Partners Project Title Page
Proposal for a Partners Project

Title: Towards Improved Decision Support for Snow Covered Watersheds: A Snowmelt Risk Advisory (SRA)

Date: 12/1/2020

Signatures for University
University Name: BoR, NSHE, obo DRI
Address: 2215 Raggio Parkway
Reno, Nevada, 89512-1095

Principal Investigator
Name (typed): Benjamin J. Hatchett
Telephone number: 530-307-9044
FAX number: 775-674-7001
Address: 2215 Raggio Parkway
Reno, NV 89512-1095
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Benjamin Hatchett Digitally signed by Benjamin Hatchett
Date: 2020.12.01 20:38:48 -08'00'

University Official (usually dept. chair)
Name (typed): Naresh Kumar
Title: Executive Division Director
Telephone number: 775-674-7006
FAX number: 775-674-7016

Naresh Kumar Digitally signed by Naresh Kumar
Date: 2020.12.16 14:23:00 -08'00'

University Official (contract sent to)
Name (typed): Margie Stuart
Title: Business Manager
Address: 2215 Raggio Parkway
Reno, NV 89512-1095
Telephone number: 775-674-7028
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Email: Margie.Stuart@dri.edu

Margie Stuart Digitally signed by Margie Stuart
Date: 2020.12.16 15:52:31 -08'00'

SUMMARY OF BUDGET REQUEST:

COMET FUNDS: Year 1 $14,999

NWS FUNDS: FY 1 None FY 2 None

Signatures for NWS
NWS Office: NWS Reno
Address: 2350 Raggio Parkway
Reno, NV 89512

Principal Investigator
Name (typed): Tim Bardsley
Telephone number: 775-673-8104
FAX number: 775-673-8110
Email: tim.bardsley@noaa.gov

BARDSLEY.TIMOTHY.JOHN.1407611507 Digitally signed by BARDSLEY.TIMOTHY.JOHN.1407611507
Date: 2020.12.02 14:05:57 -08'00'

MIC/HIC
Name (typed): Jon Mittlestadt
Telephone number: 775-673-8100
FAX number: 775-673-8110

MITTELSTADT.JON.C.1365872038 Digitally signed by MITTELSTADT.JON.C.1365872038
Date: 2020.12.03 08:32:48 -08'00'

SSD Chief
Name (typed): Matthew Jeglum

JEGLUM.MATTHEW.EDWARD.1393959203 Digitally signed by JEGLUM.MATTHEW.EDWARD.1393959203
Date: 2020.12.09 12:45:59 -07'00'

Regional Director
Name (typed): Dr. Grant Cooper

COOPER.GRANT.ALEXANDER.1047689399 Digitally signed by COOPER.GRANT.ALEXANDER.1047689399
Date: 2020.12.16 10:07:53 -07'00'

Towards Improved Decision Support for Snow Covered Watersheds: A Snowmelt Risk Advisory (SRA)

BACKGROUND

Rain-on-snow is linked to many of the largest floods in the United States[1]. In snow-dominated watersheds, snowmelt can increase the water available for runoff by 30% or more[2]. Forecasting runoff in snow covered areas prone to flooding is complicated due to the difficult nature of predicting and observing the rain-snow transition elevation and the variation in runoff efficiency and magnitude when snow is present. Looking at forecasts, reservoir operators must constantly weigh decisions to store water for economic and ecological benefits (resource) or to release water to mitigate downstream flooding potential (hazard). Rain-on-snow events are projected to increase in frequency and magnitude as the climate warms[3]. This change will multiply uncertainties and risks in operational decision making related to extreme weather. To meet these mounting challenges, we propose to explore the feasibility for an empirically-based mesoscale Snowmelt Risk Advisory system (SRA), which considers the likelihood of snowmelt runoff through risk quantification (Figure 1).

An opportunity to improve impact-based decision support (IDSS; Uccellini and Ten Hoeve 2019) for local forecasts exists by focusing on the knowledge gap that stems from a poor understanding of runoff timing and generation, specifically during rain-on-snow events, in snow-dominated or transitional rain-snow watersheds. Current operational models treat the snowpack as a bulk mass[1,4]. During rain-on-snow events, these models assume a uniform wetting front where rain enters the snow, warms the snow evenly, then flows downwards through snowpack. In practice, rain-on-snow processes are much more complex[5]. Rain penetrates the snow following preferential flow paths, which are poorly understood[1,4,5]. Additionally, storms with high winds and humidity cause surface melting of snow through turbulent fluxes of latent heat, increasing the water available to runoff. The efficiency of runoff originating as snowmelt and/or direct precipitation (throughflow) will be determined by the saturation level of soil moisture.

