

# Development of an operational Fire Danger System for Mexico

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## Abstract

This presentation summarizes the goals of the 2015-2018 project "Development of a Fire Danger System for Mexico" funded by CONAFOR-CONACYT. The project will be conducted by a consortium integrated by researchers from the following institutions from Mexico: UJED, UNAM, CONABIO, CIIDIR, CUCSUR-UdeG, and the following international partners: Washington University (Seattle, USA), Pacific Southwest Research Station (US Forest Service), Instituto Nacional de Pesquisas Espaciais (Brazil), Centro de Investigaciones Forestales de Lourizán (Spain). The goal of the Project will be to develop an operational Fire Danger System for Mexico, available on a free website for decision making CONAFOR (Forest Agency of the Mexican Government) and agents involved in forest management in Mexico.

## Introduction: Project Goals and Partners

Several countries have developed operational fire Danger systems for prediction of fire Risk and Danger. Examples of such operational systems are the NDFRS of the USA (<http://www.wfas.net/>), the Canadian CFFRDS (<http://cwfis.cfs.nrcan.gc.ca/home>) or the Brazilian Fire Mapping System (<http://www.inpe.br/queimadas/sitAtual.php>)

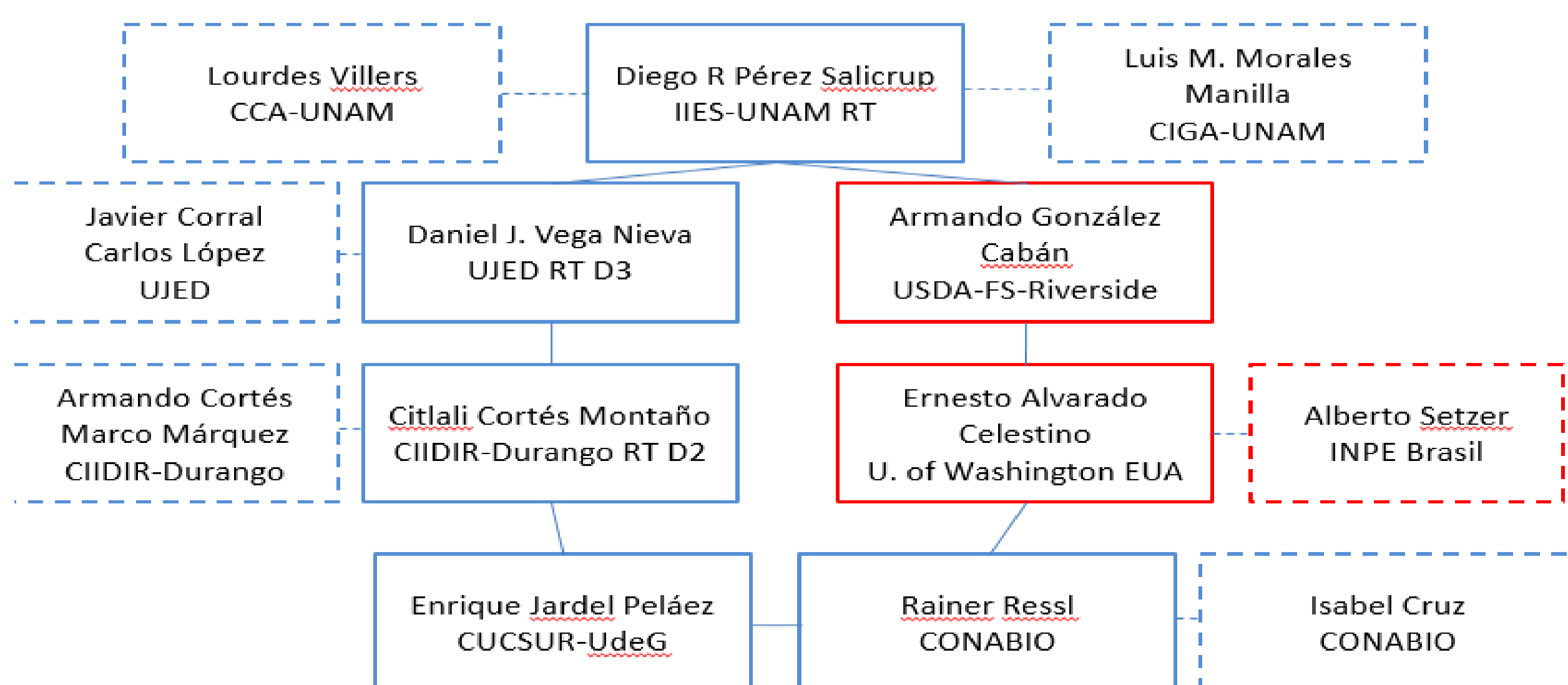
In Mexico, a system for near real-time mapping of fire Hotspots has been implemented by CONABIO (Figure 3 on the next section, available online at <http://incendios1.conabio.gob.mx/>), but no operational system for prediction of Fire Risk (probability of fire occurrence) or Fire Danger (expected fire behaviour and difficulty of suppression) is currently available for Mexico.

