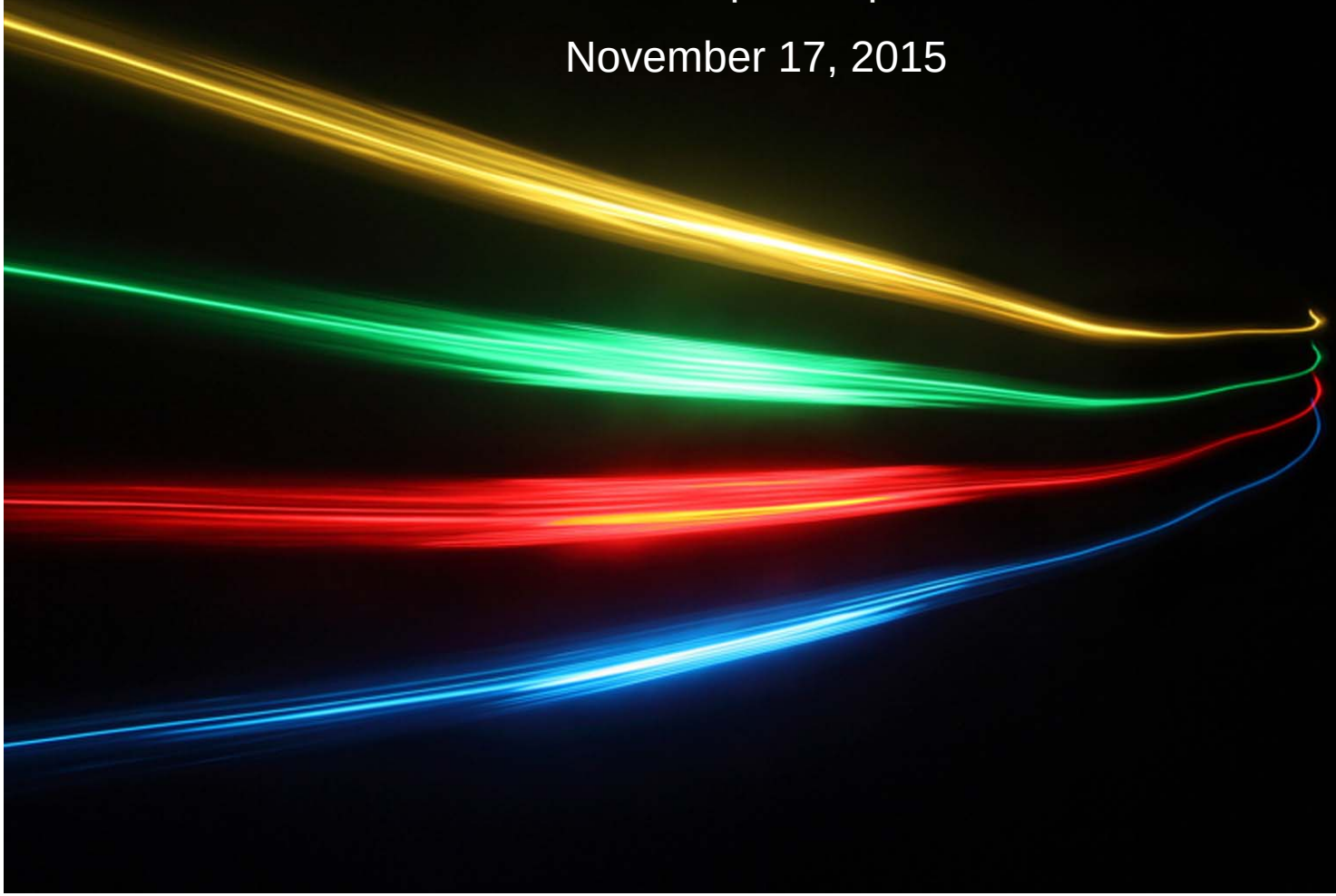
MANAGING EXTREMES

Willis Re

TAMING CATASTROPHE RISK

Portfolio Management and Pricing Strategies for Catastrophe-Exposed Lines

November 17, 2015



Catastrophe management spans the whole insurance company

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Departments	Metrics	Decisions
Finance	PML	Pricing
Catastrophe Modeling	AAL	Growth
Actuarial	TVAR	Reinsurance
Claims	Gross and Net	Portfolio Optimization
Underwriting	Total Limits	Capital

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“Don’t let perfect be the enemy of good”

- Voltaire

Catastrophe exposure management ecosystem

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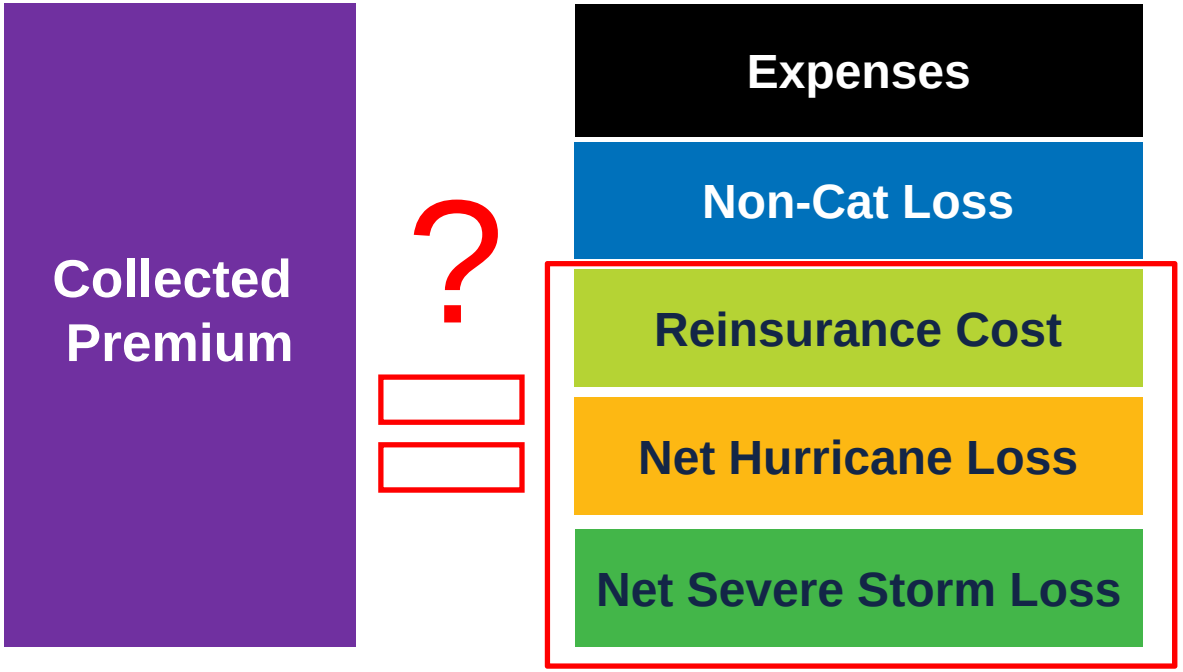
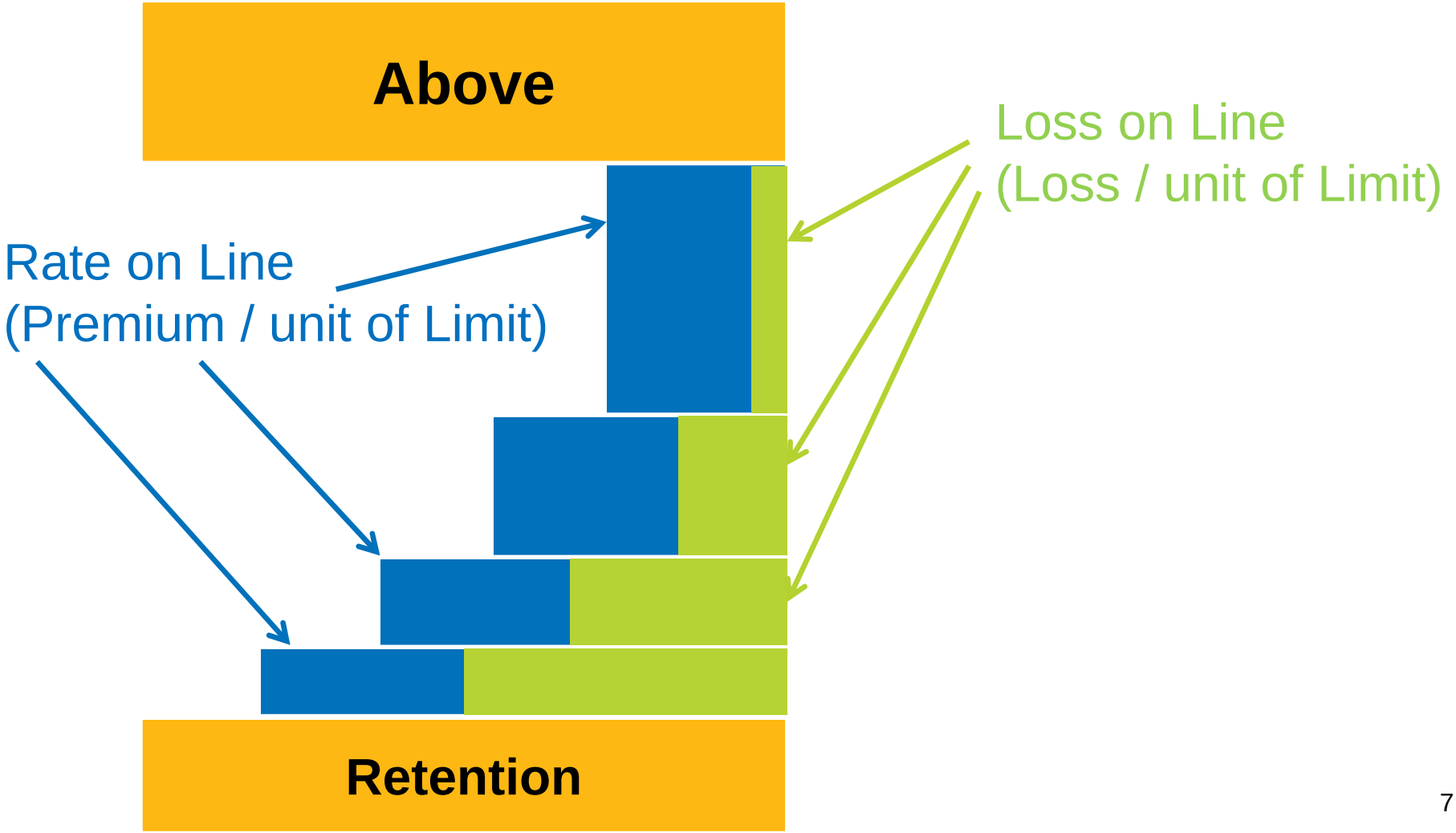
Profitability analysis

