Data Exploration in the Ecology Classroom: The Science-Pipes Approach

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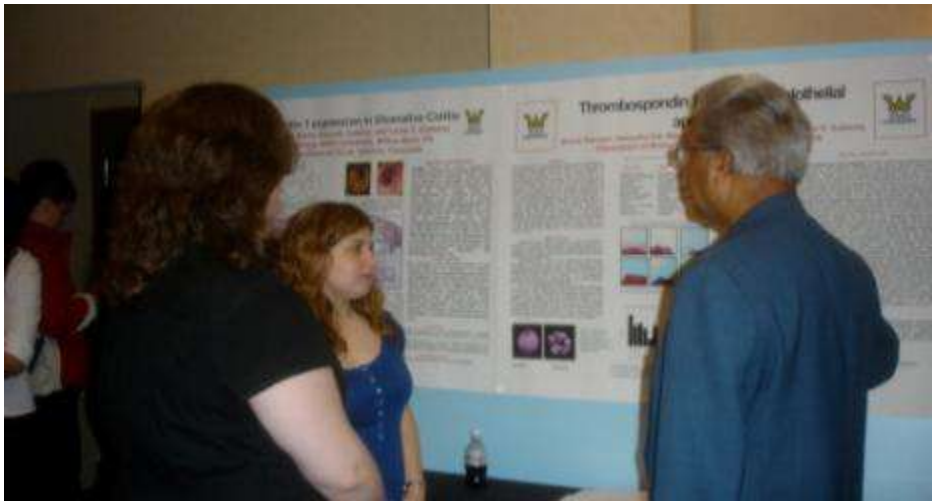
What education reformers think we do

What reformers want us to do

What students want to do

What we want our students to do



Science education is becoming more student-centered

- Recommendations of national panels
  - Less emphasis on lecturing
  - More on student active data gathering, analysis, reporting, critical thinking
- Goal to have students master competencies, rather than rote knowledge

Student-active learning involves data collecting and analysis

- Students behave as scientists to construct knowledge
- Feasible when examining phenomena of limited spatial and temporal scale
  - Cell / Molecular biology
  - Physiology
- Less feasible for phenomena of longer temporal scale or broader spatial scale
  - Ecology
  - Evolution

Still, want to teach ecological / evolutionary principles with data

- Use data from individual studies
  - Limited in terms of extent
- Use data multiple studies (data mining)
  - Access, compatibility an issue
- Statistics / data visualization software often challenging for students

Challenge: Facilitating access to, and visualization of, ecological data

Welcome to the ESA Data Registry. This is a publicly accessible registry describing **scientific data sets on ecology and the environment**. The data sets registered here are associated with articles published in the journals of the Ecological Society of America. They are registered here in order to facilitate communication and data sharing by scientists. See individual registry entries for citation information as well as usage rights.

Registry Tools

- **Search for Data Sets**

Search
Search only within the ESA Data Registry
Search entire Knowledge Network for Biocomplexity
Search Title, Abstract, Keywords, Personnel (Quicker)
Search all fields (Slower)

This tool allows you to search the registry for data sets of interest. When you type text in the box and click on the "Search" button, the search will only be conducted within the title, author, abstract, and keyword fields. Checking the "Search All Fields" box will search on these and all other existing fields (this search will take more time). Checking the "Search Knowledge Network for Biocomplexity" box will allow you to search the Knowledge Network for Biocomplexity (KNB) in addition to the ESA Data Registry. The KNB is an international data repository dedicated to facilitating ecological and environmental research. Click here for more information on the KNB.

You can use the '%' character as a wildcard in your searches (e.g., '%biodiversity%' would locate any phrase with the word biodiversity embedded within it).

- **Browse data sets**

Browse all existing data sets by title. This operation can be slow as the number of entries in the registry grows.

One Solution: Science Pipes

- Workflow system developed by Cornell Lab of Ornithology
- Allows students to analyze and visualize complex datasets.
- Uses an object-oriented interface.
- Found at http://www.sciencepipes.org

Science Pipes workflow system:

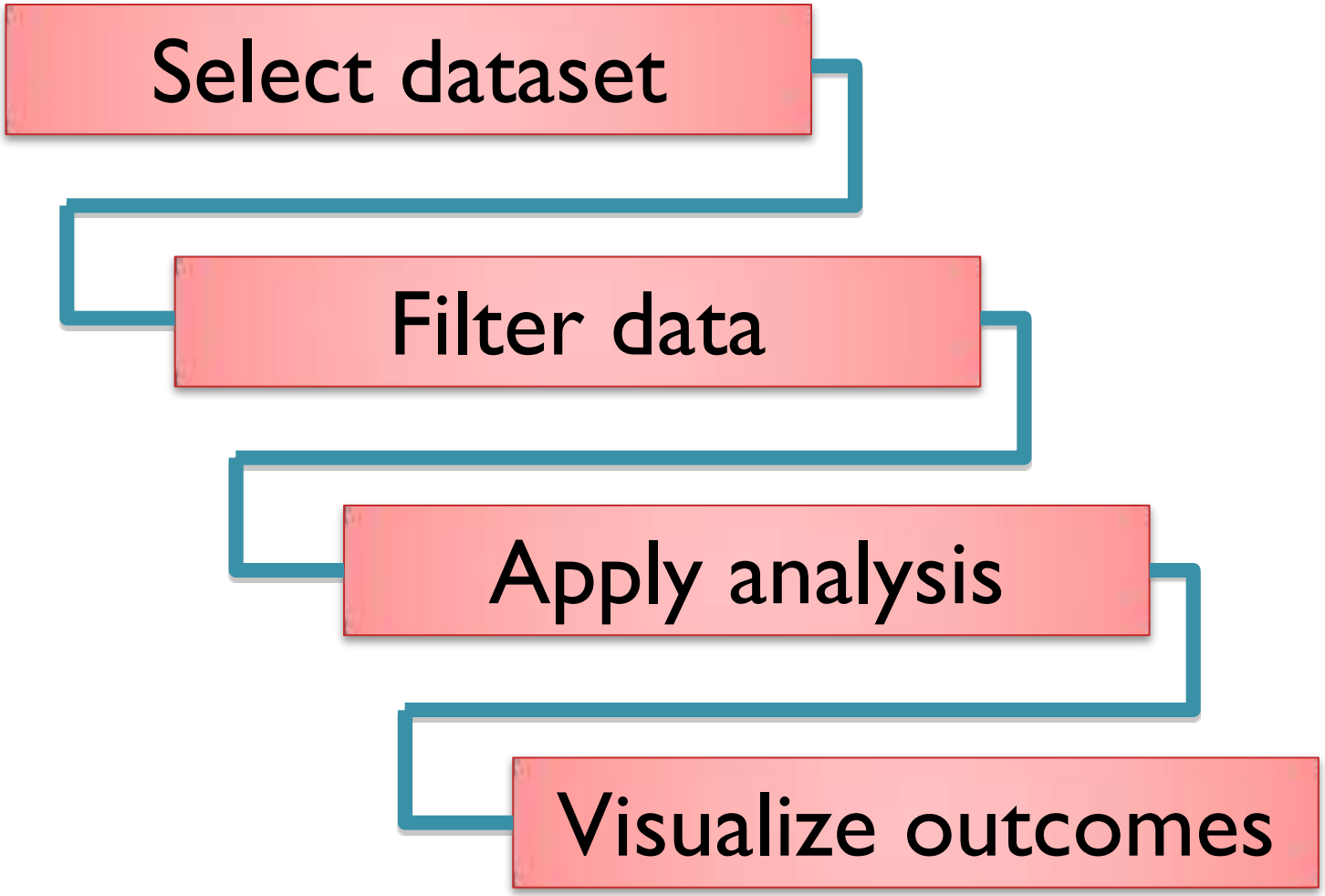
Select dataset

Filter data

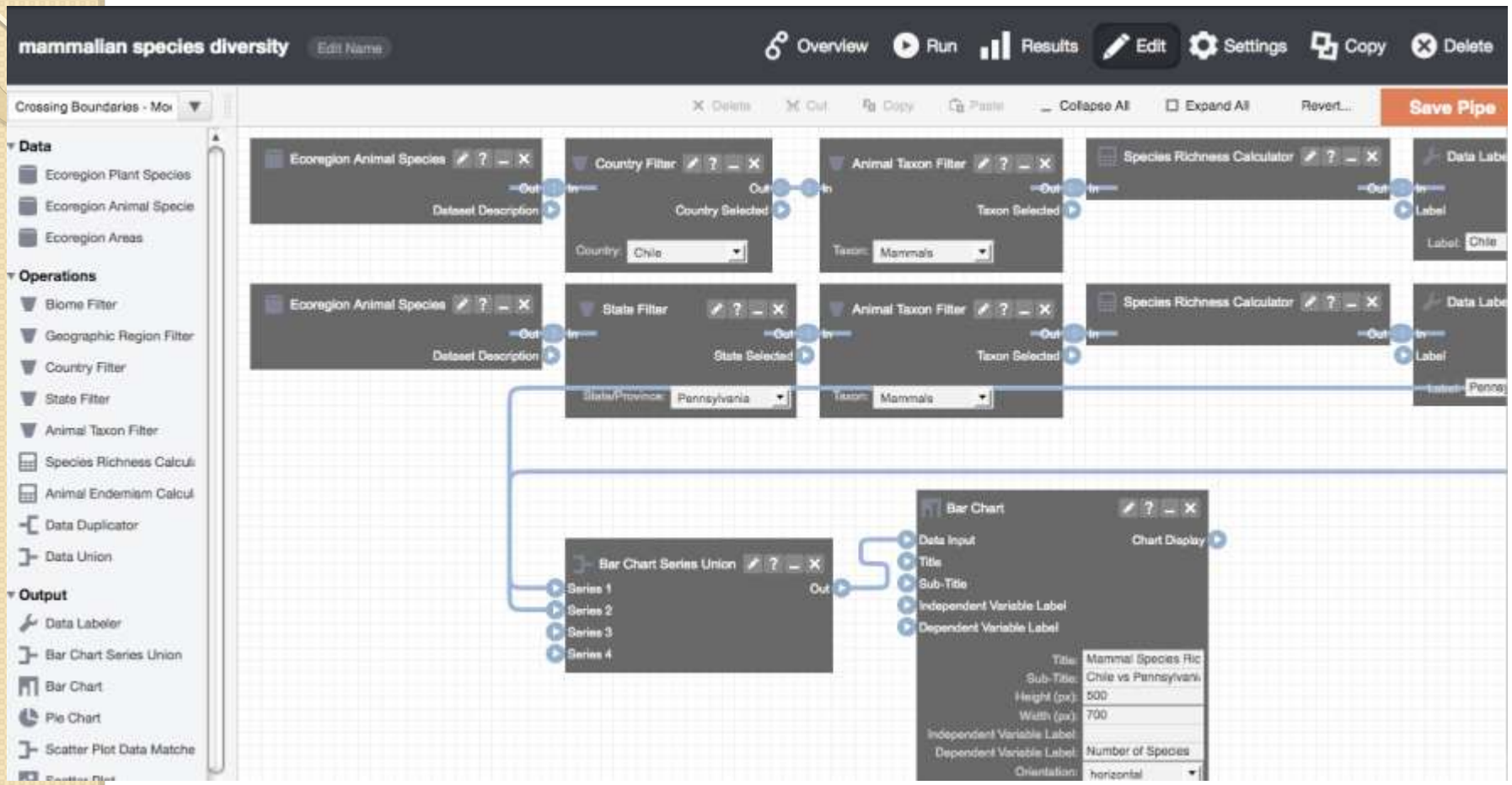
Apply analysis

Visualize outcomes

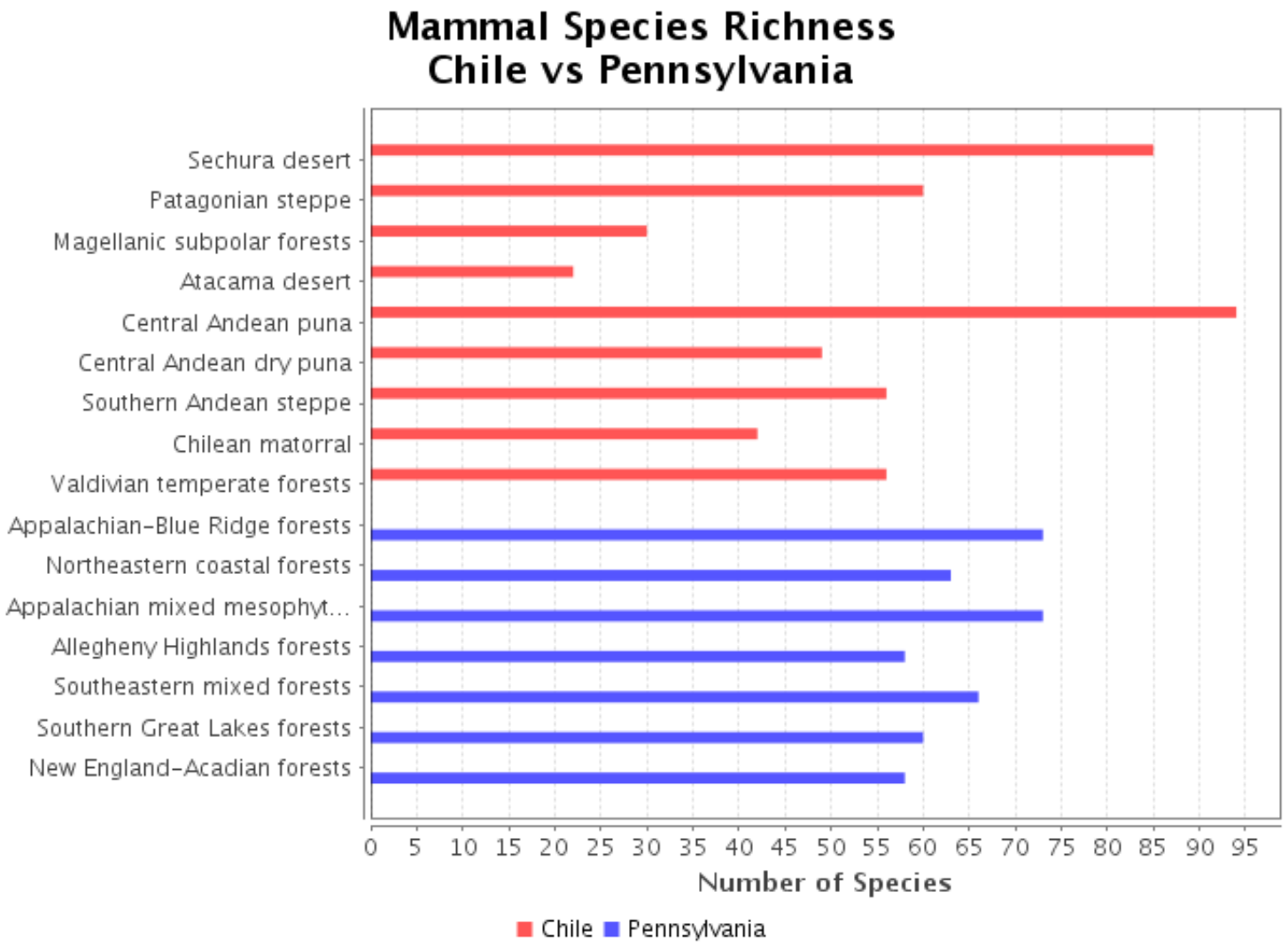
Science Pipes workflow system:



