Community Resilience: Demonstrating the Socioeconomic Value of Earth Science Data

Arika Virapongse
Middle Path EcoSolutions & Ronin Institute
av@middlepatheco.com

ESIP summer meeting 2018, Tucson, AZ, July 18, 2018

Session Co-organizers:

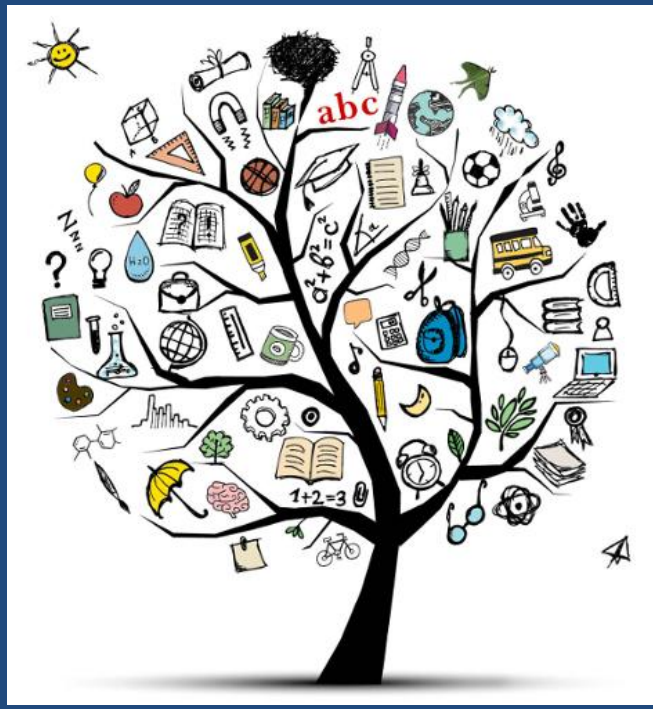
- Arika Virapongse, Middle Path EcoSolutions & Ronin Institute
- Lindsay Barbieri, University of Vermont
- Ruth Duerr, Ronin Institute
- Beth Huffer, Lingua Logica

Acknowledgements:

- Brian Wee, Neptune and Company, Inc.
- Christine White, Esri
- Elizabeth Covelli Metcalf, University of Montana

Outline

- Background
- Goals of the session
- Introduction of Presenters
- Presentations
- Feedback
- Next steps



Background

A place-based community: physical, geographically-defined entities, such as towns, cities, or incorporated rural areas, with a governance structure and an ability to engage in meaningful ways toward a structured resilience plan (Adapted from NSF S&CC)

Community resilience: a community's capacity to utilize available resources and respond to disturbances by recovering rapidly, adapting to change, building back better (bouncing forward), and improving their quality of life. (NIST, RAND, PHE)

ESIP winter 2018 session

Goals were to seek out:

- Linkages between data-driven community resilience and other ESIP work, as well as with the overall Earth Science data community
- Specific ways that ESIP can contribute to place-based community resilience

Blog:
http://esipfed.org/collaboration-updates/the-socioeconomic-value-of-earth-science-data-for-community-resilience
White paper: https://tinyurl.com/y6vl4oev
Peer-reviewed paper: Virapongse, A., R. Duerr, E.C. Metcalf (in press). Knowledge mobilization for community resilience: Perspectives from data, informatics, and information science. Sustainability science.

Results

1. Helping communities access the right tools and information
2. Documenting place-based community resilience use cases to help enable the development of useful data and information products, processes, and tools
3. Developing and sharing conceptual and technical tools that enable transdisciplinary collaboration and community resilience

Blog: http://esipfed.org/collaboration-updates/the-socioeconomic-value-of-earth-science-data-for-community-resilience
White paper: https://tinyurl.com/y6vl4oev
Peer-reviewed paper: Virapongse, A., R. Duerr, E.C. Metcalf (in press). Knowledge mobilization for community resilience: Perspectives from data, informatics, and information science.. Sustainability science.

Moving forward

- Partner with other ESIP clusters
- Create an actionable framework within ESIP
- Capture the process of our workflow

Blog:
http://esipfed.org/collaboration-updates/the-socioeconomic-value-of-earth-science-data-for-community-resilience
White paper: https://tinyurl.com/y6vl4oev
Peer-reviewed paper: Virapongse, A., R. Duerr, E.C. Metcalf (in press). Knowledge mobilization for community resilience: Perspectives from data, informatics, and information science.. Sustainability science.

Goals of the session

- Present case studies of community resilience issues that highlight their data challenges
- Seek feedback from the ESIP community on how to overcome data challenges
  - Feedback at **https://tinyurl.com/ybdz9hrk**

Presenters

Chelsie Romulo

Assistant Professor

Environmental & Sustainability Studies,
University of Northern Colorado

email: chelsie.romulo@unco.edu

“Modeling conditions that enable payments for watershed services programs”

Sari Ladin-Sienne

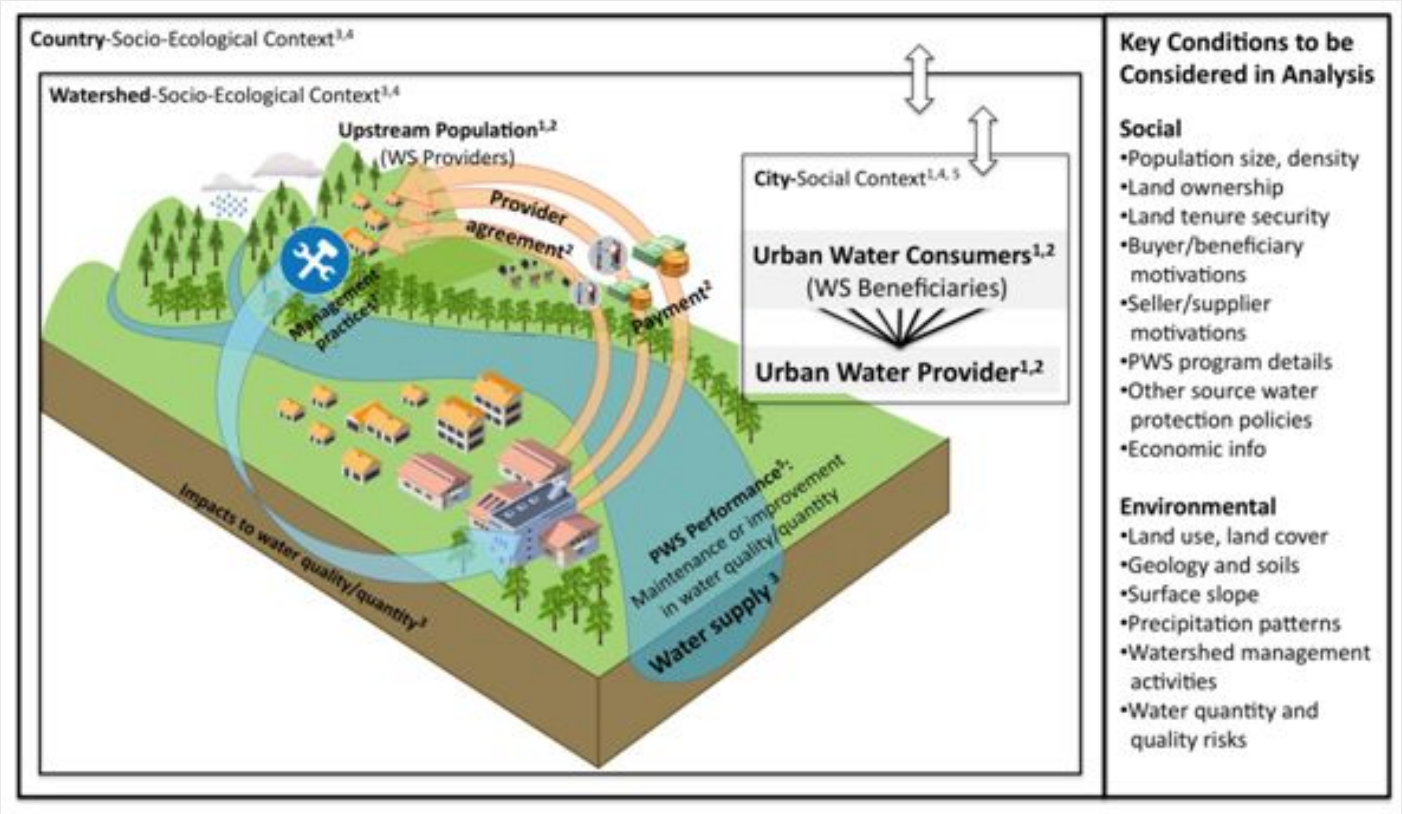
Chief Data Officer

City of Los Angeles

email: sari.ladin-Sienne@lacity.org

“From Data Literacy to Civic Action”

Modeling conditions that enable payments for watershed services programs



Chelsie L. Romulo

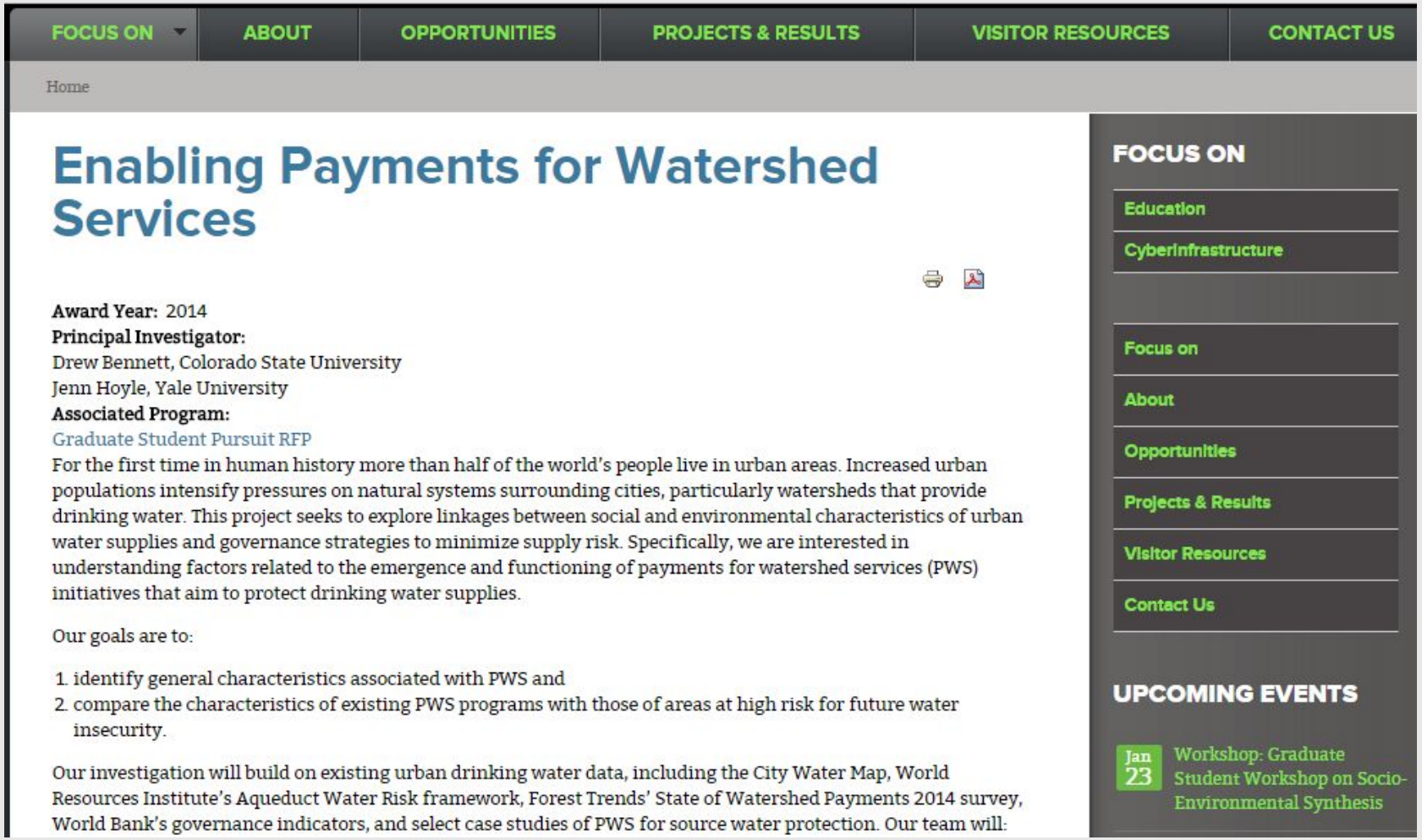
Assistant Professor, Environmental & Sustainability Studies, UNC

Drew E Bennett, Colorado State
Stella JM Cousins, UC Berkeley
Jenn Hoyle Fair, Yale University
Heidi Huber-Stearns, U of Oregon
Stephen Posner, COMPASS
Ryan C Richards, CAP

Outline

- Background
  - Investment in Watershed Services
  - The Nature Conservancy Data Concerns
- Enabling Conditions
  - Terminology
  - Literature Review
- IWS Programs
  - Enabling Condition Data
  - Modeling Importance
- Next Steps

SESYNC



FOCUS ON | ABOUT | OPPORTUNITIES | PROJECTS & RESULTS | VISITOR RESOURCES | CONTACT US

Home

Enabling Payments for Watershed Services

Award Year: 2014
Principal Investigator:
Drew Bennett, Colorado State University
Jenn Hoyle, Yale University
Associated Program:
Graduate Student Pursuit RFP

For the first time in human history more than half of the world's people live in urban areas. Increased urban populations intensify pressures on natural systems surrounding cities, particularly watersheds that provide drinking water. This project seeks to explore linkages between social and environmental characteristics of urban water supplies and governance strategies to minimize supply risk. Specifically, we are interested in understanding factors related to the emergence and functioning of payments for watershed services (PWS) initiatives that aim to protect drinking water supplies.

