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Wildfire Hazard Evaluation in the Metropolitan Area of Concepcion Chile Central.

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Problem

The risk of wildfires in Chile is latent, especially in the densely populated urban centers found in the Wildland-Urban Interface (W-UI). The risk is heightened by conflicting development models, such as the Chilean Forestry Model (CFM) and the Chilean Urban Development Model (UDM), both of which express liberalized economic and spatial growth that lead to scenarios that are favorable to wildfires (Andersson et al., 2016).

Approach

We address the complexity of the risk of wildfires in the Metropolitan Area of Concepcion (CMA) (36°35'-37°00' S and 72°45'-73°15' W) (Fig. 1), which has 985,034 inhabitants (INE, 2017). Specifically, it was evaluated by using satellite images (Chuvieco et al, 2011; Yakubu et al., 2013) to analyze the anthropic factors (land cover, road networks, and controlled burning points, camping) and natural factors (topography, inflammability, insolation, altitude) (Fig. 2) and the following equation:

$$PI = 4V + 3H + 2I - A$$

Where:

PI = fire hazard

V= vegetation factor (inflammability)

H= human factor (land covers and anthropic environment)

I= insolation factor, and

A= altitude factor

To corroborate the data, we used information obtained from governmental organizations, we also spatialize the starting-points of fires, which coincided with the detected risk areas (Fig. 3).