Example of Science Pipe



Output of Pipe

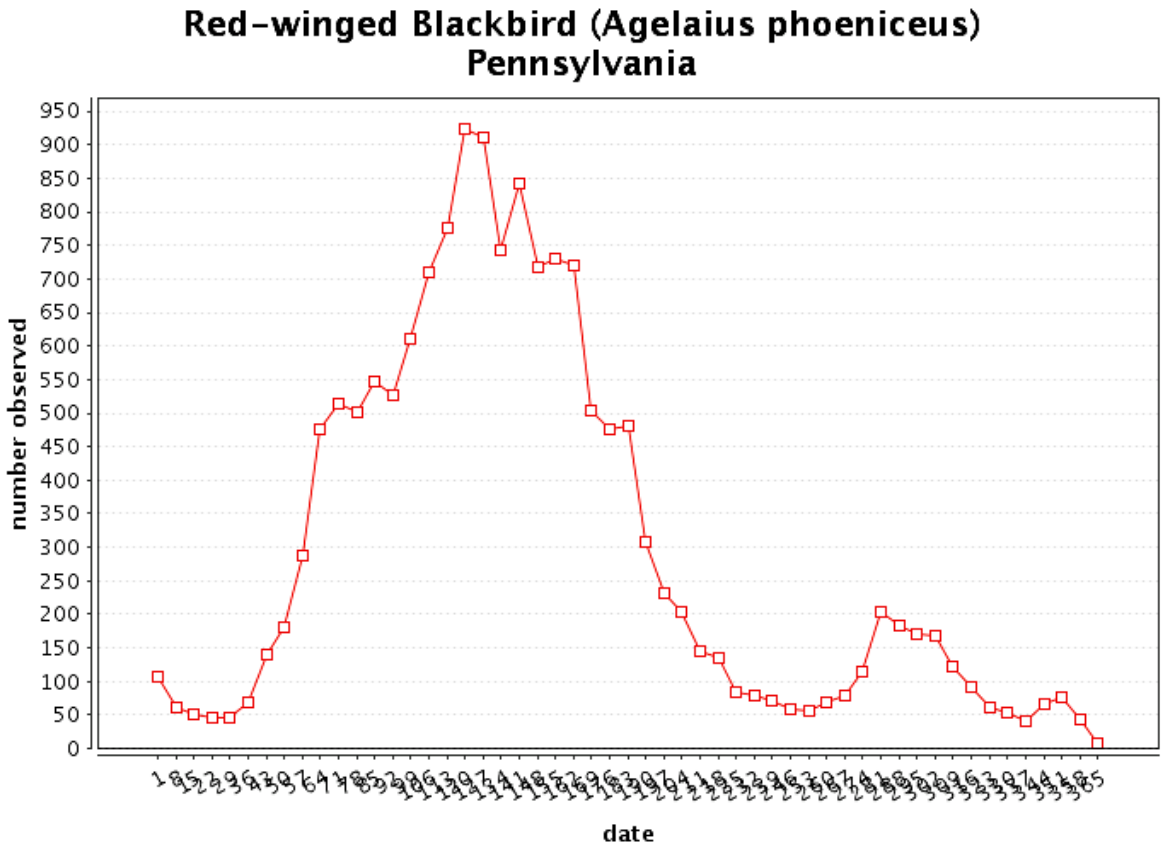


Datasets in Science Pipes

- From Cornell Lab of Ornithology
  - Avian Knowledge Network (eBird, Project Feeder Watch)
  - WWF WildFinder (Crossing Boundaries)
- From Ecological Society of America
  - Cemetery Demography
  - Adaptive radiation
  - Pollen data
  - Forest Inventory & Analysis

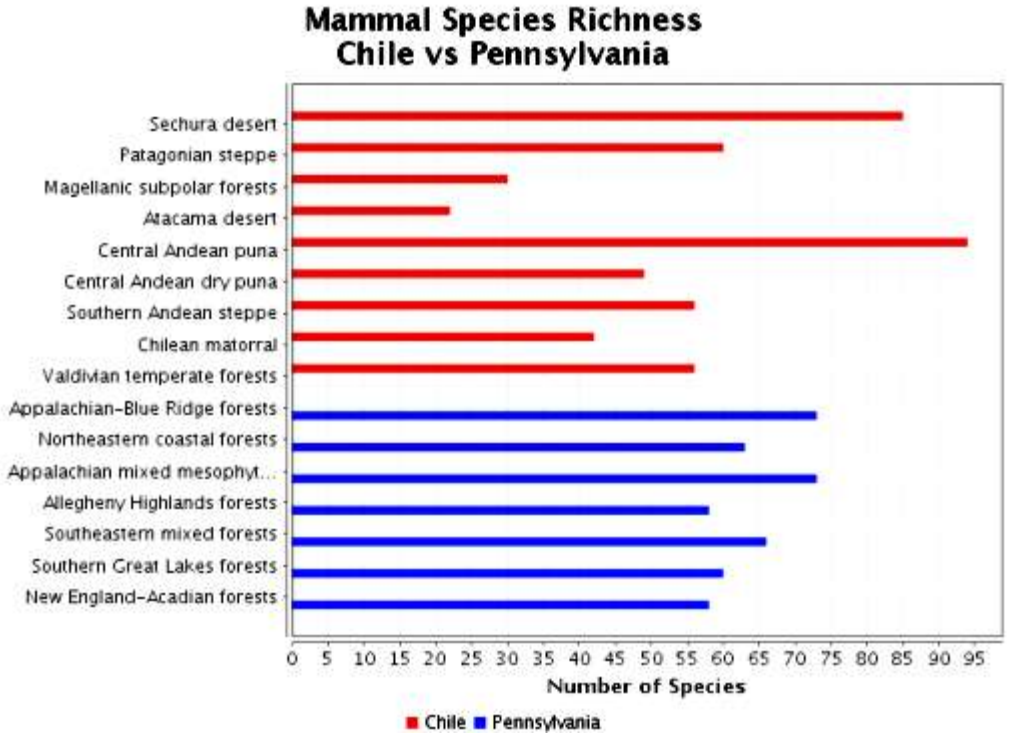
Avian Knowledge Network (eBird, Project Feeder Watch)

- Massive dataset from researchers and citizen science volunteers
- Analyze populations and communities over time and space



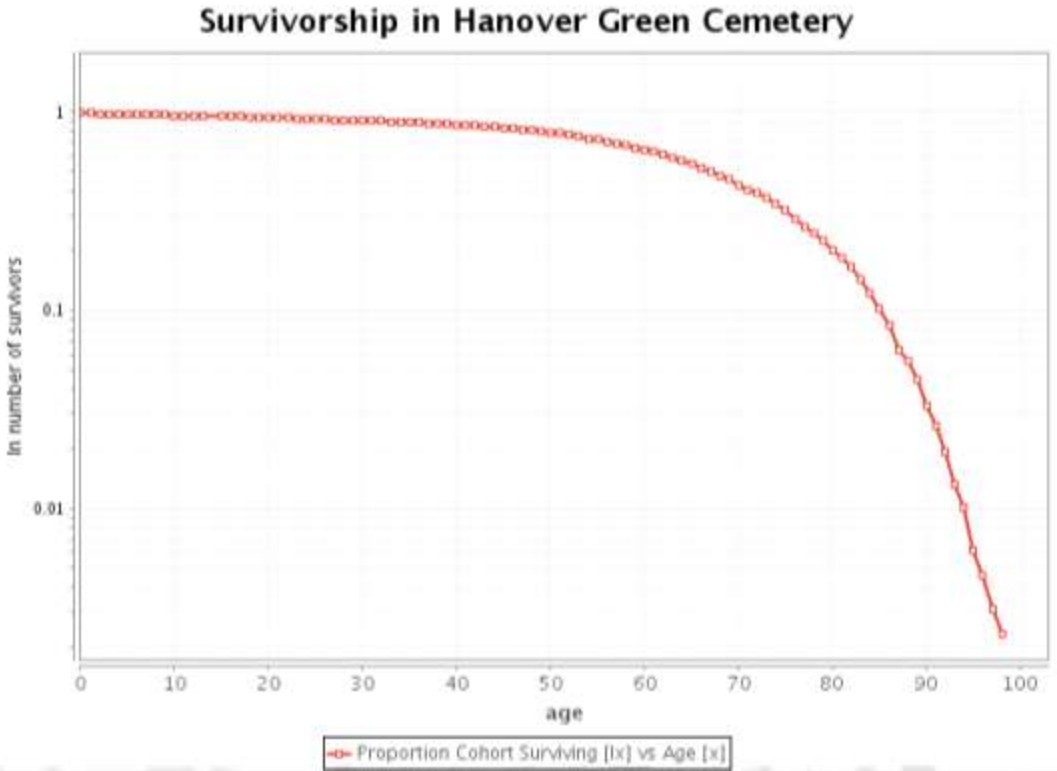
WWF WildFinder (Crossing Boundaries)

- Species diversity in different ecoregions
- Compare countries and states



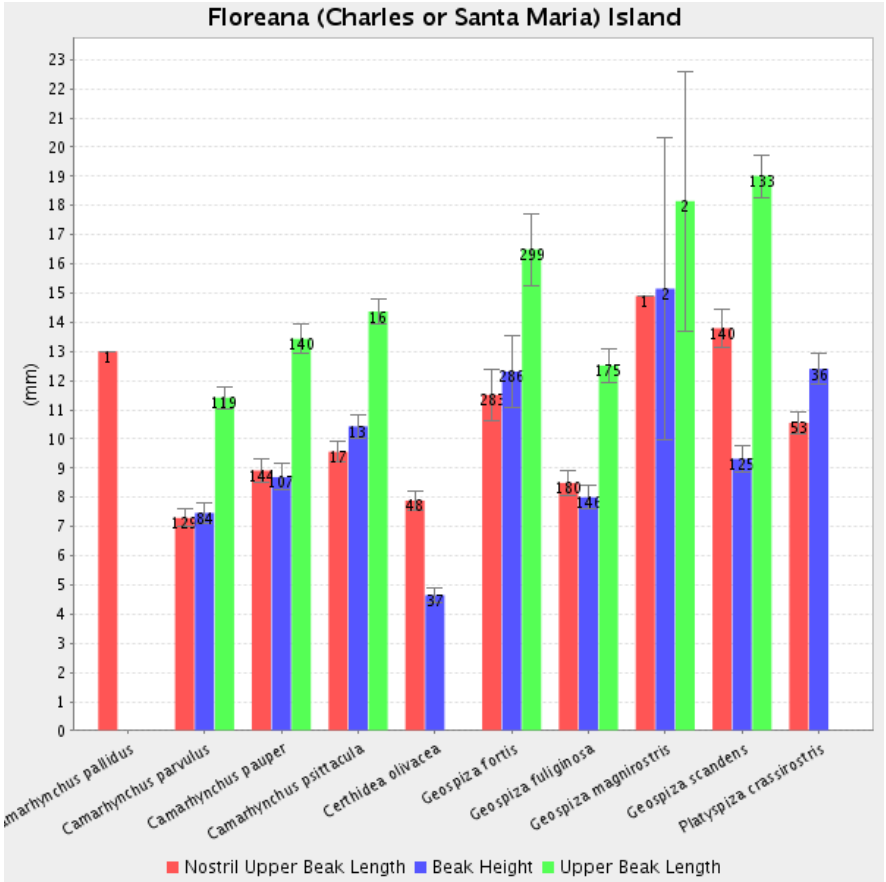
Cemetery demography

- Allows students to construct
  - life tables
  - age distributions
  - survivorship curves



