

Technical Report: XSEDE Return on Investment Data and Analysis, 2015-2017

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1. Introduction

In an effort to develop an understanding of return on investment (ROI) for National Science Foundation funding provided to the XSEDE supercomputing support ecosystem, a longitudinal study based on annual surveys was started in 2015. This report outlines the results of the study to date.

ROI is understood to be the ratio of value generated from an activity to value of assets used to perform that activity. When this ratio is greater than 1, the net return is more than the value of assets used, and is therefore a profitable activity. As applied to investments in cyberinfrastructure, “value” may be defined in many ways. On the investment side, value can be measured as the funding put into providing services to be consumed. On the return side, value is determined via output measures such as productivity of the user community, efficiency represented by user uptake of shared services, efficiency in conducting research, user satisfaction, and cost avoidance of users inefficiently spending their own funds to provision and consume similar resources.

The overall approach taken was to define stakeholder groups of users based on the services they consumed, identify costs associated with the production of those services, and establish a basis for valuing the actual consumption of those services versus an alternative. For instance, an investigator may consume a specific amount of training expressed as hours. The cost for offering this training can be expressed as the total cost for the service divided by the total units of service (hours) delivered. Costing for a hypothetical alternative for which investigators could pay instead of using the XSEDE service can be established using commercial benchmarks.

In this study the components of ROI are defined as:

1. Investments or costs related to providing specific XSEDE services,
2. Returns related to user satisfaction, or perceived value of XSEDE services to users versus not having the services, and
 - a. utility of the services as measured by usage,
 - b. cost avoidance based on end-user estimates of time spent in training provided by XSEDE (the “alternative” value discussed in the paragraph above)

As a general note, the methodology for data collection is maturing and becoming more complete year by year. Also, the instruments ask respondents to provide fundamental measures of consumption, such as hours of service consumed or delivered. These measures are independent of a broad range of approaches for valuation, so the longitudinal utility of the study data is preserved even when some assumptions in valuation computations may need to be changed in the future, or different valuation models applied.

2. Methodology

In order to measure investment and return related to XSEDE services, a series of survey instruments were designed to collect relevant measures, and were issued to provider and user stakeholders annually in 2015, 2016 and 2017.

Stakeholders were identified:

1. Service Providers – Institutions funded by the NSF to provide XSEDE services
2. End-user Investigators who used Extended Support Services (ECSS) to develop specific research solutions using XSEDE facilities
3. End-user Investigators with XSEDE allocations

Input (or “investment”) measures for specific stakeholder groups were selected:

1. End-users: In-person training - Total hours of training delivered (session length x participants) x \$11.29 per hour (cost for training for a reference service)
2. End-users: Online training – Total hours of training consumed x \$4.62 per hour (cost for a reference on-demand basic web development class)

Return measures per stakeholder group were selected:

1. Investigators with XSEDE allocations
 - a. Usage of in-person training - Total hours of training delivered (session length x participants) x \$11.29 per hour (cost for training for a reference service)
 - b. Perceived value of in-person training
 - c. Usage of on-line training – Total hours of training consumed x \$4.62 per hour (cost for on-demand basic web development class from Udemy)
 - d. Perceived value of on-line training
 - e. Perceived time savings through the use of XSEDE service - number of hours of stakeholders’ time that use of XSEDE saved them; calculated return based on an average estimated value of \$50 per hour across all user type
2. Investigators using ECSS services
 - a. Number of person-months that they estimate they saved as a result of use of ECSS services multiplied by the average per-month cost of XSEDE ECSS staff

Table 1 summarizes the stakeholder groups, input measures, and output measures defined in this study.

Table 1. Summary of stakeholders and valuations

Stakeholder group	Services evaluated	Role of measure (investment or return)	Measures used for valuation
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Service Providers	Services provided by XSEDE to SPs	investment	Surveyed SPs to determine how many person-months they believe XSEDE services cost them; calculated value based on actual average cost per relevant group of XSEDE staff
Investigators	Usage of XSEDE services	return	
Investigators	Perceived value of XSEDE	return	Surveyed end users regarding the number of hours of their own time that use of XSEDE saved them; calculated return based on an average estimated value of \$50 per hour across all user types
Investigators	In-person training	return	Total hours of training delivered (session length x participants) x \$11.29 per hour (cost for training from Fred Pryor on use of spreadsheet software [2])
Investigators	Online training	return	Total hours consumed x \$4.62 per hour (cost for on-demand basic web development class from Udemy [1])
Investigators using ECSS services	Consulting and programming	return	Surveyed PIs to determine the number of person-months that they estimate they saved as a result of use of ECSS services; costed at the average per month cost of XSEDE ECSS staff

2.1. Instruments for Service Providers

XSEDE Service Providers fall in to three groups: Level 1 (5 sites), facilities located at primary supercomputer centers funded by the NSF and dedicated to providing XSEDE services (e.g., Comet at San Diego Supercomputer Center, Stampede II, etc. at Texas Advanced Computing Center, Bridges at the Pittsburgh Supercomputer Center, and Jetstream at Indiana University); Level 2 (9 sites), facilities that provide some of their services through XSEDE; and Level 3 (24 sites), facilities that are listed as potentially usable by XSEDE investigators.

The target audience for Service Provider surveys is the leadership of the facilities belonging to the XSEDE Service Provider Forum. (See <https://www.xsede.org/about/governance/spf>)

The two instruments used for Service Providers are contained in Appendices III and IV, for Project Years 4 and 5, and Project Year 6:

- For 2015 and 2016 - XSEDE SP Return on Investment Assessment PY4 and PY5 Data Collection Instrument (Appendix III)
- For 2017 - XSEDE SP Return on Investment Assessment PY6 Data Collection Instrument (Appendix IV)

The differences between the two instruments are the date ranges that users were asked to consider in forming their answers. All other questions and descriptive text are the same.

The aim of the surveys was to:

- Establish classification of the SP respondents into Levels 1-3
- Determine time that an SP respondent was active during a given project year or years
- Assess quantitatively the value of XSEDE activities to the SP respondent, expressed in terms of effort equivalents
- Assess quantitatively the value of XSEDE activities to the SP respondent, expressed in terms of replacement cost
- Assess qualitatively the value of XSEDE to the SP respondent
- Solicit textual replies regarding elements the respondent found useful, and changes the respondent would like to see

2.2. Instrument for XSEDE Investigators and ECSS users

Appendix I contains the “XSEDE Return on Investment Micro Survey” sent to investigators with XSEDE allocations. The aim of this instrument was to determine the extent to which individual XSEDE allocation holders used XSEDE services, and how satisfied, overall, they were with those services. In addition, this instrument was used to identify users who took advantage of ECSS services, and estimate time savings as a result of using ECSS.

3. Results and Analysis

The XSEDE survey instrument included general satisfaction questions, and questions aimed at the sub-group of XSEDE allocation Principal Investigators who self-identified as users of ECSS services.

For the XSEDE survey instrument included in Appendix I, there were 354 responses to 1686 requests of XSEDE allocation Principal Investigators. De-identified responses are included in Appendix II. Some of the responses were redacted because of the presence of identifying information in comments or other fields.

Basic statistics for this survey:

Question	Average	Minimum	Maximum	Standard deviation	Count "yes"	Count "no"
Q1: How many hours do you estimate that you have accessed training resources via XSEDE?	520.2	0.0	50000.0	5364.6		

Q2: Have you run a job on XSEDE computation, storage, and/or visualization resources?					331	20
Q3: How many hours of your time have been saved by the XSEDE ticket system?	499.7	0.0	50000.0	5099.8		
Q4: Receive help from ECSS?					64	273
Q5: How many hours would have taken to complete the work without ECSS?	18539.4	0.0	999999.0	176814.6		
Q6: Not possible to complete work without ECSS?					44	
Q7: Productivity gain per year	40.9	0.0	5000.0	415.6		

In order to determine and evaluate the “investment” part of the ROI equation, a second survey instrument was sent to XSEDE Service Providers at three levels: Level 1, or primary NSF funded sites; Level 2, or sites with some NSF funded resources that have been dedicated to XSEDE; and Level 3 sites, with services provided “voluntarily” to the XSEDE community. Summary statistics for these provider surveys for all SP types in are included in Appendix III, and further summarized and costed in the tables below on pages 7-10.

