

An aerial photograph of a rural farm area. The landscape is dominated by numerous rectangular and irregular plots of land, each filled with different types of crops. Some plots show rows of green leafy vegetables, while others have taller plants or are covered in dark plastic mulch. Several small buildings with blue and grey roofs are scattered throughout the farm, interspersed with clusters of trees. The overall scene is a vibrant green, indicating a healthy and active agricultural environment.

THE HIDDEN OASES OF HONG KONG

*HIGH ECOLOGICAL VALUE FARMLANDS
IN THE PROPOSED NORTHERN METROPOLIS*

Kadoorie Farm and Botanic Garden



Mission

To harmonise our relationship
with the environment.

Vision

A world in which people live sustainably with
respect for each other and nature.



K F B G

Kadoorie Farm & Botanic Garden
嘉道理農場暨植物園

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1. Summary

To identify farmlands of high ecological value in the proposed Northern Metropolis, Kadoorie Farm and Botanic Garden (KFBG) conducted a comprehensive biodiversity study on farmland birds from December 2021 to November 2022 at nine selected farmland sites. A total of 154 bird species were recorded during the study period, 66 of which were of conservation concern. The surveyed farmlands are interspersed with brownfields, villages, infrastructure and other anthropogenic land uses, and are susceptible to disturbances, incompatible development plans and environmental destruction. Based on an analysis of habitat and species characteristics, farmland sites with the highest ecological value are Sandy Ridge Wetland Mosaic, Chow Tin - Lei Uk and Tai Po Tin - Shan Kai Wat. KFBG recommends that future development plans should incorporate a comprehensive farmland conservation strategy to safeguard these farmlands of both natural and agricultural significance, preferably with the concepts of “Nature Park”, “Agricultural Priority Areas” and “Urban-Rural Greenway”. Relevant stakeholders should consider farmland conservation a priority and take immediate conservation actions, such as strengthening farmland-related research and policies, developing subvention mechanisms (e.g., payments for ecosystem services) and mainstreaming farmland conservation.



2. FARMLAND BIODIVERSITY IN PERIL

Globally, farmland biodiversity is in steep decline as it is sensitive to changes in agricultural practices and land use (Donald et al. 2001; Uchida & Ushimaru 2014). As one of the better-documented wildlife taxa, farmland birds have suffered long-term declines across Europe since the 1970s, with population declining by 52% from 1980 to 2010 (BirdLife International 2013; Eurostat 2021; Gregory et al. 2004). A staggering 74% of farmland bird species in North America experienced population decline from 1966 to 2013 (Stanton et al. 2018). In Australia, there is mounting evidence of substantial population declines and local extinctions of birds in agricultural landscapes, and populations of 37% of grassland species have declined since 1977 (Attwood et al. 2009). The concept of “High Nature Value” farming was developed in the early 1990s, when concerns about biodiversity conservation in Europe were raised as a reaction to the agriculture intensification and its impact on the environment.

The conversion of agricultural land and intensification of agricultural practices has also posed great pressure on China’s farmland biodiversity (Wood et al. 2010). China possesses the largest share of the world’s agricultural lands at 9.9% of the global total, with a great number of threatened bird species depending on farmland habitats for survival, such as the Endangered Asian Crested Ibis *Nipponia nippon*. However, explicit farmland biodiversity conservation target or policy is still lacking in China (Li et al. 2020).

In Hong Kong, the decline of local agriculture has a significant impact on farmland bird communities; many farmland bird populations have 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 reported over 77% of bird species with a reduced distribution were open-country species (Hong Kong Bird Watching Society 2020b), many of which depend on farmlands for survival.



Farmlands at Tai Po Tin - Shan Kai Wat

3. KFBG'S FARMLAND BIODIVERSITY STUDY

On 6 Oct 2021, the Hong Kong SAR 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 to mitigate the impacts, with an overwhelming ecological protection emphasis put on fishponds and waterbirds (Hong Kong Special Administrative Region Government 2021). An extensive area of the northern New Territories is included in this plan, which supports substantial areas of active as well as high value abandoned farmlands remaining in Hong Kong. While the ecological importance of fishponds and forests is widely recognised 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 scant, their importance to local biodiversity conservation are recognised and several government-funded projects have been implemented to conserve the unique agricultural landscapes of Hong Kong, such as at Long Valley, Ho Sheung Heung and Lai Chi Wo (Agriculture, Fisheries and Conservation Department 2021b; Chick 2017).

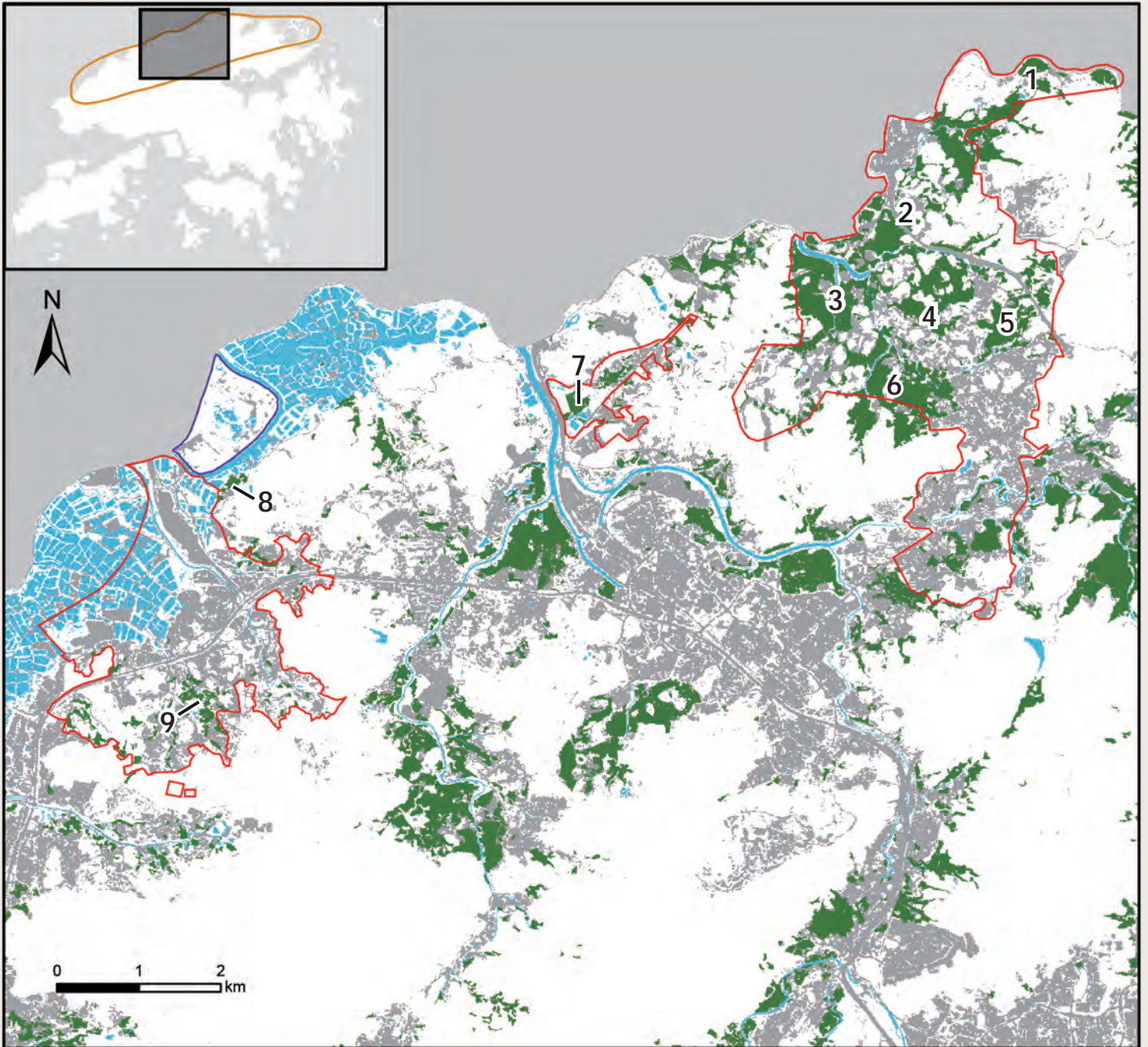
In view of the mounting development pressures and existing gaps in our knowledge regarding farmland biodiversity in the proposed Northern Metropolis (NM), KFBG initiated a systematic biodiversity study of selected farmlands in the proposed NM, data from this study were used to: (1) understand farmland biodiversity in NM; (2) identify high ecological value farmland sites in NM and propose priority sites for conservation.

