

Services for the MIDAS Network: Visualization and Synthetic Ecosystems

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We want to aid MIDAS researchers

We are making **tools** to study infectious diseases.

SPEW - Synthetic Populations and Ecosystems of the World

SPEW View - a tool for visualizing historical diseases in the US

SPEW View - a tool for Early Data Analysis

- **Project Tycho** data
 - diphtheria, hepatitis, measles, mumps, pertusis, polio, rubella, and smallpox
 - All 50 states and 100+ cities
- **6 interactive** tabs
 - animated maps, time series, correlations, clustering, chorpleths, and data download
- **1st Place** in Pittsburgh Supercomputing Center Public Health Hackathon

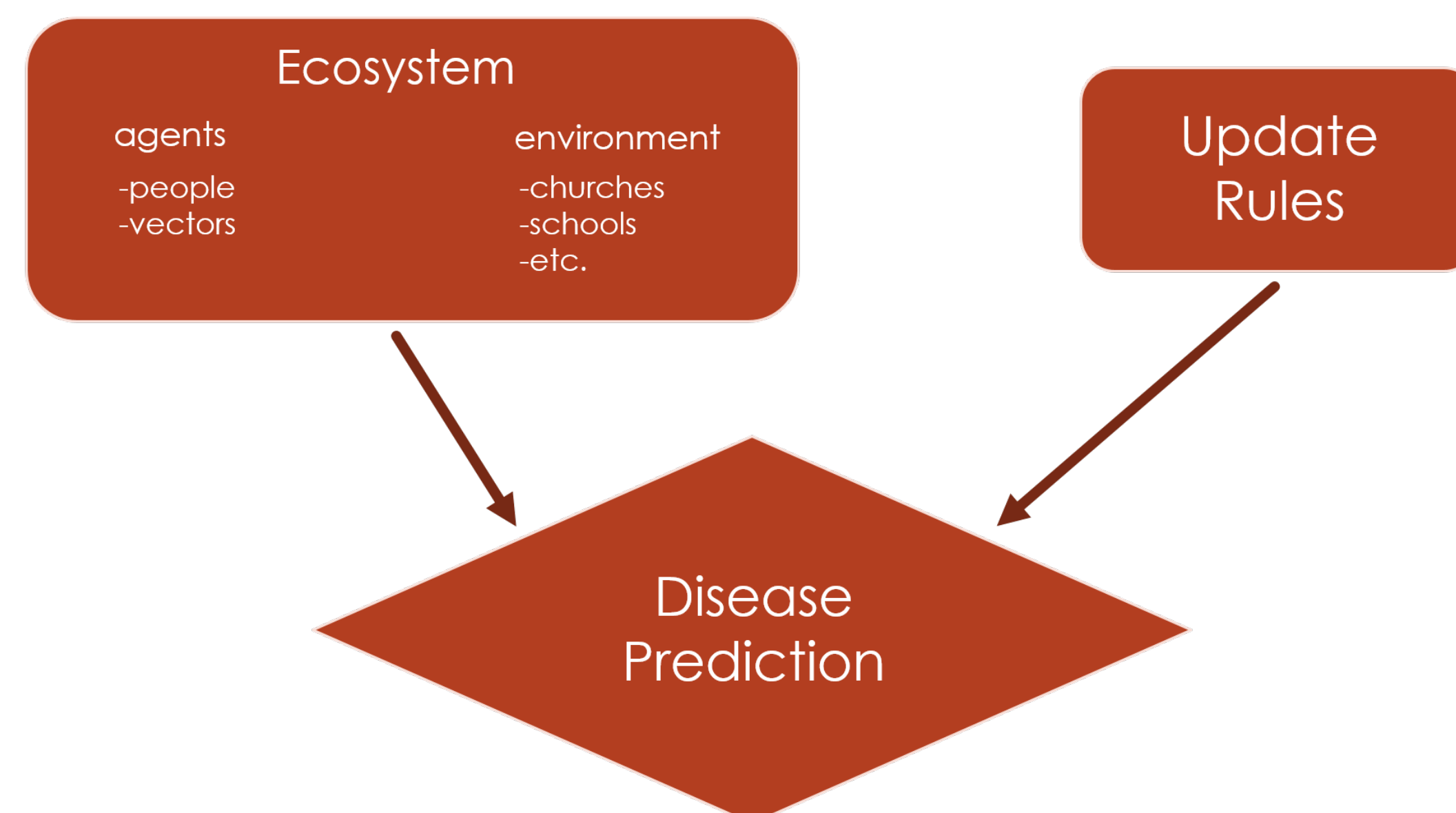
Snapshot of the app seen in the figure to the right.

