Progress Report

Population Size and Ecology of Giant Nuthatch (*Sitta magna*) in Thailand
Introduction

The Giant Nuthatch (Sitta magna) is a resident species (Aves: Sittidae) of mixed coniferous and broadleaf forest, in which pine (Pinus kesiya) and oaks (Quercus spp.) predominate, at 1,000 – 2,000 m (Round, 1983). Its small world range encompasses southwestern China, eastern Myanmar and northern Thailand (Birdlife International, 2001). Giant Nuthatch is at risk globally due to its limited range and the degradation of its habitat through logging, fuelwood collection, shifting cultivation, habitat clearance and uncontrolled burning carried out by local people. The population of Giant Nuthatch is thought to have declined dramatically with only 6-50 mature individuals in the largest subpopulation (BirdLife International, 2013). The relatively imprecise population estimate (c.1,500 – 3,800 individuals) (BirdLife International, 2014) indicates a high level of uncertainty as to its actual status, but even an upper limit of 3,800 individuals for this relatively small bird would be indicative of extreme scarcity. The species was upgraded from IUCN Vulnerable to Endangered in 2012 (BirdLife International, 2013). Although found in three countries, it has disappeared from parts of its range (especially in China and Myanmar, and some former localities in Thailand). Moreover, the information and knowledge of this species is scarce.

Thailand is particularly important for the conservation of Giant Nuthatch due to the apparently high density of the species in better-quality habitat, combined with the country's extensive protected area infrastructure and the absence of legal logging. Most of the research will be conducted in Chiang Dao Wildlife Sanctuary (a BirdLife IBA), perhaps the best remaining habitat for Giant Nuthatch in Thailand, based on the relatively frequency of sightings and the large and extensive areas of pine-oak association forest that is accessible by tracks and footpaths in the zone 1000-1500m.

Many species are affected by human activities at large scales and the present management does not ensure adequate conservation. Effective conservation requires baseline data on distribution and ecological habitat utilization (Osborne et al., 2001; Brichetti & Capi, 1986). Accurate population estimates are also important to predict extinction risks for threatened species and to compare alternative options for their management (Akçakaya, 2000). Telemetry data will give information in fine-scale of species territory and habitat use which is useful for management such as to protect core area, to design the landscape and plantation, and to compare and develop the effective conservation project in other protection areas.

This study aims to investigate the current distribution and estimate the population density of Giant Nuthatch to provide the baseline study of the species. Moreover, we aim to examine the ecology of Giant Nuthatch by using telemetry and direct observations to gather more information in fine-scale habitat use, such as territory size, bird movement and to investigate the relationship between pines, broadleaved trees, habitat quality, and nuthatches in order to propose the better conservation planning of the habitat.

Objectives

1. To study site occupancy and distribution of Giant Nuthatch in northern Thailand
2. To investigate relative abundance and density of nuthatches in a range of forest habitats in Chiang Dao wildlife sanctuary and investigate the relationship between nuthatch density in different habitat types (pine forest, mixed forest, and pine plantation)
3. To estimate the size of the Thai population through combining forest cover data (including remote sensing data) with presence /absence data across a range of Northern Thailand sites

4. To assess territory, home-range, and habitat requirements of Giant Nuthatch
5. To study the detailed foraging behavior, diet, and breeding biology of Giant Nuthatch (incidental objective)

Distance Sampling Survey

Stratified sampling conducted in three different habitats which are pine forest, evergreen forest and pine plantation taking into account accessibility in Chiang Dao wildlife sanctuary. Thirteen line transects of at least 200m have been placed along road and trails for a total distance of 6km. Birds of all species detected by direct observation or call will be recorded during an observation, moving on a constant speed approximately 1km/hr. The survey had been conduct during November 2014 to April 2015 from sunrise until 10am. Total effort of the observation is 66800 meter and detected 50 nuthatches with detection probability of 26.7% and encounter rate of 73.3%. All field work and vegetation within line transect had done. The estimate density of Giant Nuthatch is 0.067couple/ha (SE=0.031).