PY4 Service Provider ROI Analysis

XSEDE Project Year 4				Level 1 Service Providers					Level 2 Service Providers					Level 3 Service Providers				
Resource	Actual Cost/FTE (in dollars)	Budgeted FTEs	Total Resource Budget	Average FTEs/SP	SPs Responding	Total Value per SP (in dollars)	Total Value for Responding L1 SPs	Total Value for All L1 SPs (extrapolated) N=5	Average FTEs/SP	SPs Responding	Total Value per L2 SP (in dollars)	Total Value for Responding L2 SPs	Total Value for All L2 SPs (in dollars), extrapolated, N=5	Average FTEs/SP	SPs Responding	Total Value per L3 SP (in dollars)	Total Value for Responding L3 SPs (in dollars)	Total Value for All L3 SPs (in dollars), extrapolated, N=7
Allocations	209,302	2.15	450,000	2.33	3	488,372	1,465,116	2,441,860	0.13	4	26,163	104,651	130,814	0.33	3	69,767	209,302.33	488,372.09
Account Management and Authentication Services	200,000	2.85	570,000	0.90	3	180,000	540,000	900,000	0.09	4	17,500	70,000	87,500	0.00	3	0	0.00	0.00
24x7 Operations	196,593	19.99	3,930,000	1.67	3	327,656	982,967	1,638,278	0.03	4	4,915	19,659	24,574	0.00	3	0	0.00	0.00
Ticket Support	196,593	*	*	1.03	3	203,146	609,439	1,015,732	0.03	4	4,915	19,659	24,574	0.00	3	0	0.00	0.00
User Survey	237,950	1.31	311,000	0.18	3	43,624	130,872	218,120	0.01	4	2,974	11,897	14,872	0.00	3	0	0.00	0.00
Leadership	221,021	6.66	1,472,000	0.25	3	55,255	165,766	276,276	0.09	4	19,339	77,357	96,697	0.09	4	19,339	77,357.36	135,375.38
Project Management and Financial Functions	200,000	4.50	900,000	0.50	3	100,000	300,000	500,000	0.05	4	10,000	40,000	50,000	0.00	3	0	0.00	0.00
User Information Services, including XSEDE.org	200,000	6.36	1,272,000	0.45	3	90,000	270,000	450,000	0.00	4	0	0	0	0.03	3	6,667	20,000.00	46,666.67
Training and Education	218,903	6.51	1,425,056	0.75	3	164,177	492,531	820,885	0.38	4	82,088	328,354	410,442	0.17	5	37,213	186,067.22	260,494.11
Outreach	236,713	9.53	2,255,875	0.92	3	216,987	650,961	1,084,935	0.03	4	5,918	23,671	29,589	0.05	4	11,836	47,342.60	82,849.55
Network	196,593	*	*	0.23	3	45,872	137,615	229,359	0.03	5	5,898	29,489	29,489	0.00	3	0	0.00	0.00
Systems Engineering and Deployment	201,020	17.83	3,585,000	0.33	3	67,007	201,020	335,033	0.15	4	30,153	120,612	150,765	0.00	3	0	0.00	0.00
Parallel Computing Support, Advanced Support, Consultation, and Programming	207,008	35.71	7,392,000	5.83	3	1,207,547	3,622,642	6,037,736	0.31	4	64,690	258,760	323,450	0.00	3	0	0.00	0.00



(e.g., value of ECSS to your SP)

* FTEs and budgets for Network and Ticket Support services are included in the Operations budget line

	23,562,931	15.38		9,568,929	15,948,215	1.31		1,104,111	1,372,766	0.67		540,069.50	1,013,757.80
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**PY5 Service Provider
ROI Analysis**

XSEDE Project Year 5				Level 1 Service Providers					Level 2 Service Providers					Level 3 Service Providers				
Resource	Actual Cost/FTE (in dollars)	Budgeted FTEs	Total Resource Budget	Average FTEs/SP	SPs Responding	Total Value per L1 SP (in dollars)	Total Value for Responding L1 SPs (in dollars)	Total Value for All L1 SPs (in dollars), extrapolated, N=5	Average FTEs/SP	SPs Responding	Total Value per L2 SP (in dollars)	Total Value for Responding L2 SPs (in dollars)	Total Value for All L2 SPs (in dollars), extrapolated, N=5	Average FTEs/SP	SPs Responding	Total Value per L3 SP (in dollars)	Total Value for Responding L3 SPs	Total Value for All L3 SPs (in dollars) extrapolated, N=7
Allocations	209,302	2.15	450,000	1.81	4	379,360	1,517,442	1,896,802	0.13	4	26,163	104,651	130,814	0.25	4	52,326	209,302.33	366,279.07
Account Management and Authentication Services	200,000	2.85	570,000	0.80	4	160,000	640,000	800,000	0.09	4	17,500	70,000	87,500	0.00	5	0	0.00	0.00
24x7 Operations	216,739	18.40	3,988,000	1.67	3	361,232	1,083,696	1,806,159	0.03	4	5,418	21,674	27,092	0.00	5	0	0.00	0.00
Ticket Support	216,739	*	*	0.96	4	208,611	834,446	1,043,057	0.03	4	5,418	21,674	27,092	0.00	5	0	0.00	0.00
User Survey	237,405	1.31	311,000	0.20	4	47,481	189,924	237,405	0.01	4	2,968	11,870	14,838	0.02	5	4,748	23,740.46	33,236.64
Leadership	214,031	7.12	1,523,903	0.21	4	45,482	181,927	227,408	0.09	4	18,728	74,911	93,639	0.13	6	28,538	171,225.08	199,762.60
Project Management and Financial Functions	200,020	4.81	962,097	0.50	3	100,010	300,030	500,050	0.05	4	10,001	40,004	50,005	0.00	5	0	0.00	0.00
User Information Services, including XSEDE.org	200,000	6.00	1,200,000	0.40	4	80,000	320,000	400,000	0.00	4	0	0	0	0.06	5	12,000	60,000.00	84,000.00
Training and Education	218,045	6.65	1,450,000	0.59	4	128,102	512,406	640,508	0.38	4	81,767	327,068	408,835	0.17	7	37,379	261,654.14	261,654.14
Outreach	238,512	9.14	2,180,000	0.71	4	169,940	679,759	849,699	0.03	4	5,963	23,851	29,814	0.05	6	11,926	71,553.61	83,479.21
Network	216,739	*	*	0.18	4	37,929	151,717	189,647	0.03	5	6,502	32,511	32,511	0.00	5	0	0.00	0.00
Systems Engineering and Deployment	201,114	15.26	3,069,000	0.28	4	55,306	221,225	276,532	0.15	4	30,167	120,668	150,836	0.10	5	20,111	100,557.01	140,779.82

Parallel Computing Support, Advanced Support, Consultation, and Programming (e.g., value of ECSS to your SP)	207,000	35.57	7,363,000	4.38	4	905,626	3,622,505	4,528,131	0.31	4	64,688	258,750	323,438	0.05	5	10,350	51,750.07	72,450.10
* FTEs and budgets for Network and Ticket Support services are included in the Operations budget line		109.26	23,067,000		12.68													10,255,077

4. Appendices

4.1. Appendix I - XSEDE Return on Investment Micro Survey Instrument

XSEDE Return on Investment Micro Survey

1. Since the beginning of XSEDE Project Year 5 (July 1, 2015), how many hours do you estimate that you have accessed training resources via XSEDE? (In this case, **accessed** can mean downloading, reading, or watching online, or attending in-person).

[Open text]

2. Since the beginning of XSEDE Project Year 5 (July 1, 2015), have you run a job on XSEDE computation, storage and/or visualization resources?

- Yes (go to #3)
- No (go to #6)

3. Since the beginning of Project Year 5 (July 1, 2015), how many hours of your time (or that of your staff, graduate students and/or colleagues) would you estimate have been saved by XSEDE staff resolving operational, trouble-shooting, and/or system-related issues via the XSEDE ticket system?

[Open text]

4. Have you received help from XSEDE Extended Collaborative Support Services (ECSS) during Project Year 5 (since July 1, 2015)?

- Yes (go to #5)
- No (go to #6)

5. Since the beginning of XSEDE Project Year 5 (July 1, 2015), how many hours of your time (or that of your staff, graduate students, and/or colleagues) do you estimate it would have taken to complete the work without the help of XSEDE ECSS staff?

[Open text]

- Please check here if it would not have been possible for you to have completed the work without assistance from XSEDE ECSS.

6. Considering all of the XSEDE resources and services that you use, what do you estimate is your overall productivity gain per year? Please express your response in the **nearest full-week increment**.

7.

[two-character open text box]

8. Please share any comments you have about the value to you of XSEDE resources and services in Project Year 5?

[Open text]

9. If necessary, may we contact you regarding your comments?

- Yes
 No

[End Page]

Thank you for participating in the XSEDE Return on Investment Micro Survey.

All survey questions are optional and your answers are confidential. Data will be reported in aggregate without identifying information that you choose to, or inadvertently, disclose.

For questions about this survey, including problems with accessing the survey, please contact cesg@iu.edu and reference Protocol # 1301010398/Exempt.

