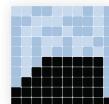


MESA, ABMS IN PYTHON 3

OVERVIEW AND DISSERTATION PROPOSAL

By Jacqueline Kazil

CSS Friday Seminar, March 29, 2018



AGENDA

- Mesa - Overview and Live Demo
- Research questions
- Breakdown of work -- four papers
- Questions / discussion about Ph.D proposal
- *Brief discussion of Mesa packages*

Speaker notes

The last part is brief stage setting to how Mesa Packages are proposed to work. First, a little about me, CSS Student, PSF Board, Python programmer for > 10 years.

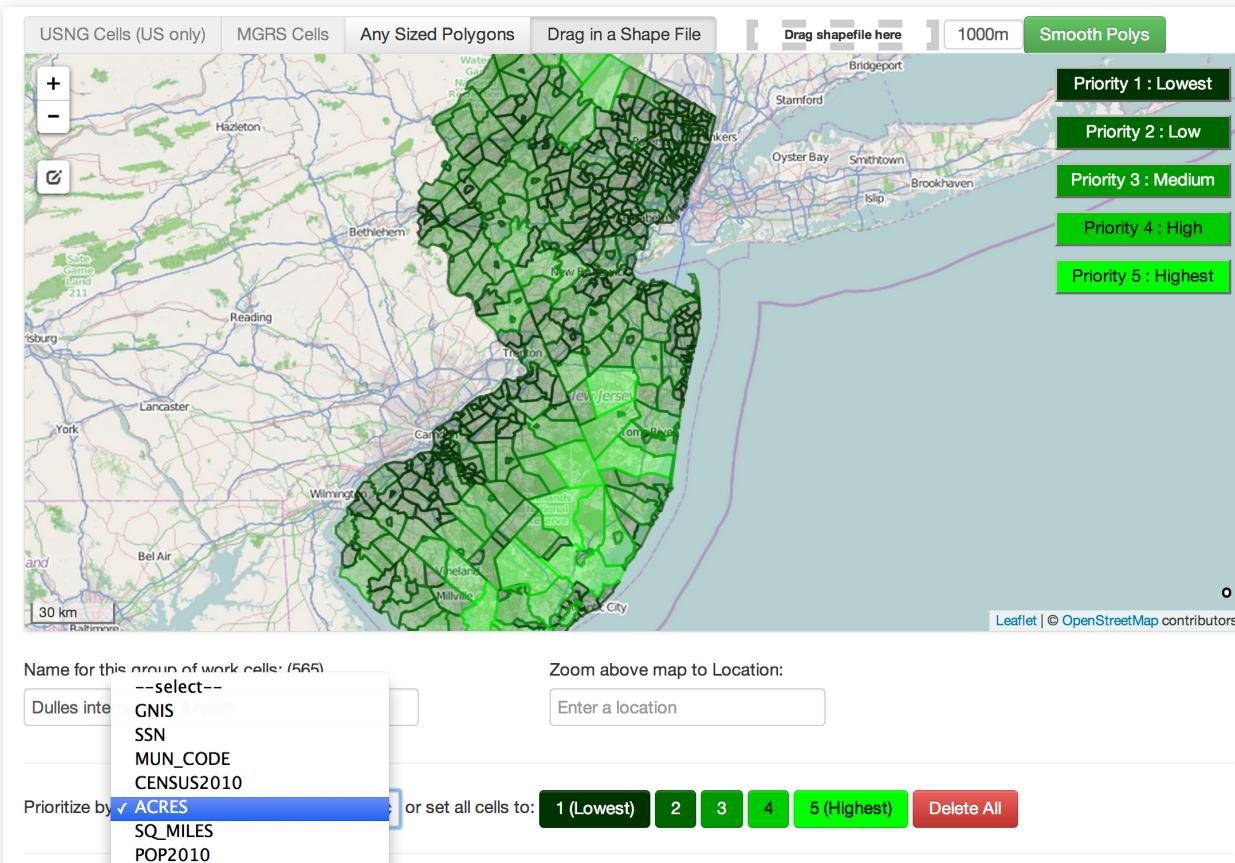
BIAS WARNING



Speaker notes

- I fear an inheritant bias. (Click to show Izzy)
- Explored various frameworks & languages over the years
- Taught/built curriculum for various languages
- I try to back my approach/decisions with data