Our goals are to:

1. identify general characteristics associated with PWS and
2. compare the characteristics of existing PWS programs with those of areas at high risk for future water insecurity.

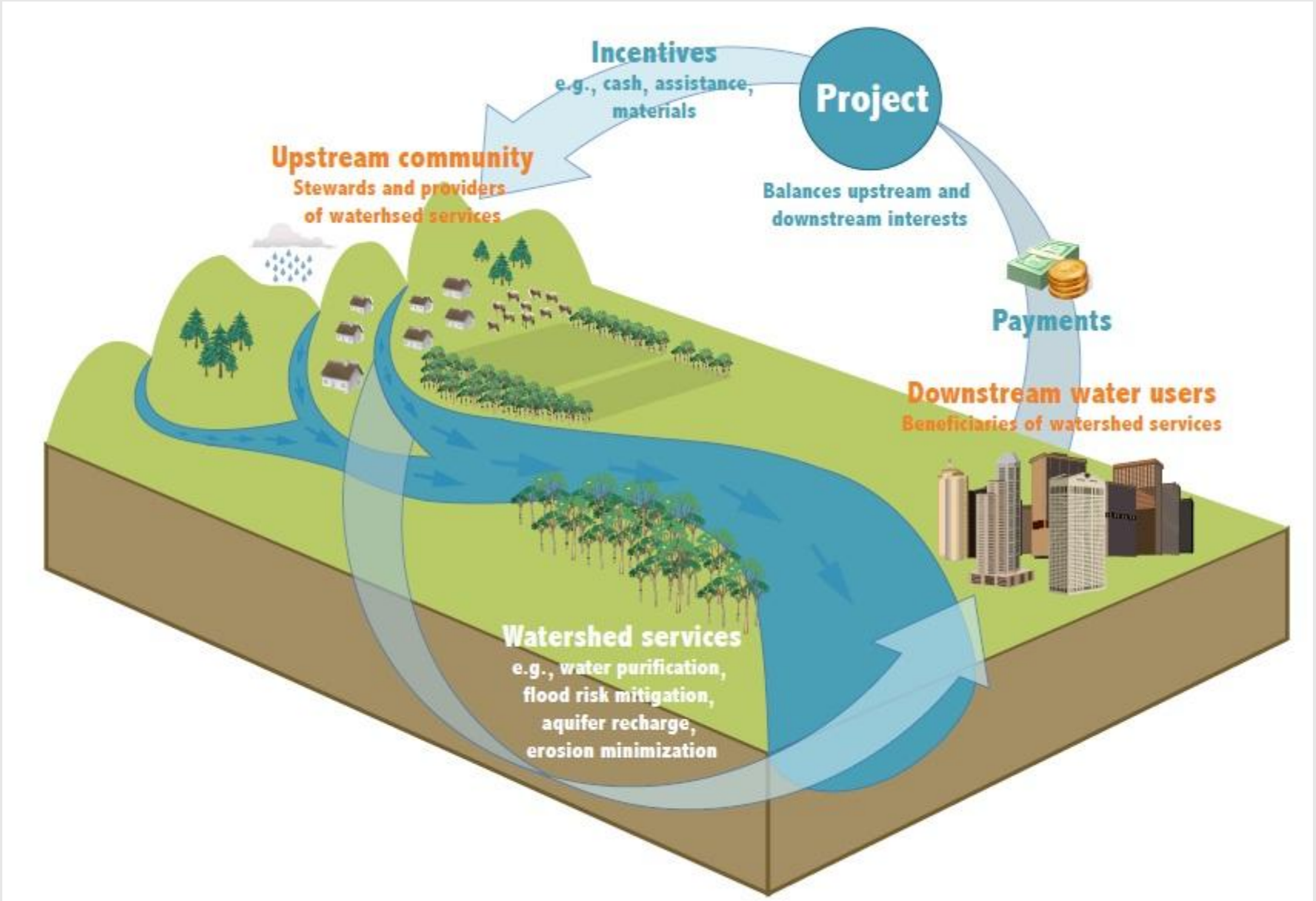
Our investigation will build on existing urban drinking water data, including the City Water Map, World Resources Institute's Aqueduct Water Risk framework, Forest Trends' State of Watershed Payments 2014 survey, World Bank's governance indicators, and select case studies of PWS for source water protection. Our team will:

FOCUS ON
Education
Cyberinfrastructure
Focus on
About
Opportunities
Projects & Results
Visitor Resources
Contact Us

UPCOMING EVENTS
Jan 23 Workshop: Graduate Student Workshop on Socio-Environmental Synthesis

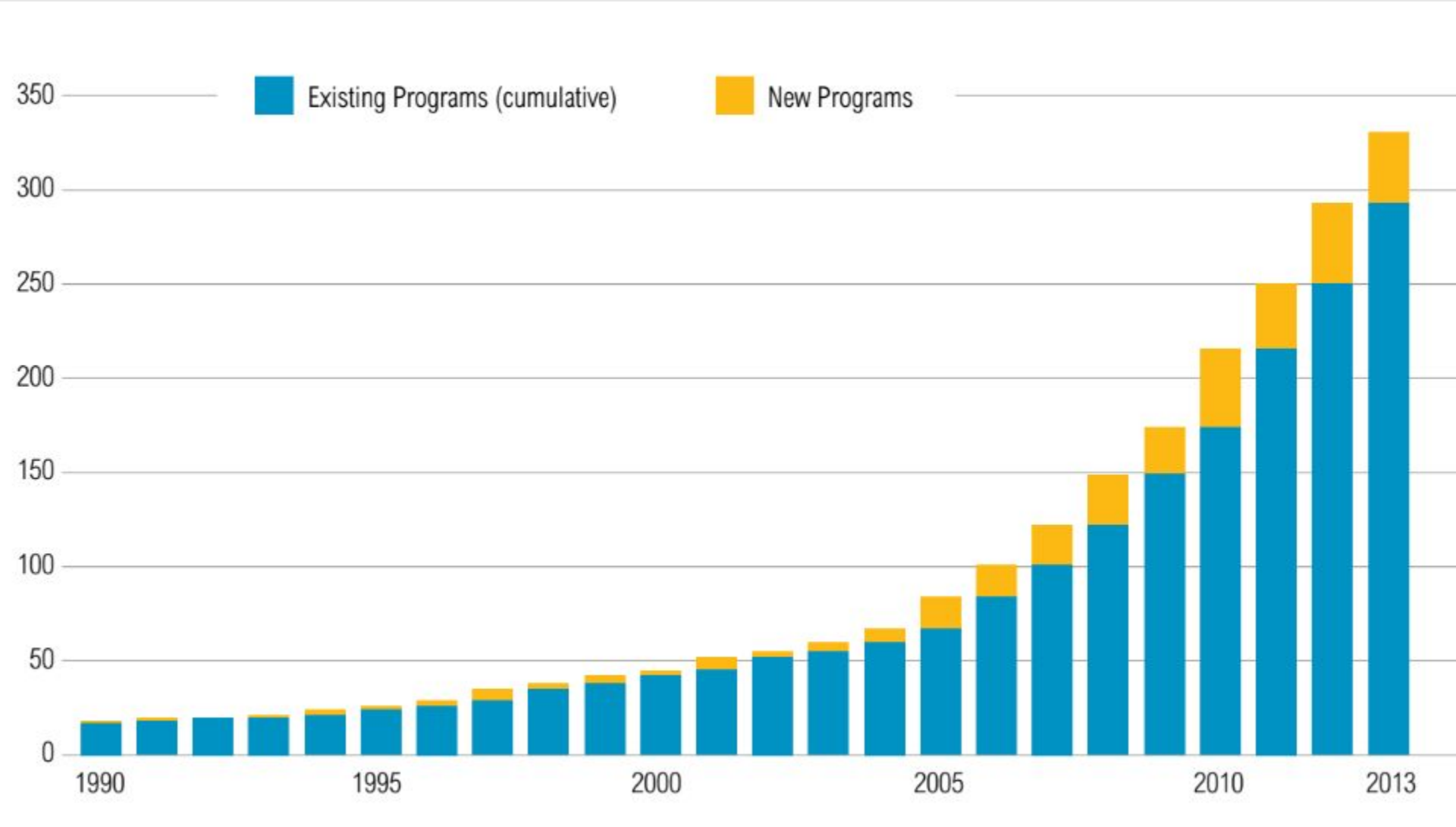
https://www.sesync.org/project/graduate-student-pursuit-rfp/enabling-payments-for-watershed-services

Investment in Watershed Services Programs



Source: Bennett & Ruef 2016

Number of Global Watershed Investment Programs 1990-2013



Source: Bennett & Carroll 2014

Establishing Water Funds

The Nature Conservancy

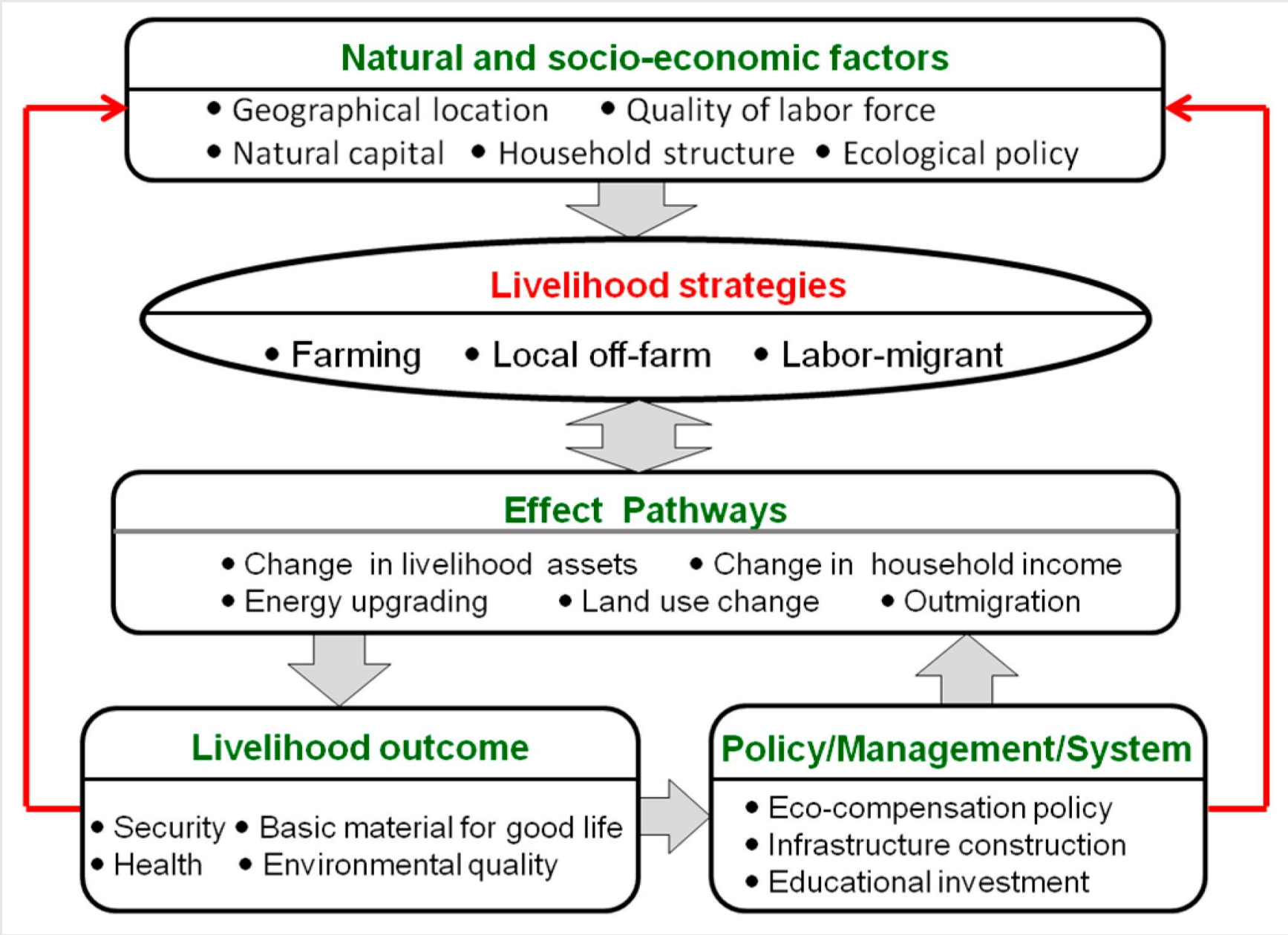
OUR WORK GET INVOLVED ABOUT US

Latin America

Creating Water Funds for People and Nature

Water funds help to provide fresh water today and into the future.

