Rural Resilience in Appalachia

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This paper documents the recent efforts of Studio Appalachia, a multidisciplinary design studio that addresses regionally specific challenges through community engaged processes. In addition to a set of shared values among faculty, students, and community partners, Studio Appalachia is guided by an evolving set of research questions: How can architecture contribute to a more resilient future in Appalachia? What are the limits of design when engaging issues of economic and environmental change? Which methods of design might offer the greatest potential for impact? How can these efforts withstand future fluctuations? In its most recent iteration, students and faculty from the University of Kentucky worked with community leaders in Hazard, Kentucky to develop a network of design interventions that resulted in a public exhibition of rural resilience in Appalachia.

INTRODUCTION

In recent years, resilience discourse in architecture has privileged large urban centers, often overlooking the many rural communities that increasingly experience the effects of climate change.[1] Moreover, resilience discourse often overlooks the uneven impacts of climate change on rural communities where contributions to greenhouse gases pale in comparison to urban and suburban areas. At the same time, rural landscapes have received significant attention among the design professions.[2] However, the idea of rural resilience in architecture remains largely unexamined.[3] In this paper, we propose a framework for rural resilience specific to Appalachia that leverages land-based resources in non-exploitative ways through a network of design interventions at both urban and architectural scales. After outlining a brief history of regional economic and climatic change, the paper documents a multiyear design effort among an interdisciplinary team, consisting of students and faculty working alongside community leaders in Appalachia.

HISTORICAL CONTEXT

Appalachia is home to an abundance of social and ecological life that, despite much adversity, continues to thrive. Historically, land has been the source for much prosperity among enterprising capitalists, often from outside of the region.[4] In the nineteenth century, timber accounted for a significant share of the regional economy and provided the material required for much urban growth at the time. Often clear-cut by large industrial operations and replanted monoculturally, the timber industry placed significant stress on both communities and habitats through the application of extractive and exploitative logics.

During the same period, the rising demand for coal to fuel industries in distant urban centers led to exponential increases in mining. As early as 1899, the United States became the leading producer of coal, of which the Appalachian region was "by far the most important."[5] As demands for coal further increased throughout the twentieth century, mining companies adopted new mechanisms and technologies that sought to keep pace. One of these mechanisms—the broad form deed—enabled mine operators to use any method "deemed necessary or convenient" in the extraction of coal. Historian Stephanie Lang describes the broad form deed as creating "two separate estates on a single piece of land by horizontally severing the mineral estate from the surface estate."[6] While surface estates often remained under local control, mineral estates were predominantly held by large mining companies which were driven exclusively by financial profit, at the expense of much social and environmental damage. In the 1970s, coal mines authorized under broad form deeds implemented widespread use of explosives in an emerging technology called mountaintop removal. According to Erik Reece, who chronicled the piecemeal destruction of a specific peak in eastern Kentucky, mountaintop removal mining "buries headwater streams, causes erosion and flooding, degrades water quality downstream, kills a lot of aquatic life, shakes the walls and cracks the foundations of nearby homes, and wipes away huge portions of an extremely diverse ecosystem."[7] Through mountaintop removal, the extractive and exploitative logic that guided outside interests in Appalachian land reached their most destructive ends, the effects of which endure.

Figure 1. Underground mine workers in 1908 (Image: Library of Congress); coal miners protesting for fair pay in 2020 (Image: Sydney Boles)

CONTEMPORARY CONTEXT

Recent changes to climatological systems and physical landscapes have placed enormous stress on Appalachian habitats and communities. In eastern Kentucky, for example, stormwater runoff from abandoned surface mines contributes to the inundation of many towns, often forcing communities to combat these extraordinary floods with their own limited resources.[8] Furthermore, the widespread alterations of geologic structures attributed to mountaintop removal mining "are much more similar to volcanic eruptions, where the entire landscape is fractured, deepened, and decoupled from prior landscape evolution trajectories, effectively resetting the clock on landscape and ecosystem coevolution."[9] In addition to the disproportionately high impacts of coal combustion on anthropogenic climate change, mountaintop removal mining has permanently altered the physical morphology of the Appalachian region.

