Big Hole Watershed Committee

Monthly Meeting Minutes

September 18, 2024 – 7:00 pm at the Divide Grange

Zoom option also provided

In Attendance

In-person: Pedro Marques, BHWC; Tana Lynch, BHWC; Randy Smith, Rancher/BHWC; John Reinhardt, Rancher/BHWC; Tom Bowler, Butte Resident; Betty Bowler, Butte Resident; Jim Keenan, BSB Water Utility/BHWC; Jim Hagenbarth, Rancher/BHWC; Mary Sutherland, MBMG; Jim Griffin, Butte Resident; Mark Mariano, Montana Wetlands and Waterfowl; Kaitlin Boren, DNRC; Luke Lutz, MFWP; Michael Downey, DNRC; Sarah Tessendorf, U.S. National Science Foundation National Center for Atmospheric Research/Research Applications Laboratory; Mary Ann Nicholas, Dillon Resident; John Grant, Hamilton Resident; Craig Fellin, Big Hole Lodge; Roy Morris, GGTU/BHWC; Erik Kalsta, Rancher/BHWC; Ginette Abdo, MBMG; Jenna Dohman, MBMG; Dana Miller, Divide Resident; Paul Siddoway, Butte/Melrose Resident; and Liz Jones, Rancher/BHWC.

Zoom: Mary Marlie, Resident; Diane Hutton, Resident/BHWC; Stephen Begley, USFWS; Jeanne; Kathy; and Mike Gurnett.

Meeting Minutes

BHWC monthly meetings are held at the Divide Grange with a virtual (Zoom) option provided thanks to Southern Montana Telephone Company, who donated the internet service. Meeting minutes and recordings are available at https://bhwc.org/monthly-meetings/ (scroll down for meeting minutes archive). Printed copies are available during in-person meetings. Contact Tana Lynch, BHWC Associate Director, at tlynch@bhwc.org or (406) 267-3421 to suggest additions or corrections.

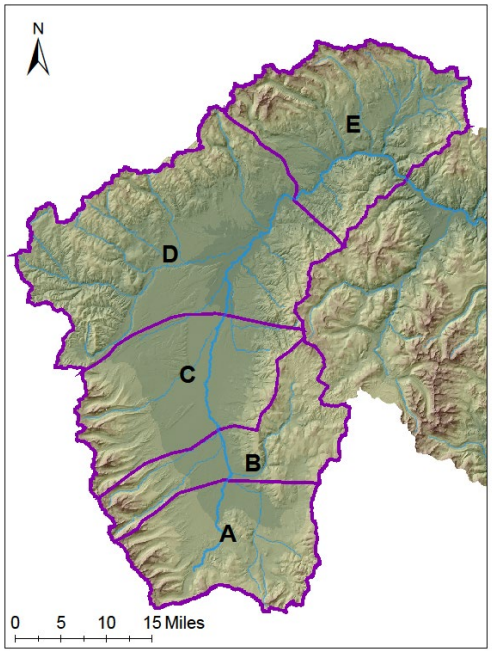
Reports

Streamflow and Snowpack Report – Kaitlin Boren, Department of Natural Resources and Conservation

- *Streamflows: (September 18th)*
  - Wisdom (06024450): 37 cfs
  - Mudd Creek (06024540): 53 cfs
  - Maiden Rock (06025250): 245 cfs
  - Melrose (06025500): 189 cfs
  - Glen (06026210): 230 cfs
  - Hamilton Ditch (06026420): 111 cfs
  - Stream And Gage Explorer (StAGE): https://gis.dnrc.mt.gov/apps/stage/
- *Precipitation:* Currently 79% of median.
- *Outlook*: The 8-14 day outlook predicts slightly above normal temperatures and slightly below precipitation.

- *Seasonal Outlook*: The seasonal outlooks predicts slightly above normal temperatures and equal chances of below or above normal precipitation.

