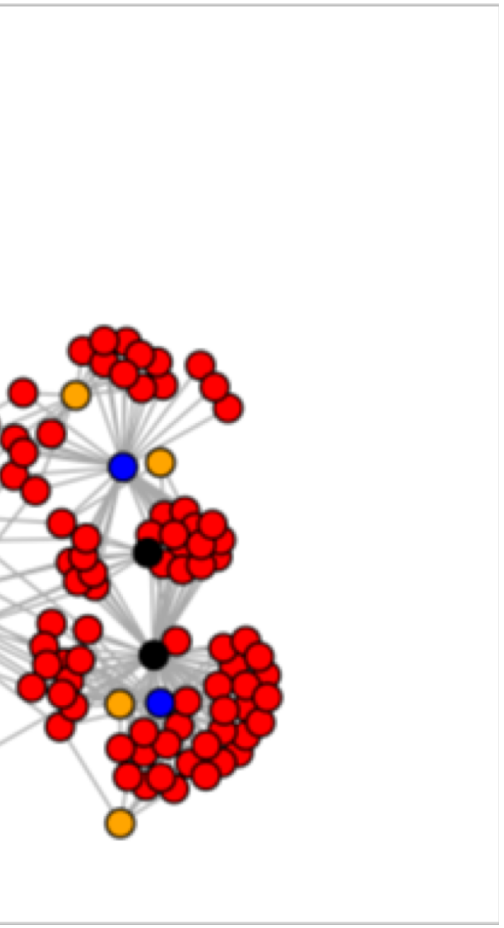
RESEARCH PROGRAM ON Roots, Tubers and Bananas

CGIAR

Intro to the R packages seedHealth and INApreliminary



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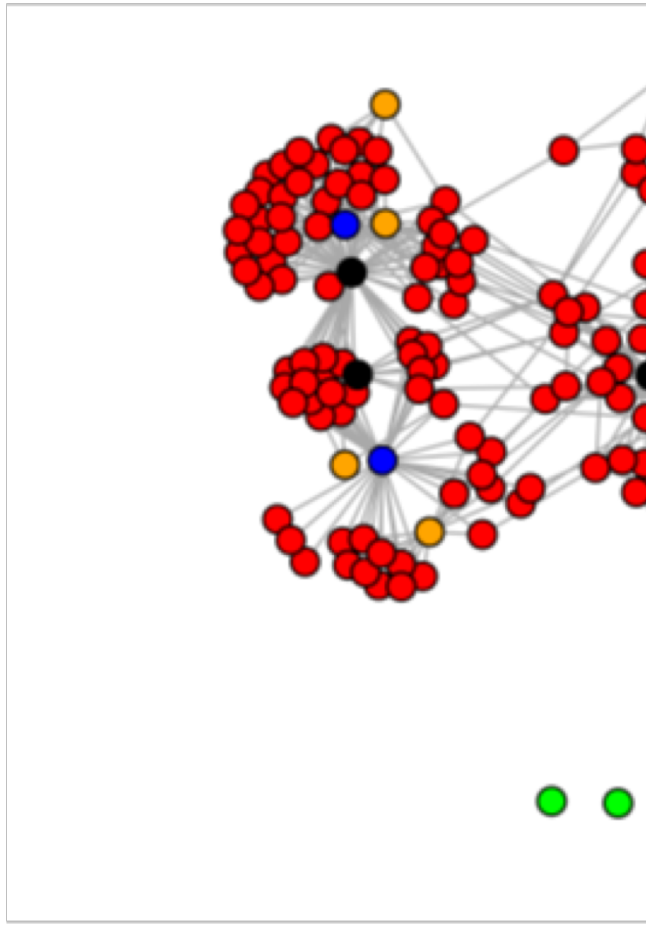
UF IFAS UNIVERSITY of FLORIDA

Institute for Sustainable Food Systems



seedHealth

R package

Contributors include: K. A. Garrett, S. Thomas-Sharma, K. F. Andersen, Y. Xing, R. I. Alcalá-Briseño, J. Andrade-Piedra , R. A. Choudhury, W. Dantes, J. Fayette, G. A. Forbes, J. F. Hernandez Nopsa, I. Navarrete, K. Ogero, J. Yuen

Plant Pathology (2015) Doi: 10.1111/ppa.12439

REVIEW

Seed degeneration in potato: the need for an integrated seed health strategy to mitigate the problem in developing countries

S. Thomas-Sharma[a]*, A. Abdurahman[b], S. Ali[c], J. L. Andrade-Piedra[d], S. Bao[e], A. O. Charkowski[f], D. Crook[g], M. Kadian[c], P. Kromann[h], P. C. Struik[b], L. Torrance[i], K. A. Garrett[aj] and G. A. Forbes[g]

[link]

Sara Thomas-Sharma

A Risk Assessment Framework for Seed Degeneration: Informing an Integrated Seed Health Strategy for Vegetatively-Propagated Crops

S. Thomas-Sharma, J. Andrade-Piedra, M. Carvajal Yepes, J. F. Hernandez Nopsa, M. J. Jeger, R. A. C. Jones, P. Kromann, J. P. Legg, J. Yuen, G. A. Forbes, K. A. Garrett

