Supplementary Information

Supplementary 1. Interface Development for Implementing the DDSLOP Model.

We used C++/C to develop the DDSLOP model. Furthermore, a user-friendly interface which can be embedded into the ArcGIS platform using C# language (Figures S1–S4) is available for interested users. The output land use raster files can therefore be shown in ArcGIS.

Figure S1. Add the DDSLOP toolbox into ArcGIS.

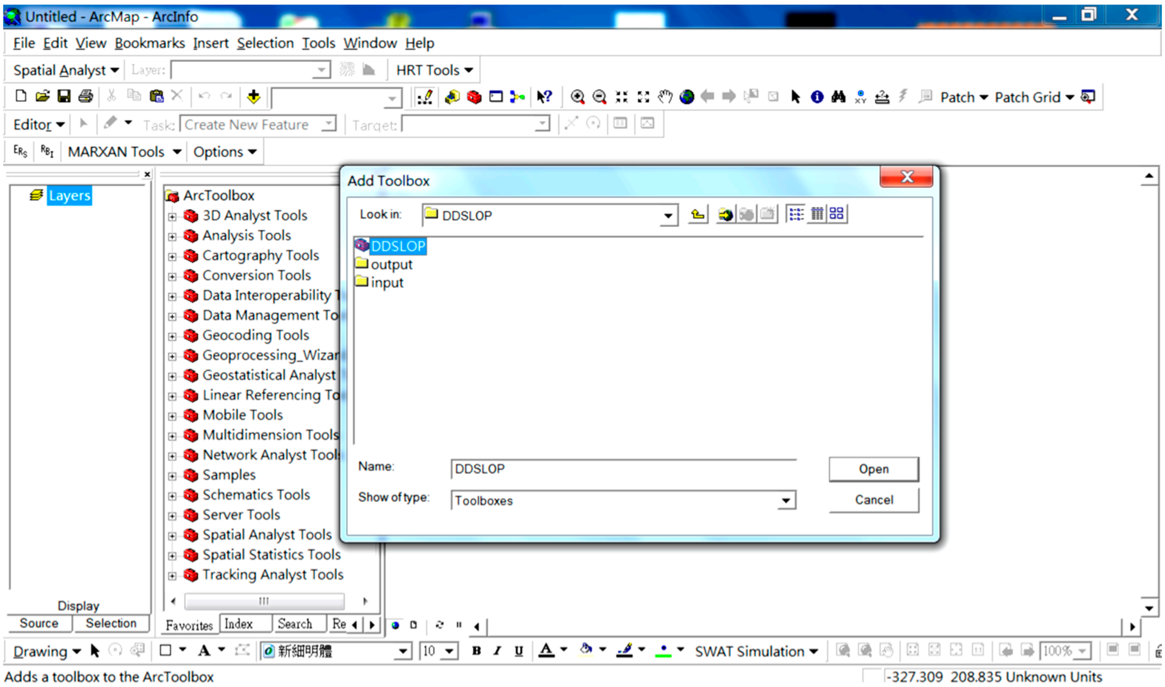


Figure S2. Initiate the interface for inputting parameters.

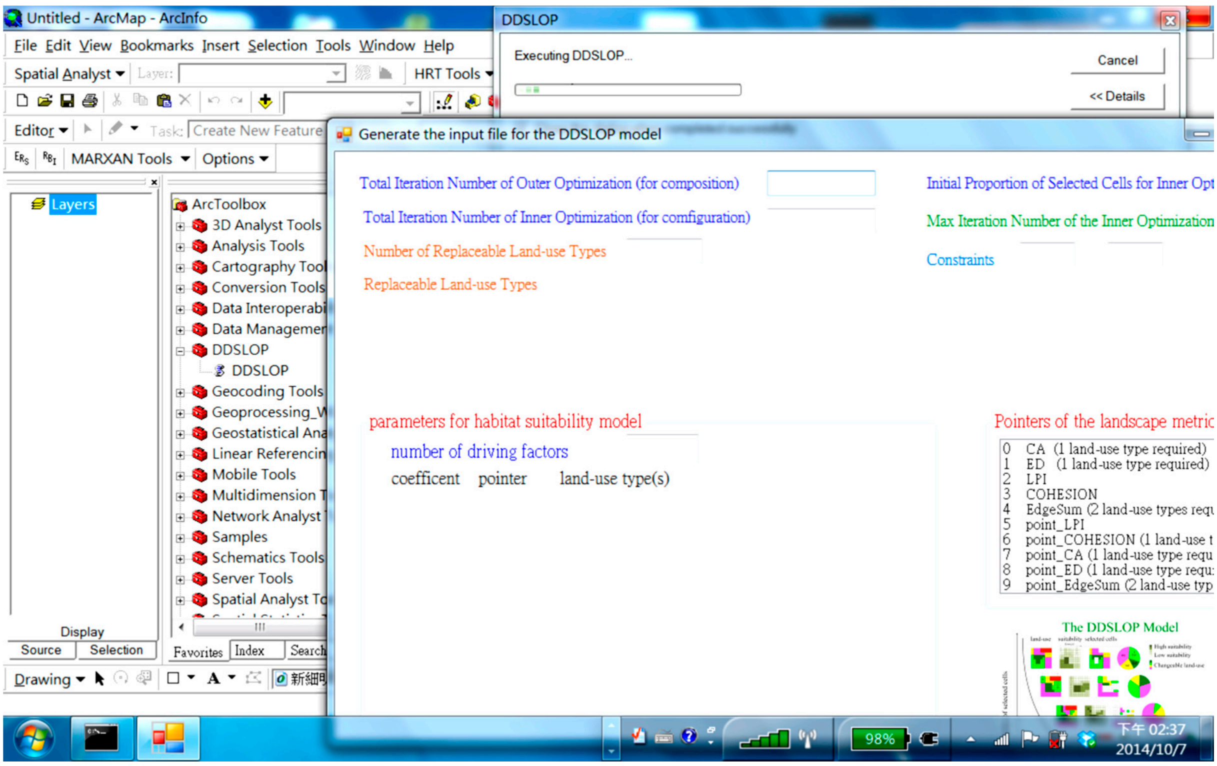


Figure S3. Interface of the DDSLOP model.