- *La Nina watch*: La Niña is favored to emerge in September-November (71% chance) and is expected to persist through January-March 2025. The continuation of negative subsurface temperatures and enhanced low-level easterly wind anomalies supports the formation of a weak La Niña.
- *U.S. Drought Monitor:* The Big Hole watershed is currently in extreme drought.
- *CCAA Streamflow Contributions:*



Reach	Contributions to date (cfs)
A	12.5
B	12.5
C	88.85
D	15

Director's Report – Pedro Marques, Executive Director

- Water and Fish:
  - Drought and Conservation
    - Tough year for water all around, but plan has been followed
    - R3 leadership first year, fresh eyes. Now is time to discuss, improve, revise
  - USFWS and Partners renewing CCAA
    - USFWS has 12 months to make a new finding.
- People:
  - Ben's departure, new normal
  - Setting up remote work. Same phone #
  - Tana signed on to Bank account
  - Board and friends- BHWC Archives and Strategy days
- Comms:
  - Clark Fork Coalition uplands tour
  - U. Montana Masters student tour
  - Upcoming: WLA and High Divide
- Restoration:
  - Pennington Bridge (Madison County) – In Design/Planning
    - Great West just contracted
  - Elkhorn:
    - Elkhorn 30% Design (DNRC) – Construction/Implementation

        - Nearly complete
    - Elkhorn Repository (DNRC) – Complete/Final Billing
        - Final report in-progress
    - Elkhorn EE/CA (USFS) – Construction/Implementation
        - $500K from USFS
    - Elkhorn Biofilter – Contracting
        - Groundwater biofiltration pilot – Need sole-source
- Upper French Gulch (DNRC) – Proposals/Fundraising, Complete/Final Billing
    - Some maintenance required
- Eastern Pioneers (BLM/USFS/Mule Deer Foundation/RMEF) – Contracting, In Design/Planning
    - $300K, units being cut this week (through 2027)
- Sage Smith Springs (DEQ) – In Design/Planning, Complete/Final Billing
    - Phase 1 monitoring complete. Filming ongoing; Phase 2 design RFQ next
- Hydro Study (MBMG) – Construction/Implementation
    - Reporting out in 2024
- Smelter Hills Uplands (FWP) – Construction/Implementation
    - Monitoring plan and SOW for 2025
- ADLC Restoration Planning – Construction/Implementation
    - Public plan writing this winter
- Wise River, Jerry Creek, Wood/Pendergast Irrigation – Proposals/Fundraising
    - Proposals denied by DNRC Irrigation grant program – trying to learn more about why
- Trail Creek Conifer (USFS) – Complete/Final Billing
    - Conifer encroachment treatments complete
- Moose Creek Meadow (USFS) – Proposals/Fundraising
    - Wetland enhancement in conceptual design
- Future Fisheries Monitoring – Construction/Implementation, Complete/Final Billing
    - 11 projects surveyed in 2024, final report due
- Water Storage/Restoration Plan (BoR) – Contracting
    - 3-year grant, $300K, SOW in review
- Elkhorn Preserve/Riparian Planting (DEQ) – Contracting
    - $225K secured
- Kamperschroer Enhancement Channel (FWP Future Fisheries) – In Design/Planning

Steering Committee Report – Jim Hagenbarth, Chair; Dean Peterson, Vice-Chair; Steve Luebeck, Treasurer; and Roy Morris, Secretary

- The Steering Committee is pleased with the progress BHWC is making.

Communications and Wildlife Report – Tana Lynch, Associate Director

- Communications:
    - Events:
        - Recent:
            - Weed Whackers Ball
            - September 14th, Wise River
        - Upcoming:
            - Patagonia tabling event
                - October 24th, Dillon

        - UMW Community Water Conversations panel
            - December 3rd, Dillon
    - Publications:
        - *Ripples of Change: The Impactful Work of the Big Hole Watershed Committee*
            - International Business Times, May 31st
        - *Conifer Encroachment: The Big Hole Watershed Committee's Innovative Solutions for Sustainable Ecosystems*
            - MSN, June 15th
            - Link broken, working with MSN to get it fixed
        - *La Niña could deliver better snowpack this winter*
            - Montana Standard, Sept. 5th
        - *Thanks, landowners, for the water*
            - FWP Director, Dustin Temple
            - Montana Outdoors, Sept-Oct 2024 edition
- Wildlife Program Update:
    - Carcass Removal and Composting
        - New dump truck!
            - Benton Lake Refuge, USFWS
            - Year-round availability
            - Delivered today (9/18/24)
    - Upper Big Hole Range Rider – in-progress
        - July-September
        - Seeing plenty of wolves, black bears, and grizzly bears

New Business

- None

Break – 10 minutes

Meeting Topic:

Cloud Seeding in the Big Hole Watershed

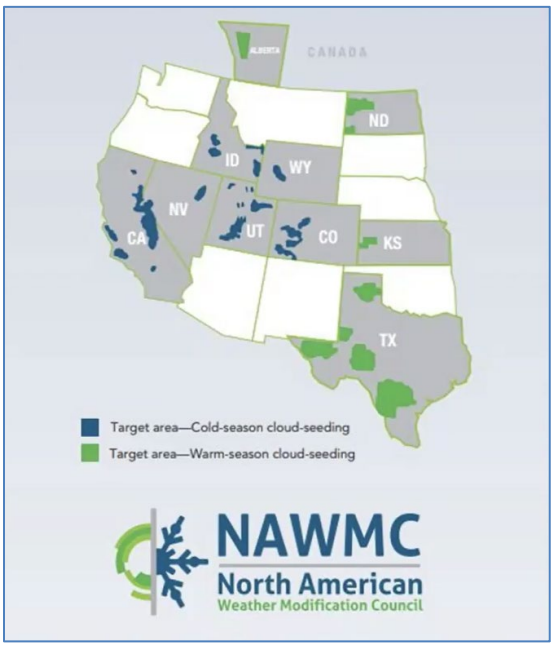
Presented by:
Michael Downey, Montana Department of Natural Resources and Conservation (Water Resources Division)
and
Dr. Sarah Tessendorf, U.S. National Science Foundation National Center for Atmospheric Research, Research Applications Laboratory

Southwest Montana Cloud Seeding Feasibility Study – Michael Downey, DNRC

- Study Goals:
    - Goal #1: Assess the potential for cloud seeding to augment snowpack and subsequent streamflow in select target mountain ranges in southwest Montana.
    - Goal #2: Complete a preliminary cost/benefit analysis and preliminary program design based upon weather/climate analysis.

- Goal #3: Support development of public engagement and education activities and materials related to cloud seeding.

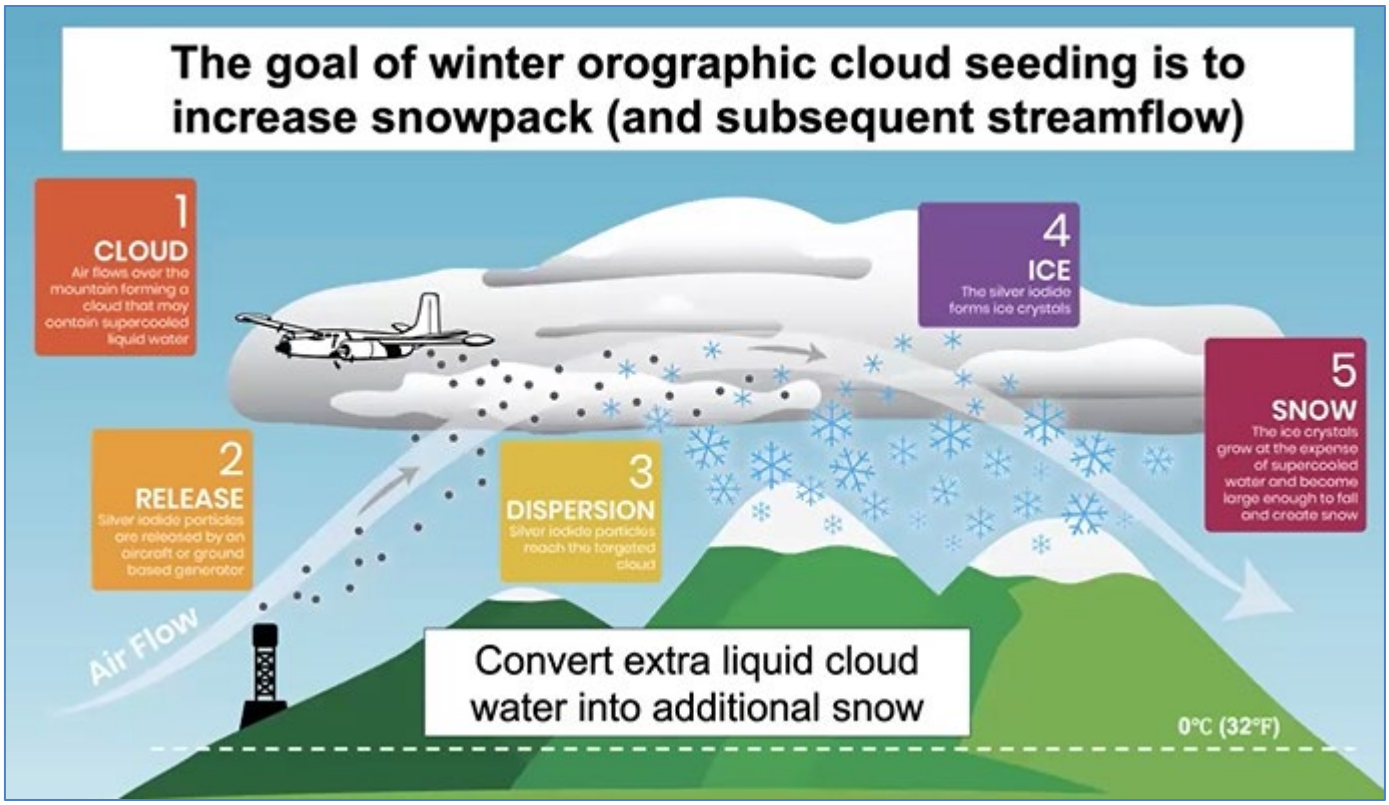
- Cloud Seeding in North America
  - Utah Collaborative Cloud Seeding Program:
    - Launched in the early 1950s. Continuous operation since 1973.
    - One-time only funding $12M in 2023.
      - Annual state contribution increased to $5M
    - Historically, $250K state funding, $250K local, $200K lower basin states.
    - Program relies upon network work remote, manual, and airborne operations.
    - Manually operated ground generators cost ~$3K each vs ~$50K each for remote generators.
    - Water generated from cloud seeding costs $2-15 per acre-foot.



