Virginia Tech Climate Action Living Laboratory Framework

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Honors Service Learning: Sustainability Living Laboratory
UH 3204
December 13, 2023

Introduction and Purpose

The past twenty years have proven to be a pivotal time for sustainable practices and policy as climate change continues to worsen. Climate change is "long-term shifts in temperatures and weather patterns" (United Nations, n.d.); it consequently impacts our livelihoods, including but not limited to our health and wellbeing, agricultural sector, and housing. Moreover, according to the Intergovernmental Panel on Climate Change (IPCC), "human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming" (The Intergovernmental Panel on Climate Change n.d.). Climate change has become an increasingly pressing issue throughout the world.

Universities have unique opportunities and resources to address climate change with a "distinct freedom of action and influence", which allows them to practice campus sustainability and foster social change within and beyond the campus (Washington-Ottombre et al., 2018, p. 565). Universities also have unique motivations for addressing climate change, including the ability to "stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities" (Breen, 2010, p. 686). One way that universities have attempted to address climate change is through living laboratories, which "couple academic rigor with applied learning on sustainability-related campus infrastructure projects" (Cohen & Lovell, 2013, p. 7). Virginia Tech is developing a Climate Action Living Laboratory (CALL), as outlined in goal 10 of the Virginia Tech Climate Action Commitment (VT CAC) "… to enhance offerings and build bridges between facilities and academic departments, facilitating and supporting opportunities" (VT CAC, 2020). Goal 10 emphasizes the opportunity for experiential learning, specifically through the CALL, while also addressing the climate crisis on our campus.

Universities have the position and the responsibility to be leaders of social change, and this is especially true for land-grant institutions like Virginia Tech. These institutions have a mission to be of the people and for the people: affordable for the general population, providing education in relevant fields like agriculture, and dedicated to conducting research relevant to the pressing needs and interests of society. While their establishment took place a century and a half ago, land-grant universities continue to receive federal support, and still bear a responsibility to provide quality education and research for the improvement of life in their immediate communities and beyond (Dooley, 2012-13, para. 1). Virginia Tech specifically has incorporated the purpose and goals of the land-grant system into its own mission, asserting that through transdisciplinary education, innovative research, and a "collaborative environment…[Virginia Tech] can serve as a force for positive change around the commonwealth, the country, and the world" (Facts about Virginia Tech, 2023, para. 2). Universities educate and develop the changemakers of tomorrow, and they have a greater ability for

experimentation and research than other organizations like governments and companies. Institutions of higher education, and the individuals within their communities, have historically embraced this role as leader of social change. For example, Higher Education Institutions were centers for individuals who opposed slavery and assembled to work against it. Later, these universities took a stance against Apartheid in South Africa through economic sanctions (Washington-Ottombre et al., 2018, p. 565). Universities provide both the floor for academic discourse and the resources to investigate new questions, creating a unique environment for both action and insight. At Virginia Tech, the pursuit of knowledge and impactful solutions holds a high priority, with the University dedicating $650 million to research expenditures by most recent estimates (Research and Innovation, 2023, Figure 1). The University is committed to crossing disciplines and investigating relevant challenges to "provide a healthy, secure future for the nation and the world" (Research, 2023). Virginia Tech is a large institution with large groups of students, faculty, and staff members who are driven by curiosity and purpose to create innovative solutions in a variety of different fields. This university has strong commitments to both research and teaching, and, as represented by their motto and in the land-grant mission, "Ut Prosim", service (Office for Strategic Affairs, 2022, para. 4). Dedication to service, ingenuity, and a transdisciplinary approach are all essential for meeting the challenge of climate change, which goes beyond any one professional field or group of people (Filho et al., 2017, p. 302). The mission and values of Virginia Tech provide an environment in which the CALL can thrive.

CALL projects depend on faculty and students (i.e., academic partners) working alongside staff (i.e., operational and administrative partners). The Office of Sustainability and the CALL team aim to engage faculty and students through adding climate and sustainability content to the curriculum and research, specifically using the Virginia Tech campus and surrounding community as the context to work towards the 2020 VT CAC goals.

Beginning in fall 2023, the Honors College Service Learning course Sustainability Living Laboratory is the first course to merge Virginia Tech's student, staff, and faculty with hands-on engagement to develop a CALL framework, which will support future CALL projects and efforts. The course explores real world problems through unique experiential learning opportunities by working with and for staff mentors from the Climate Action, Sustainability, and Energy (CASE) team and Office of Sustainability. As students, we are learning and developing deeper understandings of sustainability and climate change action—particularly on the VT campus and surrounding community—while simultaneously learning how to approach these problems in the real world and engaging in hands-on projects. The CALL provides opportunities for professional development by connecting us with mentors to guide us through our individual projects. The work in this course is complementary to that of the CASE team, who are focused on

expanding connections to the VT CAC through the curriculum. The course operates within the Virginia Tech academic programs, but it connects students with operational staff and our overall community. Through this course, we helped develop a CALL vision statement with and for the CASE Team:

The Virginia Tech Climate Action Living Laboratory (CALL) will integrate students and faculty with staff to achieve the goals of VT Climate Action Commitment through a collaborative framework. Through transformative research, teaching and learning, and service, the CALL will build a sustainable and equitable future for our campus and the surrounding community.

This Honors Service Learning CALL framework project includes three components and teams: a Benchmarking and Priority Alignment team, a Communications Plan team, and a Showcase team. Each team presents critical components for supporting VT's CALL, as each team is focused on a different aspect that provides a foundation for the CALL in the future, and in turn, satisfies VT CAC goals. In this report, we provide a purpose, description of our approach, and outcomes for each project component. First, however, we begin with an overall background on living laboratories generally, the history of the VT CAC, and the VT CALL to further ground our project components. Finally, we close our report with an overall conclusion on how our various components help build a CALL framework.

