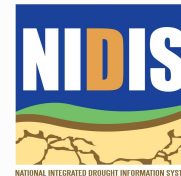
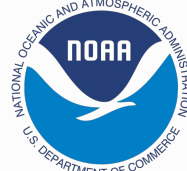


INSTITUTE ON THE
ENVIRONMENT

UNIVERSITY OF MINNESOTA
Driven to DiscoverSM



Improving the Understandability and Usability of NOAA CPC Drought & Week 2 U.S. Hazards Outlooks

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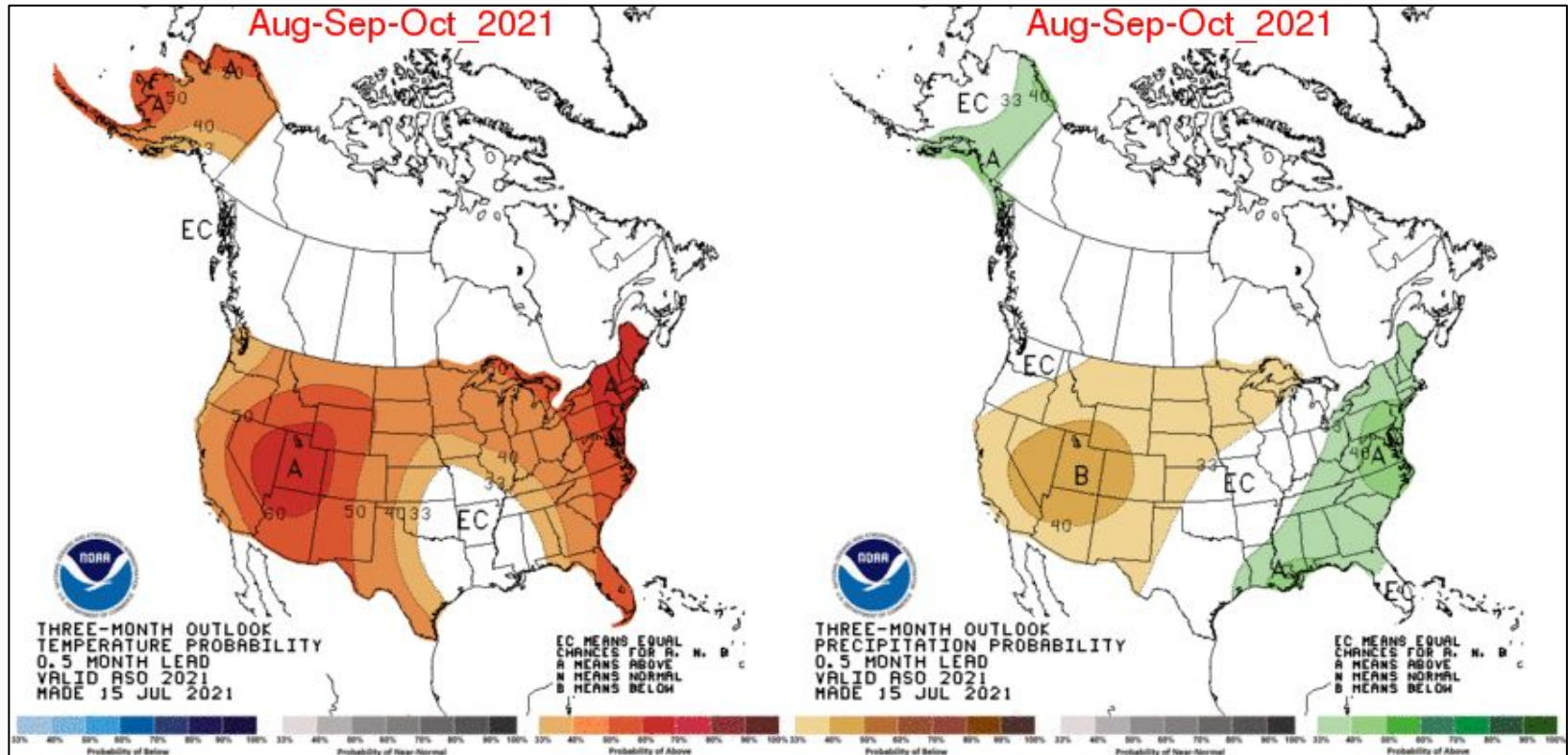
*University of Maryland, Earth System
Science Interdisciplinary Center*

