

HOW TO LIVE WITHOUT FOOD + The Gene-Patent War + 25 Geek Trips

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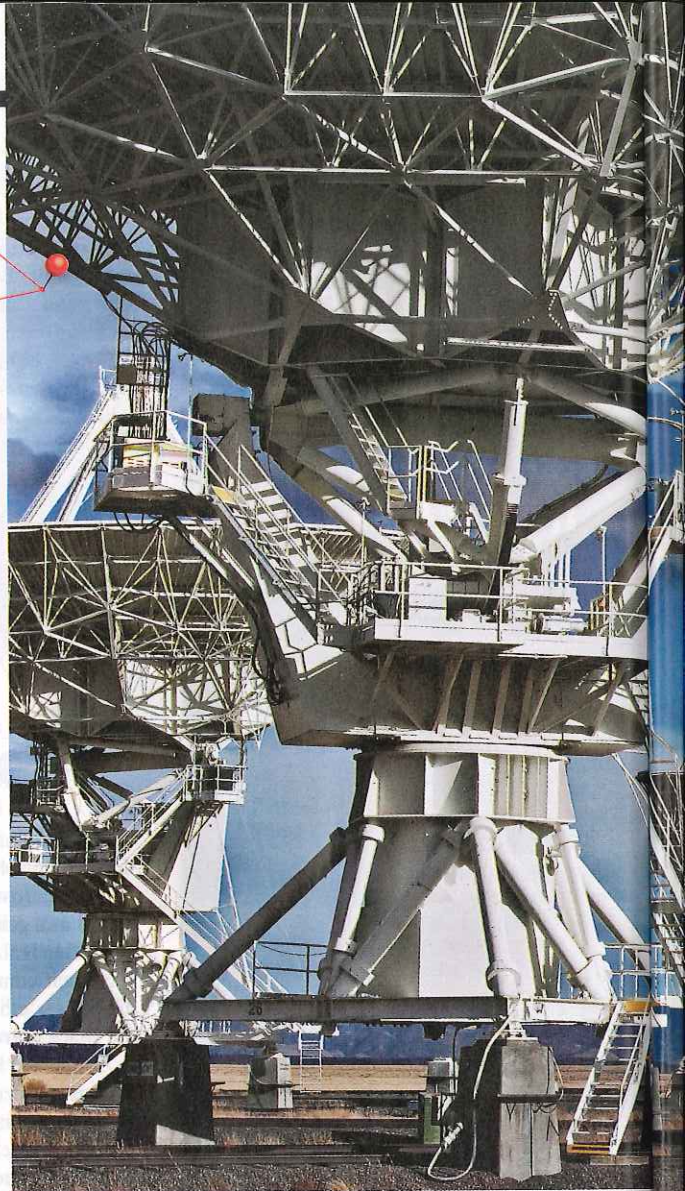
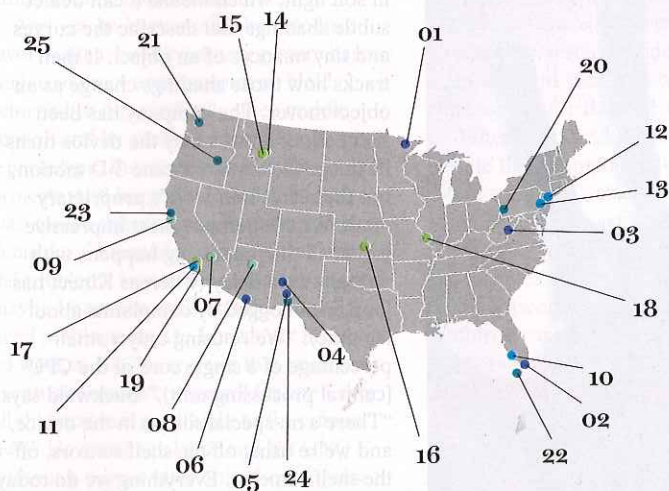
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ANTHONY BEASLEY
520 EDGE MONT RD
CHARLOTTESVILLE VA 22903-2454