Disease Modelers Need Synthetic Ecosystems

Problem: Researchers often lack data

Result: Models are hard to make and/or train

Solution: Simulation via Agent-Based Models (ABMs)

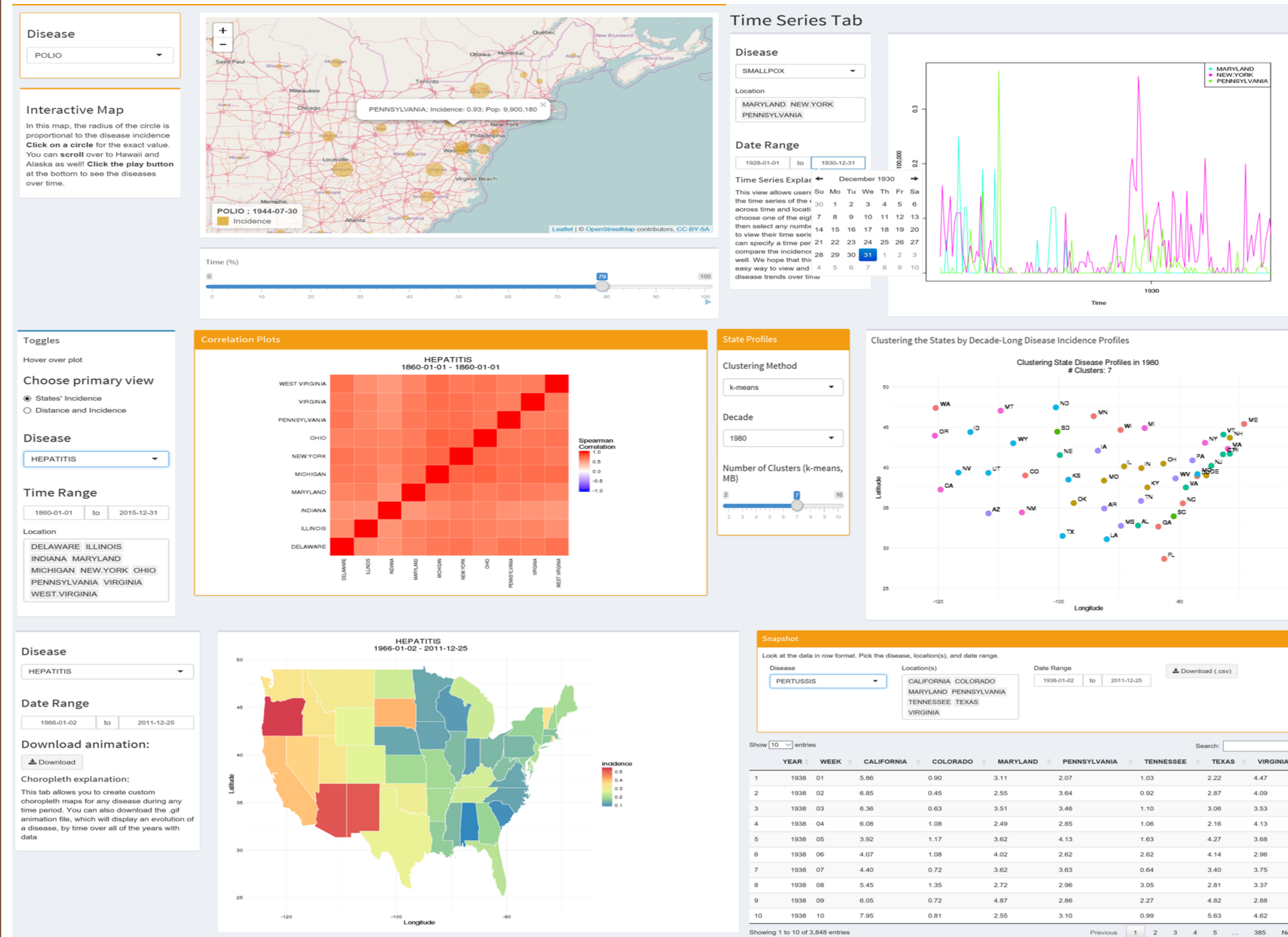


ABMs require Synthetic Ecosystems!

ABMs can incorporate:

- Transmission type
- Reproduction number
- Cultural factors
- Prevention strategies

SPEW View



Available at stat.cmu.edu:3838/sgallagh/spewview/

SPEW - Synthetic Populations and Ecosystems of the World

SPEW is our general framework R package used to create synthetic ecosystems.