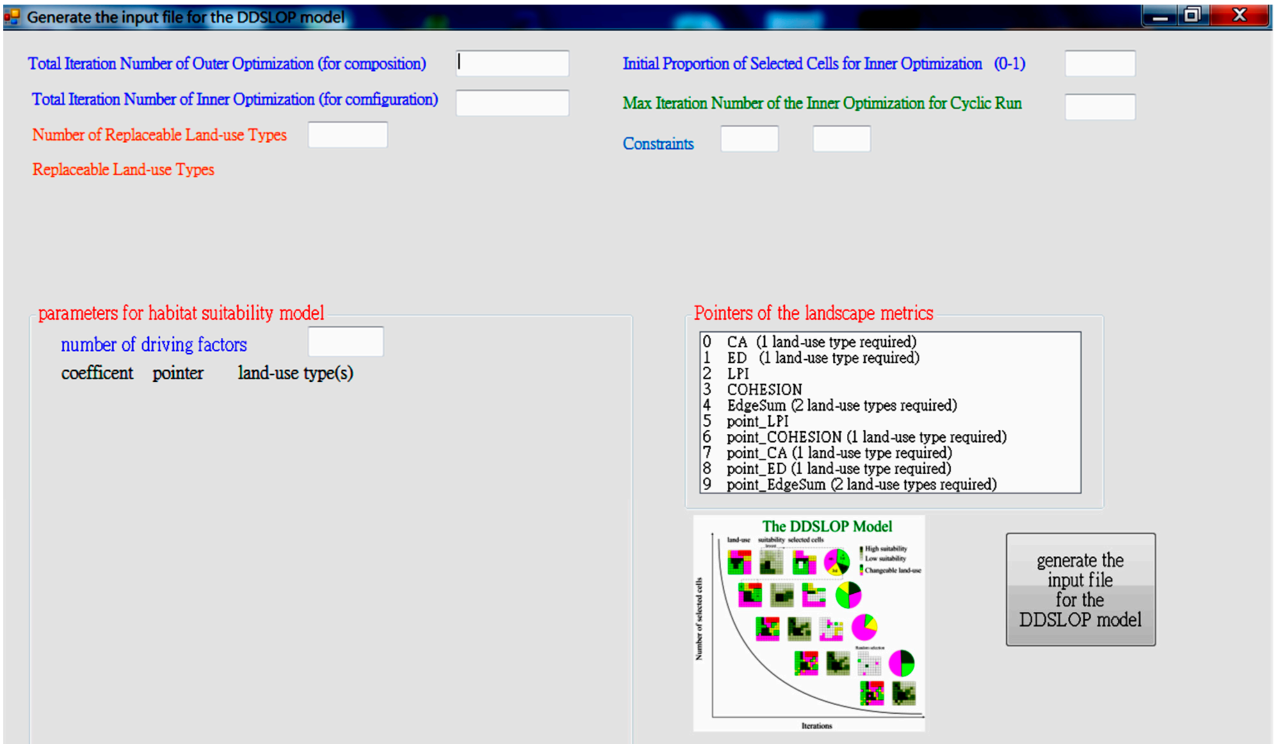
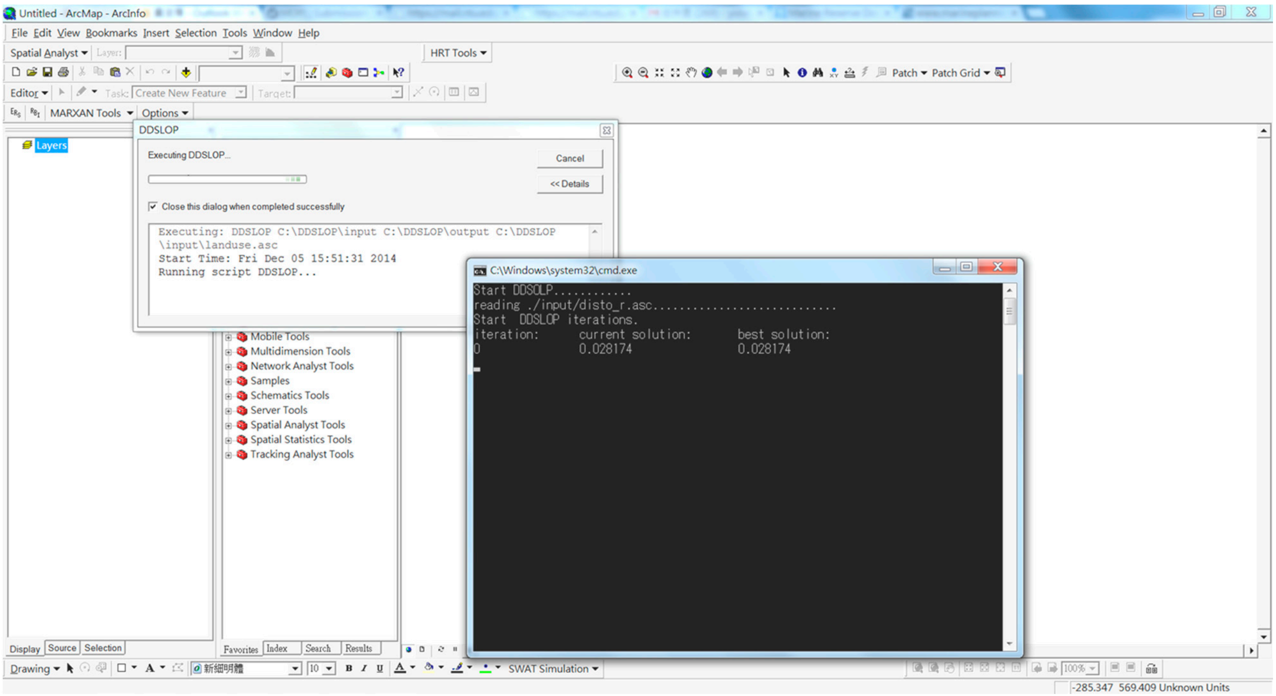


