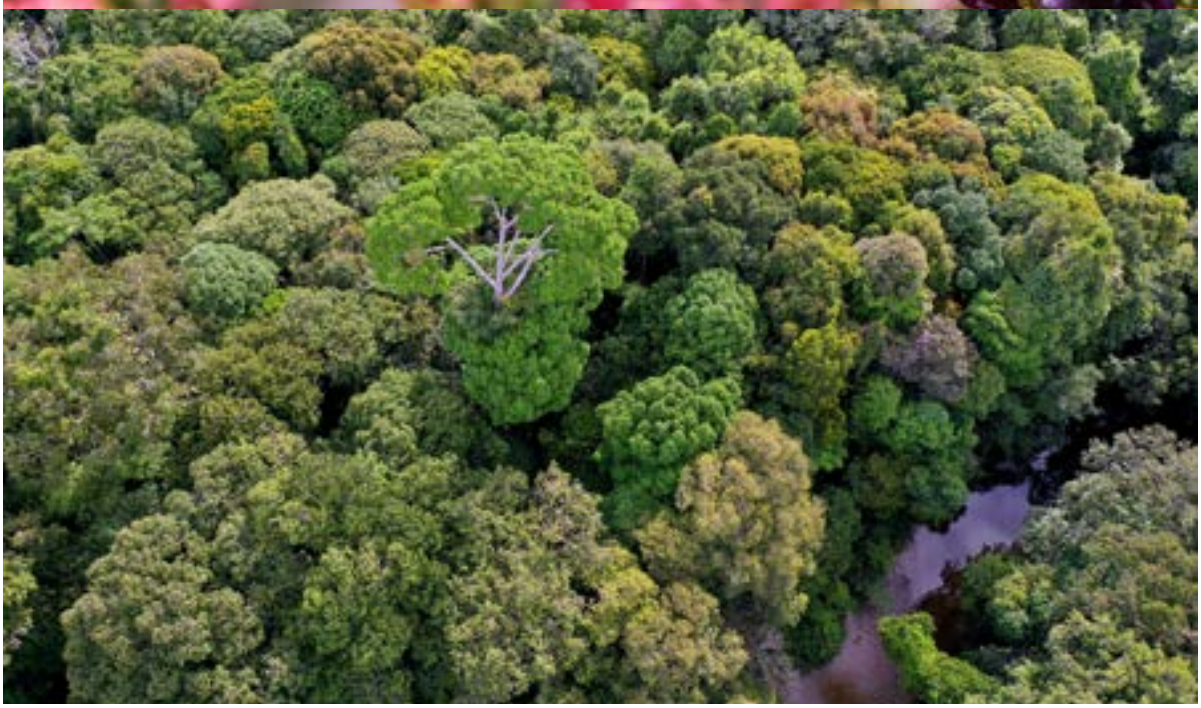
Ecology and Biodiversity

Solutions for preserving the biodiversity of the Bay Area and maintaining a healthy ecosystem



Beekeeping Regulation

Protect tiny pollinators by changing from a code based on zoning and distance to a nuisance mitigation model

The Impact

Implementing a nuisance-mitigation model for regulating beekeeping allows beekeepers to have healthy colonies without the barriers imposed upon them by arbitrary restrictive codes. More bees and beekeeping means more and better pollination, which is essential to food security and maintaining a healthy ecosystem. As we try to maintain biodiversity in the face of climate change, beekeepers can help. Many are knowledgeable about planting for pollinators. This is a skill they can share with their community to maintain insect-pollinated native plants instead of wind-pollinated plants, which are more susceptible to fire.

Description

A nuisance-mitigation strategy directly addresses the source of a complaint and offers win-win solutions. In contrast, restrictive regulations, while easy for a code enforcement officer to apply, can have unintended and negative consequences. Restricting hive numbers or the location of hives based on distance setbacks, lot size or zoning can limit beekeepers' ability to locate or manage their bee colonies in ways that enhance their survival. According to a Burlingame (Calif.) city report, complaints of beekeeping being a nuisance are rare, with only one case from 2014 to 2018, which was resolved by the Beekeepers' Guild of San Mateo County.

Where It's Been Implemented

Only three of San Mateo County's 21 jurisdictions still use restrictive beekeeping policies. San Carlos has a policy that effectively bans beekeeping. Policies in South San Francisco and Hillsborough are less onerous but make it hard to keep colonies alive. The other 86 percent use a variety of nuisance-mitigation strategies to regulate beekeeping.

Key Drivers

Since 2009, honeybee colony losses have increased dramatically. Losses used to be as few as 5 to 20 percent in a bad year. Now U.S. losses commonly reach 30 to 50 percent of hives every year. Beekeepers must constantly replace lost colonies to maintain populations.

Bees, both honeybees and a wide variety of native bees, are prolific pollinators. They are essential to the functioning of the ecosystem as well as our agricultural efficacy and, thus, the stability and resilience of our food system. They are responsible for pollinating 70 percent of the top crops for human consumption. They are also critical for the restoration of native California ecosystems after fires, which are increasing with climate change.

Key Factors for Success

Cities need expert evaluators to assess whether a beekeeping nuisance has occurred and to suggest solutions to resolve complaints. The Bee Legal Project in San Mateo County started a Beekeeping Site Evaluation program to offer mitigation services. Expert volunteer beekeepers, working at the request of code enforcement, respond to complaints to evaluate if there is a nuisance and to offer management changes if needed. If there is no nuisance, they educate neighbors and beekeepers. Complaints are rare, with only about one or two every year in the county. All have been resolved by the local Beekeepers' Guild.

