RISKS IN THE SYSTEM

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WHAT RISK?

- Risk of not getting the water we need
- Increasing pressure on both supply and demand
- If there’s not enough water flowing, various states and users could be deprived of water
- Question is, how likely is that to happen and who takes the hit?

WHY DOES THE RISK MATTER?

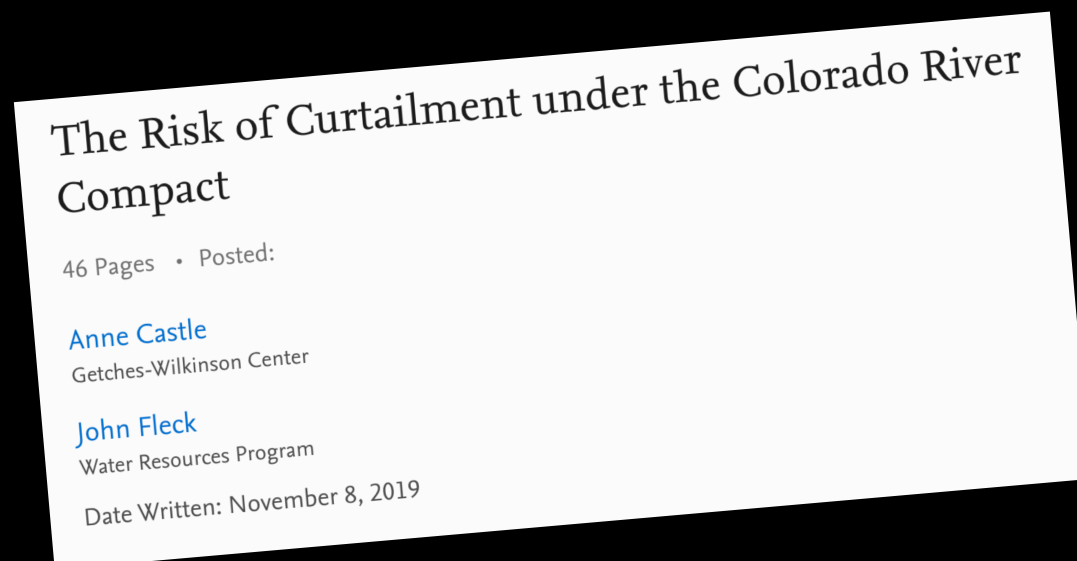
- As with most risks, you can insure against it
- Consider magnitude of risk and odds that it will happen
- That calculation tells us how big a policy we want and how much we're willing to pay

NEED AN OBJECTIVE RISK ASSESSMENT FOR:

- Evaluation of insurance like demand management
- Thinking about "going bare"
- Renegotiation of 2007 Guidelines

