

RECLAMATION

Managing Water in the West

Sub-Seasonal Climate Forecast Rodeo

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U.S. Department of the Interior
Bureau of Reclamation

Bureau of Reclamation

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

- **Manage water in 17 western states**
- **Operate 337 reservoirs**
- **Largest wholesaler of water in the country; provides 1 out of 5 Western farmers with irrigation water for 10 million farmland acres**
- **Second largest hydropower producer; 53 hydroelectric powerplants providing 14000+ MW capacity; generate enough electricity to power 3.5M U.S. homes**



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Bureau of Reclamation Research & Development (R&D) Office

- **Science and Technology Program**
 - R&D Projects
 - Water Prize Competition Center
 - Technology Transfer
- **Desalination and Water Purification Program**



<https://www.usbr.gov/research/>

[Knowledge Stream Magazine](#)

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R&D Customers

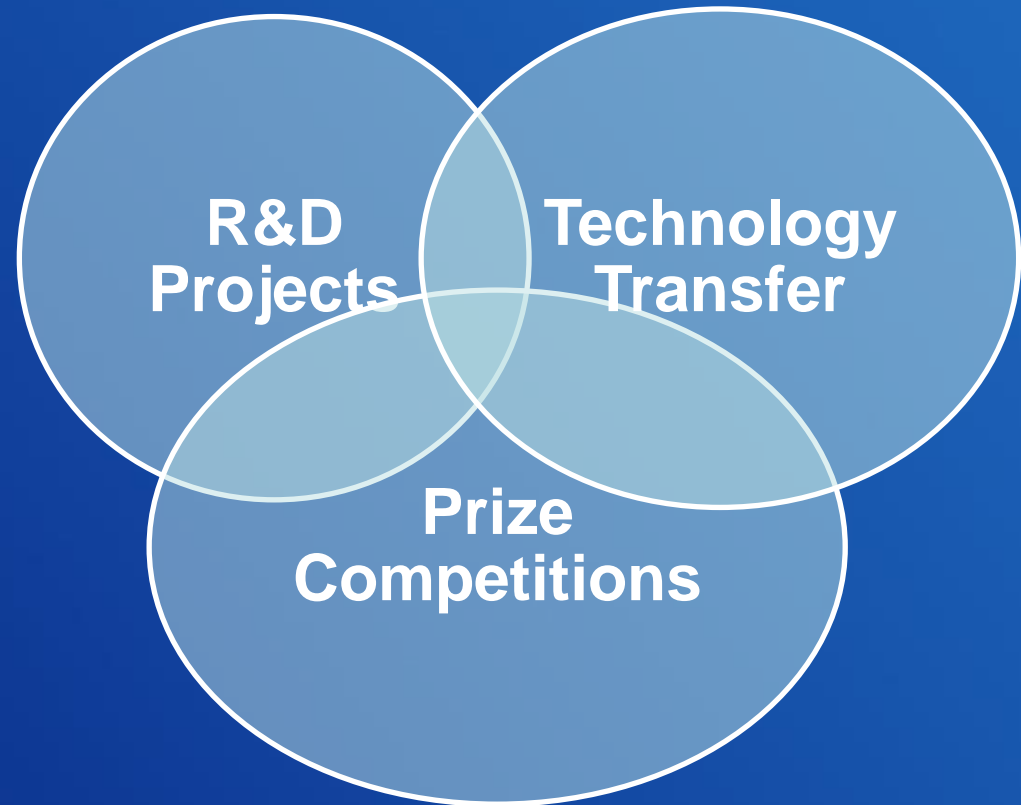
- Primary: Reclamation resource and facility managers, customers, and stakeholders.
- Secondary: As federally funded R&D Office, we serve the broader communities of practice in water and water-related resources and the U.S. public.