Another key to success is to educate the public and normalize beekeeping. In Redwood City, Calif., hives were established on top of the downtown public library to spread awareness of beekeeping and demonstrate how noninvasive it is, even in an urban setting.

Key Obstacles

In the San Mateo County jurisdictions that still use a restrictive approach to regulating beekeeping, the main pushback has come from staff, city council members or commissioners who are unaware of the value of pollinators and the fact that feral bees are widespread, and who assume, despite scientific evidence to the contrary, that restrictions will help to avoid conflicts. Another obstacle is the people who are misinformed about bees and fear them. The Beekeepers' Guild works hard to educate and promote safe beekeeping, and this is much easier when beekeeping is not effectively illegal.

Timeline to Implementation

The Bee Legal Project offers services to advise which nuisance policies work well for bees and neighbors, while helping to reduce staff time to implement code changes. In Burlingame and Foster City, Calif., ordinances that previously restricted beekeeping were simply deleted, so the city defers to the California private nuisance law. This way, the jurisdiction doesn't have to spend time on drafting new ordinances. Specific nuisance regulations that address the main sources of nuisance have been implemented in San Mateo and Pacifica, Calif.

References and Resources

Nickie Irvine, Bee Legal Project Coordinator, Beekeepers' Guild of San Mateo County, nickieirvine@gmail.com

Beekeepers' Guild of San Mateo County petition

Corporate Conservation Programs

Business campuses that develop voluntary conservation programs help biodiversity and can receive Wildlife Habitat Council Conservation Certification.

The Impact

Conservation programs certified by the Wildlife Habitat Council (WHC) across the U.S. and internationally can have significant impacts on biodiversity and species' populations. For example, at a manufacturing facility in Florida, a nesting box program yielded 94 bluebird fledglings in three years. In Montana at an ExxonMobil refinery site, its WHC certified program has restored, protected and maintained about 60 percent of the refinery's property to its "natural state."

Where It's Been Implemented

Forty-seven states in the U.S. have at least one WHC Conservation Certification program in place. In the San Francisco Bay Area, IBM's Silicon Valley Laboratory (SVL) and Almaden Research Center campuses in San Jose have had WHC Conservation Certified programs since 2005 and 1991, respectively. IBM's SVL program is Certified Gold, the highest tier. Also in San Jose, Waste Management's Kirby Canyon Recycling and Disposal Facility (KCRDF) and Guadalupe Recycling and Disposal Facility programs are WHC Conservation Certified. KCRDF is Certified Gold. Vulcan Materials Company's Pilarcitos Quarry in Half Moon Bay, Calif., also has a WHC Conservation Certified program.

Description

Founded in 1988, WHC is a nonprofit organization and an international conservation nongovernmental organization (NGO). WHC Conservation Certification certifies conservation programs on corporate landholdings. Campuses can apply for certification if they have a conservation program with one or more ongoing projects. WHC Conservation Certification programs are primarily either habitat, species or education programs. Sometimes they can even be a combination of all three areas. Programs must renew their certification every two to three years. City conservation programs can also apply for certification.

IBM SLV and Almaden Research Center maintain WHC Conservation Certification of their wildlife habitat management and conservation education programs. In 2015, at the Almaden Research Center, the center's program brought six beehives to the on-campus orchard in order to help increase the bee population as well as increase pollination of native plants on campus. IBM partnered with a local beekeeper to move the beehives and provide continued management and care for the bees. Efforts have also been underway to keep the Western Bluebird population on site at the Almaden Research Center; this included building, installing and monitoring 115 nest boxes on campus. As of 2018, the SVL campus had 29 honey beehives. IBM SVL's program also involves annual nest monitoring, bird counting that involves employees and various other education outreach projects.

KCRDF's program maintains a total of six projects that involve managing serpentine grassland habitats, focusing on conservation of the Bay Checkerspot butterfly, educational and community outreach, studying rare plants on the property, and entering into land conservation agreements. In 2013, KCRDF partnered with the Creekside Center for Earth Observation to provide a total 10,000 butterfly larvae that were relocated to Santa Clara County's Tulare Hill and San Mateo County's Edgewood Natural Preserve in order to help reestablish the butterfly in the Bay Area. KCRDF also received WHC's "Corporate Wildlife Habitat of the Year" award in 2013.

Key Drivers

Biodiversity is threatened all over the world. In San Mateo County, more than 40 species of plants and animals are in danger of becoming locally extinct. There are around 250 endangered species in California. In addition, more than 1 million acres of natural land in California have been destroyed in the past 20 years, and most of California's native grasslands are gone. Such habitat loss is the biggest threat to biodiversity. The majority of endangered species in the U.S. depend on private lands, including corporate campuses.

According to a 2019 research study published in "Environment, Development and Sustainability," voluntary WHC certification conservation benefits might have about equal longevity as financially incentivized program conservation benefits, and overall conservation benefits from WHC Certified programs might be about equal to benefits from individual USDA Conservation Reserve Programs. Thus, the study says, WHC certified voluntary programs "could yield conservation outcomes analogous to incentivized programs."

Key Factors for Success

To apply for certification, applicants must have one or more projects promoting biodiversity and conservation by being tailored to the local environment, exceeding existing regulatory requirements, working toward a conservation or conservation education goal, providing a conservation or education value, and having measurable and reported results. There are two deadlines a year for applications. Applications are reviewed and scored.

Since programs need to renew their certification every two to three years, it is important that companies have a system in place to maintain the program and continually evaluate and improve it.

For programs to earn certification, they must be voluntary efforts that go beyond any regulatory requirements in their area. Projects also must have a conservation (education) objective.