Project Goal

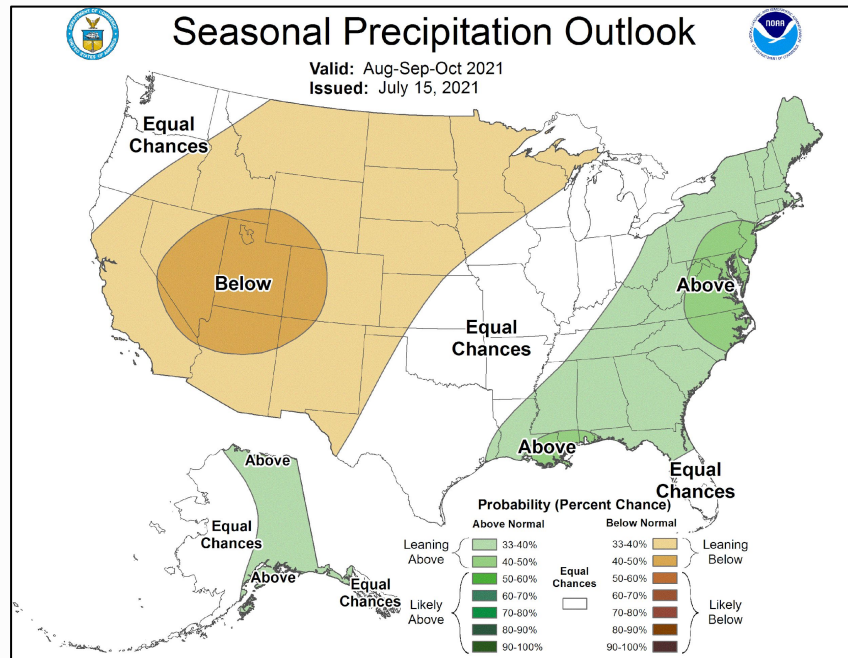
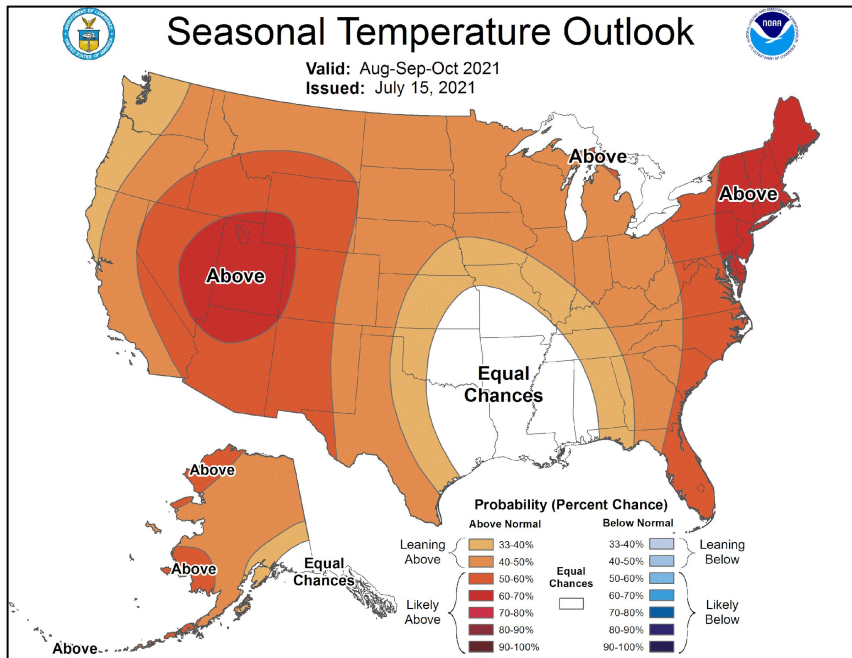
Provide NOAA **actionable information** to improve the understandability and usability of forecast products based on

- Social science methods of diagnosing visualization problems
- Evaluating trade-offs of different design modifications
- Testing of existing and modified graphics