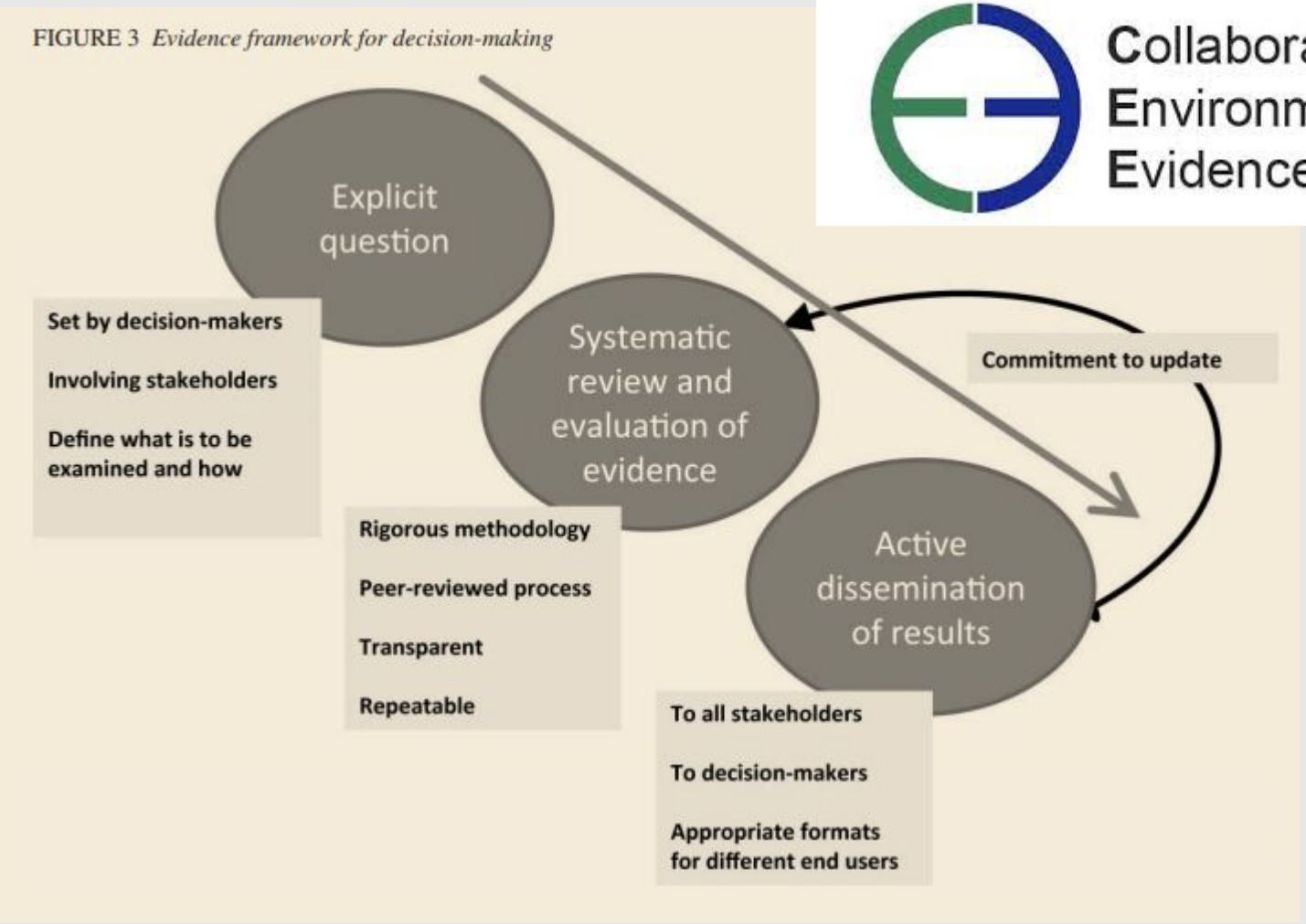
Nature Conservancy Data Needs



Nature Conservancy Data Needs

We hypothesized that there ARE general conditions that are important, and that some are more important than others.

Systematic Review

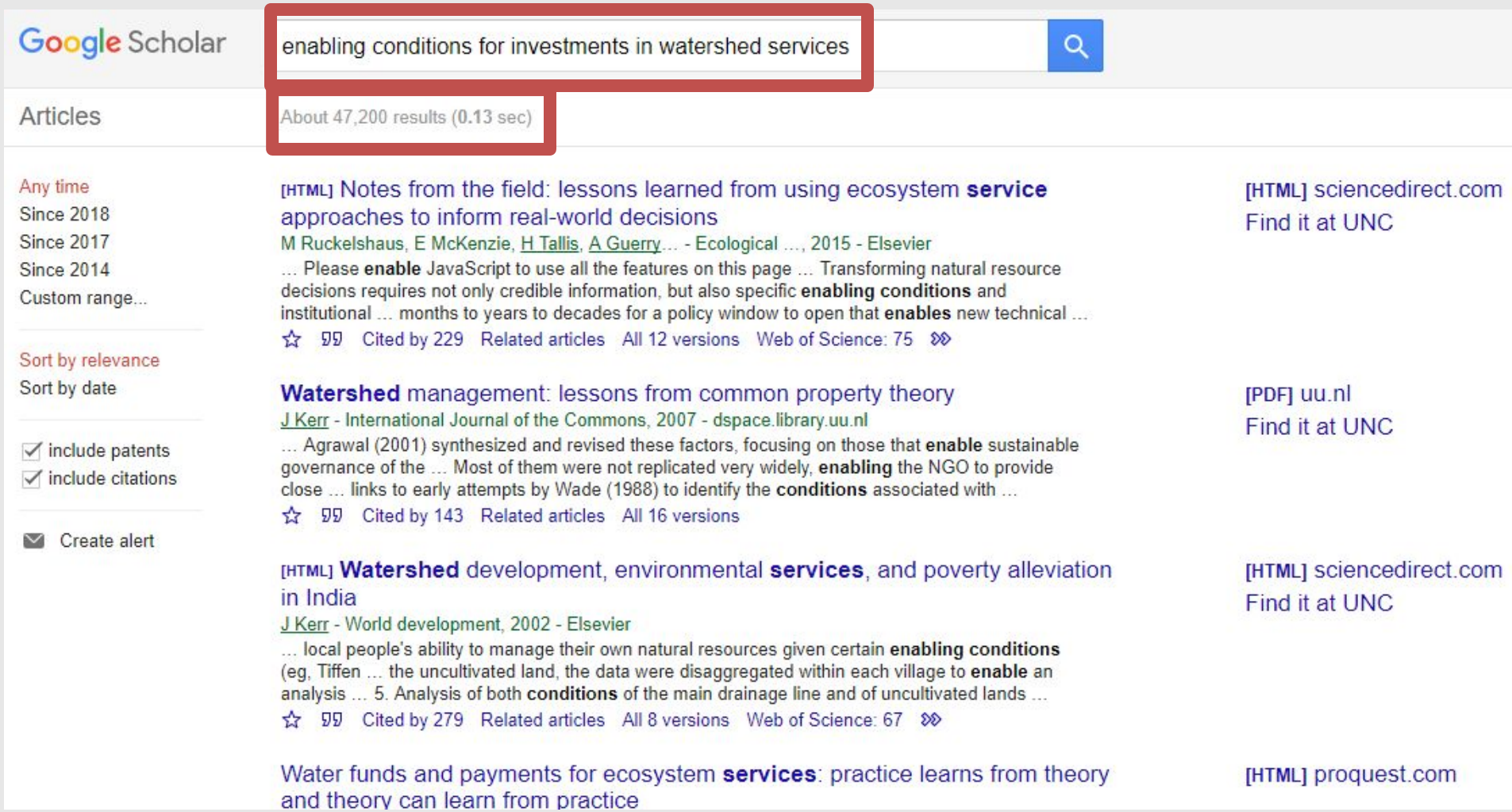


Collaboration for Environmental Evidence

Petrofsky et al. 2011
https://doi.org/10.1505/146554811798201161

The Collaboration for Environmental Evidence
http://www.environmentalevidence.org/

Systematic Review



Enabling Conditions

Terminology	Focal Area(s)	Citation
Variables associated with self-organization for collective action	Collective action, new institutional economics	Ostrom 2009
Facilitating conditions for the successful governance of common-pool resources; *Critical enabling conditions* for sustainability on the commons	Collective action, common-pool resources	Agrawal 2001
Antecedent conditions associated with the successful adoption and operation of community-based collaborative governance arrangements	Collaborative governance	Weber 2009
Appropriate social arrangement for dealing with harmful effects	Transaction cost economics	Coase 1960
Enabling conditions for policy implementation	Ecology, biodiversity conservation	Rands et al. 2010
Preconditions for policy diffusion	Environmental policy, policy diffusion	Kern et al. 2001
Social dimension that enables adaptive ecosystem-based management	Resilience theory, adaptive governance	Folke et al. 2005

NOTE: Inconsistent data terminology

Source: Huber-Stearns et al. 2017

Enabling Conditions

Factors that increase the likelihood of an intended change in the governance approach, strategy, or management regime.

NOTE: Lack of enabling conditions can create a barrier to intended change.

Enabling Conditions

Huber-Stearns, H. R., D. E. Bennett, S. Posner, R. C. Richards, J. B. H. Fair, S. J. M. Cousins, and C. L. Romulo. 2017. Social-ecological enabling conditions for payments for ecosystem services. *Ecology and Society* 22(1):18. https://doi.org/10.5751/ES-08979-220118

Synthesis

Social-ecological enabling conditions for payments for ecosystem services

Heidi R. Huber-Stearns[1], *Drew E. Bennett*[2], *Stephen Posner*[3,4], *Ryan C. Richards*[5,6], *Jenn Hoyle Fair*[7], *Stella J. M. Cousins*[8] *and Chelsie L. Romulo*[5,6]

ABSTRACT. The concept of "enabling conditions" centers on conditions that facilitate approaches to addressing social and ecological challenges. Although multiple fields have independently addressed the concept of enabling conditions, the literature lacks a shared understanding or integration of concepts. We propose a more synthesized understanding of enabling conditions beyond disciplinary boundaries by focusing on the enabling conditions that influence the implementation of a range of environmental policies termed payments for ecosystem services (PES). Through an analysis of key literature from different disciplinary perspectives, we examined how researchers and practitioners refer to and identify enabling conditions within the context of PES. Through our synthesis, we identified 24 distinct enabling conditions organized within 4 broad themes: biophysical, economic, governance, and social-cultural conditions. We found that the literature coalesces around certain enabling conditions, such as strong ecosystem science and existing institutions, regardless of disciplinary background or journal audience. We also observed key differences in how authors perceive the direction of influence for property type, program objectives, and number of actors. Additionally, we noted an emphasis on the importance of the contextual nature of many enabling conditions that may cause certain conditions to have a disproportionate impact on successful implementation in some circumstances. Unraveling the relative importance of specific enabling conditions in diverse contexts remains a research frontier. Ultimately, no single disciplinary perspective is likely to provide all necessary insights for PES creation, and given the intertwined nature of enabling conditions, practitioners need to consider insights from multiple dimensions. Our work suggests opportunities to better connect diverse conversations through integration of concepts, a common vocabulary, and a synthetic framework.