INTELLECTUAL MERIT

The development of the SRA will strengthen the partnership between Desert Research Institute and the National Weather Service with other operational entities (e.g., state agencies, floodplain managers, reservoir operators) by providing a much-needed IDSS. No tool currently exists that provides real-time potential for snowpack to contribute to runoff. This project will explore the feasibility of developing such a tool by focusing on the Truckee and Carson watersheds in collaboration with the National Weather Service (NWS) Reno Office, specifically working with hydrologist Tim Bardsley. This operationally-focused Snowmelt Risk Advisory has been developed specifically to achieve a real-world impact to help create a weather ready nation by leveraging available data and methods to develop a near real-time decision support tool to improve prediction of the snowpack runoff risk.

To date, most studies that explore rain-on-snow flooding are case studies focus on a specific region for a single storm event using daily data and overlook critical antecedent snowpack properties[2–4]. While hourly snow data is collected, it is rarely presented, analyzed, or used in a meaningful fashion to address runoff risks. The objective of the SRA is to advance knowledge within hydrometeorology by: (1) identifying snowpack properties that increase snowmelt risk though machine learning using hourly observational datasets, (2) linking antecedent and land surface snowpack conditions, storm characteristics, and streamflow response which could improve prediction of runoff generation, (3) making information available through a translational framework for improved reservoir operations beyond currently available forecasts.

RESEARCH APPROACH

Hypotheses: Meaningful, physical relationships exist between weather, antecedent snowpack conditions, and runoff timing that improve the prediction of runoff.

Research Objectives:

The proposed research will address the following four objectives:

O1: Categorize and rank hazard parameters from surface weather stations at polit study location (Truckee and Carson watersheds).

O2: Develop a testable risk matrix based on hazard to be applied to individual basins.

O3: Design a framework to categorize basin vulnerabilities and capacities.

O4: Validate feasibility and resources required to fully develop the Snowmelt Risk Advisory.

FORECASTING RELEVANCE FOR THE NWS RENO:

This project has been outlined in collaboration with Tim Bardsley, Senior Service Hydrologist at the NWS Reno office (the NWS partner). In advance of major cool season precipitation events (e.g., landfalling atmospheric rivers), or spring and summer snowmelt-induced flooding concerns, the NWS Reno often must access information from a handful of skilled observers and snow surveyors, SNOTEL stations, sporadically distributed surface observations, and satellite imagery to understand current snowpack and soil moisture conditions that impact runoff. The proposed SRA decision support tool would synthesize the snowpack and soil moisture data, quantify antecedent conditions, and disseminate how those risks change over time. The SRA has great potential to advance internal NWS office understanding of antecedent conditions, provide guidance for RFC forecasters, inform snowmelt runoff scenario exercises, and aid in communicating flood risk to NWS partners. The NWS in Reno fully supports this collaborative approach.

TASKS & TIMELINE:

Three research phases are proposed from January through October 2021. The work will be reviewed by Dr. Benjamin Hatchett but will be primarily conducted by Atmospheric Sciences Graduate Program PhD student Anne Heggli spending 25% time each month on tasks.

Phase 1 (O1 & O2, Jan–Apr 2021):

Task 1*: Build calibration data set (PhD Student Heggli)*

Hourly precipitation, air temperature, snow depth, snow water equivalent, soil moisture, soil temperatures, and wind speed (where available) data from the US Department of Agriculture SNow TELemetry (SNOTEL) network from 2005-present in the Truckee and Carson watersheds will be the foundation of the test dataset. The data will undergo a quality assessment where only stations and water years where the sensors remained online and without error will be utilized in the machine learning training dataset. The data sets will also only include data during the snowcover season to eliminate soil moisture response of rain on bare soil.

Task 2*: Select test data set (NWS, Reno and PhD Student Heggli)*

Four difficult to forecast events, two over-forecasted and two under-forecasted, will be left out of ML training as the test data set to measure the risk matrix results. This test data will be selected by the NWS Reno office and will not be included in the ML process.

Phase 2 (O3, Apr–Jun 2021):

Task 1: Machine Learning (PhD Student Heggli)

Machine learning (ML) will use the training dataset to quantify the snowpack runoff risk for the parameters (Figure 2) to test the hypothesis. The meteorological observations will be classified by energy

input type (rain-on-snow, humid+windy, or warm day melt) and soil moisture response will validate snowpack water release (Figure 3). Predictability of snowmelt and its sensitivity to different predictors will be quantified using ML algorithms such as random forests and multivariate regression using established libraries such as scikit-learn. Results from the ML algorithms will guide the development of two risk matrixes to demonstrate what can be learned from hourly data: present weather risk and antecedent snowpack risk.

Task 2: Validating ML (NWS Reno, PhD Student Heggli)

The ML capability to predict snowpack runoff will be tested with the test dataset selected by the NWS Reno. The results of the ML derived risk matrix will be presented to the NWS office for qualitative feedback.

