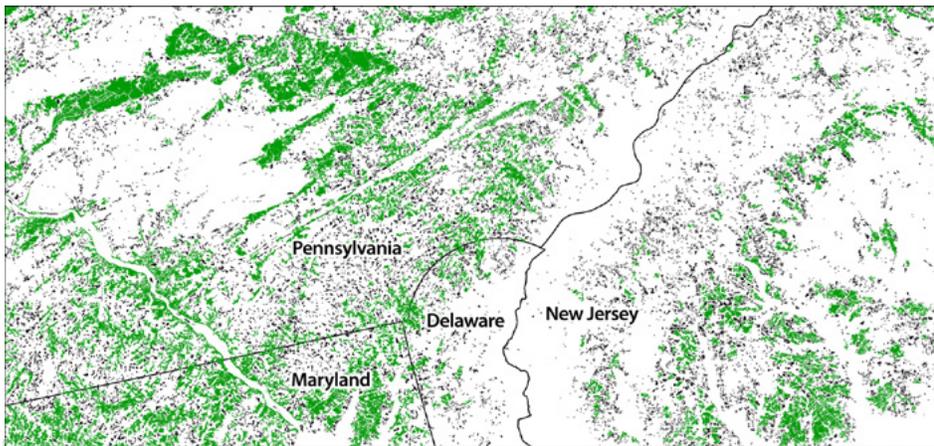




# The Cross-Pollinator

*Connecting forested communities & delivering science for the trees outside your door*

## Natural Turned National Infrastructure: Urban Forest Patches in the 21st Century



The urbanized area stretching from Boston, MA, to Washington, DC, contains over 250,000 temperate deciduous forests that are 1.6 acres (1 ha) or larger. The vast majority are less than 32 acres (20 ha). On this map of a portion of the urbanized east coast, forests smaller than 32 acres are colored black and larger forests are in green. Map compiled by Vincent D'Amico, USDA Forest Service.

### URBAN FOREST PATCHES

The term “urban forest” is often used to refer to all the trees within a city or town. Trees along streets and sidewalks and within yards and parks are the most visible and have helped to shape how we conceive of the term. However, cities, communities, and neighborhoods nationwide contain natural areas—patches that have more in common with their larger, wild brethren than they do with a street tree or manicured park. We refer to these natural, wooded areas interchangeably as “urban forested natural areas,” “urban forest patches,” “urban woodlands,” or “forests in cities.” Indeed, recognizing and learning more about these spaces can help us better understand and care for them.

With about 82 percent of the U.S. population living in urban areas today, it may sometimes feel that we’re removed from nature. Yet science is increasingly revealing how dependent we are on nature for our individual and collective physical, emotional, and mental health, as well as for climate resilience. In some cases, the connections we need for our own and other species’ survival and well-being may literally be just down the street.

### The Value of Forest Patches

Ask most people to list what constitutes important public infrastructure in cities,

and you may hear some familiar and important responses: roads, bridges, railways, electric lines, water and sewer systems, and the like. But it so happens that there is a layer of critical national—and natural—infrastructure that undergirds this all; one that is only beginning to be fully recognized and understood: urban natural areas, which often take the form of “forest patches.”

Several researchers in the USDA Forest Service’s Urban Field Station Network are studying urban natural areas, which can take the form of forested or shrubby areas that range in size from many acres to as small as 10,000 square feet, or about the size of a baseball diamond. Especially

in the East, these natural areas are often forested (as opposed to western natural areas that may resemble shrubland or prairie patches). Forested natural areas, or forest patches, are “forests in cities.” They are unique from more manicured parks and street and yard trees. Yet on another level, they are anything but unique; forest patches are far more prevalent and omnipresent than larger, more traditionally conceived, and more rural forests. For urban dwellers, larger forests may be a vacation destination, but forest patches in cities, communities, and neighborhoods—whether visited or not—shape ecosystem health, quality of life, and our experience of



nature in critical ways that research is just beginning to unpack.

Many forest patches support a wide variety of plant and animal life, although this benefit is limited by the habitat fragmentation inherent to these wooded “islands.” Forest patches also cool the surrounding air temperature, provide shade, control stormwater runoff, provide habitat, and serve as stopover sites for migratory birds. For these reasons and many more, they are a critical but sometimes overlooked component of climate resilience, public health, social justice, and community well-being.

