
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Little Grebe	<i>Tachybaptus ruficollis</i>					✓				✓			

Common Name	Scientific Name	IUCN Red List of Threatened Species (2021)	Redlist of China's biodiversity (2015)	State Key Protected Wild Animals List (2021)	Tai Po Tin	Sandy Ridge Wetland Mosaic	Chow Tin - Lei Uk	Ping Yeung Old Village - Shui Lau Hang	Heung Yuen Wai - Tsung Yuen Ha	Lok Ma Chau Village	Shek Wu Wai	Chuk Yuen	Sing Ping
Little Ringed Plover	<i>Charadrius dubius</i>				✓		✓	✓		✓			
Long-toed Stint	<i>Calidris subminuta</i>				✓								
Greater Painted-snipe	<i>Rostratula benghalensis</i>									✓			
Eurasian Woodcock	<i>Scolopax rusticola</i>								✓				
Swinhoe's / Pintail Snipe	<i>Gallinago megala/stenura</i>				✓					✓			
Common Snipe	<i>Gallinago gallinago</i>							✓		✓			
Common Sandpiper	<i>Actitis hypoleucos</i>									✓			
Green Sandpiper	<i>Tringa ochropus</i>				✓	✓	✓		✓	✓	✓		
Wood Sandpiper	<i>Tringa glareola</i>				✓				✓	✓			
Common Greenshank	<i>Tringa nebularia</i>					✓					✓		
Great Cormorant	<i>Phalacrocorax carbo</i>					✓				✓			
Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>					✓							
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>					✓	✓		✓				
Striated Heron	<i>Butorides striata</i>								✓				
Chinese Pond Heron	<i>Ardeola bacchus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Eastern Cattle Egret	<i>Bubulcus coromandus</i>				✓	✓		✓	✓	✓	✓		
Grey Heron	<i>Ardea cinerea</i>				✓	✓	✓		✓		✓		
Purple Heron	<i>Ardea purpurea</i>					✓							
Great Egret	<i>Ardea alba</i>				✓	✓		✓		✓	✓		
Intermediate Egret	<i>Ardea intermedia</i>					✓				✓			
Little Egret	<i>Egretta garzetta</i>				✓	✓	✓		✓	✓	✓		✓
Western Osprey	<i>Pandion haliaetus</i>		NT	II			✓						
Black-winged Kite	<i>Elanus caeruleus</i>		NT	II				✓					
Crested Serpent Eagle	<i>Spilornis cheela</i>		NT	II	✓	✓	✓	✓	✓	✓	✓		
Eastern Imperial Eagle	<i>Aquila heliaca</i>	VU	EN	I		✓							
Bonelli's Eagle	<i>Aquila fasciata</i>		VU	II	✓	✓							
Crested Goshawk	<i>Accipiter trivirgatus</i>		NT	II		✓		✓	✓				
Japanese Sparrowhawk	<i>Accipiter gularis</i>			II					✓				
Besra	<i>Accipiter virgatus</i>			II	✓				✓	✓	✓		

