Warmer Winter Temperatures

2008: More then 1.25 million homes lose power in Northeast

One half of NH's homes are included in this figure.

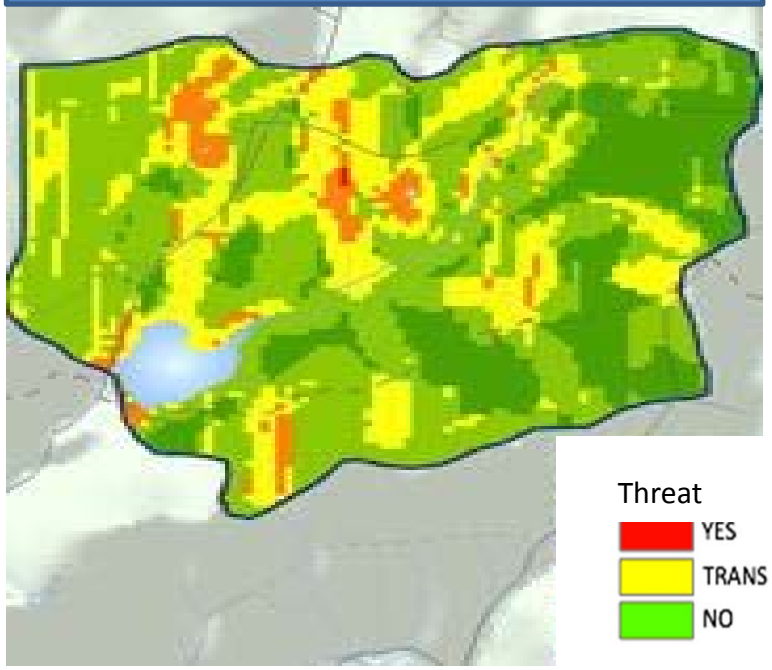
Warmer Winter Temperatures

Increased Frequency of Larger Precipitation

Increased RUN-OFF

Increased Run-off

Water Quality Threat

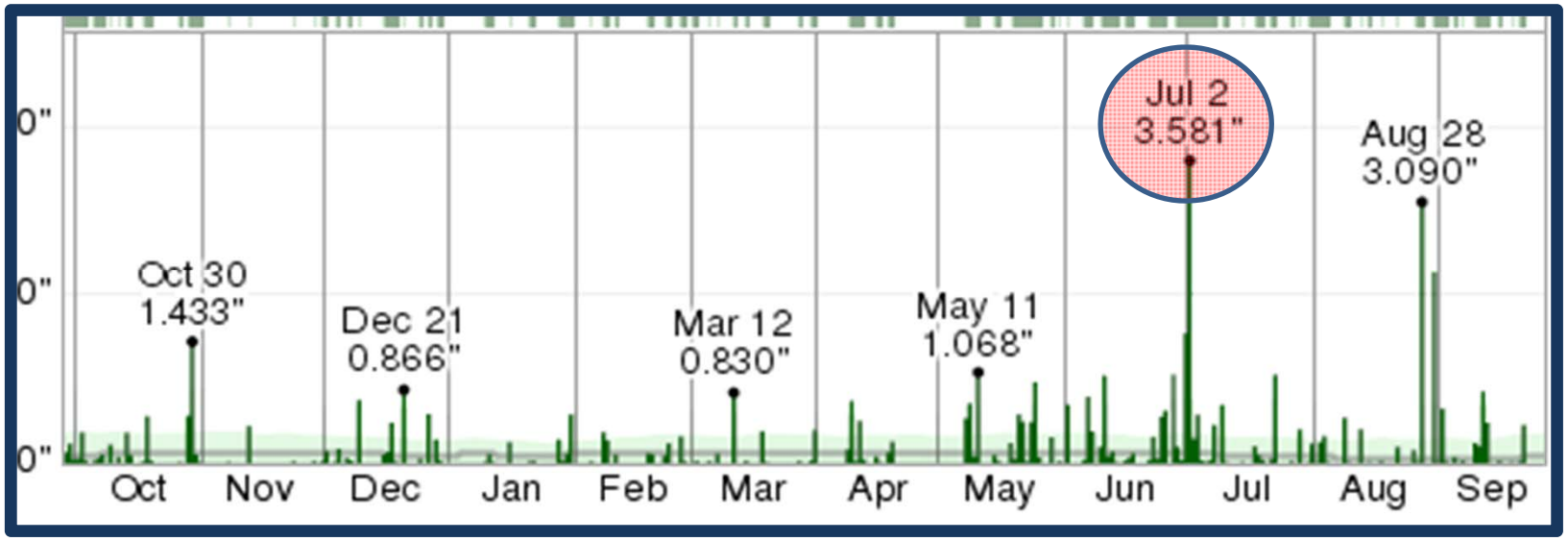


VALLEY NEWS

July 3, 2013

Flash Floods Hammer Lebanon; Rivermere Residents Evacuated

