



**P****PS**

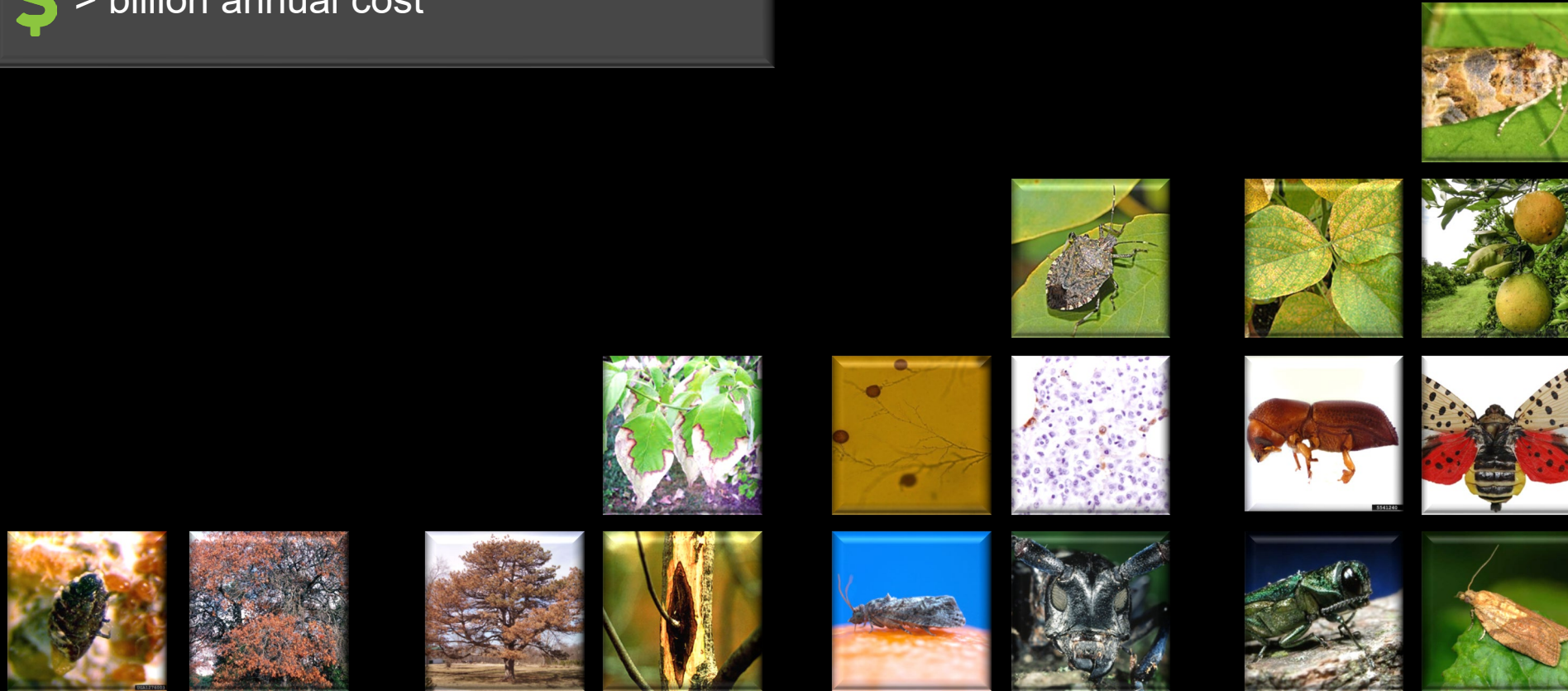
# Iterative Forecasting and Near Real-time Detection for Decision Support

Center for  
**Geospatial** Analytics

**NC STATE UNIVERSITY**

# Invasive Pests and Pathogens are increasing globally

\$ > billion annual cost



SDMs for management decisions



1940 – 1959

1960 – 1979

1980 – 1999
















2000 – 2019

2020

\*Each box represents ~500 new introduced species

Based on data from Seebens, Hanno, et al. *Nature communications* 8 (2017): 14435.