Background

Schools that "[use] their campus buildings and grounds … for sustainability education" are "using the campus as a living laboratory" (Hansen, 2017, p. 225). Improved sustainable education can be a direct result of living laboratories, because they promote transdisciplinary collaboration between diverse disciplines within the academic and operational sectors of a university. Sustainability is inherently a transdisciplinary field, because climate action and sustainability are, "integrative, socially-relevant, and oriented around problem solving, while also drawing upon various disciplines" (Evans, 2015, p. 1). These disciplines can include both academic and non-academic stakeholders to provide a more holistic solution to these incredibly complex issues. Not only do living laboratories serve as a space for transdisciplinary collaboration and community engagement with various stakeholders, they are a type of service learning, combining community service and academic learning (Hansen, 2017). Specifically, living laboratories provide efficient learning, a positive impact on the environment, and hands-on experiences (Cohen and Lovell, 2013). In this way, students can engage in substantive efforts to address complex issues like climate change and sustainability.

Virginia Tech Climate Action Commitment

Over the past decade, Virginia Tech has become a leader in seeking a sustainable future to mitigate the effects of climate change. A direct result of an ambitious "network of students, faculty, and staff from across operations, academics, and research, the university's original Climate Action Commitment was endorsed by the Board of Visitors in 2009 and revised and reaffirmed in both 2014 and 2020" ("In A Virtual Environment", 2020). Following its approval, the "Virginia Tech Climate Action Commitment acts as the university's guiding framework around sustainability and energy efficiency in campus operations, facilities, curriculum, and research" ("In a Virtual Environment", 2020). Additionally, "President Tim Sands ensured the most stringent climate and sustainability standards are implemented as Virginia Tech continues to grow and seeks to be a leader in environmental stewardship when he called for the renewal and revision of the Climate Action Commitment" ("In a Virtual Environment", 2020). Examples of these sustainable efforts include: steam plant conversion, LEED-certified buildings, sustainable efforts in recycling and waste management, and creation of the Office of Sustainability. Student engagement opportunities are key to these efforts, such as the Green RFP program and the Internship Program through the Office of Sustainability ("Decade of Virginia Tech Sustainability Achievements", n.d.).

Virginia Tech Climate Action Living Laboratory

On September 17th, 2023, over fifty academic and operational leaders came together to discuss and brainstorm pathways to bring the new CALL to fruition through institutional and resource planning ("Academics and Climate Action Living Laboratory", n.d.). The CALL seeks to elevate and coordinate climate related teaching, research, and outreach at Virginia Tech through a climate action-related curriculum. This curriculum will be centered around clean energy, social equity, and innovative financing, which will be enhanced through experiential learning opportunities in Blacksburg campus and the surrounding community ("Academics and Climate Action Living Laboratory", n.d.). The next steps for developing the CALL include establishing an institutional home; integrating the lab with university initiatives like Climate Action Commitment implementation and Sustainability Tracking, Assessment & Rating System (STARS), solidifying program leadership; and devising strategies to enhance coordination among and visibility of existing sustainability-related academic programs ("Academics and Climate Action Living Laboratory", n.d.). In spring 2023, the CASE Team began collaborating with Dr. Budowle through a VT Engage faculty fellowship development grant. That project used the Honors College Service Learning course as a platform to develop a CALL framework and pilot best practices for CALL teaching and learning. Below, we share the project components that help build that framework.

Project Components

CALL Benchmarking and Virginia Tech Priority Alignment

This project component identified established living laboratory programs at peer institutions and benchmarked them with the CALL at VT. To benchmark these programs, this team contacted stakeholders and reviewed websites at peer institutions to collect data and identified their program's key features and best practices. This component also connected the goals of the CALL with VT's broader goals and priorities, beyond sustainability. This team analyzed how the goals of the VT CALL overlap and align with other VT priorities to further situate its role and need beyond achieving VT CAC goals, specifically.

Project Description

We began by identifying institutions to further our research into the CALL, while reviewing internal VT documents to identify how the VT CALL can align with VT's broader goals for the university, beyond sustainability.

To benchmark the CALL with other institutions, we identified nine institutions with living laboratories to research the successes and challenges of the living lab model, and intentionally chose an additional institution absent of a formalized living laboratory program to research how institutions without formalized living laboratories are enacting sustainability initiatives. We used AASHE STARS, a forum where institutions can self-report their sustainability initiatives and outcomes, to assist in identifying institutions with the highest STARS ratings that also had a living laboratory, keeping in mind to limit the number of institutions we researched from a particular U.S. state. For the institution which did not have a formalized living lab, we identified it on a list of institutions with the highest STARS ratings.

After identifying these 10 institutions, we emailed contacts at peer institutions with existing living laboratories to obtain more information on how they have successfully integrated a living laboratory into their campus and community. We collected the following data: institution name, land grant university status, formal living laboratory status, primary contact's info and role, contact's involvement in the institution's living laboratory, STARS rating, percentage of courses and academic departments with sustainability course offerings, source of funding for the living laboratory, a description of living lab research areas or sources of living lab research, how students and faculty are connected with operational/administrative staff, the mission statement and goals of the living laboratory, obstacles/setbacks from running the living lab, an "anything else you want to share", and additional comments with relevant notes and links to the living lab websites. Then, we arranged these data in an Excel spreadsheet for mentors to easily access.

Additionally, we identified some of VT's top priorities and goals and analyzed whether and how the VT CALL aligns with these priorities. Through researching VT's most

important goals, extending beyond sustainability, we determined that VT's values can be organized into four overarching categories: (1) Service; (2) Accessibility and Affordability; (3) Diversity, Equity, and Inclusion; and (4) Experiential Learning. Under each of these categories, we found examples of already established programs and organizations at VT that relate to these values, or future projects that VT has planned out in the Campus Master Plan that relate to these values.

