

Where, when and why do wildfires occur?



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## Introduction

- 🔥 Fire represents a basic ecological factor in driving vegetation and landscape dynamics.
- 🔥 Its regime is controlled by several landscape components, like fuel, climate, vegetation, and human pressure.
- 🔥 If the different land cover types were equally fire-prone, wildfires would happen according to a random scheme.



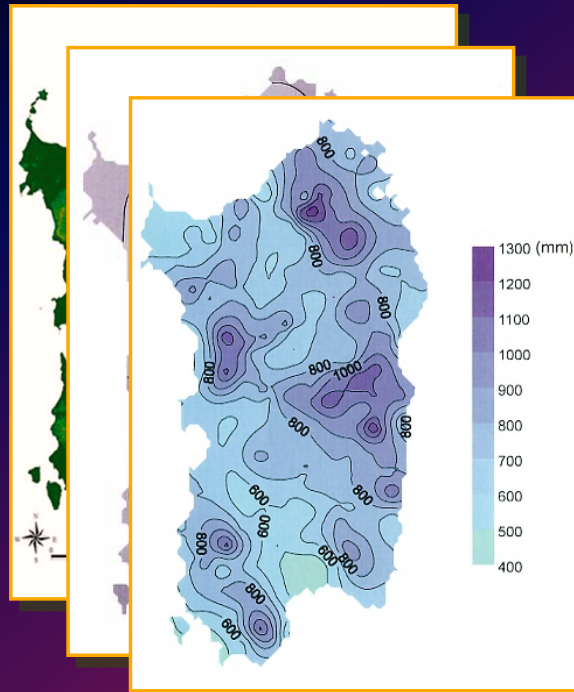
Actually, some land cover types are “preferred” or “avoided” by fire, according to fuel load, climate and human pressure.

# Objective

*To propose a method for relating fire occurrence in time and space to its main biophysical and anthropogenic drivers*



## Study area



## *Sardinia*

- ✓ Surface: 24098 km<sup>2</sup>
- ✓ Mean altitude: 338 m
- ✓ Mean temperature: 11-17°C
- ✓ Mean precipitations: 500-900 mm