Profitability overview

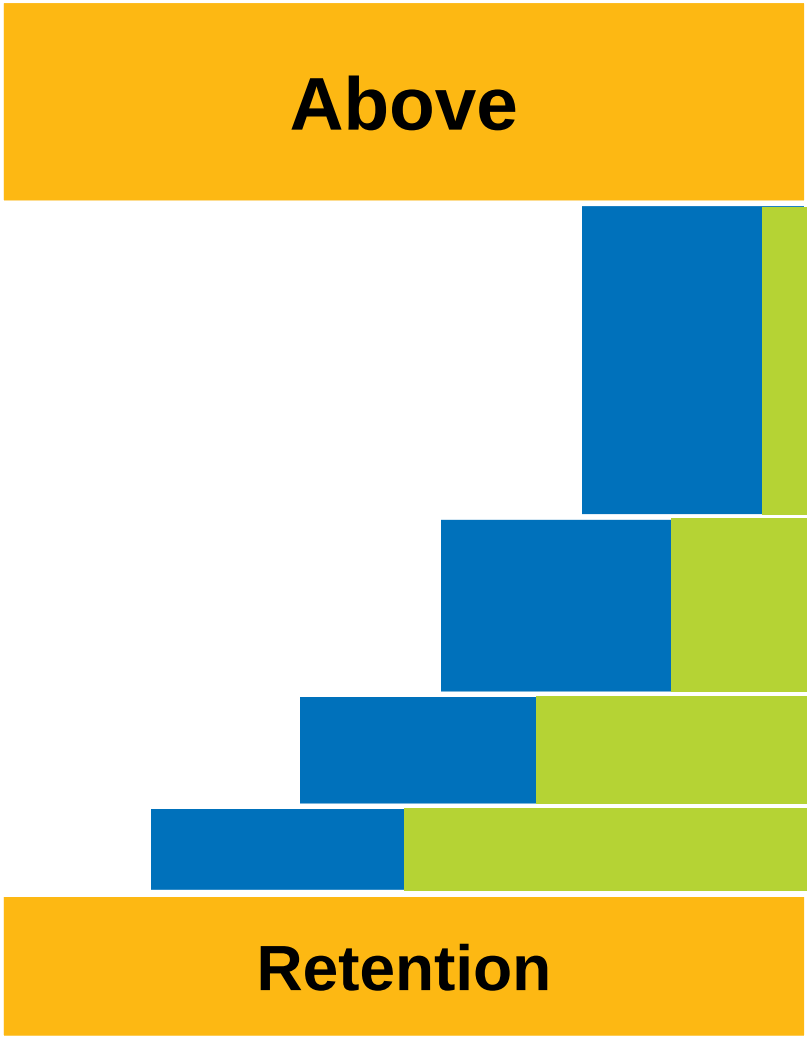


Calculate an income statement for each policy

Reinsurance Program Pricing



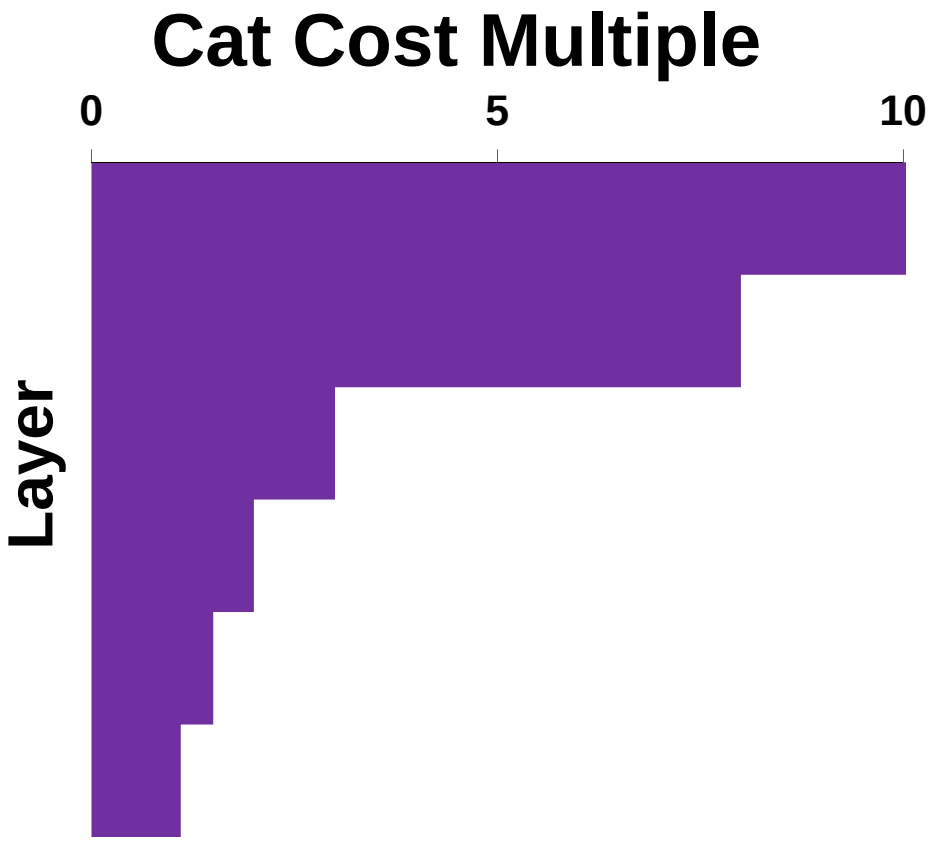
Reinsurance Program Pricing



Cat Cost Multiple

$$\frac{\text{Rate on Line}}{\text{Loss on Line}}$$

Reinsurance Program Pricing

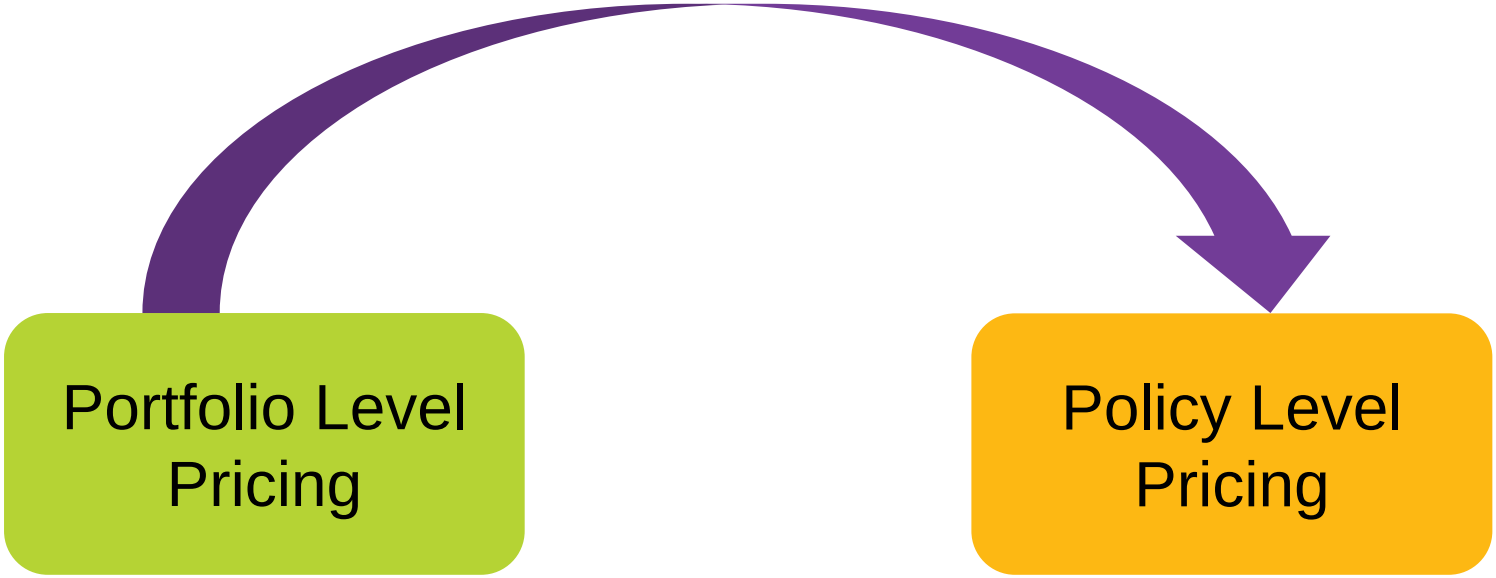


Cat Pricing: Example

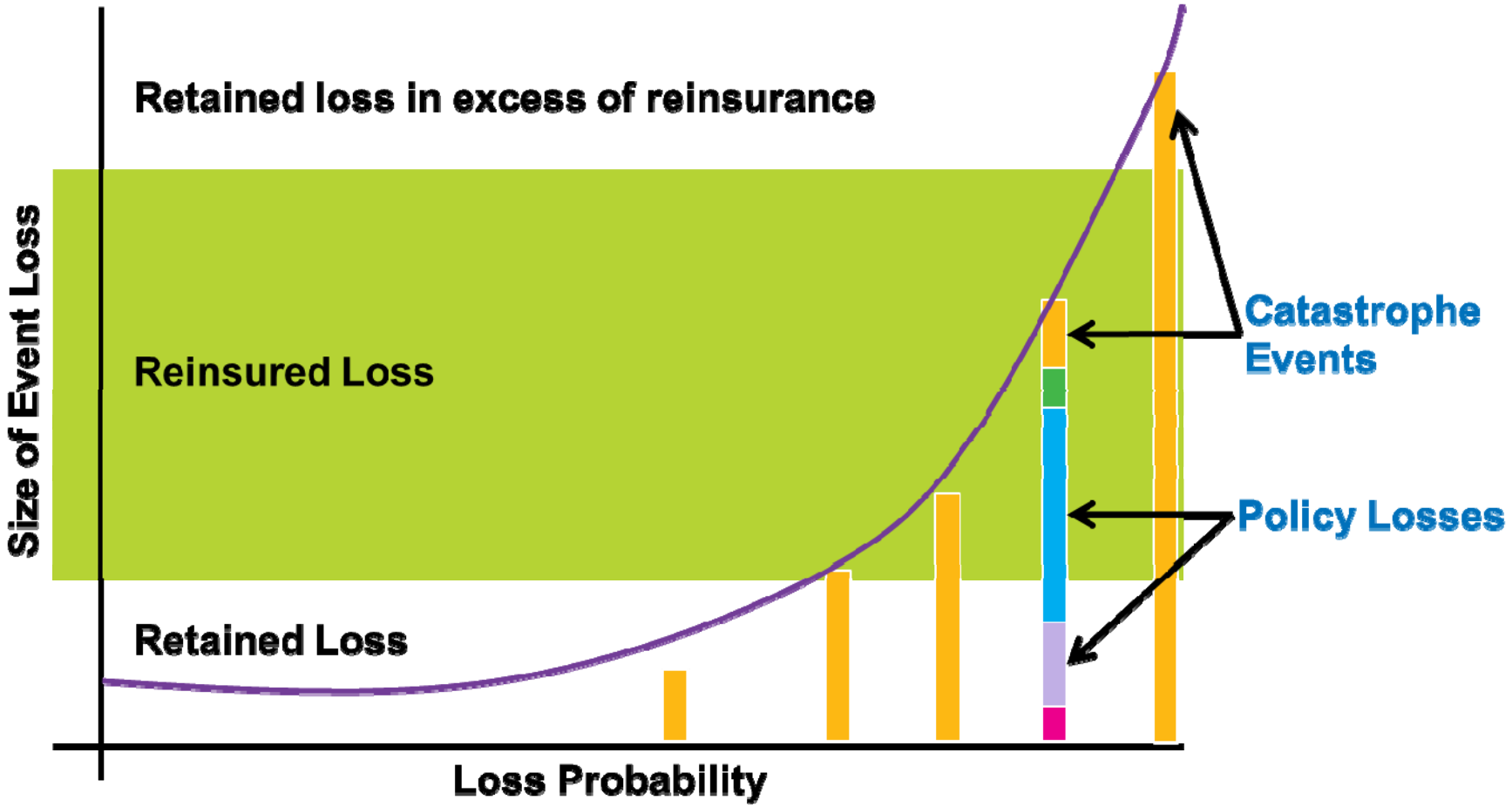
Reinsurance Layer Pricing			
	Premium	Expected Loss	Premium / Loss
Below	40.5	36.8	1.10
Layer 1	21.9	13.7	1.60
Layer 2	49.2	22.4	2.20
Layer 3	51.6	17.2	3.00
Layer 4	23.	4.6	5.00
Above	15.	2.1	7.00
Total	201.2	96.8	2.08