Outcomes

For Benchmarking, we identified 10 institutions in the U.S. that had living laboratory programs. We identified 10 institutions: Stanford University, Colorado State University, University of California Berkeley, Cornell University, University of California Merced, Dickinson College, University of Maryland, Furman University, UVM, and Portland State University.

Of these 10 institutions, six are land-grant universities. Nine of these institutions had a formalized living lab program, and a total of 4 of these 10 institutions responded to the questions that we emailed to an appropriate primary contact at the institution. Of the 10 institutions, five had gold STARS ratings and five had platinum ratings (see Appendix A).

All 10 of these institutions had at least 12.95% of all courses at the institution offer sustainability coursework, with 72.00% of academic departments, overall, offer sustainability coursework (see Appendix A).

Of the seven institutions with living labs that had information on funding support (Colorado State University, University of California Berkeley, Cornell University, Dickinson College, Furman University, and University of Vermont), we observed the following themes: (1) funding came from a sustainability fund; (2) funding was provided by a home department working for the living lab; (3) funding was provided by the institution's equivalent to a "Office of Sustainability"; and (4) Funding from a legislative bill (see Appendix A).

We observed that based on the four institutions that responded (Cornell University, Dickinson College, Furman University, and the University of Vermont), in addition to Stanford University (information provided on a website), that each institution had different approaches to how faculty and students partner with operational staff. Common approaches include: (1) students are supported by staff and faculty who partner together to form advisory boards comprising of subject experts and industry professionals; (2) a sustainability coordinator or other individual with a relevant job title assists in answering inquiries directed at the facilities team and helps narrow the work that students and faculty do; (3) administrative staff directly supervise student interns, with each student intern having a faculty sponsor that serves as a mentor; and (4) students and faculty provide operations staff with

recommendations from high-quality research projects (see Appendix B).

Additionally, of the six institutions with living labs with relevant research info (University of California Berkeley, Cornell University, Dickinson College, Furman University, University of Vermont, and Portland State University), the following themes emerged: (1) living labs utilize faculty research; (2) living labs utilize course research to educate students on sustainability; (3) student-led research projects would inform living labs about sustainability efforts; and (4) common research areas include environmental policy, carbon pricing, data analytics, landscape improvements, and beekeeping (see Appendix B).

A final observation – of the four institutions that responded to our emails, we observed the following obstacles: (1) not enough collaboration and coordination to meet the evolution of the initiative; (2) turnover and commitment of students, faculty, staff, and community volunteers; (3) not furthering sustainability goals because the living lab's initiatives were only offering surface-level info; and (4) identifying sources of funding and writing succinct purpose and objectives statements to be implemented into the living lab framework (see Appendix B).

One notion we wish for a future team to analyze deeper is a "best practices" data set, data that describes how a particular living lab can improve upon the performance of the living lab. These data should be grounded on a living lab's obstacles.

While we currently do not have a "best practices" data set available, we recommend living lab mentors to ground their work with these 8 tips: (1) engage the right campus participants; (2) identify key collegiate programs; (3) build credibility through engagement and data; (4) integrate it into the curriculum; (5) expand beyond individual programs of study; (6) build partnerships with industry; (7) engage support beyond the campus; and (8) open your labs to the community (Cohen & Lovell, 2013, pp. 9-21).

Priority Alignment: For the first priority category, we identified VT Engage and explained how it exemplifies service, and more specifically, the school's motto *Ut Prosim*. For the second category, we included the Virginia Tech Advantage as well as specific ways that VT has made the campus more accessible. For the third category, we included InclusiveVT and their Principles of Community. For the fourth category, we included programs at VT that foster transdisciplinary and experiential learning, including the Bridge Experience program, specific campus developments, destination areas, and pathways minors. In addition to this, we evaluated how the CALL has the potential to also align with each of these values and programs, and suggested how the CALL may even work in collaboration with some of these VT programs to better align with these values.

VT Priority	Subcategory
Service	
	Ut Prosim
	VT Engage
Accessibility & Affordability	
	The VT Advantage
Diversity, Equity, & Inclusion	
	Inclusive VT
Experiential Learning	
	Beyond Boundaries 2047: The Campus Plan
	The Bridge Experience Program
	Campus Developments
	Cross-Disciplinary Opportunities

Figure 1.1
The first two columns from the priority alignment deliverable, showing VT's top priorities and specific plans/organizations that relate to these priorities.

Our final deliverable for the priority alignment, a table created in Excel, shows that the CALL does align with all four of these top priorities. Figure 1.1 displays the first two columns of the table, which include VT's four top priorities as well as identified VT programs and organizations that relate to these priorities. It also has the potential to work hand-in-hand with some of VT's established programs, such as VT Engage or the Bridge Experience program, which maximizes its ability to align with these values. As the campus continues to grow, the Office of Sustainability and/or future students may expand on these findings, including new VT priorities and efforts in this spreadsheet. They can decide how they fit into one of the aforementioned categories or establish a new category. Future research may also expand beyond VT priorities and align the CALL with the priorities and values in Blacksburg and the broader New River Valley community.

CALL Communications Plan

The primary purpose and goal for this project component was to develop a basic communications plan that will serve the Office of Sustainability now and in the future. This project assists in grounding the message of the CALL in marketable messaging and branding that can reach the academic community, connecting faculty and students with staff in operations at Virginia Tech. This project outlines communication strategies and provides basic templates and language, presented together in a final communications packet, including a brief, a preliminary logo and slogan, a newsletter spotlight about this Honors Service learning course as a template for spotlighting other CALL projects, a draft web page outline with sample language, and poster and social media templates.

