An Urban Comparative Analysis of Los Angeles County, California's Wildfires and Melbourne, Victoria's Bushfires

Claire Choe [CC], Celia Escobar [CE], and Hailey Irwin [HI]

Sol Price School of Public Policy
PPD 410 Comparative Urban Development
Professor Rym Kaki

April 28, 2023

Introduction

Los Angeles and Melbourne are both large, sprawling metropolitan areas of national significance which are rich in biodiversity and similar geographies, both suffering from a common natural hazard - wildfires which decimate both the living ecosystems and the built environment. The two cities' similar climates and geographical attributes as well as their regional significance make them comparable cities to analyze the effects and mitigation of this natural hazard.

Los Angeles County and Melbourne: Comparative Urban Development

Los Angeles, founded in 1781, home to Hollywood, sunny weather, and gorgeous beaches, is the second-largest city in the United States (History, 2019). The County is situated along the Pacific Ocean, with its entire western flank opening up to commercial ports. Los Angeles is home to an estimated 10.1 million people and covers an area of 10,510 km^2 (World Population Review, 2023) (U.S. Census, 2022). The urban landscape of Los Angeles is known for its county's city sprawl and its many incorporated cities and communities on a country scale. Los Angeles County's City GDP is $711.9 billion, which makes the City GDP per capita estimated to be around $72,046 (U.S. BEA, 2022). Furthermore, the United States of America's Human Development Index is 0.921, Gini Coefficient is 41.5, Global Cities Index is 5, and the city's HDI is 5.43 out of 10 (Human Development Report, 2022) (LACDMH, 2021) (Kearney, 2021). The city is globally recognized for its entertainment industry, regional diversity, and staple city role on the west coast. In Los Angeles, wildfire management is handled by the California Department of Forestry and Fire Protection, Los Angeles County Fire Department, and local and federal Emergency Management Agency (Cal Fire). See **Exhibit A** in appendix for data breakdown.

Melbourne, founded in 1835, is the capital city of the Australian state of Victoria, located in the southeastern tip of Australia. The coastal city is home to Victoria's central business, administrative, and cultural hub. Melbourne's metro population is around 5.1 million people, and is the second-largest city in Australia (Australian Bureau of Statistics, 2023) (World Population Review, 2023). It has an area of 9,991 km^2 and an average population density of 500 people per km^2. The city is known for its livability, industrial and commercial development, and its dedication to nature life conservation. Melbourne's City GDP is $350 billion, which makes the City GDP per capita estimated to be around $70,500 (City of Melbourne, 2021). Furthermore, Australia's Human Development Index is 0.951, Gini Coefficient is 34.3, Global Cities Index is 12, and Melbourne's City Prosperity Index is 0.903 (Human Development Report, 2022) (State of World City, 2013) (Kearney, 2021). The city is globally recognized for creative art, medical technology, trade, and tourism (Victoria State Government, 2023). In Melbourne, bushfires are managed by Forest Fire Management Victoria and Melbourne Fire and Emergency (FFM, 2023). See **Exhibit A** in appendix for data breakdown.

Los Angeles and Melbourne have both implemented data-driven, smart city initiatives in the wake of emerging technology. LA is ranked as 50th out of 141 cities via the Smart Cities Index, while Melbourne ranked at 31st. According to the SmartLA 2028 Strategy, the City has the goal of leveraging current technologies to face urban issues and improve the quality of life for residents (City of LA). Melbourne has a similar goal in mind: enhancing the city's unique aspects using intelligent solutions (City of Melbourne, 2021). The two cities have similar areas for improvement such as transportation, sustainability, and infrastructure. From a transportation perspective, both

cities have implemented smart transportation systems which utilize data-driven traffic management solutions, connected vehicles, and real-time public transit information. Within sustainability, Los Angeles and Melbourne have used environmentally forward solutions such as energy efficiency programs, renewable energy, and waste reduction programs. Finally, both cities promote innovation through infrastructure, sharing similarities in smart lighting and technology hubs.

Los Angeles County and Melbourne: Comparative Ecological Regions

In a comparative urban development analysis of two world cities, the geographic and ecological similarities informed our examination. The Köppen Climate Classification categorizes geographic areas into five main climate zones: A (tropical), B (arid), C (temperate), D (continental), and E (polar). The tool is based on characteristics like vegetation, temperature, and precipitation (National Geographic, 2019). Both climates are categorized in Group C, (temperate climate). Within this category, the climate has the coldest month averaging between 32 °F and 64.4 °F, and at least one month averaging above 50 °F). As the two exhibit very similar climate and geography attributes contributing to the prevalence of wildfire, ample comparative evidence is available for this analysis.