Navigating Usability and Understandability Challenges



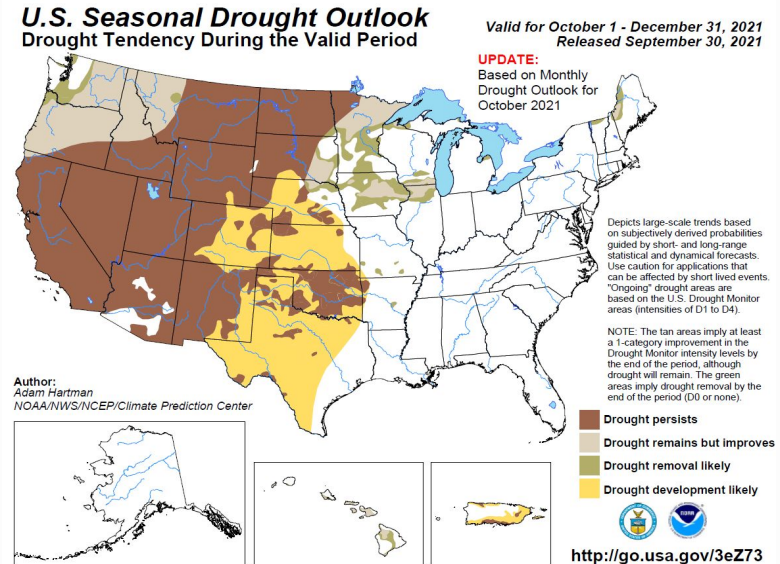
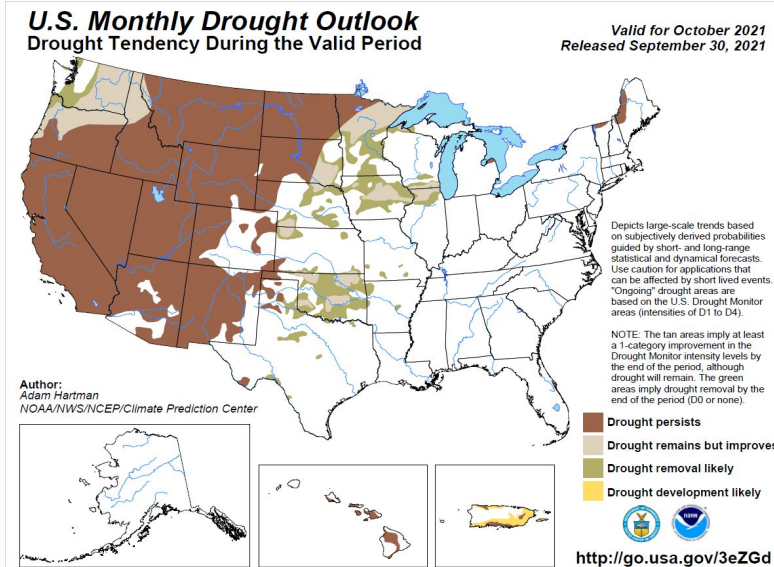
Building on Previous Work and Successful Operationalization



Products Evaluated

Week 2 U.S. Hazards Outlook

Monthly & Seasonal Drought Outlooks



Methods Overview



```
graph LR; A[Focus groups with forecast producers, translators, and users] --> B[Diagnosis of understandability challenges]; B --> C[Redesign and testing of visualizations for specific end-user audiences];
```

Focus groups with
forecast producers,
translators, and
users

Diagnosis of
understand-
ability challenges

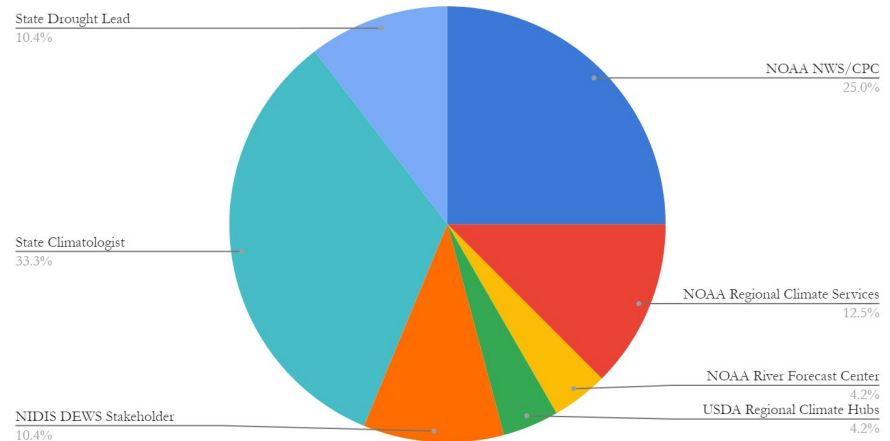
Redesign and
testing of
visualizations for
specific end-user
audiences

Engagement with Outlook Producers and Core Partners



Focus Groups

- 9 focus groups, 48 individuals
 - NOAA CPC outlook producers (n=8)
 - Outlook translators from NOAA and other federal agencies (n=14)
- Key stakeholders and end users (n=26)



Focus Group Goals

Focus groups were designed to understand

- Primary goals of the outlooks
- How information is shared with stakeholders
- The most useful elements (keep)
- Recommendations for improvement (change)

Results: The Role of Translators

- Translators are seen as the **primary audience**
- Contextualize information for end users & decision makers
 - Regionally or sectorally relevant information
 - Integrate outlooks into synthesized products



Results: Translating to Decision Making

How the outlooks are used is highly **context-dependent**

- Location
 - region, watershed, jurisdiction
- User type
 - natural resource, emergency, and water resources managers, media, elected officials
- Timing of decisions
 - shorter term preparedness, emergency response, long-term planning