Project Description

We intended to inform people at Virginia Tech about what we are doing, and encourage them to get involved where possible. We were expected to use multiple media methods and were hoping to design content that can be used by the Office of Sustainability as well as the Honors College Sustainability Living Lab in the future.

We worked with our mentors, Kristina Cook and Jack Leff in the Office of Sustainability,

to identify key goals and communications themes of connecting faculty and staff (i.e., academic) with staff (i.e., operational/administrative) to build bridges through the CALL. With their support, we developed an interview protocol/general questions about communications best practices. As the Office of Sustainability currently lacks full communications support, we met with Erin Dietzel, communications coordinator for the Honors College, to better understand what needed to be incorporated in the CALL communications plan and how to go about facilitating it. Erin provided a formal communications brief and plan template that we used. After meeting with mentors and our instructor, we identified our goals and target audiences for each piece of communications plan and packet, as described above. We compiled these materials into a central Google Drive folder to serve as a hub for VT CALL communications.

The completion of this project took place over the course of an academic semester, accomplished by the CALL Communications Team which consisted of both students and staff mentors. At the onset, the students involved first had to become familiar with the existing communications infrastructure that the Office of Sustainability has. This allowed us to determine the most pressing needs and areas for improvement. We also learned about the structural dynamics and relationships involving the Office of Sustainability, operations teams, and Virginia Tech administration more broadly. A major goal of the CALL is to build bridges between Virginia Tech's academic communities and operations departments, so it was important to gain perspective on what relationships currently exist, and on how the Office of Sustainability operates. We gained insight on these dynamics by interviewing our staff mentors who work within the Office of Sustainability and are therefore aware of its needs, goals, and potential. Since they themselves did not have a strong background in communications, the students also interviewed Erin Deitzel, who runs communications for the Honors College at Virginia Tech. Deitzel described the process of developing effective communication, and provided templates for the students to apply to this project. We used these templates to define the purpose of their project, to ground our messaging, and to organize necessary resources.

Based on the needs of the Office of Sustainability, the Communications Team identified a few essential communication pieces to focus on developing. All of these elements were assembled and presented in a communications packet.

Outcomes

Ultimately, we created the following elements for our communications plan packet, based on guidance and iterative feedback from our mentors, interviewee, and instructor:

- *Communications Brief and Template packet* - The communications plan and brief serve as a guide on how to effectively communicate the CALL, as well as why the CALL needs to be

promoted within Virginia Tech and its surrounding community.

- *A combined slogan/logo*- Logos and graphics are essential elements of any brand, and something that the Office of Sustainability has lacked overall and for the CALL, specifically. These are simple and appealing visual pieces that can draw an audience and effectively convey a message:

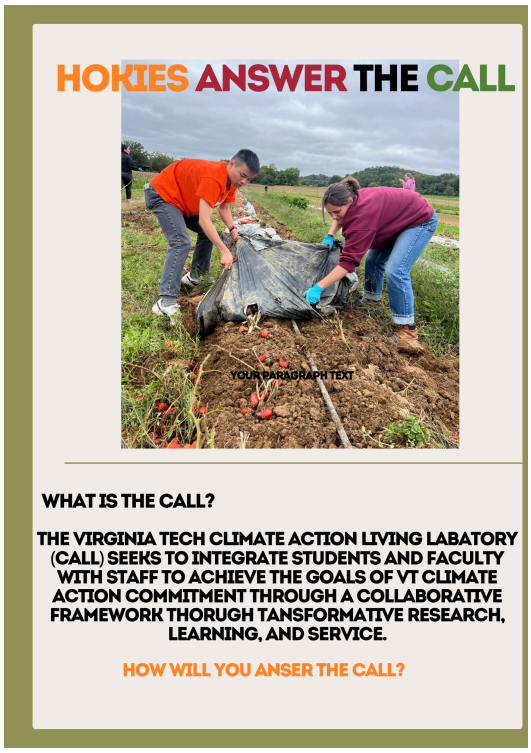

Figure 1.1

- *Spotlight*- The spotlight write-up serves as a brief yet informative explanation of a specific CALL project or effort. This write-up in turn could be used in a variety of communications platforms, including newsletters or even on the website itself. The Communications Team hopes the first spotlight is shaped around the Service Learning class over the fall 2023 semester.
- *Interest form*- The interest form will allow us as CALL team members to engage with and communicate with individuals who are not yet involved. It will allow people to contact the Office of Sustainability and express their interest to work with the CALL. The interest form will record contact information, including the primary academic unit, as well as the individual's particular interests around sustainability and the CALL. It was designed to be short, succinct, and easy to follow to maximize engagement and be accessible for a broad audience.
- *Web Page revisions*- To further develop the webpage, the communications team relied on the framework of the preexisting CALL webpage as a template. From here, they developed an updated website outline that addresses both content (e.g., including the new CALL vision statement) and aesthetic needs.
- *Social Media/Poster Template* - A template for potential social media/physical flyers was created in order to provide a basis on what language, tone, and message the Office of Sustainability will like to use in regards to informing and encouraging students, faculty, and staff to join the CALL.
- *CALL Photo Archive* - A photo archive for Honor's Service Learning was created to capture moments in the fall 2023 semester of students

actively participating in the CALL. The Communications Team hopes the photo archive will be supplemented by future Service Learning classes to document student involvement in the CALL.
- *Elevator Pitch* - A brief description of the CALL was created to spark interest and inform the student body, faculty, and staff on what the CALL is and why it came into existence.

Together, these elements will support the Office of Sustainability to create greater connections and build academic and operational bridges for the CALL now and in the future. By developing this communications plan, the fall 2023 communications cohort is providing foundational material for all future CALL mentors, faculty, staff, and students to expand upon and further develop. One of the most significant goals stated in the CALL is to bridge climate action and sustainability between the academic audience, which would be categorized as faculty and student, with the operational audience, which would be considered Virginia Tech staff. The language used in the communications packet can easily be interpreted by anyone regardless of discipline and background, which satisfies the CALL's goals of encouraging transdisciplinary participation by stakeholders.