4.2. Appendix II - XSEDE Return on Investment Micro Survey Results (Names redacted)

Q1: How many hours do you estimate that you have accessed training resources via XSEDE?	Q2: Have you run a job on XSEDE computation, storage and/or visualization resources?	Q3: How many hours of your time have been saved by the XSEDE ticket system?	Q4: Receive help from ECSS?	Q5: How many hours would have taken to complete the work without ECSS?	Q6: Not possible to complete work without ECSS?	Q7: Productivity gain per year	Q8: Comments on Resources and Services	Q9: May we contact you
1	no		yes		Required ECSS Assistance		I would not have been able to do this project without these resources.	no
48	no		no			2		no
1	no					1000	I've just started with a StartUp allocation, and will give more feedback later.	no
0	no					0	This was an SP staff project, used rarely for some system testing purposes.	no
0	no					26	It is a bit difficult to estimate productivity gain in the question 6 because my project would not have been possible without the resources of XSEDE. The resources that I had access to would have taken almost two years to accomplish what XSEDE will accomplish in a few weeks.	yes
0	no					4	I just received a first startup allocation, and am too new to the system to have any useful feedback	yes

0	no					26	I used 26 weeks because the XSEDE resources allow my group to do simulations that we could not do otherwise. Without these simulations, the 26 weeks of my year that are spend on research that are based on those simulations would not be possible.	yes
10	no		no			4	Training is most valuable, access to systems is also great for demonstrating/teaching to faculty.	yes
2	no	10	yes		Required ECSS Assistance			yes
20-Oct	no						I am currently (Summer 2016) working on my project and plan to run a job on XSEDE computation, and storage soon.	yes
0	no	0	no			0	I just started using XSEDE so I don't have any experience or comments. That's why all my answers to the previous questions are essentially 0.	yes
0	no						I do not understand question 6. Also, I answered this question for myself. Not for my lab. I don't use the resources myself, but my lab does. Perhaps these questions could be rewritten?	yes
4	no					8	The resources and services greatly facilitated research in my group.	yes

10	no					100%	XSEDE is the only resource we have to run our programs on a supercomputer. At the University of Oregon we have one cloud computer, but it is overbooked and its performance is no way even near to the performance of the supercomputers available to us through XSEDE. Without XSEDE support I would have to look into other possible supercomputer resources out of campus.	yes
3	no					8		yes
0	no					100%	This is an unusual year. For many years we have had large allocations of CPU time on XSEDE computers. This year we have only tape storage. However, it is extremely valuable as it preserves very large investments in creating our valuable data sets. We expect to make use of XSEDE CPU resources next year.	yes

15 hours	no						<p>I was not sure how to answer Question 6 above and this may be because I have not yet used my account, having been awarded the grant/access in April 2016, and for this reason, I did not answer the question.</p> <p>The value and benefits of XSEDE resources and services to me in Project Year 5 (and by this I assuming I am referring to 5 years from now) should be immense. I am focusing on using these resources to become an expert in using the Galaxy platform, and use the various tools this platform offers to do bioinformatics analysis on dog NGS/MPS data initially, because I work in a lab that focuses on dog genomics. As I use the Galaxy platform, I will also teach myself doing data analysis using command line. I also intend to use the same tools to analyze human NGS/MPS data and if I get the time and expertise, I plan to design online training courses using the galaxy platform to help resource-poor students in the US and Africa learn bioinformatics. I am African American (American as of November 2016) and I always feel saddened by the conspicuous absence of people like me at the genomics conferences that I sometimes get the opportunity to attend. I am funding myself to attend the Galaxy Community Conference.</p>	yes
0	no	0	yes	at least 4 years	Required ECSS Assistance	at least 4 years	[Name redacted] is excellent and extremely helpful in the project. Important progress has been made.	yes

0	no					4		
8	no	10	yes	2				
1	yes	20	no			52		no
2	yes	20	no			2	1	no
2	yes	4	no			10		no
10	yes	10	yes	10	Required ECSS Assistance	3		no
3	yes	20	yes	months		30		no
240	yes	100	no	200		5	It is good for educational purpose and research.	no
5	yes	100	no			20	The access to XSEDE is of fundamental importance and is indispensable to a group like mine in a relatively small, primary undergraduate department with limited computational resources. My research will not be as successful without XSEDE.	no
0	yes	0	no			4		no
0	yes	0	no			10		no
0	yes	0	no			4	Computationally replicating an experiment at the 1-to-1 level would not have been possible without XSEDE resources.	no
0	yes	24	no			50	XSEDE is CRUCIAL to my research. Without access to such machines and storage, I simply could not do the computations that I do.	no
6	yes	24	no	10		1.25		no
100	yes	30	yes	30	Required ECSS Assistance	10	It was very valuable for my research since we don't have powerful supercomputer to perform all atoms MD simulation	no

1	yes	50	no			2		no
3	yes	1	no			10		no
30	yes	5	yes	60		8		no
20	yes	10	no			4 weeks		no
0	yes	1	no			4		no
3	yes	30	yes		Required ECSS Assistance	6	XSEDE is a crucial resource for my research--it would not be possible without XSEDE.	no
5	yes	5	no			13	XSEDE resources have allowed my student to do calculations that are extremely slow on our own computers. He has been able to get results much more quickly and it has helped our progress tremendously	no
5	yes	3	no			1	Essential to research activities.	no
5	yes	10	no			200		no
100	yes	20	no			8		no
10	yes	50	no			25		no
2	yes	12	no			5		no
1	yes	10	no			1	The resources are especially useful for teaching my course.	no
4	yes	1	no			10		no
16	yes	30	no			4		no
0	yes	120	no			4		no
10	yes	150	yes	250		1	Much of the research in our lab over the past year would not have been possible without our allocation on XSEDE. It has helped us greatly in advancing our research.	no

10	yes	2	no			4	Although I do not regularly use XSEDE support because I am an advanced user, these resources are critical for my research endeavor, in particular for the support of graduate students and postdocs that are learning to use HPC resources.	no
0	yes	0	no			4	XSEDE is a fantastic resource...thanks!	no
10	yes	20	no	20		1	XSEDE resources are essential to our computational science, and the services enable us to better use them.	no
2	yes	0	no	0		0		no
3	yes	4	no			4		no
10	yes	4	no			50%	irreplaceable	no
1	yes	0	no			2		no
1	yes	0	no			1	The documentation is very useful.	no
20	yes	30	no			20		no
5	yes	4	yes	10		1		no
10	yes	5	no	-		20	clearly, our research would go at a much slower pace without XSEDE resources	no
5	yes	1	no			4	Extremely valuable resource. We look forward to using it more in the future.	no
2	yes	10	no			3	Extremely valuable.	no
0	yes	0	no	0				no
2	yes	5	no			10	Pretty much everything I needed to get started on Xsede	no
6	yes	1	yes	1		8		no
16	yes	2	no			20		no

20	yes	20	no			12		no
40	yes	25	no	0			XSEDE's compute resources and services are essential for our science. But, with the loss of accompanying long-term archival storage accessible to the compute systems we have had to devote more man-hours to data transfer and re-computation of data loss during transfer.	no
1	yes	100	no			?	In #6, productivity gain compared to what? Without XSEDE I couldn't compute, so the gain is very large. If you mean gain as a result of the ticket system, then it's 100 hours/hours per week.	no
4	yes	0	no	100000				no
2	yes	5	no			10		no
2	yes	1	no			1	this is one of the most important resources to my lab. We only wish that we could have more access to it.	no
2	yes	10	yes	10	Required ECSS Assistance	2		no
10	yes	5	no			1		no
10	yes	0	no			0		no
12	yes	10	no	12		8	Our project would not be possible without the xse de computing resources. In terms of advice, we received significant support from Globus, which was essential for high bandwidth data transfer from the Swiss accelerator center, where it was produced to TACC ,where it was analyzed.	no

10	yes	20	yes	10		4		no
2	yes	1	no	0				no
0	yes	20	no			8		no
20	yes	30	yes	40			The resources and services helped my students fast grasp the necessary techniques for running jobs on Xsede. We appreciate it !	no
2	yes	10	no			4	Our research group is at a predominately undergraduate institution without the computing resources available at major research universities. XSEDE is invaluable in helping our research move forward. THANK YOU!	no
2	yes	0	no			4	Without XSEDE, modelers at smaller universities cannot be competitive. Thank you, XSEDE!	no
1	yes	10	no			1	I could not do my research without XSEDE resources.	no
	yes	100	no		Required ECSS Assistance			no
8	yes		yes		Required ECSS Assistance	5	Our ECSS team has been invaluable.	no
30	yes	0	no			??	XSEDE has been extremely helpful in training on parallel programming technique on actual computing systems of interest.	no
2	yes	5	no	100		N/A	Efficiency and fairness	no
2	yes	6	no			4		no
300	yes	10	no			30%		no
5	yes	100	no				XSEDE is irreplaceable	no
10	yes	80	no			10	XSEDE is tremendously valuable resource that enables our science.	no

10	yes	10	no			2	XSEDE is an extremely needed resource that moves our projects forward at a much faster speed.	no
2	yes	10	no			15		no
10	yes	1000	yes	20		25		no
100	yes	10	no			10	XSEDE is an incredible computational resource for scientists. I am a college professor and I owe a lot of my research progress in computational mechanics due to this excellent service that XSEDE provides.	no
10	yes	40	no			2		no
10	yes	50	no			2	Unfortunately I haven't gathered usage information from my students. So my responses to the above questions might be very inaccurate. Regardless, XSEDE has provided very valuable computing facility to us, and I expect to only increase my group's usage of it.	no
0	yes	6	no			6		no
20	yes	10	no			25		no
1	yes	50	no			25		no
0	yes	100	no			10		no
4	yes	20	no			4		no
2	yes	96	no			10		no
1	yes	10	no			2		no
15	yes	20	yes	30		3		no