From an ecological perspective, the health of these patches cannot be considered in isolation. Forests across gradients are integrated and interdependent; their health is codependent, and society’s health is dependent on all forests, no matter where we live.

## Learning from Rural Forestry

Rich Hallett, a research ecologist with the USDA Forest Service, says that some city governments and residents are championing their small wooded resources and are seeking to understand how to

manage them to improve ecosystem health. According to Hallett, who divides his time between New Hampshire and New York City, “In rural areas, foresters and ecologists have stratified tree types for more than 100 years in support of different management strategies. Ecologists and managers are starting to do this for cities. What people are coming to realize is that not only are forest patches important to society on several levels, but management of trees in these forests has much in common with rural forest management.”

For example, one might assume that urban forest ecosystems have been degraded by the presence of nonnative and invasive species. Yet in one study that Hallett co-authored, a team of scientists determined that although invasive species have literally gained ground in the understory, the overstory of New York City’s forest patches still tends to be dominated by native tree species, rather than the nonnative trees that are often found along the city’s streets. Nonnative trees may have fewer ecological benefits than native counterparts, so these findings can have implications for prioritizing New York’s forest conservation and restoration efforts.

Another urban-rural commonality is that each type of forest can experience similar

*“One of our goals is to educate people about the existence of these forests and that they are forests. This may open up new opportunities for learning and knowledge exchange.”*

– Rich Hallett

impacts from climate change and other human-influenced stressors, albeit on different timescales. Increased carbon dioxide concentrations, higher pollution levels, higher recreational use, increased runoff, and encroachment of invasive species are anthropogenic stressors well-familiar to urban forest managers, but they are now seen in many rural forests. Urban forest managers are beginning to embrace some silvicultural techniques associated with rural forests. Conversely, rural forest managers may be able to learn from the expertise urban managers have gained from managing for resilience in these small forests.

“One of our goals is to educate people about the existence of these forests and that they are forests. This may open up new opportunities for learning and knowledge exchange,” says Hallett.

## A Forest Patch in Manhattan’s Back Yard

Forest patches can even be found in Manhattan, the most densely populated county in the United States. Consider Inwood Hill Park, located a short walk from where Hallett lives when he is in New York. Unlike many of New York City’s more manicured parks, much of Inwood Hill Park is taken up by an old-growth forest that has historic and social importance. It is where, according to legend, Dutch settlers bought Manhattan from local Native Americans back in 1626 for 60 guilders worth of goods—an amount worth \$1,000 today. Through Forest Service research and collaboration with local agencies and organizations, Hallett hopes to raise awareness of Inwood Hill Park and other forest patches throughout the city.



Urban forested natural areas cool the surrounding air temperature, provide shade, control stormwater runoff, provide habitat, and serve as stopover sites for migratory birds. Photo by Richard Hallett, USDA Forest Service.





Hikers in Forest Park (left) and Inwood Hill Park (right). Forest Service research and collaborations with local agencies and organizations may help raise public awareness and increase stewardship for forest patches in New York City, as well as natural areas in communities throughout the United States. Photos by Richard Hallett, USDA Forest Service.

The goal is not simply to increase use of these natural areas, however. In a broader sense, Hallett and colleagues at the New York City Urban Field Station and across the Network are seeking to raise understanding and appreciation of these places and the benefits—climate resilience, public health, biodiversity, and more—they provide. In this way, the care and conservation of forest patches may factor more prominently into public dialogue and policy as we realize that they are a critical part of our nation’s infrastructure.

## The Role of Partnership Organizations

As the scientific community works to achieve this more sophisticated awareness, they are often supported by volunteer stewardship organizations, particularly those that seek to expand and extend the public’s relationship with nature. These efforts often apply not just to traditional, landscaped parks, but to urban natural areas, which may provide unique social

and biophysical functions and benefits to the surrounding community.

One such organization is the Friends of Inwood Hill Park. In recent years, organized activities in the park have ranged from restoration efforts and outdoor movie showings to urban wildlife festivals and nature painting festivals. Many of these activities are sponsored or supported by the Friends of Inwood Hill Park.