STUDY AREA

The conversion of abandoned farmland has greatly reduced farmland coverage in Hong Kong (Jim 1997). Recent study suggested there was 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). Active farmland areas plummeted from 12,589 ha in 1960 (Census and Statistics Department 1969) to 733 ha in 2022 (Agriculture, Fisheries and Conservation Department 2023), which is less than 1% of Hong Kong's total land area. The remaining farmlands in Hong Kong are invariably small and contain a mosaic of active cultivation plots interspersed with abandoned fields, patches of woodland and built-up areas.

In the current study, 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 - Shan Kai Wat, Sandy Ridge Wetland Mosaic, Lok Ma Chau Village and Shek Wu Wai, were selected for our biodiversity survey (Map 1). These farmland sites vary greatly in habitat size and diversity but were strategically selected due to their representativeness – they are typical examples of those relatively intact cultivated areas (but not under any special entitlement/management regime such as Nature Park/ Agricultural Park) in the northern New Territories. These sites are also located within or adjoining the proposed development areas under the NMDS. These development areas include the Hong Kong-Shenzhen Innovation and Technology Park (purple outline in Map 1), and three New Development Areas (red outline in Map 1): New Territories North (NTN) New Town, Man Kam To Development Corridor and San Tin Technopole.

Map 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 - Shan Kai Wat, 7 = Sandy Ridge Wetland Mosaic, 8 = Lok Ma Chau Village, 9 = Shek Wu Wai)





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Wet cultivation of Watercress
Rorippa nasturtium-aquaticum
at Tai Po Tin - Shan Kai Wat



© Bosco Chan/KFBG

Dry farmland at Sandy Ridge



© Bosco Chan/KFBG

Fallow farmland of Tai Po Tin - Shan Kai Wat; the Critically Endangered Yellow-breasted Bunting was recorded here

A total of 167 ha of farmlands were surveyed at these nine sites. Depending on the size of these sites, we selected 12 transects to cover a mosaic of active and abandoned farmland plots. The survey also covered ponds and irrigation channels, which are integral parts of any farmland landscape. 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 comprised 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 fishponds or lilyponds as well as marshes formed by long-abandoned fishponds and choked waterways.

BIODIVERSITY SURVEYS

Birds were selected as the primary indicator to assess the ecological value at different farmland sites in this study. Birds are often regarded as good indicators of the broad state of wildlife, as they are wide-ranging and tend to be at or near the top of the food chain. Populations of bird communities can

tell a story about the condition of the environment and its development over time (Lee et al. 2022; Morelli & Tryjanowski 2017; Traba & Morales 2019). Moreover, farmland birds have been widely used as general indicators of the biodiversity of agricultural habitats, such as the Farmland Bird Index by the European Union and the United Kingdom (Gregory et al. 2004; Pan-European Common Bird Monitoring Scheme 2021; Scholefield et al. 2011).

From December 2021 to November 2022, systematic bird surveys were conducted at dawn or dusk at least once per month at each site; birds observed were identified, counted and recorded along the designated transects. Ad hoc night surveys were conducted to search for nocturnal avifauna, especially owls and nightjars. Amphibians, reptiles, butterflies and dragonflies were also recorded on an ad libitum basis during the night-time and daylight bird surveys. Although unsystematic, survey team members throughout the study period were consistent allowing a fair assessment across the nine survey sites, thus these extra data from these wildlife taxa provides additional information on the local biodiversity value.

4. BIODIVERSITY OF SELECTED FARMLAND SITES

BIRDS

The classification system of birds followed the *List of Hong Kong Birds* (Hong Kong Bird Watching Society 2022). Species were considered to be of conservation concern if they were: (1) listed as Near Threatened, Vulnerable, Endangered and Critically Endangered in the *IUCN Red List of Threatened Species* (HBW and BirdLife International 2022); or (2) listed as Near Threatened, Vulnerable, Endangered and Critically Endangered in the *Red List of China's Vertebrates* (Jiang et al. 2016); or (3) listed in the *State Key Protected Wild Animals List* (National Forestry and Grassland Administration 2021); or (4) listed as Global Concern, Regional Concern, Local Concern, Potential Global Concern, Potential Regional Concern in the *Hong Kong Fauna of Conservation Concern* (Fellowes et al. 2002).

A total of 154 bird species were recorded during the study period (Appendix 1), representing 27% of the 572 bird species reported for Hong Kong (Hong Kong Bird Watching Society 2022). Sixty-six species were of conservation concern, representing over one-third of the total species recorded. One hundred and one species recorded (~66% the total species) have experienced range reduction in Hong Kong (Hong Kong Bird Watching Society 2020a).

Sandy Ridge Wetland Mosaic, Chow Tin - Lei Uk and Tai Po Tin - Shan Kai Wat (Location 7, 3 and 6 in Map 1) were the top three sites in terms of bird species richness, indicating that

these farmland sites in general support rich and diverse bird communities.

The globally Critically Endangered Yellow-breasted Bunting *Emberiza aureola* was observed at Tai Po Tin - Shan Kai Wat, Lok Ma Chau Village, Heung Yuen Wai - Tsung Yuen Ha and Chuk Yuen. The Endangered Black-faced Spoonbill *Platalea minor* was found at the wet farmland of Lok Ma Chau Village. Several globally Vulnerable species were also recorded: Greater Spotted Eagle *Clanga clanga*, Eastern Imperial Eagle *Aquila heliaca*, Black-capped Kingfisher *Halcyon pileate* and Collared Crow *Corvus torquatus*.