168	yes	100	no			5	XSEDE resources are absolutely necessary for day to day computational activities of various scientific and educational projects.	no
8	yes	25	no			20		no
24	yes	10000	no			5%		no
0	yes	20	yes	5		4	I would not be able to continue my research with XSEDE resources. As a teaching faculty, I do not have time to maintain my own resources. In this way, XSEDE has been invaluable.	no
5	yes	0	no			10	I'm a small-time XSEDE user, but to me it is invaluable. I would not get access at all to high-performance computing and research software at my institution (we just don't have it!) Its extremely useful for getting some results done and exposing my students to real computational work.	no
2	yes	10	no			4		no
10	yes	50	no			52	XSEDE is the essential resources to my entire research.	no
2	yes	10	no			2		no
5	yes	20	yes	100		1		no
10-May	yes	10-May	no			8		no
5	yes	4	yes	10	Required ECSS Assistance	52	This is a weird survey. We would not be able to do any of our computational chemistry without XSEDE so these resources have given us infinite productivity.	yes
5	yes	24	no		Required ECSS Assistance	500%	It is the most valuable resource to our study!	yes

0	yes	10	yes		Required ECSS Assistance	3	I just switched to Xsede. So my experience is not representative. However, it seems like the project is well organized.	yes
0	yes	0	no			5		yes
18	yes	0	no			1		yes
2	yes	5	no			10		yes
16	yes	NA	no			1		yes
10	yes	25	no			4	Question 6 does not really capture the value of XSEDE resources to us: our project simply would not have been possible without these resources. It is not a case of saving time, it's about expanding the range of what it is possible for us to do.	yes
20	yes	100	no			12w		yes
10	yes	>50	no			3	XSEDE is the only high performance computing resource that my computational group had access to. It is absolutely crucial for the computational materials science research that my group does.	yes
10	yes	100	no			2		yes
12	yes	12	no			1	On-line documentation is excellent. And then I attended a parallel programming event streamed here to Purdue. It was very useful.	yes

5	yes	10	no			30	Questions 3 and 6 are impossible to answer, and I think they're very poorly designed. The XSEDE allocation has been essential to this research -- two papers now in press, a third about to be submitted, and a completely new grant application under review -- none of which would have been possible without the XSEDE allocation. A better question would have been "given other computer resources available to you, how long would it have taken you to complete the research you've done since the beginning of Project Year 5 (July 1, 2015)? My answer would be about ten years. Which means never, because someone else would have finished research on this problem before we got anything significant done.	yes
5	yes	20	no	80		4		yes
10	yes	1	no			25		yes
24	yes	100	no		Required ECSS Assistance	10		yes
4	yes	40	yes	60	Required ECSS Assistance	4		yes
500	yes	0	no			12		yes
1	yes	2	no	0		2	XSEDE is an essential part of the national cyberinfrastructure and should continue to receive National Science Foundation support! XSEDE is essential for carrying out computational research in the US.	yes

0	yes	50	no			10	TACC provides great service and I am fully satisfied with their service.	yes
20	yes	2	no			2		yes
5	yes	100	no			4		yes
12	yes	10	no			4	XSEDE provides a critical part of my overall computational infrastructure. High-level geometry optimizations have to be done on XSEDE machines. The support staff is incredibly helpful with technical questions on a variety of quantum chemical codes.	yes
4	yes	10	no			10%	Extremely useful to my group. Two students in the group need these reoccurs for their work,	yes
20	yes	40	no			36	Being able to run parallel matlab simulations on Gordon and Comet has increased our capacity by a factor of 3 and reduced turnaround to get results and make changes by the same amount	yes
0	yes	3	no			1		yes
5	yes	100	no			2	It's great and really really helpful for my first half year as an assistant professor (Jan 2016 to present) when my local computation resources are not ready. The start-up project in XSEDE help to move forward of my research.	yes
20	yes	100	no			30%	Very fast responses, knowledgeable, very helpful, can always find the right person to answer my questions	yes
2	yes	3	no			1	I have not run into too many issues, but the help in just getting spun up was immensely valuable.	yes

40	yes	200	no			24	It is only second year of my project, but XSEDE proved to be a great resource for me both in terms of computing power and user support, as well as a learning resource. If I had to teach a performance computing class I would definitely apply for an educational grant at XSEDE because it provides a reliable centralized system.	yes
5	yes	0	no			0	I don't know any meaningful way to estimate overall productivity gains, but since my first research allocation request is still under review, I'm sure these are negligible.	yes
3	yes	30	no					yes
15	yes	20	no			52	Much of my project relies on programs that only run on Linux, a resource I do not have access too. Mason and XSEDE have made my project possible. Locally, my transcriptome assemblies took almost 2 weeks per assembly. With XSEDE are less than 48 hours. I am also delighted with the service I have had. Contacting both XSEDE with the ticket system and my XSEDE campus champion, I have always had timely and useful responses.	yes

0	yes	0	no			52	My research simply would not be possible without XSEDE resources. While I have not used XSEDE staff in the current project year, I have been helped by them in previous project years for operational/trouble-shooting issues that probably saved a dozen of hours. I have a high opinion of XSEDE staff. We got things running smoothly with their help, and now I am able to just focus on the science rather than the hardware/software issues.	yes
1	yes	24	yes	999999	Required ECSS Assistance	10	XSEDE is great. It contains high quality professionally managed systems.	yes
4	yes		no					yes
10	yes	NA	no	na			As a post-doctoral fellow and junior researcher, the XSEDE resource is a great help for me to test my ideas and create the outline of a new research program which I plan to start in near future.	yes
0	yes	168	no			168		yes
30	yes	200	no			~5 papers per year due to the XSEDE support. thanks very much!	XSEDE is a great service and the access to its resources is indispensable to our research.	yes
8	yes	40	no			1000	I could not do the computations I have done using only locally available resources in a reasonable time frame.	yes

8	yes	80	no			12 weeks	XSEDE is indispensable in my teaching and research. I would not be able to teach high performance computing without access to these resources.	yes
10	yes	50	no				I don't really understand what the last two questions are asking. For the last, I don't know how to quantify time on XSEDE supercomputers relative to not having time on them. I don't have access to other supercomputers at moment.	yes
5	yes	2 weeks	no		Required ECSS Assistance	8 weeks		yes
20	yes	100	no			20		yes
100	yes	100	no			12	We would not be able to do the work that we do without XSEDE resources. XSEDE has the highest return on investment for any federal funding of research.	yes
4	yes	3	yes		Required ECSS Assistance	4	We have only just started using the Xsede resource, but so far the support staff have been extremely helpful with troubleshooting. We really have very little computing resources at our university, so the Xsede resource is extremely helpful to us.	yes
10	yes	100	no			10		yes
40	yes	0	no			6	Scientific results would not have been possible without XSEDE resources.	yes

1	yes	10	no			1	I regard XSEDE as a highly valuable and well-run resource, indispensable for my research on weak lensing cosmology	yes
50	yes	20	no			50	Absolutely essential to my computational research--without access to Supermic, login through Globus, and help compiling VASP we would have made NO progress on our project this year	yes
2	yes	15	no			52	I could not have done the last two papers I wrote this year without the use of XSEDE resources. They are an integral part of my research. Without XSEDE, I would not have the knowledge or tools to do the work I do.	yes
0	yes	0	no				I have no idea how to assess 6. It's a very odd way to ask that question. There are multiple sets of calculations that I simply would not be doing without XSEDE resources. It's not about "overall productivity gain"--it's the difference between science being done and science not being done.	yes
40	yes	0	no			5	XSEDE provides a critical computing resource for my research. Without XSEDE, my research would need to be reduced in scale and impact owing to lack of access to adequate computing resources.	yes
20	yes	2	no			20		yes
10	yes	20	no			1		yes

2	yes	0	no	0		5	Our education grant has been extremely useful in enabling student learning of use of HPC resources in atmospheric sciences.	yes
3 million	yes	30 hours	no			12	We have been able to explore global water challenges at scales that otherwise would not have been tractable. EXSEDE is a critical enabler for our science.	yes
0	yes	0	no			10	I love XSEDE and it has helped me a lot. But this survey needs more work. I didn't not know how to answer some of the questions!	yes
1	yes	20	no			20		yes
5	yes	0	no			100		yes
1	yes	10	no			2	support staff are very helpful	yes
10	yes	20	no				It is difficult for me to estimate the productivity gain per year in full-week increments as I would simply not be able to do the research that I do without XSEDE resources. My institution does not have supercomputing resources and, as such, I am deeply indebted to the resources provided by XSEDE. Thank you!	yes
30 hours	yes	0	yes	10			The XSEDE staff have been very helpful for my application to the XSEDE Research allocation.	yes