### NAME YOUR FAVORITE FOREST PATCH

Foresters and scientists interviewed for this story gave a wide range of answers when asked to describe the forest patches that hold special significance to them.

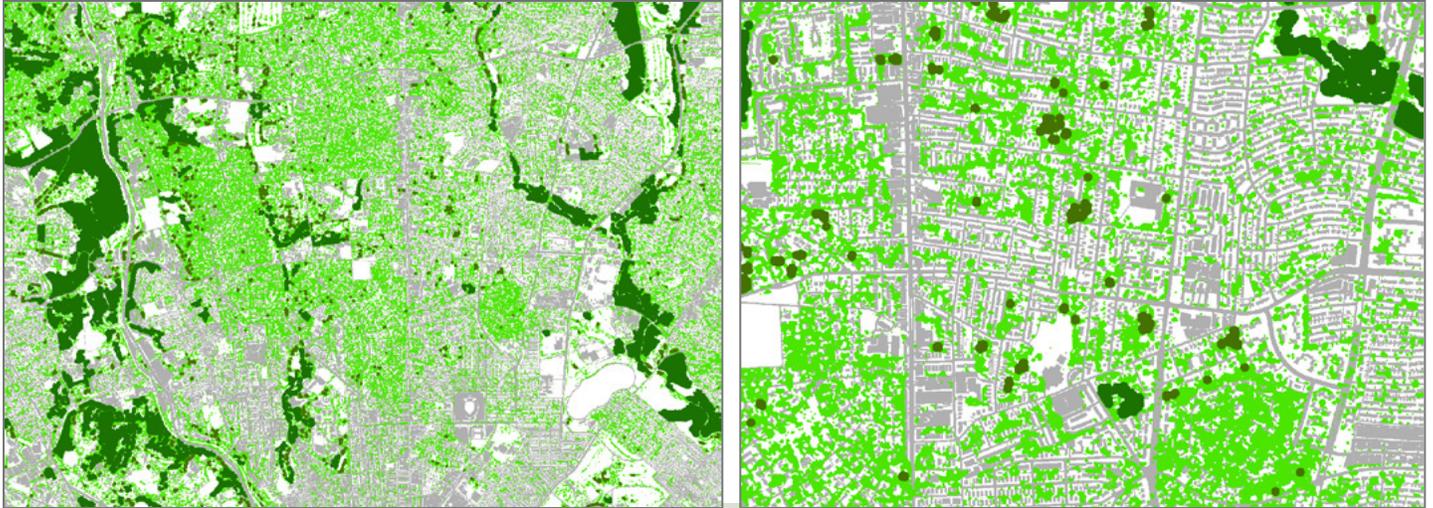
**Vince D’Amico, USDA Forest Service:** *“Like a lot of kids in the ‘70s, I grew up playing in a poor-quality woods near my house. I don’t think it had a name. It’s along the train tracks near Yonkers, and we went there whenever we could. But these days, I really like spending time in Ecology Woods on the University of Delaware campus. It has such a great heritage of research that’s important as we train new scientists to take the place of scientists who are going to retire.”*

**Rich Hallett, USDA Forest Service:** *“People assume that I spend all my time in Central Park, but there are about 29,000 acres of parkland in New York City, including many parks that are old estates that were donated to the city. Inwood Hill Park is close to where I live, and many people are surprised to find such a wild area in Manhattan that’s so easily accessible.”*

**Nancy Sonti, USDA Forest Service:** *“I grew up in Manhattan, and my only real exposure to forests was when my family went to central Massachusetts during the summer, where there was lots of rural forest. My parents probably didn’t think forests in New York City were particularly safe, so I didn’t explore urban forest patches until college and afterwards. Now I love spending time in Baltimore’s Springfield Woods, hoping I’ll see a fox or a vulture while I’m there.”*

**Clara Pregitzer, Natural Areas Conservancy:** *“Before I moved to New York City I lived in primarily rural places. I grew up in the Upper Peninsula of Michigan, and spending time in nature was something I did almost every day. When I moved to New York City I was expecting that I’d have to leave the city to spend time in nature, but I’ve had really special experiences with nature right in New York City. In Van Cortland Park I’ve seen great horned owls, snakes, beautiful wildflowers...and then I can take the subway home.”*





Maps of two different areas of Baltimore, MD, showing forest patches with interior space (dark green), along with other urban tree canopy (light green). Image developed by Matthew Baker, University of Maryland, Baltimore County, in collaboration with Baltimore Green Space.

