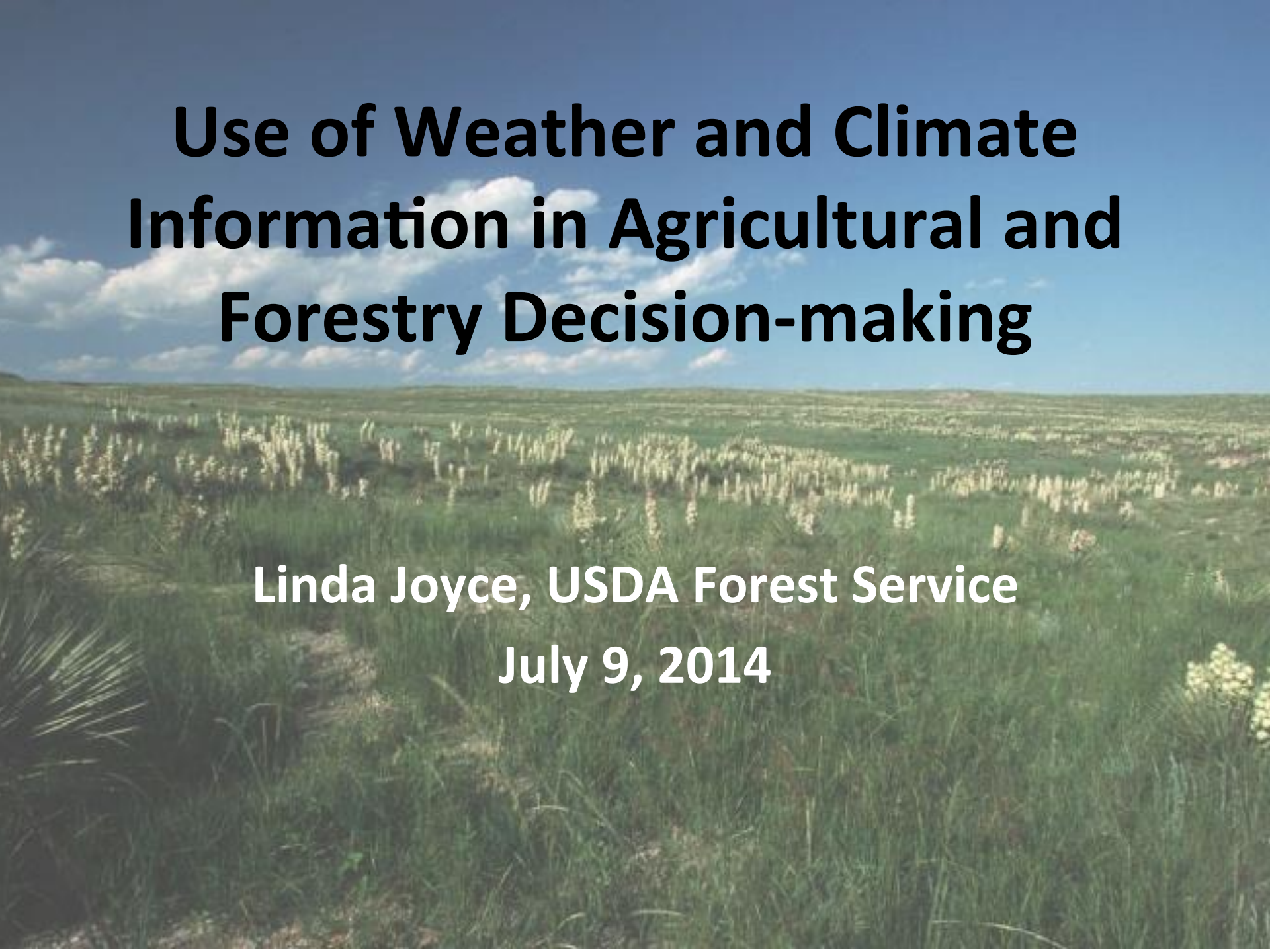


Use of Weather and Climate Information in Agricultural and Forestry Decision-making