[open access link] 2017

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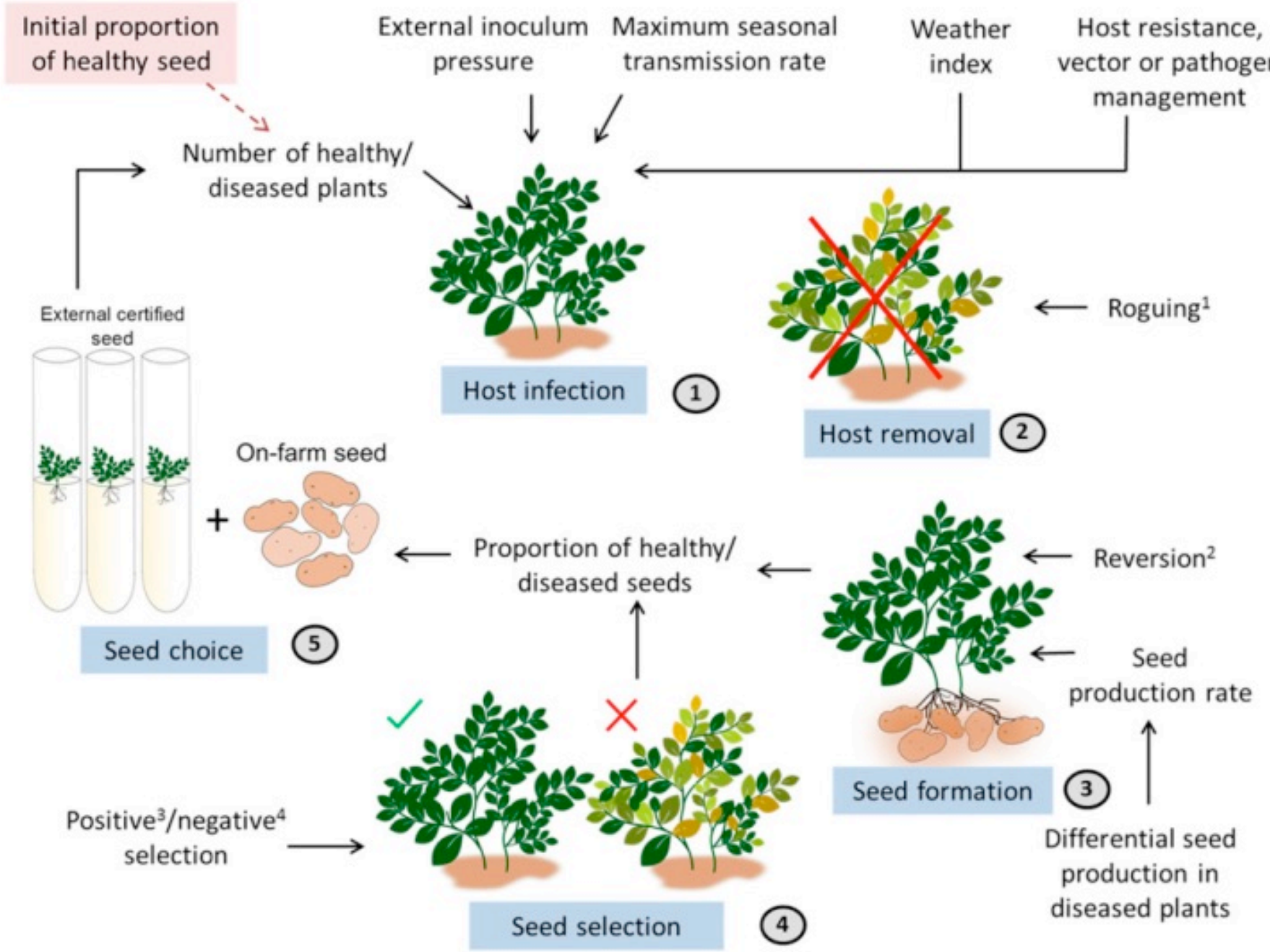
Sara Thomas-Sharma

This paper introduces the model framework and summarizes the parameter space for seed degeneration in general

The seedHealth package allows users to evaluate specific cases: hypothetical or observed

Online interface available: [Interactive interface for exploring model behavior]



