



University of Colorado **Boulder**

2017 Program Review

Cooperative Institute for Research in
Environmental Sciences

Academic Review and Planning
Advisory Committee Report

Approved

A handwritten signature in black ink, appearing to read 'Russell Wood'.

03/29/2018

Provost and Executive Vice Chancellor for Academic Affairs: Date

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Process Overview

The review of the Cooperative Institute for Research in Environmental Sciences (CIRES) was completed in accordance with the 2017 review guidelines. The Academic Review and Planning Advisory Committee (ARPAC) conducts and writes the final reviews of all Boulder campus academic units. The unit prepared a self-study during 2016, which was checked between December 2016 and February 2017 by an internal review committee of two CU Boulder faculty members from outside of CIRES. The internal reviewers found the report to be an “accurate and complete portrayal of the unit.” They made suggestions for the inclusion of additional information that had not been elicited by the required questions. The unit then submitted a response to the internal reviewers that included the suggested information. They noted some organizational and personnel issues for subsequent exploration by the external review committee and ARPAC. The external review committee, consisting of three experts within the discipline from outside of the University of Colorado, visited the unit over March 20-21 2017, reviewed relevant documents, and met with faculty, students, staff, and university administrators. Both committees’ comments and recommendations are cited at appropriate points throughout the report. This public document reflects the assessment of and recommendations for CIRES as approved by ARPAC.

Academic Review
and Planning
Advisory
Committee
(ARPAC)

Sanjai Bhagat, Professor, Business

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David Korevaar, Professor, Music

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Susan Nevelow Mart, Associate Professor, Law

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Academic Year
2017-18
Voting Members

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Bryan Taylor, Professor, Communication

Non-Voting Members

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Bob Boswell, Vice Chancellor for Diversity, Equity, and Community
Engagement and Professor of Molecular, Cellular, and
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Katherine Eggert, Quality Initiative Leader and Professor of English

Bill Kaempfer, Senior Vice Provost and Associate Vice Chancellor
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Mary Kraus, Vice Provost and Associate Vice Chancellor for
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Ann Schmeising, Interim Vice Provost and Dean of the Graduate
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Staff

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Unit Overview

The campus's standardized description of the unit may be found on the website of the Office of Data Analytics (ODA) at <https://www.colorado.edu/oda/institutional-research/institutional-level-data/information-department/academic-review-and-planning>.

ODA updates the profile annually in the fall semester. This report cites the CIRES ODA data posted in October 2016, reflecting the state of the institute as of academic year (AY) 2015-16.

CIRES is jointly sponsored by the National Oceanic and Atmospheric Administration (NOAA), NOAA's Office of Oceanic and Atmospheric Research (OAR), and the University of Colorado Boulder and, as the self-study describes, "is dedicated to interdisciplinary research on Earth's environment." The institute is the largest of the sixteen NOAA cooperative institutes. Almost half of CIRES staff is embedded in NOAA laboratories including the divisions of the OAR's Earth System Research Laboratory, the National Weather Service, the Space Weather Prediction Center, the National Environmental Satellite, Data, and Information Service, and the National Centers for Environmental Information. Its vision statement expresses that "CIRES is instrumental in enabling progress toward creation of a sustainable environment by advancing scientific and societal understanding of the Earth System." The institute does not offer undergraduate or graduate degrees.

The internal reviewers note that "CIRES is a premier, world-renown research institute and a significant benefit to the teaching and research mission of CU." The external reviewers agree with this assessment and deems CIRES to be "an international leader in earth systems and environmental science research with an ambitiously broad yet high quality research program." The institute's success in research productivity and

extramural funding is impressive, and its faculty have won prestigious university, national, and international awards.

Personnel
and
Governance

According to the Office of Data Analytics profile for AY 2015-16, CIRES personnel include a director, 269 research associates, 285 research assistants, one postdoctoral fellow, 47 student research assistants, and 69 hourly student assistants. The self-study notes a director, a five-member senior management team, 19 CIRES tenured/tenure-track (TTT) faculty (13 of the 19 are full professors), 21 collaborating TTT faculty, 12 NOAA and other faculty, 35 administrative personnel, 257 research scientists, and 264 associated scientists. It also lists 28 postdoctoral associates, seven visiting scholars, eight visiting fellows, 123 graduate students, and 97 undergraduate students who do institute work. The institute director serves a renewable four-year term. The director consults with an executive committee made up of associate directors and members at large and with a Council of Fellows made up of CU Boulder TTT faculty rostered in CIRES, CU Boulder TTT faculty hired by affiliated departments, and other NOAA or CU Boulder senior scientists. The Council of Fellows recommends appointment/reappointment of the CIRES director to the vice chancellor for research and innovation, maintains the bylaws, and provides input on institute affairs. The director also consults with the Council of Members, which represents all career-track employees besides the fellows, on issues important to the scientific staff. The institute is made up of six divisions: Cryospheric and Polar Processes; Ecosystems Science; Environmental Chemistry; Environmental Observation, Modeling, and Forecasting; Solid Earth Sciences; and Weather and Climate Dynamics; and four research centers: the National Snow and Ice Data Center [NSIDC]; the Center for Science and Technology Policy Research; the Earth Science and Observation Center; and the Center for Limnology. Each