Another factor that can strengthen an application to WHC, and thus is also indicative of the success of the conservation program in general, is engaging employees and engaging other partners, such as schools. Documenting all activities is an important factor for success. It is a requirement for certification, and it also helps evaluate the effectiveness, successes and weaknesses of the projects, so necessary changes can be made.

Key Obstacles

Obstacles to developing a successful conservation program can include a lack of funding, a lack of leadership or difficulty finding support and commitment, as well as a lack of strategy and planning. WHC provides consulting services to help businesses with their conservation efforts.

Timeline to Implementation

In order to apply for WHC certification, projects need to have been in place long enough to have had a measurable impact. Timelines for starting a conservation program on campuses can vary, depending on corporate support, employee participation, partnerships, etc. For one of Vulcan Materials' WHC certified programs, it took less than a year and a half from beginning to gaining WHC certification (which signifies a working program).

References and Resources

Wildlife Habitat Council, About WHC Certification

Wildlife Habitat Council, Project Guidelines

Wildlife Habitat Council, Overview of Requirements

Green Cleaning with Engineered Water

Stabilized Aqueous Ozone, also known as engineered water, is a powerful substance that can be used to disinfect and clean most surfaces. It can be created on demand with tap water and has no negative health or environmental impacts.

The Impact

Transitioning to Stabilized Aqueous Ozone (SAO) as a cleaning solution can eliminate the use of all cleaning chemicals. Since the solution is created using tap water in the building, filling up a reusable spray bottle, the use of SAO also greatly reduces plastic waste associated with single-use cleaning containers. The solution has no safety concerns, meaning that switching to SAO has a great, positive, impact on users' health.

Where It's Been Implemented

Stanford University began using SAO in 2014 with an experimental pilot in a sorority house. The solution is now used in 92 buildings on campus, with about 8,800 residents benefiting from it. Both custodians and students use the solution, dispensed through Tersano's Lotus Pro machine. Stanford estimates that, with SAO, it now avoids purchasing (and disposing of) 5,500 gallons of chemicals a year.

Other notable case studies using SAO products include the Colorado Convention Center and Arkansas's Clinton International Airport. Companies using SAO technology for cleaning include Bank of America, Google, Domino's, AstraZeneca, UC Davis, Proctor & Gamble, Microsoft and Nestle.

Description

SAO is created by using electricity to add an oxygen molecule to O_2, creating ozone (O_3) which is then infused with tap water. In the natural environment, a similar process takes place when sunlight

transforms oxygen molecules in the air into ozone. For 24 hours after its creation, SAO can kill 99.99 percent of viruses and bacteria. SAO also works against odors, mold and mildew. After 24 hours, SAO no longer works as a disinfectant (but still works as a cleaner) as it begins to convert back into water and oxygen. After a week, the solution will have fully converted back into water and oxygen, meaning that it is completely safe to dispose of the solution.

SAO can be used to clean almost any surface, including glass, showers, sinks, toilets, counters, floors, carpet, clothing stains and laundry, appliances, and other furniture.

To create SAO, one needs to first install a machine to a sink and have access to electricity. For individuals, there are handheld devices (similar to a spray bottle) that create SAO when filled with cold tap water. Tersano's products have a Green Seal Approval, are NSF Registered Products, are compliant with LEED (Leadership in Energy and Environmental Design) requirements, and have a 0-0-0 safety rating (on a scale of 0-4 for health, flammability, and physical hazard, SAO has a 0 rating for each category). Other companies that sell aqueous ozone machines, such as Clean Core, have similar safety ratings and green approval.

Key Drivers

There are a variety of negative impacts of cleaning products on human and environmental health.

In general, cleaning chemicals can cause a variety of symptoms (depending on the type of chemical and ingredients of the cleaning products), including sore throats, headaches, skin rashes, irritated eyes, shortness of breath, nosebleeds, coughing/wheezing and asthma. Volatile organic compounds (VOC) in cleaning products can negatively affect air quality indoors and outdoors. Bleach can cause asthma over time and cause asthma to worsen. Bleach can also irritate eyes and skin.

Cleaning chemicals enter the environment through evaporation or by going down the drain. Many ingredients in cleaners are toxic to aquatic species and can cause reproductive problems for wildlife if the wastewater is not cleaned properly. Furthermore, cleaning product ingredients that contain nitrogen and phosphorus can contribute to waterways' eutrophication (oxygen depletion caused by excess nutrients and plant growth).

Even Green-Seal-—approved cleaning products can have health concerns.

Key Factors for Success

A key factor for successful implementation of SAO is support from custodians and/or other users of the solution. Easily available resources, presentations about SAO, trainings about how to clean with SAO as well as the new cleaning practices, and surveys to identify any issues are all important in transitioning to using SAO as the primary cleaning product.

Key Obstacles

One main obstacle to implementing SAO in buildings is that it completely changes the way people clean. It may be difficult to convince people to break habits as well as accept that SAO works as well as the chemicals they previously used. Because SAO does not have a smell, does not come packaged in an official bottle, does not whiten and can be used for all surfaces, it can be difficult to believe in its effectiveness. Stanford Sustainability and Utilities Manager Kristin Parineh found that the best way to combat these obstacles was to prove SAO works by showing each custodian bacteria testing done on surfaces cleaned with SAO. Another solution is investing time in education about the product and how it is used as well as investing in new equipment (e.g., mops, towels, buckets, spray bottles) to show the custodians that they are valued.

