DEEP BLUE DAY (UNTITLED 12.6)
2012
Inkjet print in artist's frame
37 5/8 x 40 3/8 inches; 95.6 x 102.5 centimeters

WORDS
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PHOTOGRAPHS
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THE MEANING OF LIGHT

The daily rise and fall of the sun is one of the few reliable occurrences in our lives. Despite this simple cycle controlling the happenings of our planet, we don't pay much attention to sunlight's effect on our physical and mental health. And as some neuroscientists are beginning to discover, harnessing its radiant power could provide phenomenal benefits to our well-being.

Every day presents us with all kinds of decisions to make about our lifestyles, and there are plenty of self-diagnosis websites, new age books and mothers-in-law ready to indisputably instruct us on the correct choices we should make. In an attempt to better ourselves, we try to obey their mantras: We sleep eight hours a night; we opt for whole grains instead of white flour; we drag our reluctant bodies on a quick jog; we choose not to open the second bottle of cabernet. But what if there was a more vital factor affecting our health? One that predates gluten alternatives and spin classes?

For the past few billion years, the sun has reliably risen every morning and set every evening. Our bodies have therefore come to expect its daily spiral through the sky, and most of our biological systems work on the assumption that we'll follow along with its sunlight-based sequence. But now instead of waking with dawn, we have snooze buttons. Instead of dozing at dusk, we have Netflix.

Sunlight plays an intrinsic role in our lives and has a profound effect on the way we think and how our bodies function. Through its role guiding our circadian rhythms—the internal clocks that keep us regulated—sunlight can control everything from our sleeping habits to our wintertime melted cheese cravings. Regardless of the thought we put toward our well-being, it's becoming apparent that the sun could actually be the ironically inconspicuous guru we should be following.

Despite the sun's omnipresent nature, the effects of light on our mental and physical health are only just beginning to be examined. Two people who are working together to pioneer this exploration are an artist and a neuroscientist: Stephen Auger, a Santa Fe–based artist with an academic background in neuroscience who works at the intersection of science and art, and Dr. Benjamin Smarr, a doctor of neurobiology at UC Berkeley whose studies focus on the long-term effects of circadian rhythms on our physical and mental health. "A lot of people haven't heard of light's importance as 'a thing,' even though it seems very intuitive once you hear about it," Benjamin says. "I'd love to see much more attention paid to it. It's of absolutely central importance."

But how did we lose our connection to sunlight in the first place? Were we complicit in our demise into dimness?

SUNDIAL (07.5)
2007
Face-mounted color photographs
Overall: 30 x 57 ½ inches; 76 x 146 centimeters

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Improving our relationship with the sun could help both our personal well-being and society overall

When Thomas Edison popularized the lightbulb some 135 years ago, he was unwittingly ending our close relationship with natural light. "The part of our DNA that responds to light is so primal," Stephen says. "It existed when we were a one-celled organism in the primordial ooze long before we became a human species." But now, thanks to the humble lightbulb, we can work graveyard shifts and salsa until dawn. As Stephen puts it, "We've objectified light." Convenience glowed brighter than our biological clocks, and we've been slowly letting them fall out of sync ever since.

