THE CITADEL

JAMES B. NEAR CENTER FOR CLIMATE STUDIES

ANNUAL REPORT 2022-23

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EXECUTIVE SUMMARY

2022-23 marked the third year of the Lt. Col. James B. Near, Jr., USAF, '77 Center for Climate Studies (NCCS). The Center continues to advance the actions proposed under strategic initiative 6.3 of Our Mighty Citadel 2026. Highlights of the year were:

1. Finalization of the Near Center for Climate Studies collaborative space (page 5)
2. Establishing a Minor in Climate Resiliency and Environmental Sustainability Studies (CRESS) (page 9)
3. Holding the first NCCS research seminar (page 15) and second "Active Learning: Infusing Climate Change into Your Curriculum" faculty workshop (page 10)
4. Collaborations with Kids Teaching Flood Resilience and South Carolina Sea Grant Consortium to create professional development opportunities (page 10)
5. Enhancing weather and climate observations on the Ashley through a Hohonu tidal gauge (page 13)
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7. Granting $32,377 in climate studies research to faculty in Biology, Supply Chain and Operations Management, and Civil Engineering (page 11)
8. Building climate scholarship with 5 refereed journal articles and 4 conference presentations (page 12)
9. Winning $41,051 in external research proposals (page 14)

NCCS has engaged with key climate stakeholders locally and nationally, which has led to collaborations on research proposals and connections with industry and community organizations. We seek to grow in our applied climatology emphases: coastal environment and infrastructure, national security, and human health and welfare. However, NCCS is under funding constraints which caused a suspension of the Climatological Research Studies Grant program, and continues to grapple with insufficient administrative assistance.

Scott Curtis, Ph.D., Director
Near Center for Climate Studies

VISION & MISSION

The NCCS serves the students and faculty of The Citadel and citizens of South Carolina by enhancing understanding of climate and its variability, change, and risks. The vision of the Center begins with the personal vision of Lt. Col. Jim Near. Near served twenty years in the USAF as a meteorologist and in fall 2014 returned to The Citadel as an adjunct professor of Physics. Near demonstrated extraordinary generosity by providing The Citadel Foundation (TCF) with a $3.27 million gift to initiate the Center. Ever humble and not wanting to receive any recognition for his donation, he specified to TCF that his gift remain completely anonymous until his passing in March 2020.

Vision

The Lt Col James B. Near, Jr., USAF, '77 Center for Climate Studies will be nationally recognized as an academic leader in *climate science*[1] and facilitating the transition of this science from research into operational use to assist in principled decision making.

Mission

The NCCS mission is to promote climate science through education, research, transition to operations, and community engagement and the development of public-private partnerships. The scope of the Center's activities will consist of the relation of Earth's climate to (a) national security, (b) coastal environment and infrastructure, and (c) human health and welfare.

1. climate science is defined as the science of how global, regional, or local climates are maintained and change over time and their effects on the environment and society.

NEAR CENTER

The NCCS was able to use its lab space in the 2022-23 academic year even though the interior windows were delayed due to supply chain issues. The following events were held in the new space:

- Rising Up to the Challenge of Flooding in the Lowcountry Middle School Professional Development
- Richland County District 2 ALERT Program: Wind and Turbines Activity
- STEM/Robotics Activity
- 1st NCCS Seminar (see page 15)
- Swain Family School of Science and Mathematics Fall 2022 Council Meeting
- Fall and Spring Climate Fellows Meeting and January Executive Committee Meeting
- SC Sea Grant Consortium CEO talk on the FY24 Call for Proposals
- Guest lecture on Charleston's Climate Action Plan given to CIVL 322: Introduction to Environmental Engineering

June 22, 2022

April 17, 2023

The NCCS is officially opening on **September 15, 2023**. At the end of the 2022-23 academic year NCCS and TCF began planning for the event, which will include a symposium panel followed by a ribbon cutting ceremony. Panelists will provide their perspective from each of the three focal areas of the Center (see Mission statement). For the ribbon cutting ceremony, special guests will include the President, Provost, Rep. Mace, Mayor Tecklenberg, Mayor Haynie, Mayor Summey, BOV members, other friends and collaborators of the NCCS, and members of the Near family.

PERSONNEL

The NCCS is comprised of an Executive Committee, Advisory Board, and Climate Fellows.

Executive Committee

The Executive Committee (EC) is comprised of Citadel leadership and has oversight of NCCS activities as they pertain to fulfillment of the NCCS Charter. The EC went from seven to six members as Dr. Weinstein filled the role of Biology representative and Assistant Provost for Research

- Dr. Darin Zimmerman (chair), Dean of Swain Family School of Science and Mathematics
- Dr. Kevin Bower, Associate Provost for Academic Affairs and Dean of General Studies
- Dr. Scott Curtis, Director of Near Center for Climate Studies
- Dr. John Weinstein, Professor of Biology and Assistant Provost for Research
- Dr. Andrew Williams, Dean of Engineering
- Dr. Hank Yochum, Head of Department of Physics

Advisory Board

The Advisory Board (AB) is comprised of experts in the areas of environmental, climate, oceanic, atmospheric, and other closely allied sciences. Members may also include educators, policymakers, and leaders of the community and industry whose skills and activities would inform the Executive Committee on Center activities and direction, as well as provide networking opportunities for students and Center Fellows. There was no change in AB membership in the 2022-23 academic year, and Dr. Fred Holland continues to serve as the chair of the AB. During the 2022-23 academic year the AB organized themselves into committees as noted below:

- **Strategic and Governance (oversight of membership and committees):**
  - Mr. David Johnston (chair), Hamilton Advisors LLC
  - Dr. Fred Holland ‘64, former Director of NOAA Hollings Marine Laboratory
  - Dr. Susan Lovelace, SC Sea Grant Consortium
- **Outreach and Engagement Committee:**
  - Dr. Mike Johns ‘72 (chair), Winward Environmental LLC
  - Dr. Albany Irick, AgFirst Bank
  - Mr. Chris Mack, Moffatt & Nichol
  - Dr. Susan Lovelace, SC Sea Grant Consortium
  - Ms. Debra Hernandez, Southeast Coastal Ocean Observing Regional Association
  - Mr. Kevin Cooley ‘90, National Oceanic and Atmospheric Administration (NOAA)
- **Internship Committee:**
  - Dr. Hope Mizzell (chair), SC State Climate Office
  - Dr. Fred Holland ‘64, former Director of NOAA Hollings Marine Laboratory
  - Mr. Allan Clum, Mount Pleasant Waterworks
  - Mr. Joe Coates, Charleston County Emergency Management

- **Resources & Development Committee:**
  - Col. Allison Dean-Love, CGC '93 (chair), Citadel Board of Visitors, *ex officio*
  - Mr. David Johnston, Hamilton Advisors LLC
- **Resources & Development Committee:**
  - Dr. Paul Sandifer (chair), College of Charleston
  - Dr. Geoff Scott, University of South Carolina
  - Dr. Kirstin Dow, University of South Carolina
  - Dr. Brandon Emery, Lexington Medical Center

Two Advisory Board meetings were held, one on 11/3/22 and one on 3/23/23. Minutes of these meeting can be found in Appendix A.

Climate Fellows

At the close of the 2022-23 academic year there were 29 faculty and 2 community fellows of the NCCS representing all five Schools at The Citadel and the Department of Leadership Studies.