At the same time, the disappearance of coal jobs has placed increasing pressure on already strained local economies; a recent report finds that coal industry employment fell by 54% between 2005 and 2020, elaborating that "the largest loss in coal production has tended to occur in the areas with the highest dependence on coal mining jobs, pointing to high levels of economic stress."[10] While these ecological and social challenges pose significant threats, they also present opportunities for designing a more resilient future rooted in climate adaptation.

In a recent study conducted by Appalachian Voices, nearly 50,000 jobs could be created in the process of rehabilitating the nearly 700,000 acres of abandoned mine lands. Furthermore, these reclamation efforts "could have significant positive economic impacts, and contribute to carbon sequestration and climate change resilience."[11] At the federal level, the Infrastructure Investment and Jobs Act recognizes this potential by significantly expanding funding for the repair of landscapes disrupted by mining, yet while the law provides more than $11 billion to fund these efforts, the total cost of repair exceeds $26 billion.[12] In Appalachia alone, the estimate tops $9 billion. The adaptation of the built environment and its surrounding landscapes holds the potential for rebuilding a strong local economy around non-extractive and non-exploitative systems while reversing the catastrophic effects of climate change. Furthermore, the resources to support this economic transition and climate action have begun to materialize, but the full extent of regional needs—including those for repairing long-neglected infrastructure—has yet to be committed. Importantly, the resilience of rural communities relies not only on the strength of its community ties, but also on tangible, material resources.

In response to the inadequacies of resilience as a term to describe the framework for climate adaptation, critical geographers have proposed an alternative framework centered on the concept of resourcefulness. For Kate Driscoll Derickson, resilience "directs our attention toward a social formation that is uninspiring in its emphasis on enduring the effects of the very processes we ought to be focused on transforming."[13] Rather than directing efforts at reconfiguring uneven and unjust social and economic relations, discourses on resilience often reify those relations. Alternatively, an emphasis on resourcefulness "highlights the material and enduring challenges that marginalized communities face in conceiving of and engaging in the kinds of activism and politics that are likely to facilitate transformative change."[14] To rely on resilience as a strategy for climate adaptation neglects the historic oppression and diverted investments that constrain the ability to respond to rising economic and environmental changes. The idea of resourcefulness, on the other hand, recognizes inequalities and emphasizes the need to rectify resource imbalances before meaningful adaptation can happen. In this way, the infusion of resources to communities in Appalachia, alongside the recognition of self-determination and local knowledge in the planning and design for climate adaptation, becomes fundamental to a resilient future.

