

An aerial photograph of a wide river flowing through a landscape with dense forest. The trees show signs of autumn, with some yellow and orange leaves visible. The river has several rapids and white water sections. The sky is clear and blue.

Think Water: A Case Study in Innovation and Success in System Thinking-based Natural Resources Education

**James Houle, UNH Stormwater Center
2016 ASCE LID Conference**

Cuyahoga inlet to Lake Erie circa 1920



"Cuyahoga mouth". Licensed under Public Domain via Commons - https://commons.wikimedia.org/wiki/File:Cuyahoga_mouth.jpg#/media/File:Cuyahoga_mouth.jpg

- Cuyahoga caught fire at least 13 times!
- First, 1868 – Last, 1969
- 5 deaths 1912
- Largest was in 1952



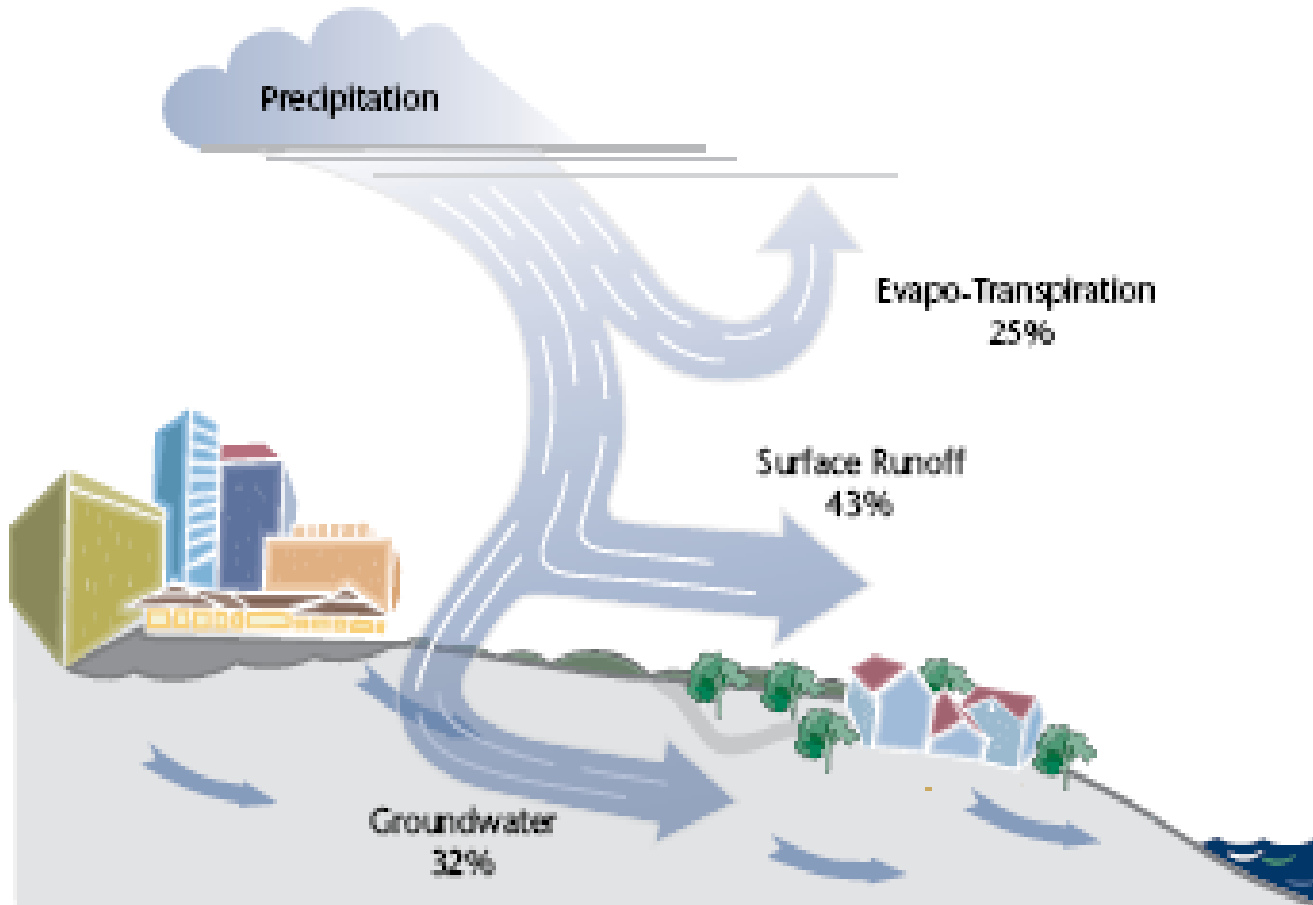
Cuyahoga River Fire Nov. 3, 1952. Courtesy of Cleveland Press Collection at Cleveland State University Library.

