Foreseeable adverse environmental impacts of Santa Cruz County's proposed ordinance on so-called "Low Impact Camping Areas"

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Prepared for the Rural Bonny Doon Association

Forest protection officer Chon Bribiescas, right, rake needles from the soil as campers Coree, left, and Andrew Dewlaney look on. The Dewlaney's, from Indio, brought a propane

Mountain Democrat

Cal Fire: Illegal campfire caused ...

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Executive Summary and RBDA Recommendations

Fire—LICAs should not be allowed in areas mapped as "high fire hazard". The proposed ordinance only excludes LICAs from "very high fire hazard" areas. Allowing LICAs in "high fire hazard" areas is predicted to increase the wildfire frequency several-fold, as quantified in the first half of this report. Residents in Bonny Doon and other parts of the County burned by the CZU wildfire are obsessed with fire safety. Many residents are having their policies "non-renewed" by insurance companies who consider the properties too risky to insure. Any camping that increases the threat or frequency of wildfire is unacceptable to these communities. (The first half of this report focuses on camper-caused wildfire statistics and impacts.)

Zoning—LICAs should not be allowed on properties zoned RA, TPZ, and SU. Noise from LICAs will be louder than residential properties and with the small setbacks specified in the ordinance the noise will disturb neighbors (as discussed on pages 19-22). TPZ parcels often have access problems and often lack residences to house campground managers.

On-site manager—LICAs should be required to have a manager on-site whenever the property is rented, to reduce fire hazards and enforce compliance with occupancy, health, and safety regulations.

Emergency communication—LICAs should be required to have a landline for emergency use on all sites in rural and mountainous areas.

Water storage—Water storage for fire-fighting should be required (as for commercial cannabis operations), except on LICA properties mapped as "low fire hazard", if any.

Generator use—Generators are inconsistent with low-impact camping; to reduce fire hazards and noise they should be prohibited at all times. See page 20.

Wildlife corridors—LICAs should not be allowed in areas mapped as priorities for conservation or as wildlife corridors, for consistency with the County's General Plan OBJECTIVE ARC-3.1 BIOLOGICAL DIVERSITY (LCP), which establishes the objective "To maintain the biological diversity of the County through an integrated program that includes … protection of plant habitat and wildlife corridors and habitats". See pages 20-23.

Compliance and enforcement—The 4/29/24 County staff report for the 5/8/24 meeting of the Planning Commission notes that several dozen small campgrounds are currently operating illegally in the County. Proponents of the LICA ordinance speculate that the ordinance will increase compliance. The fact that the County has been unable or unwilling to regulate this small number of campgrounds (advertised on-line) argues the contrary—that the County will be unable to regulate the hundreds of sites that the ordinance will allow. As noted on pages 6 and 9, rangers in San Bernardino National Forest routinely patrol for illegal campfires and found 700 of them in the first 8 months of 2020. The County

ordinance must include a plan for enforcing compliance with fire, safety, occupancy, health, and building codes, and a plan for how the County will fund the increased enforcement costs. SB620 specifically requires that "quiet hours" be enforced and specifically states that no funding will be provided. The ordinance should have a simple and straightforward procedure whereby residential neighbors can promptly shut down nuisance campgrounds that violate the regulations. Examples of code violations are shown on pages 24-28.

More formal campgrounds—Consider changing County codes to promote fewer, larger, supervised campgrounds. Compared with the same number of campers distributed over many small LICAs, this will cause fewer fires, less noise, and will facilitate enforcement of regulations.

Farm stays—The LICA ordinance or other County codes should be modified as necessary to promote farm stays on non-mountain agricultural properties.

CEQA review—The County should conduct a CEQA review of the overall ordinance, as we believe is legally required.

1. Introduction

In the County staff report on the proposed LICA ordinance prepared for the May 8 meeting of the Planning Commission, staff argued that the ordinance was exempt from CEQA review. Here we argue that the LICA ordinance has numerous foreseeable adverse environmental impacts, and that the ordinance is not exempt from CEQA review.

Increasing the number of campgrounds in Santa Cruz County—particularly in areas mapped by Cal Fire as "very high fire hazard" or "high fire hazard"—have foreseeable adverse environmental impacts on wildlife and neighborhoods including increased frequency of wildfires and their direct and indirect impacts; impact of noise on residential neighborhoods and wildlife (including species that are candidates for listing under the California Endangered Species Act); fragmentation of habitat and disruption of wildlife corridors; and increased sediment in streams.

2. Impacts of wildfire

In this section we argue that: campfires and recreation are the largest single cause of wildfires in California; outlawing campfires does not prevent them; increasing the number of campers in high-fire-hazard areas has the foreseeable impact of increasing the already large risk of wildfires; and wildfires have proven direct and indirect adverse impact on wildlife—including mountain lions that in 2020 were listed as a candidate species under the California Endangered Species Act.

Residents in Bonny Doon are rightfully obsessed with wildfire and its impacts. The community has experienced three wildfires since 2008, including the CZU fire that destroyed 911 homes in the County. Some residents are still rebuilding, and as discussed below, insurance companies are "non-renewing" insurance policies due to likelihood of future fires. Any ordinance that increases the already high frequency of wildfires will have a devastating impact.

2.1 Campfires and recreation as causes of wildfires

Recreation is the single largest cause of wildfires in in the U.S. and California. For the two decades from 2000 to 2020, recreation started 33% of wildfires of known origin in California: approximately 5000 fires out of 15,000 (Little, 2023; Figure 1a in this report). Similarly, using data from the U.S. Forest Service and the National Interagency Fire Center, Accuweather (2024) summarized the causes of post-2006 wildfires on U.S. Forest Service lands (not restricted to California). Out of the 23,303 human-caused wildfires, 11,463 (49%) were started by campfires (Figure 1b).

Of the three fires in Bonny Doon in recent decades, one (2009 Lockheed fire) was determined to have been caused by a campfire, one (2020 CZU complex fire) was ignited

by lightning; the cause of the third (2008 Martin fire) was never determined. But we can conclude that 1 of the 2 Bonny Doon fires of known origin was caused by a campfire.

The Western Fire Chiefs Association (2022, edited 2024), citing data from the Congressional Research Service (2023), reported that "Humans cause nearly 90% of wildfires in the United states[1] via discarded cigarettes, unattended campfires, burning debris, or through equipment malfunctions." Combining these data indicates that 30% - 44% of all wildfires are started by campfires (i.e., 33-49% of the 90% of wildfires started by people). This is a lower limit of the true total started by campers because fires ignited by campers smoking cigarettes, fireworks, or electrical generators are placed in those respective categories rather than campfire origin (Figures 1a and 1b). The accounts cited above can be generalized as demonstrating that campfires cause 37% ± 7% of all wildfires.

2.2 Outlawing campfires does not prevent them

Unfortunately, outlawing campfires does not prevent them, even when camping areas are patrolled by rangers. A survey by The Dyrt on-line camping community (The Dyrt, 2021) found that: "36 percent of campers reported seeing active fires in areas with burn bans this summer".

Similarly, Louis Sahagún (2020) reported that rangers in San Bernardino National Forest doused several dozen illegal fires on a single patrol and found a total of 700 illegal fires in first 8 months of 2020 (Figure 2a). Sahagún (2020) illustrated two reasons for campers lighting illegal or unsafe fires. First, some campers willfully violate fire rules. Second, some campers don't know safe fire practices. For example, one group had a permit for a propane fire appliance but placed it on flammable pine needles (Figure 2b). Regardless of the explanation, campers can't be relied on to follow safe campfire rules.

It might be thought that requiring fire pits or barbeque structures might reduce the incidence of fires, but this is not necessarily the case. Jenkins et al. (2023) stated: "Fire pits and rings at campgrounds undoubtedly create more opportunities for ignitions. Fire pits and rings are intended to reduce the risk of wildfire, but the perception of fire safety they confer may increase the likelihood of ignition if that perception results in inattention or incomplete extinguishment (Halpern and Pearl, 2005)".