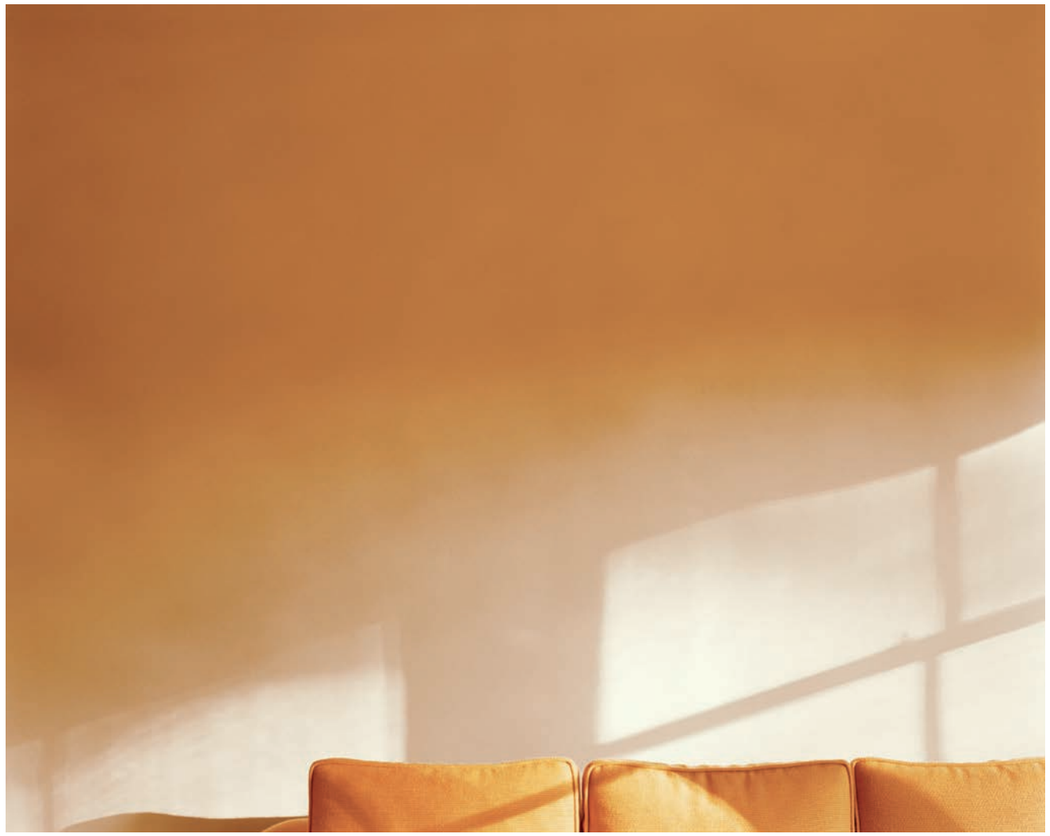
In order to fathom light's consequence on our well-being, we first need to understand circadian rhythms. Our bodies are hungry for sunlight and have come to trust it to tell us when we should eat, socialize and sleep. "Your circadian rhythm is the body's anticipation of the 24-hour cycle of sunlight and darkness," Benjamin explains. "The sun has arced through the sky every 24 hours for all of life, so life forms have evolved to assume it's not just going to suddenly stop."

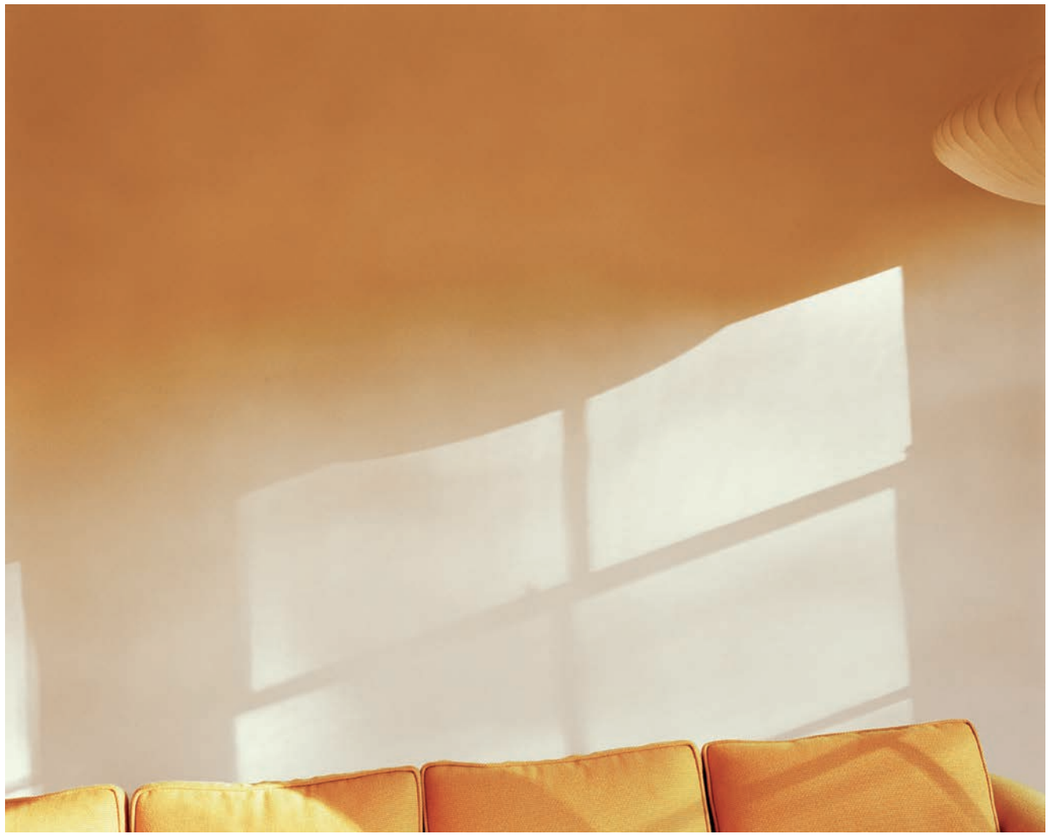
"Every single cell in your body has a clock that's trying to guess what time of day it is to get ahead of the game," he continues. "If my body knows that I get up and eat breakfast at 8 a.m. every day, then my liver, stomach and pancreas don't have to wait until there's food in my stomach to go, 'Oh shoot! We should be doing something about that.' " However, this preemptive response is only effective if we maintain a consistent routine based on the sun's movement—one that isn't influenced by impromptu midnight movie screenings and urgent deadlines. Technology and our desire to mingle have muted our biological reasoning, meaning our circadian rhythms' pleas for predictable schedules are often ignored. "People are generally dissociated with their connection to the environment," Stephen says. "And I wouldn't be the only person to say that a great deal of that has to do with light."

