

The Value of Floodplain Management



THE TEAM



Rachel Sears FEMA

Director, Floodplain Management Division

Rachel Sears joined the Federal Emergency Management Agency (FEMA) in 2004 and currently serves as the Director for the Floodplain Management Division. In this capacity, Ms. Sears provides leadership in the implementation of the floodplain management requirements of the National Flood Insurance Program (NFIP) and oversees FEMA's work as the lead agency under the Unified National Program for Floodplain Management and as the consultation agency under Executive Order 11988, Floodplain Management. Ms. Sears has a B.S. in Environment Sciences from Shepherd University and a Masters of Public Policy from George Mason University.



Kristin Murphy Booz | Allen | Hamilton

Lead Associate

Kristin Murphy is a senior strategy consultant with Booz Allen Hamilton and has spent nearly 15 years supporting federal programs and private industry within the mission spaces of resilience, hazard mitigation, environmental protection, sustainability, and climate change adaptation. Ms. Murphy is one of the leaders of Booz Allen's work for the Federal Emergency Management Agency (FEMA) - delivering integrated program and portfolio evaluation, strategy, analytics, and stakeholder engagement solutions that drive organizational behavior and optimize mission-level performance. Ms. Murphy is also an industry award-winning expert in applied innovation and design thinking theory for workshops and collaborative engagements; recognized multiple times for her work with FEMA and the National Flood Insurance Program (NFIP).



Dwayne Henclewood, PhD Booz | Allen | Hamilton

Lead Associate

Dr. Henclewood is a project manager, data scientist, and technologist specializing in establishing and leading technology and analytics projects and teams across a number of sectors. At the center of many of these research activities is the derivation of insights, from data, to inform decision-making and operations; the foundation of which is data collection, mining, exploration, and transformation exercises to support statistical and probabilistic modeling. He has also paired his data analytics expertise with his simulation skills to explore "what-if" scenarios in driving effective decision making. He has led and supported the development of several analytical and probabilistic solutions based on "big" data in a variety of markets including emergency management, consumer products, commercial aviation, and surface transportation.

THE CHALLENGE

Provide the Floodplain Management Program with a credible data-driven validation of the value of its program and a method by which to understand the likely outcomes of certain investment decisions in order to optimize the use of its resources under varying budget scenarios.



LOGIC MODEL

Define the Floodplain Management program logic model and identify a balanced set of available data across activities, providers, community behaviors, and ultimate loss reduction outcomes to depict how the program believes it influences community resilience



CHARACTERISTICS

Define available community characteristic measures that are believed to influence community behavior and decision-making irrespective of the program's interventions



LONGITUDINAL DATA

Identify, compile, clean, and enrich available longitudinal data across all measures for every community in CIS. Condense time-series insights into single data points utilizing composite scoring, change rates/slopes, sums, and averages



ANALYTICS

Perform descriptive, linear, and probabilistic modeling to produce insights that indicate the degree to which certain types, quantities, and/or providers of program interventions may lead to certain types of desired risk management behaviors and loss reduction in communities



**FLOODPLAIN
MANAGEMENT
WORKS!**

PROVE IT!



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Community Characteristics

- ✓ Type of SFHA
- ✓ FIRM Status
- ✓ Population
- ✓ Median Income
- ✓ Flood Disaster Declarations
- ✓ Structures in the SFHA
- ✓ Policies in force
- ✓ Development Growth



Program Activities & Providers

- ✓ Ordinance Reviews
- ✓ Technical Assistance
- ✓ CAVs
- ✓ CACs
- ✓ Total Program Interventions

