# Climate Risks and Resilience at Dickinson College: Infrastructure and Continuity Planning

By Sebastian Valdez Bautista
Center for Sustainability Education, Dickinson College

May 22, 2024

Prepared for *Building Climate Resilience at Dickinson and in Central Pennsylvania*, an initiative of Dickinson College, the Borough of Carlisle, and Cumberland County, PA.

Table of Contents



# 1. INTRODUCTION

Dickinson College is faced with growing risks from climate change that could significantly impact its campus infrastructure, operations, and ability to fulfill its educational mission without disruption. As climate change progresses, the Carlisle region and Dickinson's campus can expect increases in extreme heat, heavy precipitation events, flooding, droughts, severe storms, and hazardous air quality days. These changing climate conditions and extremes pose threats to the college's-built infrastructure, utilities, information technology networks, and capability to maintain normal operations and services for students, staff, faculty, and visitors.

Ensuring the resilience of the physical campus and its supporting infrastructure systems is critical for safeguarding Dickinson's assets, managing risks, minimizing potential damages and disruptions, and enabling continued operations during and after climate change related disasters and stresses. A resilient campus has the capacity to anticipate climate change hazards, prepare for and prevent potential impacts, withstand, and adapt to changing conditions, rapidly recover from damage, and emerge stronger from climate-related crisis. As such, resilient infrastructure underpins Dickinson's overall climate resilience and ability to thrive in the midst of the accelerating pace of climate changes.

This report examines the climate risks and resilience factors related to Dickinson's infrastructure and continuity planning. The findings are based on reviewing background materials, reports, policies, and plans; surveying staff with relevant expertise; and synthesizing the collected information to identify priority risks, existing resilience strengths and weaknesses, and potential metrics for monitoring resilience over time. In addition to detailing the climate risks in each infrastructure area, the report identifies current policies, plans, resources, and activities at Dickinson that contribute to infrastructure resilience while also highlighting potential gaps and areas for improvement. Specific opportunities are outlined for enhancing resilience through strategies such as increasing energy and water efficiency, installing on-site renewal energy, hardening facilities against extremes, expanding green infrastructure, and improving emergency preparedness and communications.

## 2. BACKGROUND

Climate change poses growing risks to communities across Pennsylvania, including the Dickinson College campus and surrounding areas of Cumberland County. As outlined in the flyer “Climate Risks are Growing in Cumberland County and Carlisle,” the region is already experiencing rising average temperatures, more extreme heat days, heavier rainfall events, and an increased potential for flash flooding, river flooding, droughts, severe storms, and hazardous air quality days (Center for Sustainability Education, 2024). These changing climate conditions and extremes threaten human health and wellbeing, degrade ecosystems and environment quality, strain infrastructure systems, disrupt economic activities, and disproportionately impact vulnerable populations.

To help address these challenges, Dickinson College joined the Climate Leadership Network by signing the Resilience Commitment through the organization Second Nature. As stated in the Climate Leadership Statement, Dickinson recognizes “the power, potential, and imperative of higher education’s key role in shaping a sustainable society” and the need to exercise leadership by “providing the knowledge, research, practice, and informed graduates to create a positive and sustainable future.” (Second Nature, n.d.)

By signing the Resilience Commitment, Dickinson has pledged to take several key actions over the next 3 years to enhance climate resilience in coordination with the local community. This includes establishing a joint campus-community task force, conducting a comprehensive resilience assessment, developing indicators to track resilience, integrating resilience into the curriculum and research, and completing a Climate Resilience Plan with defined resilience goals and strategies. (Dickinson College, n.d.)

The resilience assessment Dickinson conducts will build on prior efforts to understand and address climate change risks in Pennsylvania and at other colleges and universities. For example, the Pennsylvania Department of Environmental Protection's Climate Change Impacts Assessment reports detailed vulnerabilities the state faces from rising temperatures, heat waves, precipitation changes, sea level rise, and more dangerous storm events that could severely impact agriculture, energy, human health, water resources, and infrastructure statewide.

At the same time, many colleges have begun examining their own climate vulnerabilities and taking steps to enhance resilience in their institutions and communities. Resilience assessments from schools like Arizona State University, Portland State University, and the University of Arkansas have identified priority climate risks to assets like facilities, utilities, transportation systems, and housing, while also evaluating resilience strengths in areas like emergency preparedness, community networks, green infrastructure and ecosystem management. These and other institutional resilience plans provide models from which Dickinson can learn. Additionally, Dickinson can build on its own existing policies, plans and initiatives related to sustainability and resilience, as outlined in the college's 2023 Strategic Plan (Dickinson College, 2023). The plan emphasizes priorities like updating the Climate Action Plan to chart further emissions reductions, strengthening academic programs and experiential learning opportunities around sustainability, leveraging the college farm for resilient food systems, advancing green building and energy efficiency, and expanding global education programs to foster resilient mindsets.