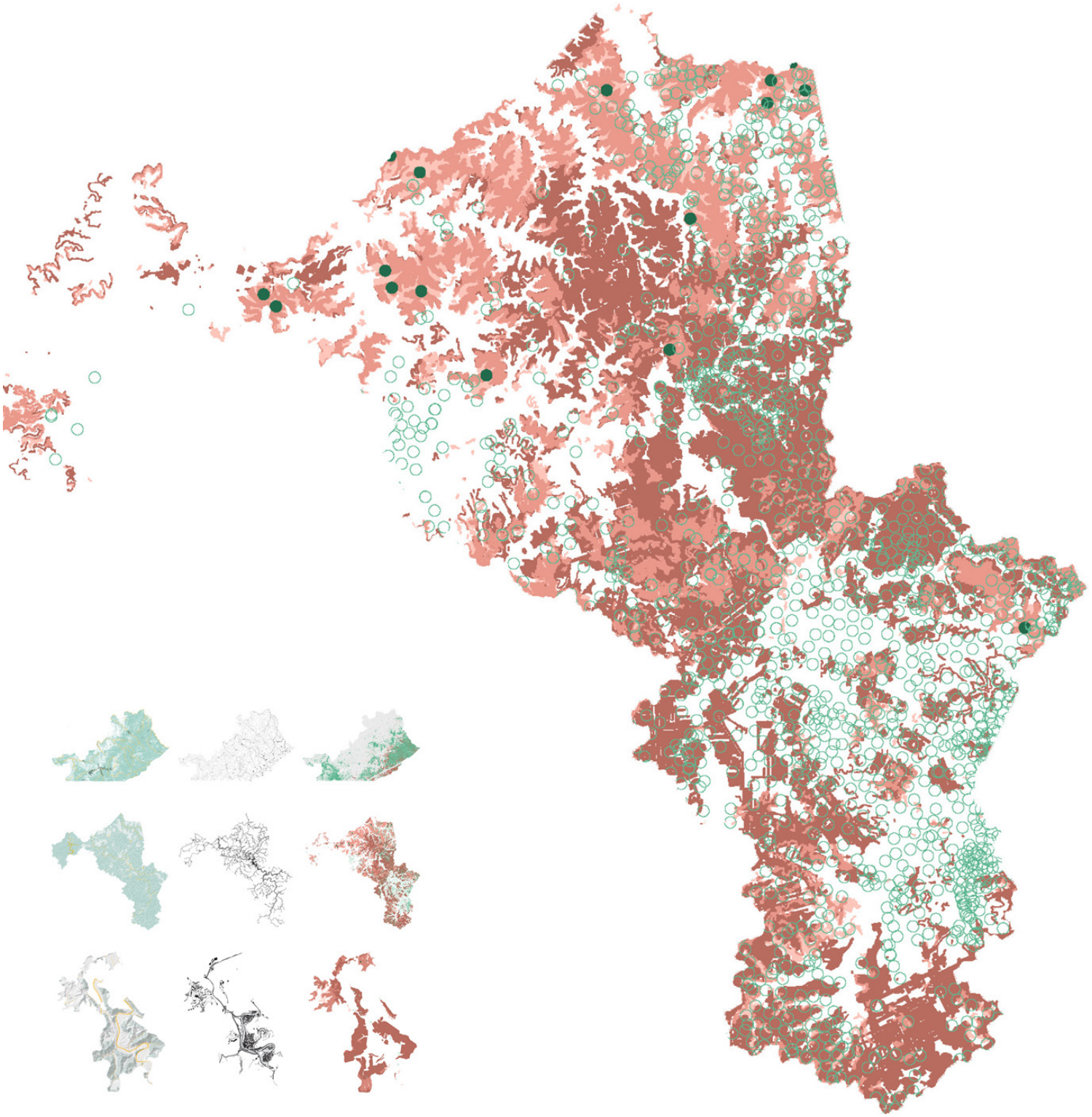


Figure 2. Student maps exploring relationships between environment, infrastructure, and extraction at multiple scales (Image: Studio Appalachia)

Figure 3. Community-based design charrettes with students and local leaders; site visits to abandoned mines (Images: Brent Sturlaugson)

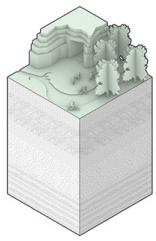
A FRAMEWORK FOR RURAL RESILIENCE IN APPALACHIA

The historical and contemporary context surrounding Appalachia presents myriad opportunities for reshaping the built and natural environments through design. At the University of Kentucky, we established Studio Appalachia, which is a multidisciplinary design studio dedicated to exploring these opportunities and addressing regionally specific challenges through community engaged processes. Studio Appalachia is grounded in the community capitals framework, which assigns value not only to financial capital, but also to intellectual, social, human, political, natural, built, and cultural capital.[15] By acknowledging the value of all parties in community-engaged design processes, the outcome is strengthened. In the case of Studio Appalachia, the design students and faculty bring intellectual, human, and financial capital. The community leadership brings cultural, social, and political capital, while the place inherently has value in natural and built capital.

While the range and scope of projects vary, the studio adheres to three core values: we value mutual benefit with communities, where students learn and communities benefit from the intentional exchange of intellectual and cultural capital; we value local knowledge and do not assume that we are entitled to it, compensating our partners either monetarily or through labor; and we value co-creative community partnerships that challenge the power structures of prevailing client-expert relationships.[16]

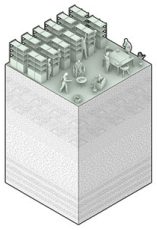
Studio Appalachia is also guided by an evolving set of research questions: How can architecture contribute to a more resilient future in Appalachia? What are the limits of design when engaging issues of economic and environmental change? Which methods of design might offer the greatest potential for impact? How can these efforts withstand future fluctuations?

