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Factsheet

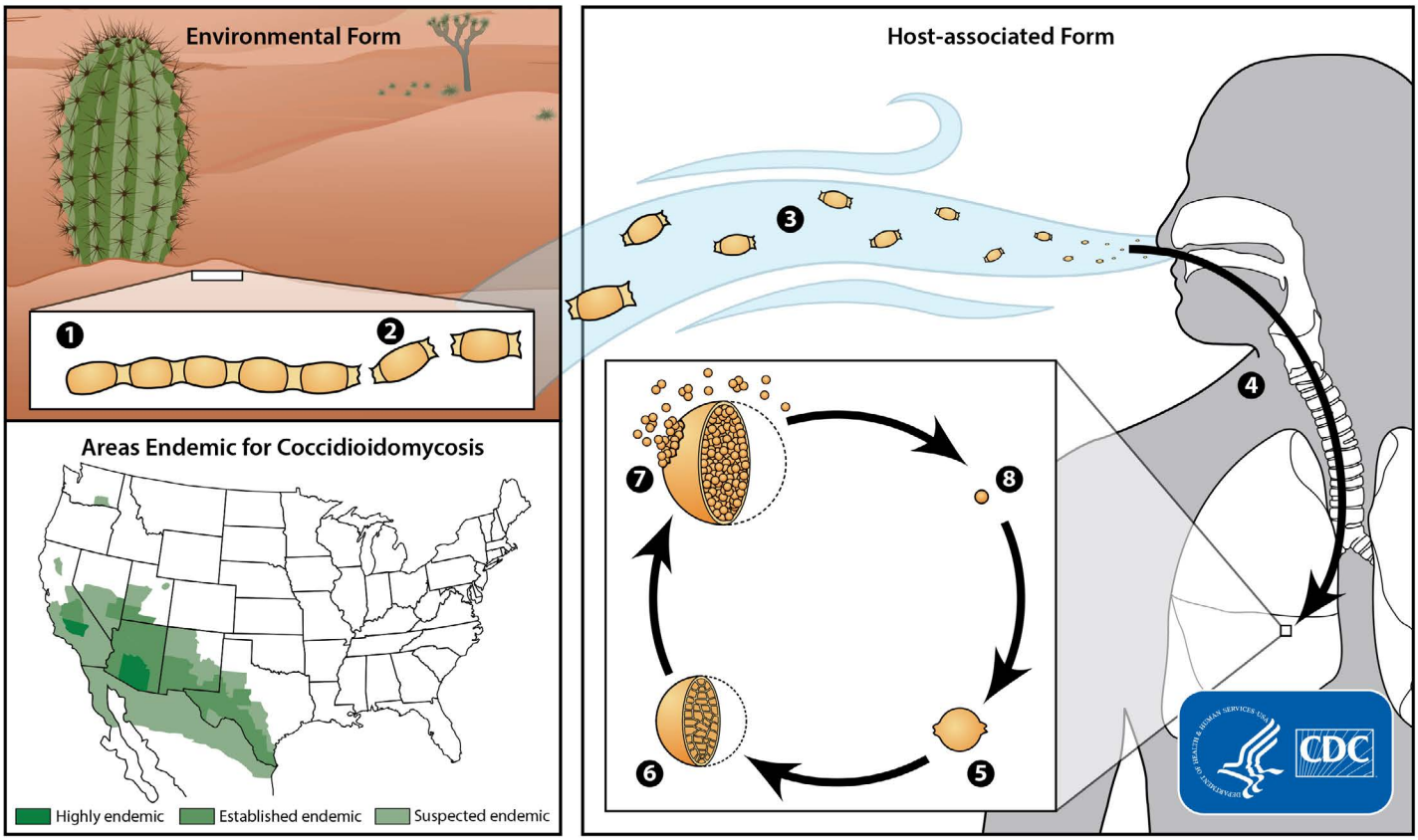
Valley Fever: A Health Hazard in Southwestern Soils

Valley fever risks can be better managed by understanding soils and desert surfaces

What grows in arid, sandy soils? How do these soils become dust?