Dickinson's sustainability commitment positions the college as a potential resilience leader. However, the strategic plan also acknowledges the need to "meet the critical challenges of our times" as the world rapidly changes due to factors like climate change, evolving student needs and demographics, competition and cost pressures in higher education, and growing skepticism about the value of liberal arts degrees. Building climate resilience across all areas of the institution emerges as a key part of the solution.

## 3. CASE STUDIES

Examining successful resilience strategies at other higher education institutions provides insights and actionable frameworks that Dickinson College could adapt to enhance its own sustainability and resilience efforts. Notable examples from institutions as Arizona State University (ASU), Villanova University, and the University of Pennsylvania highlights comprehensive approaches integrating sustainable infrastructure, community engagement, and educational initiatives into their climate actions plans.

Arizona State University has positioned itself as a leader in solar energy utilization, deploying extensive solar panels across its campus (Campbell et al, 2024). This significant investment not only reduces ASU's reliance on non-renewable energy sources but also aligns with sustainability goals, making a substantial impact on the university's carbon footprint. In addition to its renewable energy initiatives, ASU has embraced green building practices by adopting Leadership in Energy and Environmental Design (LEED) standards for all new construction projects. This supposedly ensures that infrastructure development not only meets demanding energy efficiency criteria but also aligns with sustainable practices. The effectiveness of LEED-certified buildings in making a substantial impact will be a focus discussion in **the Infrastructure and Continuity Planning** section of this report.

Similarly, Villanova University has implemented innovative green infrastructure to manage stormwater effectively (Gray-DeKraai, 2021). This approach not only mitigates flooding risks but also enhances the quality of local water bodies through advanced biofiltration systems. Villanova's shift towards geothermal energy for heating and cooling its campus buildings, a move aimed to at addressing the major sources of the school's carbon emissions. This shift not only contributes to a reduction in ecological impact but also decreases operational costs. This development showcases how traditional academic campuses can effectively transition towards more sustainable energy solutions, and stride toward reducing its ecological impact and operational costs.

The University of Pennsylvania's Climate Action Plan offers a comprehensive strategy that emphasizes not only reducing the university's carbon footprint through aggressive neutrality goals set for 2042 but also enhancing the educational component of sustainability. UPenn integrates sustainability topics into its curriculum and extracurricular activities, ensuring that students are well-informed and actively engaged in environmental conservation.

For Dickinson College, these examples underscore the importance of adopting multi-faceted approaches to climate resilience that include infrastructural advancements, educational reforms, and community engagement initiatives. To follow such successes, Dickinson could take several strategic steps:

- While Dickinson College is currently integrating several sustainable practices, there is potential for further improvement. Notably, the college features a 3-megawatt solar field that generates over 5 million kilowatt-hours of electricity annually, covering approximately 30% of the institution's electricity needs. Despite this substantial contribution, Dickinson College has the opportunity to diversify its renewable energy portfolio and increase the percentage of its energy needs met through sustainable sources. Expanding its renewable energy initiatives could significantly enhance the college's sustainability efforts and reduce its carbon footprint.

- Building on the lessons from Villanova, Dickinson College could enhance its campuses with more green spaces and permeable surfaces to improve stormwater management and reduce heat effects. These

initiatives could include the creation of additional rain gardens, green roofs, and other sustainable landscaping features that contribute to both the aesthetic and environmental health of the campus.

- Taking inspiration from the University of Pennsylvania, Dickinson College could establish specific, measurable objectives for carbon reduction. These objectives might include enhancing the energy efficiency of existing buildings, adopting sustainable building practices for new constructions, and minimizing waste through comprehensive recycling and composting programs. However, there is room for improvement in how the college measures its progress. The most recent data on building energy consumption was recorded in February 2022, according to the Center for Sustainability Education at Dickinson College. To ensure continued progress and effective monitoring, regular updates and transparent reporting of energy consumption and sustainability metrics are essential.

By adopting these strategies, Dickinson College can significantly enhance its resilience against climate impacts and continue to foster a sustainable campus environment. These efforts will not only benefit the college community but also contribute to environmental goals, reinforcing Dickinson's role as a leader in climate resilience within the higher education sector.

## 4. RISK IDENTIFICATION

Dickinson College, located in Pennsylvania's Cumberland County, faces significant climate-related risks that are becoming increasingly severe due to the changing weather patterns. The projected increase in average temperatures of 4 to 7°F by mid-century, along with escalating frequency and intensity heatwaves, pose a serious challenge to the college's infrastructure and operational continuity. These temperature rises are expected to lead to an increase in days exceeding 90°F by 20 to 50 days annually, significantly affecting the college's energy systems and cooling demands, area where the college's carbon footprint is the biggest. (Leary, 2023).