System components included in the seedHealth model

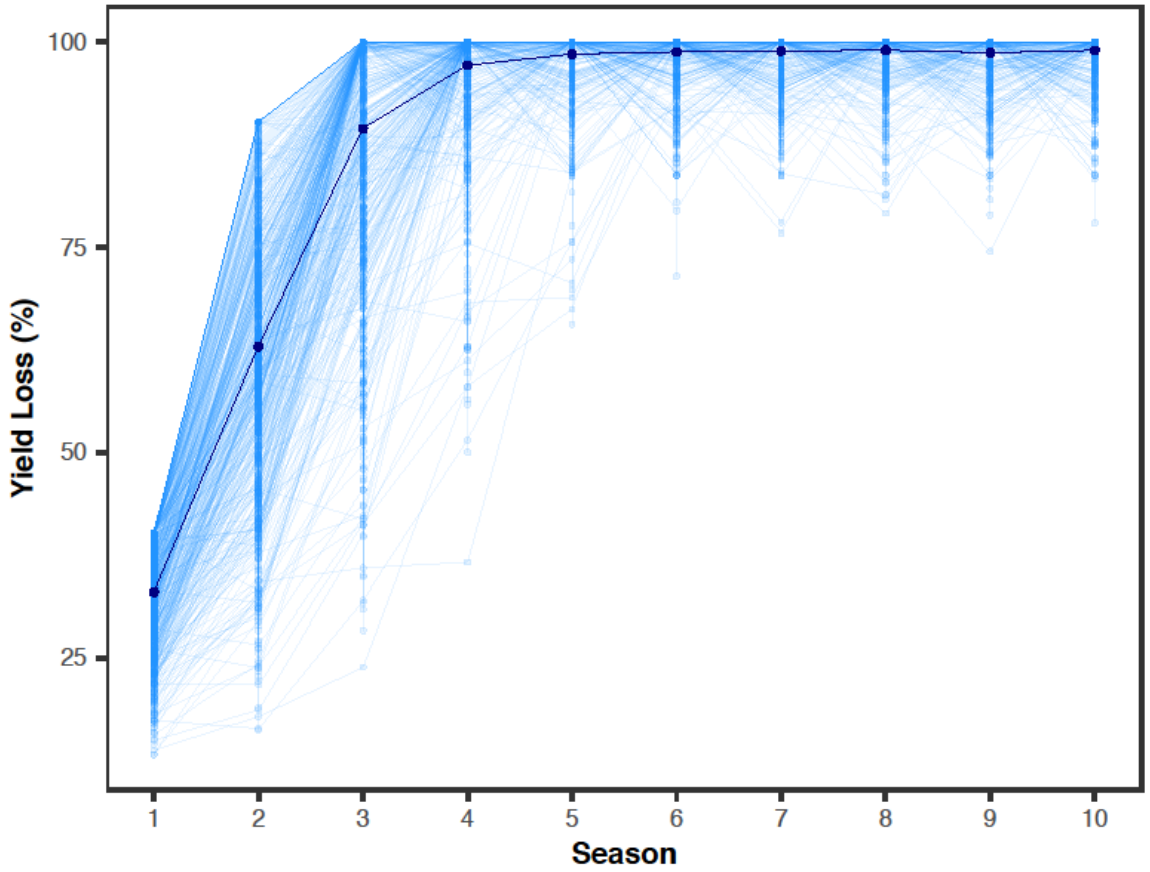
Thomas-Sharma et al. 2017

Addressing questions such as

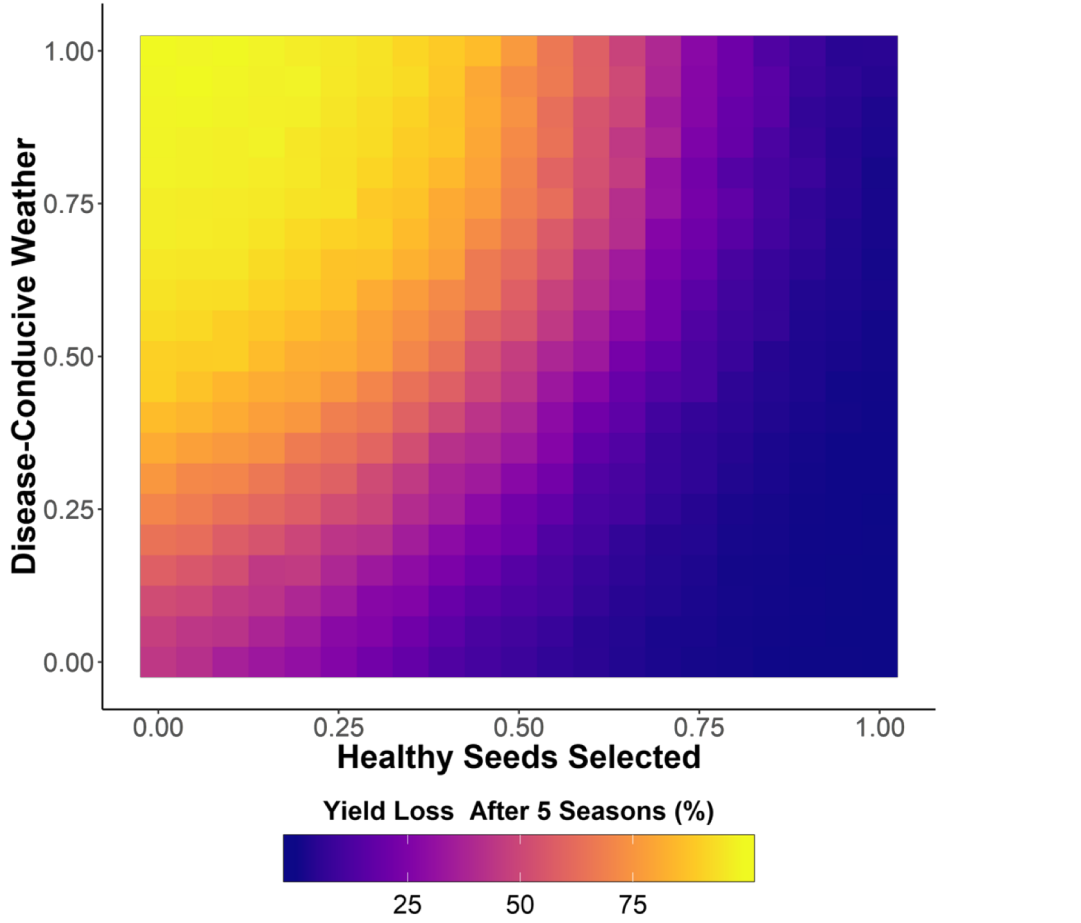
- For the scenarios considered in a given field study, how frequently is it profitable for farmers to purchase formal seed?
- In an integrated seed health strategy for these scenarios, what combinations of management components work well?

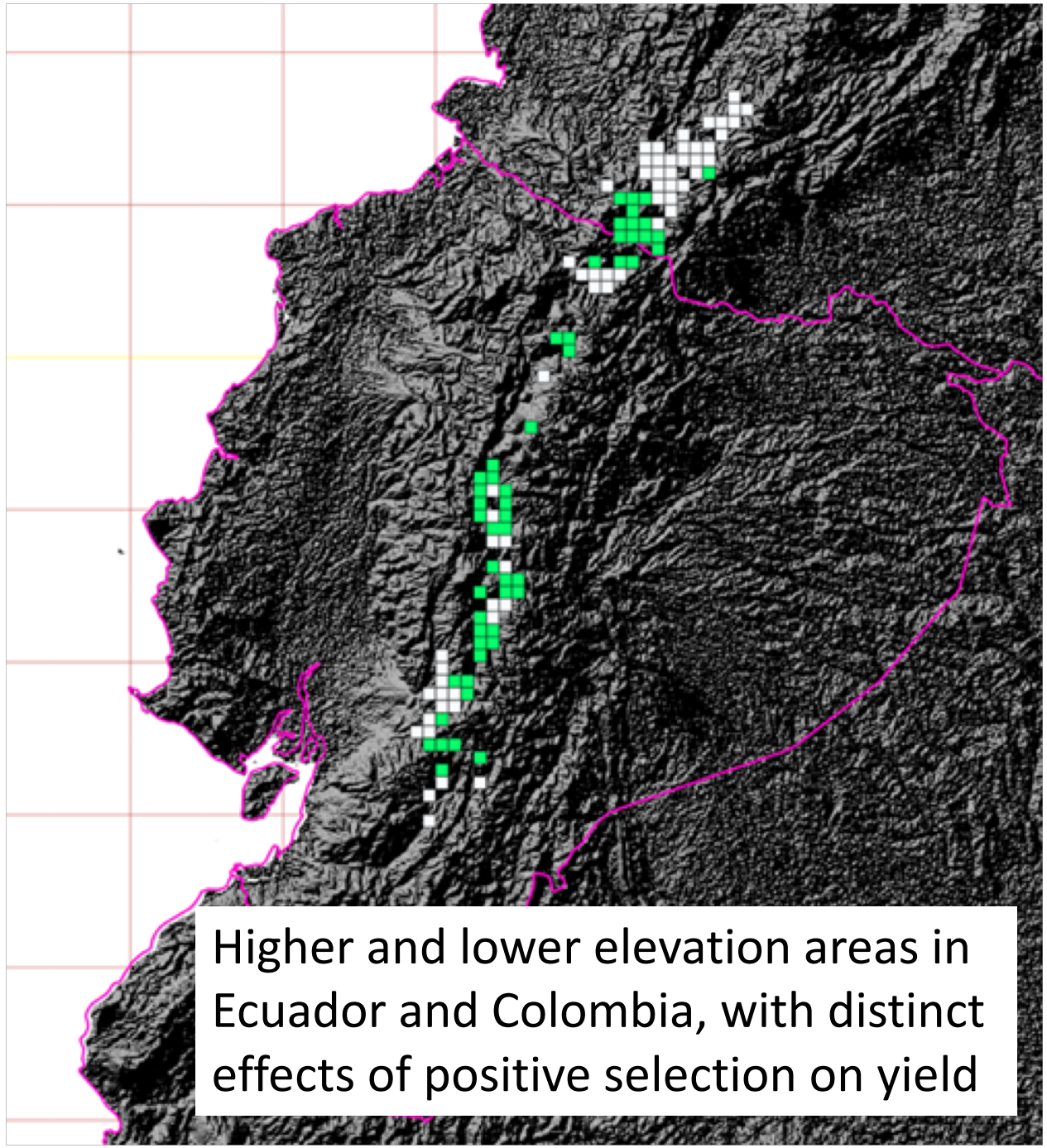
Output from seedHealth

- seedHealth provides a time series of likely disease incidence or yield loss, based on user input about the system (below).



- It also summarizes outcomes across a range of parameter values, to compare scenarios and as part of uncertainty analyses (below).





Higher and lower elevation areas in Ecuador and Colombia, with distinct effects of positive selection on yield

Management performance mapping: the value of information for regional prioritization of project interventions