division is led by a director who also serves as CIRES' associate director. The institute's bylaws were last revised in 2005.

Research
and
Scholarship

CIRES is productive in research and scholarship. The institute's self-study highlights recent accomplishments for each division. Examples include: the use of satellite data to analyze current sea level change by the Weather and Climate Dynamics division; a demonstration of decreasing Arctic summer sea ice extent since 1979 by the Cryospheric and Polar Processes division; a demonstration of potential for mineral grain luminescence for quantifying sediment transport in rivers by the Solid Earth Sciences division; and the creation of a model providing guidance on rapidly changing weather conditions by the Environmental Observation, Modeling, and Forecasting division. The institute's divisions are designed from the outset to stimulate collaboration and program development.

CIRES further explains the strength of its work by the total amount, diversity, and growth of research support. The self-study notes that "CIRES presently expends approximately \$80M per year in extramural research support; this support has grown by 36% over the last seven years." While NOAA is a strong partner and source of research funding, the institute draws nearly half of its support from other resources including the National Science Foundation, the National Aeronautics and Space Administration (NASA), and the NASA Jet Propulsion Laboratory.

The institute's success in producing peer-reviewed publications also demonstrates its strength. CIRES personnel published 4,208 peer reviewed journal articles in 2009-2015, with large numbers of them appearing in leading journals such as *Science*, *Nature*, *Geophysical Research Letters*, *Atmospheric Chemistry*

and Physics, and *Journal of Climatology*. These efforts have not gone unrecognized. Between 2002-2015, institute researchers were awarded membership/fellowship status in the American Geophysical Union (25 individuals); the American Physical Society, the American Association for the Advancement of Science, the American Mathematical Society, and the Institute of Electrical and Electronic Engineers (16 individuals). Eight researchers received a total of twenty “highly cited researcher” designations from the Institute for Scientific Information, and one was awarded the National Medal of Science.

Office of Data Analytics statistics show CIRES fourth among eight units in the current review cycle for refereed articles and chapters, first of seven for edited books, first of eight for conference presentations and papers, and third of seven for refereed books. The institute ranks first of nine relevant units in the current review cycle for grant expenditures (direct) over the last five years, with a total of \$347,123,000. It ranks third of nine for grant expenditures after allocation, with a total of \$131,864,000. Last year’s grant expenditures (direct) totaled \$79,579,000, which ranked second of nine units in the current review cycle.

Undergraduate Education

CIRES provides no undergraduate degrees but does support undergraduate education. Institute faculty hold tenure in academic departments, and CIRES requires these faculty meet departmental expectations for teaching practices and curriculum development. The self-study reports that in the fall 2015 and spring 2016 semesters CIRES faculty taught 2,293 credit hours of undergraduate courses. Institute faculty also provide individualized instruction through honors or research credit associated with CIRES programs. Between 2009-2016, according to the self-study, 127 undergraduate students received individual advising from CIRES affiliates and 103 were

employed hourly part-time in research programs operated by tenure-track faculty, research faculty, and graduate students.

The institute provides research space and graduate research assistantships for approximately fifty graduate students annually. CIRES also funds a graduate association which encourages community building and mentoring among graduate and postdoctoral researchers.

Graduate Education

The internal reviewers received 35 survey responses from 122 graduate students associated with CIRES. Nearly 80% of the respondents were “satisfied” or “very satisfied” with their experiences. The students appreciated opportunities to collaborate, professional development offerings, a sense of community, and connection with a prestigious organization as advantages. Feeling disconnected from the home department and isolation from other graduate students were counted among disadvantages. The external reviewers note that the graduate students and postdoctoral fellows they interviewed expressed “great appreciation for the opportunity and profile that comes with working on CIRES’ research projects.” While they recognized the value of their experiences, graduate students did express an interest in improved communication and more opportunities to interact with NOAA/CIRES personnel.