According to the group’s cofounder, Sally Fisher, awareness of the park and its forest patches is rising. Not only is Inwood Hill Park a place where you can immerse yourself in nature while still being in Manhattan, Fisher says, “It’s an important place for reasons that range from history to geology to health. It’s really Manhattan’s backyard from a health and social standpoint. I love that I can get on the A train in Hell’s Kitchen and be in the wilderness in 30 minutes.”

Nonprofit environmental organizations such as the Natural Areas Conservancy are also key partners in this effort, according

*From an ecological perspective, the health of these patches cannot be considered in isolation. Forests across gradients are integrated and interdependent; their health is codependent, and society’s health is dependent on all forests, no matter where we live.*

to Clara Pregitzer, a conservation scientist with the organization and a frequent collaborator with Forest Service scientists from the Northern Research Station. Some of Pregitzer’s work has focused on characterizing the amount, type, and condition of forests in New York City, starting in Van Cortland Park, New York City’s third-largest park and home to a forest that dates back about 17,000 years. A Michigan native, Pregitzer says that before she saw Van Cortland Park, she wasn’t convinced that there were forests in New York City. “People often don’t realize how much nature and forests exist in New York City,” she says. Pregitzer recently led a study that found 5.5 percent of New York City’s area is covered by forests found across dozens of parks, and the majority of trees, biomass, and native species in the entire city are found in natural areas, as compared to trees on the sidewalk or in backyards.

### **Fear of the Unknown**

One of the factors that has contributed to the lack of public use and appreciation of urban natural areas is a fear of the unknown. This perception is one that Nancy Sonti, a Baltimore-based ecologist at the Northern Research Station’s Baltimore Field Station, is working to understand as

part of her research on Baltimore’s forest patches and their benefit to local residents. According to Sonti, “It can be a challenge to introduce people to urban forests so that they feel safe and comfortable. A lot of people get immense joy from just looking at the forest, but they never actually go inside.” Once they make a habit of spending time in natural wooded areas, Sonti says, they may begin to benefit from the many health advantages associated with the outdoors, including reduced anxiety and increased ability to focus. They may also place a higher priority on learning about, preserving, restoring, and creating natural areas.

Getting more people into urban natural areas is one of the goals of Forest Service partner Baltimore Green Space, a nonprofit organization that works with communities to preserve and support community gardens, forest patches, pocket parks, and other open spaces that are managed by city residents. This fills a real need in Baltimore, where about 20 percent of the tree canopy lies in forest patches outside parks. These patches often exist because they are on land that has been abandoned or that is undesirable for development due to economic or biophysical factors.





Baltimore Green Space and a motivated community group are working together to reconnect a Baltimore community with a long-neglected forest patch called Springfield Woods. Image courtesy of Butch Berry.

## The Monster of Springfield Woods

Katie Lautar, executive director of Baltimore Green Space, describes how one community is reconnecting with a forest patch called Springfield Woods. This 3.5-acre forest is located in Wilson Park, a small community in northeast Baltimore that was one of the first African American communities in the city.

“For years,” Lautar says, “you couldn’t see kids there. People were more likely to use it as a dumping area. But a local resident named Butch Berry, who used to play in Springfield Woods as a boy, came back to the neighborhood a few years ago and spearheaded an effort to preserve and restore the woods.” Activities like clearing vines and restoring streams can make a site more accessible and appealing, as well as more ecologically functional.

Katie continues, “Last year we worked with Friends of Springfield Woods to host a fundraising event called Monster of Springfield Woods Haunted Trail, which is inspired by a short film Butch and his friends made in their younger days. Loyola University students participated by dressing up in scary costumes, and about 75 people showed up. You could hear screams all over the forest.”

Efforts like this, along with community cleanup events, are changing public attitudes toward Springfield Woods. “Locals would make signs for Springfield Woods, but they’d never step foot in it,” Lautar says, adding, “Now volunteers come to pull out poison ivy, build trails, and remove trash.” It’s an encouraging situation in light of Baltimore’s 1,000-plus forest patches, which Lautar defines as a wooded area between 10,000 square feet and 20 acres.