# The persistent threat of emerging plant disease pandemics to global food security

Jean B. Ristaino<sup>a,1</sup> , Pamela K. Anderson<sup>b,c</sup> , Daniel P. Bebber<sup>d</sup> , Kate A. Brauman<sup>e</sup> , Nik J. Cunniffe<sup>f</sup> ,  
Nina V. Fedoroff<sup>g</sup>, Cambria Finegold<sup>h</sup> , Karen A. Garrett<sup>i,j</sup>, Christopher A. Gilligan<sup>f</sup> ,  
Christopher M. Jones<sup>k</sup> , Michael D. Martin<sup>l</sup> , Graham K. MacDonald<sup>m</sup> , Patricia Neenan<sup>n</sup> ,  
Angela Records<sup>o</sup> , David G. Schmale<sup>p</sup> , Laura Tateosian<sup>k</sup> , and Qingshan Wei<sup>q</sup> 

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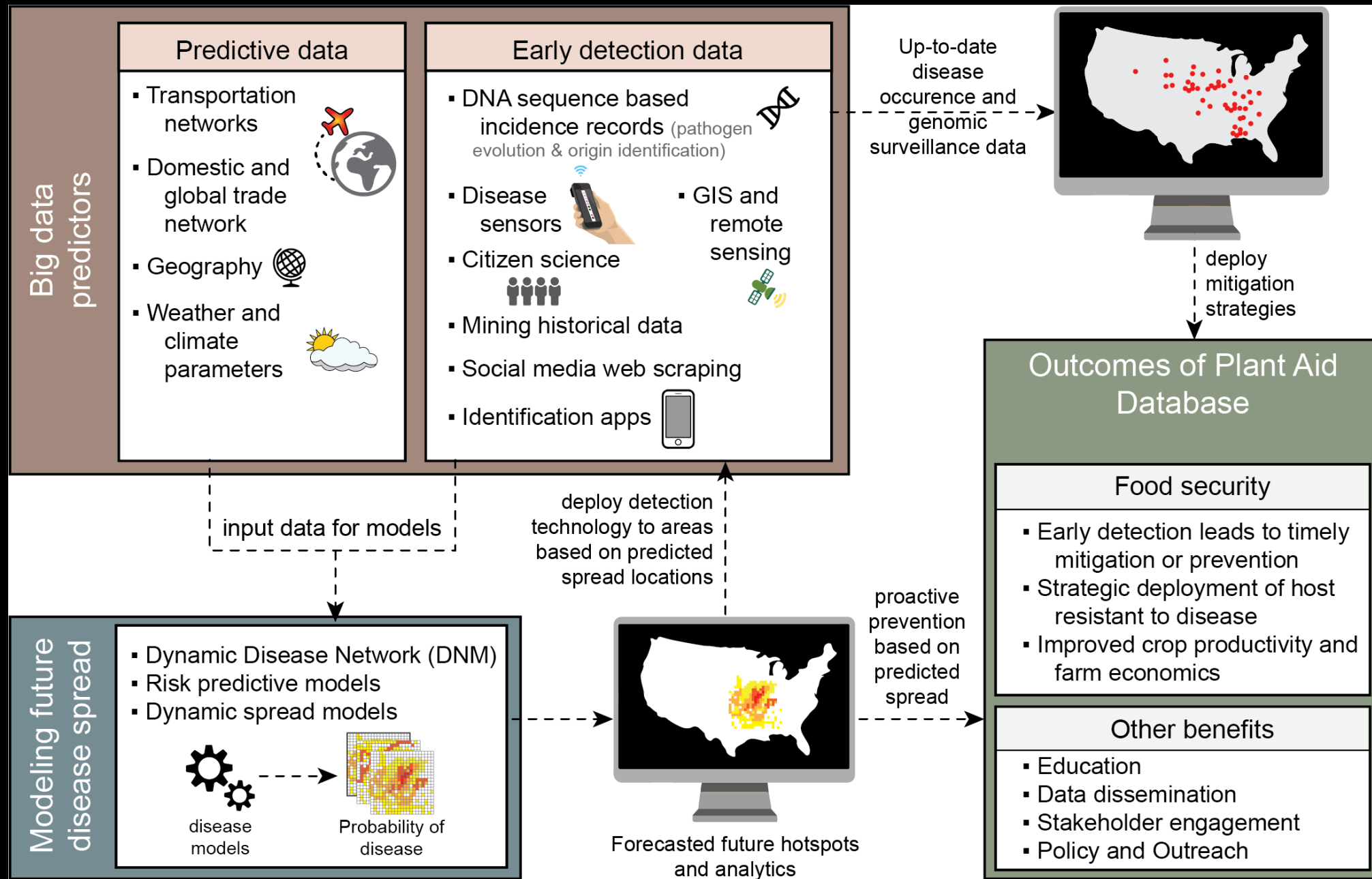
# PNAS