Results: Significance of the Outlooks

As federal products, the outlooks are seen as a **trusted source of information** which

- Provide early warning for events which might lead to significant impacts
- Provide “cover” for decision makers
- Provide needed information in a format users don't have the capacity to develop themselves



Diagnosis of Understandability Challenges



“...intuitions about good design practices may not always match best practice informed by cognitive principles, and viewer preferences may not always be predictive of ease of comprehension.” Harold et al., 2016

Design Problems

Two Types of Design Problems

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graph TD; A[Two Types of Design Problems] --> B[Encoding]; A --> C[Decoding];
```

Encoding

Fundamental design choices of translating data to visual representation

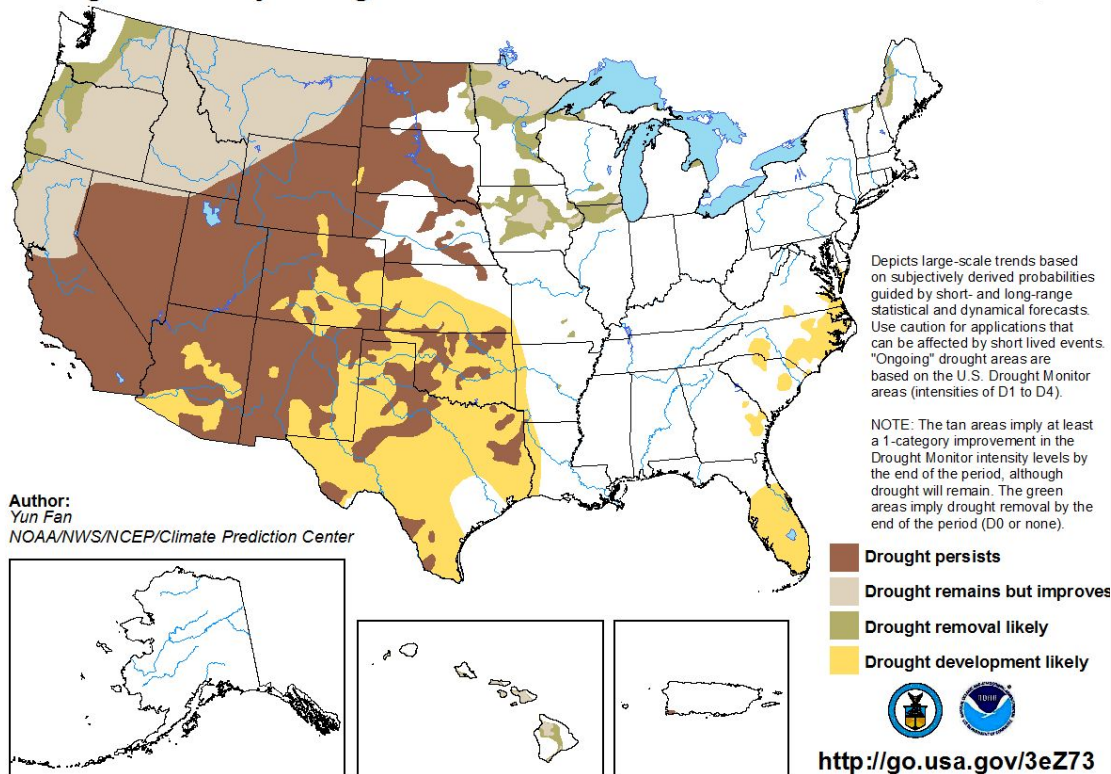
