Additional Reporting Requirements

Metrics. Performance metrics for the SSCZO fall under three categories: output metrics, outcome metrics, and impact metrics. Output metrics include the publication of data and results online in our digital library and through peer-reviewed publications. The amount of data and number of publications are tracked.

During the past year the core SSCZO team had 34 journal papers citing the SSCZO published and in review in leading peer-reviewed journals. This does not include papers by SSCZO cooperators. SSCZO research was also highlighted by team members in presentations at many conferences over the past year, and many more seminars and public talks. We are implementing tracking for publications by collaborating and cooperating investigators, but those data are not yet available. In the past year, we know of at least two peer-reviewed articles published using data obtained from SSCZO that do not list any SSCZO core team members as authors (Webb et al., 2015; Chen et al., 2016).

Data are housed in an online digital library that is hosted on UC Merced servers and also accessible through the new website portals. Core measurements, including water-balance instrument clusters, soil-moisture and flux-tower data, are posted in raw format promptly after retrieval from the field. Processed data, including full QA/QC procedures are posted at least annually for core measurements. SSCZO staff (the data manager and the field manager) help coordinate the compilation of data and appropriate metadata in the digital library. In accordance with the cross-CZO data-management policy, data from all projects will be posted within two years, with the possibility of restricting access for a third year if needed by the investigator for the purposes of publishing. During the last year we met these goals. Most core data underwent quality assurance and quality control and were posted within a few months after the end of the water year. We published the first five years of CZO data in a perpetual archive, and have a doi assigned.

As part of our effort to measure *outcomes*, we tracked citations of our peer-reviewed papers, use of our data, and online reach. We also track the number of scientists interested in coordinating with the SSCZO. As listed above, there are more than 25 collaborators working on active projects or pursuing new projects with the SSCZO team.

The depth and breadth of our reach online is tracked through several metrics, including use of our data from Google Analytics for our main website, tracking activity on Twitter and Facebook, and the use of data from the digital library. As an online resource, the Sierra Nevada-San Joaquin Hydrologic Observatory (SNSJHO) digital library is accessed not only by SSCZO team members but also by the broader population of researchers online. We now have a several dozen registered users for SSCZO data on the digital library; eight of those users registered since our last annual team meeting. Note that many of our data are public, and it is not necessary to register to access those data.

Since we started tracking website activity with Google Analytics in September 2013, we have had more than 62,200 page views, 10,760 unique visitors, and an average site visit time of 4:00. This year's highest month of site activity was in April 2016, when 802 individual sessions occurred on SSCZO website, from 567 individual users; we garnered heightened, national attention in April when articles featuring SSCZO were published in The New York Times, The Desert Sun, and USA Today. The Southern Sierra CZO is maintaining a Facebook page, with 72 likes. Through Twitter, the SSCZO connects with other observatories, researchers, and organizations interested in critical zone science. Since the SSCZO Twitter account was created in 2013, we have gained 290 followers and have posted a total of 549 tweets. In the past year, we have gained 168 new followers and 3,743 profile visits, and generated over 60,000 tweet impressions. Since starting in Dec 2014, SSCZO PI R. Bales has sent 931 tweets and has 730

followers. Several other SSCZO colleagues use twitter and post tweets relevant to SSCZO, including new SSCZO presentations and publications.

We conducted a RHESSys training workshop using CZO data for Ph.D. students from multiple universities, which focused on implementing the model to investigate forest management and climate change impacts on watershed hydrology.

We also track the adoption of our technology at other sites. The wireless sensor network developed at the SSCZO has been implemented in the American River Basin project west of Lake Tahoe. Work completed in 2014 included instrumentation at 14 sites in the American River Basin project. In summer 2016 we initiated installation of 3 instrument clusters in the Feather R. basin, in collaboration with Pacific Gas & Electric. We are also working with the California Department of Water Resources to develop broader plans for soil-water, snowpack and energy-balance sensor networks. Further proposals to expand these systems are pending with state and local agencies.

Impacts include better decision making because of our research findings, and improvements to the research process. To achieve broader impacts, we have developed an extensive dissemination network. Our dissemination strategy reaches stakeholders and resource managers as well as researchers. To that end, we have published opinion pieces in local newspapers, produced video and radio segments through collaborations with regional television and radio stations, presented at numerous stakeholder meetings, and hosted visits to our field sites and laboratories. We have communicated with everyone from foresters and other resource managers, to legislative staff and policy makers at the state and Federal level. In aggregate, SSCZO investigators average at least bi-weekly presentations to public audiences.

