

# The Ecologist and the Prisoners

*Professor Nalini Nadkarni enlists a Washington state prison in sustainability research that has turned the prison green — and may help convicts turn their lives around.* BY VALERIE BROWN

**T**HE CEDAR Creek Corrections Center is in the woods — the Capitol Forest, to be exact, about half an hour southwest of Olympia, Wash. The minimum-security facility is near the ghost town of Bordeaux, where a utopian settlement was founded in 1880. Most of its enthusiasts departed after the first winter. It's no wonder; here on the fringe of the Olympic Peninsula, rainfall totals 30 to 40 inches a year, and the peninsula itself soaks up as much as 180 inches annually. If you don't like rain, you'll go nuts here.

On a foggy November day, the Bordeaux woods ooze primeval mystery. At each turning, trees seem to crowd closer, until the road leading to the prison becomes a narrow strip identifiable as two-way only by the dotted line down its center. The facility appears as a collection of two-story white wooden buildings inside a high chain-link fence topped with coiled razor wire. Also inside the fence are two greenhouses, several garden plots and a big pile of compost. A totem pole spikes into the gray sky, flanked by two gnomish guardian figures. Deer graze near the fence. A clump of men is gathered on the patio of one building around an array of weight-lifting equipment. The place feels remote, quiet, calm. It could be a Zen retreat, a place of contemplation, and in a sense, it is.

The participants here may have tattoos and rap sheets, but thanks to an

innovative forest ecologist from nearby Evergreen State College, they're also involved in environmental research and development projects that could chart the way for sustainable operations at other large institutions.

**A**SLIGHT, ENERGETIC woman, Nalini Nadkarni was a tomboy as a kid. "I was a tree climber," she says. She spent a lot of time in the eight maple trees that lined her family's driveway in Bethesda, Md. "It was my own world," she says. "I really loved it." Her father, a pharmacology researcher with the National Institute of Environmental Health Sciences, was a native of Mumbai, India; her mother, of Jewish heritage, grew up in Brooklyn, N.Y., and taught English as a second language.

Nadkarni has always seen life from several angles simultaneously. As an undergraduate at Brown University, she discovered ecology but was also powerfully drawn to modern dance. After she worked as a field assistant in Papua, New Guinea, for a year and then danced with a studio in Paris for six months, practicality won out; a profession in science would last longer than a dance career.

As a graduate student in forest ecology at the University of Washington, she spent eight weeks in the Monteverde cloud forest in Costa Rica. There she met Don Perry (known as the "Jacques Cousteau of the rain forest"), who traveled high in the trees using mountain-climbing techniques, setting his climb-

ing lines with a crossbow. He taught her to climb.

"It was the last biotic frontier," Nadkarni says. "People hadn't climbed up there. It just seemed like what was going on in the forest was going on up there." But when she returned to school and proposed to study the forest canopy, her graduate committee balked. At the time, canopy exploration was considered "just Tarzan and Jane stuff, getting up there and swinging around," she recalls. But she was persistent, and eventually the committee acquiesced.

**A**T THE University of Washington, Nadkarni did her first research in the nearby Olympic rain forest, awestruck at the incredible jumble of plant life in the forest canopy. That jumble consists mostly of epiphytes — plants that live on, but don't derive their nutrients from, other plants. It's a group that includes orchids and bromeliads.

Most of the epiphytes she encountered were mosses. "Moss has been one of the most overlooked components of ecosystems," Nadkarni says. "People laugh about moss. I know that, because I give talks about moss, and I get laughed at." Truly, moss doesn't get much respect; it's often considered a nuisance to be eradicated from lawns or a decorative element for flower arrangements.

**Nalini Nadkarni in the Bordeaux woods of Washington.**





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But moss has hidden virtues. Among the first photosynthesizers to colonize the land, mosses have been around for about 450 million years. They are intermediate organisms between simple algae and vascular plants, which have an internal circulatory system. Mosses lack vascular structure and roots, deriving their nutrients almost entirely from minerals dissolved in fog and raindrops. Some of them can become desiccated but, with a good watering, spring back to life a century later.

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Studying bigleaf maples as a graduate student, Nadkarni noticed layers of soil and decomposing vegetable matter running along tree branches under the mosses growing there. Below that, she found something you'd never expect to find in a tree canopy — roots. When she followed the roots back to their origins, she discovered that they were maple roots. The trees were sending them out to take nutrients from the epiphytes and the soil mats piled on their own branches.

In November 1981, her study comparing canopy root systems in temperate and tropical tree species made the cover of *Science* magazine. “Suddenly people began saying maybe there are some questions up there that it’s worth taking a look at,” she says. “It was like this ‘click’ moment.”

Since then, the world of tree-canopy research has expanded, propelled in part by Nadkarni’s perseverance. She joined the faculty at Evergreen State College in Olympia in 1991 and co-founded the International Canopy Network in 1994. She’s also served as president of the Association for Tropical Biology. Canopy research, she explains, is not a separate discipline from forest ecology. But now, she says, there’s a recognition that “if you’re a forest ecologist, you’d better pay attention to the canopy, because there’s so much going on there.”