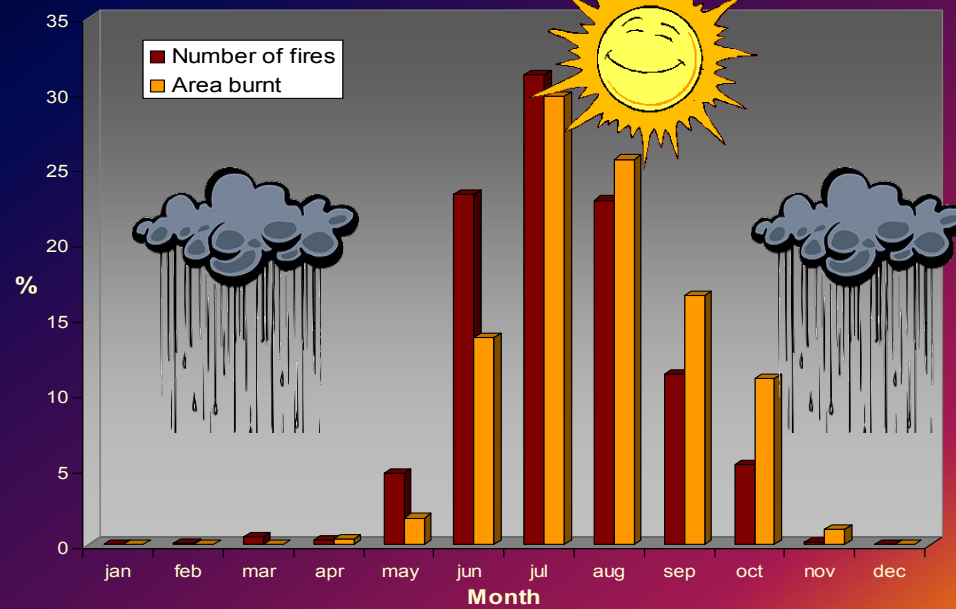
# Wildfire database

38.217 fires from 2000 to 2013; total burnt area > 200.000 ha

A	B	C	D	E	F	G	H	I	J
ANNO	DATA	COMUNE	LONG	LAT	UTM	BOSCO	PASCOLO	ALTRO	TOTALE
2000	10/02/2000	JERZU	547100	4403900	NK 471 039	0.7000	0.0000	0.0000	0.7000
2000	15/02/2000	JERZU	549100	4403500	NK 491 035	0.7000	0.0000	0.0000	0.7000
2000	20/02/2000	TERTENIA	548300	4397900	NJ 483 979	0.1000	0.0000	0.0000	0.1000
2000	20/02/2000	BARISARDO	553100	4410700	NK 531 107	1.0000	0.0000	0.0000	1.0000
2000	20/02/2000	ALGHERO	442100	4499200	MK 421 992	0.0000	9.0000	0.0000	9.0000
2000	02/03/2000	TEULADA	476500	4311700	MJ 765 117	0.0000	0.0000	6.0000	6.0000
2000	09/03/2000	DORGALI	550500	4464400	NK 505 644	0.0000	0.0000	0.1200	0.1200
2000	09/03/2000	TONARA	515900	4427800	NK 159 278	0.1000	0.0000	0.0000	0.1000
2000	10/03/2000	LOCERI	548800	4412200	NK 488 122	0.3000	0.0000	0.0000	0.3000
2000	10/03/2000	ALGHERO	436800	4493200	MK 368 932	0.0150	0.0000	0.0000	0.0150
2000	12/03/2000	AGLIENTU	505700	4531300	NL 057 313	0.0000	0.0000	0.6000	0.6000
2000	12/03/2000	SANTADI	478800	4327200	MJ 788 272	0.0000	0.0000	0.0600	0.0600
2000	12/03/2000	SILQUA	484100	4342900	MJ 841 429	0.0000	0.0000	0.0300	0.0300
2000	13/03/2000	DESULO	520700	4430900	NK 207 309	2.5000	0.0000	0.0000	2.5000
2000	13/03/2000	ALGHERO	440900	4502500	ML 409 025	0.0000	0.0000	0.0400	0.0400
2000	13/03/2000	PATTADA	507300	4487400	NK 073 874	0.0000	0.0000	3.0000	3.0000
2000	16/03/2000	BULTEI	504600	4479500	NK 046 795	0.0000	2.0000	0.0000	2.0000
2000	19/03/2000	OLBIA	550700	4527700	NL 507 277	0.1000	0.0000	0.0000	0.1000
2000	23/03/2000	ORANI	516800	4455200	NK 168 552	1.0000	0.0000	0.0000	1.0000
2000	24/03/2000	COLLINAS	487100	4390700	MJ 871 907	0.5000	0.3000	0.0000	0.8000
2000	26/03/2000	ALGHERO	440800	4495000	MK 408 950	0.0000	0.0000	0.5000	0.5000
2000	31/03/2000	VILLACIDRO	474100	4361800	MJ 741 618	0.0150	0.0000	0.0000	0.0150
2000	03/04/2000	IGLESIAS	458200	4349100	MJ 582 491	0.5000	0.0000	0.5000	1.0000

- ▶ For each wildfire:
  - Date of ignition
  - Coordinates of the ignition point
  - Size in Hectares

# Monthly distribution of fires



Clear Mediterranean

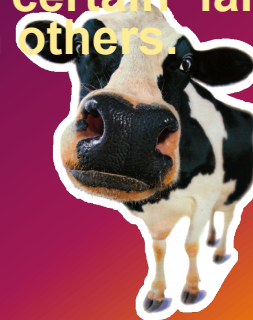
seasonality

## Fire selectivity

🔥 Fire spreads across the landscape as a function of the abundance and spatial arrangement of susceptible habitats.