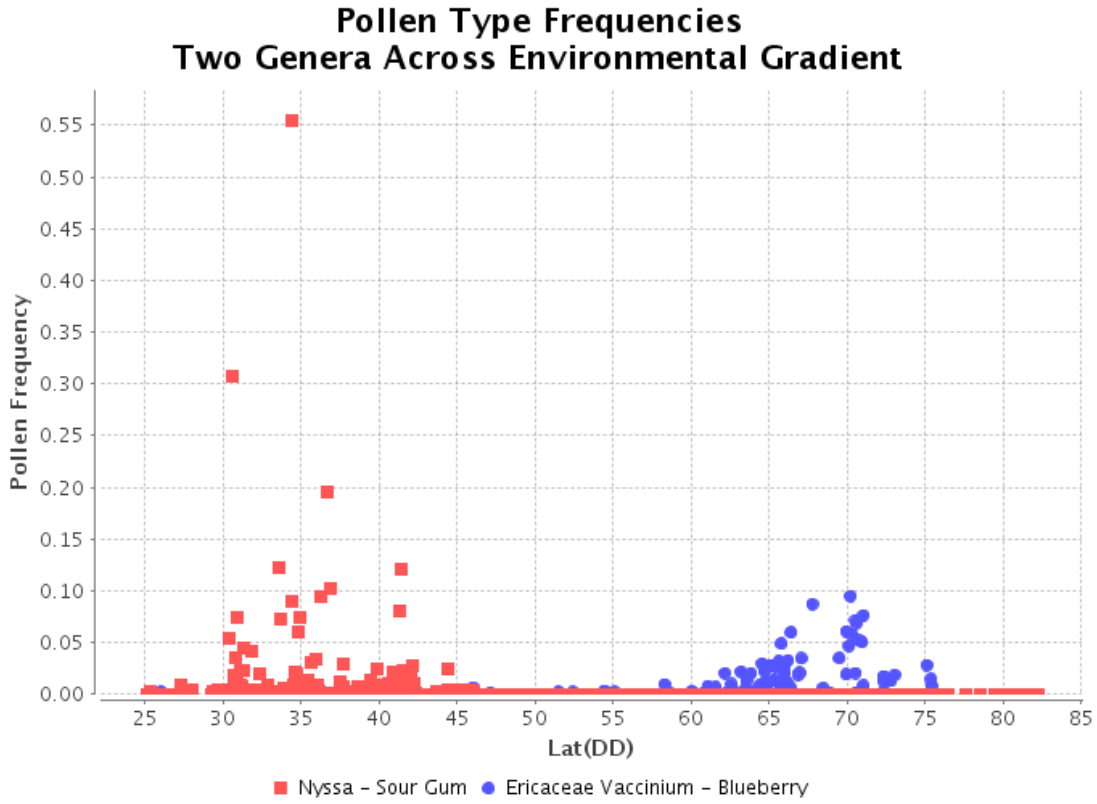
Datasets in Science Pipes

- Adaptive radiation
  - Based on Darwin's finch morphometric data
  - Compare species by island



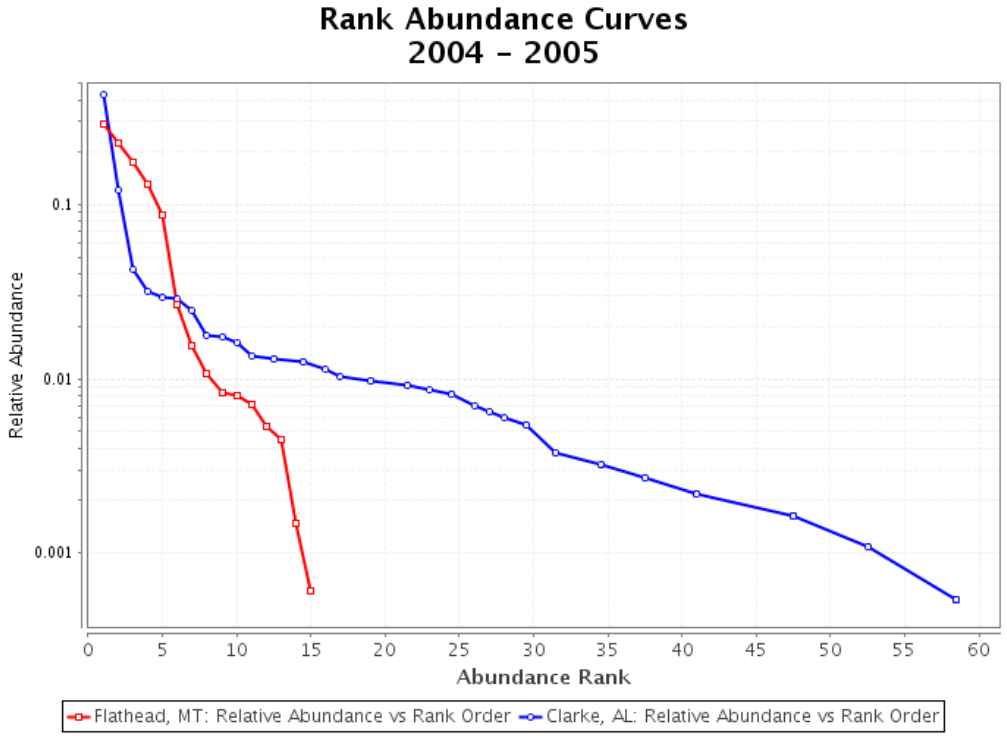
Datasets in Science Pipes

- Pollen data
  - From North America Pollen Database
  - Compare pollen frequencies by species and site



Datasets in Science Pipes

- USDA Forest Inventory Analysis
  - Focus on population and community structure
  - Use to calculate rank abundance, species richness, species diversity, diameters



The Cornell Lab of Ornithology

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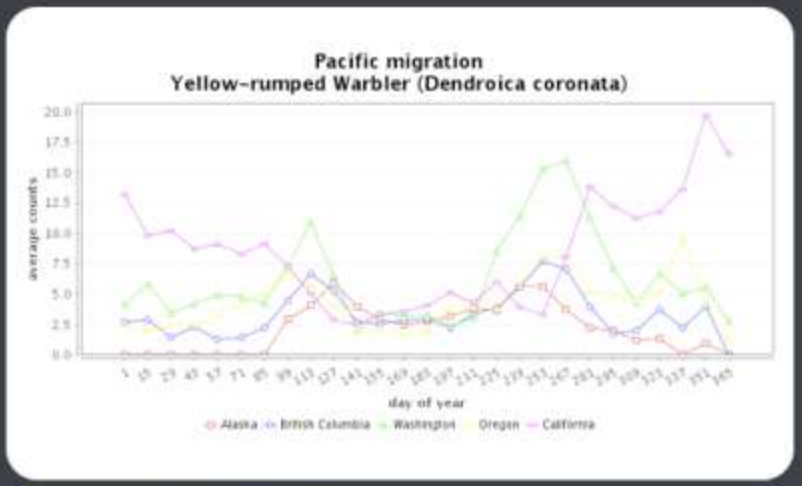

Pacific Coast Migration by Wim van Dam

NEXT →

Analyze + visualize data. Share results.

Science Pipes is a free service that lets you:

- Connect to real biodiversity data
- Use simple tools to create visualizations and feeds
- Embed results on your own web site or blog

More Info | Video Demos | Tutorials | Latest News

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Featured Pipes

DP1-demo-Histogram
Derik Barseghian — Mar 20, 2012 at 1:06 PM
No ratings yet

DP1-demo-Dual Bar Chart
Derik Barseghian — Mar 12, 2012 at 7:33 PM
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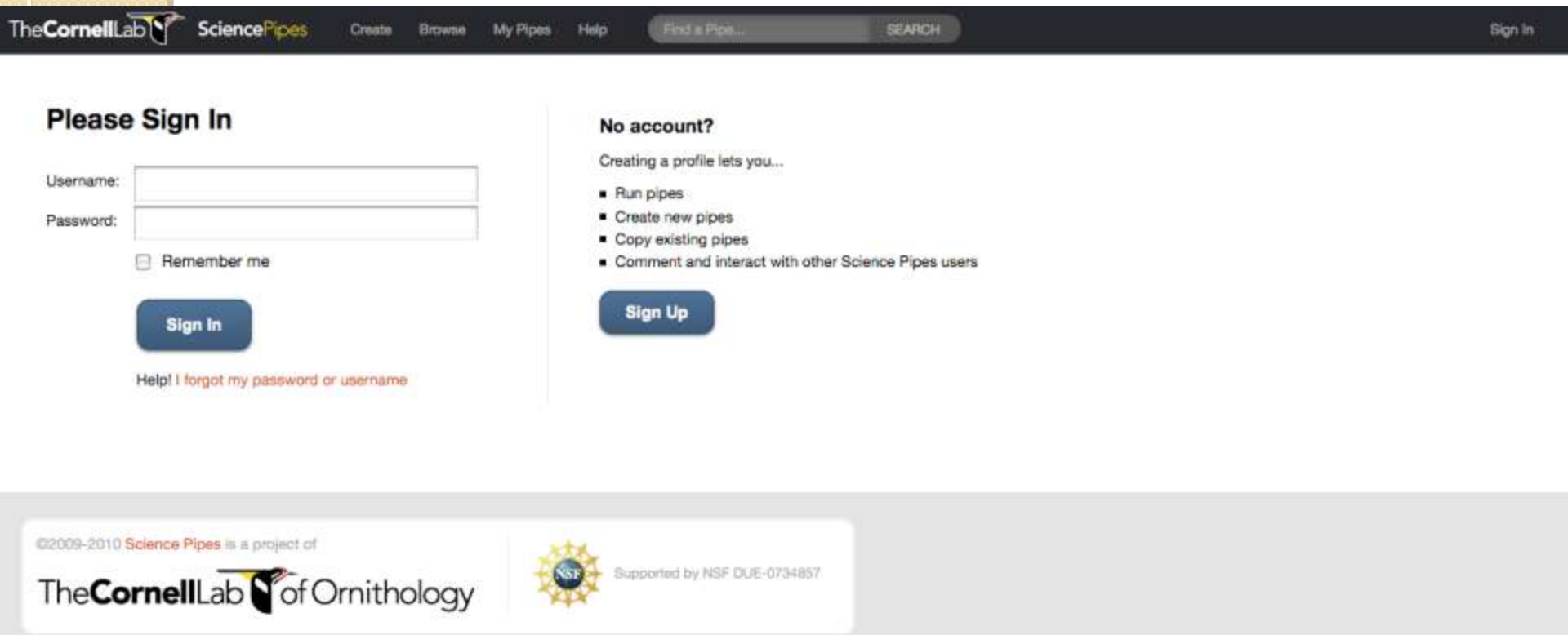
Search for a pipe...
Search