Thanks to everything from caffeine to night shifts, it's pretty easy to confuse our bodies' internal clocks, and this is especially common on the weekends. After five days of creating a semistructured morning routine, sometimes Saturday sleep-ins can leave us more tired than 6 a.m. starts. That feeling has a name: social jet lag. "It's a real thing and has a real effect, as your body is dumbly anticipating you'll get up at the same time as you did yesterday, because that's how it worked for the past four billion years," Benjamin says. This is also why Mondays can be such a drag—after two days of sleeping in, suddenly setting the alarm for dawn can shock our systems. "Your body's network has no mechanism to deal with alarm clocks or wanting to stay up to watch a movie," Benjamin says.

The act of taking care of ourselves via an awareness of sunlight's patterns is part of what Stephen and Benjamin call "sensory well-being." In addition to the other life choices we make to benefit our health, "Light is another piece of that puzzle we can now add to our lifestyles that's going to make a huge difference," Stephen says.

Improving our relationship with the sun could help both our personal well-being and society overall: If we learn how to look after ourselves through environmental adjustments, we'd free up the medical profession to concentrate on bigger problems. "Doctors shouldn't have to focus on the maintenance work—you wouldn't take your car to the mechanic every time it runs out of gas, right? That's a part of your daily maintenance," Benjamin explains. "But right now we don't really know a lot about how to maintain our bodies. And because we lack that maintenance, we therefore run into problems and need to go to the mechanic more often, which becomes a burden on the mechanics." By synchronizing ourselves with the sunlight's quirks, we may be able to help tune ourselves up the natural way.





… AND OF TIME (00.4)
2000
Color photographs in artist's frames
Overall: 35 x 90 inches; 89 x 228.5 centimeters

Here are some quick ways to fine-tune your light-related habits:

SET A ROUTINE

In order for our bodies to operate smoothly, all of our organs and systems are dependent on their clocks being wound to the same time. "They're not all able to look at each other's wristwatches though," Benjamin says. "You have to give them a routine to let them line up and coordinate." Getting up and going to bed at the same time every day allows our bodies to sync to a schedule, and we'd benefit even more by regulating the timing of meals too, like making oatmeal at the same time each morning.

SLEEP WITH A MASK

Sleeping eight hours per night is beneficial, but not if our bodies think it's daytime. Switching on the bathroom light or checking emails in a bout of insomnia might not be the biggest problem: The most disruptive factor may be ambient light pollution drifting in through the curtains. "Most bedrooms aren't well blacked-out, which often leaves them light enough that your brain registers the light all night long—especially in cities," Benjamin says. "Something as simple as wearing a sleeping mask can have a profound effect."