A Google search for wildfires caused by illegal campfires turns up many examples of campers ignoring campfire bans—even where camping areas are patrolled by rangers (Figure 3). Without rangers to patrol LICAs in Santa Cruz County, illegal fires are likely to be more prevalent. Additional fire hazards enabled by the LICA ordinance include lack of required water storage for fire-fighting (as the County requires for homes and cannabis cultivation), no required on-site manager, no required land-line for emergencies where cell coverage is poor or nonexistent, and allowing electrical generators. Moreover, the fact that property owners currently rent out unauthorized/illegal campgrounds bodes poorly for their willingness to follow fire, safety, health, and environmental campground regulations.

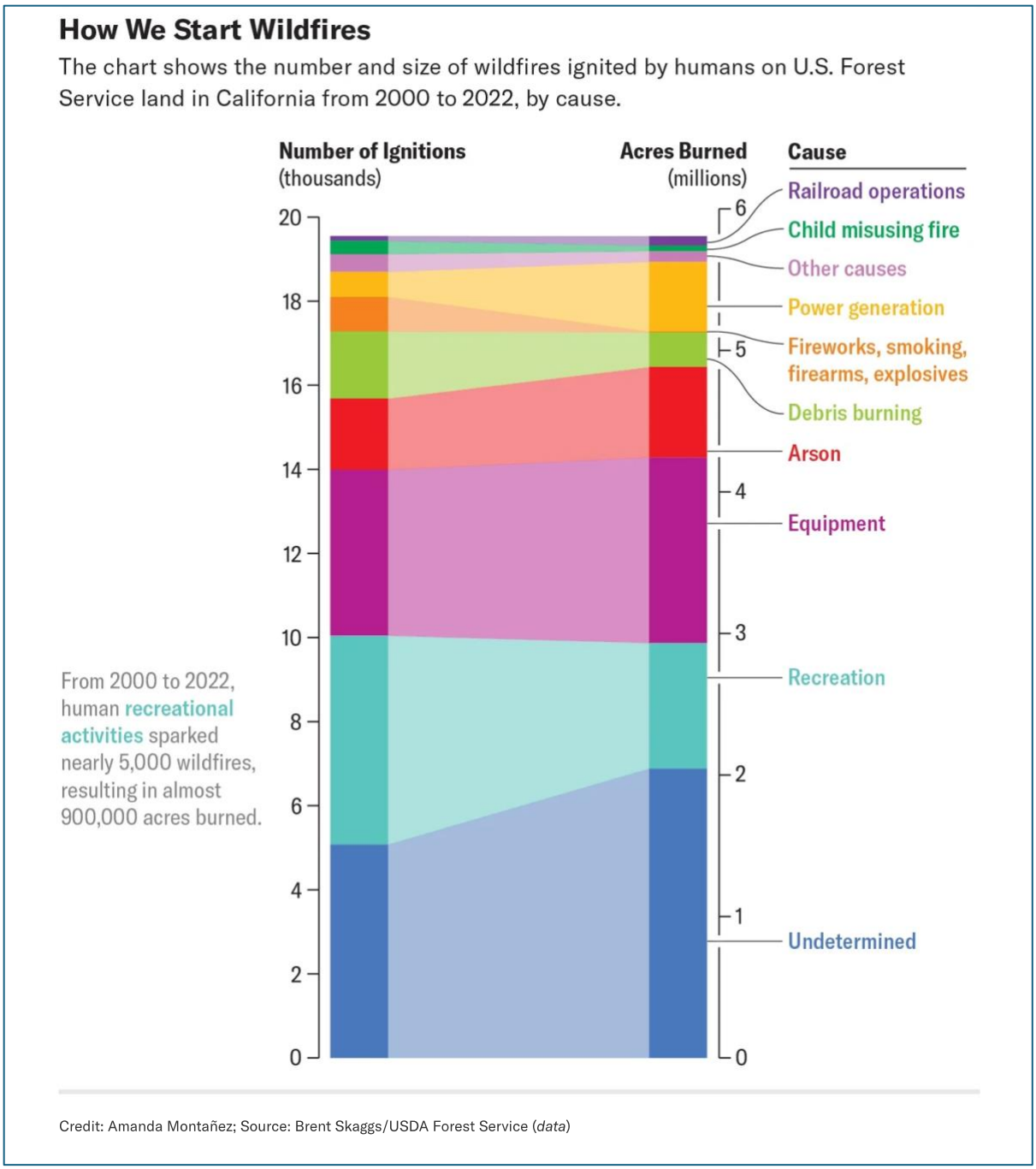

Figure 1a. Causes of California wildfires from 2000 to 2020, based on USDA Forest Service data. Recreation was the single largest human cause, starting approximately 5000 wildfires (one third of the 15,000 with a known cause). Reproduced from Little (2023).

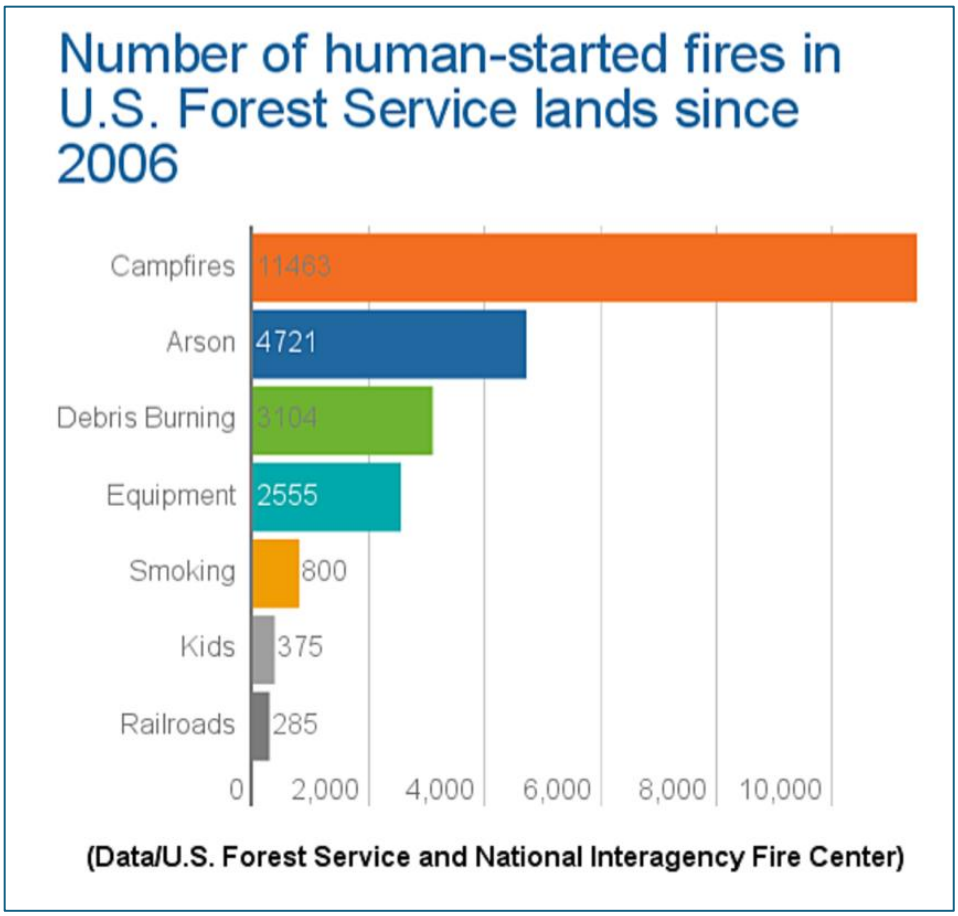

Figure 1b. Causes of post-2006 wildfires on U.S. Forest Service Lands (not restricted to California); data of the U.S. Forest Service and National Interagency Fire Center. Reproduced from Accuweather (2024). Campfires started approximately 50% of human-caused wildfires.