- Faculty Fellows
  - Dr. Jen Albert, Education
  - Dr. Mostafa Batouli, Civil and Environmental Engineering
  - Dr. Holly Bevsek, Chemistry
  - Dr. Pat Briggs, Physics
  - Dr. Kweku Brown, Civil and Environmental Engineering
  - Dr. Prosenjit Chatterjee, Cyber and Computer Science
  - Dr. Mei Chen, Mathematics
  - Dr. Sean Fourney, Public Speaking Lab Director, Leadership Studies
  - Dr. Simon Ghanat, Civil and Environmental Engineering
  - Dr. Chao Gu, Mathematics
  - Dr. Danny Gustafson, Biology
  - Dr. Ryan Integlia, Electrical and Computer Engineering
  - Dr. Deepti Joshi, Cyber and Computer Science
  - Dr. Kaelyn Leake, Physics
  - Dr. Thad Le-Vasicek, Chemistry
  - Dr. Bo Li, Mathematics
  - Dr. Michelle Lomonaco, Associate Director of Sports Medicine
  - Dr. Clinton Moran, Biology
  - Dr. Megan Moyer, Chemistry
  - Dr. Amanda Mushal, History
  - Dr. Sergey Ponomarov, Marketing Supply Chain & Economics
  - Dr. Deirdre Ragan, Mechanical Engineering
  - Dr. Claudia Rocha, Biology
  - Dr. Nandan Shetty, Civil and Environmental Engineering
  - Dr. Nahid Vesali, Engineering Leadership & Program Management
  - Dr. John Weinstein, Biology
  - Dr. Todd Wittman, Mathematics

  - Dr. John Zardus, Biology
  - Dr. Lisa Zuraw, Chemistry
- Community Fellows
  - Dr. Merrie Koester, USC Center for Science Education
  - Dr. LJ Palmer-Moloney, Visual Teaching Technologies

- Student Fellows
  - The following students were bestowed the title in 2022-23: *Andrew Hanson, Richard Milling, Benjamin Race, and Tiffany Wilson*

There were two meetings of the Climate Fellows, one on 11/11/22 and one on 4/3/23. Fellows were updated on Center activities and reports of the four standing committees were given. The four standing committees are: Academic, Research, Engagement, and Industry. The membership and goals are given below.

Academic Committee

Comprised of Fellows: Simon Ghanat, Lisa Zuraw, Jen Albert, and Megan Moyer. The charge of the Academic Committee is to propose educational and training opportunities for Citadel students and external constituents through curricular offerings, seminars and workshops, symposia, and continuing education. The committee will also engage with K-12 students and faculty.

Research Committee

Comprised of Fellows: Deepti Joshi, Nandan Shetty, Clinton Moran, Mostafa Batouli, and Prosenjit Chatterjee. The charge of the Research Committee is to seek research strategies and communicate external funding opportunities to the Director. They will also review internal research proposals, including the annual Climatological Research Studies Grant (CRSG) competition. Other Faculty Fellows may be invited to serve as reviewers in case of conflict of interest and/or a low committee membership. The committee will promote ethical behavior in the practice of research and innovative problem solving in climate science.

Engagement Committee

Comprised of Fellows: Kaelyn Leake, Deirdre Ragan, Claudia Rocha, and Thad Le-Vasicek. The charge of the committee is to facilitate NCCS outreach to the community (individuals, groups) in climate science and related environmental disciplines. The committee will listen to climate stakeholders and seek ways the Center can provide expertise and principled science-based leadership.

Industry Committee

Comprised of Fellows: Nahid Vesali, Sergey Ponomarov, and Prosenjit Chatterjee. The charge of the committee is to establish industry partnerships that benefit NCCS partners and provide research, internship, and other development opportunities for Citadel students and Fellows. The committee will provide mentoring and network opportunities for students interested in climate-related careers.

STRATEGIC ACTIVITIES

Academics

- "Develop a minor around Climate Studies"

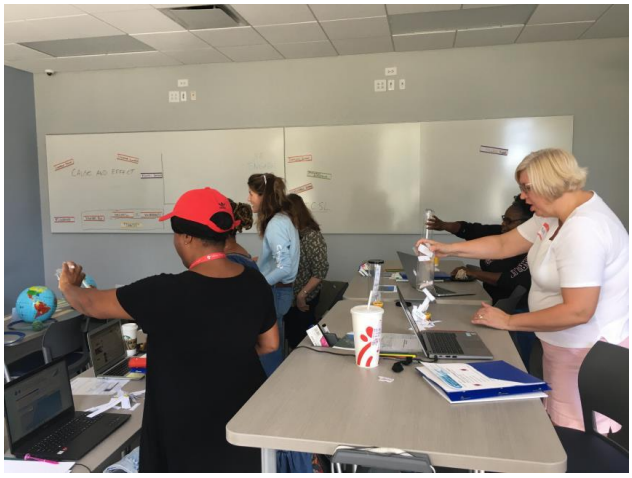
A revision of the minor "Sustainability and Environmental Studies" to "Climate Resiliency and Environmental Studies (CRESS)" was proposed to the University Curriculum Committee (UCC) on October 18, 2022. The proposal, details of which can be found in Appendix B, unanimously passed. The minor was approved by Faculty Senate and is now found in The Citadel catalog and on the web: https://www.citadel.edu/physics/cadet-programs/minor-in-applied-climatology/

- Number of students in climate studies classes
  - The three core courses for the CRESS minor are BIOL 209/NTSS 305: Environmental Science, PHYS 343 Applied Climatology, and a Capstone Course. Environmental Science was not offered during the 2022-23 academic year, while Applied Climatology was offered in Spring 2023, but only had three students. The NCCS will market and advertise the minor and we hope to see an increase in students in these core courses going forward. Below is a table of a few additional climate related courses. There does not appear to be a positive trajectory in course enrollment.

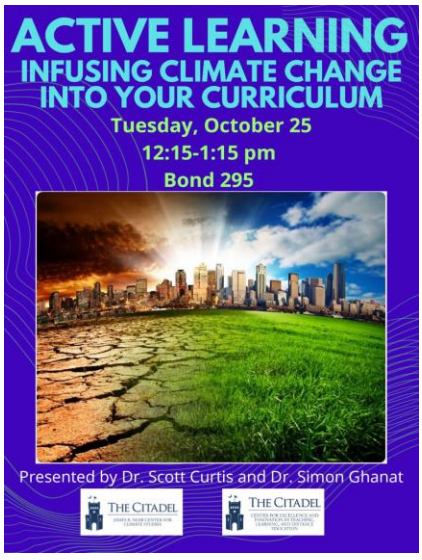
Number	Title	# Fall 2020	# Spring 2021	# Fall 2021	# Spring 2022	# Fall 2022	# Spring 2023
PHYS 244/ NTSS 305	Extreme Weather and Climate	NA	12	13	NA	NA	NA
NTSS 301	Technical Solutions to Climate Change	NA	NA	14	24	NA	19
NTSS 303	Biology, Environment, and Law	16	49	24	38	11	10
BIOL 209/ NTSS 305	Environmental Science	47	NA	36	NA	NA	NA
CIVL 322*	Intro to Env. Engineering	NA	49	NA	37	NA	33
Freshman seminars	Environmental Hazards	23	21	21	20	18	20
TOTAL		86	131	108	119	29	82

* An elective course in the CRESS minor

- "Develop a teacher workshop on infusing climate into the K-12 curriculum"
    - During the 2022-23 academic year the NCCS was funded **$10,100** by SC Sea Grant Consortium for the project: "Rising Up to the Challenge of Flooding in the Lowcountry: Mitigating the hazard of education vulnerability through STEAM PD". This was in partnership with The Citadel's STEM Center of Excellence and Kids Teaching Flood Resilience (KTFR). On September 24, 2022, six middle school teachers participated in a professional development workshop facilitated by Dr. Merrie Koester, Climate Fellow, and Director of KTFR. Representatives from SC Sea Grant also attended. The focus was assessing one's potential disaster risk from a hazard, being able to discern cause and effect relationships, observing patterns in the data, and interpreting change over time, which are fundamental community resilience and literacy skills and practices—as well as core cross-cutting concepts in the Next Generation Science Standards. This was a proof-of-concept for a "Camp Flood Resilience for Teachers". A proposal to the National Sea Grant program was submitted during the 2022-23 academic year to expand on this initial effort.



    - The NCCS, in partnership with The Center for Excellence and Innovation in Teaching, presented its second "Active Learning: Infusing Climate Change into your Curriculum" on October 25, 2022. This workshop was led by Climate Fellow, Dr. Simon Ghanat and attended by ~4 faculty. Dr. Ghanat demonstrated how students can recognize climate's impact on different environmental, engineered, and social structures through think-pair-share methodologies. These techniques were modeled by the participants.



Takeaways

It was a very successful year in addressing the NCCS strategic goals as applied to academics. A minor in Climate Resiliency and Environmental Sustainability (CRESS) was established. In 2023-24 NCCS will make a concerted effort through its Academic Committee to advertise the minor and track its enrollment. We hope that as students declare the CRESS minor there will be a spillover effect of enrollments in climate-related courses across the College. Climate Fellow Dr. Ghanat led a second active learning workshop for Citadel faculty.

Research

- "Enhance research in Climate Studies"
    - Funding from the Center to faculty and students
        - The Climatological Research Studies Grant (CRSG) program is administered through the NCCS and funds Citadel faculty and students in climate studies. This was a challenging year for the NCCS as there were fewer applications and the funds supporting the program lapsed. However, the NCCS, through contributions from the Swain Family School of Science and Mathematics, was able to support four projects amounting to $32,377. For the first time a faculty member in the Tommy and Victoria Baker School of Business was funded for a climate study.