The Project 252620 in response to the call 3-C02-2014 by CONACYT-CONAFOR aims at developing an operational Fire Risk and Danger System to be used by the Mexican Government Forest Agency CONAFOR and relevant agents in decision making on fire management in Mexico. The Project will be conducted by a consortium of researchers from several institutions from Mexico, USA, Brazil and Spain, as described in figure 1 below.

The goals of the project will be:

- 1) To conduct a literature review of Fire Risk and Danger
- 2) To test existing Fire Risk and Danger systems for the prediction of fire occurrence in Mexico.
- 3) To develop a Mexican Fire Risk System for the prediction of fire occurrence.
- 4) To develop a Fire Weather forecast system for Mexico.
- 5) To develop a module for mapping Fire Area in Mexico.
- 6) To test existing Fire Danger systems in Mexico against fire area records.
- 7) To develop a Mexican Fire Danger System
- 8) To develop and transfer to CONAFOR an online software for mapping of current and forecasted Fire Danger in Mexico.

The first three goals, resulting in a Mexican Fire Risk System for prediction of fire Occurrence, based on the analysis of the fire Hotspots and fire weather records in Mexico on the period 2000-2014, will be accomplished on the first year of the project (2016). A parallel project (Project 251694 in response to CONAFOR CONACYT call C01-2014) conducted by the members of the consortium will result in a Fuel Beds Map available for Mexico in 2017. Considering this product and the results from tasks 5 (fire area mapping module) and task 4 (fire weather forecast module), a Fire Danger System will be developed on year 2017, for prediction of fire behaviour and impact under current and forecasted conditions, based on fuel and weather information.



The flow of information is illustrated in Figure 4 on the top of the next section.

Figure 1. Consortium of researchers for the projects CO1-2014 and CO-03 for developing a Fuel Beds Map and a Fire Danger System for Mexico (CONAFOR-CONACYT Projects 251694 and 252620)

## Methods

Figure 2 below shows the sequence for development of a fire Risk system (year 1, 2016) for prediction of fire Occurrence based on the analysis of fire Hotspots (figure 3) and fire weather records from the period 2000–2014, and for the development of a Fire Danger System, considering the information of Burned area and the Fuels Map derived by this consortium in the parallel CONAFOR-CONACYT project C01-2014. Meteorological variables potentially considered for the calculation of Fire Danger and Fire Risk, as currently utilized by the systems from USA, Canada, Brazil and Australia are summarized in table 1 below.

