



Creating Solutions through Location-based Analytics

Future forward

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Objective

- Using location based analytics, create underwriting efficiencies through data and predictive analytics
- Address the business problem holistically rather than strictly as an exercise in numbers
- Bring underwriting, actuarial and modeling together to create a complete solution
- Key areas of focus
 - Define the problem & demonstrate the vision
 - Design the solution
 - Implement the program

The Business Problem

Example - Large Inspection Expenditures

1. “We need to reduce our inspection expenses, while keeping our risk exposure low.”
2. “We are growing our business, but cannot increase our inspection budget to inspect every property like we once did.”

Inspect



Do Not Inspect



The Business Problem

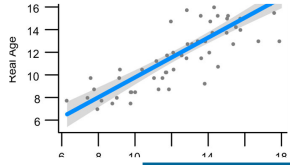
Large Inspection Expenditures

When it comes to how underwriters want to design their inspection program, there are multiple options available, each with a clear benefit and drawback

Option	Approach	Example	Benefit	Downside
1	Physical, on-site inspection on every property	Boots on the ground: External Internal & External	Complete view of every risk	Costly; ordering inspections on low risk properties
2	Business Rules	Built prior to 1987	<ul style="list-style-type: none">• Simple, lower cost• Easy to implement & monitor	Many homes built later than 1987 have significant risk
3	Advanced Analytics	Generalized Linear Models Machine Learning - Decision Trees, Random Forest, etc.	<ul style="list-style-type: none">• Further differentiate low and high risk• Targeted program: Inspect high risk, do not inspect low risk• Measurable	Black box Some error, miss risks
4	Virtual Imagery	Aerial & Satellite MLS for Interior	<ul style="list-style-type: none">• Inspections at an UW's desk	At times imagery is not existent, outdated, or poor quality

Demonstrate the Vision

Optimization



Create Risk Scores

- Leverage data and advanced analytics

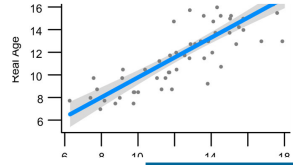
- Throw out lowest 20%
- Lowest risk, no need to inspect
- Average \$1 per property

The ideal program should incorporate data & analytics leveraging:

- The best of the carrier's existing data
- The most accurate property & location data through content providers
- Advanced modeling techniques

Demonstrate the Vision

Optimization



Create Risk Scores

- Leverage data and advanced analytics

- Throw out lowest 20%
- Lowest risk, no need to inspect
- Average \$1 per property



Imagery

- Leverage high confidence prefill data and imagery
- 40-50% available
- Leverage low-cost "call center" for collection

- Desk inspection on 40%
- Average \$5-\$10 per property

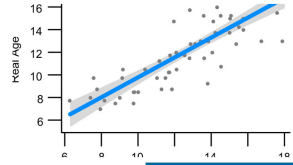


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Physical Inspection

- High risk & imagery not available
- Inspect 40%
- Average \$30 / inspection

A multifaceted program demonstrates to underwriting management the solution is not one-size-fits-all.

There are design options that leverage all the **data, technology and analytics capabilities** available in the market.



Design the Solution

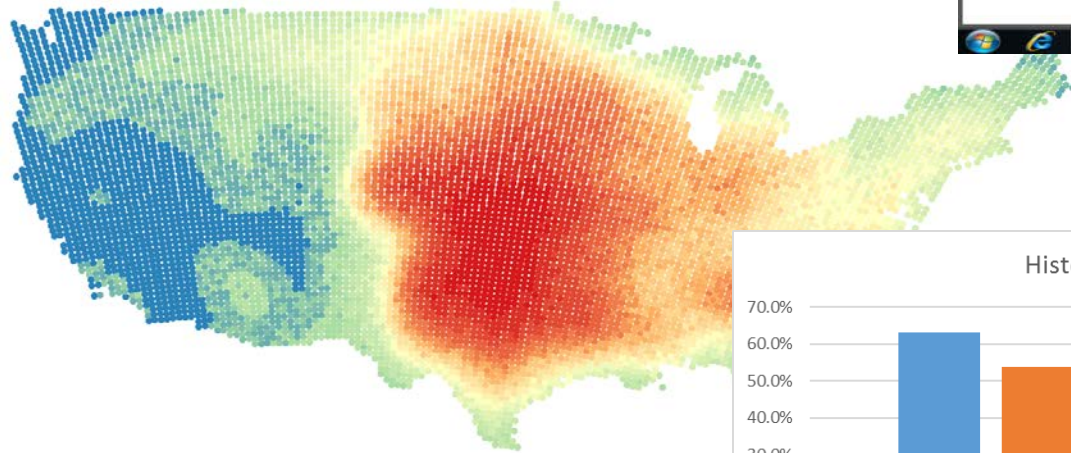
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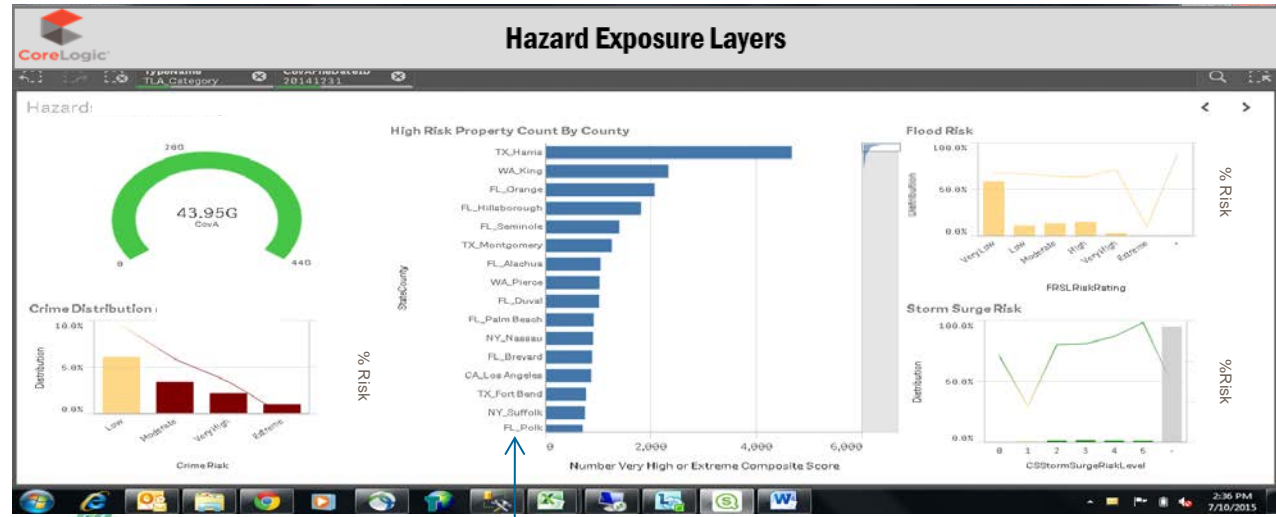