Proceedings of the National Academy of Sciences of the United States of America

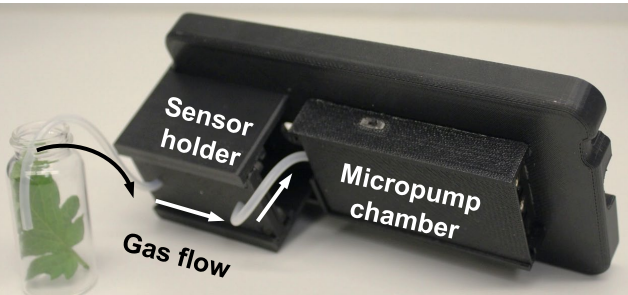
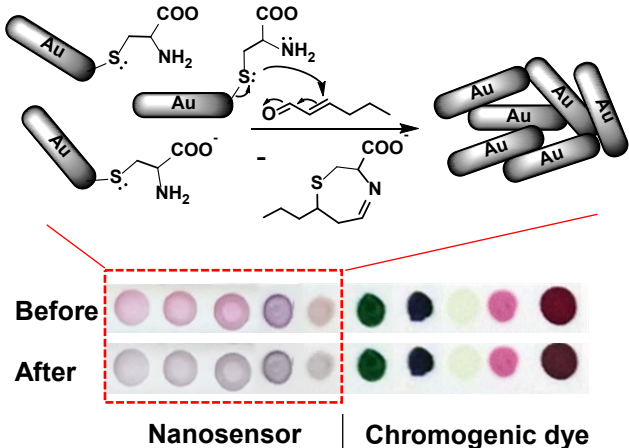
www.pnas.org

- Need for increased surveillance
- Population Genomics
- Sensors for early detection
- Spread and Risk Modeling
- Digital Delivery to stakeholders

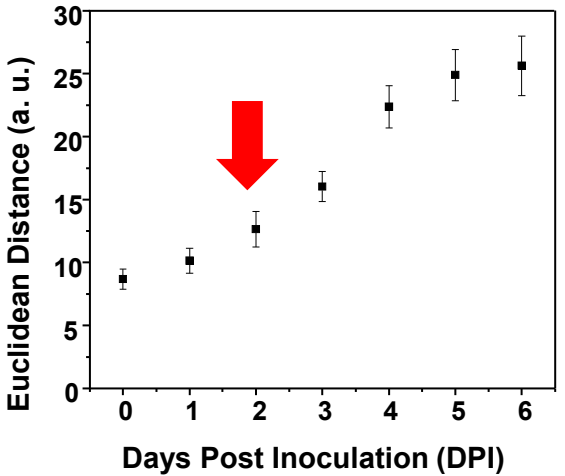
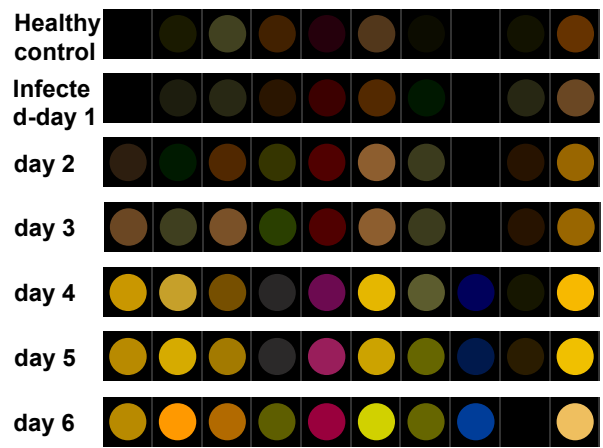
# Plant Aid Platform



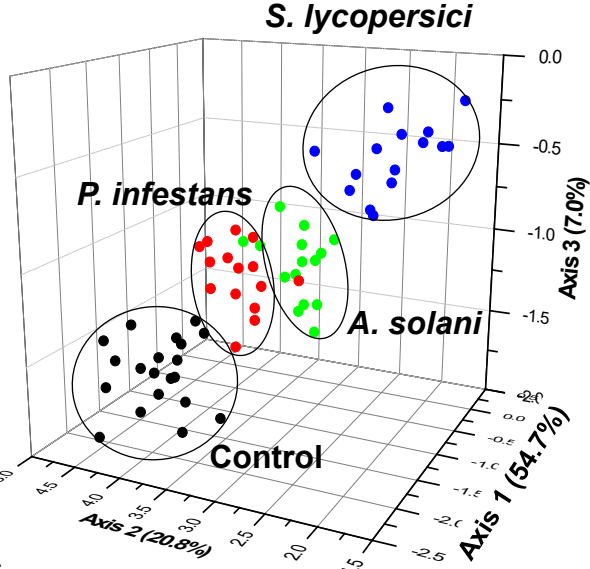
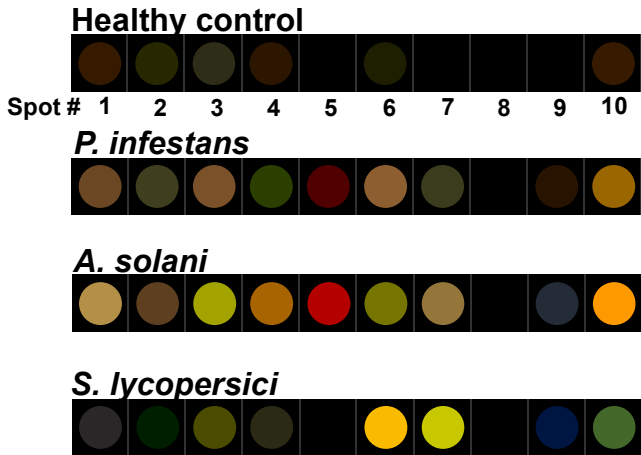
# Smartphone-Based Plant VOC Sensor – Early Detection



