

Florida's Sinkholes

Sinkhole: A circular depression in a karst area. Its drainage is subterranean, its size is measured in meters or tens of meters, and it is commonly funnel-shaped. Syn: doline; sink.

(from Bates and Jackson, *Dictionary of Geological terms.*)



FLORIDA GEOLOGICAL SURVEY
Poster No. 11

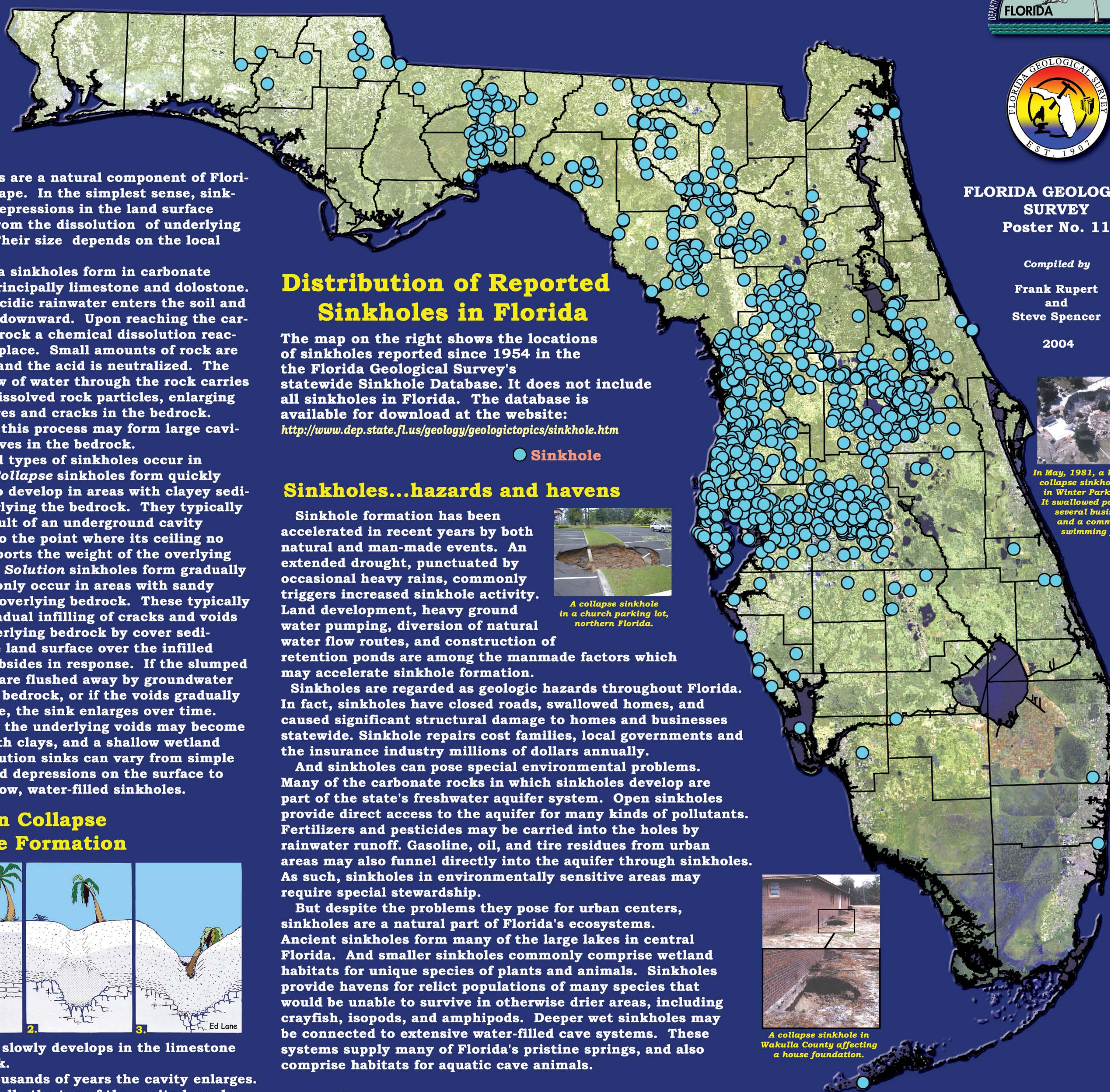
Compiled by

Frank Rupert
and
Steve Spencer

2004



In May, 1981, a large cover-collapse sinkhole opened in Winter Park, Florida. It swallowed portions of several businesses and a community swimming pool.