BIAS WARNING

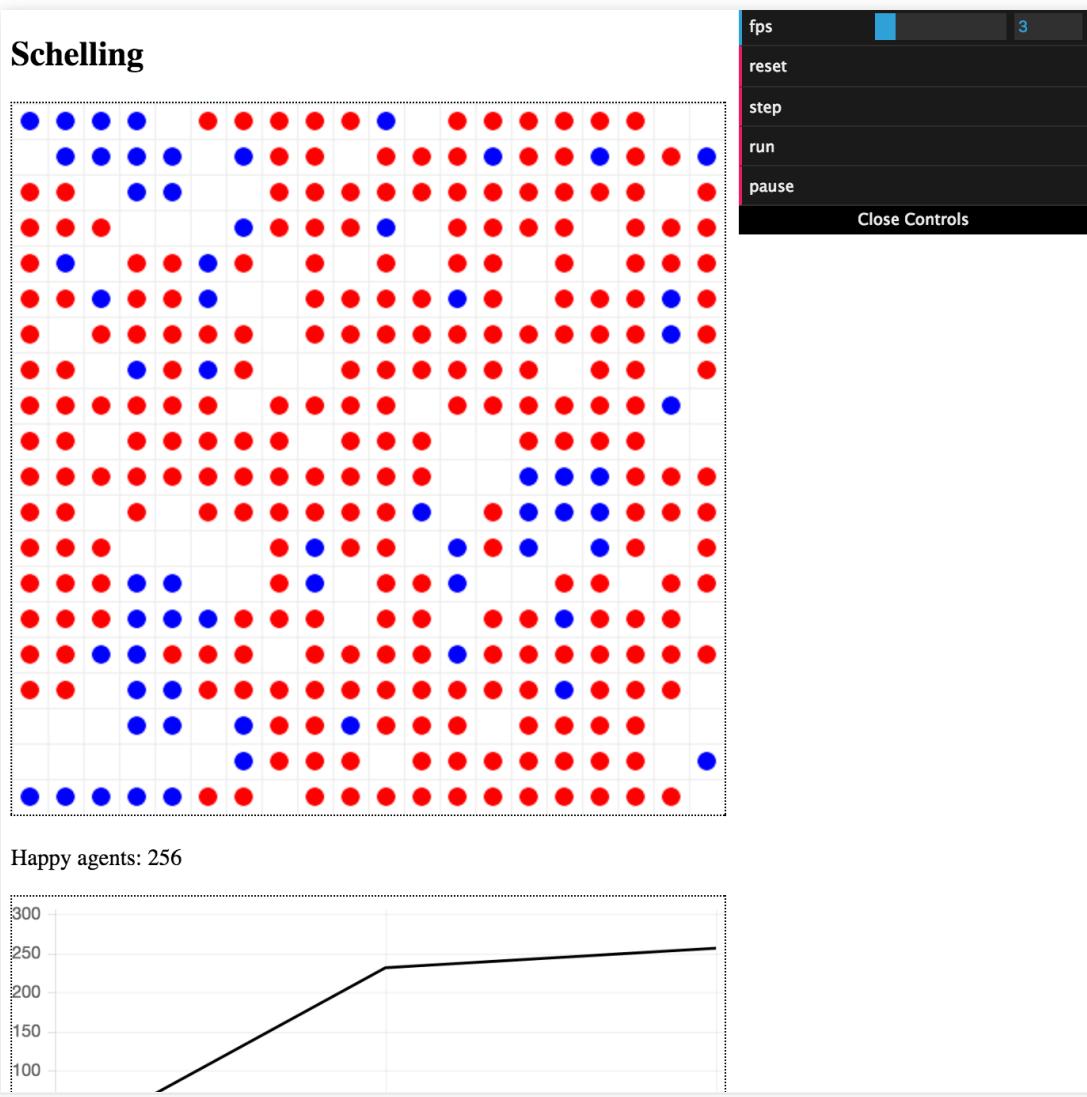


Speaker notes

- PIF project -- My mission: disaster response and recovery.
- Evaluation process - Ruby versus Python
- Example: Coding curriculum at work.
- How decision was made

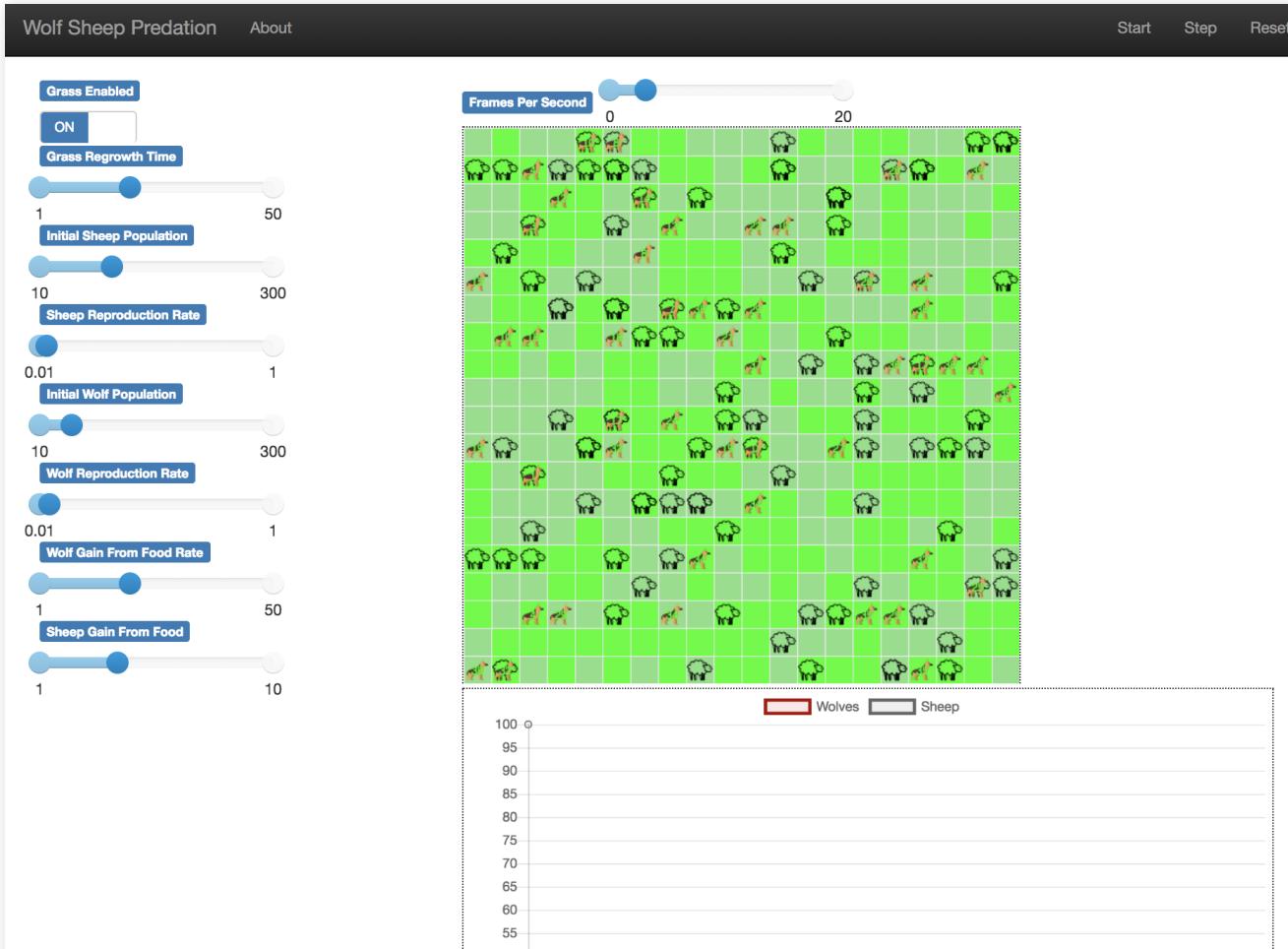
MESA: HISTORY & TODAY

- Started in 2013 w/ David Masad and I
- Up to 45 contributors
- Meet monthly for dev meetings
- Current release 0.8.3 (soon to be 0.8.4)



Speaker notes

Early Mesa.