Occupancy Survey

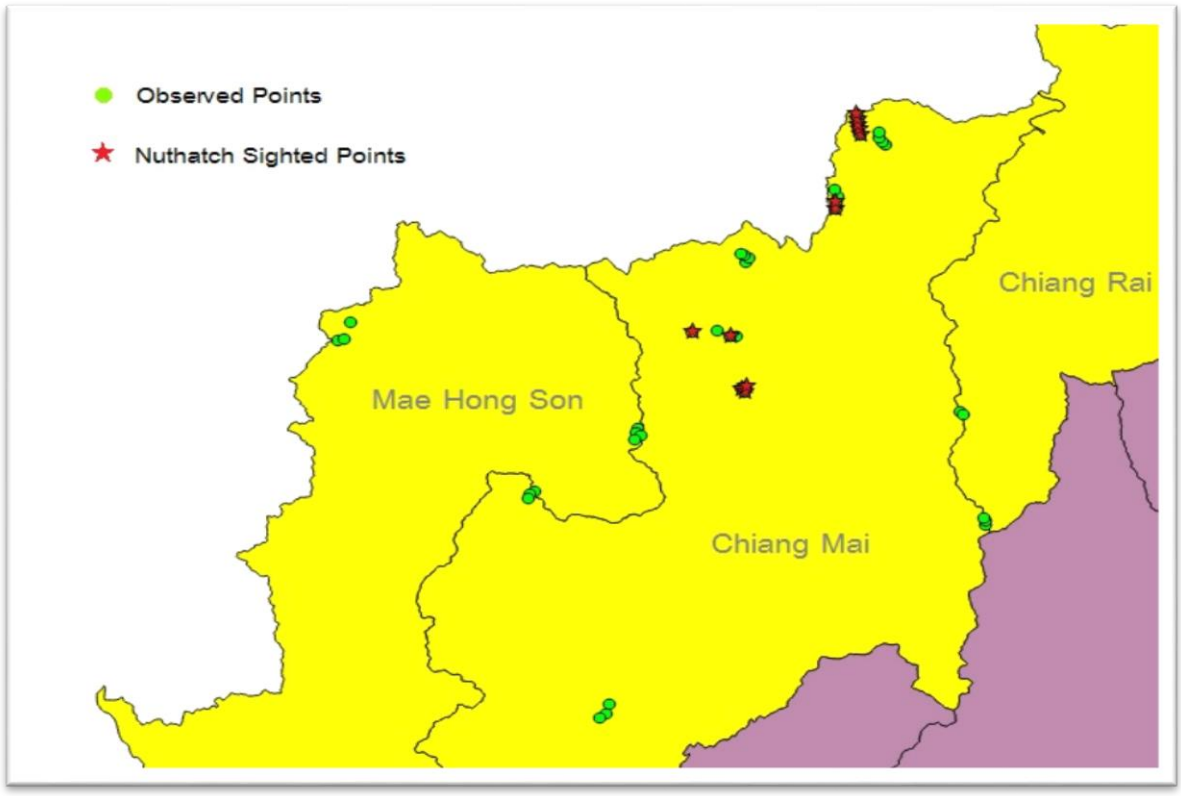
Occupancy survey had been conducted 42 sites in northern Thailand including all historical sites and the potential sites. Occupancy sites must have pine as dominate plant species and located above 1000m in elevation. Each site is independent by at least 1 km apart. The observation was conduct using 20min of point count method with tape play back of both giant nuthatch call and song. Each site was revisited for 3 times during October to December.

Table 1. Historical record of Giant Nuthatch in Thailand range

Area	**Year**
Doi Pha Hom Pok, Chiang Mai	• 1938 (Deignan. 1946) • 1982 (G. Walbridge *per* P.D.Round *in litt.* 1998) • 2012 onwards (many observers)
Doi Ang Khang, Chiang Mai	• 1982 (T. Baker and P. Jepson *per* P.D. Round *in litt*. 1998) • 1983 (Round. 1983) • 1989 (J. Hough, A.Stoddart and R.Drew *per* P.D. Round *in litt*. 1998) • 1998 (*Bird Conserv. Soc. Thailand Bull.* 1998) • 2008 onwards (many observers)
Doi Chiang Dao Wildlife Sanctuary, Chiang Mai	• 1933 (Meyer de Schauensee. 1934) • 1990 onwards (by many observers *in litt.)*
Mae Jok Luang, Chiang Mai/ Mae Hongson	• 1997 (*Bird Conserv. Soc. Thailand Bull.* 1997, R. Kanjanavanich *per* P.D. Round *in litt.* 1998)
Kiew Kor Mah, Chiang Mai/ Mae Hongson	• 1957 (specimen in Yale Peabody Museum) • 1988 (B. Briggs in litt. 1999)
Doi Lang Ka, Chiang Mai	• 1930 (specimen in Smithsonian National Museum of Natural History, Riley. 1938)
Doi Suthep-Pui National Park, Chiang Mai	• 1929,1930 (Meyer de Schauensee) • 1931, 1936, 1945 (Deignan) • 1931 (Chasen and Kloss. 1932) • 1967 (specimen in TISTR)
Doi Inthanon National Park, Chiang Mai	• 1928 (specimen in Smithsonian National Museum of Natural History, Riley. 1938) • 1931 (specimen in Field Museum of Natural History)

