# The science of sinkholes

March 6 2013, by Jessica Robertson

Sinkhole in Frederick, Maryland.

A devastating sinkhole occurred in Florida on February 28, 2013, raising questions and concerns about this incredible phenomenon. Around 20% of the U.S. lies in areas susceptible to sinkhole events, highlighting the need for research and to be informed about this hazard.

## What is a sinkhole?

Geologically, a sinkhole is a depression in the ground that has no natural external surface drainage. Basically this means that when it rains, all of the water stays inside the sinkhole and typically drains into the subsurface.

Sinkholes are most common in what geologists call, "karst terrain." What's that? These are regions where the type of rock below the land surface can naturally be dissolved by groundwater circulating through them. Soluble rocks include salt beds and domes, gypsum, and limestone and other carbonate rock. Florida, for instance, is an area largely underlain by limestone and is highly susceptible to sinkholes.

When water from rainfall moves down through the soil, these types of rock begin to dissolve and spaces and caverns develop underground. Sinkholes are dramatic because the land usually stays intact for a period of time until the underground spaces just get too big. If there is not enough support for the land above the spaces, then a sudden collapse of the land surface can occur.

Keep in mind though that while collapses are more frequent after intense rainstorms, there is some evidence that droughts play a role as well. Areas where water levels have lowered suddenly are more prone to collapse formation.

### Areas most susceptible

About 20% of our country is underlain by "karst terrain" and is susceptible to a sinkhole event. The most damage from sinkholes tends to occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania.

## Different types and various severities

Sinkholes can be characterized into two types. First, there are cover-collapse sinkholes, which can develop abruptly (over a period of hours) and cause catastrophic damages. Secondly, there are cover-subsidence sinkholes, which form slowly over time with the ground gradually subsiding or deflating. These types of events can be less noticeable and go undetected for long periods.

Sinkhole collapses can range in size and severity. Sinkholes can vary from a few feet to hundreds of acres and from less than one to more than 100 feet deep. Sinkholes can have dramatic effects, especially in urban settings. They can contaminate water resources and have been seen to swallow up swimming pools, parts of roadways, and even buildings.

## Is there a sinkhole on your property?

This is a difficult question, and unfortunately there isn't a very efficient system to determine this quite yet. It is recommended that people constantly observe their property for things such as small holes in the ground or cracks formed in a structure's foundation. People can also check to see if they live in areas underlain by soluble rock, and they can do so by checking with county offices, local or state geological surveys, or the USGS.

## Even humans cause sinkholes

While sinkhole collapses are frequent in karst areas, there are a variety of other circumstances that can lead to such events. Many sinkholes form from human activity. Collapses can occur above old mines, from leaky faucets, when sewers give way, or due to groundwater pumping and construction.

Think about all the changes that occur when water-drainage patterns are

altered and new systems are developed. And when industrial and runoff-storage ponds are created, the resulting substantial weight of the new material can trigger an underground collapse of supporting material.

Aquifer systems are another factor in sinkholes. The sediment above the aquifer system may be delicately balanced by ground-water fluid pressure, meaning that the water below ground is actually helping to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes. If pumping results in a lowering of groundwater levels, then underground structures could fail and thus sinkholes can occur.

## Start with USGS science

Starting with science is important to understanding where sinkholes are likely to occur and making the best decisions to protect life and property. Scientists at the U.S. Geological Survey (USGS) play a key role by developing geologic maps of the nation.

By mapping the nation, the USGS contributes important geologic and topographic information needed to understand karst regions and local areas. Detailed geologic mapping helps to define areas of soluble rock at the surface and in the subsurface, thus educating the land planners, policy makers, and the public about sinkhole risk.

These USGS maps and data are essential to many other purposes, including assessing ground-water quality and contamination risks; predicting earthquake, volcano, and landslide hazards; characterizing energy and mineral resources and their extraction costs; waste repository siting; land management and land-use planning; and general education.

Learn more about sinkholes by reading an online overview story or a USGS fact sheet.

Provided by United States Geological Survey