Explore the Data

- What is the origin?
- How does it relate to risk?



Heat Maps - Hail Events

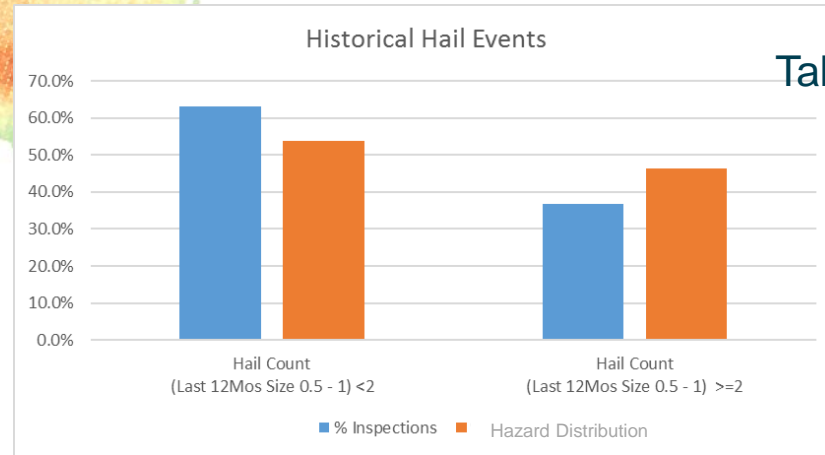


Flood Risk Exposure

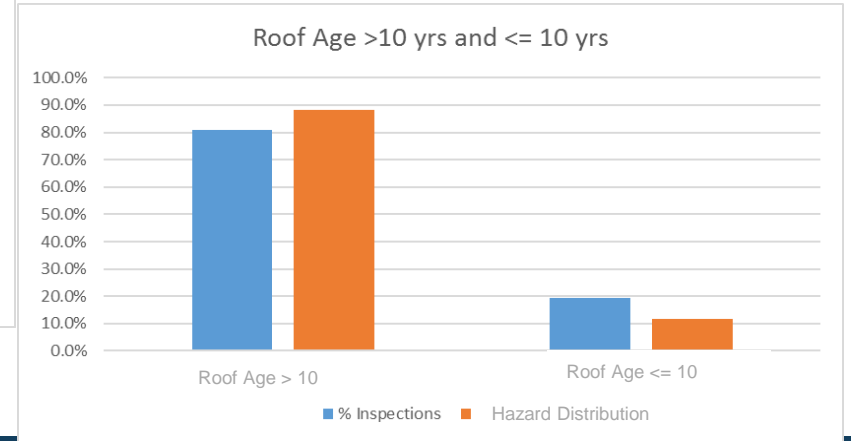
Storm Surge Exposure

Counties Prioritized by Risk

Interactive



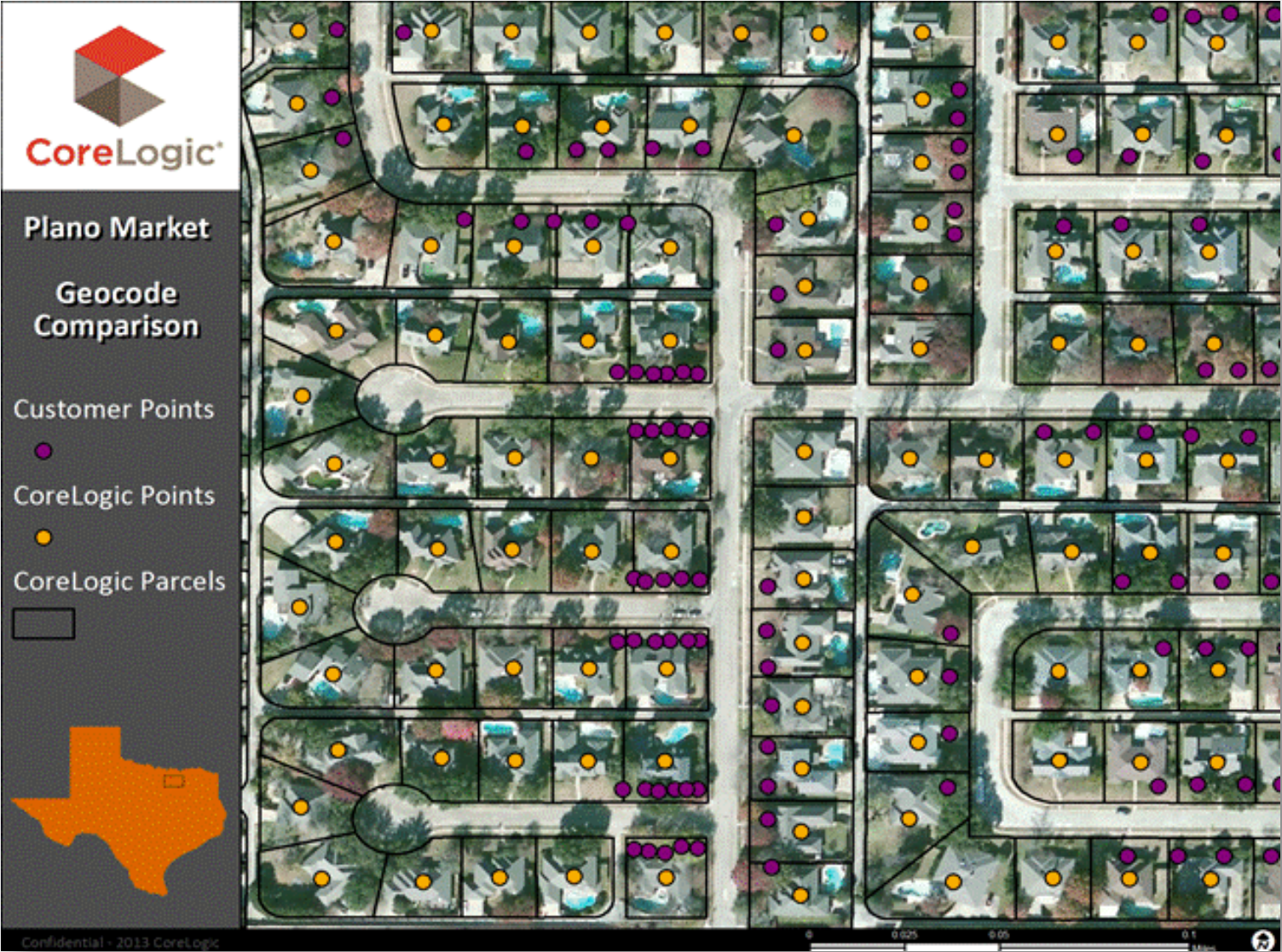
Tabular Form



Location Analytics – Geocoding accuracy

- To get the most out of Location analytics, you first need to make sure you have the correct location
 - Matching the address to the actual “parcel” that corresponds to the address
 - Parcel centroids very close match for most residential
 - Street level matches and/or interpolation may not be close
 - Multiple buildings on a parcel?

Geocode Comparison



Parcels as the Relational Link

Geocode	
Latitude	25.898951
Longitude	-80.126806
Address Line	276 BAL BAY DR
City/State Zip	MIAMI BEACH FL 33154
PxPoint Data Set	PARCEL
Elevation, Slope, and Aspect	
Elevation (Feet)	1.31
Slope (Degrees)	0
Aspect	Flat
Mainland Determination & Distance	
Distance to Seaward Water Feature	101 feet