Key Words: *content analysis; enabling conditions; environmental governance; environmental synthesis; payments for ecosystem services; social-ecological systems*

Enabling Conditions

Biophysical conditions

- Small resource area
- Resource location & arrangement
- Well-defined boundaries of PES system
- Existing fundamental ecosystem science and baseline data
- Linkages between ES provision and management practices
- Clear threat or risk to ES

Economic conditions

- Significant value of ES
- Low opportunity costs
- Manageable transaction costs
- Defining ES as an economic good or service
- Economic growth

Governance conditions

- Presence/absence of intermediaries
- Strong capacity among actors
- Influential champion
- Strong existing institutions
- Secure land tenure & property type
- Fit of governance structure with scale of PES
- Multiple/single PES objectives

Sociocultural conditions

- Trust & transparency among actors
- Stakeholder communication & engagement
- Pre-existing market based culture
- Participant willingness
- Proximity of actors to each other
- Large/small number of actors

Source: Huber-Stearns et al. 2017

Enabling Conditions

Which conditions are most important for establishing and sustaining programs?

Enabling Conditions

Huber-Stearns, H. R., D. E. Bennett, S. Posner, R. C. Richards, J. B. H. Fair, S. J. M. Cousins, and C. L. Romulo. 2017. Social-ecological enabling conditions for payments for ecosystem services. *Ecology and Society* 22(1):18. https://doi.org/10.5751/ES-08979-220118

Synthesis

Social-ecological enabling conditions for payments for ecosystem services

Heidi R. Huber-Stearns[1], Drew E. Bennett[2], Stephen Posner[3,4], Ryan C. Richards[5,6], Jenn Hoyle Fair[7], Stella J. M. Cousins[8] and Chelsie L. Romulo[5,6]

ABSTRACT. The concept of "enabling conditions" centers challenges. Although multiple fields have independently a understanding or integration of concepts. We propose a m boundaries by focusing on the enabling conditions that i payments for ecosystem services (PES). Through an analy how researchers and practitioners refer to and identify e identified 24 distinct enabling conditions organized withi conditions. We found that the literature coalesces around institutions, regardless of disciplinary background or jour direction of influence for property type, program objectives, of the contextual nature of many enabling conditions that n implementation in some circumstances. Unraveling the rel a research frontier. Ultimately, no single disciplinary persp the intertwined nature of enabling conditions, practitione opportunities to better connect diverse conversations throug

Key Words: *content analysis; enabling conditions; environm social-ecological systems*

DRAFT MANUSCRIPT
PLEASE DO NOT CIRCULATE OR CITE

Title:

Global State and Potential Scope of Investments in Watershed Services to Manage Urban Water Supplies

Abstract

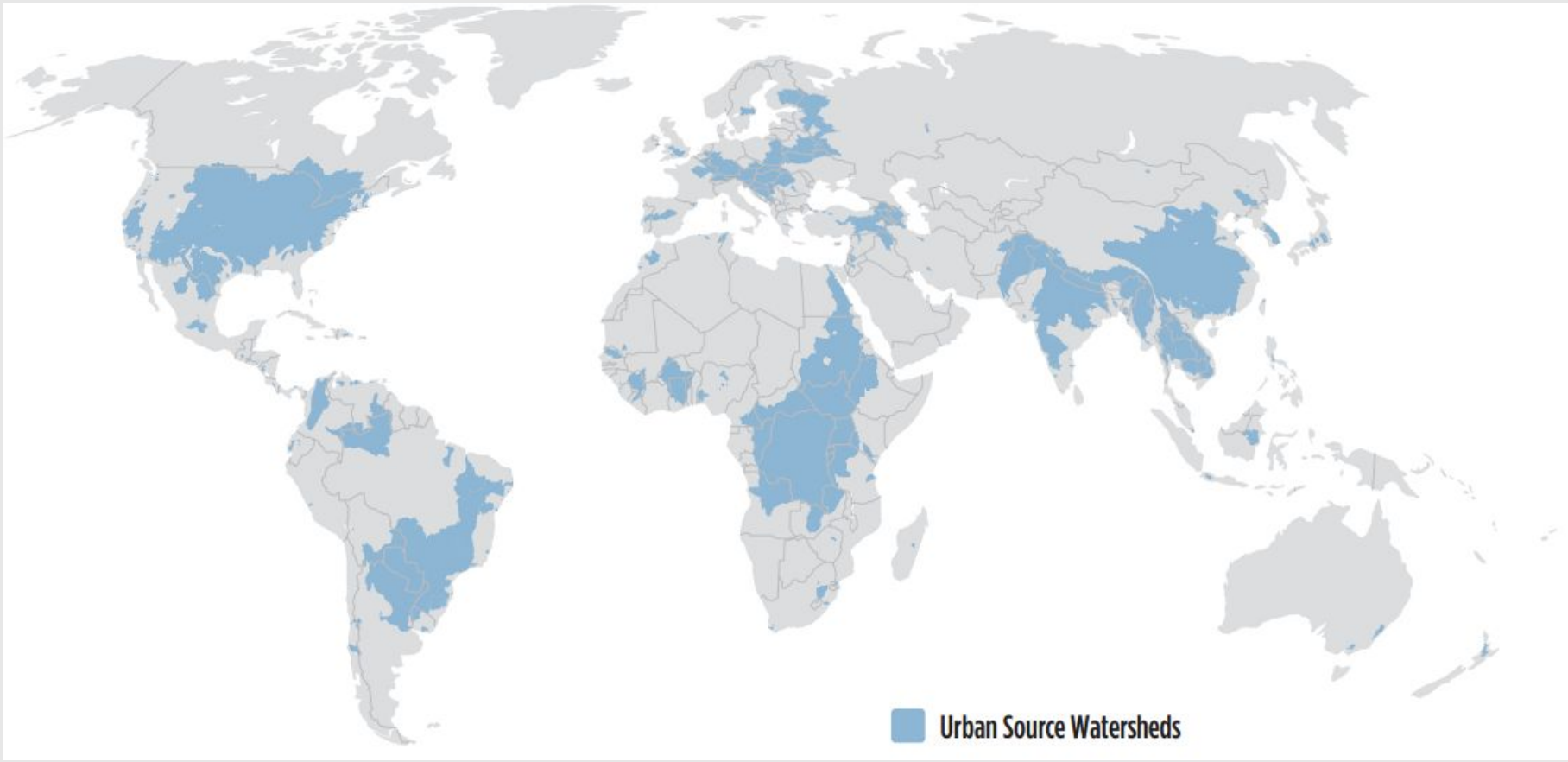
Investment in watershed services (IWS) programs, in which downstream water users pay upstream watershed service suppliers for actions that protect drinking water, are increasing in number and scope. It is not yet clear what factors contribute to the establishment and sustainability of IWS. We conducted a representative global survey of 416 of the world's largest cities, including 59 with IWS programs. These programs represent over $170 million of investment in over 4.3 million ha of watersheds, providing water to over 230 million people. Using random forest statistical models, we evaluated the relative importance of social and ecological factors as predictors of IWS presence. IWS programs are more likely to be present in source watersheds with more agricultural land and less protected area than otherwise similar watersheds. Our results suggest there is potential to expand the IWS strategy and provide an initial step to guide decisions about future program sites.