Phase 3 (O4, Jul–Oct 2021):

Task 1: Develop Framework (PI Benjamin Hatchett, NWS Reno, and PhD Student Heggli)

Development of translational Snowmelt Risk Advisory framework. Apply what was learned to a basin wide advisory. The development of the risk matrixes and the results from the test cases will support a publication discussing the opportunity and feasibility of a basin-wide Snowmelt Risk Advisory for real-time decision support in snow covered watersheds.

Timeline:

Phase # (Task #)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Phase 1 (Task 1)	■	■	■							
Phase 1 (Task 2)			■	■						
Phase 2 (Task 1)				■	■					
Phase 2 (Task 2)						■				
Phase 3 (Task 1)							■	■	■	■

REFERENCES:

1. McCabe, G. J., Clark, M. P. & Hay, L. E. Rain-on-snow events in the western United States. *Bull. Am. Meteorol. Soc.* **88**, 319–328 (2007).
2. Henn, B., Musselman, K. N., Lestak, L. & Martin Ralph, F. Extreme runoff generation from atmospheric river driven snowmelt during the 2017 Oroville Dam spillways incident 2. *Geophys. Res. Lett.* **47**, (2020).
3. Musselman, K. N. *et al.* Projected increases and shifts in rain-on-snow flood risk over western North America. *Nature Climate Change* vol. 8 808–812 (2018).
4. Rössler, O. *et al.* Retrospective analysis of a nonforecasted rain-on-snow flood in the Alps-A matter of model limitations or unpredictable nature? *Hydrol. Earth Syst. Sci.* **18**, 2265–2285 (2014).
5. Mcgurk, B. J. & Marsh, P. Flow-finger continuity in serial thick-sections in a melting Sierran snowpack. (1995).

Figures:

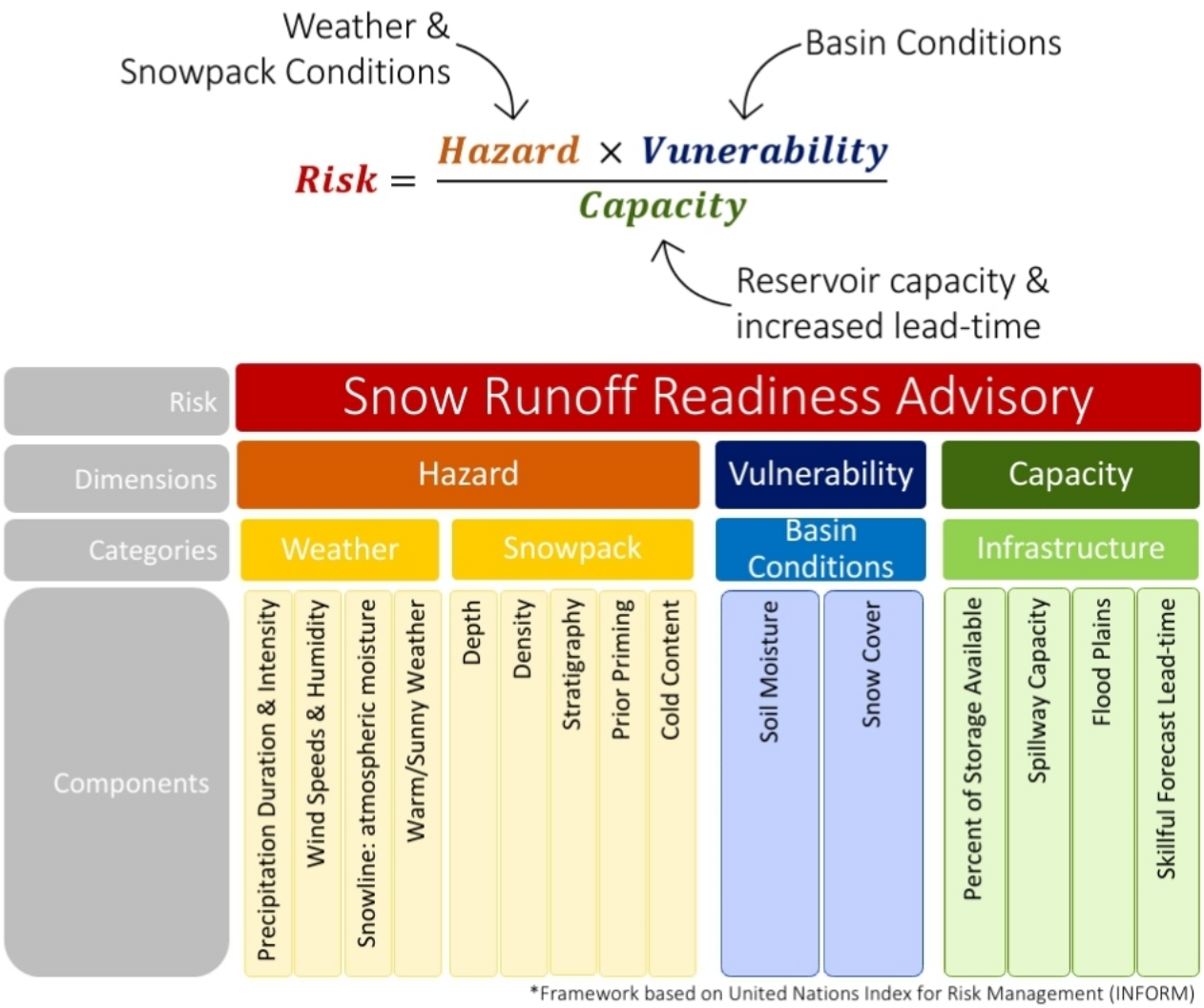

Figure 1: Snowmelt Risk Advisory Conceptual Framework

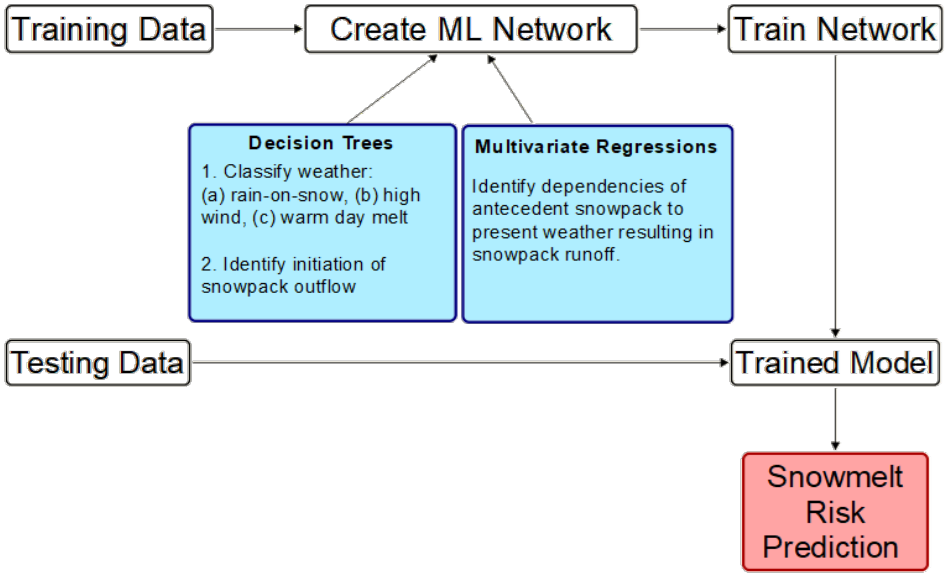

Figure 2: Machine learning workflow.

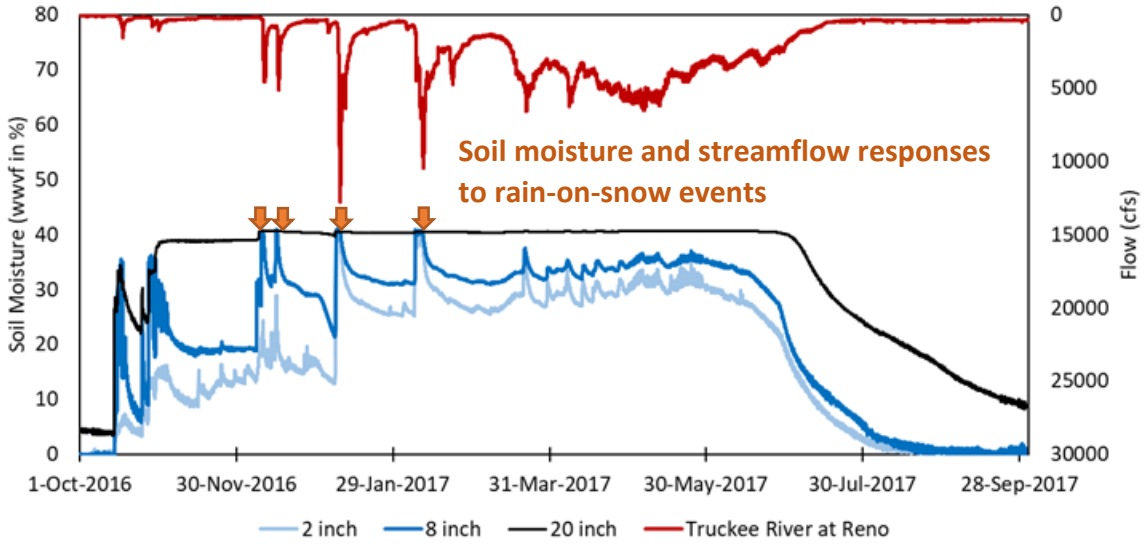

Figure 3: Raw hourly soil moisture data (blue lines) from the Central Sierra Snow Laboratory (Donner Summit) demonstrating the soil moisture response during rain-on-snow events that will be used to validate the release of water from the snowpack during water year 2017. Red line indicates the streamflow response of the Truckee River at Reno (upstream reservoir operations have not been removed). Arrows indicate rain-on-snow events.