Precipitation: Lebanon NH 2013

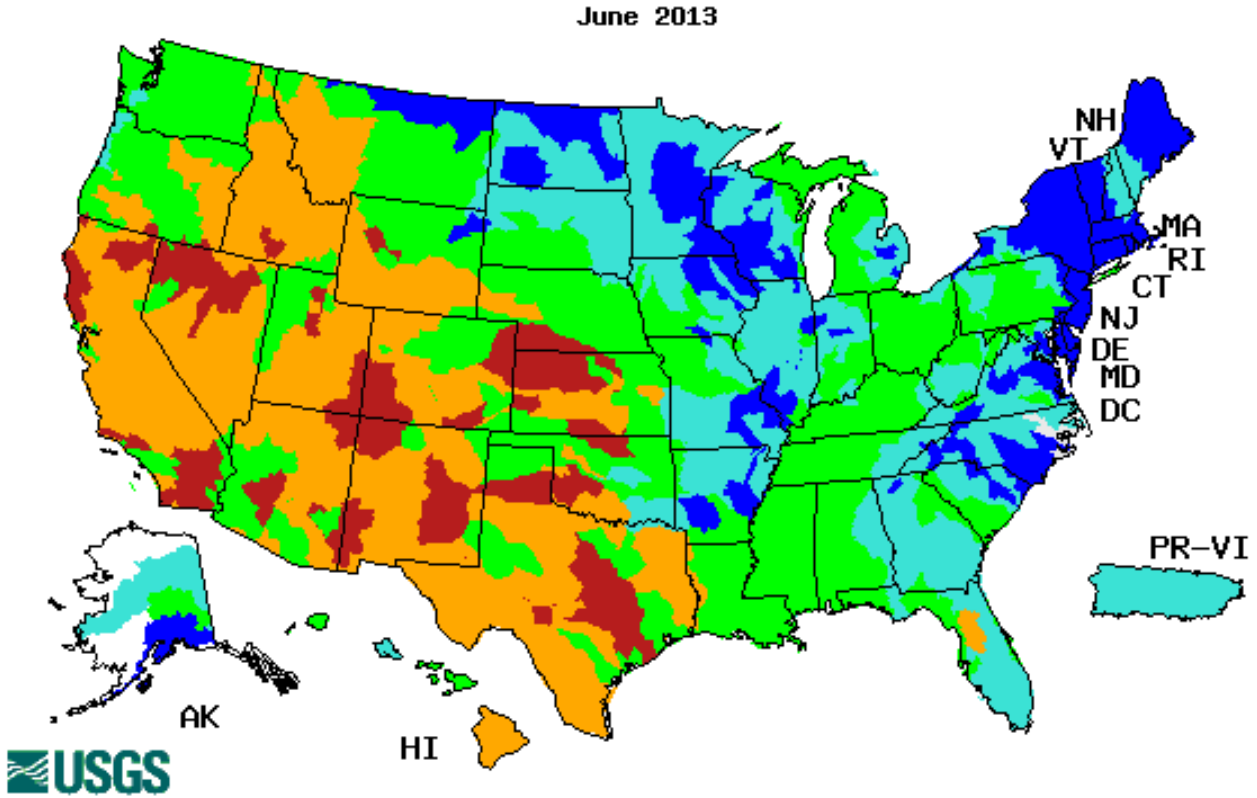


TOWN	24-hour SCS Rainfall*					
	1 yr	2 yr	10 yr	25 yr	50 yr	100 yr
LANCASTER	2.4	2.6	4.0	4.9	5.2	5.9
LANDAFF	2.4	2.5	3.9	4.8	5.1	5.8
LANGDON	2.3	2.7	4.1	4.8	5.4	6.1
LEBANON	2.3	2.6	4.0	4.7	5.2	5.8

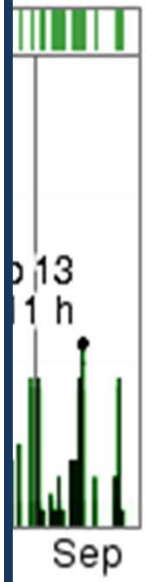
56 % of the 3.6 inches fell within a 45 minute period

Map of monthly streamflow compared to historical streamflow for the month of the year (United States)

