



A Carnegie R1 Research University

3rd Quarter FY2020

Research Report

Board of Trustees

April 23, 2020

Dear Board of Trustees Members,

First and foremost, I want to wish you all great health. I hope you and your loved ones are feeling well. The image on the cover of this report, an image you have likely seen many times now in news reports and online, is an illustration of coronavirus. The coronavirus disease COVID-19 has shifted business operations around the world and of course here at Clemson as well. Clemson, as you know, moved quickly to reduce the risk to our students, faculty, staff, visitors and the community by moving all instruction online and working remotely wherever possible.

Our research enterprise, too, has adjusted. This has been a major undertaking. We have approximately 1,200 active research projects valued at a combined \$400 million. Our 950 faculty members, 5,627 graduate students, and 158 postdoctoral and non-faculty researchers are meeting the challenge, quickly scaling down projects to only essential research. Only about 25 percent of our researchers continue to access campus at limited times and on staggered schedules to promote social distancing. To help them navigate this operational shift, we have created a [COVID-19 Research Resources webpage](#) with operating guidance, important reminders and updates, lists of COVID-19 research funding opportunities, and answers to frequently asked questions. For the Division of Research, business continuity planning conducted over the past year is paying dividends now. Staff had technologies in place to work remotely. We continue to serve our customers and work to support and enhance the research enterprise.



In adjusting our research operations, we have followed three guiding principles: No. 1, our highest priority is the health and safety of our faculty, staff, students, visitors and the community; No. 2, we will work to preserve essential research functions and activity to the extent possible; and No. 3, we will use alternative research functioning that aligns with compliance obligations to our sponsors and university policies.

I would like to highlight some of the actions taken with those guiding principles in mind.

Essential Research Continuity

The Division of Research worked in concert with college Associate Deans for Research and department chairs to determine essential research operations that must continue uninterrupted and to identify personnel capable and available to perform those operations. Faculty have received guidance on how to scale back existing research activities in order to maintain reduced levels of productivity. Both actions prioritize social distancing and backup personnel plans to ensure coverage.

Operations Guidelines for Core Research Facilities

Core research facilities set forth new access and use procedures to ensure continued research productivity in a hygienic environment to protect all facility staff and users. Priority access has been given to projects with May graduation implications, grant progress reports or upcoming deadlines.

Animal Safety and Welfare

The Godley-Snell Research Center and other animal facilities are staffed to provide all essential care on a daily basis. Faculty have been asked to defer from starting any new animal studies. New orders of animals have been put on hold.

New Proposals and Grant Management

Proposal submissions, award acceptance and financial management of grants and contracts continue uninterrupted as staff work remotely. Staff is also monitoring federal agency sponsors for impacts on application deadlines, allowability of costs, and guidance on conducting human subjects research. Compliance offices are fully operational and are available to assist faculty with human subjects and animal care protocols.

Industry Engagement

Both the Office of Industry Contracts (OIC) and the Clemson University Research Foundation remain fully operational. Investigators with industry-sponsored research projects have been asked to contact OIC if their project is paused or scaled back due to COVID-19 precautions.

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Research continuity remains our focus, which is why I will present an abbreviated Research Report here in lieu of the Research and Economic Development Committee meeting. In this report, I focus on some of our research metrics, including competitive awards, competitive expenditures and proposal submissions through the end of February, the most recent data available when this report was submitted. I look forward to presenting a full report on research news, honors, awards and faculty highlights when the university is cleared to resume normal operations and the Board of Trustees continues with its full committee-hearing schedule.

As you are aware, our research enterprise has posted tremendous growth since 2013. We have earned distinction as a Carnegie R1 institution of the highest research activity and achieved our ClemsonForward goal of \$100 million in annual competitive research expenditures *seven years ahead of schedule*.

So far in fiscal year 2020, we have recorded positive results.

- Competitive research expenditures reached \$66 million at the end of February with one month remaining in the quarter ([see page 4](#)).
- Total Clemson research expenditures, which are used in the Carnegie R1 classification, were \$219 million in fiscal year 2019 ([see page 5](#)). That's an increase of 2 percent from the prior year and 44 percent from 2013.
- Competitive research awards reached \$80 million, an 8 percent increase from the same period a year ago ([see page 6](#)). We have been successful securing large awards, receiving 7 awards valued above \$2 million during the first three quarters of FY2020 for a total of \$29 million. Since 2015, we have earned 44 such projects, bringing a combined \$210 million to Clemson.
- Proposal submissions were \$418 million as of the end of February, up 2.5 percent from the same period a year ago ([see page 7](#)). We continue to see faculty pursue high-value projects, particularly projects above \$5 million ([see page 8](#)).
- A detailed look at proposals, awards and expenditures by college and business unit are provided in the Research Report Card ([see pages 10-12](#)).

I am proud of what we have accomplished and know that even now, during a period of personal and professional challenge and uncertainty, the entire Clemson community is working together to continue research to the extent possible.