10	yes	2				3	This has been the first year that I have used XSEDE resources, and I'm still ramping up usage in a startup allocation. I anticipate greatly increased usage over the coming months during the second half of this startup period, with the potential for substantial amounts of workflow to end up migrating to XSEDE comet.	yes
10	yes	50	no			20	Once again XSEDE resourced have proved to be invaluable for the advancement of our multiple projects.	yes
3	yes	0	yes		Required ECSS Assistance	4		yes
0	yes	3	no			8		yes
0	yes	20	yes	120		20	Essential to research that led to many publications and a Science Article	yes
5	yes	24	yes	24	Required ECSS Assistance	10		yes
0	yes	5	no			40	As indicated above #6, XSEDE has provided the PI a significant part of the resources available in a small university setting. Since I have been using NAMD for studying the biomolecular systems of my interest, sometimes it is hard to look around to use any other program as an alternative approach.	yes
5	yes	at least 10 hours	no			20 weeks	Without XSEDE resources, some large simulations we have been running would simply not have been possible.	yes

0	yes	25	no		Required ECSS Assistance	52	My research group could not function without this resource.	yes
1	yes	100	yes	100	Required ECSS Assistance	10	I had a very difficult time with scripts not working when PSC Blacklight was decommissioned and my allocation was switched to PSC Greenfield. Without the help of technical staff I likely would not have been able to figure out how to properly reconfigure my scripts for the Greenfield computer. So, my estimates of 100 hours are really infinity: I would not have been able to continue.	yes
4	yes	50	yes	50		2	The XSEDE staff has been an invaluable resource in allowing us to conduct our research. Three papers were just submitted to top conferences (USENIX OSDI 2016 and ACM Symposium on Cloud Computing (SOCC) 2016), and could not have been completed in this form without XSEDE assistance.	yes
3	yes	4	no			26	XSEDE is a crucial resource for us. The previous question is poorly worded. As I understood it we were able to get calculations through about twice as fast as without the resource, i.e., gain was half a year(=26 weeks).	yes
8	yes	8	no			48	Our larger projects would not be possible without the use of XSEDE resources,	yes

8	yes	0	no				I just became XSEDE Campus Champion for the USDA-ARS very recently, but beyond taking some XSEDE-sponsored training that involved submitting jobs, I haven't used XSEDE resources in production. I'm currently focused on helping stand up USDA-ARS compute/networking resources; afterwards, I anticipate steering USDA-ARS employees to XSEDE resources when the ARS resources aren't sufficient.	yes
90	yes	20	no			50	I wouldn't be able to conduct my research without being able to utilize the XSEDE resources. Its super user friendly and staff is really helpful. Big thank you!	yes
20	yes	10	no			6 wks	An absolutely essential part of my program.	yes
100	yes	100	no			40	Having access to XSEDE computational resources was critical to the success of my research program. Without access to XSEDE resources, my research program would have failed.	yes
12	yes	28	yes		Required ECSS Assistance	8	More online access of training would be helpful, as travel is not always possible.	yes

0	yes	0	no			8	Simply put: if you do big simulations, you need resources. While local commodity clusters and GPU accelerated desktops are available, they're typically not as convenient, as powerful, or as reliable to use as XSEDE resources. I've been running on TG/XSEDE resources for many many years, I don't need much help, just computer time (which unfortunately nowadays there isn't ever enough to go around).	yes
10	yes	2	no			600	The calculations would have taken an impossible length of time using our in-house resources	yes
2	yes	24	yes	100		8	Great resources and great services	yes
10	yes	0	no			25	Because our own local resources are small-scale, we would not be able to run any of our simulations on NAMD for a useful amount of time without XSEDE resources from our startup allocation	yes
8	yes	100	no			20	This resource has been extremely valuable to our lab productivity. The staff has been instrumental in helping us set up our pipelines (installing software and troubleshooting the dependencies).	yes
1	yes	2	no			1	Improperly designed survey questions. We are using XSEDE not to save personnel time but to access computing time.	yes
1	yes	10	no			4	I highly value XSEDE resources and the variety of resources and training that XSEDE provides. It is though difficult to quantify the amount of	yes

							gains.	
6	yes	20	no			80		yes
0	yes	0	no			0		yes
600	yes	75	no			20	Our project just entered the 3rd year. My answers are based on a 3-year period rather than 5 as indicated by the questions.	yes
10	yes	2	no			5%		yes
2	yes	20-Oct	no			25	The services are quite helpful and enables me to further extend / carry out my research.	yes
2	yes	2	no			4		yes
12	yes	4	no			8		yes
20-Oct	yes	100+	yes	50+		15+	XSEDE resources have provided us tremendous value in terms of computation, increasing productivity significantly, conducting more efficient analysis using cutting edge technology.	yes
1	yes	1	no			1	It is very difficult to know how much of our time has been saved with xsede since we don't have a reference point from using other computational resources. But it is an extremely valuable aspect of our workflow and, since HPC resources are limited at our university, some of our work would not be possible at all without this grant.	yes
4	yes	10	no			2		yes

5	yes	10	no			4	It's greatly increased my research capacity by granting access to resources that would otherwise be unattainable.	yes
8	yes	20	no			4		yes
0	yes	10	no	800	Required ECSS Assistance	12	You are asking questions that are ill-defined and not easy to answer. However, XSEDE resources have been very, very valuable to our research effort in theoretical chemistry	yes
10	yes	1000s	no			20		yes
2	yes	0	no			0	Unfortunately the project that we asked for a startup allocation for has not yet gotten off the ground so I'm afraid my responses are not yet illustrative of what we plan on doing.	yes
3	yes	3	no			10	This is an excellent resource and has been invaluable to my group.	yes
2	yes	20	no			10	I've had lots of help from a direct collaborator who is a staff member at SDSC which was very helpful, without that probably would have used more training services	yes
8	yes	10	no			4	Need better big data applications resources and support.	yes
48	yes	8	no			25%	XSEDE really means a lot to me and has enormously contributed to my academic career. I have been using XSEDE since my PhD time (originally called Teragrid) when I was a user. Now as a project PI, I hope this nice idea keeps developing and evolving in the future.	yes

2	yes	2	no			52	Invaluable for our research!	yes
1	yes	0	no			12	My work isn't possible without XSEDE and other similar large supercomputing resources. I haven't needed XSEDE help or training in a while, as I am pretty good with these machines. Online resources are very useful, and where I typically go.	yes
0	yes	0	no			20		yes
2	yes	10	no			20	Xsede has been critical and made our project possible.	yes
20	yes	80	no			20		yes
8	yes	24	no			12 wk	I don't know how to estimate productivity "gain" from XSEDE. My science efforts use XSEDE compute/data resources extensively, summarized in yearly progress reports to you all.	yes
0	yes	1	no			2		yes
0	yes	0	no			12	Did not use the ticket system, but PSC staff helped resolve operational issues, saving approx. 40 hours	yes
2	yes	100	no			10	Sorry, but some of these questions would require a meeting of my entire research group, and you have not given me enough lead time for that.	yes
10	yes		yes		Required ECSS Assistance	12		yes

4	yes	0	yes	80		6	Question 6 is difficult to answer. We use XSEDE because it gives us access to resources that we wouldn't normally have available. We're not using it for "overall productivity gain". The ECSS system has been <u>extremely</u> useful to us -- - perhaps because we found exactly the right person (Jerome Vienne). He has been of critical help, and we are fast developing a collaboration with him.	yes
0	yes	0	no			0	The ability to perform large scaling studies on leadership systems is invaluable.	yes
3	yes	15	yes	30		4		yes
10	yes	1	no			52	Thanks to our allocation on Stampede through the XSEDE program, our group has been able to run simulations and undertake studies we would not have been doing otherwise.	yes
0	yes	hard to estimate this	yes	hard to estimate this	Required ECSS Assistance	I don't quite understand this question.	I don't quite understand this question.	yes
10	yes	1	yes		Required ECSS Assistance	1	I could not access certain resources without their help.	yes
10	yes	20	yes	5			We started the project at XSEDE the beginning of 2016. But we found the Xsede resource is very useful to our project. We believe it will take a more important role on our research after the full-project is on-going/	yes
2	yes	0	no			0		yes

3	yes	40	no			1000 hours	It would be extremely difficult for us to do the work we do within XSEDE resources.	yes
5	yes	10	no			4	Highly valuable!	yes
1	yes	~50000	yes	100	Required ECSS Assistance	2		yes
30	yes	120	no			3	The technical support is fast and accurate and solve my inquires in just a one day or two.	yes
0	yes	3	no					yes
1	yes	6	no	9		100	XSEDE resources are critical to my research as a computational biophysicist. I could not perform my work without this level of resources - which would be extremely challenging to obtain through other means.	yes
1	yes	0	no			30	The XSEDE service was highly accessible and reliable. XSEDE is an essential resource for our research productivity.	yes
20	yes	35	no			15		yes
1	yes	16	no			180	Our XSEDE allocation is an indispensable resource for our research.	yes
4	yes	0	no			1	XSEDE resources (computational allocation) are extremely important for my research.	yes
3	yes	10	no			2		yes
24	yes	A lot	no			8	Excellent	yes
13 hrs	yes	44 hrs	no			12 weeks	Bridges allowed us to determine the efficacy of a large node environment for our routine sequence assembly jobs.	yes

