



Big Hole Watershed Committee

Monthly Meeting Minutes

April 17, 2024 – 7:00 pm at the Divide Grange
Zoom option also provided

In Attendance

In-person: Pedro Marques, BHWC; Tana Lynch, BHWC; Ben LaPorte, BHWC; Tom Bowler, Resident; Betty Bowler, Resident; Tim Fay, Resident; Liz Jones, Rancher/BHWC; Jenna Dohman, MBMG; Mary Sutherland, MBMG; Kaitlin Boren, DNRC; Jim Hagenbarth, Rancher/BHWC; Jim Griffin, Resident; Jeff Wolk, Resident; Roger Olsen, BLM; Matt Norberg, DNRC; John Whittingham, Basic Biological Services; Diane Hutton, BHWC; Randy Smith, Rancher/BHWC; Stan Strizic, Resident; JM Peck, Rancher/BHWC; Jim Olsen, MFWP; Diana Morris, Resident; Jami Murdoch, Rancher; Erik Kalsta, Rancher/BHWC; Chris Chebul, BSB Weed Department; Art Mangels, Big Hole River Retreat; Nell Mangels, Big Hole River Retreat; Roy Morris, GGTU/BHWC; Michael Downey, DNRC; Jim Keenan, BSB-Water/BHWC; Pete Kamperschroer, ranching/outfitting; and Arica Crootof, UMW Environmental Sciences professor and her Natural Resource Conflict Resolution class (students: Sam Sturdevant; Dylan Vanderschaf; Abigail McClafin; Kaidee Maloughney; Brady Folland; Cheyenne Ellman; Ty Daniel; Gabriel Delgatto; William Snodgrass; Andrew Pokisis; Carson Burton; Zane Massnee; Trizzan Pul; April Thompson; Kim Giannone; and Blake Sullivan).

Zoom: Dale Grose, Madison County; Craig Fellin, Big Hole Lodge; Alyssa; Jim Tolton; Amber Burch, Beaverhead County; Brian Wheeler, Big Hole River Foundation/BHWC; Mike Mooney; Camden; and Danika Holmes, DNRC.

Meeting Minutes

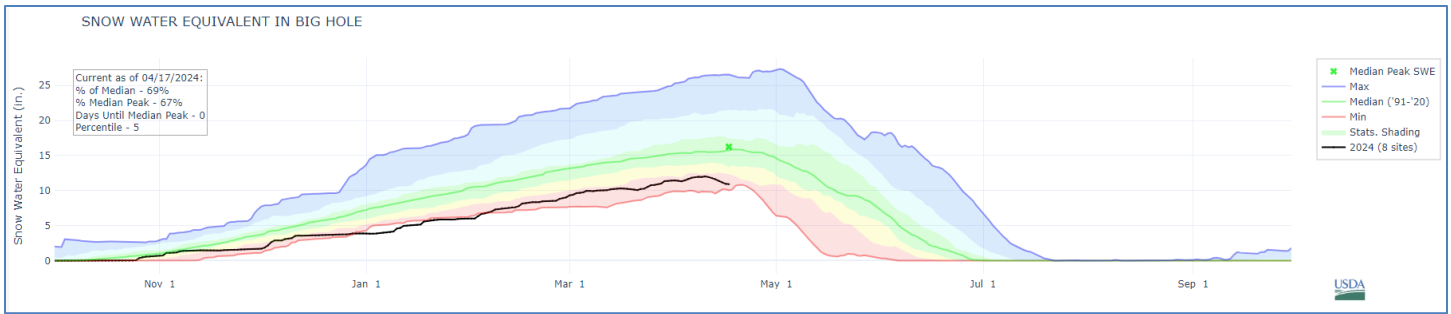
BHWC monthly meetings are held at the Divide Grange with a virtual (Zoom) option provided thanks to Southern Montana Telephone Company, who donated the internet service. Meeting minutes and recordings are available at <https://bhwc.org/monthly-meetings/> (scroll down for meeting minutes archive). Printed 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

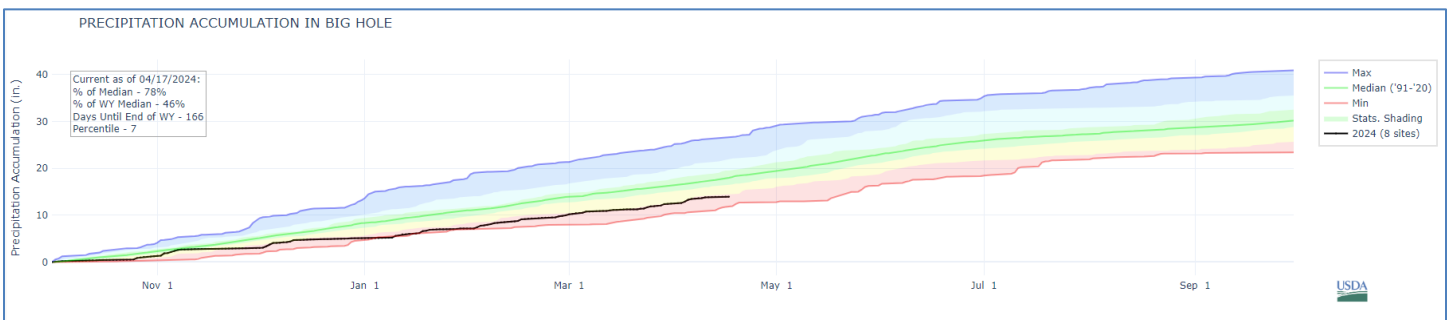
- *Streamflows: (April 17, 3:45 PM)*
 - Wisdom (06024450): 328 cfs
 - Mudd Creek (06024540): 1,160 cfs
 - Maiden Rock (06025250): 1,650 cfs
 - Melrose (06602550): 1,730 cfs
 - Glen (06026210): 1,840 cfs