Investments for Watershed Services

Identifying Cities with IWS Programs

Investments for Watershed Services

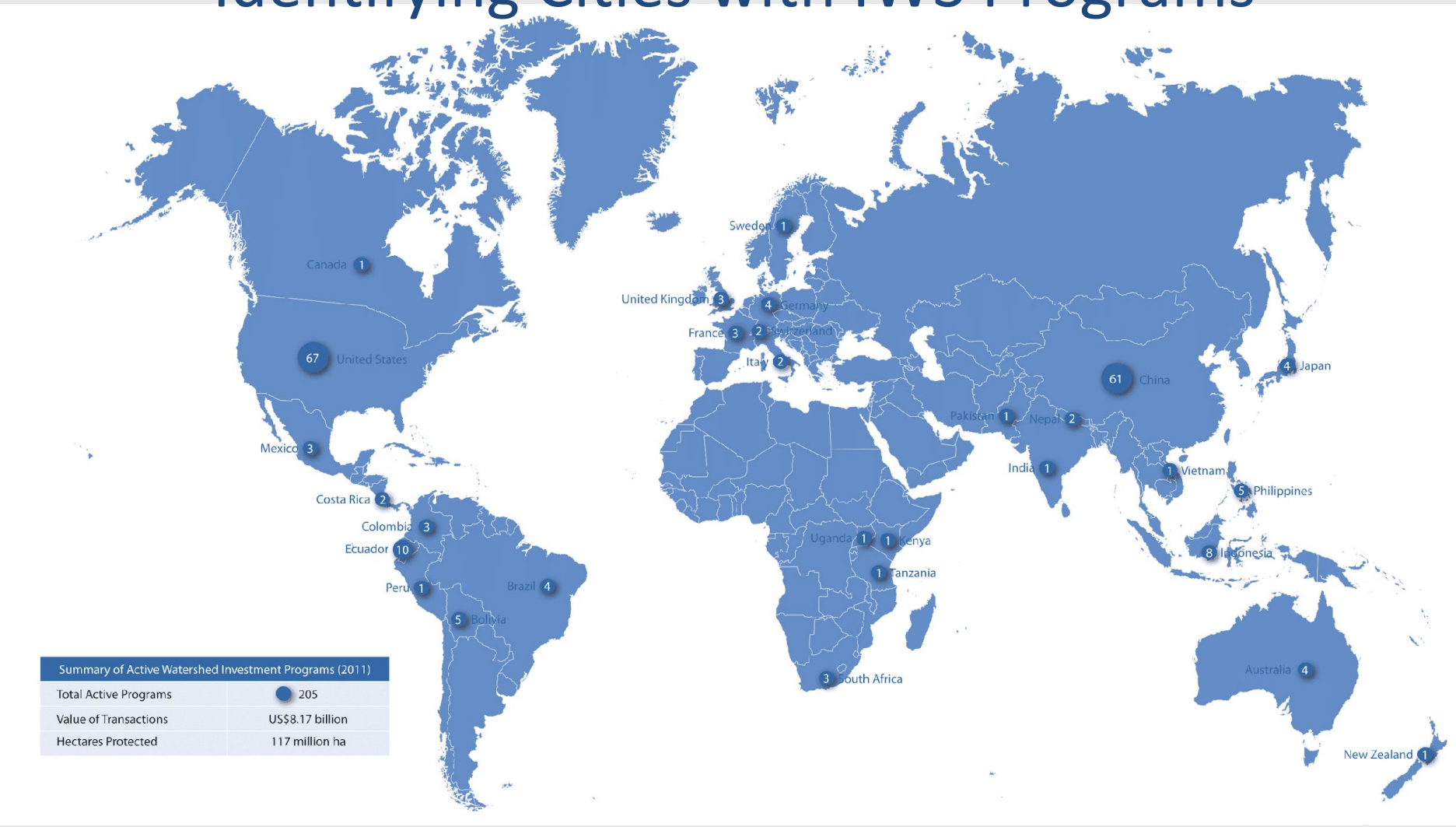
Identifying Cities with IWS Programs



Source: McDonald et al. 2014

Investments for Watershed Services

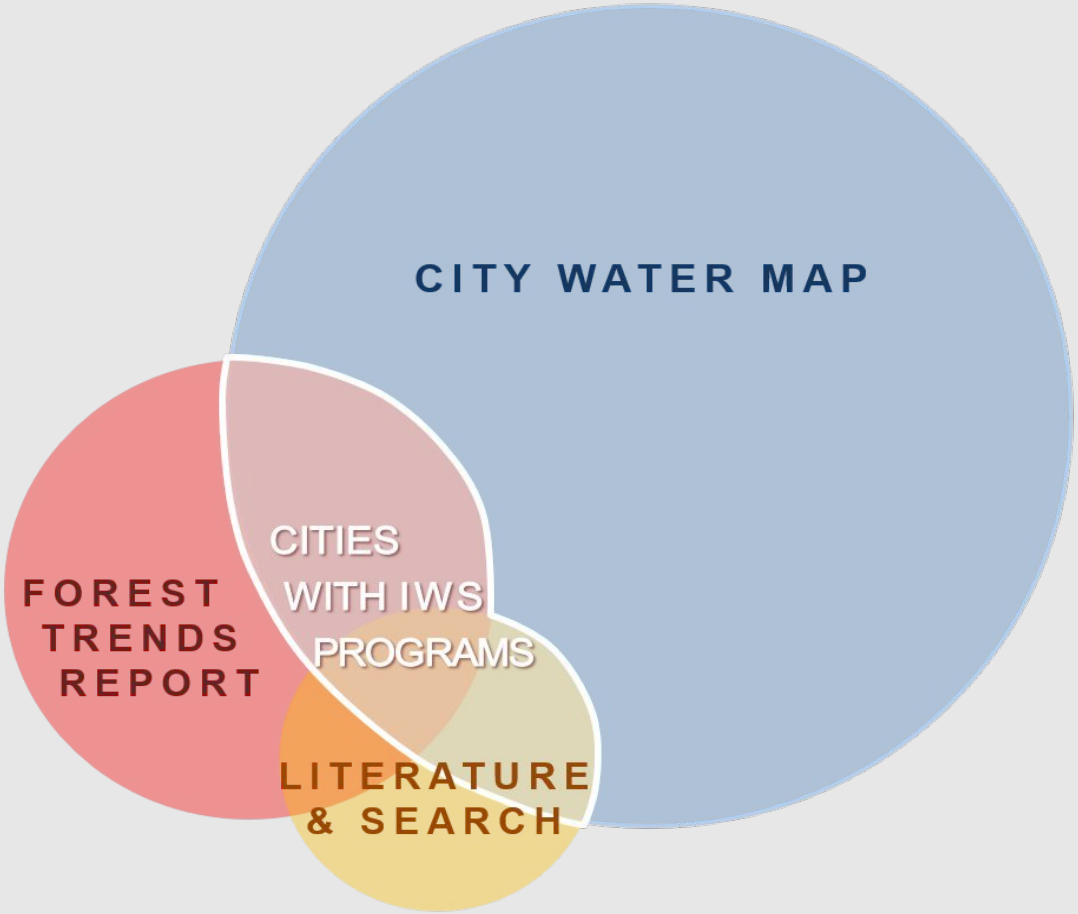
Identifying Cities with IWS Programs



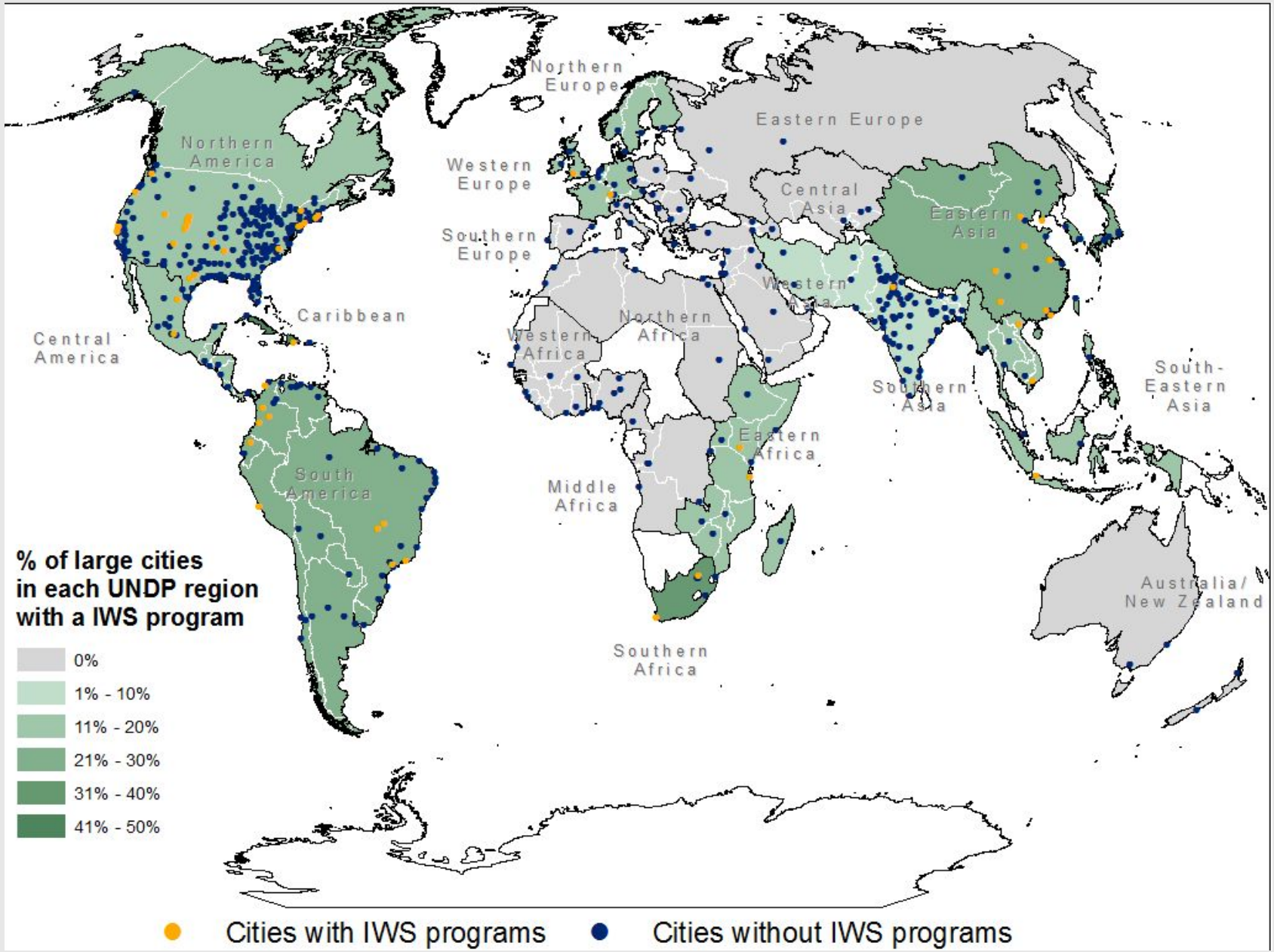
Source: Bennett & Ruef 2016

Investments for Watershed Services

Identifying Cities with IWS Programs



Investments for Watershed Services



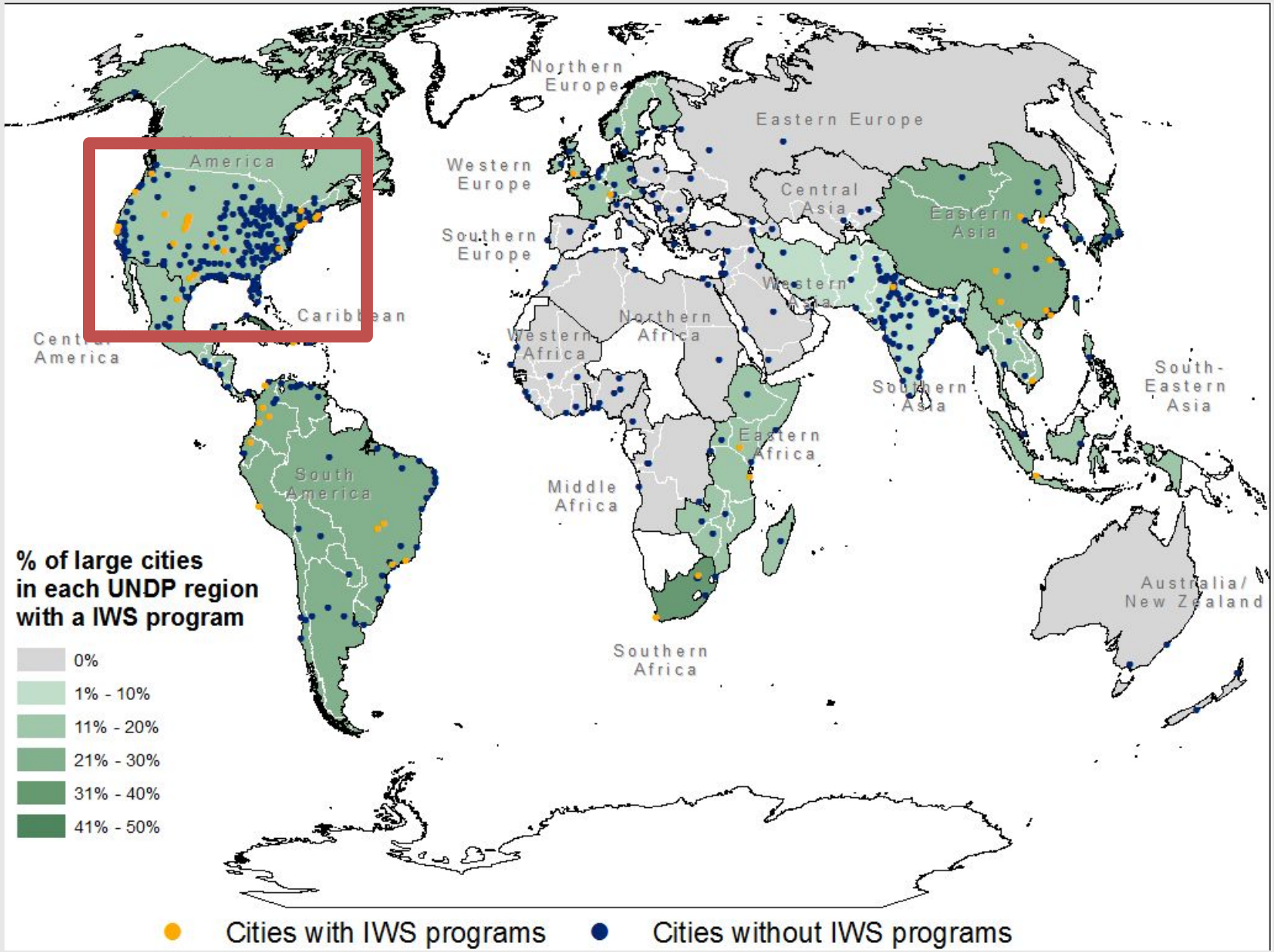
Enabling Conditions

CITY LEVEL DATA	COUNTRY LEVEL DATA
Analysis groups	**Average Annual Growth**
IWS Program (Yes/No)	**Average Governance Indicators**
Located in USA (Yes/No)	**Conservation Spending**
Water source attributes	Doing Business Indicators
Average Distance	**Enforcing Contracts Indicators**
Average Elevation	GCR Property Rights
City Population	National GDP
Distance	**National GDP per Capita**
Elevation Range	**Number of IUCN Organizations Per Million People**
International Boundary Crossings	**Registering Property**
Mean Groundwater Drought Vulnerability	
Mean Surface Water Drought Vulnerability	
Number of Diversions	
Percent Agricultural Cover	
Percent Forest Cover	
Percent Protected Area	
Percent Surface Water Withdrawals	
Quantity of Withdrawals	
Total Watershed Population	
Water Quantity	
Watershed Area	
Watershed Population Density	
Weighted Drought Vulnerability	

Data Concerns

- Inconsistent scale
- Diverse types of data (categorical, numerical, etc)
- Non-normal distribution of variables
- Spatial Distribution

Investments for Watershed Services



Enabling Conditions

CITY LEVEL DATA	COUNTRY LEVEL DATA
Analysis groups	Average Annual Growth
IWS Program (Yes/No)	Average Governance Indicators
Located in USA (Yes/No)	Conservation Spending
Water source attributes	Doing Business Indicators
Average Distance	Enforcing Contracts Indicators
Average Elevation	GCR Property Rights
City Population	National GDP
Distance	National GDP per Capita
Elevation Range	Number of IUCN Organizations Per Million People
International Boundary Crossings	Registering Property
Mean Groundwater Drought Vulnerability	
Mean Surface Water Drought Vulnerability	
Number of Diversions	
Percent Agricultural Cover	
Percent Forest Cover	
Percent Protected Area	
Percent Surface Water Withdrawals	
Quantity of Withdrawals	
Total Watershed Population	
Water Quantity	
Watershed Area	
Watershed Population Density	
Weighted Drought Vulnerability	