This challenge is not over. We continue to monitor guidance from federal agencies to understand how this will impact our awards, expenditures, and proposal submissions moving forward. Research expenditures are likely to drop in the fourth quarter due to our modified operations. I have assembled a committee in the Division of Research to prepare financial models and analyze the business impacts of COVID-19. I have also been consulting regularly with vice presidents of research at regional universities, Atlantic Coast Conference institutions, the Association of Public and Land-grant Universities (APLU), as well as with the EAB (Education Advisory Board), to compare continuity plans and learn from their experiences. This unique challenge has sparked great camaraderie and collaboration among our peer universities that will be beneficial for all of us.

I appreciate your continued leadership as we all work through this together. These unprecedented circumstances will test our ingenuity and resolve, but I believe we can tackle this challenge through empathy, cooperation and support of one another.

I want to conclude this report with a very positive note: So far this fiscal year, eight of our junior faculty members have earned prestigious CAREER awards ([see page 13](#)). *These are the most prestigious awards young faculty can receive and serve as catalysts to jumpstart their careers.*

As always, the best is yet to come.

Respectfully submitted,

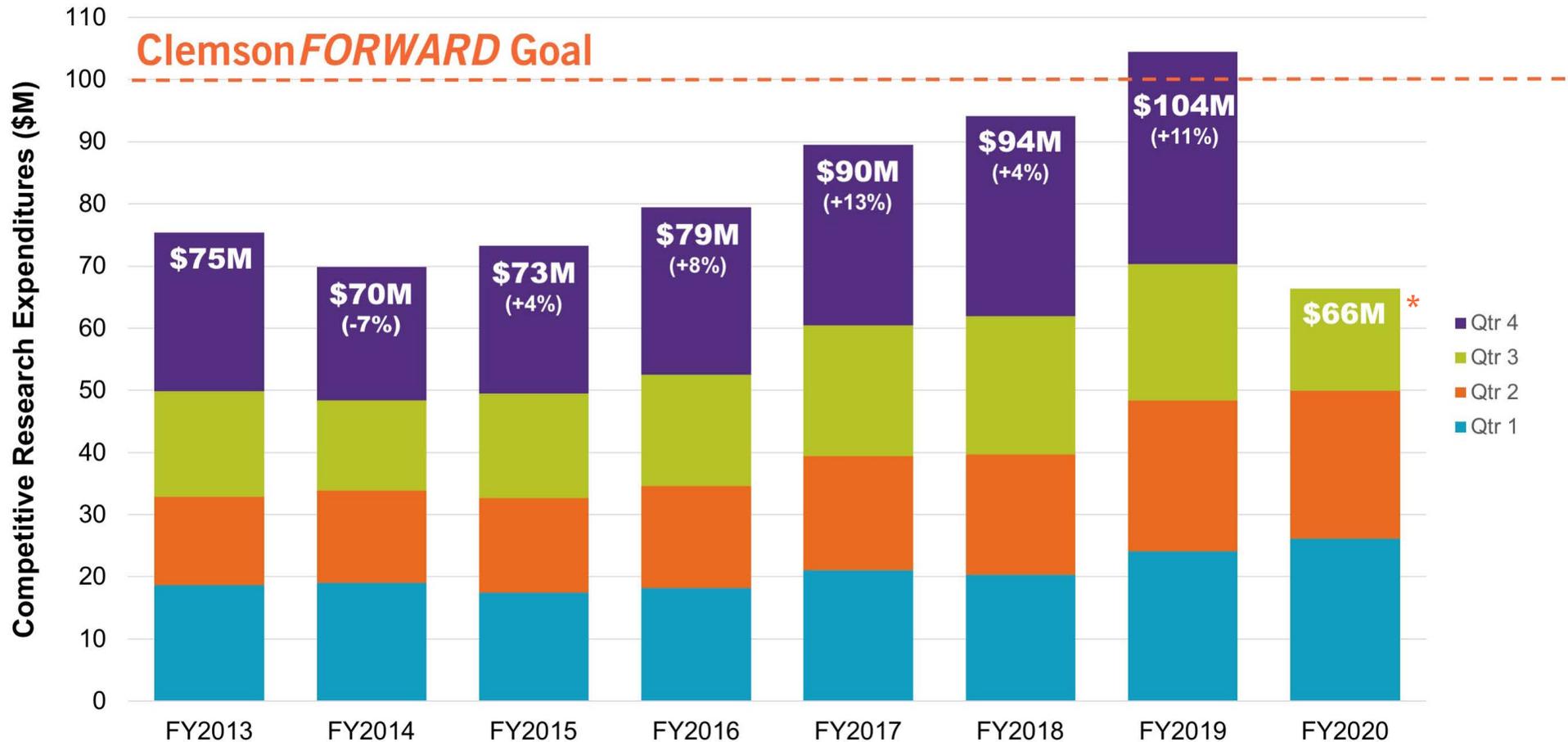


Tanju Karanfil, Ph.D., PE, BCEE, IWA Fellow
Vice President for Research



A Carnegie R1
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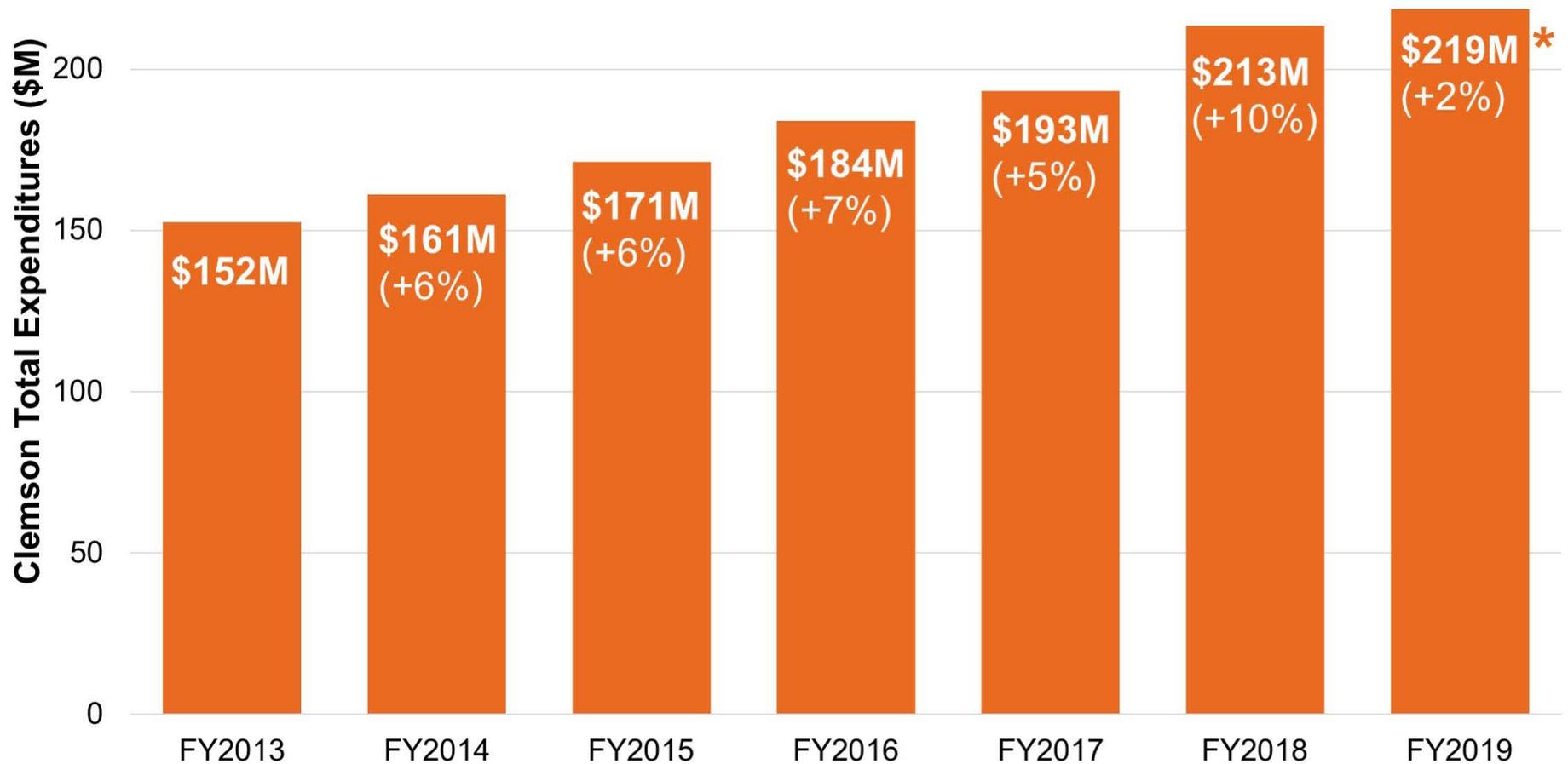
Competitive Research Expenditures FY2013-2020



* Fiscal Year 2020 data includes expenditures through the end of February. Third quarter data for fiscal years 2013-2019 includes an additional month of expenditures for March.

