Marin County is in a drought. Individuals and public entities should be, and are, looking for ways to reduce water consumption. This has led several municipalities and school districts across Marin County to consider installing artificial turf to reduce water consumption and water costs.

A large artificial turf field is proposed for Pickleweed Park in San Rafael. That project would convert about 210,000 square feet of natural grass into plastic turf. Mill Valley is also considering converting multiple fields into plastic. An additional artificial turf project under consideration is in Corte Madera Town Park. Several of these proposed artificial turf fields are located within feet of Bay tidal waterways and wildlife habitats.

Replacing fields of natural grass and soil with plastic, rubber and crushed rock comes with considerable ecological and climatological downsides.

We are in a drought, no question, but we are also in an extreme heat emergency. As Governor Gavin Newsom pointed out in his Extreme Heat Action Plan, “Extreme heat driven by climate change endangers the lives and livelihoods of Californians in every corner of our state and threatens our vital natural systems.” Adding non-natural surfaces to our community increases heat reflection into our atmosphere and creates a heat-island effect which is disruptive to the surrounding flora and fauna and the timing of natural events. “Throwing off the timing of this cycle can have cascading effects on urban ecosystems that may be harmful to birds, butterflies and other wildlife in search of food and habitat. A study shows that urban parks can provide them ‘cool island’ refuges, with natural conditions to which they are better accustomed.”

Governor Newsom’s plan emphasizes nature-based solutions over synthetic ones: “Nature-based solutions deliver multiple benefits, in-
To purchase a home in Marin is to acquire a problem. Deferred maintenance, code violations, unaddressed risk of landslide, fire, or flood. Most of these have known solutions: you hire a more-or-less specialized contractor and work with your local planning department to fix whatever you can afford to. A home on a creek, however, may come with a problem that does not have an obvious solution, namely the erosion caused by the creek itself.

We purchased a creek-side home in Fairfax with particularly pressing erosion challenges. Previous efforts to protect the property had failed, leaving the creek littered with concrete pillars. Unprotected, a sizeable piece of a 20-foot tall cliff had collapsed, and further erosion at the base of that cliff posed an imminent threat to a barn standing at the downstream edge of the property. The full extent of the problem was hidden by a thick blanket of invasive ivy draped over the cliff, and by a tree trunk lying at its base. This gargantuan log was swept away by a winter storm in 2014; that event and the undercut cliff it exposed, convinced us we had to act.

Work in the creek requires engaging with several permitting agencies operating at the County, State, and Federal levels. Those agencies evaluate such projects via the so-called JARPA, a single application describing the project. JARPA simplifies the permit process somewhat, and Marin County convenes a monthly project coordination meeting to provide pre-permit application advice to people planning a project. However, individual homeowners are still left to develop their own custom solutions, choosing, without any experience, between radically different approaches to erosion control, any of which will cost tens if not hundreds of thousands of dollars to implement.

We developed our proposal with the aid of a host of advisors. Erik Stromberg, a fluvial geomorphologist and near neighbor, designed a solution that used natural materials to build a shelf protecting the bottom of the cliff, along with a graded and planted section of the bank upstream designed to slow the water impacting the concrete retaining wall that stands between the creek and the house. Building this all required getting heavy machinery into the creek, possible only because cooperative neighbors across the way had a drive-way leading to a sloped creek bank. (It is always desirable to maintain good relations with your neighbors, but if you live on a creek, it is imperative!) A temporary bridge over the low summer flow was the last piece of infrastructure needed to give the digger access to the cliff. Once built, the shelf and upstream areas were to be planted with a variety of native trees and bushes.

Prior to design and construction, executing this plan required a property survey, a variety of biological assessments, and other specialist reports. We had to tear down and rebuild fences, coordinate the movement of equipment and materials via multiple access points, source native plants, and attend to many other details. Gary Roth, a local landscape designer and a project manager with deep experience in riparian restoration, was indispensable in making the project happen, both as coordinator and as guarantor to all parties that the complexity it entailed was manageable.