In 2021-2022, Studio Appalachia embarked on a multiyear effort in partnership with community leaders in Hazard, Kentucky to explore opportunities for adapting existing buildings and infrastructure to withstand seasonal flooding. In recent years, many communities in eastern Kentucky have experienced significant increases in flooding frequency and intensity, Hazard among them. In 2020, the North Fork Kentucky River rose to historic levels, inundating many small businesses in downtown Hazard, and in 2022, the river rose again to catastrophic effect. While flooding response efforts demonstrate the strength and resilience of communities in eastern Kentucky, the costs for repair are often insurmountable. Given that extreme rain events



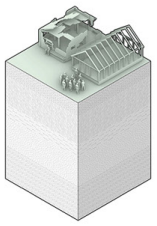
EMBRACE APPALACHIAN FUTURISM

For small towns and cities to flourish there needs to be investment in their communities to attract the younger generation while showing respect to those who have kept it prosperous. The goal of Appalachian Futurism is to envision a thriving, abundant future by providing opportunities of creativity, self-success, and entrepreneurship. Just within the last few years the city of Hazard, Kentucky has gained nearly thirty-six new businesses and has gained over 400 residents since 2010, but the growth does not stop there. As Ada Smith said in their conclusion in "Appalachian Futurism", "Appalachians must also think about a way of working that is about possibility—using aesthetics, imagination, art, and risk as the foreground. We must encourage our young people and communities to visualize and enact a new Appalachia that, at its core, provides individual and collective agency toward opportunity and an improved region."



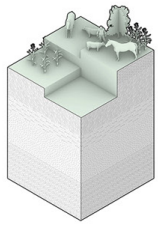
PRIORITIZE QUALITY OF LIFE

Quality of life is not just about a job that supports a healthy working environment, but one that also promotes a fulfilling climate for its employees. This aspect is often ignored because it is a system of control that companies use to manipulate their employees. This is done because it is often more cost efficient for companies to provide the bare minimum conditions for its workers because the workers are often powerless in these workplace dynamics, so there is no direct loss for the company. The quality of life in a job or career is important because if a job has poor working conditions and policies that are not supportive of their employees well-being, then at what threshold is the job not worth the benefits? What if some people cannot work due to age or illness? These people are not valued and the only value this "solution" benefits are the able bodied.



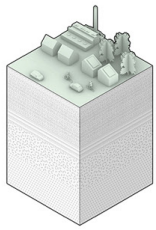
PRACTICE EMPATHY

To practice empathy is to recognize our positionality in the world and realize that people have different experiences and privileges. Practicing empathy means stepping outside our comfortable bubbles, rejecting stereotypes, facing our biases, and valuing cultural differences. It is also a consistent act that finds us engaging with communities with the intention of listening to understand their unique life experiences and needs. As designers entering the unique and complex culture of Appalachia, it is crucial that we seek to understand their history, culture, needs, and desires so that we may compassionately design a more socially and environmentally just Appalachia. In the design process, empathy can be practiced by asking where the greatest need is, in what ways we can help, and listening with open ears and hearts.



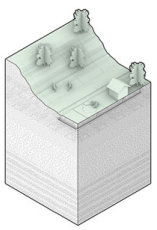
THINK REGENERATIVELY

Is it enough to be sustainable? Current definitions of sustainability, sustainable design, or green practices aim to reduce the environmental impact of decisions being made. However, the idea of restorative or regenerative thinking challenges the notion that maintaining neutrality through sustainable design is enough. Although great progress has been made in the name of sustainability, designers should continue to push the acceptable standards within their field and amongst their peers. The idea of restorative thinking involves humans doing things to nature to aid in healing the damage that has been done at human hands. One way to consider this is to return the environment to its health status before the industrial age. While attempting to replicate the balanced state of nature in the pre-industrial context, it is important to also prioritize the symbiotic relationship that humans have within that environment.