C. E. Buddenhagen, J. Andrade Piedra, G. A. Forbes, P. Kromann, I. Navarrete, S. Thomas-Sharma, Y. Xing, K. A. Garrett

bioRxiv 2018

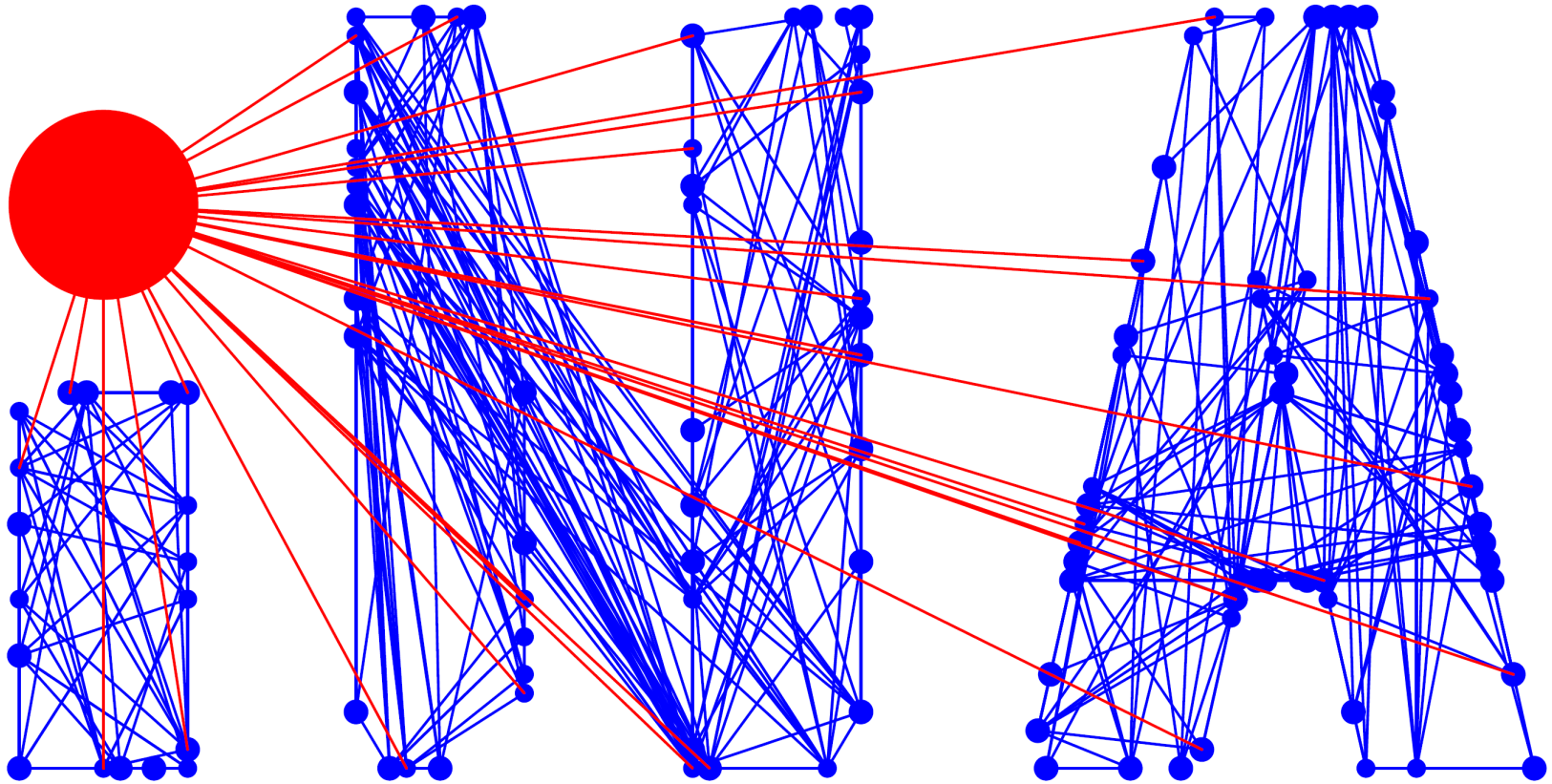
Generation of maps of [seed health] management performance for donors/funders deciding on prioritization for investment, extension agents deciding on priorities, etc.

seedHealth manuscript

- A manuscript on seedHealth (in preparation) also addresses good and optimal data sets and experimental designs – other contributors to this manuscript are welcome

- NOTE: one very important step is determining how to make the best use of existing data to develop parameter estimates to use in the seedHealth model

INApreliminary

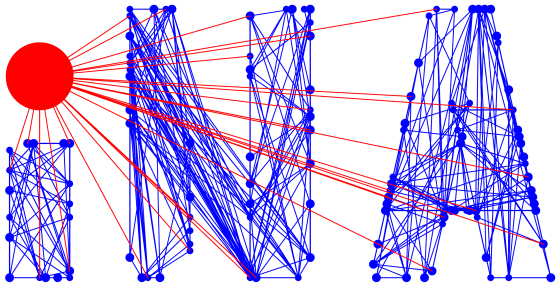


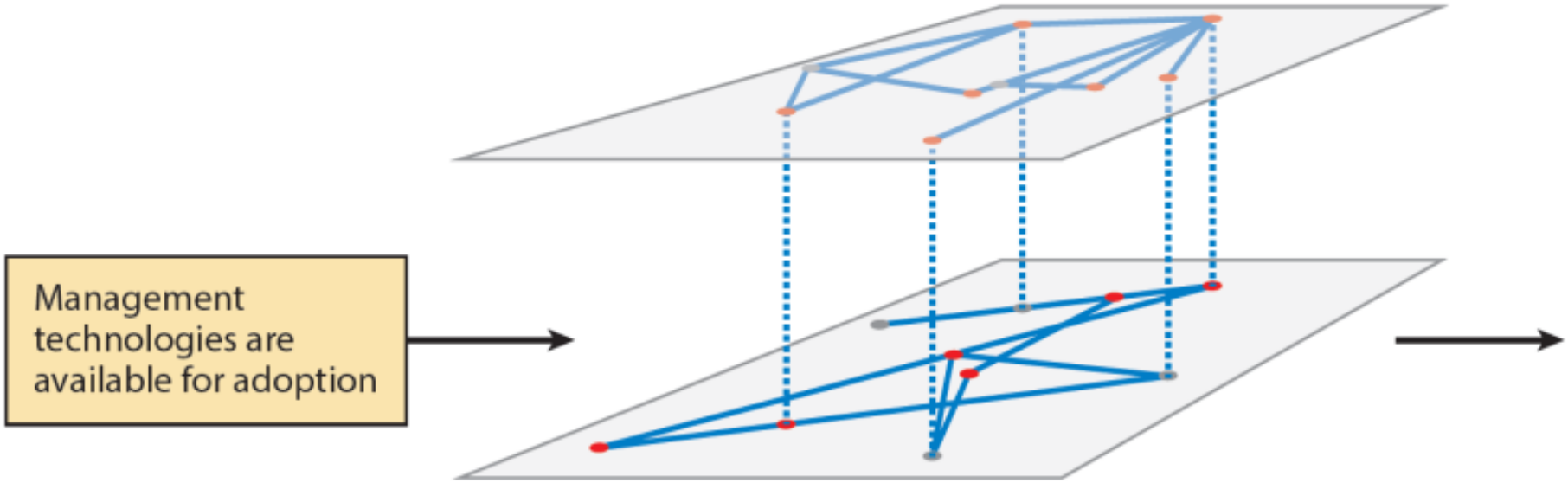
Annual Review of Phytopathology

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

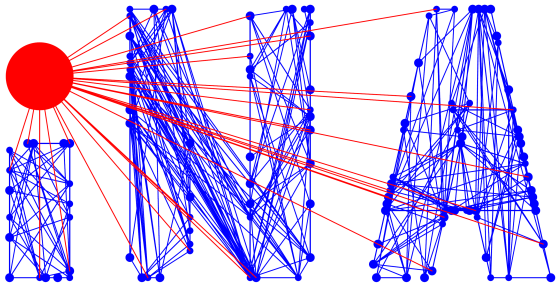
K.A. Garrett,[1,2,3] R.I. Alcalá-Briseño,[1,2,3]
K.F. Andersen,[1,2,3] C.E. Buddenhagen,[1,2,3,4]
R.A. Choudhury,[1,2,3] J.C. Fulton,[1,2,3]
J.F. Hernandez Nopsa,[1,2,3,5] R. Poudel,[1,2,3] and Y. Xing