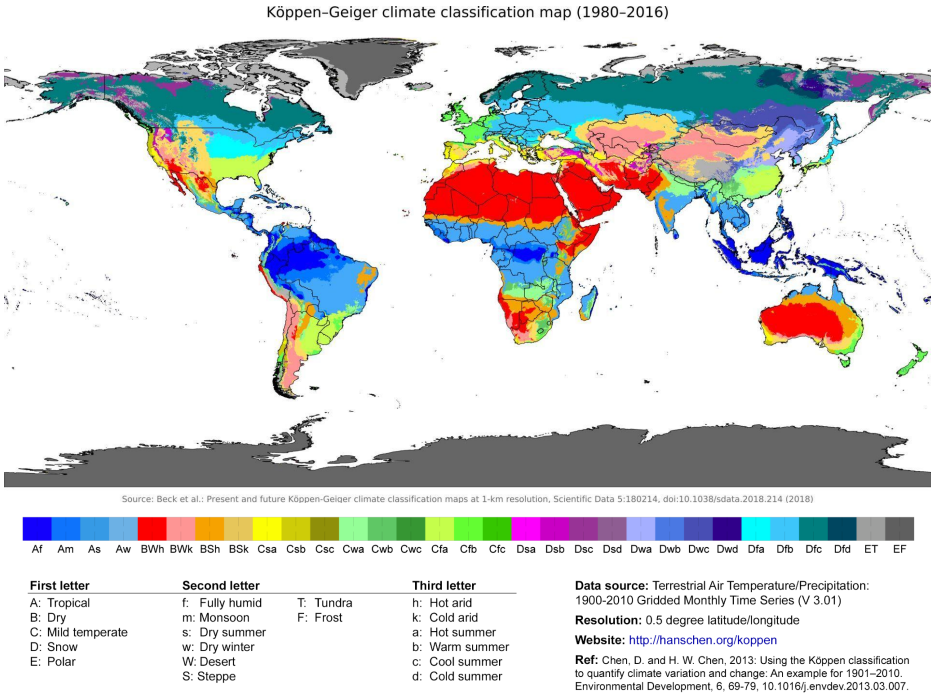

Figure 1: Köppen climate classification world map from 1980 to 2016 (National Geographic Society)

Los Angeles County, more specifically, is categorized as a Mediterranean ecosystem, yet houses multiple different bioregions within it. Of the 4,000 square miles that make up the County, roughly 47% is mountainous, which runs east to west. The rest of the region contains “alluvial valleys, coastal plains, and high desert” (LAFD). The fire prone corridors of the County are consistent with the location of primary canyon drainages running downhill, which is predominantly made up of the vegetative ecosystem called chaparral. Chaparral is a shrubby plant most commonly found in

watersheds in LA County. Burning is quintessential to the plant's life cycle and it contains an oil which increases their flammability. This explains why fires tend to be particularly severe in the corridors where chaparral "covers a broad area and are uniformly old and senescent" (LAFD).

Melbourne's ecoregion is categorized as Temperate broadleaf and mixed forests (WWF). This biome group is known for having a moderate climate and high rainfall. The capital experiences mild summers due to its coastal location and cloudy, frequently wet winters; despite its moisture the ecoregion is typically accompanied by a distinct dry season. The fire prone areas of the city are the Dandenong Ranges and the Yarra Valley, Alpine National Park and the Kinglake National Park (County Fire Authority). The vegetation in these regions consists of shrubbery, grasslands, forest litter and undergrowth, and eucalyptus trees. Eucalyptus trees are extremely common in the fire prone areas of the city, which contain volatile oils that make them highly flammable. Similar to the chaparral in Los Angeles, areas with a high concentration of eucalyptus trees can have more intense bushfires. Both of these world cities have similar ecoregions and flammable vegetation, making them unfortunate victims to wild and bushfires of mass destruction.

Los Angeles County and Melbourne: Wildfire and Bushfire Diagnosis

Both Los Angeles and Melbourne suffer from the natural hazard of large-scale fires which, oftentimes, result in human, environment, and biodiversity losses. Specifically, Los Angeles faces problems with wildfires and Melbourne deals with bushfires.

Los Angeles County has seen 57 wildfires larger than 5,000 acres since 1970, all of which are mapped in the **Figure 2** below. Some locations in LA County have burned over 6 different times and are repeat offenders for these hazardous fires. According to Headwater Economics researchers, the average number of acres burned in the West has nearly doubled since the 1990's, as the size of forest fires continue to increase. Two key areas in particular frequently suffer from these wildfires, one being the national and state forests/parks in northern LA County, and the coastal hills and canyons near Malibu. The danger to residents and property has increased in these areas as development continues to expand into the "wildland-urban interface" (Curbed LA). This interface is the geographical area where the built environment and natural flora and fauna collide. Specifically, over 13,500 homes in Los Angeles and Ventura counties are considered at "high or extremely high wildfire risk", according to CoreLogic, and roughly 60% of new development in California since 1990 has been in fire-prone areas. As a result of development encroaching on these restricted zones, over 3,300 properties have been damaged since 1970. Residents in this interface are the key victims to these wildfires and the community at risk.

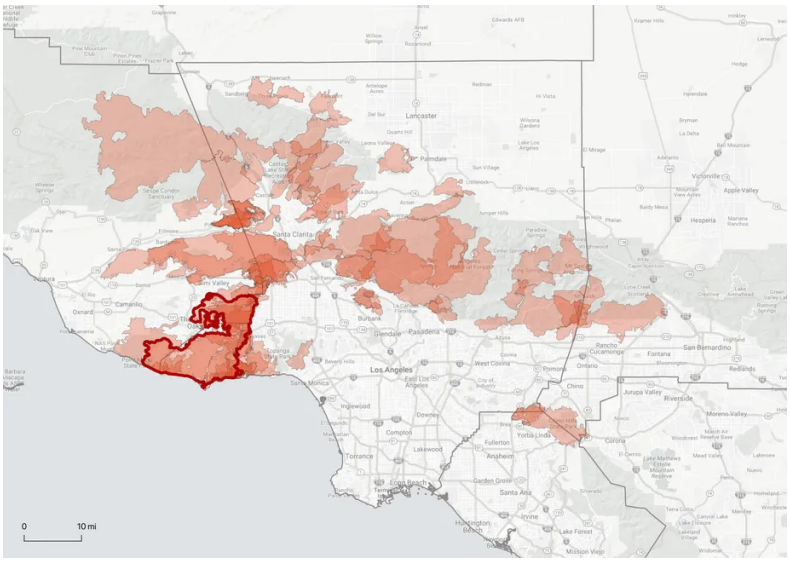

Figure 2: Fires in Los Angeles County since 1970 (RMS/Risk Management Solutions)