Moreover, heavy rainfall and storm intensities are also anticipated to increase by 20% to 65%, contributing to higher risks of flash and river flooding, which could damage buildings and essential infrastructure. Such conditions demand strong resilience and disaster recovery strategies to mitigate the impacts on critical campus facilities, including the IT department, which is particularly vulnerable to power, or internet outages as noted by Andrew Connell, because is an essential resource for students and faculty members.

The physical infrastructure of Dickinson College, including academic buildings, residentials halls, and support facilities, is at considerable risk from climate-induced events. The likelihood of increased flooding could lead to significant infrastructural damage, particularly in low-lying areas of campus, potentially contaminating water supplies and disrupting power. Academic operations could be severely affected by extreme weather events as we saw over the winter season where the school had to cancel classes for a day because of a snowstorm, impacting the scheduling and delivery of educational programs. For instance, severe heat events could make some areas of the campus unusable without adequate cooling, impacting the health and safety of student and staff, something in those lanes could be the "shoulder season" problem, which means that the temperature varies every day, and the school does not know if they must cool or heat a building, which takes time, money, and energy. Similarly, heavy rainfall and flooding could require temporary closure of key campus facilities like the HUB, underscoring the need for effective crisis management and business continuity.

The vulnerabilities within Dickinson College's systems and practices are varied, primarily revolving around the capability of current facilities to withstand the increased climate challenges. Interviews with campus staff

such as Amy Ward and Andrew Connell revealed concerns regarding the adequacy of HVAC systems and the resilience of IT infrastructure against climate-related issues.

Another significant vulnerability is the college's reliance on single utility sources. As discussed by Andrew Connell, the reliance on a single internet service provider has already resulted in operational disruptions during the weather-related incidents, such as power outages affecting online connectivity. Such vulnerability highlights the critical need for diversified utility sources and enhancing infrastructural resilience against climate impacts. Furthermore, the human element—how staff and students respond to and recover from climate related disruptions—plays a crucial role in overall campus resilience. Training and preparedness vary across departments, as indicated by Amy Ward, suggesting a need for broader educational initiatives on climate resilience and emergency response. The lack of necessary knowledge and preparation could interfere with the effective response to climate change emergencies.

Identifying these risks and vulnerabilities allows Dickinson College to prioritize interventions that enhance resilience, such as upgrading infrastructure, diversifying utility sources, and improving emergency preparedness across campus. Integration of climate resilience into operational planning and infrastructure development is crucial to safeguard the community and ensure continuity in its educational mission.

# 5. INFRASTRUCTURE AND CONTINUITY PLANNING

Dickinson College is increasingly aware of the impacts that climate change can have on its infrastructure and the continuity of its operations. Rising global temperatures, more frequent heatwaves, and extreme weather events challenge the integrity and sustainability of the college's-built environment. Additionally, flooding, power outages, and communication breakdowns pose direct threats to campus activities and the well-being of students, staff, and faculty. This section explores the critical infrastructure elements and continuity plans that are key to building resilience at Dickinson College. It assesses strengths and vulnerabilities in current systems, identifies opportunities for improvement, and proposes financially feasible strategies to ensure that the college remains a safe, operational, and sustainable learning environment.

## 5.1 Energy Efficiency

Dickinson College is an example of an institution committed to sustainability which includes energy efficiency, as an early adopter of the Carbon Neutrality Agreement, the college distinguished itself as one of the first twenty U.S. colleges and universities that committed to reducing greenhouse gas emissions and, as Lindsey Lyons the Director of Sustainability Learning pointed out, in the region Dickinson is one of the schools leading in this effort since it started earlier and is moving faster and towards climate resilience as an institution. This initiative led Dickinson to achieve zero net emissions in 2020, positioning it among the first ten carbon neutral institutions in the nation. Ken Shultes, Associate Vice President for Sustainability and Facilities Planning, emphasizes the win-win scenario of these efforts, noting significant cost savings alongside reduced carbon emissions.

The college's approach to energy efficiency is highlighted by two major initiatives: the campus-wide transformation to high-efficiency LED lighting and the construction of a solar farm> The LED lighting upgrade significantly reduces energy consumption and maintenance costs due to the bulbs' longer lifespan. The solar farm, covering between 25% to 30% of the annual electricity needs, substantially decreases reliance on external electricity sources, directly contributing to the college's sustainability goals and financial savings (Shultes, Interview).

These initiatives underscore several strengths of Dickinson's strategy. The proactive leadership in sustainability has established the college as a leader in the sector, offering substantial financial savings through reduced operational costs and serving as an educational tool for students, integrating sustainability practices into the academic environment.