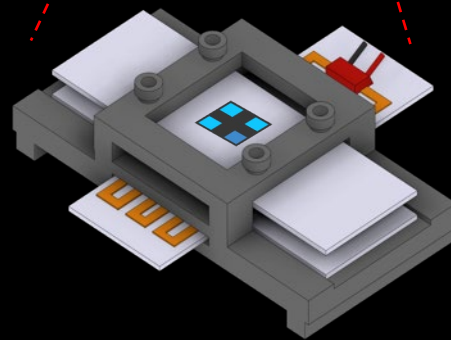
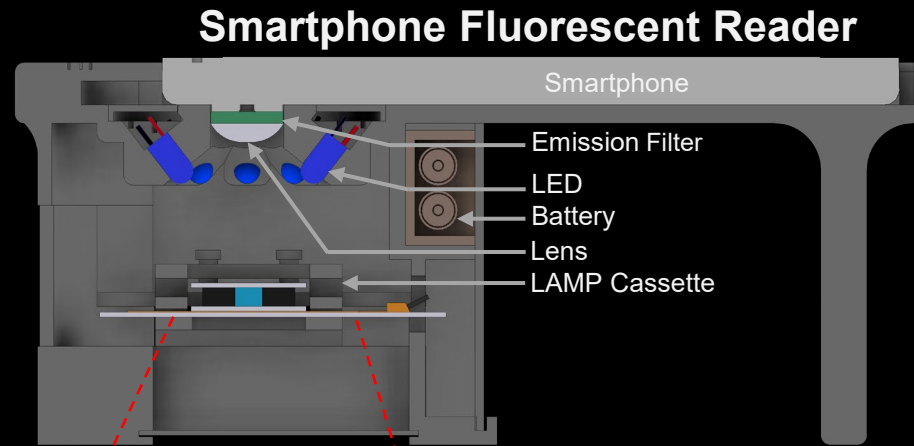
Early detection after 2 days of inoculation



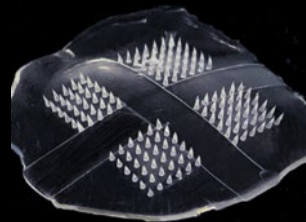
Differentiate plant pathogens with similar symptoms