Linda Joyce, USDA Forest Service

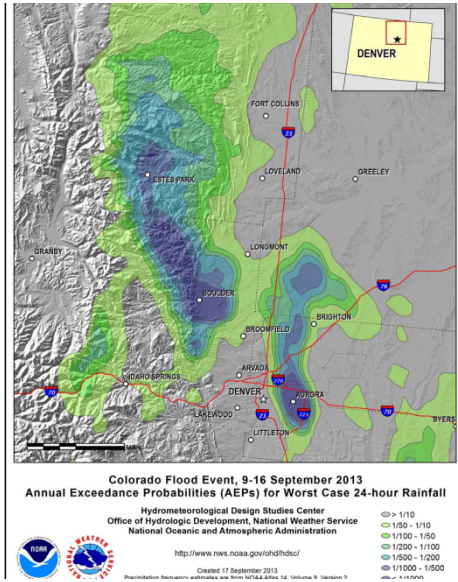
July 9, 2014

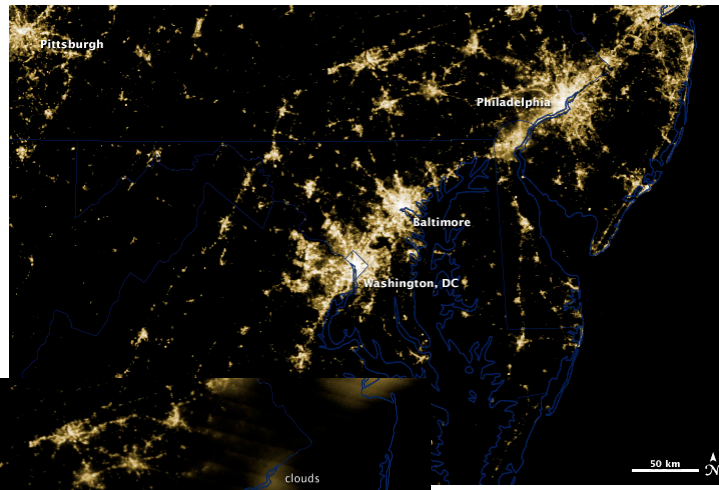
Weather/Climate Information in Agricultural and Forestry Decision-making

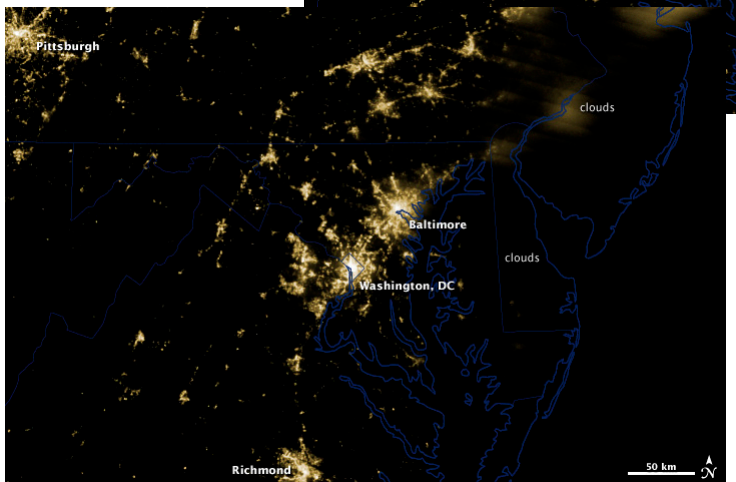
- **Historical Climate Data**
  - Fine-scale historical climate data, relevant to resource of interest, quality assured
- **Extreme Events and Weather Alerts**
  - Prediction of Extreme Events
  - Alerts, cognizant of response time, future novel conditions
- **Short-term forecast – day to months to year**
  - Fine scale relevant climate variables, accurate tbd by user
- **Climate Change Projections**
  - Climate variables used in management, fine-scale
  - Consistency of projection information across ownerships, across scale

Extreme Events

- Real-time agricultural and forestry response needed to some extreme events.
- Past experience sets the stage for the management response.
- Is the event attributable to specific forcings? Human caused?
  Natural Variability?
- In either case, it is an opportunity to reflect.