The problem is more dramatic in Melbourne Australia, where there have been over 23,000 bushfires in the greater Melbourne area since 1970, as seen in **Figure 3** below. They have killed approximately 268 people since 1970, billions of animals, and cost the region over $1.6 billion. Of Victoria's fires, the most catastrophic was the Black Saturday Bushfires in 2009, which claimed 173 lives, 2,029+ houses, and 2,000 other structures (Canyonleigh Royal Bushfire Brigade). Similar to Los Angeles, the key population at risk are those residing in rural towns in the wildfire-urban interface. In addition, since bushfires are so much more pervasive in Victoria, the harm extends to all residents of the city and even state. Air quality is known to worsen during particularly fire-heavy years, as smoke from the fires has caused air quality issues and health concerns for residents in the region (Ryan, Silver, and Schofield, 2021). As a result, the community bearing the harm are all residents of Melbourne have suffered considerable health repercussions.

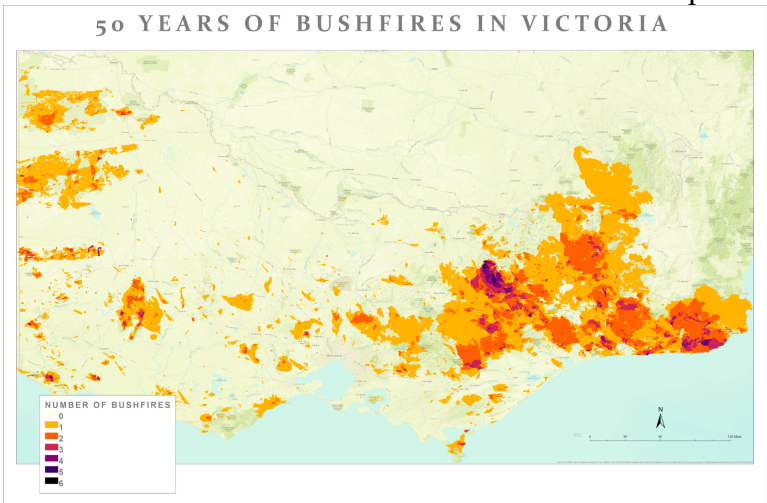

Figure 3: Bushfires in the greater Melbourne region (Wikipedia)

The causes of wildfires in Los Angeles and bushfires in Melbourne are quite similar. There are three key ingredients for wild and bush fires present in both cities, which is the combination of fuel such as dry vegetation, strong regional wind that creates an abundance of oxygen, and a heat

source (Britannica). The rising temperature and extreme heat waves have led to even drier vegetation for both Los Angeles and Melbourne over the years. For Los Angeles County specifically, the dry grasslands make the perfect fuel for fires to start. The Santa Ana Winds are unique to California and provide oxygen for these fires to spread so drastically, and the region is currently seeing its worst case of these winds in a decade. The Santa Ana winds are a strong natural phenomenon that occurs due to high pressure built over the western US, forcing air over the California deserts (Willingham). The unique mountainous topography of LA County pushes these winds down the coastal mountains and allows them to pick up speed, creating the high frequency of fires we see in fire corridors Malibu, Arroyo Seco, and the San Gabriel Canyons (LAFD).

For Melbourne, specifically, its topography and lightning are important to note in analyzing bushfire's behavior (ABC News Australia, 2019). While disastrous fire conditions, such as gusty winds, warm weather, and drought, all contribute to fires in Los Angeles and Melbourne, 85% to 90% of the fires are actually started by human activities that easily create a small spark which then expands at an accelerated speed through dry vegetation (Lai, 2021).

Moreover, in both regions, climate change is exacerbating its fires, as greenhouse gas emissions emitted by humans are contributing to drier seasons and warmer temperatures more prone to combustion (Pierre-Louis & Schwartz, 2020). The rising temperature and extreme heat waves have led to even drier vegetation for both Los Angeles and Melbourne over the years. These two factors combined with extended periods of drought in these two regions have had a massive impact. As a result of the drought, vegetation remains dry which creates more optimal material to fuel these fires and make them more difficult to contain.

Los Angeles County and Melbourne: Comparative Media and Public Awareness

Wildfires in Los Angeles County and bushfires in Melbourne have recently garnered international media attention due to the ever-present threat of one of the environment's most significant natural disasters.

From July to October, the media focuses on California and its yearly outbreaks of wildfires. Outlets ranging from The Washington Post to CNN to The Guardian cover California's record-shattering and fast-spreading wildfire seasons, ushering in a new era of media coverage (Drollette, 2020). The issue of attention to Los Angeles County's wildfires is exacerbated by the social and visual framing of what the media presents. Increased public awareness of the wildfire threat leads to a continuous cycle of news examination and article hooks (Terracina-Hartman, 2020). US media coverage of wildfires highlights "big picture" information, such as the number of homes affected, acres burned, and people evacuated. This coverage frames the social conflict of human-caused wildfires, whether they stem from direct or environmental factors (Terracina-Hartman, 2020, p. 380). Media can cause public awareness to shift from viewing wildfires as natural environmental incidents to framing them in terms of safety, protection, and damage, even if this framing might be misleading. Furthermore, increased media coverage of wildfires goes beyond Los Angeles County; it has become a global trend that exacerbates public perceptions of climate realities.

