Despite the rising popularity of drones, open spaces haven't welcomed them with open arms. While the Federal Aviation Administration regulates the national airspace, concerns about privacy, safety, and wildlife disturbances have led many public land authorities to restrict unmanned aerial vehicles (UAVs) on their grounds. Ironically, the remote-control machines that are the bane of nature lovers can be a boon for land management and conservation.

Perhaps better known for military applications, UAVs can also help scientists gather images, environmental samples, and other data. In the Bay Area, these machines have proven useful for monitoring invasive plants, tracking restoration projects, and surveying wildlife. With high-resolution mapping capabilities, the devices have even played a role in restoring public access to places where the machines will never be allowed for recreational flying.

“Drones create a dual concern,” said Marc Landgraf, the external affairs manager for the Santa Clara Valley Open Space Authority. “Our mission is to give people a peaceful experience on our lands, but we also want to further scientific research within our open space preserves. So we don’t have an outright ban on drones. We have a permitting process that would allow the responsible use of UAVs for conservation research and law enforcement.”

The darker side of drone use has been spotlighted in reports of UAVs surveilling people, provoking eagles into attacking them, and starting fires with crash landings (as happened last year in Sunnyvale’s Baylands Park). Fortunately, there aren’t a lot of those incidents, said Lance Brede, a police lieutenant and watch commander for the East Bay Regional Park District. “We’ve had a ‘no model aircraft policy’ for years, so most situations are the result of people who simply aren’t aware that UAVs aren’t allowed,” he said.

Drones can also pose risks to other aircraft. Last year a California Highway Patrol helicopter in Martinez had a close call when a student flew a drone within feet of its windshield. A brand new study claims birds are far more likely than drones to collide with planes, but as Brede noted, “A two-pound bird can go through a windshield..."
Bird’s Eye View: Science from the Sky (from page 1)

like a missile. Imagine what a 50-pound drone could do.”

In research, though, UAVs offer an enticing way to efficiently and cost-effectively gather data. Beyond the high-profile studies that use drones to hunt for poachers in Africa or track illegal logging in the Amazon, many Bay Area scientists have tested how the machines perform on a variety of environmental projects.

In Tomales Bay, for example, scientists tried out unmanned aircraft systems for the mid-winter waterfowl survey. Conducted for more than 50 years, this survey uses piloted aircraft to fly transects across Tomales Bay and much of the San Francisco Bay, as well as regional sloughs, salt ponds, and marshes. The flights take several days and the accompanying ground counts take a couple of weeks, explained Orien Richmond, a biologist for the U.S. Fish and Wildlife Service. In collaboration with several other agencies, they found that UAVs provided high-resolution images for bird counts and identified species without unduly disturbing the birds.

“It’s really challenging for biologists in a plane to get accurate bird counts,” said Richmond. “They only have a couple of seconds to look down and estimate numbers and there might be multiple species in one area. Why risk putting biologists in the air, when unmanned systems could potentially get better data, more safely?” he asked. The danger is real — aviation accidents account for two-thirds of job-related deaths among wildlife biologists, according to one study.

UAV counts can be extremely precise, according to a just-released study by Australian researchers. Published in Scientific Reports, the researchers compared UAV-derived counts with those made at the same time by on-the-ground census takers for colonies of frigate birds, terns, and penguins. Moreover, the remote-control machines can survey hard-to-reach populations and places.

The U.S. Geological Survey has also used UAVs to count colonies of white pelicans in Nevada, estimate tule elk populations on the Carrizo Plain, and search for abandoned solid waste in the Mojave Desert.

One caveat to using drones in bird surveys — or any wildlife work — is to avoid disturbing the animals, particularly during breeding season. It isn’t only the startling sounds the UAVs make. Sometimes the shape of the machine mimics a predator. “That’s something recreational drone users may not be aware of,” noted Richmond. “For some birds — particularly sensitive colonial nesting species — individuals may abandon their nests following a disturbance, which can negatively impact populations.”

“It’s important to separate recreational drones from research use,” emphasized Sharon Dulava, a Humboldt State University master’s degree candidate who took part in the Tomales Bay bird survey. “Research projects are carefully planned to minimize those sorts of impacts. There are so many types of projects where UAVs could be safer, more cost effective, and less stressful for wildlife while we acquire valuable information. So we need to keep the door open [for research drones].”