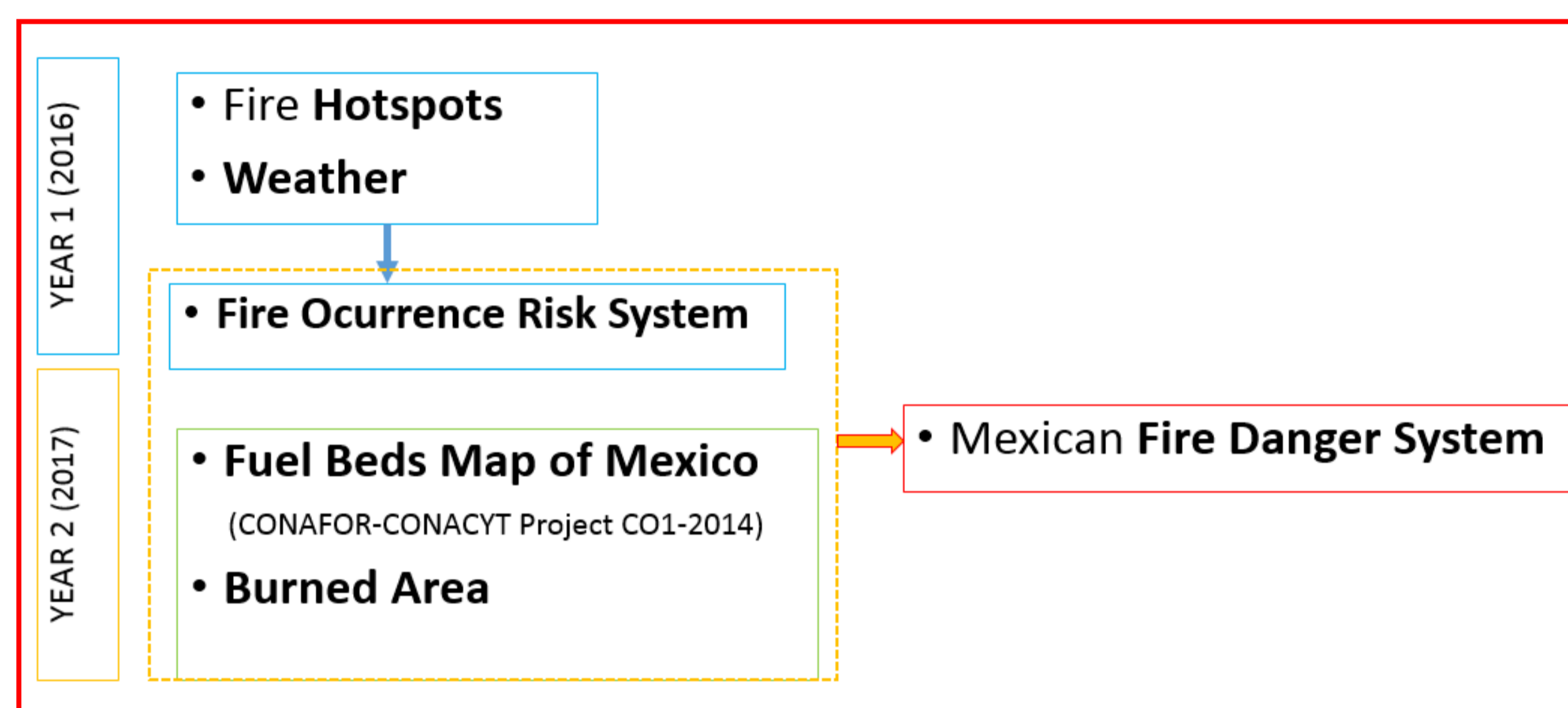


Figure 2. Task flow for the development of a Fire Risk (year 1) and a Fire Danger System (year 2) for Mexico

