

## Shedding Light: Fuertes Observatory and Cornell University's North Campus Residential Expansion

May 10, 2019

Lauren Leone

The space fills with quiet murmurs and cool air that smells of wood. Students of all ages occupy the classroom, and, after, they calmly retreat to other learning spaces within the small observatory. Voices begin to reverberate through the halls as volunteers politely ask guests if they have questions. Conversations about astronomical terms and research projects coalesce into a hum as families photograph the shiny, dark blue body of the telescope.

Grey fog and springtime chill settle on the edges of the second-floor observation deck of Fuertes Observatory. As visitors peer into the hazy horizon, thousands of distant yellow lights from dorm rooms, academic buildings and city streets blink back at them.



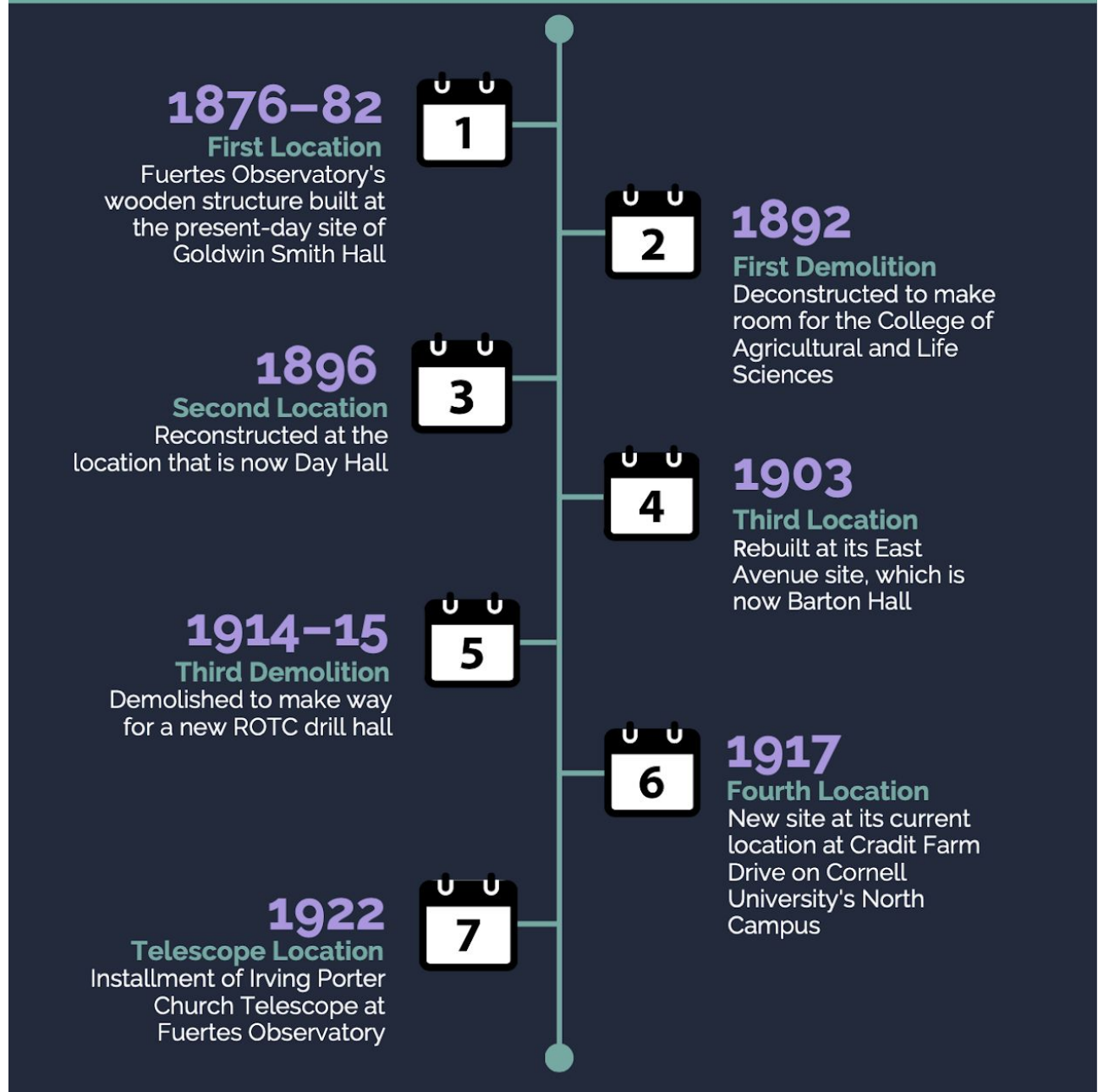
Fuertes Observatory, which is located on Cornell University's North Campus.