Distribution of Reported Sinkholes in Florida

The map on the right shows the locations of sinkholes reported since 1954 in the the Florida Geological Survey's statewide Sinkhole Database. It does not include all sinkholes in Florida. The database is available for download at the website: <http://www.dep.state.fl.us/geology/geologytopics/sinkhole.htm>

● Sinkhole

Sinkholes...hazards and havens

Sinkhole formation has been accelerated in recent years by both natural and man-made events. An extended drought, punctuated by occasional heavy rains, commonly triggers increased sinkhole activity. Land development, heavy ground water pumping, diversion of natural water flow routes, and construction of retention ponds are among the manmade factors which may accelerate sinkhole formation.



A collapse sinkhole in a church parking lot, northern Florida.

Sinkholes are regarded as geologic hazards throughout Florida. In fact, sinkholes have closed roads, swallowed homes, and caused significant structural damage to homes and businesses statewide. Sinkhole repairs cost families, local governments and the insurance industry millions of dollars annually.

And sinkholes can pose special environmental problems. Many of the carbonate rocks in which sinkholes develop are part of the state's freshwater aquifer system. Open sinkholes provide direct access to the aquifer for many kinds of pollutants. Fertilizers and pesticides may be carried into the holes by rainwater runoff. Gasoline, oil, and tire residues from urban areas may also funnel directly into the aquifer through sinkholes. As such, sinkholes in environmentally sensitive areas may require special stewardship.

But despite the problems they pose for urban centers, sinkholes are a natural part of Florida's ecosystems. Ancient sinkholes form many of the large lakes in central Florida. And smaller sinkholes commonly comprise wetland habitats for unique species of plants and animals. Sinkholes provide havens for relict populations of many species that would be unable to survive in otherwise drier areas, including crayfish, isopods, and amphipods. Deeper wet sinkholes may be connected to extensive water-filled cave systems. These systems supply many of Florida's pristine springs, and also comprise habitats for aquatic cave animals.



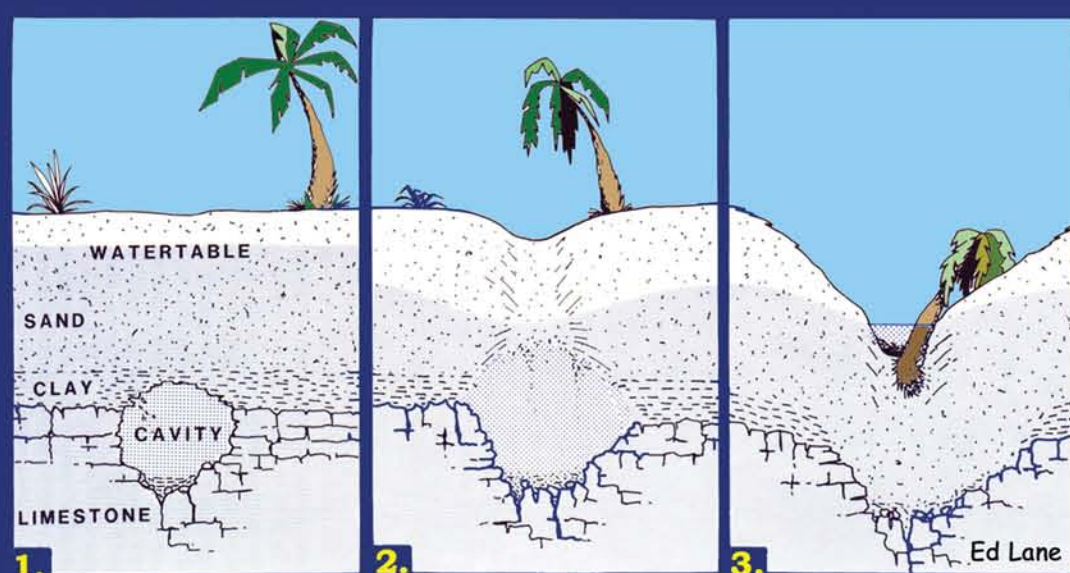
A collapse sinkhole in Wakulla County affecting a house foundation.

Sinkholes are a natural component of Florida's landscape. In the simplest sense, sinkholes are depressions in the land surface resulting from the dissolution of underlying bedrock. Their size depends on the local geology.

In Florida sinkholes form in carbonate bedrock, principally limestone and dolostone. Naturally acidic rainwater enters the soil and percolates downward. Upon reaching the carbonate bedrock a chemical dissolution reaction takes place. Small amounts of rock are dissolved, and the acid is neutralized. The natural flow of water through the rock carries away the dissolved rock particles, enlarging natural pores and cracks in the bedrock. Over time, this process may form large cavities and caves in the bedrock.