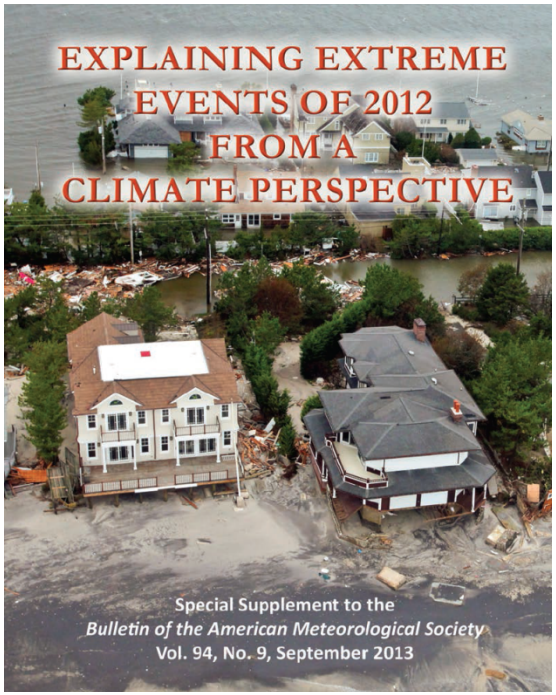




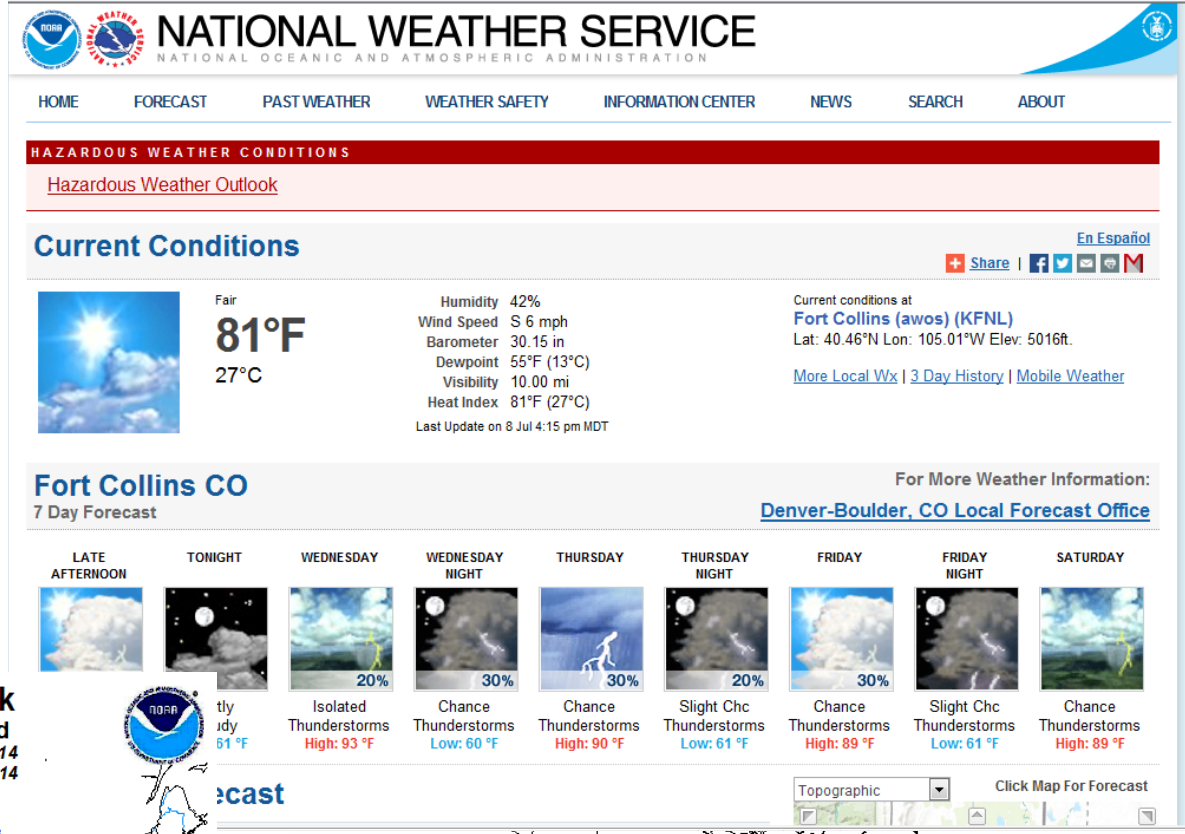
Storm across eastern US, before, and after June 29, 2012