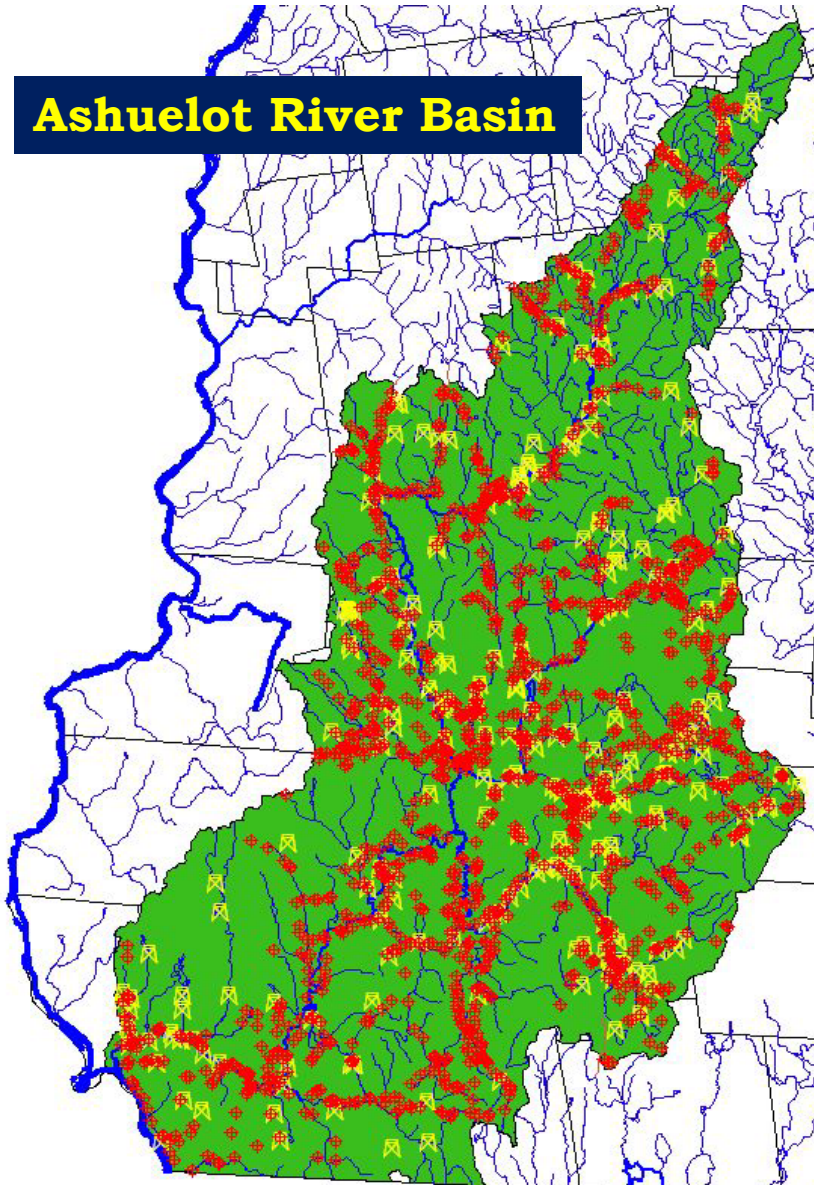
State or Water-Resources Regions



Explanation - Percentile classes						
Low	<10	10-24	25-75	76-90	>90	High
	Much below normal	Below normal	Normal	Above normal	Much above normal	



