WUI growth, fire activity, and vegetation types across Mediterranean-type landscapes

Kira A. Pfoch

Advisor: *Volker Radeloff*

Committee: *Phil Townsend, Min Chen, Anthony Ives, Amy Trowbridge, Patrick Hostert*

The Wildland-Urban Interface (WUI)

Google Earth ™

Intermix WUI

➢ *settlements intermingle with wildland vegetation*

Google Earth ™

Interface WUI

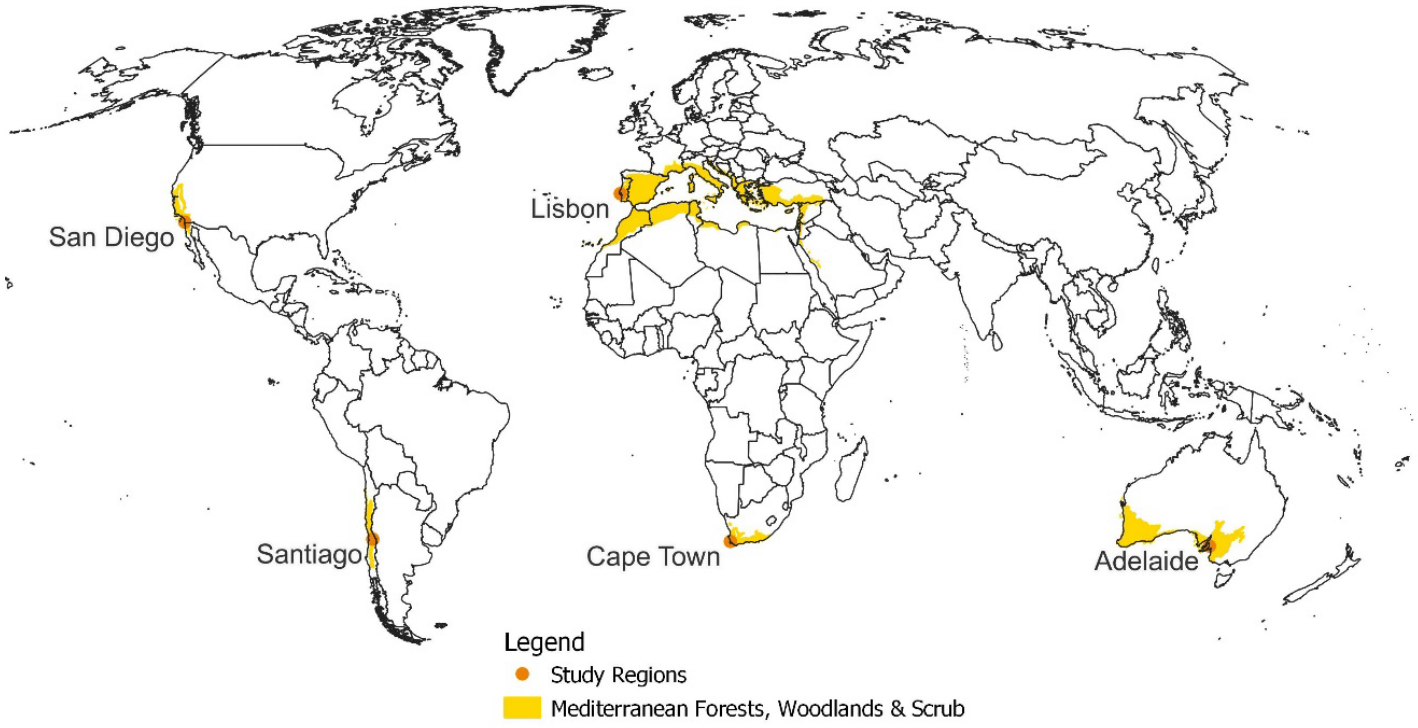
➢ *settlements near wildland vegetation*

(USDI & USDA 2001)

Mediterranean Environments

- **Characteristics:**
  - hot/ dry summer
  - cool/ wet winter
  - disturbance-prone

- **Study Areas:**
  - San Diego (USA)
  - Santiago (Chile)
  - Lisbon (Portugal)
  - Cape Town (South Africa)
  - Adelaide (Australia)