Annu. Rev. Phytopathol. 2018. 56:559–80

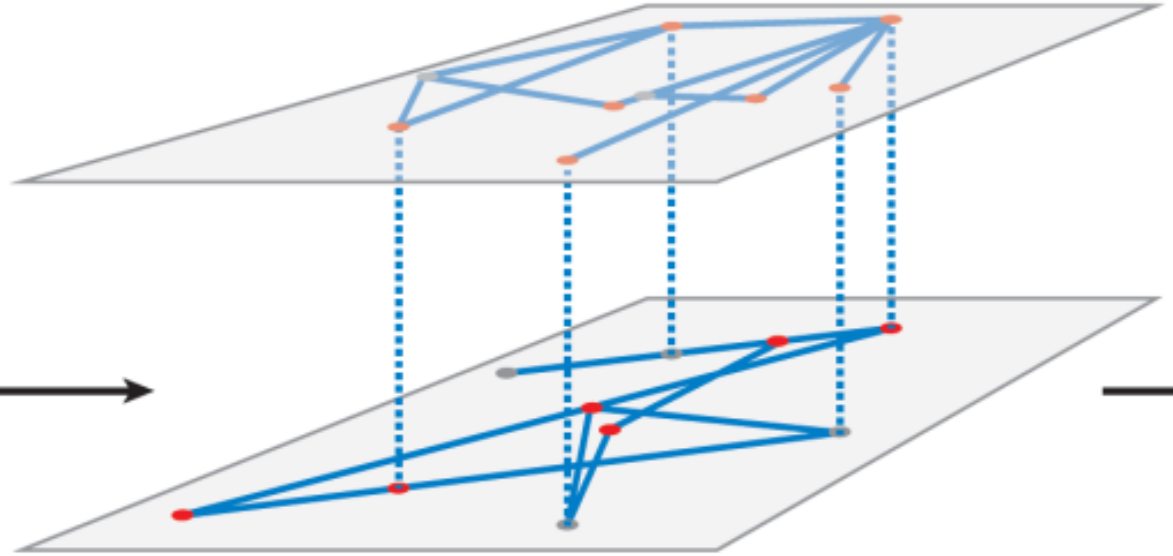




Garrett et al 2018 ARP



Socioeconomic network
Exchange of ideas and money influencing decisions about management adoption



Management technologies are available for adoption

Outcome:
Yield, profit, system resilience, etc.

Biophysical network
Movement of plants, pathogens, and vectors, with pathogen establishment influenced by management

Garrett et al 2018 ARP

“impact network analysis” versus “network analysis” 1

- “Network analysis” encompasses a lot of types of analyses
  - The simplest type of network analysis might be to estimate what nodes (e.g., farmers) and links (e.g., exchange of seed) are present in a system
    - Answers the question: **What is the structure of the system?**
- INA provides scenario analyses to address questions about information/technology impacts based on linked networks
    - Answers the question: **What are the implications of the structure of the system for important system outcomes?**

“impact network analysis” versus “network analysis” 2

- Characterizing networks is a first step for INA
  - For example, using seed tracker, seed flow mapping, seed tracing
- INA can be a considered a type of network analysis
  - (like multivariate analysis is a type of statistical analysis)
- Is INA a distinct tool? (Or is INA any type of network analysis that we want?)
  - It is a distinct tool in the sense that it addresses a set of questions, data types, and system types common to researchers interested in invasion biology, management decisions, and economic exchange – like seed systems
  - (and distinct in the sense of being a set of R functions)

Epidemic network analysis for mitigation of invasive pathogens in seed systems: Potato in Ecuador

Addresses gender using exponential random graph models

Phytopathology 2017

C. E. Buddenhagen*, J. F. Hernandez Nopsa*, K. F. Andersen, J. Andrade-Piedra, G. A. Forbes, P. Kromann, S. Thomas-Sharma, P. Useche, K. A. Garrett

[open access link]

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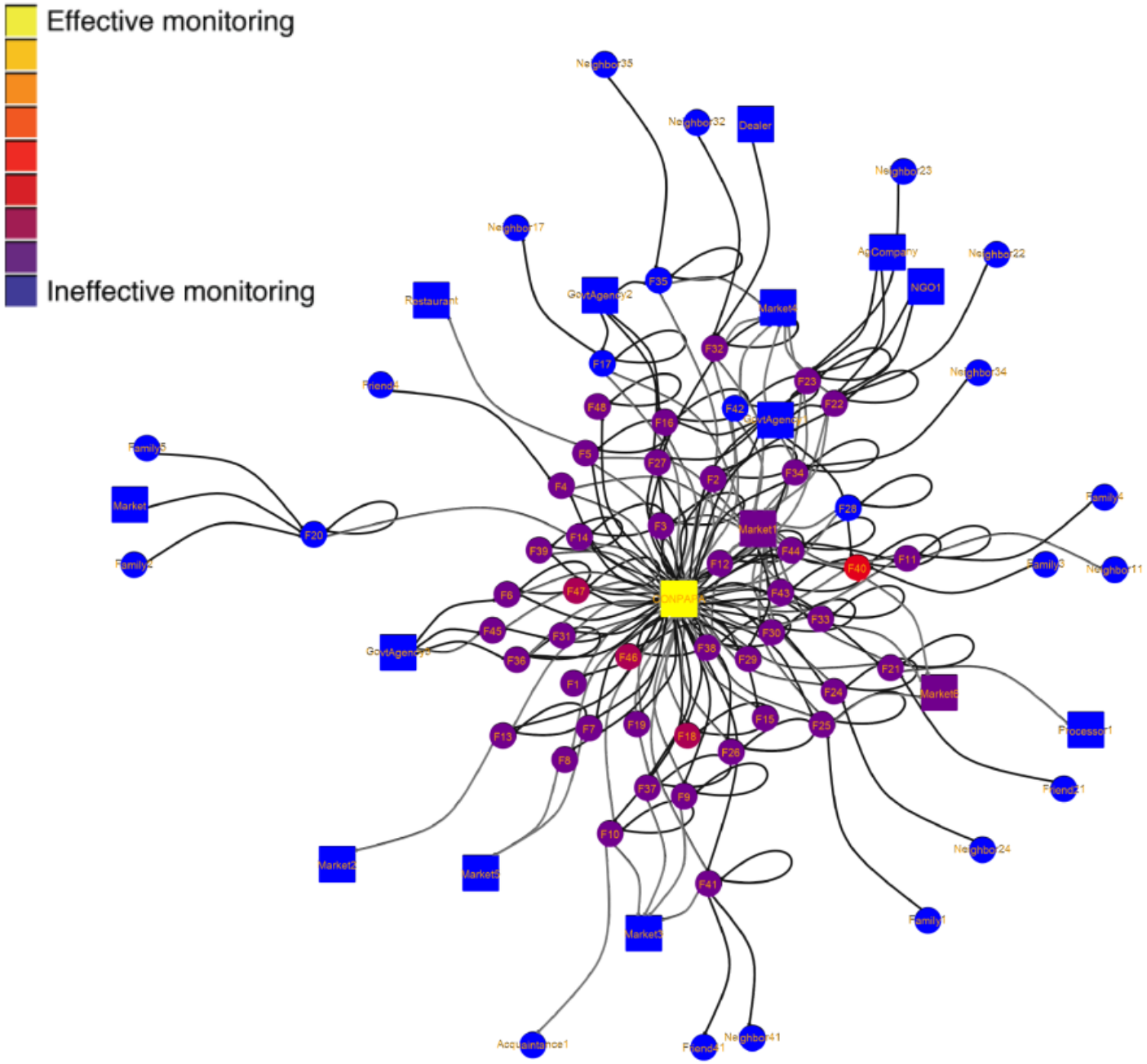
CENTRO INTERNACIONAL DE LA PAPA CIP