Forest service law enforcement officer Tyler Smith looks for evidence of illegal camping and campfires while on patrol. (Brian van der Brug/Los Angeles Times)

Figure 2a. Some campers willfully violate fire restrictions. Rangers in San Bernardino National Forest doused several dozen in a single patrol and discovered 700 in the first 8 months of 2020. Reproduced from Sahagún (2020, LA Times, August 30, 2020, https://www.latimes.com/environment/story/2020-08-30/illegal-campfires-spark-fear-of-wildfire-in-southern-california-forests).

Forest protection officer Chon Bribiescas, right, rake needles from the soil as campers Coree, left, and Andrew Dewlaney look on. The Dewlaney's, from Indio, brought a propane campfire ring which is legal for use in the forest to their dispersed campsite. (Brian van der Brug/Los Angeles Times)

Figure 2b. Other campers try to follow the rules but don't understand fire safety. These campers had a permit for their propane fire appliance but placed it on flammable pine needles. Reproduced from Louis Sahagún (2020, LA Times, August 30, 2020, https://www.latimes.com/environment/story/2020-08-30/illegal-campfires-spark-fear-of-wildfire-in-southern-california-forests).

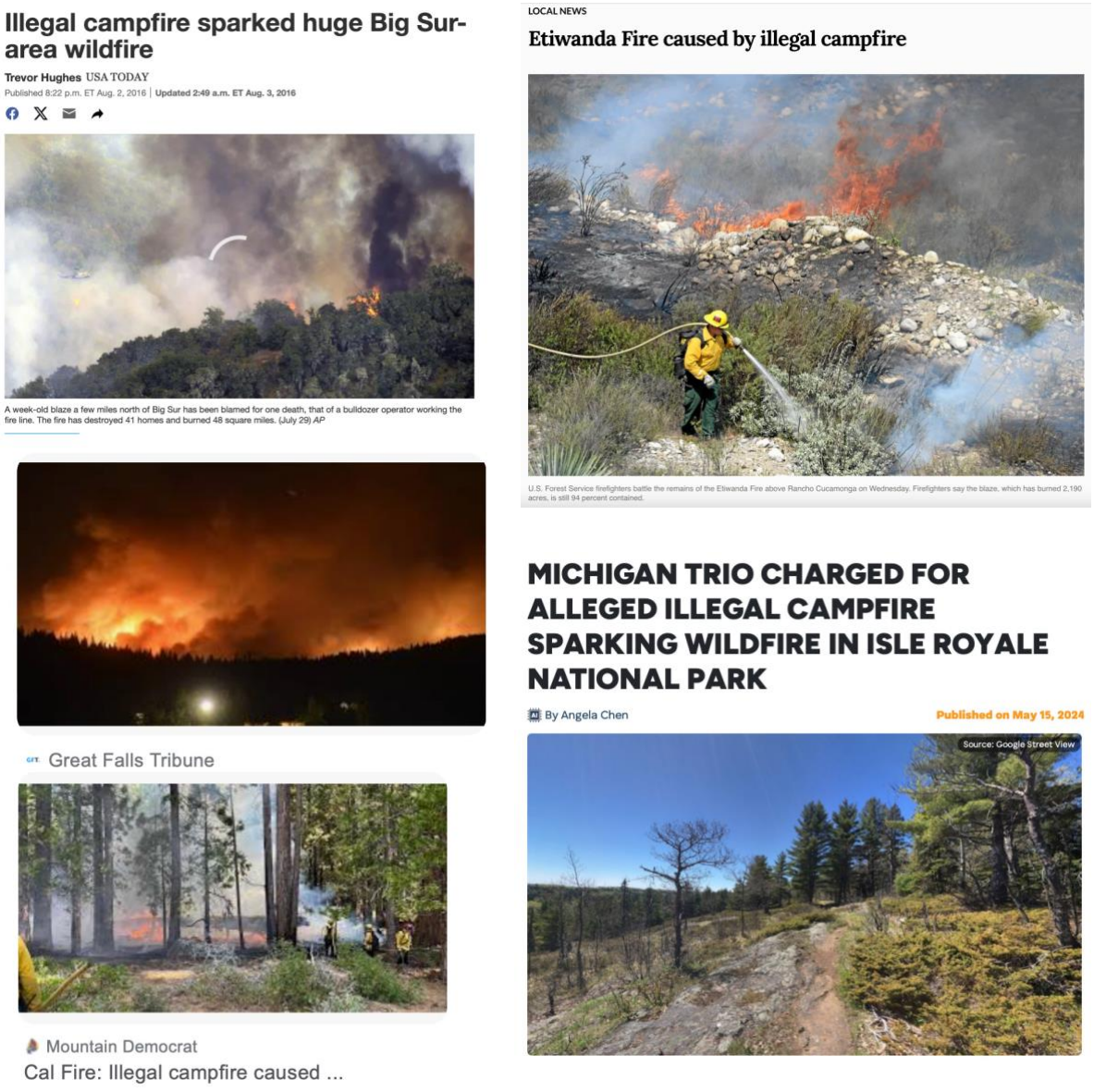

Figure 3. Sample news reports of wildfires caused by illegal campfires.

2.3 Increasing the number of campers in high fire hazard areas has the foreseeable impact of increasing the already large risk of wildfires

Much of Santa Cruz County is mapped by Cal Fire as "very high fire hazard" or "high fire hazard". Insurance companies are aware of this, and County residents are having their homeowner's insurance "non-renewed" (Figure 4b). Because campfires and recreation cause ~40% of wildfires, it is predictable that increasing camping in high-fire-hazard areas will increase the frequency of wildfires.

This prediction has, in fact, been quantified. Jenkins et al. (2023) studied the impact of campground visitation on wildfire frequency. They reported: "From 1992–2020, nearly twice as many fires occured [sic] on weekend days as on weekdays" (reproduced here as Figure 5a). Similarly, Sadegh (2023) found that substantially more fires start on July 4 than any other day of the year (Figure 5b). Jenkins et al. wrote: "Mean annual densities of recreation-caused ignitions on national forests were 7 times greater within than beyond 1 km of designated campgrounds". In other words, fires are more frequent on days with higher visitation and in locations that are closer to campgrounds. Increasing the number and distribution of campgrounds and increasing campground visitation within rural parts of Santa Cruz County can thus be expected to increase our County's wildfire frequency.

Perkins et al. demonstrate that as the number of visitors per year increases, so does the number of wildfire ignitions per year (reproduced here as Figure 5c). This trend is most pronounced in areas within 1 km (0.6mi) of a campground (red data points and red line in Figure 5c). All three of the plots in Figure 5 illustrate how increasing visitation leads to increases in human-caused wildfires.

Perkins et al. developed an equation to quantify the relation between the number of wildfire ignitions per year (y) to the number of visitors per year (x). Normalizing their equation to a specific geographic area, their equation becomes

$$y = x^b \qquad \text{(equation 1)}$$

where y is the number of ignitions in that area annually, x is annual number of visitors to that area, and the exponent b is equal to 0.52 (95% confidence interval 0.42-0.62). Equation (1) thus describes how an increase in visitation increases the number of wildfires.

Next, we calculate how much the LICA ordinance is likely to increase camping. The Santa Cruz County staff report for the 5/8/2024 meeting of the Planning Commission stated (page 17): "Research on online venues such as Hipcamp indicate that a number of these types of campgrounds already exist unpermitted in the county, so the purpose of developing this ordinance is to establish new regulations and ensure adequate public safety measures, environmental protections, and code compliance for these existing and new uses. As of the date of this staff report, there were approximately 20 sites advertising on Hipcamp."

