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Imelda's wet mess hits South

**USA TODAY, 11A** 

CLIMATE CHANGE ON THE DELAWARE BAY
Rising seas leave lifeless landscape in wake



Maddy Lauria Delaware News Journal | USA TODAY NETWORK

As Mark Wells harvested rows of corn from his farm near Fowler Beach, he praised the fertility of eastern Sussex County's soils that sent thousands of golden kernels filtering through his combine. But it wasn't this healthy crop the farmer wanted to point out.

To the north and east of his 126-acre farm at the corner of Fowler Beach Road, dozens of gray stalks of leafless and lifeless trees litter the landscape's edge. The same saltwater that killed those trees and exceeded one of the state's most striking shoot forests has left shappy of Wells' fields harron.

created one of the state's most striking ghost forests has left chunks of Wells' fields barren.

As the combine hit those decaying areas, he watched his yield drop by more than half. Wells pointed to the ghost forests skirting his farm and tried remembering where a beloved, huge persimmon tree once stood. He couldn't find it.

Ducks flew out of a pond against a backdrop of dead trees and invasive common reed, or phragmites, that no longer feed the wild deer, raccoons and other critters that once roamed in the now-mummified forest.

Some spots where Wells planted seeds earlier in the season are filled with fruitless, stunted stalks or nothing but grasses, evidence of a crop severely impacted by saltwater intrusion.

See GHOST FORESTS, Page 4A

"It's practically wasteland," he said. "It goes hundreds and hundreds of yards into the field."

The ghost forest next to Fowler Beach Road in Sussex County. JERRY HABRAKEN, DELAWARE NEWS JOURNAL

# Missing children center to help ID remains

**Jessica Bies** Delaware News Journal USA TODAY NETWORK

The National Center for Missing & Exploited Children has been asked to assist Delaware investigators in identifying the remains of a child found last week at a softball field in Smyrna.

Often in cases like this, there is no missing child report, said Carol Schweitzer, who supervises NCMEC's forensic services unit.

That's where the forensics come in. "We do a lot of facilitating," she said, running through a variety of forensic testing that will need to be done to build a profile of the unidentified child found at the Little Lass softball fields last Friday.

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#### More inside

Thousands of children go missing every year. Among them, several are from Delaware. **Page 2A** 

# State wants to dissolve 'shell' companies

Xerxes Wilson Delaware News Journal USA TODAY NETWORK

Delaware's top law enforcement official is asking a court to dissolve a list of local "shell" companies tied to acts like funneling hush money to President Donald Trump's porn star mistress to propping up the late Zimbabwean dictator Robert Mugabe.

Attorney General Kathy Jennings on Thursday petitioned Delaware's Chancery Court to dissolve 15 Delaware business entities that have been involved in federal indictments, international sanctions and political controversies that have reached the highest levels of American power.

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ROOFING WINDOWS & DOORS SIDING DECKS KITCHENS & BATHS REPAIRS

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### I-95 plane crash investigation

#### Weather

## **Ghost forests**

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The ghost forest along the edges of Wells' property is not a new phenomenon. For thousands of years, coastal ecosystems have shifted with the rising sea level, storms and other natural forces. As beach sands ebb and flow, so do the marsh and forest systems behind them. Sometimes human interference, like building roads or homes next to marshes or trying to engineer those natural systems, can hinder that natural movement.

Now scientists are learning that as sea-level rise accelerates due to climate change, these ghost forests are emerging more rapidly than ever before.

And all those dead trees could be signaling a much saltier future in the Mid-Atlantic region, where sea level is rising at nearly three times the global average.

"And a forest of dead trees is a visual indicator of that bigger story," said Matthew Kirwan, a researcher at the Virginia Institute of Marine Science.

#### Livelihoods at stake

For Wells, the ghost forest on Fowler Beach Road tells a story of government mismanagement. In 2006, Hurricane Ernesto opened the first in a series of breaches in the dunes at Fowler Beach, allowing saltwater to rush into the freshwater marsh on the northern end of Prime Hook National Wildlife Refuge.