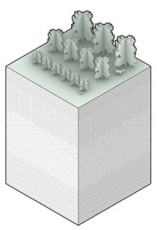
REDUCE ENERGY DEMAND

When burned to light our homes or run our vehicles, fossil fuels release carbon dioxide into Earth's atmosphere trapping the sun's heat and warming the planet, causing intense weather events such as flooding, severe storms, and drought. An important step toward a healthier planet is intentionally consuming less energy. As we do so, we are reducing the need for fossil fuels which means we are reducing our contribution to global warming. One way to imagine this is to think about roads packed with personal vehicles, buildings reliant on fossil fuels from power plants, dense air pollution and landscapes increasingly devoid of trees. An alternative reality that uses less energy could be biking to work or taking the bus, choosing products and materials that require the least amount of energy to produce, designing buildings that require less energy and which use renewable sources.



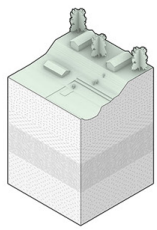
MANAGE STORMWATER ON SITE

Many Appalachian cities are currently experiencing issues with polluted waters and flooding in their downtown areas as a result of their extractive past. The consequences of extraction and mining have left the grounds with toxins and suffocatingly compacted soils making the lands barren for vegetation. Bioswales are landscape elements used as a natural way of collecting and filtering stormwater runoff and pollution. The runoff water enters the bioswale and is filtered through several layers including native plants and mulch, soils, filter fabrics, and gravel, and eventually gets collected or properly dispersed into other water bodies. For example, the runoff water makes its way down the hills of Hazard and into the river. Once the river starts to overflow the bioswale will take most of the water and filter it before it could be used back into the homes of the residents, stored for the new potential vegetation, or collected into designated recreational pool areas.



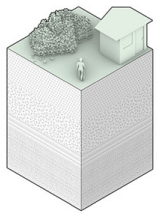
RESTORE NATURAL HABITATS

In order to ensure a healthy environment for the foreseeable future, we must make it a principle to restore natural habitats to their former lush state. Due to mining, there has been an incredible decrease in the health of the natural environment of former coal mines and mountains. Many coal companies have tried to plant grass on blighted land, hoping trees would follow shortly. Unfortunately, the process of coal removal compacted soil so tightly that trees cannot take root. Therefore, it is of utmost importance that the soil is restored to its former state, and trees are planted to provide adequate habitats, air quality, and renewable resources. This graphic shows the revitalization of a pine forest after a coal operation.



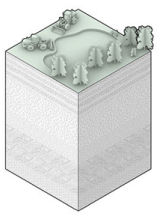
WITHSTAND FLOODWATERS

As the natural environment and climate continue to change, severe consequences such as rising sea levels and flood waters continue to harm communities. It is essential to design a future that not only withstands these hazards, but also aids the communities in becoming resilient and adaptable to changing climate consequences. Architecture and design can play a crucial role in aiding communities to fight against the damages caused by these changing water levels. As developments in the past were created without this present threat, past infrastructure is simply not equipped to handle the damage. Moving forward, it is imperative to create adaptable spaces that are able to absorb the shock of flood waters without causing great economic, emotional, and social damage to the community and its inhabitants.



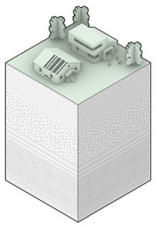
MINIMIZE EMBODIED CARBON

Regenerative materials allow for designers to restore, renew or revitalize their own resources of energy and materials. By considering a circular economy approach when constructing design spaces, buildings can better curate public space that considers the entire system that is resilient and equitable. Regenerative materials work to achieve net positive impact on the ecology, health, and society. As opposed to sustainable design projects which are based on the concept of only using the minimum resources required, regenerative buildings are designed and operated to reverse damage and have a positive impact on the environment and the surrounding community.



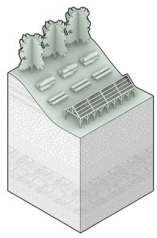
CLEAN UP HAZARDOUS MATERIALS

Coal mining has many negative effects on the land. One of these effects is the coal slurry that is left behind after the coal is cleaned and sorted. The remaining matter is oftentimes stored in artificial ponds where it is intended to remain. However, these ponds often spill over or infiltrate groundwater. Coal slurry can change the pH levels of an average stream to that of vinegar, and can infiltrate groundwater supplies. In October of 2000, a slurry pond in Martin County broke loose and spilled over 306 million gallons of slurry into the nearby Tug Fork River. The slurry contained arsenic and mercury which effectively killed every living organism in the river. These ponds should be cleaned by the companies responsible through dredging, which can be a large undertaking. Nonetheless, this is a job that must be done to further the health of the state.