The survey recorded a great number of farmland-dependent species. Little Bunting *Emberiza pusilla* and Black-faced Bunting *Emberiza spodocephala* were consistently recorded at most survey sites, sometimes in significant numbers (more than 50 Little Buntings were recorded in a single survey at Tai Po Tin - Shan Kai Wat). Japanese Quail *Coturnix japonica* was recorded at Sandy Ridge and Chow Tin - Lei Uk. Eastern Yellow Wagtail *Motacilla tschutschensis*, Richard's Pipit *Anthus richardi*, Red-throated Pipit *Anthus cervinus* and Buff-bellied Pipit *Anthus rubescens* were regularly recorded at various sites. Species dependent on wet farmland included the Greater Painted-snipe *Rostratula benghalensis* at Tai Po Tin - Shan Kai Wat and Lok Ma Chau Village; Swinhoe's/Pintail Snipe *Gallinago megala/stenura* were also recorded at these two sites, as well as Chow Tin - Lei Uk.





Yellow-breasted Bunting
Emberiza aureola
 © Eric Au/KFBG



Ashy Woodswallow
Artamus fuscus
 © Eric Au/KFBG



Crested Bunting
Emberiza lathami
 © Eric Au/KFBG

Some locally rare species were also recorded: Common Rosefinch *Carpodacus erythrinus*, Grey-capped Greenfinch *Chloris sinica* and Cinnamon Bittern *Ixobrychus cinnamomeus* at Sandy Ridge Wetland Mosaic; Japanese Grosbeak *Eophona personata* at Chow Tin - Lei Uk while the Chinese Grosbeak *Eophona migratoria* was found at an additional four sites; Bull-headed Shrike *Lanius bucephalus* at Tai Po Tin - Shan Kai Wat; Japanese Yellow Bunting *Emberiza sulphurata* at Lok Ma Chau Village.

Our findings demonstrate that some of the remaining farmlands in NM support a rich avifauna and are providing critical habitats for a significant number of globally or locally threatened species. With farmland loss and intensification of farming practices, bunting populations have been in steep decline worldwide including Hong Kong (Hong Kong Bird Watching Society 2020a), the predominantly dry farmlands of NM appear to be important stopover and wintering grounds for migrating and wintering buntings, including the Yellow-breasted Bunting. Some rare species have been recorded in this habitat as well. Ashy Woodswallow *Artamus fuscus*, a third record for Hong Kong, and Crested Bunting *Emberiza lathami*, a rare migrant used to breed in Hong Kong, were both recorded at dry farmland of Ping Yeung Old Village - Shui Lau Hang. Greater Painted-snipe is an iconic wetland-dependent species and has experienced a 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).

AMPHIBIANS AND REPTILES

The classification system of amphibians followed *Amphibian Species of the World* (Frost 2023). The classification system of reptiles followed *The Reptile Database* (Uetz et al. 2022). Species were considered to be of conservation concern if they were: (1) listed as Near Threatened, Vulnerable, Endangered and Critically Endangered in the *Red List of China's Vertebrates* (Jiang et al. 2016); or (2) listed in the *State Key Protected Wild Animals List* (National Forestry and Grassland Administration 2021); or (3) listed as Global Concern, Regional Concern, Local Concern, Potential Global Concern, Potential Regional Concern in the *Hong Kong Fauna of Conservation Concern* (Fellowes et al. 2002).

A total of 11 amphibian species (Appendix 2) and 11 reptile species (Appendix 3) were recorded from the survey sites. Species of conservation concern include Chinese Bullfrog *Hoplobatrachus chinensis*, which is listed as Endangered in the *Red List of China's Vertebrates* as well as a State Class II protected



Danaid Eggfly
Hypolimnys misippus
© Ellis Li/KFBG



Scarlet Basker
Urothemis signata
© Ellis Li/KFBG



Chinese Bullfrog
Hoplobatrachus chinensis
© Eric Au/KFBG

species in China. This lowland species was locally common at four survey sites, indicating that farmlands in Hong Kong could still serve as a stronghold for this protected species. The Local Concern Buff-striped Keelback *Amphiesma stolatum* in Ping Yeung Old Village - Shui Lau Hang and the Chinese Skink *Plestiodon chinensis* in Chow Tin - Lei Uk were of conservation concern as both species are associated with open country habitats. The populations in Hong Kong were declining due to the degradation of agricultural lands and other suitable lowland habitats (Agriculture, Fisheries and Conservation Department 2014). The record of Spotted Narrow-mouthed Frog *Kalophrynus interlineatus* in Tai Po Tin - Shan Kai Wat is also of conservation interest as the species only occurs in central and northern New Territories within Hong Kong (Chan et al. 2005).

Sandy Ridge Wetland Mosaic, Chow Tin - Lei Uk and Tai Po Tin - Shan Kai Wat were the top three sites in terms of amphibian and reptile species composition, indicating that these farmlands are still of high ecological integrity thus of high conservation value.

BUTTERFLIES AND DRAGONFLIES

The classification system of butterflies followed *The Checklist of Chinese Butterflies* (Hsu et al. 2017). The classification system of dragonflies follows *Annotated Check List of Dragonfly*

Species Recorded from Hong Kong (Reels 2019).

A total of 82 species of butterflies (Appendix 4) were recorded during the survey period. In Chow Tin - Lei Uk alone, 59 species were recorded, which was an impressive number representing 24% of the 245 butterfly species recorded in Hong Kong (Agriculture, Fisheries and Conservation Department 2021a). Tai Po Tin - Shan Kai Wat and Sandy Ridge Wetland Mosaic followed as the second and third sites in terms of the butterfly species richness.

A total of 37 species of dragonflies (Appendix 5) were recorded during the survey period, representing 30% of the 122 dragonfly species recorded in Hong Kong (Reels, 2019). Heung Yuen Wai - Tsung Yuen Ha, Tai Po Tin - Shan Kai Wat and Shek Wu Wai are the top three species-rich survey sites.

5. FARMLANDS OF HIGH ECOLOGICAL VALUE



Little Bunting
Emberiza pusilla
© Eric Au/KFBG

Our study recorded a rich assembly of birds, amphibians, reptiles, butterflies and dragonflies in a one-year field survey. The rich biodiversity demonstrates that the remaining farmlands in the NM, although highly fragmented and appearing ungainly at first sight, provide critical habitats for different wildlife taxa. As the survey sites vary in habitat size and diversity, a direct comparison of species richness would be inconclusive in drawing conservation importance. To offer a comprehensive assessment of the relative conservation significance of these farmland sites, a scoring matrix was created to ensure different biotic and abiotic factors were taken into consideration (Morelli & Tryjanowski 2017, Table 1). Scores of the four criteria were first calculated for each survey site. The

final ecological value was then calculated by the sum of weighted scores. The results were presented in Table 2, it was apparent that the ecological value of Sandy Ridge Wetland Mosaic, Chow Tin - Lei Uk and Tai Po Tin - Shan Kai Wat (Location 7, 3 and 6 in Map 1) were amongst the highest in the NM. This approach provides a useful reference to compare the overall conservation significance of different farmland sites scattered across the NM. A similar scoring system has also been developed by the local conservation authority to assess the relative ecological importance of different sites, and to evaluate Priority Sites for Enhanced Conservation (Agriculture, Fisheries and Conservation Department 2004).