OBSERVE DAWN AND DUSK

While a lot is left to discover, it's beginning to appear that these times might be the most important parts of the day to be out and about: The light quality is changing rapidly and the direction of that change serves as a biological cue for whether it's early or late, thereby orienting our cells to wake up or wind down. "The subtle movement of light is an absolutely essential component to orient us to our circadian rhythms," Stephen says. This could be as simple as getting up 20 minutes earlier to walk the dog at dawn or having an excuse to snack on charcuterie while watching the sunset.

GET SOME REAL RAYS

They say that people who live in glass houses shouldn't throw stones, but they should throw open a window: Just like sunscreen helpfully blocks our skin from certain harmful light frequencies, the glass in windows deflects some other frequencies our bodies need to trigger biological responses. It's helpful that we don't burn while sitting in a sunlit office all day, but the fact we don't scorch is a clue that we're not getting all that the sun has to offer. It's best to bask during the times of day when dangerous ultraviolet wavelengths are less prevalent, such as the first and last couple hours of sunlight. "My doctor tells me I should lie out in the sun completely buck naked for 20 minutes a day. And I'm like, 'I like that doctor!' " Stephen says, laughing. In order to trigger vitamin D production, direct sunlight needs to shine on our bare, unprotected skin.

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Every single cell in your body has a clock that's trying to guess what time it is to get ahead of the game

Circadian rhythms aside, vitamin D can also play a vital role in our sensory well-being. Our bodies naturally produce this small molecule when our skin absorbs certain helpful frequencies of ultraviolet light, causing a whole series of enzymatic responses in our cellular structure that help support a healthy immune system and balance our mood. Without its presence in our bodies, our defenses to nasty bugs weaken and our happiness also seems to nosedive.

So why natural light, and not just more lightbulbs? It's all to do with wavelengths: Just as we think of rainbows as color spectrums from violet to red, the same can be described in light wavelengths. The sun gives off white light made of all the wavelengths combined, but lightbulbs only give off a few (think of how a crystal swinging on someone's porch produces a rainbow when hit at the right angle, or Pink Floyd's *Dark Side of the Moon* album cover). Different wavelengths have different energies, so depending on the height of the sun in the sky, the rays that hit earth have different intensities—that's why it's a lot harder to get sunburned at 9 a.m. than at high noon. These wavelengths and intensities also have different effects on our bodies, from the tumor-causing overdoses of ultraviolet rays to the more positive ones that stimulate vitamin D production.

Experts are still trying to understand the complicated role vitamin D plays in our well-being, and mixed messages abound: A medical professional might tell us to wear 50+ sunscreen to protect us from cancer-triggering ultraviolet light and in the same breath instruct us to sit unprotected in the sun to kindle vitamin D production. "I don't want people to think if they hose themselves with vitamin D that all of their problems will be solved," Benjamin says. "It's one piece in a complex system that we're still understanding." Now that many of us spend our days within enclosed walls instead of outside in the wild, vitamin D deficiency has become fairly common. This is especially true in the winter when there are fewer sunlit hours in the day and therefore even less time to absorb the correct wavelengths we need to stimulate its production.

In the darker months, the combination of vitamin D deficiency and our disrupted circadian rhythms play a crucial part in Seasonal Affective Disorder, a.k.a. the aptly acronym-ed SAD. While some still consider this condition an imaginary excuse for not getting out of bed when it's dark, it is an actual emotional disorder brought on by chemical reactions in your body. It's often defined as when the natural traits that typify winter—the extra sleeping, the extra eating, the lack of desire to get out of the house and be social—are involuntarily taken to excess, which interferes with our ability to operate at our optimal level of mental health.

Our bodies anticipate seasons just like they do 24-hour days, so short instances of this stoic existence are a perfectly standard response to winter's lower light levels and dipping temperatures. For example, we're legitimately wired to crave carbs and fatty substances during the time leading up to the cold season to help us put on a nice layer of natural insulation—an evolved excuse for baking a second batch of mac and cheese. Except that where this was once a biological reaction that preempted a lack of winter produce, we now have all the food we hanker for available to us to consume year round.

"Historically it was great that my body craved cheese in October in anticipation of a cold snap," Benjamin says. "But here I am in Berkeley, in summer, where I can go out and spend a hundred dollars on cheddar and wolf it down, but that's probably not what my body intended." This is another example of how we've lost touch with what our bodies are geared to crave, and cues from sunlight might be one of the best natural ways to resolidify those missed connections.