- Stream And Gage Explorer (StAGE): <https://gis.dnrc.mt.gov/apps/stage/>



- **Snow Water Equivalent (SWE):** 69% of median
- **Hypsome-SWE for Big Hole (Huc8: 10020004):** 83% of normal
 - Hypsome-SWE is a way to evaluate snowpack distribution on a watershed scale level. It evaluates the relationship between the cumulative snow water equivalent in m^3 and elevations through a comparison of a particular day's median values to the SNODAS period of record (2004-present).
- **Precipitation:** Currently 78% of median

Station	Network	Elev. (ft.)	Obs	NRCS Median	% NRCS Median
Barker Lakes	SNOTEL	8,250	11.4	15.2	75%
Basin Creek	SNOTEL	7,180	6.8	8.6	79%
Bloody Dick	SNOTEL	7,600	8.7	12	72%
Calvert Creek	SNOTEL	6,430	0	5.5	0%
Darkhorse Lake	SNOTEL	8,945	23.9	30.4	79%
Moose Creek	SNOTEL	6,200	7.8	14.2	55%
Mule Creek	SNOTEL	8,300	10.9	16.3	67%
Saddle Mtn.	SNOTEL	7,940	17.8	24.5	73%
Slagameit Lakes	SNOTEL	8,620	22.2		
Basin Index					69%



- **Outlook:** The 8-14 day outlook predicts slightly above normal temperatures and precipitation.
- **Seasonal Outlook:** The three-month outlook (Apr-May-Jun) predicts slightly above normal temperatures and equal chances of above or below normal precipitation.
 - **ENSO Alert System Status (from NOAA):** El Niño Advisory / La Niña Watch
 - **Synopsis:** A transition from El Niño to ENSO-neutral is likely by April-June 2024 (83% chance), with the odds of La Niña developing by June-August 2024 (62% chance).
- **U.S. Drought Monitor:** The Big Hole watershed is currently in moderate-severe drought.

Director's Report – Pedro Marques, Executive Director

- **Administration:**
 - Update to our Indirect Cost Rate
 - \$90,000+ incoming
 - \$35,000 private and foundation
 - \$65,000+ project grants
 - Conservation Fund: \$5,754.12
 - USFS Elkhorn Agreement Update: Risk Assessment

- Storage:
 - Opportunities with USFS
 - MBMG Managed Aquifer Storage
 - Proposal for High Meadow storage
- Outreach:
 - Montana beaver working group
 - Outside Big Sky and MT Standard articles
 - *Logging for the Company* – Jack Losensky
 - Second Edition Books, Butte
 - Thrifty Drug, Anaconda
- Project Updates:
 - Draft language for Anaconda Amendment submitted to NRDP
 - Restoration alternatives for County-owned lands
- Proposal Season:
 - **RDGP Planning- Elkhorn Biofiltration** (submitted- BVHD CD)
 - **RRGL- Pennington Bridge** (May 15- Madison CD)
 - Design (2023) getting contracted
 - Construction request (BoR in October)
 - **RRGL- Melrose Diversion** (May 15- Madison CD)
 - Construction request (BoR in October)
 - **RDGP- Elkhorn Mine and Mill** (May 15- BVHD CD)
 - **RRG Irrigation- Wise River** (Apr. 22- BVHD CD)
 - **RRG Irrigation- Jerry Cr** (Apr. 22- SilverBow CD)
 - **RRGL Planning- High Meadow Storage** (Apr. 30-BVHD CD)
 - **GWIP Feasibility- Managed Aquifer Recharge** (July)

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

- The Steering Committee has considered a proposal by E.D. Pedro Marques to allow Pedro to work remotely from Brazil for one year starting this fall. This is a once in a lifetime opportunity for Pedro to raise his kids for a period of time in his and his wife’s native country. The steering committee has approved the proposal and sent it to the full board for review.
 - The board has reviewed and approved the proposal.

Communications and Wildlife Report – Tana Lynch, Associate Director

- Communications:
 - Recent:
 - Storytelling Workshop
 - March 21st, Dillon
 - Lara Tomov, Life in the Land
 - High Divide Collaborative
 - Upcoming:
 - Pay-on-results articles
 - Montana Folk Festival
 - July 12-14
 - Butte
 - Wildlife Speaker Series Event

- Grizzly Bears!
 - July 17
 - Fundraising Workshop:
 - April 16
 - Helena
 - Monthly donations
 - Predictable revenue
 - Lower fundraising costs
 - Increased donor retention
 - SAFE, SECURE, CONVENIENT!!!
 - *Never worry about forgetting to mail that check!*
 - LOVE YOUR WATERSHED!
 - *Consider a monthly donation TODAY*
 - Set it up at <https://bhwc.org/#donate> or scan the QR code at the right
- Wildlife Program Update:
 - Carcass Removal and Composting – in progress
 - (March-May)
 - Big Hole and Sage Creek (CVA)
 - New driver, Justin Cottingham
 - 2024 (so far):
 - 13 carcasses
 - 5 producers
 - Upper Big Hole Range Rider – planned
 - (July-September)
 - New 4 wheeler?