Seaward Water Feature Name	Biscayne Bay
Mainland: Yes or No	No
Coastal Storm Surge	
Risk Value	5
Risk Level	Extreme
Hurricane Landfall Probability	
% Tropical Storm Risk (Winds 39 - 73mph)	5.3
% Tropical Storm Risk (50-yr)	93.5
% Hurricane Risk (Cat 1-5 Storms)	1.6
% Hurricane Risk (50-yr)	56.3
% Intense Hurricane Risk (Cat 3-5 Storms)	0.4
% Intense Hurr. Risk (50-yr)	19.9
Flood Risk	
Flood Hazard Zone	AE
Undeveloped Coastal Barrier Area	COBRA_OUT
Special Flood Hazard Area (SFHA)	IN
Damaging Winds	
Straight Line Wind (SLW) Risk	Moderate
SLW Frequency	1 Event Every 4 - 6 Years
Hurricane Risk	Very High
Hurricane Frequency	1 Event Every 3 - 5 Years
Tornado Risk	Moderate
Tornado Frequency	1 Event every 5 - 8 Years
Sinkhole	
Risk	Low
Distance to Very High Sinkhole Risk	Greater than 10 miles
Wildfire Risk	
Brushfire Risk	Urban
Nearest high-risk value	Very High
Distance to High/Very High	> 1 mile

- The Parcel Identification Number (PIN) or Address links the physical parcel to real estate data; and
- Latitude/Longitude links the hazard risk and reg. compliance data to the parcel.