Table 1. Scoring matrix for accessing the ecological value of farmland sites in the proposed Northern Metropolis

Criteria	Weighting	Description	Score	Description
Habitat Size	25%	Larger sites with better habitat integrity should be more valuable than smaller sites.	1 to 9	Sites were ranked by size. The smallest site scores 1, the largest site scores 9.
Habitat Diversity	25%	Sites with greater habitat heterogeneity could provide more ecological functions. Major habitat types include: dry farmland, wet farmland, abandoned farmland and pond.	3/6/9	3: Sites with two habitat types 6: Sites with three habitat types 9: Sites with four habitat types
Bird Species Richness	25%	Birds are used as the primary surrogate to access the state of biodiversity. A site with a higher number of bird species indicates the site supports greater biodiversity.	1 to 9	Site with the lowest number of bird species scores 1, site with the highest number of bird species scores 9.
Species of Conservation Concern	25%	A site is considered to have higher ecological value if the site supports more bird species of conservation concern	1 to 9	Site with the lowest number of threatened bird species scores 1, site with the highest number of threatened bird species scores 9.

Table 2. Habitat characteristics, bird species richness and ecological value of selected farmland sites in the proposed Northern Metropolis

Survey Site	Habitat size (ha)	Habitat Diversity	Bird Species Richness	Species of Conservation Concern	Ecological Value Score
Sandy Ridge Wetland Mosaic	37	Dry farmland, wet farmland, abandoned farmland, ponds	98	39	8
Chow Tin - Lei Uk	36	Dry farmland, wet farmland, abandoned farmland	97	39	7.625
Tai Po Tin - Shan Kai Wat	48	Dry farmland, wet farmland, abandoned farmland	90	31	7
Lok Ma Chau Village	4	Dry farmland, wet farmland, abandoned farmland, ponds	83	33	5.75
Shek Wu Wai	17	Dry farmland, abandoned farmland, ponds	67	19	4.875
Heung Yuen Wai - Tsung Yuen Ha	8	Dry farmland, abandoned farmland, ponds	74	25	4.75
Ping Yeung Old Village - Shui Lau Hang	21	Dry farmland, abandoned farmland	65	18	4
Chuk Yuen	6	Dry farmland, wet farmland, abandoned farmland	48	14	2.75
Sing Ping	10	Dry farmland, abandoned farmland	55	12	2.5



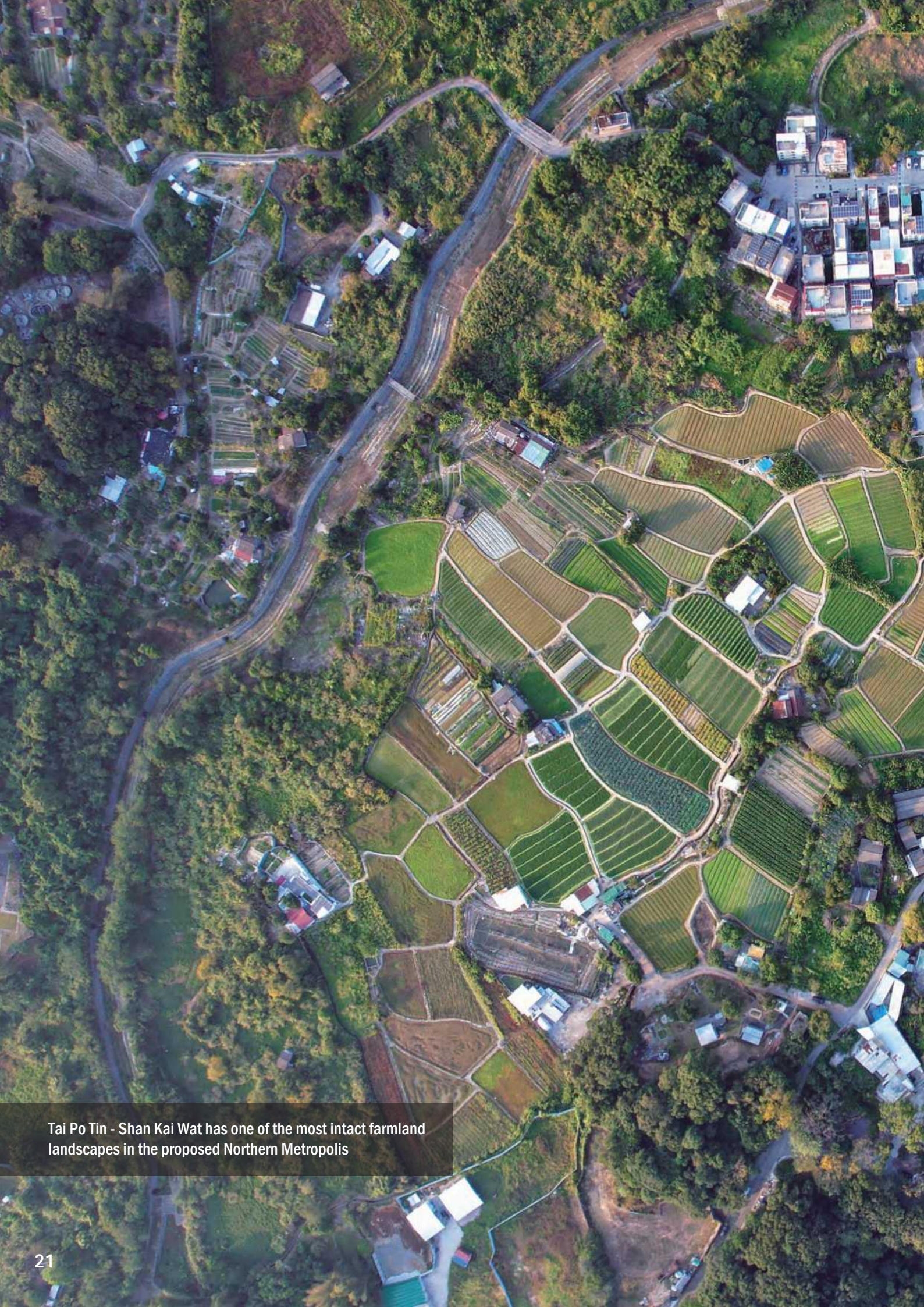
The Sandy Ridge Wetland Mosaic supports diverse habitats for farmland biodiversity





The extensive active/abandoned farmland of Chow Tin - Lei Uk bordering the upper Ping Yuen River





Tai Po Tin - Shan Kai Wat has one of the most intact farmland landscapes in the proposed Northern Metropolis



The Sandy Ridge Wetland Mosaic ranked first in terms of overall ecological value. With a relatively small habitat size of only 17 ha, this site yielded the highest number of bird species as well as species of conservation concern. 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 at this study site in 2009 (Planning Department 2010). Preliminary results of an interview survey suggested that otters are likely to be present at this site (KFBG unpublished data). Previous studies also suggested that the Greater Painted-snipe was likely to breed in the agricultural area of this site (Civil Engineering and Development Department 2016; Planning Department 2010).