8	yes	n/a	no			?	To answer this and get at #6, I don't view XSEDE resources as contributing to a 'productivity gain' necessarily. More to the point would be that I would not be able to do the numerical experiments we are doing with our allocation if we did not have it. So, I very much appreciate access to HPC resources via my XSEDE allocation. Thank you.	yes
5	yes	50	no	100		6		yes
10	yes	50	no			26	XSEDE resources have been extremely valuable to me and to my research group. We have been carrying out molecular dynamics and first-principles electronic structure calculations (DFT, MP2, SAPT, etc.) extensively on XSEDE. Without these resources which provide extensive memory as well as computational power, it would have been difficult to obtain high-quality scientific results using limited local resources.	yes
20	yes	40	no			1	keep up the good work	yes
10	yes	100	yes		Required ECSS Assistance	50	XSEDE resources are instrumental in my research. Without these resources it would have not been possible to do computationally heavy science which also requires a lot of precision.	yes
0	yes	0	no	0		10		yes

2	yes	3	no			1	I cannot really answer question 6 because my research would not be possible without XSEDE. XSEDE is so amazing, helpful, generous, and great!	yes
2	yes	4	no			26	The new capabilities of Bridges i.e., application server based gateways co-located with HPC is extremely valuable to our project as it makes our algorithms running on large memory compute nodes readily accessible to users via a web-based application.	yes
1	yes	45	yes		Required ECSS Assistance	36		yes
0	yes	24	no			1	It's hard to evaluate the benefit of the XSEDE staff (specifically through the helpdesk) in units of hours saved - rather, I would like to stress that their help has been invaluable and a necessary component to any progress on my project. Their help has always been extremely timely and thorough, and is much appreciated.	yes
8	yes	0	no				The access to high performance computing resources through XSEDE is extremely valuable to allow me to pursue computing projects that support the primarily experimental effort in my research group. We do not have our own dedicated cluster or computing time in our group, so XSEDE is a great way to supplement my research.	yes

0	yes	10	yes		Required ECSS Assistance	6		yes
3	yes	3	yes	3		15%		yes
10	yes	15	yes		Required ECSS Assistance	40	Our usage has been limited since the software access has been problematic. The support service have been wonderful in working with our information technology support persons locally to get everything running.	yes
3	yes	40	no			10	I am exceptionally happy with the efficiency and extreme usefulness of XSEDE and the way all the resources are handled.	yes
7	yes		yes	10	Required ECSS Assistance	n/a	waiting on the queue is to long: sometime even one day or more. System is not stable. Software CDO is not available.	yes
40	yes	200	yes	50		12	Excellent experience!	yes
10	yes	20	no			26	XSEDE resources are absolutely essential; however, xsede does not provide enough computer hours to its users.	yes
10	yes	72	no			20	Great resource... immensely valuable to our research.	yes
5	yes	3	no			30	Essential for our research. I could not tackle the complicated problems without this resource.	yes
1	yes	10+	no				I published 3 papers in the last two years using the XSEDE resources	yes

1	yes	200	no			35	As both a taxpayer and researcher, I consider XSEDE a superb return on investment.	yes
4	yes	8	no			4	My responses are based on a startup allocation for the period April, 2015 to the present.	yes
2	yes	15	no			2		yes
2	yes	4	no			12	invaluable resources and services	yes
50	yes	100	yes		Required ECSS Assistance	26	XSEDE remains an extremely valuable resource for institutions that do not have the computational resources available to them. I cannot understate how many hours these resources have saved our group.	yes
10	yes	3	no			5	XSEDE's new cloud platforms have really transformed the ability of myself and more importantly, my lab group, to experiment & leverage computing resources that would not otherwise be possible. While there are still growing pains in developing these new platforms such as Chameleon and Jetstream, I think it is difficult to overestimate the importance these resources have in bringing transformative computational resources into many disciplines that have traditionally made little use of HPC.	yes
0	yes	10	no	6	Required ECSS Assistance	25%	The services provided by XSEDE are very very good in my particular case XSEDE resources have made me a more productive researcher	yes
10	yes	24	no			1		yes

5	yes	5	no			16	I really appreciate the resource! We can perform multiple large-scale simulations on XSEDE computing resources which are otherwise impossible with local computer clusters. In general, the queue-time is less than 24 hours for our submitted jobs. The availability of different software and tool modules allows us to spend less time on installing and upgrading different software packages.	yes
4	yes	15	no			25	Without the XSEDE resources of supercomputer time, we could not have done most of our calculations. Our university simply cannot provide anything like even remotely comparable to XSEDE. Hence it is difficult, if not impossible, for me to answer question 6. For our group, XSEDE is absolutely essential.	yes
30	yes	40	no			2	I do not have access to high performance computing at my job site, so my access to COMET is extremely important to me.	yes
3	yes	0	no			10	Our allocation has enabled simulations of systems approaching experimentally relevant scales which would not have been possible otherwise.	yes
10	yes	10	no			8		yes
0	yes	1	no			10	Access to specific programs (Gaussian) is useful for us.	yes

4	yes	4	no			0	We are new to XSEDE, so have not needed much additional support yet.	yes
2	yes	3	no			NA, see comment #7	My work is made possible by availability of XSEDE computer resources. It isn't a productivity gain issue, it is that I couldn't do what I do without XSEDE.	yes
100	yes	10	no			8	XSEDE is a critical resource for researchers at institutions that do not have cutting-edge computational resources of their own, and for researchers who are just starting out. I read proposals for funding from faculty in my field, and frequently see that the best young faculty depend on XSEDE resources to get their work done.	yes
5	yes	10	no			3		yes
	yes		yes		Required ECSS Assistance	6	Having access to the compute nodes is great, but having someone to go to help in using it and running programs is priceless. We couldn't have done the transcriptome assembly (huge) we did without xsede resources and technical support. THANKS!	yes
0	yes	1,000	yes					yes
5	yes	20	no		Required ECSS Assistance	200		yes

30	yes	4	yes	200		8	XSEDE is an incredibly valuable resource because it not only provides computing infrastructure, but it organizes many different computing sites under a single umbrella. This structure greatly improves access and efficiency. In addition, I have found the ECSS support to be extremely helpful in moving our research project forward and accelerating our progress.	yes
100	yes	20	no			1	Access to XSEDE resources is extremely valuable. We have many, many users who are able to take advantage of them. In addition, the documentation and informational sessions are invaluable as teaching aids.	yes
4	yes	0	no			20		yes
30	yes	15	no			1	Access to computational resources that are essential for my research. Otherwise I would have to buy and run my own compute cluster.	yes
0	yes	0	yes	10		40	The resources and services have been extremely useful for people, like myself, who are not experts in supercomputing, in carrying out computational jobs and have substantially reduced the computational runtime. The resources have greatly facilitated the progress of our research project.	yes

20	yes		no				XSEDE is extremely important for my work and everything works great for me and I would like to express my appreciation in any possible way, but unfortunately the questions in this survey are impossible to answer.	yes
10	yes	5	yes	50		5	Extremely valuable.	yes
0	yes	20	yes	5		6	XSEDE resources provide access to computer hardware that we could not afford as a young and growing lab on a tight research budget. XSEDE has proven very important for our work during the past year.	yes
4	yes	3	no			14	The simulations that the XSEDE resources allow, could not be achieved without them.	yes
1-2h	yes	Cannot precise (12 h)	no			6	In my opinion, the online resources are very well done and more than adequately helpful in resolving the issues that our group has faced in executing computational jobs. Also, communications from XSEDE staff about anticipated down times of computational resources have been highly helpful in planning our task scheduling.	yes
5	yes	200	no			As only availing of the startup allocation recently, it is yet to be estimated.	The service is indeed very conducive for gaining scientific productivity.	yes

4	yes	1	yes	100		24	We could not do our work without the XSEDE resources of the assistance given by the XSEDE team; as such, it is difficult to estimate what has been saved through the interactions. They are invaluable.	yes
10	yes	5	no			1	XSEDE is a great resource. My research is experimental. The simulations, which I can run on XSEDE resources are very critical to my research. I am planning to use my startup allocation over summer 2016.	yes
3	yes	15	no			0.25	XSEDE resources represent a significant portion of our computational resources (over 50%). Our allocation this year was assigned 100% to NICS Darter, and the setup of that cluster (high core count jobs get priority) made it very difficult for us to utilize the entire allocation.	yes
few if any	yes		no			120	Without access to XSEDE, my group would have to work on less impactful research that can be conducted on our local, much less powerful, computing clusters. XSEDE gives us the opportunity to conduct state-of-the-art simulations for all projects my group works on in parallel.	yes
4	yes	12	no	no problems		5000	Immense value	yes
0	yes	300	no			10	The training classes are great.	yes