Another obstacle is paying the upfront cost of the machine and installation, which can cost around $1,500 to $2,500 (depending on the building setup). However, after the initial costs, using SAO means no chemicals need to be purchased in the future. Stanford estimates the payback period to be between two and a half to five and a half years; this estimate only looks at chemical cost savings and does not take into account employee health savings, environmental health savings, or increased water and electricity costs. Furthermore, since the machine can dispense as much SAO as desired, multiple residents/businesses/groups in a building can split the cost of one machine that they all share or otherwise consider how multiple parties can split the cost and share the machine.

Timeline to Implementation

Stanford has been working on implementing SAO cleaning on campus since 2014, ensuring that in each building with SAO, the custodians and/or residents are educated about the product and are convinced of its effectiveness.

The timeline for each building and organization will be different, depending on building size, size of the custodian staff (or number of residents), and organization priorities.

References and Resources

Kristin Parineh, Sustainability and Utilities Manager, Stanford University, kparineh@stanford.edu

Tony Almeida, Elk Grove (Calif.) School District, talmeida@egusd.net, 916- 686-7723

Tersano Inc., https://tersano.com/

Safety Data Sheet for Tersano Iotus® PRO SAO Dispenser & iClean mini, https://cdn.shopify.com/s/files/1/0298/2389/3557/files/SDS_IotusPRO_iClean_mini_EN_191111.pdf?v=1607372423

Safety Data Sheet for Clean Core Aqueous Ozone Solution, https://cleancoresol.com/wp-content/uploads/2019/10/CCT-SDS.pdf

Integrated Pest Management Policy/Ordinance

Minimizing the use of chemical pesticides can protect plants and animals, as well as aquatic and terrestrial ecosystems.

The Impact

According to the U.S. EPA, Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

IPM policies and ordinances can help a city or county reduce the amount and toxicity of pesticides it uses. For instance, pesticide use in Palo Alto, Calif., measured by amount of active ingredient use, decreased 73 percent from 2005 to 2016. Use of pesticides of the “highest concern” in Palo Alto decreased 95 percent from 2005 to 2016. In San Francisco, “most hazardous” pesticide usage decreased 97.5 percent from 2010 to 2020. Expanding a policy or ordinance to target additional specific concerns and/or increase its reach can make a policy more impactful.

Where It's Been Implemented

San Francisco implemented an IPM Ordinance in 1996 and revised it in 2011. Palo Alto implemented an IPM Policy in 2001 and revised it in 2020. Menlo Park, Calif., implemented an IMP Policy in 1998 and revised it in 2015. Santa Clara County (Calif.) also has an IPM Ordinance. All permittees of the Municipal Regional Stormwater Permit, which includes all San Mateo County (Calif.) cities, must report on how they follow the Municipal Regional Stormwater Permit’s best IPM practices. (See “Background” section for more detail.)

Description

Integrated pest management policies and ordinances can be structured in many ways and include a variety of components. The San Mateo Countywide Water Pollution Prevention Program’s model IPM policy template includes the following components: written standard operating procedures;

pesticide use tracking; an annual report about pesticide use; a review of the city's purchasing procedures, contracts and service agreements; educational outreach; a decision-making process based on IPM practices; and the establishment of an IPM coordinator.

In addition to these common components of IPM policies and ordinances, there are several other best practices that cities and counties in the San Francisco Bay Area have implemented in their policies and ordinances:

Reduced-Risk Pesticide List (RRPL): Some IPM policies, like Palo Alto's, detail toxic ingredients and chemicals that are not allowed to be in pesticides in the city/county in order to protect water quality, pollinators, children, etc. Other IPM policies, such as San Francisco's ordinance, prohibit the use of pesticides at all properties owned by the City or County of San Francisco, with the exception of pesticides on a list of approved pesticides (an RRPL) to be used in the city/county. Santa Clara County's IPM ordinance also maintains a list of approved pesticides.

Pesticide Use Restrictions: IPM policies can institute restrictions on what pesticides can be used for. For example, San Francisco's ordinance prohibits the use of pesticides "for the purpose of improving or maintaining water quality" at certain locations such as reservoirs or drinking water treatment plants.

Pesticide-Free Locations: Some policies implement limits on where pesticides can be used. For instance, Palo Alto's policy prohibits the use of pesticides within 100 feet of playgrounds and creeks (with a few exceptions for creeks). Palo Alto also maintains a list of pesticide-free locations in the city; currently, there are 21 pesticide-free parks and facilities in Palo Alto.

Public Notice of Pesticide Use: Requiring public notice of pesticide use can help reduce the negative human health impacts of pesticides by allowing the public to know what kinds of pesticides are being used and letting the public have the option to avoid the area. San Francisco, Palo Alto, Santa Clara County and Menlo Park all have Notice of Pesticide Use components in their IPM policies/ordinances.

Pollinator Protection: Palo Alto seeks to protect pollinator populations in the city and has a pollinator protection section in its IPM policy that prohibits the use of systemic pesticides that specifically threaten pollinators.

Key Drivers

Pesticides can have a variety of negative ecological effects, posing unintended risks for species not targeted by the pesticides. These negative effects can decrease plant and animal biodiversity and have consequences for aquatic and terrestrial ecosystems. Uncontrolled pesticide use has led to population decreases of many species and has threatened some populations in the past, including those of bald eagles, peregrine falcons and ospreys.

IPM practices can significantly reduce pesticide use and allow jurisdictions to focus on mitigating negative effects on non-target species.

Key Factors for Success

In order for the policy to be effective, it is important to accompany the policy with action and a robust plan. An annual (or periodic) reporting process to identify the biggest areas of concern and evaluate success, as well as annual training for city staff, are two ways to ensure that there are pest management improvements over time. Tracking, reporting and training can all be included as procedures in the policy. In addition, an IPM committee and/or coordinator can help ensure that the policy and pesticide practices in the city/county get attention, updates and enforcement each year. The Palo Alto IPM Coordinator can also grant exemptions for certain pesticide use.