The Fuertes Observatory is owned by Cornell University and operated by the Cornell Department of Astronomy. It is the university's fourth location of the observatory. Its predecessors from the 1800s were located on Central Campus, but they have since been demolished or repurposed to make way for the expansion of the university. After several [deconstructions and relocations](#), the Cornell Department of Civil Engineering completed the observatory's current site in 1917. North Campus was the ideal location to rebuild the observatory because, until recently, the land stood undeveloped.

Although Fuertes Observatory has remained in operation after previous Cornell University expansion projects, light pollution emitted from the upcoming North Campus Residential Expansion may endanger the viability of the observatory.

# TIMELINE

## Fuertes Observatory Locations



The observatory and its telescope are dedicated to Estevan A. Fuertes and Irving Porter Church, respectively, who were two notable professors in the Department of Civil Engineering.



The Fuertes Observatory relies heavily upon its telescopes to draw in visitors and stay in operation. Installed in 1922, the [Irving Porter Church Refractor](#) is a 12-inch refracting optical telescope. Several smaller telescopes served as placeholders until the arrival of the Irving Porter Church telescope, and those supplemental telescopes still live inside the observatory.

Above, the various telescopes that supplement the Irving Porter Church telescope.  
Below, the Irving Porter Church Refractor housed in the Fuertes Observatory.



The [telescopes](#) record the precise timings of astronomical events, determine the longitude of the observatory and set local clocks to the correct time. To synchronize with the rotating axis of the earth and to center objects in the eyepiece, the telescope uses a mechanical clockwork mechanism to turn 15 degrees per hour.

According to the Fuertes Observatory [website](#), very few antique telescopes in the United States have their original clock drives intact, which makes this telescope an authentic feature of the Fuertes Observatory and the science of astronomy. The Irving Porter Church telescope invites visitors to stargaze at inimitable views of Saturn's rings, Jupiter and its moons, bright star clusters and the Moon.



The [Cornell Astronomical Society](#), an astronomy club constituted of university students from numerous fields of study, has led weekly public viewing nights at the observatory for approximately 40 years during academic semesters and university breaks. Fuertes remains well attended in the summer months even when the departure of Cornell University and Ithaca College students considerably decreases the population of Ithaca.

Regardless of weather conditions, open houses occur from 8 p.m. to midnight on Friday evenings. On cloudy nights with low visibility, the society demonstrates the historical astronomical equipment and hosts tours of the observatory. On clear [viewing nights](#), society members operate the telescopes and help visitors view the night sky.

[Various activities](#) transpire at the observatory on a weekly basis. Cornell professors teach introductory astronomy classes in the observatory. Community organizations and informal groups can request private observing sessions with society volunteers in addition to the regularly scheduled events. Open house nights are occasionally preceded by lecture series related to astronomical topics that appeal to guests. The society invites Cornell University astronomy faculty, researchers and students to speak about their passions and scholarly work. Past lecture topics include the history of space exploration and ancient star formation.



The interactive lecture classroom at Fuertes Observatory.

Karen Perez, Cornell Astronomical Society president, says that compared to when she began her involvement with the society in 2015, “I think our outreach efforts have increased significantly since then. We’ve had a lot more lectures, a lot more people show up, we advertise a lot more.”

The educational opportunities at the observatory intrigue guests from Ithaca and surrounding regions. Katherine McKane, a frequent visitor of the observatory, lives in Corning, New York, and she and her friend drive approximately 45 minutes to arrive at the observatory each week. “I like to learn new things about the science aspects because I want to also go into some sort of science” after graduating high school, she says, her interest piquing as she spoke.

“For me, I think it’s just something cool to learn about. Every time we come here, [my friend] enjoys looking at the mechanics and learning new things about the dome and the history of it.” McKane’s voice softened and filled with inflection as she notes that “the history and having it being restored” are features that attract locals and out-of-area visitors to Fuertes.

Since over [4,000 guests](#) visit the observatory annually, Fuertes seeks resources and assistance to preserve vintage astronomical instruments. The observatory hopes for future restoration and [expanded exhibits](#) such as a planetarium, displays dedicated to famous local astronomers and boards showcasing astronomical research.

The 100-year anniversary of the Irving Porter Church Refractor’s installment, 2022, coincides with the completion date of the North Campus Residential Expansion (NCRE). It is difficult to tell if the telescope will withstand another 100 years of operation in the face of increasingly illuminated night skies.

