# A Global Early Warning System for Wildland Fire


GOFC-GOLD GLOBAL OBSERVATION OF FOREST AND LAND COVER DYNAMICS

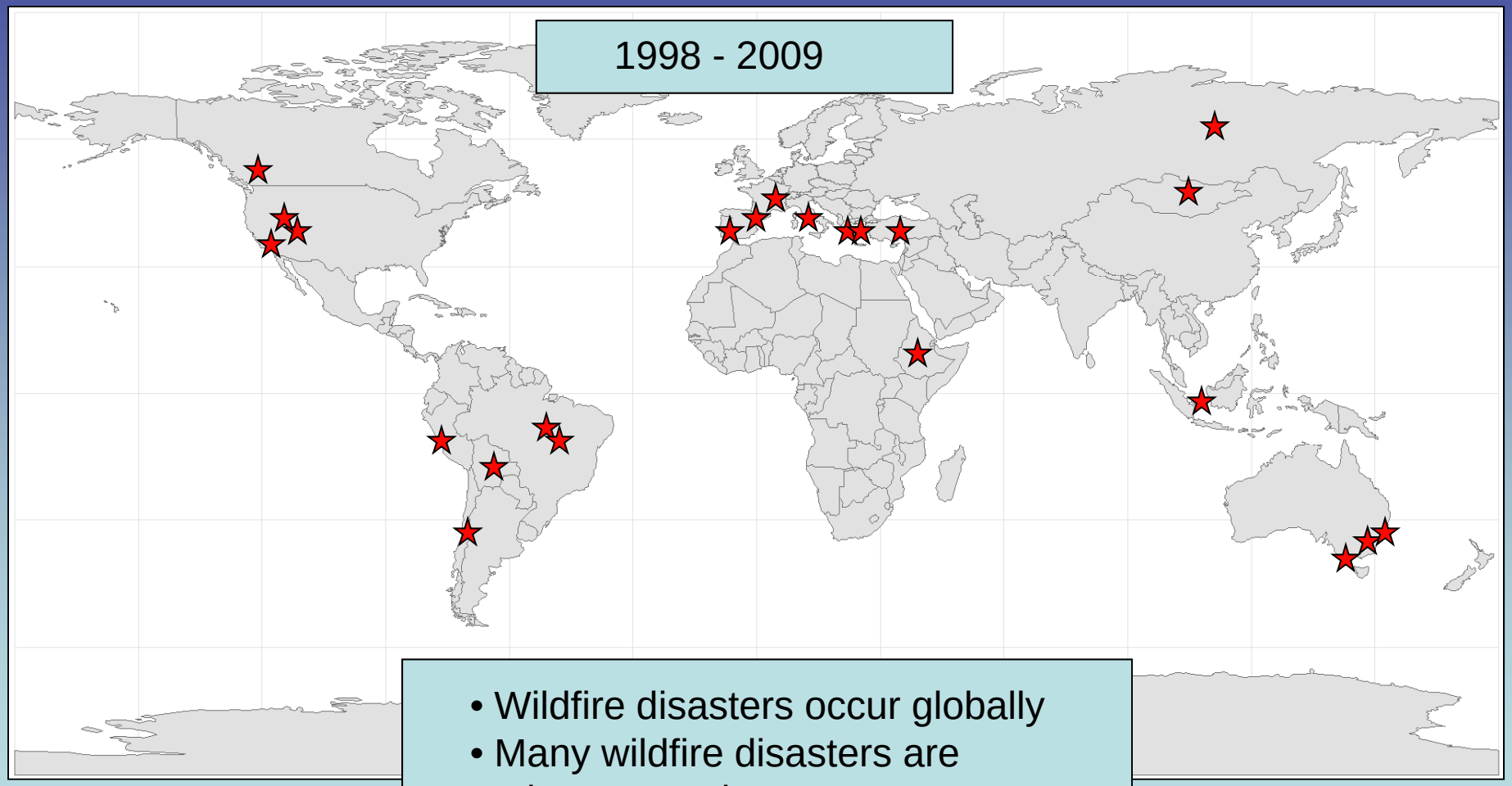
MODIS Rapid Response Active Fire Detections for 2007

Wildland fire is a constant, pervasive global phenomenon

January February March April May June July August September October November December

Active fires, shown in red, are detected using MODIS data from the Terra Satellite.
Source: MODIS Rapid Response http://rapidfire.sci.gsfc.nasa.gov/
Fire Information for Resource Management System (FIRMS)
http://maps.geog.umd.edu

# Examples of Recent (Documented) Wildfire Disasters




- Wildfire disasters occur globally
- Many wildfire disasters are undocumented

## Fire Early Warning System

Early warning allows implementation of fire management action plans to mitigate or prevent wildfire disasters before they occur.