Since completing the project, we have suffered both drought and high water—the one following the other is a worst-case scenario for erosion—with all components of the solution performing as expected. As important, we have observed an increase in wildlife, and bird populations in particular, as the many trees grew.

### Creek Bioblitz

*Continued from Page 1*

All the photos and data that were captured will be available to those who wish to monitor the ecosystem over time, with everything stored and accessible to scientists and students on iNaturalist, a free app for nature enthusiasts.

Learning more about our watershed and its many inhabitants makes it clear that we humans are just one component in a broad web of life, and that all life forms depend on each other to thrive and survive.

Whether it’s at one of our future bioblitzes, with another organization, with your family and friends or on your own, find a quiet corner of our watershed to explore and see what’s out there. Better yet, organize an event of your own and see how many different species you can photograph. As a community, we’ve documented over 3,000 species in our watershed and are excited to use community science tools like iNaturalist to document and preserve the bounty of life that surrounds us.

*Photo by Alycia Matz*

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Marin County funds the **Urban Streams Coordination (USC)** program under the auspices of the Resource Conservation District. The USC program provides support and assistance to residents that live along Marin County’s creeks in the unincorporated areas of Marin County through educational workshops, presentations, watershed tours and site visits that can result in targeted restoration actions. The program provides permitting guidance to property owners pursuing projects that include development and/or restoration along the creeks of Marin, by collaborating with local, state and federal regulatory agencies. The USC program aims to facilitate communication among all interested parties invested in the urban streams of Marin.
Flooding continues to be a problem in the Ross Valley and it’s clear that to make major progress in reducing the flood risks, we need a combination of detention of creek flows and increased channel capacity, including restoration of flood plains wherever possible. That is a tall order. The communities of San Anselmo and Fairfax have been hostile to detention basins, and private property ownership complicates the task of increasing channel capacity. However, we can make some progress by implementing green infrastructure projects. Most of these will be modest in size and scope, but, if the concept is pursued consistently, cumulatively they will make a significant difference.

In 2019, Congress enacted the Water Infrastructure Improvement Act, which defines green infrastructure as "the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters."

Just a few of the benefits of green infrastructure are: reducing peak flow during rainstorms to mitigate flooding; cleaning the water as it filters though the soil; and recharging groundwater that supports cooler stream flow in the summer. Candidates for retrofitting with green infrastructure are parking lots, landscaped areas that presently drain directly into storm drains, and roof drains that can be diverted into swales.

The Red Hill Swale in San Anselmo, a Town of San Anselmo project, designed by Siegfried Engineering, and funded by an anonymous donor, is an outstanding example of green infrastructure. The project occupies about 2,000 feet of the median of Red Hill Avenue between The Hub and Hilldale Avenue. It functions as a small detention basin with a capacity of 3,000 cubic feet.

Another green infrastructure project, along Center Boulevard in Fairfax, receives drainage from the parking lot of the Fair-Anselm Center. This project demonstrates that it isn’t necessary to have a large area to install green infrastructure. The newly landscaped area around RH Marin on the east side of The Village shopping center in Corte Madera is more ambitious. The low-impact development elements include use of permeable pavement and creation of rain garden bioretention areas. Bioretention areas encompass approximately 4% of the paved area, with the total landscaped area comprising approximately 11% of the site. All stormwater is filtered before it is discharged. A third local example is the bioswale at the east end of the Rose Lane development beside a tidal section of Larkspur Creek. Full trash capture storm drains that serve about 70% of the development feed into this capacious swale, where it infiltrates into the soil rather than flowing directly into Larkspur Creek. Even when local areas were flooding on October 24, 2021, this swale was well under capacity.