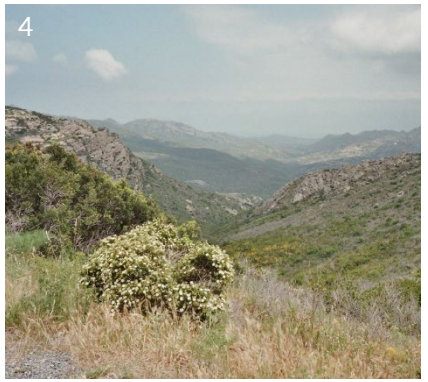
The Mediterranean-type landscapes,
Olson et al (2001) Terrestrial ecoregions of the world: a new map of life on Earth

Mediterranean Vegetation Communities

Chaparral
California

Fynbos
South Africa

Mallee
South Australia



Maquis
Portugal

Matorral
Chile

- Composed of sclerophyllous-leaved, evergreen shrublands, semi-deciduous scrubs, woodlands, grasses
- Fire return interval ~10-60 years

(Keeley, 2012; Medail, 2008)

Major research questions

1. How to map the WUI with Landsat and Sentinel-2 imagery?

2. How did WUI change from 1990 to 2022?

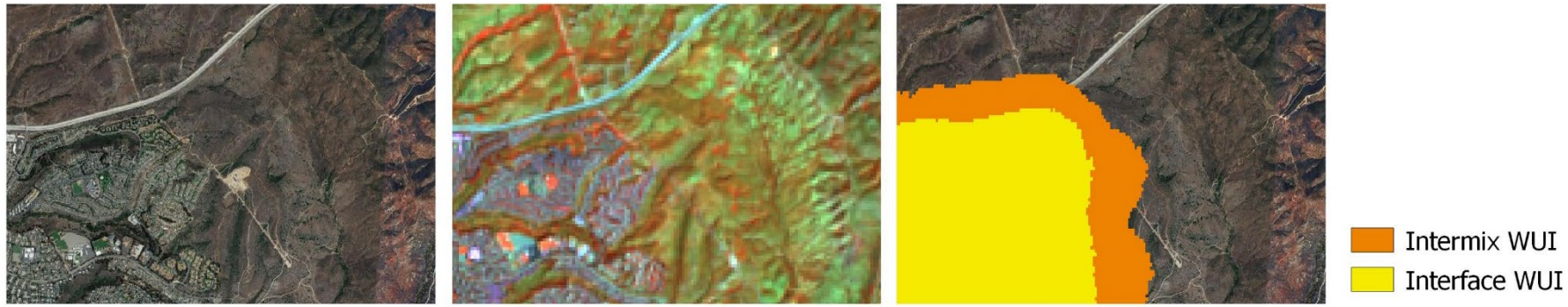
3. What drives WUI change?

4. Did fire frequency, fire season length, and burned area increase?

5. Does WUI growth lead vegetation type conversion?

Chapter 1: Mapping the WUI

- How to map the WUI using Landsat and Sentinel-2 imagery?
  - Novel WUI mapping approach
  - spectral unmixing of satellite imagery
  - assess vegetation cover and housing density via land cover fractions



Google Earth | Landsat | WUI Map

Chapter 2: Quantifying WUI change

- How much did WUI grow from 1990 to 2022?

