## Material and Method

### Data Collection

#### Presence-Absence Data Points

To overcome the shortage of using presence-only data to model species distribution, we collected both presence and absence data for two study species. Presence data only within the past 10 years was collected due to fast change of Chinese Forest. We systematically searched Web of Science (xxx), Google Scholar (link:xxx), CNKI (Chinese National Knowledge Infrastructure), CSTJ (Chinese Science and Technology Journal Database) for articles published since 2007 using the searching terms “XXX”, “XXX”. We collected presence data from PKU’s regional camera-trapping networks in Southwest China (primarily in Sichuan and Shaanxi provinces). This network contains over 30 nature reserves that all conduct camera-trapping surveys following a standardized protocol (citations). We also collected citizen science bird data from China’s largest birder website [www.birdreport.cn](http://www.birdreport.cn) for further study species presence data.

For absence data, we first examined the sampling effort of the camera-trapping sites that detected study species, the longest detection period is 128d and 180d for redXXX and whiteXXX respectively. Thus we consider sites do not have study species detection in >500d period is absence site. Then we systematically collected species list of Nature Reserves in China from NSII (National Specimen Information Infrastructure, database link: <http://www.papc.cn/html/folder/13113591-1.htm>). Since both golden pheasant and Lady Amherst's pheasant have conspicuous male individuals and are considered as prior conservation species in China, thus we assume that if one of these species is not listed on the species list of certain Nature Reserve means absence of this species in that Nature Reserve.

All of the presence-absence data were processed using ArcMap 10.3.1(citation) to generate geo-referenced vectorial point layers, respectively, for subsequent modeling and analysis. We used Verbruggen’s Occurrence Thinner with t1=0.1 and t2=1 (Verbruggen, 2012) to reduce the spatial redundancy and class imbalance prior to model construction (finally absence nG = 141, nA = 100, presence nG = 156, nA=92).

#### Environmental Layers

Since the algorithm we chose to model distribution can handle redundant features (environmental factors), we collected all climate data from BIOCLIM (link: [www.worldclime.org](http://www.worldclime.org)), we also collected land use and annual average NDVI from MODIS (link: ), DEM from XXX, topographic ruggedness (was an index calculated as the standard division of elevation values of the nearest neighboring nine pixels (citation)), tree cover form Global Forest Watch, as well as human population from Harvard and Human Influence Index (HII) from XXX. All 27 factors are shown in table XXX.

All environmental layers are processed using ArcMap 10.3.1(citation) and resample to 10km resolution for model construction.

### Distribution Modeling and Overlay Analysis

We used Random Forest (RF) algorithm in R package BIOMOD2 (citation) to construct distribution model of two study species, with 85% of the presence-absence data as training data set while 15% as evaluation data, while other parameters remain default. We used True Skill Statistic (TSS) (Thuiller, Georges et al. 2016) and Receiver Operating Characteristic curve (ROC) (Thuiller, Georges et al. 2016) to evaluate the model performance using evaluation data. Threshold recommend by ROC evaluation for golden pheasant was 0.595 while Lady Amherst's pheasant was 0.393. We got binary map for two study species by using these thresholds to cut off the probability map.

Potential distribution overlap was identified by overlay analysis using binary map of two study species.

## Results

### Distribution Modeling and Factor Importance

TSS and ROC-AUC shows both two model perform good (for G: TSS: .839, AUC: .972, for A: TSS: .955, AUC: .998) (Table XXX). Random Forest can also give relative factor importance estimation, for golden pheasant, the most important factors for model prediction are BIO4 (0.026) and BIO15 (0.025), while for Lady Amherst's pheasant, the most important factors is BIO7 (0.090) (Table XXX).

### Co-occurrence Pattern of Two Study Species

Distribution modeling results and co-occurrence are shown in Figure XXX. Generally, two species are not co-exist only except for Minshan Mts. The total coexist area predicted by distribution modeling is 50,500 km2, while total area of golden pheasant predicted by model is 622,300 km2, and Lady Amherst's pheasant is 796,800 km2. Co-occurrence region predicted by model mainly divided into two parts, in north Minshan Mts and south Minshan Mts.