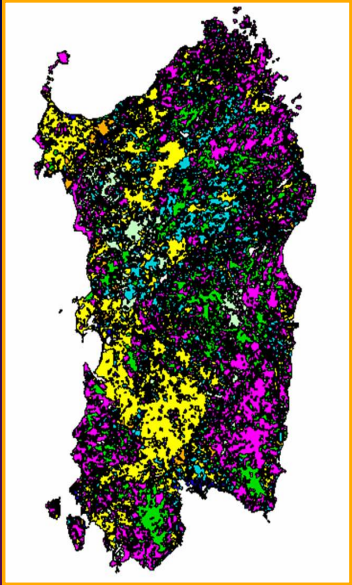
🔥 Therefore, wildfires are not randomly distributed through the territory, but actually certain land cover types are more fire-prone than others.

🔥 Fire selectivity analysis is based on methods originally designed to study habitat-selection by animals. Accordingly, fire can be considered as an 'herbivore' that exhibits variable preferences for different resources (i.e. land cover types) considered 'selective' when resources are used disproportionately to their availability.



# Land Use Map

CORINE Land Cover 2000 (1:100000)



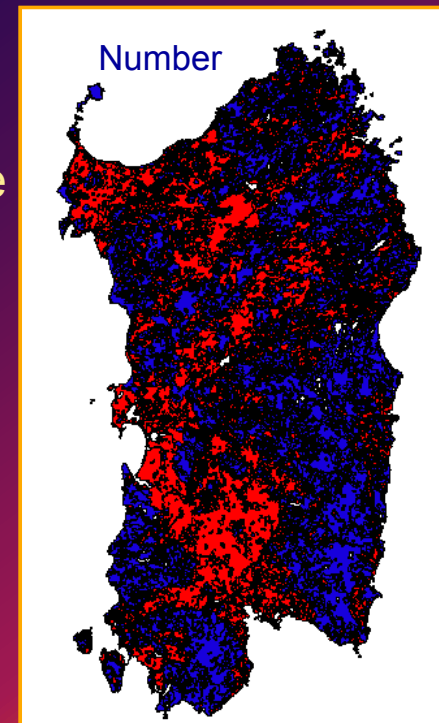
- 1- Urban areas ■
- 2.1- Arable lands ■
- 2.2- Permanent crops ■
- 2.4- Heterogeneous agricultural areas ■
- 3.1- Forests ■
- 3.2.1- Natural grasslands and pastures ■
- 3.2.3- Transitional woodland-shrub and sclerophyllous vegetation ■



## Wildfires selectivity: number and size

For analyzing fire selectivity we used a randomization test  
Number of fires and burnt area were tested separately

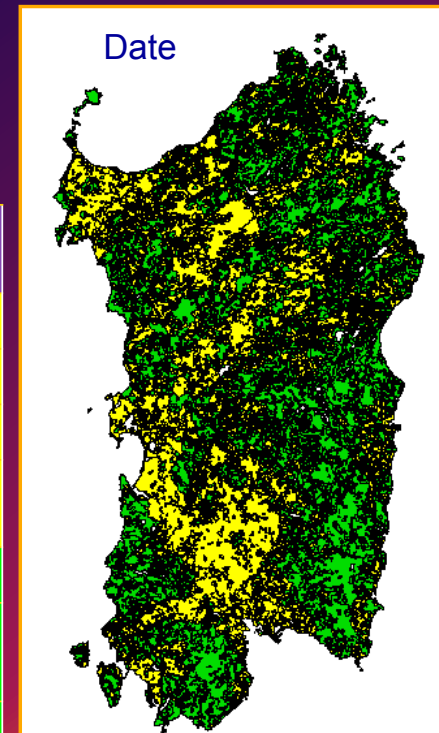
CORINE Land Cover classes	Burnt surface	Number of fires
1. Urban areas	-	+
2.1. Arable lands	+	+
2.2. Permanent crops	-	+
2.4. Heterogeneous agric. areas	-	+
3.1. Forests	-	-
3.2.1. Natural grasslands/pastures	+	-
3.2.3. Sclerophyllous vegetation	+	-