One of the biggest limitations to research drones — aside from navigating the permit process for permission to fly — are the short flight times dictated by limits to the vehicle’s power supply. The Tomales Bay study drones only had enough power to fly for about 40 minutes, while a regular, piloted plane could go at least four hours before refueling.
Another design constraint involves making machines that can carry big “payloads” (such as fancy cameras) yet retain maneuverability and lower body weights. And many of the less expensive machines are downright noisy. But it seems only a matter of time before Silicon Valley technology can solve these performance issues.

Sean Headrick, the man behind the San Carlos-based company AeroTestra, is working to optimize drone designs for research. He views the flying machines as collection devices that operate similarly to scanners, gathering visual data from the world that can then be processed by computers. Most of his projects involve mapping. With photogrammetric software tools, the two-dimensional images gathered by his unmanned machines are translated into richly detailed 3-D maps.

“For a fraction of the cost of a manned aerial survey, we can use UAVs to map on the ground with centimeters of resolution,” said Headrick. These high-resolution methods helped make the topographical maps needed by the Midpeninsula Regional Open Space District to plan for opening parts of Mount Umunhum for public use this fall.

Some companies, such as the San Francisco-based Airware, sell only software that researchers can customize for particular projects (like tracking rhinos in Africa). Others, like GeoWing, headquartered in Oakland, focus on mapping services that may use drones or manned aircraft to get the job done. “Drones can be great tools to cost-effectively monitor change over time,” said Jeffrey Miller, the company’s vice president.

But, it isn’t all cameras and maps. As Headrick noted, the data gathering is only limited by the loads a UAV can carry. At the Blue Oak Ranch Reserve in San Jose, director Mike Hamilton outfitted drones to remotely sample ponds to analyze water quality and temperatures at various depths. These ponds are key habitats for tiger salamanders and western pond turtles. As methods are refined, data from the reserve could be compared with tests from ponds on grazing lands to assess the impact of cattle on water quality, for example. Other researchers have used unmanned aircraft to analyze particles in the Arctic atmosphere to help them better understand climate change.

“What we’re doing [with drones] related to conservation will allow us information that we could never have gathered any other way,” said Headrick. “And with an immediacy that we can do no other way, at a cost that’s so low there’s not a comparable thing out there.”

Elizabeth Devitt covers open space for the Monitor.

Keeping Waterways Trash-Free

By Robin Meadows

Our winter rains — much as we love them — have a dark side. As all that welcome water rushes along, it picks up trash, propelling it down storm drains and into our waterways. Besides being an eyesore, trash carries toxicants and chokes wildlife. It also collects in the Great Pacific Garbage Patch, a Texas-sized soup of plastic and other debris between the West Coast and Hawaii.

“We’ve become more of a throwaway society, increasing trash significantly in creeks and shorelines throughout the Bay Area,” said Tom Mumley of the San Francisco Bay Regional Water Quality Control Board.

But in California, that’s about to change. We recently became the first state in the nation to ban trash in waterways. California already had anti-litter laws to dissuade people from, say, tossing soda cans and chip bags out car windows. Enforcement is a challenge, however, partly because violators must be caught in the act. The new law approaches the problem from the other end, holding cities and other entities responsible for curbing trash in storm drains regardless of who produced it.

The state ban on trash in waterways was inspired by successes in major urban areas. “LA was way ahead on reducing trash in water and the Bay Area was right behind it,” said Greg Gearheart of the State Water Resources Control Board, which put California’s ban in place. “They showed the state it could be done.” LA began regulating trash in...
Keeping Waterways Trash-Free (from page 3)

Waterways in 2001, and this year the Los Angeles River is on track to become nearly trash-free. And the Bay Area banned trash in storm drains in 2009. The region has until 2022 to get storm drain trash close to zero, and it’s already down 40 percent in local waterways.

Even so, Bay Area volunteers collected more than 230,000 pounds of trash from beaches, rivers, and streams during last year’s Coastal Cleanup Day, held annually on the third Saturday in September. Major culprits include plastic bags and styrofoam fast food containers. While convenient, they’re also lightweight and wind can blow them right out of trash cans. “Plastic bags account for about 10 percent of the trash in water,” Mumley said. Other top offenders include cigarette butts, food wrappers, bottles, bottle caps, and straws.

Cleaning Storm Drains

The Bay Area has tens of thousands of storm drains and each one can accumulate an enormous amount of trash — a recent big rain washed 43 gallons of garbage into a single drain. Ways to keep trash out of storm drains include retrofitting them with screens or traps that catch debris while letting water flow through, as well as cleaning streets more often. Simple though these fixes are, they’re still an added expense to tight city budgets, and many cities share that cost by tapping business districts to add trash cans and do extra cleanups.