Key Obstacles

Time, funding and staff are all limited resources that are essential to successful, up-to-date and detailed IPM policies/ordinances and programs. However, cities can collaborate with and learn from each other in order to expand their IPM policies/ordinances. The Bay Area IPM Coordinators' Group meets a few times a year and is a great resource and network.

Timeline to Implementation

Timelines will vary depending on whether a city/county is creating or revising a new policy/ordinance or expanding its IPM Program. Collaboration among cities and counties can help to reduce implementation timelines.

Background

The California San Francisco Bay Water Board issued municipal regional stormwater permits in the 1990s and reissued them in 2015 and 2022. San Mateo and Santa Clara counties are among the counties that were issued permits. All permittees, which includes all San Mateo County cities, must have an IPM policy or ordinance.

References and Resources

Julie Weiss, City of Palo Alto, julie.weiss@cityofpaloalto.org

City of Palo Alto's Integrated Pest Management Policy

City and County of San Francisco's Integrated Pest Management Ordinance

San Francisco Reduced-Risk Pesticide List for City-Owned Properties

San Francisco Pesticide Usage Trends

California Academy of Sciences Integrated Pest Management Plan

San Mateo Countywide Stormwater Pollution Prevention Program Model Integrated Pest Management (IPM) Policy Template

Pollinator-Friendly Solar

Planting native grasses and plants (that attract pollinators) on solar farms can help increase biodiversity and support pollinator populations.

Photo by Solar Trade Association

The Impact

Pollinator-friendly solar farms provide habitats to native species, help retain water and topsoil, and improve soil health, in addition to helping provide a food source for pollinators. At pollinator-friendly solar installations in Minnesota, pollinator habitats increased trifold over two years and beneficial pollinator insects increased by four times over three years. In addition, pollinator-friendly solar is aesthetically pleasing and can make solar installations more attractive to the surrounding communities. In fact, pollinator-friendly solar also provides opportunities for community engagement and partnership with schools in the area.

Where It's Been Implemented

Minnesota has been a leading pioneer of pollinator-friendly solar, adopting the first statewide voluntary pollinator-friendly solar pledge in 2016. In California, Marin Clean Energy (MCE), a Community Choice Aggregation (CCA) that serves communities in Contra Costa, Marin, Napa and Solano Counties, instituted a pollinator program requirement in 2020 for all of its new solar project partners. It was the first CCA to do so. The requirement means that all new MCE solar projects in California will have to plant pollinator-friendly ground cover as well as evaluate its effectiveness helping pollinators every three years with a pollinator scorecard. In Napa, Calif., the Soscol Ferry Road Solar Project, which began construction in July 2020, has a pollinator plant meadow. Wildflower Solar is a solar farm in Sacramento County with a capacity of 16.5 MWdc (megawatts of direct current), enough to power about 2,600

homes. The project, completed in 2020, was a partnership between Lightsource bp and the Sacramento Municipal Utilities Division.

Description

Pollinator-friendly solar is a straightforward idea — planting pollinator-friendly grasses, wildflowers and other plants on the land at solar farms. The grasses and plants can grow between rows of solar panels and even under the panels to maximize the land use of solar farms. By planting species that support pollinator populations, the plants can thrive, and pollinator populations can grow.

Key Drivers

One of the problems associated with renewable solar energy is the amount of needed land and the habitat destruction associated with transforming the land into solar farms. According to the National Renewable Energy Laboratory (NREL), utility-scale solar installations may use close to 2 million acres of land in the U.S. by 2030.

Honeybee populations, among other pollinator populations, are decreasing in the U.S. According to the U.S. Fish & Wildlife Service, pollinators are primarily threatened by habitat loss, degradation and fragmentation. Pollinators support hundreds of billions of dollars' worth of global annual food production. In fact, pollinators are bringing us one out of every three bites of food we eat.

Key Factors for Success

One of the main key factors for the success of pollinator-friendly solar is to prioritize and consider pollinators through all steps of the solar farm's construction and operation. For instance, when designing a farm and the placement of solar panels, it is important to consider the types of native plants and their heights and shade requirements in relation to the panels. When constructing a solar farm, it is best to preserve as much of the native, existing habitats and vegetation as possible. Once the farm is operational, maintenance of the farm should involve considering pollinators and how to protect them. For instance, pollinators should be a consideration when using herbicides, removing invasive species, watering and mowing.

Key Obstacles

Starting pollinator-friendly solar projects is one of the biggest challenges since it involves pursuing a less traditional path that involves extra time and money to understand the best way to make a solar farm "pollinator-friendly" over the long run, as well as extra costs and time to obtain and plant appropriate plants. Vegetation should attract pollinators and be native to the area so that it will grow and survive easily in the natural climate. However, there are many resulting environmental, economic and social benefits of pollinator-friendly solar once it is established.

Another obstacle is the lack of standards for pollinator-friendly solar. Standards help ensure that solar farms that are pollinator-friendly are legitimately beneficial to pollinators. Pollinator-friendly scorecards, which help to evaluate pollinator-friendly solar farms, are not available in all states, but Northern California/Oregon and Southern California both have published scorecards. The Northern California/Oregon scorecard is published by Pollinator Partnership and Fresh Energy (a nonprofit organization). The University of California at Davis' Wild Energy, in addition to Pollinator Partnership and Fresh Energy, are publishers of the Southern California scorecard.

Timeline to Implementation

The timeline to create a pollinator-friendly solar farm involves selecting a site, designing the farm, connecting with stakeholders, obtaining permits, conducting environmental studies, planning related to

land management and biodiversity, engineering, financing and construction, all before the farm is ready for operation and continued maintenance. This process can take around two years.