Retrofitting parking lots with swales and rain gardens is an obvious priority. Almost every school, shopping center, commercial building, and apartment building has a parking lot. They are located all over the watershed from Fairfax to Larkspur and Corte Madera. Let your local officials, school districts, and businesses know that they could help reduce flooding, one step at a time, by installing green infrastructure. Urge jurisdictions to require green infrastructure whenever building permits are issued.

Another good step is to oppose the installation of artificial turf on playing fields. In addition to their many other disadvantages, rainwater quickly passes through the plastic faux grass and substrate, leaching chemicals in the process, and delivers it to local storm drains and

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Green Infrastructure
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creeks. This degrades water quality and promotes flooding.

The information below from MCSTOPPP will help you plan a green infrastructure project, also known as Low-Impact Development or LID, for your own property. Consider redesigning your drainage to reduce water quality impacts. Rain runoff carries pollutants to creeks and other water bodies. When rain flows over hard surfaces the speed and volume of water can cause creek erosion downstream. For ideas on how to use Low Impact Development design to protect fish and other wildlife in Marin’s creeks, explore the resources below and consider implementing the following practices:

- Disconnect downspouts to let water run off your roof onto a splash block and into landscaped areas.
- Install a rain barrel.
- Slow down your roof runoff by connecting rain chains to your roof gutters.
- Use mulch on plant beds to slow the flow in areas where water can seep in.
- Consider installing a rain garden.

LID and stormwater-friendly development resources:

- LID: A Sensible Approach to Land Development and Stormwater Management, from the California Water and Land Use Partnership
- Blue-Green Building: Water Friendly Development in the East Bay
- Using Bioretention on Residential Lots: How to incorporate bioretention facilities into residential lots including how to calculate sizing
- Slow It. Spread It. Sink It: Rainwater Capture and Management.
- BASMAA Rain Gardens Fact Sheet: a four-page technical guide on how to build a rain garden

Pass the (California) Roach
by Gerhard Epke

The California roach can grow to four inches long. Photo by Charles Kennard

The plate of fried fish still crackled, and a delicious aroma wafted as my friend passed them around the circle. Eaten with some fries, tartar sauce and vinegar, it was a delicious meal that would probably not have raised an eyebrow on any continent of this earth or at any point in human history. Except that, in this case, the fish being consumed was a local minnow known as the California roach, Hesperoleucus symmetricus. It even seemed that our quest to eat a safe and healthy meal of local fish had led us to a place, however improbable, of discovering an overlooked local delicacy.

The West Coast has been a place of ample fishing stocks, presumably leading us to disregard the value of eating many species of small fish. But small schooling ‘bait’ fish or forage fish such as sardines, herring and anchovies might be precisely what we Marin omnivores are looking for. From clean water they are healthy and safe. Because they are fast-growing and low on the food chain, they do not accumulate mercury like larger piscivorous fish in the Bay, and they are high in omega-3 fatty acids that everyone raves about.

California roach seems to be the most common fish in the middle reaches of Corte Madera Creek. These are small native minnows that school in the freshwater pools throughout the spring and summer. Their chunky little brown bodies have a touch of gold, hinting at their distant relation to goldfish. They can live for several years and lay thousands of eggs, but what makes roach so common here is their tolerance of high water temperatures and the fluctuations in dissolved oxygen levels that result from algae growth. They eat filamentous algae, invertebrates, even hitting tiny dry flies from the surface.

The poor, forgettable, unfortuitously-named California roach gets overlooked for so many reasons, and its taxonomy doesn’t do it any favors in this regard. As with so many of our wild animals in California, its common name came from a vaguely similar and distantly related European species of minnow, the common roach. The word minnow often gets thrown around for any small fish, but minnows are a specific family of fish, Leuciscidae, within the order of Cypriniformes, which includes carp. Central California roach, Hesperoleucus symmetricus symmetricus, is apparently a very symmetrical subspecies of the hespero, or western, leucus or minnow.