YES – THERE IS A RISK

Castle/Fleck paper on risk of curtailment in the Upper Basin



The Risk of Curtailment under the Colorado River Compact

46 Pages • Posted:

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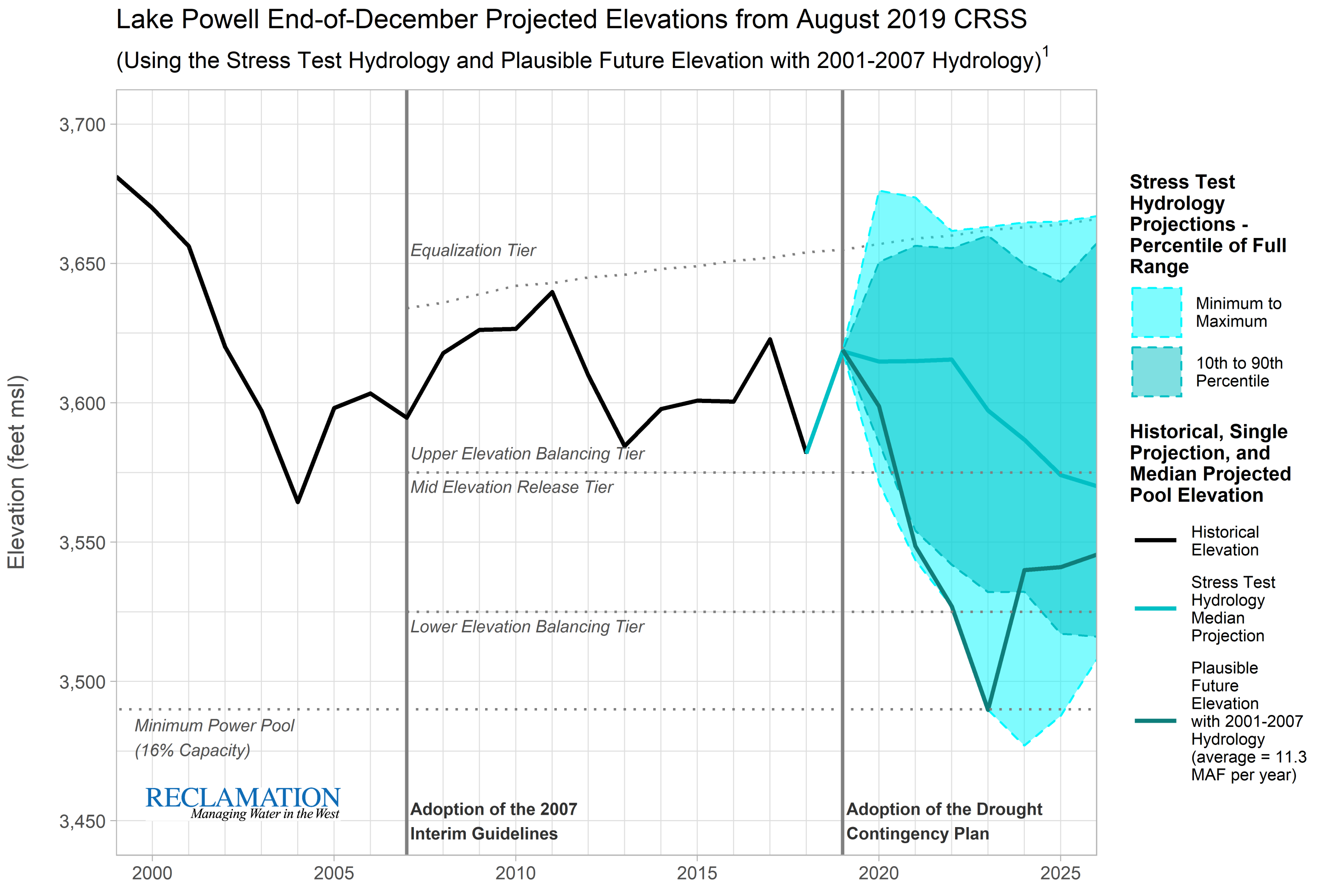
https://ssrn.com/abstract=3483654

HYDROLOGIC RISKS



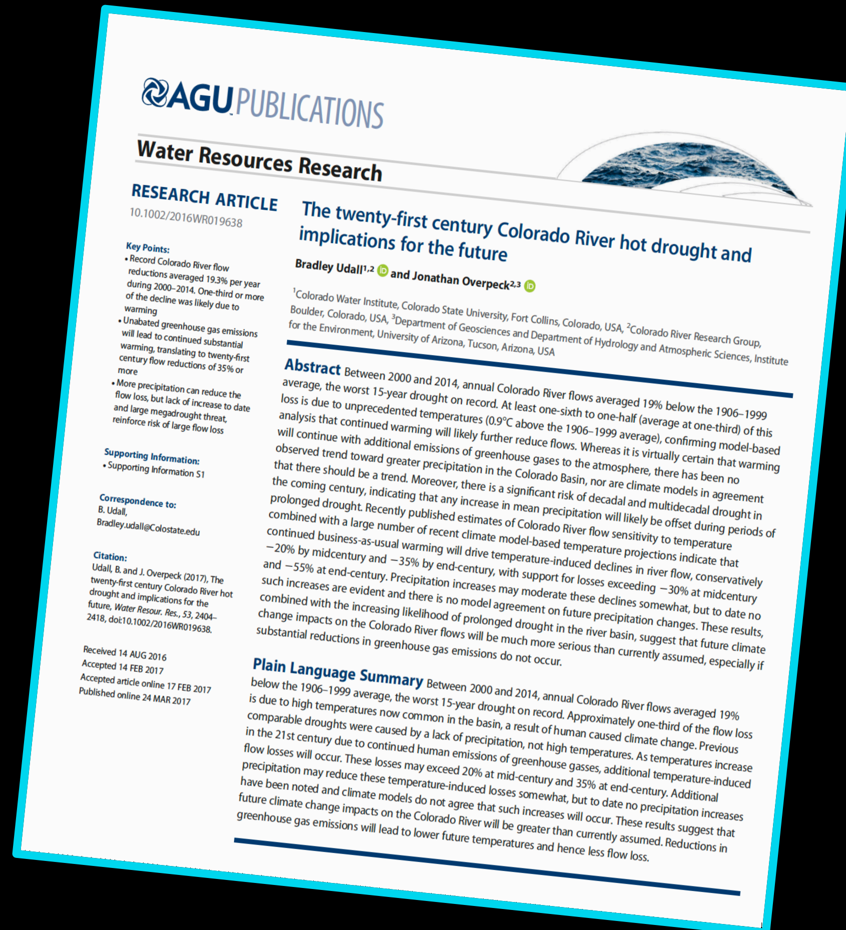
[1] Stress Test Hydrology uses 30 hydrologic inflow sequences based on resampling of the observed natural flow record from 1988-2017.