[Light pollution](#) is the excessive use of artificial light. This causes skyglow — a brightening of the night sky over areas where it is not needed — which results in lighting and electricity waste. The [International Dark-Sky Association](#) (IDA) reports that 80 percent of the world’s population lives under skyglow and that 99 percent of United States and European citizens experience skyglow at night. Fuertes and other observatories across the nation, such as [Lowell Observatory](#) in Flagstaff, Arizona, are scaling up their light-reducing measures to preserve their institutions.

Cornell University’s North Campus Residential Expansion originated from the January 2016 Student Housing Master Plan, which indicated a need for increased student housing. The [Student Housing Master Plan](#) was a nine-month process intended to “improve the student experience, support the university's academic mission and support the surrounding community's goal of providing affordable housing.”

According to the [site plan](#), the expansion in residential facilities will allow Cornell to house “100 percent of its first-year students in developmentally appropriate campus housing and 100 percent of its sophomores in campus residence halls, co-ops and Greek housing.” This new two-year residency requirement is due to a low percentage of students who choose to live on campus after their freshman or sophomore years. The university also attributed its residency requirement to the anxiety that first-year, sophomore and transfer students experience during lottery housing selection and the uncertainty of residing on campus in future academic years.

Cornell contacted students, faculty, staff and town, city and county officials when developing the site plan. The Cornell University Division of Student and Campus Life and U3 Advisors consulting firm conducted research during [this study](#) and found that 50 percent of undergraduate students and 10 percent of graduate and professional students could not meet their housing needs. Further, the survey revealed that only 56 percent of undergraduate students managed to live on campus in 2016 despite 78 percent of respondents who wanted to reside on campus.

Cornell situates itself among other Ivy League schools, like [Yale University](#), that are in the process of growing enrollment and executing residential projects. A goal that the Division of

Student and Campus Life would like to see realized by the NCRE is increased capacity to accept more first-year students in coming years. The university hopes to [increase undergraduate enrollment](#) by 900 students after the completion of the three-year expansion in 2022.

Another aim is for the new residence halls to suit the needs of freshman, sophomore and transfer students more appropriately than the current living situation. Due to a lack of space for incoming undergraduates, first-year students have been housed in [townhouses](#) or, in some cases, [residence hall lounges](#). The university aspires to also alleviate the demand for expensive [off-campus housing units](#) in the city and town of Ithaca and the Village of Cayuga Heights with its new residence halls.

Based on a FOIL request to the New York Department of Environmental Conservation, the residential expansion will feature three freshman and transfer student residence halls, a sophomore village with four housing facilities and a dining hall, outdoor sports fields and other recreational areas. First-year students will receive 1,200 beds, and sophomores will claim 800 beds. The first-year facilities are slated to begin June 2019 and end May 2022, and the sophomore village housing is poised to start February 2019 and conclude May 2021.

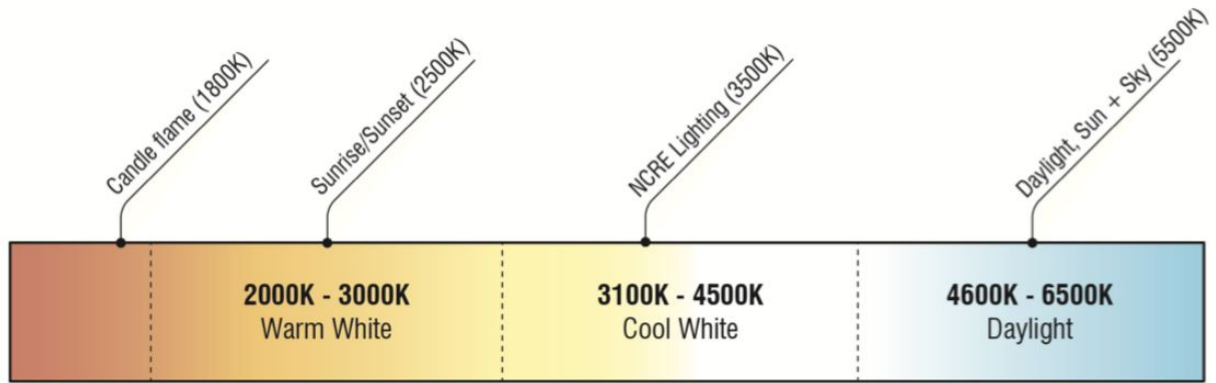


The proposed freshman housing units will be located on the Appel South Fields, which are [500 feet](#)— or 1.5 football fields — away from the Fuertes Observatory. The concern about light pollution arises from the indoor, outdoor and parking lot light fixtures that may illuminate the night sky surrounding the Appel South Fields. In turn, this increased scattered light could produce skyglow that detracts from the stargazing experience provided by Fuertes Observatory.