Last name	First name	Dept.	Amount	Title
Batouli	Mostafa	Civil and Construction Engineering	$11,000	Modeling the Coupled Effects of Sea-Level Rise and Electric Vehicles on Low Lying Coastal Roads
Ponomarov	Sergey	Supply Chain and Operations Management	$11,221	Climate Change Impacts to Ports and Extended Coastal Supply Chains: Exploring Critical Infrastructure Vulnerabilities and Strategies for Strengthening Supply Chain Climate Adaptation and Resilience
Weinstein	John	Biology	$10,156	Assessing Environmental Exposure and Temperature-Related Effects of Floodwater-Associated Tire Wear Particles to Daggerblade Grass Shrimp, *Palaemon pugio*

- Publications, technical reports, undergraduate research projects, or conference proceedings per year. There was a total of 5 journal articles**,** 0 conference papers, and 4 national and international conference presentations, with co-authorship by Citadel students. We are also very pleased that many Citadel students presented NCCS-funded work at the SFSSM Banquet and Academic Excellence Day in the spring semester.

  Journal Article

  - Swofford, D. R., S. Guillermo, and T.W. Vasicek, 2023: Surface Chemistry and Biomolecule Density Impact Adsorbed Cellulase Activity. *The Chemist*, 94, 27-38.
  - Mukherji, A., S. Curtis, J. Helgeson, J. Kruse, and A. Ghosh, 2023: Mitigating compound coastal water hazards in eastern North Carolina. *Journal of Environmental Planning and Management*, doi:10.1080/09640568.2023.2183112.
  - Guillermo, S., D.R. Swofford, G. Coulter, and T.W. Vasicek, 2022: Optimization of Enzyme Activity of Cellulases Immobilized to Magnetic Nanoparticles with varying Functional Group Densities. *Journal of Undergraduate Chemistry Research.* 21(4), 96.
  - Curtis, S., A. Mukherji, J. Kruse, J. Helgeson, A. Ghosh, and N. Adeniji, 2022: Perceptions of risk to compound coastal water events: A case study in eastern North Carolina, USA. *Progress in Disaster Science*, 16, 100266, doi:10.1016/j.pdisas.
  - Sugg, M.M., J.D. Runkle, K. Dow, J. Barnes, S. Stevens, J. Pearce, B. Bossak, and S. Curtis, 2022: Individually experienced heat index in a coastal Southeastern US city among an occupationally exposed population. *International Journal of Biometeorology*, 66, 1665-1681.

  Presentation

  - Curtis: Barriers to recognizing, communicating, and mitigating compound flood risk: A case study in rural eastern North Carolina, 20th Annual Climate Prediction Applications Science Workshop, Asheville, NC, May 2023.
  - Weinstein, Ballentine, Ertel: Deposition of Airborne Microplastic and Tire Wear Particles in Salt Marsh Habitats: Proximity to Bridges, 33rd Annual Meeting, Society of Environmental Toxicology and Chemistry – Europe, Dublin, Ireland, May 2023.
  - Schmitz (advised by Moran and Zardus): Temperature effects on larval swimming of an important biofouling barnacle, the Society of Integrative and Comparative Biology, Austin, TX, Jan 2023

- Ballentine, Ertel, Weinstein: Atmospheric deposition of microplastics and tire wear particles in salt marsh habitats: Relationship to meteorological factors, 43rd Annual Meeting, Society of Environmental Toxicology and Chemistry – North America, Pittsburgh, PA, Nov 2022.

Student Presentation – SFSSM Annual Awards Banquet

- Savannah S. Fisher (Moran, Zardus): Temperature impacts on biofouling barnacle locomotion
- Rion Zack Reynolds (Moran, Zardus): Barnacles in hot water: temperature impacts on feeding behaviors of the striped barnacle
- Mary C. Ballentine (Weinstein): Atmospheric deposition of microplastics and tire wear particles in marsh habitats: Relationship to meteorological factors
- Gavin Coulter (Le-Vasicek): Immobilized catalyst performance: comparison of absorption and covalent attachment
- Evan Banks (Moyer): Development of a corn-fiber filter for cleaner water
- Justin Hedges (Chatterjee): Network of drones with facial recognition capabilities
- Hannah Collee (Joshi): Detecting climate-related events from social media using NLP and image classification

Student Presentation – Academic Excellence Day

- Hannah Collee (Joshi): Climate event detection in twitter data FIRST PLACE IN SCIENCE AND MATH CATEGORY!
- Evan Banks (Moyer): Synthesis of nano carbon microspheres (nCMS) for the absorption of water-soluble pollutants FIRST PLACE IN SIGMA XI CATEGORY!

- The 2022-23 academic year marked 100 years of The Citadel on the Ashley River. Fittingly, the NCCS purchased and deployed a Hohonu tide gauge on the Ashley at the mouth of Citadel Creek. Data collected by the tide gauge in October and November was used in a briefing to General Walters on boat rental operation efficiency. Research opportunities have increased greatly with the collocated tide gauge and weather station.
- During the Spring 2023 AB meeting Dr. Fred Holland proposed a NCCS Climate Monitoring and Assessment Initiative (see Appendix C), building off NCCS's current efforts. The NCCS is actively seeking funding and faculty champions for this initiative. The director has been in touch with Dr. Dwayne Porter

(USC) to determine if the Citadel could join or potentially assume the current environmental monitoring efforts in the Rosemont neighborhood.

- Proposals for external funding per year. During the 2022-23 academic year three proposals were pending and three funded.

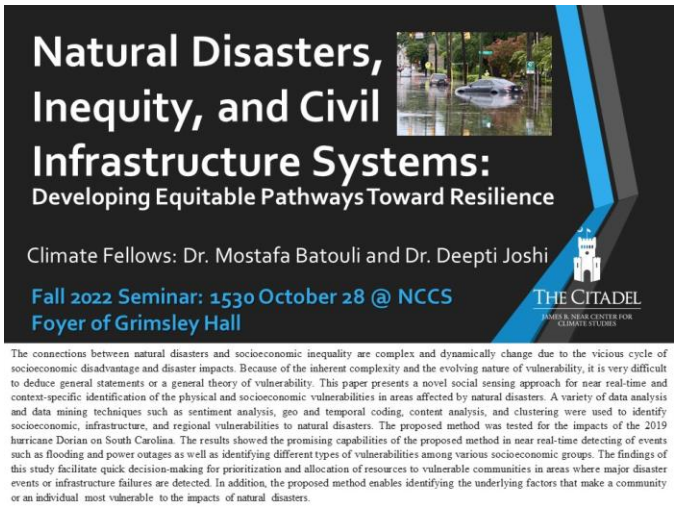
Short Title	Citadel PI	Program	Funded?	Extent	Direct Funds	F&A
Intended and Unintended Consequences of Buyout Programs	Scott Curtis	NOAA	FUNDED	9/1/2022-8/31/2024	$20,553	$4,974
Southeast Heat and Equity Pilot – Heat as a Stressor in Urban Low-resource Neighborhoods	Scott Curtis	NOAA/OAR	FUNDED	9/1/2022-8/31/2024	$10,398	$0
Rising Up to the Challenge of Flooding in the Lowcountry: Mitigating the hazard of educational vulnerability through STEAM PD	Scott Curtis	SC Sea Grant Consortium	FUNDED	9/1/2022-8/31/2023	$10,100	$0
Kids Teaching Flood Resilience: Step Up! Get Ready! Respond!	Scott Curtis	National Sea Grant	PENDING	9/1/2023-8/31/2025	$86,750	$1,914
Human and Ecosystem Heath Effects of Climate Change on Microbes, Harmful Algal Blooms and Contaminants of Emerging Concern and Development of Predictive Forecasts and Tools to Protect Public Health	John Weinstein	NIEHS-Oceans and Human Health	PENDING	12/1/2023-11/30/2028	$225,219	$0
Climate Action Engagement Academy for Minority and Women Owned Small Businesses: Fostering Economic Empowerment in the Midst of the Evolving Environment	Scott Curtis	SC Sea Grant Consortium	PENDING	1/1/2024-12/13/2025	$78,300	$0

Takeaways

It was a successful year for climate research at The Citadel. Three proposals were funded totaling $41,051 and three proposals are pending totaling $390,269. Research was conducted and disseminated by many students and faculty. Dr. Shetty's CRSG-funded work was covered in a story by ABC News 4: https://abcnews4.com/news/local/citadel-professor-finishing-up-unique-research-on-cooling-effects-of-local-trees-charleston-nadan-shetty-the-citadel-wciv Unfortunately, the CRSG is currently suspended pending availability of funds. The Director is working with the Executive Committee, Advisory Board, and TCF to strategize about funding opportunities. To sustain the program will likely require an endowment.