Total catastrophe premium is 2.08 * expected loss

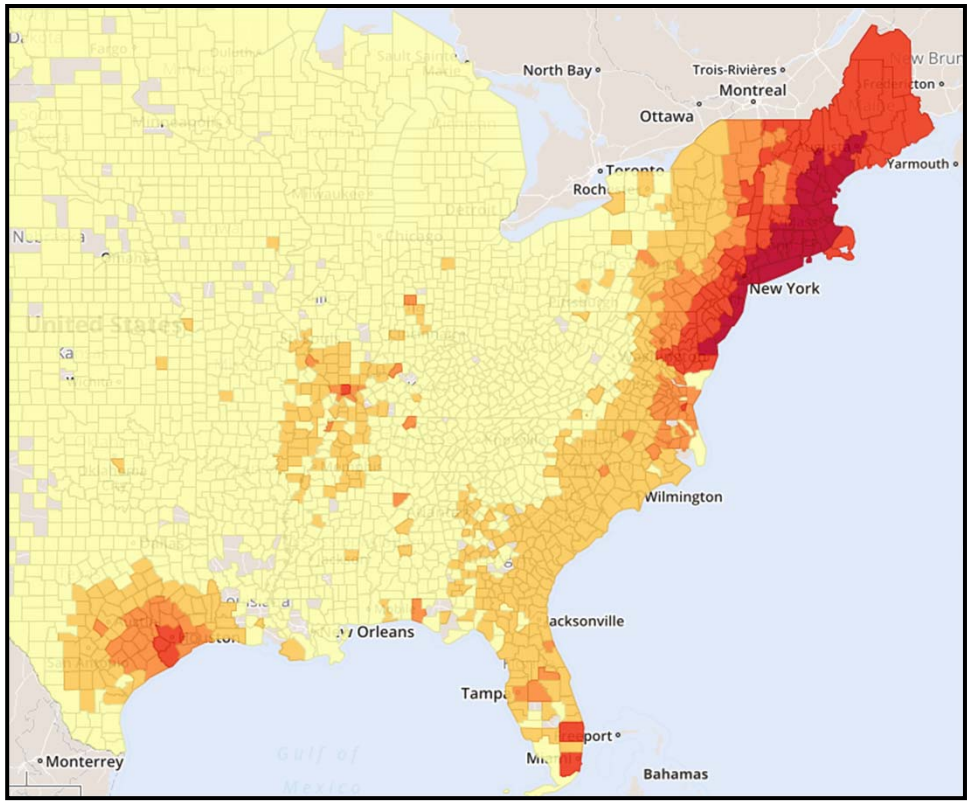
Now, shift your framework



Catastrophe cost allocation



Catastrophe cost multiples

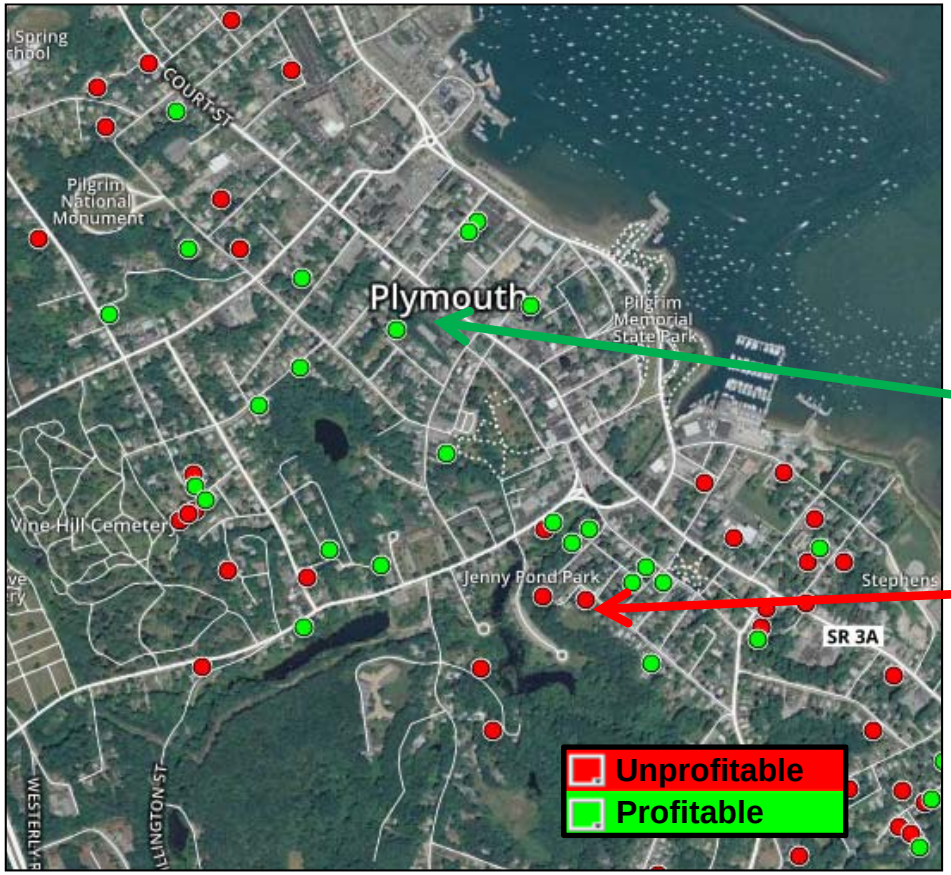


$1 of gross AAL leads to :

= $1.20 of cat cost in Dallas, TX

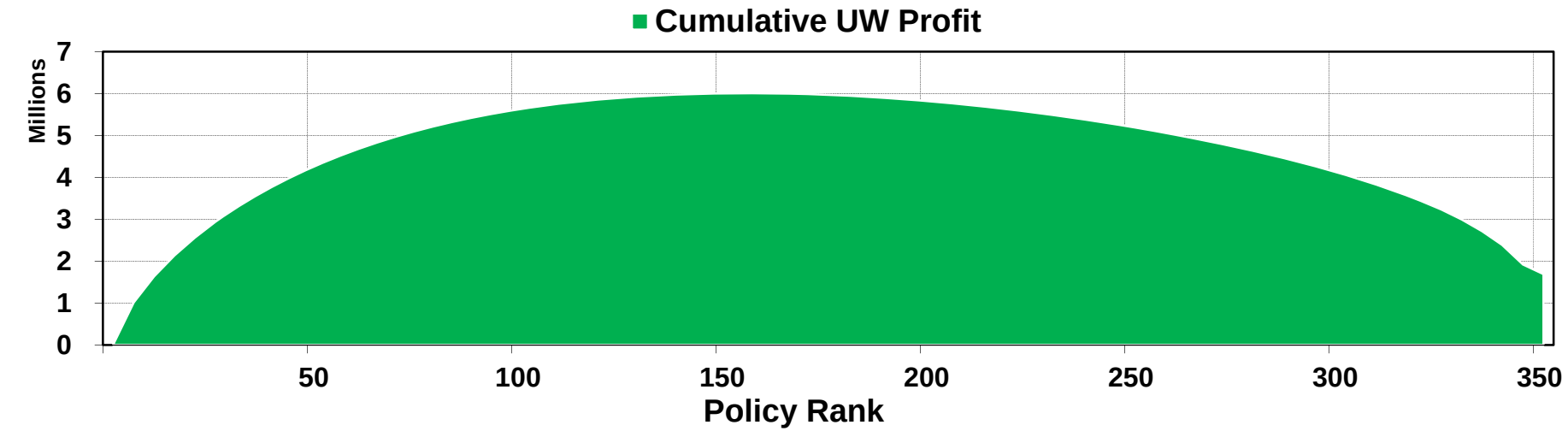
= $3 of net cat cost in Cape Cod, MA

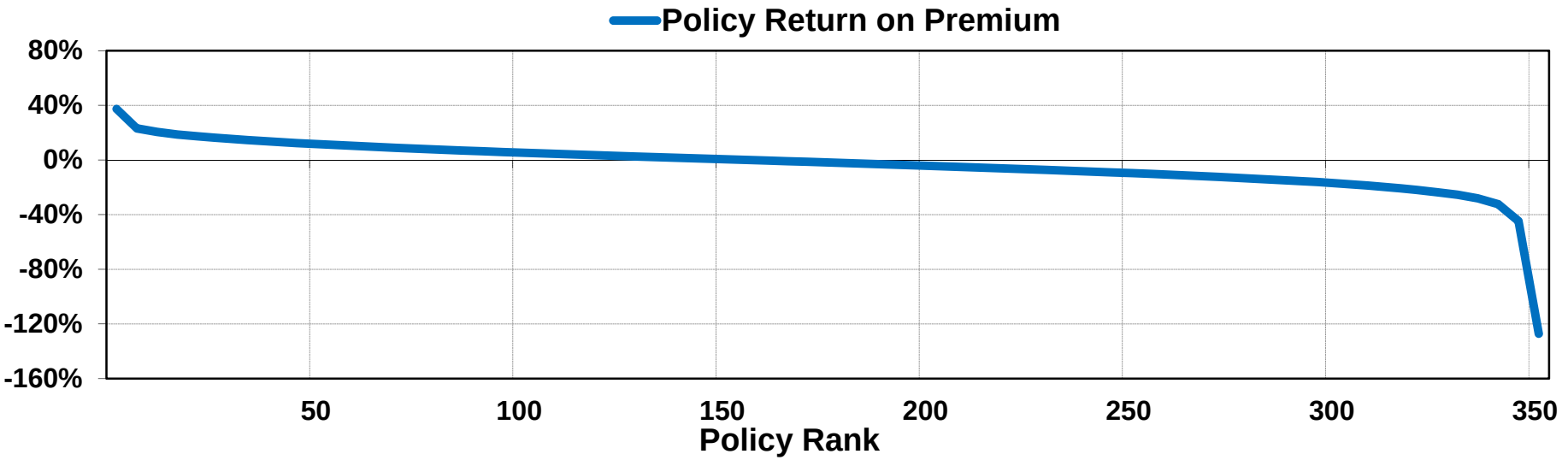
Profit by policy example



Profit Comparison		
Policy:	**1268540**	**1280561**
TIV	1,515,750	2,867,799
Premium	821	4,164
Reinsurance Cost	775	781
Net Cat Loss	85	86
Non Cat Loss	164	833
Expense	216	691
Net Profit	**(419)**	**1,773**