The best ways to ward off the winter blues and be kind to your sensory well-being are the same year round: Set a routine to keep your circadian rhythms ticking, try to be outside with your skin exposed during daylight hours for as long as your frosty epidermis can bear it, and don't always reach for the wheel of Brie when the slightest cheese craving gurgles within you (only give in on some days).

But often the people most affected by SAD live in areas where they don't have the choice to bask in the sun, even if they wanted to. For the residents of the world's northernmost communities who don't experience a sunrise for months during winter, or night-shift workers who have to be awake during nocturnal hours, no amount of positivity and goodwill can tilt the earth on its axis to grab some more rays. Without normal hours of natural light, how can these populations possibly set any semblance of a steady circadian rhythm or produce enough vitamin D to stay healthy?

That's where artificial light starts to shine. Through a project that fuses art with science, Stephen has helped create an artificial light with the ability to replicate the movement of specific wavelengths of sunlight, potentially opening up a whole can of glowing worms for light-starved people around the world.

The technology was invented as part of *The Twilight Array*, an art exhibition that will take place at Gary Snyder Gallery in New York City this winter. For this project, Stephen collaborated with many esteemed experts (including neurobiologist Dr. Margaret Livingstone, founder of the Livingstone Lab at Harvard University and author of *Vision and Art: The Biology of Seeing*) to create a series of works that explore the subtleties of twilight perception. His paintings will be illuminated by a light that replicates the movement and wavelengths of twilight, sending the viewer's mind into an entirely simulated biological state akin to watching a sunset. "Something really critical in my work is engaging someone's sense of wonder, and we have that when we're looking at a sunset or sunrise," he says. The interplay of his canvases and the specialized light will allow him to emulate what your body feels when watching a Tahitian sunset while standing in a windowless gallery high above the streets of Manhattan.

Working with a series of optical engineers, Stephen and Benjamin have developed a highly sensitive dimmer that can artificially imitate multitude wavelengths and the changes in sunlight's movement. Instead of walking into a room and flipping a simple on/off switch, owners of the dimmer will be able to download many different light sequences so they can have a romantic twilit dinner in a Moroccan dusk or wake up to the same wavelengths seen in the Scottish Isles. His team is currently measuring the light wavelengths around the world everywhere from Alberta, Canada, to Tasmania, Australia.

Aside from the romanticism of your body thinking it's waking up in the foothills of Nepal or the Italian Riviera, this artificial lamp could also be used to benefit those who don't have the privilege of experiencing a normal pattern of sunlight. "If you work until 3 a.m. and wake up at 10 a.m., there's no reason why you can't push your circadian rhythm back and program a dawn sequence for 9 a.m. and then turn your twilight mode on at 11 p.m.," Stephen explains. The same could be said for northern populations who never see the sun at all: By regulating their circadian rhythms and stimulating vitamin D production with these lights, it might help stave off SAD.

"It's absolutely the case that sunlight can be mimicked with the right technology; it's just that it hasn't been up until now. Our grandchildren are going to say, 'What do you mean the lights were either on or off? That's crazy!' " Benjamin says, laughing. "Once the technology is in place to control your light environment, it's going to be huge. It's such a fundamental quality of life issue that it's impossible to imagine a future where it's not part of the technological milieu."