AS SHE pursued her treetop obsession, Nadkarni came to realize that something was amiss in the world of moss. She encountered trees whose trunks and lower branches had been scraped clean; she learned that most of the lost moss went to the horticulture industry, which uses it to pack flower bulbs for shipment, among other things. It’s a \$265 million business, and 95 percent of the moss used in horticulture comes from the Pacific Northwest.

In fact, moss has been classified as a “non-timber forest product” suitable for sustainable harvesting in public forests. But much of it is taken without the required permits. Nadkarni was uneasy: Sustainability means the resource can’t be depleted faster than it’s replaced, and moss grows very slowly. It would take 20 to 40 years for the mosses to grow back to their former glory, Nadkarni says.

But could moss be farmed? She knew she was too busy to do all the work it would take to answer that question. She

needed assistants, preferably with “new fresh minds (and who) aren’t botanists or biologists,” she says. “So then I thought, *prisons!* They’ve got time, they’ve got space — and you don’t need sharp tools to work with moss, because you can just pull it apart.”

Nadkarni pitched her idea to two prisons that, she recalls, were “not ready for it.” But when she approached Cedar Creek in 2004, she says, “The superintendent was very open-minded. I said, ‘I want to work on this project, which is really about ecological sustainability, and I want to use your men to be partners with me in this.’

“And he said, ‘You know, that sounds kind of interesting. What do you need?’”

THE CEDAR Creek Correctional Center was already going green, partly out of necessity.

The state of Washington had seen an explosion in its inmate population, and Cedar Creek needed to expand its capacity by 100 beds. But there was an environmental impediment. “I was told we couldn’t (expand) because we didn’t have enough water rights,” says Dan Pacholke, the superintendent of Cedar Creek approached by Nadkarni. Pacholke, a corrections lifer who worked his way up from high-security prison guard to his current position as a deputy director of the Washington Department of Corrections, says the amount of organic waste generated by Cedar Creek was adversely affecting groundwater, and the state would not permit an increase in waste without a \$1.4 million expansion of the water treatment plant.





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Cedar Creek inmates already thinned undergrowth, planted new trees and fought forest fires, all activities with a natural twist to them. So Pacholke started conserving water by installing low-flow showerheads and no longer watering the lawn. He also started taking environmental science classes at Evergreen.

About that time, Nadkarni, by then a forest ecology professor at the college, was visiting the prison regularly to check on her moss project. She proposed a science lecture series for the prisoners, to be funded by a grant she had already received; Pacholke liked the idea. Recruited by Nadkarni's infectious enthusiasm, scientists came to Cedar Creek, but the first attempt at an academia-corrections interface

was awkward. Prison dogma precludes inmates and staff sitting in the same room, but Nadkarni knew the professors wouldn't be willing to deliver separate lectures. "I said, 'You want these speakers or not?'" Nadkarni recalls, and Cedar Creek relented, allowing talks that inmates and staff attended together.

Science, she says, erased some of the tension between prisoners and jailers. "A prisoner would ask a really smart question," she says, "and you could just



Cedar Creek inmates work with moss (above) and tend the prison garden.

see the guards going, 'Holy shit!' And then a staff member would raise his hand, and the prisoners said, 'Wow!'"

Speakers talked about the hydrological cycle, organic gardening, beekeeping. Pacholke acquired a surplus rainwater catchment barrel, a massive black cylinder that now sits at the corner of one of the administration buildings, gathering runoff from the rain gutters. A nursery donated two greenhouses that had been flattened by a snowstorm; inmates rehabilitated them. Pacholke tore

up lawns, reduced the use of chemicals and planted vegetables. He expanded Cedar Creek's modest recycling efforts and added worms to the compost. He even acquired bees.

For the study of moss farming, Nadkarni provided inmates with four species of moss from the Olympic rain forest. The prisoners were free to design their own experiments, trying out different growing conditions by varying temperature, light, moisture and the type of wood they used as a substrate to see what encouraged the fastest growth. Nadkarni and her graduate students provided advice and scientific background.

CEDAR CREEK inmates don't get to pick their jobs, and they get paid poorly. So the moss project and all the sustainability activities are, in a sense, forced labor. But former Cedar Creek inmate Craig Ulrich says, "It gives you a reason to go out and work and appreciate what you're doing rather than mopping the prison floor or something." Before his release in May 2008, Ulrich managed the composting program, voluntarily keeping detailed records of temperature and worm populations. He and Nadkarni published a paper on his work at Cedar Creek. Ulrich was in prison on a manslaughter conviction resulting from the accidental shooting of a friend at a party; he is now a doctoral student in biochemistry at the University of Nevada in Reno.

The moss study ended in 2006 with a disappointing finding: Moss probably can't yet be grown commercially at a scale comparable to what's now harvested from the wild. But the moss project — along with the prison's compost-

ing, organic gardening and beekeeping efforts — made Cedar Creek a different place. Even those not directly involved in environmental work enjoyed the benefits, since the prison kitchen uses most of what the vegetable gardens produce. And the inmates love eating their home-harvested honey on biscuits.