Ranking of policy profitability





Analyze drivers of profitability

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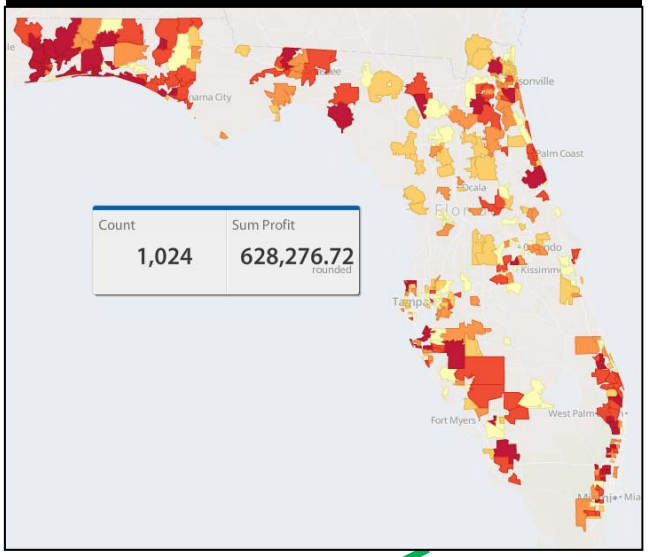
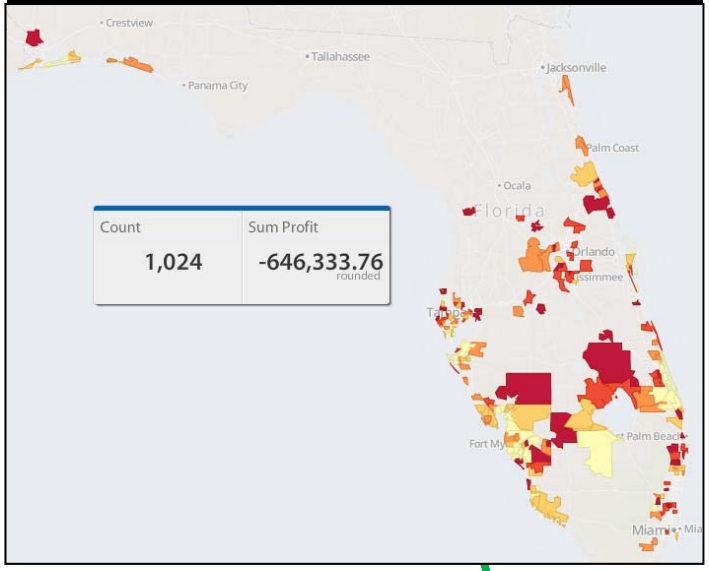
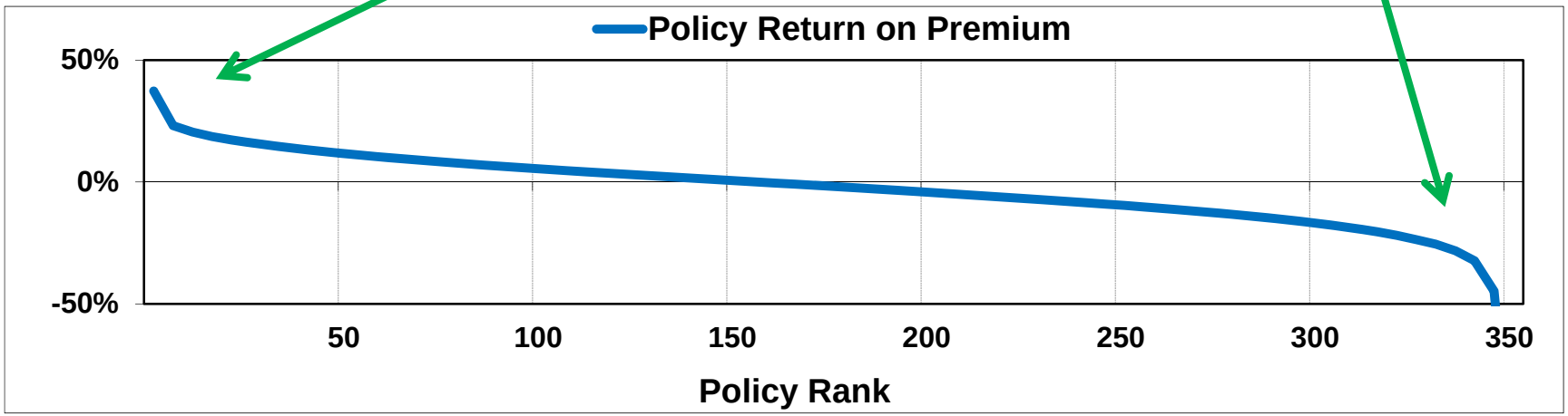
Most Profitable