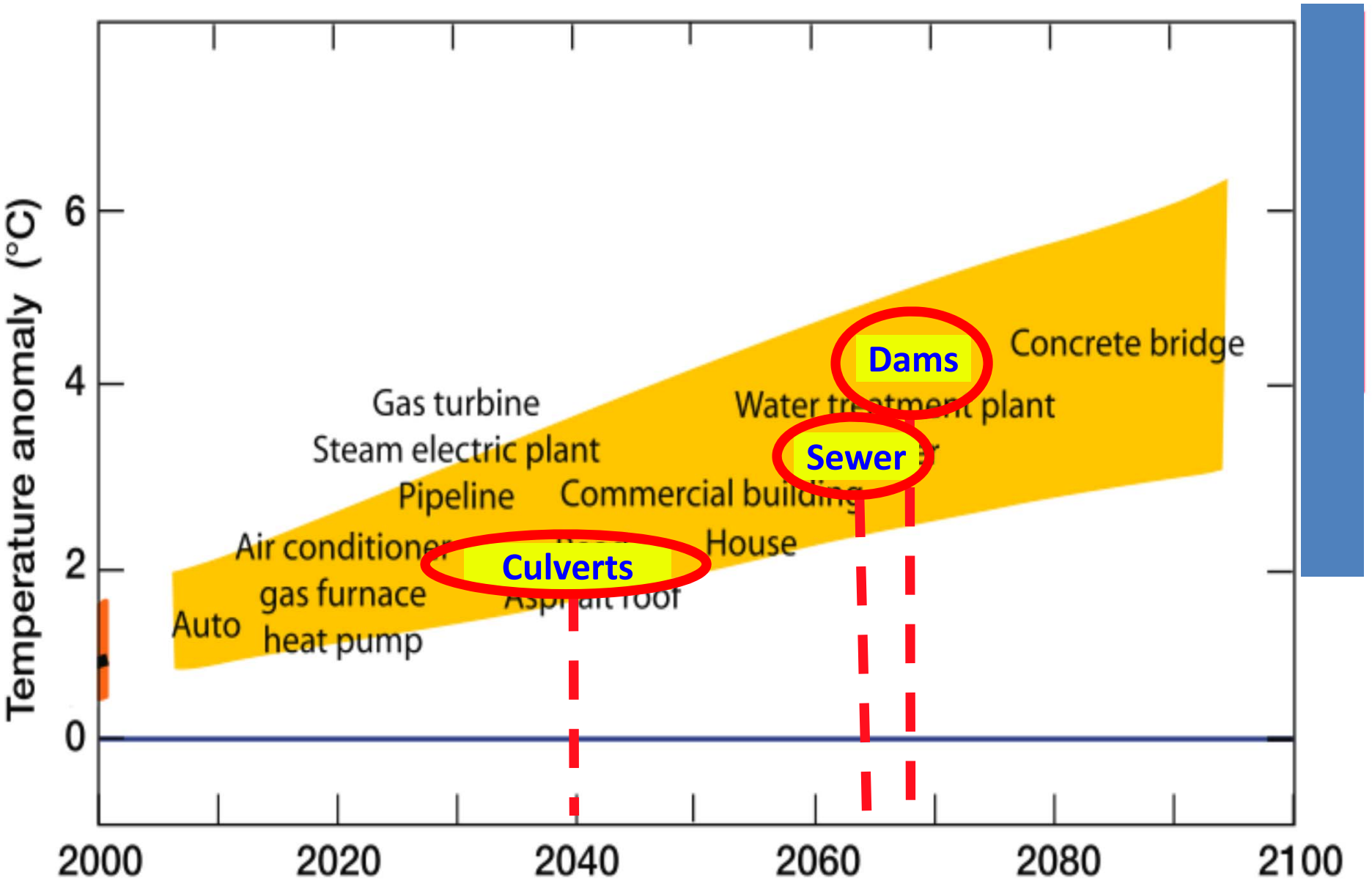
Understanding What is Vulnerable



River and Lake **dams**: ~150

Number of stream crossings (**maintained roads**): 1,039

TIME FOR PLANNING



Vulnerability is Contextual

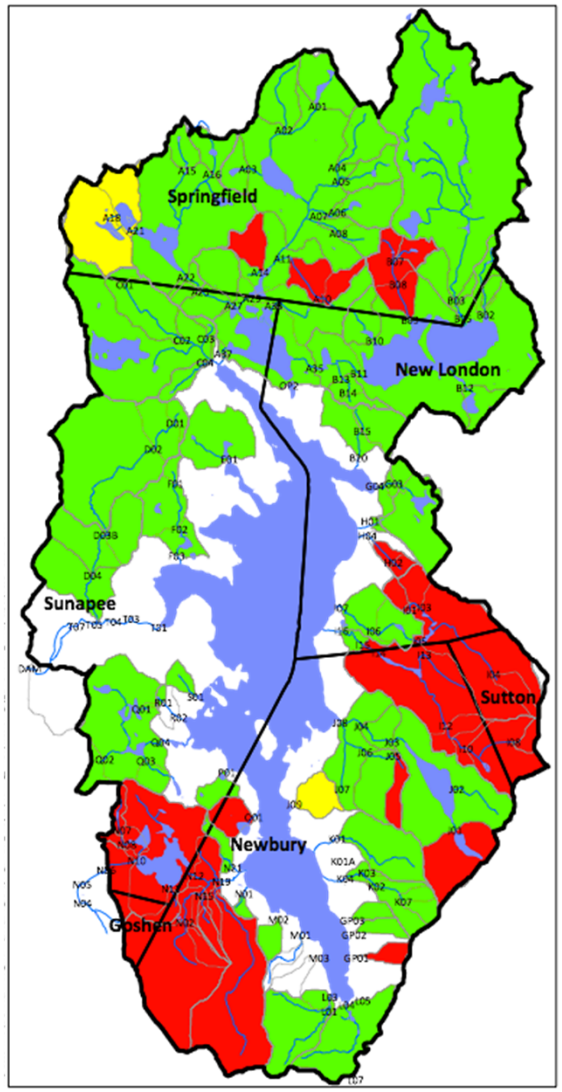
Percentage of stormwater infrastructure already undersized for 24hr, 25year rainfall amount			
Minneapolis, MN	**12%**	Minnehaha Watershed Vulnerability Study	**Simpson & Stack, 2013**
Newbury, NH	**14 %**	Lake Sunapee Basin Study	**Simpson et al, 2012**
New London, NH	**23%**	Lake Sunapee Basin Study	**Simpson et al, 2012**
Springfield, NH	**14%**	Lake Sunapee Basin Study	**Simpson et al, 2012**
Sunapee, NH	**0%**	Lake Sunapee Basin Study	**Simpson et al, 2012**
Stratham, NH	**46%**	Winnicut River Basin Study	**Lawson & Simpson 2011**
Durham, NH	**9%**	Oyster River Basin Study	**Stack & Simpson 2010**
Keene, NH	**26%**	White Brook Watershed Study	**Simpson et al, 2006**
Ottawa, Canada	**21%**	Ottawa 2001 Study	**Waters et al, 2003**

