NATURE'S DYING MIGRANT WORKER

Story by Josephine Marcotty
Photos and videos by Renée Jones Schneider

The past few decades of farm economics have created a system in which one-third of the food on our plate now relies on just one pollinator — the honeybee. And it's dying.

StarTribune (http://www.startribune.com)

NATURE'S DYING

MIGRANT WORKER

PART 1 The past few decades of farm economics have created a system in which one-third of the food on our plate now relies on just one pollinator — the honeybee. And it's dying.

Story by Josephine Marcotty
Photos and videos by Renée Jones Schneider

SAN JOAQUIN VALLEY, CALIF. / *First in an occasional series*

SAN JOAQUIN VALLEY, CALIF.

On a cool January day in the foothills of the Sierra Nevada mountains, Steve Ellis culled his sick bees. The only sounds were their steady buzz and the chuffing of the smoker he used to keep them calm as he opened the hives, one by one, to see how many had survived. The painful chore has become an annual ritual for Ellis, and, hardened now like a medic on the front lines, he crowned another box with a big rock to mark it.

"This one is G.A.D.," he said. "Good as dead."

Ellis, of Barrett, Minn., is one of some 1,300 commercial beekeepers from across the United States who migrate to California each year, along with nearly 2 million hives, for the single largest pollination

event in the world. Below him in the sprawling valley, nearly 1,400 square miles of almond trees — three-fourths of the global supply — were ready to burst out into a frothy sea of pink and white. To grow into a nut, every single blossom would need at least one American honeybee.

Ever since the ominous phrase “colony collapse disorder” first surfaced in 2006, scientists have struggled to explain the mysterious mass die-offs of honeybees. But here in America’s food basket the escalating stakes are laid out as clearly as the almond trees that march in perfect rows up to the horizon.

BEES AT THE BRINK

An occasional series examining the mysterious decline of the honeybee and its consequences for the American consumer. (1:27)

BEES AT THE BRINK

An occasional series examining the mysterious decline of the honeybee and its consequences for the American consumer. (1:27)

Modern farm economics have created an enormously productive system of genetically engineered, chemically dependent agriculture. But it relies on just one domesticated insect to deliver a third of the food on our plate.

And that insect is dying, a victim of the very food system that has come to depend on it.

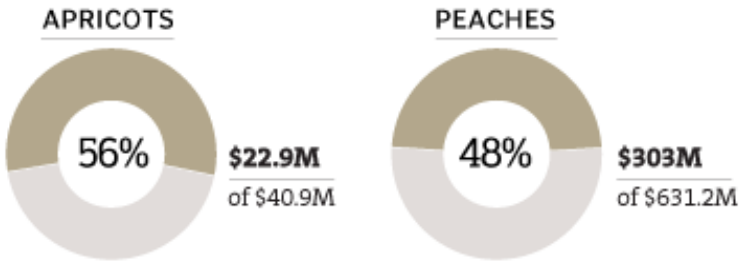
A rush of recent research points to a complex triangle of causes: pervasive pesticides, a flowerless rural landscape dominated by cash crops, and the spread of parasites and diseases. Together they inflict enormous damage on the honeybees that crisscross the country each spring and summer, like migrant laborers, to pollinate everything from almonds in California to apples in Maine.

In the past several decades, the number of crops that depend on bees for pollination has quadrupled, even as the number of hives available to pollinate them has dropped by half. Every winter, beekeepers on average continue to lose a fourth to a third of their hives, raising fears that the gradual decline of these remarkably resilient insects will soon limit the production of foods that Americans now take for granted.

Most consumers are insulated from the threat — as long as the aisles of America's grocery stores are resplendent with apples, lemons, coffee, cocoa, peanuts, grapes, onions, cucumbers and watermelons.

But not Ellis and his sometimes partner Jeff Anderson, a third-generation beekeeper from Eagle Bend, Minn., whose family has made the annual trek to and from the California almond bloom since 1961.

For them, catastrophe could be just one harvest away.



(http://apps.startribune.com/news/bees/264776651.html)

Graphic (http://apps.startribune.com/news/bees/264776651.html) Foods that rely on bee pollination

---

Graphic (http://apps.startribune.com/news/bees/264799461.html) Ailing hives: Fewer bees, less honey

Minnesota beekeeper Steve Ellis examines a frame from one of his dying hives.