Doi Khuntan National Park, Chiang Mai and Lamphun	• Unconfirmed record (reported to P.D.Round *in litt.* 1998)
Om Koi Wildlife Sanctuary, Chiang Mai	• Unconfirmed record (reported to P.D.Round *in litt*. 1998)
Mae Tuen Wildlife Sanctuary, Tak	• Unconfirmed record (reported to P.D.Round *in litt*. 1998)
Muang Na, Chaing Dao, Chiang Mai	• 2009 (Unpublished data from observers)

Giant nuthatches were found only in Chiang Mai province (12 of 42 sites, naïve occupancy estimate = 0.2857). Occupancy probability (psi) estimated is 0.35 (SE=0.0966) and Detection probability (p) is 0.43 (SE=0.1069).



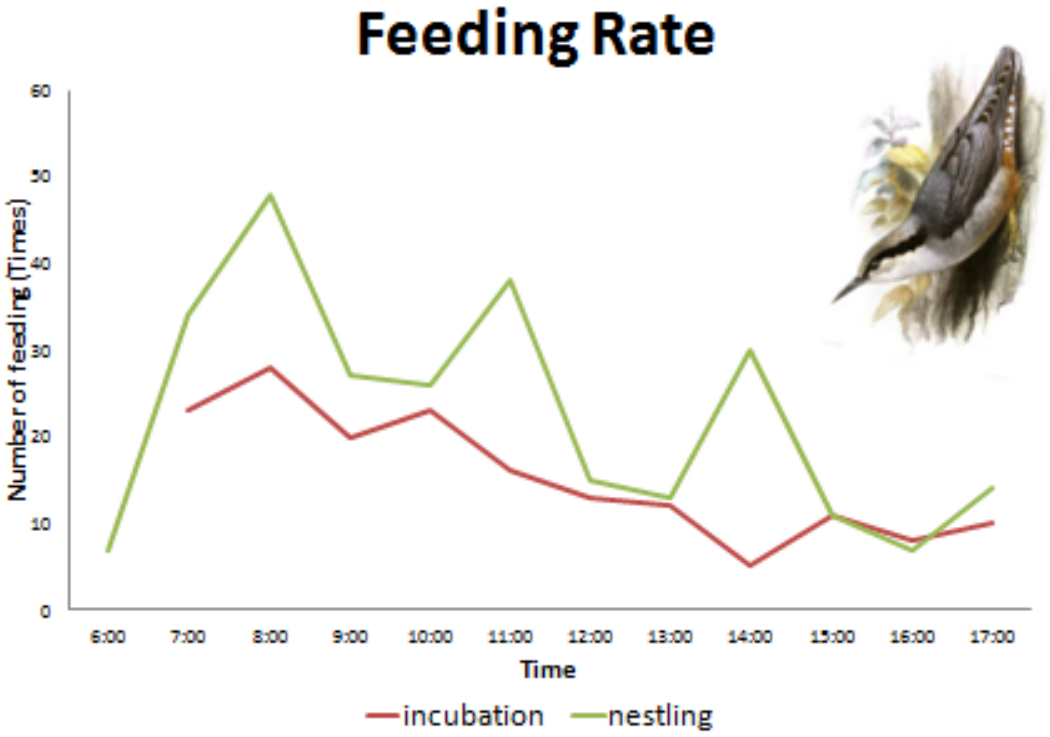
We found that some historical record site of Giant nuthatch was became agricultural areas, especially corn field and cabbage farm. Agriculture expansion and habitat lost may be the main threat of this species.

Moreover, we also conducted vegetation survey of every site by using angle gauge sampling (Cruze-all). Vegetation information and GIS data will be use to improve occupancy analysis and to estimate the population size across suitable habitat in Thailand.