Total R&D Expenditures FY2013-2019

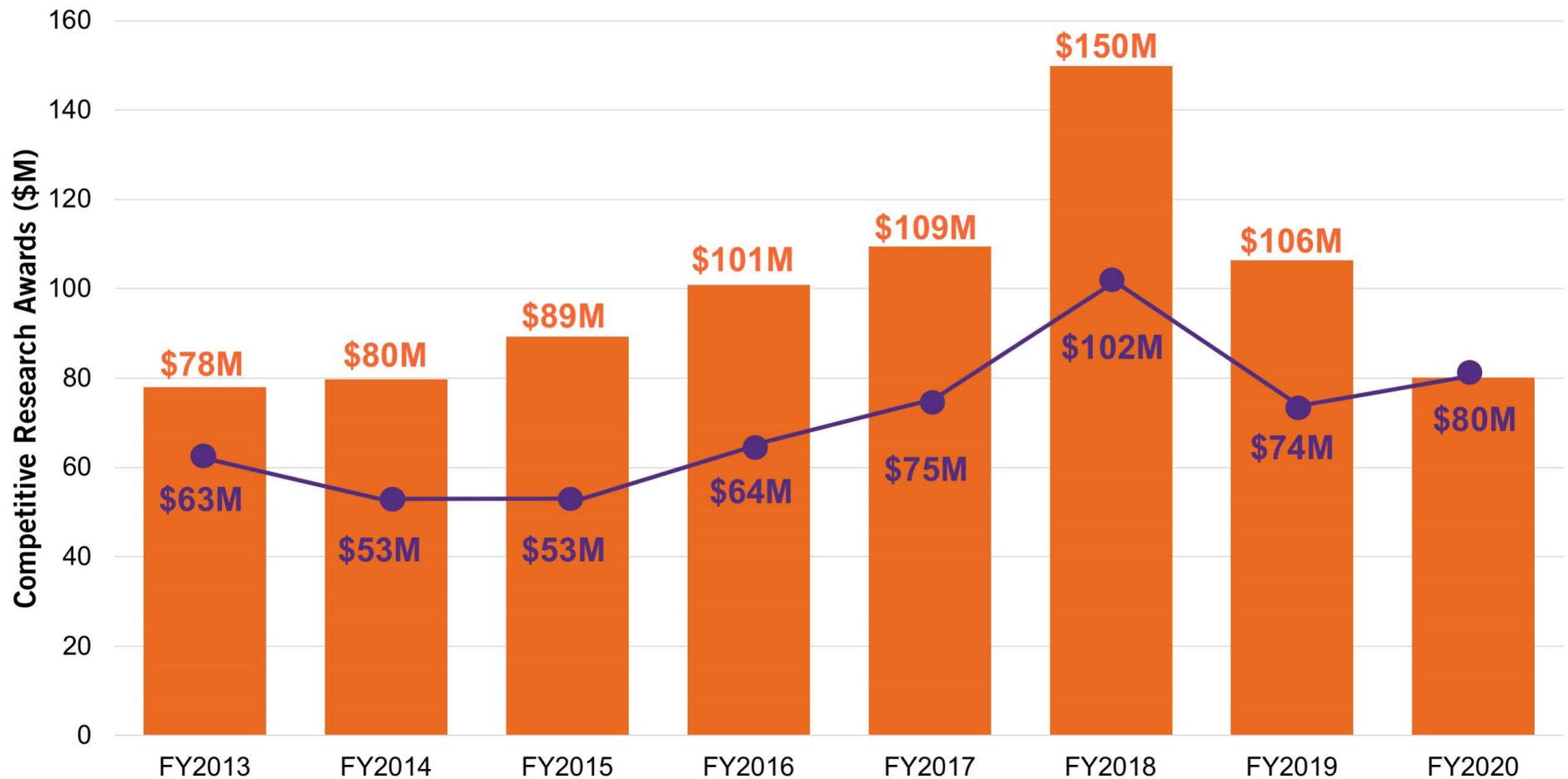
Total expenditures include competitive research awards, external research services, research gifts, institutional research support, state research support, etc., reported to the National Science Foundation (NSF). These totals are used for the Carnegie R1 classification.



SOURCE: National Science Foundation Higher Education Research and Development Survey