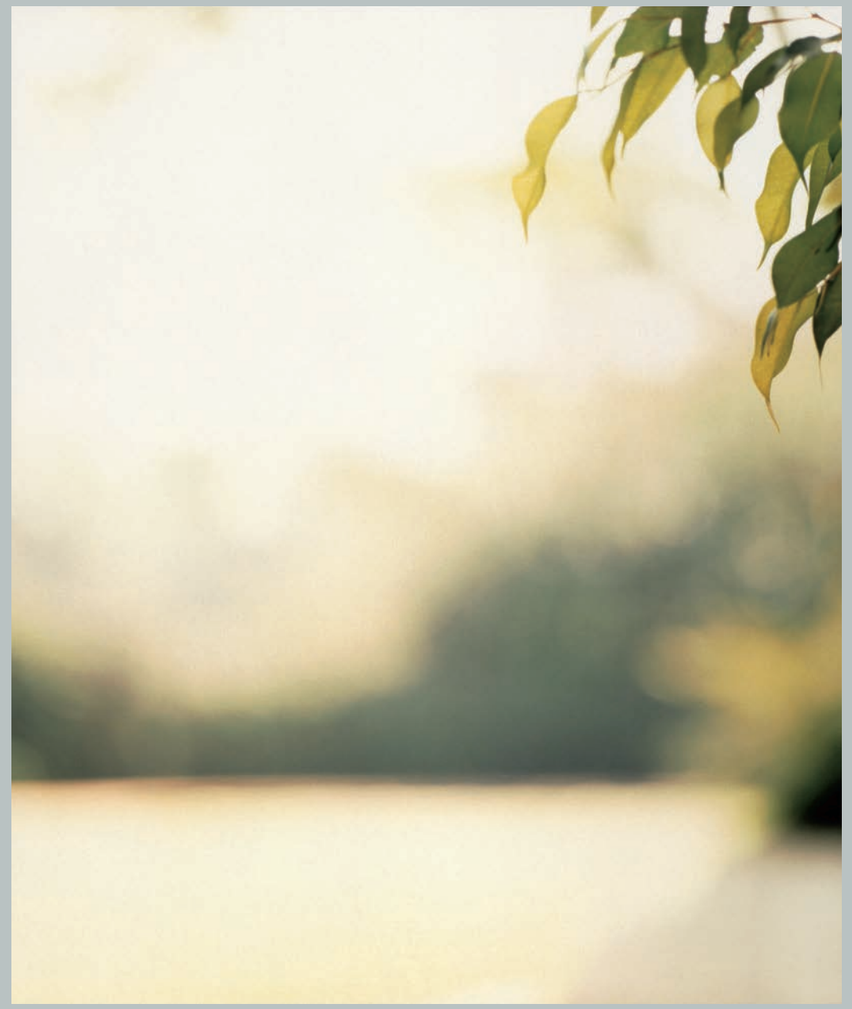
As it turns out, our eyes don't really mind if light comes from a halogen lamp or the sun, as long as it provides them with the wavelengths they want, when they want. "If you're able to replicate a light spectrum, physiologically there will be no difference between the experience of that in nature or in a space with an artificial light source," Stephen says.

Stephen is by no means suggesting that we can have a happy lifestyle sitting in a room with a lamp that mimics light curves, but artificial lights could help us in times when nature's benefits aren't easily accessible. "I'm humbled by our innate relationship to nature, so I've always been suspicious of a technology claiming to replace the magnificence that nature provides," he says. "It took me some time to stop romanticizing, but I've begun to demystify light and look at it empirically: It's a spectrum, it's a curve." The dimmer may be artificial, but it can bring us back to a baseline from which we can build a healthy emotional and physical state.

The irony of the artificial-versus-real-light dichotomy lies in the fact that we've become so hooked on the freedoms technology has afforded us that we might also need to use technology to set us right again. While it would be idealistic to suggest that we live by the light like we did for eons, rising and retiring with twilight and eating our granola at the same time every morning for the rest of eternity, what kind of existence would that be? Like most things in life, employing a little give and take will often lead us to optimal gratification (and will certainly be easier to uphold). Inventions such as Stephen's may allow us to reap sunlight's health benefits while still taking advantage of the joys that contemporary society allows us. We're never going to beat our bodies' yearning for routine and sunlight, but we can learn to work with them instead of against them. "We have trouble enough accepting that we turn into our parents, right?" Benjamin explains. "With circadian biology, we have four billion years of ancestry that we have to come to terms with."

The most important factor to consider when it comes to sensory well-being is figuring out what works best for you. Whether it's sleeping with a mask to help all your body's clocks align or programming an artificial dimmer to simulate a 6 a.m. dawn sequence in the depths of winter, even the act of being conscious about sunlight is a step in the right direction. As time goes on and the sun continues to rise and set every day until it flickers out, humans will continue to learn how to have a better relationship with it. There is still so much to discover, but at least we're beginning to see the light.

FOR MORE INFORMATION ON STEPHEN, BENJAMIN AND SUGGESTED READING MATERIALS, SEE PAGE 158.



GROUND (95.6)
1995
Color photograph on panel
16 ⅛ x 15 ⅛ inches, 41 x 38.5 centimeters