# Wildfires selectivity: date of ignition


Analysis of the mean Julian day of ignition

CORINE Land Cover classes	Ignition date	Day of Ignition
1. Urban areas	E	July 19 <sup>th</sup>
2.1. Arable lands	E	July 21 <sup>st</sup>
2.2. Permanent crops	E	July 20 <sup>th</sup>
2.4. Heterogeneous agric. areas	E	July 23 <sup>rd</sup>
3.1. Forests	L	July 27 <sup>th</sup>
3.2.1. Natural grasslands/pastures	L	August 13 <sup>th</sup>
3.2.3. Sclerophyllous vegetation	L	August 1 <sup>st</sup>



## Climate and fire

 Climate is the main factor affecting the coarse-scale spatial distribution of vegetation types and hence determining the pattern of the different land cover categories.

 Climate also plays an important role in characterizing wildfire regimes, controlling fuel availability and moisture, which are the main determinant for fire



The influence of climate on coarse-scale landscape classification and fire regimes invites a comparison of climatic maps to

# Climatic regions

🔥 According to GIS Natura (2005), Sardinia is classified into three main climatic regions (CRs) characterized by a clear gradient of decreasing summer

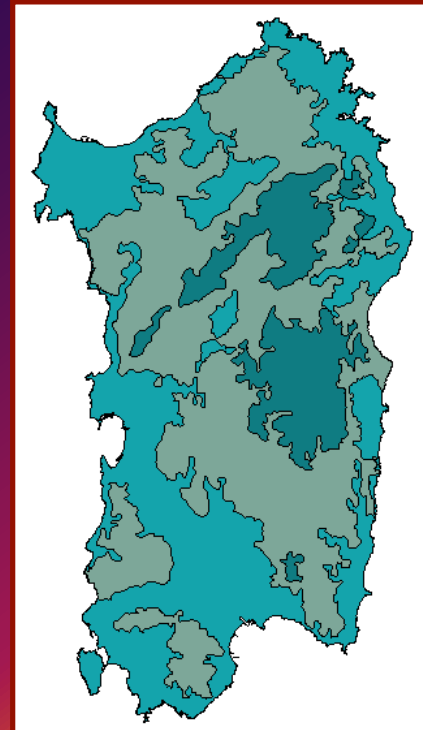
precipitation:

■ Mediterranean (M)

■ Transitional Mediterranean

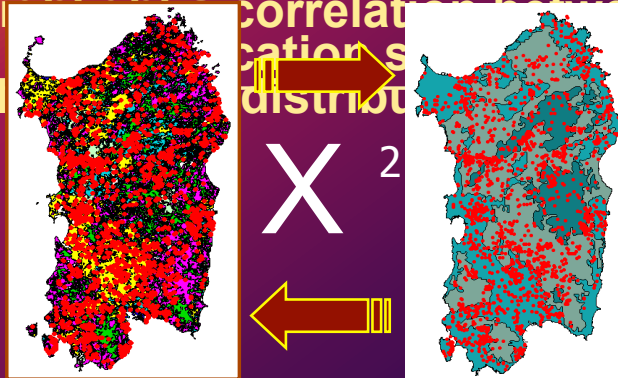
■ (TM)

3. Transitional Temperate (TT)



# Association between CLC e GRs

Can we highlight a correlation between the two according to their distribution of wildfires?



		Land use classes						
		Urban areas	Arable lands	Permanet crops	Heterogeneous agricult. areas	Forest	Natural grasslands	Wood-shrubland
CRs	M	839	4244	855	2748	343	275	1080
	TM	510 <sup>NS</sup>	1691	156	2161	541	577	1226
	TT	64	67	2	434	252	98	291

- ▶ Non-random association between the spatial pattern of the climatic regions and the corresponding CORINE land cover classes.
- ▶ Control of bioclimatic factors over land use

# Conclusions

- 🔥 The analysis of fire selectivity highlighted that the different land cover types are differentially 'used' by fire in terms of number of events, fire size and date of ignition.
- 🔥 There are two complementary factors ruling fire regimes: human pressure, which directly influences fires incidence patterns, and climatic factors that affect the start of the fire season and determine the spatial distribution of fuel and land use types.



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