UF IFAS UNIVERSITY of FLORIDA

Potato production in Tungurahua Province, Ecuador

Photos: J Hernandez Nopsa

In this analysis, we have survey data for both potato transactions and sources of information for IPM



Scenario analysis indicating how effective monitoring of the spread of a pathogen would be at each node, based on location in network and IPM information sources

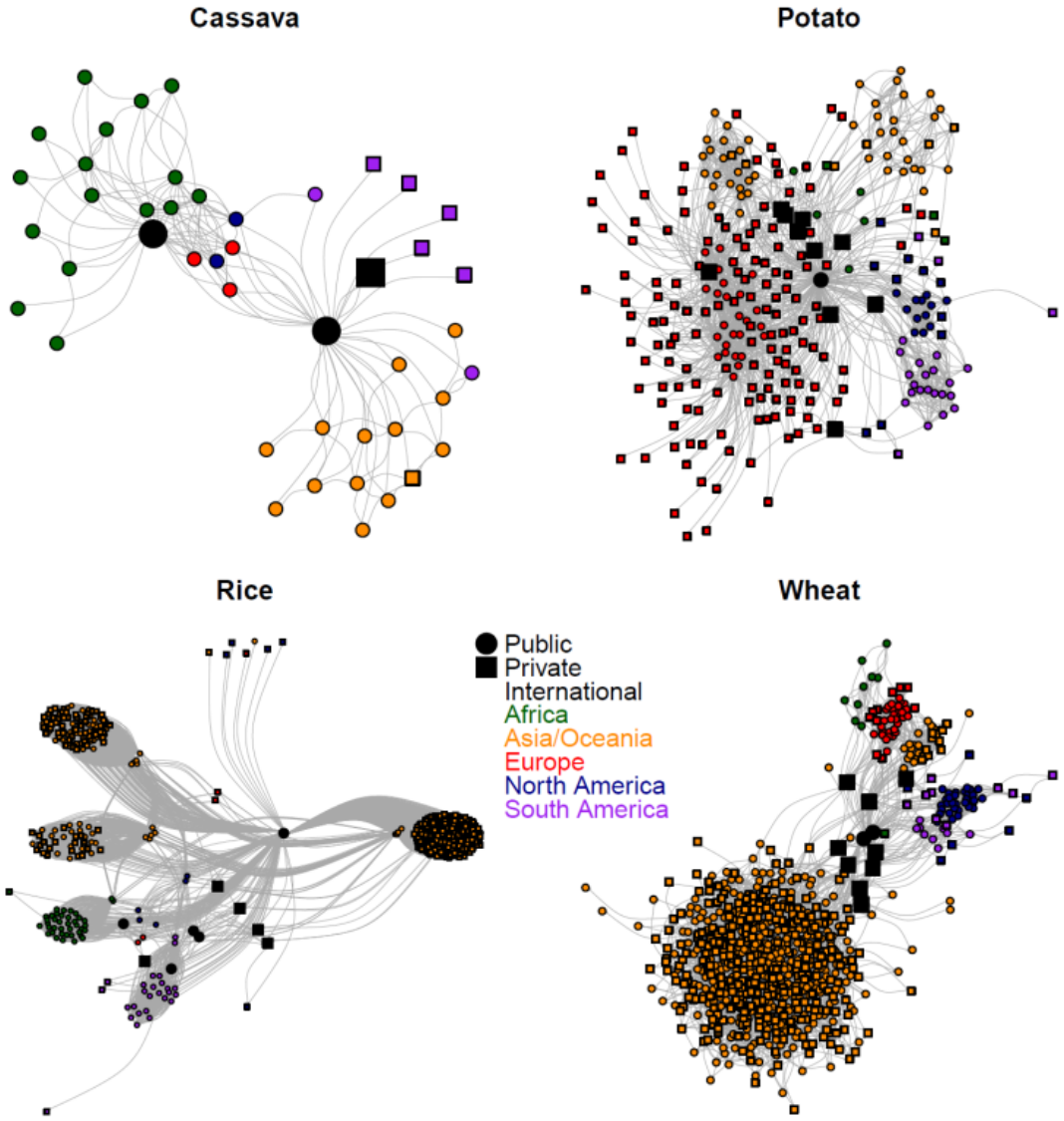
Buddenhagen, Hernandez Nopsa, et al. 2017

Resistance Genes in Global Crop Breeding Networks

K. A. Garrett,† K. F. Andersen, F. Asche, R. L. Bowden, G. A. Forbes, P. A. Kulakow, and B. Zhou

Phytopathology 2017

[open access link]



Cross-crop analysis

An opportunity for linking crop breeding and seed systems in follow-up studies

Modeling epidemics in seed systems and landscapes to guide management strategies: The case of sweetpotato in Northern Uganda

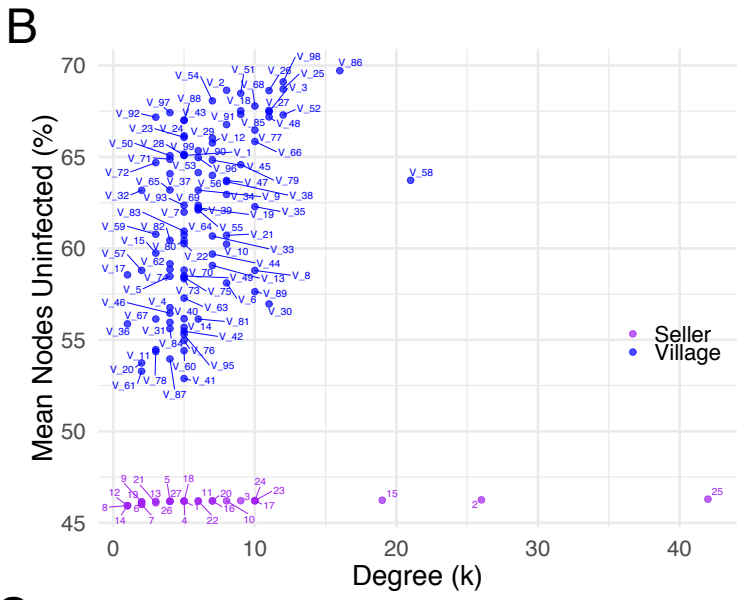
K. F. Andersen, C. E. Buddenhagen, P. Rachkara, R. Gibson, S. Kalule, D. Phillips, and K. A. Garrett