The self-study indicates that graduate students who have worked in the institute have gained positions in federal laboratories and agencies, and at research universities— all indicators of CIRES’ success. The institute has also expressed interest in developing a professional master’s degree in remote sensing, but awaits further approval from CU Boulder administrators, and from the academic units that will handle the coursework.

Space
and
Infrastructure

The 36% increase in extramural funding noted by the CIRES self-study has not been accompanied by an increase in available space. The institute traditionally collaborates with departments on gaining space and claims to be highly efficient in its use. Recent gains are already subscribed, including 4,000 square feet in the Sustainability, Energy and Environment Community (SEEC); meanwhile, space allotted to CIRES in the Research Laboratory #2 (RL2) has proved inadequate. The institute requests 25,000 square feet for new or renovated space (50% for new hires, 50% to replace inadequate space). It requests university or advancement funds to cover this need as grant funding will not suffice. The institute has initiated meetings with the CU Boulder Office of Advancement and is seeking private funds for needs that may not be fully met by the Boulder campus. The internal reviewers endorse the institute's plans and suggests that "CIRES be represented at campus planning meetings concerning space, and that they be at the forefront of these discussions given their contributions to both CU's ICR and reputation in a highly visible research field."

Outreach

The institute's outreach activities are centered in the Education and Outreach Program and the CIRES Communication Group. The Education and Outreach Program has built long-term relationships with school districts and engages in a number of geoscience education initiatives. These include working with underrepresented groups to make videos about local climate change impacts through the Lens on Climate Change project and providing research opportunities through the Research Experience for Community College Students project. The CIRES Communication Group manages the institute's internal and external communications. CIRES stories and researchers are frequently featured on media outlets. The institute also maintains a strong social media presence.

Climate The external reviewers report that “across the entire range of staff, from fellows to students, the consensus is that individuals are treated with respect and feel privileged to be a part of CIRES.” Their report goes on to state that “CIRES is a world class, successful, and effective institution that provides the required conditions for scientific growth.” The external reviewers also notes high morale among administrative staff, who “see themselves as a model unit for the rest of CU-Boulder.” The external reviewers’ report shows, however, that some NOAA-embedded personnel embedded at NOAA feel alienated from the rest of CIRES and that others are apprehensive about funding.

Inclusive Excellence According to the self-study, CIRES has had some success in recruiting women faculty, noting an increase from 34% to 37% over the last seven years, and expects this trend to continue. The self-study also reports that the composition of the institute (80% white and 62% male) does not match the demographics of CU Boulder or of Colorado. According to the Office of Data Analytics, seven of the CIRES-affiliated tenured and tenure-track faculty are women (32%), and two are members of underrepresented minority groups (9%).

CIRES faculty and staff engaged in several outreach activities related to inclusive excellence during the review period, including participation in the CIRES Tribes Eye Program, the Colorado Advantage Program, the Research Experience for Community College Students program (funded by the NSF), and Research Experiences in Solid Earth Science for Students which a nonprofit university/government consortium funds.

Past Reviews

CIRES was last reviewed as part of the ARPAC process in 2010. The recommendations to the unit from that review included developing strategies for diversifying extramural support. This remains an issue as the institute is still heavily dependent upon the NOAA cooperative agreement. CIRES was asked to develop an effective diversity plan with an appraisal mechanism. No mention of such a plan was made in the self-study. The institute was also charged with investigating means of communicating opportunities to CIRES-affiliated graduate students. Some progress seems to have been made in this area, as only a few complaints about communication were submitted in the internal reviewers' graduate student survey.

Recommendations to the unit, college, and campus included the development of a strategic plan to coordinate future hires within the geosciences, the integration of social science policy within CIRES's scientific portfolio and exploring partnership with the campus "computing condominium" project. CIRES reports that it "maintains its own computing facility as well as the computing facilities of a number of research groups and centers." The self-study also reports that the institute has expanded its programming scope to more fully address matters touching on ecology- and environment-focused social science research.

The institute has repeatedly expressed the need for additional space since its first program review in 1985. A request for seven new faculty positions over seven years was included in the 2010 review and this request was repeated in the current self-study. While CIRES was granted a 0.5 FTE faculty position in 2017 faculty numbers have not increased significantly in over a decade.