S&T Program Goals and Tools

Goals

- Develop cost-effective solutions for technical and scientific problems
- Partner with other research entities
- Build and strengthen scientific and engineering capacity for Reclamation
- Communicate solutions to Reclamation offices, other water and power management officials, and the general public

Tools



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Presentation Overview

- Prize Competitions 101
- Sub-Seasonal Forecasting Challenge
- The “Rodeo”

What are Prize Competitions?

Prize competitions are a form of crowd sourcing and a way to reach a broader group of thinkers to address difficult topics.



The screenshot displays the Challenge.gov website. At the top, the logo features a stylized starburst with the text "Challenge.gov" and the tagline "Government Challenges, Your Solutions". Social media icons for Facebook, Twitter, and Email are in the top right. The navigation menu includes "CHALLENGES", "PRIZEWIRE", "ABOUT" (highlighted with an upward arrow), and "CONTACT". Below the menu are "LOG IN" and "SEE HOW IT WORKS" links. A secondary navigation bar contains "ABOUT CHALLENGE.GOV" and "HOW IT WORKS". The main content area is titled "About" and includes a section "Introduction to Challenge.gov" with the text: "Welcome to the hub for federal incentive prize and challenge competitions! You can look through hundreds of open competitions and if anything catches your attention, you may register to 'follow' a competition or enter one and submit your own solution."

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How Competitions Work

- Issue a national challenge to solve a specific, typically difficult problem.
- Establish monetary and/or non-monetary incentive prizes.
- Winners must achieve predetermined performance metrics established by sponsors.
- Anyone can compete at their own risk.

R&D Water Prize Competition Center

The screenshot shows the website for the Reclamation Research and Development Office's Water Prize Competition Center. The header features the Reclamation logo with the tagline "Managing Water in the West" and a search bar. A navigation menu includes "Water & Power", "Resources & Research", "About Us", "Recreation & Public Use", and "News & Multimedia". The main content area has a banner image of a mountain range with the text "Research and Development Office". Below this is a breadcrumb trail: "Reclamation / R&D / Water Prize Competition Center". A sidebar on the left lists "RESEARCH AND DEVELOPMENT OFFICE" and its sub-sections: "Research and Development Office", "Science and Technology (S&T) Program", and "Desalination and Water Purification Research (DWPR) Program". The main content area is titled "Water Prize Competition Center" and includes the heading "Share your expertise and ideas!". It contains two paragraphs: "You can help solve some of the most critical water and water-related resource problems facing our Nation." and "You can also help us think of problem topics especially well-suited to solve through prize competitions. Review the Prize Competition Candidate Topics to learn more about Reclamation's problem spaces." At the bottom of the main content area is the heading "Follow Reclamation's Competitions".

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Managing Water in the West

Search

Water & Power Resources & Research About Us Recreation & Public Use News & Multimedia

Research and Development Office

Reclamation / R&D / Water Prize Competition Center

RESEARCH AND DEVELOPMENT OFFICE

Research and Development Office

Science and Technology (S&T) Program

Desalination and Water Purification Research (DWPR) Program

Water Prize Competition Center

Current

Upcoming

Water Prize Competition Center

Share your expertise and ideas!

You can help solve some of the most critical water and water-related resource problems facing our Nation.

You can also help us think of problem topics especially well-suited to solve through prize competitions. Review the [Prize Competition Candidate Topics](#) to learn more about Reclamation's problem spaces.

Follow Reclamation's Competitions

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Sub-Seasonal Forecasting – Relevance to Reclamation

During the past eight years, every state in the Western United States has experienced drought that has affected the economy both locally and nationally through impacts to agricultural production, water supply, and energy.

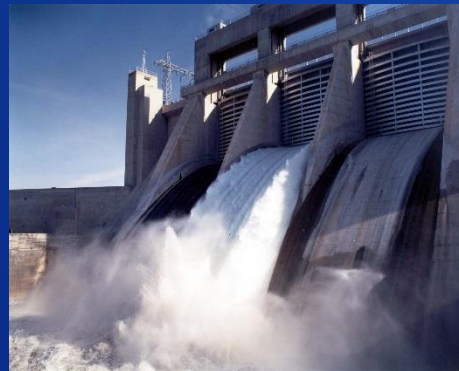
Improved sub-seasonal forecasts for temperature and would allow water managers to better prepare for shifts in hydrologic regimes, such as the onset of drought or occurrence of wet weather extremes.