By 2007, Cedar Creek had reduced potable water use by 14.5 percent; it was diverting as much waste to recycling and composting as it sent to the landfill. It had reduced the organic material in its wastewater so much that the state granted permission to add 100 beds to the prison without expanding the waste treatment plant. In the new living quarters, toilets will be flushed with rainwater eight months of the year, and the new administration building will meet the U.S. Green Building Council's LEED sustainability standards.

Pacholke has been promoted, but the current Cedar Creek superintendent, Hisami Yoshida, has every intention of continuing the facility's sustainability, in part because she and Nadkarni have observed surprising positive responses from the inmates who participate in environmental activities. For example, Nadkarni gave the moss workers pencils and notebooks to keep logs of their observations and the experimental actions they took. She was astounded to discover that two of the workers had carefully avoided showing each other their notebooks, not out of competitiveness or hostility, but because they didn't want to contaminate their results. This is a first principle of the scientific method — which they had implemented without being told about it.

Cedar Creek does not allow inmates access to computers, and many prisoners have less than a high school education, but those working on the moss, compost and beekeeping projects often read widely. Ulrich, who is the first person in his family to attend college, estimates he read 1,000 books in the four years he was incarcerated.

Although the moss research has come and gone, a new project is im-

minent. By spring of 2009, Yoshida and Nadkarni hope, Cedar Creek will be raising highly endangered Oregon spotted frogs to be released into what's left of their habitats. A consortium including the Washington Department of Fish and Wildlife and three zoos has tried to repopulate parts of the species' range, which formerly extended from British Columbia to Northern California. But the process is labor-intensive, and the project has been less than successful, Nadkarni says. Like growing moss, raising frogs is something inmates can do because they have plenty of time.

And, of course, frog husbandry requires no sharp implements.

#### FURTHER READING

"Canopy Roots: Convergent Evolution in Rainforest Nutrient Cycles," by Nalini M. Nadkarni, *Science*, Vol. 214, 27 November 1981, pp. 1023–1024 ([http://academic.evergreen.edu/n/nadkarnn/cv/pdfs\\_science/Canopy\\_Roots\\_Science\\_1981.pdf](http://academic.evergreen.edu/n/nadkarnn/cv/pdfs_science/Canopy_Roots_Science_1981.pdf))

"Sustainability research and practices in enforced residential institutions: collaborations of ecologists and prisoners," by Craig Ulrich and Nalini M. Nadkarni *Environment, Development and Sustainability*, 2007, DOI 10.1007/s10668-008-9145-4 (<http://www.springerlink.com/content/3074v62030633859/fulltext.pdf>)

#### Moss Acres

[www.mossacres.com/default.asp](http://www.mossacres.com/default.asp)  
A Web site with ideas about landscaping with moss

One in 100: Behind Bars in America 2008 ([www.pewcenteronthestates.org/uploadedFiles/8015PCTS\\_Prison08\\_FINAL\\_2-1-1\\_FORWEB.pdf](http://www.pewcenteronthestates.org/uploadedFiles/8015PCTS_Prison08_FINAL_2-1-1_FORWEB.pdf))

"Moss Conservation behind Bars: Prison inmates help researchers cultivate threatened mosses," by Adelheid Fischer, *Conservation Practice*, July–Sept 2005 Vol. 6 No. 3 ([http://academic.evergreen.edu/n/nadkarnn/cv/pdfs\\_new/moss\\_prison\\_2005.pdf](http://academic.evergreen.edu/n/nadkarnn/cv/pdfs_new/moss_prison_2005.pdf))

ONE OF THE cardinal rules of science is that experiments should be independently replicated. So far, though, Cedar Creek's foray into sustainability in a corrections setting is unique. It is clear that it can save taxpayers' money. But there are as yet no statistics to reveal whether working on composting, organic gardening, beekeeping and the like reduces recidivism or helps convicts find jobs. Because it takes about five years to track recidivism trends, Pacholke says, "It's too soon to tell."

Still, the collaboration between Nadkarni and Cedar Creek has inspired Evergreen and the Washington Department of Corrections to sign a formal agreement to create similar programs at other prisons.

Clearly, the system at Cedar Creek works so well partly because it's coercive; the prison administration can command behavior in a way that is not possible on the outside. But large institutions like factories, military installations and schools may be able to make use of the Cedar Creek model. "I think you can use corrections to experiment to see what's possible," says Pacholke. "It joins you to the community. You provide demonstration projects. It leads to other ideas."

The one unique factor that has driven the Cedar Creek experience is Nadkarni's personality. She says she was surprised by the receptiveness of the Cedar Creek administration to her ideas, but others emphasize the enthusiasm she brings to most everything she does. Richard Primack, a botanist and conservation ecologist at Boston University, has known Nadkarni for about 25 years. "She's a person who's doing a million things. If you look at her range of activities, it seems like an organization — and it's just one person," he says. "She has this ability to get people very excited." [M2](#)

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Photos courtesy Nalini Nadkarni