

[Article]

Occurrence data of southern butterflies in South Korea

Hyun Woo Kim¹, Youngho Cho², Pradeep Adhikari³, Ja-Young Jeon³, Younggu Han⁴, Changwan Seo^{3*}

EcoBank Team, National Institute of Ecology¹

Department of Research Policy, National Institute of Ecology²

Division of Ecological Assessment, National Institute of Ecology³

Team of National Ecosystem Survey, National Institute of Ecology⁴

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*Corresponding author: dharmascw@nie.re.kr

Abstract:

Background: In Northern hemisphere, climate change has shifted the habitats of many species including butterflies into the northern regions. Many researchers in Europe and North America have reported this type of northward shift of butterflies. Thus, we collected the species occurrence data of southern butterflies and presented in this study for understanding the impact of climate change on the southern butterflies in the future.

New information: This study presents the 456 occurrence data of nine southern butterflies under five families in Korea. These data were selected from the 3rd National Ecosystem Survey (NES) conducted by National Institute of Environment Research (NIER) in Korea. Those will be a part of input data for MOTIVE-Ecosystem model, an integrative model to understand the influence of climate change and land cover change on the habitat suitability of sensitive, native and invasive species. These data will be important to the researchers and conservation agencies for understanding the current conditions of southern butterflies and developing conservation policy.

Keywords: Climate change, southern butterflies, National Ecosystem Survey (NES), MOTIVE-Ecosystem model

1. Introduction

Butterflies are widely considered as the indicator of the environmental change, habitat fragmentation, agriculture activities, air pollution, and climate change (Samways, 2005; Nakamura, 2011). They are highly sensitive to climatic variables (Manzoor et al., 2013). The increased temperature directly or indirectly effects on ovipositional sites, egg laying rate, larval development, and survival rate of the butterfly (Davies et al., 2006). Similarly, precipitation influences larval development and survival by controlling phenology of the host plant (Rodriguez et al., 1994). Therefore, climatic variables determine the habitat expansion, and range shift of the butterfly. Many studies revealed that contemporary and anticipated effects of climate change on butterflies, includes altitudinal and latitudinal range shift across the globe (Parmesan et al., 1999; Gonzalez-Megias et al., 2008; Kwon et al., 2010). However, very few studies have found to describe the distribution and range shift of butterflies under the climate change in South Korea (Kwon et al., 2010, 2014).

The southern butterflies are native to the southern regions of the South Korea, approximately below 36.5° latitudes. However, their presence have recorded in central and northern regions too (Kim et al., 2012). The southern butterflies

such as *Graphium sarpedon*, *Papilio memnon*, *Catopsilia pomona* and *Eurema laeta* contributes 16.42% of the total butterflies found in the South Korea (Kim et al., 2012). The Southern region of the South Korea is relatively warm and humid compared to the northern and central regions. Therefore, the southern butterflies are well adapted to warm and humid climatic environment.

In this study, we presented the species occurrence data of southern butterflies in different locations of South Korea. These data will be a part of inputs on the MOTIVE ecosystem model (officially not announced), an integrated model for climate change impact and vulnerability assessment. The model has been developing to understand the impact of climate change on various ecological phenomena including the habitat suitability change of sensitive, native, and invasive species under the financial support of the Korea Environmental Industry & Technology Institute (KEITI) since 2014.

Table 1. Selected southern butterfly species in South Korea

Family name	Scientific name	Korean name	Habitat type	Occurrence points
Hesperiidae	<i>Choaspes benjaminii</i>	푸른큰수리팔랑나비	Forest edge	17
Lycaenidae	<i>Zizina otis</i>	극남부전나비	Grassland	15
Lycaenidae	<i>Lampides boeticus</i>	물결부전나비	Grassland	9
Lycaenidae	<i>Taraka hamada</i>	바둑돌부전나비	Forest inside	23
Nymphalidae	<i>Dichorragia nesimachus</i>	먹그림나비	Forest inside	35
Nymphalidae	<i>Parantica sita</i>	왕나비	Forest edge	13
Papilionidae	<i>Papilio protenor</i>	남방제비나비	Forest edge	86
Papilionidae	<i>Graphium sarpedon</i>	청띠제비나비	Forest inside	92
Pieridae	<i>Eurema laeta</i>	극남노랑나비	Grassland	166

2. Project description

Title: Integrated model for climate change and vulnerability assessment

This is a seven years project started in 2014 for studying climate change impact and vulnerability assessment of subalpine species, northern species, southern species, native species, sensitive species, and invasive species present in South Korea via developing ecological model. The project is supported by the Korea Environmental Industry and Technology Institute (KEITI) through the "Climate Change Response Technology Project", funded by Ministry of Environment, South Korea.