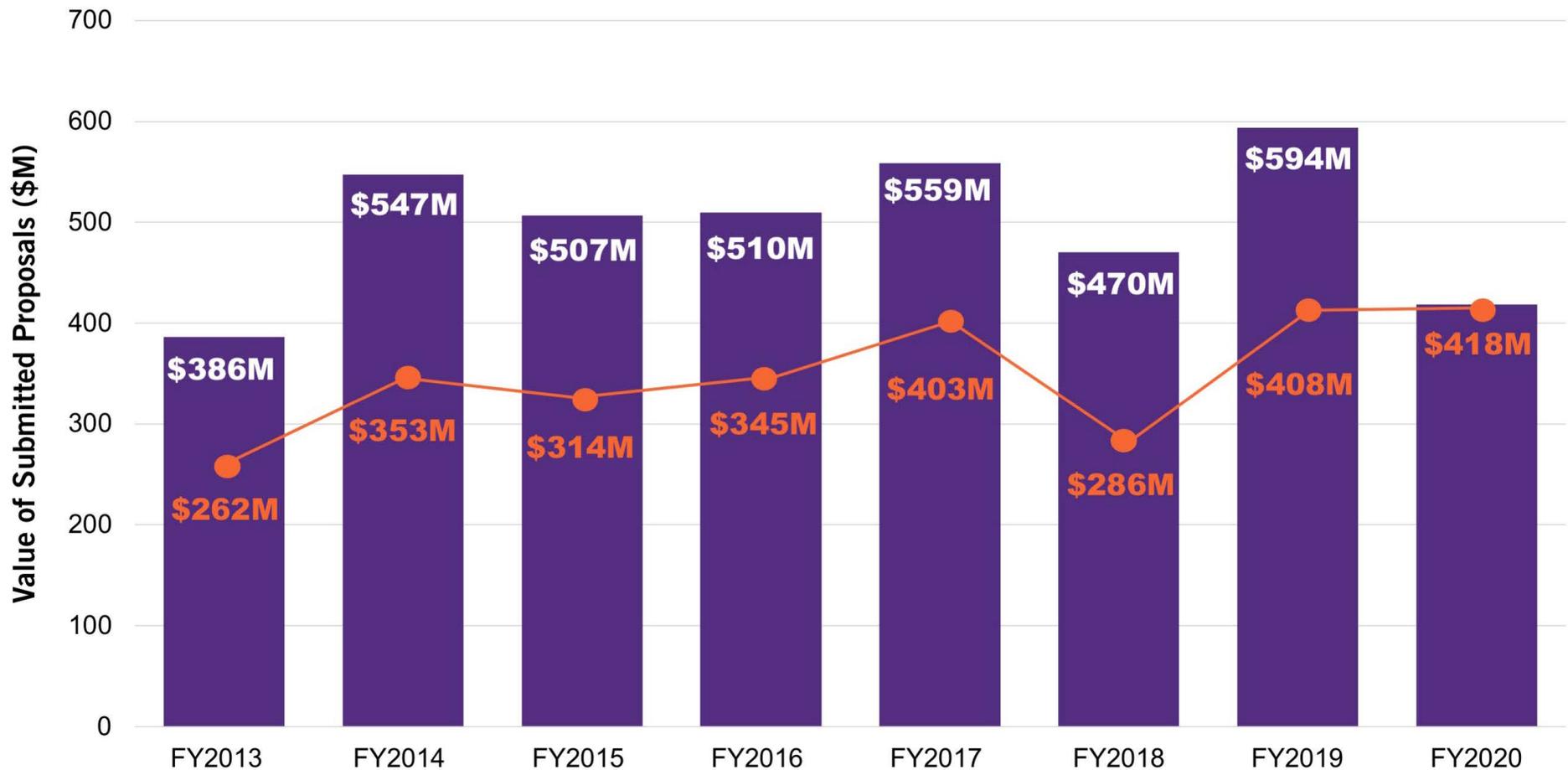
* The figure for 2019 is a preliminary number submitted for review to the National Science Foundation.

Competitive Research Awards FY2013-2020



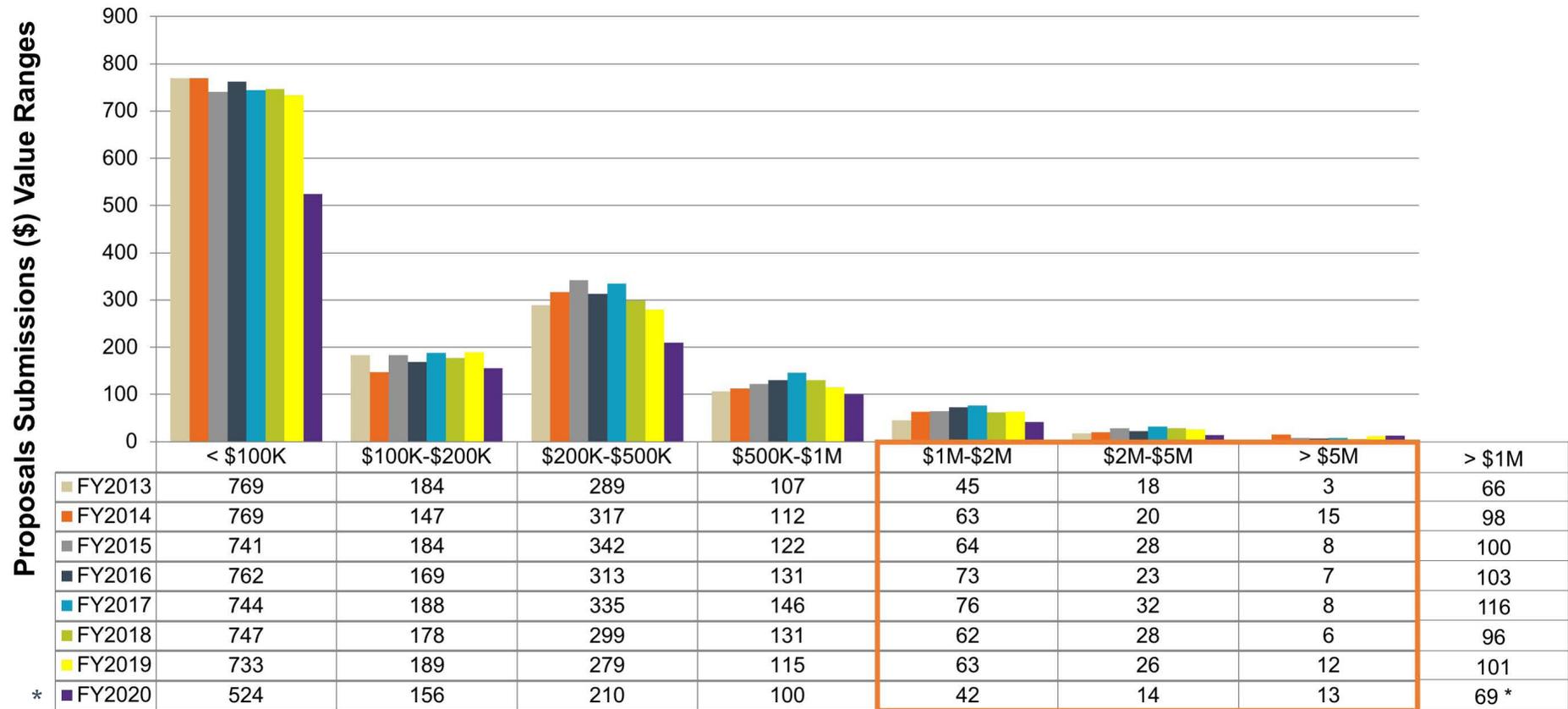
* Data on the purple line indicates totals as of the end of February for each fiscal year.