Figure S4. Excute the DDSLOP model on ArcGIS platform.



Supplementary 2. Functions of the Landscape Metrics

The study focuses on how the landscape structure affects habitat suitability of target species at a local scale. We used four landscape metrics to measure the composition, integrity and edge dynamics of habitat structure. The functions of landscape metrics, including: class area, largest patch index, sum of edge lengths between two land-use types, and patch cohesion are listed as follows [1,2]:

$$ca_l = \sum_{p=1}^{n} a_{p,l} \tag{S1}$$

$$lpi = \frac{1}{A_r} \max\left(a_{p,l}\right) \times 100 \tag{S2}$$

$$coh_l = \left[1 - \frac{\sum_{p=1}^{n} P_{p,l}}{\sum_{p=1}^{n} P_{p,l}\sqrt{c_{p,l}}}\right]\left[1 - \frac{1}{\sqrt{C_r}}\right]^{-1} \times 100 \tag{S3}$$

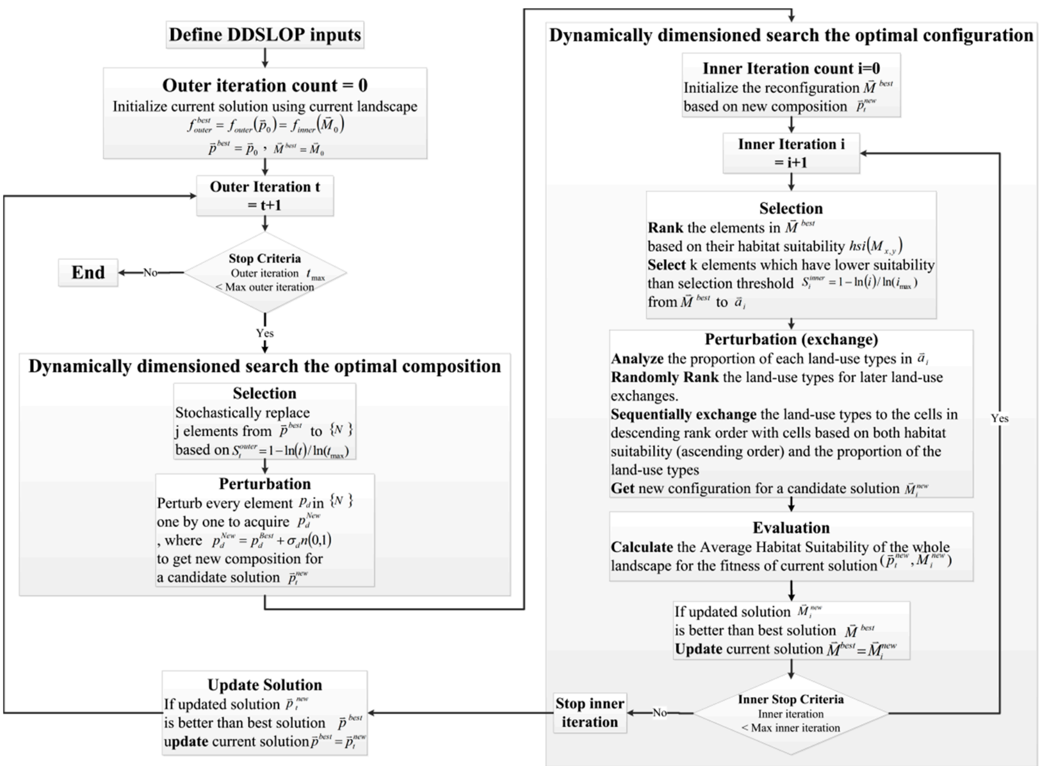
$$es_{l,m} = \sum_{p=1}^{n} ec_{p,l,m} \tag{S4}$$

where a_{lp} (m^2) is the area of patch p with land-cover type l, A_r (m^2) is the total area of a sub-landscape within the species' territory size r, $P_{p,l}$ is the summation of the perimeters of patches in terms of number of cell surfaces exposed at the edge of different land-use types, $c_{p,l}$ is the area of patch p with land-cover l, C_r is the total number of cells in the study area, $ec_{p,l,m}$ is the number of edge cells in patch p between land-cover type l and land-cover type m.

Supplementary 3. The Flowchart of the DDSLOP Model

The DDSLOP model consists of outer and inner optimization processes. In the outer optimization process, the DDSLOP model conducts iterative adjustments of the land-use type ratios within a user-specified number. Based on the new ratios given by the outer process, the configuration of the target land-use structure is then modified during consecutive inner optimizations within the predefined maximum number of inner iterations (Figure S5).