3. Methods

The Ministry of Environment, South Korea has carried out the National Ecosystem Survey (NES) for the mainland of

South Korea since 1986. The third NES data (2006–2013) for butterflies collected from 2006 to 2013 were used in this study (National Institute of Environmental Research, 2007). These data were produced under the process of data standards and quality control of EcoBank, ecological information portal system in NIE, Korea.

4. Results and Discussion

Altogether, 456 occurrence point data of nine southern butterflies *Eurema laeta*, *Zizina otis*, *Papilio protenor*, *Dichorragia nesimachus*, *Lampides boeticus*, *Taraka hamada*, *Parantica sita*, *Graphium sarpedon*, and *Choaspes benjaminii* corresponding to five families have presented in this study (Table 1). These butterflies were recorded mainly inside the forest, edge line of the forest, grassland, riverbanks, agriculture land, and swampy meadows. Kim et al. (2011) reported similar habitats of southern butterflies.

The southern butterflies were abundant in both mainland and islands of the southern region of South Korea particularly Jeju-do, Jeollanam-do, Jeollabuk-do, Gyeongsangnam-do, Busan, Ulsan, and Daegu. However, some southern butterflies such as *Eurema laeta*, *Papilio protenor*, *Parantica sita*, and *Choaspes benjaminii* were recorded in northern region of South Korea including Seoul, Gangwon-do, Gyeongsangbuk-do (Ullong Island). This indicates that southern butterflies could have range shift due to the various environmental effects such as climate change, land use or land cover change, and anthropogenic activities.

Although, recent conservation status of southern butterflies listed in this study are not evaluated currently, four species namely *Papilio protenor*, *Lampides boeticus*, *Taraka hamada* and *Parantica sita* were listed as the rare species and the *Graphium sarpedon* is listed as the protection required species in South Korea (Choi and Kim, 2012). Therefore, these species presence data could be reference for assessment of their conservation status. The data presented in this study, will be important resource to the researcher and conservation agencies for understanding the ecology, distribution, and impact of climate change on southern butterfly and developing conservation strategies of southern butterfly, respectively.