Common Name	Scientific Name	IUCN Red List of Threatened Species (2021)	Redlist of China's biodiversity (2015)	State Key Protected Wild Animals List (2021)	Tai Po Tin	Sandy Ridge Wetland Mosaic	Chow Tin - Lei Uk	Ping Yeung Old Village - Shui Lau Hang	Heung Yuen Wai - Tsung Yuen Ha	Lok Ma Chau Village	Shek Wu Wai	Chuk Yuen	Sing Ping
Northern Goshawk	<i>Accipiter gentilis</i>		NT	II	✓								
Black Kite	<i>Milvus migrans</i>			II	✓	✓	✓	✓	✓	✓	✓	✓	✓
Eastern Buzzard	<i>Buteo japonicus</i>			II	✓	✓	✓	✓	✓	✓			
Asian Barred Owlet	<i>Glaucidium cuculoides</i>			II	✓	✓	✓	✓	✓				
Collared Scops Owl	<i>Otus lettia</i>			II			✓		✓				
Eurasian Hoopoe	<i>Upupa epops</i>							✓					
White-throated Kingfisher	<i>Halcyon smyrnensis</i>			II	✓	✓	✓	✓	✓		✓	✓	
Black-capped Kingfisher	<i>Halcyon pileata</i>					✓							
Common Kingfisher	<i>Alcedo atthis</i>				✓	✓		✓	✓		✓		✓
Pied Kingfisher	<i>Ceryle rudis</i>					✓				✓	✓		
Eurasian Wryneck	<i>Jynx torquilla</i>						✓						
Speckled Piculet	<i>Picumnus innominatus</i>				✓	✓	✓		✓			✓	
Common Kestrel	<i>Falco tinnunculus</i>			II	✓		✓					✓	
Alexandrine Parakeet	<i>Psittacula eupatria</i>	NT		II	✓	✓	✓	✓				✓	✓
Ashy Woodswallow	<i>Artamus fuscus</i>							✓					
Scarlet Minivet	<i>Pericrocotus speciosus</i>				✓			✓	✓				
Black-winged Cuckooshrike	<i>Lalage melaschistos</i>							✓					
Bull-headed Shrike	<i>Lanius bucephalus</i>				✓								
Brown Shrike	<i>Lanius cristatus</i>				✓	✓		✓				✓	
Long-tailed Shrike	<i>Lanius schach</i>				✓	✓	✓	✓	✓	✓			✓
Hair-crested Drongo	<i>Dicrurus hottentottus</i>				✓	✓		✓	✓	✓	✓	✓	✓
Black Drongo	<i>Dicrurus macrocercus</i>				✓	✓		✓		✓	✓		
Black-naped Monarch	<i>Hypothymis azurea</i>				✓			✓					
Azure-winged Magpie	<i>Cyanopica cyanus</i>									✓			
Red-billed Blue Magpie	<i>Urocissa erythroryncha</i>				✓	✓	✓	✓	✓	✓	✓	✓	
Indochinese Green Magpie	<i>Cissa hypoleuca</i>		NT	II				✓					
Oriental Magpie	<i>Pica serica</i>				✓	✓	✓						✓
Collared Crow	<i>Corvus torquatus</i>	VU	NT			✓	✓	✓	✓	✓	✓		
Large-billed Crow	<i>Corvus macrorhynchos</i>				✓	✓	✓	✓	✓	✓		✓	✓

嘉道理農場暨植物園公司

Kadoorie Farm & Botanic Garden Corporation

Common Name	Scientific Name	IUCN Red List of Threatened Species (2021)	Redlist of China's biodiversity (2015)	State Key Protected Wild Animals List (2021)	Tai Po Tin	Sandy Ridge Wetland Mosaic	Chow Tin - Lei Uk	Ping Yeung Old Village - Shui Lau Hang	Heung Yuen Wai - Tsung Yuen Ha	Lok Ma Chau Village	Shek Wu Wai	Chuk Yuen	Sing Ping
Cinereous Tit	<i>Parus cinereus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Chinese Penduline Tit	<i>Remiz consobrinus</i>									✓			
Black Bulbul	<i>Hypsipetes leucocephalus</i>				✓								
Chinese Bulbul	<i>Pycnonotus sinensis</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Barn Swallow	<i>Hirundo rustica</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Red-rumped Swallow	<i>Cecropis daurica</i>					✓	✓	✓	✓		✓		
Manchurian Bush Warbler	<i>Horornis canturians</i>					✓	✓	✓	✓				
Pale-footed Bush Warbler	<i>Urosphena pallidipes</i>								✓				
Yellow-browed Warbler	<i>Phylloscopus inornatus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Pallas's Leaf Warbler	<i>Phylloscopus proregulus</i>				✓	✓	✓	✓	✓				✓
Dusky Warbler	<i>Phylloscopus fuscatus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Two-barred Warbler	<i>Phylloscopus plumbeitarsus</i>						✓						
Oriental Reed Warbler	<i>Acrocephalus orientalis</i>						✓						
Russet Bush Warbler	<i>Locustella mandelli</i>				✓		✓		✓				
Zitting Cisticola	<i>Cisticola juncidis</i>				✓		✓	✓					✓
Golden-headed Cisticola	<i>Cisticola exilis</i>				✓			✓	✓				
Yellow-bellied Prinia	<i>Prinia flaviventris</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Plain Prinia	<i>Prinia inornata</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Common Tailorbird	<i>Orthotomus sutorius</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Swinhoe's White-eye	<i>Zosterops simplex</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Rufous-capped Babbler	<i>Cyanoderma ruficeps</i>						✓	✓	✓				
Chinese Hwamei	<i>Garrulax canorus</i>		NT	II		✓	✓	✓	✓				
Black-throated Laughingthrush	<i>Pterorhinus chinensis</i>			II	✓		✓	✓	✓				
White-browed Laughingthrush	<i>Pterorhinus sannio</i>							✓	✓				
Masked Laughingthrush	<i>Pterorhinus perspicillatus</i>				✓	✓	✓	✓	✓	✓	✓		✓
Velvet-fronted Nuthatch	<i>Sitta frontalis</i>				✓			✓					
Crested Myna	<i>Acridotheres cristatellus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓

Common Name	Scientific Name	IUCN Red List of Threatened Species (2021)	Redlist of China's biodiversity (2015)	State Key Protected Wild Animals List (2021)	Tai Po Tin	Sandy Ridge Wetland Mosaic	Chow Tin - Lei Uk	Ping Yeung Old Village - Shui Lau Hang	Heung Yuen Wai - Tsung Yuen Ha	Lok Ma Chau Village	Shek Wu Wai	Chuk Yuen	Sing Ping
Common Myna	<i>Acridotheres tristis</i>				✓		✓	✓		✓	✓	✓	
Red-billed Starling	<i>Spodiopsar sericeus</i>									✓			
White-cheeked Starling	<i>Spodiopsar cineraceus</i>				✓	✓	✓		✓	✓			
Black-collared Starling	<i>Gracupica nigricollis</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
White-shouldered Starling	<i>Sturnia sinensis</i>				✓			✓		✓	✓		
Chinese Blackbird	<i>Turdus mandarinus</i>				✓	✓	✓				✓		
Oriental Magpie Robin	<i>Copsychus saularis</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Grey-streaked Flycatcher	<i>Muscicapa griseisticta</i>					✓		✓					
Asian Brown Flycatcher	<i>Muscicapa dauurica</i>					✓	✓						
Blue-and-white Flycatcher	<i>Cyanoptila cyanomelana</i>						✓						
Verditer Flycatcher	<i>Eumyias thalassinus</i>				✓	✓					✓		
Siberian Rubythroat	<i>Calliope calliope</i>			II	✓	✓	✓	✓	✓		✓	✓	
Blue Whistling Thrush	<i>Myophonus caeruleus</i>					✓			✓				
Red-throated Flycatcher	<i>Ficedula albicilla</i>				✓	✓	✓	✓			✓		
Daurian Redstart	<i>Phoenicurus aureus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Stejneger's Stonechat	<i>Saxicola stejnegeri</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Fire-breasted Flowerpecker	<i>Dicaeum ignipectus</i>							✓					
Scarlet-backed Flowerpecker	<i>Dicaeum cruentatum</i>				✓	✓							
Fork-tailed Sunbird	<i>Aethopyga christinae</i>					✓	✓	✓	✓		✓		
Eurasian Tree Sparrow	<i>Passer montanus</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Scaly-breasted Munia	<i>Lonchura punctulata</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
White-rumped Munia	<i>Lonchura striata</i>								✓		✓		✓
Chestnut Munia	<i>Lonchura atricapilla</i>				✓				✓				
White-headed Munia	<i>Lonchura maja</i>				✓				✓				
Eastern Yellow Wagtail	<i>Motacilla tschutschensis</i>				✓	✓	✓	✓		✓	✓	✓	
Grey Wagtail	<i>Motacilla cinerea</i>				✓	✓	✓	✓	✓		✓	✓	✓
White Wagtail	<i>Motacilla alba</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓
Richard's Pipit	<i>Anthus richardi</i>				✓		✓	✓					
Olive-backed Pipit	<i>Anthus hodgsoni</i>				✓	✓	✓	✓	✓	✓	✓	✓	✓

Common Name	Scientific Name	IUCN Red List of Threatened Species (2021)	Redlist of China's biodiversity (2015)	State Key Protected Wild Animals List (2021)	Tai Po Tin	Sandy Ridge Wetland Mosaic	Chow Tin - Lei Uk	Ping Yeung Old Village - Shui Lau Hang	Heung Yuen Wai - Tsung Yuen Ha	Lok Ma Chau Village	Shek Wu Wai	Chuk Yuen	Sing Ping
Red-throated Pipit	<i>Anthus cervinus</i>	NT	NT	I	✓					✓	✓		
Buff-bellied Pipit	<i>Anthus rubescens</i>				✓								
Chinese Grosbeak	<i>Eophona migratoria</i>				✓	✓	✓	✓	✓	✓			
Japanese Grosbeak	<i>Eophona personata</i>						✓						
Grey-capped Greenfinch	<i>Chloris sinica</i>					✓							
Yellow-fronted Canary	<i>Crithagra mozambica</i>					✓							
Crested Bunting	<i>Emberiza lathamii</i>	CR VU	EN VU	I				✓					
Little Bunting	<i>Emberiza pusilla</i>				✓	✓	✓	✓	✓	✓			
Yellow-breasted Bunting	<i>Emberiza aureola</i>				✓				✓	✓			
Japanese Yellow Bunting	<i>Emberiza sulphurata</i>									✓			
Black-faced Bunting	<i>Emberiza spodocephala</i>				✓	✓	✓	✓	✓	✓	✓		