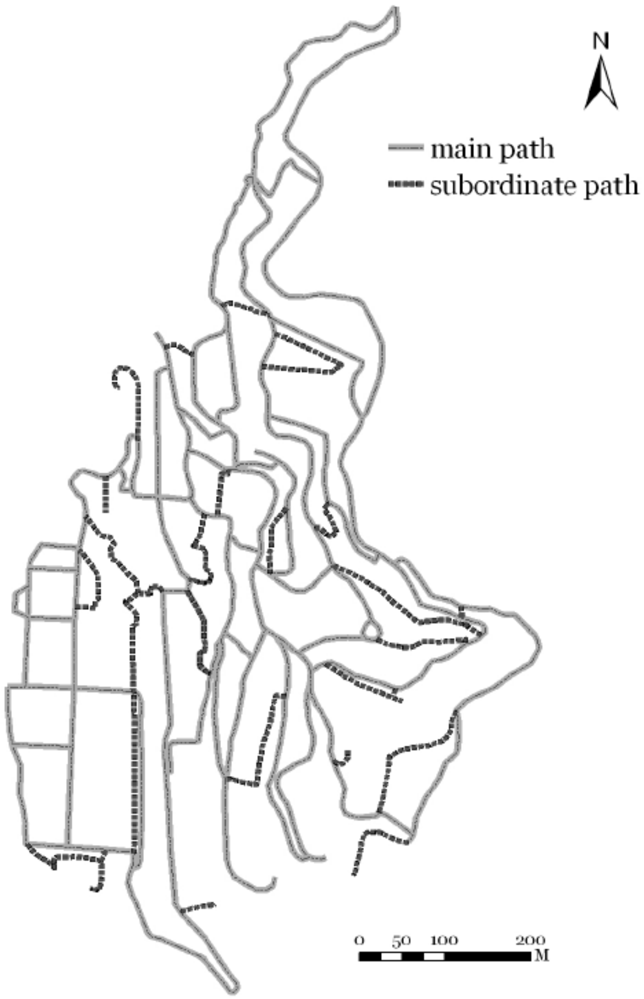
Figure S5. Flow chart of the DDSLOP model.



Supplementary 4. The Investigation of Birds Using a Territory Mapping Method

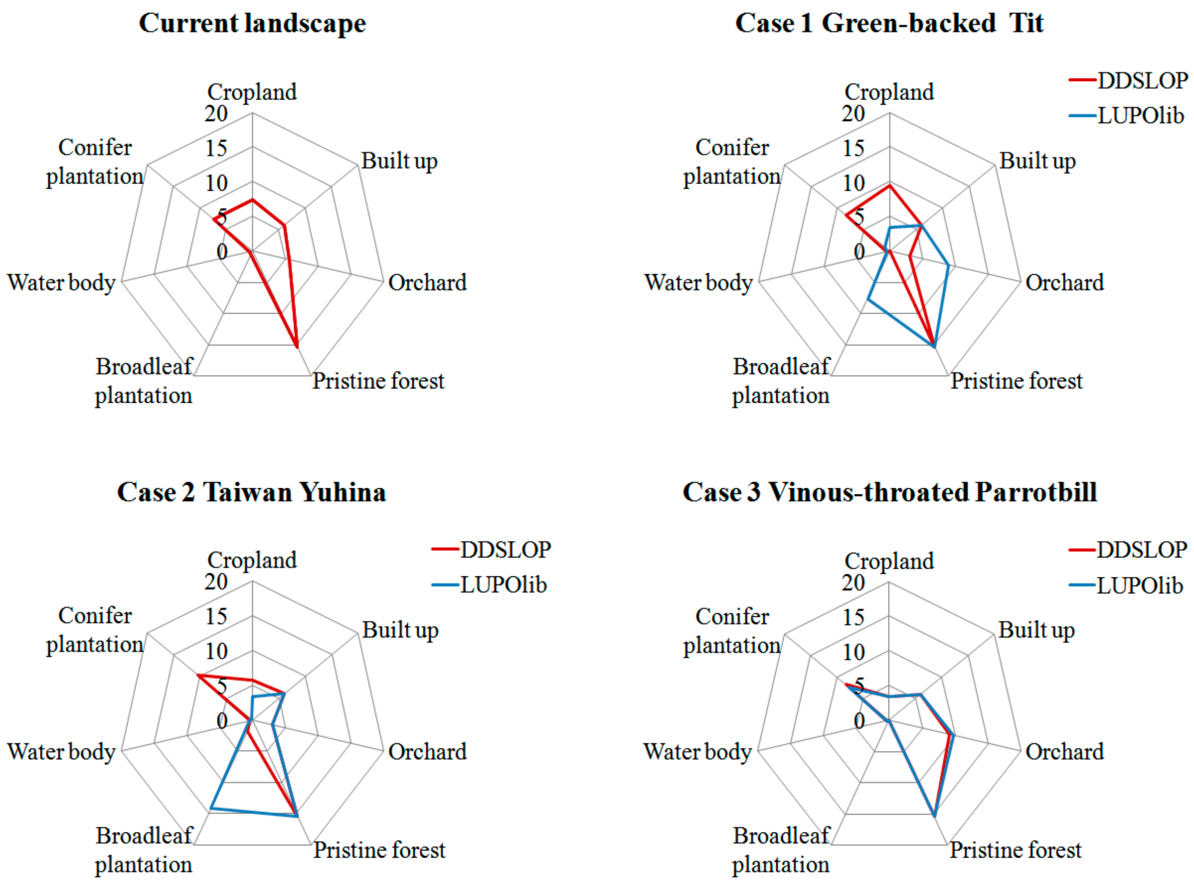
The presence-absence bird distribution data were converted from 62 field surveys which mapped the exact presence and or absence of target species using a spot mapping method [3] during the breeding seasons of 2005 to 2007. As all 10 × 10 m grids were within the predefined maximum distance of 50 m from the survey path (in order to ensure proper recognition of birds) the census covered the entire study area and recorded all heard and or sighted individuals [3]. Therefore, the presence data was valid and we also feel confident about the quality of the absence grid data, which correlates to no recorded presence in all 62 field surveys.