Model 1

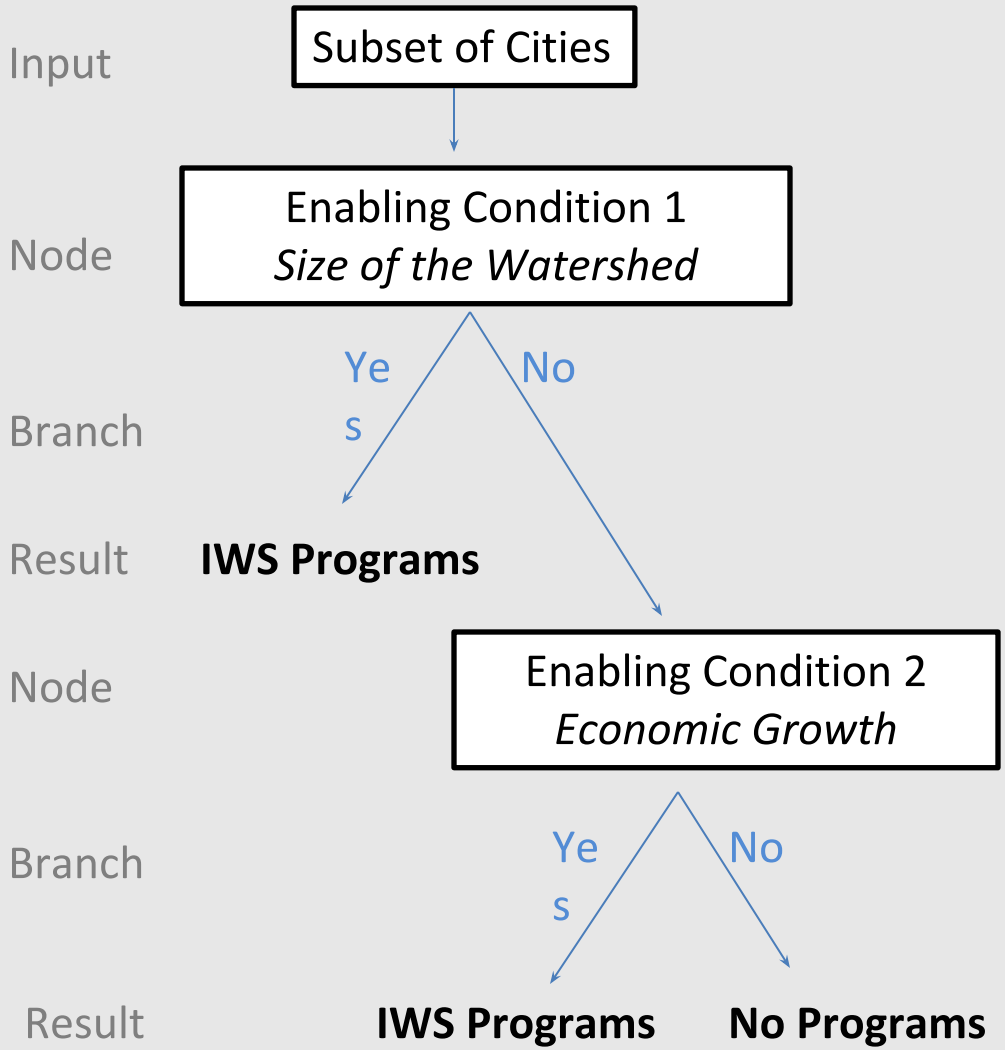
All cities

Model 2

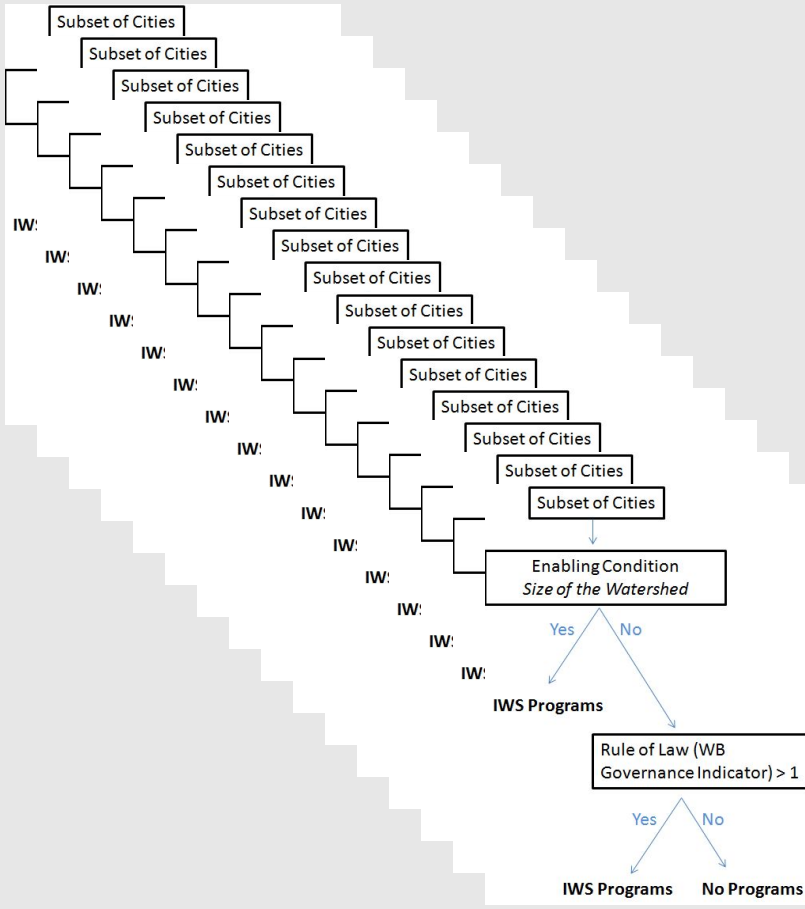
Non-US Cities

Modeling Importance

Decision Tree

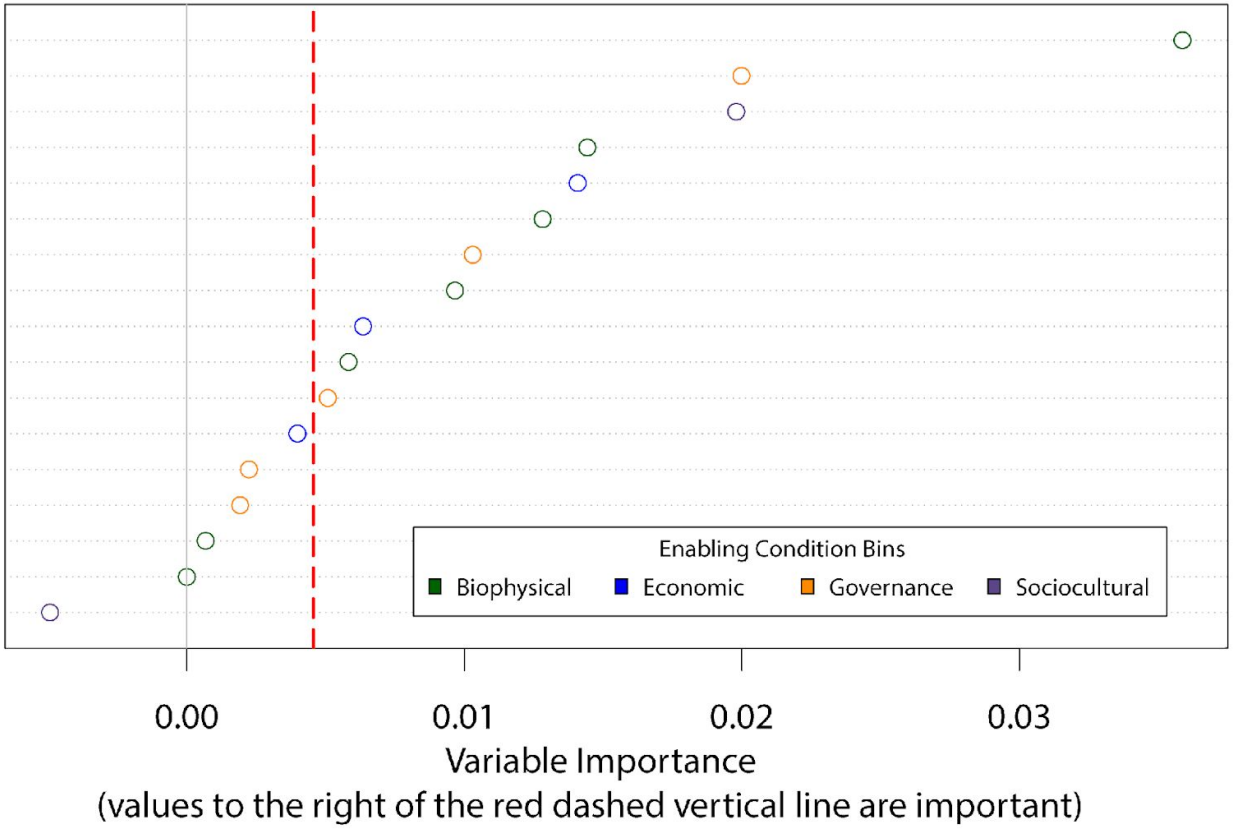


Random Forest



Global Cities Model

Percent agriculture cover
Percent protected watershed
City population
Weighted drought vulnerability index
Average annual growth
Average distance*
Average annual conservation spending
Average elevation
Enforcing contracts indicator*
Total watershed area
Registering property indicator*
National GDP per capita
Average governance indicators*
IUCN organizations per million people
Total diversion volume
Percent forest cover
Average watershed population density



The Most Important Conditions

Agriculture Land +

Protected Area -

Enabling Conditions

So what?

Establishing Water Funds

How are cities selected for new Water Fund Projects?

Establishing Water Funds

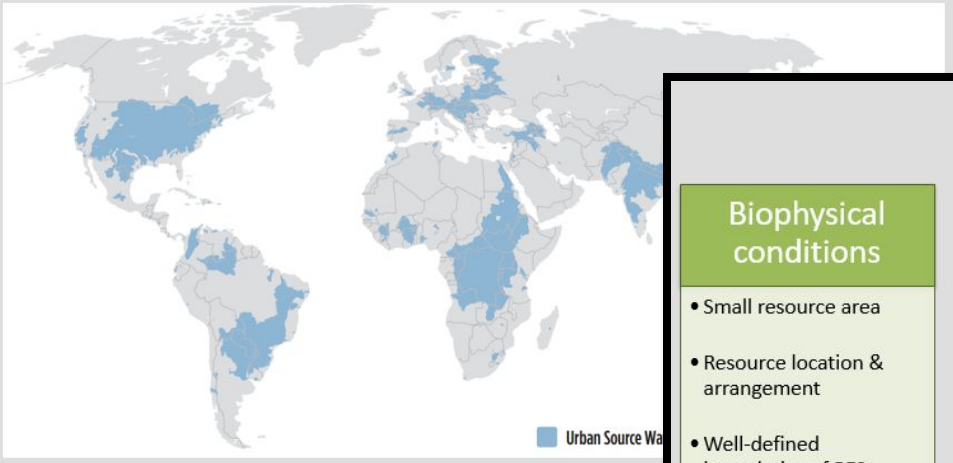
How are cities selected for new Water Fund Projects?

City	Percent Agriculture (+)	Average Elevation (-)
Recife	34.21%	100m
Salvador	9.06%	85m

