



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

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- 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

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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}
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and Y. Xing^{1,2,3}

Major societal projects

- Food security
- Food safety
- Wildlands conservation
- Scientific understanding of the world

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

Operational challenges for plant pathology

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

New opportunities

Benefits of network analysis

- A** Identify geographic and temporal priorities for interventions
- B** Provide new tools to operationalize concepts such as sustainability and resilience
- C** Link plant pathology with socioeconomics to reach low-income farmers and increase agricultural development impacts
- D** Integrate global data layers across scales
- E** Clarify phytobiome interactions and identify key players
- F** 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



- 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

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