A Changing Landscape

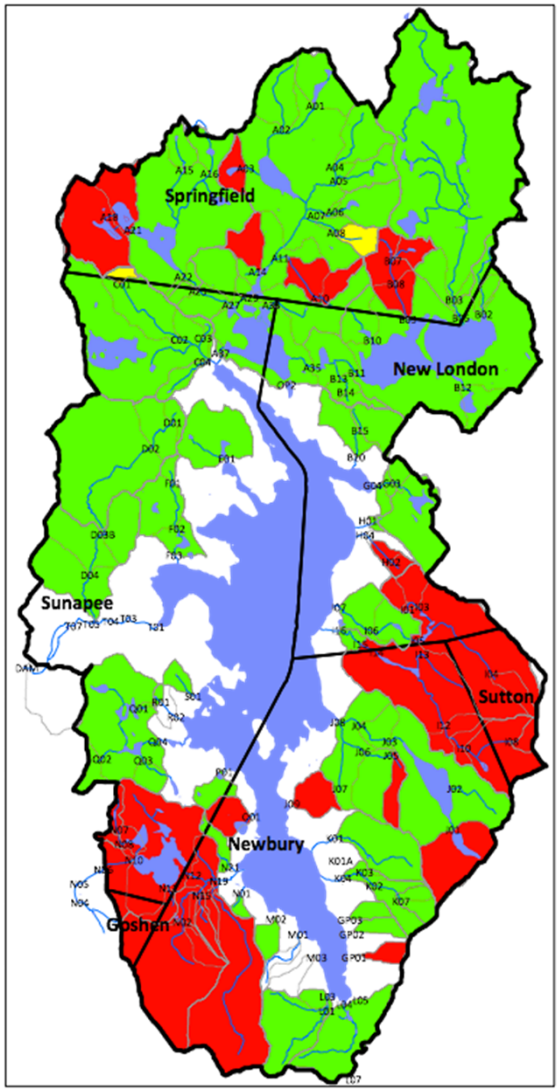
Courtesy of UCONN Cooperative Extension

Drainage system adequacy (Sunapee Basin)

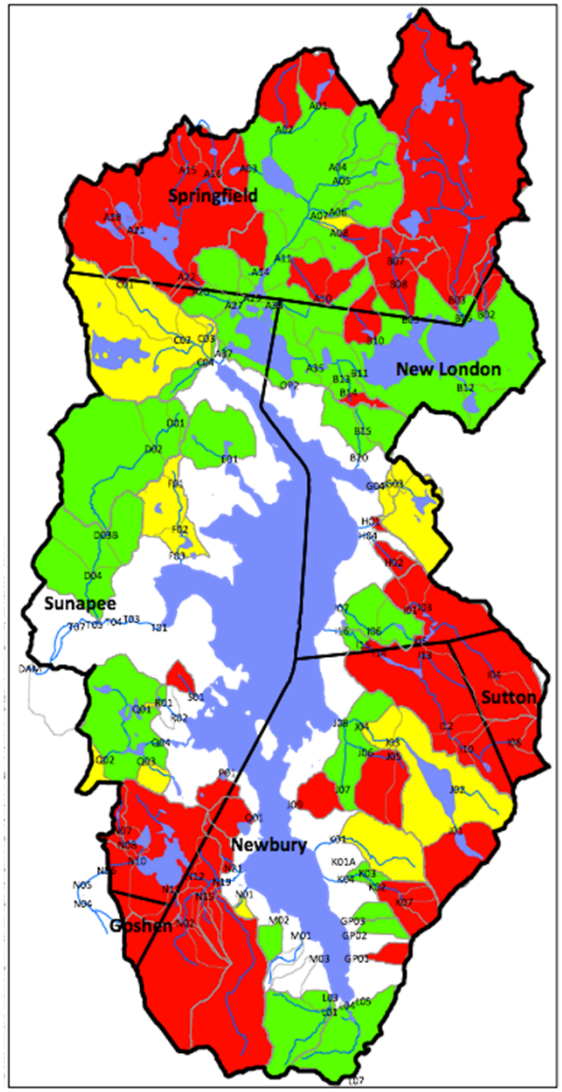
Recent conditions



With population growth



And more extreme rainfall



REPLACE (YES, TRANS, or NO)

- YES
- TRANS
- NO

Trans = transitional

SYNTECTIC INTERNATIONAL

ANTIOCH UNIVERSITY NEW ENGLAND

Climate Techniques

NOAA

Understanding Why It Is Vulnerable

TOWN	24-hour SCS Rainfall*					
	1 yr	2 yr	10 yr	25 yr	50 yr	100 yr
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Lake Sunapee watershed:

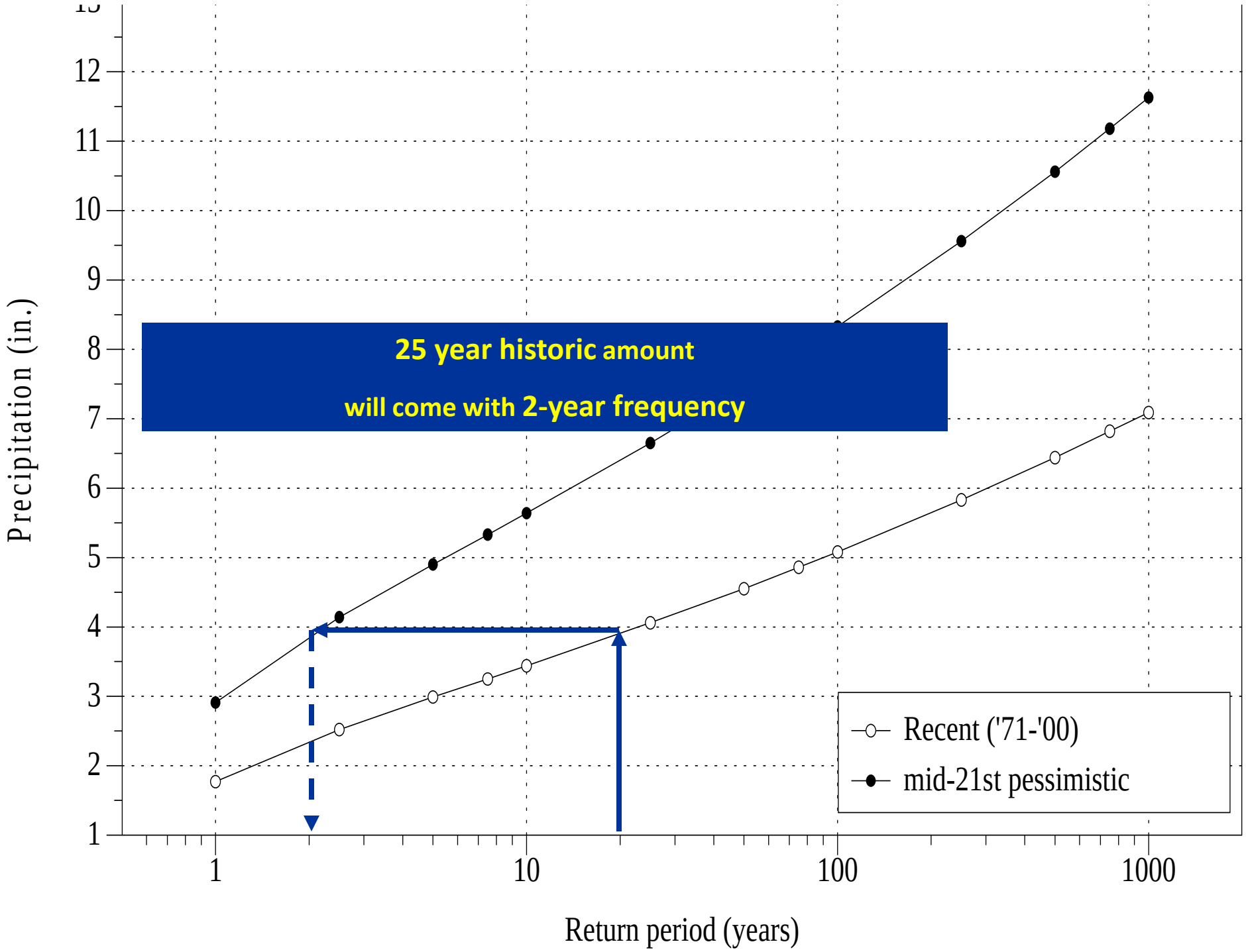
Results of precipitation modeling

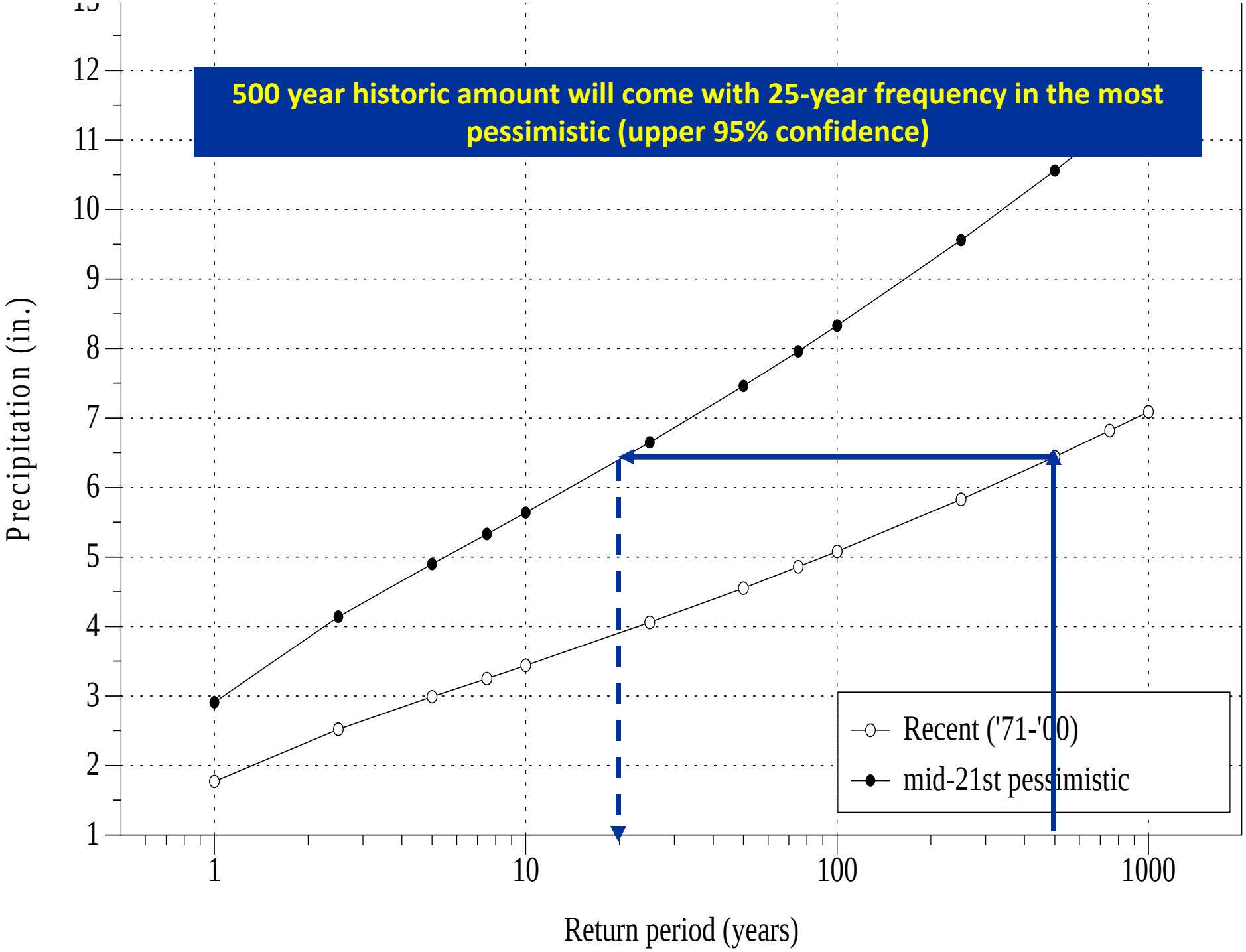
Sunapee 25-year, 24-hour precipitation, regionalized shape parameter