Restoration Report – Ben LaPorte, Program Manager

- Smith Sage Springs Film: MT Film Office Grant-Submitted Filming Already!
- Elkhorn Ranch Revegetation and Fencing Project: DEQ 319 Grant-Submitted
- BLM Agreement Modification
 - \$300k Toward Eastern Pioneers
- Trapper Creek Tributary Riparian Cutting Started Last Week
- Erik Kalsta posed the question that if Montana has decided beavers are good and we want them on the landscape, should landowners be reimbursed for the damages they cause? Pedro will bring this up to the beaver working group.
- A few years ago, a lot of controversy in Idaho about the water rights and use of water in Beaver Dam Analogs and its potential conflict with preexisting water rights. Has that conversation happened in Montana?
 - DNRC put together guidance for wetland restoration that answered the question of water rights associated with stream restoration. In 2015-2016, the Division Administrator convened a group within the department to hash this out. Guidance criteria addresses BDAs and sets a De Minimis amount that can be held back without a water right. For a BDA structure, that's 0.1 acre-feet, which is not a lot of water. But it's probably pretty close to the amount in the average beaver dam.

- Danika Holmes, Upper Missouri Water Planner with DNRC, clarified that a water right isn't needed as long as any wetland/floodplain restoration efforts occurring in existing/historic floodplains and wetlands don't exceed their holding capacities. As soon as new diversions are needed, OR folks are proposing to impound more water than a wetland/floodplain stored historically, that's when water right requirements would come into play.

New Business

- *Final Decree Transition – Danika Holmes, Upper Missouri Water Planner*
 - DNRC's Comprehensive Stakeholder Water Review meetings (started August last year)
 - Looking at key challenges that DNRC's Water Resources Division is undergoing. Working to reflect changes that stakeholders want to see happen.
 - Looking at two things:
 - What will happen when Final Decree Transition takes place
 - Water Planning Growth and Exempt Well group
 - Monthly, full-day meetings around the state/virtual
 - Open to the public
 - End goal is a bill to be presented to the Legislature to enact the changes these stakeholders are suggesting.
 - Danika is available to answer questions.
 - Contact information: Danika Holmes, Regional Water Planner – Upper Missouri River Basin
 - Phone: 406-444-1451
 - Email: dholmes@mt.gov
 - 2023-24 Stakeholder Working Group: [Meetings and Materials](#)
- *Cloud Seeding Feasibility Study – Michael Downey, DNRC*
 - Statutes in the Legislature have prevented cloud seeding from happening in Montana.
 - Many other states in the West are already doing cloud seeding (North Dakota, Wyoming, Idaho, etc.), so Montana is behind.
 - During the last session, thanks to the work of Jim Hagenbarth and others, the DNRC provided funding to do a cloud seeding feasibility study.
 - In Southwest Montana. This location is most promising due to work going on in Idaho and Wyoming, just over the border.
 - What is cloud seeding?
 - Super-cooled liquid
 - Silver iodide is injected into clouds, water molecules grab onto it, and it snows.
 - Feasibility Study:
 - Deliverables:
 - Plan for pilot study
 - Report that summarizes cost/benefits
 - Does cloud seeding steal water from downstream neighbors?
 - No, it does not. Not enough time for Michael to go into detail right now, but you can reach out to him with questions or he'll be back for a full presentation at our September monthly meeting!
 - Contact information: Michael Downey, DNRC Drought Program Coordinator
 - Phone: 406-444-9748 (office)
 - Email: mdowney2@mt.gov
 - Handouts attached with more information.

Meeting Topic: Invasive Weeds in the Big Hole Watershed

Presented by:

Amber Burch, Beaverhead County
Chris Chebul, Butte-Silver Bow County
Dale Grose, Madison County
John Whittingham, Basic Biological Services