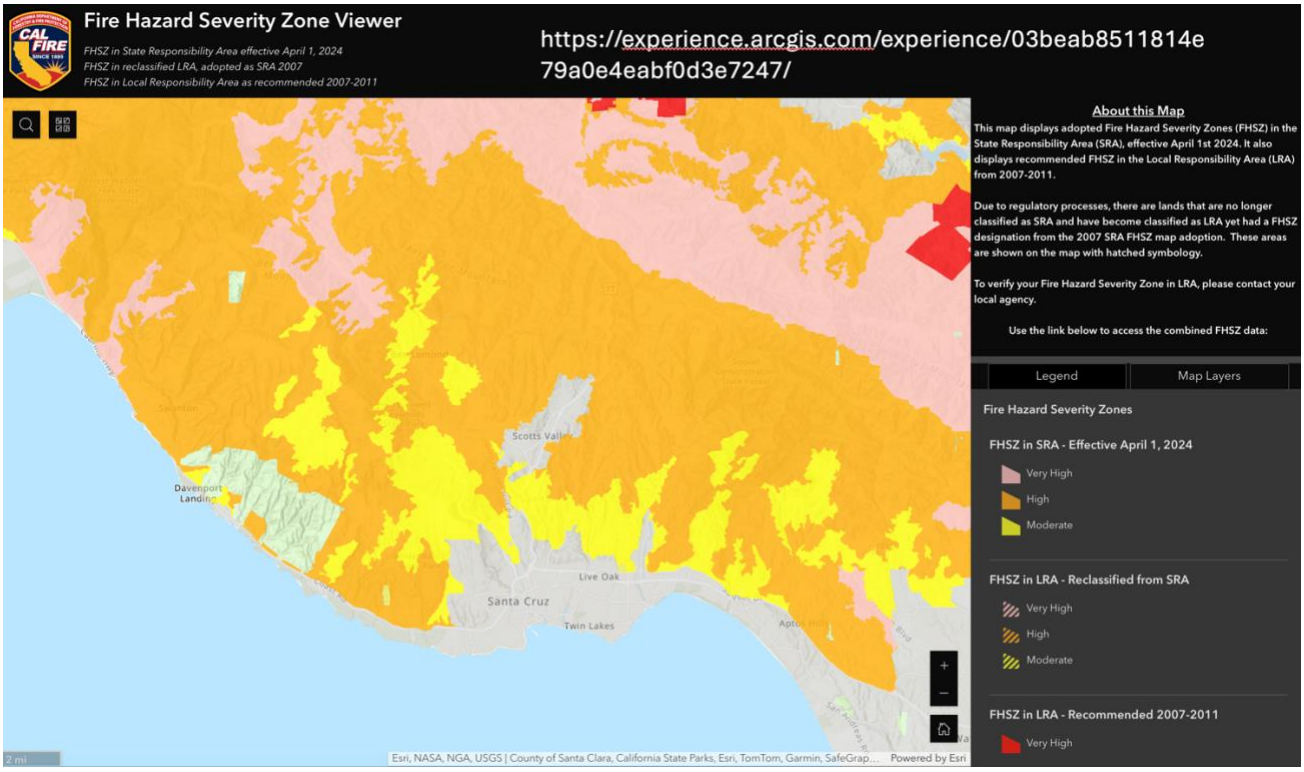

Figure 4a. Cal Fire's map of fire hazard severity. Most of Santa Cruz County is mapped as "very high" or "high" (effective 4/1/2024).
https://experience.arcgis.com/experience/03beab8511814e79a0e4eabf0d3e7247/

Figure 4b. Map showing where State Farm plans to "non-renew" their customers due to high fire hazard. This includes much of the rural parts of Santa Cruz County. Reproduced from Munce (2024, San Francisco Chronicle, https://www.sfchronicle.com/projects/2024/ca-statefarm-nonrenewal-map/).

The same County report estimates that the County has a total of 1300 eligible LICA parcels. Using the equation of Jenkins et al., occupying this number of campgrounds is predicted to increase the annual number of human-caused wildfires by a factor of 9 $(1300/20)^{0.52}$. This 9-fold increase in the number of fires ignited by humans corresponds approximately to a 4-fold increase in fires of all causes. Of course, not all 1300 eligible parcels would develop LICAs, but this number is what the ordinance allows.

If we take a more conservative estimate that only 10% of the eligible parcels were to develop LICAs, then equation (1) predicts that human-caused wildfires will increase 2.6-fold $(0.10 \times 1300/20)^{0.52}$, and the number of wildfires of all causes is predicted to approximately double. But the ordinance does not guarantee this reduced number of LICAs.

These various measures all predict substantial increases in the number of wildfires ignited by recreation. The temporal data show a doubling of recreation-caused fires on weekends (Figure 5a) and nearly a doubling on the 4th of July (Figure 5b); the proximity data show a 7-fold increase in recreation-caused fires near campgrounds; the predictions based on increased visitation and equation (1) suggest a 2.6-fold to 9-fold increase in recreation-caused fires.

Equation (1) of Jenkins et al. is based on data from increased camping within existing campgrounds. Their results (term "b" in the equation) show that wildfires increase at a lower rate than visitation. For example, a four-fold increase in visitation causes only a doubling of wildfires. We hypothesize here that this arises because of a nonlinear effect of increasing visitation by adding more campers to existing campgrounds—perhaps allowing peer pressure to cause safer fires or perhaps because unattended fires are more likely to be viewed by nearby campers in the campground.

In contrast, if visitation were to increase by increasing the number of small LICA-sized campgrounds distributed away from each other, this supervision by nearby campers would not exist, and we would expect that doubling the number of campgrounds (rather than the number of campers in existing campgrounds) would cause wildfires to increase in number proportionately to the number of campgrounds. In this case, the number of wildfires would be substantially greater than the 2.6-fold to 9-fold increase in recreation-caused fires calculated using equation (1).

The increase in wildfires cannot be quantified precisely because we don't know what the future visitation will be, how frequently campers will violate campfire regulations, or how some of the LICA rules will make fires more likely than in the published studies. Specifically, the County ordinance does not require an on-site manager, water storage for fire-fighting, or a telephone connection to call for fire fighters. Nevertheless, the results presented above suggest that increasing the number of camping areas in the County from the current level of a few dozen unpermitted sites to a few hundred sites can be expected to cause a several-fold increase in the overall number of wildfires.

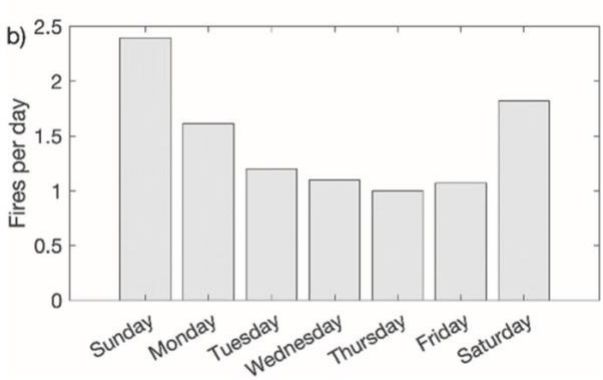

Figure 5a. Example of how increased human visitation causes more wildfires. Wildfires are twice as frequent on weekends as mid-week. From Jenkins et al. (2023).

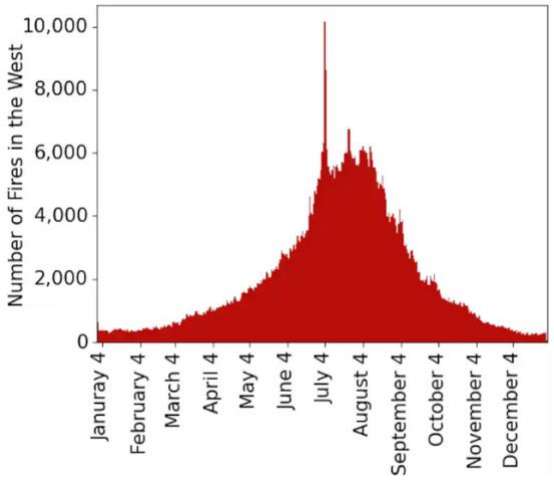

Figure 5b. Human-caused wildfires spike on the 4th of July. From Sadegh (2023).

