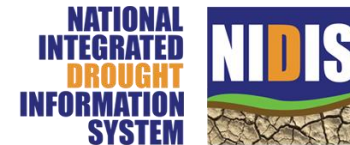# Planning as a Prerequisite to Using Drought Information

- Livestock grazing on Public Lands
- Drought is not the Primary Threat
- Planning Process is Barrier to applying Drought Info
- Using Drought Info to Motivate Planning Process

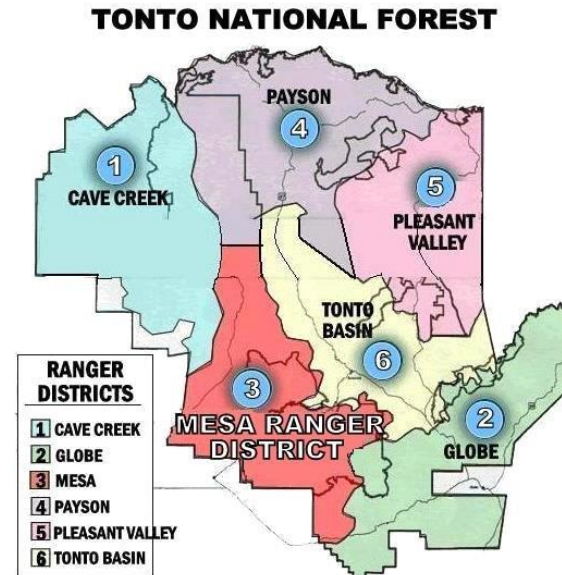Drought Outlook and
Impacts Workshop

25 October 2016, Las Cruces, NM

Mitch McClaran
University of Arizona
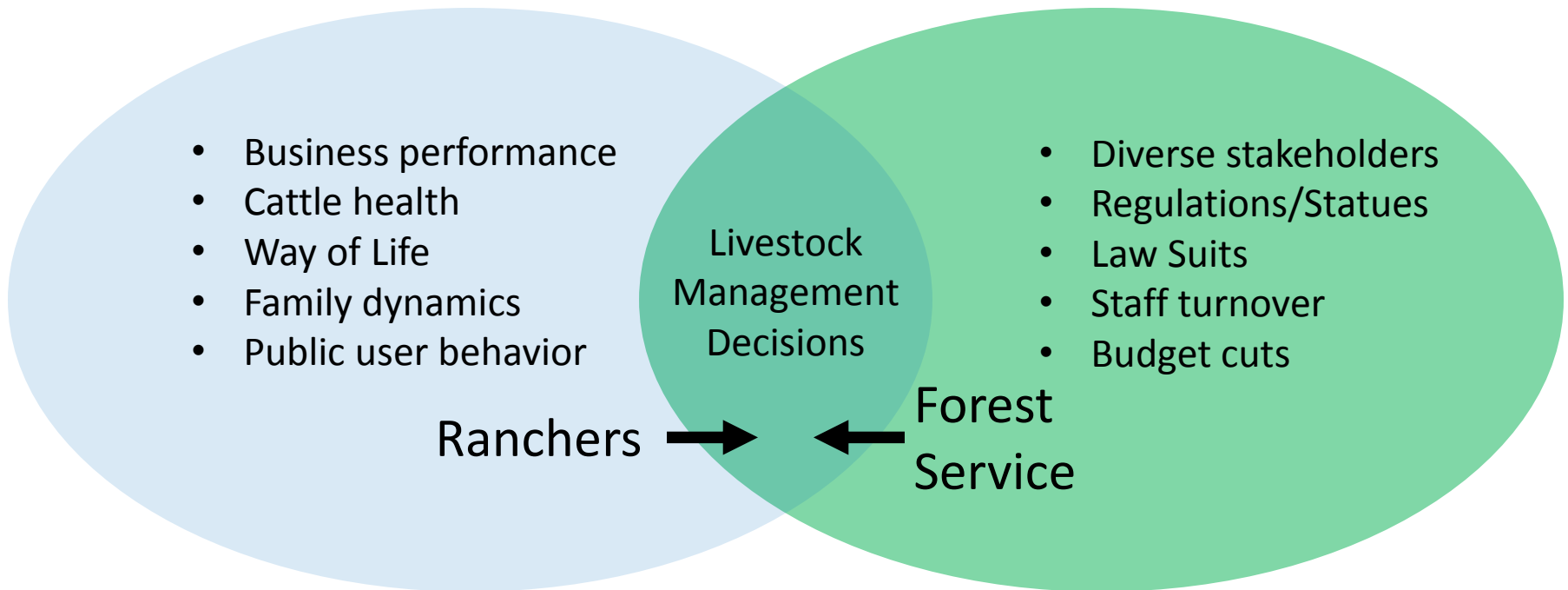mcclaran@u.arizona.edu