Parcel Information	
PIN:	1222260022310
Address Line:	276 BAL BAY DR
	BAL HARBOUR FL
City/ State/ Zip:	33154
Latitude:	25.898951
Longitude:	-80.126806

PIN:	1222260022310
Property Address:	276 BAL BAY DR
Owner:	BEV SIEVERT
Land Value:	\$9,892,934
Building Value:	\$2,349,327
Market Value:	\$12,242,261
Assessed Value:	\$9,375,066
Adj Sq Footage:	9,988
Year Built:	1977
Bedrooms:	9
Baths:	10
Stories:	2
Living Units: 2	2
Adj Sq Footage:	9,988
Lot Size (Sq Ft):	46,279
Year Built:	1977
Construction:	Composite
Pool:	In Ground
Roof Cover:	Tile



Location Analytics – Natural Hazards

- Once you build a scientific model to estimate Natural Catastrophe Hazard risk, if the model is working properly it should identify locations with higher risk of loss
 - Frequency
 - Severity
- Validating models provide analytics that translate into Underwriting and Pricing decisions
 - Underwriting: Using the model to identify high risk locations, along with other underwriting variables, to make risk selection
 - Pricing: using the model to identify which locations have higher, or lower estimated annual losses

Location Analytics – Wildfire Risk Score

- CoreLogic Wildfire Risk score: 1-100 score that assesses the Wildfire risk at any location for Western states with the highest incidence of damaging Wildfires

Single Family Residences in Wildfire States						
	Low	Moderate	High	Very High		%
State	<u>1-50</u>	<u>51-60</u>	<u>61-80</u>	<u>81-100</u>	<u>Total</u>	<u>Very High</u>
AZ	1,919,351	14,308	27,159	19,578	1,980,396	0.99%
CA	8,286,708	133,654	367,457	263,319	9,051,138	2.91%
CO	1,454,787	52,823	122,509	128,348	1,758,467	7.30%
ID	476,310	9,554	27,868	43,423	557,155	7.79%
MT	243,990	13,114	27,301	32,348	316,753	10.21%
NM	523,755	14,487	32,139	39,871	610,252	6.53%
NV	848,682	2,337	9,184	7,237	867,440	0.83%
OK	1,250,888	1,431	2,219	735	1,255,273	0.06%
OR	1,091,300	22,616	46,655	79,799	1,240,370	6.43%
TX	6,458,363	197,548	487,247	451,848	7,595,006	5.95%
UT	693,256	14,713	24,311	8,845	741,125	1.19%
WA	2,192,567	8,662	17,001	21,139	2,239,369	0.94%
WY	<u>176,983</u>	<u>1,766</u>	<u>2,764</u>	<u>4,641</u>	<u>186,154</u>	<u>2.49%</u>
Total	25,616,940	487,013	1,193,814	1,101,131	28,398,898	3.88%

Location Analytics – Wildfire Risk Score

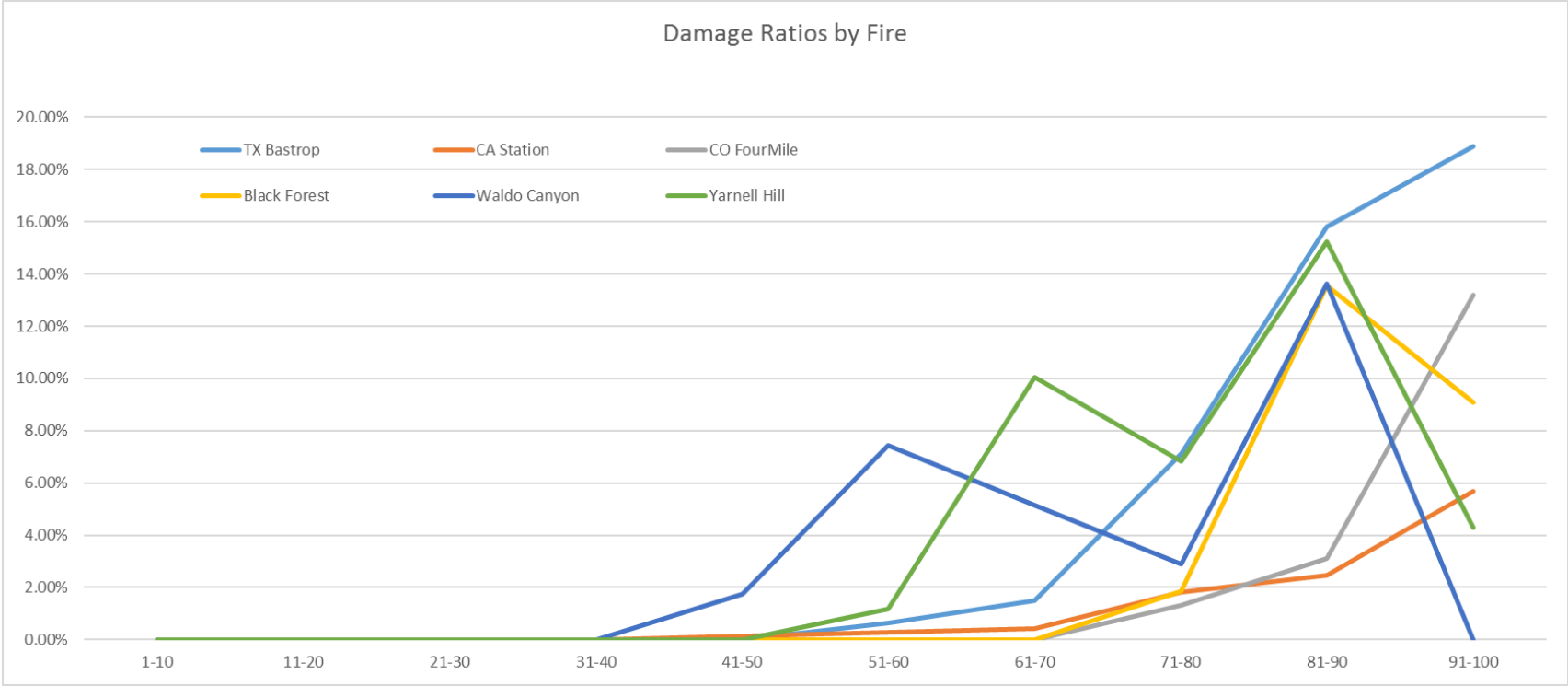
- Sample Fire results: higher risk areas surrounding known fire events
 - 10.9% of the locations were “very high” risk with score 81-100
 - 69.6% of locations damaged were “very high” risk