STORY BY GEOFF MANAUGH AND NICOLA TWILLEY

Popular Science
PRESENTS

THE BEST NERD ROAD TRIPS

*Twenty-five curious, mysterious,
or otherwise beguiling
destinations to satisfy your
inner science-history geek*



I N THE
PAST 16 MONTHS,

writers Geoff Manaugh and Nicola Twilley have toured 150 of the built, natural, and virtual landscapes of the United States, collecting images and interviews. They call the project Venue, and they are documenting their progress at v-e-n-u-e.com. For POPULAR SCIENCE, they selected 25 of their favorite sites, each one open to the public and perfect for a late-summer road trip.



01 SOUDAN UNDERGROUND MINE STATE PARK SOUDAN, MINNESOTA

N 47.819302 / W 92.242954

This 19th-century iron mine in the boreal forests of Minnesota has been repurposed as one of the deepest physics experiments in North America—and the deepest that's open to the public. In this subterranean lab, a neutrino detector looks for changes in subatomic particles emitted 460 miles away at the



SPACE AGE

04 VERY LARGE ARRAY

SOCORRO, NEW MEXICO

N 34.078700 / W 107.618251

The **Very Large Array** is a 20-mile-wide collection of 27 radio telescopes trained permanently on the skies above. Astronomers have used the glinting white receiving dishes to make discoveries for decades—including ice on Mercury and microquasars. Signage along a walk amid the telescopes illustrates how vehicles push the 230-ton dishes over 40 miles of rails into four observing configurations.

Visitor center and museum open daily, 8:30 a.m.–sunset, with guided tours on the first Saturday of each month. Free.

Fermilab particle accelerator. Another experiment searches for dark matter. Visitors take a three-minute mine-cage ride for a physics lesson half a mile below the Earth.

Open daily until September 30, 2013; check website for hours and tour times. Adults: \$12.

02 AEROJET-DADE ROCKET FACILITY HOMESTEAD, FLORIDA

N 25.362118 / W 80.562392

A three-mile walk down a closed road in the Everglades leads to the unprotected remains of an abandoned rocket factory—including the shell of the largest solid-fuel rocket booster ever built, still sealed inside its 150-foot-deep test silo. The aerospace company Aerojet built the facility in 1963 to produce four test rockets for the space program. Aerojet tested three boosters, nose

down, with massive detonations that could be seen 80 miles away. But after NASA decided the liquid-fuel Saturn rockets would perform better in space, Aerojet walked away from the project, leaving filing cabinets, ignition panels, and the case of the fourth solid-fuel rocket booster rusting in the swamp.

Enter at your own risk. Free.

03 NATIONAL RADIO QUIET ZONE WEST VIRGINIA–VIRGINIA BORDERLANDS

N 38.430791 / W 79.818249

The U.S. enforces strict limits on the placement and broadcast power of cellphone towers and other transmitters over 13,000 square miles in the Appalachian Mountains. In the National Radio Quiet Zone, the Green Bank Telescope searches



the radio universe for targets like star-forming clumps of gas. Nearby, the Naval Information Operations Command is used by the National Security Administration to intercept international communications. The zone has also become a haven for people who claim to suffer from electromagnetic sensitivity.

Free.



The National Radio Quiet Zone covers an area the size of Maryland.

THE BEST NERD ROAD TRIPS



05 SPACEPORT AMERICA SIERRA COUNTY, NEW MEXICO

N 32.990308 / W 106.975261

Virgin Galactic plans to offer 20 minutes at the edge of space as early as next year for a mere \$250,000. Those without money to burn will have to settle for ticketed tours of the firm's future spaceport. So far, the facility consists of a dual-purpose hangar and terminal designed by architect Norman Foster; a smaller dome that houses administrative offices and the air, fire, and rescue team; and a 12,000-foot runway named after former New Mexico governor Bill Richardson, who in 2005 helped pass the legislation that allowed construction of the world's first commercial spaceport.