Moving forward, the Office of Sustainability in partnership with the CALL will use the communications packet to promote the CALL and encourage participation from students, faculty, and staff. The Office of Sustainability intends to work with the Facilities communication team to incorporate the interest form, the webpage updates, and the spotlight onto the web page. Additionally, the Honors College can use the spotlight to promote the Honors Service Learning class in spring 2024.Social media posts regarding the CALL can begin immediately, and should be posted to the Virginia Tech Office of Sustainability Instagram.

CALL Showcase

The Showcase, set to occur in spring 2024, will be a public event to celebrate the development of a more formal CALL framework and other CALL-relevant teaching, research, and service activities at VT. Through involvement in the showcase, faculty and students (i.e. academic) will connect with staff (i.e., operational and administrative) to coordinate and begin accomplishing VT CAC goals through teaching, research, and service. This project includes scheduling and event logistics and identifying speakers and guests. An information packet with sample emails, timelines, and other templates will assist future students and/or Office of Sustainability staff in hosting this event.

Project Description

The majority of our project approach included multiple informational and planning sessions with our mentor, Jack Leff. In planning sessions, we determined that the Showcase should be less of an academic conference and instead focus on

celebrating and sharing best practices around existing CALL-related research projects and courses; showcasing students' work, including from this course; and connecting academic and operational stakeholders for future CALL efforts. We also worked with Assistant Dean Vandyke to book a space, date, and time for the event. Throughout the semester, we worked with our mentor to plan all logistics and communication pieces necessary to host the CALL Showcase.

Outcomes

The CALL Showcase will take place in the Honors College Discovery Studio in Squires Hall on Friday, April 19, 2024 from 1:00-5:00pm (with additional set up time beginning at 12:00 pm). This date was chosen intentionally because it is directly before Earth Week, as well as its vicinity to next semester's class' final presentations. This date will allow those students to present their work in the poster session. The Showcase entails a welcome and keynote speech from the Office of Sustainability and the Honors College, a student-led poster session, faculty panel, information session on GreenHouse Gases, as well as a facilitated activity.

The final packet includes the following elements:

- Cover Letter
- A Note From the Organizer
- Description of the Showcase
- Event Planning Timeline
- Schedule for the Day
- List of Potential Speakers/Distinguished Attendees
- Email Script for the Invitation to the Potential Keynote Speakers
- Email Script for the Invitation to the Potential Distinguished Attendees
- Email Script for the Thank You to All Guests
- Flier for the Showcase

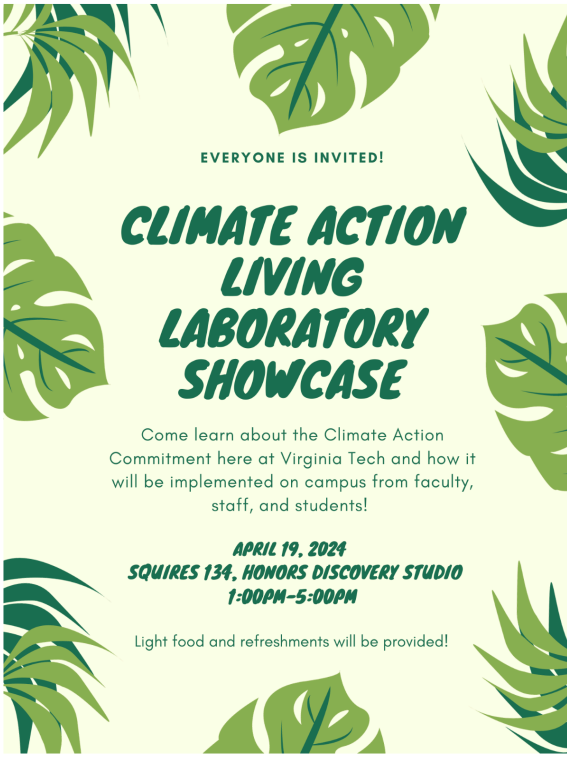

Figure 1.3
Flier for the Showcase

While the Showcase has not happened yet, our efforts have significantly lowered the burden on Jack Leff and the Office of Sustainability to plan and host it. The CALL intern within the Office of Sustainability will implement the activities described in the timeline for the Spring 2024 semester. This intern will have guidance from Jack Leff and Dr. Budowle. Finding the intern will be the next step in this research/planning process.

The Showcase will allow faculty to share research and classes that address climate action goals at VT. Additionally, students and student-led groups will present their projects and programs as they relate to the CALL, especially the students in UH 3204 Honors Service-Learning, including ourselves. Finally, it will provide an exchange platform, wherein sustainability staff will share their VT CAC and CALL needs, and VT faculty will share their teaching, research, and/or service opportunities that could support those needs. Ideally, the Showcase will serve as a catalyst for CALL actions taken by those it connects, and these actions will help us reach the goals of the VT CAC. By bringing partners together in a CALL event like this, we can celebrate shared efforts and concrete work being done in courses that have been made to help build up the Office of Sustainability, as well as the CALL program at Virginia Tech. It is also a celebration to announce the launch of the framework of the CALL.

Conclusion

Throughout this semester, our class has been working on developing the framework for the Climate Action Living Laboratory at Virginia Tech, as outlined in the VT Climate Action Commitment. The CALL will work to build a sustainable and equitable future for our campus through service work, experiential learning, and collaboration between students, faculty, and staff. Through our work this semester, from completing our three project components (Benchmarking & Alignment, Communications, and CALL Showcase), meeting and collaborating with mentors, and going on field trips, we have been able to learn about and participate hands-on in the CALL, fostering its development. Our three project components all play key roles in the development of the CALL's framework with a transdisciplinary learning opportunity providing a foundation for future students to build upon. We hope that this will be used as an example for other courses across the university and beyond.

