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Environmental Economics

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Climate Resilient SD: Wildfire Adaptation

Project Scope

The greatest environmental threat to human lives in San Diego, California is the increasing threat of wildfires. Roughly 88% (~1 million homes) of San Diego County residents are exposed to wildfire hazard according to a county hazard mitigation report published in 2018.¹ With the 2021 release of San Diego's resilience plan, *Climate Resilient SD*, this report intends to support the climate adaptation efforts outlined in the agenda. *Climate Resilient SD* provides strategies to prepare, respond, and recover from potential climate change hazards, the most pressing being wildfires. This paper will work to contextualize the wildfire issue in San Diego by examining economic considerations and behaviors that have contributed to a lack of preparation. Solutions will be proposed to address externalities produced from wildfires in San Diego. Recommendations for addressing the issue will be made through performing a cost and benefit analysis that examines county building developments, brush management, and insurance regulation.

Introduction

Fire has been a part of California's landscapes for millions of years, with many native plant species even dependent upon fire as part of their reproduction and germination processes. California's natural ecosystems relied on these fires for nourishing its vast ecosystems, with burn cycles that served to thin vegetation, return nutrients to the soil, and spur regeneration. Hundreds of generations of Indigenous

¹ Multi-Jurisdictional Hazard Mitigation Plan. Office of Emergency Services, county of San Diego. (October 2017). Retrieved 28 April 2022. ([Link](#))

peoples lived and worked with these fires to aid the health of the landscape and support their crop production. These natural burn cycles changed when Europeans moved to California en masse in the 1800s to pursue settlement and industrialization. Forests were cut down to make way for development and infrastructure. Human fire suppression methods halted burn cycles, decreasing forest brush clearing methods and halting natural ecosystem processes. The United States Forest Service aimed to suppress any forest fires it could reach. Instead of periodic fires that would naturally pass through the woods and burn out smaller trees, current forests are too dense, resulting in unhealthy, overstocked forests. The current situation provides fuel for the enormous wildfires that now rage today.

Keeping the trees in the forest more widely spaced allows for adequate ground water retention for trees that need to drink deeply, but with denser tree ratios, that moisture is spread thin. There are now more trees than the landscape can support. Dry south slopes once covered with a patchwork of trees sculpted by medium-sized fires have now filled in to become dense tinderboxes for the large wildfires of today. Because trees are growing so close together and the biodiversity decreases with a tree makeup that features conformed species and ages, the forests have become prime real estate for diseases and insect outbreaks that can affect the forest all at once. These outbreaks result in dead branches and downed trees on the forest floor. Combined with the hotter, drier, windier conditions from climate change, the fire season now lasts 40-80 days longer.

In Southern California today, extreme heat and severe drought caused by climate change has created conditions for events called “megafires”, a single blaze that can engulf over 100,000 acres (40,000 hectares).² A “gigafire” is the name given to the burning of 1 million acres (404,685 hectares).³ The combination of hotter, drier landscapes and the autumnal phenomenon of unpredictable Santa Ana winds creates

² Andrew Hay (14 November 2018). "Deadly 'megafires' the new normal in California". Reuters. Retrieved 27 April 2022. ([Link](#))

³ Kaur, Harmeet (6 October 2020). "California fire is now a 'gigafire,' a rare designation for a blaze that burns at least a million acres". CNN. Retrieved 28 April 2022. ([Link](#))

annual conditions for megafires to take place. If sparks are caught by these 40 miles per hour winds⁴ during the lowest humidity periods of the year in San Diego, a small brush fire can suddenly explode into a megafire.

The Issue

The growing scale of wildfires come at a severe cost. The Cedar Fire that ignited in the autumn of 2003 destroyed 273,246 acres (110,578 hectares) and 2,820 buildings, claiming the lives of 15 people.⁵ In 2007, a series of fires in San Diego County burned 375,912 acres (152,126 hectares), destroyed 2,860 structures, and caused 7 fatalities.⁶ A swarm of wildfires in 2014 and 2016 further solidified San Diego's vulnerability to these natural disasters and fulfilled reports that these events would occur more frequently as long as drought and high temperatures persist. At current burn rates, San Diego forests face extinction. The Cedar Fire of 2003 burned 24,000 acres (98%) of Cuyamaca Rancho State Park, resulting in a 95 percent mortality rate for pines and conifers.⁷ The burn intensity was so strong, that the seedbank and conifer canopy were almost entirely destroyed. In normal fire conditions, old growth trees like firs and pines are adapted to withstand fire, but with human development choking natural burn paths and increasing unhealthy forest density, the ecosystem has been damaged. Since 2001, San Diego has lost 98,595 acres of trees (39,900 hectares). Though plants like shrubbery and low oakland return quickly to replace the cleared land after a major burn, conifers do not. With that level of deforestation, San Diego lost the ability to naturally remove 6.93 metric tons of CO₂e emissions.⁸ Many of the county forests will not recover in a single lifetime.