A Global Early Warning System provides international coordination and sharing of:

- fire risk intelligence
- suppression resources and expertise during times of wildland fire disaster

# Global Fire EWS
## 3 Component System

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- general fuel dryness
- fire monitoring
- potential fire activity

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- fire occurrence
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- fuel consumption
- fire intensity
- fire emissions (ground and RS-based)

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**Fire Management Response Tools**

Use EWS decision-support tools to:

- adjust resource levels (implement resource-sharing agreements)
- mobilize, preposition resources
- increase prevention activities
- enhance detection

# Global Fire EWS
## - Driving Inputs -

**Fire Weather, Fire Activity Products**

Ground-based:
- WMO actual weather, forecast weather models

Remotely sensed:
- hot spots
- spatial rainfall, temp. and RH (ie, ROSA)

**Fire Behaviour Products**

Ground-based:
- fire behaviour models

Remotely sensed:
- fuel distribution and classification
- fuel load (biomass)
- energy release rate
- seasonal greenup and veg curing
- live fuel moisture

**Fire Management Response Tools**

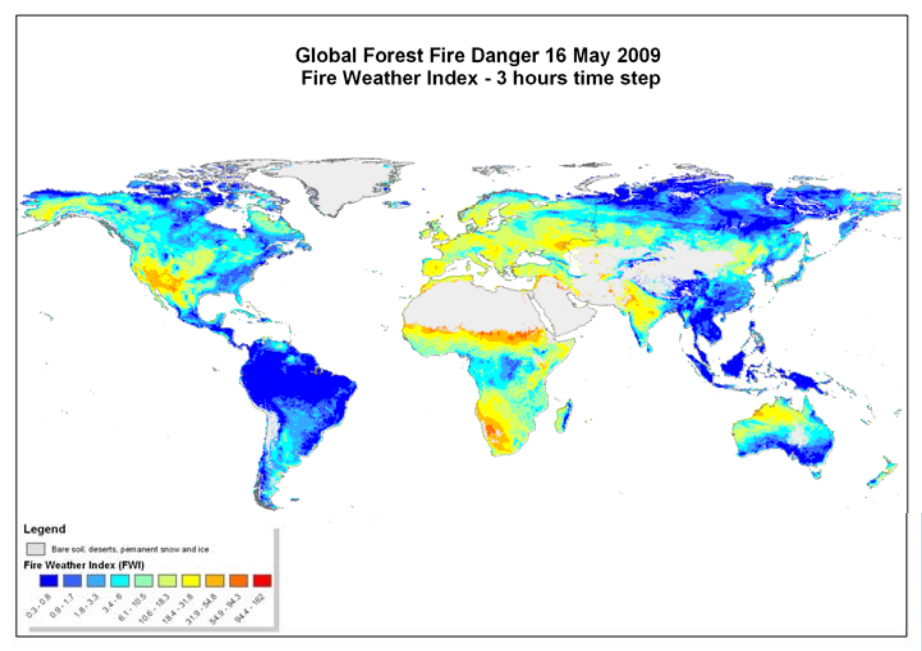
Operational Fire Mgt Decision-aids:

- International, regional resource-sharing agreements
- National and locally calibrated guidelines :
  - prevention
  - detection
  - pre-suppression

# Global Product Example

**Products are designed to support:**

- globally accessible (www) sharing of basic fire danger and early warning information
- large-scale decision-making such as implementing international or regional fire policy agreements, including resource-sharing (equipment and fire mgt expertise) in times of fire disaster