Australian media's coverage of wildfires follows a similar pattern. As in the US, media coverage describes it as a "compounded crisis," necessitating urgent action (Anderson, 2018, p. 928). Mainstream Australian media frames the bushfires as a political question of whom to blame. With

the frequency of bushfires in Australia, the media lens concentrates on the "public's expectations of fire protection" and "public accountability" (Anderson, 2018, p. 930). As a result, both in the United States and Australia media coverage of wildfires has become politicized and part of the broader debate over environmental-climate concerns. Thus, increased media attention leads to heightened public awareness, fear, and strong opinions. Through the modern media lens, images of loss and damage enable wildfires and bushfires to produce a sense of enormous urgency in public minds, influencing government policies and capturing global attention.

Los Angeles County and Melbourne: Stakeholder Analysis

As a result of the fires, diverse populations are impacted and various institutional stakeholders enter the scene to alleviate the situation in both Los Angeles and Melbourne. Specifically, in Los Angeles, Native Americans, Black, and Hispanic people are found to be far more vulnerable than other residents (Hutson, 2018). Additionally, the same study found that those who live in immigrant communities, low-income neighborhoods, or rural areas are also hard-hit, as they often do not have access to the necessary resources to rebuild their lives from fire ruins. In Melbourne, various towns and its houses are impacted by the fires to the point where it's unlivable. Melbourne's biodiversity also had devastating effects as national parks and habitats were also destroyed, which its ecosystem became at risk (Victorian Government, 2023). See **Exhibit B** and **Exhibit C** in appendix for stakeholder analysis tables.

To deal with these destructive fires and help the residents impacted, local governments and its task forces and departments come into play. Agencies such as Cal Fire and Cal EPA help impacted communities in Los Angeles with fire prevention and emergency response. Likewise, the Office of Bushfire Risk Management and the Local Bushfire Management Committee prevent and manage the bushfires in Melbourne. For both regions, there exists a state-wide science research center that conducts research on its respective fire to analyze its behavior and pattern to better prepare for future occurrences.

Los Angeles County and Melbourne: City Responses

Wildfires in Los Angeles County are not a new phenomenon; rather, they represent a yearly cycle in the climate of California. Los Angeles County's urban governance and approach to fighting wildfires are constantly being updated. In 2021, California dedicated $15 billion to tackling the threat of wildfires and to "build climate resilience in communities" (Office of Governor Gavin Newsom, 2021). The budget was increased in 2022 with an additional $1.2 billion over the next two years (Office of Governor Gavin Newsom, 2021). With extensive funding, Los Angeles County has structured its response to wildfires by dividing the issue diagnosis into three phases: mitigation, emergency, and recovery. By addressing all three phases, Los Angeles County can respond effectively and make critical decisions for the future of its city year-round.

Ongoing wildfire management is crucial in the city's response and preparation for future wildfire threats. Los Angeles is implementing proactive measures to protect the city and its residents, from geographic information system (GIS) maps to education programs to updated maintenance and building code requirements. The local government provides public resources and instructions for understanding the threat of wildfires and the risks individuals may face. One critical example of how the city responds is through its public-facing GIS mapping platform (County of Los Angeles

Fire Department, 2023). The map offers information to residents, helping them understand which areas are most at risk of wildfire severity and the local resources available within their community and local fire department. The county's GIS mapping platform provides government and fire safety transparency to local citizens, enabling informed decision-making. The GIS platform is part of Los Angeles County's education program about wildfires. Such programs included in the county's mitigation plan are Ready! Set! Go! (a home preparation and prevention initiative) and Home Hardening (a home safety and retrofitting guide) (L.A. County Planning's Climate Action, 2023). Brush clearance, defensible space, and building codes are critical parts of the L.A County's Fire Hazard Reduction Program. Brush clearance is defined as the removal and burning of vegetation and the accumulation of other obstacles that pose a combustible threat, while defensible space is defined by the County of Los Angeles Fire Department as a 100-foot buffer between your property and the surrounding area (County of Los Angeles Fire Department, 2023). Brush clearance and defensible space mitigate the potential for wildfire spread and limit the extent of possible damages. Similarly, since 2005, the "Office of the State Fire Marshal's emergency regulations have been amending the California Code of Regulations" to combat potential wildfire damage in Fire Hazard Severity Zones (Office of the State Fire Marshal, 2023). Recognized as both a state and local county responsibility, these laws have established minimum material standards to protect buildings from wildfire exposure and support overall mitigation efforts.

California and Los Angeles County have allocated funding for targeted wildfire fighting and recovery initiatives. This funding has been directed towards additional fire crews and equipment to combat catastrophic wildfires (Office of Governor Gavin Newsom, 2021). In 2021, Governor Gavin Newsom authorized the hiring of 1,399 firefighters and the expansion of CAL FIRE's fleet with 12 additional fire combat aircraft (Office of Governor Gavin Newsom, 2021). On a local level, Los Angeles County has expanded its use of technology, such as uncrewed aerial vehicles and GIS, to coordinate and respond to wildfires in real-time (Binversie, 2018; Quednow, 2020). In 2022, the Los Angeles County Fire Department created a countywide plan to address post-fire responsibilities, including "natural resource recovery, watershed protection, reforestation, and ecosystem restoration" (County of Los Angeles Fire Department, 2022, p. 3). The Los Angeles Fire Department also collaborates with California's Department of Social Services to support people and families impacted by wildfires (County of Los Angeles Fire Department, 2022, p. 4). The California Disaster Assistance Act provides financial assistance to repair public property damage (Cal O.E.S., 2023). Los Angeles County's well-funded, multi-faceted, and targeted wildfire protection plan addresses the city's annual wildfire threat. As the dangers from climate change evolve and urban areas expand, the importance of how Los Angeles County addresses and innovates solutions will become increasingly crucial.