Amber Burch, Beaverhead County

- Species of Concern:
 - Oxeye daisy – A pretty flower, often seen in flower beds because people don't realize they're invasive but can take over pastures and riparian areas very quickly.
 - Common Tansy – Divide/Wise River area
 - Spotted Knapweed – Have 2 kinds of bugs treating knapweed
 - Houndstongue – a problem across Beaverhead County
 - The bug that eats it (*Mogulones crucifer*) is considered a pest species, so it can't be designated as biocontrol, but it can be very effective.
 - *Mogulones* is being seen just over the river in BSB County; expect to see it in Beaverhead County this year.
 - Decimates Houndstongue
 - Yellow Toadflax – Wise River area, Jerry Creek
 - Canada thistle
 - Musk thistle – County listed
 - Black henbane – County listed
 - Leafy spurge – Mostly in the lower stretches of the Big Hole but starting to see a few plants upstream. Takes over very quickly and tough to treat.
 - Dalmatian Toadflax – Know of a few areas near Wise River. If you see any in another part of the Big Hole, please let Amber know.
 - Rush skeletonweed – Rapid response, early detection – HIGH PRIORITY SPECIES
 - 3 sites in the Big Hole
 - Treated, haven't seen reoccurrence in several years.
 - Ventanata – Relative of cheatgrass, but worse. No nutritional value for grazing animals.
 - Absinthe wormwood – Just outside of Wise River (Tie Creek), Maidenrock
- Goals:
 - Maintain, reduce weeds in the Big Hole
 - Develop and expand inventory of noxious weeds infestations
 - Develop tools and support
 - Build relationships with landowners, stakeholders
- 2023:
 - 13 spray days
 - Wisdom/Jackson, Wise River, Dewey, Divide, Maidenrock, Melrose, Glen

- RAC funding through USFS for treating Scenic Byway and West and North Big Hole roads
- EddMaps – app you can download to your phone to map weeds species (Amber will get an alert)
- Noxious weed education: posters, flyers, BHWC meeting
- Weed Whacker Ball: raised ~\$19,000 in 2023 – best year yet!
 - Thank you to everyone who came out and supported us!
 - The money raised at the WWB stays in the Big Hole (supports educations, noxious weeds trust fund for treating river corridors, and landowner cost share)
- 2024:
 - Funding through noxious weeds trust fund
 - 2 different applicators (upper and lower sections)
 - 13 Spray days scheduled (attached) – can answer questions, help with calibration, etc.
 - Can help with cost share
 - Weed Whacker Ball: September 14th this year (in Wise River)
 - Beaverhead County is hiring for their summer weeds crew!
 - Applicator training on April 23rd in Dillon at the 4H building

Chris Chebul, Butte-Silver Bow County

- 2024:
 - Will be participating in some of the spray days that Amber mentioned (Melrose, Dewey, Maidenrock, 2 on Fleecer WMA)
 - Will be spraying along Interstate 15, have a contract with MDT
 - Working with Union Pacific Railroad to encourage them to treat weeds on their property
 - Aerial spraying will be available in the area, weather-dependent
- Species of Concern:
 - Along the Highways:
 - Spotted knapweed
 - Hoary alyssum
 - In the Highlands up Soap Gulch:
 - Dalmatian Toadflax
 - Canada thistle
 - Houndstongue
- Loaner program for spray equipment (anyone can borrow spray equipment within BSB County):
 - Have to buy your own herbicide but have several large sprayers that can be towed or put in the back of a pickup.
 - Monthly weed board meetings are the first Tuesday of each month in Butte – everyone is welcome.

Dale Grose, Madison County

- Madison County has more weeds than Beaverhead County but fewer species:
 - Tall buttercup – Lower Big Hole
 - Difficult to treat, because it's often growing in fields of wild clover, and farmers & ranchers don't want to kill the clover.
 - Leafy spurge – foothills near Pennington Bridge area
 - Spray day here each year, well-attended
 - Hard to tell if progress is being made, a never-ending project
 - Provide a meal for attendees, well attended

- Spotted knapweed
- Hoary alyssum – a tough one to get rid of, seems to thrive with chemicals
- Working with ranchers to help them keep their weeds under their control to the best of their ability

John Whittingham, Basic Biological Services

- Should willows have standing? Part 1 (C. Stone, 1972)
 - Benefits
 - Native species (most are)
 - Streambank stabilization
 - Cooling stream temperatures
 - Creation of brushy habitat
 - Food source for wildlife
 - Detriments:
 - Invasive species (non-native too!)
 - High water consumption and ET
 - Loss of grass/forb habitat
 - Hindrance to access and line of sight
 - Hiding cover for predators
 - Examples of willows as invasive species:
 - Good?
 - *Salix boothii* – booth willow
 - *Salix exigua* – coyote, sandbar, streambank willow
 - *Salix lutea* – yellow willow
 - Bad?
 - *Salix alba* – Chinese or white willow
 - *Salix fragilis* – crack willow
 - Tamarisk – 3 species in Montana
 - Gathering willows
 - Ethical vs. unethical
 - Willow handling prior to planting
 - Planting willows
 - Care of willow plantings
- Should willows have standing? Part 2
 - Mechanical controls – BBS clears willows for landowners trying to access certain parts of their land/streambanks, due to concerns regarding wildlife, so the land can be used for grazing, and also for safety reasons due to visibility on roadways.
 - Handheld equipment
 - Heavy equipment (see photo right)
 - Burning
 - Apply dry straw onto willow colonies with “bale buster”
 - Spray diesel fuel onto straw and willows