Fuertes Observatory is located approximately 500 feet away from the NCRE construction site. Image derived from Google Maps.



An International Dark-Sky Association [study](#) indicates that street and outdoor lighting fixtures using 4000K lamps may increase surface brightness by 2.5 percent. Since light sources that emit higher color temperatures are more polluting, the IDA recommends lights at temperatures of [3000K](#) or below. NCRE commercial and residential lighting emits 3500K, according to a visual in the [NCRE project application report](#).



**Typical Color Temperature Range (in °K) for Commercial and Residential Lighting**

The North Campus Residential Expansion lighting emits [3500K](#), which is above the IDA recommended light temperature of 3000K.

Image derived from the July 2018 Cornell University Project Application Report.

Several types of [glass lenses](#), [astrophotography cameras](#), [solar filters](#) and [color correctors](#) inside the Irving Porter Church refractor enable viewers to see true-to-color images with wavelengths detectable to the human eye. Visitors can identify deep-sky stars, planets and galaxies in the eyepiece of the telescope. During viewings at the observatory, guests must refrain from the use of electronic devices that emit white light in order for other visitors' eyes to be fully dark adapted and for the observing experience to occur with full impact.

The cool white light radiated from North Campus and nearby buildings may make it difficult to see the Milky Way and most of the fainter naked-eye stars on open house nights. According to an informational poster in the observatory, even if internal and external ambient light does not block the entire view of the night sky, the fine details and dimensions of astronomical images could be obscured or overexposed. This ambient light may partially or entirely obstruct the nighttime images the Irving Porter Church telescope captures and, thus, render the telescope useless.

Riley Jacob, Cornell Astronomical Society vice president, feels as though the observatory may not actually lose its hallmark feature to excess light pollution emissions. He says that observatory visitors tend to look at the brightest deep sky objects. Although light pollution may conceal more precise objects, only skilled observers will forgo that detailed observing experience. Therefore a portion, but not all, of the guests at the observatory would be missing out. Jacob mentions that in order to conduct personal studies of the night sky in a darker setting, society members travel to the [Hartung-Boothroyd Observatory](#) atop Mount Pleasant in Dryden, New York, which is approximately 10 minutes away from Cornell University.

A recurring theme in the statements provided by society members is that there may not be an immediate drop off in visitor attendance. This is because light pollution increases gradually over centuries and skyglow has small effects over time. Still, Dang Pham, member of the Cornell Astronomical Society, laments “The light pollution source from the North Campus actually affects significantly our viewing here. In the past, there was really no consideration of that.” Pham’s voice raises as he finishes his thought, “I hope in the future [the university] can consult the Cornell Astronomical Society when it comes to making decisions like that.”

Throughout the planning process, the Fuertes Observatory struggled to voice its concerns about the residential expansion. Project coordinators have incorporated the input of the Cornell Astronomical Society, but society members feel [their frustrations were not addressed](#) in the July 2018 project application report. The university acknowledges that light from the residential buildings, in addition to light pollution from the city and town of Ithaca, will be [visible from the observatory](#). Society members urge the project planners to collect sky quality measurements, and they encourage ongoing response from Cornell University in the campus development process.

---

“The sky we have now is nothing compared to what it was one hundred years ago.”

—Karen Perez, Cornell Astronomical Society President

---

Environmental activists in the Ithaca community have [vocalized their concerns](#) about the sustainability and ecological friendliness of the construction project. Climate Justice Cornell, a student-run environmental campaign organization, circulated a [petition](#) for Cornell to release an Environmental Impact Assessment. Students and community members pushed back against the university’s lack of research and poor transparency in regard to environmental extraction from the North Campus area. Light emissions from residence halls may disrupt the [habitats](#) and behaviors of animals and disturb plant growth in the Appel South Fields and surrounding woods.

Julie Kapuvari, president of Climate Justice Cornell, believes Cornell has been transparent in planning the expansion “to some extent.” Kapuvari feels as though the university consulted certain groups while excluding the opinions of other organizations like Climate Justice Cornell. With a slight sigh, Kapuvari says that she wished Cornell University had sought more feedback before proceeding with the planning.

Kapuvari notes that one of the largest concerns shared by members of Climate Justice Cornell is the [disproportionate window-to-wall ratio](#) in the project plans. She explains that most windows included in the upcoming residence halls will occupy more than 15 percent of wall space, and, particularly in the freshman facilities, floor-to-ceiling windows will appear on the first-floor level.