Los Angeles County and Melbourne have similar approaches in their efforts to mitigate and educate their citizens about the threat of wildfires, with the government allocating $1.4 billion to bushfire prevention and safety efforts (Reuters, 2020). Melbourne, Victoria's approach to addressing bushfires involves the joint efforts of Melbourne Fire and Emergency, Forest Fire Management Victoria, local government, and other organizations. The Victoria Government hosts programs and a website containing information about bushfire and grassfire preparedness (V.I.C. Government, 2023). From the up-to-date Australian Fire Danger Rating system, created using weather data from the Bureau of Meteorology and other environmental conditions to advice on defending one's property, Melbourne and the state government provide a transparent system for relaying information to the public (V.I.C. Government, 2023). The Victoria state government also

offers resources for residents to create defensible spaces around their homes clear of vegetation for fire-ready conditions. However, this is not mandatory, and one may need a planning permit to do so (Department of Transport and Planning, 2023). Victoria's building authority does enforce bushfire protection policies for domestic buildings, which must be constructed to be as bushfire prone as possible (VBA, 2023). Protection methods for bushfire-prone construction include enclosing subfloors with non-combustible material and installing metal doors and window protectors (VBA, 2023). For physical fire mitigation, Forest Fire Management Victoria employs techniques such as planned burning, strategic fuel breaks, and joint fuel management to mitigate bushfire potential (Forest Fire Management Victoria, 2023). Planned burning involves deliberately setting fires to reduce fuel loads (i.e vegetation and dead plants), while strategic fuel breaks are strips of land where vegetation is permanently removed to reduce bushfire spread rates (they are known as the last line of defense). The state has invested over $35 million in these measures (Forest Fire Management Victoria, 2023). Joint fuel management is a statewide public and private land risk mitigation cooperation involving Forest Fire Management Victoria and the Country Fire Authority to ensure the "sharing of resources, vehicles, and other equipment" (Forest Fire Management Victoria, 2023). In short, both Los Angeles County and Melbourne have extensive cooperation with their state governments to battle bushfires in a formal and organized manner. This collaboration has resulted in well-planned and complex systems that aim to mitigate future fires.

However, Melbourne and Los Angeles County have different approaches to emergency and recovery responses. During emergencies, the state of Victoria has created a network of 'Neighborhood Safer Places' and 'A Place of Last Resort,' both offering aid and protection to citizens during bushfire events (Fire Rescue Victoria, 2023). Victoria's government has dedicated $517 million to fire services to prepare for the bushfire season (ABC News, 2021). What sets Melbourne, Victoria apart from Los Angeles County is its formal investment in recovery and resilience. There are two aspects to Melbourne's recovery and investment: the environmental and the civilian side. In 2020, the federal government allocated $50 million for an emergency response project focused on natural resource management, wildlife and habitat rescue, and an additional $150 million for recovery and resilience in land care, koala conservation, and Indigenous land management (DCCEEW, 2022). The second aspect of Melbourne's recovery response is its investment in protecting and supporting its people, with a total government allotment of $2 billion (Crowe, 2020). From bushfire support to communities, temporary accommodation, rebuilding and planning assistance, and funds for business recovery, Melbourne and Australia prioritize helping communities recover (VIC Government, 2023) (Department of Transport and Planning, 2023) (Business Victoria, 2023). Bushfires, like wildfires, affect the lives and livelihoods of Melbourne's community, and the government recognizes this.

Policy, Planning, and Management Proposal

There are two key types of action that can be taken in regards to urban-wildlife conflict: mitigation and adaptation. Mitigation measures prevent or minimize the negative impacts by responding proactively to climate change and natural hazards. This includes addressing the root of the problem. Adaptation consists of making lifestyle or physical changes to the existing built environment to accommodate the effects of climate change.

Los Angeles, despite having far more funding than Melbourne, has many lessons to take from the Australian hub. In the future, their planning strategy should include Melbourne's structure of recovery and reinvestment through both the environmental and civilian sides. Los Angeles' funding should include recovery housing and financial assistance as a reactive solution. Yet, reactivity cannot be the only answer to the County's proposal. Los Angeles is unique in that it has a large portion of homes and structures located on the wildlife-urban interface, as visited before. For preventative measures, the county should consider future no build zones, which are defined as" areas or portions of a lot that is designated by deed not to contain any buildings, structures or other built improvements on a permanent basis" (WWF). Residents who are most prone to be victims of wildfires live on this fringe, and it does not make sense to pour out funding to accommodate this lifestyle which ends up costing the county millions of dollars in repairs and insurance.

On the other hand, Melbourne should invest more and focus on taking mitigation measures. In comparison to Los Angeles, Melbourne's budget for its mitigation efforts is too low relative to the scale of the destruction its bushfire brings about. An initiative Melbourne could take on is to partner or invest in new technology and scientific research and development that could help with managing the spread of the fire. For instance, a Sydney-based manufacturer Carbonix designs drones that are equipped with thermal cameras that could fly over 8 hours and verify the fires started by lightning in remote regions and send alert signals to firefighters and water bombers to quickly turn off the fire before it spreads to inhabited areas. They are also working on equipping these drones with "sniffers" that could detect bushfire smoke, methane leakages, and other chemicals. Clearly, partnering up or investing in such technologies would be very helpful for Melbourne's future fire mitigation efforts (Hannam, 2022). In addition, there are innovations such as mist bombs that are foot-ball sized, water-filled vessels that would be dropped from an aircraft (Technet Digital, 2020). These bombs would transform water into mist and quickly disperse in civinity of where it "explodes." The mist droplets would help remove some energy from the bushfire and make it relatively easier for firefighters to put the fire out in the long run. Last but not least, Melbourne should dedicate more effort into preventative forest and vegetation management by partnering up with Aboriginal, or indigenous, people of Australia. While the city has already looked into and tried planned burnings, it has not worked well in the past. Contrarily, Aboriginals have always practiced "cultural burning," which is planned burning, where they purposely executed knee-high blazes across landscape to burn up fuel such as leaf detritus and kindling so that natural bushfire would devour less (Nunn, 2020). By working with Aboriginals who are scientifically experts in cultural burning and the micro-climate benefits it brings about, Melbourne could better prevent its bushfire from spreading to an extreme level.