Return on Investment

Healthy vegetation on solar farms can actually increase energy production by cooling the panels. Vegetation shades the ground, making it cooler, and it increases evaporation in the area.

If solar farms are built to be pollinator-friendly farms, then developers can have less work to get the ground ready because they do not need to remove topsoil, which is typically done. The process of removing topsoil can cost as much as 20 percent of all utility costs.

In addition, some pollinator-friendly solar farms harvest and sell honey from beehives on or near the farms. The Clif Family Winery sells “Solar Grown” honey from hives on pollinator-friendly solar farms in Napa, Calif.

According to an analysis from the Yale Center for Business and the Environment, pollinator-friendly solar might actually have enough benefits to justify it to developers. Policies encouraging this practice can result in quicker adoption of pollinator-friendly solar.

References and Resources

Fresh Energy, Pollinator-Friendly Solar Sample Ordinance and Procurement Language

Northern California/Oregon Pollinator-Friendly Solar Scorecard

Wildflower Solar, solar farm in Sacramento County

Rooftop Gardens and Green Roofs

Installing a rooftop garden can improve building insulation, energy efficiency, aesthetic appearance and carbon offsets

The Impact

Rooftop gardens and green roofs can help trap heat during the winter months and keep the office cool during the summer, which reduces annual energy bills. Insulation provided by the garden also decreases noise pollution, leading to a more productive work environment.Description

Rooftop gardens, living roofs and green roofs are all variations of eco-friendly roof designs that are outfitted with greenery such as shrubs and native plant species. There is a range of intensities as well. Sedum green roofs are vegetated mats that are low maintenance and easy to install, while still being quite environmentally friendly. Semi-intensive green roofs involve planting shrubs and small plants. Intensive green roofs require some significant landscaping, but they can provide a beautiful area for employees to relax, and they act as a carbon sink. Biodiverse roofing is the most intense type of green roof. While it may be less aesthetic than a typical rooftop garden, it provides a habitat for important species such as pollinators and birds, and the sustainability benefits are immense.

Where It's Been Implemented

A number of businesses and facilities have implemented rooftop gardens throughout the San Francisco Bay Area. Facebook headquarters in Menlo Park, Calif., offers an expansive example, with a nine-acre rooftop park (shown in photo) hosting 90 percent native flora, 350 trees and dozens of bird species.

San Francisco recently became one of the first cities to mandate the incorporation of solar or living roofs on new nonresidential construction smaller than 10 stories. More than 25 extensive green roof projects in the San Francisco Bay Area have been implemented by a single company called Symbios Design.

Key Drivers

All types of green roofs can improve building insulation and lower energy costs, thus helping to reduce the carbon footprint of a company or organization. The long-term energy savings can be substantial. According to the EPA, the savings are about 23 cents per square foot of roof surface, due to increased energy efficiency.

Key Obstacles

Greenery on rooftops requires some maintenance. The installation and consistent maintenance of a rooftop garden can be costly, but the return on investment is promising. Businesses contemplating a green roof should weigh these costs alongside the long-term cost savings, energy reduction and aesthetic benefits.

References and Resources

Kerrie Lee Cole, Green Roof professional at Symbios Design, kerrielee@symbiosdesign.com

Lisa Fisher, Senior Urban Planner, Resilience and Sustainability Lead at SF Planning, lisa.fisher@sfgov.org, 415-575-8715

San Francisco Ordinance

Urban Tree Planting

There are a variety of ways to prioritize planting trees, which offer countless benefits.

The Impact

The impact of trees stretches far and wide. They help reduce pollution, make streets safer, reduce stress, provide oxygen, filter drinking water, lower temperatures and provide shade, remove the carbon dioxide from the atmosphere, provide habitats, increase property values and more. Trees can also block some rainfall to decrease the pressure on stormwater drainage systems.

According to a tree benefit calculator recommended by the U.S. Department of Agriculture, a coastal live oak tree with a diameter of two feet planted in front of a single-family home in San Mateo County provides $193 in benefits per year. The majority of benefits come from property value benefits, followed by electricity savings, stormwater runoff interception and air quality benefits.

Tree City USA has encouraged more than 3,400 communities in the U.S. to commit to taking care of and planting more trees. The volunteer group CityTrees has planted over 3,500 trees.

Where It's Been Implemented

Half of the cities in San Mateo County are Tree Cities USA: Belmont, Burlingame, Colma, Menlo Park, Millbrae, Pacifica, Redwood City, San Carlos, San Mateo and South San Francisco. In California, as of 2020, there were 156 Tree City USA communities and 54.29 percent of the state lived in a Tree City USA community.

CityTrees has been serving the greater Redwood City area since 2000.

Description

Tree planting programs can take many forms, from city-level recognition, like Tree Cities USA provides, to nonprofit organizations like CityTrees, to partnerships between businesses and schools. In addition, planting trees in certain locations or choosing tree species carefully can provide specific benefits. For example, planting fruit or nut trees along streets can provide people with free food and a fun

activity. Planting native trees can provide habitats for other native species. Adding trees as a barrier between streets and sidewalks can improve pedestrian safety.

Tree City USA is a national recognition program encouraging cities and other incorporated municipalities to invest time, money and energy in tree planting and continuous care. The program began in 1976 and it is sponsored by the Arbor Day Foundation, the U.S. Forest Service and the National Association of State Foresters. To be named a Tree City USA, cities must satisfy four requirements (see below, under "Key Factors for Success"). Once the city has met these requirements and celebrates Arbor Day, it can apply to become a Tree City USA. Cities must renew their applications annually.