  - Idaho Collaborative Cloud Seeding Program:
    - Upper Snake River Basin projects – 632 KAF, $1.54M:
      - Northern Upper Snake 168 KAF
      - Southern Upper Snake 464 KAF
  - Wyoming Collaborative Cloud Seeding Program:
    - 2004-2016: Feasibility/Pilot studies (Wind River, Medicine Bow, Sierra Madre, Salt and Wyoming mountain ranges)
    - 2015-2017: Siting and design studies (Medicine Bow, Sierra Madre, Laramie, Big Horn mountain ranges)
    - 2014-present: Ground-based operations (Wind River Range)
    - 2018-present: Aerial operations (Sierra Madre, Medicine Bow)
    - Funding: $2M in state funding appropriated for 2024-2026
    - Cost share: ~37% state, ~63% other partners

Cloud Seeding Feasibility in the Big Hole Watershed – Sarah Tessendorf, U.S. National Science Foundation National Center for Atmospheric Research – Boulder, CO

- The goal of winter orographic cloud seeding is to increase snowpack (and subsequent streamflow).



- SNOWIE date proves cloud seeding concept
  - SNOWIE = **S**eeded and **N**atural **O**rographic **W**intertime clouds: the **I**daho **E**xperiment
    - January 7-March 17, 2017
    - Silver iodide (AgI) produces ice
    - Ice grows into snow that falls to the ground
- First Step (for Montana): Feasibility study needed
  - Clouds can contain supercooled liquid water (SLW)
    - Candidates for cloud seeding
  - Not every mountain range or storm is the same:
    - Important to study the climatology of weather conditions to determine when, where, and how to seed.
    - Some mountains or storms are more amendable to seeding.
    - Some mountains or storms are better targeted by ground-based seeding than airborne seeding (and vice versa).
- Feasibility and Design Components:
  - Climatology analysis:
    - How often are there opportunities for seeding clouds in this region?
    - What are the characteristics of clouds in this region?
  - Preliminary design:
    - What methods of cloud seeding might target the clouds in this region most effectively?
  - Test and refine design:
    - How effective is each design option at targeting and enhancing precipitation in this region?

