Spatial attributes of fire in eastern Canada: an approach based on landscape physiography

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Context

Within the boreal forest, the characterization of the fire regime does not take into account any spatial attribute related to fire shape or the dominant fire orientation within the landscape. This study aims to determine if these spatial attributes are significantly different at the regional scale and if they result from climatic and physiographic constraints. **We hypothesize that, in addition to wind, large-scale physiography influences the dominant orientation of fire, fire area and fire shape.**

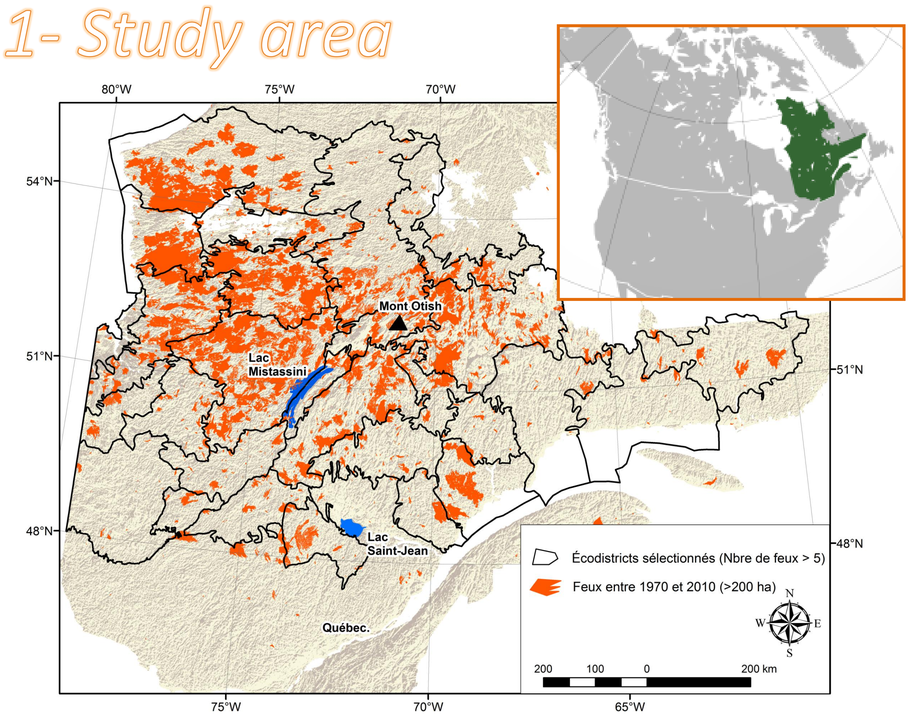
Data

Fire attributes	Description / scale	Sources
Area burned (Taille_moy)	Mean burned area by fire (ha)	ArcGIS 9.3
Shape Index (Shape)	Shape Index : Circle =1; more complex shape >1	Patch Analyst ArcGIS 9.3 (Rempel et al. 2008)
Eccentricity (Ecc)	Divergence between an ellipse and a circle (0 to 1)	R (Builling and Remmel 2008)
Orientation	Azimut (0 to 180˚) of the main (longest) fire axis. Categorical: NS, SWNE, WE, NWSE	ArcGIS 9.3 (Jenness 2004)
Environmental variables		
Climate		
Mean summer temperature (T_C)	Ecodistrict centroid	BioSIM
Mean summer precipitation (PT)	Ecodistrict centroid	BioSIM
Seasonal Severity Rating (ISS)	Ecodistrict centroid	BioSIM
Physiography		
Orientation of surface deposits parallel to the ice flow (D)	Proportion by ecodistricts of the NS, SWNE, WE, NWSE directions	GEOGRATIS
River orientation (*_E)	Proportion by ecodistricts of the NS, SWNE, WE, NWSE directions	GEOGRATIS
Landform orientation (*_R)	Proportion by ecodistricts of the NS, SWNE, WE, NWSE directions	GEOGRATIS
Mean elevation (ALT)	Ecodistrict mean elevation	GEOGRATIS