Find by tag...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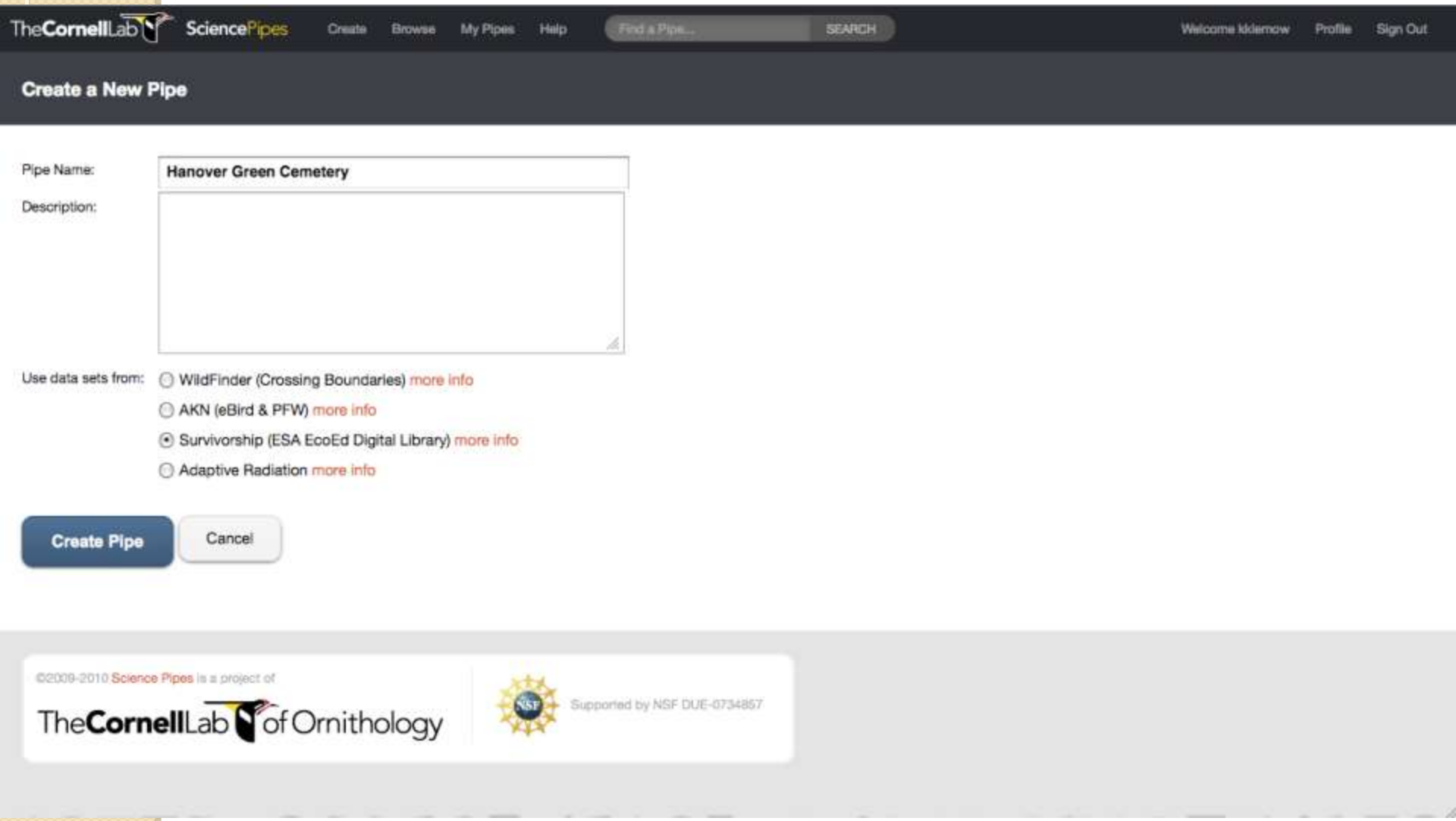
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Use data sets from:
WildFinder (Crossing Boundaries) more info
AKN (eBird & PFW) more info
Survivorship (ESA EcoEd Digital Library) more info
Adaptive Radiation more info
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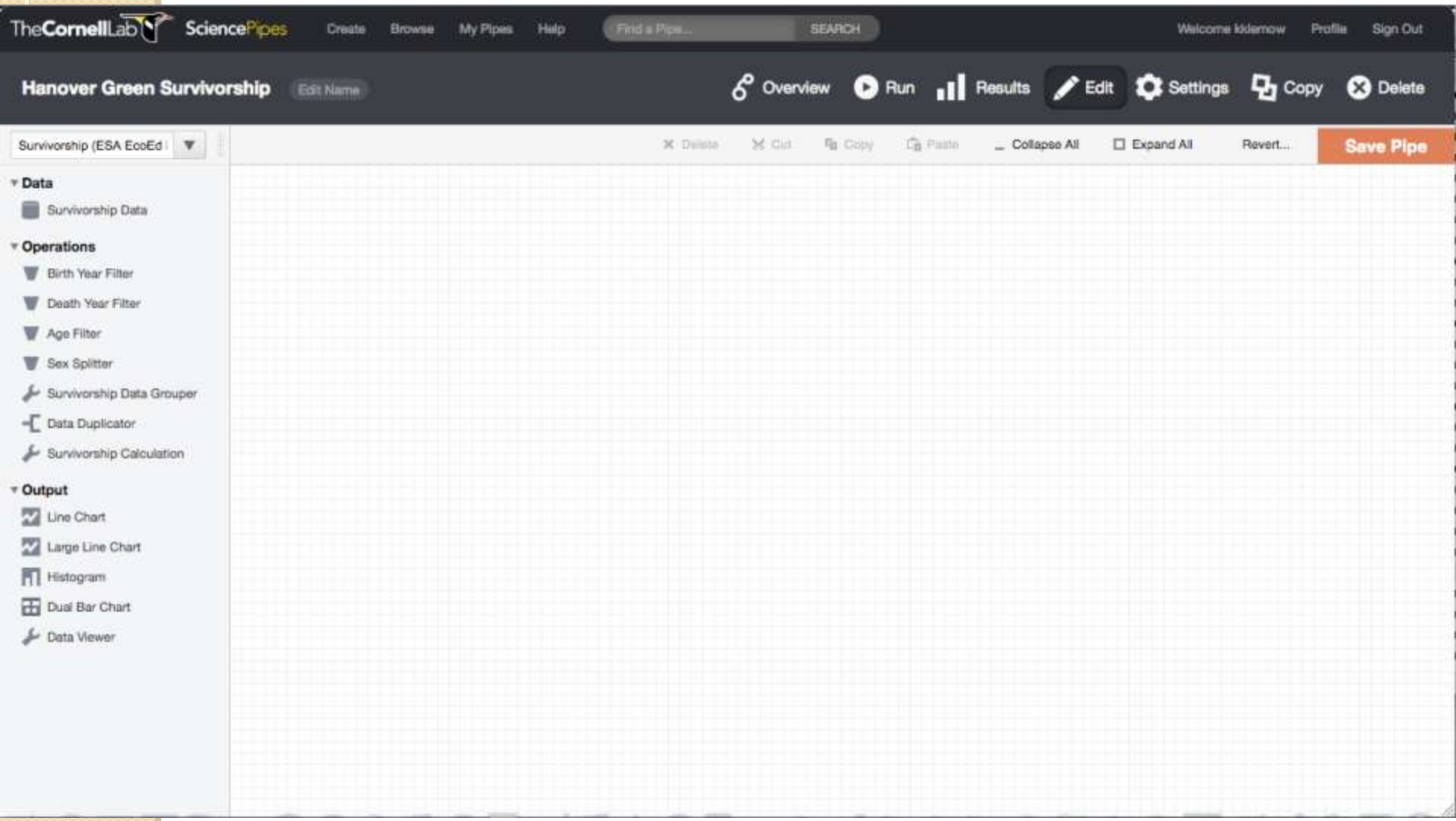
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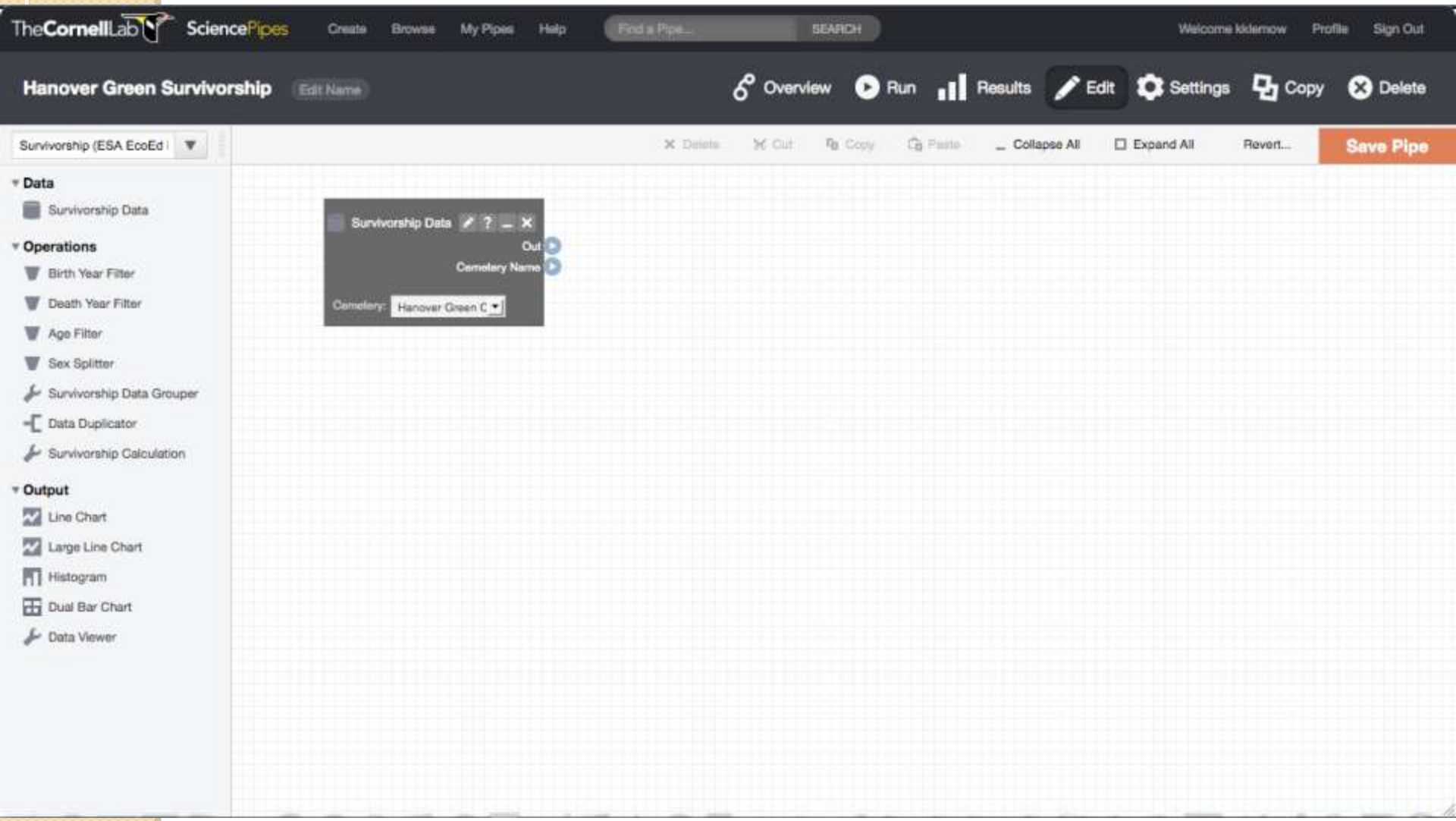
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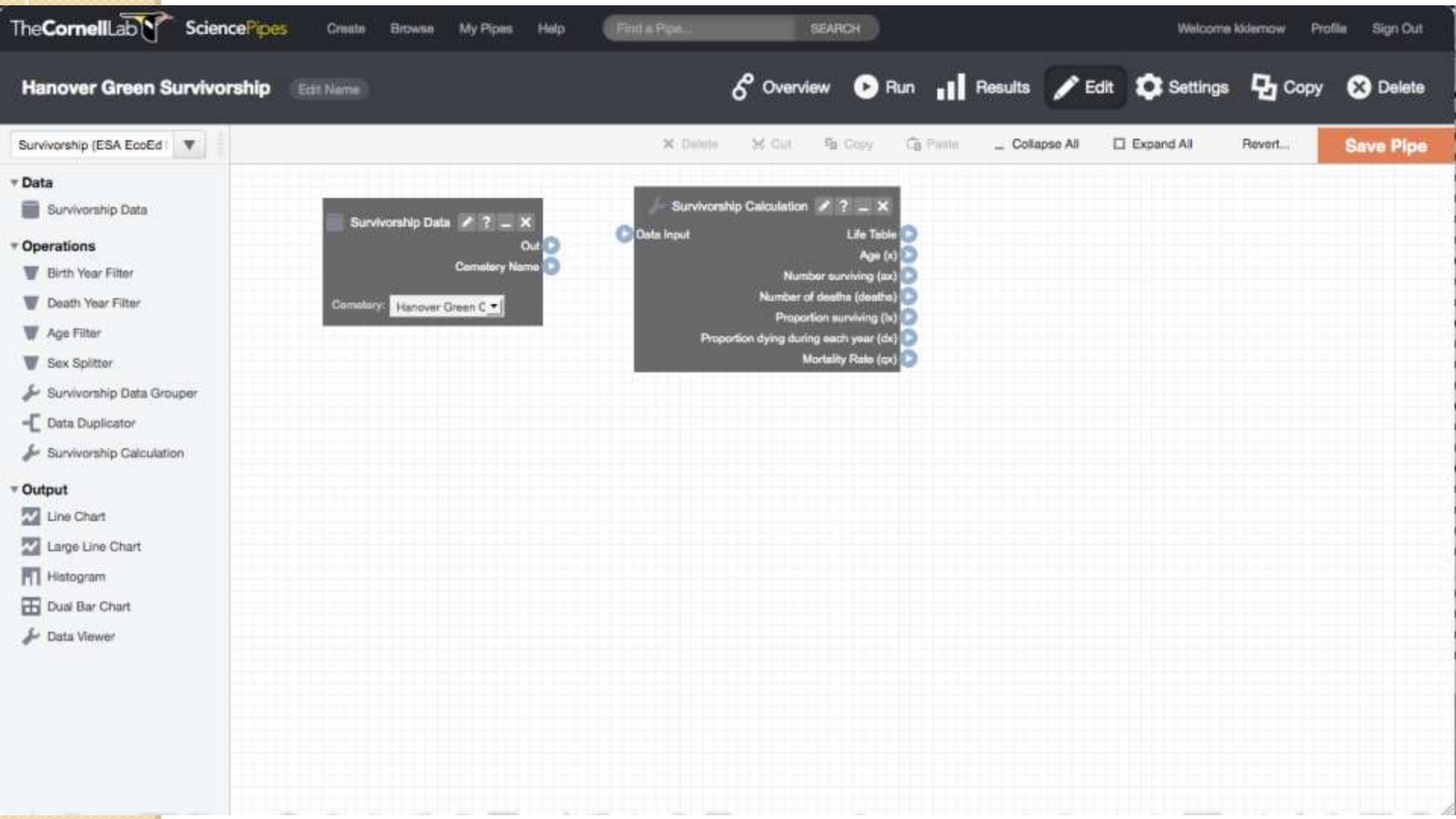