1 / 10

PreviousNext

Minnesota beekeeper Steve Ellis examines a frame from one of his dying hives.

1 / 10

PreviousNext

This winter, Ellis lost about 1,200 of the 2,200 hives he had in the summer. Last winter, Anderson lost 65 percent of his 3,000 hives and didn’t have enough bees to supply all his almond growers.

Ellis and Anderson are among the most outspoken of beekeepers nationally — in federal court, in the news media, before regulators, legislators and anyone else who will listen to their warning about the American food system's mortal reliance on pesticides and monoculture.

Yet they see this unfurling crisis through entirely different prisms. Anderson, slightly round and solid as a fireplug, is a creationist who believes that God made the world and all its creatures in seven days, and that mankind was put here to take care of it. That includes using chemicals to grow food. "But we should be judicious in how we do it," he said.

Ellis, courtly and rail thin, is entranced by the evolutionary role that pollinators have played over millions of years in the creation of flowers, color and scent. Without insects, he says, the world would be a place much more like Dorothy's Kansas than the Technicolor Land of Oz that nature has produced.

"We would go back to black and white," he said.

For the first time, Ellis and Anderson are thinking what was once unthinkable — perhaps the foraging grounds in central Minnesota, where they have made honey for decades, have become too barren and toxic for their bees.

Video The plight of the beekeeper (1:38)

Video The plight of the beekeeper (1:38)

Repercussions of the flowerless landscape

Springtime used to be a time of rebirth. It was the season when beehives grew fat and healthy on dandelions, wildflowers, and the sweet clover and alfalfa that farmers once grew to add fertilizer to the soil. It's what once made Minnesota part of a Midwestern mecca for beekeepers and long one of the top five honey-producing states in the country.

But in the space of a few decades, the central Minnesota landscape around Ellis has been transformed into one that has no room for bees.

When he looks out over the edge of the old gravel pit near Elbow Lake where he keeps his hives, Ellis sees what he calls a vast agricultural desert of corn and soybeans — two plants that don't need bees for fertilization. Synthetic fertilizers have replaced the natural ones, farming has become increasingly specialized and now about a third of Minnesota's land — and much of the Midwest — is covered with just those two crops.

Almost all Midwestern crops are now genetically engineered to withstand the herbicide Roundup, so farmers can kill weeds efficiently without harming their yields — a major advance in productivity that has revolutionized agriculture. But the widespread use of herbicides has virtually wiped out the milkweed, clover and wildflowers from Minnesota's vast farming regions. That doesn't include the millions of acres devoted to grass in urban areas, another form of chemically intensive monoculture.

For bees — which need 150 million flowers to make enough honey for one hive to survive the winter — there isn't much left to eat.

"This is supposed to be the land of milk and honey," Ellis said.

What flowers remain are increasingly exposed to a new family of insecticides that, along with corn and soybeans, have exploded across the Midwest and the world: neonicotinoids. They come coated on virtually every seed planted in every major crop across the country —

sunflowers, canola, cotton, soybeans and corn. Each spring when farmers take to the fields, some unknown quantity of the chemical escapes into the environment, especially in corn country.

(264609861.html)

Graphic (264609861.html) What makes the bee a super pollinator

Video A complex society inside the hive (3:37)

Video A complex society inside the hive (3:38)

Insecticides are blowing in the wind toward the hive

Ellis sees it every year in May, when his neighbors crisscross their fields with massive planters that inject the pesticide-coated seeds into the earth. They have to use a talc to keep the seeds from sticking together, and as the air pressure in the machines forces the seeds into the ground, the contaminated powder escapes and drifts over the land.

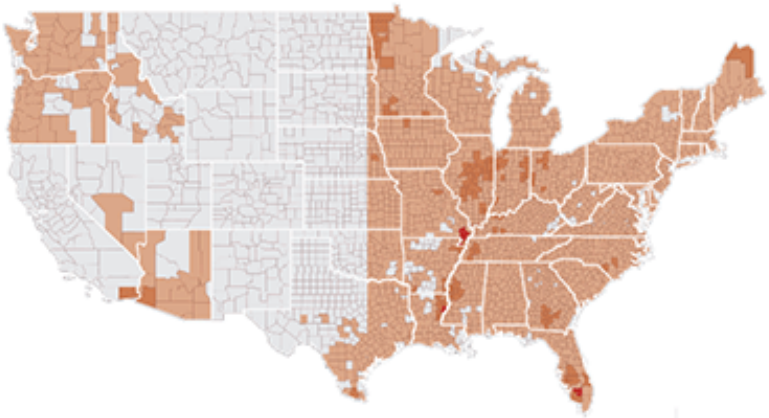
But May is also the month when his bees work the blooming willow trees, shrubs and other flowers around the gravel pit, collecting pollen and nectar as they play their part in the seasonal reproduction of plants. And when wind blows the fine powders from corn seeds over the blooming plants around his yard, many of the bees that return to the hive come back and die.