Conclusions

Both Los Angeles County and the city of Melbourne Australia have effective and efficient wildfire management resources, tools, budgeting processes, and technology. However, when comparing the two and how they address the comprehensive issues of wildfire management, the differences lie not in their mitigation strategies but on what they emphasize. Los Angeles County focuses on mitigating wildfires and protecting communities, while Melbourne's government concentrates on recovering both the natural environment and people's lives after devastating bushfires have occurred. Each could benefit from the practices of the other. Learning from Los Angeles County's extensive and proven mitigation protection actions and technology exploration would benefit

Melbourne's fire management. Likewise, Los Angeles County can learn from Melbourne's emergency and response institutional tools to recover from the devastation of wildfires better effectively and to support their communities. No system is perfect, but the foundations are in place for each city to learn and create innovative management solutions to address the climate threat of fire and the devastation it can cause.

Appendix

Exhibit A: Comparative Urban Metrics for Los Angeles County and Melbourne

	Los Angeles County	**Melbourne**
Estimated Population	10.1 million (2022)	5.1 million (2022)
Population Density	956 people per km^2	515 people per km^2
Population Growth Rate	0.19% (2022)	1.64% (2022)
City Area	10,510 km^2	9,991 km^2
City Gross Domestic Product	$711.9 billion (2021)	$350 billion (2021)
City GDP per Capita	$72,046	$70,500
Human Development Index	5.43 (out of 10) (2021)	0.951 (2022)
City Prosperity Index	—	0.903 (2013)
Gini Coefficient	41.5 (2022)	34.3 (2022)
Global Cities Index	5 (Los Angeles City) (2021)	12 (2021)
Köppen Climate Classification	Csa (temperate)	Cfb (temperate)
State Fire Management Agency	California Department of Forestry and Fire Protection	Forest Fire Management Victoria
Local Fire Management Agency	Los Angeles County Fire Department	Melbourne Fire and Emergency
Smart Cities Index	50/141	31/141

Exhibit B: Stakeholder Analysis for Los Angeles County

Stakeholders	**Involvement in the issue**	**Capacity to influence**
Minorities (Native Americans, Black,	Far more vulnerable to the fire than others	0%

HIspanics)		
Immigrant communities**, Low-income** neighborhoods**, Rural** areas	Often hard hit — do not have necessary access to rebuild lives from ruins	0%
Agencies (CAL Fire, CAL EPA, etc.)	Fire emergency response	70%
National Center for Atmospheric Research	● Improve models of wildfire behavior ● Explore air quality impact of smoke plumes ● Understand how wildfire may change in warming climate	50%

Exhibit C: Stakeholder Analysis for Melbourne

Stakeholders	Involvement in the issue	Capacity to influence
Animals & Parks	Habitats are ruined — biodiversity destroyed	0%
Residents	Towns and houses destroyed	10%
Agencies (Local Bushfire Management Committee, etc.)	Fire prevention & emergency response	70%
Commonwealth Scientific and Industrial Research Organization	● Provide climate & disaster resilience and guidance to governments, agencies, etc. ● Work to understand fire prediction, management, behavior & recovery	60%
Aboriginal Australians	Can help with preventative measures through their fire management practices	40%

Works Cited

ABC. (2021, November 6). *Victoria's fire services receive half-billion dollar investment to prepare for bushfire season*. ABC. Retrieved April 24, 2023, from https://www.abc.net.au/news/2021-11-06/victoria-bushfire-funding-season/100600580

ABC News Australia. (2019). The science of bushfires explained | ABC News. In *YouTube*. https://www.youtube.com/watch?v=l38UkQmUISs

Anderson, Chubb, P., & Djerf-Pierre, M. (2018). Fanning the Blame: Media Accountability, Climate and Crisis on the Australian "Fire Continent." Environmental Communication, 12(7), 928–941. https://doi.org/10.1080/17524032.2018.1424008

Australian Bureau of Statistics. (2022, July 26). *Regional population, 2021*. Australian Bureau of Statistics. Retrieved March 21, 2023, from https://www.abs.gov.au/statistics/people/population/regional-population/latest-release#cite-window1

Binversie, K. (n.d.). *GIS technology aids in effective response to California wildfires*. FireRescue1. Retrieved April 24, 2023, from https://www.firerescue1.com/amu/articles/gis-technology-aids-in-effective-response-to-california-wildfires-wMEUKKKl54uBwEux/

Britannica. (n.d.). *Australian bushfires*. Britannica Kids. https://kids.britannica.com/students/article/Australian-bushfires/629041

Bureau of Economic Analysis. (2022, December 8). *Gross Domestic Product by County, 2021 | U.S.* Bureau of Economic Analysis. Retrieved March 21, 2023, from https://www.bea.gov/news/2022/gross-domestic-product-county-2021

Business Victoria. (2022, September 30). *Home Grants & programs Business Recovery Advisory Service*. Business Victoria. Retrieved April 24, 2023, from https://business.vic.gov.au/grants-and-programs/business-recovery-advisory-service

