Linking Climate Change to Ecosystems

Hurricane Damage Assessment

Hurricane Damage Assessment

- The use of synthetic hurricane tracks in risk analysis and climate change damage assessment
- From a Manuscript by Stephane Hallegatte
- Probability that a hurricane will generate damage to a fishing operation

Probability of Landfall

- $Pn = 1 - e^{(NQn)}$

- Pn is probability of hurricane of category n
- Qn is the probability of a hurricane of category n making landfall
- N is the average number of storms per year

Damage Assessment

- $L = a(s)W^3$
  - L are the economic losses in $ millions
  - a(s) is the local vulnerability at location s
  - W is the wind speed in meters per second
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  - Normally the stopping point

Economic Impact Behavior Modification

- Multiply losses (dam) by the input-output multiplier (damM)
- Declare a disaster area
- Provide financial aid at $damM level instead of $dam
- Rebuild coastal communities larger than before, closer to the ocean, and pray for the next big storm

Economic Value Behavior Modification

- Estimate the expected value of the hurricane damage for a particular year
- Could be based on NOAA Weather Service hurricane predictions

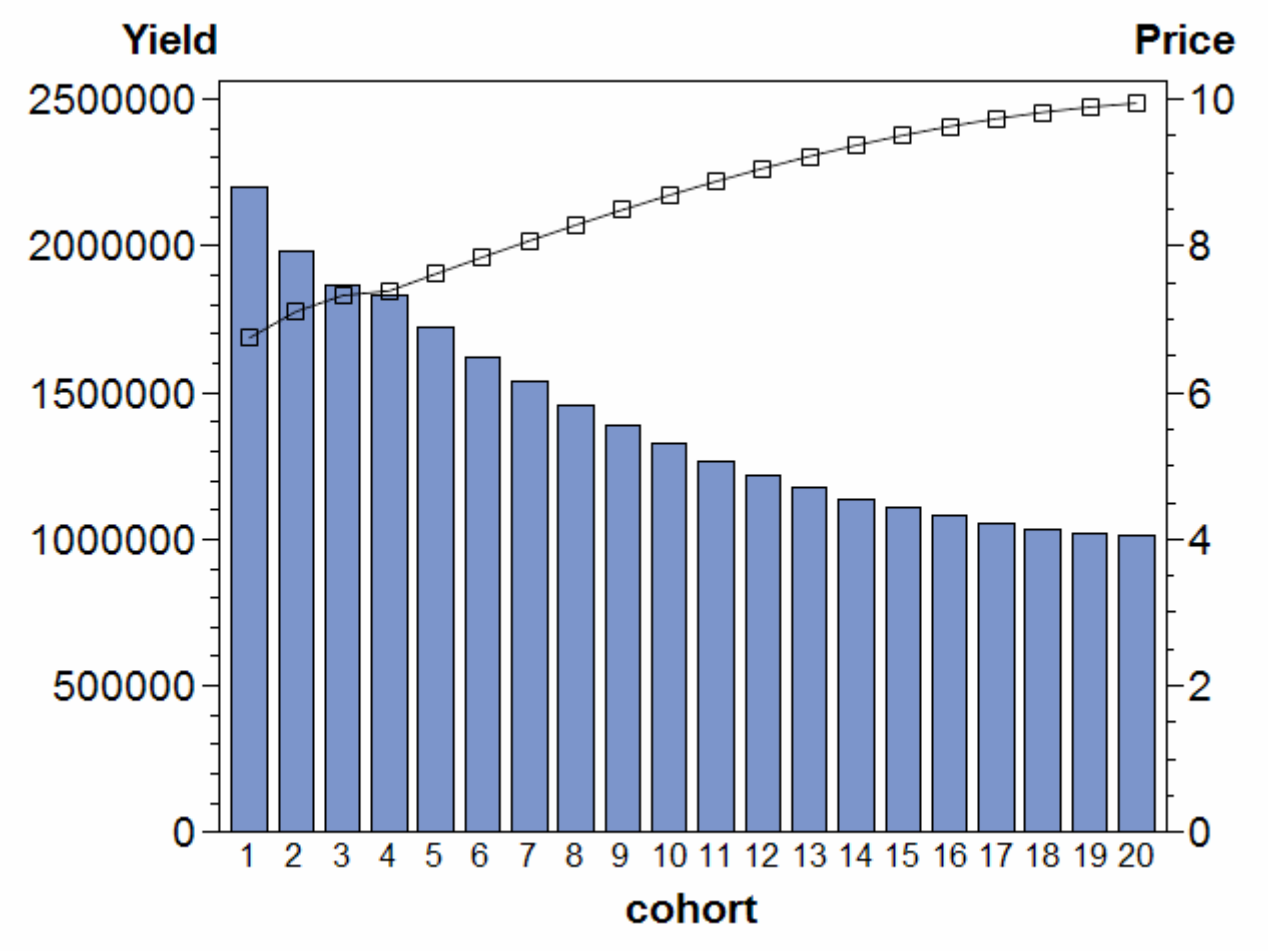
Economic Behavior Modification

- $Q(t) = \log(1-P(t))/(-N);$
- $d(t) = ((1-Q(t))^{z})\pi;$

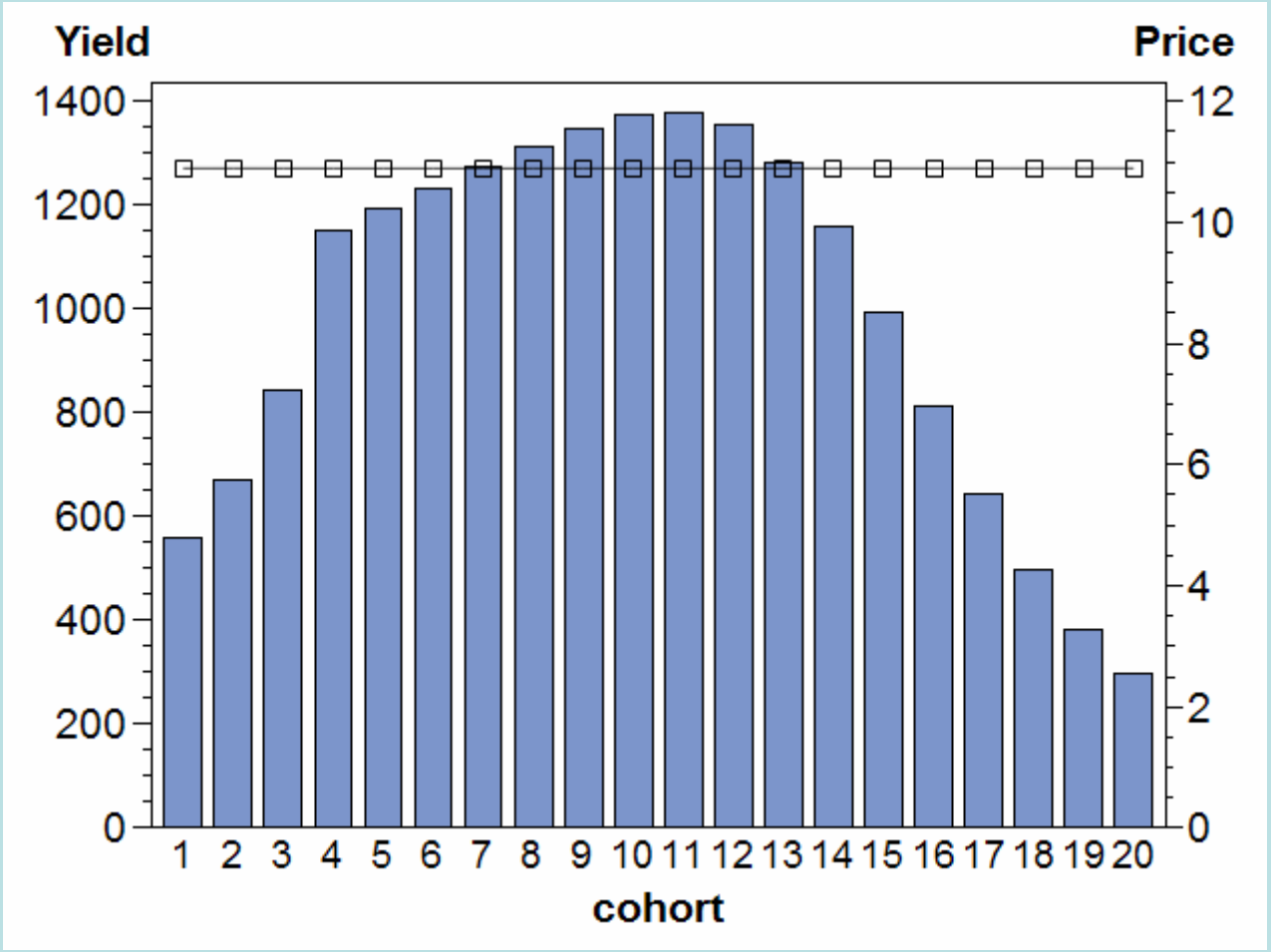
P1	P2	P3	P4	P5	Q1	Q2	Q3	Q4	Q5	d1
0.15	0.125	0.10	0.075	0.05	0.027086	0.022255	0.017560	0.012994	0.008549	32.306
0.16	0.135	0.11	0.085	0.06	0.058118	0.048342	0.038845	0.029610	0.020625	0.562
0.17	0.145	0.12	0.095	0.07	0.016939	0.014241	0.011621	0.009075	0.006597	118.183
0.18	0.155	0.13	0.105	0.08	0.022050	0.018713	0.015474	0.012326	0.009265	61.599
0.19	0.165	0.14	0.115	0.09	0.021072	0.018032	0.015082	0.012217	0.009431	69.797
0.20	0.175	0.15	0.125	0.10	0.024794	0.021375	0.018058	0.014837	0.011707	43.357
0.21	0.185	0.16	0.135	0.11	0.019644	0.017047	0.014529	0.012085	0.009711	83.753
0.22	0.195	0.17	0.145	0.12	0.019112	0.016686	0.014333	0.012050	0.009833	89.620
0.23	0.205	0.18	0.155	0.13	0.023760	0.020856	0.018041	0.015311	0.012660	49.494
0.24	0.215	0.19	0.165	0.14	0.017152	0.015129	0.013170	0.011270	0.009426	115.021