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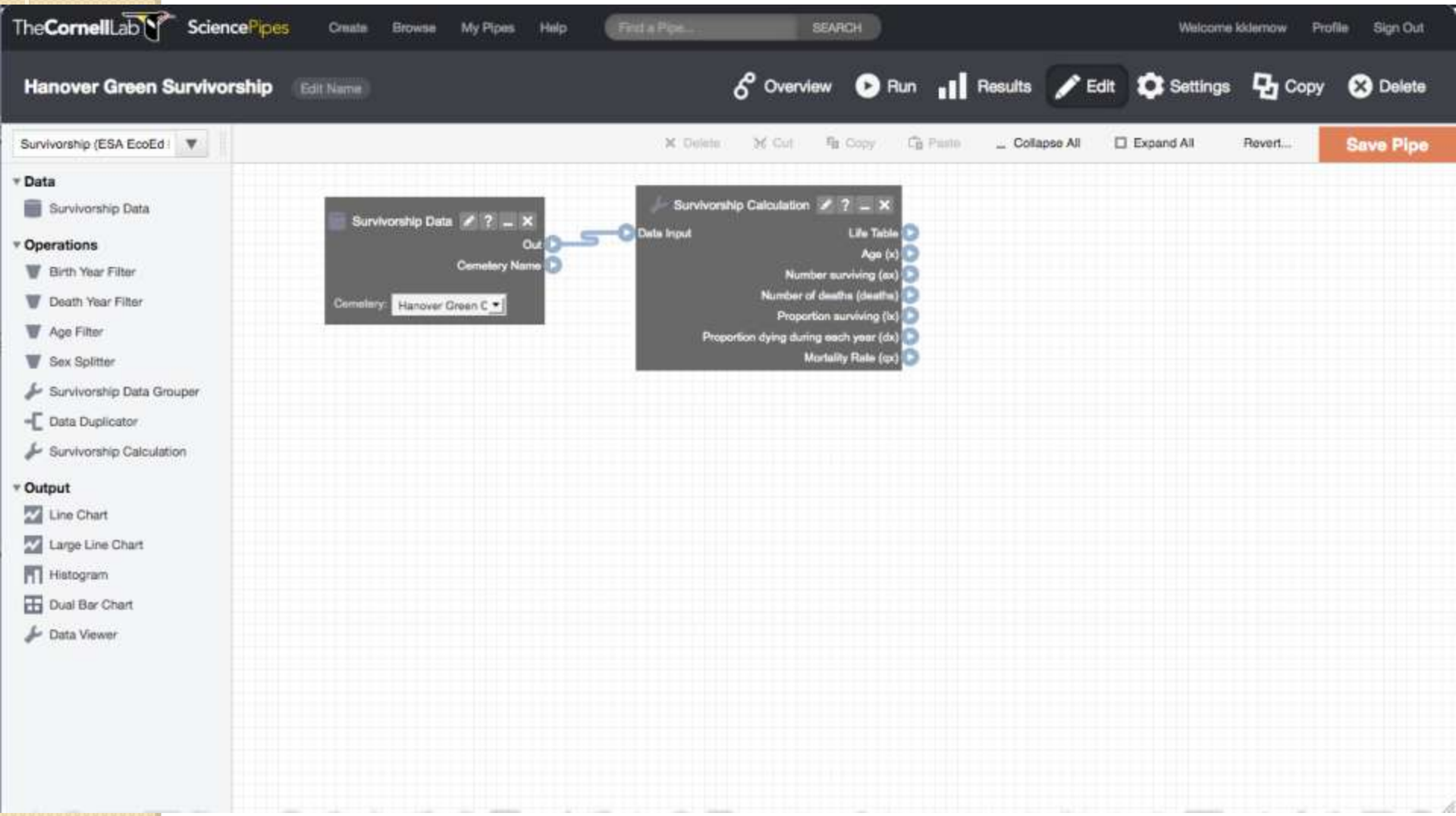
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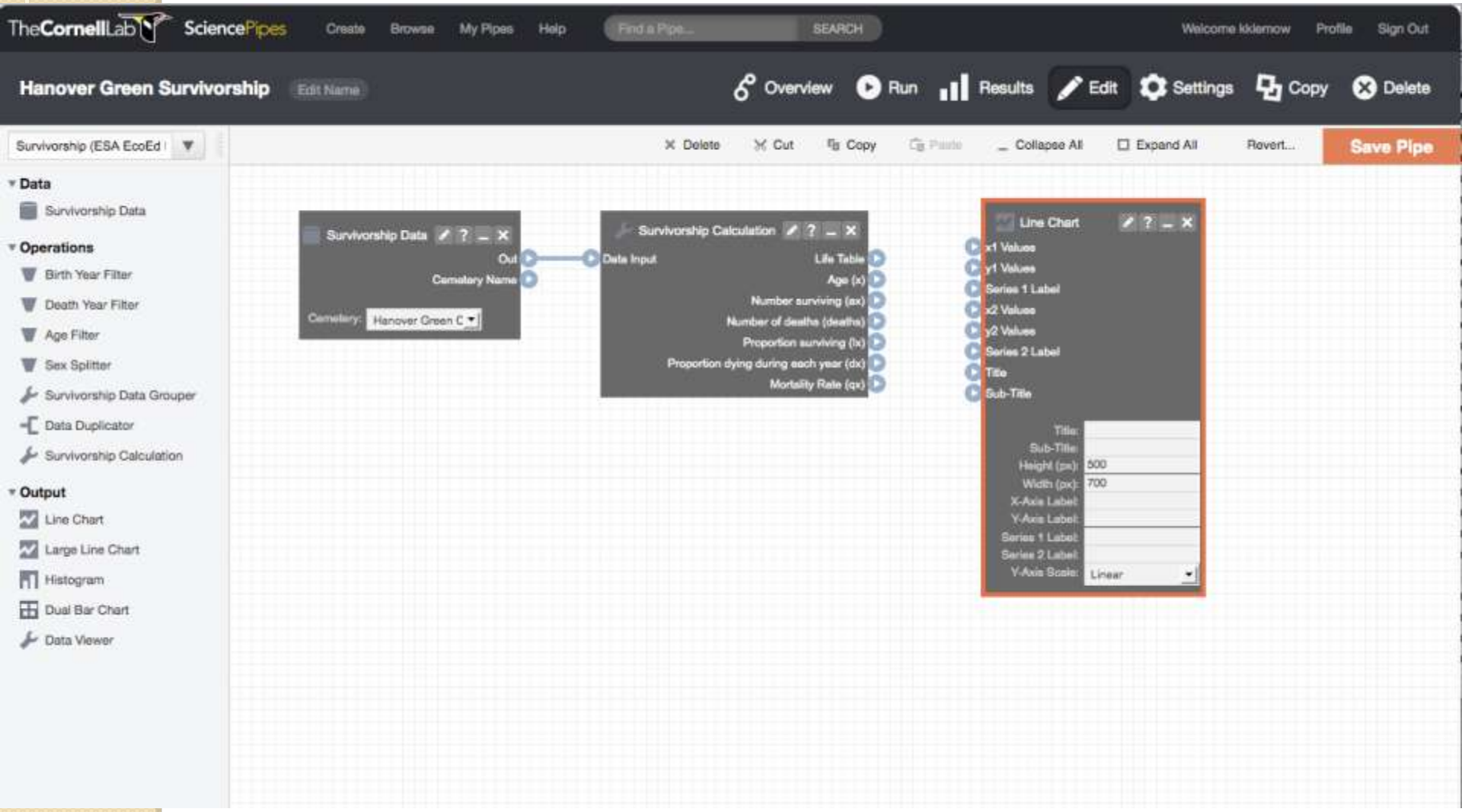
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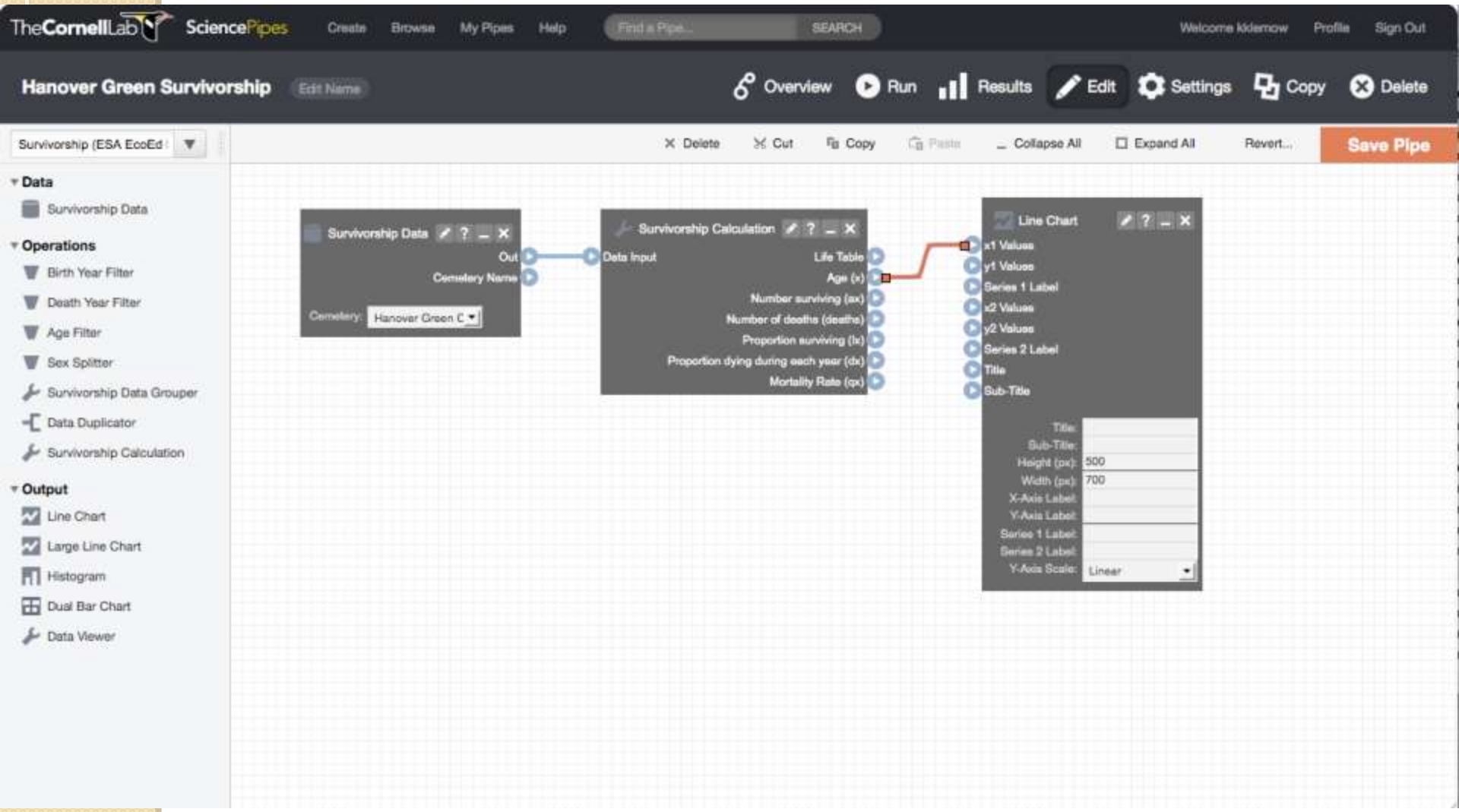
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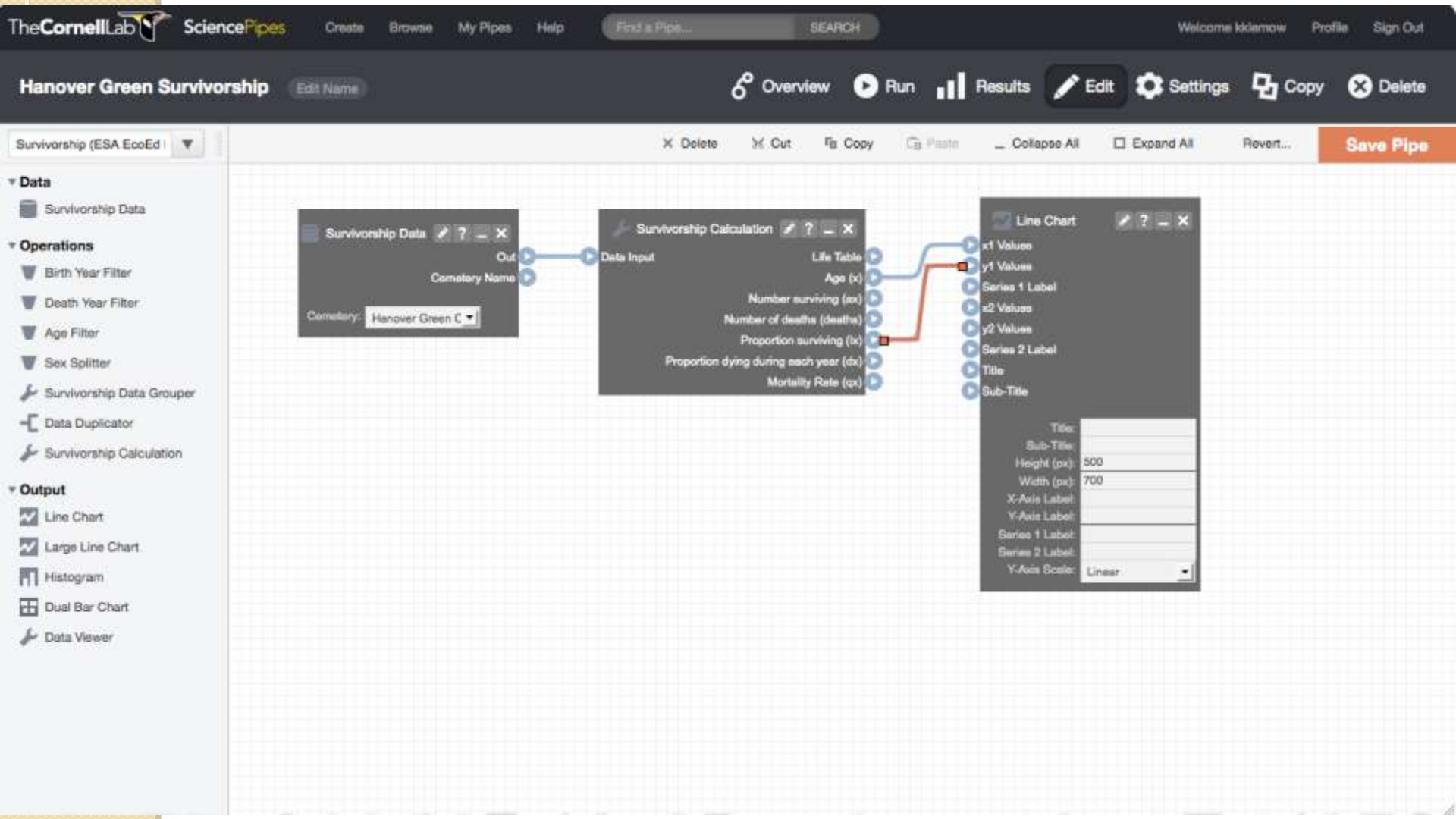
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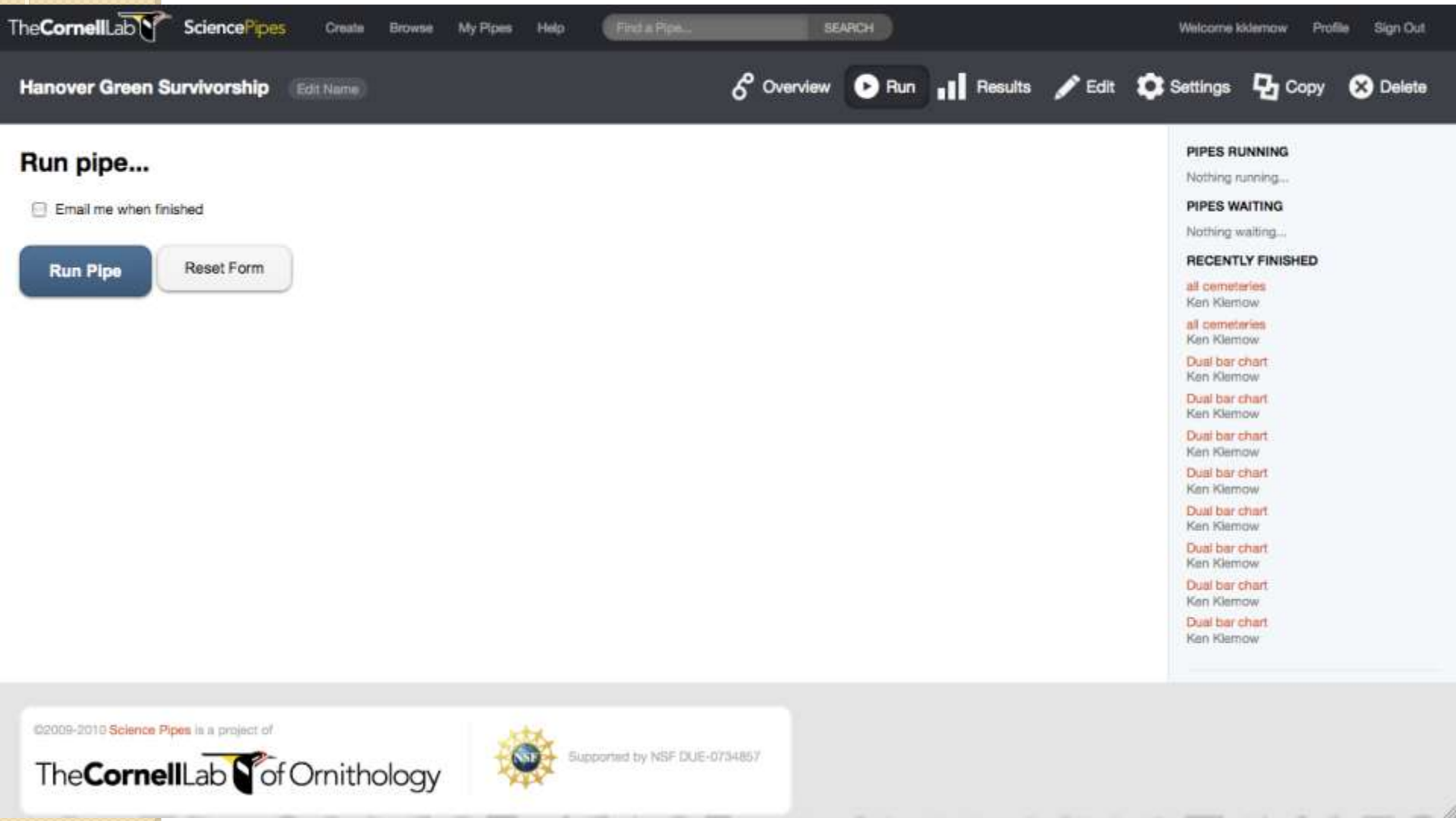
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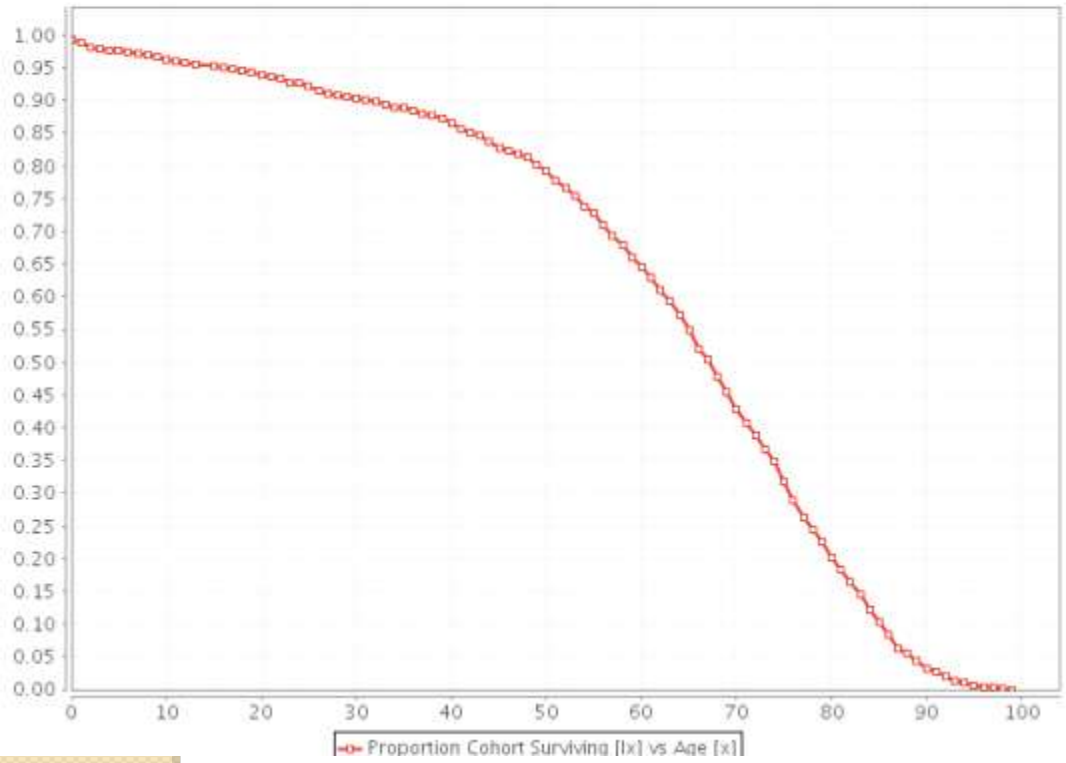