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Sub-Seasonal Forecasting – Relevance to Reclamation

In addition to managing for drought, improved sub-seasonal forecast would enhance other aspects of Reclamation's operations including:

- Water Allocations
- Flood Management
- Stakeholder Planning
- Environmental Compliance



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Forecast Rodeo

A year long, real-time sub-seasonal forecasting competition



WATER
PRIZE COMPETITION CENTER

\$800,000 in prize \$\$\$!

March 2, 2016 Forecast (in) .01 .10 .25 .50 1 2 3 4 5 7.5 10 15



Saddle up for the Sub-Seasonal Climate Forecast Rodeo!

usbr.gov/research/challenges

Competition Sponsor: **RECLAMATION**
Managing Water in the West

Competition Partners:   

- Genesis: Drought
 - Definition
 - Agricultural
 - Meteorological
 - Hydrological
 - Others
 - Common Ground
 - Temperature
 - Precipitation
- Objectives
 - Advance Science
 - Raise Awareness
 - Provide Evaluation Platform

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Competition Partners



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Forecast Rodeo – Design, Refereeing and Communication

- **Design**
 - Input from numerous organizations (NOAA, USGS, USACE, USDA, BOR, CA DWR)
- **Refereeing & Communication**
 - NOAA CPC providing obs datasets for forecast skill evaluation and also the CFSv2 as a benchmark (post-processed for bias and regressed to competition template)
 - NOAA ESRL providing damped persistence benchmark, has set up the forecast skill assessment apparatus, and is developing the forecast visualization products and stats that are being served at the NIDIS leaderboard.
 - NIDIS – set up web portal for competition information, including Leader Board, articles, etc.

Forecast Rodeo Structure

- Forecasts
 - Resolution: a 1x1 grid
 - Variables: Temperature and Precipitation
 - Outlooks: Weeks 3&4 and 5&6
 - Frequency: 2 Weeks
 - Duration: 13 Months
 - Domain: 17 Western States
- Benchmarks
 - CFSv2 (32 member ensemble)
 - Damped persistence
- Schedule
 - Announced: Dec 12, 2016
 - Pre Season: Mar 21, 2017
 - Regular Season: Apr 18, 2017
 - Final Submission: May 3, 2018
 - Winners Announced (est): Sep 8, 2018



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Forecast Rodeo Structure

- Final Submission
 - Code
 - Documentation
 - Hind-Cast*
- Scoring
 - Spatial Anomaly Correlation
 - Drought.gov Leader Board
- Prizes
 - 4 Forecast Categories
 - 1st: \$100,000
 - 2nd: \$50,000
 - 3rd: \$25,000
 - An additional \$25,000 prize may be awarded per category based on hind-cast performance solely