10	yes	5	no			<p>on behalf of 7000 users, I estimate at .least 200 person years</p> <p>XSEDE resources enabled the following: In the past 14 months, CIPRES received submissions from 1938 users in the US, representing 52 US states/territories (GU and PR), and of course DC. We have run jobs for 29/31 EPSCOR states/territories (all save DE and VI).</p> <p>These individuals are at 330 Institutions across the US and territories, 184 of the institutions are PhD granting, 68 are not, two of the latter are community colleges. Of these institutions, four are historically black colleges, 24 are Hispanic-serving institutions, and 2 are Alaska/Hawaii native-serving institutions. We received submissions from four high schools.</p> <p>We also received submissions from 24 NGOs and related independent research institutes; 13 museums, 7 botanical gardens, and 2 zoos, and four commercial entities.</p> <p>These include, for example, Woods Hole Oceanographic Institution, TGen North, Bigelow Laboratory for Ocean Sciences, Center for Infectious Disease Research, Cold Spring Harbor Laboratory, J. Craig Venter Institute, MD Anderson Cancer Center, NIMBioS: National Institute of Mathematical and Biological Synthesis, American Association for the Advancement of Science, The California Academy of Sciences, The Smithsonian Institute,</p>	yes
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						<p>American Museum of Natural History, Louisiana State University Museum of Natural Science, Sam Noble Oklahoma Museum of Natural History, University of Nebraska State Museum, The Morton Arboretum, Missouri Botanical Garden, New York Botanical Garden, Rancho Santa Ana Botanic Garden, Second Genome - The Microbiome Company, and Assured Bio Labs. A complete listing can be provided as an Excel document.</p> <p>Jobs were submitted also from 22 federal and state government agencies, as follows: DHHS: Centers for Disease Control and Prevention; Food and Drug Administration, NCI, NHGRI, NLM, NIAID; USDA: US Forest Service, National Center for Agricultural Utilization Research, National Animal Disease Center, Southern Regional Research Center, Systematic Microbiology and Mycology Laboratory; Department of Defense: Walter Reed Army Institute of Research; Department of the Interior: National Wildlife Health Center, US Geological Survey; Department of Energy, Los Alamos, Lawrence Berkeley, and Lawrence Livermore Laboratories; Department of Commerce, NOAA Fisheries; NSF; NASA Kennedy Space Center; Florida's Fish and Wildlife Research Institute;</p>	
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						<p>California Department of Food & Agriculture.</p> <p>We also ran jobs for 4560 users at 968 institutions in 85 unique countries outside the US. These jobs were run for 134 federal institutions (including the NIH equivalent in the Canada, the UK, Macedonia, and others; CSIRO in Australia; and the Chinese Academy of Sciences); 603 Universities (from all 85 countries, ranging from China and the UK to Togo and Seychelles); 161 Scientific Institutes (Including the Max Planck in Germany, and Institute Pasteur in Paris and Tunis); 34 Museums (including Museum of Zoological Research Alexander Koenig in Mexico, the Hungarian Natural History Museum, and Museo Argentino de Ciencias Naturales); 40 Botanical Gardens (including the Royal Botanical Gardens, the Korean National Arboretum, and the Fairylake Botanical Garden in Malaysia); 6 Zoos (including the Zoological Institute in Russia, and the Zoological Museum in Denmark); and 6 Private entities (including the Vale Institute and the Beijing Genomics Institute).</p> <p>Again, the complete list is attached. In short, CIPRES/XSEDE is having a very broad and deep impact on progress across all of biology for a very modest investment. 92% of users who plan to publish report that their work would be slowed, or would have been impossible if the XSEDE resources</p>	
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						<p>had not been available. In March, we crossed the "2,300 publications enabled" threshold, and are on track to support more than 650 publications in Calendar Year 2016.</p> <p>If we consider all 800+ survey respondents alone, we have probably at minimum given 800 x 0.5 months gain to each, and some received a benefit of possible one year in wall time. Even assuming the minimum, this represents 33 person years. We suspect 200 person years is closer to the real impact.</p>	
50	yes	20	yes	5		10	yes

0	yes	30	no	20		25	My research, especially that funded by the NSF, would not be possible without the XSEDE computational hardware resources. I would need to change my research program nearly entirely.	yes
15	yes	0	yes		Required ECSS Assistance	8	Without XSEDE resource it is not possible to conduct large scale simulation. Also, i need more SUs to meet my research.	yes
0	yes	16	no			10		yes
6	yes	40	no			NA	We have been working with XSEDE staff to fully deploy our integrative genomics analysis resources on XSEDE hardware. So our team's use is as tool developers rather than researchers.	yes
0	yes	10	yes		Required ECSS Assistance	4	It is hard to quantify the "value", but it suffices to say that it would not be feasible for us to support the complexity of analysis without this, at Year 5 we anticipate that our work would have spawned new allocation requests by communities utilizing what we have developed.	yes
N/A	yes	24 hours	no	10		10	Indispensable and very helpful!	yes
50000	yes	1000	no			10 week	I could not be able to achieve high level productivity without XSEDE	yes
1	yes	10	yes	1000	Required ECSS Assistance	4	For comparative biology, XSEDE has been invaluable. Without XSEDE many of the problems we are addressing would simply not be possible.	yes
4	yes	40	no			20		yes

3	yes	5000	no			8	XSEDE is an indispensable resource for our research. Without it, it would be impossible to advance our research or perform the tasks that were proposed, highly rated and funded by NSF. The resource is therefore invaluable to our scientific pursuit.	yes
			yes					
3								

4.3. Appendix III - XSEDE SP Return on Investment Assessment PY4 and PY5 Data Collection Instrument

Question 1: Basic information about the SP you represent										
	PY4 (July 1 2014- June 30 2015)	PY5 (July 1 2015- June 30 2016)								
Your SP Level (1, 2, or 3)										
For how much of each PY were you an SP (or were you acting as an SP) in months										
Question 2: Quantitative assessment of the value of XSEDE activities to your SP, expressed in terms of effort equivalents. Units are in FTEs (or percentages of FTEs)			Explanation of service areas	Question 3: Quantitative assessment of the value of XSEDE activities to your SP, expressed in terms of replacement cost. Units are dollars/year. PY5 only						
				A. If XSEDE did not exist, would it be possible for you to provision this service from your SP? (Yes, No, Unsure, Not applicable)	B. If XSEDE did not exist, what would it cost your SP to replace this service? (PY5 only, in dollars/year)	C. If XSEDE did not exist, would your SP seek to replace the service provided? (Please indicate your selection by placing an "X" in the appropriate cell.)				

	Value received from XSEDE, in terms of FTE effort that your SP would have to invest to replace the services received from XSEDE					Yes	Yes, but at a reduced level of investment	No, because the service is of low value	No, it would be impossible to obtain funding at our institution	Other (please explain)
Activity	PY4 (July 1 2014- June 30 2015)	PY5 (July 1 2015- June 30 2016)								
Allocations			Management of the XSEDE (XRAC) allocation process							
Account Management & Authentication Services			Management of accounts and accounting, login and authentication services for xsede.org and resources authenticated through XSEDE (To a first order approximation, SPs that use this service get account information in AMIE packets)							
24 x 7 Operations			Night time and weekend phone and emergency operations							
Ticket Support			Handling of problems sent to help@xsede.org							
User Survey			Value derived from information your SP receives from XSEDE user surveys							
Leadership			Value derived from XSEDE leadership (e.g. value of XSEDE leaders advocating CI funding)							
Project Managers and Financial Functions			Value you derive from project management, financial management, use of risk registry, staff portion of wiki							

User Information Services, including XSEDE.org			Information services and online information in xsede.org							
Training & Education			Value to your SP of training and education resources created and/or offered by XSEDE							
Outreach			Value of XSEDE outreach activities to your SP							
Network			Value of XSEDE network and XSEDE network operations to your SP							
Systems Engineering and Deployment			Value of XSEDE software engineering, software development, and/or software deployment to your SP							
Parallel computing support, other forms of advanced support, consultation, and programming (e.g. value of ECSS services to your SP)			Value of XSEDE Extended Collaborative Support Services (ECSS) to your SP staff activities, or to the activities of users of your SP. (For example, if ECSS optimized code that runs on your system, or if ECSS staff created a gateway that runs on your system, what would it have taken to have your own SP staff do the work?)							

<p>Question 4: Qualitative Assessments of Value of XSEDE to your SP</p>	<p>On a 1 - 5 scale, where "1" is "not at all important," "3" is "neutral - neither important nor unimportant," and "5" is "very important", how beneficial are the following aspects of participation in XSEDE to your SP? (If you have no basis for evaluating, please enter "Not applicable" or "N/A".</p>
<p>Support for Federally-funded resources offered to national community by your SP</p>	
<p>Opportunity to share technical information with other SPs</p>	
<p>Opportunity to receive technical information from XSEDE</p>	
<p>Software distributed by XSEDE</p>	
<p>Enhanced grant competitiveness because of the formal relationship with XSEDE</p>	
<p>Other:</p>	
<p>Other:</p>	

Other:	
Other:	
Other:	

Question 5: OpenText Comments - What is helpful or unhelpful about XSEDE from the standpoint of your SP? What would you like XSEDE to do differently in the future? Or keep the same?	