"It was like a drain plug being pulled in a bathtub," the 49-year-old farmer said. "Each time high tide came in it scalped more and more of the beach away, pushed the beach into the dunes and water into the marsh. The problem over the next five to six years kept getting exacerbated more and more."

It wasn't until the Mother's Day nor'easter of 2008 that the intruding saltwater began damaging his lands. He spent \$10,000 to build an 8-foot berm along his property's eastern edge to keep those waters out. The trouble was likely exacerbated by floodwaters surging through ditches historically dug to manage water levels and mosquitoes in the Prime Hook National Wildlife Refuge, as well as strong storms like Hurricane Irene and Superstorm Sandy.

"Let's face it, nature is behind all of them," said the refuge's project manager Al Rizzo.

After four years of repairs at the refuge, a large chunk of the restored marsh is finally coming back to life, he said.

But Wells, who credited Rizzo for leading the charge to repair the refuge, said federal officials could have fixed the vulnerable dunes years ago and avoided that catastrophe that drowned the marshes and ultimately poisoned the edges of his fertile fields.

"It's a shame," Wells said. "It's not just a few trees. It's a heritage and highly productive farm land. It's livelihoods."

Since the breaches at Fowler were fixed in 2015, as part of a \$38 million restoration project at the refuge supported by emergency funding from Superstorm Sandy, saltwater has not reached Wells' 126-acre farm on the south side of Fowler Beach Road, he said.

"But the damage is done," he said.
"It'll take generations to get this salt out of the ground."

Even the lowest sea-level rise projections used by state officials show that up to 97% of Delaware's marshes, which soak up rising tides and storm surges, are at risk of total drowning by the end of the century, according to a 2012 state study. The Mid-Atlantic may be a hot spot for ghost forests, partially because it is sinking.

About half of the sea-level rise in Delaware is due to climate change warming the ocean and melting glaciers exacerbated by greenhouse gas emissions. The other half is from subsidence, a natural

#### What is a ghost forest?

A ghost forest emerges when saltwater intrudes into a freshwater system, namely a freshwater tidal wetland that is often marked by specific vegetation and trees such as Atlantic white cedars.

When that saltwater gets into a freshwater system, most vegetation cannot survive. At a slow, natural pace, the ecosystem would convert to a saltwater marsh while the freshwater system regrows farther inland.

But as sea level accelerates, due to a warming and expanding ocean and melting glaciers driven by climate change and excess greenhouse gas emissions trapped in the atmosphere, that change takes place more rapidly. Some marshes can keep pace and migrate naturally. Others can't.

And if there are roads, buildings or developments blocking the marsh's natural retreat, that causes something scientists call "coastal squeeze" because there is nowhere for the marsh to go. That can result in marshes drowning and becoming open water.

When that happens, it reduces the natural flood-storage capacity of wetlands, which in turn protect property and infrastructure behind them during large storms.

process that has been underway for 20,000 years as ice sheets from the last ice age retreated and caused the region to begin sinking back into place.

Adding consistent damaging storm surge to future sea-level rise could spell trouble not only for coastal farmers like Wells, but also residential and commercial properties that benefit from the marshes that store floodwaters during storms, trap carbon and filter out pollutants. And as that salty water creeps ever inland, it also could threaten Delaware's vulnerable — and valuable — groundwater resources that provide farmers, businesses and residents with clean, fresh drinking water.

For the first time in recent history, Delaware Department of Agriculture officials have sent letters to a handful of Kent County farmers, urging them to test their water for the potential of intruding saltwater.

"When you lose those beaches to breaches and overwash, you lose everything behind them," Wells said. "I've been a farmer all my life. My father was a farmer all his life. My grandfather was a farmer all his life. His father was a farmer all his life. I have no intention of giving up. I'll fight to the last."

#### Land use changes an ecosystem

Farther north in Kent County, another ghost forest tells a story of what happens when humans try to engineer nature. The grayish stalks spotted along Cypress Branch, a tributary of the St. Jones River best seen from Cypress Branch Road, likely started dying in the 1930s, said Stephanie Stotts, an environmental scientist and professor at Wesley College.