Livestock grazing on Public Lands

- 90 million acres Forest Service land grazed in the West

- Over 9,000 grazing permits in the West

- Tonto National Forest, Arizona

  - 2.8 mill acres, 105 grazing permits

  - $48 mill/y cattle sales Gila and Yavapai Counties*

  - Federal rangeland provides 90-95 % of livestock forage

* National Agricultural Statistics Service 2012

Drought is not the Primary Threat

Top 3 Risks for Managing Livestock on the Tonto National Forest Q3	Ranchers say: Forest Service, Drought, Federal Regulations	Forest Service says: Drinking Water Reliability & Livestock Practices (tie), Drought

Ranchers
- Business performance
- Cattle health
- Way of Life
- Family dynamics
- Public user behavior

Livestock Management Decisions

Forest Service
- Diverse stakeholders
- Regulations/Statues
- Law Suits
- Staff turnover
- Budget cuts

Drought is not the Primary Threat

- Management flexibility is critical to reduce drought impact

- 3-4 year Forest Service planning process limits flexibility

- **THREAT IS** Length and uncertainty of planning process

R=Ranchers and F=Forest Service

	Agree (%)		
	0	50	100
Flexibility to address drought reduces impact to livestock production Q76			**F91R92**
National Environmental Policy Act (NEPA) allows enough flexibility Q77	**R11**	**F46**	

Drought is not the Primary Threat

- **THREAT IS** Length and uncertainty of planning process

Limited Utility of Drought Early Warning

Ranchers and Forest Service are
   Not in a position to respond to warning info,
   until practices are approved and applied

Using Drought Info to Motivate Planning Process

- **NOAA-SARP Funding: 2015-2017**
  - http://cals.arizona.edu/droughtandgrazing/

- **Opportunity to Focus on SPI**
  - FS Drought Policy starts at 12-month **SPI -1**
  - Focus on Increasing familiarity with **SPI**
  - Structure Planning Scenario Workshops on **SPI -1**
  - Develop Drought Info Tools using **SPI**

Using Drought Info to Motivate Planning Process

- Drought Scenario Planning Tool
  - Spreadsheet-based for typical grazing allotment

- Assess Threats, Coping Practices, Policy Constraints
- Estimate Length of Planning Approval Process, and Likelihood of Approval
- Compare to ~6 y Return Interval for SPI-1

- Outcomes
  - Motivated to apply on actual allotments
  - Motivated to start the planning process
  - Improved communications and relations

Using Drought Info to Motivate Planning Process

Drought Scenario Planning Tool

Reference Values for Drought Severity Effects on Seasonal Forage Production

	Winter*		Summer	
Standard Precipitation Index (SPI)	-1	-2	-1	-2
Estimated Forage Reduction (% of Average)	0.58	0.34	0.72	0.52

*Winter = October - May; Summer = June - September

Herd Composition

	Jan - May	June - Dec
Cows	300	300
Bulls	20	20
Yearlings	150	40
Total Herd AU's	440	363