However, there are weaknesses within the cycle of climate impact, where increased temperatures lead to higher air conditioning usage, thus increasing energy consumption and carbon emissions. This cycle presents a significant challenge in maintaining energy efficiency and complicates efforts to reduce environmental impacts (Shultes, Interview).

To enhance its energy strategy, Dickinson College could consider multiple improvements. Conducting comprehensive energy studies would help identify further inefficiencies. Investing in advanced, energy efficient HVAC systems could address the increased demand for air conditioning due to rising temperatures. Expanding renewable energy sources, such as adding more solar panels or exploring wind energy, could further reduce reliance on non-renewable energy sources.

### 5.2 Water Usage and Stormwater System

Water resource management is a critical component of sustainability initiatives. Guided by both regional challenges and institutional goals, the college has developed an approach to managing water usage and stormwater. Cumberland County, where the college is located, experiences a range of water-related issues that influence these initiatives, including periodic droughts and intense rainfall events that demand effective stormwater solutions.

Dickinson College has implemented several water conservation measures to reduce consumption and minimize its environmental footprint. According to Ken Shultes, these measures are not only about aligning with sustainability goals but also about reducing operational costs and enhancing the resilience of the college infrastructure. An example is the use of an underground cistern at the High Street residential hall. This cistern is designed to capture and store rainwater during heavy rainfall events before its enters the town's stormwater system. By capturing rainwater, the cistern helps to reduce the volume of runoff that flows directly into the town's stormwater system. This is crucial during heavy rainfalls where the capacity of municipal stormwater systems can be exceeded, leading to flooding. By mitigating the flow rate and volume of stormwater runoff, the cistern helps prevent the overwhelming of local drainage systems, thereby reducing the risk of flood damage both on campus and in the surrounding community.

The college employs a variety of green infrastructure techniques to manage and mitigate stormwater runoff, like the installation of rain gardens, and green roofs which absorb and filter rainwater. Such infrastructure not only helps in managing water effectively but also contributes to the aesthetic and ecological value of the campus.

Despite these efforts, challenges remain. Dickinson faces significant challenges as it has spent more on water than on electricity, marking a shift from just a few years ago when water expenses first surpassed those for natural gas. A substantial portion of the utility bill is attributed to water usage, with the primary consumer being the irrigation of athletic fields. Additionally, Dickinson's central energy plant, housed in Kaufman Hall, is the second-largest user of water. This plant utilizes a chilled water system for cooling many of Dickinson's buildings, accounting for 70% of campus cooling needs and consuming approximately 4,000,000 gallons of water annually (Shultes, Interview).

The changing climate poses new risks, including increased rainfall intensity and fluctuation that can damage

existing infrastructure. To address these challenges the County has conducted a detailed study to identify the worst flooding areas and has developed strategic plans to address these vulnerabilities. To fund these initiatives, a stormwater fee has been implemented for every resident and business within the county. The collected funds are for enhancing stormwater infrastructure, ensuring sustainable management and mitigation of flood risks.

### 5.3 Heating, Cooling Systems

Ensuring the resilience of Dickinson College's heating and cooling systems is crucial in maintaining the comfort, safety, and well-being of students, staff, and faculty. As this is the activity that produces the most greenhouse emissions, is something that we must improve in every aspect, but the college faces significant challenges to improve in this area, like rising temperatures, more frequent heatwaves, and extreme weather events. This section delves into the current state of Dickinson's HVAC systems, the challenges posed by climate change and proposed improvements to enhance resilience and efficiency.

The heating, ventilation, and air conditioning (HVAC) systems across Dickinson College vary in age and efficiency, reflecting the historical development of the campus. Older buildings, such as Deny Hall and Old West, present the most significant challenges due to their outdated HVAC systems, where there are complaints from the faculty members that teach and have their office there due to the failure in the cooling and heating of these buildings. These buildings often struggle to maintain consistent temperatures, leading to discomfort as mentioned before, and potential health risk for occupants. The lack of modern insulation and climate control technologies in these buildings worsens these issues, making them more vulnerable to extremes of both heat and cold.

In contrast, newer buildings like Rector Science Complex and Althouse Hall have more advanced HVAC systems that offer better temperature regulation and energy efficiency. However, even these buildings face challenges. For instance, the Rector Science Complex uses a chilled water system for cooling, which consumes significant amounts of water and energy. This system, while effective in maintaining temperatures, highlights the broader issue of sustainability and resource consumption within the college's infrastructure.

One of the primary challenges in managing HVAC systems at Dickinson College is the seasonal variability in temperatures, often referred to as the "shoulder season". During this period, temperatures can vary dramatically from day to day, complicating the management of heating and cooling systems. As Amy Ward from the library staff mentioned, this inconsistency leads to daily discomfort among staff, who often experience significant temperature variations within their workspaces. The need to frequently switch between heating and cooling modes can also strain HVAC systems and increase maintenance costs.