We have employed evaluation forms to assess multiple events. Among these are the 2015 Annual Meeting, and visiting researchers. Feedback from the 2015 Annual Meeting has directly informed agenda structure and logistics for the 2016 meeting. Response rate from visiting researchers is low. We also have, for the first time, used program evaluation forms in our ongoing high school field research partnership with the Center for Advanced Research and Technology. Survey feedback will be analyzed this summer, with two-fold potential to improve future programming and to evaluate impacts of the research project on participants. Evaluation forms were also administered by Merced County Office of Education to TEAM-E participants; a report of teachers' survey results will be shared with SSCZO in the coming months.

CZO network activities. Cross-CZO work was used to finalize a method using LiDAR data, computer vision, and machine learning to optimally configure multi-node snow observatories. We gathered data from Jemez River and Boulder Creek CZOs to examine the effect of site physiographic variables on the optimal number and distribution of sensor nodes. We use snow on / snow off LiDAR data to determine site-specific correlations with independent physiographic variables. Optimal sensor locations at each CZO were determined using the expected values from a Gaussian Mixture Model applied to the site data.

A CZO National Office-funded proposal by E. Aronson (SSCZO), Rachel Gallery (CJCZO), and S. Hart (SSCZO) supported a CZO Biogeochemistry Workshop in fall 2016 at UC Riverside. Goals will be to agree upon and address a set of cross-CZO questions, with future cross-CZO sampling to test and validate these conceptual models. Participants were recruited through the CZO PI network and through recommended international participants.

SSCZO team members are also participating in other cross-CZO working groups and workshops. R. Bales and M. Conklin participated in the critical-zone services working group meeting hosted by the Luquillo CZO at UC Berkeley in January. Plans were made during this past year for several meetings in fall 2015.

C. Tague and colleagues received a National Socio-Environmental Synthesis Center grant that is supporting a two-year working group on integrating economic and biophysical models to examine pre- and post- ecosystem service impacts of wildfire and fuel treatment using several Western U.S. case-study sites, including the Sierra CZO. Work by B. Kastl and C.Tague involves investigating how science-based model presentation influences the way stakeholders understand the complex watershed dynamics studied by scientists at the CZO. The SESYNC working group involves forest managers from agencies as well as communication expertise through COMPASS (compassonline.org), a group that specializes in science based communication for the public.

CZO program budgets. See attached budget summary.

Additional funding. CZO investigators routinely leverage funding to support students and postdocs, install equipment, engage collaborators and initiate complementary research. All of the students listed above were supported at least in part by non-CZO funds, and most were largely supported by non-CZO funds. Leveraging with the USDA Forest Service is also important, and the SSCZO is in part co-located with Forest Service research programs. UC Merced provided institutional support for four incoming graduate students last year. The U.S. Forest Service provides a budget of several hundred thousand dollars per year for the streamflow, met station and stream geochemical measurements and data, as well as some vegetation surveys used by the CZO team and collaborators. The U.S. Forest Service and UC Merced also jointly supported a research scientist whose main focus was on the SSCZO, and the co-located Kings River Experimental Watersheds program.

Southern Sierra CZO Carryover Report, based on encumbrances. Does not include projected expenses in budget report that are not yet encumbered.