Kapuvvari fears that the windows may not insulate heat well during winter months and may cause heat to escape from the building, which would mean more [natural gas use and waste](#). The window-to-wall ratio also demonstrates that light is more likely to radiate from the buildings and cast cool-toned light in the direction of the observatory. Even light-reducing solutions posed by the university may not cover the large expanses of glass lining the perimeters of the ultra-modern



A rendering of the proposed floor-to-ceiling windows on the first floor of one of the freshman housing sites. Image derived from the Cornell University Project Application Report.

residence halls.

Kapuvvari also describes the number of existing outdoor light fixtures on campus to be “irrational.” She feels that fewer light fixtures are sufficient to provide adequate safety and visibility after the sun sets. The North Campus Residential Expansion will multiply the lampposts surrounding the residence halls and create more fluorescent lighting sources in the line of sight of the Irving Porter Church telescope.

In planning for the North Campus Residential Expansion, Cornell University promised to incorporate light-reducing measures to reduce glare. The university has attempted to employ [preventative actions](#) such as a row of fast-growing trees on the north side of the observatory, closed window shades at night, repositioned outdoor light fixtures and sharp cutoff light coverings. However, window coverings may cause downward-cast light to spill over onto the ground and radiate outward, a method that works against the preservation of night skies.

Zach Whipps, Cornell Astronomical Society community outreach coordinator, admits with resignation, “They planted some new trees for us, and that’s really all that’s been talked about and done. ... Right now, North Campus — the viewing there in that section of the sky — is still pretty bad. So, I don’t even know if it will affect that much.”

“As soon as we brought it up to [project planners], they did take us much more seriously than I would have even expected. So, in that sense, I think they did actually an OK job responding to us, and they did plant some trees and they did try to make it better for us.” Whipps says with a breathy laugh.

Karen Perez, society president, agrees that “Cornell is trying to do as much as they can. Last time we spoke with them, they planted all these trees out here. ... So, the plan is these trees will grow and hopefully block out some of the light coming from the new dorms.” With optimism in her voice, she concedes, “Obviously, it won’t happen soon, but in the long run, maybe.”

In response to the solutions offered by the university, Perez encourages proactive behavior on behalf of the prospective residents who will live in the new residence halls. She suggests, “It might be smart for future students going forward to take initiative in closing their blinds. It would be that kind of thing where you’re doing someone a favor if they want to come here [to the observatory] and they want to have a clear night. Just be considerate of others who are visiting if you want to have the same good experience.”

Cornell University’s neighboring higher-education institution, Ithaca College, cannot extend its residential facilities due to the [Clinton B. Ford Telescope Observatory](#). Located on the [Ithaca College Natural Lands](#) conservation reserve, the positioning of this observatory and the protected area prevent the school from encroaching upon the observatory for its housing needs. Ithaca College’s preservation of the Natural Lands observatory thwarts concerns about environmental damage and the erasure of local history that currently afflict Cornell University.

The need for more on-campus housing units at Cornell is evident. However, the university’s desire for development may infringe upon the autonomy of the observatory to operate its symbolic telescope in future years. Fuertes Observatory is volunteer-run; its services are free to the public; and it is primarily [funded](#) by alumni, faculty and the university. In contrast, Cornell is not only the [largest employer](#) in Ithaca, but it is also tax exempt. If it chooses, the university possesses the resources to take more drastic measures and mitigate its light pollution.

Can the observatory survive? In the short term, it appears as though the gradual brightening of the sky due to the North Campus Residential Expansion will be small in comparison to the existing amount of skyglow above the North Campus. If light pollution continues to increase over the next century, however, Fuertes and other local observatories will most likely not own the adequate telescopes and astronomical equipment to discern the deep-sky objects that attract visitors.

When older buildings lose their novelty, Cornell tends to [expand and modernize](#) rather than restore features of its campus community. Once the Irving Porter Church telescope is overexposed to the light pollution that has intensified since the early 1900s, it will no longer serve its purpose for visitors, the society or the university. A fifth relocation of Fuertes, or, possibly, the demolition of its present site, would perpetuate the pattern of Cornell University’s systemic development and expansion.

Meanwhile, the tranquility of the white, domed Fuertes Observatory will be swept into the dizzying spiral of “bigger” and “newer.” Student’s eyes may no longer absorb images of Jovian satellites or awe-inspiring meteor showers. Volunteers may cease to manually crank the clock drive of the indigo-hued telescope. Silence will fall upon the empty observation deck, and the lights surrounding the observatory will burn steadily on.