The school has multiple mold problems during the year but it always finds its ways to mitigated them, with almost no impact on the students and staff, but this past semester a significant incident highlighting the challenges of the college's HVAC systems occurred in the library, where a mold outbreak was linked to HVAC failures. The outbreak, which took place during a period of high humidity and temperatures fluctuations, underscored the vulnerabilities of the college's current systems. Amy Ward explained that mold is always present in indoor environments to some degree, but it becomes a problem when conditions favor its rapid growth. The library's HVAC system failed to maintain consistent temperature and humidity levels, which led to substantial remediation efforts, including the removal and cleaning of affected materials and the installation of temporary dehumidifiers to stabilize the indoor climate. The outbreak caused significant disruption to library services and highlighted the need for more robust climate control systems. The event also emphasized the importance of regular maintenance and monitoring to prevent similar occurrences in the future.

To address these challenges and enhance the resilience of its heating and cooling systems, Dickinson College can consider several strategic improvements:

- **Comprehensive Energy Audits:** Conducting energy audits of all campus buildings is a crucial first step in identifying inefficiencies and areas for improvement. These audits can help pinpoint specific issues, such as poorly insulated areas, outdated equipment, and opportunities for energy savings. By understanding where energy is being lost or inefficiently used, the college can prioritize upgrades and interventions that will have the most significant impact.

- **Upgrading HVAC Systems:** Investing in energy-efficient HVAC systems is essential for reducing energy consumption and improving climate resilience. Modern systems equipped with smart controls and automation can optimize temperature controls based on real-time conditions, ensuring that buildings are heated or cooled only when necessary.

- **Expanding Renewable Energy Sources:** This is something that has been mentioned multiple times on this report, because this is something that we as a campus and as a community have to adapt and make the 100% change to it. Increasing the use of renewable energy sources to power HVAC systems is another critical strategy. Dickinson College has already made strides in this area with its solar farm, which provides a significant portion of the campus's electricity. Expanding this initiative by adding more solar panels or exploring other renewable energy options, such as geothermal or wind energy.

- **Educational and Behavioral Initiatives:** Educating the campus community about energy conservation and efficient use of HVAC systems can also contribute to overall efficiency. Encouraging simple behaviors, such as closing the windows are doors to prevent heat loss, using programmable thermostats, and being mindful of energy use, can collectively make a significant difference. An idea could be making a energy and water consumption competition between the residence halls where the one with the lowest energy consumption gains a prize to incentivize students to be more mindful about the energy consumption.

The heating and cooling systems at Dickinson College are a critical component of its infrastructure resilience strategy. By addressing current challenges and implementing improvements the college can enhance the efficiency, reliability, and sustainability of these systems. This will not only improve the comfort and well-being of the campus community but also contribute to Dickinson's broader goals of sustainability and climate resilience. Through strategic investments, innovative technologies, and a commitment to continuous improvement, Dickinson College can set a benchmark for resilient and sustainable campus infrastructure.

## 5.4 Resilient Buildings

Resilient Buildings are essential for ensuring the long-term sustainability and functionality of Dickinson College's infrastructure. As climate change intensifies, it is crucial for the college to have buildings that can withstand extreme weather conditions and fluctuating temperatures while maintaining energy efficiency and the resident's comfort. This section explores the current status of Dickinson's buildings, the effectiveness of LEED-certified buildings, and proposed improvements to enhance building resilience.

Dickinson College's campus includes a mix of historic and modern buildings, each presenting unique challenges in terms of resilience and sustainability. Older buildings such as Denny Hall and Old West are particularly vulnerable due to outdated construction techniques and materials. These structures often struggle with temperature regulation, insulation issues, and are susceptible to weather-related damage. As Lindsey Lyons pointed out, maintaining a comfortable indoor climate in these older buildings can be challenging.

Dickinson College has committed to constructing new buildings and major building renovations to a minimum standard of LEED (Leadership in Energy and Environmental Design) Silver but has exceeded that in all new construction projects. LEED certification is a globally recognized symbol of sustainability achievement and leadership. LEED-certified buildings are designed to reduce energy and water consumption, lower carbon emissions, and create healthier indoor environments.