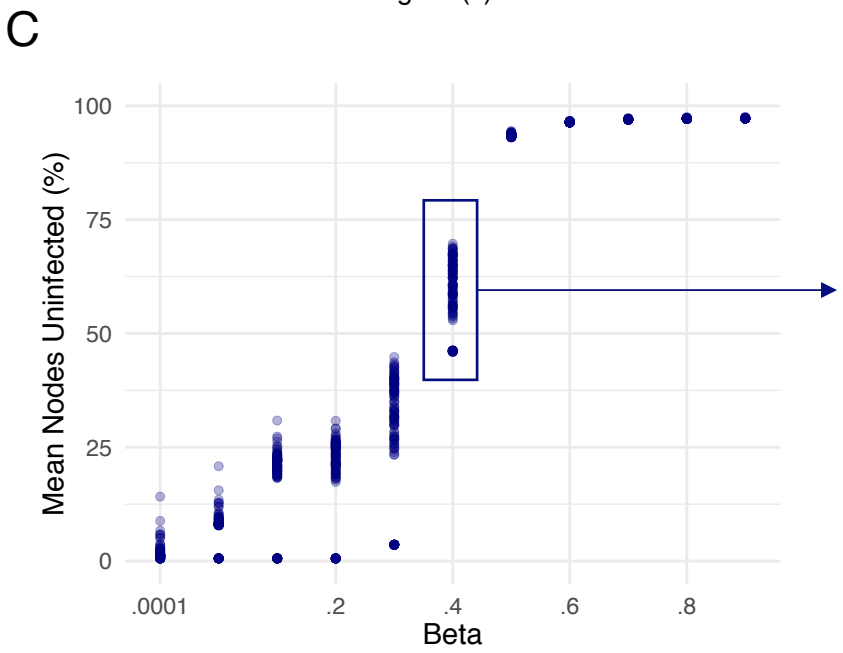
Phytopathology 2019

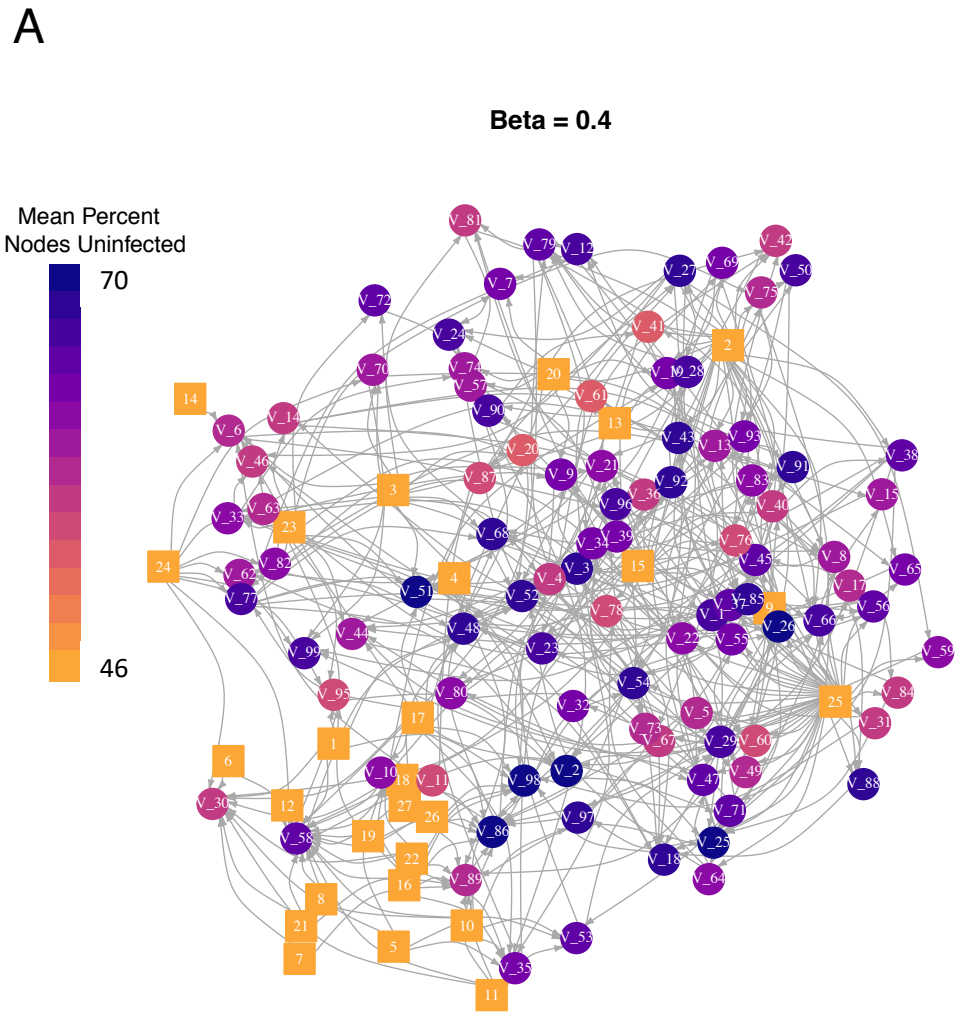
Code from analyses in this paper is available at https://github.com/kelseyandersen/ugsweets