California Department of Forestry and Fire Protection. (n.d.). California Department of Forestry and Fire Protection. Retrieved March 23, 2023, from https://fire.ca.gov/

California Governor's Office of Emergency Services. (n.d.). *California Disaster Assistance Act | California Governor's Office of Emergency Services*. California Governor's Office of Emergency Services. Retrieved April 24, 2023, from https://www.caloes.ca.gov/office-of-the-director/operations/recovery-directorate/recovery-operations/public-assistance/california-disaster-assistance-act/

Carnegie Endowment for International Peace. (n.d.). *Global Protest Tracker*. Carnegie Endowment for International Peace. Retrieved March 22, 2023, from https://carnegieendowment.org/publications/interactive/protest-tracker

City of Melbourne. (2021, July). *City of Melbourne*. City of Melbourne Medium-Term Economic Outlook. Retrieved March 21, 2023, from https://www.melbourne.vic.gov.au/SiteCollectionDocuments/medium-term-economic-outlook-report-2021.pdf

City of Melbourne. (n.d.). *DRAFT URBAN ECOLOGY AND BIODIVERSITY STRATEGY The city as an ecosystem*. Amazon AWS. Retrieved April 24, 2023, from https://hdp-au-prod-app-com-participate-files.s3.ap-southeast-2.amazonaws.com/4214/6524/9371/Draft_Urban_Ecology_and_Biodiversity_Strategy.pdf

County of Los Angeles. (n.d.). *County of Los Angeles*. LACounty. Retrieved March 23, 2023, from https://lacounty.gov/

Crowe, D. (2020, January 6). *'We will meet every cost': Bushfire recovery to take priority over budget surplus*. Sydney Morning Herald. Retrieved April 24, 2023, from https://www.smh.com.au/politics/federal/bushfire-recovery-fund-to-get-2-billion-over-two-years-20200106-p53p8j.html

Curbed LA (2019). *Maps show where wildfires have burned over and over again in LA county.* Retrieved March 23, 2023 from https://la.curbed.com/2019/1/22/18184154/california-wildfire-map-risk-insurance

Department of Climate Change, Energy, the Environment and Water. (n.d.). *Activities and outcomes*. DCCEEW. Retrieved April 24, 2023, from https://www.dcceew.gov.au/environment/biodiversity/bushfire-recovery/activities-and-outcomes

Department of Regional Planning. (n.d.). *Home*. Department of Regional Planning. Retrieved April 24, 2023, from https://planning.lacounty.gov/long-range-planning/climate-action-plan/

Department of Transport and Planning. (2022, April 19). *Vegetation management for bushfire protection*. Department of Transport and Planning. Retrieved April 24, 2023, from https://www.planning.vic.gov.au/policy-and-strategy/bushfire/prepare-your-property/vegetation-removal-for-bushfire-protection

Drollette, D., & Pacheco, P. (2020, September 10). *California's wildfires: Best coverage in the media*. Bulletin of the Atomic Scientists. Retrieved April 24, 2023, from https://thebulletin.org/2020/09/californias-wildfires-best-coverage-in-the-media/

Duff, T. (2022, May 26). *Wildfires, Flammable Oils, and Eucalyptus Trees: The Persistence and Volatility of Terpenes in Excised Leaves*. SSRN Papers. Retrieved April 24, 2023, from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4120325

Elmqvist, Goodness, J., Marcotullio, P. J., Parnell, S., Sendstad, M., Wilkinson, C., Fragkias, M., Güneralp, B., McDonald, R. I., Schewenius, M., & Seto, K. C. (2013). Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment. Springer Nature. https://doi.org/10.1007/978-94-007-7088-1

Fire Rescue Victoria. (2023, March 30). *Neighbourhood Safer Places*. Fire Rescue Victoria. Retrieved April 24, 2023, from https://www.frv.vic.gov.au/neighbourhood-safer-places

Forest Fire Management Victoria. (n.d.). *Forest Fire Management Victoria*. Forest Fire Management Victoria - Forest Fire Management Victoria. Retrieved March 23, 2023, from https://www.ffm.vic.gov.au/

Hannam P. Send in the drones: how to transform Australia's fight against bushfires and floods. the Guardian. Published November 12, 2022. https://www.theguardian.com/australia-news/2022/nov/13/send-in-the-drones-how-to-transform-australias-fight-against-bushfires-and-floods

History.com. (2019, February 28). *Los Angeles: A History*. Los Angeles: A History. Retrieved April 26, 2023, from https://www.history.com/topics/us-states/los-angeles-california

Hutson, S. (2018, November 14). *Study: People of Color and Low-Income Residents Most Vulnerable to Wildfire Impacts*. KQED. https://www.kqed.org/news/11706264/study-people-of-color-and-low-income-residents-most-vulnerable-to-wildfire-impacts#:~:text=By%20far%2C%20Native%20Americans%20are

IMD. (n.d.). *Smart City Observatory*. IMD. Retrieved April 24, 2023, from https://www.imd.org/smart-city-observatory/home/

Kearney. (n.d.). *2021 Global Cities Report*. Kearney. Retrieved April 24, 2023, from https://www.kearney.com/global-cities/2021