This increased awareness and participation ties into Sonti’s work, which includes evaluation of historical and current environmental conditions and changing human use patterns in urban natural areas. According to Sonti, “Many urban forest patches have surprisingly intact soils and high native species abundances, and some provide habitat for species of concern. This information has helped build a case for the human and ecological values of these places. On the other hand, the soils in other areas aren’t as healthy as they could be, and

we see threats from invasive species.” She goes on to say, “Our hope is that by raising awareness of the value of forest patches, you’re also elevating the importance of maintaining and improving these places.”

## FRAMING Research at the University of Delaware

In Newark, Delaware, Forest Service entomologist Vince D’Amico has been busy with a related study called FRAME, or FoRests Among Managed Ecosystems. A collaboration between the Forest Service and the University of Delaware, the FRAME study has the goal of understanding the causes and consequences of soil, plant, and animal changes in the forest patches that are found in our country’s urban parks, riparian buffers, and undeveloped lots.

Most of the forests in the eastern United States are not virgin; the vast majority of forested land in the east was cleared at some point after European colonization. Then, due to changes in agricultural practices, development patterns, and demographic patterns, it was given a chance to regrow in some places. As a result, “we now have lots of heterogeneous forests that have grown up where they had a chance to do so, that are close to lots of people, and are very important,” says D’Amico.

### KEY FINDINGS

- Most forests in the eastern United States are small; in the Boston-Washington, DC corridor, the vast majority of wooded areas are less than ~125 acres (~50 hectares).
- While often overlooked, small forest patches can have benefits that are out of proportion to their size. They serve millions of people, cool surrounding air temperatures, provide shade, control stormwater runoff, and serve as stopover sites for migratory birds.
- Forest patches are critical to any sustainability plan, from local to national scales. Patches relate to climate resilience, public health, social justice, community well-being, and more.
- While people sometimes resist engaging with nature in urban forested areas, local residents and visitors can benefit from nature’s restorative qualities, even when they do not actually enter the woods.
- Across Baltimore, Delaware, and New York City, native tree species dominate the overstory canopies of urban forest patches. However, the understory is often composed of nonnative invasive plants, bringing into question the sustainability of these forests.





In Baltimore, Northern Research Station scientists have studied Spring field Woods to better understand soil quality, stormwater infiltration, tree growth, and the attitudes of local residents toward the forest patch. Left photo by Nancy Sonti, USDA Forest Service. Right photo by Katie Lautar, Baltimore Green Space, used with permission.

Some of the 50 forest patches in the FRAME study were also studied by the Forest Service in the 1960s, which has allowed for valuable comparisons related to invasive species, bird habitat, soil conditions, altered climate conditions, and more. Comparing today's findings with data from more than 50 years ago has yielded a wealth of insights, D'Amico says, adding, "We've followed changes in bird populations, seen the effects of pesticide use in the 1960s, measured how deer populations have risen with reforestation in some areas, and noted how there's much less recreating in these places than there used to be. We're trying to understand everything about them from the soil to the canopy."

Raising awareness of the benefits of forest patches is a critical first step. However, there is a need that extends beyond conservation of these places, to improving their ecological function. To the untrained eye, all urban forested natural areas may appear similar, yet there can be large differences in ecological function and benefits. Patches covered in weeds and vines that have fewer native species and degraded soils may not offer the same level of climate resilience or stormwater benefits; they may be less aesthetically appealing or accessible, thereby reducing potential mental-emotional and public health related benefits. The data collected at these sites are being analyzed to help cities and landowners manage urban forested natural areas to optimize ecosystem services and improve resilience. This includes predicting

## MANAGEMENT IMPLICATIONS

- Documenting native forest types, mature native trees, rare understory plants, and forest interior dwelling birds provides information that can help make the case for protecting forest patches from development. This will hopefully ensure support for ongoing conservation and restoration activities.
- In some communities, ecological assessments of forest patch vegetation, soils, and biodiversity conducted by those in the Urban Field Station Network are helping to inform forest management strategies, from site-specific restoration efforts to bigger-picture prioritization based on health and threat assessments.
- Maintaining and restoring forest patches can help improve human health and well-being and climate resilience.
- Documented similarity in form and function between urban forested areas and rural forests presents opportunities for engaging with rural forest managers to adapt silvicultural management techniques to the city and to share mitigation and adaptation strategies with rural forest managers.
- The unpredictable and unprogrammed nature of the woods is what can make them restorative and exhilarating. Targeted programming and group activities that integrate local social values can help urban residents perceive natural areas as inviting and inclusive spaces to increase psycho-social benefits and strengthen shared stewardship around urban forest patches and other natural areas.

areas that are most likely to be exposed to invasive species in order to mitigate invasion, as well as determining whether simple soil treatments can lead to healthier and more productive green spaces.