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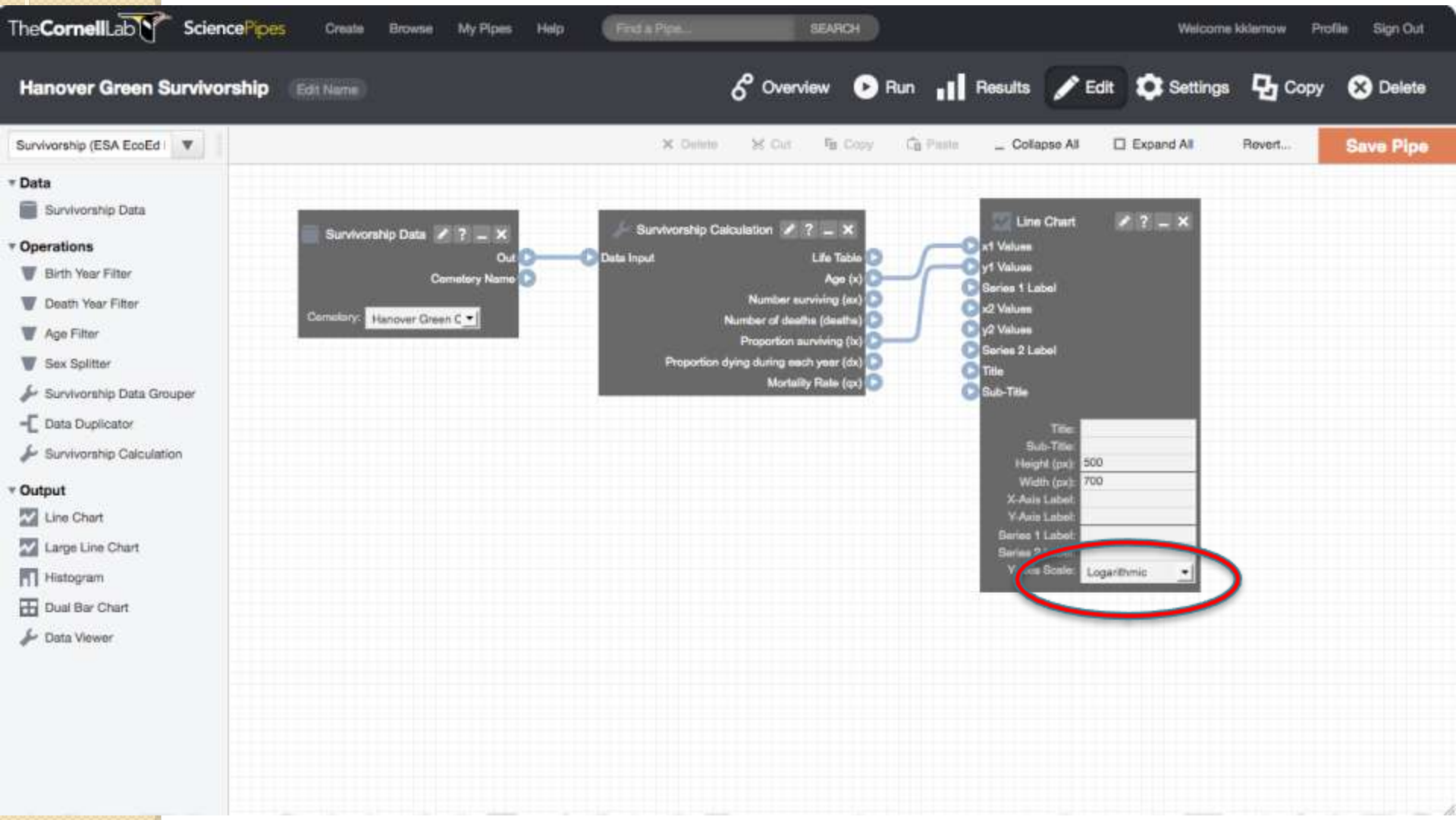
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Sign Out
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Run
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Data
Survivorship Data
Operations
Birth Year Filter
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Sex Splitter
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Survivorship Calculation
Output
Line Chart
Large Line Chart
Histogram
Dual Bar Chart
Data Viewer
Survivorship Data
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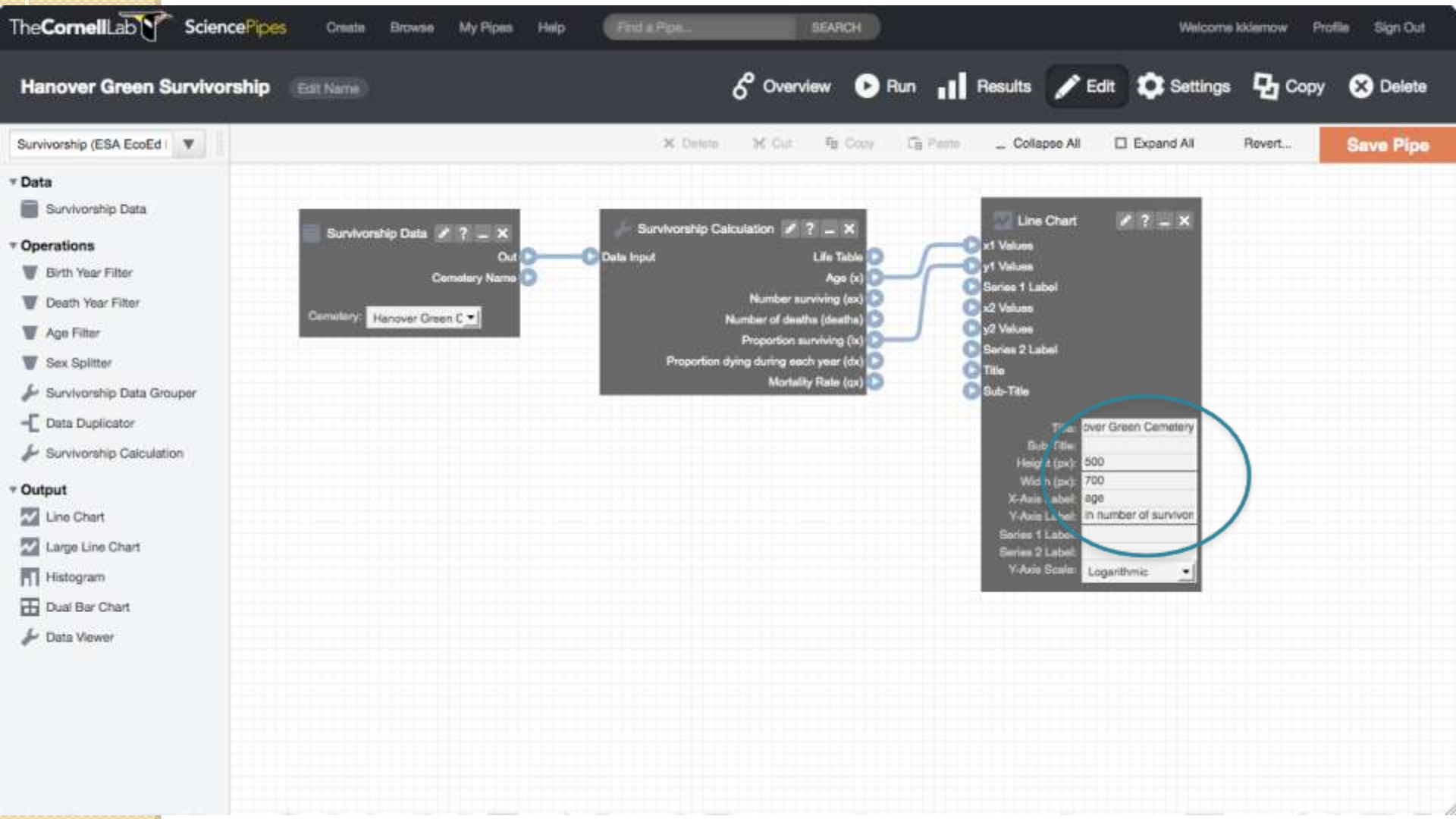
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Hanover Green Survivorship
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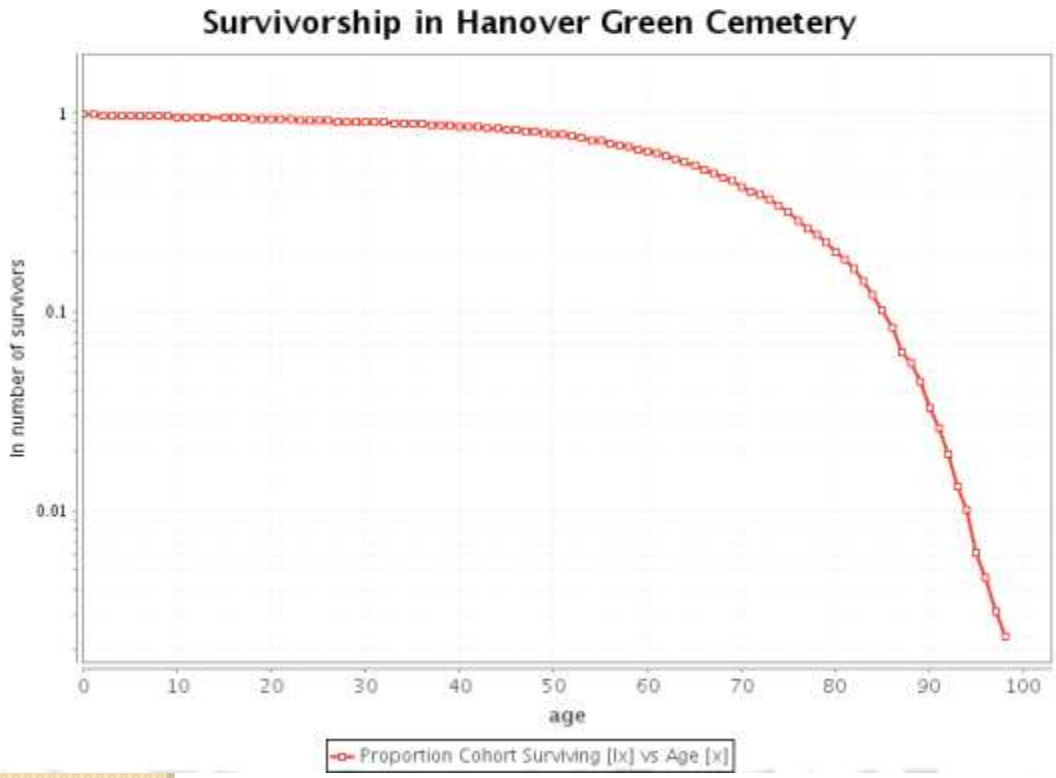
LINE CHART FIT FRAME ACTUAL SIZE NEW WINDOW HIDE