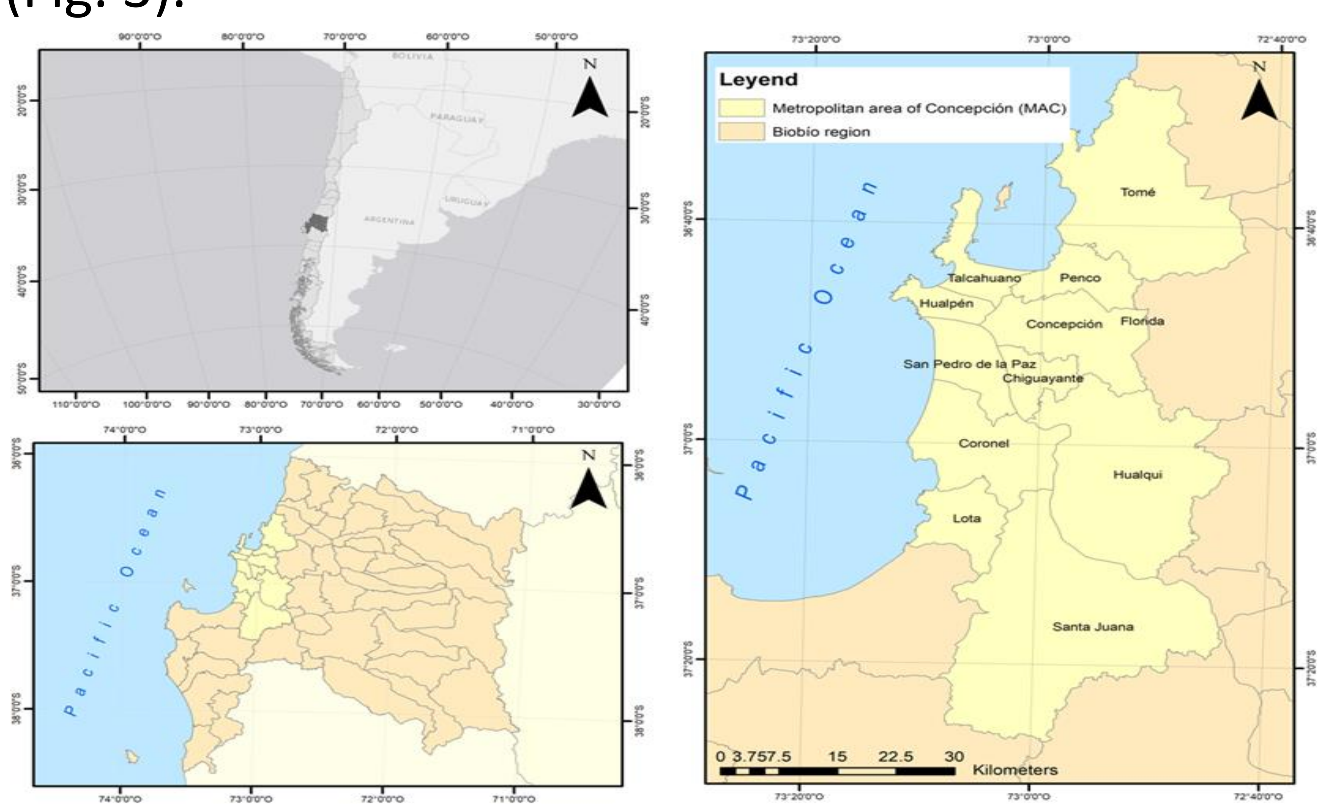

Fig. 1 Map of the study area

Variables	Hazard Values		
	1- Low	2- Medium	3- High
Height	25 – 175 m.a.s.l.	176 – 325 m.a.s.l.	326 – 475 m.a.s.l.
Land cover	Bared soil	Native Forest	Shrubland
	Water bodies	Prairies	Exotic plantations
	Sand		
	Urban		
Anthropic elements	Controlled burn areas	Roads	Camping
			High Tension Line
			Railway road
Intervals of insolation factor	< -0,46	-0,95	> 0,49
NDVI index	-0,5722 – -0,2890	-0,2892 – -0,0676	-0,0677 – -0,2579
NDII index	0,4370 – 0,6631	0,6632 – 0,7358	0,7359 – 0,8401
Flammability index	1 – 2	3 – 4	6 – 9

Fig. 2 Ponderation of criteria in hazard evaluation model

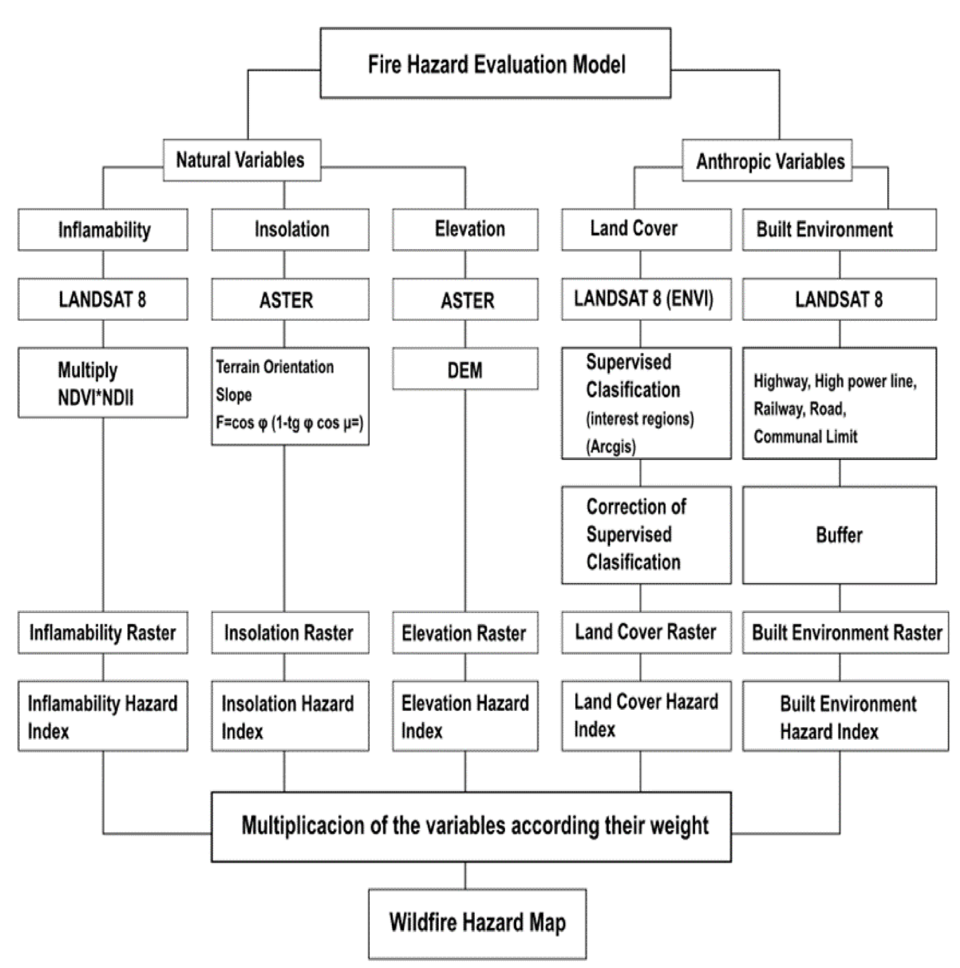

Fig. 3 Flux diagram of Fire Hazard Evaluation Model

Results

The results indicate that 40.8% (115,348 ha.) of the CMA's surface area has a high risk of a forest fire; 38.3% (108,098 ha.) has a medium risk and only 20.8% (120 km2) has a low risk. Finally, we invite to discuss the main structural agents that have expanded this risk: first, the proximity between land cover associated with monoculture and areas of urban expansion; second, the state economic incentive that has increased the surface area of plantations in a CFM context, as well as the surface area inhabited by cities (W-UI) (Figs. 4-8).

