

## Ensemble Project of Brown Planthopper Overwintering Area under Future Climate Conditions

Semi Lee, Kwang Soo Kim

Interdisciplinary Program in Agricultural and Forest Meteorology, Seoul National University

The brown planthopper (BPH), *Nilaparvata lugens* (Stål), is an important pest in rice paddies. Because BPH cannot survive under low temperature conditions ( $<12^{\circ}\text{C}$ ), its outbreak in temperature areas depends on migration from overwintering areas of BPH. Geospatial distribution of BPH overwintering area would be changed under future climate. The objective of the present study was to assess potential areas for BPH overwintering in Asia under current and future climate conditions. To reduce model uncertainty, we explored an ensemble modeling approach using five species distribution models (SDMs) and climate data from five general circulation models (GCMs). For future projections, outputs from an SDM with five sets of GCM data were averaged into a single map. Then, five maps from individual SDMs were summarized to assess the potential overwintering areas of BPH. Overall, the BPH overwintering areas expanded northward under future climate conditions. The degree of expansion in overwintering areas differed by region. For example, the uppermost boundary of BPH overwintering areas shifted north about 150 Km in southern China by 2050s. In Japan, small areas in the southern Kyushu were projected as potential areas of BPH overwintering. These results indicated that migration of BPH into East Asia including northern China, Korea, as well as Japan would occur early in the growing season, which could result in considerable damages in rice production.

**Key words:** *N. lugens*, overwintering, SDM, ensemble method, climate change

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