....Provided by FEMA or the State



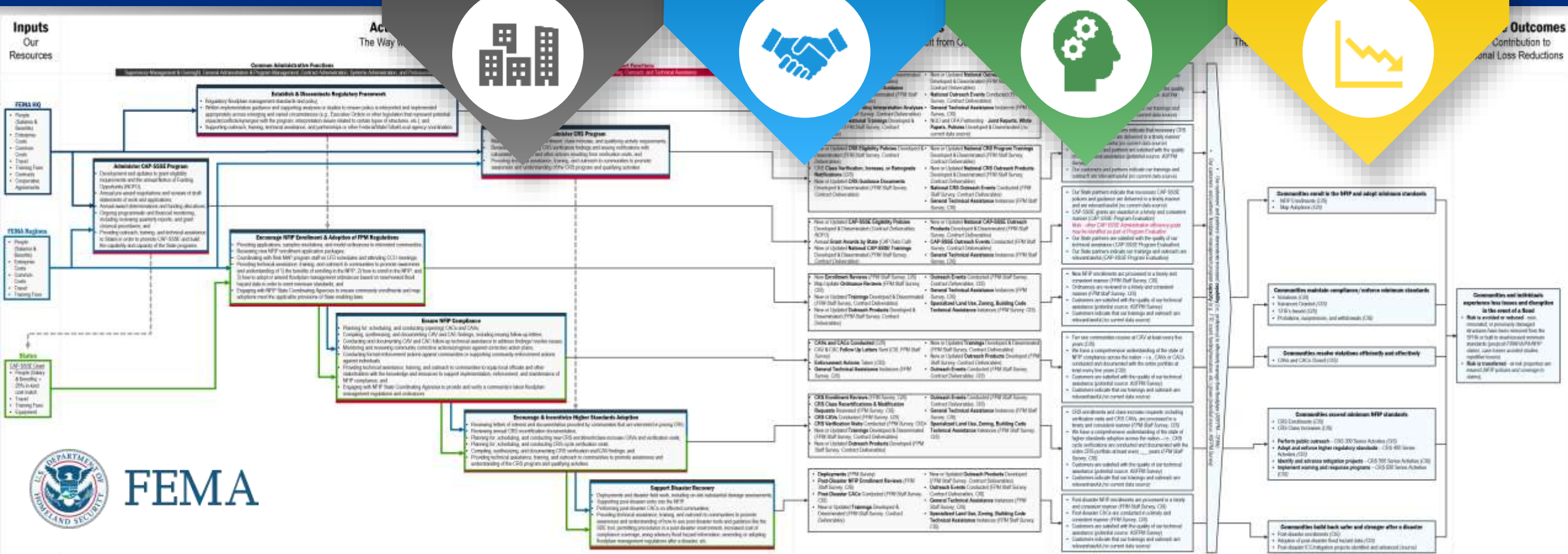
Community Behaviors

- ✓ Enrollments
- ✓ Map Adoptions
- ✓ Restrictive Ordinances
- ✓ Composite Compliance Score (CAV/CAC Findings)
- ✓ CRS Participation
- ✓ CRS Class Increases



Loss Reduction Outcomes

- ✓ Structure Growth in the SFHA
- ✓ Policy Growth
- ✓ Claims Growth



Identify the order of significant variables towards predicting the desired outcome

Develop a Bayesian Belief Network model for each desired outcome, depict the conditional dependencies between independent variables, and predict the probability of certain types of communities ultimately demonstrating the desired outcome(s).

Machine-Learned Probabilistic Model



3-PRONGED ANALYTICAL APPROACH

Descriptive Analysis



Identify potential relationships

Isolate communities that are demonstrating desired outcomes, compare distributions across independent variables (i.e., characteristics, interventions, and other intermediate outcomes) in the subset of communities vs. the general population of communities, and describe observable differences.

Identify statistically significant relationships and understand their directionality