NPS is Part of the Problem and managing it is part of the solution

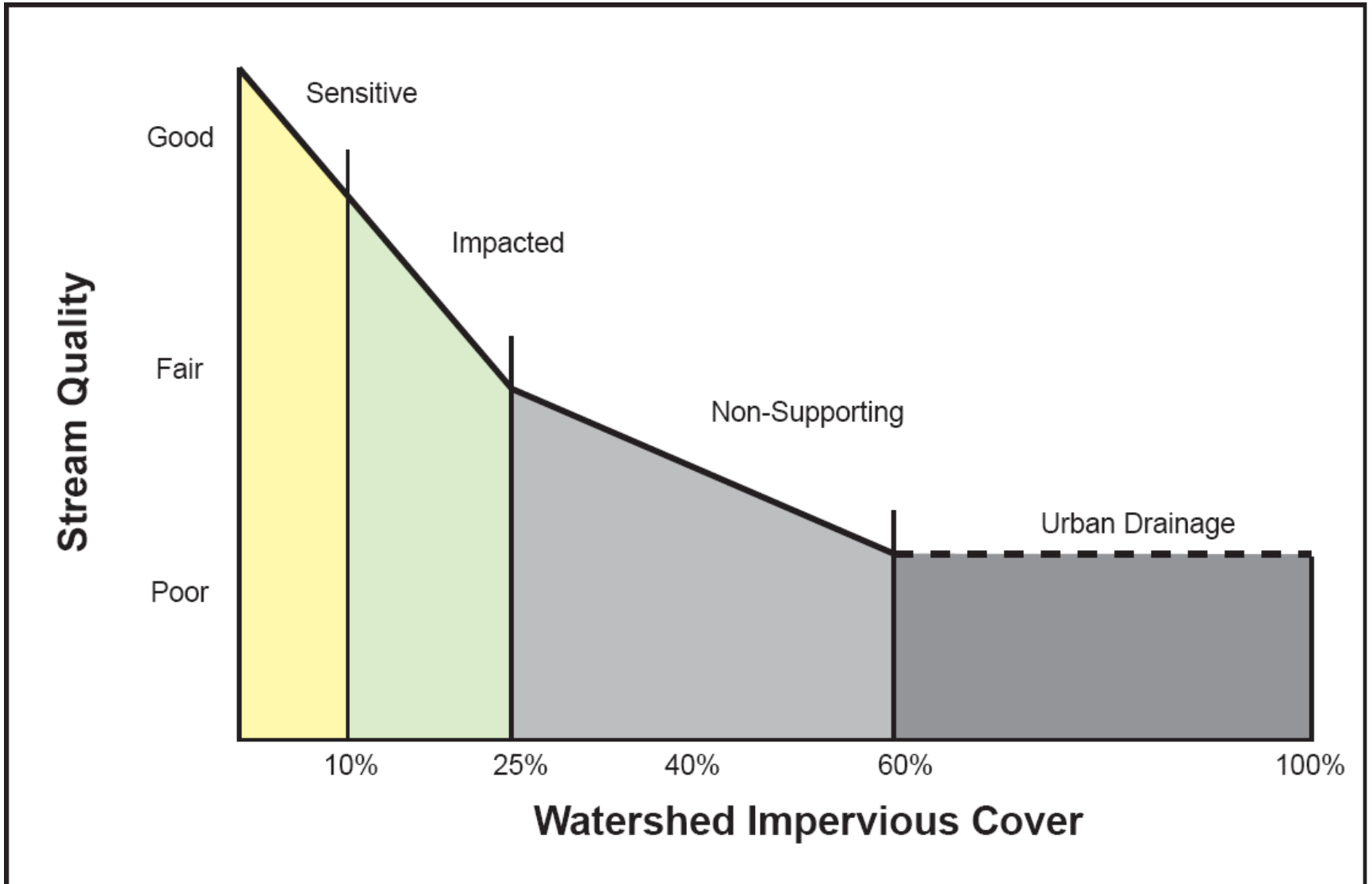


Water Cycle

TYPICAL ANNUAL WATER BUDGET: DEVELOPED WATERSHED

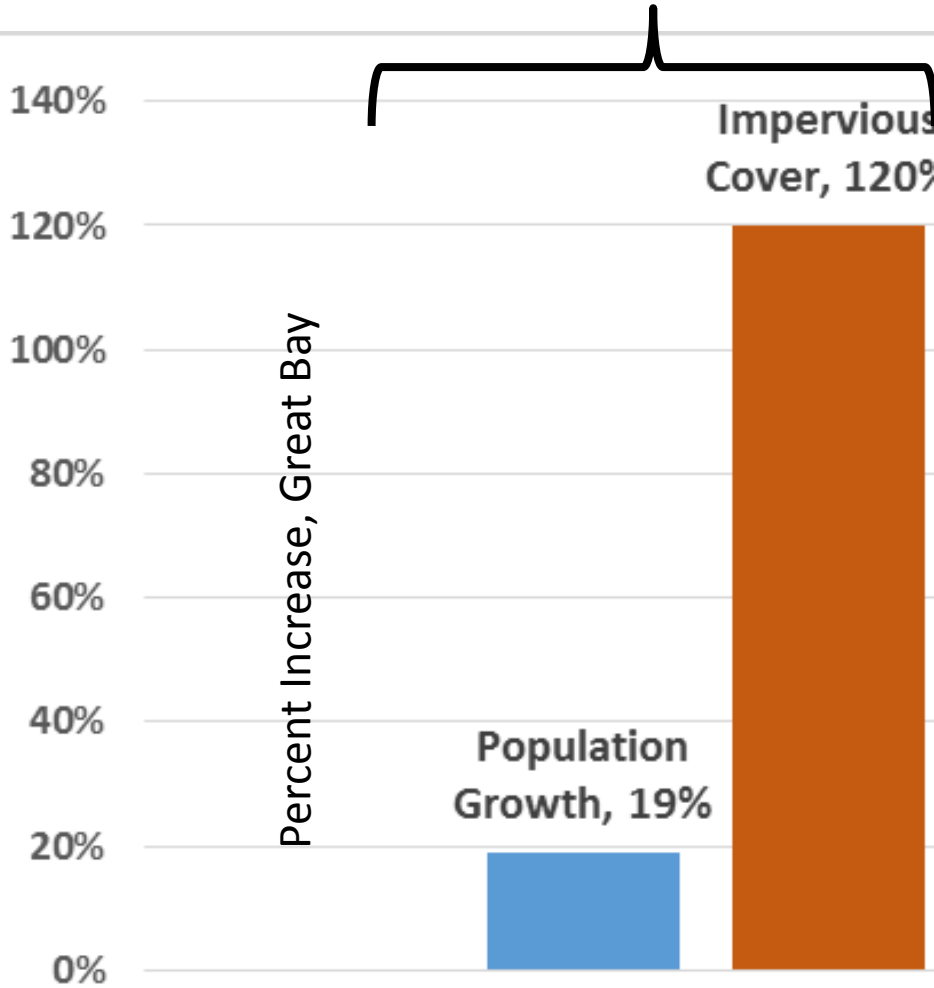


Impact of Impervious Cover

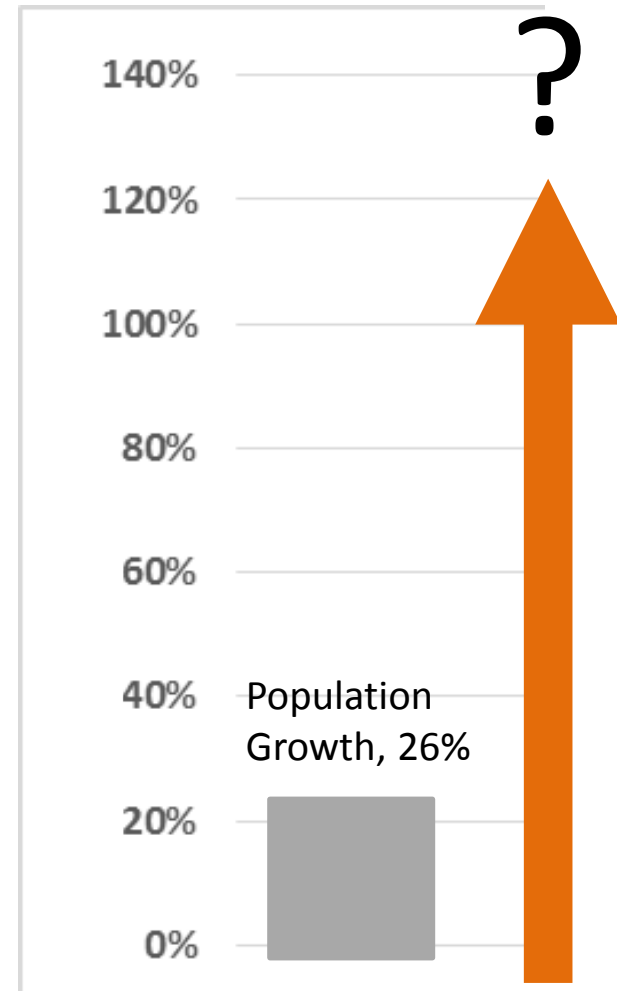


Population Growth & Quality Problem

Last 20 years



Next 30 years



From 1990 to 2010 (Source: US Census; UNH earth systems research center; PREP; 2010-2040 Projections, UNHSC)