Kelsey Andersen

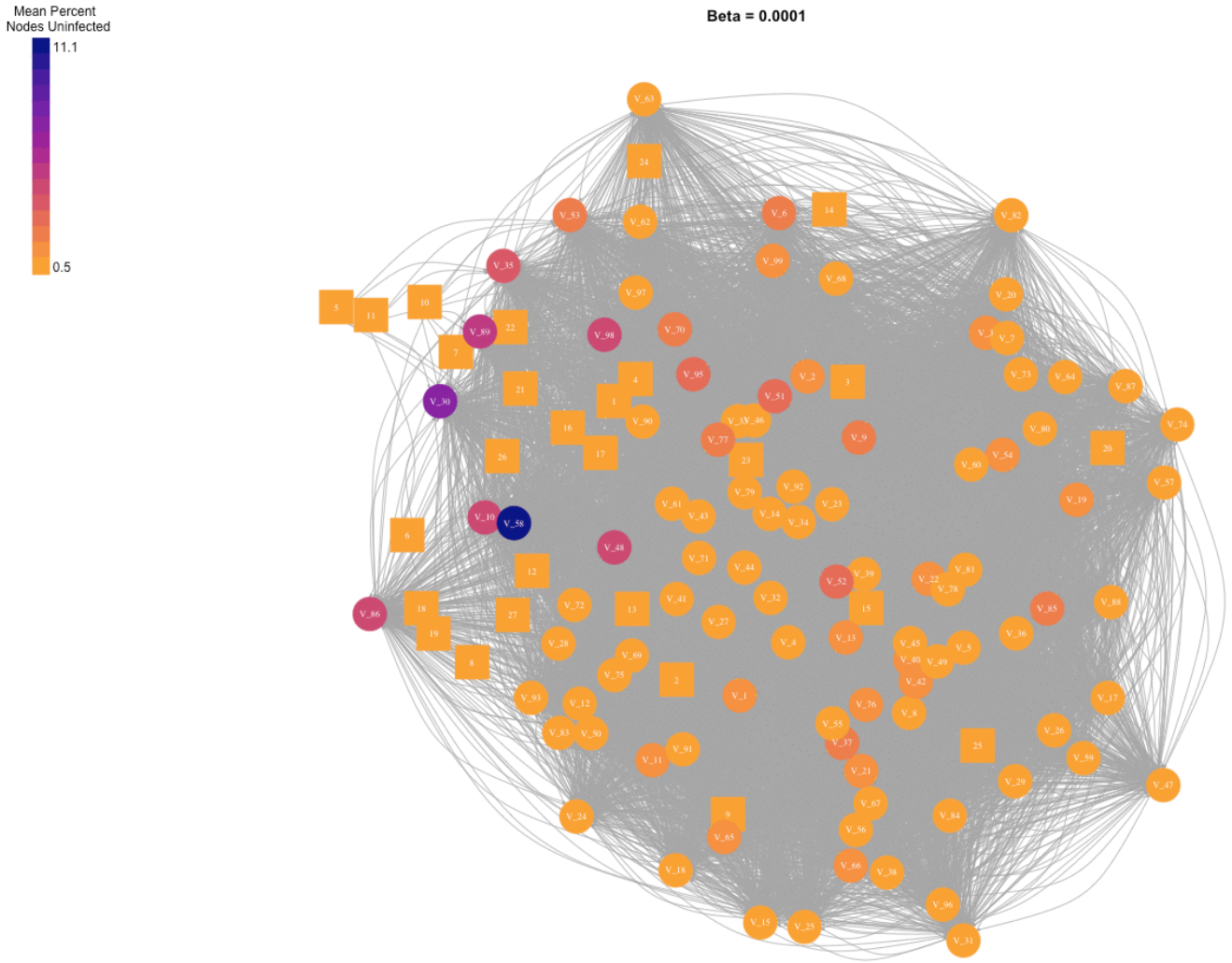
Experiment 1: The value of villages as risk-based surveillance locations





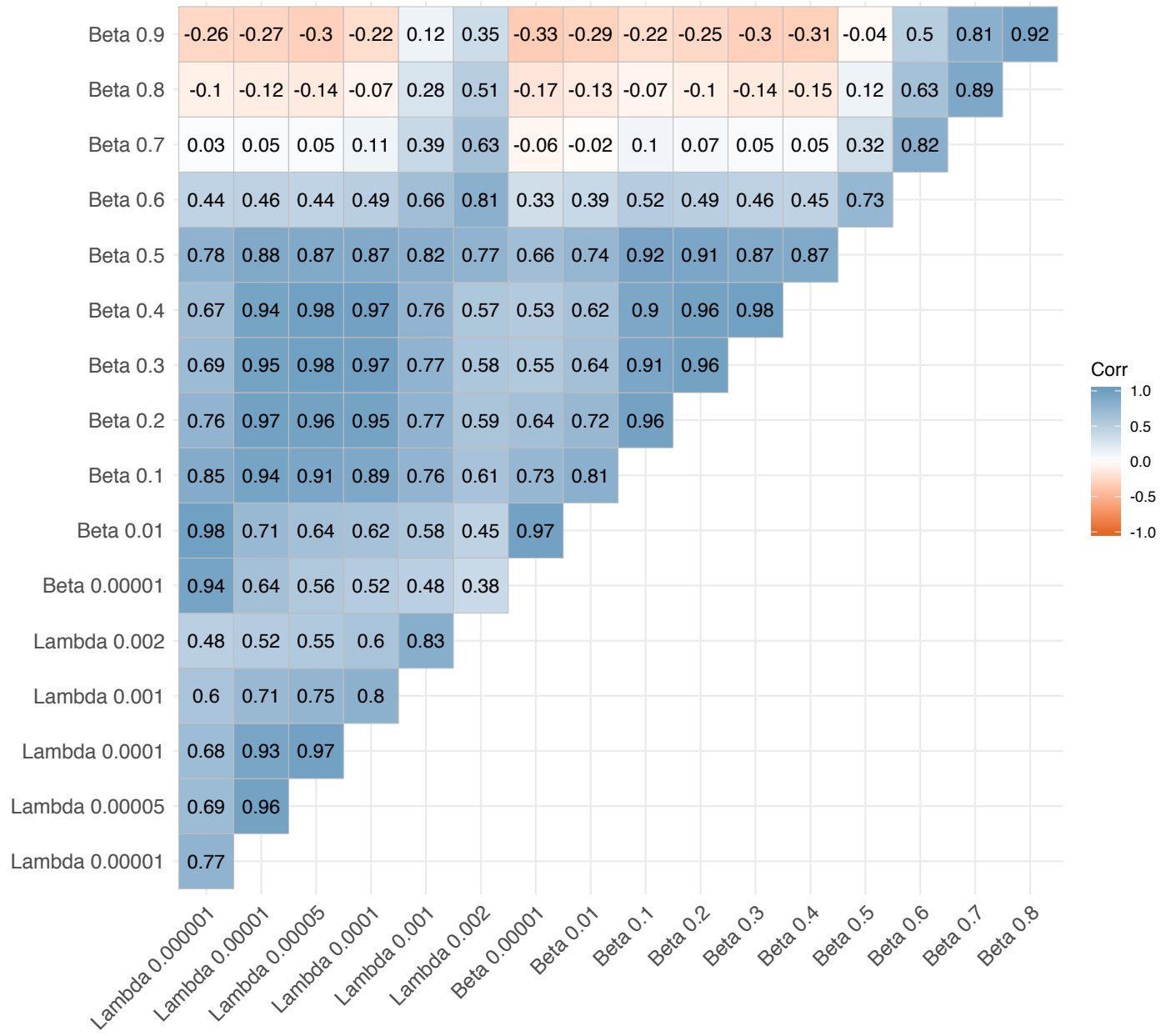


Sensitivity of results to spread parameter



At intermediate values, the rank of locations as risk based surveillance locations is similar

Spearman's rank correlation for Surveillance Scores across parameter values for spread parameters λ & β.



Andersen et al. 2019 includes several other analyses that could be useful in your studies

- The example code we will look at in INApreliminary looks at which locations in a network are most important for sampling to detect an epidemic (or diffusion of a crop variety) while it is still in the early stages of spread

- The paper also includes
  - Several types of sensitivity analyses
  - Identification of the nodes most important for stopping the spread of an epidemic (or increasing the spread of a crop variety)
  - Testing comparison of methods for identifying key nodes in a given types of network

- The code is available at
- https://github.com/kelseyandersen/ugsweets