Data Source	SRES	Period	25-year precip (in.) -95%c.i.	Most Likely	+95%c.i.
Historic	Baseline	1971-2000	2.70	4.06	6.65
PROJECED Rainfalls	B1	2046-2075	2.63	4.25	7.47
	A1b	2046-2075	3.23	4.87	8.00
	A1fi	2046-2075	4.34	6.65	11.10

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

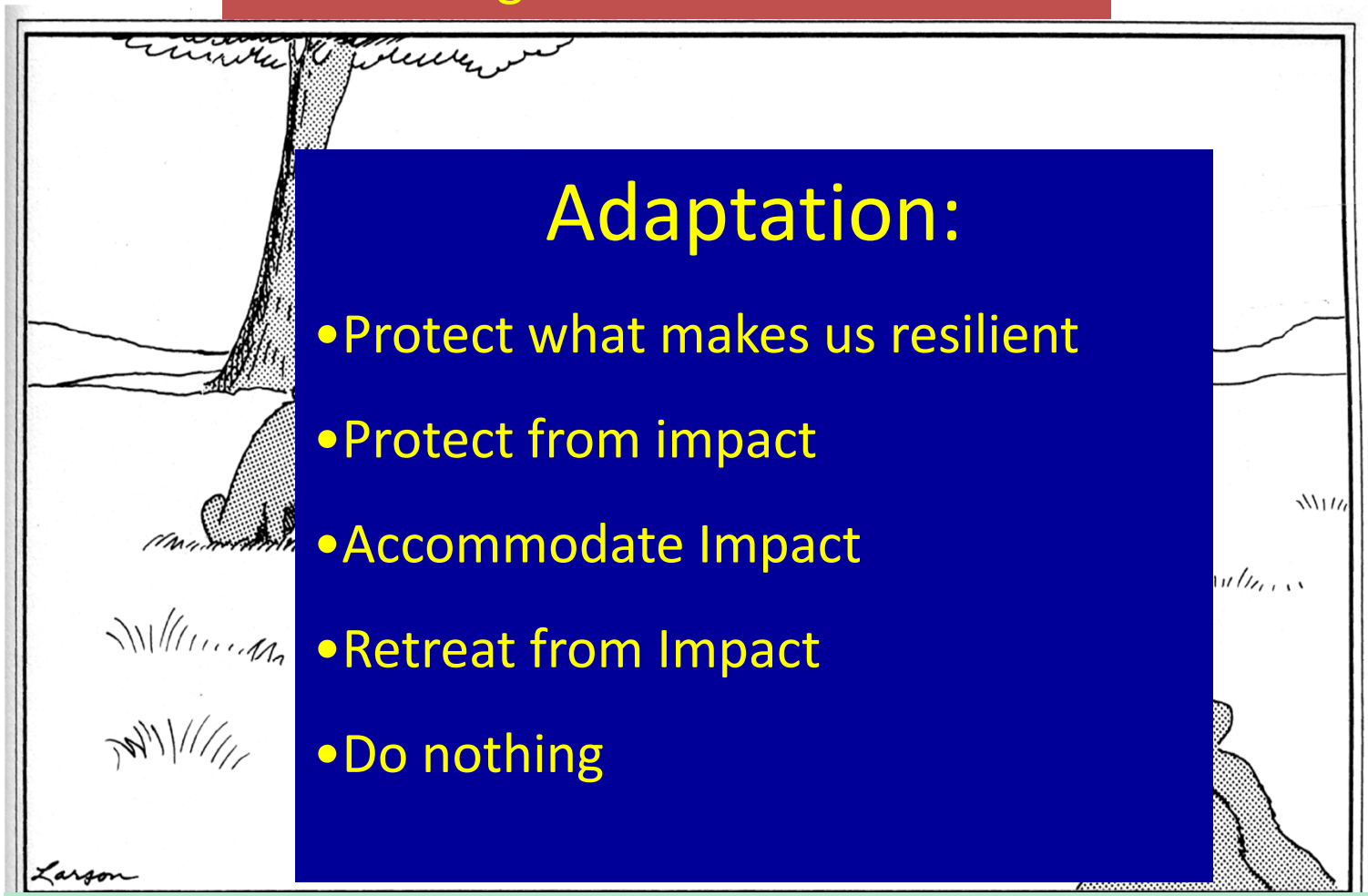
Antioch University New England


25 year historic amount
will come with 2-year frequency
Precipitation (in.)
Return period (years)
Recent ('71-'00)
mid-21st pessimistic
1
2
3
4
5
6
7
8
9
10
11
12
1
10
100
1000