University of New Hampshire Stormwater Center

Providing Data to Protect Water Quality Since 2004





Hydrodynamic Separator



Isolator Row



Subsurface Infiltration



Filter Unit



Porous Asphalt



Pervious Concrete



Retention Pond



Stone Swale



Veg Swale



Gravel Wetland



Sand Filter

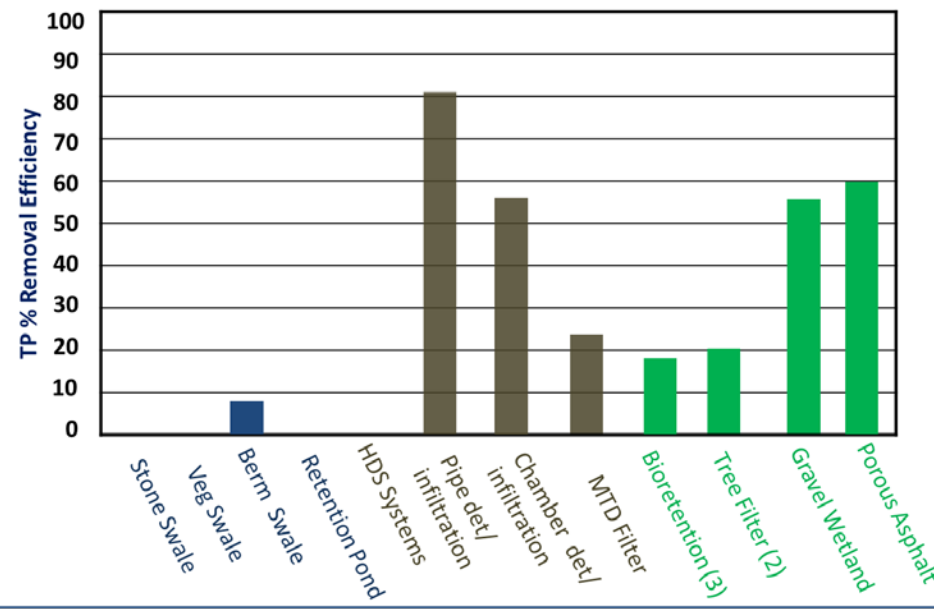
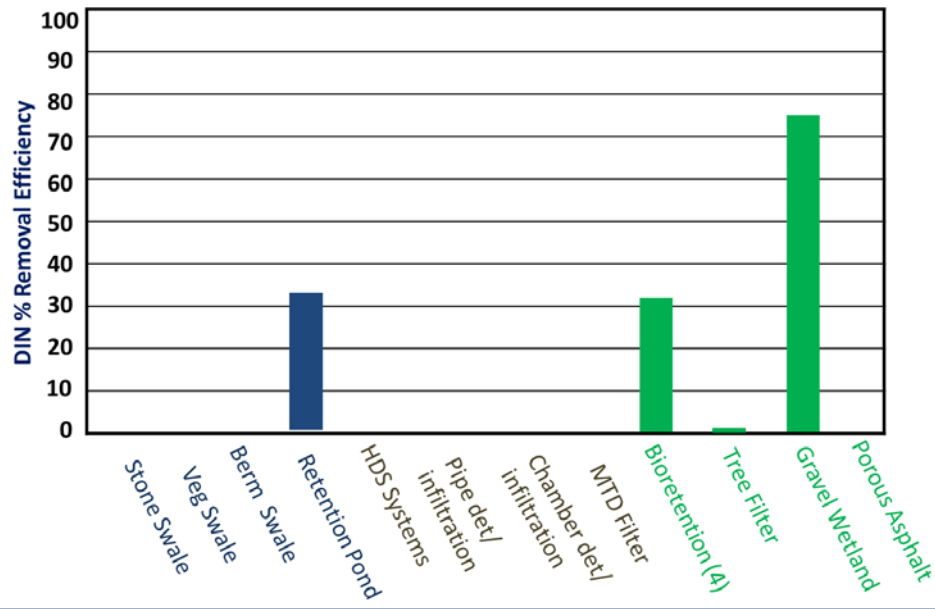
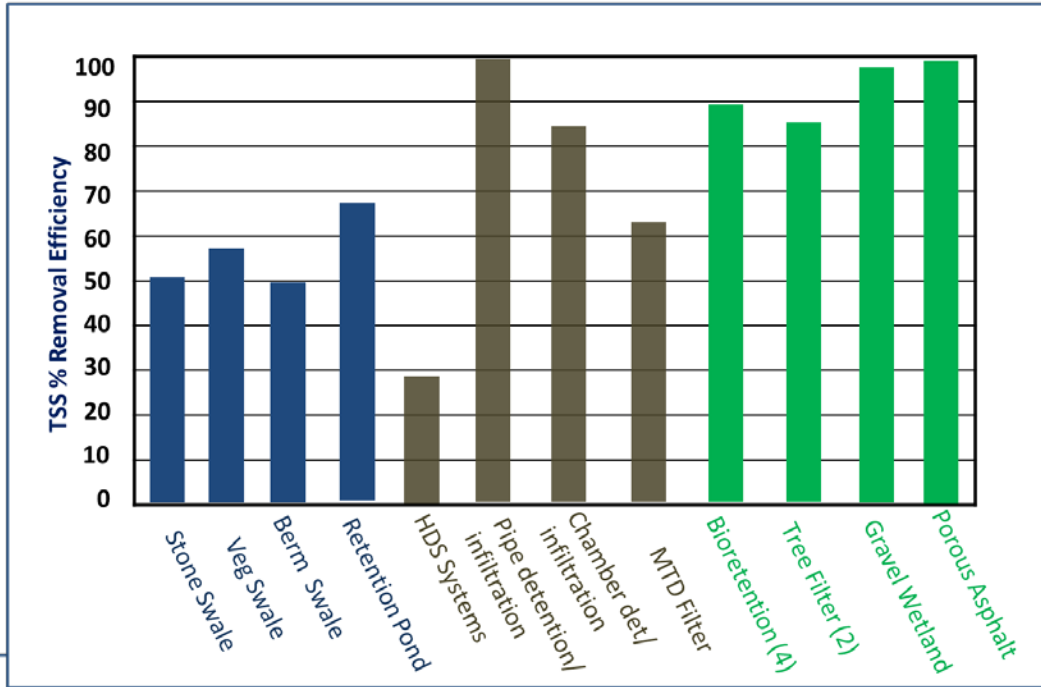


Bioretention Unit



Tree Filter

Common Pollutant RE's

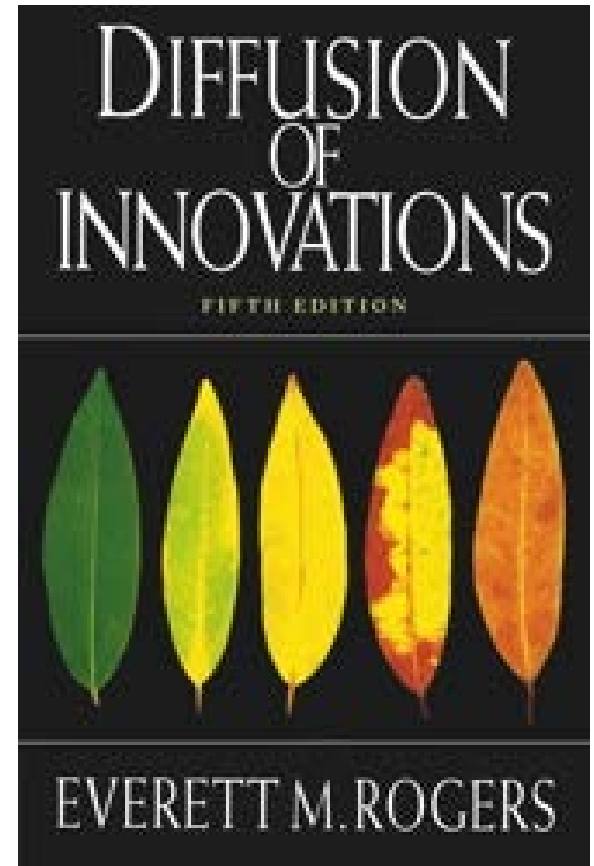


If we know what the problem is...
...and science informs us what we
can do...

...Then how are we doing on
implementation?

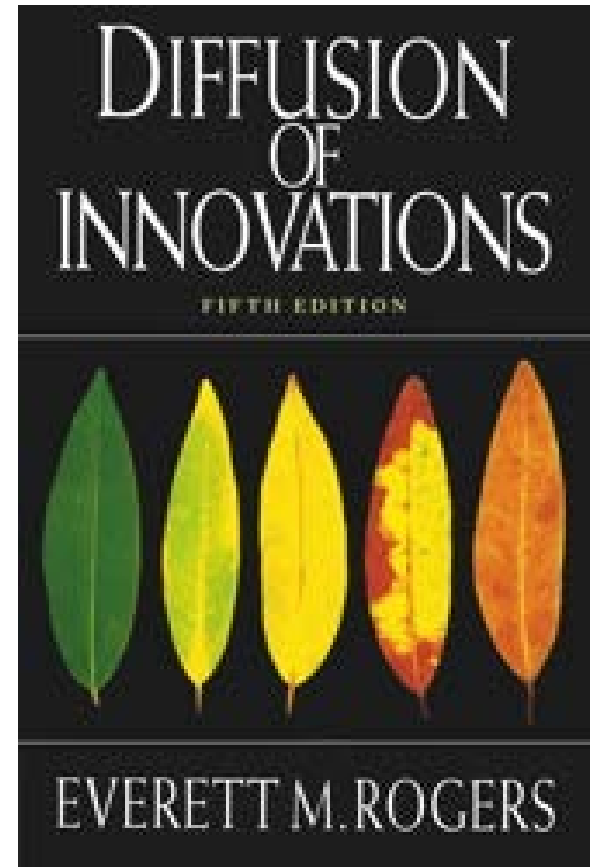
Diffusion of Innovation

- Diffusion of innovation is the process by which an **innovation** is communicated through certain channels over time among the members of a social system (Rogers, 2003)