Rabio Telemetry

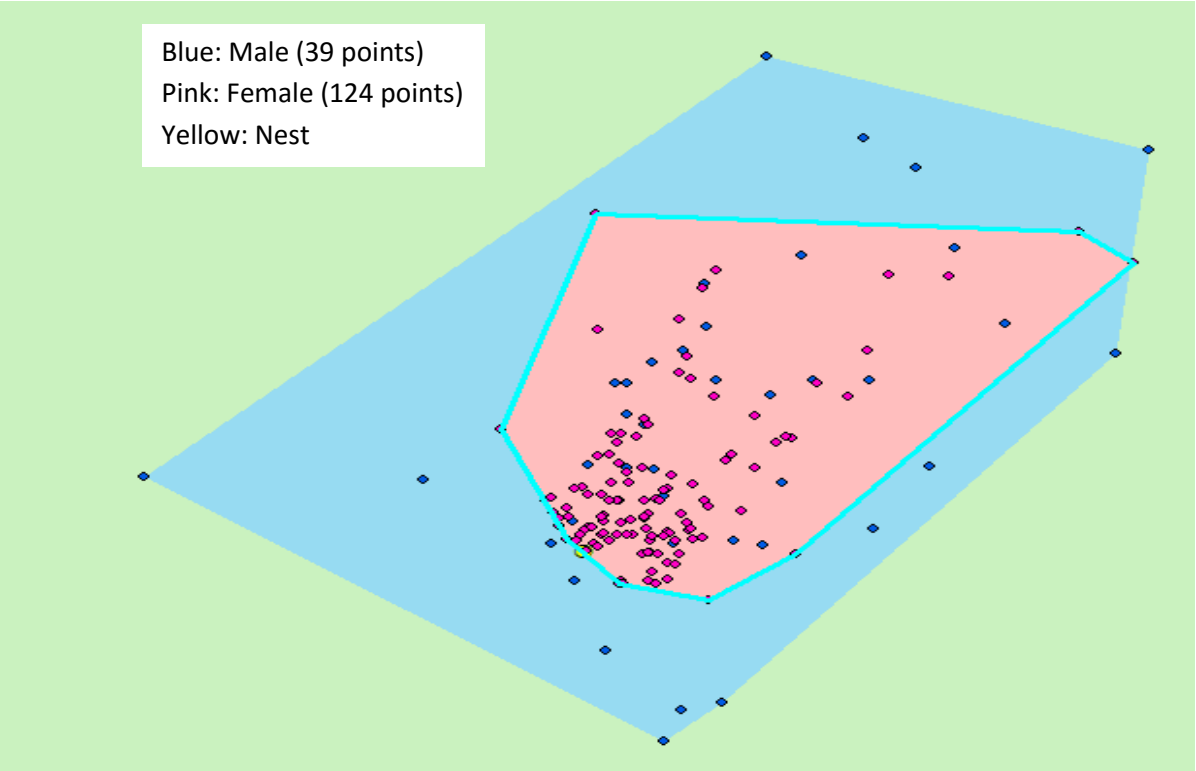
A cavity nest of Giant Nuthatch was found on broadleaf tree (*Premna latifolia*) among pine plantation. Female nuthatch was captured and attached the VHF radio transmitter of 1.4g (Holo hill BD-14) by harness method and latex-base glue on 21st Feb 2016 during the egg laying period while Male was captured on 22nd March 2016 after the eggs hatched.

Only female incubated the eggs while male came to feed the female. Female did foraging by herself several times a day nearby the nest site. The nuthatch incubated the eggs for about 18days. During the nestling period, male and female reciprocally feed nestling with caterpillars, insects, spiders, and acorns. The feeding observation was conducting from sunrise till the bird gets back to the nest at around 6pm. Time and behavior were recorded. Food item were photograph for future analysis.



Feeding rate of male during incubation period is **11times/day** (min-max: 9-16times/day) and highly active in the morning and reducing in the late of the day, while feeding rate of both male and female during nestling period is **30times/day** (min-max: 19-48times/day). The rate is highly active 3 times of day: morning, noon and afternoon, and several times in the evening.

Radio tracking was conducting by using homing method with a handheld receiver and antenna. Successive relocations were separated by > 1 h to ensure behaviorally independent samples. Bird location was recorded using handheld GPS. Time, behavior, tree species and position on tree height were recorded. All locations were plotted in ArcGIS and analysed by Minimum Convex Polygon (MCP) method, the smallest polygon that can encompassed all recorded location.



Number of female fixed point (exclude nest) is 124 points and number of male fixed point (exclude nest) is 39 points as male were captured after egg laying period. Female home range is encompassed in male home range, about 2.5 times smaller. Male home range (presented in blue area) is 20.34ha while female home range (presented in pink area) is only 8.27ha.