Wildfire Risk Score	TX Bastrop		CA Station		CO FourMile		Black Forest		Waldo Canyon		Yarnell Hill		Total		
	Range	Tot #	# dam	Tot #	# dam	Tot #	# dam	Tot #	# dam	Tot #	# dam	Tot #	# dam	Tot #	# dam
1-10	2	-	43,849	2	1,482	-	227	-	-	-	-	-	-	45,560	2
11-20	1	-	660	-	4	-	383	-	-	-	-	-	-	1,048	-
21-30	382	-	18,321	-	787	-	348	-	80	-	19	-	-	19,937	-
31-40	1,446	-	16,820	-	1,024	-	647	-	478	-	224	-	-	20,639	-
41-50	1,553	-	13,609	18	652	-	677	-	1,895	33	436	-	-	18,822	51
51-60	1,130	7	5,514	16	217	-	282	-	1,355	101	255	3	-	8,753	127
61-70	2,201	33	6,110	26	291	-	326	-	2,421	125	517	52	-	11,866	236
71-80	3,245	231	5,109	93	231	3	695	13	3,437	99	323	22	-	13,040	461
81-90	5,394	853	2,199	54	1,378	43	2,675	363	191	26	289	44	-	12,126	1,383
91-100	<u>1,838</u>	<u>347</u>	<u>492</u>	<u>28</u>	<u>848</u>	<u>112</u>	<u>1,232</u>	<u>112</u>	<u>15</u>	<u>-</u>	<u>606</u>	<u>26</u>	-	<u>5,031</u>	<u>625</u>
	17,192	1,471	112,683	237	6,914	158	7,492	488	9,872	384	2,669	147	-	156,822	2,885
% in 81-100 range	42.1%	81.6%	2.4%	34.6%	32.2%	98.1%	52.1%	97.3%	2.1%	6.8%	33.5%	47.6%	-	10.9%	69.6%

Location Analytics – Wildfire Risk Score

- Sample Fire results: Risk of damage increases with score
 - Locations with scores 81-100 (very High) are over 6 times more likely to be damaged

WFRS	Total	
Range	Tot #	# dam
1-10	45,560	0.00%
11-20	1,048	0.00%
21-30	19,937	0.00%
31-40	20,639	0.00%
41-50	18,822	0.27%
51-60	8,753	1.45%
61-70	11,866	1.99%
71-80	13,040	3.54%
81-90	12,126	11.41%
91-100	<u>5,031</u>	<u>12.42%</u>
All Scores	156,822	1.84%
Low (1-50)	106,006	0.05%
Moderate (51-60)	8,753	1.45%
High (61-80)	24,906	2.80%
Very High (81-100)	<u>17,157</u>	<u>11.70%</u>
	156,822	1.84%