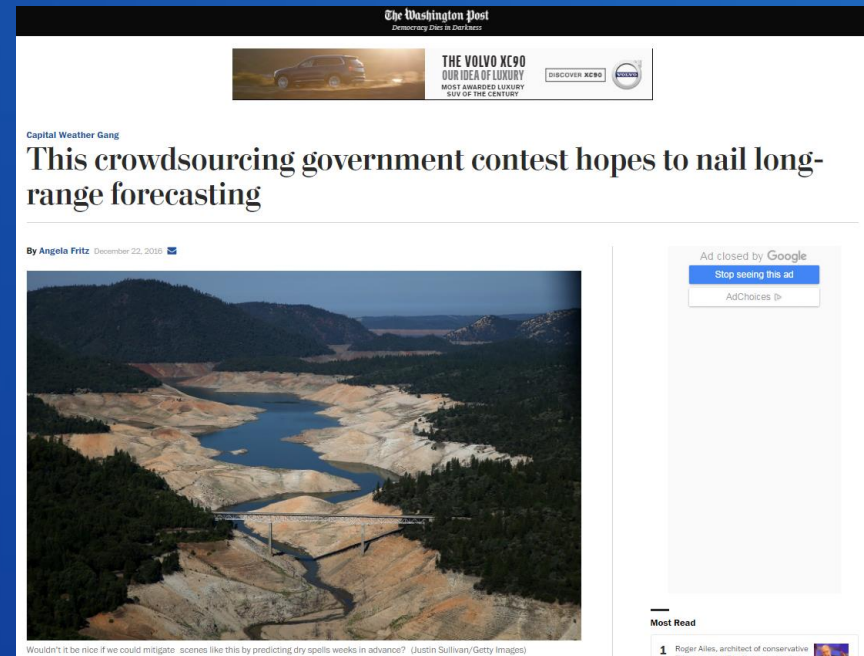


*Hind-cast is period is 1999-2010. Performance must be equal to or better than the CFSv2 to be eligible for prizes.

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Recruiting Solvers, Building Interest

- Media Release
- WSWC Newsletter
- Social Media (BOR, NIDIS, CBRFC, AMS, SWCSC, NCAR)
- Mailing lists (UCAR Opps List, ClimList)
- AGU Mtg exhibit
- AMS Mtg exhibit and talk
- Web postings at: [BOR Water Prize Competition Center](#), [Challenge.gov](#) and [Innocentive](#)



[Capital Weather Gang article](#)

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Recruiting Solvers – Results...

- **188 Active Solvers at Innocentive = people who were interested and registered to get more information about the competition...**
- **... leading to 8 Competitors = Active Solvers who opted to build a forecasting apparatus and enter the competition**

Recruiting Solvers – Thoughts...

- **Clearly had hopes for more Competitors...**
- **Outreach was aggressive, but we're not experts on how to build this kind of solver community**
 - Use other solver pavilions, like Top Coder?
 - Different outreach/media strategy?
 - Different incentives?
 - Different terms of solver agreement?
- **Bright Side**
 - We only pay purses when Competitors beat benchmarks
 - If all Competitors stay engaged, this could be great value.

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Track Results at NIDIS' Leader Board

- Leader Board is live! [LINK](#)
 - Weeks 3&4 forecasts from first submission (4/18) scored this week, made available today
- Features
 - Rankings by forecast category
 - Time series plots of forecast scores for top 5 teams and benchmark forecasts
 - Individual team pages
 - Visualize forecast with corresponding observations and benchmark forecasts
 - Time series plots of forecast scores
 - Tabular forecast scores
 - Competition “news feed”

The screenshot displays the Drought.gov website's "Sub-Seasonal Climate Forecast Rodeo" page. The header includes the "NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM" logo, the "NIDIS" logo, and the "Drought.gov U.S. Drought Portal" text. A navigation menu contains links for Home, Data, Maps & Tools, Regions, Research, Resources, What is NIDIS?, FAQs, Calendar, and Contact Us. The main content area features the title "Sub-Seasonal Climate Forecast Rodeo" and a sub-headline "And they're off: Solvers compete for up to \$800,000 in prizes". Below this is a paragraph describing the competition. To the right, a "FORECAST RODEO LEADER BOARD" section lists four categories: Weeks 3&4 Temperature, Weeks 5&6 Temperature, Weeks 3&4 Precipitation, and Weeks 5&6 Precipitation. A bar chart titled "Anomaly Correlation Scores f..." shows the performance of teams: Damped..., lupoat3, CFsv2, and THE T&E. The bottom of the page features the "RECLAMATION" logo in large, gold, serif font.

Questions?

Links:

<https://www.usbr.gov/research/challenges/forecastrodeo.html>

<https://www.drought.gov/drought/utility-type/forecast-rodeo-update>

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