4.4. Appendix IV - XSEDE SP Return on Investment Assessment PY6_Data Collection Instrument

Question 1. Basic information about the SP you represent during XSEDE Project Year 6 (September 1, 2016-August 31, 2017)									
Your SP Level (1, 2, or 3)									
For how much of each PY were you an SP (or were you acting as an SP) in months									
Question 2. Quantitative assessment of the value of XSEDE activities to your SP, expressed in terms of effort equivalents, during XSEDE Project Year 6 (September 1, 2016-August 31, 2017). Units are in FTEs (or percentages of FTEs)			Question 3. Quantitative assessment of the value of XSEDE activities to your SP, expressed in terms of replacement cost, during XSEDE Project Year 6 (September 1, 2016-August 31, 2017). Units are dollars/year.						
Activity	Value received from XSEDE, in terms of FTE effort that your SP would have to invest to replace the services received from XSEDE during Project Year 6 (September 1,	Explanation of service areas	A. If XSEDE did not exist, would it be possible for you to provision this service from your SP? (Yes, No, Unsure, Not applicable)	B. If XSEDE did not exist, what would it cost your SP to replace this service? (PY5 only, in dollars/year)	C. If XSEDE did not exist, would your SP seek to replace the service provided? (Please indicate your selection by placing an "X" in the appropriate cell; if "other" is				

	2016-August 31, 2017)				your selection, please provide a brief response in the cell.)				
					Yes	Yes, but at a reduced level of investment	No, because the service is of low value	No, it would be impossible to obtain funding at our institution	Other (please explain)
Allocations		<i>Management of the XSEDE (XRAC) allocation process</i>							
Account Management & Authentication Services		<i>Management of accounts and accounting, login and authentication services for xsede.org and resources authenticated through XSEDE (To a first order approximation, SPs that use this service get account information in AMIE packets</i>							

24 x 7 Operations		<i>Night time and weekend phone and emergency operations</i>							
Ticket Support		<i>Handling of problems sent to help@xsede.org</i>							
User Survey		<i>Value derived from information your SP receives from XSEDE user surveys</i>							
Leadership		<i>Value derived from XSEDE leadership (e.g. value of XSEDE leaders advocating CI funding)</i>							

Project Managers and Financial Functions		<i>Value you derive from project management, financial management, use of risk registry, staff portion of wiki</i>							
User Information Services, including XSEDE.org		<i>Information services and online information in xsede.org</i>							
Training & Education		<i>Value to your SP of training and education resources created and/or offered by XSEDE</i>							
Outreach		<i>Value of XSEDE outreach activities to your SP</i>							

Network		<i>Value of XSEDE network and XSEDE network operations to your SP</i>							
Systems Engineering and Deployment		<i>Value of XSEDE software engineering, software development, and/or software deployment to your SP</i>							
Parallel computing support, other forms of advanced support, consultation, and programming (e.g. value of Extended Collaborative Support Services (ECSS) support services to your SP)		<i>Value of XSEDE Extended Collaborative Support Services (ECSS) to your SP staff activities, or to the activities of users of your SP. (E.g., if ECSS optimized code that runs on your system, or if ECSS staff created a gateway that runs on your system, what would it have taken to have your own SP staff do the work?)</i>							

<p>Question 4. Qualitative assessments of value of XSEDE to your SP during XSEDE Project Year 6 (September 1, 2016-August 31, 2017)</p>	<p>On a 1 - 5 scale, where "1" is "not at all important," "3" is "neutral - neither important nor unimportant," and "5" is "very important", how beneficial are the following aspects of participation in XSEDE to your SP? (If you have no basis for evaluating, please enter "Not applicable" or "N/A".</p>
<p>Support for Federally-funded resources offered to national community by your SP</p>	
<p>Opportunity to share technical information with other SPs</p>	
<p>Opportunity to receive technical information from XSEDE</p>	
<p>Software distributed by XSEDE</p>	
<p>Enhanced grant competitiveness because of the formal relationship with</p>	

XSEDE	
Other:	
Other:	
Other:	
Other:	
Other:	

<p>Question 5. What is helpful or unhelpful about XSEDE from the standpoint of your SP? What would you like XSEDE to do differently in the future? Or keep the same?</p> <p>Open Text Comments:</p>	
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4.5. Appendix V – Instruction Letter Sent with the Service Provider Survey for PY6

Dear SP Forum Representative,

In everything we do that is supported by federal funding, we must document the return on investment that accrues for the nation. This is true of any project, including XSEDE. So, as ROI lead, I am again requesting your help with another round of ROI analyses for XSEDE. The data requested are broken into five key questions:

- **Q1: Basic information about the SP you represent**
- **Q2: Quantitative value (in FTEs) of XSEDE activities in PY6**
The data requested are in FTE-years, to the nearest 0.25 FTE. For example, if the value to your SP of a given activity was 0.25 FTE in PY6, you would enter 0.25. Values may be negative.
- **Q3: Quantitative value (in replacement cost) of XSEDE activities in PY6**
Using the same categories as Q2, please estimate the replacement cost to your SP if XSEDE did not exist. In addition, please estimate what your SP would spend to procure these services. Finally, please indicate the priority your SP places on the listed activities by indicating the level investment that would be made to replace the activity should XSEDE not exist.
- **Q4: Qualitative value of XSEDE activities in PY6**
SP Forum representatives are asked to rate the qualitative importance of various factors. Many of the items evaluated will be most relevant to Level 3 SPs. Noting this fact, your suggested additions are welcome.
- **Q5: Free text comments**
All comments are welcome and, again, your comments will not be associated with your name or institution, and all will be anonymized or redacted as necessary.

So that your responses remain confidential, I have arranged for the IU Center for Survey Research to collect and compile data via the attached spreadsheet. I am asking that you return the completed spreadsheet to csr@indiana.edu by XXXXXX. All data will be shared in aggregated form and all comments will be anonymized. Please direct any questions about the survey to csr@indiana.edu.

Thanks in advance!

Sincerely,

--Craig

Craig Stewart, Ph.D.
ROI Lead, XSEDE

4.6. Appendix VI – Instruction Letter Sent with the Service Provider Survey for PY4 and PY5

Dear SP Forum Representative,

In everything we do that is supported by federal funding, we must document the return on investment that accrues for the nation. This is true of any project, including XSEDE. A couple of years ago, the SP Forum helped XSEDE assess its value by assessing its value to each of the SPs. This data led to the paper, *XSEDE Value Added, Cost Avoidance, and Return on Investment*, presented at XSEDE '15 (<http://dx.doi.org/10.1145.2792745.2792768>.)

As ROI lead, I am again requesting your help with another round of ROI analyses for XSEDE. Per discussions with the SP Forum, the data requested are broken into five key questions:

Q1: Basic information about the SP you represent

Q2: Quantitative value (in FTEs) of XSEDE activities in PY4 and PY5

The data requested are in FTE-years, to the nearest 0.25 FTE. For example, if the value to your SP of a given activity was 0.25 FTE in PY4 and of no value in PY5, you would enter 0.25 and 0, respectively. Values may be negative. Some newer SPs may have data for only PY5; for others, the data might be similar for both years. The list of categories is less fine grained than in the previous ROI assessment, but categories of activities are combined to enable comparison with data collected previously.

Q3: Quantitative value (in replacement cost) of XSEDE activities in PY5

Using the same categories as Q2, please estimate the replacement cost to your SP if XSEDE did not exist. In addition, please estimate what your SP would spend to procure these services. Finally, please indicate the priority your SP places on the listed activities by indicating the level investment that would be made to replace the activity should XSEDE not exist. Data requested in Q3 is for PY5 only.

Q4: Qualitative value of XSEDE activities in PY5

SP Forum representatives are asked to rate the qualitative importance of various factors. Many of the items evaluated will be most relevant to Level 3 SPs. Noting this fact, your suggested additions are welcome.

Q5: Free text comments

All comments are welcome and, again, your comments will not be associated with your name or institution, and all will be anonymized or redacted as necessary.

So that your responses remain confidential, I have arranged for the IU Center for Survey Research to collect and compile data via the attached spreadsheet. I am asking that you return the completed spreadsheet to csr@indiana.edu by **May 12, 2016**. All data will be shared in aggregated form and all comments will be anonymized. Please direct any questions about the survey to csr@indiana.edu.

These results will appear in a paper similar to the one that was given at XSEDE15; however, this time we plan to take it to one of the various quality and assessment conferences.

Thanks in advance!

Sincerely,

--Craig

Craig Stewart
ROI Lead, XSEDE

5. References

- [1] Udemy, "Online Courses - Learn Anything, On Your Schedule," 2018.
- [2] Pryor Learning Solutions, "Microsoft Excel 2007/2010 Basics," 2018.