- Ignite
- Herbicidal controls
 - Broadcast methods
 - Cut stump methods
 - Legal issues
 - Herbicides are generally mild acids with low human toxicity; but not carcinogenic, teratogenic, mutagenic, etc. There are exceptions!!!
 - “Aquatic” labeled herbicides like aquatic 2,4-D or aquatic glyphosate are formulated to photo-degrade and hydrolyze in water very quickly (days)
 - USEPA and State of Montana allow for specific registered herbicide products to be applied directly onto or into water bodies
 - Most herbicide products used to control willows DO NOT allow for application directly into water
 - Practical considerations:
 - ALWAYS READ AND UNDERSTAND THE ENTIRE PRODUCT LABEL
 - Confirm whether “selective” or “non-selective” products
 - Foliar applications during vigorous growth when foliage is maximal (summer)
 - Thorough coverage of leaves and stems
 - Use high rates of surfactant (sticker), consider methylated seed oils
 - Over-spray is inevitable so consider impact on non-target species
 - “Cut-stump” methods require herbicide application immediately after cutting, and coverage of the cut area, the remaining basal stem, and soil around base
 - Herbicides commonly used on willow:
 - 2,4-D ester or amine – tens of product names, growth regulators
 - Triclopyr – Garlon 3A, Garlon 4 Ultra, growth regulators
 - Glyphosate – Rodeo, Roundup, Gly Pro, tens of product names, aromatic amino acid inhibitors
 - Imazapyr – Habitat Aquatic, Arsenal AC, RM43, branched-chain amino acid inhibitor
 - Metsulfuron Methyl – Escort XP, MSM Turf, branched-chain amino acid inhibitor
 - Hexazinone – Velpar, photosynthetic inhibitor
 - Legal and environmental considerations
 - Do not apply near “shallow” water tables or areas where soils and substrate are highly permeable. Examples?
 - Do not apply where surface water runoff may result in herbicide residues being washed into adjacent water bodies. Examples?
 - Do not apply to flooded areas when surface water is present. Examples?
 - Damage claims for off-site and non-target “accidents” like polluted water wells
 - Headwaters Inc. ver. Talent Irrigation District, Oregon, 9th Circuit Court, 2001, regarding NPDES permit requirements



- See attachment for John's contact information.

Upcoming Meetings

- May 15, 2024: **Big Hole River Fishery Update**
 - 7:00 PM at the Divide Grange Hall
- June 19, 2024: **MBMG Groundwater Investigation Program Study near Glen**
 - 7:00 PM at the Divide Grange Hall
- July 17, 2024: **Annual Wildlife Speaker Series event: Grizzly Bears**
 - 6:00 PM at the Divide Grange Hall

Adjourn



*The Wildlife Speaker Series
of Southwest Montana
Presents*

**GRIZZLY
BEARS**

C.M. LANSCHER IMAGES

What: Join us for a free and informative presentation on GRIZZLY BEARS!
Who: Biologist Cecily Costello, PhD, MT Fish, Wildlife & Parks will present.
 The presentation will be preceded by a potluck meal, with the main dish of elk burgers provided by BHWC. Please bring a side dish, salad, or dessert!
When: Wednesday, July 17, 2024
 Dinner at 6:00 pm, Presentation at 7:00 pm
Where: Divide Grange Hall - Divide, MT
Sponsored by: Big Hole Watershed Committee

 **BIG HOLE
WATERSHED COMMITTEE**
Conservation Through Cooperation

 info@bhwc.org  406-960-4855



SOUTHWEST MONTANA
SAGEBRUSH
PARTNERSHIP

Sustainable Ranching Workshop #2

Building Profitability & Resiliency Through Regenerating Soil Health

June 4 - 5, 2024 | 8:30 – 4:30 both days

@ the Hamilton Ranch Round Barn – Twin Bridges, Montana

The Southwest Montana Sagebrush Partnership cordially invites you to this workshop focused on increasing net profitability and resiliency of ranching in SW Montana. Emphasis will include using your livestock to improve soil health, forage biomass, water infiltration and retention, animal performance, and system resilience.

Attendees will gain knowledge and practical skill sets needed to take the best next steps in progress. The workshop will provide extensive hands-on instruction with interactive discussion facilitated by Understanding Ag.

This Understanding Ag Workshop will teach you:

- Why regenerative approaches are important – and even life-changing: The keys to enhanced profitability and resilience
- Why the soil microbiome is a rancher's and farmer's friend
- How to forge symbiotic relationships and use nature's ecosystem processes to our advantage
- How to capture more water and retain that water
- Knowledge and tools for efficient and effective grazing and cover cropping
- Understanding the Six Principles of Soil Health and the Three Rules of Adaptive Stewardship
- The Four Ecosystem Processes – Still free and still working for us!

Lunch will be provided by the Beaverhead Conservation District and Ruby Valley Conservation District.

Workshop hosted by the Southwest Montana Sagebrush Partnership and Hamilton Ranch

Register Here!

(click or scan) →



Please register early. Workshop will be capped at 75.

For more info, contact **Pat Fosse**
pafosse.pf@gmail.com | (406) 660-2386

Understanding Ag is a team of consultants who are farmers and ranchers themselves, and who combine decades of experience to help teach others. Working across all 50 states on more than 34 million acres including clients in Southwest Montana, their clients comprise some of the largest ranches in North America. UA's Mission is "To use our passion and experience to educate farmers, ranchers and communities in applying time-tested ecological principles to regenerate our living ecosystems thereby restoring the health of all." To learn more, go to their website at www.UnderstandingAg.com.