CityTrees is an example of how volunteers can make a difference in a city. CityTrees is a nonprofit that works to plant and maintain trees in urban areas in Redwood City. It works with various other organizations in the city, including its Public Works Department, to plant trees along streets, on school campuses and on other public properties. CityTrees also focuses on educating people and advocating for urban trees.

Key Drivers

Numerous environmental problems are facing San Mateo County and the world in general, from climate change driven by CO_2 emissions to poor indoor and outdoor air quality, to loss of habitats and biodiversity to erosion and water pollution. Planting trees can help mitigate effects from all of these problems.

Furthermore, wildfires in California have been getting more frequent and severe. Eighty percent of forest restoration needed in the U.S. National Forests is due to wildfires. In areas where wildfires have destroyed trees, replanting will help minimize erosion and water pollution.

Key Factors for Success

To successfully plant trees, it is important to consider carefully why, where and how to plant trees. For example, planting native tree species is important in order to not threaten biodiversity and provide habitats for native species. Native trees are usually well adapted to the local climate conditions and, thus, have a better chance of thriving.

In addition to favoring native trees, there are many other considerations to think about when choosing the best tree species and best locations for the tree. For example, a key factor of success is to choose a native tree species that will grow at an appropriate speed, require an appropriate amount of shade and have appropriately sized roots. It is also important to engage the community in choosing a location for trees that benefits the people and ensures that the tree can be easily cared for.

The four requirements for becoming a Tree City USA Community are (1) a Tree Board or Tree Department, (2) a Tree Care ordinance, (3) a Community Forestry Program that has a yearly budget of at least $2/person and (4) an Arbor Day Proclamation and Observance.

Other key factors for success include forming a group to champion the project and finding a member on the city council who supports the idea. A cohesive group, such as the citizens' group Tree City Pacifica, is important in order to work on the requirements and get the attention of the city. A supporter on the city council can be instrumental in pushing through barriers.

Some key factors for the success of CityTrees are its loyal and hardworking volunteers, its partnership with the Public Works Department and its relationships with other public entities, including staff from Redwood City, San Mateo County and public schools. CityTrees hosts pruning seminars, as well as events called "Prune and Pub" where volunteers prune trees that CityTrees had previously planted and then eat together afterward. These regular events ensure that trees receive needed attention in the years after planting.

Having a canopy goal — a goal to increase the tree canopy in the city — provides an incentive to maintain and replant trees instead of choosing cheaper options like cutting down trees and not replacing them.

Key Obstacles

Establishing and maintaining a focus on trees requires a strong program to ensure continued support, funding and effort. Furthermore, trees themselves require a maintenance system or program to ensure the continued health of the tree and deal with any problems that arise (for example, issues with sidewalks and tree roots). It can be difficult to secure grants to help maintain trees as opposed to grants to help plant trees.

If a city does not have an existing heritage tree or tree care ordinance, then the process to become a Tree City USA takes longer.

Acquiring funding is a continual effort for most nonprofit organizations, especially in the beginning phases. CityTrees secures funding through various fundraising strategies including collecting donations, hosting fundraising events and maintaining a grant-writing program. Another obstacle tree planting organizations might face is developing and maintaining key relationships with public entities. CityTrees has found that understanding the needs of these entities is important and can be accomplished through ongoing communication.

Timeline to Implementation

The timeline to becoming a Tree City USA will be different for each city depending on its existing programs, budgets and ordinances. For example, Pacifica, Calif., which has been a Tree City USA city for two years, already had a tree care ordinance and a community forestry program, so to become a Tree City USA, residents of Pacifica had to focus only on meeting the remaining two requirements: forming a Tree Board (which is typically a grassroots citizens' group) and developing an annual Arbor Day Celebration with an Arbor Day Proclamation. The process took about a year for Pacifica.

It took CityTrees about two years to form. From idea to official establishment, the process included enlisting support from community members, the mayor and the city arborist; forming a steering committee; creating a plan and searching for funding.

References and Resources

Gail Benton Shoemaker, founder of Tree City Pacifica, gailbentshoe@igc.org

Tom Cronin, CityTrees, tom.cronin@sbcglobal.net

Tree City USA

CityTrees

Arborday.org Sample Tree Ordinance

Arborday.org Sample Arbor Day Celebration Proclamation

Wildlife Corridors

Wildlife corridors facilitate the migration, travel and movement of species to or between other habitats.

The world's largest wildlife crossing connects two parts of the Santa Monica mountains over a 10-lane freeway.

The Impact

Wildlife corridors promote biodiversity because they ensure that migration is still possible for some species, that animals have a safe space to cross roads or highways, that populations can be connected and reproduce together and/or that species can have enough space to find food, shelter, mates and nesting sites.

Where It's Been Implemented

There is a very wide range in the size and scale of wildlife corridors. There have been multiple projects in San Mateo County to preserve Pescadero Creek (and ensure that it remains a viable wildlife corridor) and deal with the problems (primarily erosion and safety concerns) associated with the Old Haul Road. There have also been various other habitat conservation, management and restoration projects in the county.

The Robert L.B. Tobin Land Bridge in San Antonio, Texas, is currently the largest constructed wildlife crossing in the United States and is now home to native plants and trees and provides a space for animals, including deer, coyotes and cats, as well as humans to cross.

Over time, the Lower Rio Grande Valley National Wildlife Refuge and partners have been purchasing land along the Rio Grande and restoring, protecting and connecting it so that there will be a complete corridor from the Falcon Dam to the Gulf of Mexico when finished. Mexico is working to extend the corridor along the Rio Grande on the Mexican side of the border.