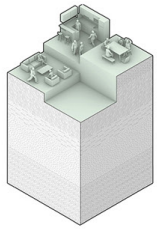
ADAPT EXISITING BUILDINGS

Adapting and reusing existing structures, and redeveloping areas reduces energy and resource consumption, greenhouse gas emissions, as well as habitat and farmland loss. Re-using an existing structure means repurposing a once vacant and unused building or converting a functioning building into a building that serves other uses. By adapting an existing building you may give a historic building life again and bring huge savings on greenhouse gas emissions. There are opportunities for new housing and mixed-use developments. There could be an increase in density, an upgrade of public space or greenspace, environmental repair, energy efficiency upgrades, and improved connectivity for pedestrians.



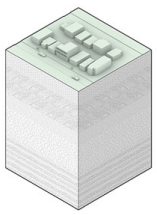
USE REGENERATIVE MATERIAL

Regenerative materials allow for designers to restore, renew or revitalize their own resources of energy and materials. By considering a circular economy approach when constructing design spaces, buildings can better curate public space that considers the entire system that is resilient and equitable. Regenerative materials work to achieve a net positive impact on the ecology, health, and society. As opposed to sustainable design projects which are based on the concept of only using the minimum resources required, regenerative buildings are designed and operated to reverse damage and have a positive impact on the environment and the surrounding community.



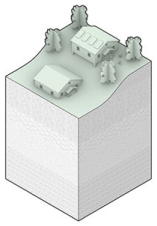
CREATE FLEXIBLE SPACES

By creating flexible spaces in Appalachia, the proposed projects can create versatile public spaces that can help aid positive exchange in these communities. By encouraging users to make the space their own, the implementation of adaptive systems will allow these spaces to grow with the community. Public space has the ability to cultivate an area for communal activities and allow for social exchange of ideas and interaction. In utilizing this principle, flexibility and adaptability can ensure the vitality of the surrounding area by allowing the space to accommodate many different types of events, such as a community office, library, or kitchen. These qualities encourage participation and appeal to the community's curation of these spaces that may not be expected when designing. These open areas will encourage their ability to explore new forms and situations on their own terms without prescribed ideas of social interaction. In addition to this public interaction with space, flexibility in design removes the need for additional areas that only serve the community in one way.



DESIGN FOR COMPATIBILITY

Architecture compatibility results from designing and building facilities in harmony with their surroundings. Architecture compatibility can be achieved when an addition to an existing building is designed to reflect the surrounding context. Incorporating elements such as building placement, landscaping, safe access, and parking into a site's natural features—as well as those of well-designed adjacent properties—contribute to urban space. A building's height and mass defines its relationship to other structures and the street, as well as contributes to an neighborhood, town, or city. Neighboring buildings of similar size and massing work together to create a coherent streetscape and provide consistency between adjacent buildings with different uses. The design of new buildings, as well as modifications to existing structures, should reflect a site's specific considerations. Generally buildings that are incorporated into a site's natural topography and reflect how neighboring structures have addressed topographic conditions are more likely to complement the local character.



ENLIST CLIMATE RESILIENT STRATEGIES

By enlisting climate resilient strategies, a building can be prepared to withstand environmental disasters. When designing in flood-prone areas, it is essential to plan for possible inundation by elevating structures or leaving space for water flow without compromising the structural integrity of buildings and infrastructure. Incorporate trees, shrubs, fences to integrate the building with its surroundings, help control erosion and protect the structure from debris and fast-moving water. There are many ways to design for climate resiliency. Another example may be the integration of solar panels for energy efficiency as seen in the illustration above.