Decoding

Implications of design choices for how users interpret visuals given user and device abilities and limitation

Diagnosing Usability and Understandability Issues

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for October 21, 2021 - January 31, 2022
Released October 21, 2021



Communication gaps:

- Meaning of “tan”
- Whitespace
- Ordering of legend entries
- Boundaries
- Scale differences
- Drought category

Colormap:

- Reconsider changes in hue

Graphic Redesign and Experimental Testing



Focusing on deterministic and probabilistic monthly and seasonal drought outlooks

Approach to Control vs. Treatment Testing

Focus groups and Diagnostic

Translators
Context
Confusing colors
Legend categories

CPC priorities

Color scheme
Drought categories
Product consistency
Usability + Understanding

Literature review

Color choice
Visuals and heuristics
Reducing cognitive load
Gestalt

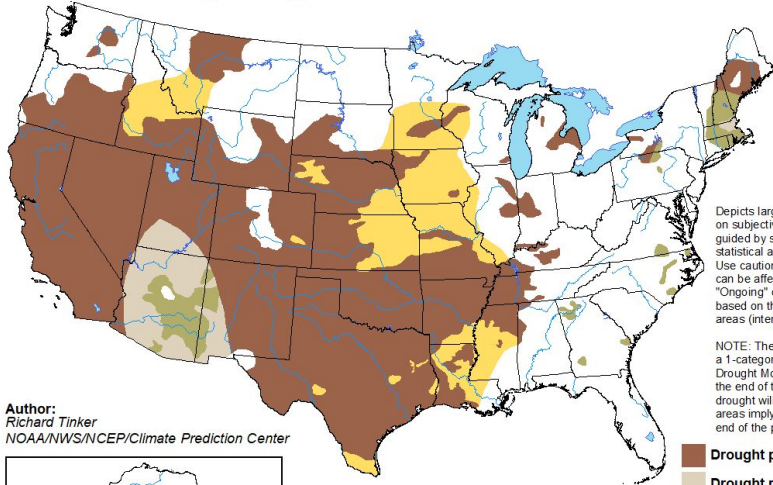
Final testing

Identifying trade-offs
Product consistency
Color scales
Category scales
Category labels

2022 Original vs. Redesigned Drought Outlook

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for July 21 - October 31, 2022
Released July 21

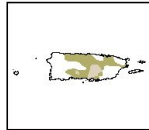
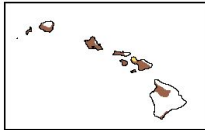
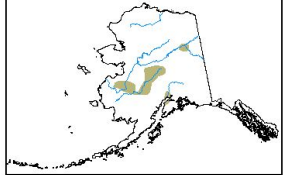


Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

- Drought persists
- Drought remains but improves
- Drought removal likely
- Drought development likely

Author:
Richard Tinker
NOAA/NWS/NCEP/Climate Prediction Center

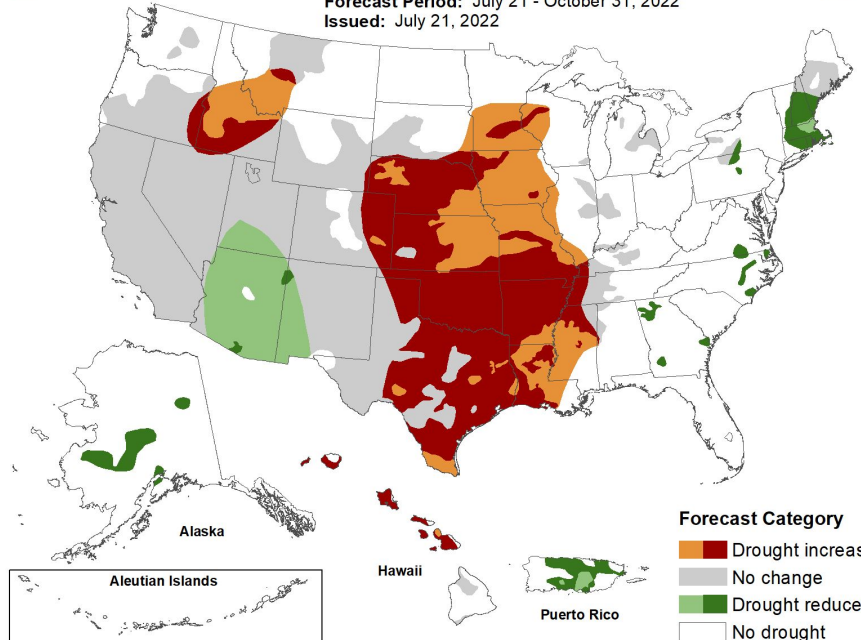


<http://go.usa.gov/3eZ73>



Seasonal Drought Outlook

Forecast Period: July 21 - October 31, 2022
Issued: July 21, 2022



Forecast Category

- Drought increases