Exceptions to the Bay Area ban on trash in waterways include San Francisco, which has a combined storm drain-sewer system that already captures trash. In addition, the North Bay — Marin, Sonoma, and Napa counties — is exempt from the Bay Area ban because fewer people live there. Under the new statewide ban, however, North Bay counties must keep trash out of waterways too; they have until 2026.

The Bay Area ban on trash in storm drains was “driven by awareness and advocacy,” Mumley said, explaining that nonprofits like Save the Bay helped his agency institute the regional prohibition. “Awareness is key to the politics of regulating human behavior — it increases willingness to be regulated rather than resisting.”

Banning Plastic Bags

Effective as it is to clean up storm drains, producing less trash in the first place is even better. People in the Bay Area generate less trash than the national average — roughly 2.5 versus 4 pounds per person per day — but it still adds up to a whopping 3.5 million tons each year. And even when we throw it away properly, it doesn’t always stay put. According to a 2016 World Economic Forum report, “A staggering 32 percent of plastic packaging escapes collection systems.”

One solution is to use less packaging. “Product bans can help,” said Allison Chan of Save the Bay. “Plastic bag bans lead to a dramatic reduction in trash in creeks.” San Francisco was the first city in the U.S. to prohibit stores from providing customers with single-use plastic carryout bags, and similar bans are now also in place in San Jose, as well as in Alameda and San Mateo counties. Today about 80 percent of people in the Bay Area live in areas with plastic bag bans and about 60 percent also have styrofoam bans, Chan said.

The rest of California may be about to catch up. In 2014, our legislature passed the first statewide plastic bag ban (SB 270) and Governor Jerry Brown signed it into law. But it’s been on hold due to a challenge from the plastic bag industry, which placed a referendum to overturn the ban on the November 8, 2016 ballot. According to a 2014 USC Dornsife/Los Angeles Times poll, nearly 60 percent of Californians support the ban.

Social Issues

But even if we keep storm drains clean and ban plastic bags, that still won’t be enough. A lot of trash gets into waterways via illegal dumping and homeless encampments along urban creeks. Both bypass storm drains and both have no easy solution.

“People drive out to empty spaces and dump,” said Chan, adding that landfill fees can be high and that “if people have a choice between putting food on the table and illegal dumping, they’ll choose food.” Surveillance cameras in empty lots can help, but fail to address the underlying issue.

In 2013, a quarter of the homeless population in San Jose
— about 1,200 people — lived in encampments along rivers and creeks. In 2014, the city offered housing and other help to homeless people living along Coyote Creek, and closed the encampment. Then they cleaned the site, removing 618 tons of debris. The final step was blocking access to the creek with 1,500 feet of eight-foot fencing. Total costs exceeded $1 million, and this was for just one, albeit the largest, encampment in the Bay Area.

Getting our waterways trash-free by 2022 will be a huge task. “Given all the challenges our communities face, trash is not always high on the list,” Chan said. “But it should be.” And if Los Angeles can do it, we can too.

Robin Meadows covers water for the Monitor.

The Cost of Clean Air: Motivation for Minimizing Motor Emissions

By Leslie Stewart

Over the past five years, drivers on Bay Area roadways may have noticed more and more clean air vehicle decals, visible indicators of the growth in cars and trucks that use cleaner fuels and produce lower emissions. Incentives for drivers to join this trend include rebates, fuel costs, access to special highway lanes, and environmental benefits.

Lee Lawrence, a Moraga resident who owns both a full hybrid and a plug-in hybrid, is familiar with the incentives — and disincentives. She’s constantly aware of range limits, as well as locations of nearby charging stations. She’s learned that “when I’m chatting with other users at charging stations, ‘range anxiety’ is the most frequent topic that comes up.”

“Vehicle sales are up, but charging stations are lagging,” according to Karen Schkolnick, head of Strategic Incentives for the Bay Area Air Quality Management District. Although the region has more than 2,500 stations now in place, she asserted that “we need to make a lot more stations available to make everyone feel they can participate in the transition.” Her agency seeks to encourage electric vehicle use as part of its mission to control regional air pollution. As she explained, “Because we don’t regulate mobile emissions sources, we need to incentivize change instead.”