Campus Context

CIRES is one of the largest Boulder campus units. It is a leader in interdisciplinary research and advances graduate education through training and financial support, and actively aids undergraduate education. The institute shares interests in environmental research with a dense network of Boulder Campus collaborators. CIRES tenured/tenure-track faculty members are rostered through the Office of the Vice Chancellor for Research and Innovation but have a tenure home in one of nine affiliated departments. CIRES has shown steady growth in grant expenditures, research productivity, and reputation.

Disciplinary Context

The external reviewers consider CIRES “a world-class research institute” and “an international leader in earth systems and environmental science research.” The self-study cites a 2016 NOAA review that concludes that “CIRES is essential to the successful research operations of NOAA and is critical to those of CU.” The NOAA report also notes that “the CIRES director is highly regarded by NOAA, CIRES, CU and the broader science community.” The institute clearly has an outstanding national and international reputation.

Analysis

The institute's impact, as measured by research productivity and extramurally funded research expenditures, is impressive. CIRES asserts that to maintain and improve its stature, it needs support in the form of new faculty and new/improved campus space. The institute again requests seven additional tenure/tenure-track (TTT) faculty lines. CIRES states, "a constant numeric base of tenure-track faculty for CIRES forces the Institute to choose between maintaining excellence in fields of research for which CIRES is known globally, or creating new programs and research thrusts that reflect constantly changing research environment[s] for specific disciplines." The institute asserts that new faculty are key to generating extramural funding that does not derive from the NOAA cooperative agreement and contributing to a diversity of research. The external reviewers agree, stating that "we emphatically recommend that new faculty lines be created, starting with areas that are critical for the existing centers (such as the National Snow and Ice Data Center). This will mitigate the reliance of CIRES on soft money in an era of budget pressure." The institute's strategy for new hires includes initiating a new energy and the environment program, reinforcing environmental policy research, building on emerging strength in space weather and ecosystem microbiology, and personnel diversification. ARPAC agrees with the focus of the proposed faculty lines.

Research

CIRES is a high performing research institute that excels in scholarship and acquiring extramural funding. The internal reviewers warn against complacency with this success, however, as growth in tenure/tenure-track faculty has not kept up with the productivity increase. Some areas of research, such as space weather prediction, are covered by NOAA, but there are no tenured/tenure-track faculty in these areas at CU Boulder. "This has led to what is perceived by both CU faculty

and NOAA researchers as missing various significant opportunities to partner and collaborate on cutting edge issues... To maintain research momentum and develop and strengthen academic ties to existing and emerging research areas, new tenure track lines are essential for CIRES.” ARPAC agrees that there is reason for concern. ARPAC recommends that CIRES clarify how new TTT faculty positions would stabilize and diversify institutional funding and suggests that the institute work with allied departments to integrate proposed faculty positions.

Undergraduate Education

ARPAC commends the institute for the commitment it has made to supporting undergraduate education including curriculum development, individualized instruction, and employment. Undergraduates who take advantage of opportunities offered by CIRES benefit from the experience they gain and are better prepared for graduate school and to take the steps necessary to enter science and engineering professions.

Graduate Education

ARPAC commends the support CIRES offers to graduate students and the high satisfaction level that graduate students express regarding exposure to world-class experts, research opportunities, and community. Some students expressed frustration with communication and understanding their status within the institute; ARPAC recommends that the institute work on improving communication.

ARPAC notes that there is now a structure for moving forward with professional master’s programs and recommends that CIRES assess how it may best contribute. ARPAC also encourages the institute to better track graduate student and postdoctoral fellow placements.

Climate The external reviewers describe the institute’s climate as excellent, noting a high degree of satisfaction among personnel. However, the external reviewers also note perceived inconsistencies in criteria for merit reviews across NOAA/CIRES, and reports that some CIRES personnel feel NOAA views them as contractors rather than as independent scientists. ARPAC encourages the institute to continue to improve communication in order to overcome some of the challenges associated with having a workforce divided between a federal research facility and the Boulder campus.

Space and Infrastructure CIRES has asked for more space in every program review since 1985. Over the last seven years, the institute’s extramural funding has increased by 36%. This increase has been accompanied by an increase in non-faculty personnel and a need for more space. In the current self-study, CIRES requests 25,000 square feet of new or updated space for office and laboratory facilities. In response to an internal review query, the institute provided plans for how gained space would be used. In this scenario the National Snow and Ice Data Center (NSIDC) would be moved to new, larger space that would allow the institute to co-locate faculty with interests aligned with those of NSIDC. The four faculty currently in Sustainability, Energy and Environment Community (SEEC) building would move to new space, as would the seven proposed hires. Administrative and infrastructure functions would also be located in new space. These moves would concentrate expertise in cryospheric studies, climate and climate change, and climate modeling in one location. CIRES asserts that without new space it would be unable to accommodate any new faculty hires and that “any new TTT faculty would need to be placed outside of CIRES (e.g., in departments) and this would result in separation of these hires from the CIRES environment and would cause CIRES to lose much of the grant-based indirect cost that is the