Create the Model

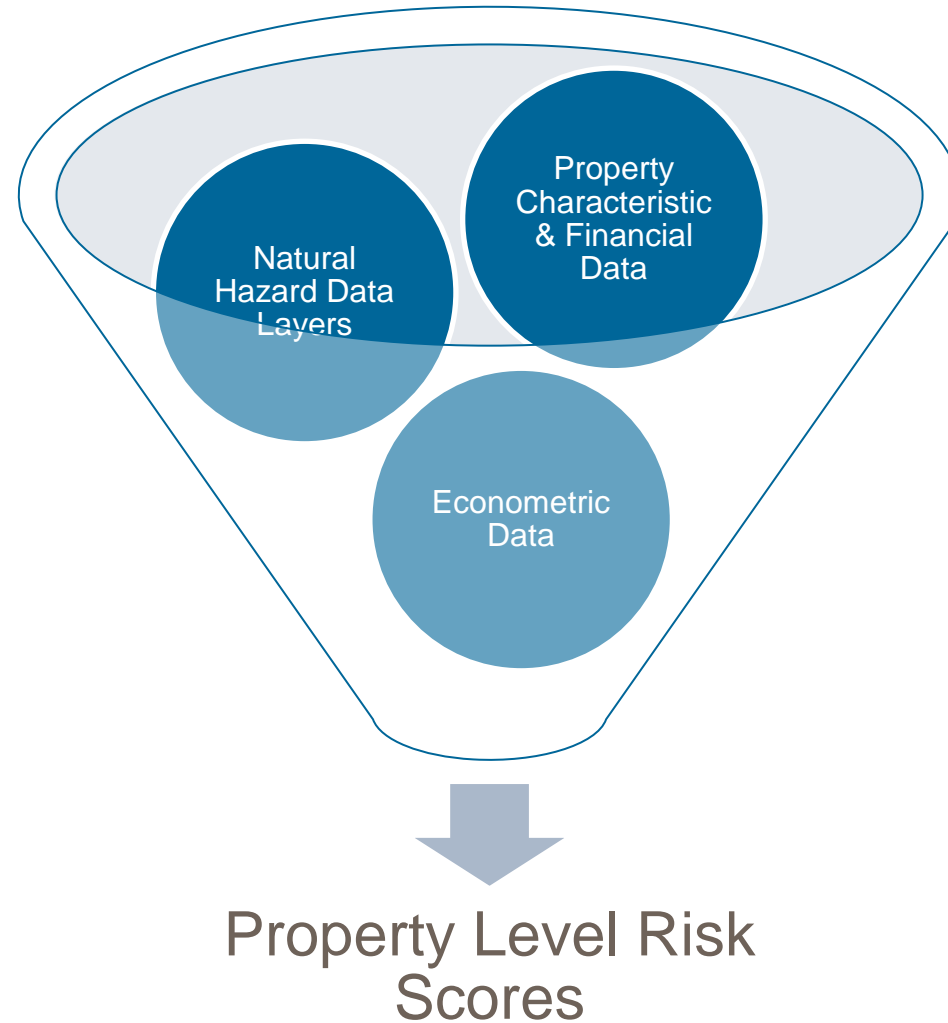
Creating the Risk Scores

- Leverage the best of the carrier's existing data
- Leverage the most accurate property & location data through content providers
- Advanced analytic techniques:
 - Generalized Linear Models
 - Machine Learning such as Decision Trees or XGBoost
- Demonstrate the value of a more complex model using cross validation and test sets

Create the Model

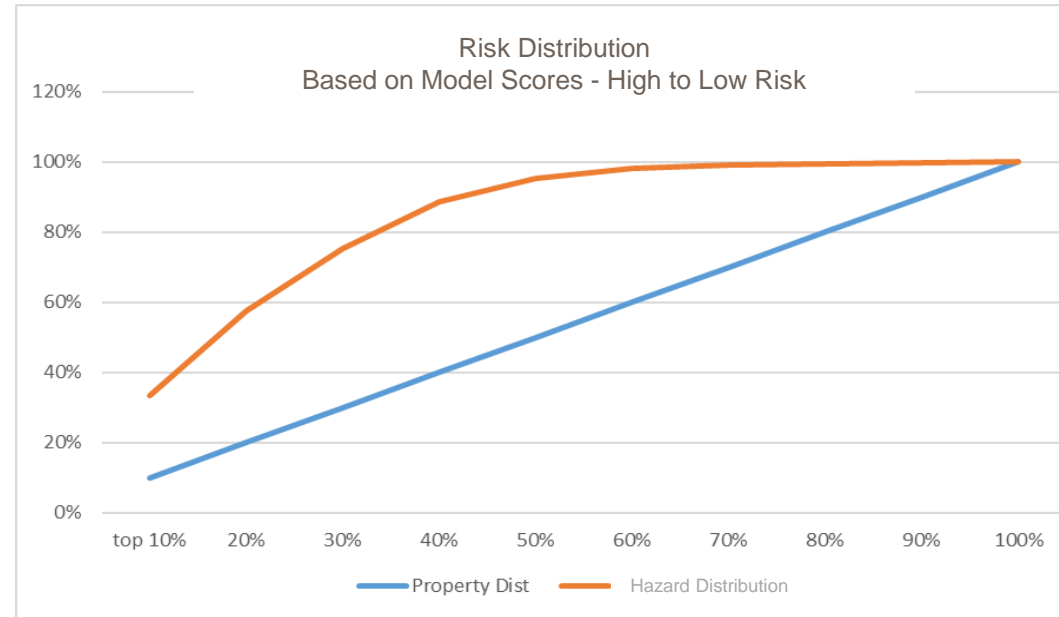
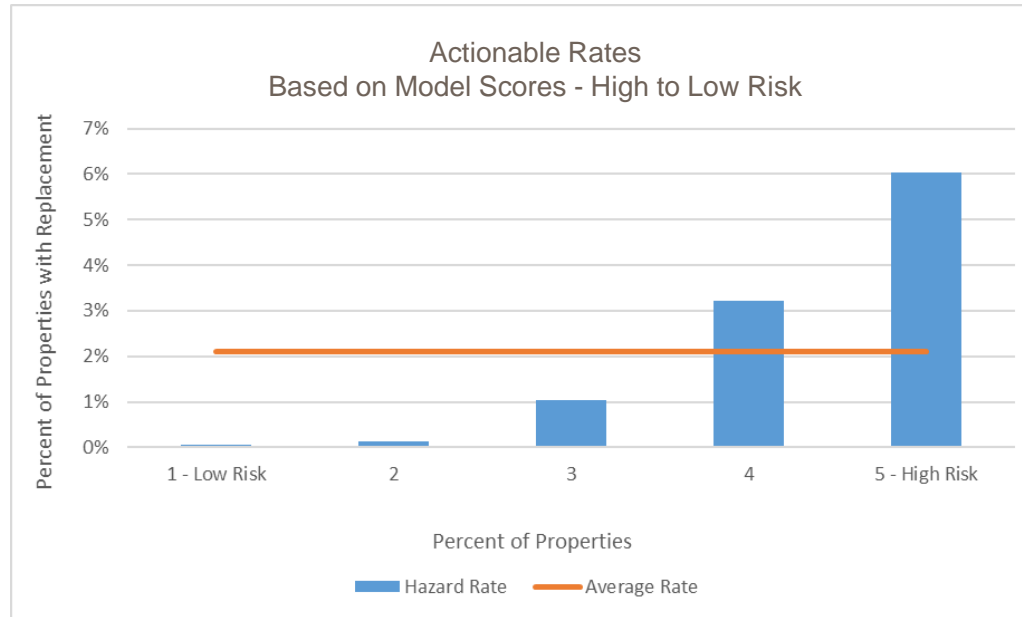
GLMs or Machine Learning Techniques