Some of the farmland sites within the proposed NTN New Town are considered to be of conservation importance. The ecological value of Chow Tin - Lei Uk and Tai Po Tin - Shan Kai Wat, two neighbouring sites along the Ping Yuen River catchment, ranked second and third, respectively. The integrated agricultural landscape consists of wet, dry and high agricultural value abandoned farmlands, and includes some of the largest farmland areas remaining in Hong Kong. The habitat integrity and diversity, together with rich bird communities, make these two farmland sites among the top in terms of conservation significance. It is also worth noting that Lok Ma Chau Village, the site with the smallest farmland areas, had amazing bird species richness and ranked fourth in ecological value, demonstrating the uniqueness of this farmland site in the surrounding fishpond landscape.



An aerial photograph showing a rural landscape with mountains in the background, a mix of green fields and brown patches, and a construction site in the foreground with yellow excavators and various materials.

6. THREATS

LOSS OF FARMLAND HABITAT

A recent study forecasted that global farmland loss would likely continue and approximately 80% of the global agricultural land loss from urban expansion would take place in Asia and Africa, with the highest loss in Asia (D'Amour et al. 2017). In Hong Kong, rapid urbanisation has put great demand on land ever since the 1960s; this acute land shortage has long been considered as the limiting factor of local agricultural development (Wong 1964), thus influencing various farmland-dependent species. Indeed, the loss of farmlands to development has been considered a major threat to farmland birds in Hong Kong (Allcock 2009). Farmlands are often treated as land banks for development by some parties, and the large number of brownfield sites scattered throughout our study area reflects the substantial scale of this issue in Hong Kong. According to the latest government report, there were 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 (Planning Department 2019). A recent study also found that 608 ha of brownfield sites occupied lands primarily intended for agricultural purposes (Liber Research Community 2022).

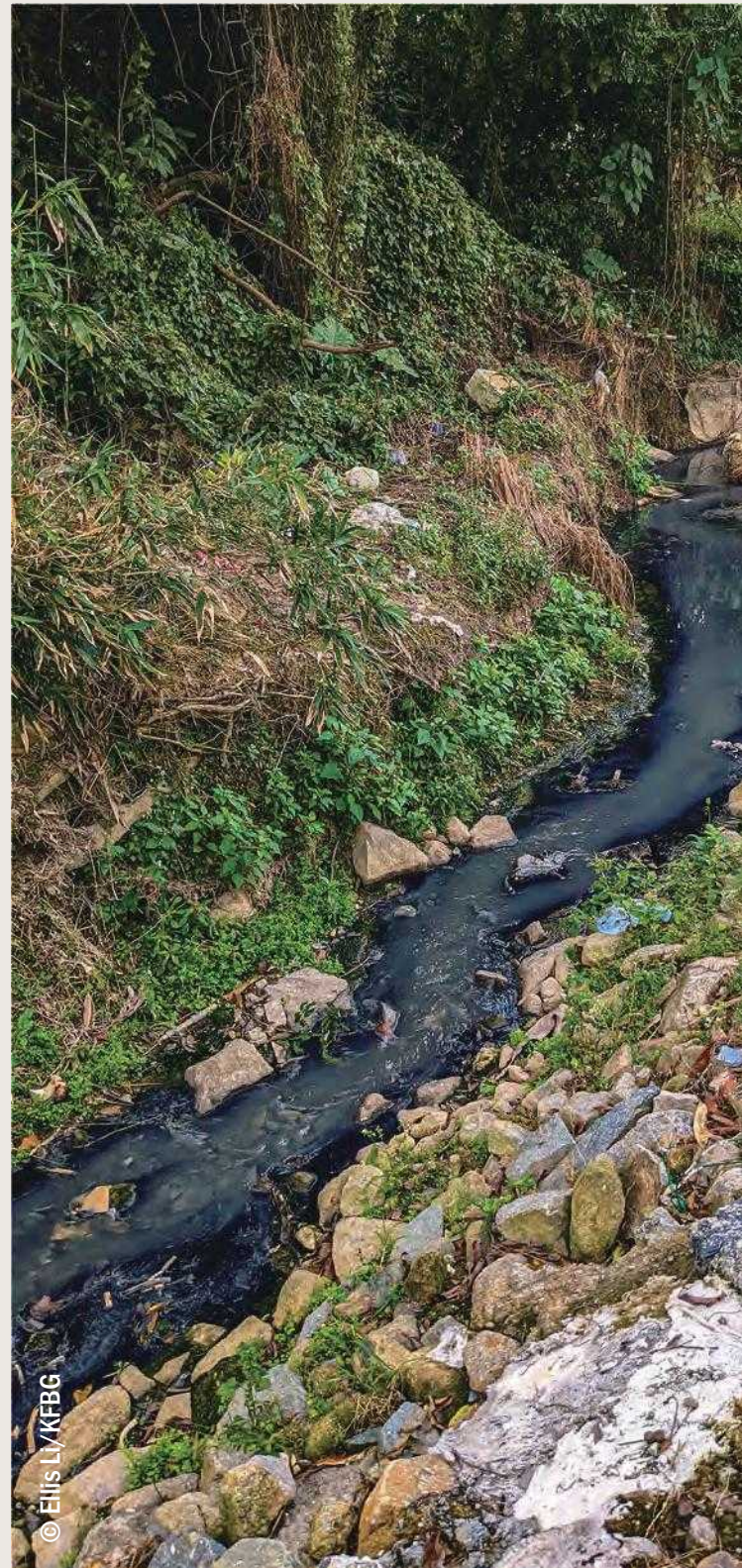
POLLUTION

Most rivers in the New Territories that cross rural areas have been turned into concrete channels for flood prevention, and many are grossly polluted by livestock and domestic waste, giving off pungent smells and were filled with domestic waste. In fact, many rural areas within the NM are still covered with a mosaic of farmlands, livestock farms, villages and brownfield sites. 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 Hong Kong. Local studies have suggested that changes of agricultural land use to other purposes could lead to a surge of toxic chemicals in the 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 prioritised by the relevant government authorities.

MIST-NETTING

Setting up mist nets in Hong Kong is prohibited as decreed by the Wild Animals Protection Ordinance; however, nets were found at Chuk Yuen and Ping Yeung Old Village - Shui Lau Hang, presumably erected to protect crops from birds or bats. Although an uncommon practice in Hong Kong, mist nets could be deadly to wildlife. The nets also cross the flight paths of birds and bats not predated on the crops so can be considered indiscriminate in targeting different fauna species.

- Left:** The grossly polluted stream flowed through Chuk Yuen
- Top Right:** Sections of Ping Yuen River were filled with domestic waste
- Bottom Right:** Mist nets found at Chuk Yuen





7. CONSERVATION RECOMMENDATIONS

Farmland habitat is usually considered to be of low ecological value in Hong Kong, especially sites scattered amongst brownfields and villages, due to the high level of human disturbance. Contrary to this common perception, our survey results clearly demonstrate that many farmland areas in the NM are still supporting thriving wildlife communities, many of which are heavily dependent on farmlands for their survival in Hong Kong. Further degradation or loss of these fragmented farmlands could be detrimental to these declining species. To prevent further loss of this vanishing wildlife habitat, we urge relevant stakeholders should consider farmland conservation a priority and take immediate conservation actions to make Hong Kong a truly sustainable city.