In the mid-1920s, the U.S. Army Corps of Engineers straightened the St. Jones for navigation purposes, allowing the salty water from the Delaware Bay to move rapidly upstream.

"It's a bit of a unique ghost forest in that respect," she said. "Now you have this new habitat, which is the marsh, but with these relics, these dead, standing stumps. You can see what was once there but isn't there anymore."

The standing corpses are Atlantic white cedars. These trees were logged by settlers and coveted for their straight trunks that were ideal for Colonial ship masts, said Gerald Kauffman, director of the University of Delaware's Water Resources Center.

"What makes the Delaware Bay the

Delaware Bay is the Atlantic white cedar," Kauffman said.

"They are sentinels. They are early warning systems of what's occurring."

Now Stotts, through a National Science Foundation-supported research initiative called Project WiCCED (Water in the Changing Coastal Environment of Delaware), is studying what those trees' rings might have to say about what happened to them.

They could also shed light on how trees respond to salt, how long it takes for a ghost forest to become a ghost forest and what might signal that impending change, Stotts said.

That, in turn, may help experts decide where land could be preserved and how experts might help marshes and forested wetlands migrate inland and keep pace with sea-level rise.

She also will seek any kind of signal that shows how rings — which signify each year of a tree's growth — are impacted by changes in climate, salinity and other factors.

"They're a constant and visual reminder that we are at risk," Stotts said.

"Because we are so low-lying, we're going to have much greater impact from climate change because of the sea-level rise. That is going to impact us in the very near future. It's already impacting us."

#### A Mid-Atlantic hot spot

Across the Delaware Bay, the ghost forests of New Jersey tell the story of a changing climate.

Many of the trees on the Jersey Bayshore also are Atlantic white cedars, said LeeAnn Haaf with the Partnership for the Delaware Estuary. It's a swamp species that spends most of its life with roots immersed in fresh water. Saltwater pushed in from storms or other influences cause them to rapidly die off.

"You can definitely see in midsummer these trees that should be green or growing, but they're just standing in the middle of the marsh-like toothpicks," said Haaf, who is the estuary program's wetland coordinator. "They're a sign that not only has sea level been rising for a long time, but as we see more dead trees, that it's rising faster in areas that never had salt before."

Delaware-based studies have discovered a net loss of more than 3,000 acres of wetlands from 1992 to 2007. An update study conducted by the Delaware Department of Natural Resources and Environmental Control found significant changes in First State wetlands, especially along the mid-portions of the

Delaware Bay, where more than 300 acres were lost between 2007 and 2012.

DNREC scientists are now updating their wetlands inventory. The results should be available by year's end.

But on the other side of Delaware in the Chesapeake Bay, researchers like Kirwan with the Virginia Institute of Marine Science also are seeing rapid changes in wetlands. In the last 150 years, about 100,000 acres of dry land in the Chesapeake Bay — which is very similar to the Delaware Bay ecologically — have been converted to wetlands.

"That is significant because the dry land is usable, it's farmable, people live there," Kirwan said.

"Converting to wetlands is really good ecologically, but comes at a cost to the people that live in those areas."

In some areas, marshes will be able to migrate if they're not trapped by high slopes or the roads or buildings of development. In other areas like the ghost forest along Cypress Branch, reforestation efforts could help.

Still, some land vulnerable to sealevel rise will ultimately be reclaimed by Mother Nature. That's what happened with the dry land on the Eastern Shore of Maryland where Kirwan's greatgreat-grandmother lived. It is now marshland and ghost forest, the family farm fields long abandoned to the salt.

"All of this takes place just slowly enough that if you're not looking out for it, you won't notice it," Kirwan said. "But it's fast enough that you could ask your grandparents about it."

That rapid change is not limited to the Delaware Bay or Chesapeake Bay. It's a signal for all coastal communities at risk of future sea-level rise that future decisions about building, farming and where they get their drinking water may have to rely on changing tides.

"For me, sea-level rise and coastal flooding is the single biggest water issue we have in the state of Delaware, both economically and also how it affects people's personal lives and industry," Kauffman said. "These reminders from nature are good to keep us aware."

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