Speaker notes

- Now, instead of telling you about it, let me show you...

Afterwards...

- At the end of this talk, I will touch on a specific part of Mesa to transition into the next talk.

PYTHON GROWTH AND DATA SCIENCE

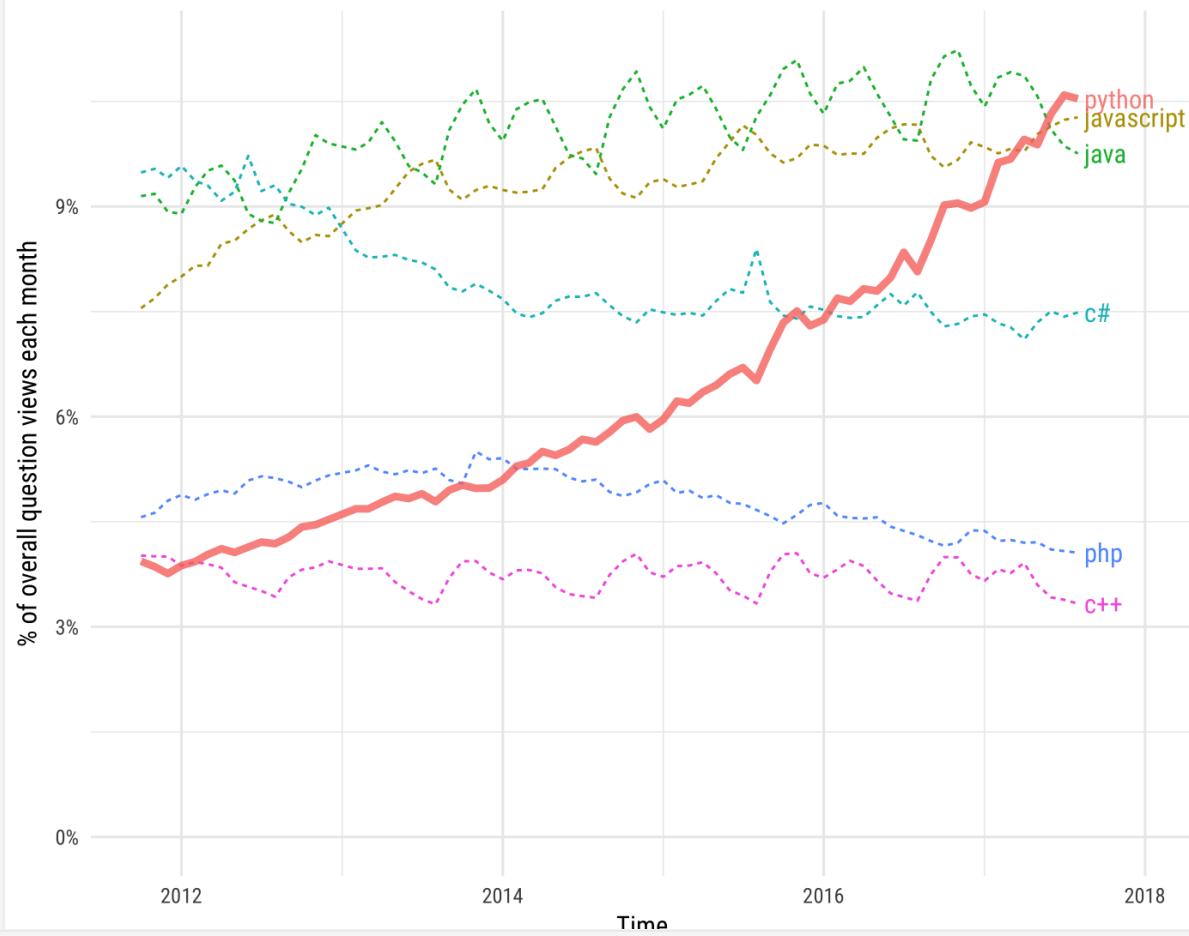
- Guido van Rossum's Darpa Proposal (1999): "Computer Programming for Everybody."
 - Source: van Rossum, Guido. "Computer Programming for Everybody." , July 1999, citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.123.6836&rep=rep1&type=pdf.
- Python is the next big thing for [Insert domain] science.

Speaker notes

- Next big thing in Science is a series of research.. every domain seems to claim it.
- ie Earth Sciences
- Scipy even has domain specific mini tracks
- Overall we have been pretty successful