Tours twice daily Friday–Saturday, once daily on Sundays. Adults: \$59.

06 MCMATH-PIERCE SOLAR TELESCOPE TUCSON, ARIZONA

N 31.959158 / W 111.598046

Once inside the doorway at the base of a 100-foot-tall white triangle, visitors find themselves inside the world's largest solar telescope. The aboveground structure points skyward; belowground the building stretches another 300 feet. The McMath-Pierce telescope is singular but not alone: There are more than two dozen astronomical instruments on Kitt Peak, a windy mountaintop 40 miles west of Tucson.

Tours daily, but check website for restrictions. Adults: \$8; the self-guided tour is free.



The body of McMath-Pierce solar telescope points due north, angled at about 32 degrees—Kitt Peak's latitude. A mirror at the top of the building's hypotenuse reflects an image of the sun into the telescope. The mirror rotates throughout the day to follow the sun across the sky.



07 FORT IRWIN NATIONAL TRAINING CENTER FORT IRWIN, CALIFORNIA

N 35.349436 / W 116.594167

Prior to combat deployment, units of the U.S. military spend a few weeks at Fort Irwin, a base in the Mojave Desert the size of Rhode Island. There, they simulate combat, clearing tunnels, performing house-to-house sweeps, and reacting to carefully choreographed car bombs. Visitors watch soldiers move through the dusty streets of 11 fake towns built from shipping containers.

Twice-monthly tours fill up quickly. Free.

08 CINDER LAKE FLAGSTAFF, ARIZONA

N 35.322496 / W 111.518140

In 1967, NASA engineers unleashed a four-day aerial-bombing campaign in the black cinder remains of an ancient volcanic field 11 miles northeast of Flagstaff. Their goal was to duplicate the precise landscape of craters found in the Sea of Tranquility, where Apollo astronauts would land two years later. Fully suited astronauts drove prototype lunar rovers, practiced their routes for extravehicular excursions, and tested geologic equipment. Today, intrepid visitors can hike half a mile from a small parking area on Forest



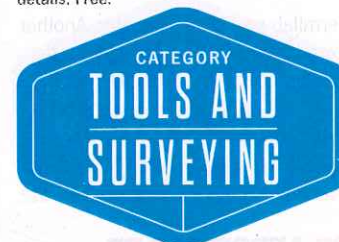
Road 776 to explore the rapidly weathering Apollo-era pockmarks. With careful planning, a modern-day explorer could even re-create Neil Armstrong's first steps. Free.

09 BAY MODEL SAUSALITO, CALIFORNIA

N 37.864216 / W 122.495370

Opened in 1957, the Bay Model served for decades as an analog calculator for high tides and storm surges in the San Francisco Bay. The Army Corps of Engineers still fills the 1.5-acre scale model with flowing water, but as an educational tool and tourist attraction in a waterfront warehouse in Sausalito.

Hours are seasonal; check website for details. Free.



10 KORESHAN STATE HISTORIC SITE ESTERO, FLORIDA

N 26.433601 / W 81.812155

In 1894, a "hollow Earth" cult called the Koreschan Unity Foundation settled on a homestead near what is now Naples, Florida. Cult members believed the Earth was round but hollow and that humans lived on the inside, with the sun at the center. Members took to the wide sandy beaches near Naples to try to measure the planet's curvature, using



TOOLS AND SURVEYING

13 MERCER MUSEUM

DOYLESTOWN, PENNSYLVANIA

N 40.30784 / W 75.127198

What did buckets look like before machines could stamp them out of steel? Henry Mercer, 19th-century gentleman anthropologist, thought future generations ought to know. So he collected the preindustrial tools of everyday life as they were becoming obsolete: tiny butter molds, car-size threshing machines, and, yes, wooden buckets, three feet across and made from the hollow trunks of black gum trees. Today, 40,000 objects are on display in a soaring poured-in-place concrete castle that Mercer built near his home. The sprawling collection is housed behind glass, propped up against walls, and even strapped to arches, banisters, and ceilings.