500 year historic amount will come with 25-year frequency in the most pessimistic (upper 95% confidence)
Precipitation (in.)
12
11
10
9
8
7
6
5
4
3
2
1
1
10
100
1000
Return period (years)
Recent ('71-'00)
mid-21st pessimistic

Understanding Who is Vulnerable

Deciding What to Do About It



Adaptation:

- Protect what makes us resilient
- Protect from impact
- Accommodate Impact
- Retreat from Impact
- Do nothing

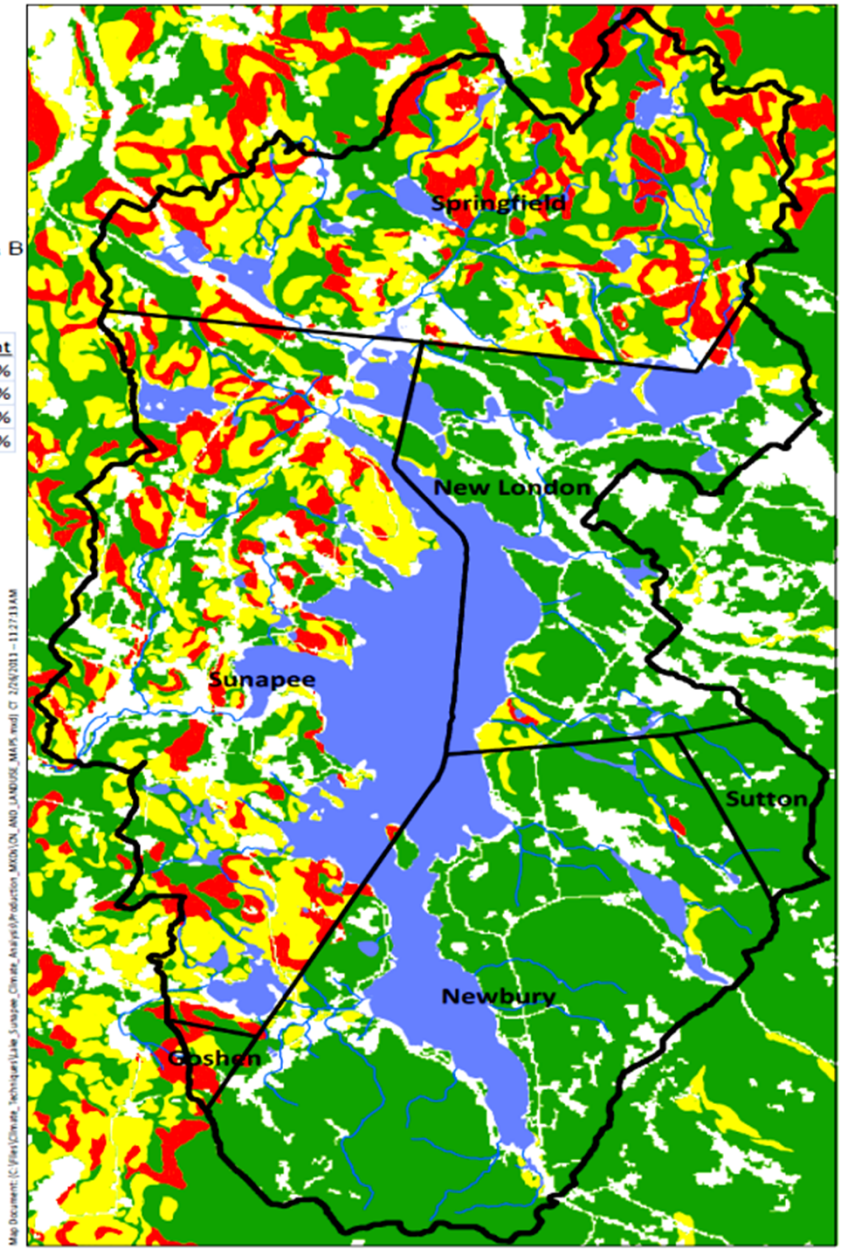
"Drive, George, drive! This one's got a coat hanger!"

Protect what makes us resilient

FOREST COVER
WITH HIGH
WATER RETENTION

- All Forested Landcover
- Forest Landcover on A & B Soils
- Forest Landcover on A & B Soils with Slopes >15%

Scenario	Acres	Percent
A & B >15%	2531	7.6%
All A & B	7575	22.7%
All Forested	22491	67.4%
All Watershed	33393	100.0%



Possible Consequences of Doing Nothing

Road Crossing Upgrade

$ 56,000

FEMA Response: $ 28,000

Crossing & Road Repair

$ 93,000