FORMULATE A COMPREHENSIVE FARMLAND BIODIVERSITY CONSERVATION STRATEGY

This study highlights both the urgent need and the opportunity to formulate a comprehensive farmland biodiversity conservation strategy. Previous studies have highlighted the importance of integrating multiple conservation practices in broader agricultural landscapes to maximise conservation effectiveness for a larger suite of species (Evans et al. 2014). To preserve the unique wetland-farmland mosaic at Sandy Ridge Wetland Mosaic, it is recommended to incorporate this site into the proposed Sha Ling/Nam Hang Nature Park. Hong Kong government's "Agricultural Priority Areas" (APA) should also recognise high ecological value farmlands; farmland areas under this category, such as Chow Tin - Lei Uk and Tai Po Tin - Shan Kai Wat, deserve to be preserved and enhanced for agriculture, and by covering these sites with APA we believe the associated biodiversity and habitats (and

future passive recreation potential) can also be preserved. In addition, by adopting the concept of the proposed NTN "Urban-Rural Greenway" mentioned under the NMDS, a "Greenway Network" (Map 2) could be designed to help preserve and enhance these ecologically sensitive areas in the proposed NM (Kadoorie Farm and Botanic Garden 2023). The Greenway Network could encompass a system of pedestrian walkways, cycling tracks, hiking trails, wildlife corridors, tree belts and well-managed preserves, to link important natural, agricultural and cultural features for conservation, education and recreation purposes. A study conducted on urban farmlands of Guangzhou, another metropolis in the Pearl River Delta, has indicated that the degree of farmland fragmentation in landscape scale could affect bird diversity (Lee et al. 2022). The Greenway Network could serve as an ecological corridor to connect these high ecological value farmland sites, as well as linking them up with other important habitats (e.g., the Deep Bay Wetland, proposed Robin's Nest Country Park); this can effectively fill the important gaps in the current protected area system, and greatly enhance the biodiversity value of the entire region.

STRENGTHEN RESEARCH CAPACITY ON FARMLAND BIODIVERSITY

To support the design and implementation of farmland conservation strategy, more scientific research is required to fill the current knowledge gaps in local farmland biodiversity and wildlife-friendly farming techniques. A baseline of biodiversity distributions in farmlands should be established to identify high ecological value farmland sites in Hong Kong. Monitoring schemes like Farmland Bird Index (BirdLife



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Top: Farmlands at Lok Ma Chau Village
Bottom: Historical building next to farmlands at Ping Yeung

International 2013; Morelli & Tryjanowski 2017) should be developed to monitor these high ecological value farmlands. Interdisciplinary research should be initiated to investigate the integration of conventional agricultural knowledge and modern scientific knowledge to foster the successful coupling of sustainable farming with wildlife protection (Li et al. 2020). Studies have demonstrated that farmland management practices such as optimising the agricultural cycle, diversifying non-cropped habitats, maintaining fallow land and reducing pesticide input could positively influence farmland wildlife without significantly reducing agricultural crop yields (Feber & Macdonald 2013; Maeda 2001; Stanton et al. 2018; Traba & Morales 2019). Habitat enhancement measures should also be investigated to protect targeted farmland species of conservation concern (Hong et al. 2022; Pursner & Lin 2022).

CULTURAL HERITAGE SPOT

- *1. Ho Tin Temple, She Tau Kok
- 2. Macleish Fort, Pak Kung Au
- 3. Macleish Fort, Kung Shan
- *4. Residence of Ip Ting-ai
- 5. Heung Yuen Wai Historical Buildings
- *6. Cheung Shan Monastery
- *7. Kang Yung Study Hall
- *8. Fat Tai Tong
- 9. Macleish Fort, Nga Tin
- 10. Macleish Fort, Ma Tau Lung
- 11. (M) Tak Study Hall
- *12. (M) Man Shek Tong Ancestral Hall
- 13. Clubhouse and Half-way House, Forling Golf Course
- *14. Ho Ku Shek Ancestral Hall
- *15. Tai Fu Tai Mansion
- 14. Pun Uk
- 17. Tin Hsu Temple, Ho Yuen
- *18. Fortified Structure of Ho Pok Nal

*Declared Monument

NATURAL HERITAGE PRESERVE

- a. Proposed Robin's Nest Country Park
- b. San Kwai Tin
- c. Tin Ma Hang
- d. Heung Yuen Wai
- e. Wo Leng Shui
- f. Tai Po Tin to Chow Tin (unimproved)
- g. Proposed Sha Ling/Wom Hong Nature Park
- h. Sandy Ridge Wetland Mosaic
- i. Fanling Golf Course (unimproved lowland forest)
- j. Long Valley Nature Park (under construction)
- k. Proposed Hoau Huk Wai Wetland Conservation Park
- l. Proposed Sam Po Shek Wetland Conservation Park
- m. Proposed Nam Sang Wai Wetland Conservation Park
- n. Proposed Coastal Protection Park

AGRICULTURAL HERITAGE PRESERVE

- i. Tai Po Tin/Shan Kai Wai
- ii. Chow Tin/Lai Uk
- iii. Sing Ping
- iv. Cheuk Yuen/Kan Tau Wai
- v. Shui Lou Hang
- vi. Sandy Ridge East (adjacent to but outside proposed MET NDA)
- vii. Sandy Ridge Wetland Mosaic
- viii. Shek Wu Wai
- ix. Agricultural Park (under construction)



LEGEND

- Greenway Network
- Existing major Ecological Habitat Network
- Protected areas
- Ramsar Site
- Wildlife Bridges/Underpass
- Seashore viewing platform
- Major road
- Proposed NDAs
- Planned NDAs
- Existing new towns
- HK-SZ I&T Park (under construction)
- Chinese Swamp Cypress
- Eurasian Otter
- Honeysuckle Crab
- Mangrove
- Rare mammals
- Rare fishes
- Rare open country birds
- Rare waterbirds
- Seagrass bed



Coastal ◀ ◀ ◀ ◀ Wetlands ◀ ◀ ◀ ◀ Farmland and Heritage ◀ ◀ ◀ ◀ Mountains
GREENWAY NETWORK IN NORTHERN METROPOLIS

Map 2. Conceptual map of the proposed “Greenway Network” (modified from Kadoorie Farm and Botanic Garden 2023)