1. Develop model on training set
2. Use cross-validation
 - Assess performance
3. Apply to model holdout/test dataset
 - Assess performance
 - Performance difference between cross-validated and test datasets



Create the Model

Model Performance – Test Dataset



Price:

- Reduction factor for 'Low' risk
- Increase factor for 'High' risk

Underwriting:

- Select 4 & 5 risk for inspection
- Automatically renew 1 & 2 risk

Create the Model

The Financial Benefit

Benefit of An Optimized Inspection Program

	Current	Optimized
New Business Volume	30,000	30,000
Inspection Volume	100% 30,000	80% ¹ 24,000
Percent of Inspections with condition issues	30%	37%
Cost per Inspection 1. Imagery and pre-fill data 2. Boots-on-the-ground	\$5 - \$10 \$30	
Inspection Type Allocation 1. Imagery and pre-fill data 2. Boots-on-the-ground	100%	40% ² 40% ³
Total Inspection Program Cost	\$900,000	\$384,000
Loss Mitigated	\$3.2M	\$3.1M ⁴

1. Using data and advanced analytics, create a risk score for every property. Ignore the lowest 20 percent risk—which is not where inspection dollars need to be spent
2. Collect current, high-quality imagery—usually available 40 percent of the time—from an appropriate source.
3. Where high-quality, current imagery is unavailable and the risk score is high, send an inspector to physically inspect the property.
4. For less than half the cost, a carrier could mitigate the same amount of claims. Claims mitigation = inspection volume * percent with issues * \$7,000 (avg. claim amt.)
* 5% (percent to incur claims)



Implement the Program

Future forward

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Implement the Program

Design the Solution

1. What is the risk score for each property? If bottom 20%, No Inspection

Policy ID	ADDRESS	CITY	STATE	ZIP	Inspection Risk Score	Recent Imagery Available	Lowest 20%	Workflow
12	3650 Wood Lenhart Rd SW	Warren	OH	44481	0.197	Y	Y	No Inspection
14	633 Prouty Ave	Toledo	OH	43609	0.080	N	Y	No Inspection
15	175 EMERY RD	DingmansFerry	PA	18328	0.114	N	Y	No Inspection
16	2222 Pinefield Rd	Waldorf	MD	20601	0.062	N	Y	No Inspection
....

1

2. Is recent imagery available? If yes, Virtual Inspection

1	10590 Colony Glen Dr	Alpharetta	GA	30022	0.912	Y	N	Virtual Inspection
3	110 FORREST DR	Marion	AR	72364	0.767	Y	N	Virtual Inspection
4	372 N MATTESON LAKE RD	Bronson	MI	49028	0.421	Y	N	Virtual Inspection
5	1657 Rice Sq	Lithonia	GA	30058	0.463	Y	N	Virtual Inspection
6	656 DUKE AVE	Odessa	TX	79765	0.557	Y	N	Virtual Inspection
....

2

3. Top 80% scores and no imagery? Physical Inspection

2	17 Malby Ave	Massena	NY	13662	0.486	N	N	Physical Inspection
7	2303 Spenrock Ct	Lewisville	TX	75077	0.640	N	N	Physical Inspection
8	11215 Bramshill Dr	Alpharetta	GA	30022	0.440	N	N	Physical Inspection
9	747 Greenwood Ave	Clarksville	TN	37040	0.377	N	N	Physical Inspection
11	4 MISTY DALE WAY	Gaithersburg	MD	20877	0.396	N	N	Physical Inspection
17	25 Stangel Dr	Woodbourne	NY	12788	0.748	N	N	Physical Inspection
....