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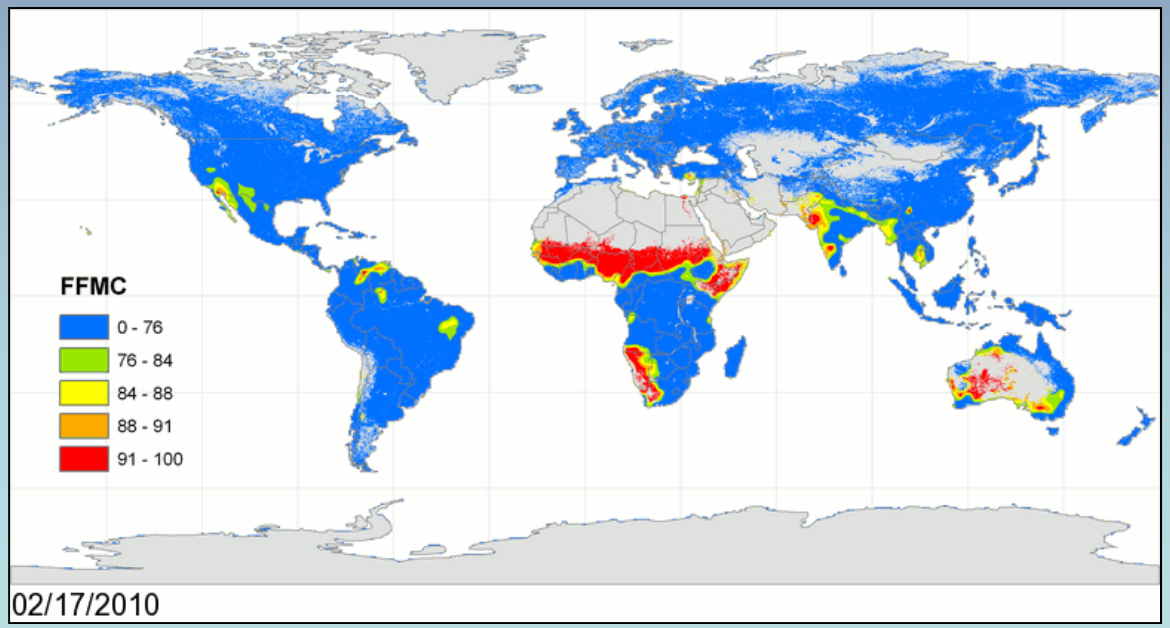


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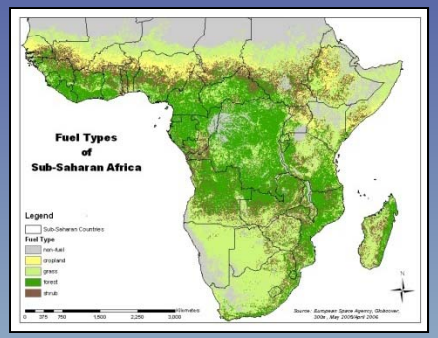
# Global Products

## Long-term Fire Regime Documentation

- Calculation global fire danger climatology based on long-term simulations with ECMWF ERA-INTERIM (1989-2009) re-analysis data.
- Reconstruction of fire danger point data series with surface weather observations (i.e. at selected WMO stations) for the period 1989-2009.
- Important for :
  - Establishing current fire danger status and trends
  - Long-term fire management planning
  - Research (developing new fire models)