DEVELOP SUBVENTION MECHANISMS

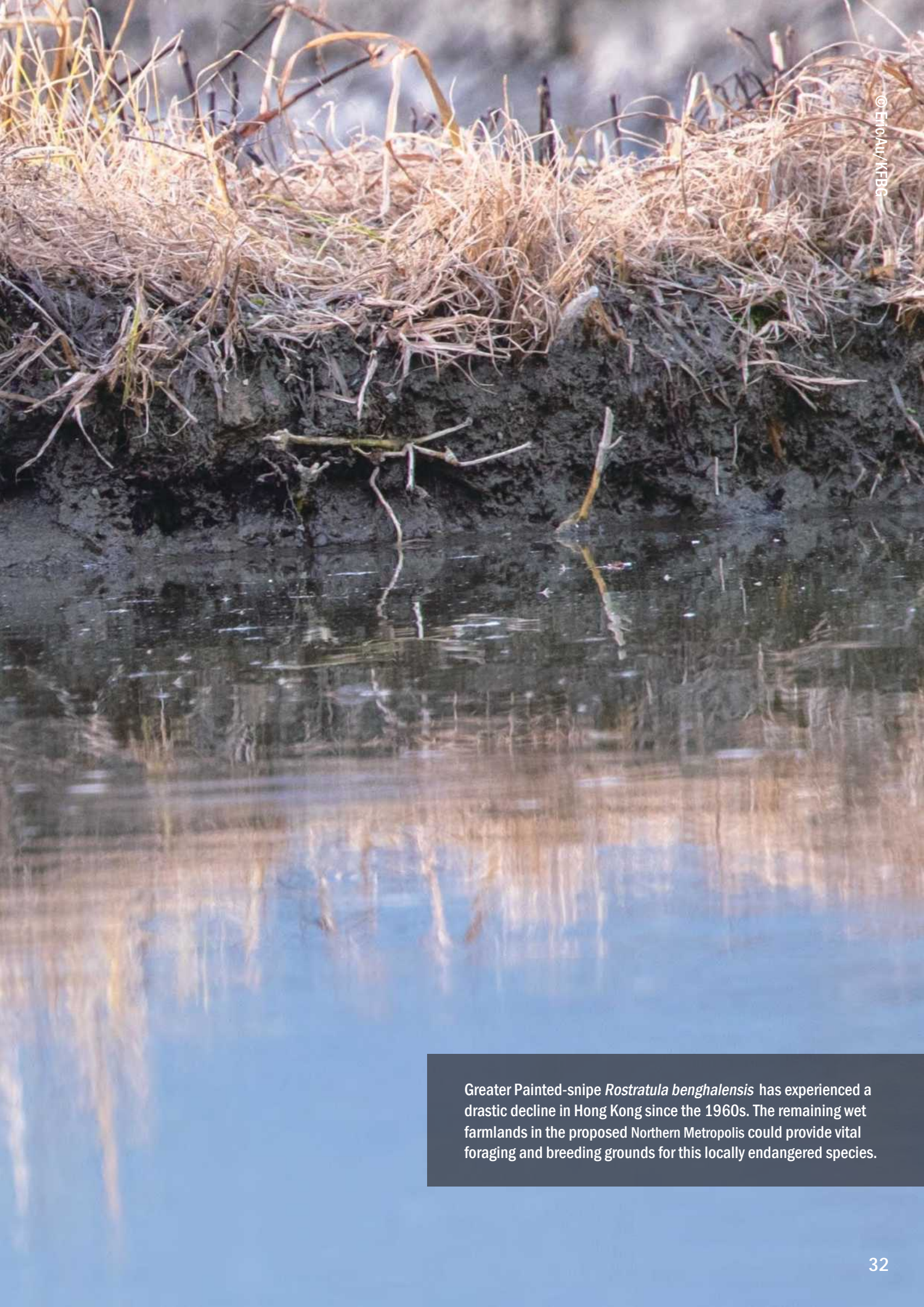
Policy and market incentives should be created to reward wildlife-friendly farming or compensate for farmers’ losses in production. In Europe, a range of farmland conservation activities is undertaken through incentive schemes, or more widely known as agri-environment schemes, which focus explicitly on the wise management of the agricultural matrix (Hardman et al. 2016; Sharps et al. 2023). These agri-environment schemes often include compulsory changes in farmland management, whereby landholders are provided with financial incentives to manage their properties for the benefit of biodiversity or other environmental objectives. Countries in Europe and North America are also investing considerable efforts into innovative farmland conservation initiatives such as land purchases and private-public partnerships (Aebischer et al. 2016; Evans et al. 2014; Heckert 2020). Whilst the different approaches to conservation on private land in Hong Kong and Europe reflect the two continents’ different ecologies, land-use histories and political economies of agriculture, there are many parallels between bird population decline in the two regions, and an opportunity may exist to incorporate some of the successful aspects of the European agri-environment approach while developing similar subvention schemes in Hong Kong. Studies have suggested that further farmland biodiversity decline is potentially reversible through appropriate management of high ecological value farmlands (Doxa et al. 2010). Well-targeted schemes deploying effective interventions have also been proven to increase the abundance of target groups (Sharps et al. 2023). Future subvention schemes in Hong Kong should focus on preserving and extending high ecological value farmlands, by favouring the maintenance of low-intensity agriculture and landscape

complexity. It should also be emphasised that the primary purpose of the subvention scheme is to work with farmers, inspire them to be stewards of farmland and encourage them to provide a series of designated environmental public goods and services. Indeed, the Management Agreement at Long Valley can be seen as a very good local example in this aspect (Agriculture, Fisheries and Conservation Department 2011).

MAINSTREAM FARMLAND CONSERVATION

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; Li et al. 2022; Zhang et al. 2022); a shift of mindset regarding the conservation importance of farmlands should be promoted among stakeholders, including local farmers, the general public as well as policymakers. The development of a Farmland Bird Index could also be a great opportunity for raising public awareness. The UK’s wild bird index, which is sometimes popularly known as the “Skylark index”, has proven to be a successful conservation campaign (Gregory et al. 2004). It has resonated both with the public and the media, and generated regular media interest. The Farmland Bird Index could turn a large amount of scientific data into a simple, understandable and meaningful presentation. This, in turn, will raise awareness and act as a spur for research and policy action. The Hong Kong government is also proposing to designate APAs, mainly for the purpose of preserving farmland; in this regard, we also suggest the government to consider incorporating the subvention mechanism highlighted above for promoting sustainable farming practices in APAs.





Greater Painted-snipe *Rostratula benghalensis* has experienced a drastic decline in Hong Kong since the 1960s. The remaining wet farmlands in the proposed Northern Metropolis could provide vital foraging and breeding grounds for this locally endangered species.

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10. APPENDICES

Appendix 1. Bird data collected from December 2021 to November 2022 from the nine survey sites in the proposed Northern Metropolis.

Appendix 2. Incidental amphibian records from the nine survey sites in the proposed Northern Metropolis.

Appendix 3. Incidental reptile records from the nine survey sites in the proposed Northern Metropolis.

Appendix 4. Incidental butterfly records from the nine survey sites in the proposed Northern Metropolis.

Appendix 5. Incidental dragonfly records from the nine survey sites in the proposed Northern Metropolis.