Figure 4. Design principles co-created with community partners (Image: Studio Appalachia)

Figure 5. Public exhibition of faculty research and student design projects (Images: Studio Appalachia)

are more likely in the coming climate era, Appalachian communities, particularly post-mining communities facing acute socio-economic and demographic shifts, will continue to suffer flooding impacts they can ill afford.[17] Recognizing that flooding will continue—and likely increase in the coming years—the research and design of Studio Appalachia examined a range of possibilities for designing a more resilient future.[18]

For this iteration of Studio Appalachia, students first completed a series of maps that illustrated the relationship between environment, infrastructure, and extraction at multiple scales. The production of these maps coincided with discussions about climate justice and the uneven impacts of climate change. Next, students created a set of design principles to guide future proposals by building on the community development efforts of our local partners. These principles offer a versatile guide for implementation on a range of sites, which adds to the growing archive of Studio Appalachia. Lastly, students proposed speculative designs for a network of sites that created functional and experiential connections between downtown Hazard and the abandoned mines that surround it. In one example, a student team designed a series of greenhouses and a sprawling farm that mitigated stormwater runoff from an abandoned mine, which provided year-round harvests to be distributed at a community food hub designed as an adaptive reuse of a neglected building in downtown Hazard. In another example, the students designed a regional art museum that embraced the fluctuating water levels at its downtown site and proposed a visitor experience to a sculpture park that occupied another nearby abandoned surface mine.

CONCLUSION

Rather than focusing solely on sites where the impacts of climate change are experienced, the design proposals addressed the sites where many of these effects are produced. And instead of a portfolio of speculative projects, the team created a public exhibition as their final deliverable. In this way, the exhibition facilitated a conversation around climate adaptation among community members while creating an experience that featured visions of regional climate adaptation. The exhibition, designed and built by a team of graduate students in the School of Architecture and School of Interiors, showcased how Appalachian communities might leverage an abundance of land-based resources to create healthier and more equitable futures.

ENDNOTES

1. For example, in 2013 the U.S. Department of Housing and Urban Development and the Rockefeller Foundation created "Rebuild by Design," which featured coastal cities in the northeast. Also in 2013, the Rockefeller Foundation also established "100 Resilient Cities," later renamed the "Resilient Cities Network."
2. See Joshua Bolchover, John Lin, Christian Lange, eds. "Designing the Rural: A Global Countryside in Flux," *Architectural Design* (August 2016); AMO, Rem Koolhaas, *Countryside: A Report* (Cologne: Tacschen, 2020); The Architectural League, "American Roundtable" (2020)
3. Landscape architecture, by contrast, has made significant contributions to designing for rural resilience. Notable efforts include the many projects conducted by the Coastal Dynamics Design Lab based at North Carolina State University.
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5. United States Geological Survey, Mineral Resources of the United States (Washington: Government Printing Office, 1899), 329
6. Stephanie M. Lang, "'Titles Must Be Perfect': The Broad Form Deed, Politics, and Landownership in Eastern Kentucky at the Turn of the Twentieth Century," *Register of the Kentucky Historical Society* 33, no. 1 (Winter 2015): 27-57
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9. Matthew Ross, Brian McGlynn, Emily Bernhardt, "Deep Impact: Effects of Mountaintop Mining on Surface Topography, Bedrock Structure, and Downstream Waters," *Environmental Science and Technology* 50 (2016): 2071
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12. Infrastructure Investment and Jobs Act, Public Law 117-58, *U.S. Statutes at Large* 135 (2021): 429-1467
13. Kate Driscoll Derickson, "Resilience Is Not Enough," *CITY* 20, no. 1 (2016), 165
14. Danny MacKinnon, Kate Driscoll Derickson, "From Resilience to Resourcefulness: A Critique of Resilience Policy and Activism," *Progress in Human Geography* 37, no. 2 (2012), 265
15. Cornelia Butler Flora, Jan L. Flora, Stephen P. Gasteyer, *Rural Communities: Legacy and Change* (New York: Routledge, 2018)
16. For an application of similar values in marginalized communities, see the Blackspace Manifesto, https://blackspace.org.
17. Anisha Kohli, "Kentucky Floods Destroyed Homes That Had Been Safe for Generations. Nobody's Sure What to Do Next," *Time* (August 13, 2022) https://time.com/6205977/eastern-kentucky-floods-appalachian-homes/ (accessed November 5, 2022(
18. The concept of resourcefulness, as elaborated by Kate Driscoll Derickson and others, remains central to the work of Studio Appalachia. Internal fundraising efforts include support for community partners, and project proposals rely on both the strength and fortitude of existing communities as well as the infusion of external resources.