Figure S6. Survey routes of the investigation.



Supplementary 5. Comparison of the Proportions of Land-Use Types in Each Study Case

Figure S7. Radar chart of the composition of the current landscape against each optimalized landscape.



Supplementary 6. Driving Factors and ROC Curves of Three Habitat Suitability Models

Table S1. Driving factors for the logistic regression.

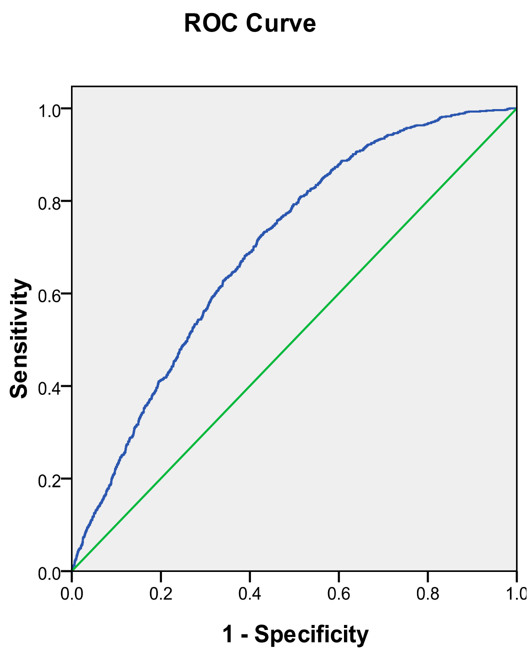
Drivers	Green-Backed Tit		Taiwan Yuhina		Vinous-Throated Parrotbill	
	Beta	Significance	Beta	Significance	Beta	Significance
Landscape metrics:						
Sum of edge length between building and cropland ($es_{buildind, cropland}$)	−0.105	0.01	−0.003	0.005	−0.115	0.013
Sum of edge length between building and orchard ($es_{buildind, orchard}$)	-	-	-	-	−0.141	0.008
Sum of edge length between pristine forest and cropland ($es_{forest, cropland}$)	−0.089	0.004	-	-	0.103	< 0.001 *
Sum of edge length between pristine forest and orchard ($es_{forest, orchard}$)	-	-	-	-	0.079	1.082
Sum of edge length between cropland and conifer plantation ($es_{orchard, conife}$)	0.14	< 0.001 *	0.062	<0.001 *	-	-

Table S1. *Cont.*

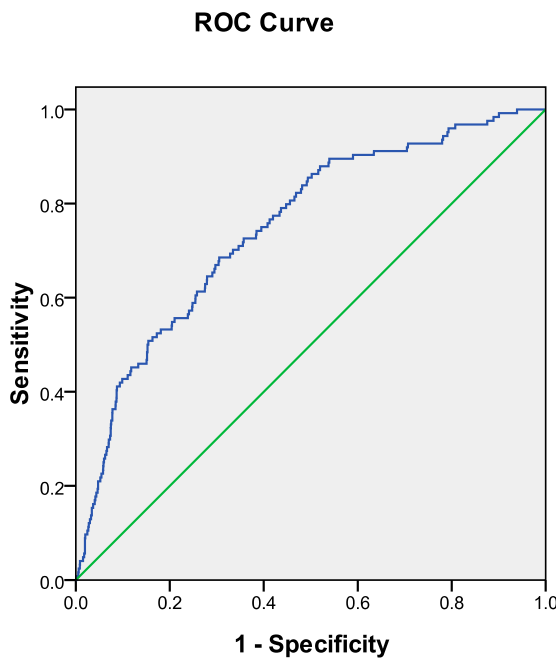
Drivers	Green-Backed Tit		Taiwan Yuhina		Vinous-Throated Parrotbill	
	Beta	Significance	Beta	Significance	Beta	Significance
Sum of edge length between cropland and broadleaf plantation ($es_{cropland,\ broadleaf}$)	-	-	−0.066	0.015	-	-
Sum of edge length between orchard and broadleaf plantation ($es_{cropland,\ broadleaf}$)	-	-	-	-	-	-
Sum of edge length between orchard and conifer plantation ($es_{orchard,\ conifer}$)	-	-	-	-	0.07	0.01
Cohesion of pristine forest (coh_{forest})	-	-	-	-	-	-
Cohesion of conifer plantation ($coh_{conifer}$)	-	-	−0.006	0.013	-	-
Cohesion of broadleaf plantation ($coh_{broadleaf}$)	-	-	-	-	−0.03	0.015
Large patch index (*lpi*)	-	-	−0.016	< 0.001 *	-	-
Class area of pristine forest (ca_{forest})	2.305	0.006	2.465	< 0.001 *	2.501	< 0.001 *
Class area of conifer plantation ($ca_{conifer}$)	−3.575	0.004	3.719	< 0.001 *	-	-
Class area of broadleaf plantation ($ca_{broadleaf}$)	-	-	4.796	< 0.001 *	-	-
Distance variables:						
Distance to building	-	-	-	-	-	-
Distance to road	−0.028	0.03	−0.058	< 0.001 *	-	-

-: Not statistically significant (p-value > 0.05) in stepwise logistic regression analysis; *: Statistically significant (p-value < 0.05) in stepwise logistic regression analysis.

Figure S8. The ROC curve of the habitat suitability models for (**a**) the Green-backed Tit; (**b**) the Taiwan Yuhina and (**c**) the Vinous-throated Parrotbill.