Owner: Ken Klemow
Mar 28, 2012 11:05 PM

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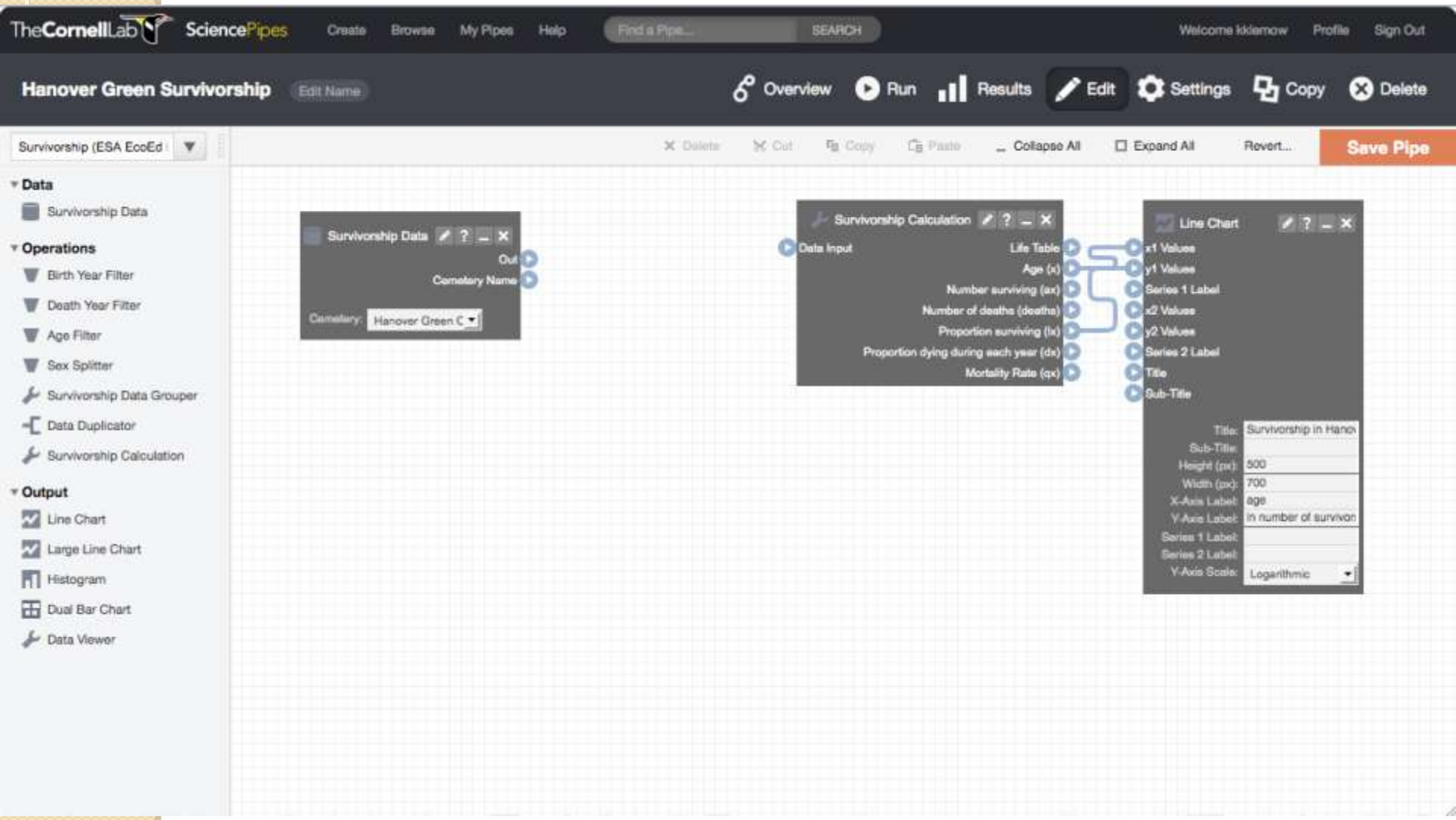
TheCornellLab SciencePipes
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Browse
My Pipes
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Find a Pipe...
SEARCH
Welcome kklemow
Profile
Sign Out
Hanover Green Survivorship
Edit Name
Overview
Run
Results
Edit
Settings
Copy
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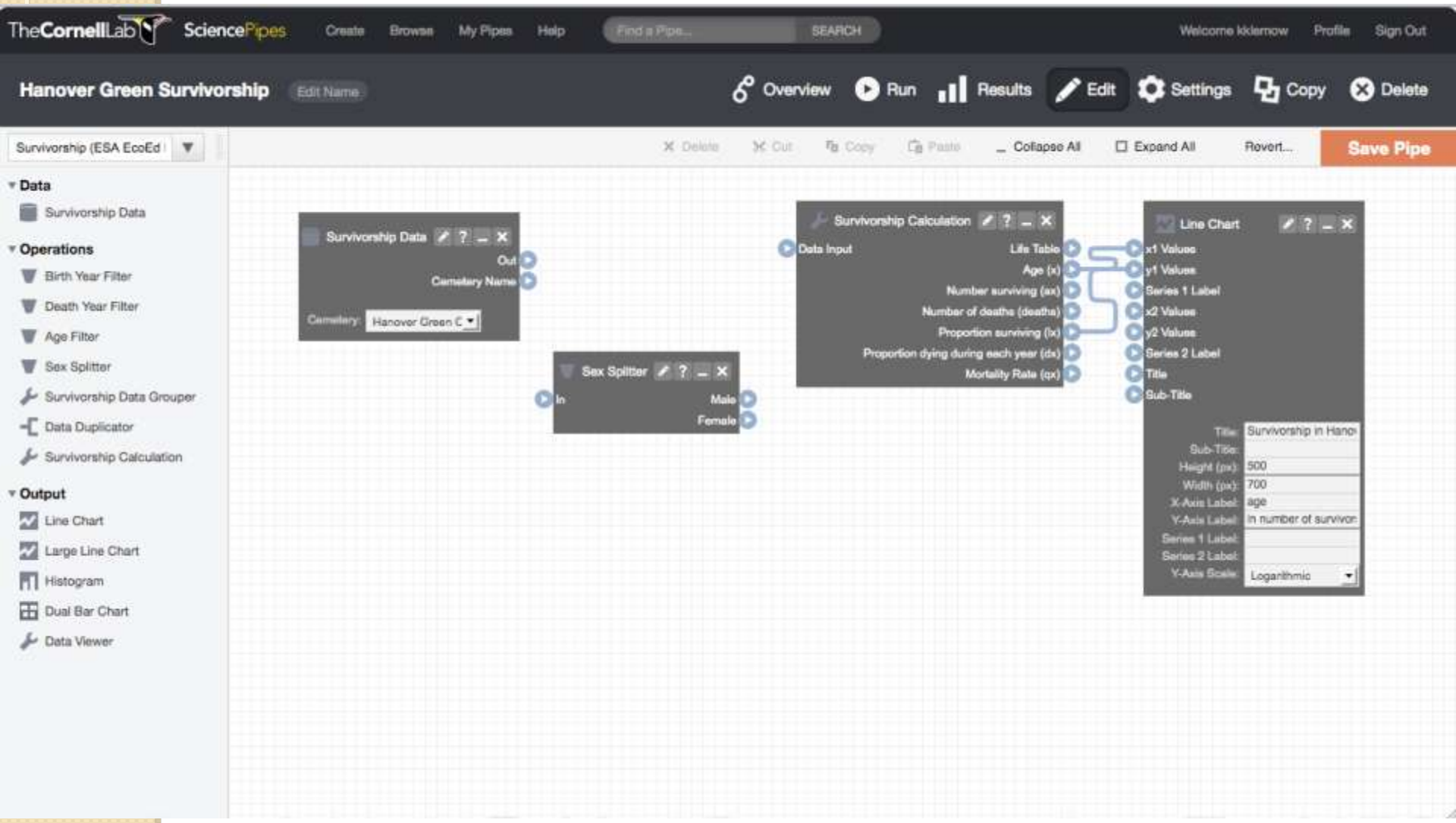
Survivorship (ESA EcoEd
Delete
Cut
Copy
Paste
Collapse All
Expand All
Revert...
Save Pipe
Data
Survivorship Data
Operations
Birth Year Filter
Death Year Filter
Age Filter
Sex Splitter
Survivorship Data Grouper
Data Duplicator
Survivorship Calculation
Output
Line Chart
Large Line Chart
Histogram
Dual Bar Chart
Data Viewer
Survivorship Data
Out
Cemetery Name
Cemetery:
Hanover Green C
Survivorship Calculation
Data Input
Life Table
Age (x)
Number surviving (ax)
Number of deaths (deaths)
Proportion surviving (lx)
Proportion dying during each year (dx)
Mortality Rate (qx)
Line Chart
x1 Values
y1 Values
Series 1 Label
x2 Values
y2 Values
Series 2 Label
Title
Sub-Title
Title:
Survivorship in Hanov
Sub-Title:
Height (px):
500
Width (px):
700
X-Axis Label:
age
Y-Axis Label:
in number of survivor
Series 1 Label:
Series 2 Label:
Y-Axis Scale:
Logarithmic


TheCornellLab SciencePipes
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SEARCH
Welcome kklemow
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Edit Name
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Paste
Collapse All
Expand All
Revert...
Save Pipe
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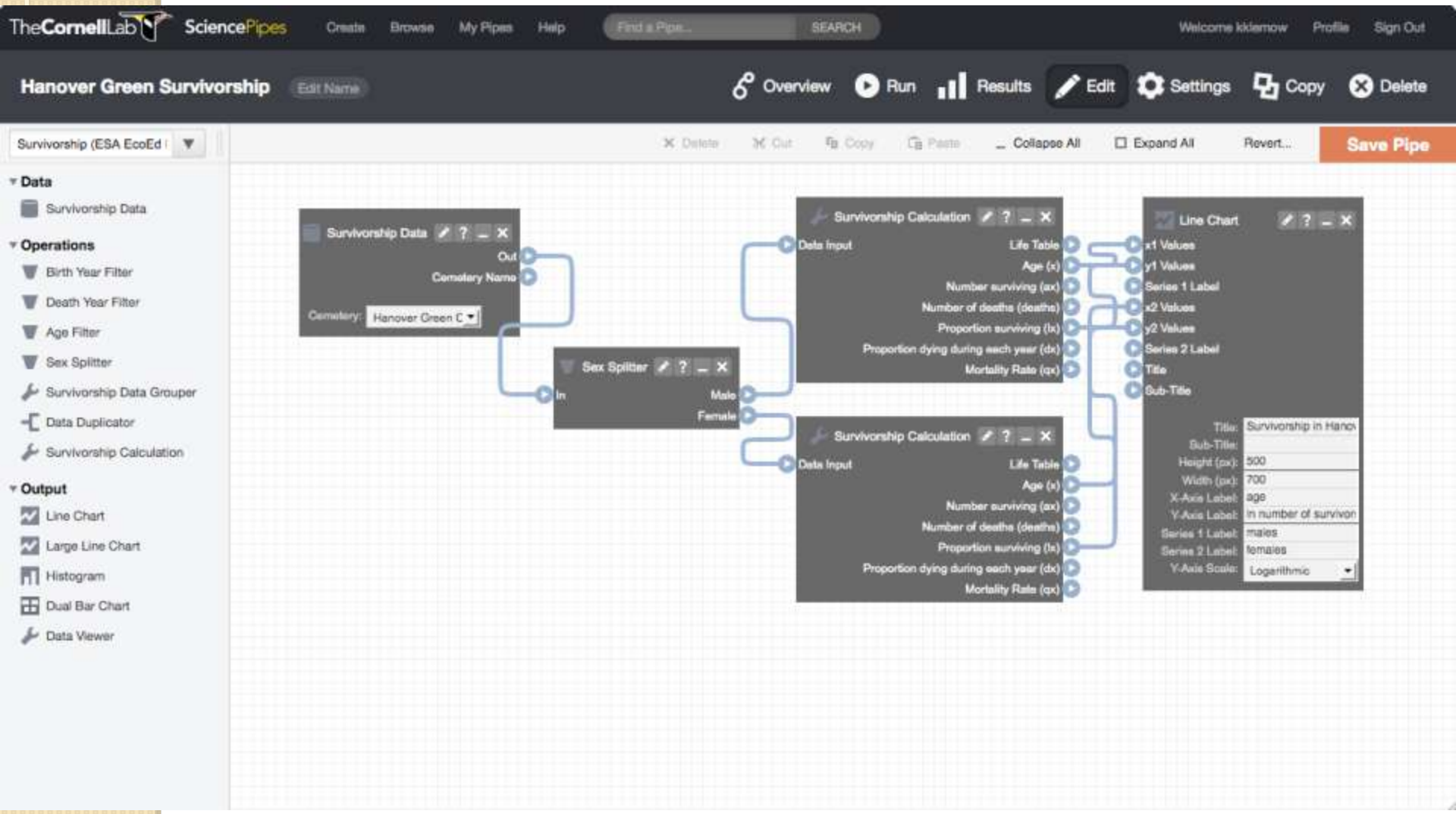
Survivorship Data
Operations
Birth Year Filter
Death Year Filter
Age Filter
Sex Splitter
Survivorship Data Grouper
Data Duplicator
Survivorship Calculation
Output
Line Chart
Large Line Chart
Histogram
Dual Bar Chart
Data Viewer
Survivorship Data
Out
Cemetery Name
Cemetery:
Hanover Green C
Sex Splitter
In
Male
Female
Survivorship Calculation
Data Input
Life Table
Age (x)
Number surviving (ax)
Number of deaths (deaths)
Proportion surviving (lx)
Proportion dying during each year (dx)
Mortality Rate (qx)
Line Chart
x1 Values
y1 Values
Series 1 Label
x2 Values
y2 Values
Series 2 Label
Title
Sub-Title
Title:
Survivorship in Hano
Sub-Title:
Height (px):
500
Width (px):
700
X-Axis Label:
age
Y-Axis Label:
n number of survivor
Series 1 Label:
Series 2 Label:
Y-Axis Scale:
Logarithmic