Linear Regression Model



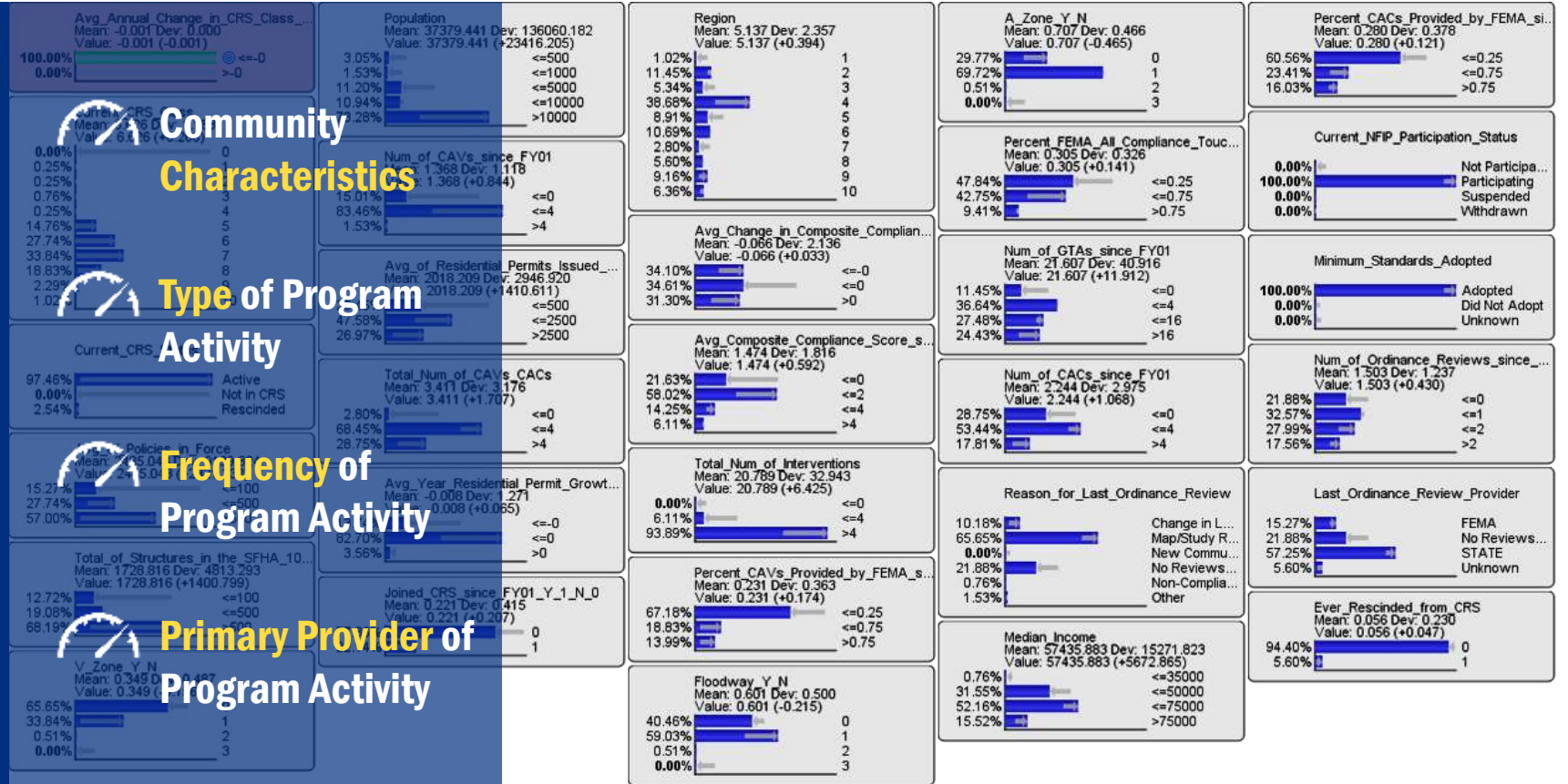
Develop multivariable linear regression models for each desired outcome and identify where significant correlations exist with independent variables.



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A LITTLE PREDICTION GOES A LONG WAY

The probabilistic graphical model can allow us to **perform if/then scenarios** by selecting specific characteristics based on actual communities or groups of communities, and testing the provision of certain activities by certain providers **to predict intermediate risk management behaviors and ultimate loss reduction outcomes** for those communities.



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DEBUNKED

Communities with a higher median income perform better due to their higher capacity and sophistication, while communities with a lower median income have a higher barrier to entry due to their limited capacity and sophistication

Communities with higher populations are more interested in enrolling in the NFIP

Ultimately, we have no control or influence over what a community does – their own priorities and characteristics are the biggest predictors of their risk management behaviors



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COMMUNITY CHARACTERISTICS

- ✓ Median income is one of the least significant community characteristics when it comes to predicting risk management behaviors and loss reduction outcomes. The type of flood risk, whether it is mapped, and the number of people and structures in the SFHA are much more important predictors.
- ✓ Community characteristics are more important predictors of map adoption, NFIP enrollment, and CRS participation than program interventions. However, the program's interventions (thus, influence) are more important predictors of compliance improvement and higher standards adoption than a community's characteristics.
- ✓ It is easiest to enroll smaller, less complex communities into the NFIP. Once they are in the NFIP, larger and more complex communities are more driven to adopt maps, higher standards, and join CRS. Larger more complex communities are not more likely to improve their compliance, the best we may be able to hope for is that they do not get worse.
- ✓ New communities to the NFIP have often joined CRS quickly after enrolling over the last 15 years; so much so that the probabilistic models reveal that CRS participation and NFIP enrollment are significantly related. Newer communities to the NFIP are more likely to have positive loss reduction outcomes.
- ✓ While coastal communities are more likely to participate in CRS and increase policy counts, they have more severe compliance issues, demonstrate less compliance improvement, and are increasing claims and development in the SFHA.