Engagement & Industry

- "Develop a symposium series on relevant climate topics"
    - The NCCS's first seminar was held October 28, 2022. Climate Fellow Dr. Mostafa Batouli presented his research: "Natural disasters, inequity, and civil infrastructure systems: Developing equitable pathways towards resilience". The talk was well received. In conjunction with the ribbon cutting ceremony planned for September 15, 2023, the NCCS has planned a panel composed of three nationally renowned speakers to present on the relationship between Earth's climate and human health and welfare (Dr. James Lawler), coastal environment and infrastructure (Lt. Col. Timothy Smith), and national security (Dr. Sherri Goodman). Upon this early success, the Engagement Committee will develop a NCCS symposium series, which will feature at least one speaker per semester.



- "Develop a summer camp on climate information and communication"
    - This action has not been taken yet, but the NCCS partnered with the Tommy and Victoria Baker School of Business, Trident Technical College, and Virtual Teaching Technologies to propose a Climate Action Engagement Academy (CAEA) through SC Sea Grant's biennial call for research proposals (see Table on page 14). We will test whether the CAEA and its byproducts will help position participants as reliable leaders of climate preparedness, confronting multiple interacting climate-related stressors and

whether community-scale, climate compatible solutions improve resilience for the women and minority owned small business community.

- "Increase operational support"
    - Operational support comes through partnerships with academia, government, non-profits, and corporations. The NCCS keeps track of its engagement with these entities.
        - The NCCS is part of the Charleston Heat Health Research Project (CHHRP), which includes Climate Adaptation Partners, SC Sea Grant Consortium, NOAA, City of Charleston, and MUSC. NCCS was funded **$10,398** to measure heat stress and dialogue with the Gadsden Green public housing community, neighbors of The Citadel. This funding allowed NCCS to purchase three Forward Looking Infrared (FLIR) cameras and four Kestrel Wet Bulb Globe Thermometers with tripods and support an undergraduate student in summer of 2023. The NCCS also hosted a tabletop exercise in Grimsley Hall on March 15, 2023, which expanded partnerships to Charleston County, NWS, and other federal agencies.

        - NCCS partnered with the South Carolina Aquarium and The Citadel Sustainability Club to present a panel: "Brainstorming Solutions to Plastic Pollution" on December 1, 2022. On January 16, 2023, NCCS again joined the SC Aquarium in co-sponsoring (with Sustainable Ocean-Alliance Charleston, Charleston Parks Conservancy, and Keep Charleston Beautiful) a MLK Day of Service Litter Sweep along Harmon Field and Haygood Street.

- The NCCS hosted a NOAA facilitator training, which was attended by Citadel faculty
- The Director was appointed as a member of the Charleston County Resiliency and Sustainability Committee
- The Director presented "Overview of the Lt. Col. James B. Near, Jr., USAF, '77 Center for Climate Studies" to the Charleston Chapter of the Society of American Military Engineers

- The NCCS continues to seek opportunities to engage with corporations and industry. The Director invited special guests to the 2022-23 Advisory Board meetings to communicate Citadel policy and procedures. In the fall, Bobby Houck and Jonathan Kresken spoke to the Board on NCCS financials and how The Citadel fundraises. In the spring, Page Tisdale and Susan Pope were invited to discuss how to seek out corporate funding and connect internship opportunities with Citadel students. The Advisory Board and Executive Committee see value in creating marketing materials and a prominent web presence as important for "getting the foot in the door". The NCCS is also exploring using the ribbon cutting ceremony and GiveCampus.com as means to fundraise.

Takeaways

The NCCS continues build on academic and government partnerships established in previous years, which has led to research funding. The NCCS hopes to generate revenue through industry, especially the insurance market, with assistance from Bobby Houck, Page Tisdale, and the Advisory Board. The ribbon cutting ceremony is an excellent opportunity to promote the NCCS and publicize opportunities for gifts and financial partnerships.

BUDGET

During the 2022-23 academic year a new index was established and the overall budget of the NCCS was clarified

- 341450: Dr. John Lining Professorship
  - Revenue: Annual grant from TCF of $13,086. It is spend or lose.
  - Expenses:
    - Director Stipend: $10,000 + Fringe
  - Balance as of 5/31/2023: $13,087
- 341455: Program for Climatological Studies
  - Revenue: Annual grant from TCF of $68,511. It is spend or lose.
  - Expenses:
    - Salary above Physics base salary: $43,000 including fringe
    - Remaining balance used for supplies or operational costs
  - Balance as of 5/31/2023: -$495.02
  - Grant balance for the 2023-24 academic year is $93,539
- 343130: TCF-Climate Center
  - Revenue: Donations held at TCF and sent to NCCS upon Dr. Zimmerman's request
  - Expenses:
    - CRSG and other major expenses
  - Balance as of 5/31/2023: $41,415

GOALS & CHALLENGES

- **Administration and Communication**

A recurring challenge is not having dedicated administrative assistance for the NCCS. Currently the Center is partially supported by the Dean of the Swain Family School of Science and Mathematics' office and the Department of Physics' office, but the Director spends an inordinate amount of time on administrative tasks. A staff assistant would benefit NCCS in several ways:

  - Keeping records of revenues and budgetary expenses
  - Engaging with TCF in managing proposals, grants, and gifts
  - Gathering data from Climate Fellows
  - Communicating important NCCS meetings and events to Fellows and the larger Citadel community
  - Working with OCM to promote NCCS successes and connect with alumni (through press releases, newsletters, and an up-to-date website)

This fits into strategic plan: "increase operational support".

- **Revenue Generation**

The CRSG program was suspended temporarily due to the cost of the room renovation eclipsing revenue generation from the endowment, gifts, or grants. However, the current budget (page 18) looks promising for the 2023-24 academic year. The Program for Climatological Studies already has $41,415 and the NCCS is exploring using the ribbon cutting ceremony and GiveCampus.com as means for additional fundraising. The director is working with TCF to identify specific opportunities for garnering support. The CRSG and a NCCS symposium series are high on the list as they are both named in the strategic plan.

APPENDICES

- Appendix A

Date: 18 November 2022

Subject: Minutes of 3 November 2022 Advisory Board Meeting of the Near Center for Climate Studies (NCCS)

Members Present or Available by Zoom: Scott Curtis (Director), Fred Holland (Chairperson), David Johnston, Hope Mizzell, Mike Johns, Allison Dean Love, Joe Coates, Allan Clum, Chris Mack, Debra Hernandez (Zoom), Kirstin Dow (Zoom)

Members Absent: Kevin Cooley, Geoff Scott, Susan Lovelace, Paul Sandifer, Albany Irick, Brandon Emery

Prepared by: Fred Holland (Chairperson, Advisory Board) & Scott Curtis (Director, NCCS)

Welcome: Dr. Darin Zimmerman, Dean of the Swain Family School of Science and Mathematics (SFSSM), provided a brief welcome and thanked attendees for their support for NCCS. He emphasized the focus of the Center should be training students in climate sciences and communications of the consequences of climate on coastal stewardship, human health and national security.

Board Member Updates: Committee members briefly discuss recent activities they have been involved in relevant to the Center.

David Johnson discussed he recently had briefed the Charleston Regional Policy Board of the Chamber of Commerce about NCCS and stressed the desire of NCCS to engage with the business community. Ms. Page Tisdale is The Citadel's representative to the Chamber and should be invited to a future NCCS meeting.

Action Item: Scott Curtis should invite Page Tisdale to attend the next NCCS Board meeting.

Mike Johns reported he had recently been consulting for mine closures in South America where sustainability and resilience are becoming watchwords for restoration and mitigation activities.

Scott Curtis reported that Major General Steve Smith of the Swain Center for Corporate Engagement informed him that many of the U.S. Army Climate Plans relied on technology that did not exist. Scott also reported that The Citadel was also working on establishing electric vehicle charging stations on campus.

Hope Mizzell, SC State Climatologist, reported she was involved in the creation of a Climate Taskforce (similar to the Floodwater Taskforce) and hoped to involve the NCCS.