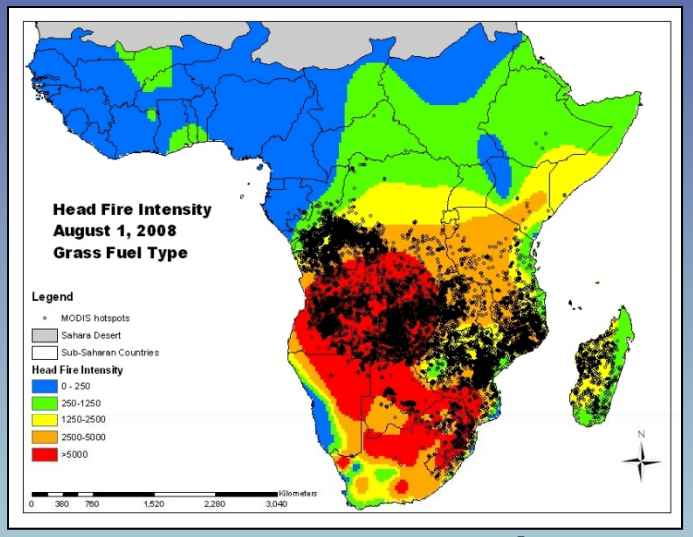
# Regional Product Examples

**Vegetation – Fuel Classification**



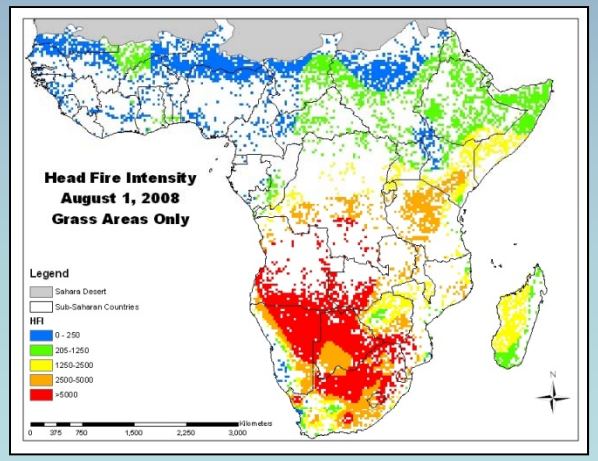

**Fire Intensity**
in savannah and grasslands, classified by thresholds of suppression capability (ie, hand tools, power pumps, aircraft, indirect attack with burnout fire)