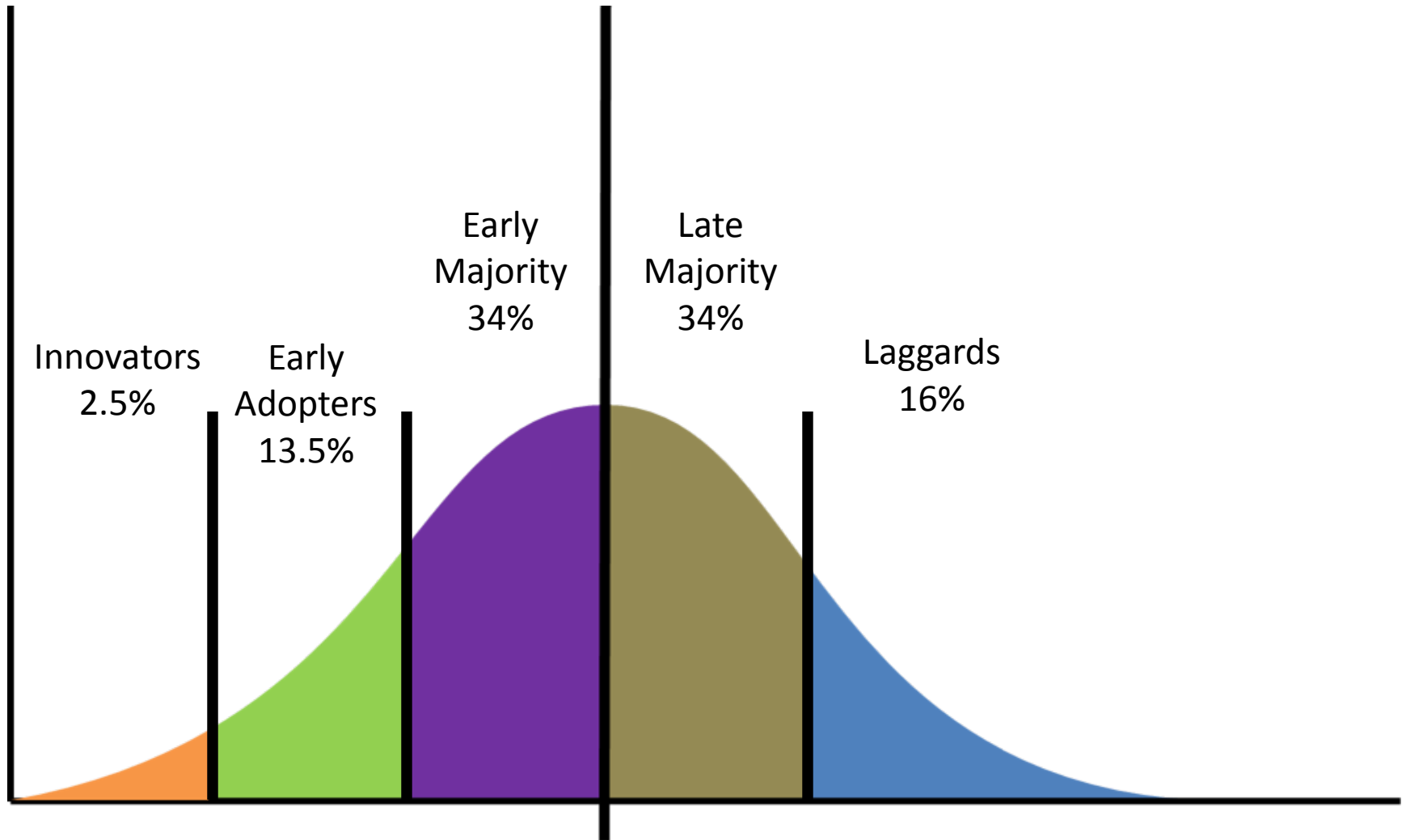


Innovation

- An idea, practice, or object that is perceived as **new** by an individual or other unit of adoption (Rogers, 2003).



DOI Adopter Categories



Adapted from Rogers, 2003

How do innovations spread through populations?



Building Green Infrastructure Through a Complete Community Approach

The following measures outline a comprehensive strategy towards achieving the complete community approach:

- Adopt ordinances and regulations for new development that mandate the use of stormwater filtration to clean runoff, and infiltration practices to reduce runoff.
- Require improved stormwater controls for reducing runoff for redevelopment projects or other significant construction, and for site improvements such as repaving or building renovations.
- Apply conservation strategies such as protecting naturally vegetated areas near water bodies and wetlands, and limiting the size or percentage of allowable impervious cover in high value natural resource areas.
- Reduce existing impervious cover through targeted site improvements and stormwater management changes in high impact locations (i.e. locations that contribute high amounts of polluted runoff).
- Make a long-term commitment to fund and maintain stormwater controls along with an accounting mechanism to track long-term benefits of strategies. Consider innovative funding mechanisms such as impacts fees, exaction fees and stormwater utilities.



BIORETENTION SYSTEM



POROUS PAVEMENT



RAIN GARDEN SIGNAGE

- Provide opportunities for outreach by sharing plans and progress with citizens and business owners through community newsletters, cable access, and on-site signs that explain what steps are being taken to protect waterways or improve stormwater management.

FILTRATION SYSTEMS



TREE FILTERS



BIORETENTION SYSTEM



BIORETENTION SYSTEM



This project is funded by the **NEERs Science Collaborative** to a project team led by the **University of New Hampshire Stormwater Center** and the

Great Bay National Estuarine Research Reserve.

It supports Green Infrastructure implementation with local municipal, non-profit and private sector partners.

For more information please visit southeastwatershedalliance.org/green-infrastructure

2013 Model Regulations



MODEL STORMWATER STANDARDS FOR COASTAL WATERSHED COMMUNITIES

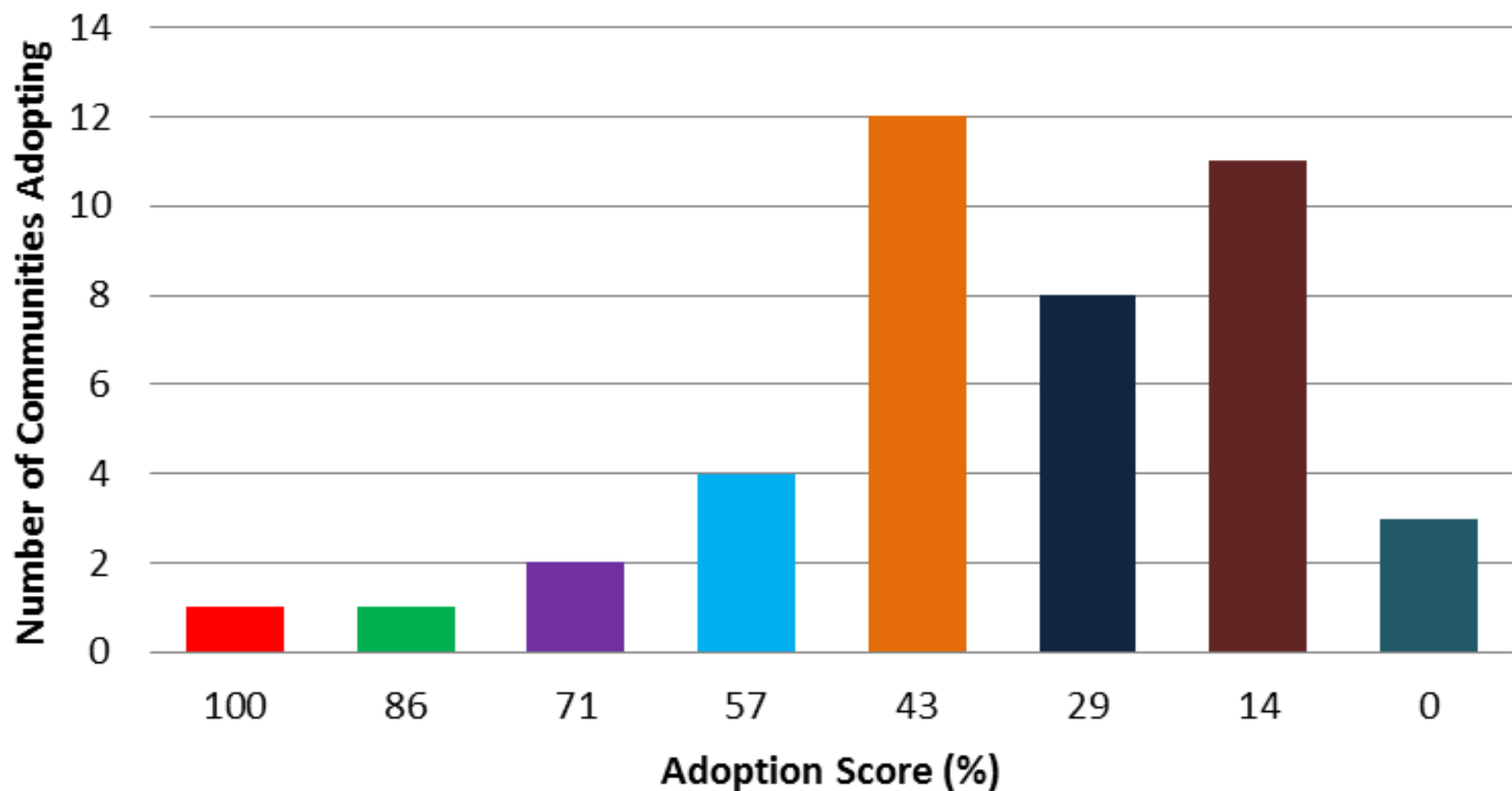
*Prepared by the University of New Hampshire Stormwater Center and
The Rockingham Planning Commission
December 2012*