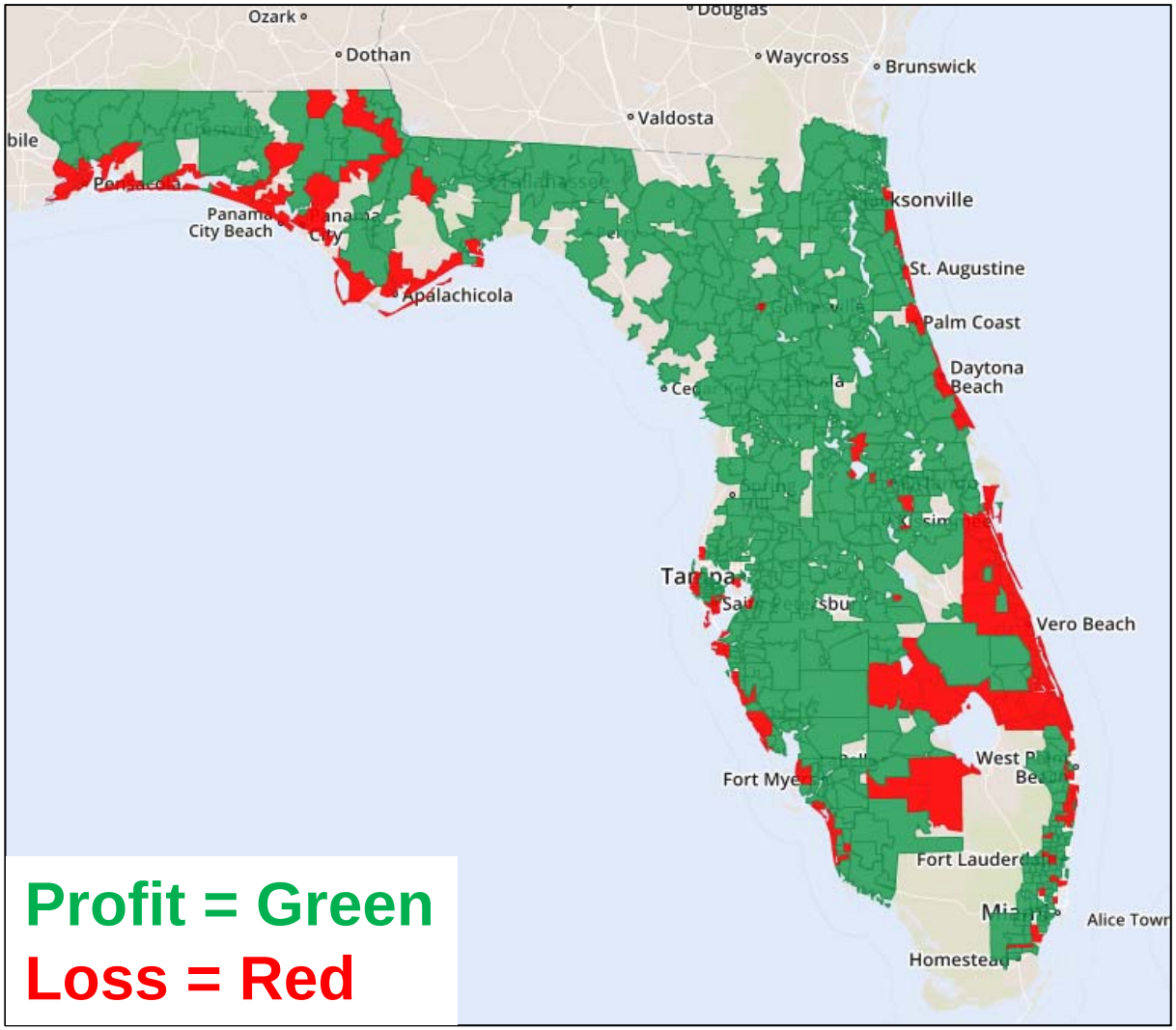


Least Profitable

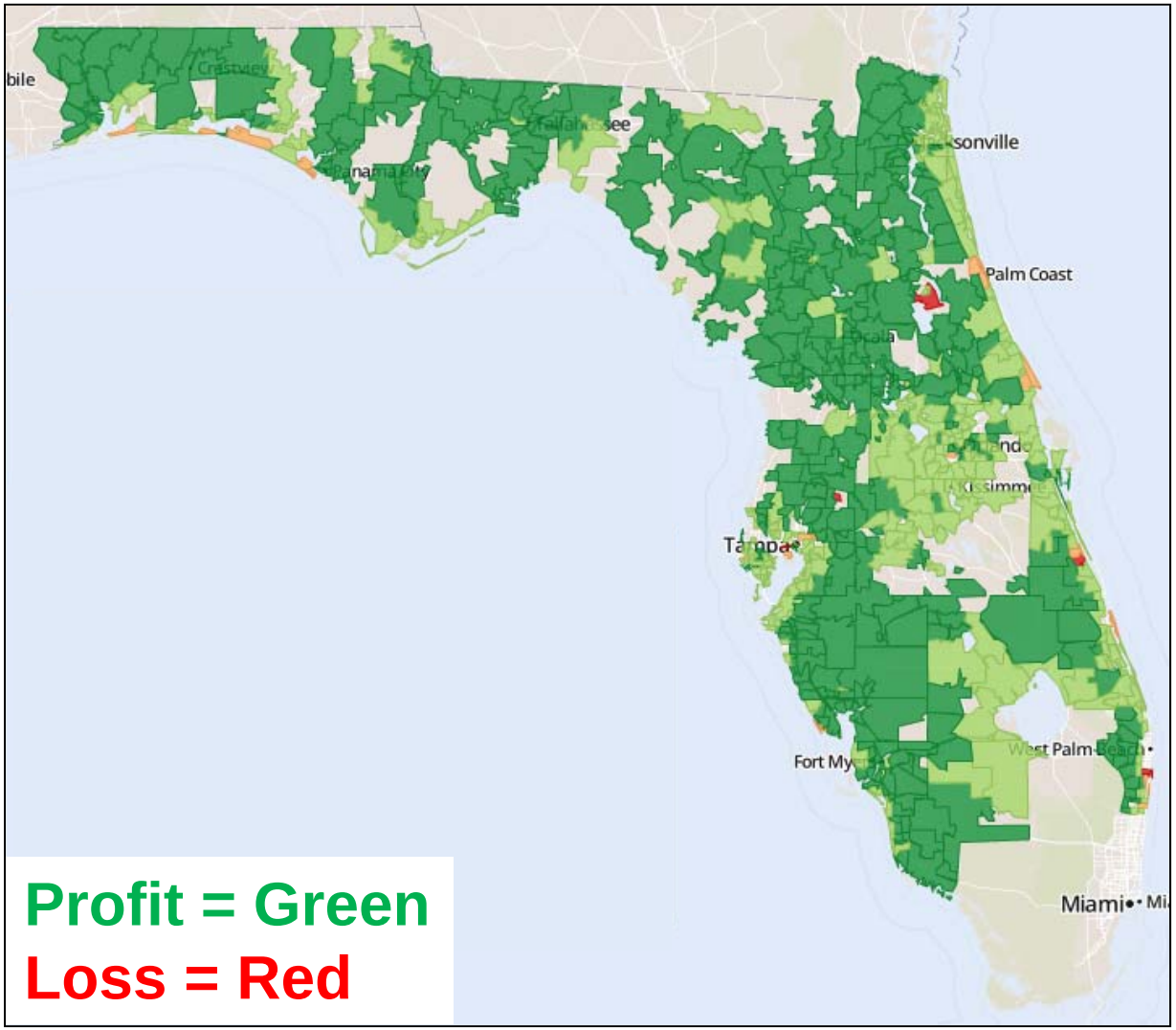




Highlight key areas of profitability



Isolate characteristics that are profitable everywhere



Portfolio planning

Put the catastrophe models in the hands of everyone

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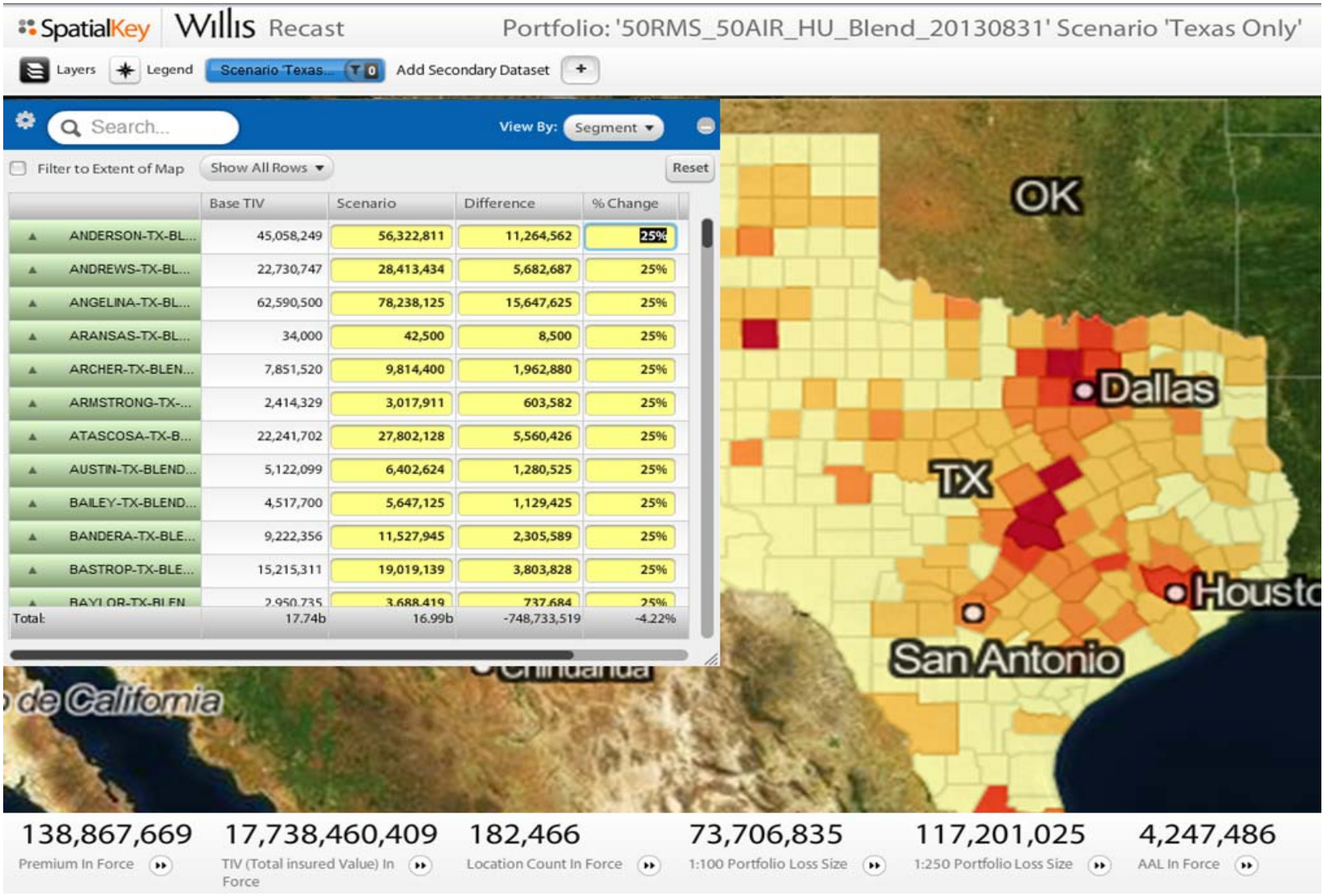
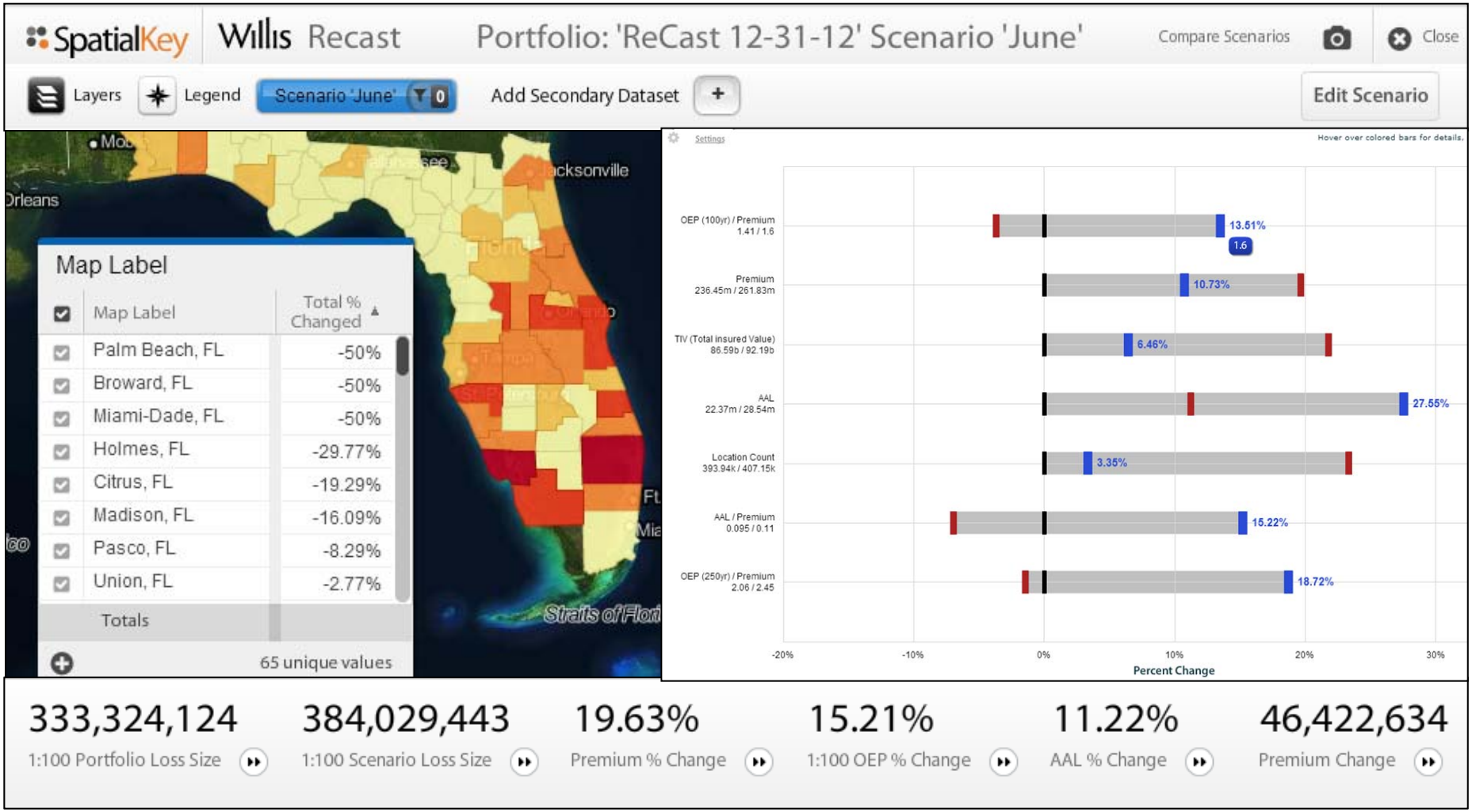
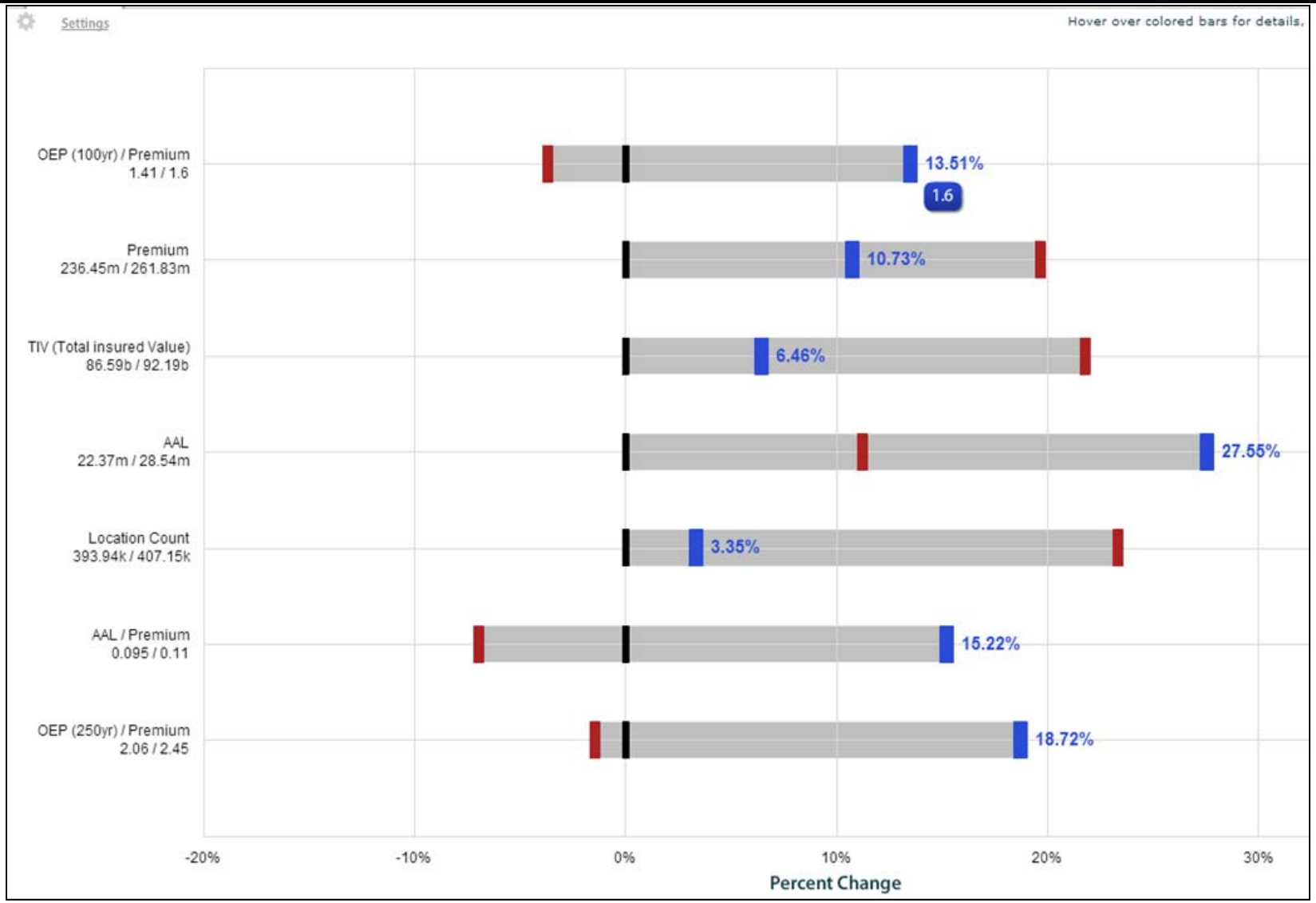