Lai, O. (2021, November 12). *What Causes California Wildfires?* Earth.org - Past | Present | Future. https://earth.org/what-causes-california-wildfires/
L.A. County Fire Department. (n.d.). *Fire Hazard Reduction Programs – Fire Department*. L.A. County Fire Department. Retrieved April 24, 2023, from https://fire.lacounty.gov/fire-hazard-reduction-programs/#1566334443711-cda9aa0a-16fa
Lewis, K., & Burd, S. (2021, March 8). *Human Development Index*. ArcGIS StoryMaps. Retrieved March 23, 2023, from https://storymaps.arcgis.com/stories/8a0dde9db3914544be567b592769a8c8
Limón, S. M. (2021, September 23). *Governor Newsom Signs Climate Action Bills, Outlines Historic $15 Billion Package to Tackle the Climate Crisis and Protect Vulnerable Communities | California Governor*. Gavin Newsom. Retrieved April 24, 2023, from https://www.gov.ca.gov/2021/09/23/governor-newsom-signs-climate-action-bills-outlines-historic-15-billion-package-to-tackle-the-climate-crisis-and-protect-vulnerable-communities/
Los Angeles Almanac. *Wildfires in Los Angeles County.* Retrieved March 23, 2023 from https://www.laalmanac.com/fire/fi07.php
Los Angeles County Economic Development Corporation. (n.d.). *Industry Cluster Development*. Los Angeles County Economic Development Corporation. Retrieved March 21, 2023, from https://laedc.org/industry-cluster-development/
Los Angeles Fire Department. (n.d.). *Brush Clearance Requirements*. Los Angeles Fire Department. Retrieved April 24, 2023, from https://www.lafd.org/fire-prevention/brush/brush-clearance-requirements
National Geographic Society. (2022, May 19). *Köppen Climate Classification System*. National Geographic Society. Retrieved March 21, 2023, from https://education.nationalgeographic.org/resource/koppen-climate-classification-system/
Nunn G. Why Aboriginal planners say the bush “needs to burn.” *BBC News*. https://www.bbc.com/news/world-australia-51043828. Published January 12, 2020.
Pierre-Louis, K., & Schwartz, J. (2020, September 18). Why Does California Have So Many Wildfires? *The New York Times*. https://www.nytimes.com/article/why-does-california-have-wildfires.html
Reuters. (2020, January 19). *Australian budget surplus in doubt as bushfire funding boosted*. Reuters. Retrieved April 24, 2023, from https://www.reuters.com/article/us-australia-bushfires-idUKKBN1ZJ029
SGS Economics & Planning. (2018, December). *Economic performance of Australia's Cities and Regions*. SGS Economics & Planning. Retrieved March 21, 2023, from https://sgsep.com.au/assets/main/SGS-Economics-and-Planning-Economic-performance-fo-asutralias-cities-and-regions-report.pdf
Sisson, P. (2019, January 22). *Map shows historic wildfires in LA*. Curbed LA. Retrieved April 24, 2023, from https://la.curbed.com/2019/1/22/18184154/california-wildfire-map-risk-insurance
State Fire Marshal. (2022, May 25). *Los Angeles County Fire Department 2022 Strategic Fire Plan*. State Fire Marshal. Retrieved April 24, 2023, from https://osfm.fire.ca.gov/media/ugwfw535/2022-los-angeles-county-unit-fire-plan.pdf
Technet Digital. New Innovative Technology to Tackle Bushfires – Bombs. TechNET Digital Recruitment. Published January 6, 2020. https://technet-digital.co.uk/blog/new-innovative-technology-to-tackle-bushfires-bombs/

Terracina-Hartman. (2020). Fanning the flames: How U.S. newspapers framed 10 historically significant U.S. wildfires. Newspaper Research Journal, 41(3), 368–386. https://doi.org/10.1177/0739532920950498
Un Habitat. (2013). *State of the World's Cities 2012/2013: Prosperity of Cities*. Routledge. https://doi.org/10.4324/9780203756171
United Nations Development Programme. (2022, September 8). *Human Development Report 2021-22 | Human Development Reports*. Human Development Reports. Retrieved March 21, 2023, from https://hdr.undp.org/content/human-development-report-2021-22
United States Census Bureau. (n.d.). *Los Angeles city, California*. Census Bureau. Retrieved March 21, 2023, from https://www.census.gov/quickfacts/losangelescitycalifornia
Victorian Building Authority. (n.d.). *Bushfire protection*. Victorian Building Authority. Retrieved April 24, 2023, from https://www.vba.vic.gov.au/consumers/bushfire
Victorian Government. (2023, January 24). *Plan and prepare for fire*. Victorian Government. Retrieved April 24, 2023, from https://www.vic.gov.au/plan-and-prepare
Victoria State Government,. (2023). *Victoria's industries*. Live in Melbourne. Retrieved March 21, 2023, from https://liveinmelbourne.vic.gov.au/connect/victorian-industries
VIC Government. (n.d.). *2019-20 Eastern Victorian bushfires | Victorian Government*. Www.vic.gov.au. https://www.vic.gov.au/2019-20-eastern-victorian-bushfires
Von Quednow, C. (2020, June 12). *LAFD using drones to determine brush clearance compliance amid coronavirus pandemic*. KTLA. Retrieved April 24, 2023, from https://ktla.com/news/lafd-using-drones-to-determine-brush-clearance-compliance-amid-coronavirus-pandemic/
World Population Review. (n.d.). 2023 World Population by Country (Live). Retrieved April 24, 2023, from https://worldpopulationreview.com/
World Shipping Council. (2020). *Top 50 Ports — World Shipping Council*. World Shipping Council. Retrieved March 21, 2023, from https://www.worldshipping.org/top-50-ports
World Wide Fund for Nature. (n.d.). *Home*. World Wide Fund for Nature. Retrieved April 24, 2023, from http://wwf.panda.org/about_our_earth/ecoregions/about/habitat_types/selecting_terrestrial_ecoregions/habitat12.cfm