Proposal Submissions: \$ Value FY2013-2020



* Data on the orange line indicates totals as of the end of February for each fiscal year.

Proposal Submissions: \$ Range FY2013-2020



* Figures for FY2020 are through the end of February; all other years include totals at fiscal year-end.

Research Report Card

		2013	2014	2015	2016	2017	2018	2019	2020	
RESEARCH INPUTS										as of Feb. 29
a. Proposal Submissions by Number		1,414	1,443	1,489	1,478	1,529	1,451	1,417	1,059	
1	CAAH (College of Architecture, Arts & Humanities)	38	51	65	62	69	64	69	64	
2	CAFLS (College of Agriculture, Forestry & Life Sciences)	235	230	224	222	241	229	377	284	
3	CBSHS (College of Behavioral, Social & Health Sciences)	81	93	102	104	112	101	105	75	
4	CECAS (College of Engineering, Computing & Applied Sciences)	549	555	582	617	618	587	562	397	
5	COE (College of Education)	51	54	39	45	46	37	39	27	
6	COB (College of Business)	7	15	13	15	7	10	5	9	
7	COS (College of Science)	242	247	263	239	230	227	186	154	
8	CCIT (Clemson Computing & Information Technology)	12	12	6	3	5	1	1	1	
9	PSA (Public Service & Agriculture)	88	90	118	97	170	163	33	16	
10	VP for Res & Interdisc Inst	31	17	7	17	14	12	25	18	
11	All Other	80	79	70	57	17	20	15	14	
b. Proposal Submissions by Dollar Value (in millions)		\$386	\$547	\$507	\$510	\$559	\$470	\$486.4*	\$418.3	FY 2020 Targets
12	CAAH	N/A	N/A	\$9.4	\$8.6	\$3.1	\$5.7	\$4.4	\$2.5	\$5.5
13	CAFLS	N/A	N/A	\$42.6	\$23.8	\$43.4	\$37.1	\$64.1	\$49.7	\$66.4
14	CBSHS	N/A	N/A	\$28.4	\$40.1	\$41.4	\$25.9	\$47.9	\$17.0	\$49.6
15	CECAS	N/A	N/A	\$260.5	\$281.2	\$306.4	\$235.5	\$255.3	\$224.4	\$283.1
16	COE	N/A	N/A	\$13.8	\$14.7	\$18.1	\$19.1	\$10.1	\$12.1	\$12.2
17	COB	N/A	N/A	\$7.5	\$4.3	\$2.8	\$1.8	\$2.1	\$2.0	\$2.2
18	COS	N/A	N/A	\$100.2	\$111.3	\$95.9	\$100.4	\$73.8	\$81.5	\$84.7
19	CCIT	N/A	N/A	\$4.3	\$2.0	\$4.0	\$0.9	\$0.4	\$2.0	
20	PSA	N/A	N/A	\$23.3	\$10.4	\$31.3	\$25.8	\$11.4	\$5.1	\$13.4
21	VP for Res & Interdisc Inst	N/A	N/A	\$5.6	\$7.7	\$6.0	\$12.7	\$9.5	\$16.3	
22	All Other	N/A	N/A	\$11.4	\$5.6	\$6.0	\$5.0	\$7.4	\$5.8	

N/A - Data per college and unit was unavailable for fiscal years 2013 and 2014.

***This figure excludes a large \$107 million proposal from a multi-disciplinary collaborative between Clemson and Prisma Health.**