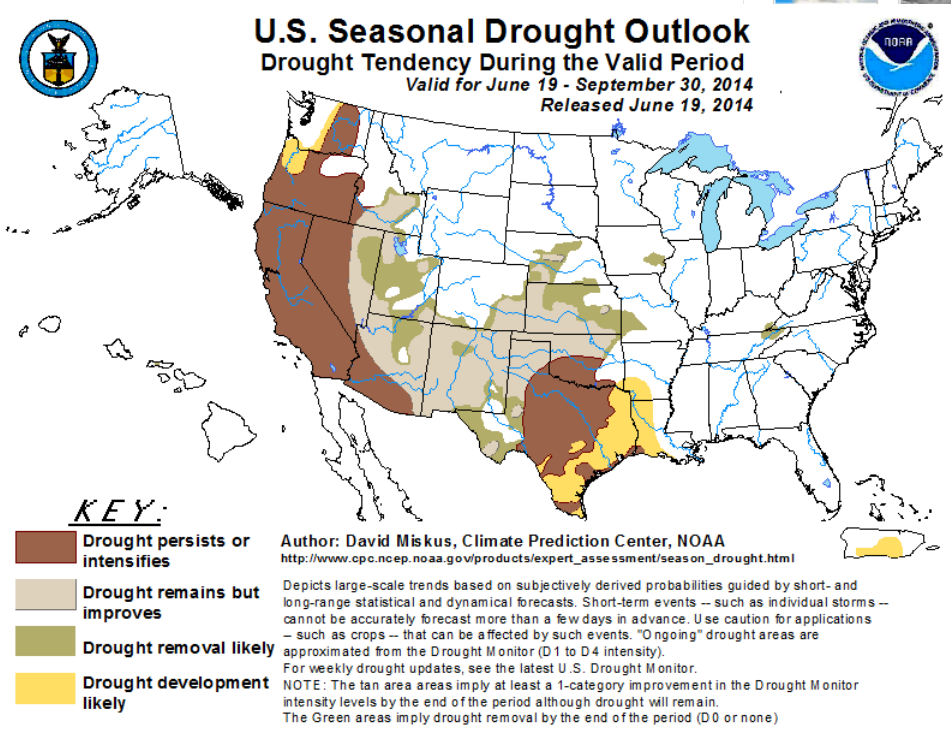
Extreme Events

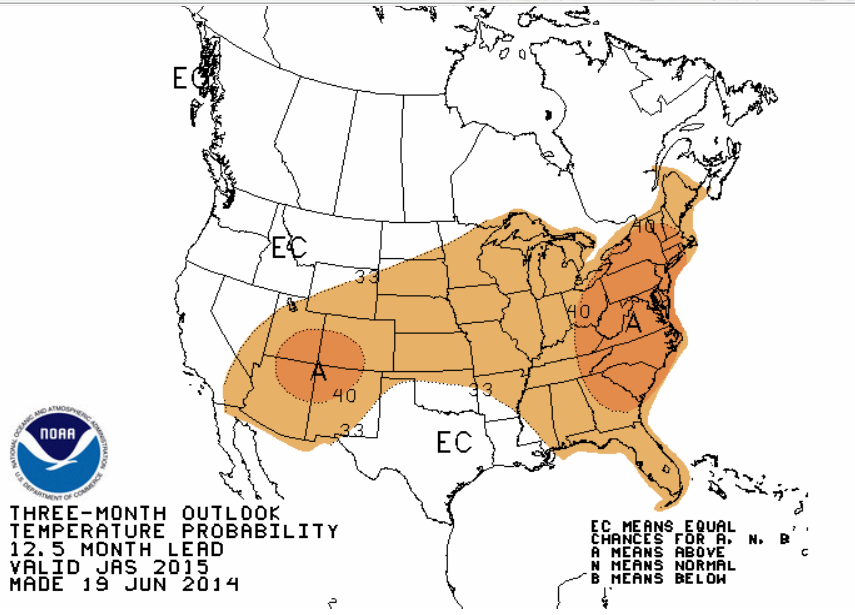
- Research needs:
  - Attribution of extreme events
  - Prediction of extreme events
- Types of Extreme events
  - 2013 Flood in Northern Colorado
  - 2012 Drought, Great Plains
  - 2013 September snowstorm, South Dakota/Wyoming
- Conditional Forecasts
  - Timing of Alert
  - Alerts for novel events



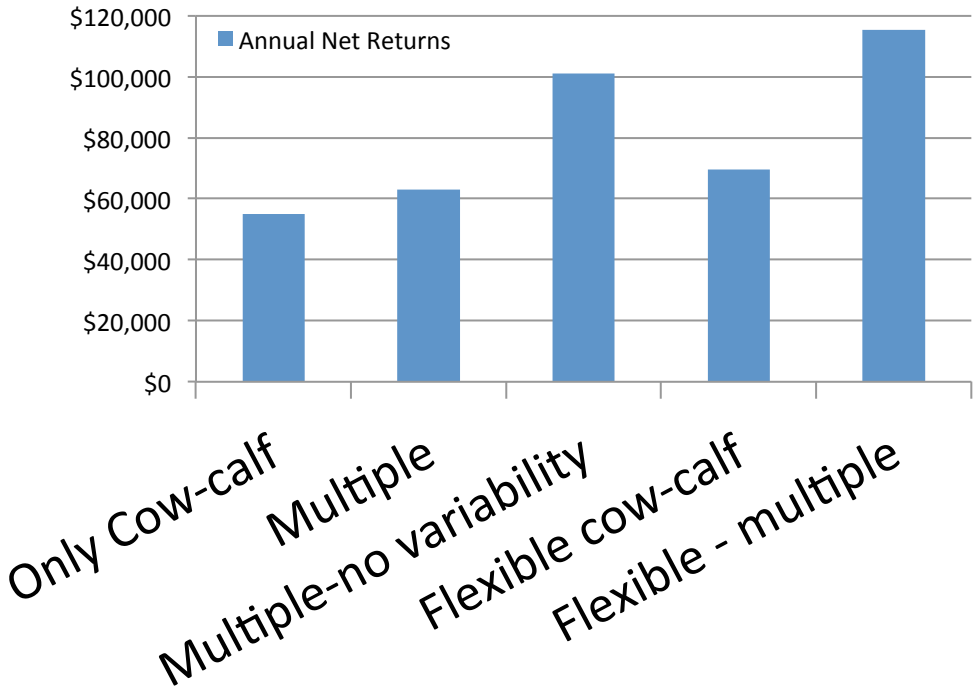
Short-term Forecasts







Flexible Grazing Strategy Depends on Short-term Meteorological Forecasts



- Multiple – no variability – second highest net returns; variability is a significant challenge to revenue
- Flexible – multiple yields the greatest annual net returns – higher costs, dependent upon accurate short-term climate forecast (90 days)

Multiple – Cow-calf and yearling operations
Flexible – can shift numbers and/or operations

New Mexico ranch - Torell et al. 2010

Short-term Forecasts

- Research needs
  - Fine scale short-term forecasts
  - Fine-scale prediction of on-going drought that spans a season, a year, or multiple years; Tradeoff analysis involving predictions of continued drought would likely improve the reactive management to drought
- Additional dialogue with stakeholders about certainty of the short-term forecasts