Since July 2015, the Air District has awarded grants to build more than 200 charging stations; more grants will be made before the end of the fiscal year in June. Funded projects range from a pair of dual-port medium-fast charging stations at California State University East Bay, to 98 dual-port stations at a Santa Clara County business park. One Air District demonstration program entitled “Charge!” is funding 92 publicly available charging stations — including 28 in neighborhoods designated under the agency’s CARE (Community Air Risk Evaluation) program as being vulnerable to greater health impacts from higher air pollution levels. The companion program “Charge Fast!” will fund direct-current fast-charge ports in CARE areas and fill gaps in the fast-charge network.

The Air District has been awarding charging station grants through its Transportation Fund for Clean Air. Broadly speaking, the TFCA helps pay for efforts to reduce on-road vehicle emissions — everything from walking, biking, and transit projects, to purchasing cleaner vehicles for government fleets. The revenue for the fund comes from a $4 surcharge on Bay Area vehicle licenses, a fee approved by the state legislature in 1991 that generates roughly $22 million a year.

In addition to charging stations, the Air District has solicited TFCA applications for shuttle and rideshare services, electronic bike lockers, hydrogen fueling stations, and plug-
The Cost of Clean Air (from page 5)

in electric vehicle rebates. The plug-in electric vehicle rebates, available to public agencies, also cover smaller “neighborhood vehicles” and electric motorcycles. Motorcycle awards have already gone to police departments in Pittsburg and Colma. “The number of motorcycles is small, but we’re developing a program to scrap more motorcycles,” said Air District Supervising Staff Specialist Chengfeng Wang. “There are no regulations to control motorcycle emissions, and we’re finding they are higher than we had thought.”

Other projects that will be funded this year include light-duty and heavy-duty zero-emission or partial-zero-emission vehicles for public agencies. There is a June 22 deadline to apply for up to $500,000 for heavy-duty vehicles. Schkolnick noted that earlier grants have been effective. “We now have 70,000 light-duty clean vehicles, which is 1.5 percent of the overall fleet,” she said.

In the last half of 2015, 33 TFCA-eligible projects totaling over $5 million were evaluated and awarded. Schkolnick observed that “Air District funds are going a long way to fast-track the transition over to zero-emission vehicle technology in the region.” The next necessary step is better range for electric vehicles, but as she pointed out, “The manufacturers are working on it. Between Air District investments and the manufacturers, the Bay Area is in great shape to move forward.”

Looking ahead, the region should see more progress on these issues overall, as the Air District recently allocated $90 million for the next fiscal year to reduce mobile source air pollution. In addition to TFCA grants, this money will primarily be available through the agency’s Carl Moyer Program, the Mobile Source Incentive Fund, and the Goods Movement Program.

To learn more about the Air District’s grant programs, visit www.baaqmd.gov/grant-funding or call (415) 749-4994.

Leslie Stewart covers air quality and energy for the Monitor.

A Bicycle Built for Two Thousand: Sharing Spreads Across Bay Area

By Cecily O’Connor

This spring, the City of San Mateo will distribute 50 royal blue bicycles across 10 to 12 stations within the town’s borders, unveiling a bike share pilot program that lets residents rent bikes for short trips.

“We’re hoping to launch in time for Bike to Work Day” on May 12, said Kathy Kleinbaum, a senior management analyst with the city.

The launch — and what it takes to pedal the system toward success — is being watched by Bay Area transportation professionals. Bike sharing is emerging as a potential step toward improving transportation networks. As traffic levels rise, bikes are a great car substitute to zip around town and connect to that last mile home from public transit. Programs complement larger city goals by inspiring health and wellness, and chipping away at air pollution and greenhouse gas emissions.

San Mateo is establishing its “Bay Bikes” program with smart bikes from New York-based supplier Social Bicycle. They have a GPS-enabled lock so riders can park them at regular bike racks, even mid-reservation to run errands without halting a trip. San Mateo is adding 40 more racks to increase riders’ route flexibility. It also hired the firm Bikes Make Life Better to collect bikes at racks and re-stock them at station hubs.

“It is our hope that San Mateo’s fleet will give us an opportunity to figure out if a different model works better for a smaller city,” said Shiloh Ballard, executive director of the Silicon Valley Bicycle Coalition.