The increase in housing development in the San Diego Wildland Urban Interface (WUI) has contributed to wildfire scale and become a large problem in managing

⁴ "Santa Ana Wind". NOAA's National Weather Service Glossary. NOAA National Weather Service. Archived from the original on 21 July 2011. Retrieved 27 April 2022.

⁵ "Cedar Fire". CALFIRE. November 5, 2003. Retrieved 28 April 2022. ([Link](#))

⁶ "2007 Archived Fires". cdfdata.fire.ca.gov. CAL FIRE. 24 July 2018. Retrieved 28 April 2022.

⁷ "Regenerating Cuyamaca". California Department of Parks and Recreation. Accessed 1 May 2022 ([Link](#))

⁸ Interactive Map. Global Forest Watch. Accessed 1 May 2022. ([Link](#))

human safety during wildfire season as population has boomed over the past decades. The Wildland Urban Interface defines an area “where humans and their development meet or intermix with wildland fuel”.⁹ Urban planning in San Diego is defined by low-density, single family units built directly in the middle of natural fire pathways.⁹ This has resulted in the reduction of open space and natural habitat and increasing traffic on roads and highways—a danger when evacuations out of these regions need to occur quickly during an extreme fire event.

As one of the top twenty biodiversity hotspots in the world, the balance between urban growth and habitat conservation has become a difficult challenge to navigate.¹⁰ The Regional Housing Needs Allocation Assessment (RHNA) declared that 108,036 housing units need to be constructed by 2029 to accommodate growth rates in San Diego.¹¹ Current build rates are not able to keep up with this target, with only 5,200 units built in the past three years.¹² The housing shortage crisis in San Diego has provided arguments for large real estate development expansions into high-risk, fire prone areas. A push for this development to occur in already-developed urban areas, distributed across San Diego County, is recommended so as not to increase human activity in the WUI where fires are often started. A hopeful sign in the past couple of years has been the halting of developments in the WUI based on insufficient evacuation routes in the event of a wildfire.¹³ These decisions were made as a direct result of the deadly Camp Fire of 2018 where 7 of the 85 fatalities occurred because of blocked roads and victims trapped inside of vehicles.¹⁴

⁹ United States Department of Agriculture and Department of the Interior. Urban Wildland Interface Communities Within the Vicinity of Federal Lands that Are at High Risk from Wildfire. Fed. Reg. 2001, 66, 751–777.

¹⁰ Rahn, Matt. “Wildfire Impact Analysis” 2009. San Diego State University. Accessed 28 April 2022. ([Link](#))

¹¹ 6th Cycle Regional Housing Needs Assessment Plan. San Diego Association of Governments (SANDAG). 10 July 2020. Retrieved 1 May 2022. ([Link](#))

¹² “2021 Annual Housing Report”. San Diego Planning. Retrieved 2 May 2022. ([Link](#))

¹³ “Environmentalists Halt 3,000-Home Santee Project Over Fire Evacuation Concerns”. 5 May 2022. Times of San Diego. Accessed 5 May 2022. ([Link](#))

¹⁴ “The Camp Fire Public Report, A Summary of the Camp Fire Investigation”. Butte County District Attorney. June 16, 2020. Accessed 2 May 2022. ([Link](#))

These court wins target halting development in danger zones, but a large risk still remains for the 88,000 homes located within the San Diego County WUI and deemed a high-extreme level of risk.¹⁵ Building code in California is some of the most stringent in the nation when it comes to fire protection. Under these standards, new homes have to be made up of noncombustible materials, a noncombustible roof, closed eaves, and a removal of combustible materials in the home ignition zone (100-200 ft radius around the foundation).¹⁶ Those building codes were put to the test after the 2017 California Thomas Fire and largely failed when 90 percent of homes destroyed were revealed to have been built with strict, fire-safe protections in a damage inspection report.¹⁷ The report showed that even the highest building standards may not be enough to protect homes against the magnitude of modern wildfires and even stronger fire adaptation methods for providing guardrails need to be considered.

Caring for a house in San Diego has become more costly because of wildfires. Residents of San Diego rely heavily on fire insurance to help cover costs in the event of extreme damage or complete destruction. As frequency and coverage of wildfires have increased, insurance companies have hiked premiums or increasingly enacted non-renewal policies for zip codes in high-risk fire zones. A research scientist in the U.S. Forest Service revealed findings that from 1970 to 2009, 49 percent of all burned buildings by 29 wildfires were rebuilt on their exact plots.¹⁸ Two years after the Cedar Fire destroyed 300 homes in the Scripps Ranch neighborhood of San Diego, only about a third of the homeowners rebuilt and moved back.¹⁹ The COVID-19 pandemic conditions have exasperated supply chains, driving building material prices upwards.²⁰

¹⁵ "A million California buildings face wildfire risk. 'Extraordinary steps' are needed to protect them". L.A. Times. 18 December 2018. Accessed 2 May 2022. ([Link](#))

¹⁶ Wildland Urban Interface County Fire and Building Code Requirements. County of San Diego, Planning & Development Services. ([Link](#)).