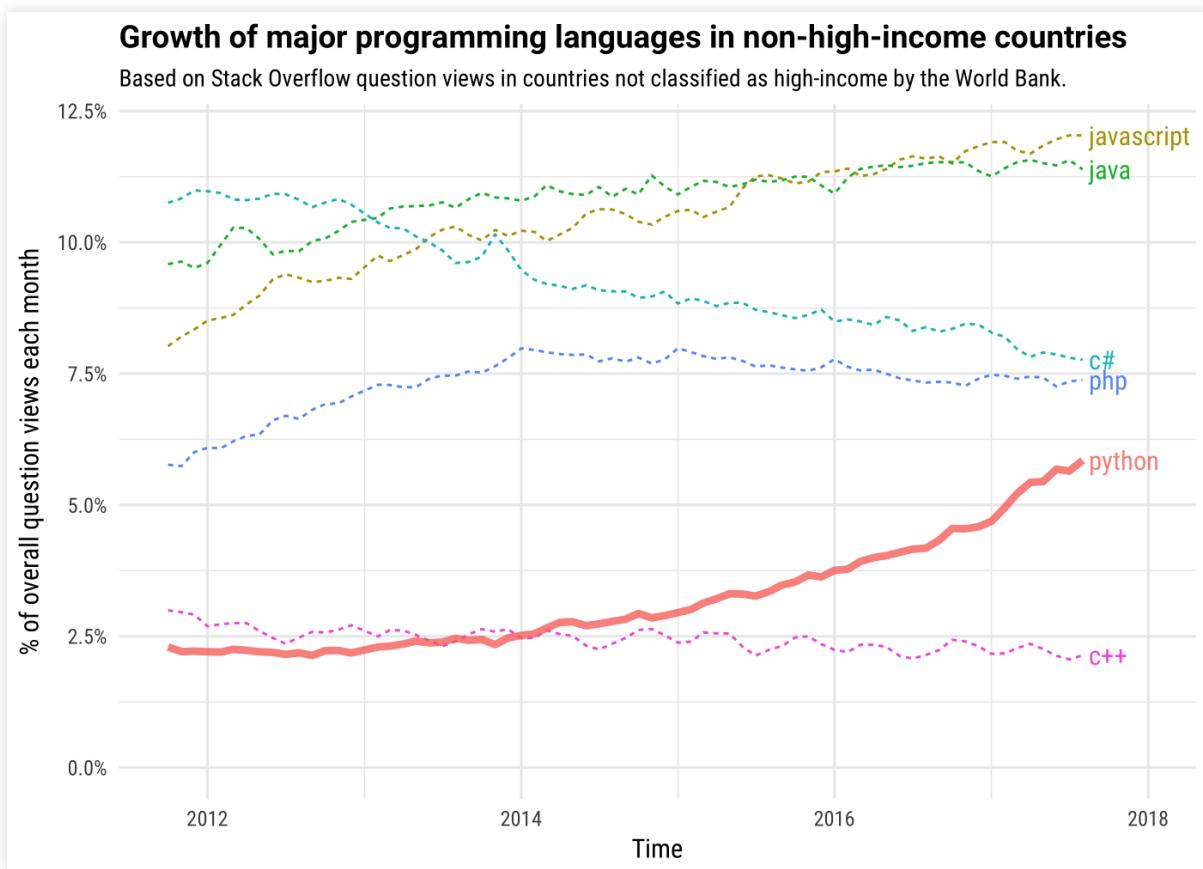
Growth of major programming languages

Based on Stack Overflow question views in World Bank high-income countries



Speaker notes

"wealthy countries (those defined as high-income by the World Bank) tend to visit a different set of technologies than the rest of the world."



Speaker notes

But non-high income countries show a similar trend, but slightly different. At PSF a large portion of our grant money goes to non-high income countries Grant process grew largely in 2016 & 2017, when we scaled it up. So, we haven't seen the effects yet. We also have official Ambassadors in South America and soon in Africa.

RESEARCH QUESTIONS

Theme one: Python and Open Source

- RQ 1: How can the Python programming language, which is rooted in open source, enable agent-based modeling to a wider audience?
- RQ 2: How does an ABM library in Python compare to the most popular ABM libraries used by researchers?

RESEARCH QUESTIONS

Theme two: ABM in Python compared to other ABMs

- RQ 3: How have development patterns varied on agent-based libraries impacted the success or failure of those libraries?
- RQ 4: How do users want to use an ABM API? What are the expectations?

CHESTERTON'S FENCE



Speaker notes

- Just because the fence doesn't have a clear purpose, work to understand it.
- First understand the historical context first - it can help you in the long run.
- Deploying is hard, because people are risk averse in government.
- Same reason for the cloud.
- "if it is not broken, then why fix it?"

BREAKDOWN OF WORK -- FOUR PAPERS

- Comparison contribution patterns for Mesa, Netlogo, Mason, Swarm, Repast
- Mesa paper - architecture, features, sample projects...
- Mesa 1.0 - What do users want - locking the API
- Benchmarking Mesa, against other libraries

Speaker notes

- The meat of the output will be 4 papers.
- Which we will discuss is more detail now.
- I know enough to be dangerous and to frame this work.
- Some areas I know more, but I am not "expert" yet.

PAPER: COMPARISON CONTRIBUTION PATTERNS & CULTURE

- Mesa, Netlogo, Mason, Swarm, Repast
- Popularity of... [framework, language] over time
- Commits, conversations, general activity, release cycles, etc.
- Conferences / Events? - Mesa has no formal ones, but what about Swarmfest?