Quickly view key catastrophe metrics



Quickly view key catastrophe metrics



Refine analysis to see if PML growth is profitable

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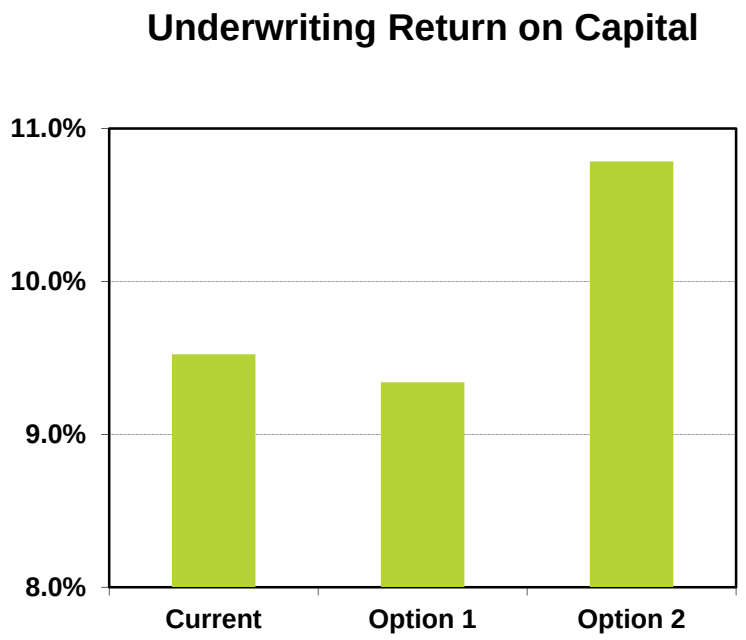
Portfolio Growth Options					
$M	Current	Option 1	Option 2	Option 1 vs Current	Option 2 vs Current
Gross Premium	100	125	125		
Reinsurance Premium	30	34	40	13.3%	33.3%
Net Premium	**70**	**91**	**85**	30.0%	21.4%
Net Retained Losses	35	47	40	34.3%	14.3%
Expenses	25	31	31	25.0%	25.0%
Underwriting Result	**10**	**13**	**14**	27.5%	37.5%
Required Capital	**105**	**137**	**128**	30.0%	21.4%
Combined Ratio	85.7%	86.0%	83.8%	0.3%	-2.2%
UW Return on Capital	9.5%	9.3%	10.8%	-1.9%	13.2%



Risk UW and pricing

Implement pricing strategy at the front end

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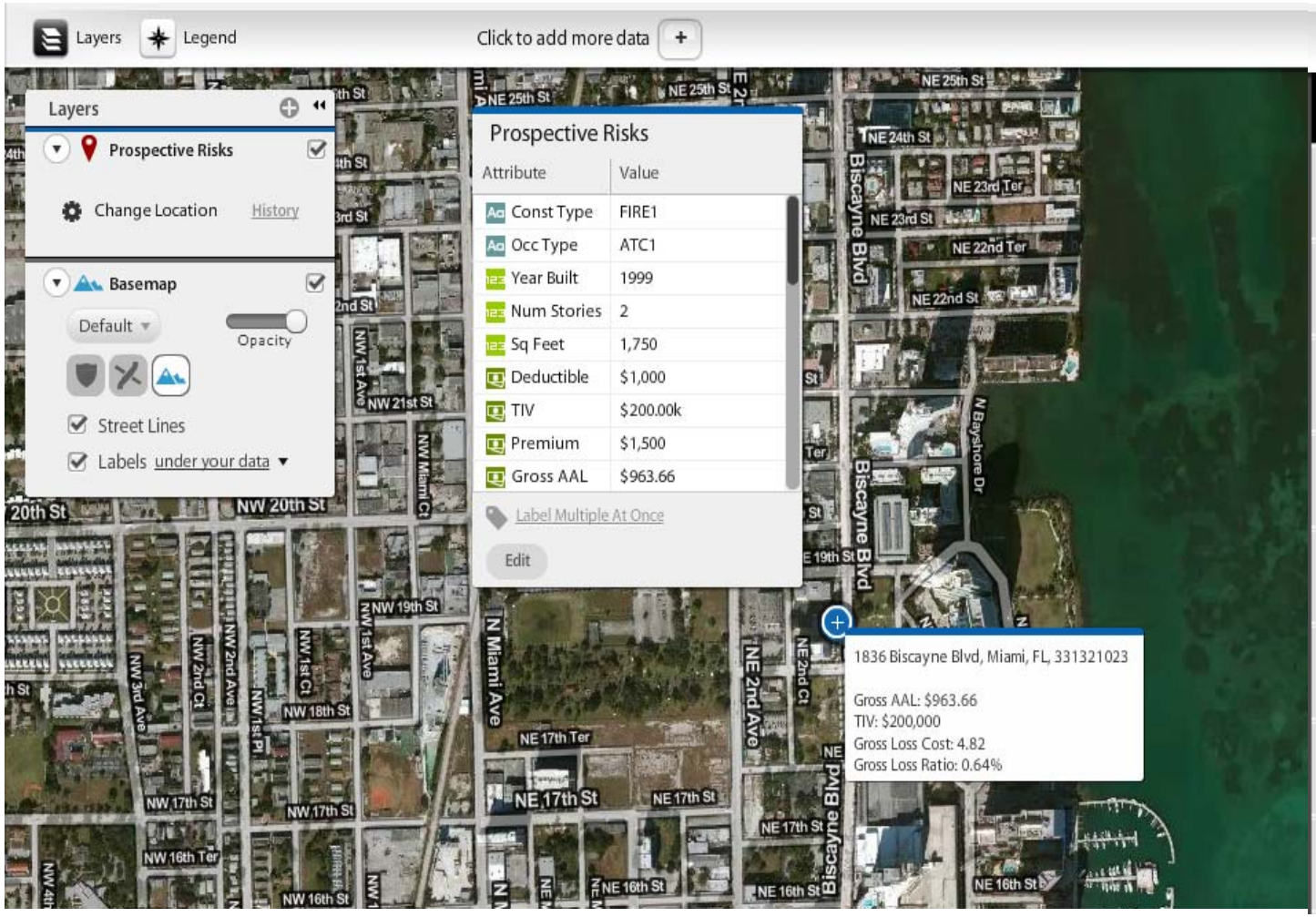

Prospective Risks	
Gross AAL	$964
TIV	$200,000
Gross Loss Cost Gross AAL/TIV(1000)	4.82
Gross Loss Ratio Gross AAL/Premium	64%
Cat Cost	$1687
Cat Cost / Premium	112%
Net Return on Premium	(52%)
Net Profit	($787)

Real-time monitoring

Typical catastrophe management report

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Ground Up OEP Loss

		Dec 2014, Feb 2015 .0					Jun/Jul, 2015 .0					% Change				
Critical Probability	Return Period	Fire Following	Hurricane LOB 1	Hurricane LOB 2	Severe Storm	Combined	Fire Following	Hurricane LOB 1	Hurricane LOB 2	Severe Storm	Combined	Fire Following	Hurricane	Severe Convective Storm	Winter Storm	Combined
0.01%	10,000	$1,092.1	$1,918,571.7	$94,867.1	$59,455.4	$1,918,571.7	$894.4	$1,870,027.5	$94,576.5	$58,070.0	$1,870,027.5	(18.1%)	(2.5%)	(0.3%)	(2.3%)	(2.5%)
0.02%	5,000	$7.5	$1,501,606.6	$67,098.7	$46,033.0	$1,501,607.6	$4.0	$1,462,318.1	$66,995.7	$45,120.3	$1,462,319.2	(46.8%)	(2.6%)	(0.2%)	(2.0%)	(2.6%)
0.05%	2,000	$0.0	$1,055,969.4	$43,487.2	$30,656.1	$1,055,982.3	$0.0	$1,027,013.3	$43,401.8	$30,229.3	$1,027,027.2	0.0%	(2.7%)	(0.2%)	(1.4%)	(2.7%)
0.10%	1,000	$0.0	$771,780.3	$31,662.4	$23,991.1	$771,884.4	$0.0	$750,724.1	$31,575.2	$23,667.7	$750,814.4	100.0%	(2.7%)	(0.3%)	(1.3%)	(2.7%)
0.20%	500	$0.0	$536,748.4	$22,994.2	$19,347.0	$536,910.2	$0.0	$522,479.2	$22,881.0	$19,091.5	$522,644.8	0.0%	(2.7%)	(0.5%)	(1.3%)	(2.7%)
0.40%	250	$0.0	$353,232.3	$16,402.7	$15,642.4	$353,532.4	$0.0	$344,211.3	$16,285.9	$15,448.6	$344,521.4	0.0%	(2.6%)	(0.7%)	(1.2%)	(2.5%)
0.50%	200	$0.0	$303,951.8	$14,604.3	$14,590.0	$304,299.0	$0.0	$296,416.7	$14,493.9	$14,411.6	$296,762.8	0.0%	(2.5%)	(0.8%)	(1.2%)	(2.5%)
1.00%	100	$0.0	$177,518.9	$9,884.9	$11,663.7	$177,996.0	$0.0	$173,975.6	$9,798.5	$11,536.2	$174,426.2	0.0%	(2.0%)	(0.9%)	(1.1%)	(2.0%)
2.00%	50	$0.0	$87,249.5	$6,501.5	$9,170.6	$87,968.7	$0.0	$86,373.7	$6,426.9	$9,079.0	$87,063.2	0.0%	(1.0%)	(1.1%)	(1.0%)	(1.0%)
4.00%	25	$0.0	$30,034.8	$4,164.5	$6,996.3	$32,118.0	$0.0	$30,149.4	$4,108.0	$6,930.8	$32,167.4	0.0%	0.4%	(1.4%)	(0.9%)	0.2%
10.00%	10	$0.0	$1,940.6	$2,189.2	$4,467.7	$8,654.1	$0.0	$1,998.6	$2,160.3	$4,432.4	$8,619.6	0.0%	3.0%	(1.3%)	(0.8%)	(0.4%)
20.00%	5	$0.0	$4.6	$1,247.5	$2,809.3	$4,529.8	$0.0	$5.2	$1,231.9	$2,793.9	$4,501.5	0.0%	11.6%	(1.2%)	(0.5%)	(0.6%)
Average Annual Loss		$1.8	$7,287.7	$1,703.5	$2,953.9	$11,946.9	$1.7	$7,165.0	$1,677.7	$2,944.3	$11,788.6	(6.5%)	(1.7%)	(1.5%)	(0.3%)	(1.3%)
Standard Deviation		$496.7	$58,440.8	$3,319.4	$3,393.3	$58,635.4	$477.6	$56,922.7	$3,290.7	$3,359.2	$57,118.6	(3.8%)	(2.6%)	(0.9%)	(1.0%)	(2.6%)
Coefficient of Variation		277.3	8.0	2.0	1.2	4.9	285.1	7.9	2.0	1.1	4.9	2.8%	(1.0%)	0.5%	(0.9%)	(1.2%)