3

Implement the Program

Iterate Through the Process

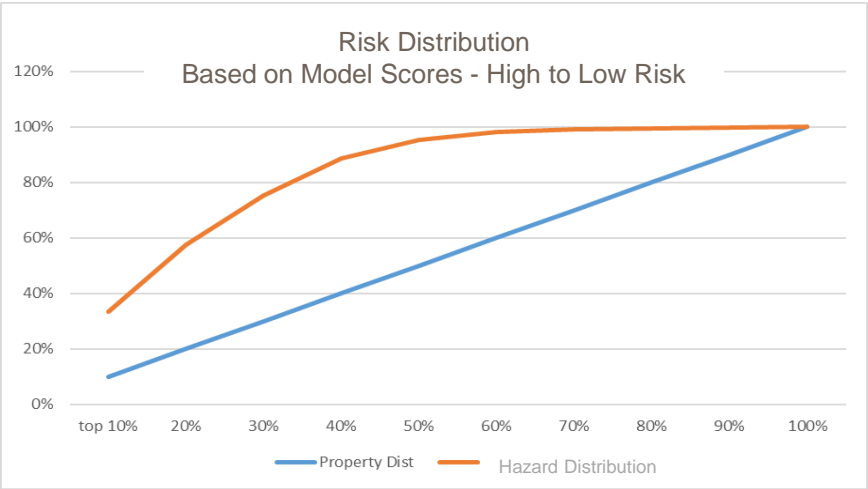
- Identify and address questions from decision makers and key stakeholders
- Recognize business needs vary, demonstrate flexibility
 - Business rule overlays
 - Analysis on key relationships / data drivers in the model

Business Rule: Inspect when High+ Wildfire Risk



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15	175 EMERY RD	DingmansFerry	PA	18328	0.114	N	Y	No Inspection	Low
16	2222 Pinefield Rd	Waldorf	MD	20601	0.062	N	Y	No Inspection	Very High
....

Assess the Business Rule:
What is the impact to model and financial performance?



Implement the Program

Design the Solution

- Understand workflows & create workflow options
 - How do we create the most low touch, high accuracy process?
 - What are the major decision points within the workflow?



No Touch



Send to offshore team,
collect imagery, review

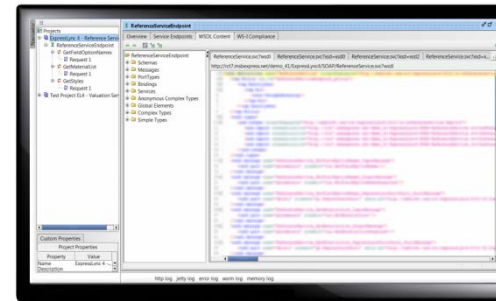


Send to inspection company for
boot-on-the-ground

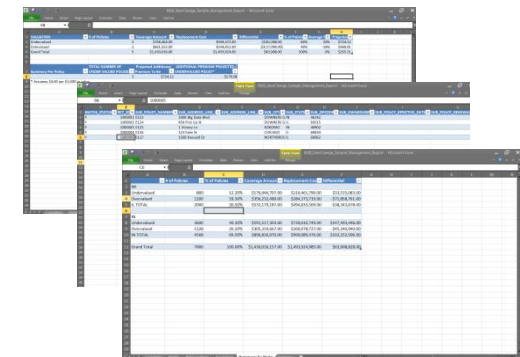
- What is the end user experience? Does the workflow help the user experience?
 - What data is needed in the model and when in the workflow is it available?
 - Integrate at time of quote OR at time of application

Workflow Options

Real Time Scoring
Web Service Calls



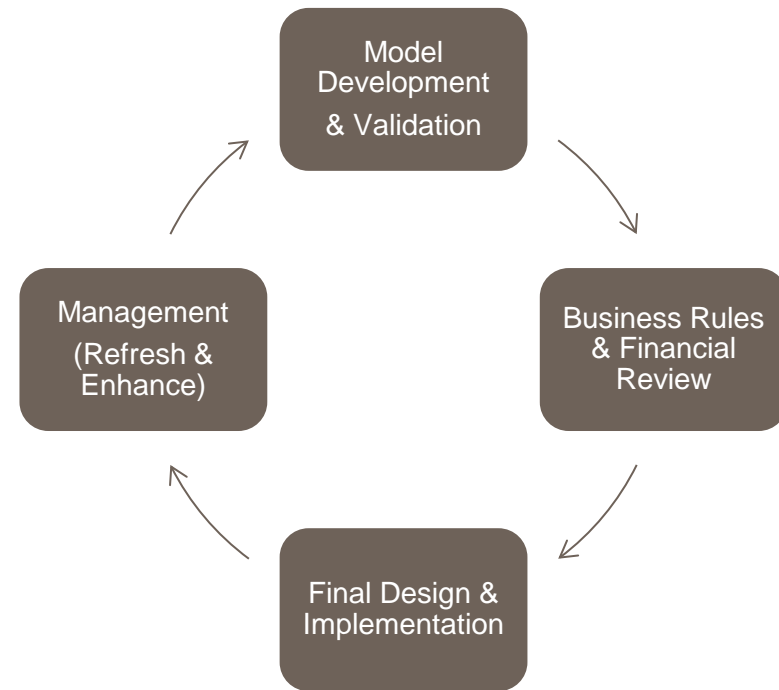
Batch Scoring
(Renewal)



Implement the Program

Solution Support

- Ongoing solution maintenance and support
 - Waterfall reports: Policies coming through the process and how they shake out
 - Risk Analysis: Is the incoming risk profile similar to analysis data profile?
- Monitor performance
 - Establish control groups
 - Hitting target action
 - Model recalibration





Questions?

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