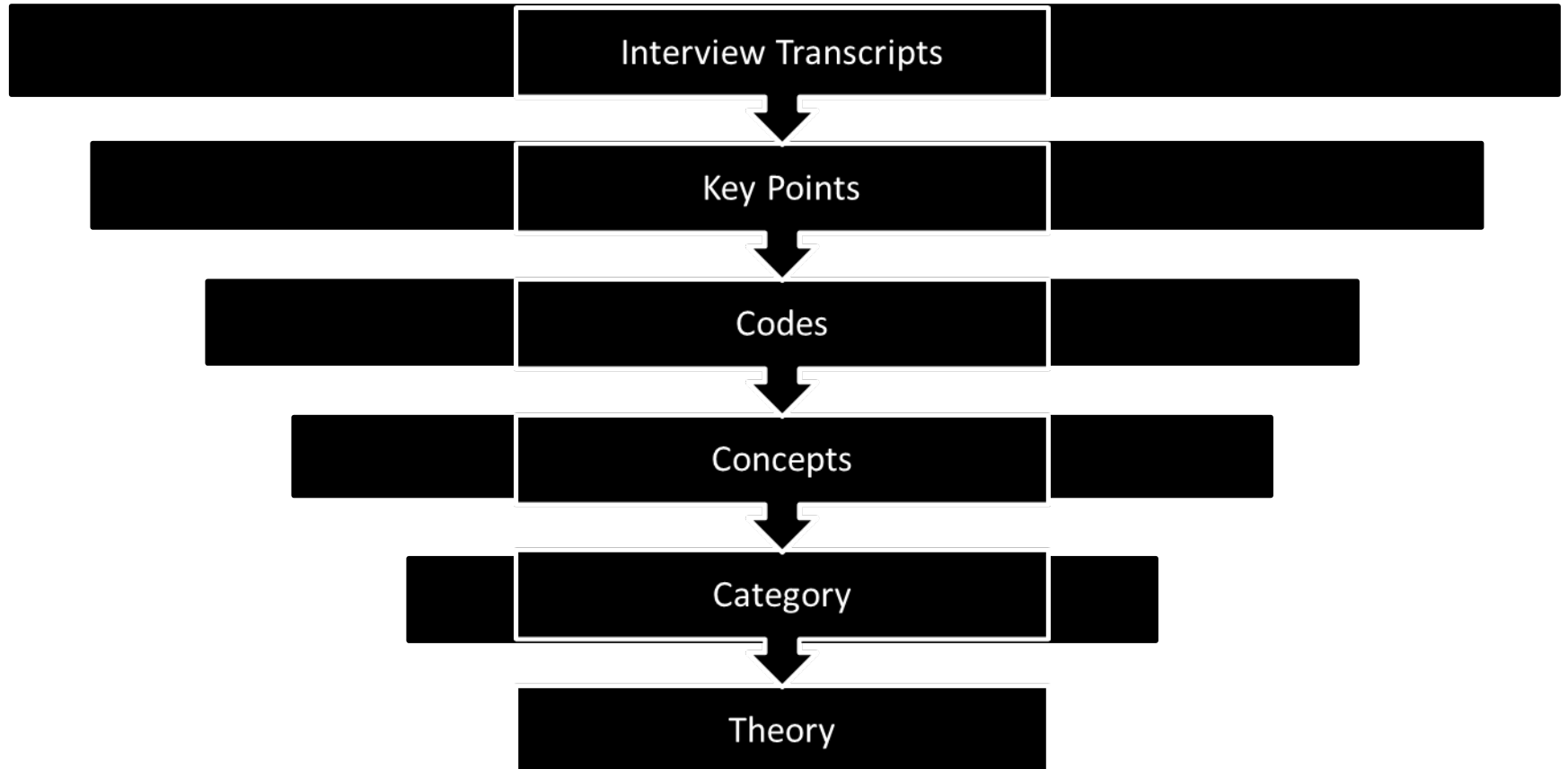
This project was funded under the Coastal Zone Management Act by NOAA's Office of Ocean and Coastal Resource Management in conjunction with the New Hampshire Coastal Program.

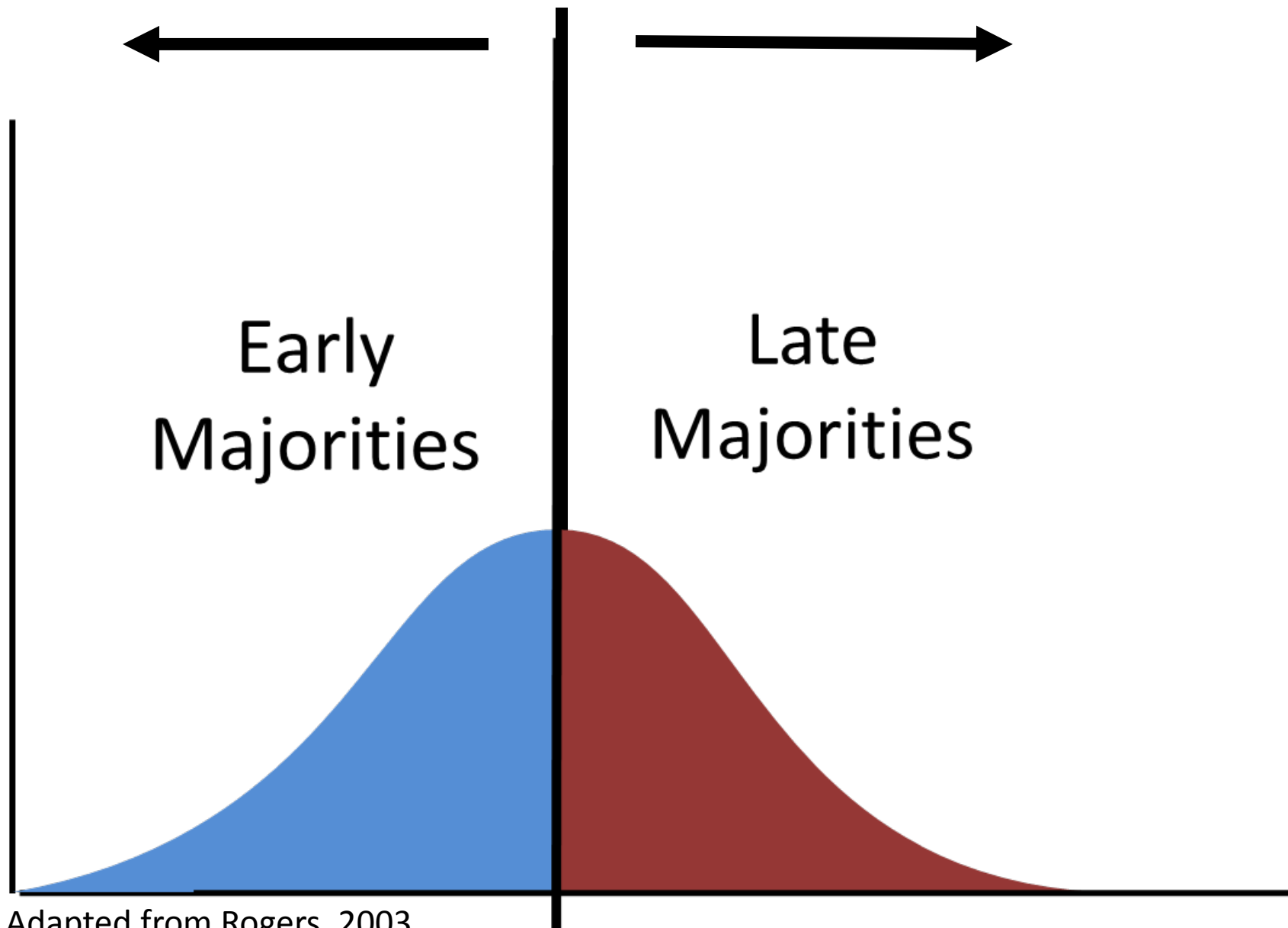


NH Great Bay Communities (n=42)