LEED certification categorizes buildings into four types based on their performance across six credit categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovative Design. Dickinson has seven LEED-certified buildings:

- The Center for Sustainable Living (Treehouse)
- Rector Science Complex
- Waidner Admissions House
- Althouse Hall
- Durden Athletic Training Center
- Kline Athletic Center
- High Street Residence Hall

These buildings incorporate resource-saving technologies such as energy wheels that efficiently exchange heat between indoor and outdoor air, high-efficiency HVAC systems, sensors to optimize airflow, temperature, and lighting. Ken Shultes emphasized the importance of LEED-certification in the college's infrastructure strategy. He noted that LEED-certified buildings not only reduce operational costs through improved energy efficiency but also serve as educational tools for students, integrating sustainability practices into the academic environment. Lindsey Lyons echoed the benefits of LEED certification, highlighting how these buildings contribute to the college's goal of carbon neutrality. Although they supported the LEED buildings certification, is it worth paying for the certification for all the buildings? While LEED certification provides a recognized standard for sustainability, it comes with a cost associated with the certification process itself. These costs include application fees, commissioning fees, and ongoing monitoring to ensure compliance with LEED standards. Some argue that these funds could be better spent directly on sustainable building practices rather than on certification.

Building sustainably without seeking LEED certification can still achieve many of the same environmental and health benefits. For example, Dickinson's commitment to green building principles—designing structures that use less energy, water, and natural resources—can be implemented without the additional cost of certification. Sustainable practices such as high efficiency HVAC systems, incorporating renewable energy sources, and utilizing sustainable materials can be adopted independently of LEED certification.

However, LEED certification also offers significant advantages. It provides a clear, measurable framework for sustainability, ensuring that buildings meet high standards across multiple criteria. This can be particularly valuable for institutional accountability and transparency, demonstrating to stakeholders—students, staff, alumni, and donors—that the college is committed to sustainability goals. Additionally, LEED-certified buildings can enhance the institution's reputation, potentially attracting students and faculty who prioritize environmental responsibility.

To enhance the resilience and efficiency of its buildings, Dickinson College should prioritize retrofitting and renovating older structures with improved insulation, windows, and HVAC systems, and expand LEED

certification to more buildings to ensure high sustainability standards and keep making observable the commitment of the school to sustainability. Implementing passive design strategies, such as natural ventilation and shading, can reduce reliance on mechanical systems. Establishing a robust maintenance schedule and proactive upgrades will prevent small issues from becoming major problems. Additionally, educating the campus community on energy conservation and sustainable practices can collectively enhance building resilience.

Resilient buildings are a cornerstone of Dickinson College's strategy to combat climate change and ensure long-term sustainability. By leveraging the benefits of LEED certification, retrofitting older buildings, and implementing passive design strategies, the college can enhance the resilience and efficiency of its infrastructure. Insights from Ken Shultes and Lindsey Lyons underscore the importance of these efforts in achieving Dickinson's sustainability goals and maintaining a comfortable, healthy environment for the campus community.

## 5.5 Communication Infrastructure

The resilience of Dickinson College's communication infrastructure is vital for maintaining operations and ensuring the safety and well-being of the campus community. Reliable communication systems are essential for coordinating emergency responses, disseminating information, and supporting daily activities. This section explores the current state of Dickinson's communication infrastructure, the challenges it faces, and proposed improvements to enhance its resilience.

Dickinson College's communication infrastructure includes internet services, telephone systems, and campus-wide alert systems. However, this infrastructure is vulnerable to disruptions caused by climate-related events such as severe storms and power outages. A significant incident highlighting these vulnerabilities occurred recently when the college experienced a major internet outage due to a fallen tree. The tree knocked out power lines and fiber optic cables, leading to a prolonged disruption of internet services on campus.

Andrew Connell, the Director of User Services, provided detailed insights into this incident. He explained that the college relies on a single internet service provider, Lumen, for its connectivity. During the outage, the fallen tree not only disrupted power but also caused a brush fire, delaying repairs and extending the internet downtime. This event underscored the critical dependency on a single internet connection and highlighted the need for redundancy in communication systems.

The outage had significant operational impacts. As Connell noted, without internet access, the IT department and many other campus functions were rendered almost entirely inoperative. This highlighted a crucial vulnerability: the lack of a secondary, backup internet connection. Despite repeated requests for funding to establish a redundant internet service, these have been denied, primarily due to budget constraints. Connell emphasized that having a backup internet connection is not just a convenience but a necessity to ensure continuous connectivity and operational resilience during such disruptions.

Establishing redundant communication systems, particularly a secondary internet connection, is critical. This backup connection will provide an alternative pathway for internet traffic if the primary connection fails, ensuring that the college remains connected even during outages. This redundancy is crucial for maintaining academic operations, administrative functions, and emergency communications.

## 5.6 Emergency Planning

Effective emergency planning and robust backup energy systems are crucial for ensuring the resilience of

Dickinson College in the face of climate change and other potential disruptions. These systems help to minimize disruptions, protect critical infrastructure, and ensure the safety of the campus community.