Action Item: Scott Curtis should contact Hope about the Climate Taskforce as he would be the most logical NCCS representative.

Chris Mack reported he recently worked with the U.S. Army Corps of Engineers (USACE) and the University of Georgia on methods and standards for engineering with nature.

Joe Coates reported Charleston County had recently hired a Sustainability Officer and noted that he was working to improve student opportunities for involvement with the County on sustainability and resiliency issues.

Action Item: Fred Holland will contact Joe about opportunities for Citadel students.

Membership Committee Report: David Johnson (Membership Committee Chairperson) reported that the Membership Committee recommends that its' mission be expanded to include improving interactions among NCCS Board Members and Committees and that its' name be changed to the Strategic & Governance Committee. The major responsibilities of the Strategic & Governance Committee would include improving coordination within NCCS, proposing and staffing committees, and working closely with the NCCS Director to develop new Advisory Board initiatives.

The Membership Committee recognizes that the relationship between climate and national security is an essential part of the mission of NCCS and recommends the NCCS Director request the SC State Ports Authority CEO, Ms. Barbara Melvin, to identify a SCSPA representative to serve on the Advisory Board. Ms. Melvin and SCSPA should also be solicited to suggest how they could best assist and be involved in NCCS activities. The Board recommended that NCCS should seek to understand SCSPA needs and how best to engage them in NCCS activities. Many of the storm surge and flooding issues (e.g., USACE perimeter storm surge wall) unfortunately did not include SCSPA. The Advisory Board members also suggested NCCS and the Membership Committee should seek to partner with other military/DoD facilities by including a second national security board member representing Joint Base Charleston and/or other SC DoD facilities to represent climate change issues.

Action Item: Scott Curtis will discuss the proposed name and mission change for the Membership Committee with NCCS Executive Committee and report their response back to the Advisory Board. He will also solicit Ms. Barbara Melvin (SCSPA) to identify a SCSPA representative for inclusion on the NCCS Advisory Board and discuss how NCCS may assist SCSPA.

Engagement Committee Report: Mike Johns (Engagement Committer Chairperson) reported the Engagement Committee needed to update their report before the next NCCS meeting (March 2023). A discussion by the Board members about "tag line" recommendations from the draft Engagement Committee Report indicated most members did not feel the currently recommended NCCS "tag lines" adequately represented the mission and goals of NCCS. Some members suggested a "tag line" may not be needed. All present seemed to agree that if developed, the "tag line" should not include geographic references (e.g., southeast) and should focus on broader climate issues (i.e., national security, human health and sustainability impacts).

Internship Committee: Hope Mizzell (Internship Committee Chairperson) reported that the Internship Committee needed members. Currently, she is the only member. Allan Clum indicated he would be willing to serve on this committee and that there may be internship opportunities with Mt. Pleasant Waterworks. Fred Holland agreed he would also be willing to serve on the Internship Committee. Hope indicated that the State Climate Office had a potential internship that could be filled with a Citadel student, but she needed information to make this happen including:

- What was the process for acquiring Citadel interns? Who is the contact point?

- Do students get credit for internships? Are they required?
- How many hours can students commit to an internship while taking "normal" courses and during the summer?

Action Item: Scott Curtis agreed to get Hope the additional information needed to determine if the State Climate Office internship could be filled by a Citadel student.

Development/Fundraising Committee Report: Allison Dean Love (Committee Chairperson) reported that she met with The Citadel Foundation (TCF) representatives (Bobby Houck, Johnathan Kresken) to solicit their assistance in identification of potential development opportunities. She indicated the Development Committee needed additional members and information/materials describing ongoing NCCS research and related activities that could be provided to potential corporate supporters. Potential corporate supporters she identified and would like to develop partnerships included the agriculture industry, AgSouth, and the insurance industry, USAA. Allison stressed that we need to rethink the "tag line" as supporters will want to know how NCCS research and/or solutions were going to assist them. There was a suggestion that NCCS identify corporate needs and match the needs to NCCS expertise. The Board suggested that NCCS should also seek support from SCSPA and/or FEMA. Chris Mack said he may be able to identify SCSPA opportunities related to port security. Allison indicated the Development/Fundraising Committee did not feel the current name reflected what the committee felt their charge was and planned to suggest a new name (e.g., Corporate Engagement) and clearly define their charge before the spring meeting.

Action Item: Scott Curtis should work with the Development/Fundraising Committee to clearly define their charge.

Progress Report from Scott Curtis (Director NCCS): Dr. Scott Curtis provided an update of NCCS resources and activities since spring 2022 including:

- NCCS's dedicated space and plans for the upcoming ribbon cutting ceremony
- The ribbon cutting ceremony is planned to coincide with the Fall 2023 Advisory Board meeting and include a panel and VIP seating at a Citadel parade
- NCCS's updated organizational chart
- Data collection activities at the Citadel pier including meteorological and tidal stage data. Southeastern Coastal Ocean Observing Regional Association (SECOORA), directed by Board member Debra Hernandez, played a key role in providing funding for the tide gauge
- A professional development workshop, funded by SC Sea Grant Consortium, and led by Climate Fellow Dr. Merrie Koester
- A middle school student camp experience, led by Climate Fellow Dr. Jen Albert and The Citadel's STEM Center of Excellence
- Hosting the 2022 SC Sea Grant Consortium Research Symposium.
- Attending the 2022 Sea Grant / SERPPAS Coastal Resilience Workshop
- Co-leading the Charleston Heat Health Research Project (CHHRP) and conducting a heat experiment in the Gadsden Green neighborhood.
- Publications, presentations, and faculty-led seminars and workshops
- Four Climate Research Studies Grant proposals for ~$44,000 were submitted for 2022/2023 but budget confusion has delayed funding. Johnathan Kresken (TCF), however, indicated that there may be ~$51,000 available in the NCCS account.

The Citadel Foundation Update: Mr. Johnathan Kresken and Mr. Bobby Houck provided an overview of the history of the creation and funding for NCCS. They also noted that one of the roles of

TCF was to identify and raise money for NCCS, since it is part of The Citadel strategic plan. Johnathan reported that ~$500,000 of additional funding would be added to the NCCS endowment in the next several months.

Discussion of Curriculum: The current Citadel minor "Sustainability and Environmental Studies" was revised into the minor "Climate Resiliency and Environmental Sustainability Studies". The course PHYS 343 Applied Climatology (taught by Scott) was added to the core. It is hoped that the new emphasis on climate and additional marketing will grow the minor. There was some concern that a PHYS prefix will scare students away, even though the course has no prerequisites and will be taught in a seminar style.

Presentation by Dr. Thad Le-Vasicek: Dr. Le-Vasicek presented "Optimization of catalyst immobilization for bioethanol production", work that was funded with a CRSG grant. His talk was very well received and sparked many questions.

Next meeting: Suggestion of March 23 or 24, 2023. Feedback from the Advisory Board is requested.

Date: 23 April 2023

Subject: Minutes of 23 March 2023 Advisory Board Meeting of the Near Center for Climate Studies (NCCS)

Members Present or Available by Zoom: Scott Curtis (Director), Fred Holland (Chairperson), David Johnston, Hope Mizzell, Mike Johns, Kevin Cooley, Allison Love, Joe Coates, Paul Sandifer, Susan Lovelace, and Brandon Emery

Members Absent: Geoff Scott, Albany Irick, Kirstin Dow, Allan Clum, Debra Hernandez, and Chris Mack

Guests Present: Page Tisdale (The Citadel Foundation), Susan Pope (Citadel Internship Coordination), Andrew Hanson (NCCS undergraduate researcher)

Prepared by: Fred Holland (Chairperson, Advisory Board) & Scott Curtis (Director, NCCS)

Welcome: Dr. Darin Zimmerman, Dean of the Swain Family School of Science and Mathematics (SFSSM), provided a welcome and thanked attendees for their support of NCCS. He emphasized that NCCS was looking for opportunities to stimulate research and the Advisory Board need to assist NCCS in defining its national security focus. He also noted that NCCS should be training students in the climate sciences and the communications of the many consequences of climate and weather events on coastal stewardship, human health, and national security.