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11. ABOUT US

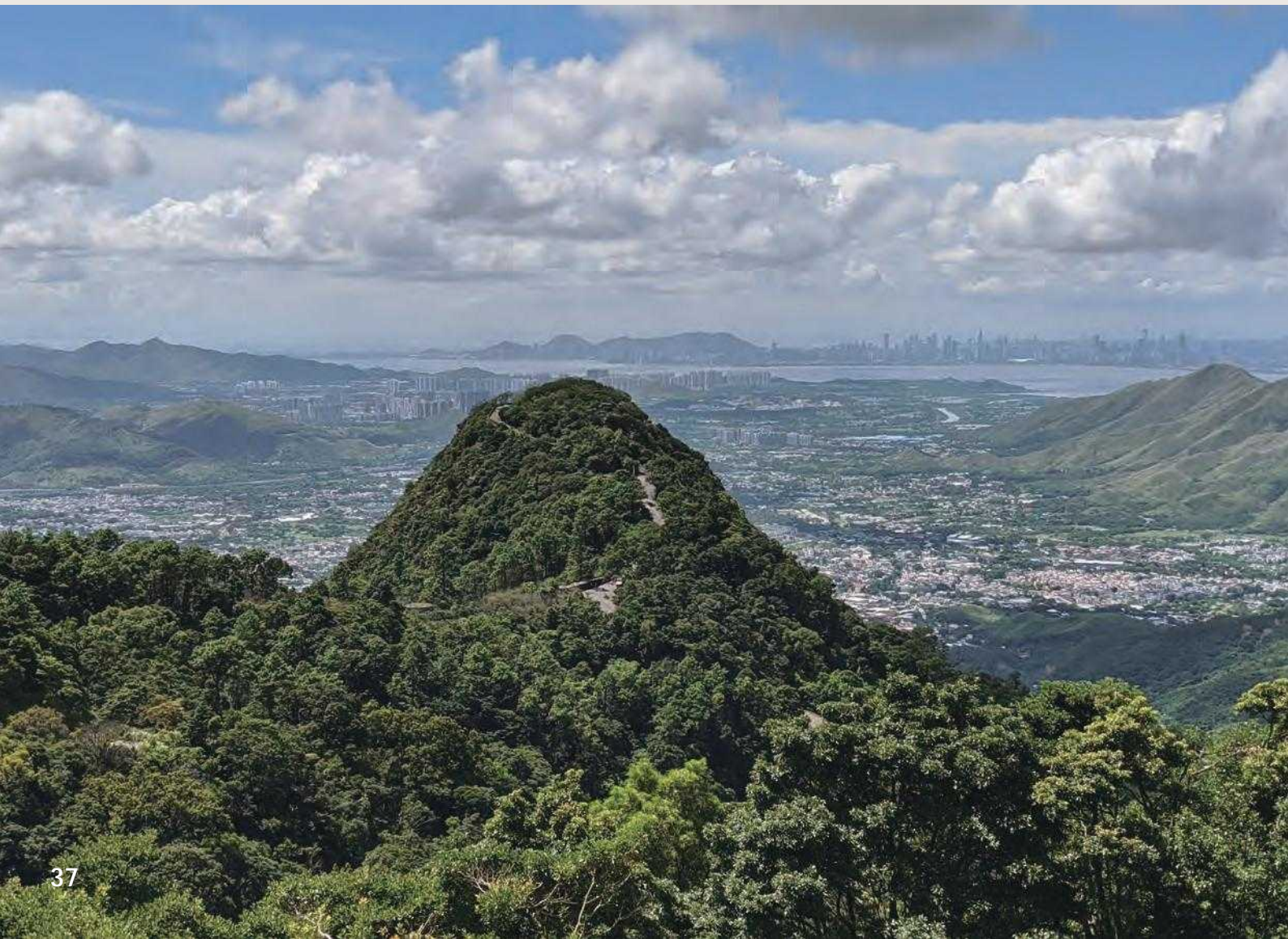
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To comply with the Law on Administration of Activities of Overseas Nongovernmental Organizations in the Mainland of China, KFBG (Hong Kong) Beijing Representative Office was registered on 1st January 2019 and the National Forestry and Grassland Administration supervises our operations in mainland China.



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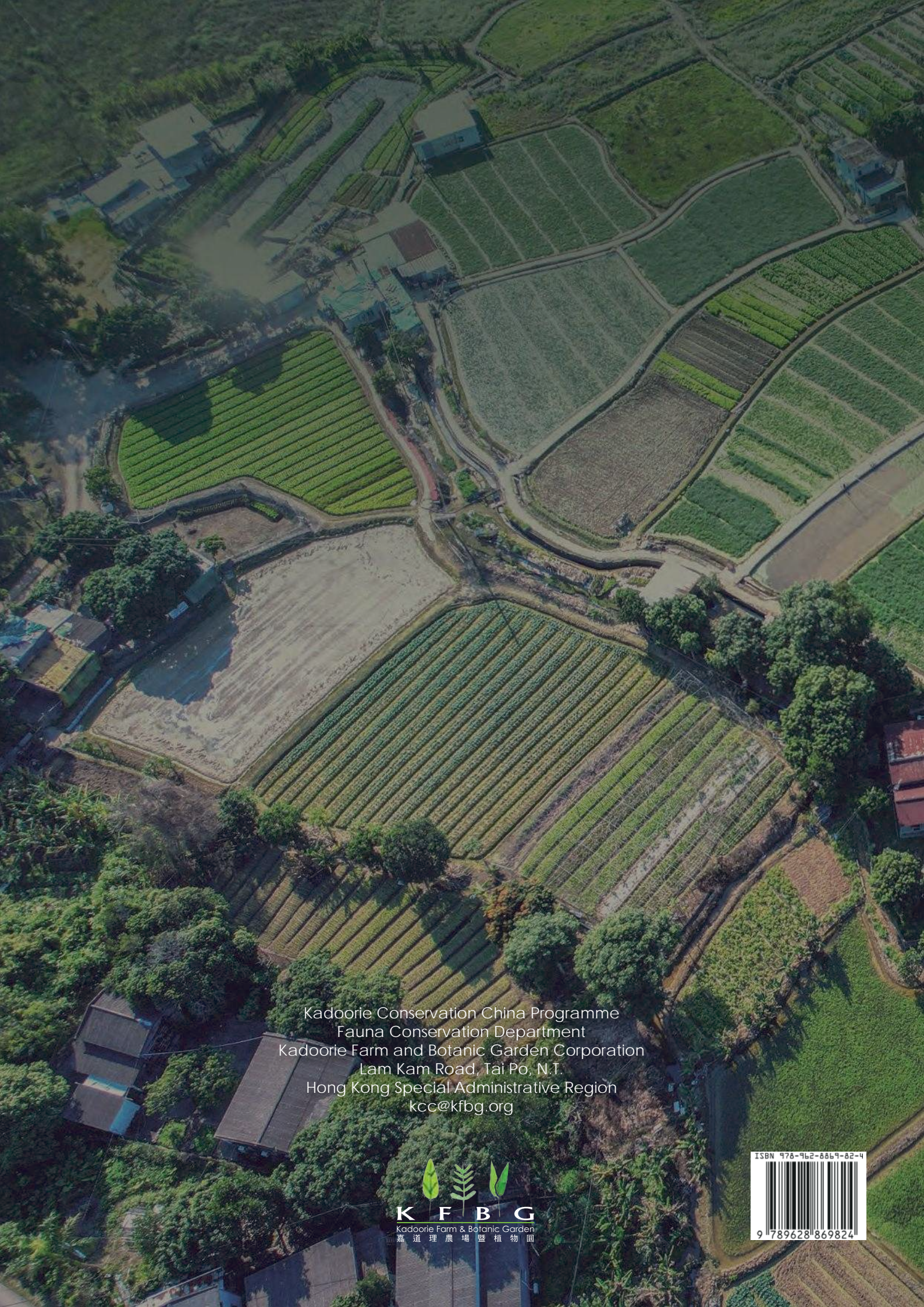
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