Budget Justification:

Heggli Salary – Coverage for 2.75 months' salary for Co-PI Heggli will provide time for continued program development, and co-management with other PIs. It will also allow Heggli to create the data management portal, conduct on going data quality control, develop training/education materials for citizen scientist engagement, analyze results, and produce the final report.

Hatchett Salary – Coverage for 0.25 months' salary for PI Hatchett will be donated by Hatchett to provide time to serve in an advisory role to Co-PI and graduate student Heggli and contribute to the development of project deliverables (reports, manuscripts, presentations to NWS personnel).
Materials/Supplies – No materials or supplies are required; existing computational resources are sufficient to perform necessary tasks. Publication fees will be covered by PI Hatchett.

Timeline for project expenditures

Jan-Apr 2021: Heggli will spend 0.25 FTE/mo working towards objectives O1 and O2. Hatchett will allocate 0.05 FTE reviewing work and providing feedback.

Apr-Jun 2021: Heggli will spend 0.25 FTE/mo working towards objective O3. Hatchett will spend 0.05 FTE reviewing work and providing feedback.

Jul-Oct 2021: Heggli will spend 0.25–0.5 FTE/mo working towards objective O4. Hatchett will spend 0.15 FTE working with Heggli to finalize results and interpretationns, complete the publication, and presentation. Additional support for Hatchett will leverage an existing National Weather Service Project.

Benjamin J. Hatchett **benjamin.hatchett@dri.edu**

Professional Preparation

University of Nevada	Geography	B.S.	2008
University of Nevada	Atmospheric Sciences	M.S.	2012
University of Nevada	Geography	Ph.D.	2016
Desert Research Institute	Atmospheric Sciences	Postdoc	2016

Appointments

2018 – Present	Desert Research Institute-Assistant Research Professor
2016 – Present	Sierra Nevada College-Adjunct Faculty
2013 – 2016	University of Nevada-Graduate Research Assistant/Advisor: Douglas. P. Boyle
2011– Present	Lake Tahoe Community College-Adjunct Faculty
2009 – 2013	Desert Research Institute-Graduate Research Assistant/Advisor: Darko R. Koracin

Five products most closely related to the proposed project

1. 2020. **Hatchett, B.J.** and 19 co-authors: Observations of an extreme atmospheric river storm with a diverse sensor network. *Earth and Space Science*, 7, e2020EA001129, doi:10.1029/2020EA001129

2. 2019. Sterle, K., **B.J. Hatchett**, L. Singletary, and G. Pohll: Hydroclimatic Variability in Snowfed River Systems: Local Water Managers' Perspectives on Adapting to the "New Normal". *Bulletin of the American Meteorological Society*, 100, 1031–1048, doi:10.1175/BAMS-D-18-0031.2.2. 2019

3. 2018. **Hatchett, B.J.**, 2018: Snow level characteristics and impacts of a spring typhoon-originating atmospheric river in the Sierra Nevada, USA. *Atmosphere*, 9(6), 233, doi:10.3390/atmos9060233

4. 2018. **Hatchett, B.J.,** and McEvoy, D. Exploring the hydrometeorological origins of snow drought in the northern Sierra Nevada. *Earth Interactions*, 22, 1-13, doi:10.1175/EI-D-17-0027.1

5. 2017. **Hatchett, B.J.**, B. Daudert, N.S. Oakley, C.B. Garner, A.E. Putnam, A.B. White, 2017: Recent winter snow level rise in the Sierra Nevada, California, 2008-2017. *Water*, 9(11), 899, doi:10.3390/w9110899

Five other significant products

1. 2020. Abatzoglou., J.T., **B.J. Hatchett**, P. Fox-Hughes, A. Gershunov, and N.J. Nauslar: Global climatology of synoptically-forced downslope winds. *International Journal of Climatology*, in press, doi:10.1002/joc.6607

2. 2019. Hudson, A.M., **B.J. Hatchett**, J. Quade, D.P. Boyle, S.D. Bassett, G. Ali, and M.G. de los Santos: North-south dipole in cool season hydroclimate in western North America during the last deglaciation. *Nature Scientific Reports*, **9**, 4826, doi:10.1038/s41598-019- 41197-y

3. 2019. Rondanelli, R., **B.J. Hatchett**, J. Ruttlant, D. Bozkurt, and R. Garreaud: Strongest Madden-Julian Oscillation on record triggers extreme Atacama rainfall and warmth in Antarctica. *Geophysical Research Letters*, **46**(6), 3482–3491, doi:10.1029/2018GL081475

4. 2018. **Hatchett, B.,** Fingerprints of the thermal equator. *Nature Geoscience*, **11**, 327, doi: 10.1038/s41561-018-0129-1

5. 2017. **Hatchett, B.J.**, S. Burak, J. Rutz, N.S. Oakley, N.H. Bair, and M.L. Kaplan, 2017: Avalanche fatalities during atmospheric river events in the western United States. *Journal of Hydrometeorology*, **18**, 1359-1374, doi:10.1175/JHM-D-16-0219.1

Total Publications: 27 peer-reviewed, 19 non-peer reviewed.