¹⁷ Thomas Fire Damage Incident Report ([Link](#)).

¹⁸ "Americans Are Moving Closer to Nature, and Fire Danger" NY Times. 15 November 2018. Accessed 25 April 2022. ([Link](#))

¹⁹ In San Diego, Lessons on Rebuilding From a Neighborhood Once Ravaged by Fire. NY Times. ([Link](#))

²⁰ Rebuilding Your Home After a Disaster Will Cost More Right Now. NBC San Diego. ([Link](#))

Addressing the Issue: Solutions and Externalities

This paper seeks to look at two actions as possible wildfire risk mitigation efforts for the possibility of government budget attribution: Fireproofing already-existing buildings for the most vulnerable populations and utilizing controlled burn sites to remove excess fuel sources. By determining the true cost of fireproofing a home and applying that number at scale to the most vulnerable homes in the San Diego WUI, perhaps the case can be made for application of the proposed 2022-23 California Wildfire and Forest Resilience Package.²¹ Retrofit programs have not been built into the fire preparedness roadmap, leaving many homeowners in San Diego to bear the burden of hardening communities out of their own pockets.

Barriers to A 2019 study found the cost of hardening homes against wildfires to be the most significant challenge to achieving homeowner compliance with California defensible space guidelines.²² Clearing vegetation from yards in compliance with home ignition zone best practices can be an expensive and sometimes unequitable undertaking. A 94-year-old San Diegan was reported to have been quoted a \$14,000 price tag for the removal of trees on his property, or to perform the labor himself.²³ Retrofits at scale need to be considered for protecting existing communities in San Diego where fire conditions have worsened over time and place old housing stock at utmost risk of catching embers and igniting. Properly preparing private properties for inspection is typically a prerequisite for achieving a manageable fire insurance rate. If homeowners don't pass this inspection, insurance companies have the power to deny insurance to properties.

Overdue changes to wildfire risk zone maps that are slated to be published later this year, and the results could have a ripple effect of increasing costs to current

²¹ California Wildfire and Forest Resilience Package 2022-23 ([Link](#))

²² Kuang, Jennee. "2019 Defensible Space Study". UC Berkeley's Goldman School of Public Policy. Accessed 1 May 2022. ([Link](#))

²³ Ome, Morgan. "When Your Yard Can Kill You". 11 August 2021. The Atlantic. Accessed 1 May 2022. ([Link](#))

homeowners, buyers, and builders in San Diego County, California. There's a lot more risk in foothill areas, where large tract-style home developments exist.

Prescribed burns of the San Diego landscape could provide many benefits to curb negative externalities experienced from wildfires. They aid in systematically reducing dense forests and preserving larger, older trees that do a better job at storing carbon. By burning underbrush and small trees, prescribed burns create controlled burn patches on the landscape that are better equipped to resist accidental ignitions that could turn into a catastrophic wildfire. These burn systems can “reduce fire emissions of carbon dioxide in the West by an average of 18 to 25 percent, and by as much as 60 percent in certain forest systems”.²⁴

Another externality that prescribed burns could address is better health outcomes. They produce far less smoke than wildfires do, with potential for easing the asthma and cardiovascular disease rates that burden the city after large wildfire events—particularly communities most vulnerable to heavy air pollution. Following the 2007 San Diego Wildfires, hospital visits for specific conditions increased. There was a 34% increase in visits for respiratory conditions and a 112% increase in visits for asthma. Children aged 0-1 were at highest risk, experiencing a 243% visit increase for asthma during the peak fire period. Children aged 0-4 had a 136% visit increase for asthma. After the peak fire period, there was a 72% increase in outpatient visits for acute bronchitis in the 5 days following the peak fire-period.²⁵

Cost and Benefit Analysis

A cost and benefit analysis was performed to determine net benefits of implementing a retrofit program (Figure 1). Perhaps some cost needs to be incurred by the city government to incentivize retrofits en masse across homes in San Diego that

²⁴ “Prescribed Burns May Help Reduce U.S. Carbon Footprint”. 17 March 2010. National Science Foundation. *News Release 10-041*. ([Link](#))

²⁵ “The San Diego 2007 wildfires and Medi-Cal emergency department presentations, inpatient hospitalizations, and outpatient visits: An observational study of smoke exposure periods and a bidirectional case-crossover analysis”

are exposed to wildfire hazard risk. As data around fire hazard retrofit programs currently has yet to be discovered fully, the focus of the cost and benefit analysis follows Cal Fire's recommended low-cost retrofit list of items for consideration to determine what an estimated cost could look like for homes at risk.²⁶ The costs for retrofitting pre-existing homes with fireproof house sidings, fireproof roofs, double-paned windows and clearing vegetation and debris from the defensible space of 100ft around the home. The active spread sheet can be accessed [here](#). The number of homes most at risk in San Diego's WUI is 88,000. This number was used as the multiplier on the first tab to reflect an approximate amount for how much the retrofit cost would be for older homes. The retrofit cost for a single home would be far less than the damage costs accrued over fifty years if a house were to be destroyed.

