





# Resurrection



Even in the built-up San Francisco Bay Area, vestiges of the pristine past linger on ready to spring back to life. But first, says Sarah DeWeerd, you have to find them

Surprise: ecologists have discovered the secret wealth of San Francisco Bay's wetlands



AT FIRST GLANCE, you would probably mistake the place for a vacant lot in the semi-industrial landscape of southern San Francisco Bay. To the west lie giant industrial salt ponds; to the east, a profusion of freeways, power lines and hastily built Internet office parks. Until recently, most conservationists would have dismissed it as not worth their attention. Yet this patch of earth—once a horse pasture, before that a beet field—is one of the most precious ecological jewels in the Bay Area. It is a remnant of the seasonal, or vernal, pools that dotted the area before Europeans arrived.

This hidden treasure was recognized for what it is thanks to some extremely careful historical sleuthing by the San Francisco Estuary Institute (SFEI), a nonprofit environmental research center in Richmond, just across the bay from San Francisco. SFEI is a leader in the worldwide trend toward deeper, more thorough use of historical sources in habitat restoration. By piecing together old maps, settlers' journals and other historical sources often ignored by ecologists in the past, researchers at the institute mapped what the

Bay Area looked like when Europeans arrived about 200 years ago.

What they found suggests that the region's true ecological past looked a lot different from what people thought, and this in turn has changed what conservationists aim for in restoring native habitat. The maps also reveal that bits of the past still survive tucked in amid a seemingly random jumble of housing tracts, parking lots, warehouses and neglected fields.

Among these surprising survivors are the vernal pools. Most ecologists had thought the ponds found in the Bay Area today were not true vernal pools because such pools had never existed in the area. Yet according to SFEI's maps they once occupied a broad strip running along what is now Interstate 880 between the cities of Fremont and Hayward. "Once you see it on a map, you understand why those pools are there," says Carl Wilcox, a regional conservation planning manager with the California Department of Fish and Game. "If we hadn't had that historical picture, people wouldn't have realized what a unique remnant it is."

All attempts at restoration have to begin with at least a rudimentary notion of what the landscape once looked like, but few previous efforts can match the detailed, comprehensive view of an ecosystem's history provided by SFEI's maps. Part of a compilation called the Bay Area EcoAtlas, they illustrate features as small as 100 square metres, across a region encompassing almost 4000 square kilometres. The maps were produced for SFEI's Historical Ecology Project, initiated in 1993 by wetlands scientist Josh Collins to help guide conservationists in restoring the estuary. "Josh's insight was that there was a lot of mythology out there about how things used to be," says Robin Grossinger, another SFEI scientist. "There were always a couple of old documents used in restoration planning, but they got over-interpreted. The story changes if you go through a lot of historical sources."

### Army of volunteers

Information from over 1000 documents has gone into the maps. These sources include 18th and 19th-century maps, paintings, photographs, pamphlets on local history, interviews with elderly residents, and journals of explorers, settlers and early naturalists. It took Grossinger, other scientists and an army of volunteers more than two years of research to assemble the sources. "Resources were scattered throughout the community, in historical societies, attics and people's memories," Grossinger says. Previous workers had neglected historical documents, in part because of their uncertain accuracy. But SFEI cast a scientific eye on these records, and developed a system for scoring the likelihood—possible, probable or definite—of the presence, size and location of each feature of the landscape.

To make the maps, Grossinger and Elise Brewster, an artist and collaborator on the project, assembled layer upon layer of information from this profusion of sources. As Brewster drew the final copies of the maps, Grossinger sat beside her, annotating the sources and certainty of each line.

The basic history of the Bay Area is well known. When Spanish explorers sighted San Francisco Bay in 1769 it was an unbroken expanse of mudflats and marsh inundated twice daily by the tides—one of the largest estuaries in the world. Since then it has become a sprawling metropolis, home to 7 million people. But what exactly did those original marshes look like? The fragments that remain are relatively flat, homogenous plains lush with cordgrass and pickleweed, and well drained by tidal creeks that leave little standing water. Most experts assumed that's what the original marshes looked like too.

'SAN FRANCISCO BAY IS A SPRAWLING METROPOLIS, HOME TO 7 MILLION PEOPLE. WHAT DID THE ORIGINAL MARSHES LOOK LIKE?'



Restoring such marshes would benefit some of the Bay Area's nearly two dozen threatened and endangered species, such as the salt marsh harvest mouse and birds like the California clapper rail. Scientists also know that when Europeans started to settle the estuary it supported huge waterfowl populations: early settlers wrote that the sky darkened with ducks at a single rifle crack. Today, ducks and other waterfowl still inhabit the bay's drained marshes and industrial salt ponds. But if the marsh were returned to what was believed to be its original state, these habitats would be eliminated. So where exactly had these enormous flocks lived in the past?