	Cost Element	YR1 Sponsor Approved Budget	YR1 Supplemental Funds: REU & All-Hands	YR1 Expenses as of 9/30/2014	YR1 Carryforward	YR2 Sponsor Approved Budget	YR2 Budgeted + YR1 Carryforward	Y2 Expenses as of 9/30/2015	YR2 Carryforward	YR3 Sponsor Approved Budget	YR3 Budgeted + YR2 Carryforward	Y3 Expenses as of 5/31/2016	Year 3 Projections + Commitments through 9/30/2016	YR3 Projected Carryforward
Senior Personnel														
A.1	Principal Investigator Bales	25,472	-	15,592	9,880	26,235	36,115	28,175	7,940	27,022	34,962	-	32,217	2,745
A.2	Co-Investigator Conklin	11,922	-	12,522	(600)	12,280	11,680	6,261	5,419	12,648	18,067	-	9,575	8,492
A.3	Co-Investigator Hart	6,489	-	6,617	(128)	6,683	6,555	6,817	(261)	6,884	6,623	-	6,950	(327)
A.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A.7	Total Personnel	**43,883**	**-**	**34,731**	**9,152**	**45,198**	**54,350**	**41,253**	**13,097**	**46,554**	**59,651**	**-**	**48,742**	**10,910**
Other Personnel														
B.1	Post-Docs	-	-	-	-	-	-	-	-	-	-	-	-	-
B.2	Other Professionals	154,831	-	99,745	55,086	175,024	230,110	118,726	111,384	171,581	282,965	102,694	53,951	126,320
B.3	Graduate Students	-	-	-	-	-	-	29,687	(29,687)	26,225	(3,462)	9,841	4,399	(17,702)
B.4	Undergraduate Students	7,725	-	7,121	604	7,957	8,561	8,443	118	8,195	8,313	2,218	20,707	(14,612)
B.5	Clerical	-	-	-	-	-	-	-	-	-	-		-	-
B.6	Other	-	4,415	3,172	1,243	-	1,243	749	494	-	494	-	-	494
Total Salaries and Wages		**206,439**	**4,415**	**144,769**	**66,085**	**228,179**	**294,264**	**198,858**	**95,407**	**252,555**	**347,962**	**114,753**	**127,799**	**105,410**
C.	Fringe Benefits	59,126	1,545	46,428	14,243	66,342	80,585	60,401	20,184	65,656	85,840	43,678	30,159	12,003
Total Salaries, Wages, and Fringe		**265,565**	**5,960**	**191,197**	**80,328**	**294,521**	**374,849**	**259,259**	**115,591**	**318,211**	**433,802**	**158,431**	**157,958**	**117,413**
D.	Equipment Replacement	27,311	-	17,429	9,882	8,000	17,882	31,197	(13,314)	19,689	6,375	710	-	5,664
	Tower Rebuild	30,000	-	-	30,000	-	30,000	-	30,000	-	30,000	-	-	30,000
Total Equipment		**57,311**	**-**	**17,429**	**39,882**	**8,000**	**47,882**	**31,197**	**16,686**	**19,689**	**36,375**	**710**	**-**	**35,664**
E.1	Domestic Travel	18,048	-	3,992	14,056	23,748	37,804	16,708	21,096	17,848	38,944	18,126	1,167	19,651
E.2	Foreign Travel	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Travel		**18,048**	**-**	**3,992**	**14,056**	**23,748**	**37,804**	**16,708**	**21,096**	**17,848**	**38,944**	**18,126**	**1,167**	**19,651**
F.1	PS Stipends	-	10,000	10,000	-	-	-	-	-	-	-	-	-	-
F.2	PS Travel	-	94,290	1,116	93,174	-	93,174	55,934	37,240	-	37,240	375	-	36,865
F.3	PS Subsistence	-	54,825	-	54,825	-	54,825	64,913	(10,088)	-	(10,088)	-	-	(10,088)
F.4	PS Other	8,000	50,949	8,990	49,959	2,000	51,959	50,425	1,533	8,500	10,033	473	-	9,560
Total Participant Support		**8,000**	**210,064**	**20,106**	**197,958**	**2,000**	**199,958**	**171,272**	**28,685**	**8,500**	**37,185**	**848**	**-**	**36,337**
G.1	Materials and Supplies	21,362	1,027	6,653	15,736	21,020	36,756	13,830	22,926	23,404	46,330	16,890	4,712	24,728
G.2	Publication Costs	1,200	-	-	1,200	1,200	2,400	1,009	1,391	1,200	2,591	-	-	2,591
G.3	Consultant Svcs	-	-	-	-	-	-	-	-	-	-	-	-	-
G.4	Computer Services	-	-	-	-	-	-	-	-	-	-	-	-	-
G.5	Subawards	312,719	-	246,114	66,605	461,142	527,747	297,032	230,714	336,420	567,134	355,060	17,520	194,554
G.6	Other (Drilling Subcontract, GSR Fe	60,000	3,040	103	62,937	-	62,937	8,220	54,718	21,685	76,403	27,331	-	49,072
Total Direct Costs		**395,281**	**4,067**	**252,869**	**146,479**	**483,362**	**629,841**	**320,091**	**309,750**	**382,709**	**692,459**	**399,281**	**22,232**	**270,946**
H.	**Total Direct Costs**	**744,205**	**220,091**	**485,592**	**478,704**	**811,631**	**1,290,335**	**798,527**	**491,808**	**746,957**	**1,238,765**	**577,397**	**181,357**	**480,010**
I.	**Indirect Costs**	**205,796**	**2,607**	**114,652**	**93,751**	**188,369**	**282,120**	**159,511**	**122,609**	**203,040**	**325,649**	**117,107**	**90,110**	**118,431**
J.	**Total Direct & Indirect Costs**	**950,001**	**222,698**	**600,245**	**572,454**	**1,000,000**	**1,572,454**	**958,039**	**614,415**	**949,997**	**1,564,412**	**694,504**	**271,467**	**598,441**
K.	**Residual Funds**	-	-	-	-	-	-	-	-	-		-	-	-
L.	**Amount of Request**	**950,001**	**222,698**	**600,245**	**572,454**	**1,000,000**	**1,572,454**	**958,039**	**614,415**	**949,997**	**1,564,412**	**694,504**	**271,467**	**598,441**

This carryover report also includes supplemental funds not reflected in the budget report.