d2	d3	d4	d5	dam	TC	N
60.005	109.207	194.983	341.911	738.41	758.41	6
2.042	7.066	23.349	73.896	106.92	126.92	3
166.468	231.967	319.979	437.185	1273.78	1293.78	11
94.296	142.371	212.186	312.398	822.85	842.85	9
102.836	149.621	215.133	305.906	843.29	863.29	10
67.152	102.506	154.355	229.472	596.84	616.84	9
116.568	160.493	218.736	295.281	874.83	894.83	12
122.053	164.541	219.712	290.762	886.69	906.69	13
71.752	102.723	145.344	203.391	572.70	592.70	11
148.728	190.673	242.494	306.085	1003.00	1023.00	16

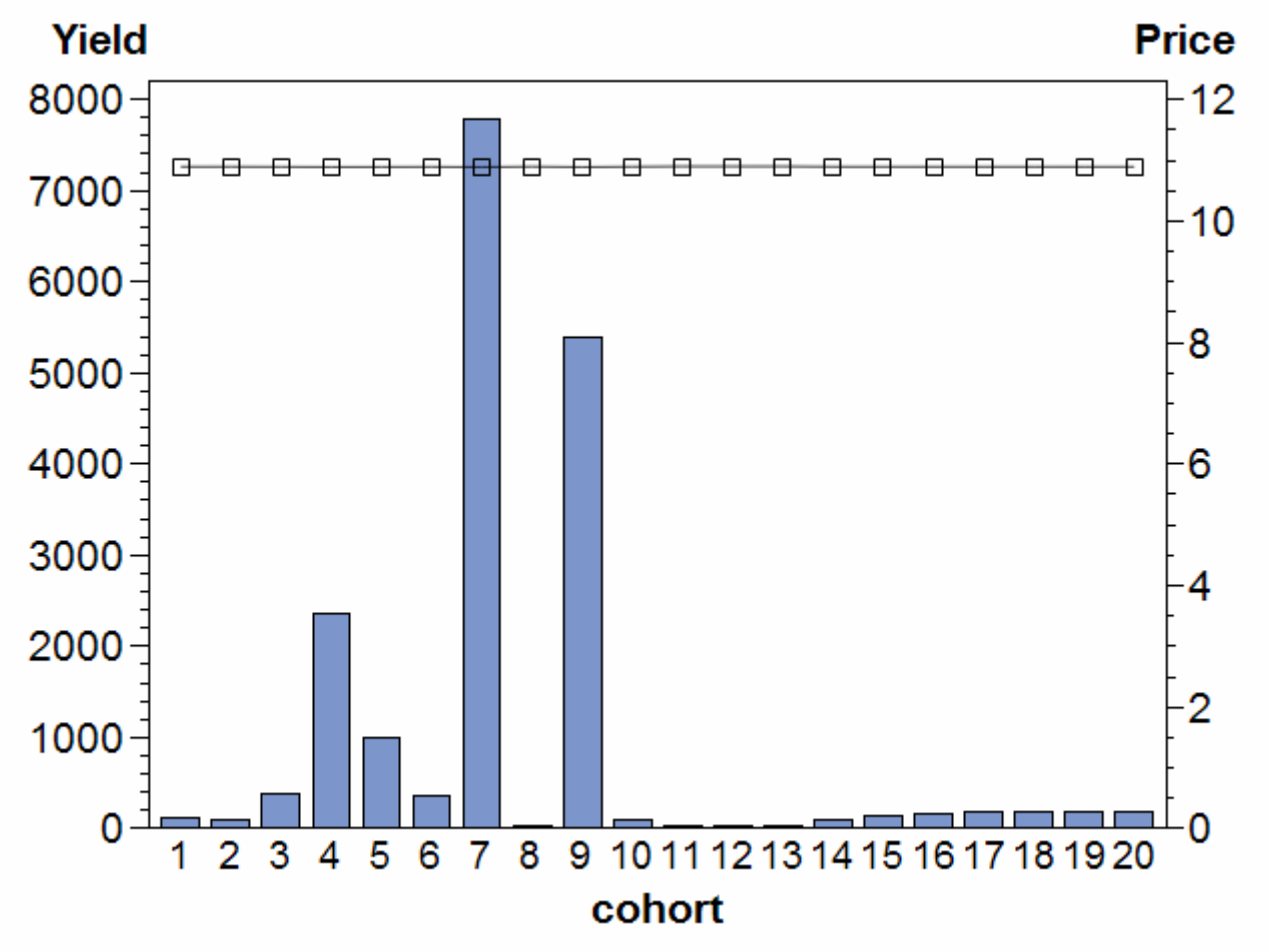
No Hurricane Effect Base Case



Variable Hurricane Effect on Yield for Changes in Fixed Costs



Variable Hurricane Effect on Yield for Changes in Variable Costs



Summary

- The economic effect of climate change depends on how individual behavior changes as a result of the environmental change.
  - Economic values (benefits net of costs) can either increase or decline depending on the industry being affected; for example,
    - Corn farmers could be hurt, while at the same time
    - Rice farmers could benefit much greater than the losses to corn growers.

Summary

- Once the net benefits are estimated then the economic impacts on jobs, income, and sales can be determined for each potential climate change scenario.

Summary

- Most important, in determining how individual behavior as well as net benefits will change, is the need to work with other scientific expertise to incorporate the uncertainty and risk of climate change into the expected damage function for each industry sector.