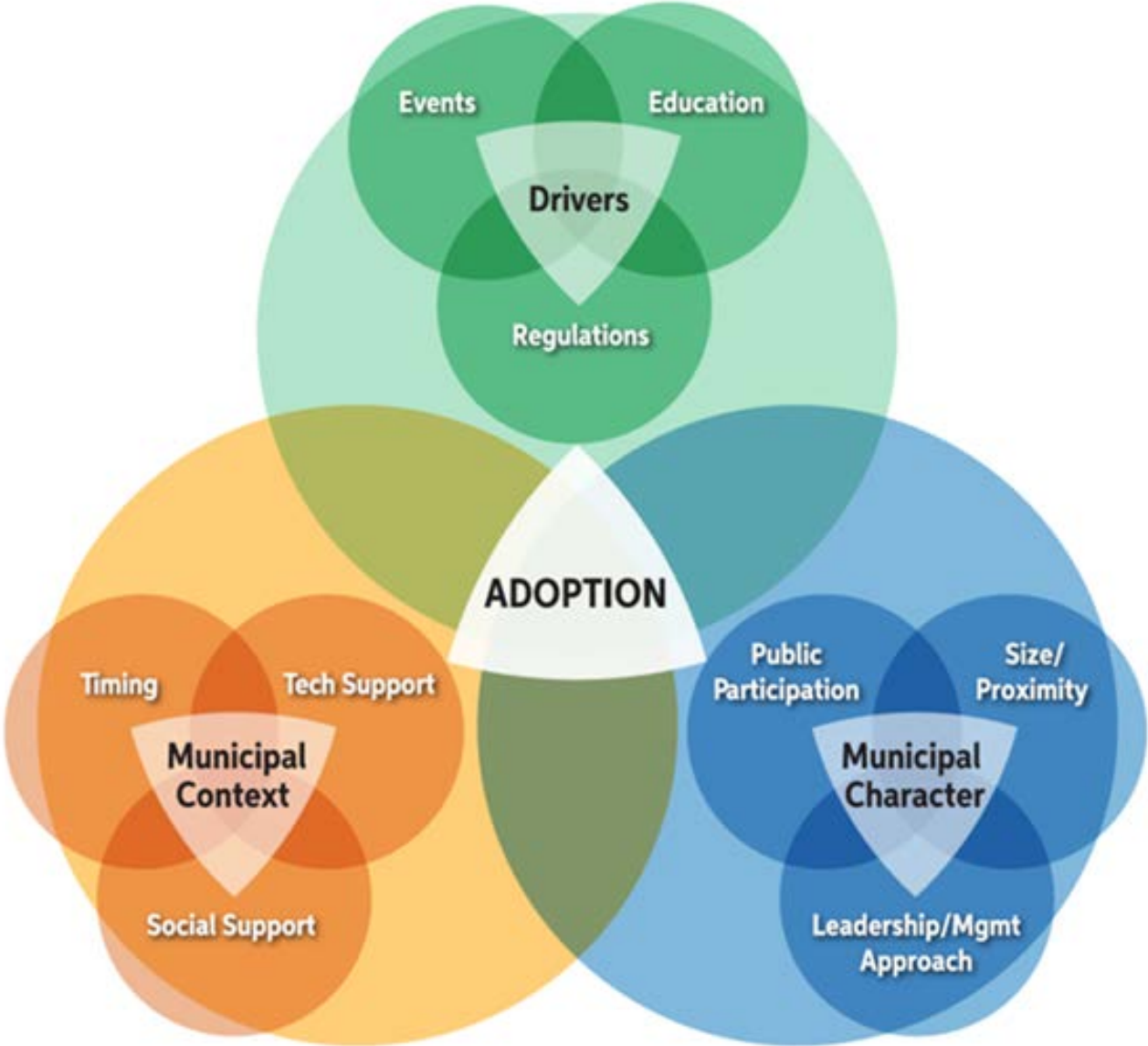
Interviews





Adapted from Rogers, 2003

Conceptual Model Factors Influencing Adoption



Simplified Solution Model



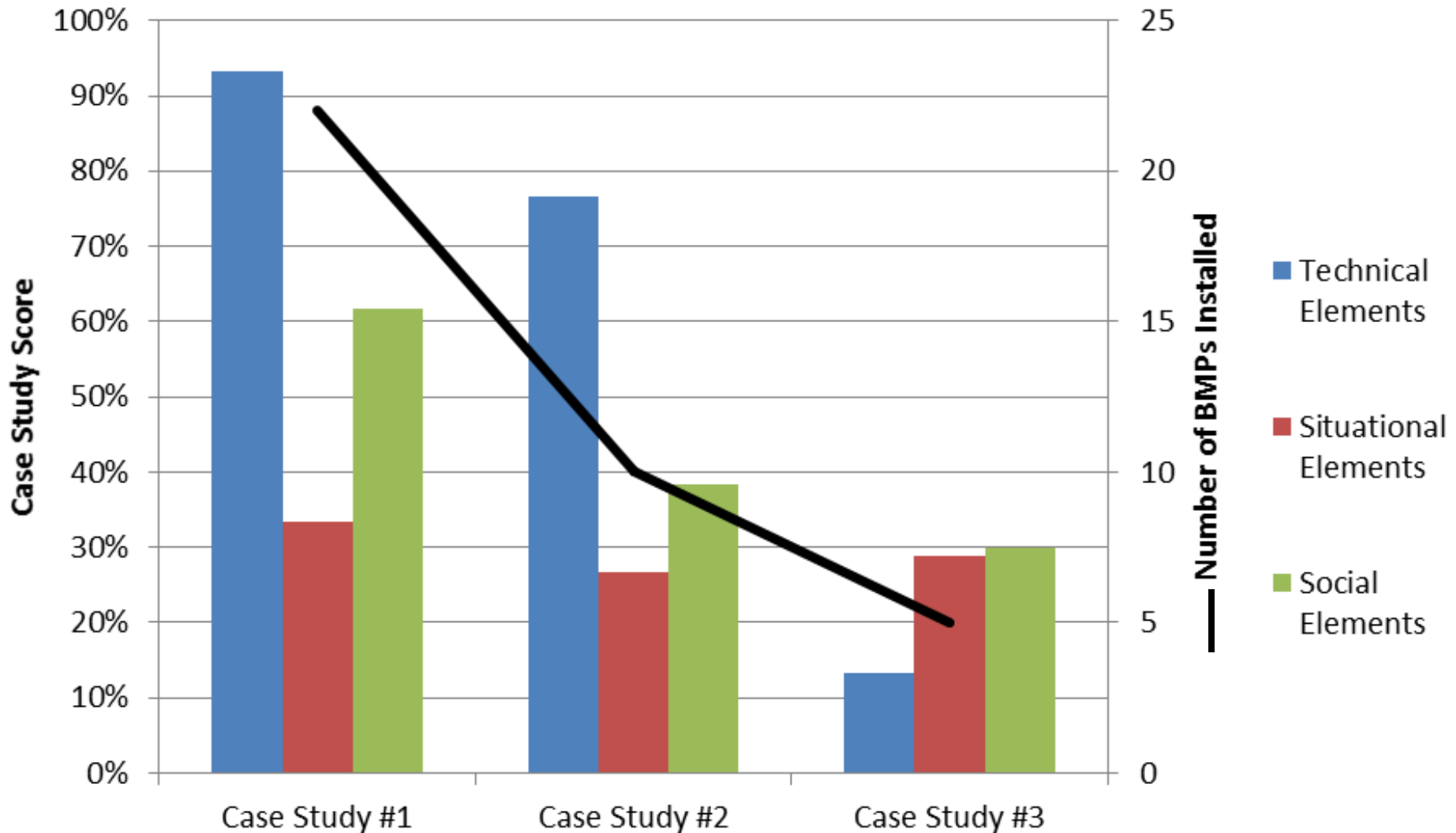
■ Technical ■ Social ■ Situational

Technical: Elements pertaining to efforts that require technical expertise and understanding