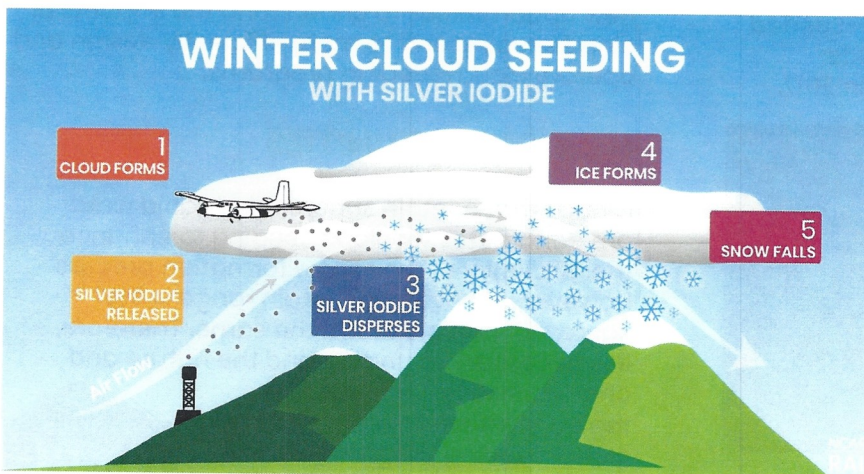


WINTER OROGRAPHIC CLOUD SEEDING

PRECIPITATION ENHANCEMENT

Enhancing Snowfall

In mountainous regions where the water supply depends on winter snow pack, cloud seeding is a technology that 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 can lead to greater resilience in long-term water management solutions under a changing climate and increasing water scarcity by increasing water supply.



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

Benefits & Impacts

- Direct observations of cloud-seeding effects
- Model evaluation of cloud seeding
- Real-time forecasting for cloud-seeding opportunities
- Simulations can now inform cloud-seeding program designs

 ral.ucar.edu

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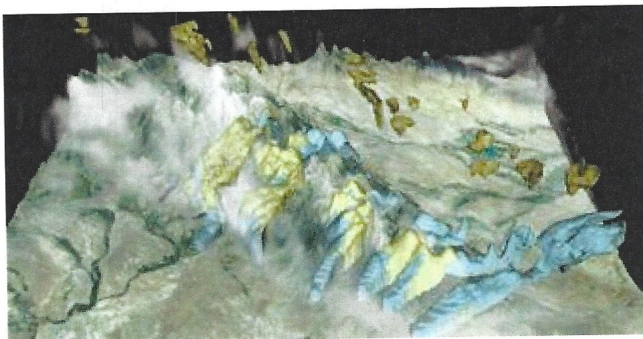
Some common apprehensions with cloud seeding approaches include concern over downwind or extra area effects and environmental safety. While extra area impacts are an active area of investigation, there is no substantial evidence that an increase in precipitation from cloud seeding directly leads to a systematic decrease elsewhere. In addition, measured concentrations of silver in snowpack have been in the parts per trillion (ppt) range, similar to natural background levels of silver (e.g., due to mineral dust) and are orders of magnitude below the levels considered concerning by environmental regulatory agencies worldwide.

COMPUTER MODELING

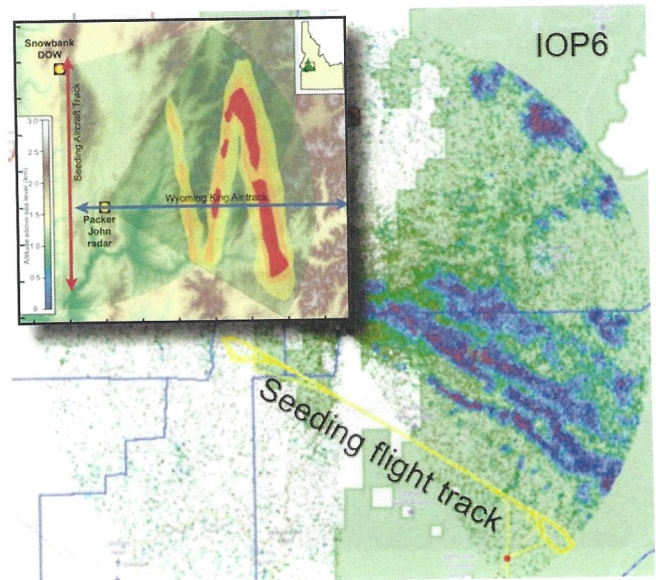
In recent years, supercomputing capabilities and weather models have advanced significantly, providing new opportunities to assess the impact of cloud seeding. Model simulations can be performed with and without seeding to directly quantify the simulated seeding effect, which helps overcome the challenge of obtaining statistically significant findings using only randomized statistical experiments. These advances also open the door for new applications for cloud-seeding modeling, such as model evaluation of cloud-seeding activities, real-time forecasting for cloud-seeding opportunities, and simulations aimed to inform new cloud-seeding program designs.

OBSERVATIONAL STUDIES

While the advances in computer modeling are promising, detailed observations are still needed to verify that the model is accurately representing orographic clouds, precipitation formation, and the response to cloud seeding. SNOWIE—Seeded and Natural Orographic Wintertime clouds: the Idaho Experiment— was conducted in 2017,



Model simulation of clouds (white), ice (yellow) and AgI seeding plumes (blue). Grid resolution is 667 m.