Drought Factors **Grazing Plan**

SPI Value (pasture level) Winter Season	SPI Value (pasture level) Summer Season	Pasture	Pasture Rotation Sequence	Planned % Utilization	Water (dates when unavailable)	Seasonal Use Restrictions (dates)	Number Days in Pasture	First Day in Pasture	Last Day in Pasture	Maximum Seasonal Grazing Days	Drought Season Affecting Forage Production	Pasture Warnings	Herd Grazing Days Without Drought	Drought-Adjusted Seasonal Herd Grazing Days Winter Season	Drought-Adjusted Seasonal Herd Grazing Days Summer Season
-1	0	Riparian	1	20%			43	1/1/2016	2/12/2016	25.9	Winter	Exceeds Maximum S	45	26	45
-1	0	Headquarters	2	40%			19	2/13/2016	3/2/2016	11.4	Winter	Exceeds Maximum S	20	11	20
-1	0	Pipeline	3	40%			60	3/3/2016	5/1/2016	44.6	Winter	Exceeds Maximum S	77	45	77
-1	0	Wydot	4	40%			50	5/2/2016	6/20/2016	51.4	Winter		89	51	89
-1	0	Son of A Gun	5	40%			40	6/21/2016	7/30/2016	71.2	Summer		71	41	71
-1	0	Miners Camp**	6	20%			25	7/31/2016	8/24/2016	30.5	Summer		31	18	31
-1	0	Timber Top**	7	0%			0	8/24/2016	8/24/2016	0.0	Summer		0	0	0
-1	0	Preacher Tom	8	40%			76	8/25/2016	11/8/2016	93.2	Summer		93	54	93
-1	0	Old Homestead	9	40%			52	11/9/2016	12/30/2016	81.4	Summer		81	47	81
		Total					365			410			506	294	506

**Rest rotation every other year, summer use

Pasture Sequence Re-Sort

Instructions for Drought Scenario Planning
1. Input user defined data into open white boxes
2. Enter SPI value for winter and summer for each pasture
3. Enter Unavailable water dates for each pasture
4. Enter use restriction dates for each pasture
5. Examine warnings for use levels exceeded (red text)
6. Consider adjustments to maintain use within allowable levels. Consider the following:
    a. Herd size and composition
    b. Days in pasture
    c. Pasture rotation sequence
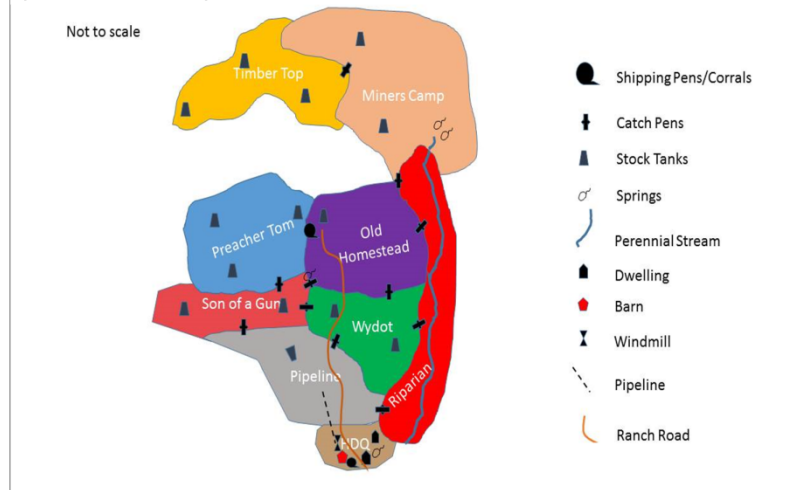   d. Planned utilization

Other Features

1. "Pasture Sequence Re-Sort" button on the screen will re-arrange the pastures and dates according to the pasture rotation sequence you selected if you decide to make changes to the original sequence (cannot undo this action except by hand).

2. Saving scenario solutions in spreadsheet tabs: Identical copies of the tool with the specific scenario details are saved in different spreadsheet tabs located at the bottom of the window; these can be used to save different possible solutions to a single drought scenario. These are labeled by default as "Solution 1", "Solution 2", etc.

3. Worksheet: used in conjunction with this tool to identify solutions and determine whether they will need consultation and approval with updated AOI and deviation from AMP.

Sprinkle Ranch Allotment Map

Not to scale

Timber Top
Miners Camp
Preacher Tom
Old Homestead
Son of A Gun
Wydot
Pipeline
Riparian
HDQ

- Shipping Pens/Corrals
- Catch Pens
- Stock Tanks
- Springs
- Perennial Stream
- Dwelling
- Barn
- Windmill
- Pipeline
- Ranch Road

Using Drought Info to Motivate Planning Process

- SPI Explorer Tool
  https://uaclimateextension.shinyapps.io/SPItool/
  - Historic values any location in US
  - Referenced to actual PPT values

  - Drought Category Transition Function
    - Likelihood of future SPI value give current value