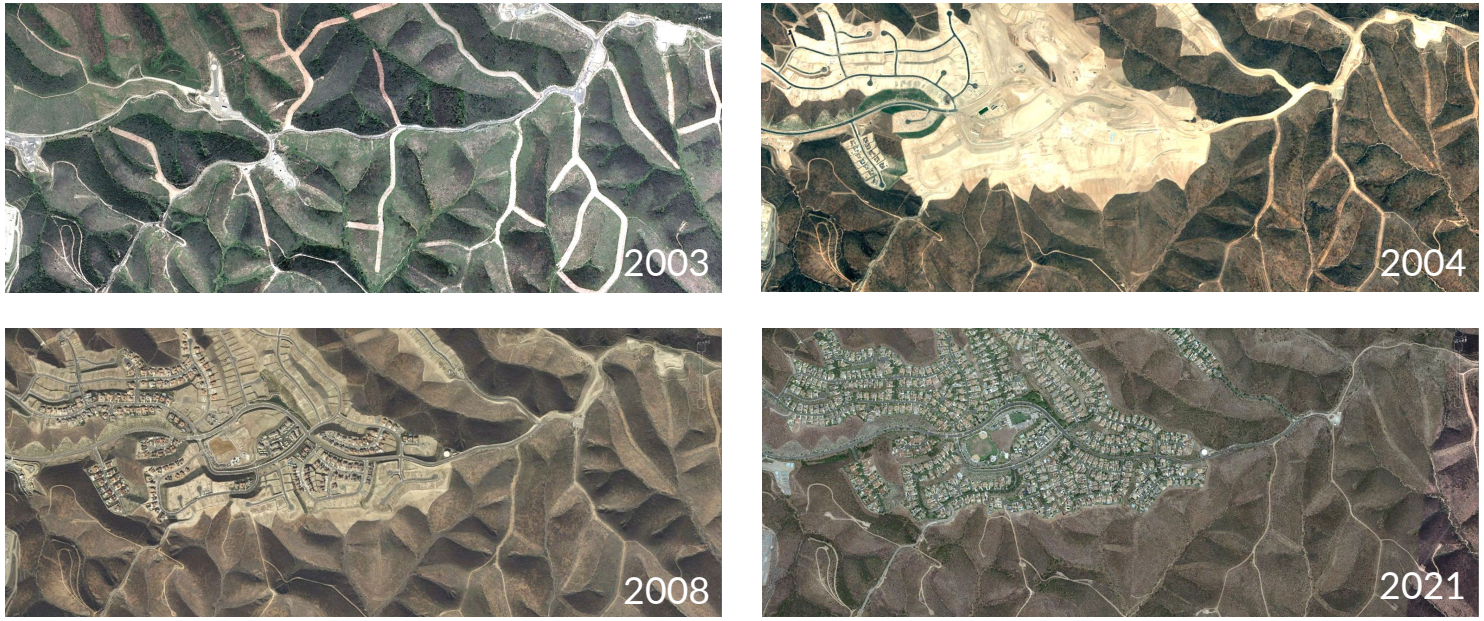
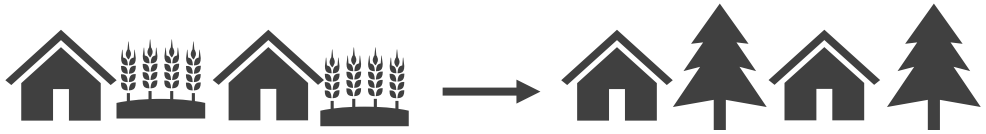