TheCornellLab SciencePipes
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Find a Pipe...
SEARCH
Welcome kklemow
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Survivorship (ESA EcoEd
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Cut
Copy
Paste
Collapse All
Expand All
Revert...
Save Pipe
Data
Survivorship Data
Operations
Birth Year Filter
Death Year Filter
Age Filter
Sex Splitter
Survivorship Data Grouper
Data Duplicator
Survivorship Calculation
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Line Chart
Large Line Chart
Histogram
Dual Bar Chart
Data Viewer
Survivorship Data
Out
Cemetery Name
Cemetery:
Hanover Green C
Sex Splitter
In
Male
Female
Survivorship Calculation
Data Input
Life Table
Age (x)
Number surviving (ax)
Number of deaths (deaths)
Proportion surviving (lx)
Proportion dying during each year (dx)
Mortality Rate (qx)
Survivorship Calculation
Data Input
Life Table
Age (x)
Number surviving (ax)
Number of deaths (deaths)
Proportion surviving (lx)
Proportion dying during each year (dx)
Mortality Rate (qx)
Line Chart
x1 Values
y1 Values
Series 1 Label
x2 Values
y2 Values
Series 2 Label
Title
Sub-Title
Title:
Survivorship in Hanov
Sub-Title:
Height (px):
500
Width (px):
700
X-Axis Label:
age
Y-Axis Label:
n number of survivor
Series 1 Label:
males
Series 2 Label:
females
Y-Axis Scale:
Logarithmic

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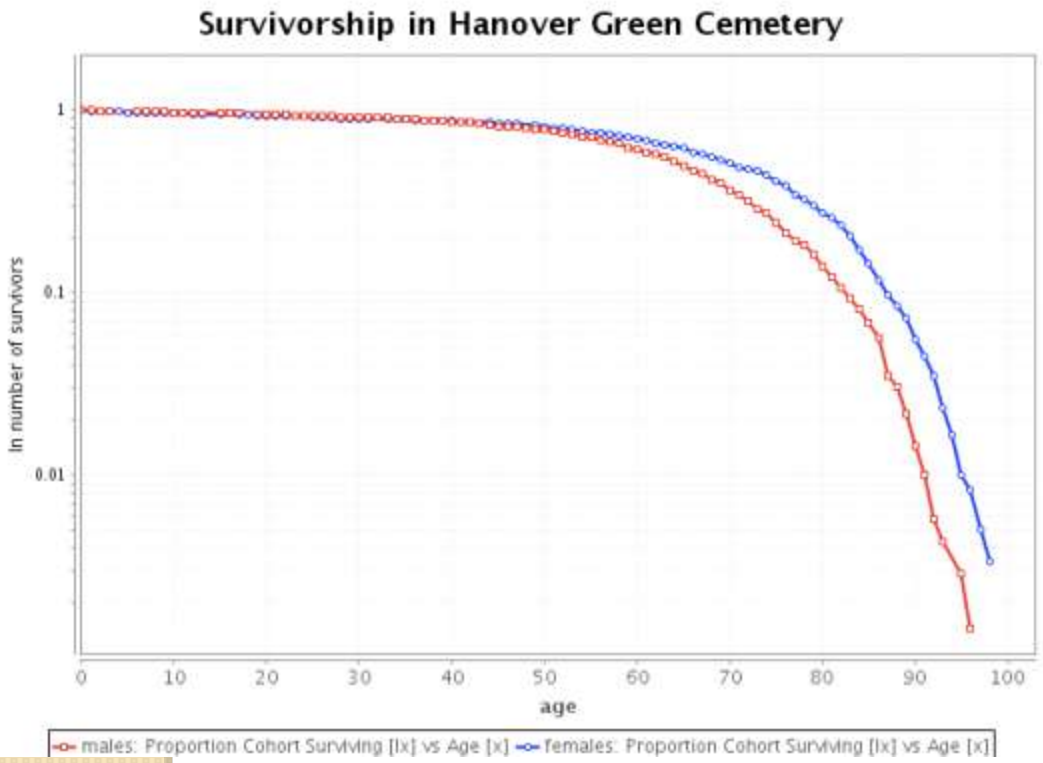
Hanover Green Survivorship Edit Name

Overview | Run | Results | Edit | Settings | Copy | Delete

Results > Mar 28, 2012 11:11 PM (1 second and 920 milliseconds) ▶ View Settings

LINE CHART — FIT FRAME | ACTUAL SIZE | NEW WINDOW | HIDE



Owner: Ken Klemow
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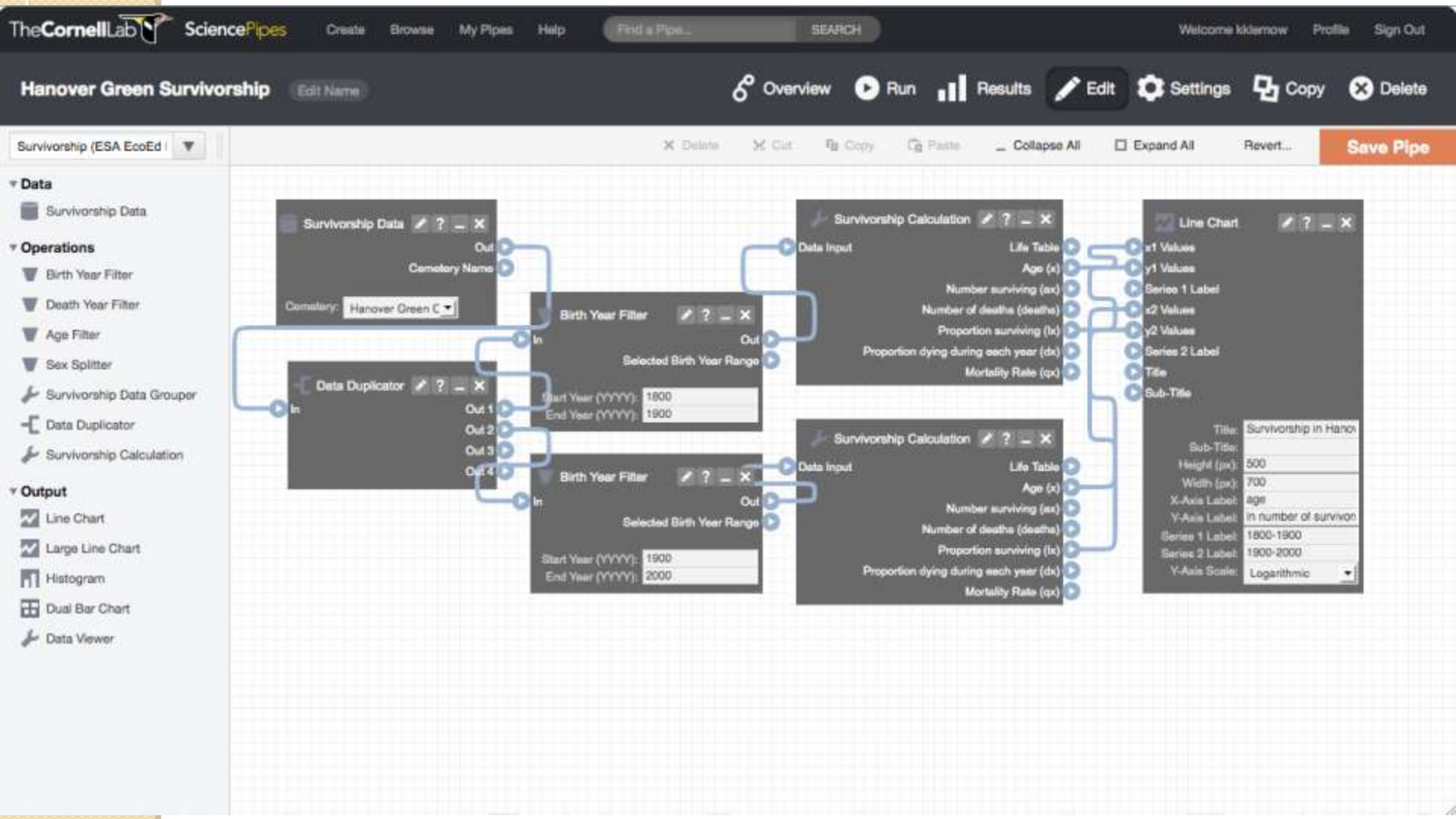
TheCornellLab SciencePipes
Create
Browse
My Pipes
Help
Find a Pipe...
SEARCH
Welcome kklemow
Profile
Sign Out
Hanover Green Survivorship
Edit Name
Overview
Run
Results
Edit
Settings
Copy
Delete
Survivorship (ESA EcoEd
Delete
Cut
Copy
Paste
Collapse All
Expand All
Revert...
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Data
Survivorship Data
Operations
Birth Year Filter
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Line Chart
Large Line Chart
Histogram
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Data Viewer
Survivorship Data
Out
Cemetery Name
Cemetery:
Hanover Green C
Data Duplicator
In
Out 1
Out 2
Out 3
Out 4
Birth Year Filter
In
Out
Selected Birth Year Range
Start Year (YYYY): 1800
End Year (YYYY): 1900
Birth Year Filter
In
Out
Selected Birth Year Range
Start Year (YYYY): 1900
End Year (YYYY): 2000
Survivorship Calculation
Data Input
Life Table
Age (x)
Number surviving (ax)
Number of deaths (dx)
Proportion surviving (lx)
Proportion dying during each year (dx)
Mortality Rate (qx)
Survivorship Calculation
Data Input
Life Table
Age (x)
Number surviving (ax)
Number of deaths (dx)
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Mortality Rate (qx)
Line Chart
x1 Values
y1 Values
Series 1 Label
x2 Values
y2 Values
Series 2 Label
Title
Sub-Title
Title: Survivorship in Hanov
Sub-Title:
Height (px): 500
Width (px): 700
X-Axis Label: age
Y-Axis Label: in number of survivor
Series 1 Label: 1800-1900
Series 2 Label: 1900-2000
Y-Axis Scale: Logarithmic

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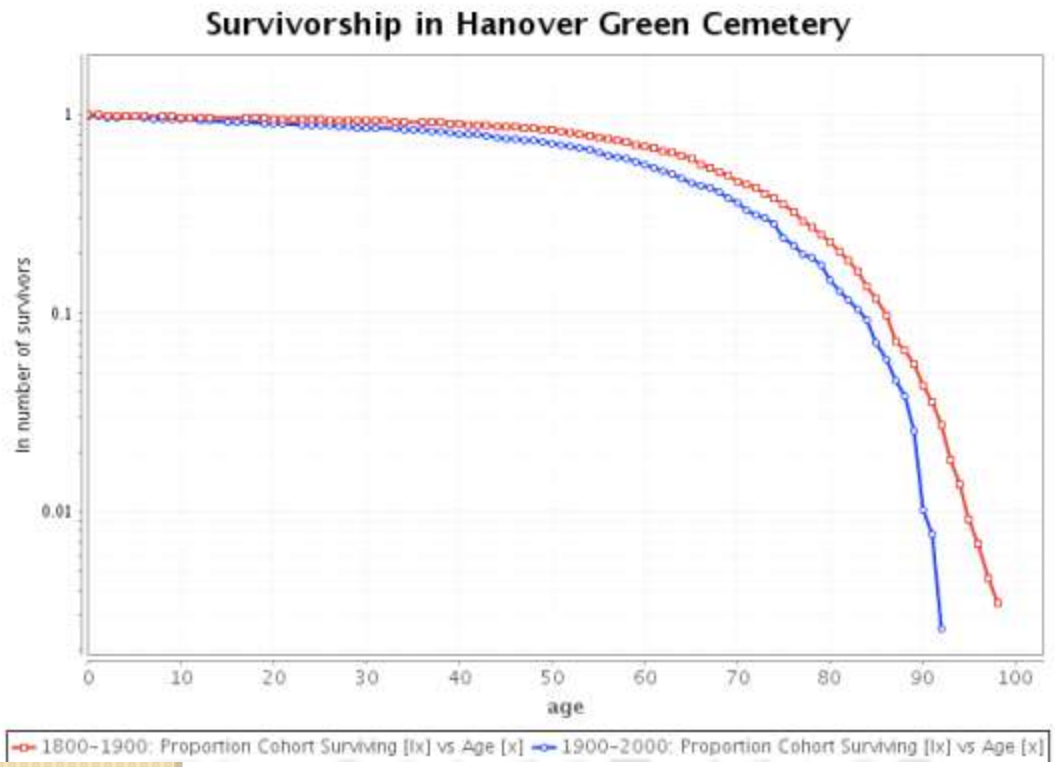
Hanover Green Survivorship Edit Name

Overview | Run | Results | Edit | Settings | Copy | Delete

Results > Mar 28, 2012 11:19 PM (2 seconds and 11 milliseconds) ▶ View Settings

LINE CHART — FIT FRAME | ACTUAL SIZE | NEW WINDOW | HIDE



Owner: Ken Klemow
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Ideas for future datasets?

- http://www.sciencepipes.org

Kenneth M. Klemow, Ph.D.

Chair, ESA Data in Ecology Classroom (DECA) Panel

Kenneth.klemow@wilkes.edu

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