Open Monday–Saturday 10 a.m.–5 p.m. and Sundays 12–5 p.m.

Adults: \$12.



This “Vampire Killing Kit,” a leather-covered briefcase whose contents include flowers of garlic, engraved bullets, and lead balls, is displayed in a hallway outside the museum proper. It was removed from the collection when 21st-century scholarship concluded it was a fake, likely assembled in the mid-1900s and donated to the museum.

their purpose-built “rectilineator.” The site is now a small state park, preserving for curious visitors the Koreschan Unity houses, general store, and other structures.

Open year-round, 8 a.m.–sunset. Adults: \$4.

11 CENTER FOR LAND USE INTERPRETATION CULVER CITY, CALIFORNIA

N 34.025906 / W 118.394825

From its small storefront gallery on Venice Boulevard, the Center for Land Use Interpretation is conducting an ambitious survey of America’s manmade environments. The Center curates rotating exhibitions, like a taxonomy of construction-site office trailers—shown in a temporary on-site office trailer. Visitors may come away with a new perspective on contemporary American civilization.

Open Friday–Sunday 12–5 p.m. and by appointment. Free.

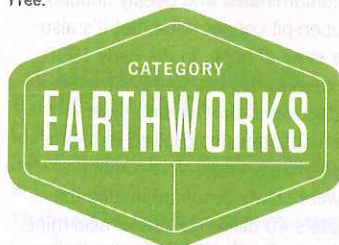
12 CENTRAL PARK BOLT NEW YORK CITY

N 40.769418 / W 73.973436

In the 1810s, before concrete and skyscrapers consumed Manhattan, surveyor John Randel laid out

the city’s future street grid. An unassuming iron bolt hammered into Central Park bedrock is one of the few remaining products of his work. It marks an intersection that never came to be: West 65th Street and Sixth Avenue.

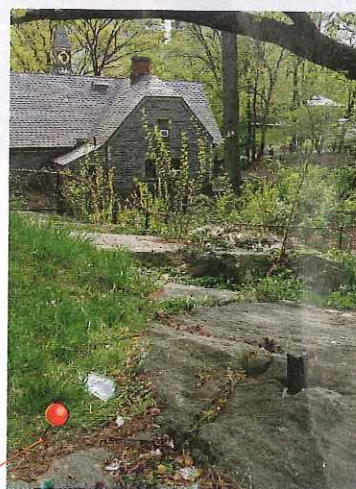
Free.



14 FREE ENTERPRISE RADON HEALTH MINE BOULDER, MONTANA

N 46.271749 / W 112.154152

Visitors to this former uranium mine pay to sit in lounge chairs 85 feet belowground and breathe the radon gas seeping from the tunnel’s rock walls. The facility, founded in 1952, is one of four radon-therapy sites in the U.S., all in Montana. Radon gas—emitted by radium, a radioactive byproduct of uranium—causes lung cancer in high doses. Here, exposed



Despite receiving no explicit attempts at preservation or historical signage, the Central Park bolt is now part of the National Spatial Reference System, a database of officially verified physical reference points that allow surveyors to demarcate land in the U.S.

to more moderate levels, radon bathers seek relief from arthritic, respiratory, and other chronic illnesses.

Hours are seasonal; check website for details. Treatment prices vary; a 60-minute visit costs \$8.