Many small organisms, such as bacteria and fungi, grow among the sand and silt particles in dry valley and desert soils. At the soil's surface, these organisms often form biological webs ("microbiotic crusts") that keep small sand and silt particles from blowing away. In other places, desert soil surfaces are held together by small, closely packed rocks ("desert pavement") or by salt crusts. These soil surfaces are resistant to strong winds, droughts, and temperature extremes, but vulnerable to mechanical disturbances such as human foot traffic, cars, or grazing cattle. When these soil surfaces are destroyed, they erode more easily and are more likely to release dust into the air. This dust is composed of small particles of sand, minerals, and pieces of the organisms that were growing in the soil. While most organisms growing in desert soils are not harmful, spores from the *Coccidioides* fungus, when inhaled, can cause an infection called valley fever (Coccidioidomycosis).

Understanding the conditions that enable the *Coccidioides* fungus to grow and tracking the processes that release it into dust can help with managing valley fever risks to people and communities.



In soils, *Coccidioides* grows as a chain-like mold (1). When disturbed, the mold chains fragment into smaller spores (2), which may be inhaled. In the lungs of an infected person, the fungus grows and spreads (5 to 8) but is not contagious. Bottom-left: map of areas where *Coccidioides* is common ("endemic"). Image Credit: Centers for Disease Control and Prevention

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When and where does *Coccidioides* grow?

Coccidioides is found in desert soils throughout the southwestern United States, as well as parts of eastern Washington (Figure 1). The specific locations where Coccidioides is actively present range in size from roughly 200 square feet to more than a square mile. The geological and environmental factors that are thought to determine whether *Coccidioides* can grow are:

- **Soil composition**. *Coccidioides* thrives in well-drained, salt-rich desert and valley soils made of very fine sand and silt particles. Scientists are currently studying whether it can grow in desert soils covered with microbiotic crusts, or if it only grows in disturbed soils, information that will help improve land management decisions in the future.
- **Temperature and moisture**. Climatically, *Coccidioides* prefers arid regions with hot and dry summers, cold winters, and little rainfall.
- **Distinct wet-dry seasons**. *Coccidioides* seems to be more abundant in areas with distinct wet and dry periods. Seasonally, *Coccidioides* outbreaks often occur during the dry seasons that follow particularly wet periods.
- **Presence of rodents**. Rodent burrows are one risk factor that suggests *Coccidioides* may be present in a specific location.
- **Agriculture**. *Coccidioides* typically does not grow in tilled and irrigated farmland.

How can dust generation be reduced?

The best way to prevent dust is to minimize the destruction of soils in deserts and semi-arid regions, especially in open areas that depend on microbiotic crusts or desert pavement for stability. This can be achieved by:

- **Location**. Roads and other infrastructure can be built in less sensitive areas, with carefully designed runoff drainage to prevent erosion. Other effective measures include limiting recreational use to specific, concentrated-use areas like well-marked campsites and hiking trails, and avoiding the disruption of desert surfaces in steeper areas, which are more prone to erosion.
- **Timing of disruptive activity**. Desert surfaces, especially microbiotic crusts, are less vulnerable during the winter or fall, especially when the ground is frozen. Microbiotic crusts are especially vulnerable during the dry season.

The environmental and geological conditions at a given location can be determined using freely available maps and online resources, like soil maps from the U.S. Geological Survey (USGS) and U.S. Department of Agriculture (USDA), and climate databases from the National Oceanic and Atmospheric Administration (NOAA). Together, these tools can be used to help assess *Coccidioides* risk in any given location. In areas that are likely to be Coccidioides positive, the safest option is to avoid any non-essential activity that may disturb the soils, and when this is not possible, to closely follow the safety precautions recommended by the Centers for Disease Control and Prevention. To minimize health impacts, including the risk of valley fever, many communities require dust management plans for large-scale disturbances of desert and dry valley soils.

How can geoscience help prevent exposure to the valley fever fungus?

The geosciences can help manage valley fever risks by:

- Helping land managers, industrial planners, and the outdoors community identify locations that, based on their geological and environmental characteristics, are likely to have the *Coccidioides* fungus present in the soil.
- Helping design essential infrastructure in areas likely to have *Coccidioides* present so as to minimize soil surface damage and erosion.
- Using atmospheric modeling to understand how soil disturbance and dust formation in one location will disperse and affect downwind communities or recreational areas.

References

For a complete listing of references and even more resources please visit the web version of this factsheet at www.americangeosciences.org/critical-issues/factsheet/valley-fever

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