- Outcomes
  - More familiar and comfortable with SPI
  - Using empirical climatology to judge drought risk
  - Motivated to apply on actual allotments

Using Drought Info to Motivate Planning Process

Standardized Precipitation Index Explorer Tool

About Tool | Set location/time period | Site Climate Summary | SPI Timescale Comparison | SPI-Precip Comparison | **Drought Category Transitions**

Period 1 SPI timescale:
- ◉ 1 month
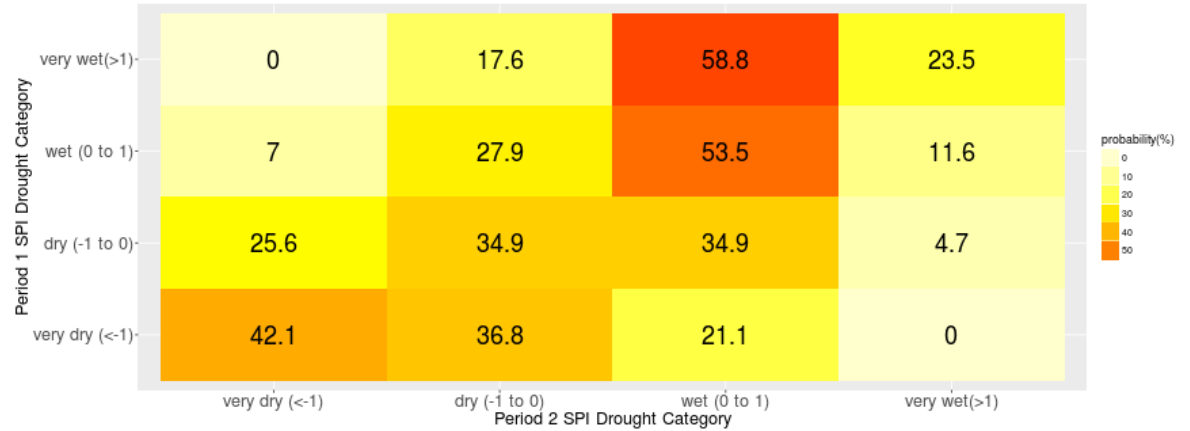- ○ 3 month
- ○ 12 month

Period 1 - End Month: 7

Period 2 SPI timescale:
- ○ 1 month
- ◉ 3 month
- ○ 12 month

Period 2 - End Month: 9

This tool examines the probability of moving from one SPI based drought category to another based on the historical precipitation record at this location. The chart is read as the row indicating the drought category for the initial month and the column as 'forecast' month. For example, if you were interested in how often a very wet July was followed by an overall very wet summer (July-Aug-Sep) precipitation total, you would set Month 1 to 1-month SPI and July and Month 2 to 3-month SPI and September. Reading across the first row (month 1-very wet) to the last column (month 2-very wet) indicates the probability of this outcome based on historical occurrences. A longer period of record yields more stable results.

Period 1 SPI Drought Category (rows) vs **Period 2 SPI Drought Category** (columns):

Period 1 \ Period 2	very dry (<-1)	dry (-1 to 0)	wet (0 to 1)	very wet(>1)
very wet(>1)	0	17.6	58.8	23.5
wet (0 to 1)	7	27.9	53.5	11.6
dry (-1 to 0)	25.6	34.9	34.9	4.7
very dry (<-1)	42.1	36.8	21.1	0

probability(%): 0, 10, 20, 30, 40, 50

	Category	Period 1	Period 2
1	very dry (<-1)	< 0.71 in.	< 2.99 in.
2	dry (-1 to 0)	0.71 to 1.39 in.	2.99 to 4.46 in.
3	wet (0 to 1)	1.39 to 2.44 in.	4.46 to 6.33 in.
4	very wet(>1)	> 2.44 in.	> 6.33 in.

Wooton Hall, NMSU : 1895-2016
- July SPI is known (Y-axis)
- Likelihood of July-Sept SPI (X-axis)
- Translation to inches provided

Summary

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Web Resources

- SPI Explorer Tool
  https://uaclimateextension.shinyapps.io/SPItool/

- Drought and Climate Dashboard
  https://cals.arizona.edu/droughtandgrazing/dashboard

- Drought Scenario Planning Tool
  https://cals.arizona.edu/droughtandgrazing/ (scroll to Publications and Papers)

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