Appendix 2. Habitat characteristics, bird species richness and conservation value of survey sites in the proposed Northern Metropolis

Survey Site	Habitat size (ha)	Habitat Diversity	Species Richness	Species of Conservation Concern	Conservation Value Score
Tai Po Tin	48	Dry farmland, wet farmland, abandoned farmland	90	15	7.25
Sandy Ridge Wetland Mosaic	17	Dry farmland, wet farmland, abandoned farmland, ponds	90	15	7.125
Chow Tin - Lei Uk	36	Dry farmland, wet farmland, abandoned farmland	79	16	6.625
Ping Yeung Old Village - Shui Lau Hang	21	Dry farmland, abandoned farmland	86	16	6.125
Heung Yuen Wai - Tsung Yuen Ha	8	Dry farmland, abandoned farmland, ponds	84	18	6
Lok Ma Chau Village	4	Dry farmland, wet farmland, abandoned farmland, ponds	71	11	4.5
Shek Wu Wai	17	Dry farmland, abandoned farmland, ponds	59	7	4.125
Chuk Yuen	6	Dry farmland, wet farmland, abandoned farmland	41	8	3.25
Sing Ping	10	Dry farmland, abandoned farmland	39	3	2.25

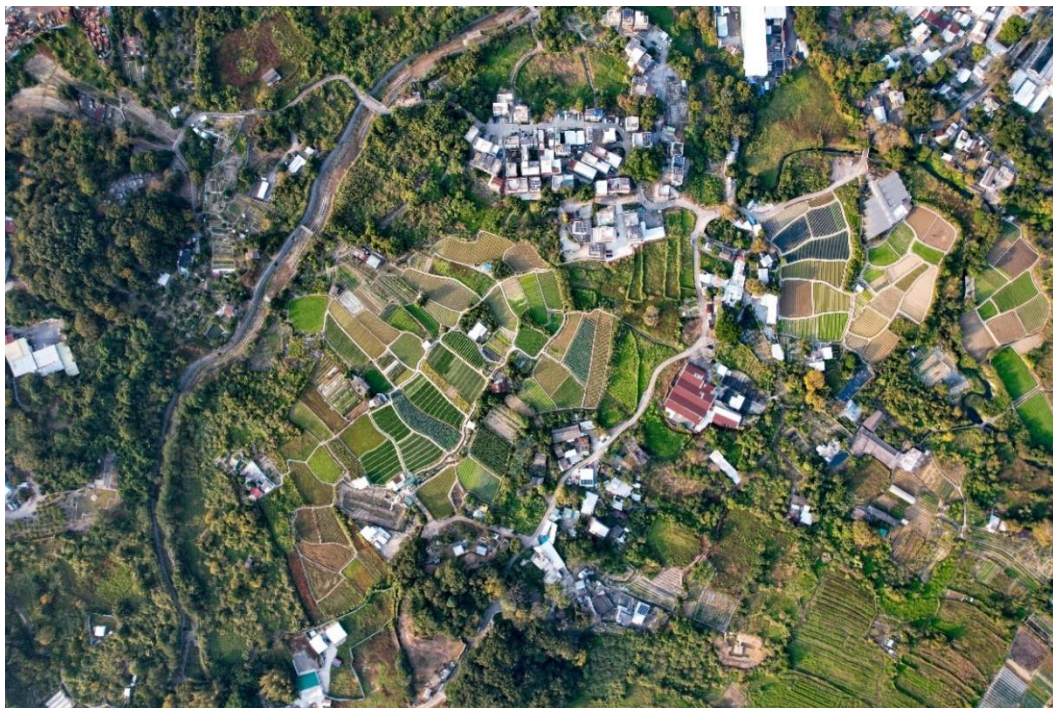


Plate 1. Tai Po Tin has one of the most intact farmland landscapes in the proposed Northern Metropolis, and attained the highest score in a preliminary conservation value ranking exercise conducted.