Funded Competitive Grants and Fellowships: (~$950,000)

Synergistic Activities

1. **STEM Outreach:** Two field trips for Bishop, Walker, Mono, and Pyramid Paiute Indian tribes (K-12) to desert terminal lakes with emphasis on extreme weather and climate of the Great Basin. Two 60-minute presentations to underprivileged youth in Reno, NV about careers in STEM fields. Multiple ~40-minute lectures to K-12 teacher training on utilizing paleoclimate data to teach climate change.
2. **Public Outreach:** Sixteen public lectures on droughts, floods, abrupt climate changes, and avalanche hazards.
3. **Mentoring:** Mentored one undergraduate (Henry Meier, U. Maine) during one-month field season collecting 10-Be surface exposure samples from Last Glacial Maximum moraine belts in June Lake, CA. Mentored UCSD undergraduate Cody Poulsen (now Ph.D. student at Scripps Institution of Oceanography) and UNR undergraduate Zoey Rosen (now M.S. student in Science Journalism at Colorado State University) on rain shadow science and communication projects (NASA-EPSCoR-funded). Currently mentoring UNR undergraduate Adora Shortridge (now M.S. student in Sustainability at Arizona State University) on an evaluation of extreme heat and urban heat island effects in Reno, Nevada, UNR undergraduate Shawn Roj on changes in rain-snow transition in northern California (NASA-EPSCoR-funded; now M.S. student in Climate Science at UC San Diego/Scripps Institution of Oceanography), UNR Masters of Public Health student Kellan Flanagan on heat-health relationships in the Mojave and Sonoran Deserts, and UC San Diego/Scripps Institution of Oceanography Ph.D. candidate Tashiana Osborne on snow levels in the Sierra Nevada, and Ph.D. student Anne Heggli in the UNR Atmospheric Sciences Graduate Program.
4. **Peer Review:** Reviewer for 19 different peer-reviewed academic journals since 2016.

Anne Heggli

e-mail: anne.heggli@dri.edu, tel: +1-530-830-1830

(a) Professional Preparation

San Francisco State University, San Francisco, CA; International Relations; B.A., 2009
San Francisco State University, San Francisco, CA; Spanish; B.A., 2009
California State University, Fresno, Fresno, CA; Water Resource Management; M.S., 2017
University of Nevada, Reno, Reno, NV; Atmospheric Science; Ph.D, 2020–Present

(b) Appointments

2016–present: **Co-Owner**, Alpine Hydromet, Auburn, CA

2015–present: **Owner**, Unearth, Auburn, CA

2010–2015: **Technical Sales Manager**, Hydrological Services America, Lake Worth, FL

2007–2009: **Technical Hydromet Assistant and Interpreter**, Innovative Hydrology, Auburn, CA

(c) Products

1. **Heggli, A.E.**, and B. Hatchett. Towards Improved Decision Support in Snow-dominated Watersheds During Extreme Weather. In: *International Atmospheric River Conference*, October 5-9, 2020.
2. **Heggli, A.E.**. Observing Rain on Snow: Using Existing Networks and New Technologies to Improve Forecasts. In: *California Extreme Precipitation Symposium*, June 30, 2020.
3. **Heggli, A.E.**. Research and Development in Advancing Fluidless Snow Water Content Monitoring. In: *Proceedings of the 86th Annual Western Snow Conference*, April 16-19, 2018.
4. **Heggli, A.E.**. Data analysis of the snow pack analyzing system tested by UCAR. In: *Proceedings of the 81st Annual Western Snow Conference*, April 15-18, 2013.

(d) Synergistic Activities

1. **Research and Development:** (i) Development of snow water content sensors, market study, research and development, sourcing, pilot study, installation, data analysis. (ii) PI for SBIR grant for research and development of cosmic ray detection system for snow water content. (iii) Prototype design of non-contact snow profile temperature sensor for cold content observations.
2. **Collaborative Projects:** (i) Hydrological expert team member for University Corporation for Atmospheric Research (UCAR) for the 3D-PAWS (3D-Printed Automatic WeatherStation) initiative.
3. **Field Work:** (i) Pilot study and data collection at Central Sierra Snow Laboratory from 2016-2019 and Sagehen Creek Field Station from 2019-2020. (ii) WMO 10-meter meteorological station design and installation for Ministry of Agriculture, Panama in Darien, Panama.
4. **Hydromet Network Modernization:** (i) Interpret and consult with the World Bank for Peruvian National Water Authority network modernization. (ii) HRIT/LRIT systems integrator for direct readout from GOES. (iii) Consultant to national and private hydro-meteorological network operators for QA/QC workflow for real-time data management.
5. **Conferences:** (i) Co-Lead for breakout rooms: “Polar Regional Atmospheric Rivers", 2020 International Atmospheric Rivers Conference, Virtual, October 5–9, 2020. (ii) Conference website organizer and developer for the World Bank Central Asia Water Future Forum and Expo, Almaty, Kazakhstan, September 19–22, 2016.