The sight of thousands of bees twitching and convulsing in front of their boxes has become a near-annual event for Ellis and other beekeepers in the same predicament.

Farmers don't have much choice in this transaction; 90 percent of the seed corn available to them comes precoated with neonicotinoids. It's just one of the many chemical and genetic advances that have helped farmers double their production from 80 or 100 bushels per acre to up to 200 today, said Leon Johnson, who farms near Ellis in Barrett.

"It's hard to argue with success," he said, even though he recognizes that there is a downside to that abundance.

"Most farmers are smart enough to know you can't kill all the bees going forward," he said. "But we haven't been asked."



(http://apps.startribune.com/news/20140629-bees-neonicmap/?jjj)

Graphic (http://apps.startribune.com/news/20140629-bees-neonicmap/?jjj) The rapid spread of neonicotinoids

Unlike most other beekeepers, Ellis has complained repeatedly about his bee kills — to Minnesota regulators, to the U.S. Environmental Protection Agency and to the pesticide's manufacturer, Bayer CropScience, a branch of the giant German pharmaceutical company.

Last spring, officials from Bayer determined that neonicotinoid exposure was one likely cause of Ellis' bee kill, affecting most of his hives. While the bee deaths were "clearly undesirable," the source of

the insecticides was undetermined, and the die-off did not pose a serious threat to Ellis' operation because the bees could get back to their normal numbers, the Bayer report concluded.

David Fischer, Bayer's chief scientist for ecotoxicology, says insecticide-related bee kills are rare. Fewer than a dozen have been reported across the nation's 150,000 square miles of cornfields, he said. Nevertheless, Bayer is now working with a consortium of beekeeping organizations and scientists to devise new products that will minimize the airborne spread of planting dust.

"We want to do what we can to help bees," Fischer said.

Beekeepers say such events are, in fact, quite common. But few are willing to complain about them: They fear alienating their neighbors — or worse. Two years ago, when Ellis filed a complaint with the Minnesota Department of Agriculture, investigators said they found nothing. Instead, they fined him $5,000 for improperly using a chemical to control bee parasites.

Ellis fought the fine and won, but it cost him $15,000 in legal bills.

"What was I thinking?" he said, laughing as he recounted the story. "I'm supposed to be a businessman!"

(http://stmedia.startribune.com/images/BEES-FINALS027_2.png)

Photo (http://stmedia.startribune.com/images/BEES-FINALS027_2.png) This winter Steve Ellis lost more than half of his 2,200 hives. Photo by Jeff Anderson.

(http://stmedia.startribune.com/images//BEES+FINALS051.JPG)

Photo (http://stmedia.startribune.com/images//BEES+FINALS051.JPG) Seed corn is coated with Poncho, the brand name for one of the neonicotinoid insecticides linked to bee deaths.

Since their introduction in the mid-1990s, neonicotinoids have sparked a quiet revolution in agriculture. Because they are considered far safer than their predecessors, they won fast-track approval by the

EPA and are now the most widely used insecticides in the world. Made from a synthetic nicotine, they are a neurotoxin to insects — but not for people, their livestock and their pets.

But it's their delivery system that makes neonicotinoids truly novel.

As the chemical-coated seed germinates and matures, the insecticide moves into the circulatory system and grows with the plant. As a result, today all major crops — and even many of the geraniums and petunias at retail garden centers — are poisonous to insects, regardless of whether they need to be protected. It's a built-in insurance policy.

"Making plants themselves toxic is a whole different thing than killing bugs with a toxin," Ellis said. "It's a game-changer."

And when pests infest plants that don't have this systemic protection, neonicotinoids are often the first line of defense for farmers and gardeners, as a spray, soil drench or injection.

Used correctly, neonicotinoids are not supposed to kill bees and other wild insects that collect pollen and nectar. Bayer and other manufacturers say that as the plants grow, the toxins become diluted and too weak to kill bees directly.