SFEI's analysis yielded a totally different view of the marshes—a view that resolved some of these apparent conflicts. A series of maps made by the US Coast Survey in the 1850s and 60s showed the tidal marsh as a mosaic of interconnected habitats. Some areas did have numerous creeks and channels, while others were poorly drained and contained seasonal and permanent ponds of diverse shapes, sizes and salinities. Maps and records made by private hunting clubs identified some of these marsh ponds as key hunting grounds—in other words, excellent habitat for the huge flocks of ducks.

Moreover, herbarium records and the notebooks and journals of early naturalists showed that in some parts of the bay the



Back to life: restoring the marshes will benefit some of the Bay Area's nearly two dozen threatened and endangered species

landward edges of the early marshes were not generally steep, as they are today, but rather a gradual slope along which marsh vegetation gave way to a broad swath of transitional plants and then upland grasses. This transitional zone, which is not found in modern marshes, contained entire plant communities not found today, with more species than the marsh proper. "The EcoAtlas helped us understand that a natural marsh is not a sea of pickleweed. There's lots of habitat diversity within it," says Wilcox.

Other historical sources revealed an array of forgotten habitats that disappeared soon after Europeans settled. "In the 1870s to 1890s, people were already talking about how much had been lost," says Grossinger. "One hundred years later we have a very simplified view of the ecosystem." The Coast Survey maps, for example, showed sandy beach ridges, both within the tidal marsh and adjacent to it, that would have supported rare plants such as California salt-bush and northern salt marsh bird's beak, as well as shorebirds such as the endangered snowy plover. Spanish written accounts made frequent reference to "sauvals" or willow groves, which probably provided



habitat for songbirds and amphibians.

Now that ecologists know what to look for, they are finding unexpected bits of the past all over the urban landscape. "There are many habitats that are talked about now that previously weren't on anybody's radar screen," says Grossinger. "There's actually a lot more left than you would think." Once, these fragments would have seemed random. Now they look like opportunities.

In the early 1990s, when biologists began noticing vernal pool plants in pastures at the southern end of the Bay, they initially classified them as "erratic"—an ecological accident. A few years later, when real estate developers wanted to build an office park on a nearby 300-hectare parcel of old horse pasture in Fremont, biological surveys again turned up vernal pool plants. By then, SFEI had a rough draft of the EcoAtlas maps, as well as information from a 1913 soil survey that suggested these areas included old vernal pools. After a lengthy regulatory battle,

the developers were allowed to build on only 150 hectares, and agreed to restore the vernal pools on the other half of the parcel.

### A wilderness of tollbooths

Even in newly formed habitats, careful historical reconstruction can point to similar, long-vanished equivalents in the past. Over the past few years, for example, a series of beach ridges has grown up beside the eastern approach to the San Francisco-Oakland Bay Bridge, an area that to the untrained eye looks like a wilderness of tollbooths, asphalt and steel bridge pilings, with distant views of the downtown San Francisco skyline. SFEI's maps show that similar ridges once occurred at other locations in the bay with similar tides, currents and topography.

That link helped Peter Baye, a botanist with the US Fish and Wildlife Service, decide that the coarse, well-drained sand of the ridge tops would be a perfect habitat for California sea-blite. This obscure plant is now

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extinct in San Francisco Bay, but Baye hopes to reintroduce it beside the bridge and in half a dozen other sites around the bay where beach ridges might support it. Though he might quibble with a few details of SFEI's reconstruction, Baye says it has changed his vision of what species belong where in the bay. "And that's the holy grail of restoration—to know what habitats and species assemblages belong where, and what processes contribute to producing them," he says.

This changing vision of the value of history in ecological restoration is spreading well beyond the Bay Area. Similar efforts are under way for the rivers of the Seattle area, Chesapeake Bay, the Grand Canyon and other environments worldwide. In Britain, Ian Rotherham and his colleagues at Sheffield Hallam University are digging into the history of Britain's wetlands, woodlands and heaths. At Wharmcliffe Heath and Craggs near Sheffield, they have found that the heathland now preserved in this urban refuge probably formed after Roman workers destroyed the area's original soil as they quarried the quernstones used for grinding grain. "The landscape we see today is a complex overlaying of historical and ecological factors," says Rotherham.

This human role in creating habitat will be SFEI's next focus. "Every plant and animal community in the Bay Area has interacted with human beings for thousands of years," says Chuck Striplen, a Native American ecologist of the Ohlone tribe who is collaborating with SFEI to rediscover native land management practices.

Meanwhile, SFEI's maps have formed the basis for a comprehensive set of restoration goals in the Bay Area, and are influencing a variety of government and private restoration projects. The US Fish and Wildlife Service, for example, is now incorporating transitional zones into the marshes they restore, says Wilcox. Restorationists are also scooping out ponds at the back of newly created marshes to provide waterfowl habitat.

Thanks to SFEI and its careful study of history, the past is re-emerging around the bay, side by side with the 21st century and within sight of San Francisco's gleaming skyline. As Grossinger says, "The historical landscape is not as far away as it seems." □

Sarah DeWeerd is a writer based in Seattle