Products are based on regionally/locally calibrated fire behaviour

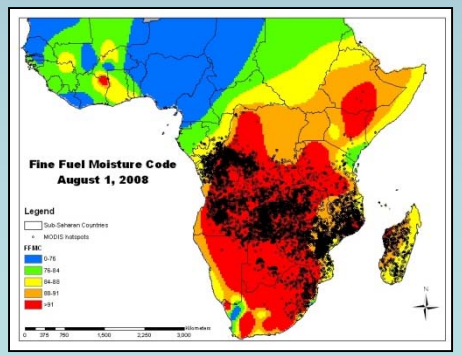



**Suppression Requirements and Active Fires**

**Fire suppression criteria**




**Predicted Suppression Requirements**




**Fire Weather**

**Hot spots**

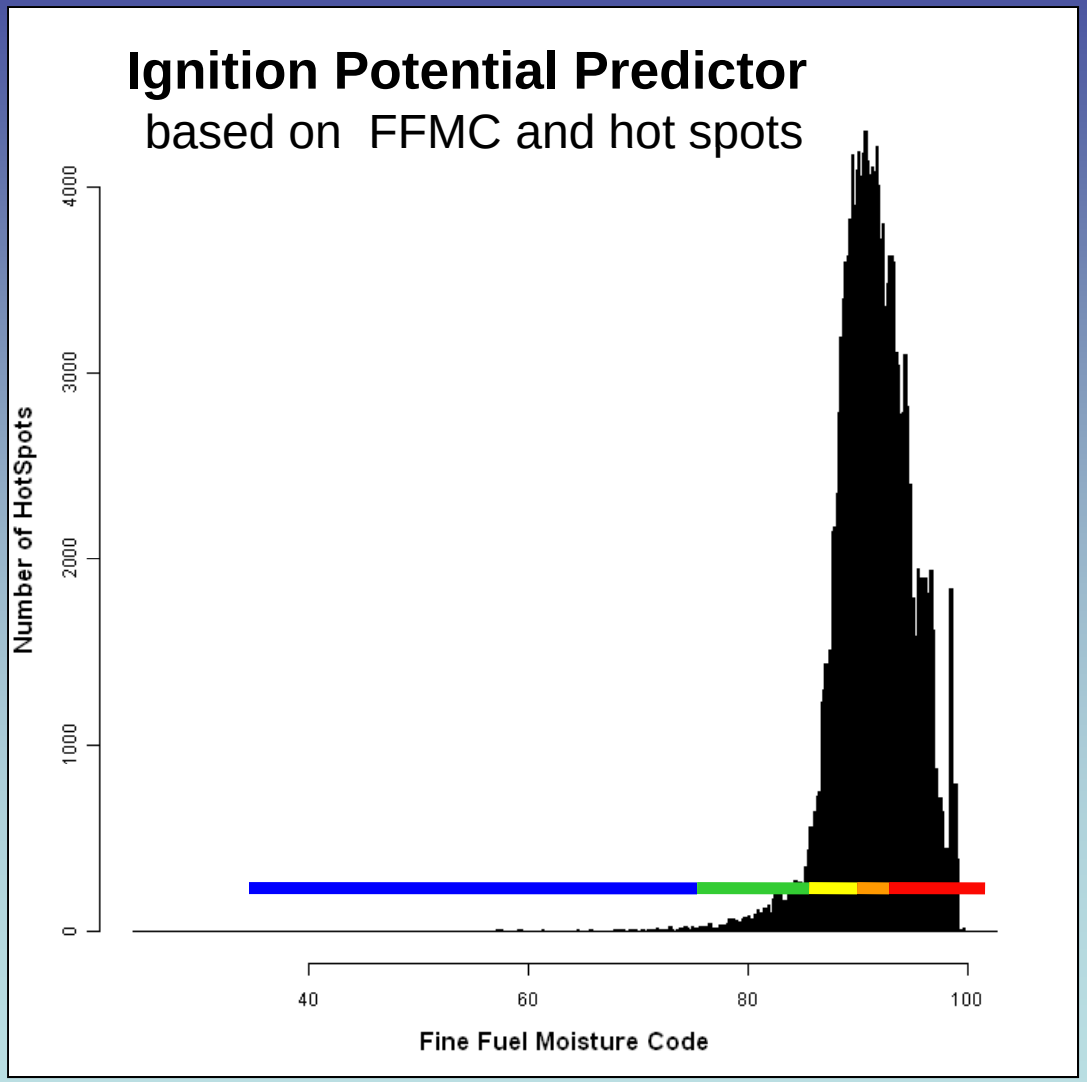
# Fire Suppression Criteria

| Resource | HFI limit (kW/m) |
|---|---|
| Hand tools | 0-250 |
| Power pumps | 250-1250 |
| Mechanized equipment for control lines | 1250-2500 |
| Aircraft | 2500-5000 |
| Indirect attack (burning out) | 5000+ |

## Pre-Suppression Action

| Wildfire Threat Level | Resources on Standby | Alert Period | Dispatch Time |
|---|---|---|---|
| Low | crews, hand tools | mid-day | 60-min |
| Moderate | crews, hand tools | all day | 30 min |
| | pumps, water tanks | mid day | 60 min |
| High | crews, hand tools | all day | 15 min |
| | pumps, water tanks | all day | 30 min |
| | control line-building equip. | mid-day | 60 min. |
| Extreme | crews, hand tools | all day | 15 min |
| | pumps, water tanks | all day | 15 min |
| | control line-building equip. | all day | 30 min |
| | aircraft, burnout equip. | mid-day | 60 min |

# Calibration Example




Ignition thresholds defined by hot spot occurrence

# Strategic Partnerships

- GOFC-GOLD Fire IT
- Global Fire Monitoring Centre
- Canadian Forest Service and Canadian Meteorological Centre (WMO)
- University of Maryland/FIRMS
- NOAA/NESDIS
- Joint Research Centre (EC)
- GEO
- Possibly: ECMWF, Australian Bushfire Cooperative Research Centre, Centre for Australian Climate and Weather Research (WMO)

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# Next Steps

RS information to include in future that influence fire behaviour and EWS Products:

- spatial rainfall, temperature, RH
- seasonal vegetation greenup and curing
- live vegetation moisture content
- biomass (fuel load), affecting emissions as well as fire behaviour
- fire radiative power, indicating fuel consumption and emissions
- Good/bad fire: values at risk, and couple with fire growth models
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# Next Steps

- Setup global daily fire danger/active fire website
  - http://www.fire.uni-freiburg.de/gwfews/index.html
- EWS workshop – Int'l Conf. on Forest Fire Research (Nov 2010, Coimbra, Portugal)
- Incorporate improved early warning accuracy (RS data: spatial weather, fuel classification, seasonal green-up and curing, live vegetation moisture)
- Incorporate RS biomass for improved fire intensity and fire emissions prediction
- utilize Fire Radiative Power to calibrate predictive fuel consumption and emission models
- Calibrate predictive ignition models with hot spot data
- Develop regionally calibrated EWS products
- Support national and local technology transfer of EWS through workshops via Regional Networks