- No change
- Drought reduces
- No drought

Alaska

Aleutian Islands

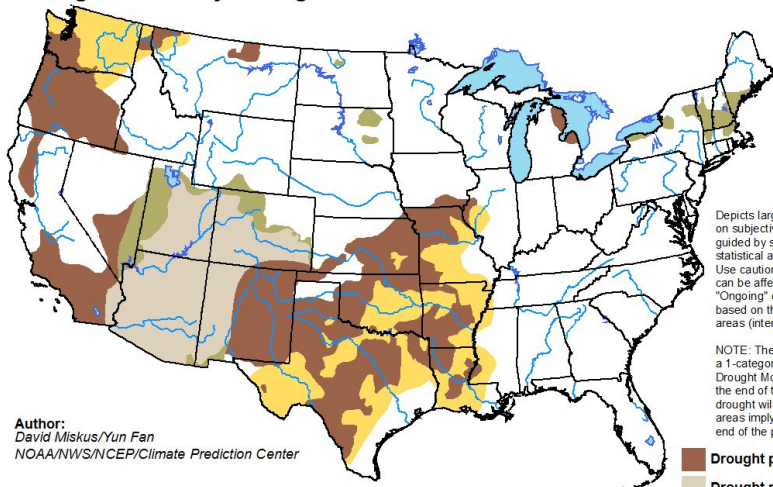
Hawaii

Puerto Rico

2018 Original vs. Redesigned Drought Outlook

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for July 19 - October 31, 2018
Released July 19, 2018



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

Author:
David Miskus/Yun Fan
NOAA/NWS/NCEP/Climate Prediction Center

- Drought persists
- Drought remains but improves
- Drought removal likely
- Drought development likely

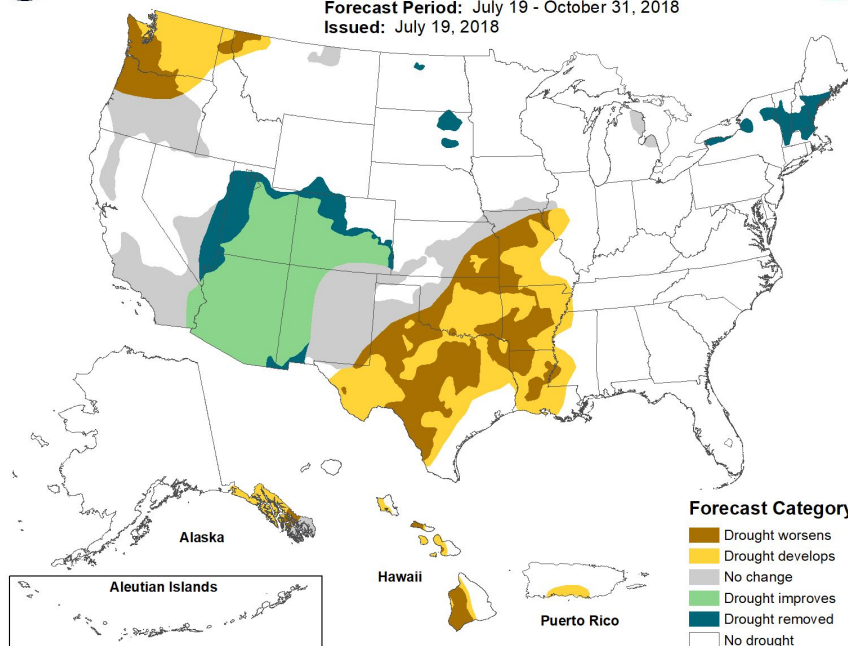


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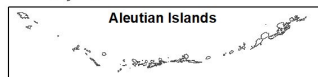


Seasonal Drought Outlook

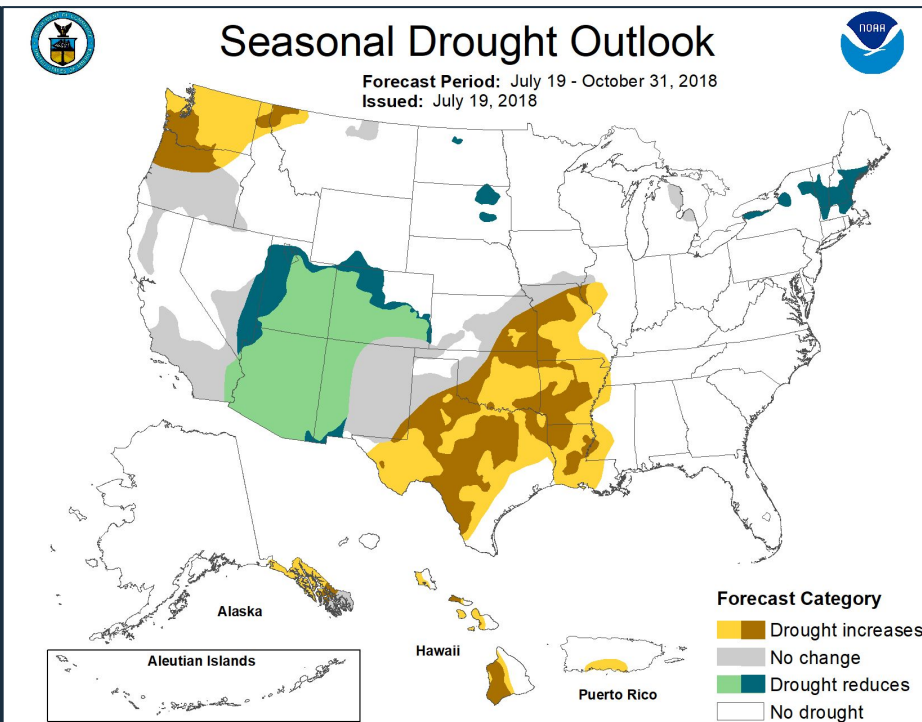
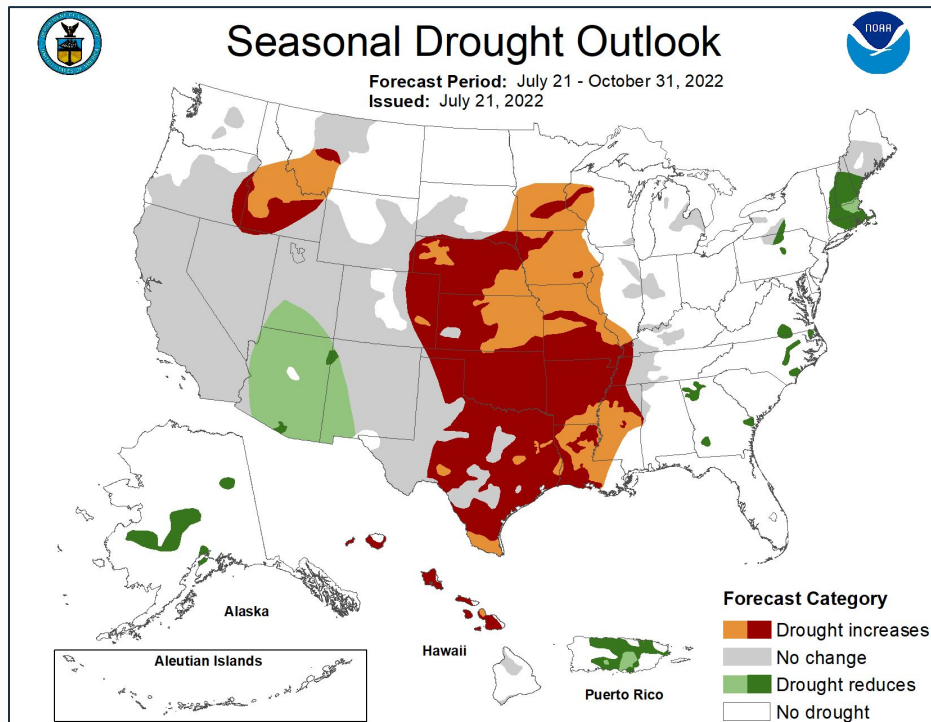
Forecast Period: July 19 - October 31, 2018
Issued: July 19, 2018



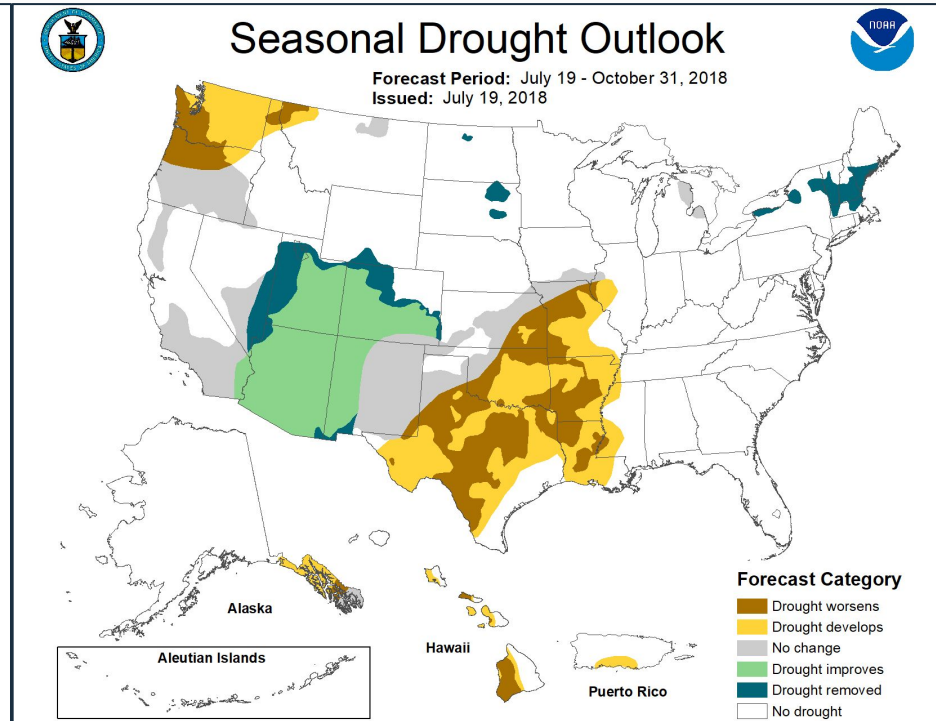