Though the results revealed savings if homeowners invested in solutions today, there is still an incredible cost burden on homeowners who lose their homes as a result of natural disaster. The cost for fireproofing a home is almost one third of the mean income earned by San Diego residents at \$83,454.²⁷

²⁶ Low Cost Fire Retrofit List. Cal Fire. ([Link](#))

²⁷ "San Diego Quick Facts". US Census Bureau. Retrieved July 11, 2019. ([Link](#))

Figure 1

		San Diego Homes				Defensible Space in the Home Ignition Zone				Air Quality				
Discount Rate	7%	Average Sq Ft. of 1 House	2,417 sq ft	Cost per acre	\$ 2,354.25	acre	2,354.25	1 bus = 32 cars						
Inflation Rate	2%	Roof Sq Ft	2,320 sq ft	Average Lot Size San Diego	6,500 sq ft	6,500 sq ft		CO2e Emission	150.8	metric tons per year	150.8			
Blue = user inputs		# Exposed to Wildfire Hazard	1,000,000 homes	# at Extreme Risk	88,000 homes	Window Retrofit		Social Cost of Carbon	\$ 5	\$ 6,957.50	\$ 5 per metric ton			
Grey = calculation		Property Tax	0.007%	Roof Retrofit		Double-paned Windows	\$300	Carbon Cost	\$ 6,957.50	\$ 5 per year				
		Class A fire rated roof	\$350 per sq ft	Labor Cost	50% of total roof materials cost	Labor Cost	\$140.00 per hour							
		Service Life	50 years	Service Life	50 years	Window per house	10 windows							
		Disposal Cost	12% of total roof cost	Disposal Cost	\$100	Service Life	20 years							
		Noncombustible gutter cover	\$100	California Hardening Budget	\$44,000,000	over 2 years								
		Chimney Spark Arrestor	\$100	Wildfire Mitigation Tax Credit	25%	of costs incurred in performing wildfire mitigation measures								
		House Siding Retrofit	\$6,000 for ~1,200 sq ft house	Average Cost of Rebuilding	\$100	per sq ft								
		Labor Cost	35% of total siding materials cost	Price Increase of Building M.	30%									
		Service Life	30 years	Private Damages Cost for Majority of San Diegoans										
		Disposal Cost	10% of total siding cost	Private Damages Cost for Homes at Extreme Risk										
		Caulk	\$11	San Diego										
				Average Home Cost in SD	\$825,000									
Costs														
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12
	Fireproofing Private Property at Extreme Risk													
	Roof Retrofit Installation	\$1,240,400.480												
	House Siding Retrofit Installation	\$1,037,688.000												
	Window Retrofit Installation	\$274,560.000												
	Defensible Space Cost	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401	\$30,914.401
	SUM PRIVATE BENEFITS	\$2,583,482.881	\$28,819,363	\$27,011,835	\$25,235,360	\$23,564,448	\$22,041,540	\$20,599,571	\$19,251,935	\$17,962,463	\$16,815,386	\$15,715,314	\$14,667,209	\$13,726,364
	Discounted													
	Public Cost													
	Avoided ind. inc. tax	\$56,836,623,375.246	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600
	SUM PUBLIC BENEFITS	\$56,836,623,375.246	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600	\$7,728,600
	Discounted													
	SUM TOTAL DISC. COSTS	\$56,836,208,858,27	\$36,114,954	\$33,782,294	\$31,544,200	\$29,460,560	\$27,559,928	\$25,746,483	\$24,064,919	\$22,499,578	\$21,019,232	\$19,644,142	\$18,359,911	\$17,157,850
Benefits														
	Year	0	1	2	3	4	5	6	7	8	9	10	11	12
	Fireproofing Private Property at Extreme Risk													
	Avoided Cost of Losing Home	\$72,600,000.000												
	Avoided Cost of Rebuilding Home	\$7,850,480.000												
	Avoided Displacement Costs	\$132,000.000												
	Avoided Cost of Debris Removal	\$106,800.000												
	Avoided Cost of Replacing Assesst	\$2,200,000.000												
	SUM PRIVATE BENEFITS	\$182,886,080.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000	\$2,200,000.000
	Discounted													
	Public Benefits													
	Avoided Property Tax Loss	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000
	SUM PUBLIC BENEFITS	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000	\$529,980,000
	Discounted													
	SUM TOTAL DISC. COSTS	\$103,218,880,000	\$2,591,983,178	\$2,384,470,298	\$2,212,621,549	\$2,068,319,204	\$1,937,888,418	\$1,823,146,652	\$1,720,044,908	\$1,628,453,169	\$1,546,740,053	\$1,474,414,958	\$1,411,589,880	\$1,357,317,406
COST-BENEFIT														
	Private + Public													
	Discounted Net Benefits	(\$6,735,968,718,126.70)	2,515,289,223.49	2,350,717,965.85	401,077,349.23	374,838,844.14	350,316,489.85	327,398,588.65	305,979,889.39	285,962,606.91	267,254,772.81	249,770,815.71	233,430,668.89	218,159,503.63
	Initial													
	NPV	(\$6,735,968,718,126.70)	\$2,565,573,588	\$2,445,888,972	\$429,628,492	\$409,737,403	\$386,777,711	\$368,703,987	\$351,474,828	\$335,050,711	\$319,394,193	\$304,469,231	\$290,241,696	\$276,679,000