Image Source: Google Earth Pro

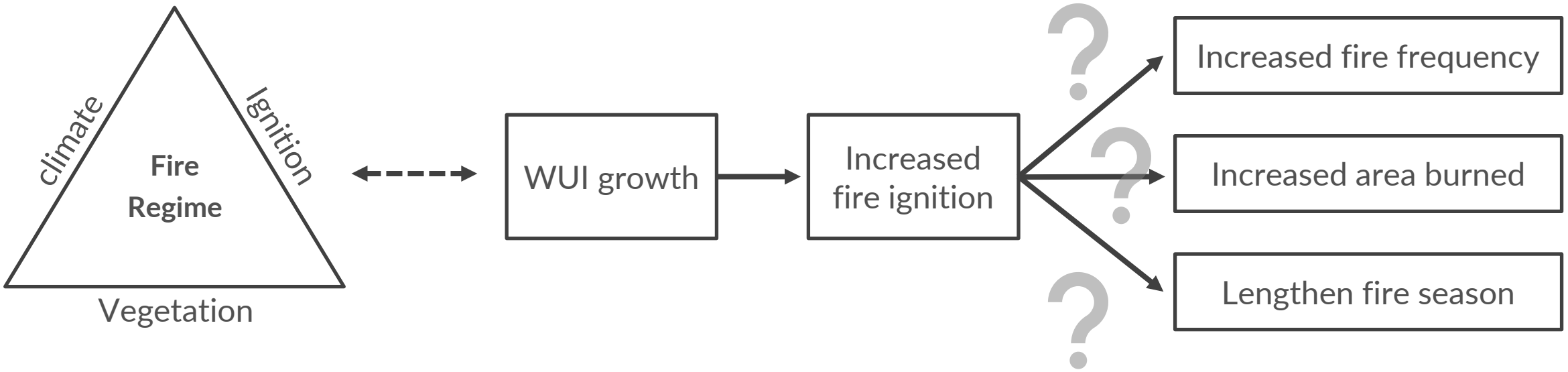
Chapter 3: Quantifying WUI drivers

I. What is the main driver of WUI growth (vegetation or buildings)?

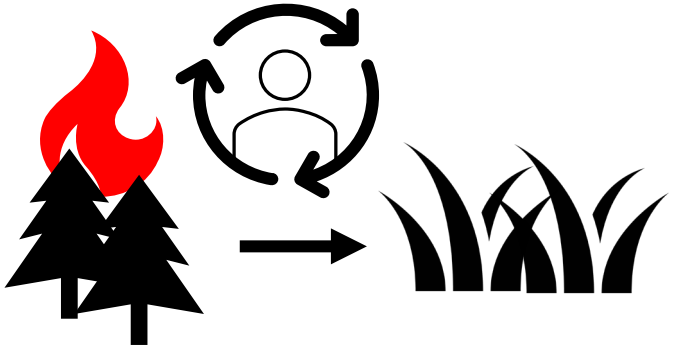
II. How did land cover change within newly created vs. stable WUI areas?

- *Increasing houses:* 
- *Increasing vegetation:* 

Chapter 4: Changing fire activity in the WUI

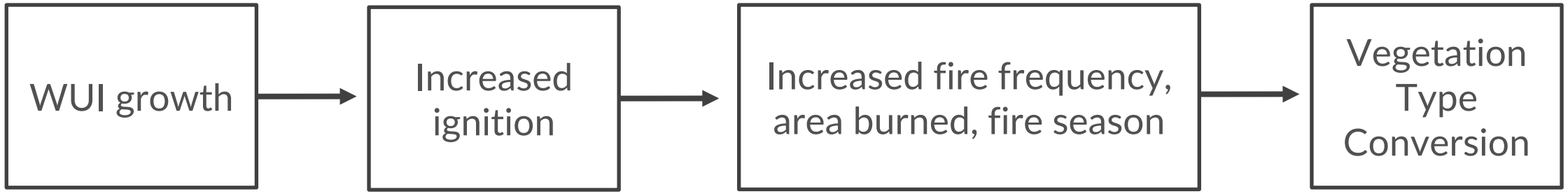


Chapter 5: Vegetation Type Conversion



I. Did shifts from woody to non-woody vegetation occur?

II. Does WUI growth lead vegetation type conversion?



Overall Significance

- Scientific contributions:
  - Assess WUI growth across the Mediterranean biome
  - Investigate drivers of WUI change
  - Trends in fire activity and vegetation communities
- Methodological contributions:
  - Novel WUI mapping approach with Landsat & Sentinel-2
  - WUI maps to assess human-environmental conflicts
- Conservation and management implications:
  - Feedbacks between WUI growth, fire activity, and type conversion
  - Woody to non-woody transition as proxy for biodiversity loss

Timeline

Year		PhD Start	First Meeting	Preliminary	CH1	CH2	CH3	CH4	CH5	Defense
2021	III	x								
2021	IV									
2022	I		x							
2022	II									
2022	III									
2022	IV									
2023	I									
2023	II			x	Analysis					
2023	III				Analysis					
2023	IV				Manuscript	Analysis				
2024	I				Manuscript	Analysis	Analysis			
2024	II					Manuscript	Analysis			
2024	III					Manuscript	Manuscript	Analysis		
2024	IV						Manuscript	Analysis		
2025	I							Manuscript	Analysis	
2025	II							Manuscript	Analysis	
2025	III								Manuscript	x
2025	IV								Manuscript	x


Thank you for your attention!