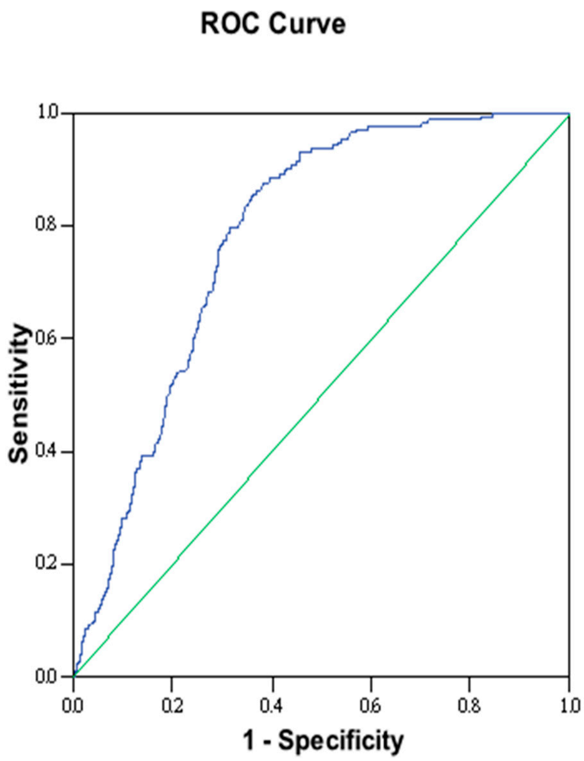


(**a**)



(**b**)

Figure S8. *Cont.*



(c)

Supplementary 7. Habitat Suitability Maps of Target Species under Each Optimized Landscape

In order to assess landscape structure preference agreement between the three target species, we estimated spatial distributions of habitat suitability under each optimized landscape for each target species. The results indicate that while the suitability of Green-backed Tit is promoted, the suitability of Taiwan Yuhina also increases and vise versa (Table S2). However, the results also indicate a conflict between the Vinous-throated Parrotbill and the other two species (Table S2).

Table S2. The average habitat suitabilities of target species under each optimized landscape.

Average Habitat Suitability Index	Green-Backed Tit	Taiwan Yuhina	Vinous-Throated Parrotbill
Current landscape	0.0282 [d]	0.2147 [d]	0.0397 [d]
Green-backed Tit (DDSLOP) [a]	0.0829 [d]	0.3578	0.0361
Green-backed Tit (LUPOlib) [a]	0.0432 [d]	0.2826	0.0299
Taiwan Yuhina (DDSLOP) [b]	0.0500	0.3668 [d]	0.0279
Taiwan Yuhina (LUPOlib) [b]	0.0374	0.3630 [d]	0.0191
Vinous-throated Parrotbill (DDSLOP) [c]	0.0362	0.2530	0.0789 [d]
Vinous-throated Parrotbill (LUPOlib) [c]	0.0293	0.2110	0.0613 [d]

[a] An optimization output for the Green-backed Tit using the optimization model indicated in brackets; [b] An optimization ouput for the Taiwan Yuhina using the optimization model indicated in brackets; [c] An optimization output for the Vinous-throated Parrotbill using the optimization model indicated in brackets. [d] The results are from Table 1.

Figure S9. The habitat suitability distributions of the Green-backed Tit under (**a**) current landscape; (**b**) optimized landscape for the Taiwan Yuhina (DDSLOP); (**c**) optimized landscape for the Taiwan Yuhina (LUPOlib); (**d**) optimized landscape for the Vinous-throated Parrotbill (DDSLOP); (**e**) optimized landscape for the Vinous-throated Parrotbill (LUPOlib).