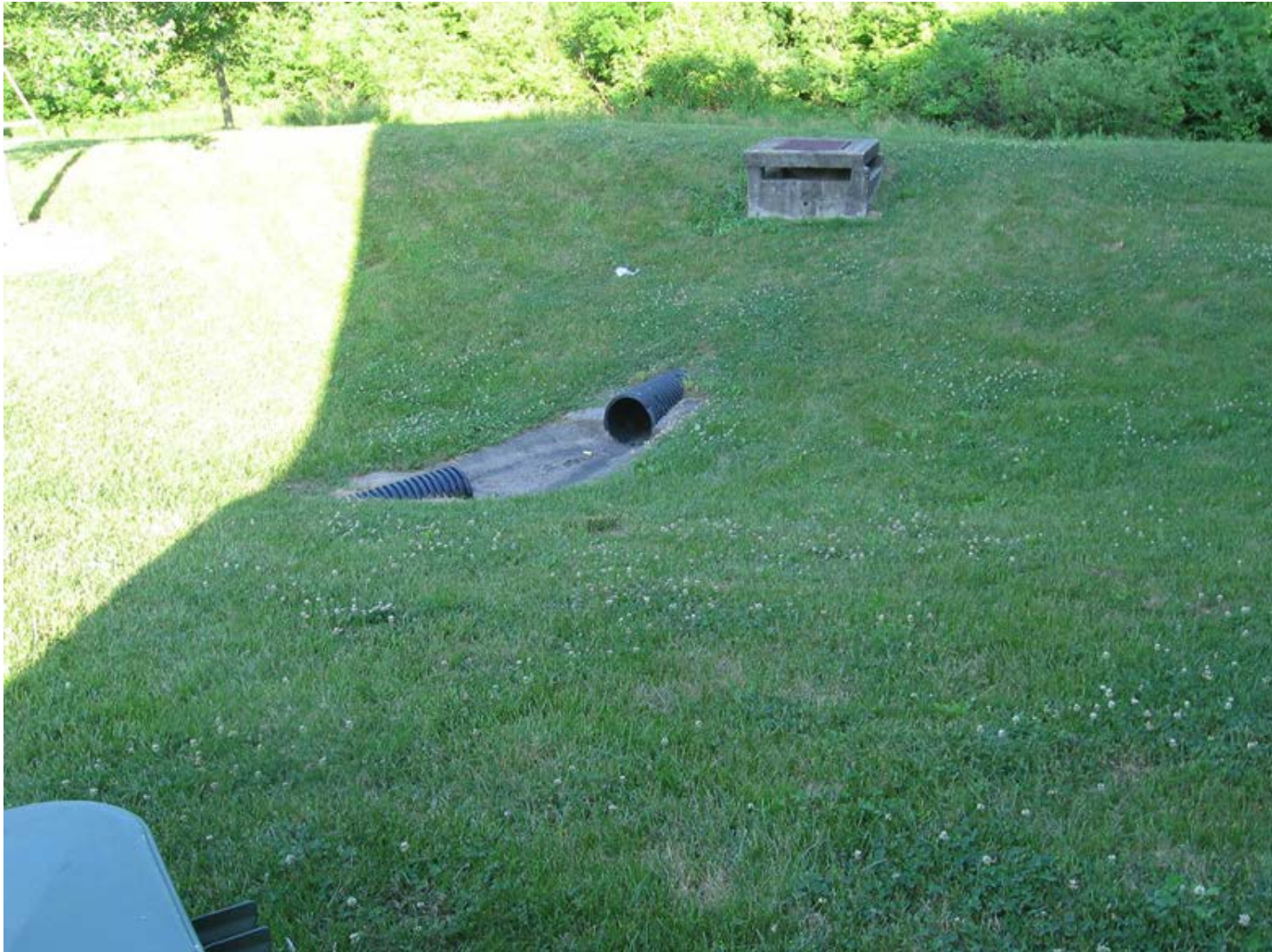
Social: Elements pertaining to efforts that relate to public involvement and civic support for a cultural approach or common social responsibility.

Situational: Elements that are largely out of the control of any municipality or occur according to an external probability, such as an event or regulation.

Case Study Score vs # BMPs



Technical: Elements pertaining to efforts that require technical expertise and understanding