Enabling Conditions

Investments for Watershed Services

Identifying Cities with IWS Programs

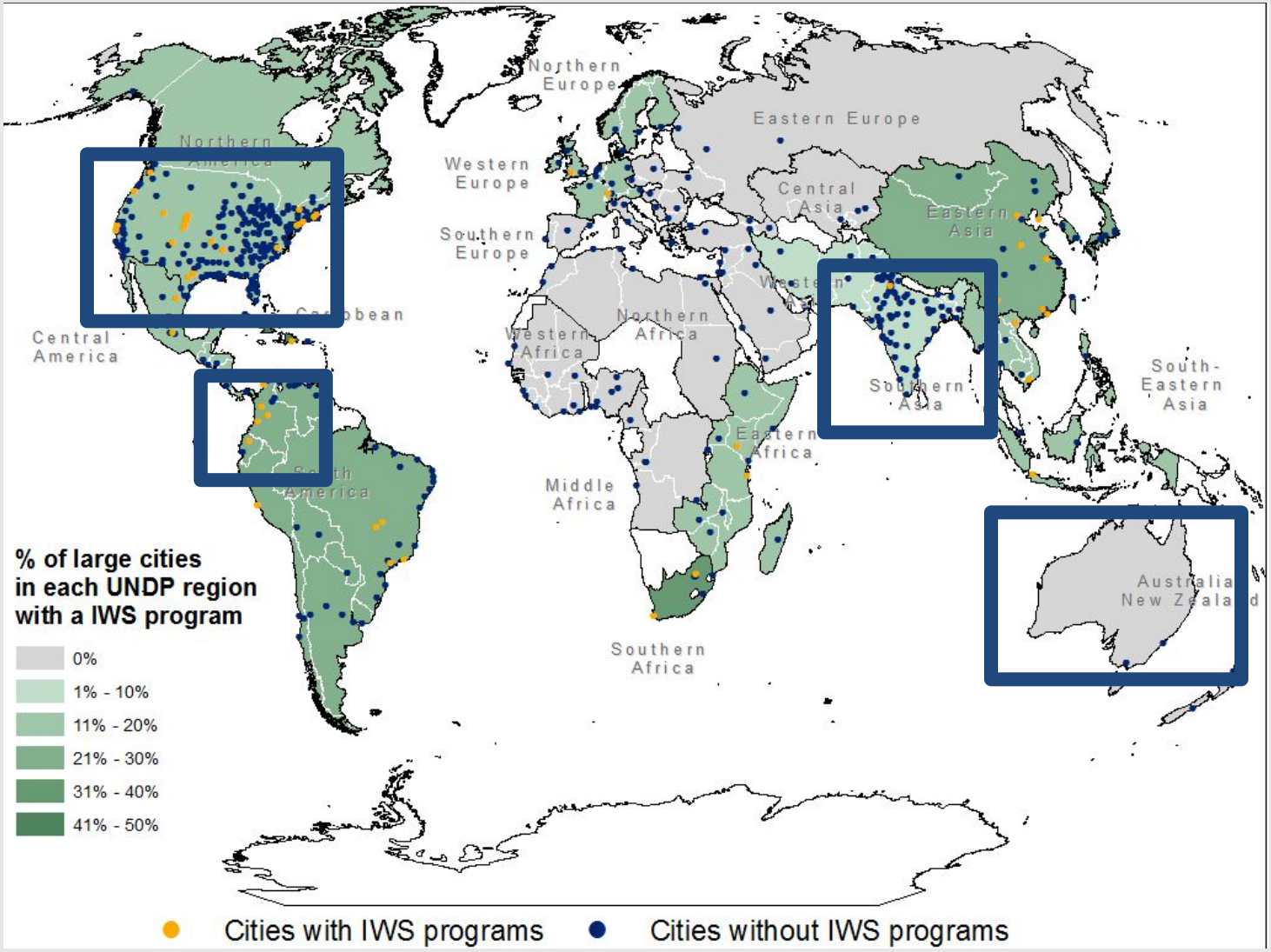


Enabling Conditions

Biophysical conditions	Economic conditions	Governance conditions	Sociocultural conditions
• Small resource area	• Significant value of ES	• Presence/absence of intermediaries	• Trust & transparency among actors
• Resource location & arrangement	• Low opportunity costs	• Strong capacity among actors	• Stakeholder communication & engagement
• Well-defined boundaries of PES system	• Manageable transaction costs	• Influential champion	• Pre-existing market based culture
• Existing fundamental ecosystem science and baseline data	• Defining ES as an economic good or service	• Strong existing institutions	• Participant willingness
• Linkages between ES provision and management practices	• Economic growth	• Secure land tenure & property type	• Proximity of actors to each other
• Clear threat or risk to ES		• Fit of governance structure with scale of PES	• Large/small number of actors
		• Multiple/single PES objectives	

Next Steps

Regional Analysis

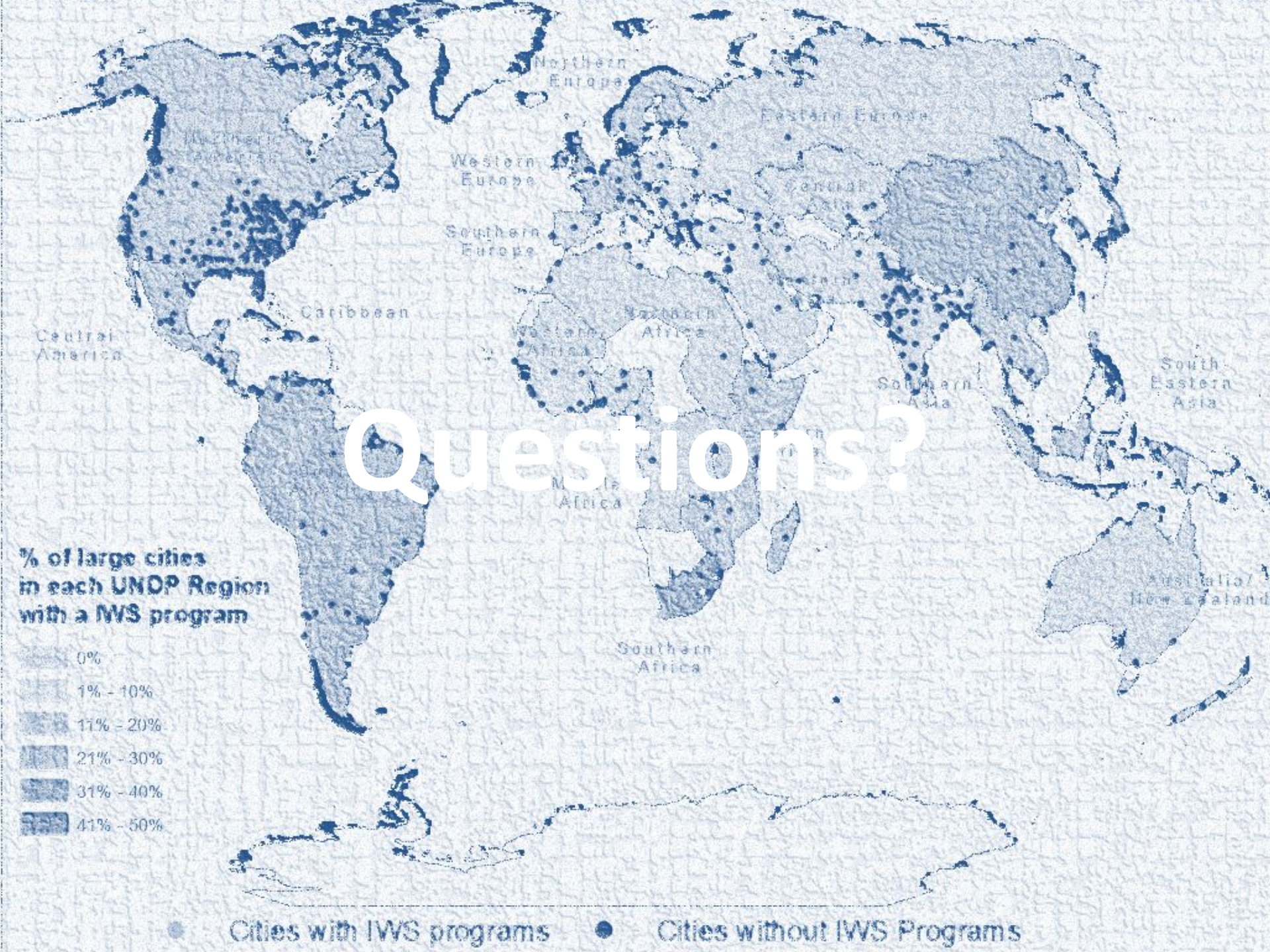


Enabling Conditions

Enabling establishment

vs

Enabling sustainability


Northern Europe
Western Europe
Eastern Europe
Southern Europe
Caribbean
Central America
Southern Africa
South Eastern Asia
% of large cities in each UNDP Region with a IWS program
0%
1% - 10%
11% - 20%
21% - 30%
31% - 40%
41% - 50%
Cities with IWS programs
Cities without IWS Programs

Questions?

Presenters

Chelsie Romulo

Assistant Professor

Environmental & Sustainability Studies,
University of Northern Colorado

email: chelsie.romulo@unco.edu

“Modeling conditions that enable payments for watershed services programs”

Sari Ladin-Sienne

Chief Data Officer

City of Los Angeles

email: sari.ladin-Sienne@lacity.org

“From Data Literacy to Civic Action”

From Data Literacy to Civic Action

•••

Sari Ladin-Sienne
Chief Data Officer, City of Los Angeles
@sariladin
July 18, 2018

4 million residents

469 square miles

40 departments

50,000 city staff

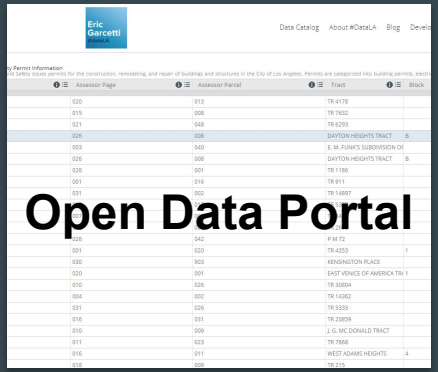
Mayor Garcetti's vision for open data

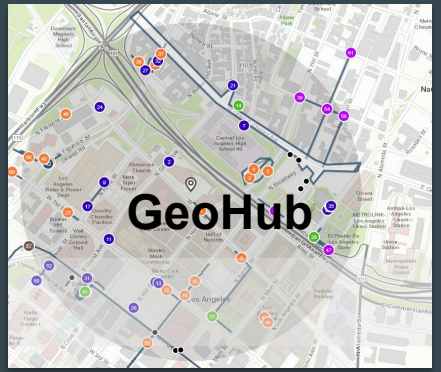
Make raw data available on intuitive platforms to:

- Develop new pathways for civic engagement
- Promote innovation among entrepreneurs and businesses
- Leverage one of government's greatest assets: public information
- Foster creative problem-solving with community at forefront

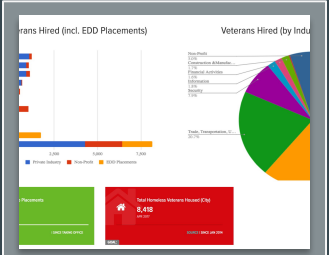
World Class Data Assets

2 data portals

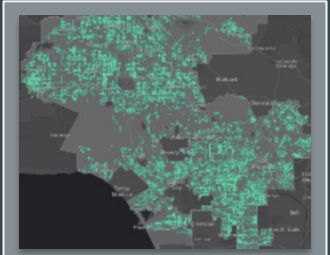




Apps powered by city data

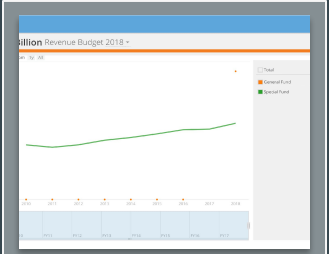


Mayor's Dashboard



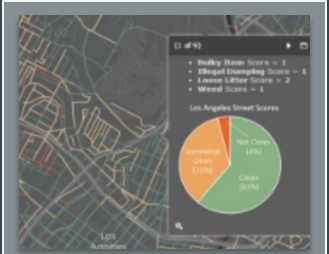
Road to 2400

Citywide Web Analytics



Open Budget

Streetwize



CleanStat

… just to name a few!

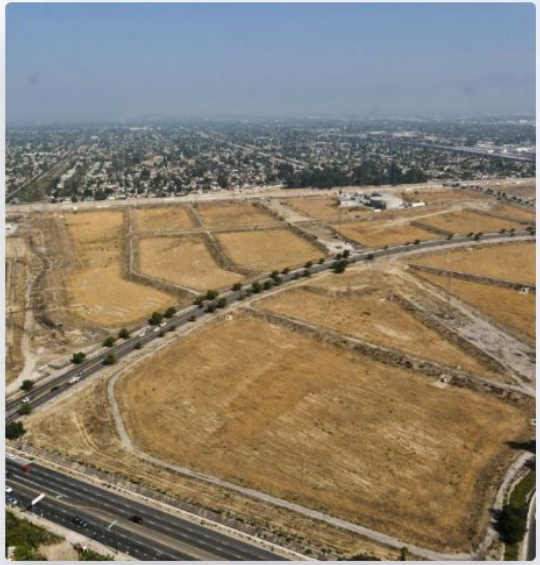
stormwaterdashboard.lacity.org

Background | Spreading Grounds | Rain Barrels & Cisterns | Green Stormwater Infrastructure | Incidental Capture

Background

Multiple efforts are already underway to increase stormwater capture, including multiple projects that will capture thousands of acre-feet of stormwater per year. City and local entities that support stormwater capture include the LA Department of Public Works, LA Department of Water and Power, and LA County Flood Control District. Stormwater capture project benefits vary from improving water quality in rivers, creeks, and oceans to capturing stormwater more effectively to increase our local water supply.