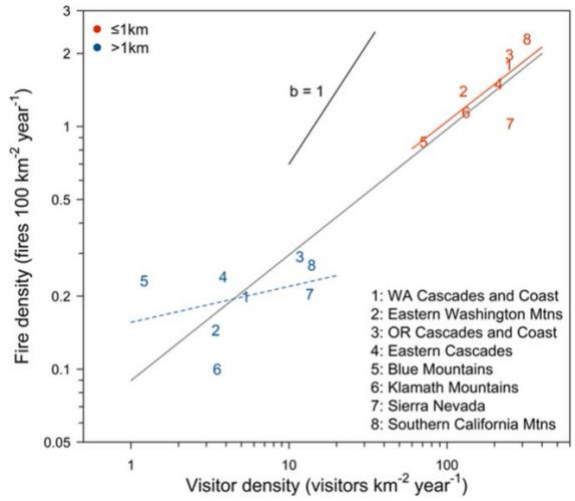

Figure 5c. Plot showing that the number of wildfires increases goes up in response to increased visitation. From Jenkins et al. (2023).

Having shown above that increasing the number of campgrounds and campers predictably leads to more wildfires, we will next consider the direct and indirect environmental impacts of wildfire.

2.4 Direct and indirect effects of wildfire on wildlife

That wildfires have a negative impact on wildlife is common sense, but many of the details are complex and not intuitively obvious. Direct impacts include injuries and mortality from heat, smoke inhalation, acute heat stress and flight from the fire. Indirect effects include predation risk, loss of prey, and habitat modification (Gutiérrez and de Miguel, 2021), which can include increased sediment input to streams.

Specific impacts of wildfire vary from species to another, and for this discussion we first consider impacts to mountain lions. (On April 16, 2020, the California Fish and Game Commission issued a notice that the Central Coast evolutionarily significant unit (ESU) of mountain lions (*Puma concolor*) is a candidate species under the California Endangered Species Act, CESA).

Blakey et al. (2022) tracked the movement of 17 mountain lions in southern California before and after the 2018 Woolsey Fire. Two of them were presumed to have died during or shortly after the fire. Blakey et al. reported: "After the wildfire, mountain lions avoided burned areas and increased behaviors associated with anthropogenic risk, including more frequent road and freeway crossings (mean crossings increased from 3 to 5 per month) and greater activity during the daytime (means from [sic] increased 10% to 16% of daytime active), a time when they are most likely to encounter humans. Mountain lions also increased their amount of space used, distance traveled (mean distances increased from 250 to 390 km per month), and intrasexual overlap, potentially putting them at risk of intraspecific conflict. Joint pressures from urbanization and severe wildfire, alongside resulting risk-taking, could thus increase mortality and extinction risk for populations already suffering from low genetic diversity, necessitating increased connectivity in fire-prone areas."

Similarly, Jennings et al. (2016) tracked the movement of more than 40 individual mountain lions in southern California from 2001 to 2011 and observed how their movement was affected by wildfire. They concluded that fire-caused shifts in the landscape threatened the existence of the pumas: "Given that a trend in increased fire size and fire frequency is already underway in southern California, fire-induced habitat changes in an urbanizing landscape will reduce the quality or availability of puma habitat in an ecosystem where their persistence is already threatened by urbanization and habitat fragmentation. The indirect effects of these anthropogenic landscape changes on natural processes, namely wildfire, cause additional landscape shifts such as vegetation-type conversion from shrublands to non-native annual grasslands that cross threshold levels for continued puma persistence." Both studies (Blakey et al., 2022, and Jennings et al., 2016) noted that **wildfires threatened the mountain lions' existence**.

Next, we briefly review how wildfires can impact influence aquatic species, including salmonids that are present in Santa Cruz County watersheds (Figure 6 and Table 1). Effects of fire can be immediate or prolonged. The first effect is elevating water temperatures, which can happen within hours of a fire. A small slash burn in the Needle Branch in Oregon caused water temperatures to rise rapidly from 55° to 82°, killing large numbers of juvenile coho salmon and cutthroat trout (Hall and Lantz, 1969).

Elevated temperatures that immediately kill fish are unusual, but longer-term rises in temperature are common where fires kill vegetation on the bank, allowing more sunlight to warm the water or where sunlight on exposed ground increases the temperature of groundwater flowing into creeks (Chandler et al. 1983).

In addition to increasing water temperatures, fires that remove vegetation also result in greater flux of sediment from hillsides to creeks (Warrick and Rubin, 2007). Increases in sediment flux can be exceptionally great where intense post-fire storms trigger debris flows into creeks. Excessive sediment on a stream bed can reduce spawning and rearing habitat (Hall and Lantz, 1969), and excessive sediment in suspension in the water can adversely affect salmonid physiology, behavior, and habitat (Bash et al., 2001).

Beakes et al. (2014) monitored the effects of a wildfire in Santa Cruz County's Scott Creek watershed. They found that the fire resulted in an increase in water temperature that would have increased the metabolism of steelhead/rainbow trout but was not accompanied by increased feeding. The authors wrote: "Presumably due to starvation, mortality, or emigration, we found a significant negative relationship between the change in total salmonid biomass over the post-fire summer and the average energy costs ($kJ \cdot g^{-1} \cdot day^{-1}$) within a burned pool. This study demonstrates that wildfire can … drive short-term increases in stream temperature, exacerbating bioenergetically stressful seasons for coldwater fishes."

Fire, therefore, can increase sediment input to streams and can increase water temperature, both of which impact salmonids' physiology, behavior, and habitat (Table 1).

In summary, studies of wildfire have demonstrated direct and indirect impact on wildlife, including mountain lions and salmonids. These impacts are contrary to the County's General Plan OBJECTIVE ARC-3.1 BIOLOGICAL DIVERSITY (LCP), which establishes the objective "To maintain the biological diversity of the County through an integrated program that includes … protection of plant habitat and wildlife corridors and habitats."

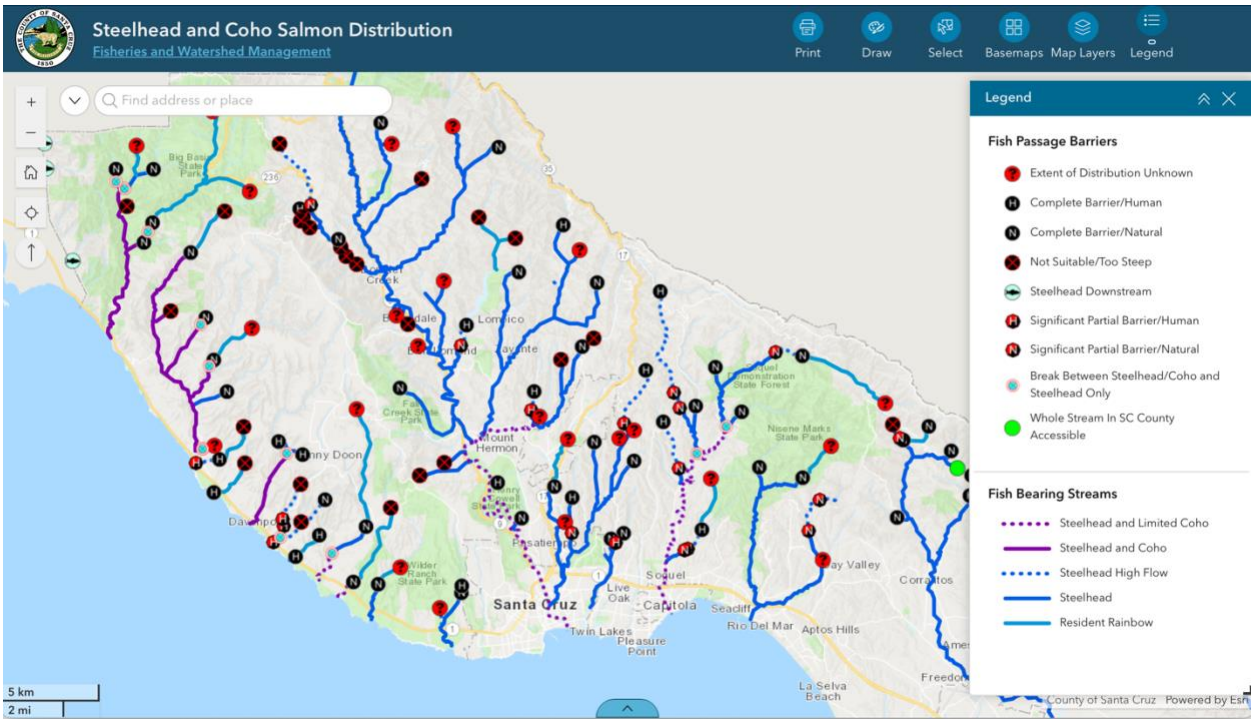

Figure 6. Distribution of steelhead, coho salmon, and rainbow trout in Santa Cruz County watersheds. From Santa Cruz County Fisheries and Watershed Management (https://experience.arcgis.com/experience/eb7a5b7a51d64706b2977788f6da66da).