The Compliance & Enterprise Risk Management department plays a central role in coordinating these efforts. They have created Emergency Quick Reference Guides, which are strategically placed throughout the campus, primarily near fire alarm pull stations and exit doors. These guides provide detailed instructions on what to do in various emergency situations, including severe weather, medical emergencies, and hazardous materials spills. The guides also include information on evacuation routes, shelter-in-place locations, and the nearest Automated External Defibrillators (AEDs).

In addition to these guides, Dickinson College has implemented an emergency notification system called Red Alert. This system is designed to disseminate urgent messages to the campus community via text messages, emails, and other communication channels. The system ensures that students, faculty, and staff receive timely and accurate information during emergencies, allowing them to take appropriate actions to protect themselves and others.

Despite these comprehensive plans and systems, several challenges remain. One significant challenge is ensuring that all members of the campus community are aware of and familiar with the emergency procedures. Regular training and drills are essential to reinforce this knowledge and ensure that everyone knows what to do in an emergency. However, coordinating these drills across a large and diverse campus can be logistically challenging.

Dickinson College also has an emergency team that convenes when unforeseen urgencies happen, requiring fast decision-making. This team analyzes the situation and makes critical decisions to ensure the safety and continuity of campus operations. However, there has been limited disclosure and transparency regarding what goes on within that team and the decisions made by the emergency team. Improving communication about the team's actions and decisions could improve trust and readiness within the campus community.

### 5.7 Backup Energy

Backup energy systems are a critical component of Dickinson College's resilience strategy, particularly in the context of climate change. These systems ensure that essential services and infrastructure remain operational during power outages, which can be caused by severe weather, technical failures, or other disruptions.

Currently, the college has several backup generators in place to provide emergency power to key buildings and systems. These generators are primarily located in buildings that house critical infrastructure, such as the library, and the Rector Science Complex. The backup power systems are designed to kick automatically in the event of power failure, ensuring that essential functions continue without interruption.

However, the existing backup power has limitations. For instance, the capacity of these generators may not be sufficient to power all essential services during a prolonged outage. This was evident towards the end of he semester when a power outage in the lower quads and other residences halls resulted in backup generators failing to kick in for several hours. During this time, students had to relocate to other buildings to continue their activities, highlighting the necessity of electricity in modern society and the critical need for reliable backup systems. This incident underscores the need for more sustainable and resilient backup energy solutions.

### 5.8 Continuity Planning in Academics

Dickinson College is deeply committed to integrating sustainability across its curriculum, ensuring that students are not only aware of but also actively engaged in addressing sustainability challenges. This commitment is exemplified by the college's requirement for students to complete at least one sustainability course as part of their general degree requirements, starting with the Class of 2019. However, Dickinson goes beyond mere requirements, offering over 100 sustainability-related courses each academic year across 39 academic departments. These courses help students gain knowledge about sustainability concepts, problems, and solutions for a sustainable world.

Faculty designate these courses each semester using the Sustainability Course Designation process. Sustainability Investigations (SINV) courses engage students in deep and focused study of sustainability problems, often examining social, economic, and environmental dimensions of these issues. In contrast, Sustainability Connections (SCON) courses integrate sustainability into the broader context of the course, using assignments, readings, and case studies to explore human interactions with the environment and their consequences for social, economic, or environmental objectives.

According to Dickinson's academic continuity plan, provisions should be made for moving learning environments online during disruptions. These plans must be easily accessible through the institution's learning management system (LMS) and should include training modules for faculty and students on using digital tools effectively. The report highlights the importance of communication with students and the delivery of course content and assessments as critical components of continuity planning.

Continuity planning in academics at Dickinson College is a thorough effort that blends sustainability into the curriculum and prepares for disruptions. By using digital learning tools, improving training and practice sessions, regularly updating plans, and working with local resources, Dickinson can keep academic operations running and stay committed to sustainability even in crises. These steps make sure the college remains a strong and flexible learning environment, ready to handle challenges from climate change and other disruptions.

# 6. CONCLUSION

Dickinson College is facing big challenges due to climate change. The college's plan to deal with these includes improving buildings, making emergency plans, ensuring that education continues smoothly, and integrating sustainability into all aspects of learning. By carefully assessing risks, planning strategically, and using innovative solutions, Dickinson aims to protect its campus and community from climate-related problems.

**Infrastructure Resilience:**
Dickinson has made good progress in making its buildings more resilient. The college has committed to LEED-certified buildings and is using renewable energy sources like solar power. However, older buildings still need improvements, especially in their heating and cooling systems. Conducting energy audits, upgrading HVAC systems, and expanding renewable energy use are essential steps to reduce the college's carbon footprint and ensure efficient operations.