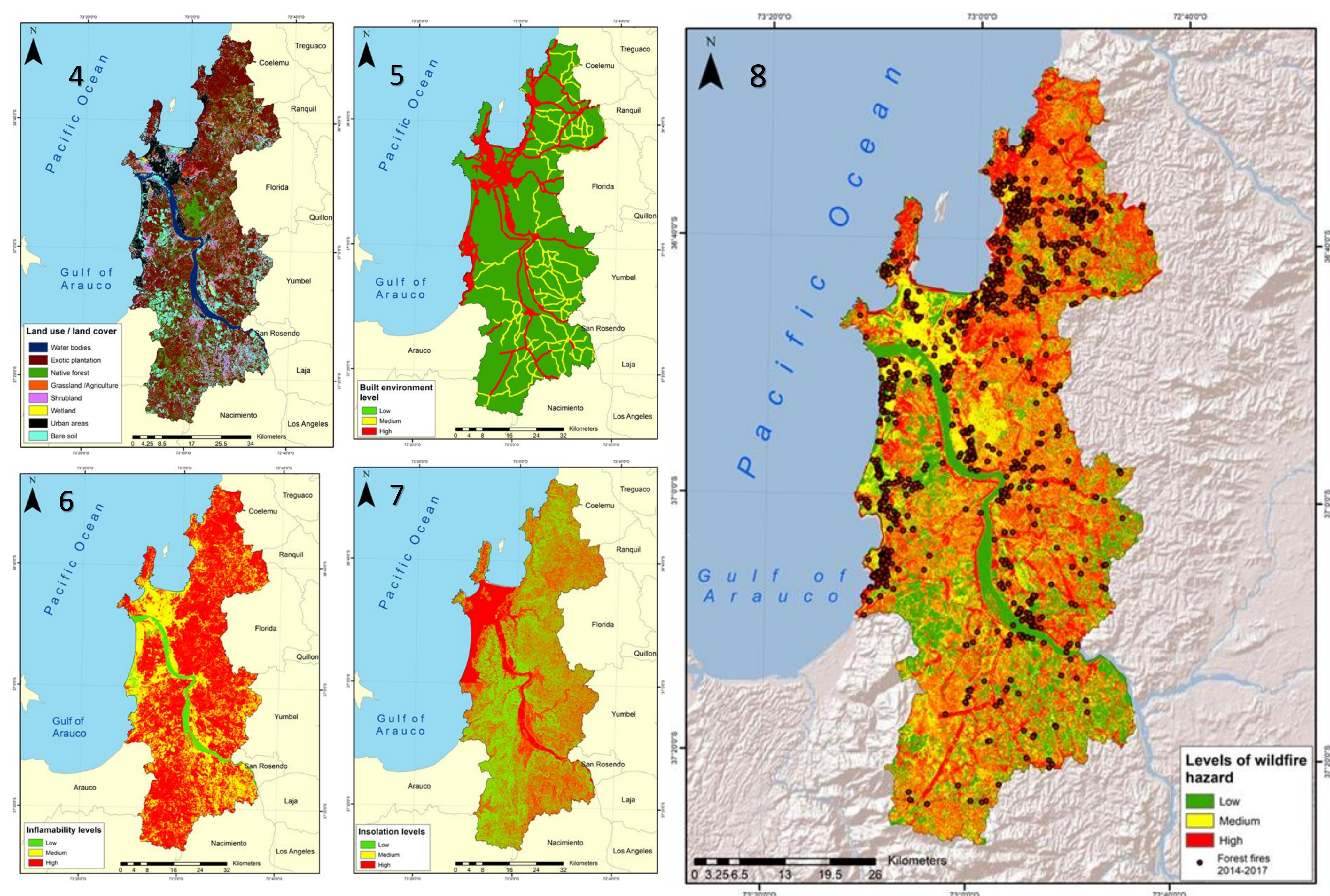

Fig. 4 Land cover Map. Fig. 5 Anthropic factors Map. Fig. 6 Flammability Map. Fig. 7 Insolation Map. Fig. 8 Wildfire Hazard Map.

Future Work

- ✓ We will try to incorporate climate data in order to strengthen the fire threat model in particular climatic series of temperatures, winds and rainfall. Also, incorporate vulnerability assessments against this threat to both urban and rural communities. Finally, to improve the measurement of the impact of wildfires in the rural economy.

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