

## **Methodological considerations for estimating the total economic impacts of natural disasters for the agriculture industry**

Topic: Thematic IO analysis: Disaster and Adaptation

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The agricultural sector frequently experiences substantial adverse impacts following natural disasters due to losses in crops, livestock, and animal products, as well as damage to buildings, equipment, fencing, irrigation systems, and perennial plantings. These losses and damages impact local businesses and worker communities that are economically dependent on agriculture. The manner in which data on agricultural losses and damages are currently collected, analyzed, and published in response to a disaster presents numerous challenges for stakeholders, including: 1) redundant and uncoordinated information collection efforts, 2) conflated reporting of losses (changes in economic flows) and damages (changes in economic stock), which should be reported and evaluated separately, and 3) prolonged temporal distribution of losses in agriculture as some occur immediately after an event while others might manifest over longer periods. Input-output models have a long history of use for disaster impact assessment. However, unique characteristics of the agriculture industry, namely the heavy reliance on operating loans and seasonal nature of expenditures for crop and livestock production in particular, make these and other methods that estimate total impacts based on backwardly-linked expenditures inappropriate for assessing the broader regional economic impacts of production losses. This manuscript focuses on conceptual and methodological considerations for producing unbiased, timely, and accurate estimates of direct economic losses to the agriculture system and associated total economic impacts to the region. An analysis of the total economic impacts of Hurricane Michael (2018) is presented as a case study of the novel methods proposed. Using geospatial data on cropland area and hurricane windswath along with survey data on direct losses for production agriculture and the agribusiness sector and input-output data for the State of Florida (2017) available from IMPLAN, the total economic impacts of agricultural losses associated with Hurricane Michael are estimated.