Table 1. Effects of turbidity on salmonids

Physiological	Behavioral	Habitat
gill trauma	avoidance	reduction in spawning habitat
osmoregulation	territoriality	effect on hyporheic upwelling
blood chemistry	foraging and predation	reduction in BI habitat
reproduction and growth	homing and migration	damage to redds

Table 1. Water turbidity effects salmonid physiology, behavior, and habitat. From Bash et al. (2001).

3. Impacts of campground development on sedimentation

Development of campsites, sanitation facilities, and access roads all disturb vegetation and soil, which can increase the flux of sediment to streams. There is potential for campsites and access roads to degrade, individually or cumulatively, the water quality of streams. This is particularly true where there are impacts from sediment already evident in the streams, as generally acknowledged in the Bureau of Land Management Environmental Assessment for San Vicente Creek, Liddell Creek and Laguna Creek (Bureau of Land Management, 2020, pages 65, 75-76).

The Central Coast RWQCB has adopted a turbidity standard that is applicable to streams providing that "Where natural turbidity is between 0 and 50 Jackson Turbidity Units (JTU), increases shall not exceed 20 percent." At the May 22, 2024, meeting of the Rural Bonny Doon Association, an attendee mentioned that he currently operates 2 unpermitted campsites on his property bordering San Vicente Creek (a creek with salmonids). He mentioned that to reduce fire hazard, he cleared 100 ft of his property at the campsite area down to bare dirt. This would help reduce fire hazard, but it can cause increased sediment yield to creeks.

4. Impacts of LICA noise on wildlife

4.1 Noise levels of LICAs

Four factors contribute to high noise levels in campgrounds, (1) people generally talk louder outdoors than indoors; (2) LICAs allow from 5-9 campsites (groups of four campers), which can make noise simultaneously; and (3) most significantly, campgrounds don't have building walls to attenuate sound. For comparative purposes, we will evaluate how these three factors effect campground sound levels relative to a family of four people conversing one person at a time inside a dwelling with the windows closed.

People talking indoors speak at a volume of approximately 60 db (Decibel Pro). A family of four people taking turns speaking generates the same sound level. The degree to which their building attenuates sound depends on construction materials, and how many windows the structure has. A typical wood-framed exterior wall with fiberglass insulation and double-paned glass windows attenuates sound by 38 db (U.S. Department of Housing and Urban Development). A family of four indoors will therefore produce 22 db outdoors (60 db – 38 db).

For comparison, we assume a person speaking outdoors has a volume of 65 db (using their "outdoor voice"). This is a few times as loud as an "indoor voice" levels, but much quieter than shouting, which at 70 db is 10 times as loud as an indoor voice level. Because a LICA can have between 5 and 9 campsites, and because campsites can have conversations simultaneously, the overall sound level for a fully occupied LICA is 5-9 times as loud as for

a single campsite. For simplicity, we assume an average LICA has 7 campsites, which corresponds to an 8 db increase in overall noise relative to a single campsite.

Combining these factors, we calculate that a 7-campsite LICA will generate 73 db, whereas the family indoors will generate 22 db of outdoor noise. This means that the LICA will be 51 db louder (73 db minus 22 db) than a family inside a house.

The numbers calculated above are in decibels (db), a logarithmic scale which is difficult to conceptualize. Converting these numbers to relative loudness—which is more intuitive—shows that 51db corresponds to a factor of 100,000. In other words, one LICA with 7 outdoor campsites produces 100,000 times as much noise as a family indoors with the windows closed. So even though a campground might seem to have less environmental impact than a residence, a single LICA with a handful of campsites can produce more noise than an entire rural residential neighborhood.

An increase in noise by a factor of 100,000 does not mean that sound will carry 100,000 times as far, but it does mean that sound will cover 100,000 times as much area. Any specified sound level will extend 300 times as far from the LICA, creating a much greater potential to disturb wildlife or neighbors.

The calculations presented above consider only noise from people speaking. They don't consider noise from generators, which the LICA ordinance allows from 10:00am to 6:00pm. Nor do the calculations consider campers playing music—live or played over amplifiers or portable speakers—which is not addressed by the LICA ordinance.

The LICA ordinance allows each campground to have 5-9 campsites, each of which is allowed to run a generator during the daytime. The National Park Service prohibits use of "motorized equipment or machinery that exceeds a noise level of 60 decibels measured on the A-weighted scale at 50 feet, or, if below that level, nevertheless makes noise that is unreasonable." This corresponds to a noise level at 3 feet of 84 db for one generator and 92 db for a LICA with 7 generators. This noise level is approximately 100 times as loud as a LICA with people talking (i.e., ten million times as loud as the noise leaking outside from a family talking inside a residence). Any specified noise level will extend 3000 times as far from the LICA as from the residence.

Having shown in this section how loud LICAs can be compared to a residence, the next section considers how human voices and equipment can impact wildlife.

4.2 Impact of LICA noise on wildlife

Although wildfire is devastating for wildlife, a LICA-ignited wildfire might not occur immediately after the LICA ordinance goes into effect. Other impacts can, however, begin

immediately. These include possible sediment increases in streams mentioned above in section 3, and the impacts of LICA noise on wildlife. For this discussion, we focus on the impact on mountain lions, which, as noted in section 2.4, became a candidate species under the California Endangered Species Act, CESA in 2020.

Wildlife corridors and habitats can be adversely affected by human voices a considerable distance away. On October 22, 2020, Dr. Wilmers of the Santa Cruz Puma Project sent an email to the Coastal Commission in which he stated: "[o]ur research has shown that local carnivore species such as bobcats and the state threatened mountain lion are negatively impacted by human voices."

The comments [by Dr. Wilmers] cite numerous studies, including Smith et al. (2017) to demonstrate mountain lions fear people, which results in mountain lions fleeing their kill sites when humans are nearby and possibly killing up to 50% more deer a year as a result of this reduced feeding time at kills (Smith et al., 2015), and increasing the energetic expenditure of mountain lions (Wang et al., 2015). The Puma Project research has also shown that mountain lions usually require a buffer of at least 600 meters [~2000 ft] from human activity to site nurseries to raise their kittens (Wilmers et al. 2013).

In a study that is particularly relevant to development of LICAs, Suraci et al, (2019) installed loudspeakers in the Santa Cruz Mountains and monitored the effect of human voices on mountain lions. They found:
"Mountain lions significantly altered their movement through the same physical landscape in response to hearing humans (Fig. 1), exhibiting antipredator behaviours comparable to those previously documented in small-scale experiments (Smith et al. 2017), but at a substantially larger scale (Fig. 2a). Observational and manipulative studies have similarly found that risk from humans affects large carnivore behaviour across the landscape (Valeix et al. 2012; Ordiz et al. 2013b, 2019; Oriol-Cotterill et al. 2015; Suraci et al. 2019), including in our study area, where increased human development is correlated with impacts on mountain lion movement and habitat use (Wilmers et al. 2013; Wang et al. 2017). Our results confirm that, even in the absence of changes in human infrastructure (e.g. buildings, roads) or habitat fragmentation, increased human presence can impact large carnivore movement by inducing antipredator responses, which, if sustained for long periods, could lead to effective habitat loss for carnivores by limiting hunting and feeding behaviour (Smith et al. 2015) or forcing individuals to abandon high risk areas of their home range (Schuette et al. 2013)."