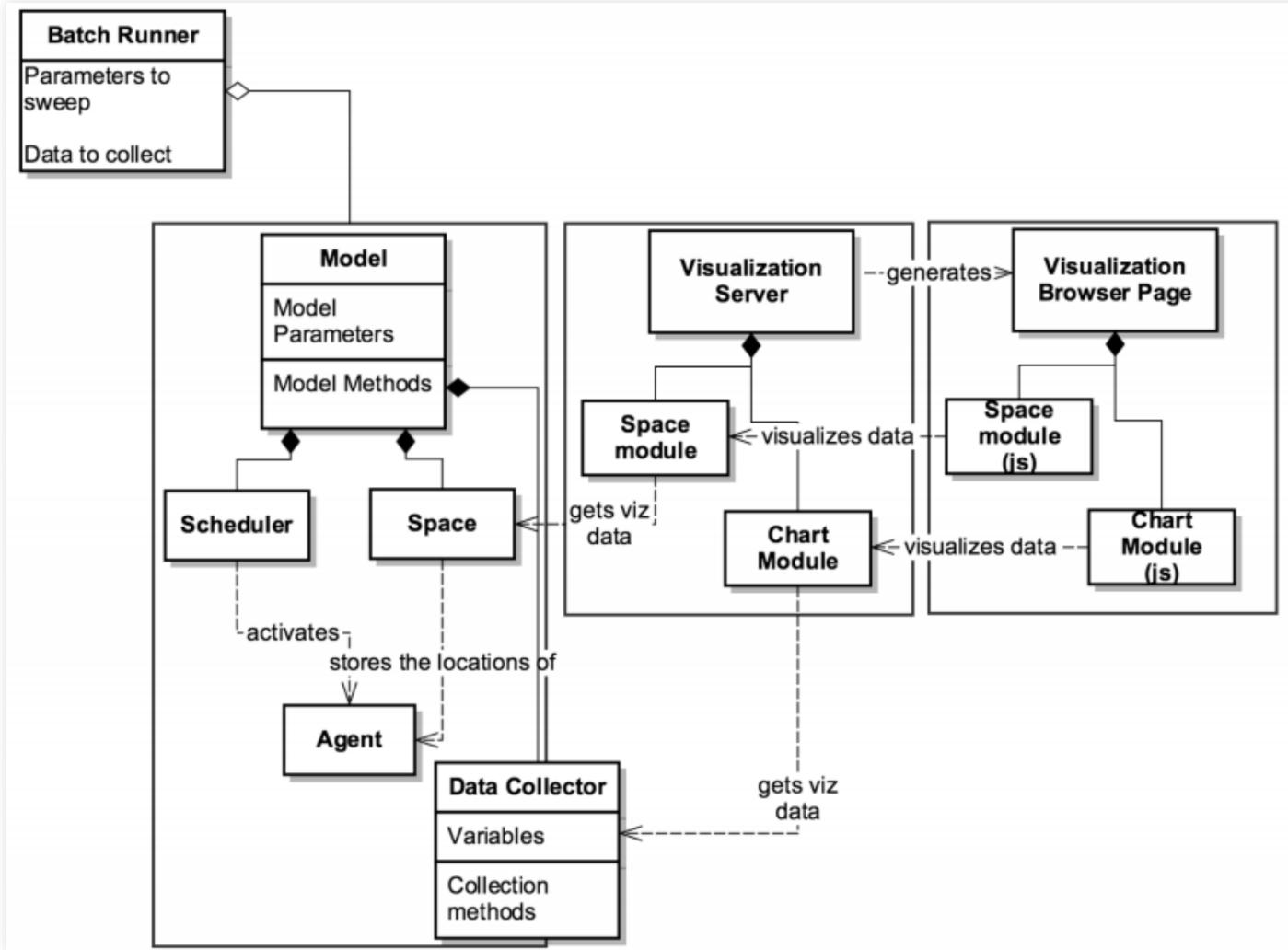
Speaker notes

- How to validate these five as THE ones to compare?
- Citations? What if there are multiple papers - ie Mason has 3.
- A project with little development != dead. It could mean stable?
- Development culture changed over time - comparison apples to apples?

- ie CVS, SVN, Git

PAPER: MESA

- aka 'the Mason paper' but for Mesa
- Why is Python a good idea? Why is it a bad idea?
- Architecture, features, sample projects, etc
- How we came up with the architecture
- What is the bus factor and how will work carry on?
- Mesa modularity and working with other libraries



- Source: Masad, David, and Jacqueline Kazil. "MESA: an agent-based modeling framework." 14th PYTHON in Science Conference. 2015.

MESA 1.0

- The Mesa team discussed, "What is Mesa 1.0? / What does it mean to be 1.0?"
- Many possibilities came up for 1.0 -- like general housekeeping
- But what does it REALLY mean to be 1.0?
- 1.0 is an opportunity to break backwards compatibility
- It means being stable.

Speaker notes

- Housekeeping
 - moving examples out and making sure they version match, Add bar charts
 - These are not hard
- But what does it mean to be one?

PAPER: MESA 1.0, LOCKING THE API

- Talking to users about the good and bad of actually using Mesa.
- i.e. "When you tried to build a model, where did you start?"
- Yes... IRB. No... a survey only won't work
- Methods will be grounds in user-center design

Speaker notes

I am going to spend a little more time on this one, since it might not be as clear. (at the end)

- So why is this important?



Kenneth Reitz 
@kennethreitz

Following



P.S. your API is a user interface

12:23 PM - 24 Feb 2016 from Winchester, VA

464 Retweets 805 Likes



21

464

805



Speaker notes

- The idea is to make the API as accessible as possible.
- Mesa is not Netlogo, but should it be?
- I don't know. I need to talk to users.
- Are there minor things that I can fix to improve the experience?

0_urllib2.py

```
1 #!/usr/bin/env python
2 # -*- coding: utf-8 -*-
3
4 import urllib2
5
6 gh_url = 'https://api.github.com'
7
8 req = urllib2.Request(gh_url)
9
10 password_manager = urllib2.HTTPPasswordMgrWithDefaultRealm()
11 password_manager.add_password(None, gh_url, 'user', 'pass')
12
13 auth_manager = urllib2.HTTPBasicAuthHandler(password_manager)
14 opener = urllib2.build_opener(auth_manager)
15
16 urllib2.install_opener(opener)
17
18 handler = urllib2.urlopen(req)
19
20 print handler.getcode()
21 print handler.headers.getheader('content-type')
22
23 # -----
24 # 200
25 # 'application/json'
```



1_requests.py

```
1 #!/usr/bin/env python
2 # -*- coding: utf-8 -*-
3
4 import requests
5
6 r = requests.get('https://api.github.com', auth=('user', 'pass'))
7
8 print r.status_code
9 print r.headers['content-type']
10
11 # -----
12 # 200
13 # 'application/json'
```

Speaker notes

- This is the power of an API that was empathic to users.
- URLLib2 (Standard Python) versus Requests
- In doing user research, to try to get to this for Mesa -- should I also talk to users from the other libraries? That could get really big really fast.