Hypothesized (left) and radar-observed effect of cloud seeding in SNOWIE

collecting unprecedented measurements from seeded clouds, using a variety of technologies. Findings include the unambiguous evidence that cloud seeding resulted in precipitation, as observed via radar. Specifically, a zig-zag pattern of precipitation was observed mimicking the dispersion pattern of AgI released by a seeding aircraft. These and other SNOWIE data are being used to better understand the physical response of seeded clouds and improve the cloud-seeding modeling capability. Together, these observational and modeling advances set the stage for new opportunities to address the research, program design, and evaluation of cloud seeding. Recent advances in modeling and observations of seeding impacts provide new opportunities to understand the impacts of cloud seeding and to more efficiently design and operate cloud-seeding programs.

NEW OPPORTUNITIES

Clouds that contain supercooled liquid water are candidates for cloud seeding to enhance the efficiency of their snow formation process. However, not every mountain range is the same, nor is every storm the same. Therefore, it is necessary to understand the nature and characteristics of clouds in a region of interest before starting a cloud-seeding program.

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





Cloud Seeding Program

Frequently Asked Questions

What is Silver Iodide (AgI), and is it environmentally safe?

AgI is a non-organic chemical compound with a level of solubility close to that of quartz; it is inert in the natural environment. More than 20 comprehensive studies and data reviews on the environmental effects of the use of AgI for cloud seeding all concur that there is no evidence for adverse effects to human health or the environment from the use of silver iodide for cloud seeding. States such as California, Colorado, and Utah have also had continuously operational cloud seeding programs for more than 3 decades without evidence of environmental concern.

Does cloud seeding take water from downwind basins (AKA “robbing Peter to pay Paul”/downwind effect/extra-area effects)?

Atmospheric rivers, analogous to surface flowing rivers, are very dynamic and experience many “gains” and “losses” as they move across the continent. On average, roughly 20% of the total atmospheric water budget in a given area will condense into clouds; of that amount, only about 30% will fall to the ground as precipitation naturally (roughly 6% of the overall water budget). It is estimated that less than 1% of the total water budget in a given area is impacted by cloud seeding. Additionally, the nucleation process, once initiated in a seeded cloud, can continue for a given distance downwind, aiding downwind precipitation as a result. While further research is required to better address this question, evidence suggests there is either a neutral or positive benefit to downwind users.

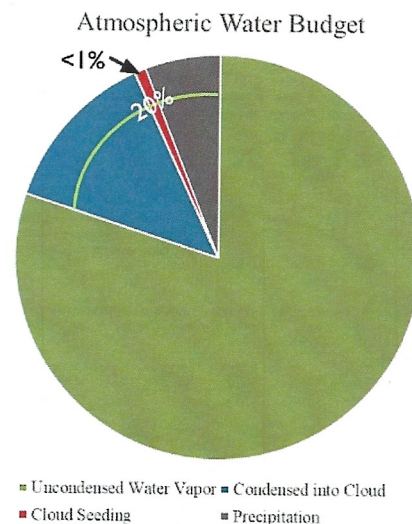


Figure by Idaho Power Company

How much additional water is generated from cloud seeding?

The amount of precipitation generated is based on a number of factors, including the geography and climatology of the individual basins where operations occur, the conditions of the storms passing through, and the level of operations being conducted. In Idaho, cloud seeding generates about a 10% average annual increase in snowpack across all basins of operation. Statewide this results in approximately 1,240,000 acre-feet of additional water on an average annual basis.

How much does it cost to operate a cloud seeding program?

The cost for operating a program varies by basin/region and is largely dependent upon the number of seeding opportunities each season and the scale of operations being conducted. In total, Idaho’s basins are supported by 57 remote ground generators, 25 manual ground generators, 3 aircraft, and a network of weather instrumentation. During seasonal operations, programs are supported 24-7 by a team of atmospheric scientists. The average annual cost to operate Idaho’s cloud seeding programs is about \$3.9 million dollars, equal to roughly \$3.22/acre foot of water produced.



Cloud Seeding Program

Frequently Asked Questions

For more information, please visit: <https://idwr.idaho.gov/iwrb/programs/cloud-seeding-program/>

iwrbcloudseeding@idwr.idaho.gov | (208) 287-4800

What is cloud seeding?

Cloud seeding is a form of weather modification that increases the efficiency of a cloud by enhancing its natural ability to produce precipitation.

Why do we seed clouds?

In Idaho, cloud seeding is used during the cold season to augment high elevation snowpack, our primary storage reservoirs. In other areas of the US and around the world, cloud seeding is also used for rain enhancement during warm seasons, hail mitigation to reduce damage to crops and infrastructure, and for fog suppression around airports.