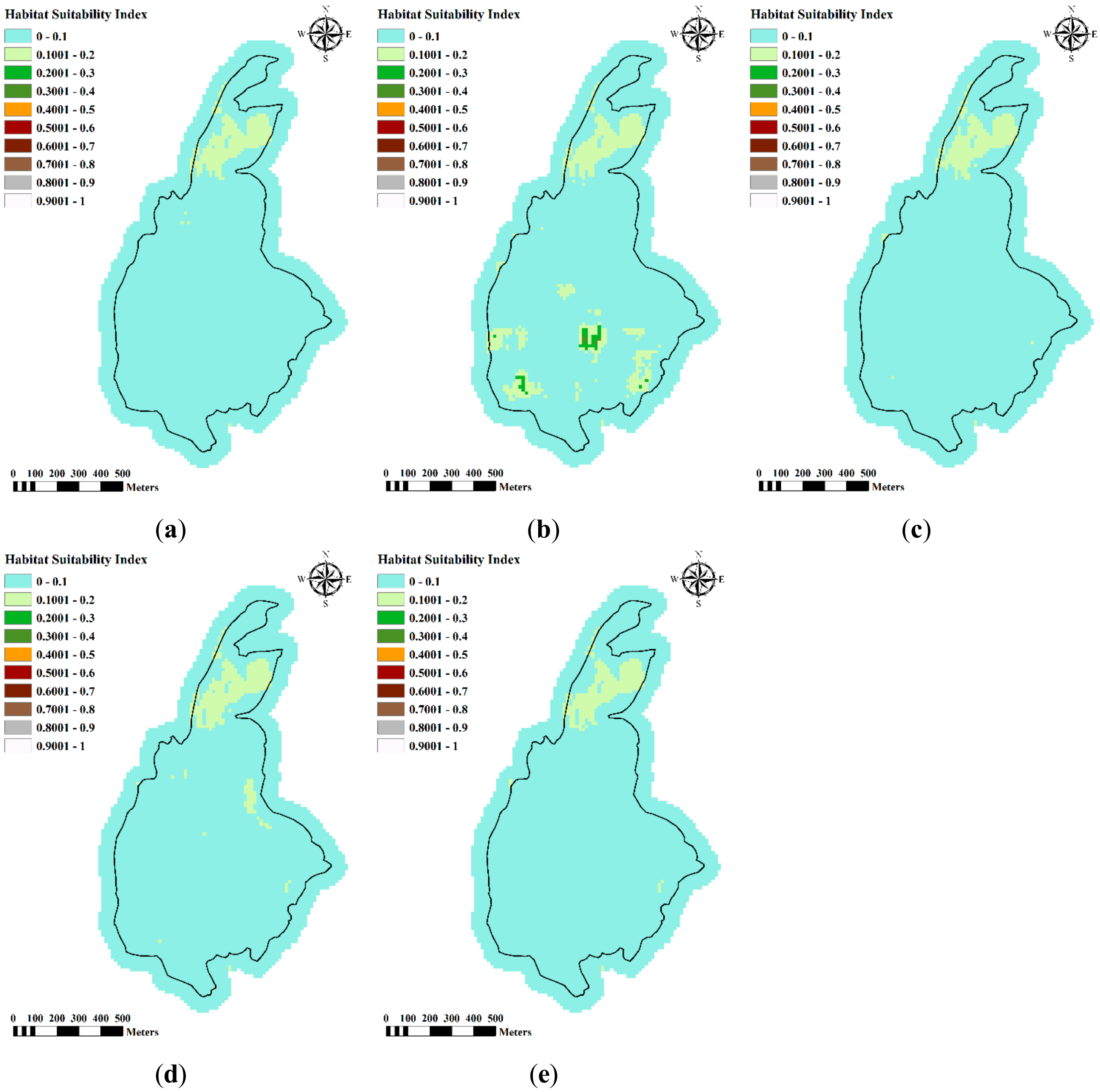


Figure S10. The habitat suitability distributions of the Taiwan Yuhina under (**a**) current landscape; (**b**) optimized landscape for the Green-backed Tit (DDSLOP); (**c**) optimized landscape for the Green-backed Tit (LUPOlib); (**d**) optimized landscape for the Vinous-throated Parrotbill (DDSLOP); (**e**) optimized landscape for the Vinous-throated Parrotbill (LUPOlib).

