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Index-based insurance design for drought and flood events in rice cultivation

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Index-based insurance is a very efficient strategy for protecting farmers′ incomes, when a climatic catastrophic event occurs. The extreme climatic events that affect farmers more frequently are drought and floods, which in turn are associated with large economic. Index-based insurance does not need in situ verification of the insured event, with the occurrence being determined by an index that is much correlated with the farmer′s losses.

For this study, we rely in previous studies, which helped determine agro-ecological homogenous zones (AHZ) with similar climatic and soil conditions through principal components analysis. In the rice crop study area, in Babahoyo canton-Ecuador, two main AHZ were delimited, named f7 and f15. The differences among these two AHZs, both over bare soil and over rice crop, were statistically significant using soil reflectance and NDVI respectively. The most important soil differences between zones f7 and f15 are slope, texture, and effective depth; and related with climate is precipitation.

In this stage of the study, seventeen years of NDVI data (2001-2017) along rainfed rice crop cycle in Ecuador (January to May) were analysed using MODIS imagery. It permitted sampling rice yield in zones f7 and f15 during rice crop cycle of 2016 and 2017. Then, these yields were correlated with its corresponding NDVI values, obtaining a correlation coefficient of 0.84. The correlation coefficient between the estimated yields with found yields was also acceptable (0.8). Therefore, we have chosen NDVI as an index for indicating the occurrence of drought and flooding, due to the high sensibility of this index to these events, evidenced in the temporal data analysis and for its high correlation with yield.
The threshold value of NDVI average of rice crop cycle was 0.4, which was established through the mean of the years that were deeply affected by drought (2013, 2016) and floods (2008, 2012). Although, that NDVI was found significant different between zones f7 (0.45) and f15 (0.48), we could use a unique threshold value (0.4) for monitoring drought and flooding events in both zones. The differences found in zones f7 and f15 were reflected in the insurance's premium price, because each zone faces different drought and flooding risk, and the ensured yield is going to be different between these zones (f7=5.1 TM/ha and f15=6.7 TM/ha).

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