15 BERKELEY PIT BUTTE, MONTANA

N 46.017618 / W 112.512016

The Berkeley Pit may be a highly

CLOCKWISE FROM TOP LEFT: GEOFF MANAUGH AND NICOLA TWILLEY; GEOFF MANAUGH AND NICOLA TWILLEY; GEOFF MANAUGH AND NICOLA TWILLEY; GEOFF MANAUGH AND NICOLA TWILLEY; GEOFF MANAUGH AND NICOLA TWILLEY; GEOFF MANAUGH AND NICOLA TWILLEY; GEOFF MANAUGH AND NICOLA TWILLEY; GEOFF MANAUGH AND NICOLA TWILLEY; GEOFF MANAUGH AND NICOLA TWILLEY; GEOFF MANAUGH AND NICOLA TWILLEY

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EARTHWORKS

19 PUENTE HILLS LANDFILL

WHITTIER, CALIFORNIA

N 34.020261 / W 118.009300

Puente Hills is a 500-foot-tall mountain built from 130 million tons of Los Angeles County trash, given shape by garbage-moving heavy machinery and contaminant-sealing geotextiles. Before the recession, the site took in more daily trash than any other U.S. landfill. Today, visitors watch engineers sculpt each day's deliveries into a terraced landscape. Puente Hills will close its gates on October 31, when its permit expires. The sanitation department will divert trash to other nearby dumps, including the Mesquite Regional Landfill—a site whose 20,000-tons-a-day capacity should last a century.

Occasional free public tours (or you can pay to dump).

contaminated and deeply flooded open-pit copper mine, but it's also a story of hope. In the early 1990s, chemists Donald and Andrea Stierle discovered that extremophiles—microorganisms evolved to endure seemingly impossible conditions—were slowly decontaminating the site's 40 billion gallons of acid-mine waste. They're now isolating those microorganisms for possible use in pharmaceuticals. A small viewing platform lets visitors look out over the dark waters—which are still so acidic they pose a lethal threat to geese unlucky enough to land there.

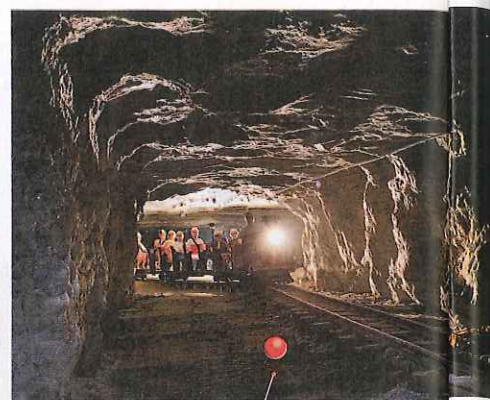
Open March–November (call for hours).

Adults: \$2.

16 STRATACA HUTCHINSON, KANSAS

N 38.043384 / W 97.867831

More than 650 feet beneath the prairie, Strataca—also known as the



Kansas Underground Salt Museum—offers tours of the cavernous tunnels created by miners extracting solid rock salt. The site is the only active salt mine in North America that's open to the public. Visitors see exhibits on the mechanics of a salt operation as they wander the glittering halls of what 275 million years ago was the bed of a Permian Age sea.

Open Tuesday–Saturday 9 a.m.–6 p.m.;
Sundays 1–6 p.m. Adults: \$14.

17 SAN ANDREAS FAULT PALMDALE, CALIFORNIA

N 34.562649 / W 118.132457

Heading north from Los Angeles to Palmdale, drivers will glimpse frozen crashing waves of rock, revealed by a roadcut on Highway 14. The undulations mark the San Andreas Fault, sliced open by California highway engineers and laid bare for the geologically curious. To get a better view than a drive-by affords, visitors can risk walking across some private land from nearby Pelona Vista Park and contemplate geology in action from the western edge of the cut.

Free.

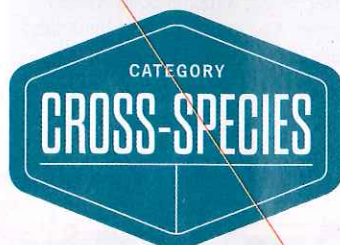
18 CAHOKIA MOUNDS STATE HISTORIC SITE COLLINSVILLE, ILLINOIS

N 38.655052 / W 90.059191

The largest pre-Columbian settlement north of Mexico, Cahokia Mounds is a broad meadow punctuated by nearly 90 artificial hills. The site has been studied by anthropologists since the 1960s. At its prime, 900 years ago, Cahokia was larger than London was at the time. Today, volunteers can help uncover American Indian history at ongoing archaeological excavations.