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Fields of Plastic Not the Solution
Continued from Page 1

including addressing extreme heat by cooling communities … and regulating temperature of…surfaces during extreme heat events. This track includes actions to promote nature-based solutions to reduce extreme heat risks.”

How much heat does a synthetic turf field add to the atmosphere? Studies have shown that the surface temperature of artificial turf runs between 35 to 60 degrees hotter than natural grass on full-sun days. One study conducted at Brigham Young University found that “The surface temperature of the synthetic turf was 37° F higher than asphalt and 86.5° F hotter than natural turf.” Penn State University’s Center for Sports Surface Research conducted studies comparing surface temperatures of synthetic turfs composed of various fiber and infill colors/materials and found that the maximum surface temperatures during hot, sunny conditions averaged from 140° F to 170° F.

The artificial turf industry’s standard solution to hot fields is to spray them with water, weakening the water-saving argument. Even Marin Water’s own guidance highlights the issues and lack of water savings. Even if artificial turf does save some water, it is a terrible trade-off with a net-negative impact to the environment. Artificial turf increases the risk of MRSA and Staph infections in users of the product. This can only be combated with frequent cleaning with water and anti-biotic and antifungal chemicals which leach into the groundwater, into the waterway, leading to another problem for insects, wildlife and the local environment.

It is also important to point out that installing an artificial surface bakes the underlying native soil to a point where it creates an ecological dead-zone beneath the plastic, rubber and rock. Unlike grass and soil, plastic does not sequester carbon. This further increases global warming and destroys the habitat for micro-organisms, insects and wildlife up and down the food chain.

The impact of winter weather extremes would also be exacerbated by synthetic fields, which greatly reduce the ability of a flood zone to hold and then slowly infiltrate stormwater. This increases stormwater runoff and can cause flooding, toxic runoff, and sewage overflow into adjacent habitat areas. Many of the proposed synthetic fields in Marin County are located in natural flood zones.

There is also a chemical concern associated with artificial turf. Synthetic turf blades, backing, shock pads and even plant-based infill have shown a 100% positive test rate for total fluorine, the gold standard for testing products for the presence of PFAS, a family of 12,039 ‘forever’ chemicals (US EPA). These chemicals leach into the soil, waterways and oceans. They cross human placentas, enter human breast milk, and bioaccumulate in humans, wild terrestrial and aquatic life. If these artificial turf fields are installed directly adjacent to Bay watersheds, the impact to fish, shellfish, ducks, egrets, otters, herons, other animals and humans that inhabit the immediate area, and the downstream waterways, could be severe.

Artificial turf blades also break down in extreme heat and UV light over time. Combined with frequent use and agitation, this creates microplastic particles that make their way into the waterways and subsequently into the bay ecosystem. According to Dianne Woelke, a former Advanced Practice and Public Health Nurse, “The plastic blades in the carpets begin to degrade the moment they are laid. The grinding action during play, UV radiation and environmental exposure causing breakdown, forming microplastics. Each field loses 0.5 to 8.0% of its blades annually, contributing 200 to 3200 pounds of plastic waste to our environment.”

A 2006 Chinese study states, “Marine microplastics will affect many aspects of the marine fish and marine food chain. The microplastics can have a toxic effect on fish and other aquatic life, including reducing food intake, delaying growth, causing oxidative damage and abnormal behavior. In addition, nano-scale microplastics will penetrate the biological barrier and accumulate in tissues… and may further affect life at the molecular level.”

Lastly, artificial turf fields need to be replaced roughly every 8 years. Each square foot is roughly 1/2 pound of plastic and the average-sized field is about 80,000 square feet. That is 40,000 lbs. of plastic going to landfill every 8 years for each field, the equivalent to adding more than 760,000 plastic bottles to landfills each year for each artificial turf field. At a time when we are trying to teach our kids that we need to prioritize environmental health over convenience, our school districts and local municipalities should not be supporting artificial turf fields.