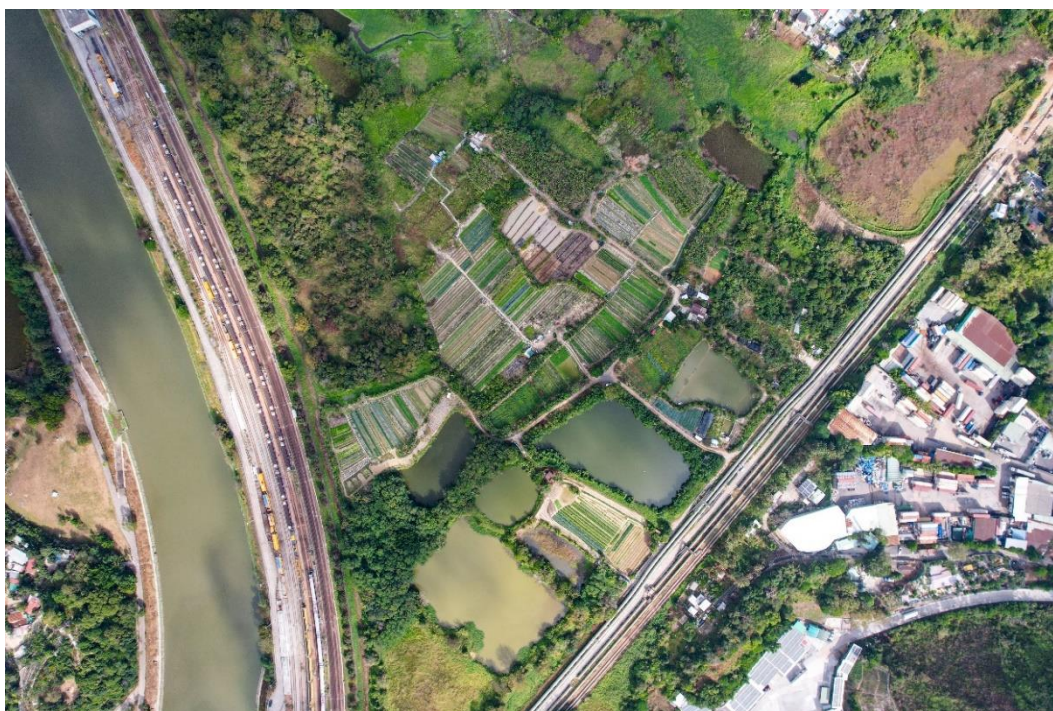


Plate 2. The Sandy Ridge Wetland Mosaic supports diverse microhabitats for avifauna



Plate 3. The extensive active-abandoned farmland of Chow Tin - Lei Uk border the upper Ping Yuen River



Plate 4. Wet cultivation of Watercress *Rorippa nasturtium-aquaticum* in Sandy Ridge Wetland Mosaic



Plate 5. Fallow farmland of Tai Po Tin; the Critically Endangered Yellow-breasted Bunting was recorded here



Plate 6. Yellow-breasted Bunting *Emberiza aureola* from Heung Yuen Wai - Tsung Yuen Ha



Plate 7. Japanese Yellow Bunting *Emberiza sulphurata* from Lok Ma Chau Village



Plate 8. Ashy Woodswallow *Artamus fuscus* from Ping Yeung Old Village - Shui Lau Hang



Plate 9. Female Crested Bunting *Emberiza lathami* from Ping Yeung Old Village - Shui Lau Hang



Plate 10. Mist nets found in Chuk Yuen



Plate 11. The grossly polluted upper Ping Yuen River flows through the Chow Tin - Lei Uk farmland