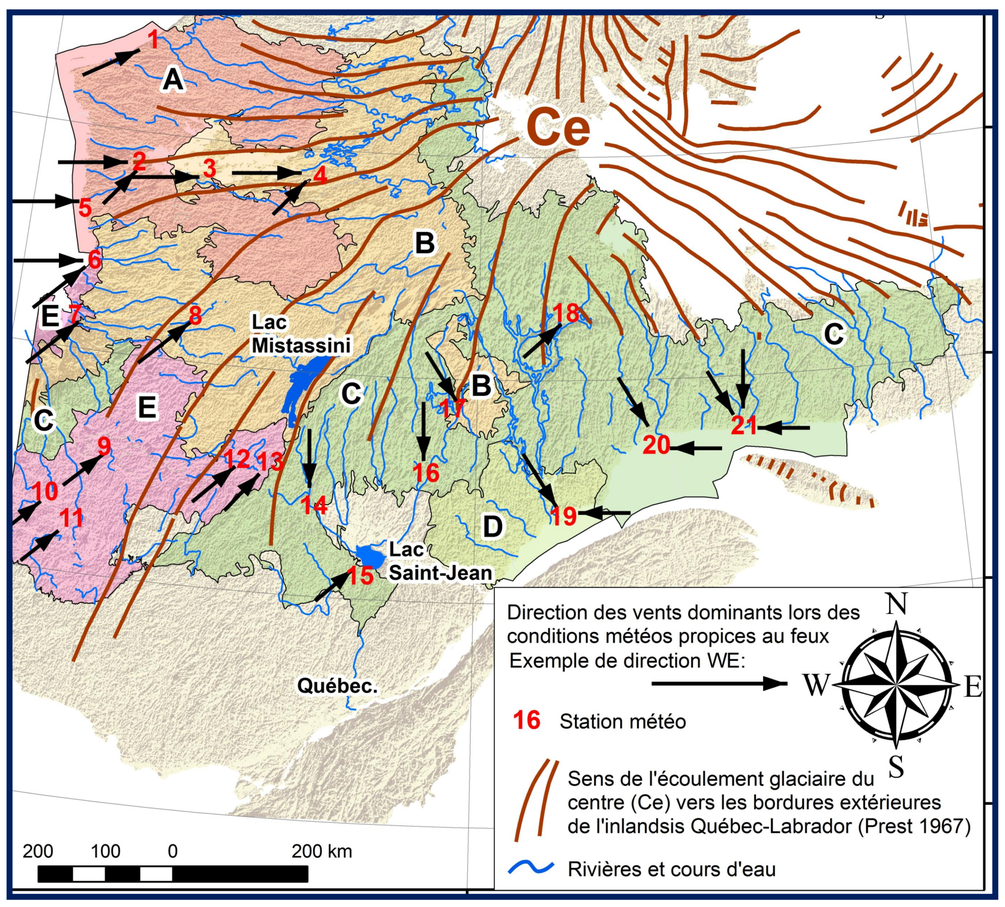
Methods

- **Ward's hierarchical clustering** of fire attributes
- **Redundancy Analysis (RDA):** Effect of environmental variables on fire regime spatial attributes

