

## Unique Study Shows Ecological Degradation Boosts Cooperation



▲ The Taiwan yuhinas is an endemic species of passerine that lives only at mid to high altitudes in the mountains of Taiwan.

Climate change leads to a deteriorating environment and threats to the survival of biological organisms. How do these organisms respond? Do they work together, or do they compete among themselves for dwindling resources?

A research team led by Prof. Hsiao-wei Yuan of NTU's School of Forestry and Resource Conservation and Dr. Sheng-feng Shen, an assistant research fellow at Academia Sinica's Biodiversity Research Center, conducted a long-term study of the Taiwan yuhinas (*Yuhina brunneiceps*), a species of bird unique to Taiwan, to seek answers to these questions. They discovered that under unfavorable environmental conditions there was less conflict between individuals and that the individuals adopted cooperative reproductive strategies that, surprisingly, resulted in more offspring surviving than would have in ideal conditions.



This study is the first of its kind to show that a harsher environment lowers social conflict and results in improved fitness outcomes in social vertebrates. The results were published under the title "Unfavourable Environment Limits Social Conflict in *Yuhina brunneiceps*" in the prestigious journal *Nature Communications* on June 6.

Prof. Yuan, who has studied the Taiwan yuhinas for 20 years, states that this passerine species lives only at mid to high altitudes in the mountains of Taiwan. The species exhibits the rare social behavior of joint nesting, in which unrelated females compete to lay

eggs in the same nest, yet cooperate on nest building, incubation, and the raising of offspring. Of the nearly 10,000 bird species, less than 20 demonstrate this type of behavior.

The researchers observed 37 nests, filming 85 days of incubation competition and analyzing 288 hours of feeding behavior. They discovered that in severe



conditions there was less competition between individuals within the group, including less conflict over egg laying. Also, fewer eggs were laid and there was an increase in incubation cooperation. These cooperative responses resulted in the survival of more offspring.

Conducted from 2004 to 2007, the study utilized such traditional methods as observation with binoculars, as well as advanced RFID identification and digital videography for monitoring. Moreover, the researchers applied an evolutionary game theory model to overturn the common view that competition intensifies as resources decline, demonstrating conversely that a degraded environment calls for greater cooperation to achieve the best outcome.

In this era of climate change, scientists from every discipline are striving to understand the influence of climatic shifts on the environment and humans. For their part, ecologists aim primarily to study the effects of climate change on the distribution and survival of species. Still, few have addressed the impact of climate change on cooperation and conflict between individuals within a species. It is this focus that earned Prof. Yuan's study publication in *Nature Communications*.