A Global Early Warning System for Wildland Fire
Wildland fire is a constant, pervasive global phenomenon.
Examples of Recent (Documented) Wildfire Disasters

1998 - 2009

- 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

Fire Weather, Fire Activity Products

• general fuel dryness
• fire monitoring
• potential fire activity
## Global Fire EWS

### 3 Component System

<table>
<thead>
<tr>
<th>Fire Weather, Fire Activity Products</th>
<th>Fire Behaviour Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>- general fuel dryness</td>
<td>- fire occurrence</td>
</tr>
<tr>
<td>- fire monitoring</td>
<td>- rate of spread</td>
</tr>
<tr>
<td>- potential fire activity</td>
<td>- fuel consumption</td>
</tr>
<tr>
<td></td>
<td>- fire intensity</td>
</tr>
<tr>
<td></td>
<td>- fire emissions (ground and RS-based)</td>
</tr>
</tbody>
</table>
Global Fire EWS
3 Component System

Fire Weather, Fire Activity Products
- general fuel dryness
- fire monitoring
- potential fire activity

Fire Behaviour Products
- fire occurrence
- rate of spread
- fuel consumption
- fire intensity
- fire emissions (ground and RS-based)

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 -

<table>
<thead>
<tr>
<th>Fire Weather, Fire Activity Products</th>
<th>Fire Behaviour Products</th>
<th>Fire Management Response Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground-based:</td>
<td>Ground-based:</td>
<td>Operational Fire Mgt Decision-aids:</td>
</tr>
<tr>
<td>• WMO actual weather, forecast</td>
<td>• fire behaviour models</td>
<td>• International, regional</td>
</tr>
<tr>
<td>weather models</td>
<td></td>
<td>resource-sharing agreements</td>
</tr>
<tr>
<td>Remotely sensed:</td>
<td>Remotely sensed:</td>
<td>• National and locally</td>
</tr>
<tr>
<td>• hot spots</td>
<td>• fuel distribution and</td>
<td>calibrated guidelines:</td>
</tr>
<tr>
<td>• spatial rainfall, temp. and RH</td>
<td>classification</td>
<td>• prevention</td>
</tr>
<tr>
<td>(ie, ROSA)</td>
<td>• fuel load (biomass)</td>
<td>• detection</td>
</tr>
<tr>
<td></td>
<td>• energy release rate</td>
<td>• pre-suppression</td>
</tr>
<tr>
<td></td>
<td>• seasonal greenup and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>veg curing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• live fuel moisture</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

Products are generally based on fire weather and fire activity.
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 mgmt expertise) in times of fire disaster

Products are generally based on fire weather and fire activity.
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)

Fire suppression criteria

Suppression Requirements and Active Fires

Predicted Suppression Requirements

Products are based on regionally/locally calibrated fire behaviour

Fire Weather

Hot spots
## Fire Suppression Criteria

<table>
<thead>
<tr>
<th>Resource</th>
<th>HFI limit (kW/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand tools</td>
<td>0-250</td>
</tr>
<tr>
<td>Power pumps</td>
<td>250-1250</td>
</tr>
<tr>
<td>Mechanized equipment for control lines</td>
<td>1250-2500</td>
</tr>
<tr>
<td>Aircraft</td>
<td>2500-5000</td>
</tr>
<tr>
<td>Indirect attack (burning out)</td>
<td>5000+</td>
</tr>
</tbody>
</table>

### Wildfire Threat Level

<table>
<thead>
<tr>
<th>Wildfire Threat Level</th>
<th>Resources on Standby</th>
<th>Alert Period</th>
<th>Dispatch Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>crews, hand tools</td>
<td>mid-day</td>
<td>60-min</td>
</tr>
<tr>
<td>Moderate</td>
<td>crews, hand tools, pumps, water tanks</td>
<td>all day mid day</td>
<td>30 min 60 min</td>
</tr>
<tr>
<td>High</td>
<td>crews, hand tools, pumps, water tanks, control line-building equip.</td>
<td>all day mid-day</td>
<td>15 min 30 min 60 min</td>
</tr>
<tr>
<td>Extreme</td>
<td>crews, hand tools, pumps, water tanks, control line-building equip. aircraft, burnout equip.</td>
<td>all day mid-day</td>
<td>15 min 30 min 60 min</td>
</tr>
</tbody>
</table>
Ignition Potential Predictor
based on FFMC and hot spots

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)
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
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