

Network Analysis in Plant Pathology Research: Disentangling Complex Data

Course materials at:

github.com/GarrettLab/NetworkWorkshopAPS2024

Workshop teachers

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Ashish Adhikari, PhD

Romaric Mouafo Tchinda, PhD

Aaron Plex Sulá (goes by Plex)

Jacob Robledo Buritica, MS

Learning goals

Course materials at:

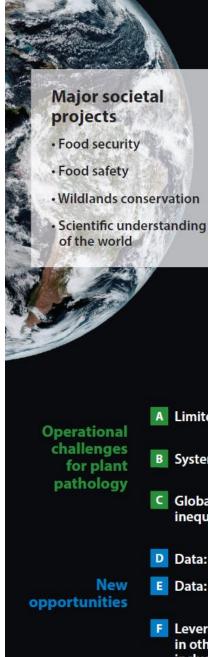
github.com/GarrettLab/NetworkWorkshopAPS2024

- Experience with R
 - No? Our goal is for you to get started with R, so you are ready to explore R more in the future
 - Yes? Our goal is for you to come away ready to use some new applications
- Experience with network analysis
 - No? Our goal is for you to get a taste of how network models may be useful in your research, ready for more exploration
 - Yes? Our goal is for you to come away ready to use some new applications in R

Annual Review of Phytopathology

Network Analysis: A Systems Framework to Address Grand Challenges in Plant Pathology

K.A. Garrett, 1,2,3 R.I. Alcalá-Briseño, 1,2,3 K.F. Andersen, 1,2,3 C.E. Buddenhagen, 1,2,3,4 R.A. Choudhury, 1,2,3 J.C. Fulton, 1,2,3 J.F. Hernandez Nopsa, 1,2,3,5 R. Poudel, 1,2,3 and Y. $Xing^{1,2,3}$





Threats due to plant disease

- · Lower crop yields, higher yield variability, lower farm profit margins
- Toxin production in foods, synergies with human pathogens
- Plant species extinction or diminished ecological function, disease management effects on nontarget species



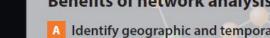
Inherent challenges for plant pathology

- Global change: climate, trade, land use, political instability, human population growth
- Pathogen invasions
- Pathogen evolution

- A Limited resources
- **B** System complexity
- C Global economic inequality
- D Data: global availability
- E Data: phytobiomes
- F Leveraging progress in other disciplines, including the science of science

Benefits of network analysis

- A Identify geographic and temporal priorities for interventions
- Provide new tools to operationalize concepts such as sustainability and resilience
- Link plant pathology with socioeconomics to reach low-income farmers and increase agricultural development impacts
- Integrate global data layers across scales
- Clarify phytobiome interactions and identify key players
- Integrate plant pathology with progress in disciplines such as human epidemiology, physics, electrical engineering, and sociology



Outline for workshop (1-5 pm)

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Introduction to networks (Plex) Introduction to R (Romaric) Break Networks in R (Romaric and Plex) Break Epidemic networks (Jacob) Break Microbiome networks (Ashish)

R2M toolbox and conclusions (Karen)

Group introductions

Course materials at: github.com/GarrettLab/Network WorkshopAPS2024

- Your name
- Your institution
- The general topics you address in your work
- What type of questions would you like to answer with network analysis?
- If you already use network analysis, what is an example of your application?
- Fun fact about you