Committee Reports:

Strategic & Governance Committee: David Johnston (Strategic & Governance Committee Chairperson) provide the following overview of the current NCCS committee structure and membership. Under this plan, every Advisory Board member is assigned to at least one committee and is actively working to achieve the goals of that committee. He also reported the creation of a new committee, the Human Health and Welfare Committee, that would have the responsibility of

coordinating NCCS human health and welfare activities. Paul Sandifer would be the Chairperson of the Human Health and Welfare Committee. The committee would be responsible for advising the Board on climate impacts on human health and welfare. The current NCCS committee structure is as follows:

- *Strategic & Guidance Committee*: David Johnston (Chairperson), Susan Lovelace, and Fred Holland.
- *Outreach & Engagement Committee*: Mike Johns (Chairperson), Albany Irick, Chris Mack, Susan Lovelace, Debra Hernandez, and Kevin Cooley.
- *Internship Committee*: Hope Mizzell (Chairperson), Fred Holland, Allan Clum, and Joe Coates.
- *Resources & Development*: Alison Love (Chairperson) and David Johnston.
- *Human Health & Welfare*: Paul Sandifer (Chairperson), Geoff Scott, Kirstin Dow, and Brandon Emery.

David also reported that the Strategic & Guidance Committee felt NCCS should focus on port security as its national security goal given the importance of the Port of Charleston to the state and regional economy. He reported that Scott Curtis, Fred Holland, and he had a conference call with Barbara Melvin, CEO of SC Ports, to discuss including her as a representative from SC Ports on the NCCS Advisory Board. Barbara stated she would be unable to participate because of other duties and recommended Mark Messersmith, Environmental Manager of SC Ports, as the representative of SC Ports. David reported that Mark Messersmith stated that because of his current work load he could not accept this responsibility at this time and requested that he be reconsidered for the NCCS Advisory Board in about a year. No decision was made about delaying Mark Messersmith's invitation to join the Advisory Board. Paul Sandifer suggested that we contact Sherri Goodman, a former Deputy Director for DOD and currently associated with the Environmental Change & Security Program at the Woodrow Wilson International Center, about being a national security representative for the Advisory Board. Paul also felt that Sherri Goodman would be a potential panelist for the planned NCCS ribbon cutting event in fall 2023. David Johnston further suggested that he was planning on attending the 3rd Annual National Security Conference at William and Mary. (https://www.wm.edu/offices/wholeofgovernment/national-security-conference/index.php).

Action Item: Strategic & Guidance Committee should continue to define the national security focus of NCCS and identify a national security representative for the NCCS Advisory Board.

Outreach & Engagement Committee: Mike Johns, Chairperson of the Outreach and Engagement Committee, stated the committee needed to update the materials they developed in 2022. The Committee was also seeking organizations and groups they could network with to share information about NCCS and climate change activities, events, and information for the Southeast region. Mike suggested that NCCS needs to develop a one-page publication that provided an overview of NCCS to share with other groups and individuals. Scott Curtis stated that he had an outline for a one-page overview of NCCS.

Action Items: The Outreach & Engagement Committee should schedule a meeting to discuss their future activities and goals. Scott Curtis should provide his outline for a one page overview of NCCS with the Outreach & Engagement Committee.

Internship Committee: Hope Mizzell, Chairperson of the Internship Committee, reported that she had difficulty obtaining information about the structure of The Citadel/Swain Family School of Science and Mathematics (SFSSM) internship program. She has a potential internship opportunity for a

qualified cadet in the future (2023/2024), but the student would need to travel to the State Climate Office at least one day per month. The internship process was confusing to her organization.

Action Item: The Internship Committee should obtain detailed information about The Citadel Internship program and decide if internships with the State Climatology Office and similar internship opportunities are practical options for cadets.

Resources and Development Committee: Allison Love, Chairperson for the Resources & Development Committee, stated the Committee was having difficulty identifying and procuring resources for NCCS. She felt the Committee needed professional resources defining the mission, goals, and objectives of the NCCS, and that NCCS needed to develop a plan for promoting its accomplishments before the committee could proceed with marketing NCCS. Mike Johns commented that he felt NCCS was still trying to define its identity and that national security niche of NCCS was not clearly defined. Allison noted that she was considering stepping down as chairperson of the Resources & Development Committee because of time commitments and lack of outreach and public engagement materials to market NCCS.

Action Items: Scott Curtis and the Advisory Board will work toward developing materials (e.g., one page overview of NCCS, list of accomplishments, vision for NCCS) that the Resources & Development Committee could use to market NCCS. The Advisory Board should identify ways and opportunities to grow the teaching and research base of NCCS. David Johnston will be the contact point for defining the national security niche of NCCS.

Report from Page Tisdale, The Citadel Development Foundation: Page Tisdale provided a summary of The Citadel career guidance activities:

- Approximately, 1/3 of the Corps of Cadets enter the military through a ROTC contract the rest go to graduate school, enter government, pursue a business opportunity or a position in education.
- Historically, Citadel students had a reactive strategy toward life after graduation (look for job opportunities and apply for ones they like usually after graduation). There was no effort by The Citadel to actively track the professions students entered or their accomplishments.
- Over last 10-20 years, The Citadel has recognized that career development is a long-term process starting in the freshman year, including developing career goals, preparing resumes, developing job interview skills, preparing for job interviews, and completing internships, as possible. The student must be an active participant and in the career development process. The current process involves three stages: explore, prepare, and engage.
- Currently, approximately 85% of Citadel graduates have a job when they walk across the stage at graduation. The goal is for 100% or graduates to have a job/professional development opportunity before graduation.
- Funding from major corporations is generally directed toward larger research institutions. The Citadel is developing a corporate engagement strategy to identify corporations not focused on large research-based institutions. For example, Boeing currently provides only small investments to The Citadel and hires few graduates. We must strive to get more support from the Boeings of the corporate world and at the same time identify businesses and corporations that needed the type of students The Citadel produces.

Report from Susan Pope, Internship Coordinator: Susan Pope provided an overview of the cadet internship process including:

- Cadets generally cannot perform off campus internship duties on Tuesday, Thursday, or Friday because of drill and other military assigned duties.
- Only juniors and seniors can accept internships during the school year. Participants must have a GPA > 2.5 (engineering students >3.0).
- Students must keep weekly documentation of internship duties.
- New faculty have historically been designated as the faculty internship coordinator which is less than ideal for successful outcomes.
- If approved, internships can be completed for credit and can be paid up to $1,500 per semester.
- Most internships by cadets are likely completed over the summer; however, the internship program does not track summer internships.
- Susan provided a description of how potential internship opportunities were posted but the process was complex and confusing. It was more like a maze.

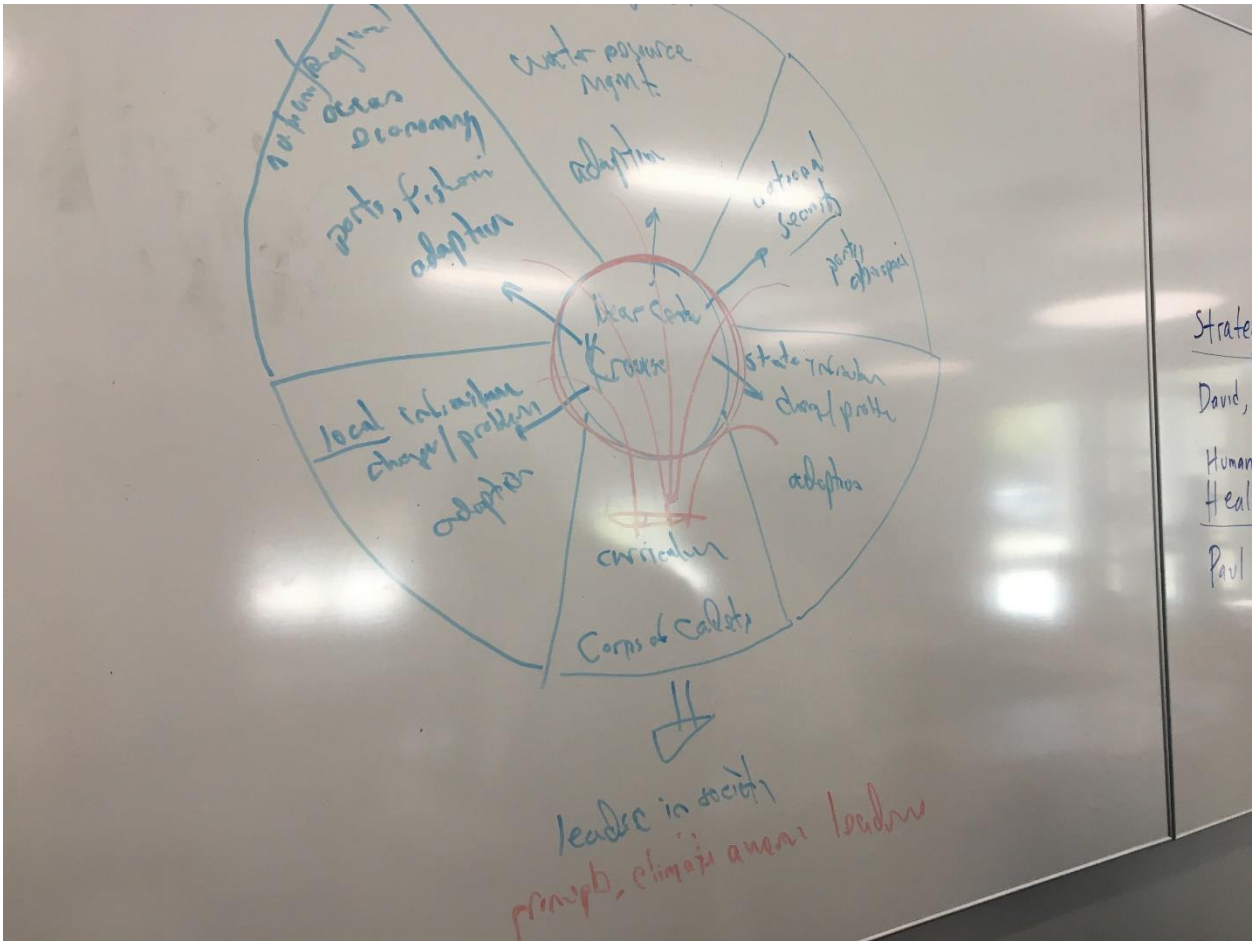
NCCS Directors Report: Scott Curtis, NCCS Director, provided the following update for NCCS activities since November 2023:

- No changes to Advisory Board, Executive Committee, or NCCS Fellows.
- A fellows meeting will be held on April 3, 2023.
- NCCS space is almost finished and is currently being used.
- The NCCS was involved in several activities
    - "Brainstorming Solutions to Plastic Pollution" panel
    - Co-sponsor of a MLK Day of Service litter sweep around Harmon field.
    - Hosted a SC Sea Grant Request for Proposals workshop
    - Hosted a NOAA facilitators training workshop
    - Hosted a NOAA Heat Pilot Tabletop Exercise
- Curtis was appointed by Charleston County to their Resiliency and Sustainability Committee
- First draft of key information that could appear on a 1-page marketing flyer

NCCS Space Ribbon Cutting: The date of the Ribbon Cutting Ceremony was finalized with input from the Advisory Board: **15 September 2023** (with a back-up date of 10 November). The current plan is to hold a shortened Advisory Board meeting from 9:30-11:30, a distinguished panel from 12:00-2:00pm, a ribbon cutting ceremony from 2:00-3:30pm, and then a parade at 3:45pm.

Action Item: Advisory Board members should provide recommendations for speakers at the ribbon cutting ceremony in fall 2023.

NCCS Role – Training Implementers of Climate Solutions: Kevin Cooley suggested that one focus of NCCS should be to train the implementers of climate solutions in the military, business, government, and other professions. Citadel graduates are renowned for their leadership, discipline, and perseverance in their professions. They should make ideal implementors of climate solutions. See sketch below.



Action Item: Advisory Board members should provide Scott Curtis comments on the training the implementers concept.

Citadel Climate Monitoring and Assessment Program: Fred Holland introduced a Climate Monitoring and Assessment Concept (see below) that he felt would directly involve SFSSM faculty and students in NCCS activities. The goal of this potential program would be to develop a long-term climate change monitoring and assessment program designed to increase cadet awareness of the consequences of climate change on The Citadel campus, the health and well-being of cadets, and Citadel operational policies. This program will provide mentoring and teaching opportunities for faculty, alumni, and cadets related to climate change issues and will developed the principled leaders for implementing climate change solutions.

Action Item: Advisory Board members should provide comments and recommendations on the climate monitoring and assessment concept.

- Appendix B

The following changes to the minor in "Sustainability and Environmental Studies" are requested

1. Rename to "Climate Resiliency and Environmental Sustainability Studies (CRESS)"
2. Reword and expand *Objectives* and *Potential Students* to include climate processes and interests more explicitly
3. Adding 1 course (3 credit hours) to required courses. In addition to the previous required courses of BIOL 209 and a capstone course, students must take PHYS 343. In an accompanying proposal, the prerequisite of PHYS 243 is being removed from PHYS 343
4. Removing an optional course (3 credit hours). Thus, the total credits remains the same (15). PHYS 343 is also removed as an optional course, as it is now a required course.

Track-changed catalog pages (326-328) are given below.

Justification

1. Climate is an integral part of environmental sustainability and climate resiliency speaks to how societies rebound from rapid climate shocks or adapt to persistent climate stresses.
2. Climate change is a critical issue affecting all aspects of society and is being addressed directly by US policy and military planning. It's impacts on the Lowcountry has been recognized at The Citadel with the creation of the James B. Near Center for Climate Studies (NCCS).
3. There are only two students enrolled in the Sustainability and Environmental Studies minor (from a Spring 2022 report to Faculty Senate). This additional objective may attract more students and will align with the mission of the NCCS. Therefore, the NCCS will expend effort in marketing and promoting the revised minor.
4. The proposed change has been vetted by the NCCS Academic Committee (members represent engineering, education, and chemistry) and viewed positively by the department head of Biology. See email below.

2022-23 CITADEL CATALOG

Minor in Climate Resiliency and Environmental Sustainability Studies (CRESS)

Objectives:

The minor in climate resiliency and environmental sustainability studies is an interdisciplinary minor designed to help undergraduate students gain climate and environmental science literacy; develop an understanding of the interactions between climate and the natural environment and an appreciation of sustainability from a variety of perspectives such as business and engineering; and create and/ or participate in a project related to local environmental and sustainability efforts. Students pursuing the minor will have the opportunity to take a variety of classes addressing climate resiliency and environmental sustainability studies culminating in a capstone course. The capstone course will provide the students a chance to build upon their previous coursework in the minor through a semester long research project, service-learning activity, or internship.

Potential Students:

The minor may be appropriate for undergraduate students from all five schools who are interested in climate, the environment and sustainability. Possible areas of interest could include climate hazard mitigation, climate adaptation, sustainable agriculture, environmental degradation, supply chain sustainability, environmental history or environmental economics.

Requirements:

To complete a minor in sustainability and environmental studies, students must take a minimum of 15 credit hours from the approved list of courses listed below.

REQUIRED COURSES:

Must take all of the following:

• BIOL 209/NTSS 305: Environmental Science (1st course)

• PHYS 343: Applied Climatology
• Capstone Course: Including EDUC 409: Service Learning in Environmental and Sustainability Studies, BIOL 320: Intern Research, or similarly approved high-impact experiences.

OPTIONAL COURSES:

Must take TWO of the following:

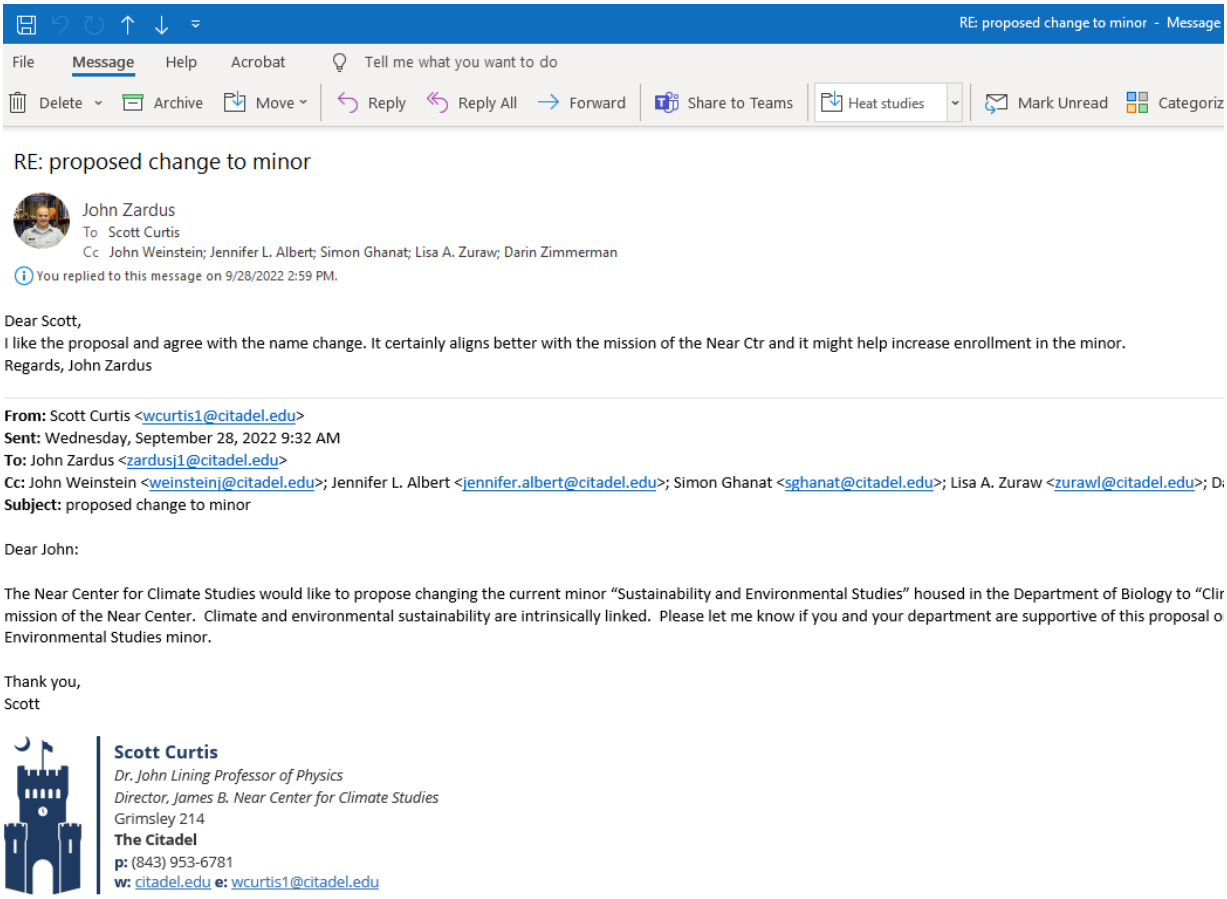
SCMT 302– Quality Management
SCMT 402 – Purchasing and Materials Management
SCMT 304- Project Management
MGMT 311 – Human Resource Management
CIVL 322 – Introduction to Environmental Engineering
CIVL 408 – Water and Wastewater Systems
MECH 417 – Renewable Energy
ELEC 427 – Energy Systems Engineering
HIST 392 – Special Topics in History*** (Environmental History)
PSCI 433 – Special Topics in International Politics*** (Global Environment)
BIOL 292 – Leadership for Environmental Sustainability
BIOL 314 – The Vascular Flora of South Carolina
BIOL 406 – Ecology
BIOL 407 – Conservation Ecology
BIOL 409 – Marine Biology
BIOL 414 – Environmental Physiology
BIOL 419 – Economic Botany
BIOL 412 –Special Topics in Biology***
BIOL 421 – Toxicology
BIOL 426 – Freshwater Biology
PHYS 243 – Meteorology
PHYS 301 – Biological Physics
EART 201 – Introduction to Earth Science
EDUC 409 – Special Topics in Education***

*note only one course can be counted for both a major and a minor

**CIVL 322 and CIVL 408 can be appropriate for non-CE STEM majors. These non-CE STEM majors must complete CHEM 151/161 as a pre-requisite for CIVL 322 and CIVL 322 as a prerequisite for CIVL408. The CE department must be notified prior to attempting registration to open the course to non-CE STEM majors.

***Special Topics Courses will require approval from the Program Director on a case-by-case basis.
Total Credit Hours Required: 15, at least 9 of which must be completed at The Citadel.

EMAIL FROM DR. JOHN ZARDUS



RE: proposed change to minor - Message

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Delete Archive Move Reply Reply All Forward Share to Teams Heat studies Mark Unread Categoriz

RE: proposed change to minor

John Zardus
To Scott Curtis
Cc John Weinstein; Jennifer L. Albert; Simon Ghanat; Lisa A. Zuraw; Darin Zimmerman

You replied to this message on 9/28/2022 2:59 PM.

Dear Scott,
I like the proposal and agree with the name change. It certainly aligns better with the mission of the Near Ctr and it might help increase enrollment in the minor.
Regards, John Zardus

From: Scott Curtis <wcurtis1@citadel.edu>
Sent: Wednesday, September 28, 2022 9:32 AM
To: John Zardus <zardusj1@citadel.edu>
Cc: John Weinstein <weinsteinj@citadel.edu>; Jennifer L. Albert <jennifer.albert@citadel.edu>; Simon Ghanat <sghanat@citadel.edu>; Lisa A. Zuraw <zurawl@citadel.edu>; D
Subject: proposed change to minor

Dear John:

The Near Center for Climate Studies would like to propose changing the current minor "Sustainability and Environmental Studies" housed in the Department of Biology to "Clir
mission of the Near Center. Climate and environmental sustainability are intrinsically linked. Please let me know if you and your department are supportive of this proposal o
Environmental Studies minor.

Thank you,
Scott

Scott Curtis
Dr. John Lining Professor of Physics
Director, James B. Near Center for Climate Studies
Grimsley 214
The Citadel
p: (843) 953-6781
w: citadel.edu **e:** wcurtis1@citadel.edu

- Appendix C

NCCS Climate Monitoring and Assessment Initiative: Forecasting Impacts of Changes in Climate on The Citadel Infrastructure and Cadet Health and Well-being for 2030 and Beyond

Objective: Develop a long-term climate change monitoring and assessment program designed to increase cadet awareness of the consequences of climate change on The Citadel campus, the health and well-being of cadets, and Citadel operational policies. This program will provide mentoring and teaching opportunities for faculty, alumni, and cadets related to climate change issues and will developed the principled leaders for implementing climate change solutions.

Methods & Major Tasks:

Phase I:

- Recruit faculty "champion(s)" to provide leadership and mentor the team of cadets, faculty, Advisory Board members, and alumni required to plan and implement the Citadel Climate Monitoring and Assessment Program (CMAP). The CMAP plan will include a tentative schedule, list of program needs, preliminary budget, and development of proposals to potential funding sources (e.g., The Citadel Foundation, SC Sea Grant, NOAA).
- Seek support and compensation for faculty champions leading CMAP training and mentoring efforts.

Phase II:

- Initiate a long-term monitoring program to measure the meteorological, water and air quality, biological, and human exposure data to assesses and forecasts the impacts of changes in climate-related variables for the Citadel Campus form 2030 and beyond.

- Develop a network linking CMAP monitoring data to other regional-scale meteorological, air and water quality, tidal height and human exposure data in a manner which facilitates hindcasting and forecasting of climate scenarios for The Citadel campus. This task includes developing and teaching students the data capture and assessment tools for forecasting the impacts of observed and predicted climate-related variables on The Citadel infrastructure, air and water quality, human exposure, and operational practices.

Results & Products:

- Increased cadet/student/faculty/Advisory Board awareness and involvement in NCCS. Student will experience and learn multidisciplinary team collaboration, equipment maintenance/standardization, quality control/quality assurance, data management, statistical analysis, modeling, and scientific presentation skills.
- CMAP proposals that advance the goals and objectives of NCCS.
- Reliable weather, air and water quality, tidal height, and human exposure data for The Citadel campus.
- Poster/publications describing the consequences of climate-related variables for The Citadel.
- An Annual Report developed each spring, by NCCS faculty and cadet fellows defining progress toward CMAP objectives. The Annual Report will be presented by Cadet Fellows at the Citadel Academy of Science and Mathematics Banquet and other appropriate presentation opportunities.

Anticipated Schedule:

- ***Phase I*** (identification and recruitment of faculty champions, developing monitoring and assessment plans, and identification of proposal opportunities) make take several months. A particularly important component is identification of variables to monitor, where to take measurements, at what time scale, and how (including defining equipment needs). Anticipate progress report to the Advisory Board by Fall 2023.

- ***Phase II*** will not be implemented until 2024.

Note:
The National Academy of Sciences/Marine Board publication, *Managing Troubled Waters: The Role of Marine Environmental Monitoring* that explaining the role of monitoring programs in decision making and detailing how to design and implement multidisciplinary monitoring and assessment programs is available as a free PDF. Dr. Fred Holland was one of the authors of this report and has stated he would be willing to mentor faculty and students during the design and implement of CMAP.