EVIDENCE

Coastal communities are increasing the number of people and structures in harm's way

For some large and complex communities, the best we may be able to expect and require is that they do not get worse

DEBUNKED

Compliance interventions (CAVs and CACs) are not an effective means of ensuring a community maintains compliance

We need to do more CAVs more often to ensure communities are maintaining compliance

General technical assistance (GTA) is just about answering the phone; more or less of it makes no difference to how well a community performs

Ordinance assistance is a necessary step in the NFIP enrollment and map adoption processes; doing more of it or doing it more effectively makes no difference



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PROGRAM ACTIVITIES AND PROVIDERS

- ✓ There is strong evidence that shared relationships with communities (i.e., FEMA and the State provide near equal amounts of total program interventions) is the best way to maximize positive loss reduction outcomes.
- ✓ Increasing compliance interventions is a significant predictor of map adoption, compliance improvement, and CRS enrollment and class increases. Increasing CAVs is more significant for map adoption and CRS activity, while interestingly, increasing CACs is more significant for predicting compliance improvement.
- ✓ Increased GTA is most important to map adoption and higher standards adoption.
- ✓ Increasing ordinance assistance is a significant predictor of NFIP enrollment, map adoption, compliance improvement, and higher standards adoption – all of which are significant predictors of positive loss reduction outcomes.
- ✓ While more analysis is required to understand the differences between Regions and States, significant predictive relationships exist between certain Regions and community performance which indicate potential differences in delivery that could be more/less effective.
- ✓ Increasing the total number of program interventions (proxy indicator of developing a closer/trusted relationship) with the community is a significant predictor of map adoption, higher standards adoption, and CRS enrollment and class increases.
- ✓ Ordinance assistance and compliance interventions are more effective when they are provided by the State, especially as predictors for compliance improvement and higher standards adoption.

EVIDENCE

Regions and States deliver parts of the program differently with differing levels of effectiveness

Relationships matter. We should make sure we are remaining in touch with as many communities as possible

States are more effective at delivering core program activities.

DEBUNKED

If we follow through with suspensions more often, we will be more effective at ensuring compliance

Communities with the most severe compliance issues are never going to improve

CRS communities are the “gold star” communities; they are our highest performers and are reducing losses over time

There are two types of communities: those that do the minimum to stay in the NFIP and those that demonstrate higher performance (e.g., adopt higher standards, join CRS), they don't intermingle



COMMUNITY PERFORMANCE

- ✓ Participation in the NFIP and adoption of minimum standards is one of the most significant predictors of positive loss reduction outcomes. We should be aiming to enroll and keep communities in the program.
- ✓ The presence of severe compliance issues increases the likelihood communities will have negative loss reduction outcomes. A community's state of compliance is a very significant predictor of loss reduction. Communities with severe compliance issues are likely to improve those issues with the right mix of program interventions and incentives as compliance is an important driver of other desired behaviors. Communities with more complexity (e.g., higher population, more structures in the SFHA, more risk) tend all have some level of compliance issues, but are also highly motivated to join or stay in CRS and are more likely to adopt higher standards.
- ✓ CRS participation is not as significant of a predictor of positive loss reduction outcomes as other behaviors (e.g., compliance). CRS communities are typically the largest and have the most complex risk profiles and, while many are increasing insurance coverage, they are also dramatically increasing the size of the built environment within the SFHA and their claims are increasing over time. CRS participation is also a significant driver of other desired community behaviors. More newly enrolled communities in the NFIP move swiftly towards CRS enrollment and demonstrate faster class improvements. CRS communities are more likely to have compliance issues, but those communities are also more likely to improve those issues.
- ✓ The frequency of disaster declarations is not a significant predictor of a community's risk management behaviors and loss reduction outcomes. Given the opportunity to influence changes in the built environment post-disaster, we'd hope to see, at the very least, a correlation between disaster frequency and compliance, however the probabilistic model indicates that disaster frequency is one of the least significant predictor variables and, in fact, communities with less disasters are more likely to improve compliance over time.

EVIDENCE

We are not making as big of a difference in the post-disaster environment as we'd like

Bringing a community into the NFIP and keeping them in is one of the most important things that we can do as a program

WHAT'S NEXT

FOR FEMA

With this analysis, we are approaching the strategy and execution of our program with a refreshed focus on applying our resources where we are most likely to have the greatest impact.

FOR YOU

If you have risk, an interest in enhancing your capability to manage it, and there's an opportunity to influence the built environment in your community, we are focused on ensuring you get the support you need.

**FOCUSING OUR STRATEGY & OPERATIONS
ON MAXIMIZING PROGRAM IMPACT**

**BETTER LEVERAGING AND LINKING WITH OUR
PARTNER PROGRAMS**

**ENHANCING OUR DATA MANAGEMENT & ANALYTICS
CAPABILITIES TO SUPPORT BETTER DECISIONS**

**EXPLORING NEW WAYS TO ENGAGE STATES AND
LOCALS TO HELP CLOSE THE INSURANCE GAP**



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Questions? More Information?

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