basis for operation of CIRES.” The Office of Data Analytics unit profile for the institute reports 55,095 square feet of net assignable space. This is fifth of nine units in the review cycle and nineteenth of sixty-four campus units. The external reviewers recognize that “physical occupancy of CIRES on CU campus is presently saturated and new space is necessary to safeguard the advancement of the institution in the coming years.” ARPAC agrees that the institute’s space request should receive serious consideration.

Inclusive Excellence

ARPAC recognizes that CIRES has experienced some success with increasing gender diversity in its personnel and notes the targeted outreach the institute has conducted. ARPAC encourages the institute to reinvigorate its inclusive excellence efforts and to take initiative in building a more diverse community. ARPAC notes that CIRES has not submitted an inclusive excellence narrative and recommends that the institute work with allied departments to accomplish this work, particularly to draw on their prior inclusive excellence planning.

Recommendations

The members of the Academic Review and Planning Advisory Committee (ARPAC) address the following recommendations to the Cooperative Institute for Research in Environmental Sciences and to the offices of responsible administrators.

To the Unit:

1. Bolster inclusive excellence efforts by engaging constituents in drafting an inclusive excellence narrative. Work with the Office of Diversity, Equity, and Community Engagement (ODECE) and the National Center for Women in Information Technology to connect with women and underrepresented minority students, researchers, and potential faculty, and take steps to increase CIRES personnel diversity. Regularly assess these efforts. Formulate ways to increase the diversity of applicant pools for faculty and research positions within the institute and allied departments. A strong inclusive excellence narrative is a prerequisite for new faculty hires.
2. Continue strategic planning for hiring tenure-track faculty in CIRES while considering implications across the geosciences. A strong argument for new positions would include working with allied departments to integrate these faculty positions with the teaching and research missions of those departments.
3. Work with the Research and Innovation Office (RIO) and allied departments to develop a plan to provide new faculty with competitive startup packages.
4. Create means of monitoring climate issues for students and staff. Address any issues identified, including those surrounding graduate students' sense of not belonging to the institute.

5. Work with the Office of Data Analytics and internal records to enhance placement tracking for CIRES-affiliated graduate students and postdoctoral fellows.
6. Determine how CIRES may best participate in a professional master's for remote sensing or other professional master's programs, given the new funding model for professional master's degrees.
7. Continue to develop and carry out strategies for diversifying extramural support.
8. Work with the Office of Advancement to develop and implement a successful fundraising program.
9. Continue to work with the appropriate units to communicate CIRES-related activities to students.
10. Work with the provost and the vice chancellor for research and innovation in seeking appropriate replacement space for RL2 and Grandview, as well as appropriate new faculty and research group space.
11. Assist CIRES in its efforts to increase faculty and research applicant diversity when positions open.
12. Consider the CIRES request for new faculty lines based on both the institute's inclusive excellence planning and the potential for new faculty integration with CU Boulder departments.
13. Support the institute's efforts to diversify sources for extramural funding.

To the Vice
Chancellor for
Research and
Innovation:

14. Work with the institutes and the provost to investigate financial and programmatic issues associated with the allocation of faculty positions to institutes rather than to a college.
15. Develop a strategic plan coordinating future institute hires across relevant units that help maintain research strengths and diversify extramural funding.
16. Work with the provost and CIRES in seeking appropriate replacement space for RL2 and Grandview, as well as appropriate new faculty and research group space.
17. Encourage the institute's participation in professional master's programs.

To the Provost:

18. Work with CIRES and the vice chancellor for research and innovation in seeking appropriate replacement space for RL2 and Grandview, as well as appropriate new faculty and research group space.
19. Work with the Office of Advancement, CIRES, the vice chancellor for research and other institutes to develop a pan-institute model for advancement

Required Follow-Up

The director of the Cooperative Institute for Research in Environmental Sciences shall report annually on the first of April for a period of three years following the year of the receipt of this report (i.e., April 1st of 2019, 2020, and 2021) to the provost and the vice chancellor for research and innovation on the implementation of these recommendations. The provost, as part of the review reforms, has agreed to respond annually to all outstanding matters under their purview arising from this review year. All official responses will be posted online.