Figure 1 The figures in this chart show the savings residents would make if they invested in retrofits along with the high upfront costs required for wildfire protection..

Recommendations

On an individual level, the financial barrier to making communities fire resilient is high. Placing the burden of time, labor, and cost on property owners disincentivizes property owners from bolstering their properties against fire. Though the declared budget from the State of California cannot cover the costs of all retrofits needed for homes most exposed to wildfire hazard, it can cover at least a quarter of them. A recommendation to the city would be to identify the most vulnerable residents located in the wildland urban interface and create a program that allows members of the county to find relief from the soaring price of making their homes safe from wildfire risk. Another suggestion would be to mobilize the community and create workforce development programs that could assist burdened, at-risk homeowners with clearing the vegetation way from their home ignition zone.

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Wildfire Adaptation CBA

Cost Benefit Analysis: Hardening Homes in San Diego, California

PURPOSE

The purpose of this CBA is to analyze the benefits of taking action for wildfire adaptation to a homeowner's property by measuring the costs associated with hardening their environment.

Agenda

Definitions & Context

Wildfire Terminology
Climate Resilient San Diego

Site Assessment

Fire History in San Diego
Fire Vulnerabilities

CBA

Private Costs
Public Costs

Definitions & Context

Definitions

Hardening

This means prepping your home for wildfire and updating the most vulnerable components of your house with building materials and installation techniques that increase resistance to flames.

Defensible Space

A defensible space, in the context of fire control, is a natural and/or landscaped area around a structure that has been maintained and designed to reduce fire danger.

Home Ignition Zone

The Home Ignition Zone is an area 100-200 feet from the foundation and includes vegetation, the home itself, and other structures or attachments like decks, furniture, fences, and outbuildings. By law, homeowners have to keep their HIZ up to wildfire code in California and clear away anything that can ignite their property.

Wildland Urban Interface (WUI)

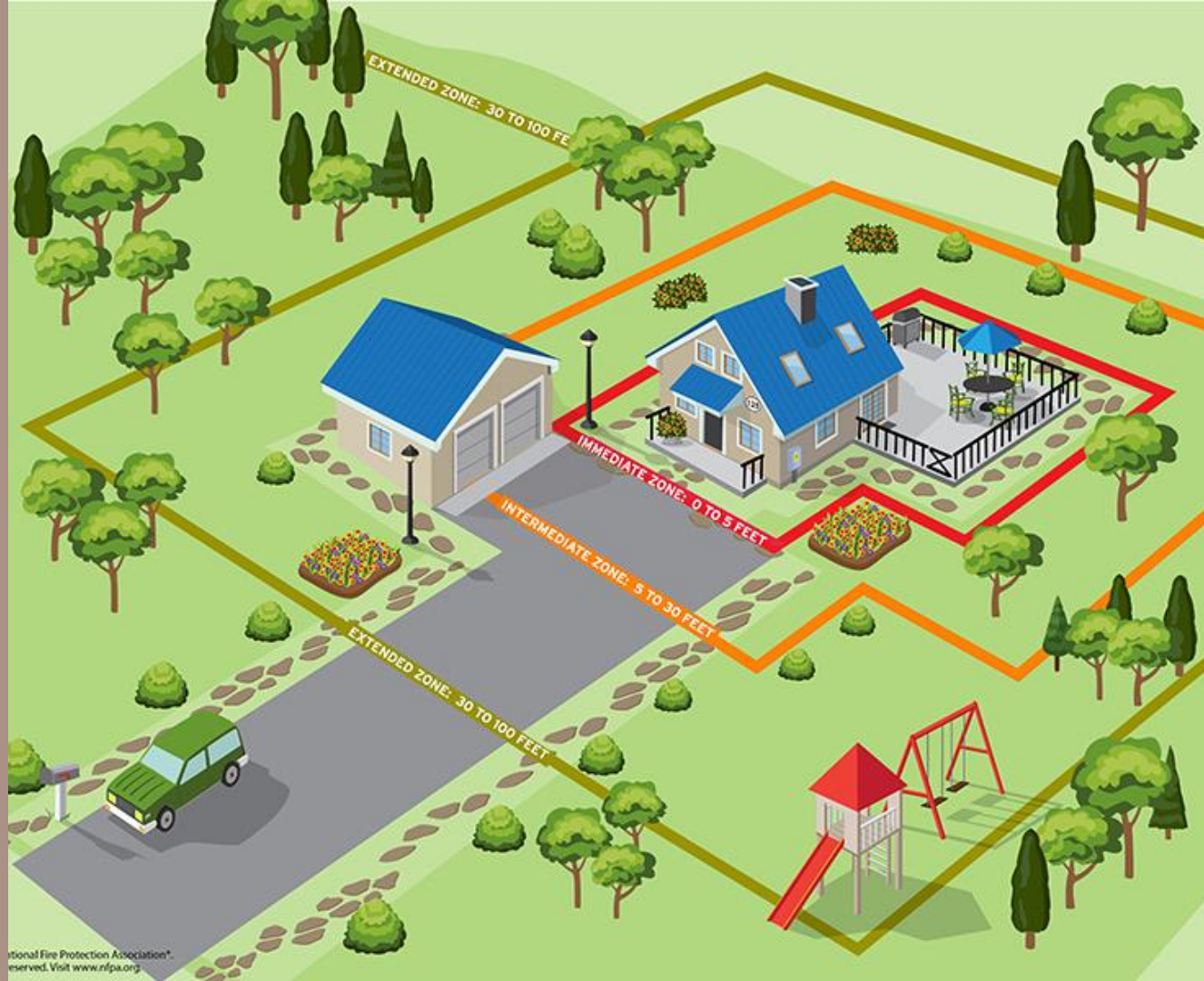
The wildland urban interface is a zone of transition between wilderness and land developed by human activity – an area where a built environment meets or intermingles with a natural environment