So far, the EPA and the U.S. Department of Agriculture agree. Last year after an extensive review, the USDA concluded that neonicotinoids may be contributing to the death of bees, but that the scientific evidence is insufficient to prove it. Moreover, the agency said, bees are hurt by many other factors, including the loss of natural habitat, invasive bloodsucking parasites that have swept through hives

around the world, diseases and the stew of other pesticides that can have any number of effects on incredibly complex beehive communities. The EPA is now in the midst of an extensive review of the science, with results expected by 2018.

Video The problems bees are facing. (1:25)

PDF (http://www.usda.gov/documents/ReportHoneyBeeHealth.pdf) USDA documentation on neonicotinoids

Video The problems bees are facing. (1:25)

PDF (http://www.usda.gov/documents/ReportHoneyBeeHealth.pdf) USDA documentation on neonicotinoids

Nonetheless, neonicotinoids have become the focus of a national fight that is raging over the fate of bees, largely because of a new and growing body of research showing that even at low doses, the compounds can have what scientists call “sublethal effects.”

Bees, which have extraordinary navigational skills, return to Jeff Anderson’s hives in a California almond grove.

Bees have evolved, with human help, to have extraordinary powers of navigation and communication. They fly as far as 5 miles at a stretch — much farther than most wild pollinators. They use the sun and an extraordinary innate sense of direction to find their way home after long foraging expeditions, as well as an intricate “waggle dance” to tell

others in the hive where the flowers are. And bees are portable: Beekeepers can pack up the hives and traverse the country, moving them from one vast field to another.

Altogether, these features make honeybees the perfect super pollinator for modern agriculture.

But when bees are exposed to low doses of neonicotinoids, some scientists say, they falter. Like drunks, they can't find their way home.

"They can't remember who they are or where to go," said Vera Krischik, an associate professor at the University of Minnesota who studies insecticides.

In addition, researchers have found that neonicotinoids can undermine bees' immune systems, making them susceptible to diseases carried by parasitic mites, the invasive insect that swept through American hives starting in the 1980s.

"It's like they have AIDS," Ellis said.

Fischer, of Bayer, dismisses the evidence of such sublethal effects, saying they largely reflect what can be induced in the artificial confines of a laboratory. There is no compelling research, he said, proving that the decline of bees is related to their exposure to neonicotinoids in the real world. Bayer's own studies have shown that in natural settings, there are no effects on bees, he said.

"It's a convenient story," Fischer said, "but it's a scapegoat."

“They can’t remember who they are or where to go.”

VERA KRISCHIK
University of Minnesota entomologist

But something is wrong. In the past decade, in most states and especially in the Midwest, the amount of honey produced by each hive has crashed. That’s clear evidence that bees are seriously impaired, said Susan Kegley, a pesticide researcher in Berkeley, Calif., who works with beekeepers. In Minnesota, for example, production per hive has plummeted by one-third in the past decade.

“The Corn Belt states are getting hammered,” Kegley said.

And it’s not just beekeepers and scientists who worry about risks to the nation’s food system. Earlier this month, the White House promised to devote $50 million to resolve what it described as a “genuine threat to domestic agriculture.” General Mills Inc. is now working with its honey suppliers to increase the amount of foraging grounds for bees around growing fields, and it’s funding bee research at the University of Minnesota and elsewhere.

“We feel it’s important and urgent enough to do something,” said Tom Rabaey, senior scientist at General Mills’ agricultural research center in Le Sueur, Minn.

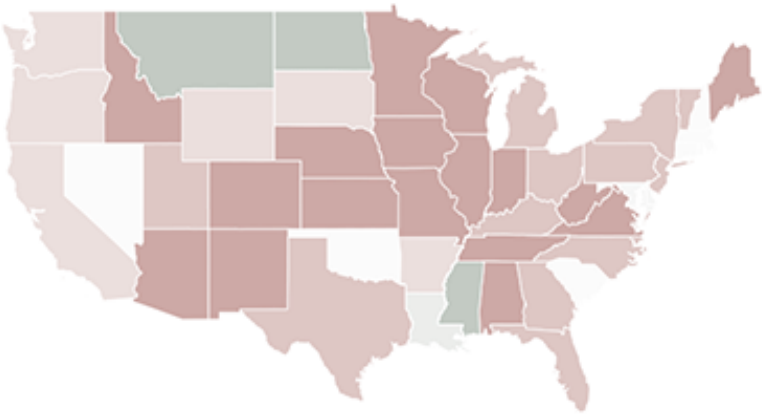
As honey production has dwindled, prices have skyrocketed. But it’s not enough for Ellis, Anderson and other beekeepers to keep up. Their expenses have doubled in recent years as they’ve come to rely on sugar

water and artificial protein patties to feed their bees — at best a temporary substitute for natural pollen and nectar. Even the price of a new queen has nearly doubled in the past decade, to $20 or more.