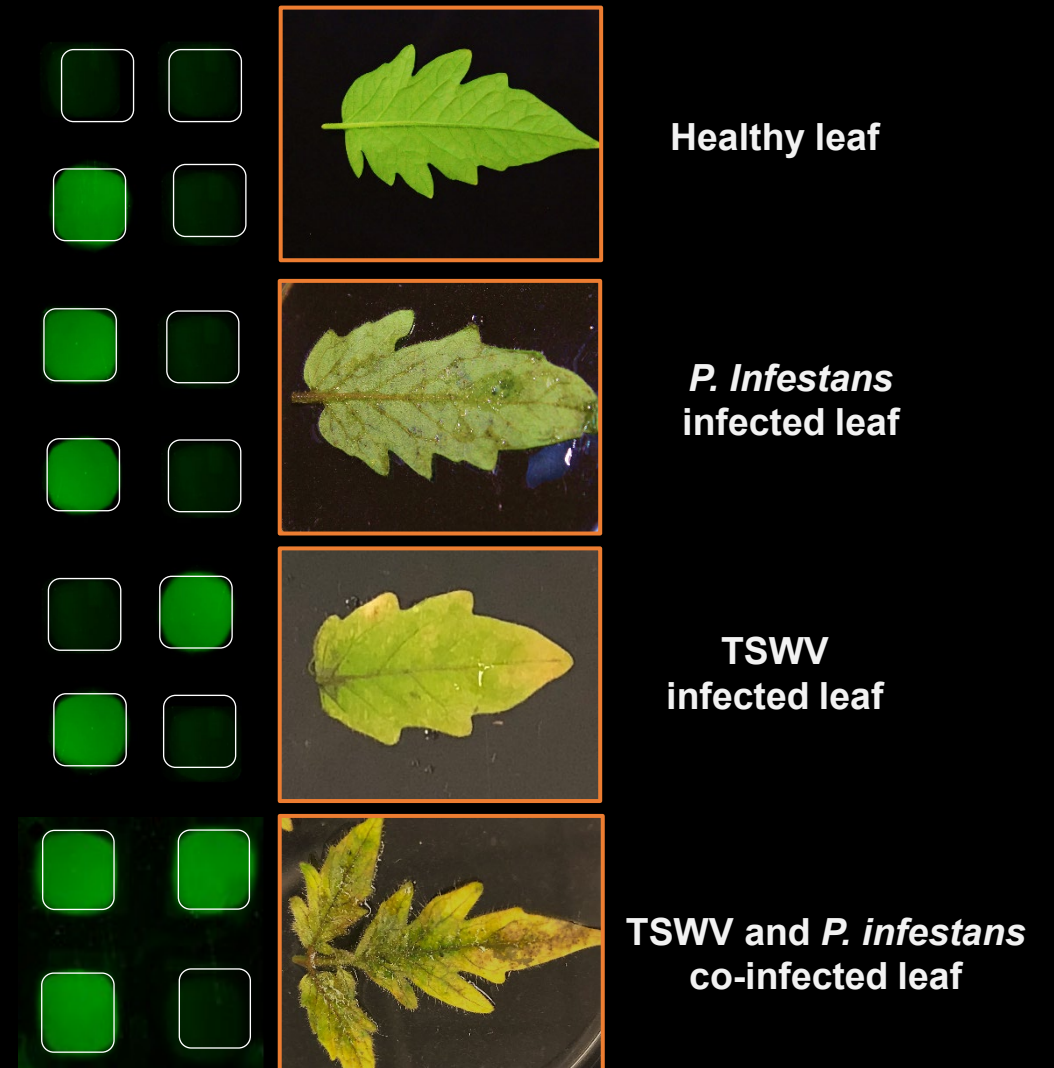
# Integrated Microneedle-Smartphone Diagnostic Platform