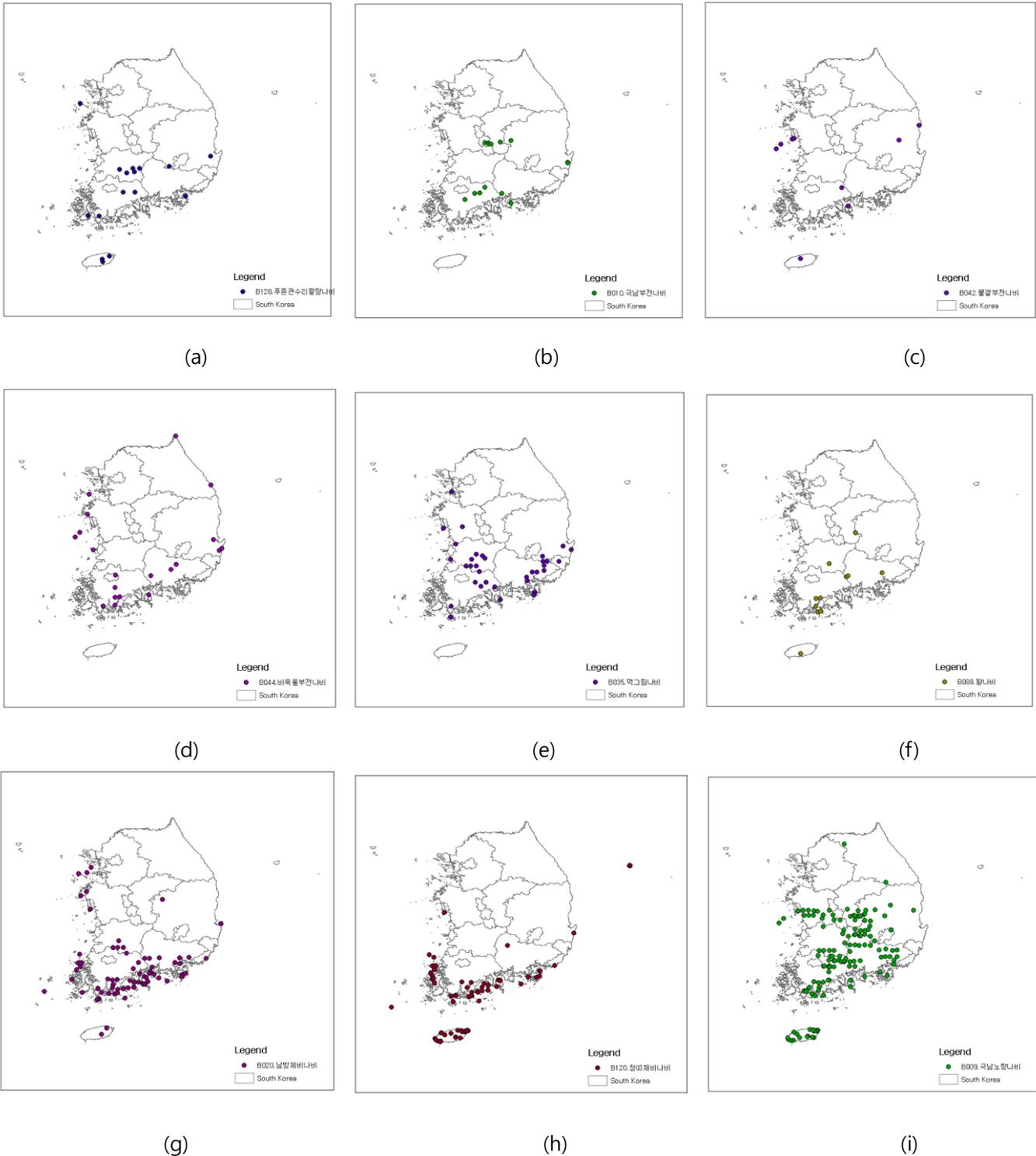


Fig. 1. Occurrence points of 9 southern butterfly species; (a) *C. Benjaminii*, (b) *Z. Otis*, (c) *L. Boeticus*, (d) *T. hamada*, (e) *D. nesimachus*, (f) *P. sita*, (g) *P. protenor*, (h) *G. sarpedon*, and (i) *E. laeta*.

5. Acknowledgements

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6. Usage rights

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7. Data resources

Number of dataset : 1

Data set name : Dataset1.zip

Data format : *.png, *.xlsx

*.png files: spatial distribution map of 9 southern butterfly species selected in this study.

sbutterflies.xlsx: Raw data of southern butterflies.

8. References

- Choi SW, Kim SS (2012) The Past and current status of endangered butterflies in Korea. *Entomol Sci* 15:1–12.
- Davies MB, Shaw RG, Etterson JR (2005) Evolutionary responses to changing climate. *Ecology*, 86(7):1704–1714.
- González-Megías A, Menéndez R, Roy D, Brereton T, Thomas CD (2008) Changes in the composition of British butterfly assemblages over two decades. *Glob Change Biol* 14:1464–1474.
- Kim SS, Lee CM, Kwon TS, Joo HZ, Sung JH (2012) Korean butterfly atlas [1996–2011]. Korean Forest Research Institute, 483 p
- Kwon TS, Kim SS, Chun JH, Byun BK, Lim JH, Shin JH (2010) Changes in butterfly abundance in response to global warming and reforestation. *Environ Entomol* 39(2):337–345.
- Kwon, TS, Lee CM, Kim SS (2014) Northward range shifts in Korean butterflies. *Clim Cha* 126 (1-2):163–174.
- Manzoor F, Sadat HB, Hina (2013) Butterflies as Indicator of Climate Change. *Zoo's Print*, 28 (2):19–21.
- Nakamura Y (2011) Conservation of butterflies in Japan: status, actions and strategy. *J Insect Conserv* 15:5–22.
- National Institute for Environmental Research (2007) Guidelines for the third national ecosystem survey (in Korean). National Institute of Environmental Research, Incheon, Republic of Korea.
- Parmesan C, Ryrholm N, Stefanescu C, Hill JK, Thomas CD, Descimon H, Huntley B, Kaila L, Kullberg J, Tammaru T, Tennent WJ, Thomas JA, Warren M (1999) Poleward shifts in geographical ranges of butterfly species associated with regional warming. *Nature* 399:579–583.
- Rodriguez J, Jordano D, Fernandez Haeger J (1994). Spatial heterogeneity in a butterfly-host plant interaction. *J Anim Ecol* 63:31–38.
- Samways MJ (2005) Insect diversity conservation. Cambridge University Press, Cambridge.
- Thomas CD, Lennon JJ (1999) Birds extend their ranges northwards. *Nature* 399:213.

9. Metadata

구분	필드명	하위카테고리#1	하위카테고리#2	설명	비고
필수	Title	남방계 나비		Dataset1	제 3차 전국자연환경조사 중 남방계 나비 9종의 분포 자료임
	*DOI name	-	-	-	
	*Category	남방계 나비			
	Abstract				
	*Temporal Coverage	2006년 4월 ~ 2013년 12월		취득기간	2006년 4월 ~ 2013년 12월
	*Spatial Coverage	위도 33 °N ~ 39 °N, 경도 125 °E~131 °E 영역	점 (point)	공간정보 (WGS84)	
	*Personnel	등록자(김현우)/소유자 (국립생태원)	이름	김현우	
			소속	국립생태원	
이메일			khw4eco@nie.re.kr		
*License	공개자료임	공개자료임	공개자료임		
선택	*Project	No. : 2014001310009 전국자연환경조사		3차 전국자연환경조사	
	*Instrument	포충망		포충망규격: 50X110 (cm)	