The Home Ignition Zone

The red line signifies the “Immediate Zone” which is 0’-5’ feet away from from foundation of the home.

The orange line signifies the “Intermediate Zone” which is 5’-30’ feet away from from foundation of the home.

The Green line signifies the “Extended Zone” which is 30’-100’ feet away from the home.





The Wildland Urban Interface

Homes located within the Wildland Urban Interface are more vulnerable to catching fire than homes located in urban areas.

This photo depicts where home development is situated among forests.

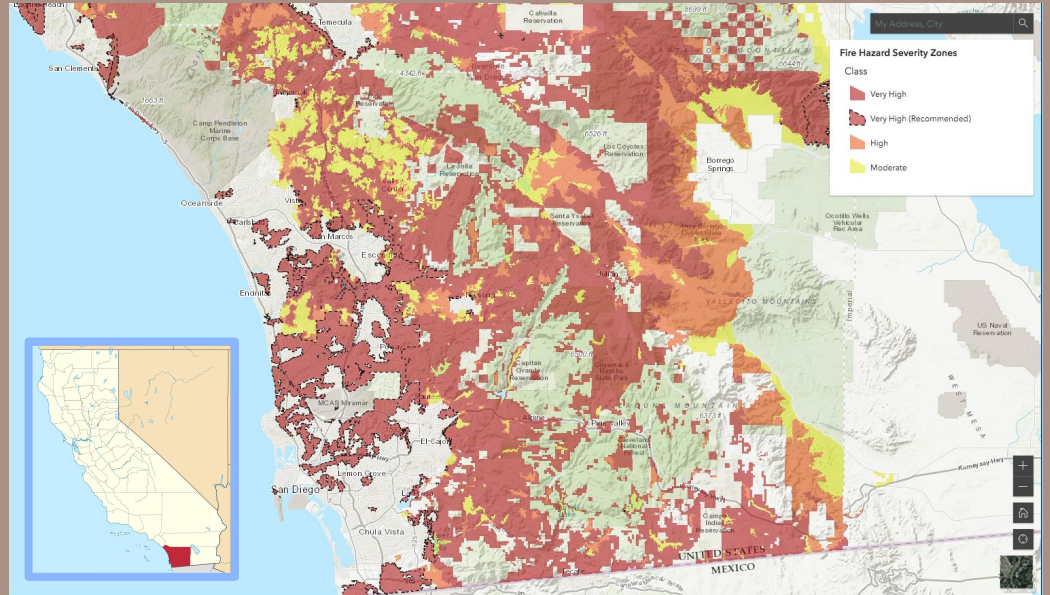


The Wildland Urban Interface

Homes located within the Wildland Urban Interface are more vulnerable to catching fire than homes located in urban areas.

This photo depicts where home development has encroached on natural, open space above a canyon that caught fire.