Last fall, worried about their bees' health, Ellis and Anderson sent their sickest hives to the deserts of Southern California in the desperate hope the warm nights and hot days would revive them. Despite all those efforts, still their hives collapse.

"I call it a death spiral," Ellis said.

Fortunately, there are almonds.



(http://apps.startribune.com/news/20140629-bees-heatmap2/?jjj)

Graphic (http://apps.startribune.com/news/20140629-bees-heatmap2/?jjj) Honey production has fallen sharply

Ginnifer Anderson watches over her sons in Oakdale, Calif., where they live six months a year. Every spring, they migrate to Minnesota, where their bees make honey.

1 / 11

PreviousNext

Ginnifer Anderson watches over her sons in Oakdale, Calif., where they live six months a year. Every spring, they migrate to Minnesota, where their bees make honey.

1 / 11

PreviousNext

Without bees, California would have no almonds

When the sun popped out for a few hours one afternoon in late February, Anderson's bees poured out of their hives. They quickly disappeared into the sweet cloud of California almond blossoms — earning his family's keep as they have for three generations.

This is where his wife, Christine, spent her winters as a child and where they raised their six children between October and April — splitting their lives between Eagle Bend, where they produce honey, and pollinating spring crops in the Central Valley. These days, four little grandkids are running barefoot across the dusty parking lot, climbing around the parked trucks and building forts in the stacks of empty bee boxes. California pollination was not Jeff Anderson's worry on this balmy day. Business is booming. All across the Central Valley, clusters of beehives were tucked into every almond grove, nearly hidden by the blanket of white blossoms.

With demand so strong, the pollination migration now generates as much revenue for beekeepers as their declining honey production — sometimes more. As a result, it's become ever more enticing for beekeepers to pack up their bees and head to California for almonds. This year, an estimated 1,300 beekeepers made the migration.

But now this arrangement may be reaching its limits, a victim of its own success and the imperiled state of honeybees. The number of available hives has topped out at under 2 million, all of which are required for California's almond crop. And demand just keeps growing.

The Central Valley's almond groves have exploded to more than 850,000 acres — with many more planted and waiting to produce — and California now provides 80 percent of the world's almonds. That crop is worth some $5 billion, twice what it was a decade ago, and is now equal to the value of California's grape crop used for wine.

Without bees, there would be no almonds — unless, Anderson likes to point out, growers hire humans to pollinate by hand as they do in China, where in some areas bees and other pollinating insects have been wiped out.

Video A migratory way of life, under threat (3:16)

Graphic (http://apps.startribune.com/news/bees/264948601.html) Pollination routes of four beekeepers

Video A migratory way of life, under threat (3:16)

Are there enough bees to do the job? Barely, beekeepers say.

“We are close to the tipping point, where the bee industry cannot respond to the needs,” Anderson said.

This year, the squeeze between supply and demand reached the point where almond growers paid $170 or $180 for every hive, a price that continues to rise every year.

“I can remember paying $40 not too long ago,” said Marty Adrian, an almond grower who has used Anderson’s bees for years. “It’s a big expense.”

The USDA estimates that in 2013 the United States had 2.6 million honey-producing hives. But that’s a summer count, when the number of hives is at its honey-producing peak. In January and February — when the hives are needed for almonds — there are about a third less.

Last year finding enough bees “was chaos,” said Denise Qualls, who runs the Pollination Connection, a California bee inspection and brokering service.

This year, she recruited new beekeepers from Ohio and Michigan to meet demand. Many almond growers, she said, are booking their contracts much earlier to ensure that they can meet the requirement set by the federal government of two hives per acre.

The Almond Board of California and growers say that bee supplies are adequate, if tight. With droughts now chronic in the West, water supplies are a far larger restriction on almond production than the availability of bees, they said.

Anderson sees it from the other side: “The water problem is solving the bee problem,” he said.