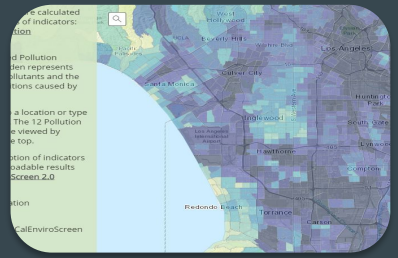
Real-Time Rain Capture (Acre-ft)	Total Rain this Season (Inches)	% Capture Designated for Water Supply
17,000	4.56	100%
Updated 05-21-18 10 am	Below Average	Learn More



Progress toward pLAn goal to increase stormwater capture capacity by 150,000 acre-ft per year

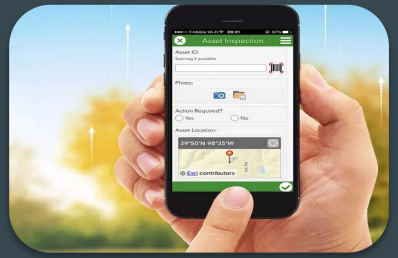
28,900

GeoHub: Suite of Data Tools

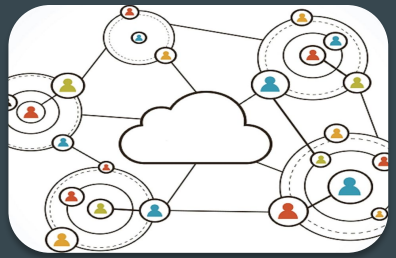


Storymaps

Dashboards



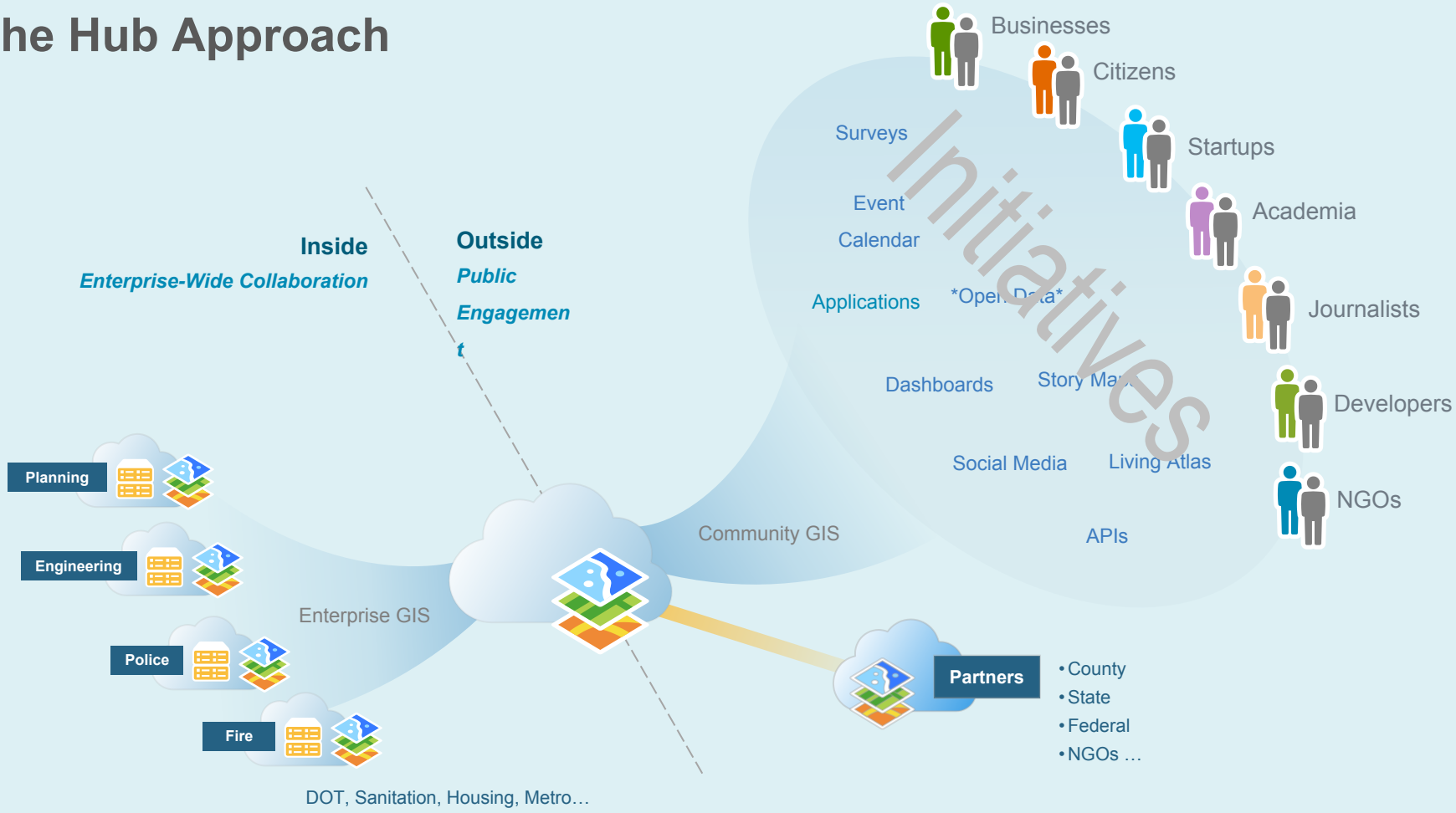
Data Collection



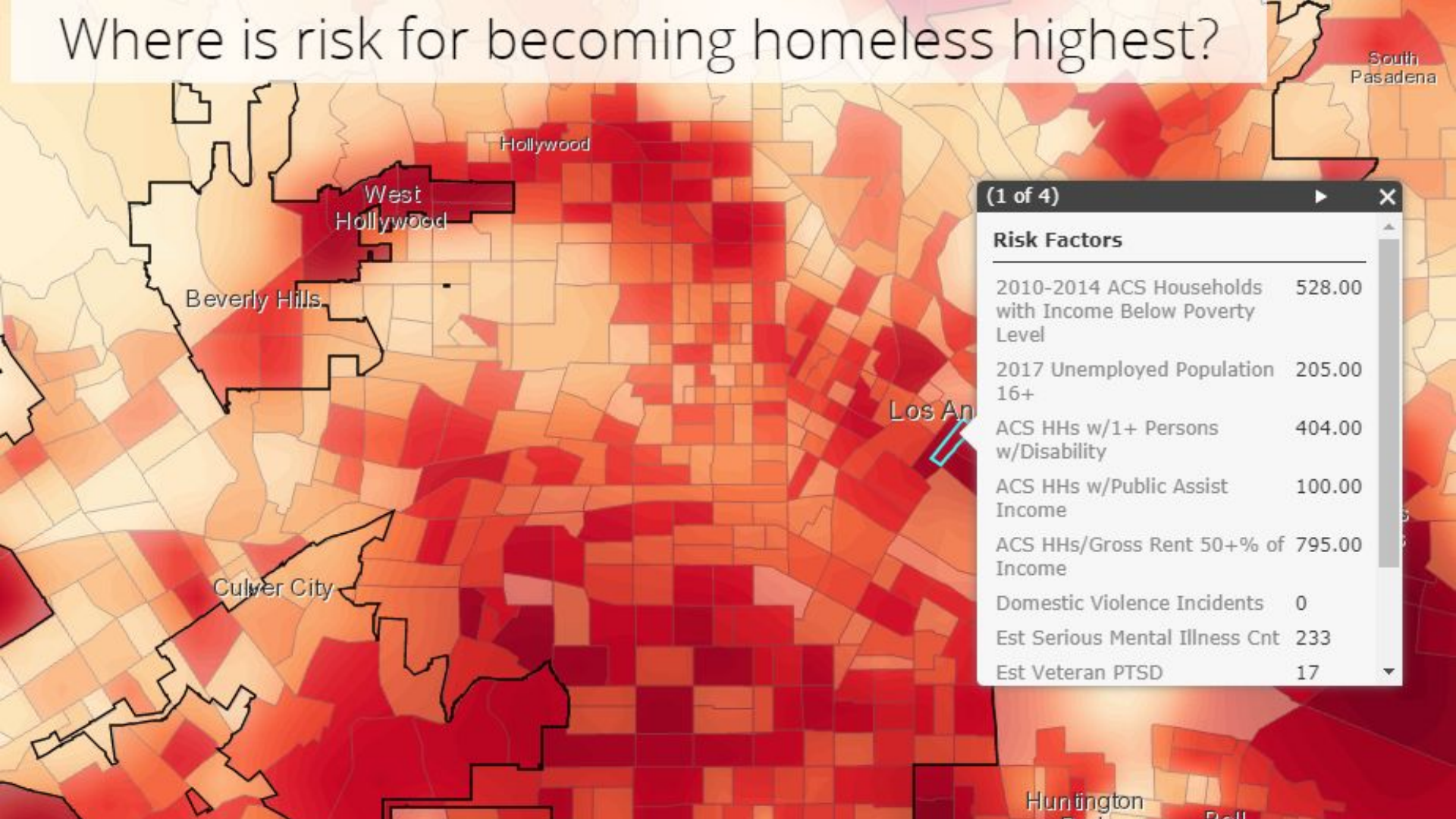
Data Sharing

Spatial Analysis

The Hub Approach



Where is risk for becoming homeless highest?



DATA PUBLISHING PRINCIPLES

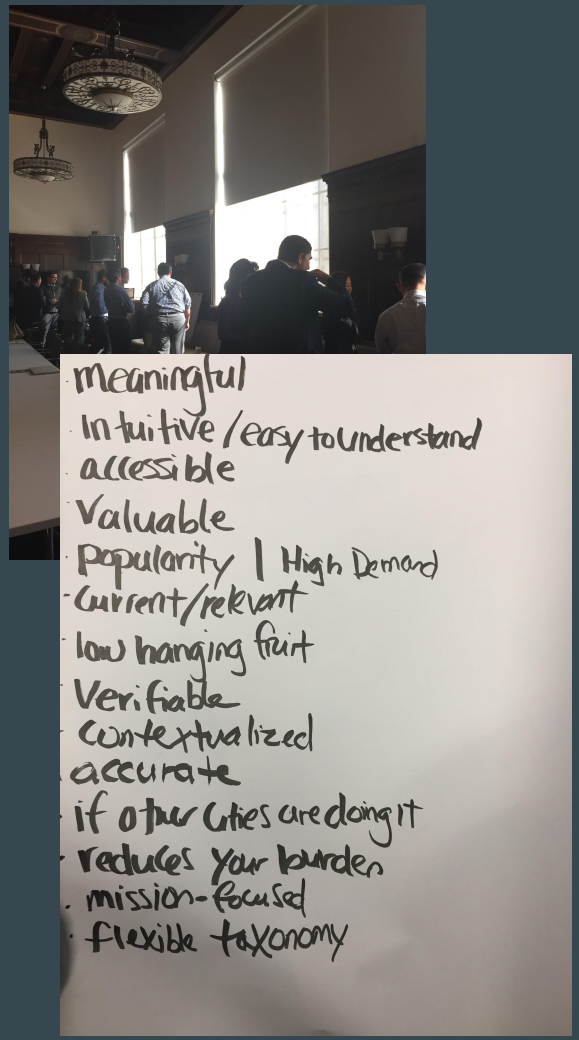
- What is the value of our data?
- How can we recognize a high-value dataset that's a great candidate for our open data library?
- What principles can we come up with collectively to help new hires and key staff flag these datasets in the future?
- DataLA Publishing Guide

From Data to Action

Identify which datasets are meaningful and ready to be published.

Publish the dataset to the open data portals. Follow metadata best practices to ensure dataset is easy to interpret.

Public and private partners use the data to communicate, advocate, and innovate.



The role of data literacy in open data

Challenge: How do we scale data literacy and encourage community data collection?

Bringing data to the people

OPEN DATA
LITERACY PROGRAM

host a free
Data Training Workshop
in your neighborhood

Scaling, growing, innovating

- Train the trainer model
- Open data audits - what's missing? what do you want us to collect?
- Community data collection - findings local partners to grow initiatives, partnering with universities

Get in touch!
sari.ladinsienne@lacity.org

Ideas for Next steps

- Funding sources for collaborative activities: ESIP Lab, FUNding Friday, Foundations, ESIP sponsors, NSF
- Forming an ESIP cluster on community resilience
- ESIP Webinar in December
- Other thoughts?

- Contact Arika: Av@middlepatheco.com

Blog:
http://esipfed.org/collaboration-updates/the-socioeconomic-value-of-earth-science-data-for-community-resilience
White paper: https://tinyurl.com/y6vl4oev
Peer-reviewed paper: Virapongse, A., R. Duerr, E.C. Metcalf (in press). Knowledge mobilization for community resilience: Perspectives from data, informatics, and information science. Sustainability science.