Project Title: Southern Sierra Critical Zone Observatory
NSF Award No.: EAR-1331939
Principal Investigator: Dr. Roger Bales
Period of Performance: October 1st, 2013 - September 30th, 2018

Cumulative Year 1, Year 2 and Year 3

CZO-Core/Main					
Budget Element	**Budgeted**	**Current Expenditures**	**Commitments through 9/30/2016**	**Balance**	
Participant Costs	**20,130**	**12,894**	**-**	**7,236**	Annual Meeting + AGU Meeting
Cross-Site Modeling Meetings, Seed Funding, PI Meetings					
Subcontracts*	**1,132,398**	**898,206**	**17,520**	**216,672**	Billing through end of year 3 will use this balance
UC Berkeley, UC Irvine, UC Davis, UC Santa Barbara, Univeristy of Wyoming					
Other Direct Costs	**60,000**	**22,368**	**-**	**37,632**	Drilling postponed evaluating results from this year
Drilling Subcontract					
Indirect Costs	**44,071**	**19,394**	**-**	**24,677**	
Account Total	**1,256,599**	**952,862**	**17,520**	**286,217**	

CZO-Project Integration and Management					
Budget Element	**Budgeted**	**Current Expenditures**	**Commitments through 9/30/2016**	**Balance**	
Senior Personnel	**416,671**	**312,382**	**58,982**	**45,307**	Postdoc offer pending (partial salary)
Principal Investigator, Data Manager, Research Engineer, Undergraduate Asst.					
Fringe Benefits	**128,584**	**115,727**	**18,291**	**(5,434)**	Balance from Education & Outreach
Equipment	**85,000**	**49,336**	**-**	**35,664**	Upgrade of water-balance instrument
Tower Rebuild, Equipment Replacement					cluster in progress
Domestic Travel	**22,944**	**19,540**	**516**	**2,888**	For summer/fall 2016
Travel to Field-Site & Meetings					
Other Direct Costs	**30,300**	**19,330**	**1,720**	**9,250**	Startup costs for postdoc, repair field
Supplies, Teleconferences, Battery Replarement, Equipment Calibration, Snowmobile E					sensors, publication costs
Indirect Costs	**329,177**	**252,939**	**43,730**	**32,508**	
Account Total	**1,012,676**	**769,254**	**123,239**	**120,183**	

CZO-Education and Outreach					
Budget Element	**Budgeted**	**Current Expenditures**	**Commitments through 9/30/2016**	**Balance**	
Senior Personnel	**160,084**	**71,228**	**29,536**	**59,320**	Postdoc offer pending (partial salary)
Co-Investigator, Staff					
Fringe Benefits	**51,608**	**29,305**	**9,302**	**13,001**	Postdoc offer pending (partial salary)
Domestic Travel	**4,800**	**9,256**	**387**	**(4,843)**	Balance from Research
Travel to Field-Site & Meetings					
Other Direct Costs	**5,100**	**6,121**	**1,428**	**(2,449)**	Balance from Project Integration &
Supplies, Teleconferences					Management
Indirect Costs	**121,876**	**63,751**	**22,359**	**35,766**	
Account Total	**343,468**	**179,661**	**63,011**	**100,796**	

CZO-Research, UC Merced					
Budget Element	**Budgeted**	**Current Expenditures**	**Commitments through 9/30/2016**	**Balance**	
Senior Personnel	**108,566**	**70,848**	**39,281**	**(1,563)**	
Principal Investigator					
Fringe Benefits	**34,298**	**16,935**	**2,566**	**14,797**	Postdoc offer pending (partial salary)
Domestic Travel	**22,346**	**10,031**	**264**	**12,051**	For summer/fall 2016
Travel to Field-Site & Meetings					
Other Direct Costs	**29,532**	**12,828**	**1,564**	**15,140**	Publication costs, field research
Supplies, Teleconferences, Publication Costs					expenses for summer/fall 2016
Indirect Costs	**92,511**	**53,603**	**24,021**	**14,887**	
Account Total	**287,253**	**164,245**	**67,696**	**55,312**	

PROJECT TOTALS	**2,899,996**	**2,066,022**	**271,466**	**562,508**