        - Which combination of design options is recommended?
- Region of current study: Big Hole Watershed
    - Most precipitation falls on the west and northern mountain ranges surrounding the basin.
    - Models predicts that ground-based seeding would be more effective for these areas.
- Climatology Summary:
    - Precipitation and cloud seeding opportunities are greatest in western and northern portions of the Big Hole watershed.
    - Ground-based layer of the atmosphere has more frequent SLW.
        - However, dispersion criteria that impacts ground seeding is still being investigation (e.g., flow blocking) which may limit some opportunities.
    - Wind regimes impacting the western Big Hole during seedable conditions are generally west-southwest.
        - There is some northwesterly flow impacting the northern region (Anaconda Range)
        - There is some (generally infrequent) easterly flow impacting the eastern portion of the watershed.
        - What this means – focus should be on western portion of the watershed for potential designs for west, southwest and some northwest flow.
- Summary:
    - Recent studies have proven that cloud seeding works to enhance precipitation in winter orographic clouds.
    - Most western U.S. states currently conduct cloud seeding aiming to enhance snowpack.
    - A feasibility study is first needed to assess the opportunities for seeding in a given region.
    - Preliminary results show most opportunities for cloud seeding in the western portion of the Big Hole basin.
- Frequently Asked Questions:
    - Concerns about extra area effects:
        - Does cloud seeding remove water from the sky that would have been precipitated elsewhere?
            - Conceptually, the effect outside of the target area is estimated to be very small. It is challenging to detect the intended effect. Extra area effects may be even more diffuse. New modeling capabilities present new opportunities to better address this question.
    - Concerns about potential environmental impacts:
        - Does cloud seeding with Silver Iodide lead to dangerous levels of silver in snow and water?
            - Trace chemistry analyses of snow, water, and soil samples have shown a negligible environmental impact from seeding operations. (Trace chemistry measures amounts of chemicals in such small concentrations that clean gear and clean procedures are required.)
            - Silver in water measured during seeding was the same order of magnitude as the baseline from years before seeding experiment started (in Wyoming).
                - Several orders of magnitude less than values considered hazardous to environmental system or human health.
    - Concerns about potential to contribute to flooding and weather hazards:
        - Will cloud seeding create floods?
            - Most operation cloud-seeding programs establish suspension criteria to suspend seeding when hazardous conditions could be likely, including (but not limited to):

    - Unusually heavy snowpack in the target area
    - Extreme avalanche danger
    - Unusually severe winter storms, as forecasted by the National Weather Service
    - Insufficient reservoir capacity for expected runoff
    - Direction to suspend (for any other reason) from clients/stakeholders
- More information:
    - Free online training module – "How Cloud Seeding Works" (produced by the COMET program)
        - https://www.meted.ucar.edu/USBR/cloud_seeding
            - You will be asked to create an account to access this training module and any others in the catalog.
            - You can also access the training by scanning the QR code to the right with your phone's camera.
    - You can also contact Dr. Sarah Tessendorf with additional questions at saraht@ucar.edu.
    - References: Tessendorf, S.A., and co-authors, 2019: A transformational approach to weather modification research: The SNOWIE project. Bull. Amer. Meteor. Soc., 100, 71-92, doi: 10.1175/BAMS-D-17-0152.1

Upcoming Meetings

- Wednesday, October 16, 2024: **BHWC Monthly Meeting: MSU Fisheries Research**
    - 7:00 PM at the Divide Grange Hall

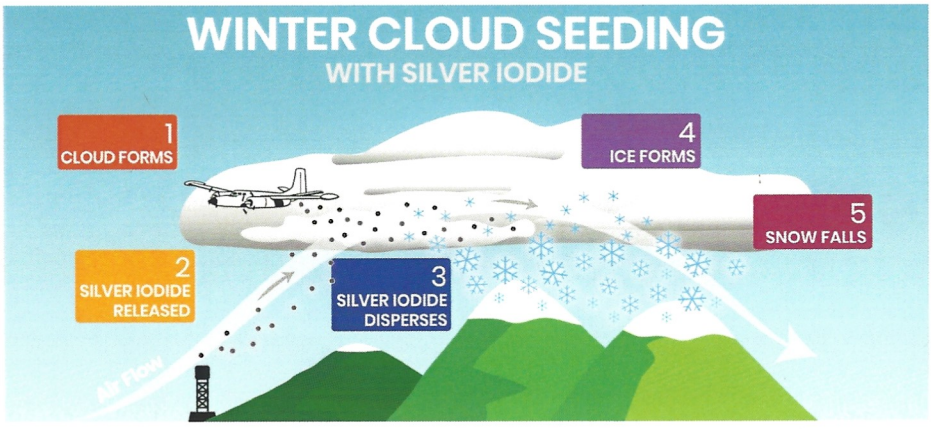
Adjourn

WINTER CLOUD SEEDING

INCREASING SNOWPACK

Enhancing Snowfall

In mountainous regions where water supply depends on winter snowpack, cloud seeding aims to enhance snowfall by dispersing silver iodide (AgI) particles into clouds to form ice and cause, or enhance, snowfall. Cloud seeding may use ground-based generators and/or aircraft to disperse AgI into the clouds. Targeting suitable conditions for cloud seeding occurs on short time scales (hours) and small spatial (50-100 km) scales and does not alter large-scale weather patterns or the climate. It cannot overcome a drought and variability in effectiveness occurs due to seasonal variations in weather patterns. Ultimately, cloud seeding should be viewed as one tool in a water resource manager's toolbox of mitigation strategies for long-term water management solutions under a changing climate and growing water scarcity. Specifically, cloud seeding can offer an effective strategy for increasing water supply.