Research Report Card

		2013	2014	2015	2016	2017	2018	2019	2020
RESEARCH INPUTS continued									as of Feb. 29
c. Research Awards (in millions)		\$78.0	\$79.7	\$89.3	\$100.9	\$109.5	\$149.8	\$106.3	\$80.1
23	CAAH	\$0.2	\$0.6	\$0.7	\$1.4	\$0.5	\$1.9	\$2.0	\$0.8
24	CAFLS	\$7.3	\$6.7	\$14.1	\$8.6	\$10.9	\$13.9	\$14.2	\$16.8
25	CBSHS	\$2.7	\$3.4	\$4.8	\$5.1	\$4.6	\$8.1	\$5.9	\$5.7
26	CECAS	\$34.2	\$37.7	\$48.2	\$45.5	\$54.0	\$80.8	\$50.4	\$30.3
27	COE	\$2.6	\$4.1	\$3.2	\$2.9	\$2.8	\$4.5	\$3.3	\$1.6
28	COB	\$2.0	\$1.1	\$1.3	\$0.8	\$1.2	\$1.1	\$0.8	\$0.7
29	COS	\$10.3	\$7.8	\$9.9	\$15.6	\$19.9	\$14.7	\$18.7	\$8.9
30	CCIT	\$1.6	\$5.7	\$0.7	\$0.8	\$0.5	\$1.3	\$0.1	\$0.3
31	PSA	\$14.8	\$12.3	\$9.6	\$13.0	\$7.9	\$6.6	\$4.0	\$0.7
32	VP for Res & Interdisc Inst	\$1.8	\$0.3	\$0.6	\$5.1	\$5.0	\$15.1	\$6.2	\$12.6
33	All Other	\$0.3	\$0.2	\$1.2	\$2.0	\$1.2	\$1.7	\$0.7	\$1.7
d. Notable Awards									
34	NSF CAREER Awards (by start date)	4	1	3	5	7	7	4	6
35	EPA CAREER Awards (by start date)	-	-	-	-	-	-	1	-
36	Air Force Young Investigator Awards	-	-	1	2	-	-	1	-
37	Army Young Investigator Awards								1
38	DARPA Young Investigator Award	-	-	-	-	-	-	-	1
39	DOE Early CAREER Awards	1	-	-	-	-	-	-	-
40	NIH R01-Equivalent Awards (by start date)	-	-	2	2	2	3	6	1
e. Supporting Workforce									
41	Graduate Student Enrollment	4,206	4,372	4,670	4,664	4,425	4,985	5,282	5,627
42	Sponsored Graduate Research Assistants	822	745	707	693	696	761	558	637
43	Postdoctoral Fellows	48	64	83	85	90	97	98	86
44	Research Faculty: Permanent 100% Non-E&G Funded	6	6	6	11	17	14	11	18
45	Research Faculty: Temporary 100% Non-E&G Funded	18	18	15	14	24	27	29	54

Research Report Card

		2013	2014	2015	2016	2017	2018	2019	2020
RESEARCH PROCESS									as of Feb. 29
f. Sponsored Research Expenditures by Business Unit (in millions)		\$75.4	\$70.0	\$73.3	\$79.5M	\$89.5	\$94.2	\$104.5	\$66.4
46	CAAH	\$0.5	\$0.4	\$0.4	\$1.1	\$1.3	\$1.4	\$1.7	\$1.0
47	CAFLS	\$8.8	\$7.7	\$6.8	\$8.6	\$11.1	\$11.0	\$14.1	\$10.2
48	COB	\$1.2	\$1.2	\$1.1	\$1.0	\$0.9	\$0.8	\$0.8	\$0.4
49	CECAS	\$35.0	\$35.0	\$35.0	\$37.5	\$42.9	\$45.1	\$50.3	\$28.5
50	CBSHS	\$3.1	\$2.8	\$3.7	\$4.1	\$4.4	\$4.9	\$5.3	\$4.1
51	COE	\$3.3	\$3.3	\$3.8	\$2.5	\$2.6	\$2.2	\$2.5	\$1.7
52	COS	\$13.2	\$10.5	\$9.3	\$11.3	\$14.8	\$16.7	\$17.2	\$11.1
53	CCIT	\$2.0	\$1.6	\$3.4	\$2.8	\$0.4	\$0.6	\$0.2	\$0.04
54	PSA	\$4.7	\$4.9	\$5.8	\$5.6	\$5.7	\$5.9	\$3.7	\$2.6
55	VP for Res & Interdisc Inst	\$1.9	\$1.3	\$1.9	\$3.5	\$3.9	\$3.9	\$7.1	\$6.3
56	All Other	\$1.7	\$1.7	\$2.2	\$1.5	\$1.5	\$1.6	\$1.5	\$0.3
g. Sponsored Research Expenditures by Innovation Cluster (in millions)		\$75.4	\$70.0	\$73.3	\$79.5	\$89.5	\$94.2	\$104.5	\$66.4
57	Advanced Materials	\$14.3	\$11.3	\$10.7	\$10.4	\$10.7	\$12.1	\$15.4	\$8.8
58	Cyberinfrastructure & Big Data Science	\$10.3	\$10.5	\$10.1	\$8.9	\$8.1	\$9.6	\$6.9	\$2.7
59	Energy, Transportation & Advanced Manufacturing	\$4.7	\$5.7	\$7.2	\$7.6	\$17.8	\$16.8	\$17.1	\$9.2
60	Health Innovation	\$13.1	\$10.2	\$10.2	\$12.5	\$16.3	\$17.8	\$23.8	\$17.3
61	Human Resilience	\$8.2	\$7.7	\$9.7	\$9.8	\$7.8	\$8.6	\$9.0	\$5.8
62	Sustainable Environments	\$18.3	\$16.9	\$17.9	\$21.7	\$18.9	\$19.5	\$20.6	\$15.2
63	Other	\$6.5	\$7.6	\$7.4	\$8.6	\$9.9	\$9.6	\$11.7	\$7.4
h. Sponsored Research Expenditures by Funding Source (in millions)		\$75.4	\$70.0	\$73.3	\$79.5	\$89.5	\$94.2	\$104.5	\$66.4
64	Federal Government	\$62.9	\$56.9	\$58.5	\$65.1	\$74.6	\$78.2	\$85.1	\$53.0
65	Foundations, Societies, and Associations	\$4.2	\$4.3	\$4.7	\$4.1	\$4.7	\$5.1	\$7.4	\$4.9
66	Industry/Other	\$4.9	\$5.6	\$6.1	\$6.9	\$6.8	\$6.3	\$5.3	\$3.4
67	International	\$0.8	\$0.6	\$0.8	\$0.8	\$0.5	\$0.4	\$0.3	\$0.2
68	Local Government	\$0.6	\$0.6	\$0.6	\$0.5	\$0.5	\$0.5	\$0.5	\$0.3
69	State Government	\$1.9	\$1.9	\$2.7	\$2.0	\$2.4	\$3.7	\$5.7	\$4.6