Two broad types of sinkholes occur in Florida. *Collapse* sinkholes form quickly and tend to develop in areas with clayey sediments overlying the bedrock. They typically are the result of an underground cavity enlarging to the point where its ceiling no longer supports the weight of the overlying sediments. *Solution* sinkholes form gradually and commonly occur in areas with sandy sediments overlying bedrock. These typically form by gradual infilling of cracks and voids in the underlying bedrock by cover sediments. The land surface over the infilled bedrock subsides in response. If the slumped sediments are flushed away by groundwater flow in the bedrock, or if the voids gradually grow in size, the sink enlarges over time. Sometimes the underlying voids may become plugged with clays, and a shallow wetland forms. Solution sinks can vary from simple bowl-shaped depressions on the surface to open, shallow, water-filled sinkholes.

Stages in Collapse Sinkhole Formation



1. A cavity slowly develops in the limestone bedrock.
2. Over thousands of years the cavity enlarges. Eventually the top of the cavity breaches the limestone surface. Overlying clayey sediments slump into the cavity and a depression at the surface may precede collapse.
3. Catastrophic collapse of the cover sediments into the underlying cavity, forming a hole at the land surface. If the local water table is high the hole may fill with water.



Although sinkholes commonly form over points of increased bedrock dissolution, such as fracture intersections, they are not necessarily isolated events. The photo above was taken at the Haile quarry in Alachua County. It shows quite dramatically the extent and interconnected nature of dissolution cavities and pipes in some regions of Florida.

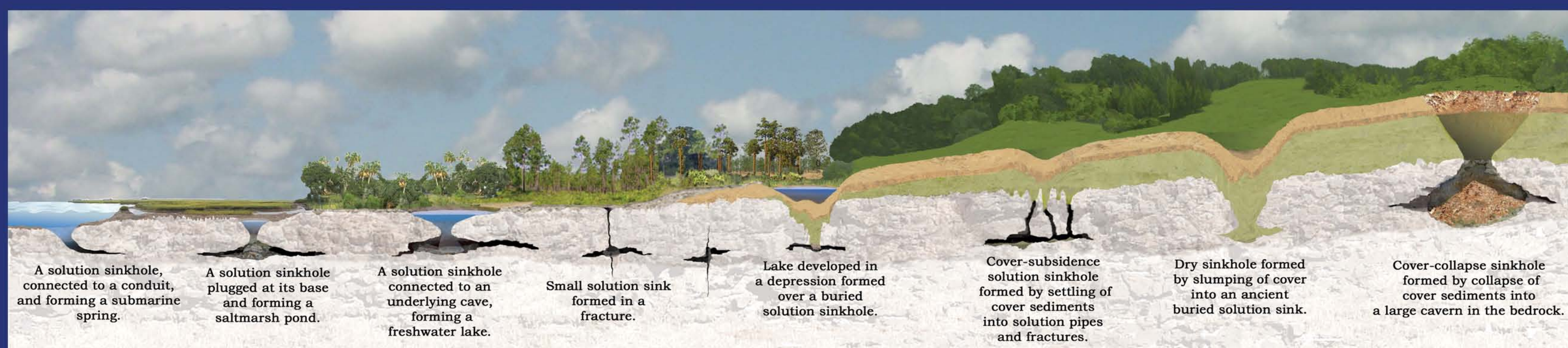
SINKHOLE ZONES IN FLORIDA

(from Florida Geological Survey Map Series No. 110, Sinkhole Type, Development and Distribution in Florida)

- Region of exposed or thinly-covered carbonate rocks. Broad, shallow solution sinkholes dominate, with less common collapse sinkholes in areas with thicker overburden sediments.
- Region of incohesive, permeable sand ranging from 20 to 200 feet thick. Small cover subsidence sinkholes dominate, with less-common collapse sinkholes forming in areas with clayey overburden sediments.
- Region of cohesive, low-permeability clayey sediments 30 to 200 feet thick. Abruptly-forming collapse sinkholes dominate. The size of these sinkholes depends upon the thickness and bearing properties of the overburden sediments.
- Region of deeply-buried carbonate rocks. Overburden sediments are primarily cohesive clayey sands and interbedded carbonates in excess of 200 feet thick. Sinkholes are uncommon, but rare deep collapse types and small subsidence sinkholes formed in shallow shell beds or carbonate lenses are possible.

Types of Sinkholes in Florida

The cross section (right) illustrates the common forms of sinkholes in Florida. Their type and abundance depend on the local geology.



A solution sinkhole, connected to a conduit, and forming a submarine spring.

A solution sinkhole plugged at its base and forming a saltmarsh pond.

A solution sinkhole connected to an underlying cave, forming a freshwater lake.

Small solution sink formed in a fracture.

Lake developed in a depression formed over a buried solution sinkhole.

Cover-subsidence solution sinkhole formed by settling of cover sediments into solution pipes and fractures.

Dry sinkhole formed by slumping of cover into an ancient buried solution sink.

Cover-collapse sinkhole formed by collapse of cover sediments into a large cavern in the bedrock.