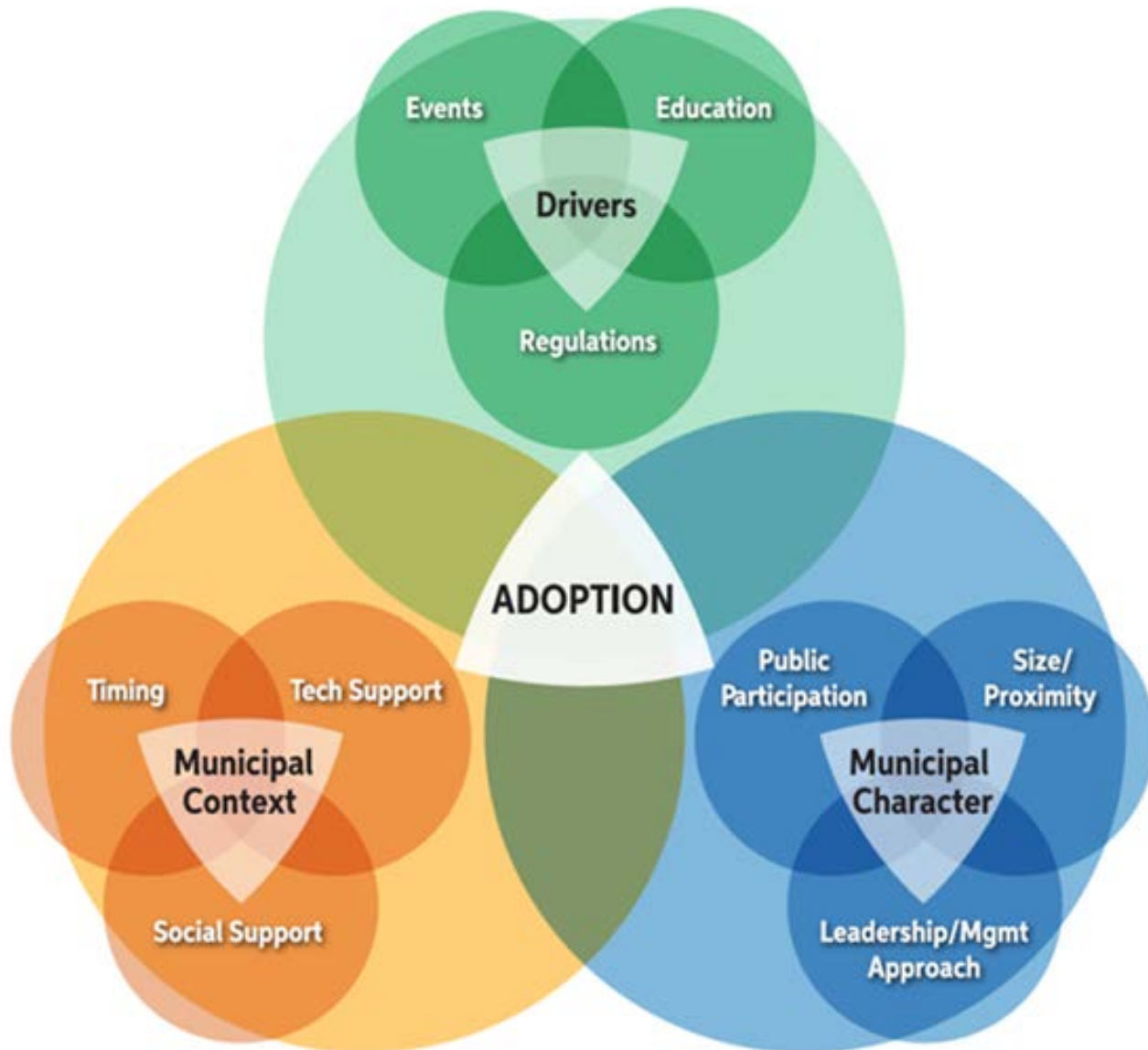
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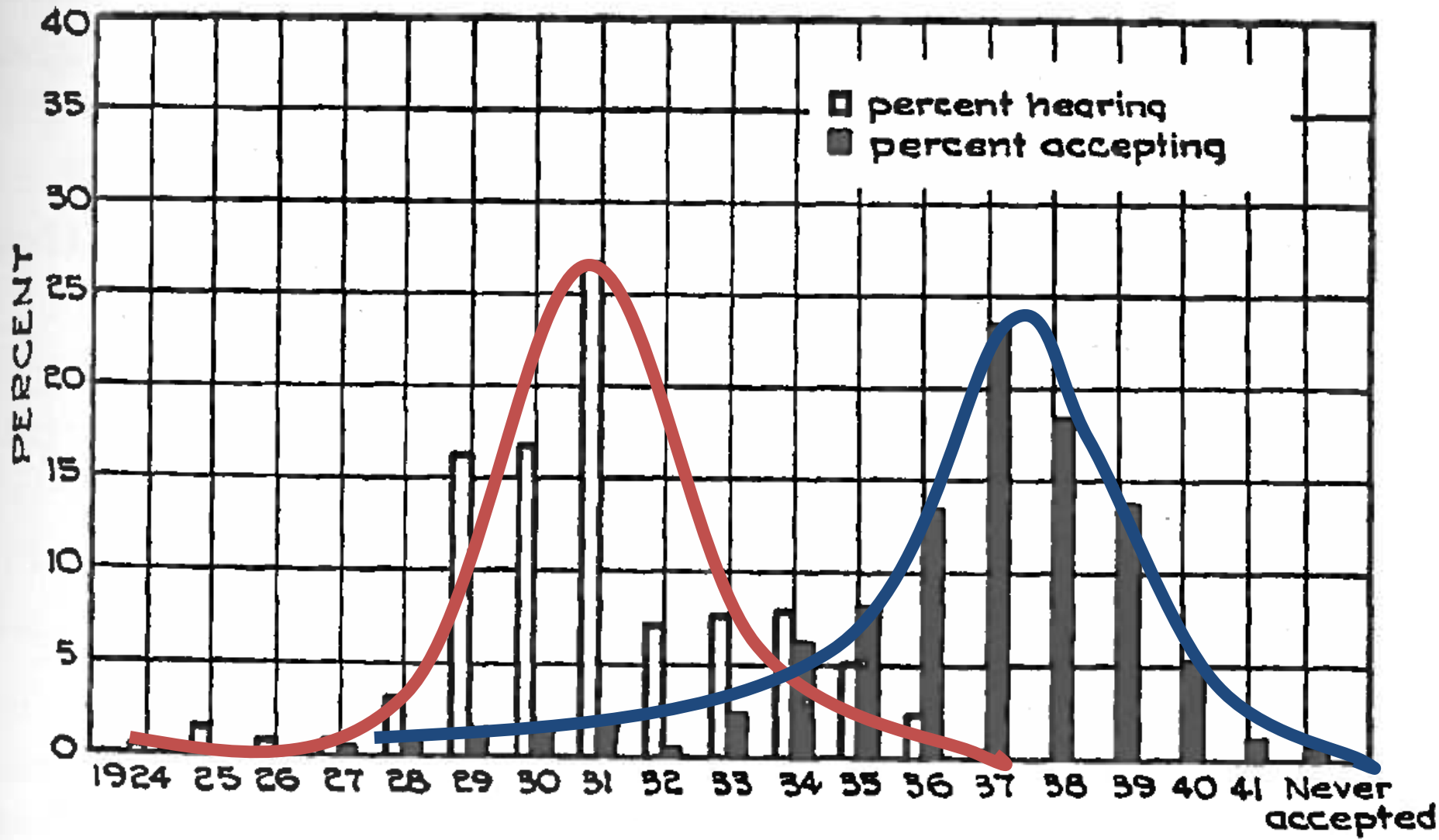
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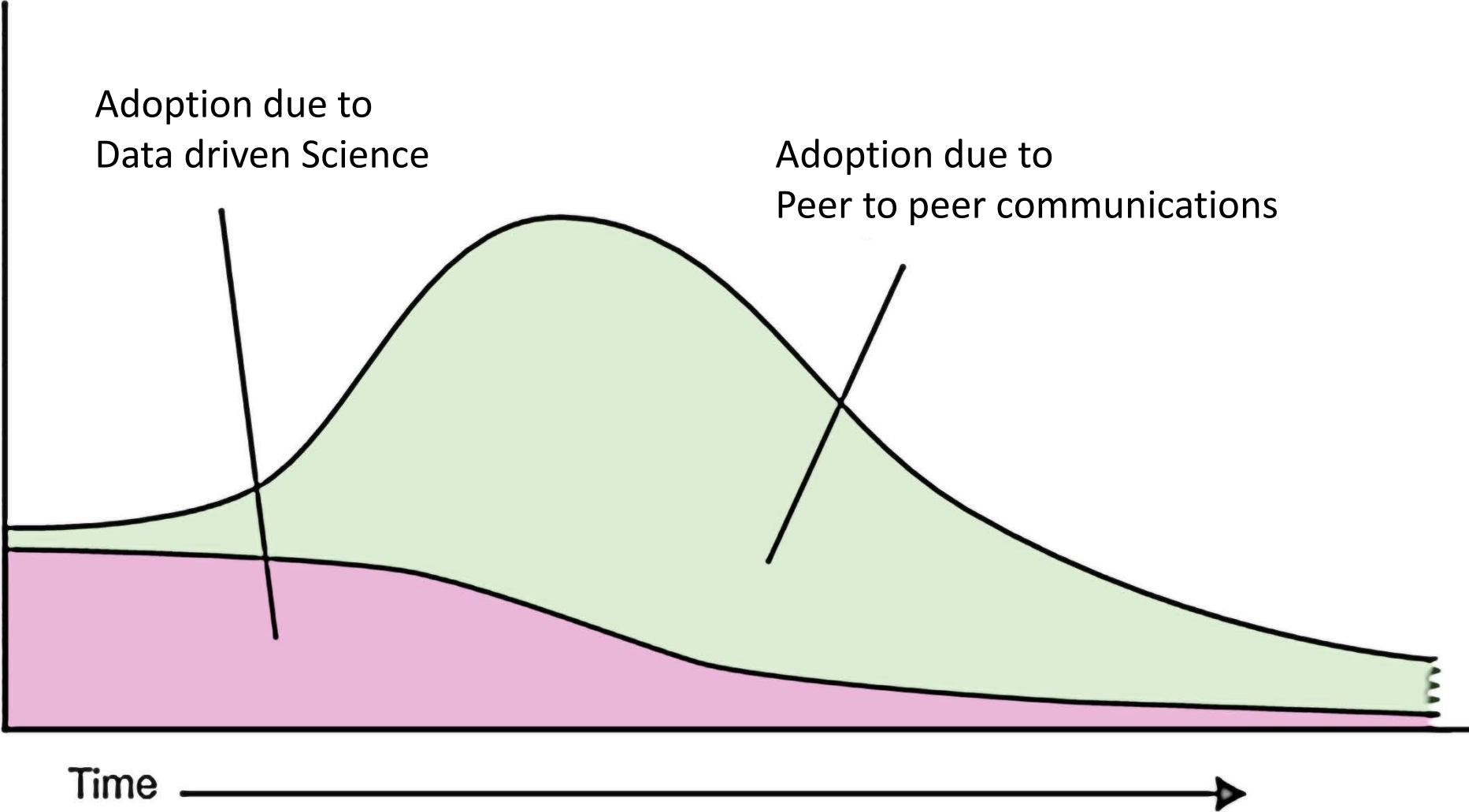


Why are these non-technical dimensions important?



Results from Ryan and Gross on farmer adoption patterns of hybrid corn.





Adoption due to
Data driven Science

Adoption due to
Peer to peer communications

Time

Conclusions

- Much more emphasis on the social and situational elements of DOI should be considered
- Social and situational elements are responsible for the majority of the metrics that influence adoption.
- At face value, this means that having strategic, audience-based communication strategies may be more critical to successful elements of innovation adoption than getting the science right.
- This is a sobering finding, particularly for professionals who may have biases in more technical fields.

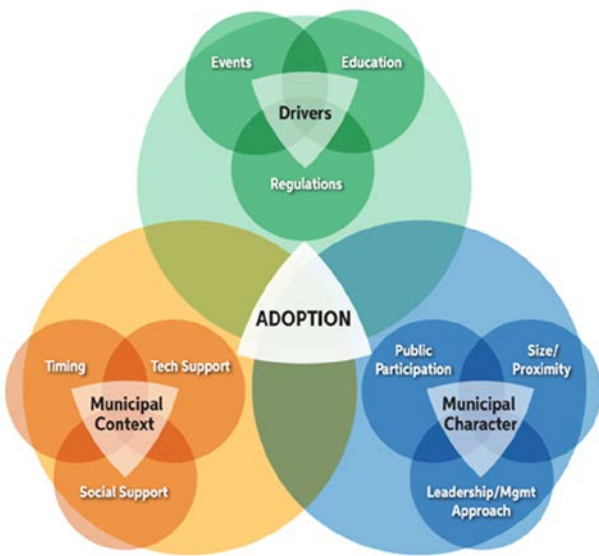
How To Use This Research

- Determine the audiences that are most ready and receptive to the innovation

- Work with early majorities where possible

- Maximize the implementation of all elements of the conceptual model

- Recruit early majority representatives to carry the message forward



Questions???