Project Budget Page

	COMET Funds	NWS Contributions
University Senior Personnel		
1. Ben Hatchett		**NA**
2.		**NA**
Other University Personnel		
1. Graduate Research Assistant	**6,809**	**NA**
2.		**NA**
Fringe Benefits on University Personnel	**2,281**	**NA**
Total Salaries + Fringe Benefits	**9,090**	**NA**
NWS Personnel		
1.Tim Bardsley	**NA**	~ 80 hours
2.	**NA**	(# of hours)
Travel		
1. Research Trips		
2. Conference Trips		
3. Other		
Total Travel		
Other Direct Costs		
1. Materials & Supplies		**NA**
2. Publication Costs (put in the NWS column if a co-author will be an NWS employee)		
3. Other Data		
4. NWS Computers & Related Hardware	**NA**	
5. Other (specify)		
Total Other Direct Costs		
Indirect Costs		**NA**
1. Indirect Cost Rate	**65%**	
2. Applied to which items?	**GRA salary and fringe benefits**	
Total Indirect Costs	**5,909**	**NA**
Total Costs (Direct + Indirect)	14,999	

DRI Cost Share:

Ben Hatchett	1,913
Fringe Benefits	945
Total Direct Cost	2,858
Total Indirect (waived)	1,858
Total	4,716

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
Western Region Headquarters
125 S. State Street
Salt Lake City, UT 84138

December 15, 2020

MEMORANDUM FOR: COMET Review Team

FROM: Grant Cooper, Ph.D.,
Western Region Director

SUBJECT: Snowmelt Risk Advisory COMET Proposal

I have reviewed the proposal entitled; **"Towards Improved Decision Support for Snow Covered Watershed: A Snowmelt Risk Advisory"** submitted by the Desert Research Institute and WFO Reno.

The proposal addresses an important operational concern regarding the provision of impact-based decision support when rain-on-snow flooding is a potential threat. The project is logical and consistent with the in kind FTE hours requested.

I endorse this proposal.

Grant Cooper, Ph.D.
Western Region Director

NWS Checklist for Submitting a COMET Outreach Proposal

Actions Before Proposal is Submitted to COMET	YES	NO	DATE
1. Did NWS office staff and university staff meet to discuss and form outline and scope of project?	x		10/22/20
2. Did NWS office consult Scientific Services Division (SSD) staff?	x		11/20/20
3. Was Statement of Work and budget formulated as a team effort between university and NWS staffs?	x		10/22/20-11/20/20
4. Was proposal submitted to SSD for review?	x		12/4/20
5. Did SSD forward copies of proposals dealing with WSR-88D data to Radar Operations Center (ROC), Applications Branch Chief for review?	n/a		
6. Did SSD forward copies of proposals dealing with hydrometeorology to the Senior Scientist of National Water Center (under NWS Office of Water Prediction) for review?	x		12/7/20
7. Did SSD review the data request for project to ensure its scope and criticality for proposal?	x		12/7/20
8. Is all data for the project being ordered by NWS offices through the National Center for Environmental Information (NCEI) (ncei.info@noaa.gov) free of charge?	n/a		
9. Does budget include publication charges and travel costs for NWS employees to present results at scientific conferences?	n/a		
10.Does budget separate NWS costs into fiscal year costs and university costs into calendar year costs?	x		11/20/20
11.Does proposal include a separate justification for university hardware purchases which are usually not funded by the COMET Outreach Program?	n/a		
12. Have the following people signed off on the proposal cover sheet: - MIC/HIC? - SSD Chief? - Regional Director?	x		12/3/20 12/9/20 12/15/20
13. Is a letter of endorsement signed by regional director attached?	x		12/15/20

NWS Checklist for Submitting a COMET Outreach Proposal

Actions after Endorsement by NWS	YES	NO	DATE
1. University submits proposal to the COMET Program.	x		12/16/20
2. Proposal acknowledgment letter sent by the COMET Program to submitting university with copies to SSDs and NWS office.			
3. COMET review of proposal (internal review for Partners Project proposals and formal review for Cooperative Project proposals).			
4. The COMET Program sends acceptance, rejection, or modification letters to university with copies to SSD, NWS office, and NWS Office of Science and Technology Integration (OSTI).			
5. The COMET Program allocates funds for university.			
6. OSTI obligates funds for NWS offices.			
7. SSD/NWS office orders data from NCEI.			
8. NWS office or SSD calls OSTI for accounting code for expenses.			
9. NWS office sends copies of all travel vouchers and expense records to OSTI.			
10. NWS office or SSD sends copies of publication page charge forms to OSTI.			
11. NWS office keeps SSD informed of progress on the project and any results or benefits derived from the project.			