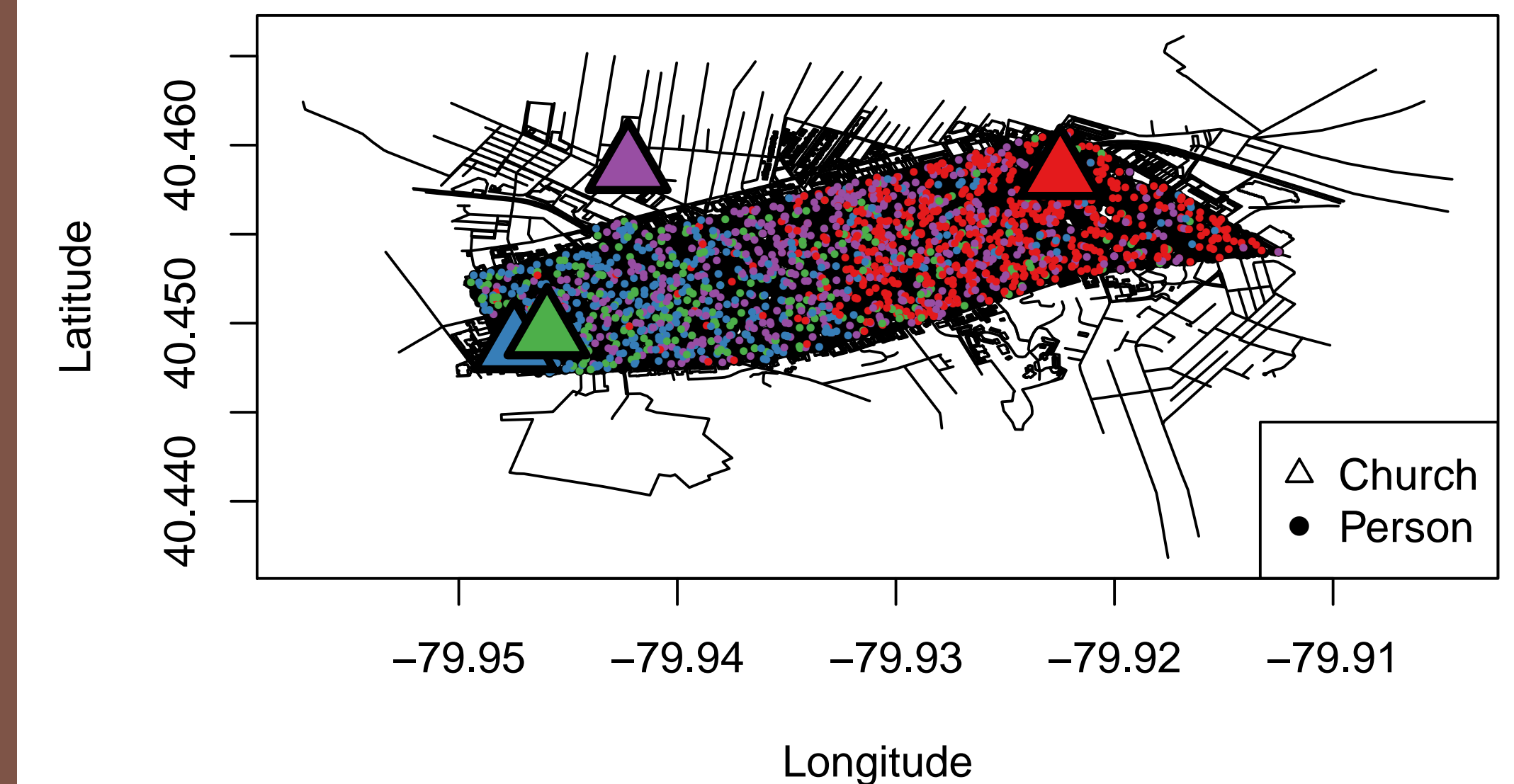


- ~ 4 billion agents
- 70+ countries and counting!
- Automatic diagnostic reports
- Multiple sampling schemes
- MIDAS Network custom ecosystems

Available at: github.com/leerichardson/spew

Place Assignment and Agent Sampling

Place of Worship Assignments Shadyside, Pittsburgh, PA



Place Assignment

Included in SPEW is a **function** to assign environmental variables to agents. We currently include **school** and **workplace** assignments but also include a general place assignment function.

- Probabilistic
- Weights from **distance** and **capacity**

In the above figure, we have assigned a fraction of our agents to attend a **place of worship** (\triangle).

Agent Sampling

We include **modules** to sample agents including:

- Uniform Sampling
- Moment Matching
- Iterative Proportional Fitting

These methods use different sources of **data** and emphasize different **features** of the resulting synthetic ecosystem. The **user** can select which features as the most important ones to synthetize.

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