Gross OEP Loss

		Year 0					Year 1					% Change				
Critical Probability	Return Period	Fire Following	Hurricane LOB 1	Hurricane LOB 2	Severe Storm	Combined	Fire Following	Hurricane LOB 1	Hurricane LOB 2	Severe Storm	Combined	Fire Following	Hurricane	Severe Convective Storm	Winter Storm	Combined
0.01%	10,000	$1,159.3	$1,784,786.5	$93,361.7	$48,900.5	$1,784,786.5	$966.3	$1,741,311.3	$93,139.9	$47,866.4	$1,741,311.3	(16.7%)	(2.4%)	(0.2%)	(2.1%)	(2.4%)
0.02%	5,000	$10.0	$1,381,082.0	$66,048.6	$36,778.6	$1,381,084.1	$5.7	$1,346,258.3	$65,983.6	$36,142.8	$1,346,260.8	(43.3%)	(2.5%)	(0.1%)	(1.7%)	(2.5%)
0.05%	2,000	$0.0	$956,349.9	$42,677.8	$23,312.8	$956,376.2	$0.0	$931,287.3	$42,639.7	$23,056.1	$931,315.3	0.0%	(2.6%)	(0.1%)	(1.1%)	(2.6%)
0.10%	1,000	$0.0	$690,584.1	$30,837.5	$17,379.2	$690,683.3	$0.0	$672,643.6	$30,806.5	$17,218.6	$672,749.4		(2.6%)	(0.1%)	(0.9%)	(2.6%)
0.20%	500	$0.0	$473,518.2	$21,967.1	$13,311.1	$473,759.5	$0.0	$461,641.7	$21,934.8	$13,202.8	$461,885.0		(2.5%)	(0.1%)	(0.8%)	(2.5%)
0.40%	250	$0.0	$306,007.6	$15,158.1	$10,198.3	$306,411.5	$0.0	$298,850.0	$15,119.1	$10,133.4	$299,254.2		(2.3%)	(0.3%)	(0.6%)	(2.3%)
0.50%	200	$0.0	$261,516.5	$13,329.2	$9,338.0	$261,968.6	$0.0	$255,653.9	$13,290.5	$9,284.4	$256,098.1		(2.2%)	(0.3%)	(0.6%)	(2.2%)
1.00%	100	$0.0	$148,896.6	$8,642.6	$7,012.7	$149,456.7	$0.0	$146,365.9	$8,606.1	$6,988.7	$146,921.6		(1.7%)	(0.4%)	(0.3%)	(1.7%)
2.00%	50	$0.0	$70,250.0	$5,319.8	$5,117.8	$71,150.4	$0.0	$69,740.1	$5,288.6	$5,110.5	$70,633.8		(0.7%)	(0.6%)	(0.1%)	(0.7%)
4.00%	25	$0.0	$22,085.1	$3,083.7	$3,554.2	$24,585.6	$0.0	$22,243.0	$3,064.3	$3,555.1	$24,689.4		0.7%	(0.6%)	0.0%	0.4%
10.00%	10	$0.0	$754.5	$1,359.3	$1,900.9	$5,467.3	$0.0	$789.2	$1,355.8	$1,907.8	$5,484.5		4.6%	(0.3%)	0.4%	0.3%
20.00%	5	$0.0	$0.1	$672.7	$971.2	$2,314.7	$0.0	$0.1	$670.8	$978.7	$2,321.6		(3.9%)	(0.3%)	0.8%	0.3%
Average Annual Loss		$1.8	$6,059.0	$957.6	$934.1	$7,952.5	$1.7	$5,963.7	$949.7	$936.8	$7,852.0	(5.7%)	(1.6%)	(0.8%)	0.3%	(1.3%)
Standard Deviation		$489.9	$52,702.5	$3,010.3	$1,869.1	$52,823.7	$475.6	$51,381.6	$2,994.5	$1,857.5	$51,504.5	(2.9%)	(2.5%)	(0.5%)	(0.6%)	(2.5%)
Coefficient of Variation		276.2	8.7	3.1	2.0	6.6	284.3	8.6	3.2	2.0	6.6	2.9%	(0.9%)	0.3%	(1.0%)	(1.2%)

Typical catastrophe management report

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Ground Up OEP Loss

		Dec 2014, Feb 2015 .0								% Change				
Critical Probability	Return Period	Fire Following	Hurricane LOB 1	Hurricane						Fire	Hurricane	Severe Convective Storm	Winter Storm	Combined
0.01%	10,000	$1,092.1	$1,918,571.7								(2.5%)	(0.3%)	(2.3%)	(2.5%)
0.02%	5,000	$7.5	$1,501,6								(2.6%)	(0.2%)	(2.0%)	(2.6%)
0.05%	2,000	$0.0	$1								7%)	(0.2%)	(1.4%)	(2.7%)
0.10%	1,000	$0.0										(0.3%)	(1.3%)	(2.7%)
0.20%	500											(0.5%)	(1.3%)	(2.7%)
0.40%	250				52.4	$0.0	$344,211.3	$16,285.9				(0.7%)	(1.2%)	(2.5%)
0.50%	200				$304,299.0	$0.0	$296,416.7	$14,493.9	$14,411.6			2%)	(1.2%)	(2.5%)
1.00%	100				$177,996.0	$0.0	$173,975.6	$9,798.5	$11,536.2	$174,42			(1.1%)	(2.0%)
2.00%	50				68.7	$0.0	$86,373.7	$6,426.9	$9,079.0	$87,063.2			(1.0%)	(1.0%)
4.00%						$0.0	$30,149.4	$4,108.0	$6,930.8	$32,167.4			(0.9%)	0.2%
10.00%						$0.0	$1,998.6	$2,160.3	$4,432.4	$8,619.6	0.0%		(0.8%)	(0.4%)
20.00%						$0.0	$5.2	$1,231.9	$2,793.9	$4,501.5	0.0%		(0.5%)	(0.6%)
Average Ann			7,287.7	$1,70			$7,165.0	$1,677.7	$2,944.3	$11,788.6	(6.5%)	(	%)	(1.3%)
Standard			$58,440.8	$3,319.4			022.7	$3,290.7	$3,359.2	$57,118.6	(3.8%)	(2.		(2.6%)
Coefficient o			8.0	2.0				2.0	1.1	4.9	2.8%	(1.0		(1.2%)

		Year 0												
Critica Probability		Hurricane LOB 1	Hurricane LOB 2	Severe Storm	Combined	Fire Following				Fire Following	Hurrica		r m	Combined
0.01%		4,786.5	$93,361.7	$48,900.5	$1,784,786.5	$966.3	$1,741,3			(16.7%)	(		%)	(2.4%)
0.02%		82.0	$66,048.6	$36,778.6	$1,381,084.1	$5.7	$1,346,258.3			(43.3%)			.7%)	(2.5%)
0.05%		9	$42,677.8	$23,312.8	$956,376.2	$0.0	$931,287.3			0%			(1.1%)	(2.6%)
0.10%	1		$30,837.5	$17,379.2	$690,683.3	$0.0	$672,643.6	$30,8					(0.9%)	(2.6%)
0.20%	5		$21,967.1	$13,311.1	$473,759.5	$0.0	$461,641.7	$21,934.8					(0.8%)	(2.5%)
0.40%	250		8.1	$10,198.3	$306,411.5	$0.0	$298,850.0	$15,119.1					(0.6%)	(2.3%)
0.50%	200			$9,338.0	$261,968.6	$0.0	$255,653.9	$13,290.5	$9,2				(0.6%)	(2.2%)
1.00%	100			7	$149,456.7	$0.0	$146,365.9	$8,606.1	$6,988.7				4%)	(0.3%)	(1.7%)
2.00%	50				50.4	$0.0	$69,740.1	$5,288.6					(0.6%)	(0.1%)	(0.7%)
4.00%	25												(0.6%)	0.0%	0.4%
10.00%	10	$0.0											(0.3%)	0.4%	0.3%
20.00%	5	$0.0										9%)	(0.3%)	0.8%	0.3%
Average Annual Loss		$1.8	$6,059.0								)	(1.6%)	(0.8%)	0.3%	(1.3%)
Standard Deviation		$489.9	$52,702.5								(2.9%)	(2.5%)	(0.5%)	(0.6%)	(2.5%)
Coefficient of Variation		276.2	8.7	3.1							2.9%	(0.9%)	0.3%	(1.0%)	(1.2%)

Analyze portfolio changes relative to profitability

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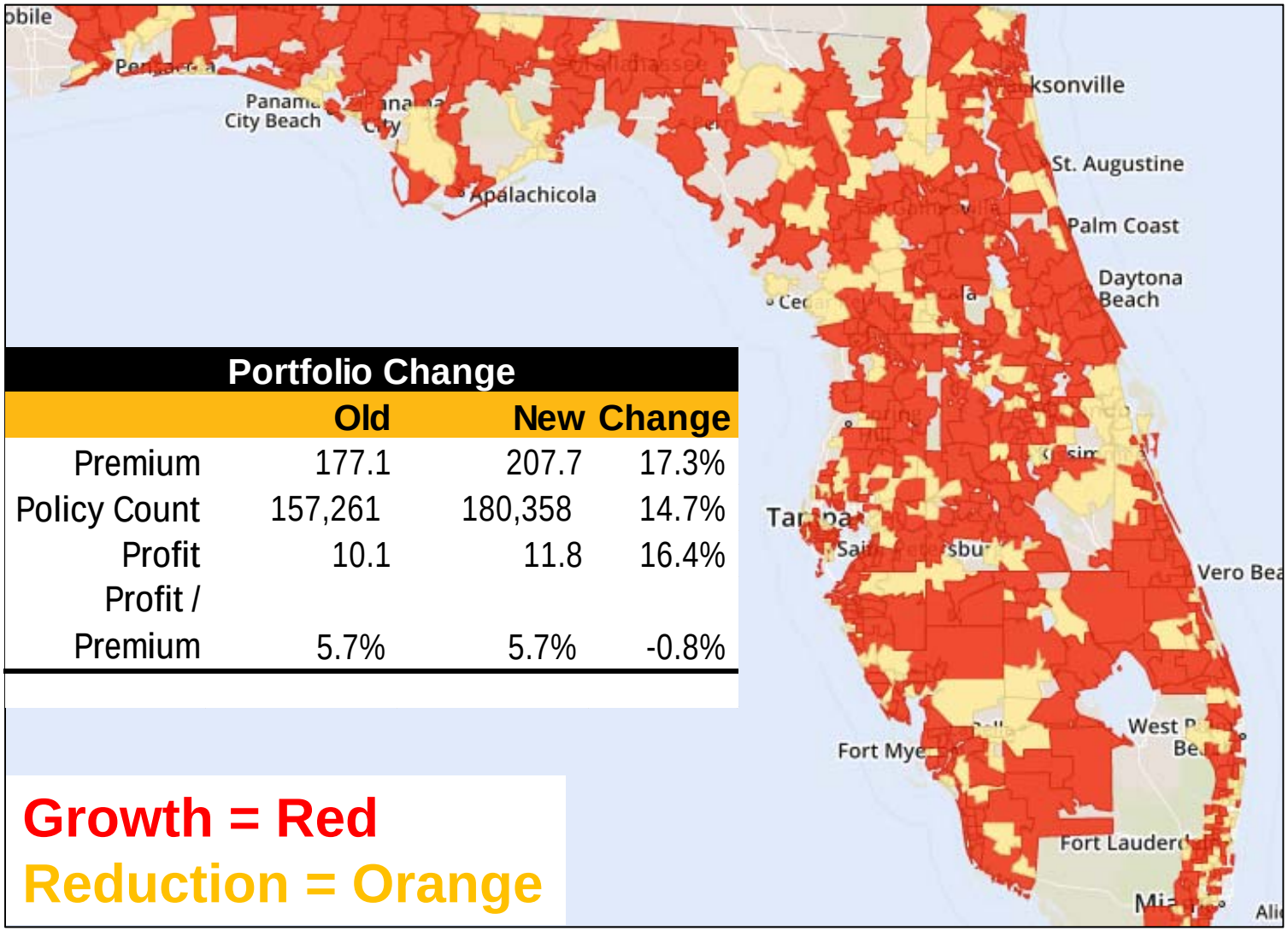

Portfolio Change			
	Old	New	Change
Premium	177.1	207.7	17.3%
Policy Count	157,261	180,358	14.7%
Profit	10.1	11.8	16.4%
Profit / Premium	5.7%	5.7%	-0.8%