Research Report Card

		2013	2014	2015	2016	2017	2018	2019	2020
RESEARCH PROCESS continued									as of Feb. 29
i. Sponsored Research Expenditures per T/TT Faculty by College									
70	CAAH	\$3,299	\$2,264	\$2,343	\$5,841	\$8,177	\$8,945	\$10,159	\$6,553
71	CAFLS	\$88,570	\$81,120	\$69,612	\$84,618	\$105,396	\$103,814	\$134,555	\$85,878
72	COB	\$14,415	\$13,047	\$11,510	\$9,683	\$8,855	\$8,269	\$8,200	\$4,172
73	CECAS	\$169,754	\$160,698	\$163,406	\$163,685	\$194,323	\$214,280	\$225,620	\$123,869
74	CBSHS	\$27,982	\$26,853	\$33,764	\$42,376	\$34,751	\$39,532	\$40,301	\$30,795
75	COE	\$54,779	\$51,688	\$62,195	\$38,037	\$44,483	\$40,197	\$47,371	\$33,048
76	COS	\$95,724	\$72,421	\$61,912	\$77,589	\$95,956	\$110,206	\$118,600	\$74,331
77	CU average (Total exp/Total T/TT faculty)	\$83,858	\$75,089	\$78,826	\$85,753	\$84,297	\$103,706	\$99,125	\$60,258
RESEARCH OUTPUTS/ OUTCOMES									
78	Doctorates Awarded (Aug, Dec, May)	187	217	237	233	231	234	301	152
79	STEM Doctorates Awarded (Aug, Dec, May)	118	153	165	138	156	171	174	105
80	Disclosures	102	129	70	60	65	48	61	84
81	Patents	16	15	15	14	18	11	18	5
82	Licenses/Options	9	7	7	5	10	10	16	5
83	Licensing Revenue	\$1,134,289	\$762,811	\$360,131	\$354,827	\$539,490	\$388,751	\$398,136	\$230,281
84	Start-up Companies (based on licenses/options)	1	4	4	2	3	3	5	1

Young Investigator Awards

Junior faculty at Clemson University continue to prove the future is bright. So far this fiscal year, junior faculty members have earned eight CAREER awards from the National Science Foundation (NSF), the U.S. Army, and the Defense Advanced Research Projects Agency (DARPA). These are the most prestigious awards young faculty can receive and serve as catalysts to jumpstart their careers.



Fadi Abdeljawad

Assistant Professor, Mechanical Engineering

Army Young Investigator Program Award

Abdeljawad is developing theoretical and computational models that explain how metals respond to outside forces.

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Kara Powder

Assistant Professor, Biological Sciences

NSF CAREER Award

Powder is working to understand the genomic and developmental origins of diversity.

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Mark Blenner

Associate Professor, Chemical and Biomolecular Engineering

DARPA Young Faculty Award

Blenner works with bacteria and yeast to make new enzymes that are able to do things nature has not yet figured out.

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Ulf Schiller

Assistant Professor, Materials Science and Engineering

NSF CAREER Award

Schiller uses supercomputing techniques to better understand complex fluids, a step toward creating new smart materials.

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Jon Calhoun

Assistant Professor, Electrical and Computer Engineering

NSF CAREER Award

Calhoun is developing techniques to help move data more efficiently, a big factor in supercomputer performance.

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Yin Yang

Associate Professor, School of Computing

NSF CAREER Award

Yang is developing customized computing methods for animation, simulation, robotics, and other applied areas.

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Carlos Gomez

Assistant Professor, Teaching and Learning

NSF CAREER Award

Gomez is working to help educators better understand and teach diverse populations of students.

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Rongzhong Ye

Assistant Professor, Plant and Environmental Sciences

NSF CAREER Award

Ye is working to better understand soil ecology to promote improved soil health and crop production.

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Board of Trustees Research Report
April 23, 2020