(http://stmedia.startribune.com/images/1000*674/Hand+Pollination01.jpg)

Photo (http://stmedia.startribune.com/images/1000*674/Hand+Pollination01.jpg) In China, humans pollinate pear trees and other crops by hand in areas where bees have been wiped out. Photo by Eric Tourneret.

(http://stmedia.startribune.com/images/1330*887/Hand+Pollination01.jpg)
In China, humans pollinate pear trees and other crops by hand in areas where bees have been wiped out. Photo by Eric Tourneret.

Nevertheless, California's almond growers have become sensitive to the plight of the bees. Growers are encouraged to spray fungicides and other chemicals at night, when bees are safely in their hives. That means some long nights for Adrian and his crew as they slowly pull their sprayers across 1,000 acres of almond trees, something he wouldn't have done a few years ago.

"Bees are an asset that growers have to take care of," he said. "It's a symbiotic relationship."

Not all growers are as careful. After the almond bloom was complete in March, beekeepers reported that some 80,000 of their colonies were dead. Many blamed the "tank mixes" of chemicals used in the almond

groves.

“Bees are an asset that growers have to take care of. It’s a symbiotic relationship.”

MARTY ADRIAN
Almond grower

Anderson’s bees were not affected, largely because he makes sure that his contracts with growers make them financially responsible if their use of chemicals kills his bees, he said. Still, the reports from other beekeepers were heartbreaking.

“I literally cried when I heard some of the beekeepers describe semi-loads with 25% totally dead,” he wrote in an e-mail at the end of March. “The queens have TOTALLY shut down brood production, and much to most of the brood still in the hives is dead.”

Almond grower Marty Adrian sprays his trees at night to protect bees from exposure to chemicals. Bees only forage during the day.

Keeping the bees out of Midwest's 'killing yards'

When the ground was white with almond blossoms in March, beekeepers in the Central Valley loaded up their hives for the annual pollination treks across the country — melons in Texas, blueberries in Michigan and Maine, cherries and apples in Oregon and Washington.

Anderson's family used to join them, but not anymore. The wide use of pesticides in fruit orchards is too hard on his bees, he said.

Instead, when almonds are done, he takes his hives up into the wild hills above the San Joaquin Valley. There, in company with Ellis' bees, they can "detoxify" with clean forage. This is where they start splitting their hives and adding queens to build their numbers for summer honey production in Minnesota.

In every previous year, Anderson loaded his semitrailer truck and, along with his wife, kids, grandkids, dogs and cats in a caravan of RVs, headed east on a three-day trip across the mountains and prairies to the family compound in Eagle Bend.

Not this year. This spring, he left most of his bees behind.

On a windy, damp night at the end of April, his maroon semi truck growled slowly up the dirt road in Eagle Bend carrying only 250 hives and a lot of empty boxes. The rest, just under 3,000, he had left in California until after spring planting in Minnesota wrapped up. It meant cutting into his summer honey production but, he said, he just couldn't face bringing his bees back to the "killing yards" of the Midwest.

Ellis stayed in California with his bees while the cold spring dragged on, delaying planting in Minnesota. In mid-May he was still there with his bees, a little homesick and trying to decide what to do.

"If I keep waiting it will make life a nightmare," he said. "But why do I want to bring them back and kill them?"

RETURN TO TOP

PART 2 > (http://apps.startribune.com/news/bees/part2.html?site=full)

SERIES CREDITS

Story
Josephine Marcotty

Photos and Videos
Renée Jones Schneider

Graphics
Ray Grumney
Mark Boswell
Jeff Hargarten
Eddie Thomas

Design
Josh Penrod
Dave Braunger
Jamie Hutt
Billy Steve Clayton

Editing
Dave Hage
Deb Pastner
Jenni Pinkley
Courtnay Peifer
Vince Tuss
Ben Welter
Tom Wallace
Mark Vancleave
Terry Sauer
Derek Simmons
Michiela Thuman

SERIES CREDITS

Story
Josephine Marcotty

Photos and Videos
Renée Jones Schneider

Design
Josh Penrod, Dave Braunger, Jamie Hutt, Billy Steve Clayton

Editing
Dave Hage, Deb Pastner, Jenni Pinkley, Courtnay Peifer, Vince Tuss, Ben Welter, Tom Wallace, Mark Vancleave, Terry Sauer, Derek Simmons, Michiela Thuman

---