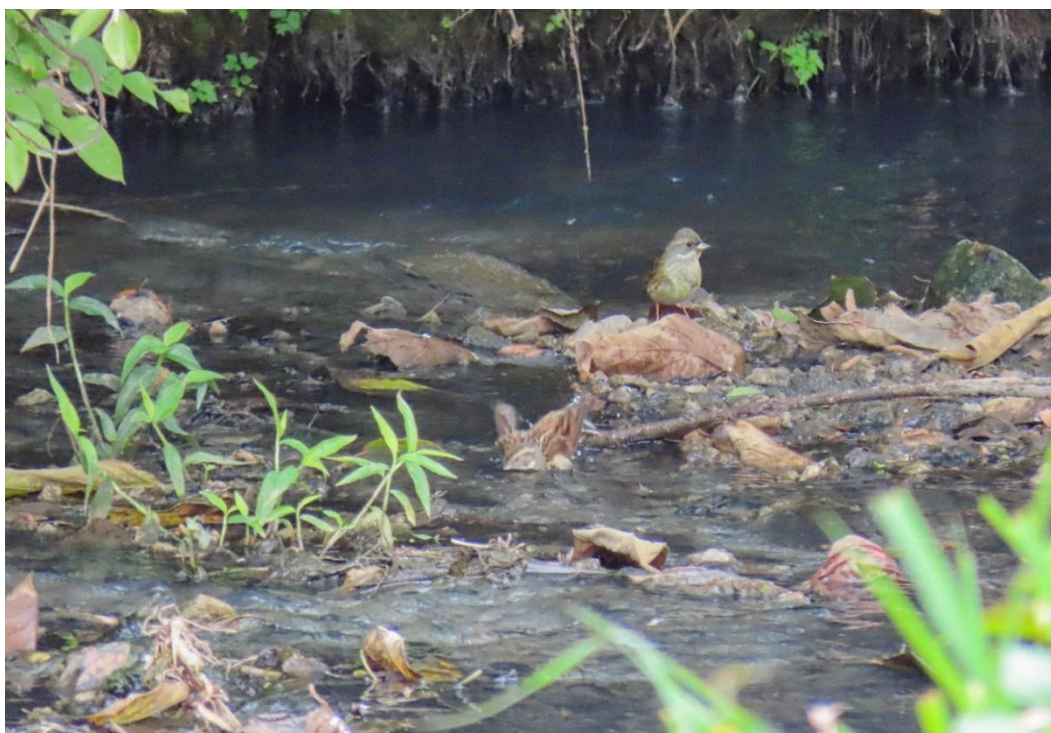


Plate 12. Birds were seen drinking/bathing in the polluted upper Ping Yuen River

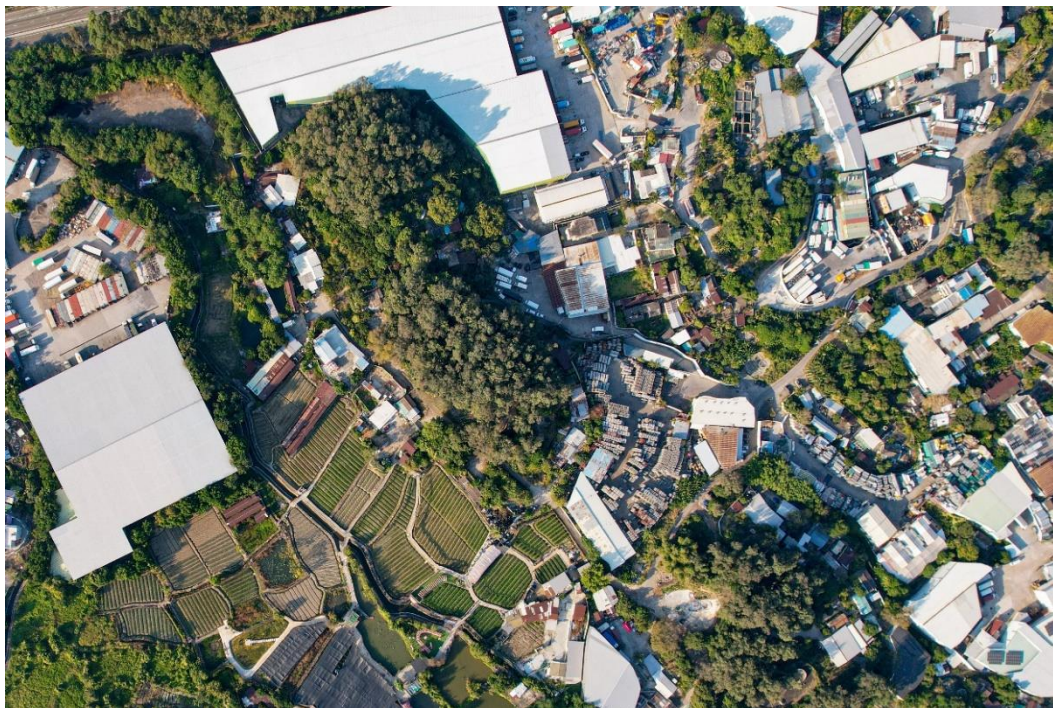


Plate 13. The Shek Wu Wai farmland is surrounded by brownfield sites