In Los Angeles, construction began in April 2022 of the world's largest wildlife crossing (pictured above), which will connect two parts of the Santa Monica mountains that are separated by a 10-lane

freeway. This $90 million overpass, named the Wallis Annenberg wildlife crossing, will be 210 feet long and 165 feet wide.

Description

Wildlife or habitat corridors seek to prevent populations from being isolated by connecting habitats. They can take many forms, from restored creeks to designated strips of woodland, to bridges over freeways, and are called different names, including habitat corridors, green corridors, land bridges and wildlife crossings. But ultimately, wildlife corridors are protected areas that facilitate the migration, travel or movement to or between other habitats.

In San Mateo County, the 8,020-acre Pescadero Creek Park is home to many native tree species, trout and salmon, mountain lions, coyotes, deer, raccoons and other important and/or endangered species. The park, however, remains affected by the lasting negative impacts of logging practices in the 1900s and the Old Haul Road. Specifically, there have been large quantities of sediment running off the Old Haul Road and polluting Pescadero Creek, which is home to endangered steelhead trout and silver salmon.

In 2018, the San Mateo County Resource Conservation District (RCD) led a project to stabilize crossing of the Old Haul Road at tributaries of Pescadero Creek: Harwood Creek and Keystone Creek. The Dark Gulch Stream Crossing Repair Project sought to repair the Old Haul Road crossing at Dark Gulch Creek, another tributary of Pescadero Creek. The county estimated that 600 cubic yards of soil entered Dark Gulch Creek every year at the crossing and if the site collapsed, 37,000 cubic yards of soil would be introduced into the Pescadero Creek network. The San Mateo RCD has worked on numerous other projects to restore fish migration corridors.

Key Drivers

Habitat fragmentation and loss are two of the most widespread and problematic human-caused changes in the natural environment. Deforestation, roads, human-caused floods and, overall, the increase of human development and need for land have greatly reduced the amount of land available for natural habitats. They have also led to the physical isolation of populations due to fragments of unconnected habitat area.

Habitat fragmentation leads to a decrease in biodiversity since isolated populations are more likely to become locally extinct (extinct in a specific area) without the benefits of a large population and resulting genetic diversity and without enough resources (food, shelter, nesting sites, etc.) available in the small fragment. In addition, habitat fragmentation can even have negative effects on human health. For example, in the northeastern U.S., Lyme disease is becoming more prevalent because habitat fragments often lack predators that control Lyme disease-spreading mouse populations. In addition, habitat fragmentation can disrupt migration patterns and lead animals to venture into roads, freeways and residential areas.

Key Factors for Success

Wildlife corridor restoration or construction projects should focus on solving an identified problem, such as disrupted fish migration or mountain lion deaths on a freeway, in order to tailor the solution accordingly. Other key factors for wildlife corridor project success include collaboration between all the stakeholders, extensive planning and research into the potential effects of the project.

Key Obstacles

As with many projects in the sustainability world, cost is a key obstacle. The San Mateo County Resource Conservation District's project to stabilize the Old Haul Road crossings at Harwood and

Keystone Creeks cost $650,000. Sixty percent of the $90 million Wallis Annenberg crossing will be financed with private donations, while the rest will come from state funds set aside for conservation purposes.

References and Resources

Sam Herzberg, San Mateo County (Calif.) Parks Department, Senior Planner, sherzberg@smcgov.org

Los Angeles Is Opening the World's Largest Wildlife Bridge That Crosses Over a Busy Freeway

The Robert L.B. Tobin Land Bridge

Restoring Fish Migration Corridors, San Mateo Resource Conservation District

Old Haul Road: Hardwood and Keystone Creeks Crossing Stabilization

Dark Gulch Stream Crossing Repair Project

Another Solution to Explore

Environmental Impact Scores for Food (Ecolabelling)

Food has a large impact on the environment over the course of its life cycle — from the land needed for farming to the final packaging. In fact, food production is one of the greatest threats to biodiversity since it leads to habitat destruction and pollution; food production is responsible for jeopardizing more than 70 percent of threatened mammals and birds worldwide.

To reduce the environmental impact of food production, consumers can become more aware of the severe environmental impacts their food has. This way consumers can put pressure on producers to put more environmentally friendly products on the market. There are several food labels that take into account biodiversity that European countries are developing and piloting.

In France, the Law on the Fight Against Waste and the Circular Economy, signed into law in February 2020, directs product packaging to inform consumers about the environmental impact of the product they are buying. In 2020, a request for proposal (RFP) to create a label to display environmental impact yielded several proposals. One such environmental impact label from France that came out of this call for projects is “Planet-Score,” which scores food products based on the product’s impact on biodiversity, climate, human health and animal welfare in addition to its life cycle assessment (LCA). Food products then receive a letter grade between A and E, depending on their score. The score also takes into account pesticide use. The WWF (World Wide Fund for Nature) and other like-minded NGOs are in support of Planet-Score.

In the U.K., Foundation Earth, a nonprofit organization, will launch a pilot of its method to assess foods’ environmental impact. Mondra developed the method, which evaluates water usage, water pollution, biodiversity impact/loss and carbon emissions associated with the farming, processing, packaging and transport of the food product. Foundation Earth expects to completely implement the program in 2022.

The U.S. as well as states and counties in the U.S. can consider developing similar environmental impact food score systems or implement existing ones, using incentives or policy to make the labels widespread.

References and Resources

Foundation Earth, Pilot Launch, https://www.foundation-earth.org/pilot-launch/

Interreg Europe, “Planet Score,” Aug. 11, 2021, https://www.interregeurope.eu/lca4regions/news/news-article/12803/planet-score/