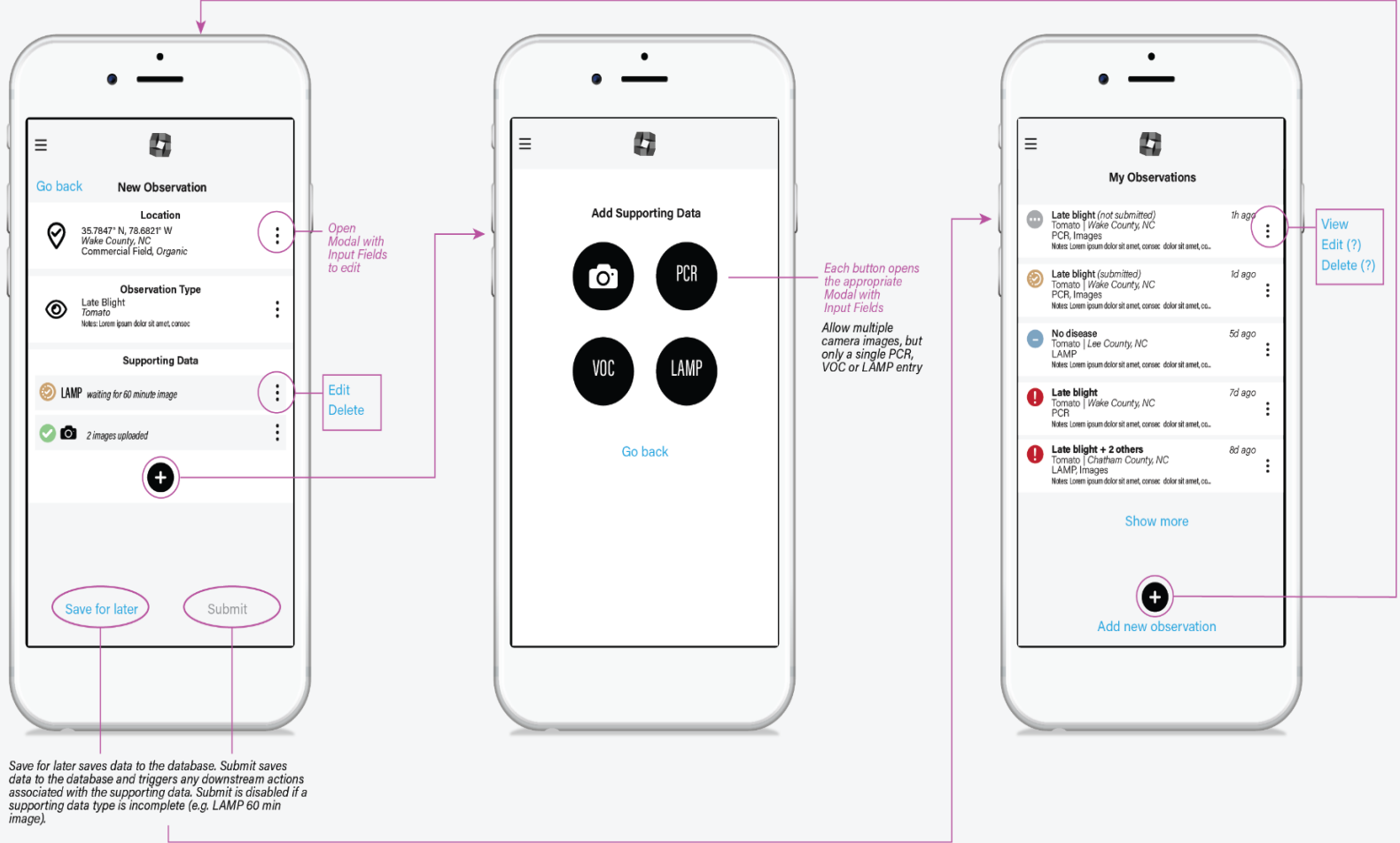
**Heated sample cassette**



**Patterned MN Patch**

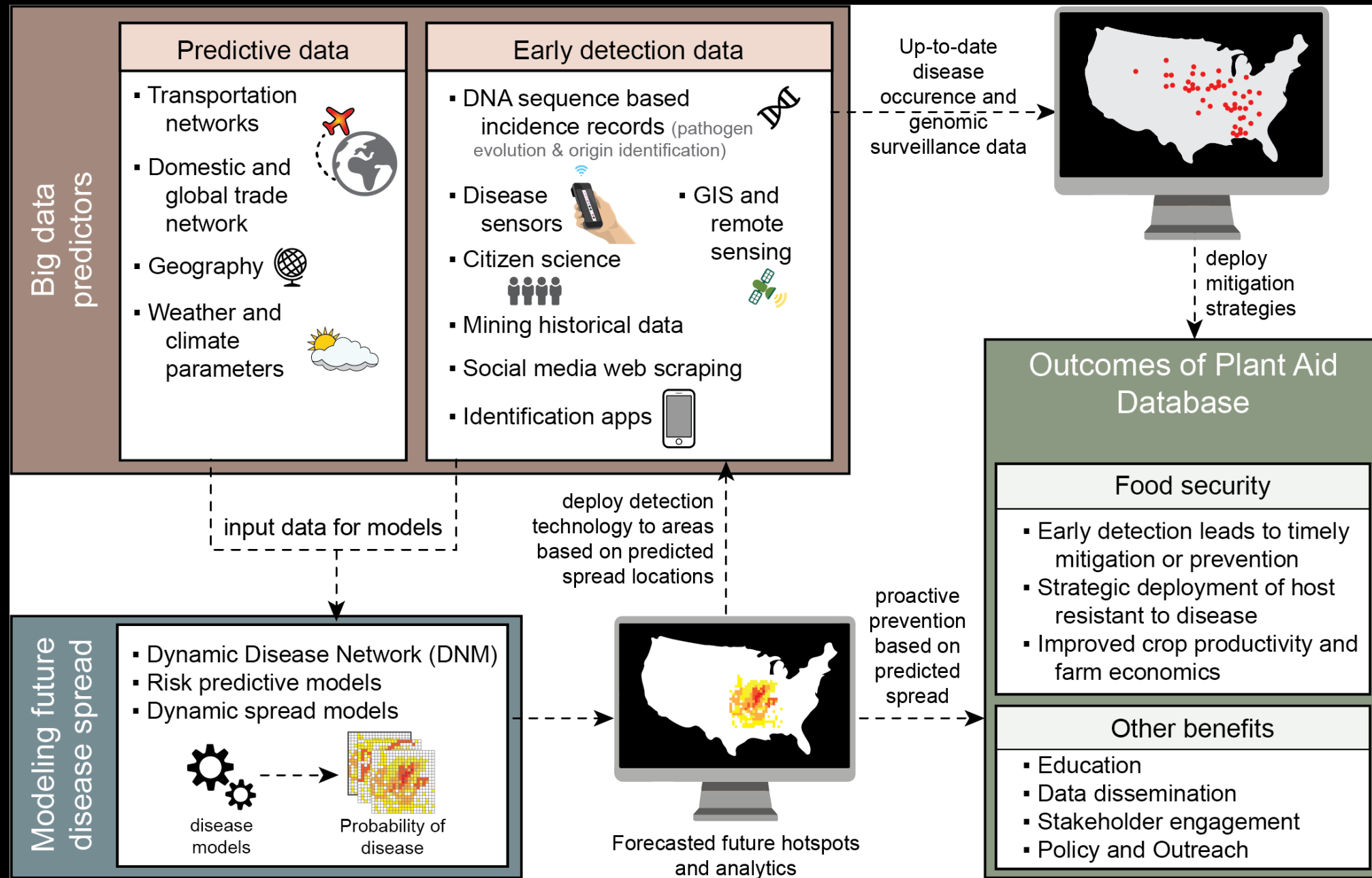


# Connecting Sensors with Real-time mapping



- Plant aid database
- ML disease predictions