PAPER: BENCHMARKING MESA

- Looking at same projects in main libraries (i.e. Heat bugs)
- Validating Mesa: Can Mesa provide the same results?
- How does each library scale - 100, 1000, 100,000, 1,000,000
- What are key features that they have
 - i.e. How does Mesa's networks perform against other libraries.

Speaker notes

- Moving on...
- What is important for bench marking?

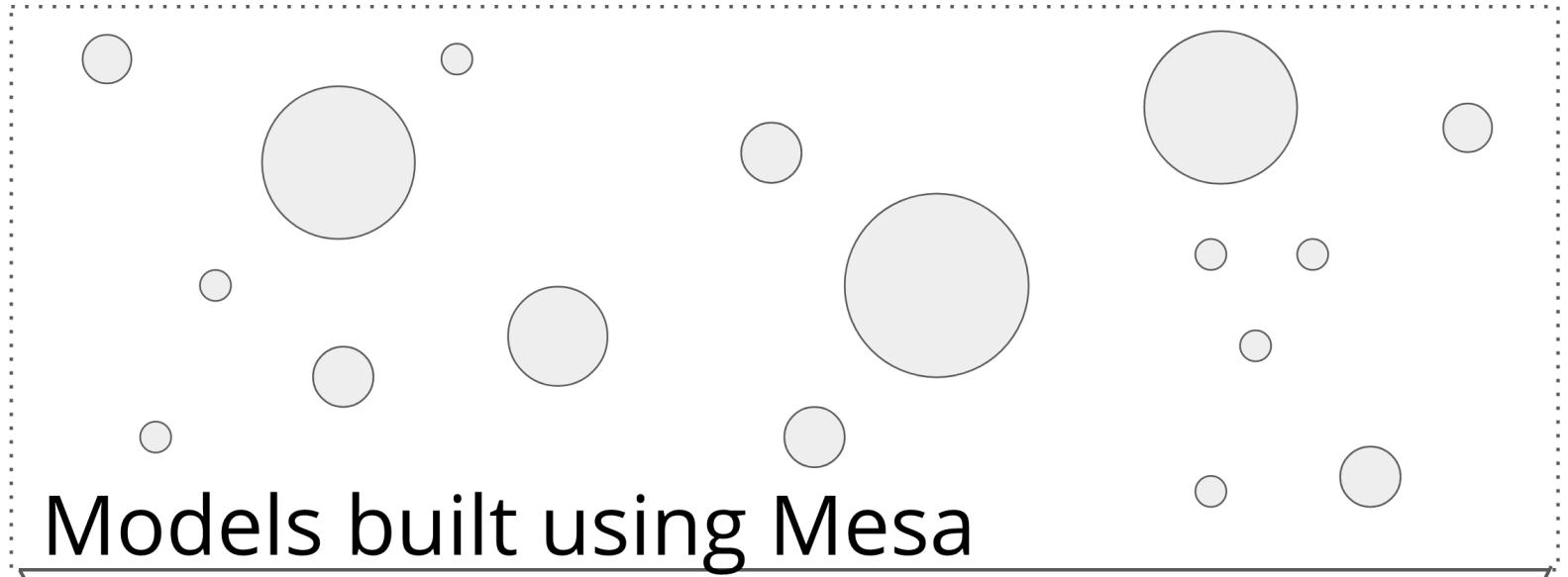
ANY PENDING QUESTIONS / DISCUSSION

Speaker notes

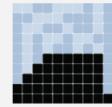
- Great! Now we can move to the bonus section!

MESA ECOSYSTEM

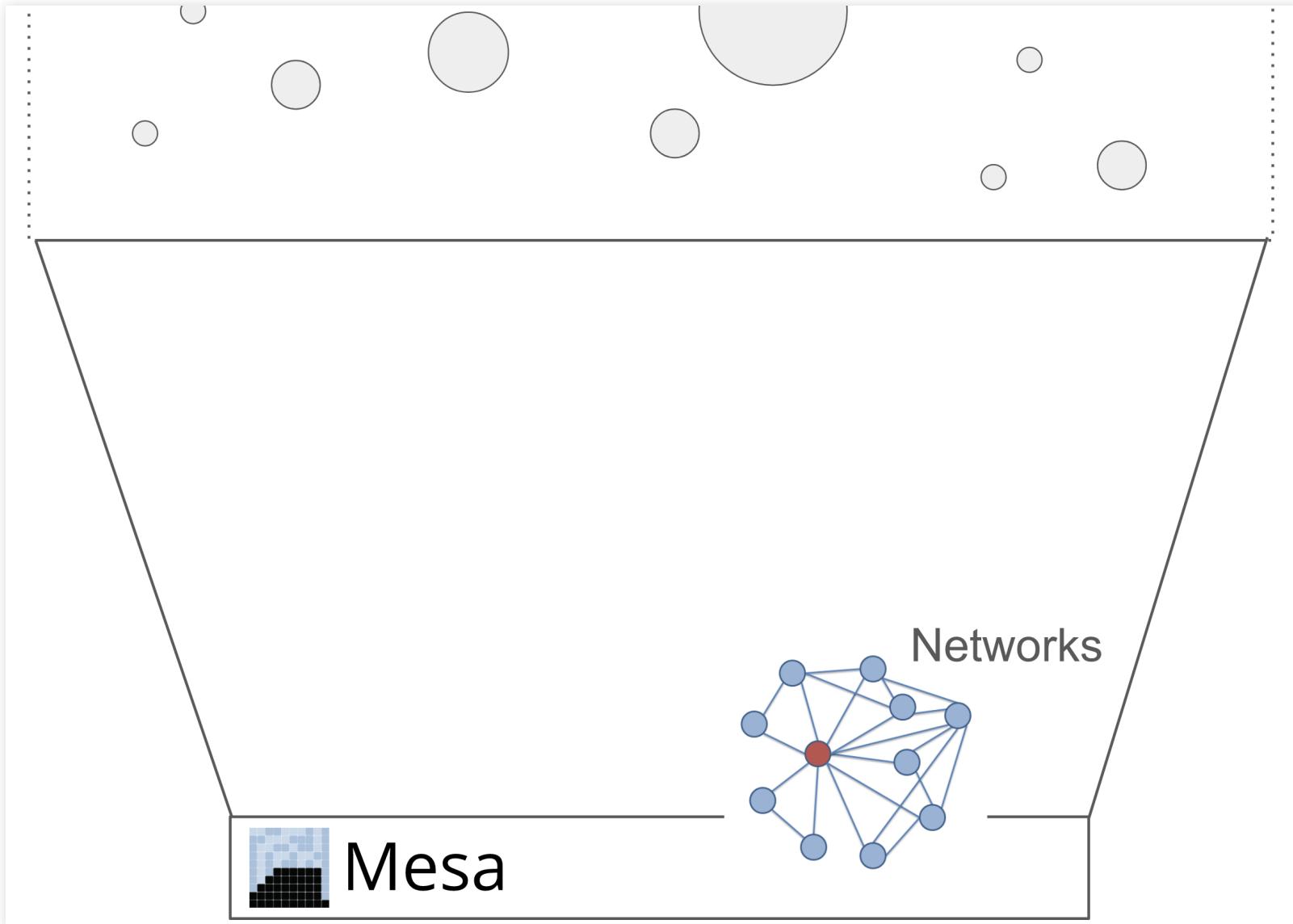
- Individuals build complementary libraries for Mesa
- Libraries include rules for agents or world, minor logic or major features (ie GIS)
- Domain experts manage their respective domains
- Mesa core team might help or facilitate
- This is being documented by Tom Pike in Mesa docs