Though street, park, and yard trees may be the most visible in a city, in many cases small forests outside their influence and benefits. As research continues to enumerate the roles and benefits associated with urban natural areas—from climate resilience, to public health, to biodiversity, and more— some communities may recognize that it is not feasible to recreate what nature provides, and the care and

stewardship of these forest patches may become more of a priority. The Forest Service's Urban Field Station Network is working to optimize the health of these patches by connecting silvicultural research and best practices across cities and urban-rural gradients nationwide. As climate and forest health impacts from invasive insects and disease threaten to tatter the often suboptimal health of our nation's existing urban natural areas, this knowledge will be essential to preserving and enhancing these critically important forests. We would be wise to realize that our health, wellbeing, and resilience may be directly tied to the health of these natural areas.



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## SCIENTIST PROFILES



**VINCENT D'AMICO** is a research entomologist with the USDA Forest Service's Northern Research Station in Newark, Delaware. He received a bachelor's degree in biology from Concordia College and a Ph.D. in entomology from the University of Massachusetts, Amherst. An adjunct faculty member at the University of Delaware, Vince is the principal investigator for the FRAME study, a long-running collaboration between the University of Delaware and the Forest Service.



**RICHARD HALLETT** is a research ecologist with the USDA Forest Service's Northern Research Station in New York City and Durham, New Hampshire. He received a bachelor's degree in forest science from the University of Wisconsin and two degrees from the University of New Hampshire: a master's degree in forestry and a Ph.D. in natural resources. His research goal is to take lessons learned from traditional forest management research and practice and apply, adapt, or adopt strategies to effectively manage urban trees and forests. In turn, these new forest and tree management practices can inform future rural forest management as those areas begin to experience increased temperatures and pressure from exotic invasive species.



**NANCY FALXA SONTI** is a research ecologist with the USDA Forest Service's Northern Research Station in Baltimore, Maryland. She received a bachelor's degree in history and biology from Stanford University, a master's degree in conservation biology from Columbia University, and a Ph.D. in plant science from the University of Maryland, College Park. Her research spans the social and biological sciences in asking questions about urban social-ecological systems.



**CLARA PREGITZER** is a conservation scientist at Natural Areas Conservancy in New York City. She received a bachelor's degree in forestry from Northern Arizona University, a master's degree in ecology and evolutionary biology from the University of Tennessee, Knoxville, and a Ph.D. from the Yale School of Forestry and Environmental Studies. A frequent collaborator with Northern Research Station scientists, Clara's work focuses on managing and understanding urban forested natural areas.





#### WRITER'S PROFILE

*BRIAN COOKE is a contract science writer for the USDA Forest Service. Brian has a degree in journalism-science writing from Lehigh University. In addition to writing for the USDA Forest Service, Brian has completed writing assignments for the National Park Service, History Colorado, and various environmental services companies.*

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#### PURPOSE

The Cross-Pollinator is a science synthesis publication produced quarterly by the Urban Field Station Network and the Urban Forest Technology and Science Delivery Team. It spotlights interdisciplinary collaborations among researchers and practitioners that “cross” forest research with urban and community forests.

#### ABOUT US

The mission of the Urban Field Station Network is to improve the quality of life in urban and urbanizing areas by conducting and supporting research and science exchange about social-ecological systems and urban-to-rural resource management. The mission of the Urban Forest Technology & Science Delivery Team is to work collaboratively to deliver quality urban natural resources science, technology, and information to improve the long-term sustainability of urban ecosystems and the broader watershed, for wildlife and people. Find out more at <https://www.nrs.fs.fed.us/ufs/>; <https://www.fs.fed.us/research/urban-science-delivery-team.php>; and <https://www.vibrantcitieslab.com/>

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