- Near-real-time mapping

# Plant Aid Platform

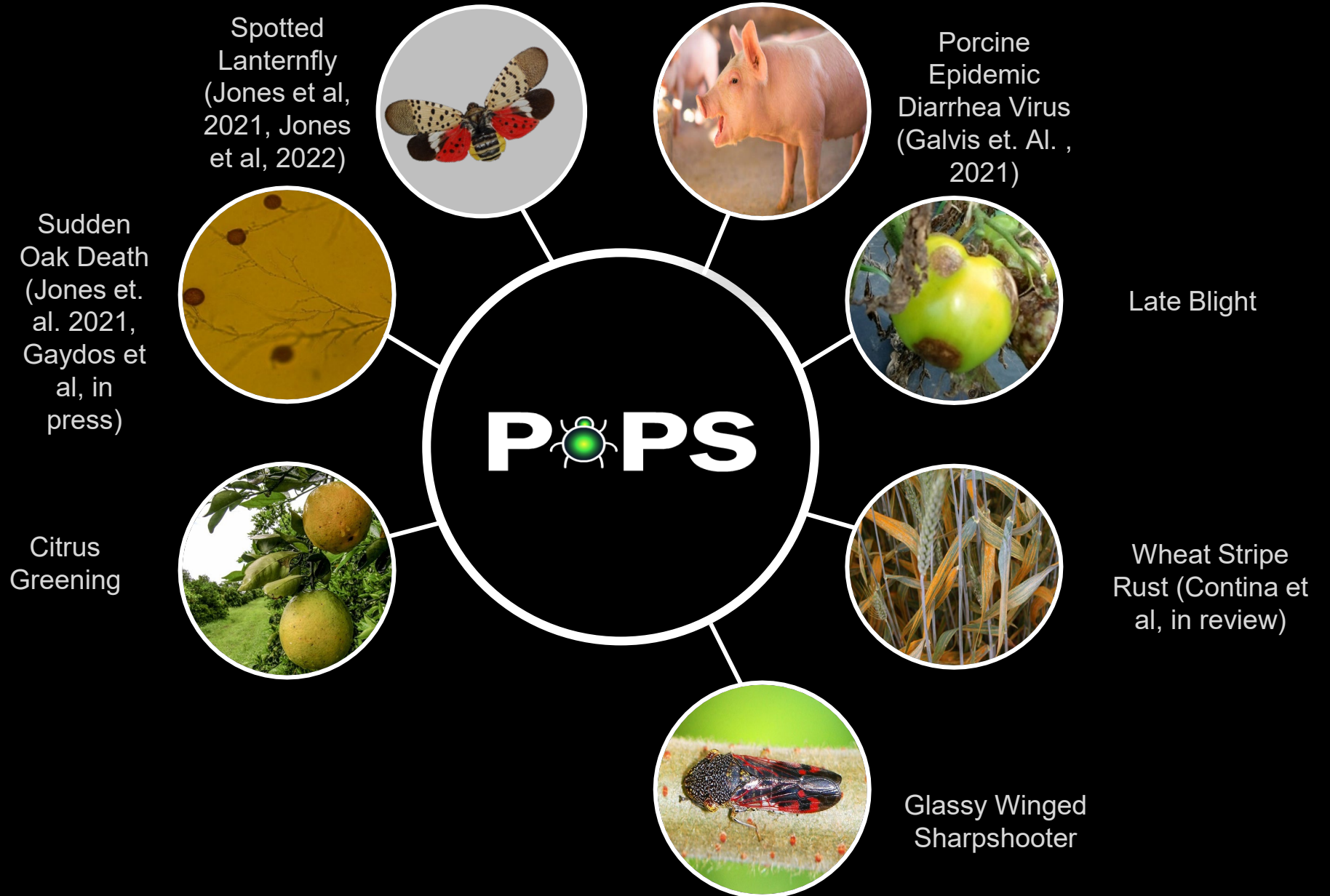




# PoPS Forecasting Platform

## Open-Source Model

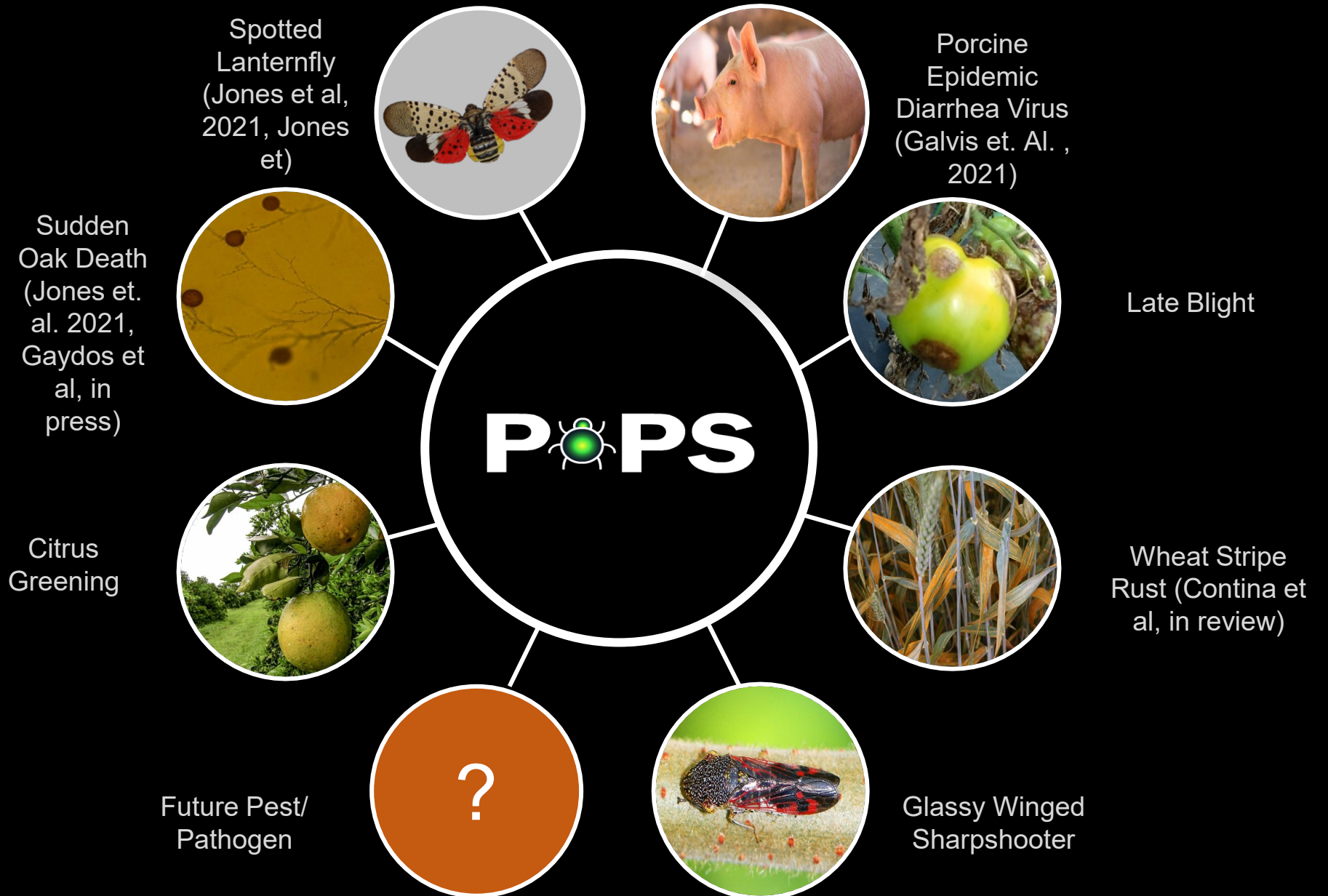
- Modular
- Spatially explicit
- Dynamic



# PoPS Forecasting Platform

## Database and Storage

- Forecasts
- All calibrated parameters and uncertainty
- Weather coefficient
- Host data





# PoPS Forecasting Platform Spatial Decision Support