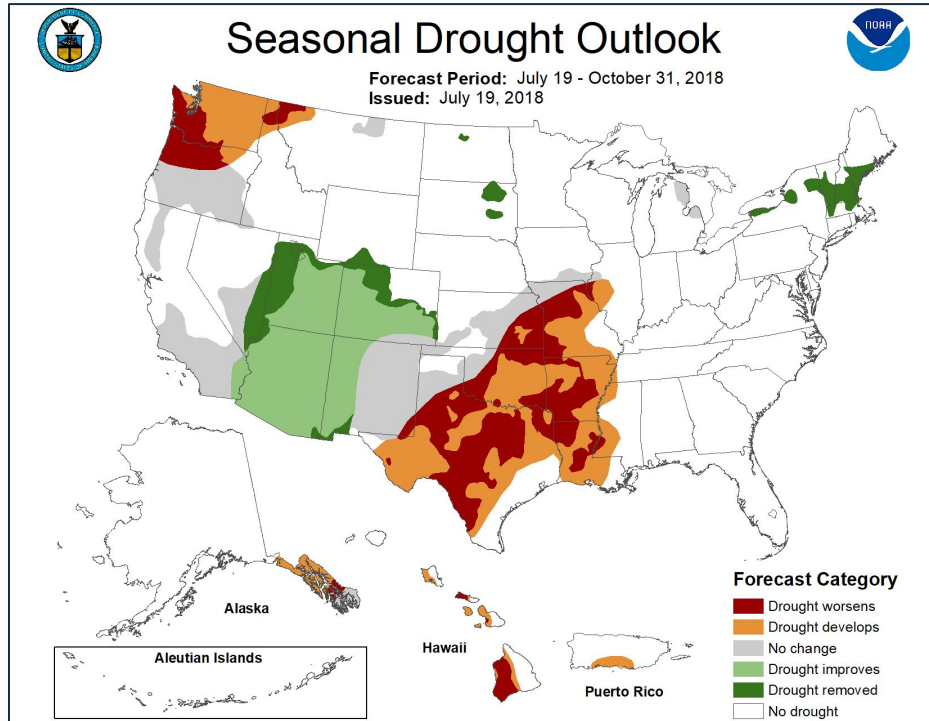
- Forecast Category**
- Drought worsens
 - Drought develops
 - No change
 - Drought improves
 - Drought removed
 - No drought



Redesigned Drought Outlooks - Collapsed Categories



Redesigned Drought Outlooks - Extended Categories



Next Steps



Testing redesign effectiveness for intended end-users



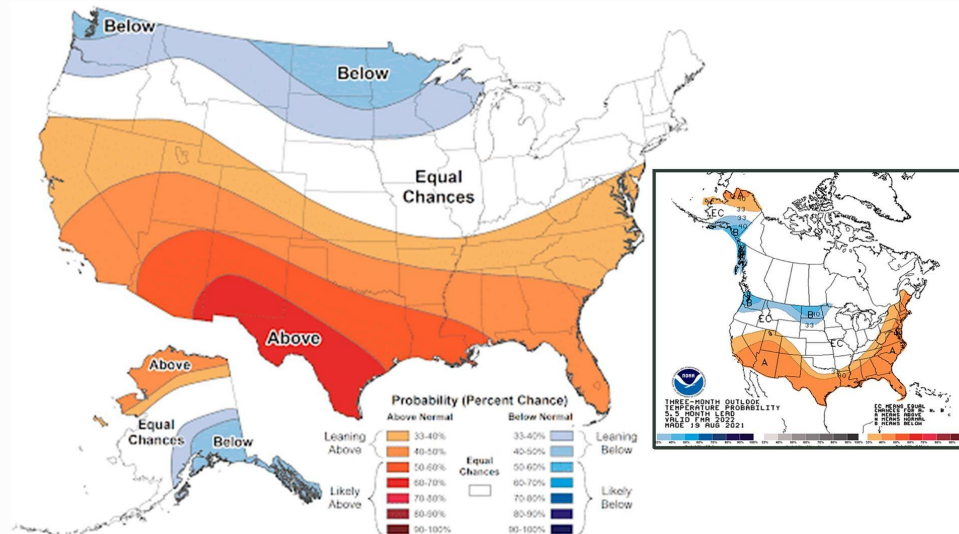
Synthesizing results and developing best practice recommendations



Additional focus groups or re-engaging with translators on recommended new version

Overcoming Obstacles

- Shift towards operationalization of social science research to improve usability of federal products
- Collaborating with social scientists from the beginning of product design transforms the products and ultimately improves lives and livelihoods



**Thank
You**

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