Figures and Appendices

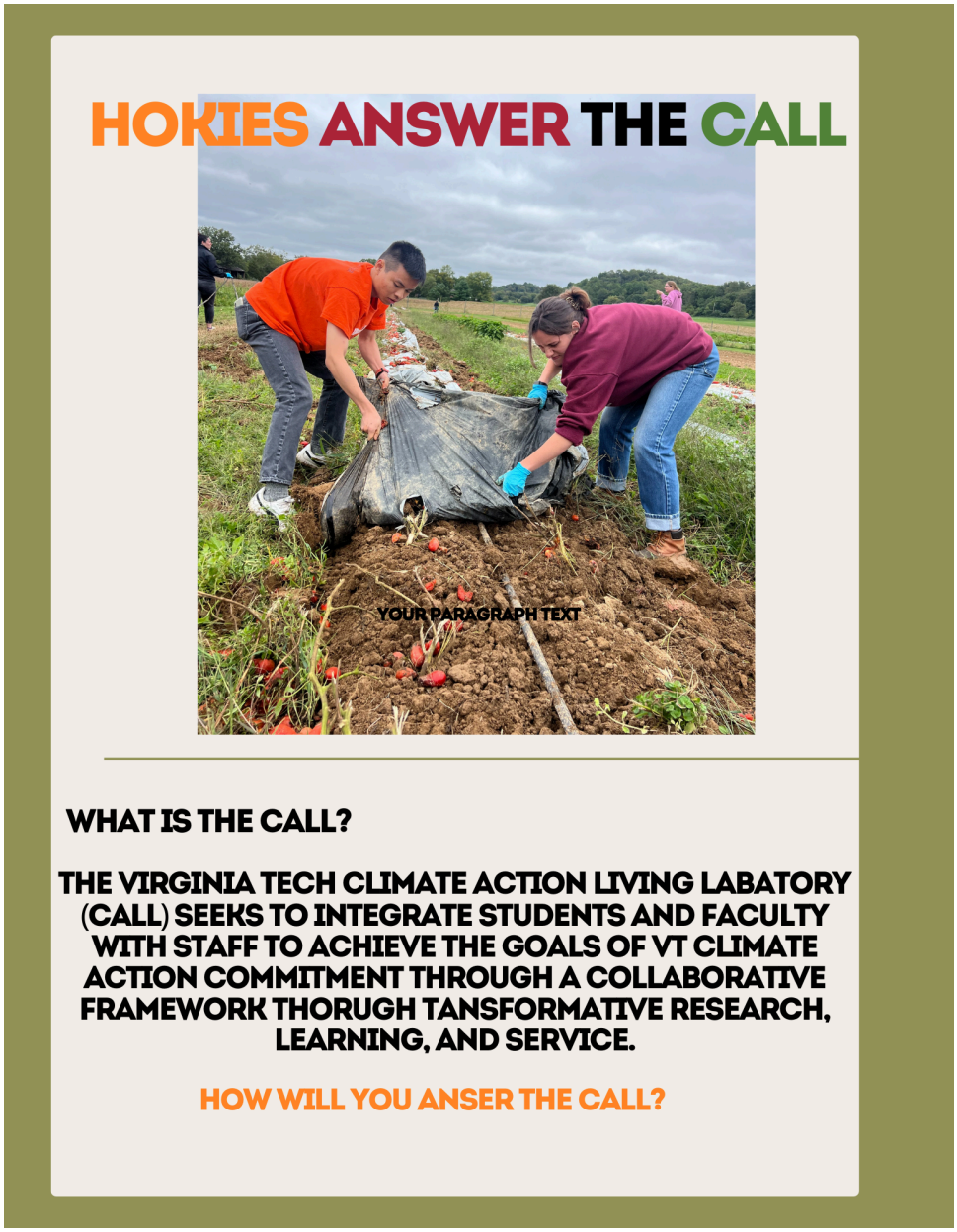

Figure 1.1
CALL Communications team social media post/poster template.