Growth = Red

Reduction = Orange

Track exposure change in most profitable / unprofitable areas

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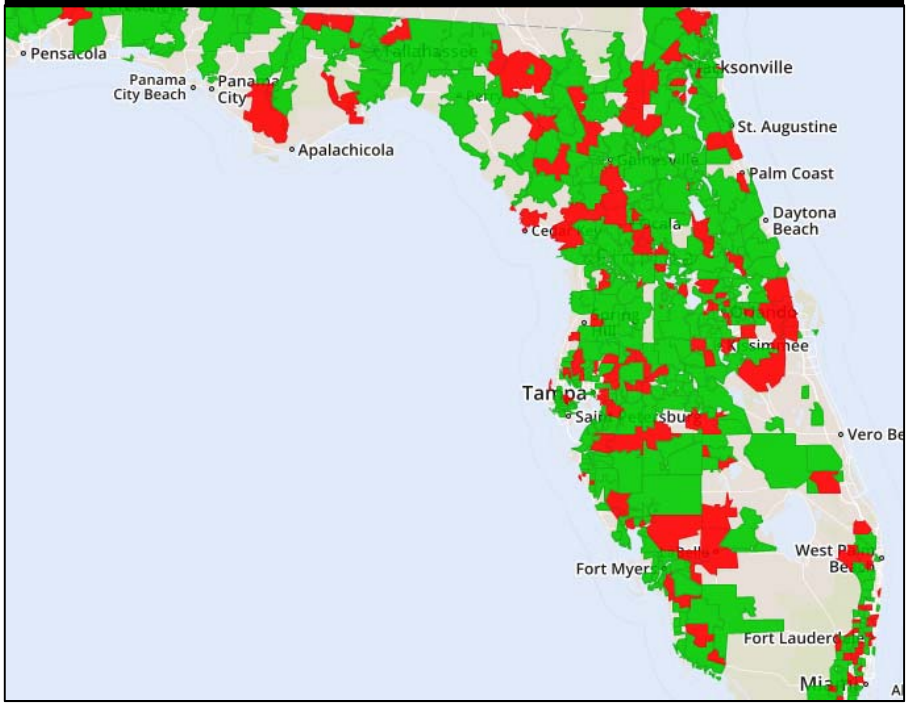
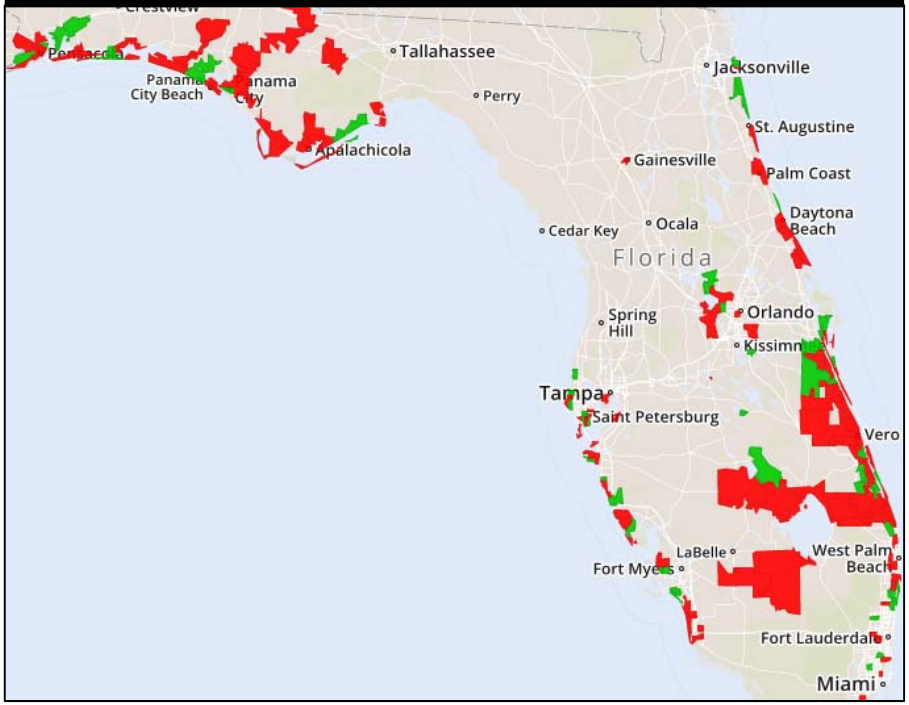
Profitable Areas



Unprofitable Areas

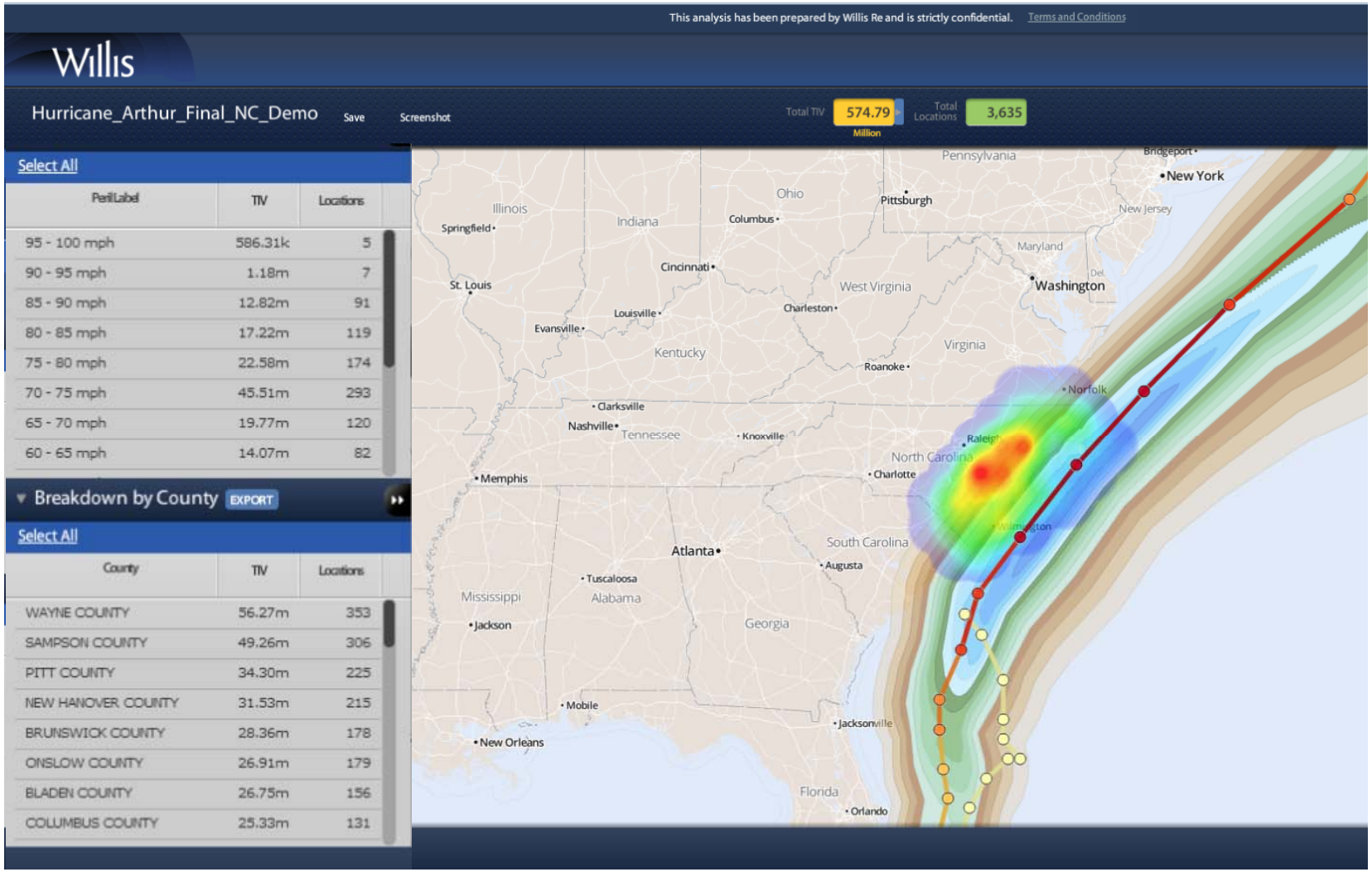


Portfolio Change (Profitable)			
	Old	New	Change
Premium	138.3	162.5	17.5%
Policy Count	129,300	143,392	10.9%
Profit	18.5	21.8	17.9%

Portfolio Change (Unprofitable)			
	Old	New	Change
Premium	38.8	45.2	16.5%
Policy Count	27,961	31,040	11.0%
Profit	-8.3	-10.	-19.7%

Event response

Live events provide a great opportunity to make models tangible



Use actual vs models to refine your view of risk

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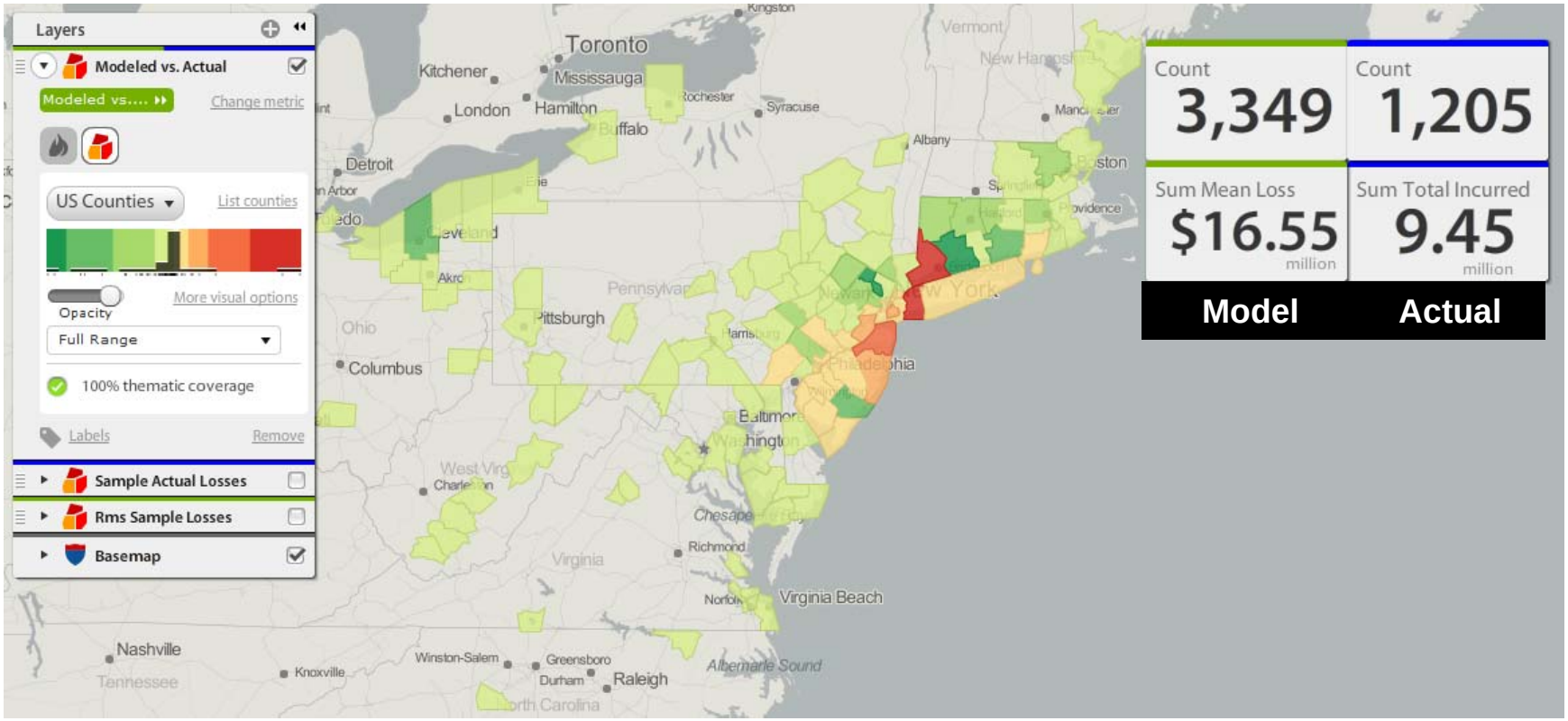
Sample Historical Event



Catastrophe exposure management ecosystem

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