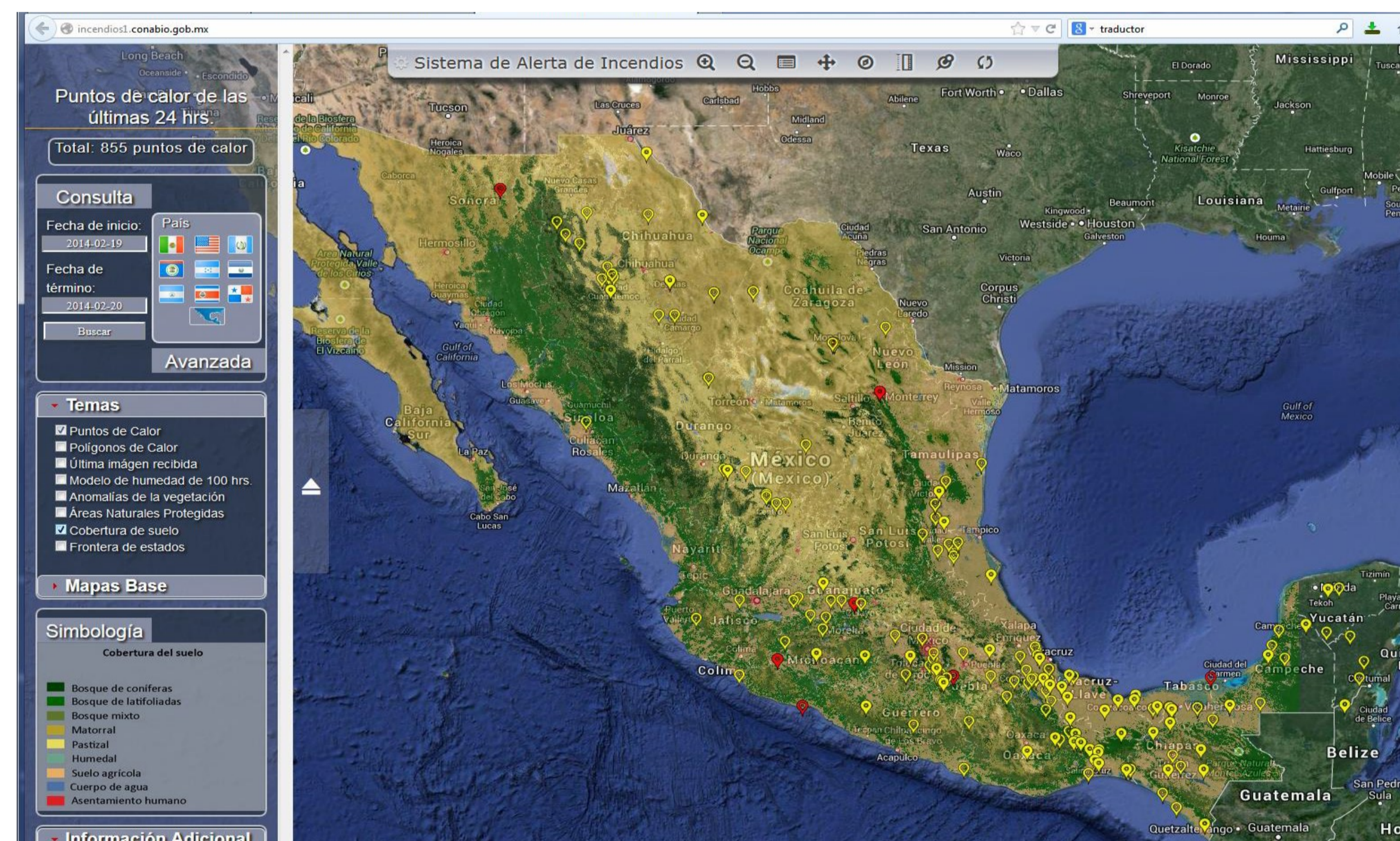


Figure 3. Fire Hotspots Early Warning System currently available in Mexico from CONABIO <http://incendios1.conabio.gob.mx/>

Variable	Time	NDFRS (USA)			Vivos	KB	CFFRDS (Canada)			Autralian (Mc Arthur)		Brazilian
		1h	10h	100h			DMC	DC	FFMC	FFDI	KB	
Temperature	at 12h	T (12 h)	T (12 h)			T (12 h)	T (12 h)	T (12 h)	T (12 h)			
	24 h			Tmax & min (24 h)		Tmax (24h)				Tmax (24h)		Tmax (18 h)
Relative Humidity	at 12 h	RH (12 h)	RH (12 h)				RH (12 h)	RH (12 h)				
	24 h			RH max & min (24 h)								RH min (18 h)
Cloudiness (state of weather)			Cloudiness	Cloudiness								
Relative greenness (NDVI)		NDVI (7 days)				Relative NDVI (7 days)						
Precipitation	mm (24h)					P (24 h)	P (24 h)	P (24 h)	P (24 h)			P (24 h)
	h (24h)			P Duration (24 h)								Days since last precipitation
Wind Speed	mm (year)					Anual P (mm)						Anual P (mm)
							Wind speed (12h)					Wind speed (12h)

Table 1. Meteorological variables potentially considered for the calculation of Fire Risk as utilized by several Fire Danger Systems (NDFRS-USA, CFFRDS-Canada, Brazil, Australia).

## Expected Project Results

Project expected results and chronogram is shown in table 2 below. The final product will be an operational system mapping fire Risk and Danger under current and forecasted weather conditions for Mexico available on a freely accessible website for fire management decision making by CONAFOR and relevant agents in fire management in Mexico.

Examples of Fire Danger systems available in other countries are shown in figure 5 below.

Project Task	Month				
	6	12	24	32	36
Literature Review of Fire Risk and Danger					
Analysis of existing Fire Risk and Danger systems for the prediction of fire occurrence in Mexico.					
Development of a Mexican Fire Risk System for the prediction of fire occurrence.					
Development of a Fire Weather forecast system for Mexico.					
Development of a module for mapping fire area in Mexico.					
Analysis of existing Fire Danger systems for the prediction of fire area in Mexico.					
Development of a Mexican Fire Danger System					
Development and transference to CONAFOR of an online software for mapping of current and forecasted Fire Danger in Mexico.					