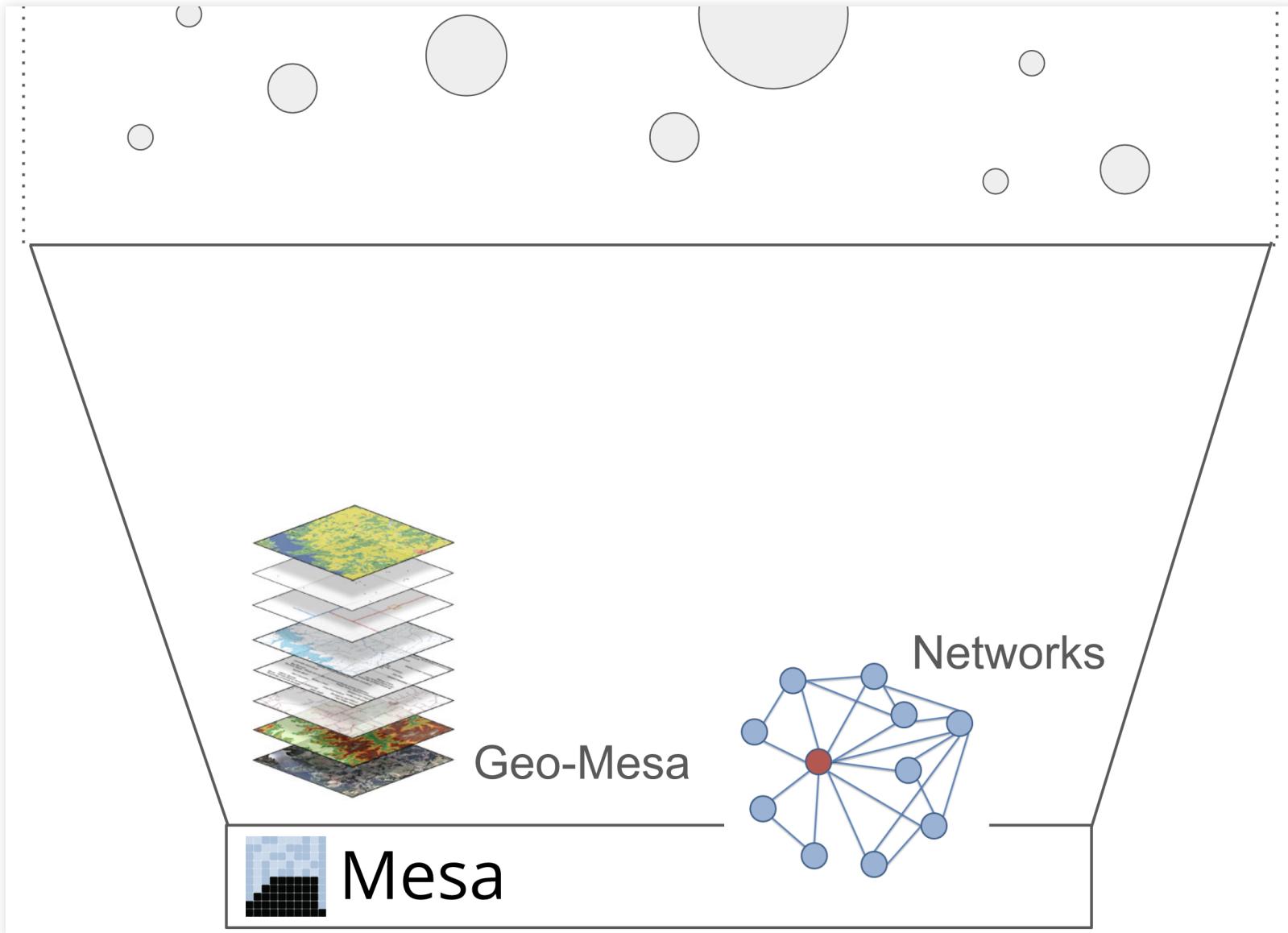


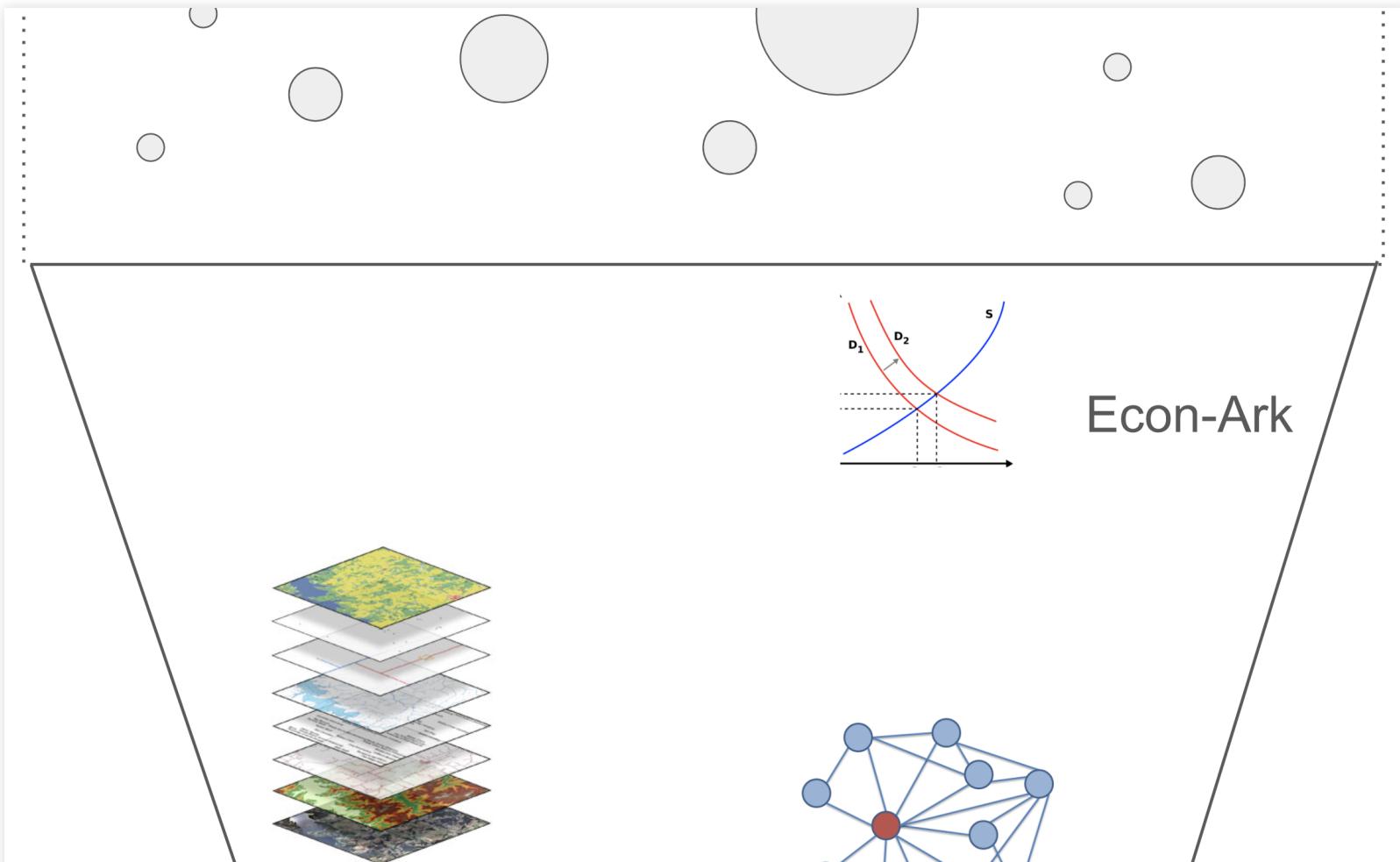
Models built using Mesa



Mesa





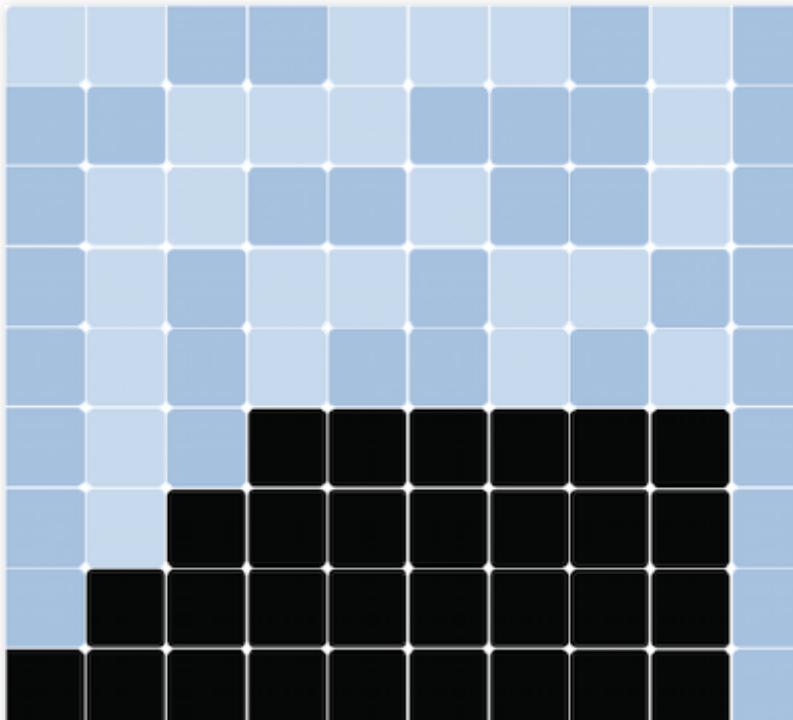


Speaker notes

- What this looks like is still being worked out.
- 2 ways to integrate
 - 1. Pull in as attributes / logic
 - 1. Create subclassed objects

THE END

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Speaker notes

- And with that, let's move to Econ-ark