By contrast, the larger Bay Area Bike Share program currently relies on a network of 70 tech-enabled docking stations for a fleet of 700 bikes. The higher number of stations, distributed across big cities like San Francisco and San Jose, gives users more choice in where they can rent and return bikes. Since rental systems are linked to kiosks...
Bay Area Bike Share was created in 2013 as a pilot between the Bay Area Air Quality Management District, the Metropolitan Transportation Commission (MTC), and other transportation agencies for an estimated cost of $7 million. The program is beginning a 10-fold expansion this year as part of a public-private partnership that’s now administered by MTC and overseen by Motivate, a bike share operator with programs in cities like New York and Chicago. The expansion blankets San Francisco and San Jose, and brings Berkeley, Oakland, and Emeryville into the mix. By 2018, the program will offer 4,500 bikes in San Francisco, 1,500 in the East Bay, and 1,000 in San Jose.

Under the expanded system, annual memberships will run $149 a year, a jump from the current $88. Memberships for eligible low-income households will be $60 a year. Twenty percent of stations will be in MTC-designated “communities of concern.” Bay Area Bike Share will announce station locations in these and other neighborhoods starting this spring.

San Mateo also is in the process of finalizing station locations. It paid $85,000 for its bike fleet, and expects ongoing operations costs of $90,000 annually. That total is based on a $293,000 contract with Bikes Make Life Better, factoring in a $1,800 per bike service fee over a three-year period, plus a $23,000 system implementation fee. Baseline membership will run $15 per month.

User fee revenue and any corporate sponsorships San Mateo strikes will cover approximately 50 percent of the operating costs in the first year, and will eventually encompass the full operating costs once the system reaches a “stabilization level,” according to information presented to the city council on November 16.

“We know [Bay Bikes] will take time to build up users and ridership, but it will be an important amenity to our community,” Kleinbaum said, adding that marketing will follow through a “Connect San Mateo” campaign to raise transit option awareness. The long-term hope is that Bay Bikes will morph into a system that connects with Peninsula cities and other communities nearby.

However, the road to thriving bike sharing programs can prove bumpy. For example, Seattle’s bike share system, Pronto, has been plagued by insufficient funding and riders since launching in 2014 and needs a city bailout if it’s going to continue. And the original Bay Area Bike Share pilot included a trio of cities — Redwood City, Palo Alto, and Mountain View — that suffered low usage rates, and were not included when the growth plan was announced last year.

The program will continue to operate in those cities through June.

SamTrans is assisting those cities in a “strategic planning effort that will help them decide whether to buy into the existing Motivate bike share system, pursue another type of bike share, or discontinue bike sharing services completely,” said Tasha Bartholomew, a communications officer with the transportation district.

MTC, the Santa Clara Valley Transportation Authority, and Caltrain also are involved in the planning, “but ultimately the three cities have to make decisions that work best for them,” Bartholomew added.

“It’s challenging right now comparing the different options,” said Jessica Manzi, a senior transportation coordinator for Redwood City, which is keeping tabs on Bay Bikes’ rollout and other alternatives.

Redwood City’s current ridership in Bay Area Bike Share is under 0.1 trips per bike per day. If it chooses to stay the course with Motivate, it would need to shell out $158,000 annually to operate seven stations with 117 docks. It could reduce the number of stations to cut its tab. However, fewer stations in a low-density area could make it even harder to generate rider interest and support growth.

Redwood City officials discussed several ideas during a March 8 committee meeting, including whether to focus resources on expanding bike parking downtown where

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there's potential to house a tech-on-bike sharing system in the future.

“Compared to other communities, [bike share demand] has been quite a bit lower, but we're also at an interesting point with development in downtown where a lot of growth is taking place,” Manzi said. “That might be a better match for bike sharing down the road.”

In the meantime, MTC has set aside $4.5 million to add more bikes to the Bay Area Bike Share network from “emerging communities” going forward. This would occur after the 7,000-bike expansion is completed.

It’s something Scott McDonald, a senior transportation planner for the Transportation Authority of Marin, is watching. A 2013 feasibility study laid out a framework for a system with 300 bikes across 37 Marin County stations.

Upfront capital and initial launch costs for various phases explored in the report would total anywhere from $250,000 in grant or other one-time funding to approximately $2.35 million for full system build-out, according to the study.

“At present time, we haven’t identified a grant to fund the upfront cost, which would include capital equipment,” McDonald said.

The City of Fremont also is interested in exploring bike share opportunities for the Downtown Fremont and Warm Springs BART stations, said associate transportation engineer Rene Dalton.

“We talked to MTC recently and they mentioned some grant opportunities within the next few months, so we’re monitoring that,” he said.

Cecily O’Connor covers transportation for the Monitor.