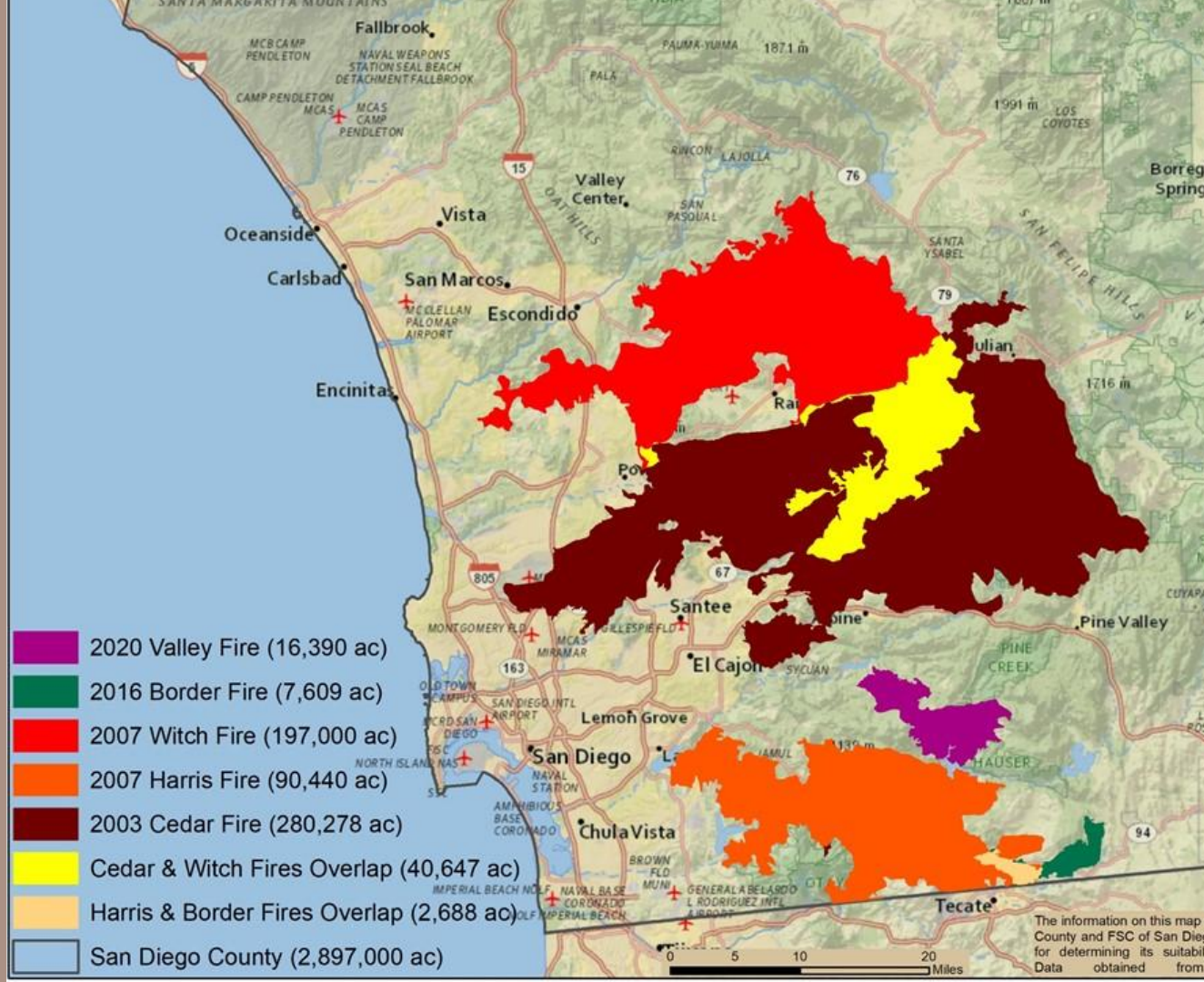
Climate Resilient SD



Site Assessment

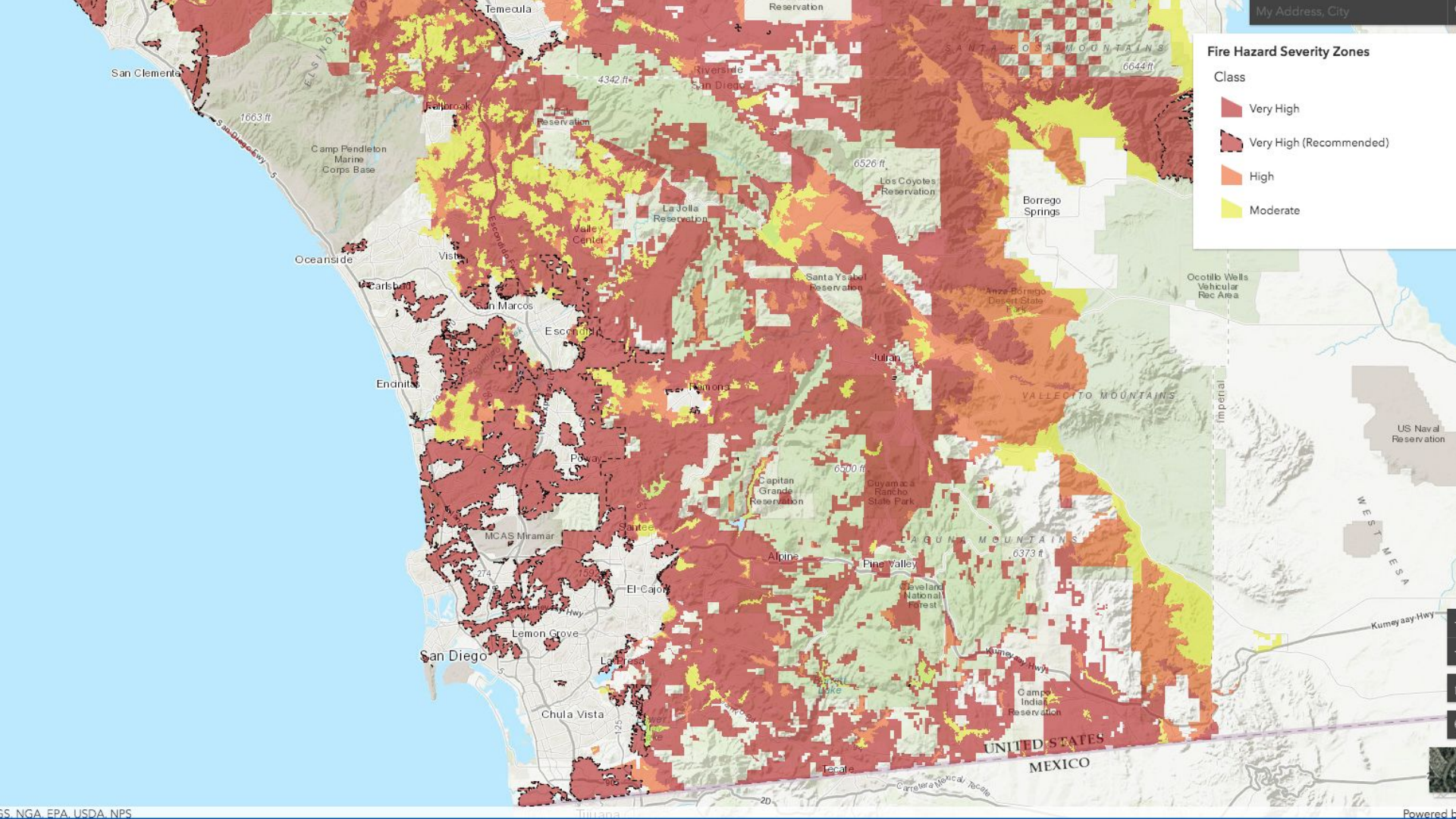
San Diego County, CA

5 of the Largest Fires in San Diego County History



Development in San Diego's WUI





Fire Hazard Severity Zones

- Class
- Very High
 - Very High (Recommended)
 - High
 - Moderate

Cost and Benefit Analysis

Retrofit Program for Environmental Hardening

CBA Spreadsheet

		San Diego Homes			Defensible Space in the Home Ignition Zone	
Discount Rate	7%	Average Sq Ft. of 1 House	2,417 sq ft	Cost per acre	\$ 2,354.25	acre
Inflation Rate	2%	Roof Sq Ft	2,520 sq ft	Average Lot Size San Diego	6,500	sq ft
		# Exposed to Wildfire Hazard	1,000,000 homes		0.15	acres
		# at Extreme Risk	88,000 homes			
Blue	= user inputs	Property Tax	0.73%			
Grey	= calculation					
		Roof Retrofit			Window Retrofit	
		Class A fire rated roof	\$3.50 per sq ft	Double-paned Windows	\$200	per window
		Labor Cost	50% of total roof materials cost	Labor Cost	\$140.00	per hour
		Service Life	55 years	Windows per house	10	windows
		Disposal Cost	15% of total roof cost	Service Life	20	years
		Noncombustible gutter cover	\$100			
		Chimney Spark Arrestor	\$104			
		House Siding Retrofit			California Hardening Budget	
		Material Cost	\$8,000 for ~2,000 sq ft house	2022-23 Budget	\$44,000,000	over 2 years
		Labor Cost	35% of total siding materials cost	Wildfire Mitigation Tax Credit	25%	of costs incurred in performing
		Service Life	30 years			
		Disposal Cost	35% of total siding cost	Average Cost of Rebuilding Home	\$100	per sq ft
		Caulk	\$11	Price Increase of Building Materials	30%	

Conclusion

Should the government help invest in retrofits?

The answer is yes.

**Given the strong cost-benefit findings,
it has been determined that from an
economic perspective, the costs of not
hardening homes against the threat of
wildfire is outweighed by the net
benefits to society.**

Thank you.