This study is particularly relevant to the proposed LICA ordinance for two reasons. First, their study was conducted in the Santa Cruz Mountains. Second, the results demonstrated that the noise of human voices impacts mountain lion behavior even in the absence of changes in human infrastructure such as buildings and roads. In other words, the mere presence of people talking (as in LICAs) impacts mountain lions.

The sound of machinery has also been reported to affect mountain lions of distances from 300 to 3000 ft (U.S. Department of Transportation Federal Highway Administration, 2004).

Sempervirens and The Nature Conservancy have both mapped lands that they consider priorities for conservation in Santa Cruz County (reproduced here as Figures 7a and 7b). Sempervirens specifies in their map that lands were selected based on their biodiversity and use as wildlife corridors between nearby protected lands. Much of Bonny Doon was included in both maps as a priority for conservation, presumably for these reasons. (Bonny Doon is bordered by Cotoni-Coast Dairies and San Vicente Redwoods on the west and by Wilder Ranch State Park on the east.)

Distributing LICAs throughout the areas of the county has the foreseeable impact of disturbing the County's mountain lion population. In particular, LICA noise may be particularly disruptive to mountain lions' use of wildlife corridors between protected areas of the County. This conflicts with the County's General Plan objective of maintaining biodiversity.

Mountain lions are not the only species potentially impacted by noise. The endangered marbled murrelet's range cover much of Santa Cruz County. Smith et al. (2023) wrote: "The relatively quiet habitat of the marbled murrelet may ease the incursion of anthropogenic noise pollution and encroachment and heighten the potential for disturbance in nesting individuals". LICAs are much louder than the noise levels reported to disturb marbled murrelets.

4.3 Impact of LICA noise on neighborhoods

Noise from LICAs will impact neighbors as well as wildlife. Even when generators are not in operation, a single LICA campground can produce hundreds or thousands of times as much noise as a residential family indoors, and dozens of times as much noise as a family outdoors. With generators running, a LICA can be 10,000,000 times as loud as a family talking indoors.

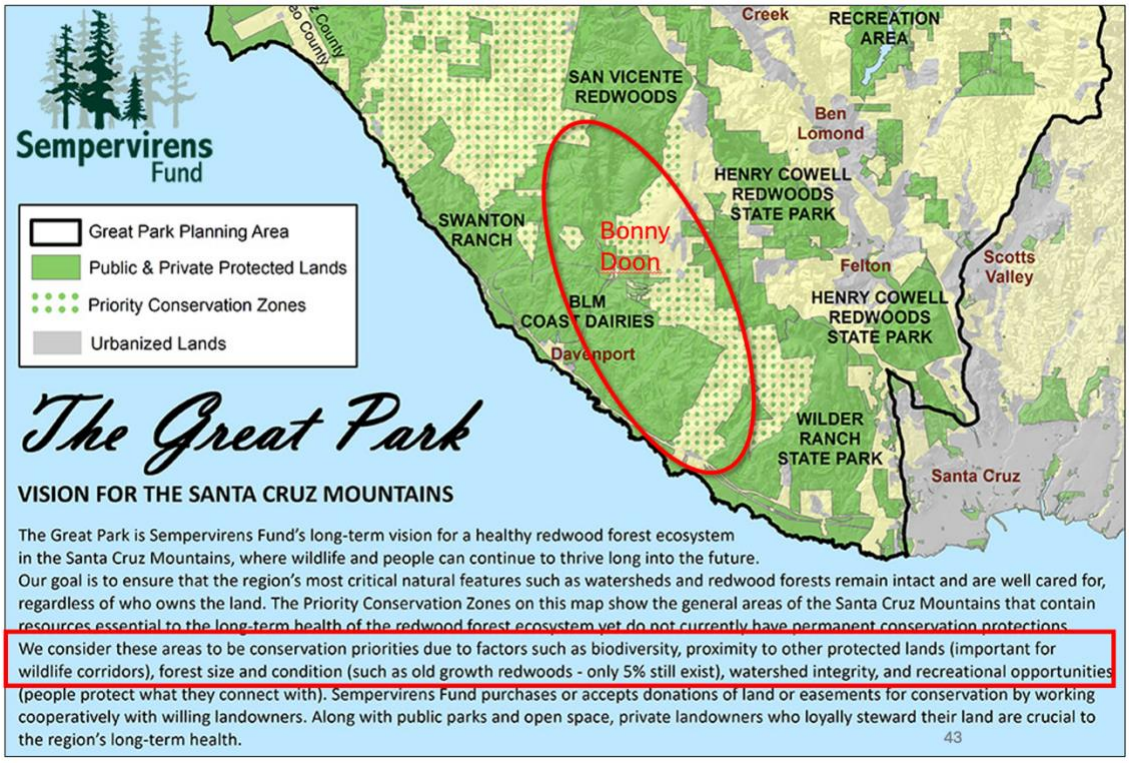

Figure 7a. Lands that Semperivirens mapped as priorities for conservation based on biodiversity and use as wildlife corridors between nearby protected lands. Much of Bonny Doon is mapped as a priority for conservation; it is bordered by Cotoni-Coast Dairies and San Vicente Redwoods on the west and by Wilder Ranch State Park on the east.

Figure 7b. Lands mapped by The Nature Conservancy as priority for conservation. The areas mapped as priorities for conservation are consistent with Semperivrens' map (Figure 5a).

5. Compliance and enforcement

As noted in the discussion of wildfire, two factors cause campers to have unsafe campfires: deliberately disobeying fire regulations and not understanding safe fire practices. The same factors can cause other negative environmental or health/safety impacts.

Proponents of the LICA ordinance have speculated that legalizing campgrounds will lead to better compliance of regulations. The existence and advertising of illegal campsites, however, suggests otherwise. A quick survey on Hipcamp turns up numerous campsites that look like they should be inspected for code compliance of health, safety, and environmental regulations. For example, Figure 8 shows a stovepipe adjacent to a tent wall, electrical conduit on the ground surface, permanent-looking installations of propane hot water systems, grey-water drainage on the ground, artificial ponds, and pit toilets.

All of the photos in Figure 8 were from Hipcamp advertisements of campsites in Santa Cruz County. If our County can't enforce the current campground regulations for the existing un-permitted campgrounds advertised on Hipcamp, how can residents rely on the County to enforce the proposed LICA regulations, including fire safety, occupancy, noise, and code compliance when perhaps hundreds of campgrounds are in operation?

Figure 8a. Tent has chimney, presumably from wood stove. PVC electrical conduit is lying on the ground (unburied). All five photographs in Figure 8a-8e were from Hipcamp advertisements of campgrounds in Santa Cruz County.

Figure 8b. Outdoor shower with propane heaters and electrical conduit on the ground. The propane heater at the right is suspended loosely by a single nail.

Figure 8c. Artificial pond. Excavating, compacting, and filling soil to create a pond requires a grading permit and a design by a CA licensed professional engineer, registered civil engineer, or registered engineering geologist.