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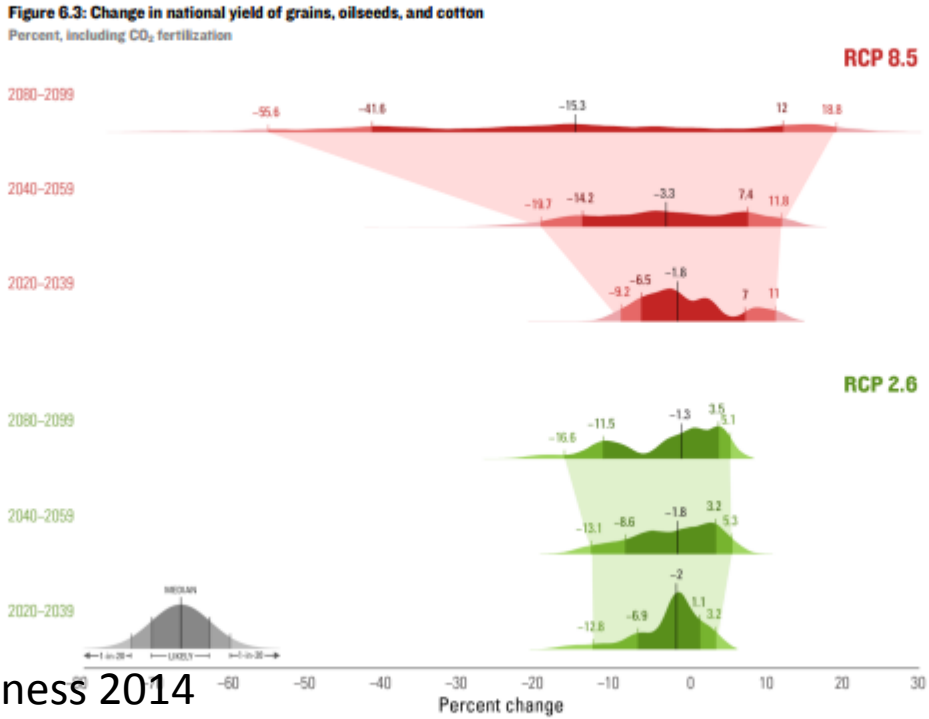
- Hyper-local weather monitoring provides assessments of field and sub field-level environmental conditions by incorporating dozens of public and private environmental observation networks and remote sensing systems, coupled with various proprietary and published models to remotely assess weather, soil, and other environmental conditions.
- Sub field-level agronomic modeling, which represents the intersection of agronomy and data science, predicts outcomes based on soil, weather events, farming practices, Climate's leading edge research and other key variables.
- High-resolution weather simulations provide insight into how an increasingly unpredictable climate will impact your operation by incorporating long-range trends, current conditions, forecasts, and climate signals, research and models into a dynamic, full-season probabilistic weather forecast at a very high resolution for each field.

Climate Projections Cacophony across the United States

- Northern Great Plains
  - Scenarios and projections developed for use by: National Park Service, Bureau of Land Management, Forest Service, Bureau of Reclamation, Academic studies
  - Different scenarios, different climate models, different downscaling techniques, different baseline periods
  - Results presented for different future periods
- Challenging, if not impossible, to compare the climate projections or vulnerability assessment using these projections

Framing Risk with Climate Projections

- Research needs - WCRP Grand Challenge (draft) -- Definition of usefulness: informing the risk management and decision making space.
  - Provide information that constitutes a solid and targeted basis for decision making concerning risk management and response options in specific sectors and contexts.



Risky Business 2014

On-going Dialogue

- Prediction and attribution of extreme events
- Conditional forecasts of extreme events
- Shared understanding of extreme events and response time needed by the manager
- Improved short-term meteorological forecasts at fine spatial scale
- Framing risk in the context of climate projections – adaptation