NONPROFIT RATE AGREEMENT

EIN:

ORGANIZATION:
Desert Research Institute
2215 Raggio Parkway

Reno, NV 89512

DATE:07/01/2020

FILING REF.: The preceding agreement was dated 07/30/2019

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

SECTION I: INDIRECT COST RATES

RATE TYPES: FIXED FINAL PROV. (PROVISIONAL) PRED. (PREDETERMINED)

EFFECTIVE PERIOD

TYPE	FROM	TO	RATE(%)	LOCATION	APPLICABLE TO
FINAL	07/01/2017	06/30/2018	65.00	On Site	All Programs
FINAL	07/01/2017	06/30/2018	42.00	Off Site	All Programs
PROV.	07/01/2018	06/30/2021			Use same rates and conditions as those cited for fiscal year ending June 30, 2018.

*BASE

Total direct costs excluding capital expenditures (buildings, individual items of equipment; alterations and renovations), that portion of each subaward in excess of $25,000 and flow-through funds.

SECTION I: FRINGE BENEFIT RATES**

TYPE	FROM	TO	RATE(%)	LOCATION	APPLICABLE TO
FIXED	7/1/2019	6/30/2020	47.50	All	Professional
FIXED	7/1/2019	6/30/2020	33.80	All	Post Doctoral
FIXED	7/1/2019	6/30/2020	59.00	All	Technologists
FIXED	7/1/2019	6/30/2020	27.10	All	Graduate Students
FIXED	7/1/2019	6/30/2020	3.80	All	Hourly/Letter of Appointment
FIXED	7/1/2020	6/30/2021	49.40	All	Professional
FIXED	7/1/2020	6/30/2021	33.80	All	Post Doctoral
FIXED	7/1/2020	6/30/2021	46.30	All	Technologists
FIXED	7/1/2020	6/30/2021	33.50	All	Graduate Students
FIXED	7/1/2020	6/30/2021	5.30	All	Hourly/Letter of Appointment
PROV.	7/1/2021	6/30/2024			Use same rates and conditions as those cited for fiscal year ending June 30, 2021.

** DESCRIPTION OF FRINGE BENEFITS RATE BASE:

Salaries and wages excluding vacation, sick leave pay and other paid absences.

SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:

The fringe benefits are charged using the rate(s) listed in the Fringe Benefits Section of this Agreement. The fringe benefits included in the rate(s) are listed below.

TREATMENT OF PAID ABSENCES

The costs of vacation, sick leave pay, and other paid absences are included in the organization's fringe benefit rate and are not included in the direct cost of salaries and wages. Claims for direct salaries and wages must exclude those amounts paid or accrued to employees for periods when they are on vacation, sick leave, or are otherwise absent from work.

OFF-CAMPUS DEFINITION: For all activities performed in facilities not owned by the institution and to which rent is directly allocated to the project(s), the off-campus rate will apply. Actual costs will be apportioned between on-campus and off-campus components. Each portion will bear the appropriate rate.

FRINGE BENEFITS:

FICA	Retirement
Worker's Compensation	Vacation
Health Insurance	Disability Insurance
Unemployment Insurance	Sick Leave
Medicare	Grant-In-Aid

This Rate Agreement reflects new Fringe Benefits Rates only.

The next Fringe Benefit proposal, based on actual costs for the fiscal year ending 06/30/2020, is due in our office by 12/31/2020.

The next F&A proposal, based on actual costs for the fiscal year ending 06/30/2019, is currently under review.

Equipment means tangible personal property (including information technology systems) having a useful life of more than one year and a per-unit acquisition cost which equals or exceeds the lesser of the capitalization level established by the non-Federal entity for financial statement purposes, or $5,000.

SECTION III: GENERAL

A. LIMITATIONS:

The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its indirect cost pool as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as indirect costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:

This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from indirect to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:

If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:

The rates in this Agreement were approved in accordance with the authority in Title 2 of the Code of Federal Regulations, Part 200 (2 CFR 200), and should be applied to grants, contracts and other agreements covered by 2 CFR 200, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:

If any Federal contract, grant or other agreement is reimbursing indirect costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of indirect costs allocable to these programs.

BY THE INSTITUTION:	ON BEHALF OF THE FEDERAL GOVERNMENT:
Desert Research Institute	DEPARTMENT OF HEALTH AND HUMAN SERVICES
(INSTITUTION)	(AGENCY)
(SIGNATURE)	(SIGNATURE)
Lindsay Sessions	Arif Karim
(NAME)	(NAME)
Controller	Director, Cost Allocation Services
(TITLE)	(TITLE)
7/9/20	7/1/2020
(DATE)	(DATE) 2701

HHS REPRESENTATIVE: Theodore Foster

Telephone: (214) 767-3261