**Water Usage and Stormwater Management:**
Managing water resources well is key to sustainability. Dickinson has taken steps to conserve water and use green infrastructure, such as rain gardens and green roofs, to manage heavy rainfall and droughts. The college needs to continue finding new and better ways to manage water to address the growing risks from climate change.

**Heating and Cooling Systems:**

Reliable heating and cooling systems are crucial for keeping the campus comfortable and safe. The changing seasons and more frequent extreme weather events mean that modern, energy-efficient HVAC systems are needed. Improving these systems and educating the campus community about energy conservation will make operations more efficient and sustainable.

**Communication Infrastructure:**
Good communication systems are critical for coordinating emergency responses and maintaining daily operations. A recent internet outage showed weaknesses in the current setup. Adding a backup internet connection will help the college stay connected and operational during disruptions.

**Emergency Planning and Backup Energy:**
Dickinson has detailed emergency plans and an emergency notification system. However, the college needs to improve transparency and communication about how emergency decisions are made. A recent power outage highlighted the need for better and more sustainable backup energy solutions. Investing in renewable energy and increasing backup power capacity will strengthen the college's resilience.

**Academic Continuity:**
Making sure that learning continues smoothly during disruptions is a key goal for Dickinson. The college offers many sustainability-related courses and uses digital tools to keep education going even in crises. Regularly updating academic plans and training faculty and students will further strengthen this effort.

In summary, Dickinson College's proactive approach to climate resilience makes it a leader in sustainability among colleges. By continually improving buildings, emergency plans, and academic continuity, Dickinson can handle the challenges of climate change while staying committed to sustainability and educational excellence. These efforts will protect the college’s assets and operations and create a resilient community ready to face future challenges.

## 7. ACKNOWLEDGMENTS

I would like to express my sincere gratitude to all those who have supported and contributed to the development of this report on climate resilience at Dickinson College. Firstly, I extend my heartfelt thanks to Neil Leary for his invaluable guidance and expertise throughout this project. His insights and dedication to sustainability have been instrumental in shaping this report. I am also deeply grateful to the Center for Sustainability Education at Dickinson College for providing essential resources, support, and encouragement. The Center's commitment to sustainability and education has greatly enriched my understanding and research. A special thank you goes to my peers, whose collaboration and constructive feedback have been crucial in refining this report.

## 8. REFERENCES

Campbell, H., Crippen, A., Hawkey, C., & Dalrymple, M. (2024). A roadmap for building climate resilience at higher education institutions: A case study of Arizona State University. Journal of Green Building, 15(4), 237-256.

Center for Sustainability Education. (2024). Climate Risks are Growing in Cumberland County. Center for Sustainability Education, Dickinson College, Carlisle, PA.

Second Nature. (n.d.). The Presidents’ Climate Leadership Commitments. Second Nature, Cambridge, MA.

https://secondnature.org/signatory-handbook/the-commitments/.

Dickinson College. (n.d.). Climate Resilience, Stepping Forward as a Leader. Dickinson College, Carlisle, PA. https://www.dickinson.edu/info/20052/sustainability/4371/climate_resilience.

Dickinson College. (n.d.). Academic Continuity. Office of Academic Technology, Dickinson College, Carlisle, PA. https://www.dickinson.edu/info/20392/academic_technology/3989/academic_continuity.

Dickinson College. (2023). Dickinson College Strategic Plan. https://www.dickinson.edu/homepage/1643/dickinson_college_strategic_plan.

Gray-DeKraai, J. R. (2021). Climate change risk and vulnerability: An initial assessment for Villanova University for improved resilience (Master's thesis). Villanova University, College of Engineering.

Leary, N. (2023). Changing Climate Hazards in Cumberland County, a Review of the Evidence. Climate Change in Cumberland County Background Paper, Center for Sustainability Education, Dickinson College, Carlisle, PA. https://www.dickinson.edu/download/downloads/id/14998/cccc_background_paper.pdf.

United States Environmental Protection Agency. (2023). Climate change impacts on the built environment. USEPA, Washington, DC. https://www.epa.gov/climateimpacts/climate-change-impacts-built-environment.

University of Pennsylvania. (2019). Climate and sustainability action plan 3.0: 2019-2024. University of Pennsylvania. https://www.sustainability.upenn.edu/resources/2019-24-climate-and-sustainability-action-plan-30-csap-30.

## 9. INTERVIEWS

Ken Shultes – Associate Vice President for Sustainability and Facilities Planning (March 19th, 2024)

Catrina Hamilton-Drager – Senior Associate Provost of Academic Affairs (March 19th, 2024)

Amy Ward – Dean of Library Services (March 20th, 2024)

Andrew Connell – Director of User Services (March 2nd, 2024)

Lindsey Lyons – Director of Sustainability Learning, Center for Sustainability Education (April 2nd, 2024)