Hours are seasonal; check website for details. Recommended donation: \$7.

SPECIMEN VAULT



20 CENTER FOR POSTNATURAL HISTORY PITTSBURGH

N 40.465345 / W 79.944628

This artist-curated cabinet of Anthropocene curiosities displays organisms that have been altered by humans through methods like selective breeding and genetic engineering. In August, a new specimen will join the collection: a taxidermic goat from the BioSteel herd, engineered to produce spider-silk proteins in their milk. The proteins can be spun into fabric stronger than Kevlar.

Open Sundays 12–4 p.m., first Fridays of the month 6–9 p.m., and by appointment. Free.

21 THE POLLINATOR PATHWAY SEATTLE

N 47.609216 / W 122.316803

Still a work in progress, the Pollinator Pathway is a mile-long corridor of bee-, butterfly-, and hummingbird-friendly planting strips to help pollinators navigate between two of Seattle's green spaces. Artist Sarah Bergmann conceived the project in 2008 as a response to the honeybee-colony collapse. The garden plots will replace grass between the sidewalk and the street with a mix of 80 percent native plants for the pollinators and 20 percent decorative

ones for the people. Volunteers can help mulch and plant on organized work days in May and October. Free.

22 SUGARLOAF KEY BAT TOWER LOWER SUGARLOAF KEY, FLORIDA

N 24.649279 / W 81.572728

In 1929, Richter Clyde Perky had a mosquito problem at his fishing resort in the Florida Keys. Hoping to install mosquito-eating bats, he built this 30-foot wooden tower, complete with a louvered bat entrance, a central guano-removal chute, and cypress roosting shelves. All of his bats left. More than 80 years later, the tower still stands, an ignominious monument to biological pest control.

Free.

23 LUTHER BURBANK EXPERIMENTAL GARDENS SANTA ROSA, CALIFORNIA

N 38.435936 / W 122.711702

The most famous plant breeder and botanical inventor of his day, Burbank used four acres here as his home, seed vault, greenhouse, nursery, and experimental fields. From 1875 to 1926, Burbank introduced more than 800 new plant varieties to American growers—an achievement that inspired the Plant Patent Act of 1930. His Santa Rosa plum and Shasta daisy are still grown today, and his Burbank potato led to the Russet Burbank, the kind McDonald's makes into French fries.

Open Tuesday–Sunday, April–October, 10 a.m.–3:30 p.m. Adults: \$7.



24 CHILE PEPPER INSTITUTE GARDEN LAS CRUCES, NEW MEXICO

N 32.280094 / W 106.770462

In its demonstration garden, the nonprofit Chile Pepper Institute grows 150 pepper varieties, including the new world's hottest—the Trinidad Moruga Scorpion, packing 2 million Scoville heat units—and the former world recordholder—the Bhut Jolokia, deposed in 2011. The institute also grows heirloom and proprietary varieties.

Self-guided tours free; guided tours \$25 per person, reservations required.

25 THE HUMONGOUS FUNGUS MALHEUR NATIONAL FOREST, OREGON

N 44.489801 / W 118.484938

This honey mushroom is the world's largest organism, stretching across more than 2,300 acres of forest in eastern Oregon. Though underfoot, the *Armillaria ostoyae* fungus is hard to see: Its black filaments are one millimeter in diameter and woven like netting throughout the soil and beneath the bark of infected trees. In the fall, the gigantic organism produces fruit, sending out clusters of diminutive brown mushrooms.

Free.



The Chile Pepper Institute has developed a line of holiday-themed ornamental chiles, which it hopes will overtake flowers and candies as popular gifts. The Valentine chile [above] starts out cream-colored and gradually blushes to red, and the Easter peppers change from lavender to pale yellow to orange.