Appendix A

Institution	Land grant university?	Does the institution have a formalized living lab?	Primary contact responded?	Primary Contact (Last Name)	Primary Contact (First Name)	Primary Contact (Email)	Role at university	ASHEE Stars Report Rating	Score	Percentage (%) of courses that are sustainability course offerings	Percentage (%) of academic departments with sustainability courses offerings	Involvement at institution's living lab	Funding
Stanford University	No	Yes	No	Murphy-Sierra	Malaika	malaika@stanford.edu	Sustainability Outreach & Communication Specialist	Platinum	85.88	36.55	88.98	N/A	N/A
Colorado State University	Yes	Yes	No	Habben	Brittany	Brittany.Habben@colostate.edu	Associate Director of Development for Student Affairs	Platinum	88.13	22.60	100.00	N/A	HDS Sustainability Fund, Alternative Transportation Fee Advisory Board, University Housing, Departments of Central Receiving
University of California, Berkeley	Yes	Yes	No	Stoll	Kira	stoll@berkeley.edu	Director of the Office of Sustainability	Platinum	85.72	46.99	89.15	N/A	California Assembly Bill 94 (AB 94) from July 2013; The Green Initiative Fund
Cornell University	Yes	Yes	Yes	Rutherford	Meredith	mr2368@cornell.edu	Sustainability Manager within Campus Sustainability Office (CSO)	Platinum	86.88	18.71	89.89	Developing an education campus about living lab across campus, as well as guidelines. Continuing work on data base (from predecessor), which was designed for our community to connect projects between students/faculty and researchers across campus	Not centrally funded. Projects are hosted by their home office/department; sometimes withthe aid of the CSO.
University of California, Merced	Yes	Yes	No	Sylvas	Breeana	bsylvas@ucmerced.edu	Interim Director of Sustainability	Platinum	85.50	25.25	93.18	N/A	N/A
Dickinson College (The Hive initiative)	No	Yes	Yes	Lyons	Lindsey	lyonsl@dickinson.edu	Director of Sustainability Learning, Center for Sustainability Education (CSE)	Gold	80.07	13.66	90.48	The Hive student intern response (all cells to the right): Role/Involvement – Manages Dickinson College's Bee Cooperative and Bee Campus USA Committee. Support practices related to a pollinator friendly campus, promote importance of pollinator conservation and education, and manage engagement with The Hive Cooperative	Dickinson's Center for Sustainability Education
Dickinson College (The Handlebar initiative)	No	Yes	Yes	Lyons	Lindsey	lyonsl@dickinson.edu	Director of Sustainability Learning, Center for Sustainability Education (CSE)	Gold	80.07	13.66	90.48	The Handlebar student intern response (all cells to the right): Role/Involvement – Helps promote biking through daily and semester-long bike loan programs, The Handlebar, and events. Works with other interns to promote sustainablity as a whole at Dickinson. Works 10 hours per week; $10/hour.	Dickinson's Center for Sustainability Education, Dickinson Idea Fund. Since CSE is an academic affair, funding totals around $5,000 annually. Receives some donations as well.
University of Maryland, College Park	Yes	No	No	Brinks	Taylor	tbrinks@umd.edu	Sustainability Coordinator	Gold	77.34	26.54	90.12	N/A	UMD Sustainability Fund
Furman University	No	Yes	Yes	Baker	Joy	joy.baker@furman.edu	Associate Director of Sustainability Assessment	Gold	77.06	31.55	72.00	Works closely with facilities and operations team; is closely aligned with campus as lab projects and helps make connections between facilities needs and faculty/classes	No specific funding for our program
University of Vermont	Yes	Yes	Yes	McCamp	Caylin	caylin.mccamp@uvm.edu	Project manager in sustainability office (full-time staff)	Gold	76.71	19.78	76.19	Aids in designing a model, identify appropriate needs, supervise and support student lab members, pursue funding sources, and further growth of the lab	Office of Sustainability general funds. Future funding aspirations: Office of Research, UVM Foundation, et al
Portland State University	No	Yes	No	Pierson	Daryl	dpierson@pdx.edu	Director of Planning & Sustainability	Gold	75.77	12.95	89.09	N/A	N/A

Appendix A. Screenshot of the first half of the spreadsheet containing benchmarking data from 10 chosen institutions.