Ground-based generators and/or aircraft are often used to disperse silver iodide into the clouds.

Recent Advances

- Scientifically-proven technology to enhance snowfall
- One tool as part of a broader strategy for water resource management
- Model simulations inform cloud-seeding program designs and estimate potential benefits

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NEW OPPORTUNITIES

Clouds that contain supercooled liquid water are candidates for cloud seeding to enhance the efficiency of the snow formation process. However, weather dynamics in mountain watersheds can differ greatly. Therefore, it is necessary to study and understand the weather patterns and characteristics of clouds in a region of interest before starting a cloud-seeding program. Recent advances in computer modeling and documented observations of seeding benefits are providing new opportunities to understand the effects of cloud seeding and to more efficiently design and operate cloud-seeding programs.

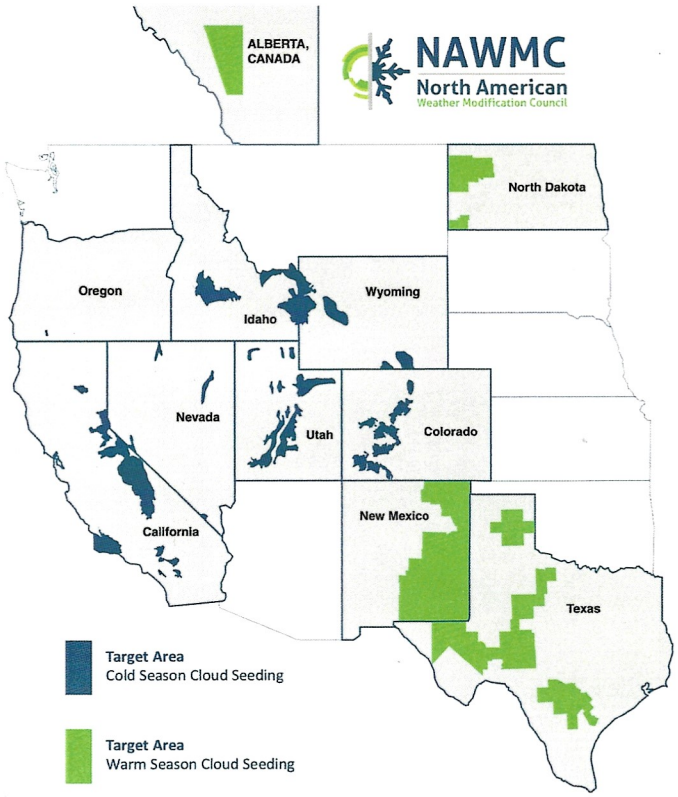
Montana's Department of Natural Resources and Conservation (DNRC) Water Resources division is sponsoring a study in collaboration with the National Science Foundation (NSF) National Center for Atmospheric Research (NCAR) Research Applications Laboratory (RAL) focused on the following objectives:

- Assess the potential for cloud seeding to increase snowpack in the Big Hole watershed
- Complete a detailed analysis of cloud and precipitation characteristics in the basin
- Analyze weather conditions under both present and future climate scenarios
- Complete a preliminary program design and cost-benefit analysis for a cloud-seeding pilot project in the Big Hole

FREQUENTLY ASKED QUESTIONS

Where is cloud seeding being conducted in the United States? Many states in the Western U.S. operate winter cloud-seeding programs, including Idaho, Wyoming, Colorado, Utah, Nevada, and California.

Ground-based generator
Photo Courtesy Idaho Power Company



What are the benefits and downwind effects of cloud seeding? The overall magnitude of impact due to cloud seeding is relatively small compared to natural precipitation, but it can be an important contributor to the water supply in some watersheds. While there is no evidence that suggests an increase in precipitation from cloud seeding directly leads to a systematic decrease elsewhere, this is an active area of further research.

Is cloud seeding cost effective? Though water costs vary across the region, cloud seeding through ground-based or aerial AgI release has been shown to be cost effective in most regions.

Is silver iodide released in cloud seeding harmful to the environment or humans? Measured concentrations of silver in snowpack are less than or similar to natural background levels of silver (e.g., due to mineral dust) and these trace values are orders of magnitude below the levels considered concerning by environmental regulatory agencies worldwide.

Sponsored by Montana Department of Natural Resources and Conservation, Water Resources

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