It is reasonable for school districts, towns and cities to be pursuing solutions that limit water use and extend playing seasons for their athletic fields. The appropriate solution, however, does not lie in covering more of our community in plastic. Rather, we should pursue natural, heat and drought resistant grass over soil and sand bases, with proper drainage. San Anselmo recently rejected artificial turf as a solution for their renovation of Memorial Park. We hope other municipalities and school districts within Marin County will follow their lead and find a sustainable, nature-based field solution that will help protect the local wildlife, the community and the planet.

*Full citations for this article are included on Friends’ website.*
A large undersea volcano erupted in Tonga on January 15, 2022 at 5:14 p.m. local time (equal to 1:14 p.m. on January 14 in Kentfield: Tonga is 20 hours ahead of Kentfield). The resulting tsunami created 50-foot waves in Tonga. As these waves traveled around the world (entering San Francisco Bay en route), they arrived in Kentfield shortly after 9:00 a.m. on January 15. Their effect in Corte Madera Creek was recorded at the water surface elevation logger Friends has installed in the concrete channel, just downstream of Stadium Way. Instead of flooding, the tsunami created turbulence as shown in the graph above. The first tidal cycle on the graph, on the left, shows normal tidal behavior before the arrival of the tsunami; the tsunami’s turbulence then lasted for about three days before subsiding.

The graph is flat at the bottom because sediment downstream of the concrete channel prevents the water surface elevation from dipping low enough to show the lowest low tides.

**Pass the Roach**

*Continued from Page 5*

Recent genetic research has defined other subspecies of roach in the western US, but also complicated the picture by indicating that roach commonly hybridize with another species of slightly larger native minnow, the hitch. Hitch, of the genus *Lavinia*, seems to live farther downstream, in sloughs and wetlands. Alas, fishing for anything in our watershed’s creeks aside from the tidal portions of the Bay is prohibited. Therefore, as you pack up your fishing gear, I suggest you go for hitch instead, and ‘pass’ on the roach. But don’t be a stranger to our most common fish.

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**Friends’ Calendar of Events**

*July—December 2022*

Please check www.friendsofcortemaderacreek.org for updates. Board meetings will be via Zoom until we feel comfortable meeting in person. Email info@friendsofcortemaderacreek.org about a week before the meeting to obtain login information or check the agenda posted on our website.

- **July 21** Monthly Board Meeting, Thursday, 7:00 p.m., Zoom.
- **August 18** Monthly Board Meeting, Thursday, 7:00 p.m., Zoom.
- **September 15** Monthly Board Meeting, Thursday, 7:00 p.m., Zoom.
- **October 20** Monthly Board Meeting, Thursday, 7:00 p.m., Zoom.
- **November 17** Monthly Board Meeting, Thursday, 7:00 p.m., Zoom.
- **December** No December meeting

Our habitat restoration projects still need care. Please contact us to schedule individual or small group volunteer opportunities.
Thank You!

Friends of Corte Madera Creek Watershed wishes to thank the following individuals, agencies, and organizations for their contributions:

- Enthusiastic thanks to Tamara Hull, CPA, for preparing and submitting our tax returns
- Paul da Silva, Lorri Gong, Liz Gottlieb, and Bill Lenarz for sharing their expertise with the community during our May 7\textsuperscript{th} bioblitz
- College of Marin for co-hosting our bioblitz and providing a location and dedicated WiFi to review and upload photos
- California Alpine Club Foundation for funding habitat enhancement
- The Coastal Conservancy for funding habitat enhancement
- Marin County Parks for support of our work at Hal Brown Park by providing the very limited amount of water we use for irrigation
- Ross Valley Sanitary District for providing water for irrigation at the Ecology Study Area
- Other dedicated volunteers who make our activities possible, including removal of invasive plants and help with bacterial monitoring
- The many people who make financial contributions that allow us to continue our day-to-day work