Appendix B

Institution	Research	How are students/faculty are connected with operational/administrative staff?	Mission Statement	Can you talk about your hopes or goals for the living lab?	Have there been any obstacles/setbacks with the living lab?	Any additional info to share about the living lab?	Additional Comments
Stanford University	N/A	Students are supported by staff, faculty, and "fellow" students to develop project-specific advisory boards comprising of subject experts and industry professionals	The Living Laboratory Fellowship Program for Sustainability provides Stanford students real-world sustainability leadership and project management opportunities that meaningfully advance Stanford's operational sustainability goals.	N/A	N/A	N/A	https://sustainable.stanford.edu/living-lab/fellowships
Colorado State University	N/A	N/A	CSU's living labs are developed with the firm belief that student success is best achieved when concepts from inside the classroom are connect with real-world experience outside of the classroom.	N/A	N/A	N/A	Alternative contact: Laura Shaver Laura.Shaver@colostate.edu https://housing.colostate.edu/wp-content/uploads/sites/8/2022/03/Living-Labs_Advancement-Flyer.pdf
University of California, Berkeley	Partnerships with faculty to do research	N/A	Berkeley's new clean energy system presents a unique opportunity for students, faculty, and other researchers to both contribute and advance their knowledge in renewable energy, project finance, and other fields. The initiative invites stakeholder engagement in the system design and continued discovery during the entire lifespan its operations. The intention of this living lab is to build mutually beneficial project partnerships between the energy operations enterprise and the research and teaching enterprise that represents the core of Berkeley's mission.	N/A	N/A	N/A	Original intended contact, Sam Lubow, no longer works at UC Berkeley https://cleanenergycampus.berkeley.edu/living-lab
Cornell University	30% of total faculty and staff researchers from across 67 departments do sustainability research	Faculty and staff reach out to CSO directly to seek sustainability applications for their courses; students reach out to CSO to obtain data for existing sustainability initiatives.	Our living laboratory harnesses campus systems as operations for sustainable improvement, utilizes our community for behavior change research to accelerate the adoption of a sustainable culture, and opens campus resources and data for teaching and research.	(1) Campus improvement (2) Behavior change (3) Campus research	Lot of collaboration and coordination required; this is sometimes overlooked and is hard to keep up with the evaluation of the initiative, thus challenging the availability of resources	Primary contact is actively working to develop process, protocol, and structure to their living lab efforts. Invited us to check back in the Spring for updates.	https://sustainablecampus.cornell.edu/campus-initiatives/living-laboratory
University of California, Merced	N/A	N/A	Young and growing, the new campus is a living laboratory of sustainability where every major building is LEED certified, and the institution utilizes multidisciplinary student learning and applied research in various topics.	LEED Lab goals: (1) Students facilitate the LEED certification audit for existing buildings: Operations & Maintenance (LEED EB: O&M) with the goal of certifying all campus buildings inside and out. (2) Students who complete the lab course will be eligible to sit for professional certification exams to earn their LEED Green Associate & LEED Accredited Professional (LEED AP) certificates.	N/A	N/A	https://sustainability.ucmerced.edu/initiatives/living-laboratory-0 (Unsure if it is research done as part of the living lab program): https://sustainability.ucmerced.edu/initiatives/research
Dickinson College (The Hive initiative)	Uses course research to educate students on sustainability, beekeeping, native bees and pollinators, etc. No long-term faculty research yet	Any student, faculty, or community member can volunteer at the Hive as long as they complete the beekeeping training. Director of Sustainability Learning and Hive Interns coordinate and plan events, though all are welcome to collaborate.	The Hive engages it's members in learning about sustainability problems and solutions through the direct experience of beekeeping, honey production and community building.	The Hive aims to educate the Dickinson community about the role of pollinators in the environment. We educate our members on the importance of not only honeybees but the vital roles of native plants and pollinators. We strive to accomplish this through hands-on activities in and out of our beehives, such as hive checks, gardening days, and wax product making. We also educate through tabling, guest lectures, and newsletters.	Common problems include varroa mites, hive beetles, and hive loss.Loses around around 50% of their hive each winter. Strong relationship with local beekeepers.	Two honeybee hives on campus. Partners with the Penn State Master Gardeners who co-sponsor various educational events and lectures on pollinator gardens, native bees, growing vegetables, seed keeping, and various other garden related topics.	https://www.dickinson.edu/info/20052/sustainability/2229/living_laboratory https://www.dickinson.edu/info/20052/sustainability/3325/the_hive
Dickinson College (The Handlebar Initiative)	Incorporated into some course schedules but is not currently involved with research.	Connected to an administrative office and with Facilities Management, who give us storage space and help with likes like bike racks, and Dickinson Public Safety, who help us run our daily loaner bikes through their office and help with things such as registering bikes and helping if bikes are ever stolen.	In The Handlebar, students, faculty and staff work as leaders and volunteers assisting fellow members of the Dickinson Community to learn the skills of bike repair and maintenance, building their own bike mechanic and leadership skills, participating in a program that reclaims and reuses materials to provide a valuable environment-friendly benefit to the community, and promoting life skills for more active, healthier and sustainable living.	The Handlebar aims to provide the necessary tools, equipment, and space for bike repairs, maintenance, knowledge sharing, and networking. It is a living laboratory for sustainable education the hopes to provide a context for meaningful service, community building, resource sharing, and experiential learning.	Recruiting and maintaining student volunteers (complexities of bike mechanics is intimidating). Turn over and commitment are challenges since The Handlebar is staffed with students, faculty, staff, and community volunteers.	Students are allowed to look through donated and broken bikes we have stored and bring them to The Handlebar to fix up and keep! Learn more here: https://blogs.dickinson.edu/dickinsonbikes/joverview-handlebar/	https://www.dickinson.edu/info/20052/sustainability/2229/living_laboratory https://www.dickinson.edu/info/20052/sustainability/2317/biking
University of Maryland, College Park	Semester-long student research projects, research centers across campus	N/A	N/A	N/A	N/A	N/A	Sustainability initiatives: (1) Sustainability minor (2) Living & Learning Programs (3) Student projects (4) Research centers https://sustainability.umd.edu/sustainability-educati
Furman University	Most projects are course-based class projects or are just simple tours of campus places like the solar farm, vegetable farm, lake restoration work	Acts as the bridge between students/faculty and facilities staff. Shields facilities team from repeated inquiries and narrows the work students do to something that is most useful for facilities.	We envision our campus as a sustainability pedagogical opportunity, a chance to infuse sustainability across our curriculum and provide applied, real-world sustainability experiences for students.	To increase the capacity of our sustainability staff, help solve a campus issue, provide hands on learning experiences for our students, and build relationships between all campus stakeholders.	Originally began as discrete places on campus which offered unique learning experiences (Solar Farm, Thoreau Cabin, Place of Peace temple, Furman Farm, etc.). Was only offering surface level info and wasn't furthering sustainability goals.	Recently narrowed our campus as lab projects to those which directly relate to Furman's climate action plan.	https://www.furman.edu/sustainability/programs/campus-as-living-learning-lab/
University of Vermont	Environmental policy, carbon pricing, data analysis, landscape improvements	Admin staff supervise student interns. Goal: faculty sponsor for each intern. If work is linked to academic requirements, an academic advisor will serve the faculty role. Otherwise, create Memorandum of Understanding with a host organization	The Sustainable Solutions Lab (SSL) is a collaborative research and action hub that responds to the needs of our university community to address sustainability challenges. The SSL bridges knowledge from the classroom to our campus operations.	a) Use the campus environment as a living laboratory to find solutions to reduce our carbon footprint and operate more sustainably. b) Facilitate collaboration between staff and faculty subject matter experts to design and support high impact projects for students to pursue. c) Address known sustainability gaps on campus by facilitating paid internships for undergraduate students, paired with staff and faculty support. d) Handle administrative needs, supervise students and provide project management, professional and leadership development support in	Only one semester into program. Looking for more sources of funding, clarifying (purpose/objectives) of mission. Ex: how is the lab distinct from other student opportunities we offer, traditional research, or service learning in the classroom?	N/A	https://www.uvm.edu/sustainabilityoffice/sustainable-solutions-lab
Portland State University	Course research and research projects	Operational staff benefit from high-quality research and recommendations from (research) projects, while faculty benefit from the access to campus resources and support of a Living Lab team that implements course research and research projects to deepen student learning.	The Living Lab Program engages students and faculty in campus-based applied sustainability projects in partnership with operational staff. By bringing together the academic and operational side of PSU, the Living Lab program empowers students, faculty, and staff to apply creative and innovative approaches to campus-based research questions or challenges, and advance and inform campus sustainability goals.	N/A	N/A	N/A	https://www.pdx.edu/sustainability/living-lab

Appendix B. Screenshot of the second half of the spreadsheet containing benchmarking data from 10 chosen institutions.

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