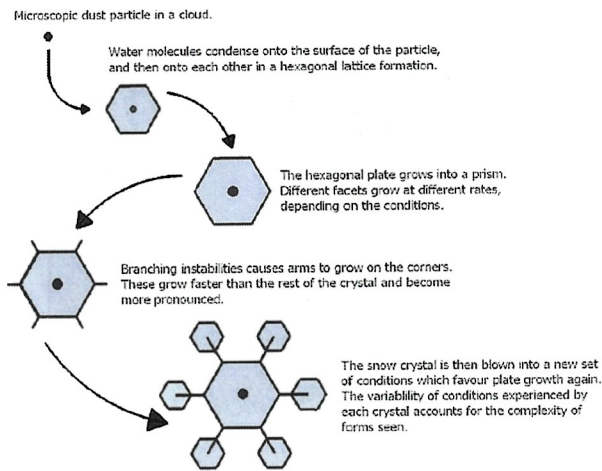
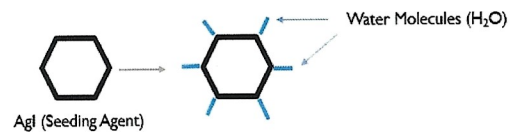


Image by Idaho Power Company

How does cloud seeding work?

Cloud seeding is a physical process whereby a seeding agent comprised of minute particles is released into an *existing* cloud formation, providing a surface for supercooled liquid water molecules to bond and formulate ice crystals. Water molecules freeze on contact with the particles and begin to grow into a snowflake as it encounters other water molecules, until the snowflake reaches a density heavy enough to fall to the ground as precipitation.



How do we seed clouds?

Cloud seeding can be done by ground and/or by aircraft. Ground generators are placed on the windward side of a mountain and rely on winds flowing up and over the mountains to carry the seeding material up into a cloud where it will generate ice, that ultimately falls out as snow over the mountain tops (the "target area"). Aircraft can also be used to fly through or above clouds to release the seeding material.

What seeding agent is used to seed clouds?

Silver Iodide (Agl) is the most common seeding agent used to conduct cloud seeding. Agl has the same physical shape (hexagonal) as naturally occurring ice. This incites the growth of ice crystals and can be used to generate ice at warmer temperatures than naturally occurring ice.

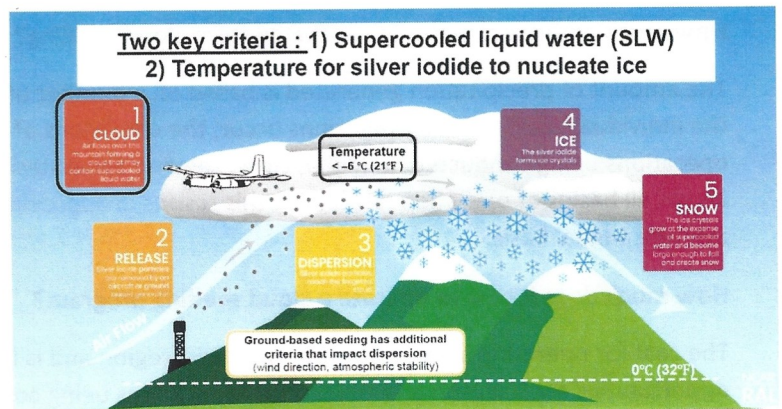


Image by the National Center for Atmospheric Research

BEAVERHEAD COUNTY WEED DAYS 2024

May 28 – May 31	Crew Training	8:00 – Whitehall
June 6	Burma	7:30 – Stack Yard
June 11	Clark Canyon Dam	7:00 – Marina
June 12	Glen	7:30 – Glen Bar Parking Lot
June 13	Maiden Rock	7:30 – Maiden Rock Bridge
June 18	Blacktail	7:30 – Rock Creek Turn-off
June 20	Melrose	7:30 – Melrose Bar
June 21	Argenta	8:00 – Bus Turn Around
June 25	Lima Dam	8:00 – Below Lima Dam Spillway
June 26	Lima	7:30 – Lima Rest Area
June 27	Big Sheep Creek	8:00 – Sheep Shearing Pens
June 28	Dewey Cemetery	8:00 – Quartz Hill Turn-off
July 2	Snowline	8:00 – Snowline Gravel Pit
July 10	Little Sheep Creek	8:00 – Below Straight Creek Cabin
July 11	Monida Hill/Price Peat	8:00 – Top of Monida Pass
July 13	BEAVERHEAD WEED DAY	8:00 – High School Parking Lot
July 16	Scenic Byway	8:00 – Wise River Fire Hall
July 17	Wisdom	8:00 – County Road Shop
July 19	Wise River	8:00 – Wise River Fire Hall
July 23	Beaverhead/Ravalli	9:00 – Chief Joseph Pass Turn-off
July 24	Mussigbrod	9:00 – Mussigbrod Turn-off
July 26	Divide	8:00 – Fishing Access
July 27	Argenta	8:00 – Bus Turn Around
July 30	Medicine Lodge	8:00 – Hansen Creek Turn-off
July 31	Horse Prairie	8:00 – Shoshone Ridge Interpretive Site
August 1	Dyce Creek	8:00 – Dyce Creek Turn-off
August 3	Grasshopper	8:00 – Grasshopper Inn
August 6	Snowline	8:00 – Snowline Gravel Pit
August 7	Red Rock Pass	9:00 – Top of Pass
August 8	Lima Dam	8:00 – Below Lima Dam Spillway
August 9	Wise River Pull/Deep Creek	8:00 – Ralston's
August 13	Wisdom	8:00 – County Road Shop
August 14	Wolverine	9:00 – Wolverine Gate
August 16	Argenta	8:00 – Bus Turn Around
September 7	Wise River	8:00 – Wise River Fire Hall

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