HYDROLOGIC RISKS

Udall/Overpeck 2017

20-30% reduction in river flows by mid-century

35-55% reduction by 2100


AGU PUBLICATIONS

Water Resources Research

RESEARCH ARTICLE

10.1002/2016WR019638

Key Points:
- Record Colorado River flow reductions averaged 19.3% per year during 2000–2014. One-third or more of the decline was likely due to warming
- Unabated greenhouse gas emissions will lead to continued substantial warming, translating to twenty-first century flow reductions of 35% or more
- More precipitation can reduce the flow loss, but lack of increase to date and large megadrought threat, reinforce risk of large flow loss

Supporting Information:
- Supporting Information S1

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The twenty-first century Colorado River hot drought and implications for the future

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Abstract Between 2000 and 2014, annual Colorado River flows averaged 19% below the 1906–1999 average, the worst 15-year drought on record. At least one-sixth to one-half (average at one-third) of this loss is due to unprecedented temperatures (0.9°C above the 1906–1999 average), confirming model-based analysis that continued warming will likely further reduce flows. Whereas it is virtually certain that warming will continue with additional emissions of greenhouse gases to the atmosphere, there has been no observed trend toward greater precipitation in the Colorado Basin, nor are climate models in agreement that there should be a trend. Moreover, there is a significant risk of decadal and multidecadal drought in the coming century, indicating that any increase in mean precipitation will likely be offset during periods of prolonged drought. Recently published estimates of Colorado River flow sensitivity to temperature combined with a large number of recent climate model-based temperature projections indicate that continued business-as-usual warming will drive temperature-induced declines in river flow, conservatively −20% by midcentury and −35% by end-century, with support for losses exceeding −30% at midcentury and −55% at end-century. Precipitation increases may moderate these declines somewhat, but to date no such increases are evident and there is no model agreement on future precipitation changes. These results, combined with the increasing likelihood of prolonged drought in the river basin, suggest that future climate change impacts on the Colorado River flows will be much more serious than currently assumed, especially if substantial reductions in greenhouse gas emissions do not occur.

Plain Language Summary Between 2000 and 2014, annual Colorado River flows averaged 19% below the 1906–1999 average, the worst 15-year drought on record. Approximately one-third of the flow loss is due to high temperatures now common in the basin, a result of human caused climate change. Previous comparable droughts were caused by a lack of precipitation, not high temperatures. As temperatures increase in the 21st century due to continued human emissions of greenhouse gasses, additional temperature-induced flow losses will occur. These losses may exceed 20% at mid-century and 35% at end-century. Additional precipitation may reduce these temperature-induced losses somewhat, but to date no precipitation increases have been noted and climate models do not agree that such increases will occur. These results suggest that future climate change impacts on the Colorado River will be greater than currently assumed. Reductions in greenhouse gas emissions will lead to lower future temperatures and hence less flow loss.

LEGAL RISKS

- Upper Basin cannot "cause flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre feet for any period of ten consecutive years"

- Delivery obligation or non-depletion obligation?

LEGAL RISKS

"Delivery" obligation	Then Upper Basin could bear all the risk of climate change and lower flows in the river
"Non-depletion" obligation	Then as long as Upper Basin uses less than 7.5 MAF – no worries!

BUT – we don't know the answer

LEGAL RISKS

- 1922 Compact allocates 7.5 MAF to Lower Basin, with right to increase use by 1.0 MAF
- Allocation is from the “Colorado River System”
- “Colorado River System” means the Colorado River and its tributaries within the US

LEGAL RISKS

Total Lower Basin use (2000 – 2017)

Source	**Average Consumptive Use**
Mainstem	7.5 MAF
Evaporation and losses	1.2 MAF
Subtotal	**8.7 MAF**
Tributaries (2000-2005)	2.3 MAF
Total	**11.0 MAF**

Source: Wheeler, Schmidt, Rosenberg 2019

MAKING IT BETTER

- 2007 Guidelines
- Drought Contingency Plans
- Minute 323
- Working together to solve the problems

MAKING IT WORSE?

- Continued structural deficit in the Lower Basin
- Balancing of Lakes Powell and Mead
- New uses

LITIGATION – NOT A SILVER BULLET

Uncertain, lengthy, costly

Freezes parties into their positions and undermines collaboration

Politics takes on a much bigger role

OPTIONS

- Insurance policies
  - Reduced delivery schedule
  - Demand management
- Going bare –
  - Wait and see
  - Let the Law of the River operate
  - But what is the Law of the River???


QUESTIONS
AND DISCUSSION