Table 2. Project tasks and planned completion date for the Mexican Fire Danger System Project.

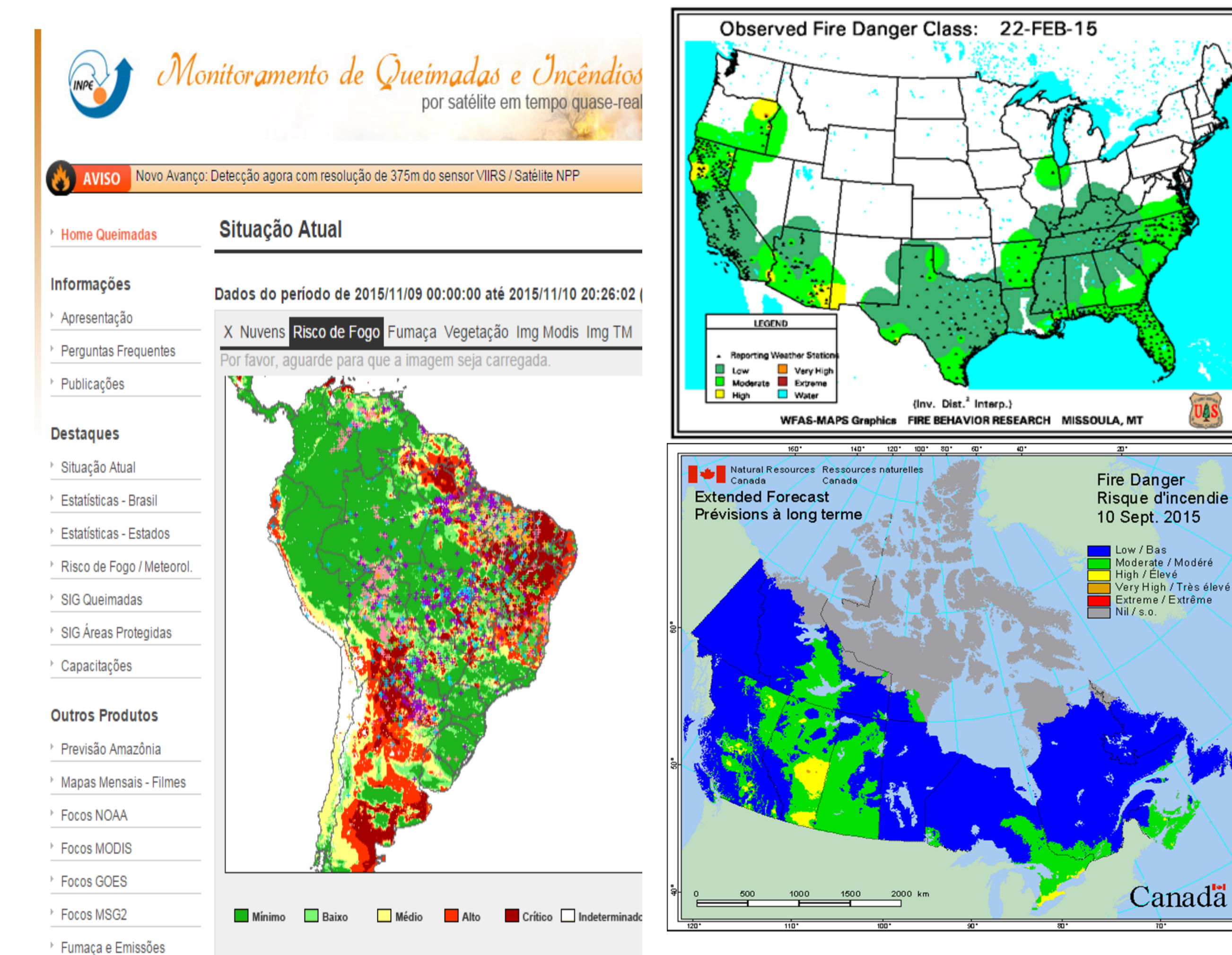


Figure 4. Examples of operational Fire Danger Systems.

Bottom right figure : Canadian CFFDRS System (<http://cwfis.cfs.nrcan.gc.ca/home>);

top right figure: NDFR of USA (<http://www.wfas.net/>);

left figure: Brazilian System for Fire Monitoring (<http://www.inpe.br/queimadas/sitAtual.php>)

## Acknowledgements

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