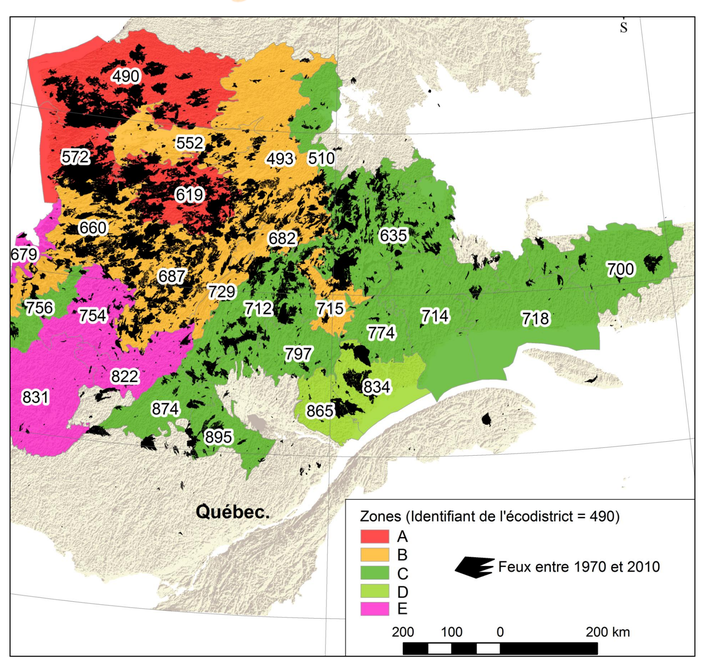
1- Study area



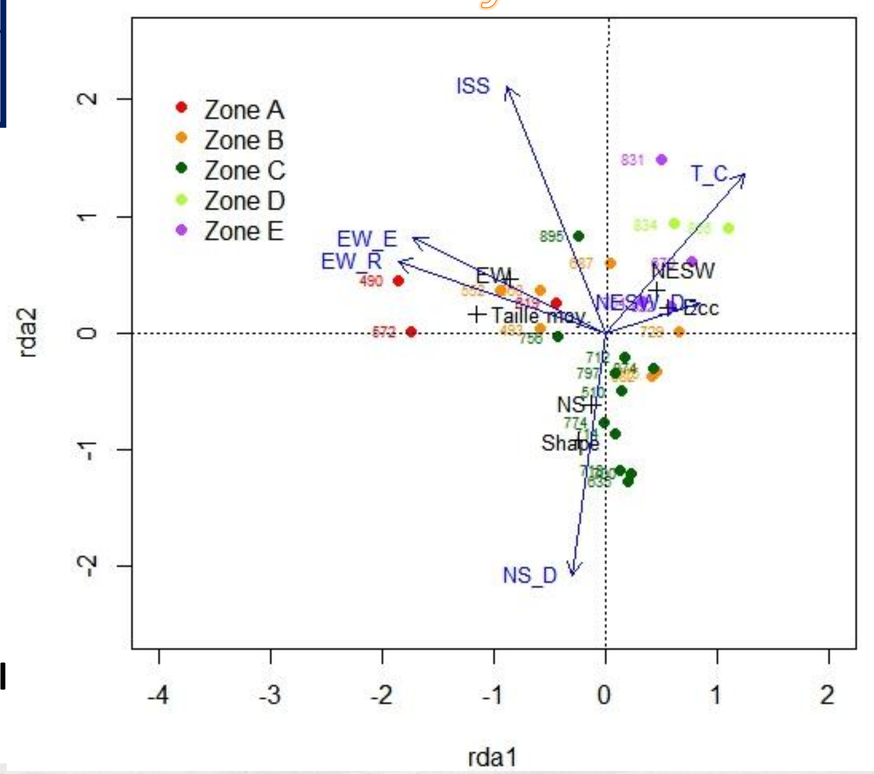
2- Landscape physiography and wind directions



3- Ecodistrict clustering based on fire attributes



4- Effect of environmental variables on fire attributes



Results

- Most ecodistricts are clustered in spatially homogeneous and contiguous zones;
- Fire area and orientation within zones are responding **to similar surface deposit and river orientations**;
- A dominant wind orientation **parallel** to the landform, surface deposits and rivers may **promote large burns** (mean > 17 000 ha)

Applications

- Integrating spatial attributes of fire in the characterization of the fire regime ?
- Adapting **sustainable management** of forests and **fire management** practices to the **regional characteristics of fire** and the **territory.**

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