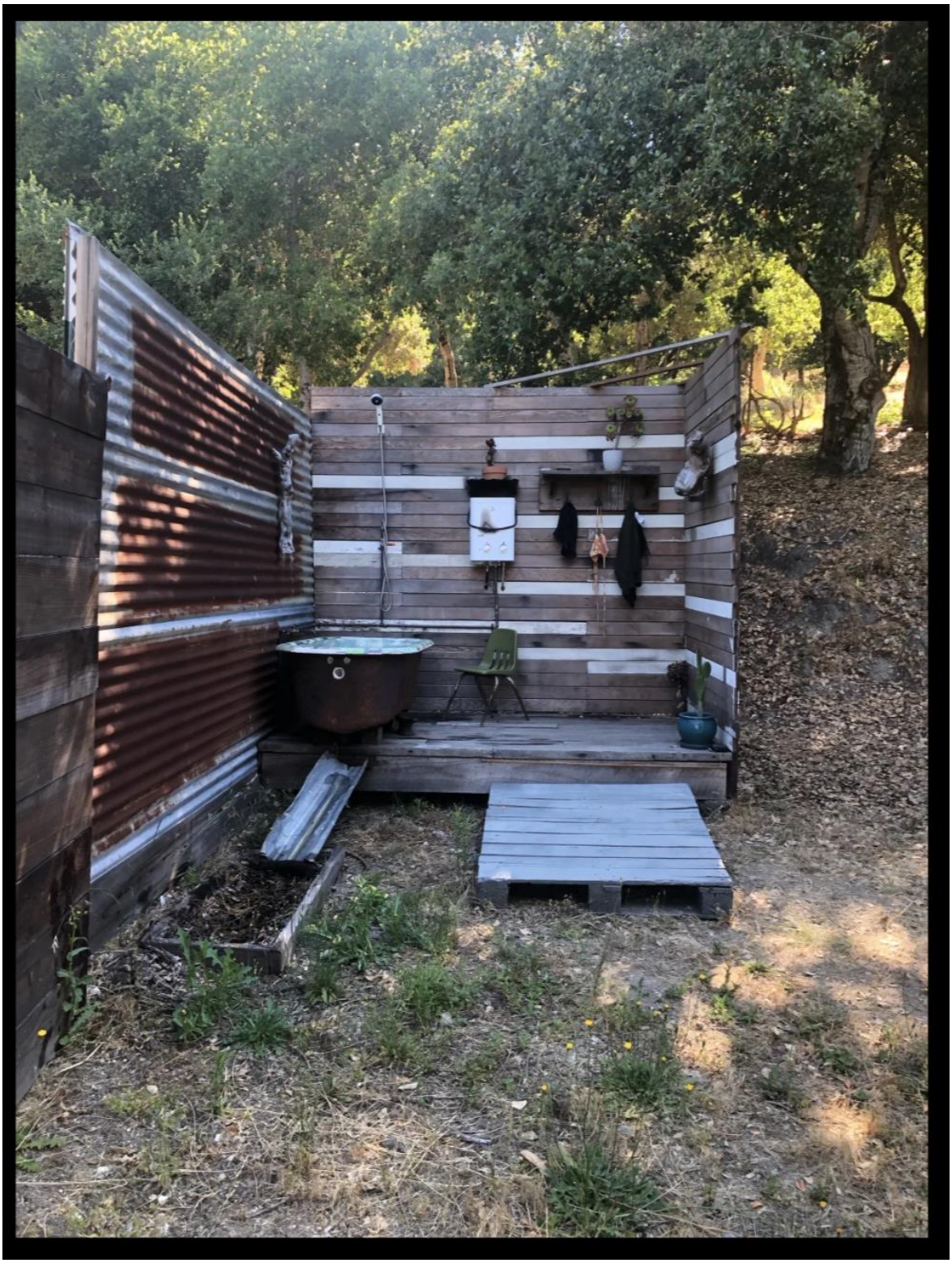

Figure 8d. Outdoor bath with propane heater and water draining on ground. Code requires grey-water systems to drain underground, except for washing machines.

Figure 8e. Pit toilet. Are these allowed by County code?

6. Summary

Santa Cruz County's camping LICA ordinance includes the terms "Low Impact", but low infrastructure development does not ensure low impact. This concept was explained in a 2020 Special Issue of the California Fish and Wildlife Journal, in which Mitrovich et al. wrote:

"In general, it can be difficult to accept that recreation activities, especially quiet, non-motorized activities like hiking and mountain biking, can have harmful effects on wildlife. Many types of recreation cause little physical habitat change. Perhaps as a result, recreation was widely assumed to be a "benign use" that is compatible with conservation goals (Knight and Gutzwiller, 1995) and is permitted in the vast majority of protected areas worldwide (Eagles et al. 2002; IUCN and UNEP 2014). ...The viewpoint that recreation is a benign use may be changing, however. In recent years, researchers have found evidence that a variety of recreation activities and intensities can have detrimental impacts on wildlife (Geffory et al., 2015; Larson et al., 2016; Samia et al., 2017)."

Here we have shown that increasing the amount of camping in Santa Cruz County will predictably increase wildfire frequency several-fold. LICAs have the potential to become the main source of noise in rural neighborhoods, particularly during the daytime, when generators are allowed. Noise doesn't just impact neighbors; it impacts mountain lions (which have protection under CESA) causing them to abandon their kills, kill more deer, and expend more energy to survive.

Many of our Rural Bonny Doon Association members have trouble believing that the County could consider adopting an ordinance that is so poorly conceived as to increase the frequency of wildfires and to allow use of generators in residential neighborhoods.

7. Recommendations for reducing the impact of camping

See Executive Summary and RBDA recommendations, page 3.

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Research

Sedimentology and sediment transport in modern and ancient oceans, beaches, rivers, and deserts on Earth and other planets

Restoration of sand bars in Grand Canyon

NASA Mars Science Laboratory Participating Scientist, using the rover *Curiosity* to study sedimentary structures on Mars

Previous appointments

Professional Researcher, UC Santa Cruz 2013-2023

Senior Scientist at USGS, 1975 - 2013

Visiting appointments at Paris Diderot University (2013), University of Tsukuba, Japan (1988, 1989, 2005); Stanford University (1976, 1987)

Awards and honors

Elected Fellow of American Geophysical Union (2020)

Francis J. Pettijohn Medal for Excellence in Sedimentology from SEPM Society for Sedimentary Geology (2011)

Flown by helicopter to a sand bar in Grand Canyon to brief Secretary of Interior Dirk Kempthorne regarding results of our 2008 experimental flood

Plenary speaker to 1000 colleagues at AGU Ocean Sciences meeting (2008)

Asked by NASA to act as confidential “Special Scientific Reviewer” of findings of sedimentary structures formed by flowing water on Mars (2004)

Awards and honors, continued

Asked by *Science* Magazine to review the first papers reporting sedimentary structures formed by flowing water on Mars and discovery of dunes on Titan

Member of Grand Canyon Experimental Flood team that received an award for “Excellence of Service" from Secretary of Interior Babbitt (1999)

Department of Interior Superior Service Award (1995)

NASA grant for "Basic Research and Analysis of a Highly Innovative Nature” (1992)

Fieldtrip leader

Geological Society of America and Society for Sedimentary Geology fieldtrips to eolian Navajo and Entrada Sandstones in Utah and Arizona (1987, 2024)

UC Santa Cruz Sedimentology class; 1-week fieldtrip to Colorado Plateau (1990)

International Planetary Dunes Workshops; 1-day fieldtrips in southern Utah and northern Arizona (2012, 2017)

Career achievements

Authored or co-authored more than 300 papers, 2 books, and 1 interactive DVD; cited by more than 11,000 other publications.

Created the first 3-D computer code relating bedforms to cross-stratification (1987). Developed a web site on bedforms, sedimentary structures, and digital grain size (used worldwide for teaching, research, and petroleum exploration).

Co-designer of Grand Canyon flood experiments (2004, 2008, 2012).

Conducted the first experiments and theory to explain the orientation of ripples and dunes in bi-directional flows (Rubin and Hunter, 1987, Science Magazine).

Developed hardware and software for in-situ grain-size analysis from digital images of sediment (patented by USGS and placed on exhibit at the San Jose Tech Museum in 2000).

Developed the first 2-D spatial generalization of algorithms previously developed for nonlinear prediction of time series and applied results to nonlinear prediction of spatial patterns of sediment bedforms. This work has been cited by papers spanning a broad range of fields including sedimentology, geomorphology, river management, petroleum exploration, paleoclimatology, turbulence in plankton, structure of DNA, neuron dynamics, diagnosis of epileptic EEG patterns, human motion, physics of condensed matter, welding, and housing markets.

Co-discovered an active offshore fault at the Humboldt Bay nuclear power plant (1977), which led the Nuclear Regulatory Commission to close the plant.

David M. Rubin Publications

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