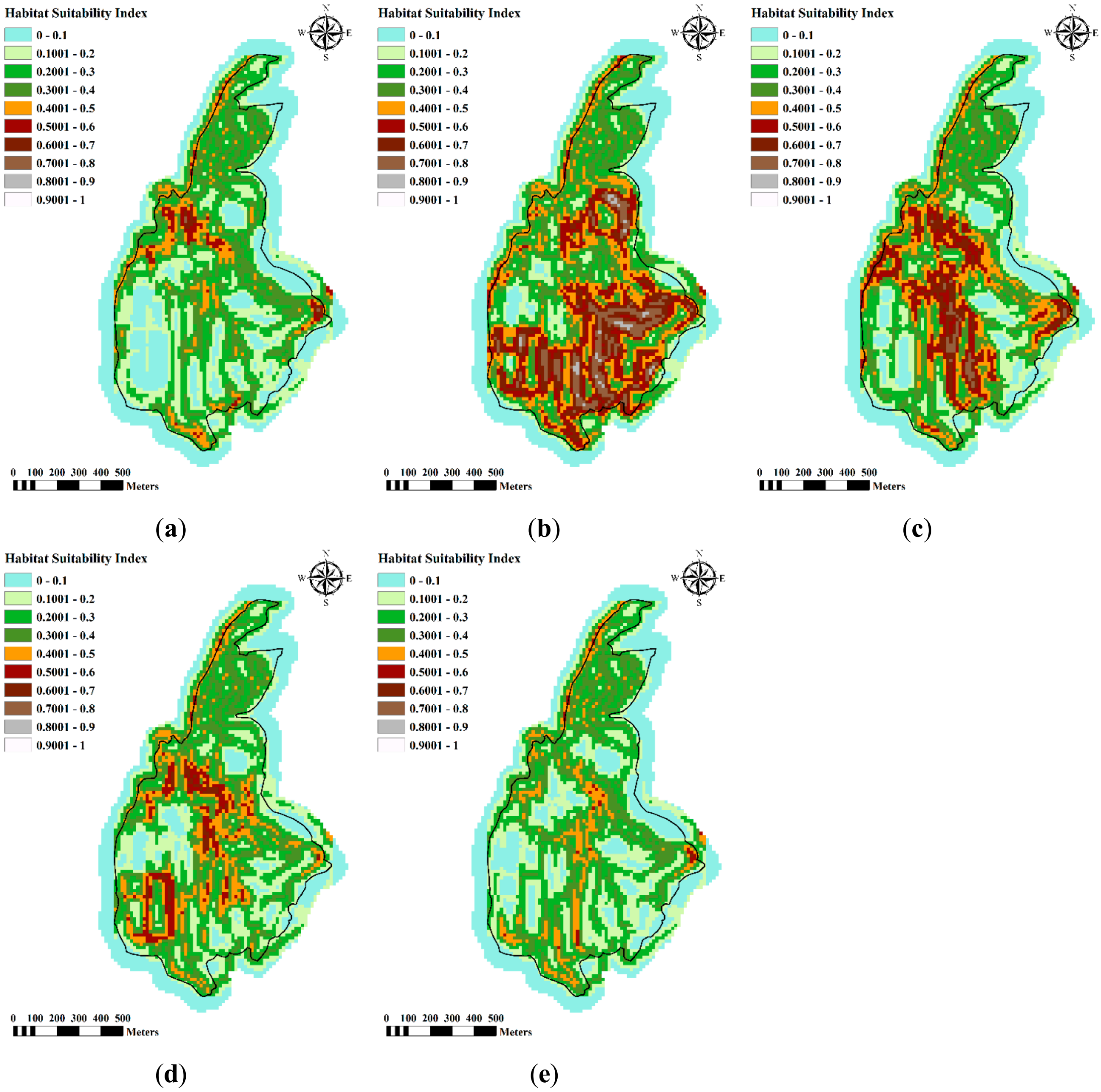
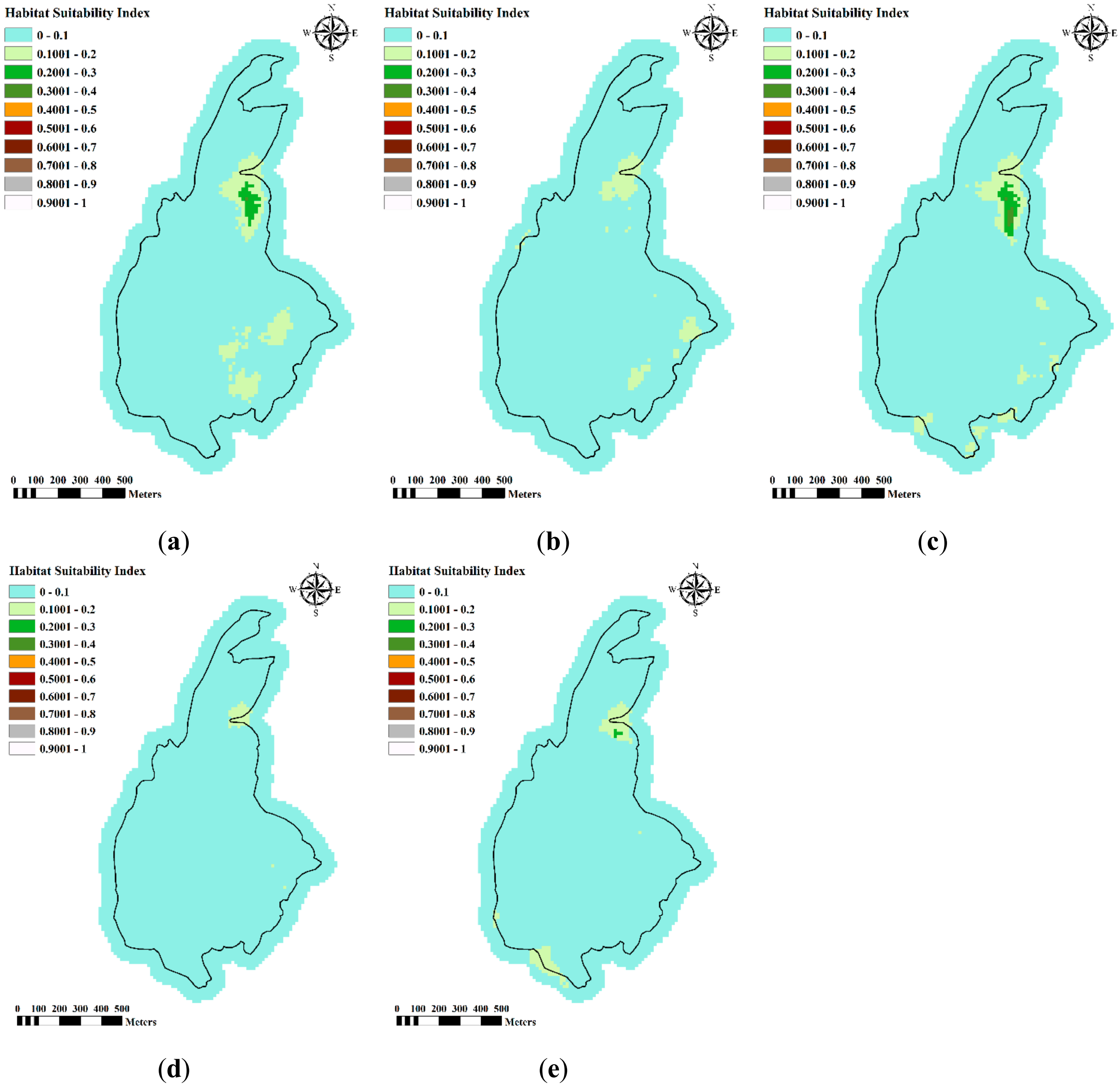


Figure S11. The habitat suitability distributions of the Vinous-throated Parrotbill under (**a**) current landscape; (**b**) optimized landscape for the Green-backed Tit (DDSLOP); (**c**) optimized landscape for the Green-backed Tit (LUPOlib); (**d**) optimized landscape for the Taiwan Yuhina (DDSLOP); (**e**) optimized landscape for the Taiwan Yuhina (LUPOlib).



References

1. Holzkämper, A.; Lausch, A.; Seppelt, R. Optimizing landscape configuration to enhance habitat suitability for species with contrasting habitat requirements. *Ecol. Model.* **2006**, *198*, 277–292.
2. Lin, Y.-P.; Huang, C.-W.; Ding, T.-S.; Wang, Y.-C.; Hsiao, W.-T.; Crossman, N.D.; Lengyel, S.; Lin, W.-C.; Schmeller, D.S. Conservation planning to zone protected areas under optimal landscape management for bird conservation. *Environ. Model. Softw.* **2014**, *60*, 121–133.
3. Lin, C.-W.; Hsu, F.-H.; Ding, T.-S. Applying a territory mapping method to census the breeding bird community composition in a montane forest of taiwan. *Taiwan J. For. Sci.* **2011**, *26*, 267–285.