

# Integrated Fire Management in resource-poor countries : Lessons from Africa



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# INTRODUCTION



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# POLL 1 What are your top 5 words that describe IFM in your country?

Whiteboards  
Valerie Charlton 5/2/2023, 1:58:23 PM

POLL 1

What are common features of IFM?

Systematic

Prevention

Coordination

Who can see what you share here

In the room –  
sticky notes

ONLINE –  
whiteboard on  
ZOOM. Press N  
to get a note to  
type your word.

One idea per note/card



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# Lessons Learned 20+ years of Cooperation in Africa

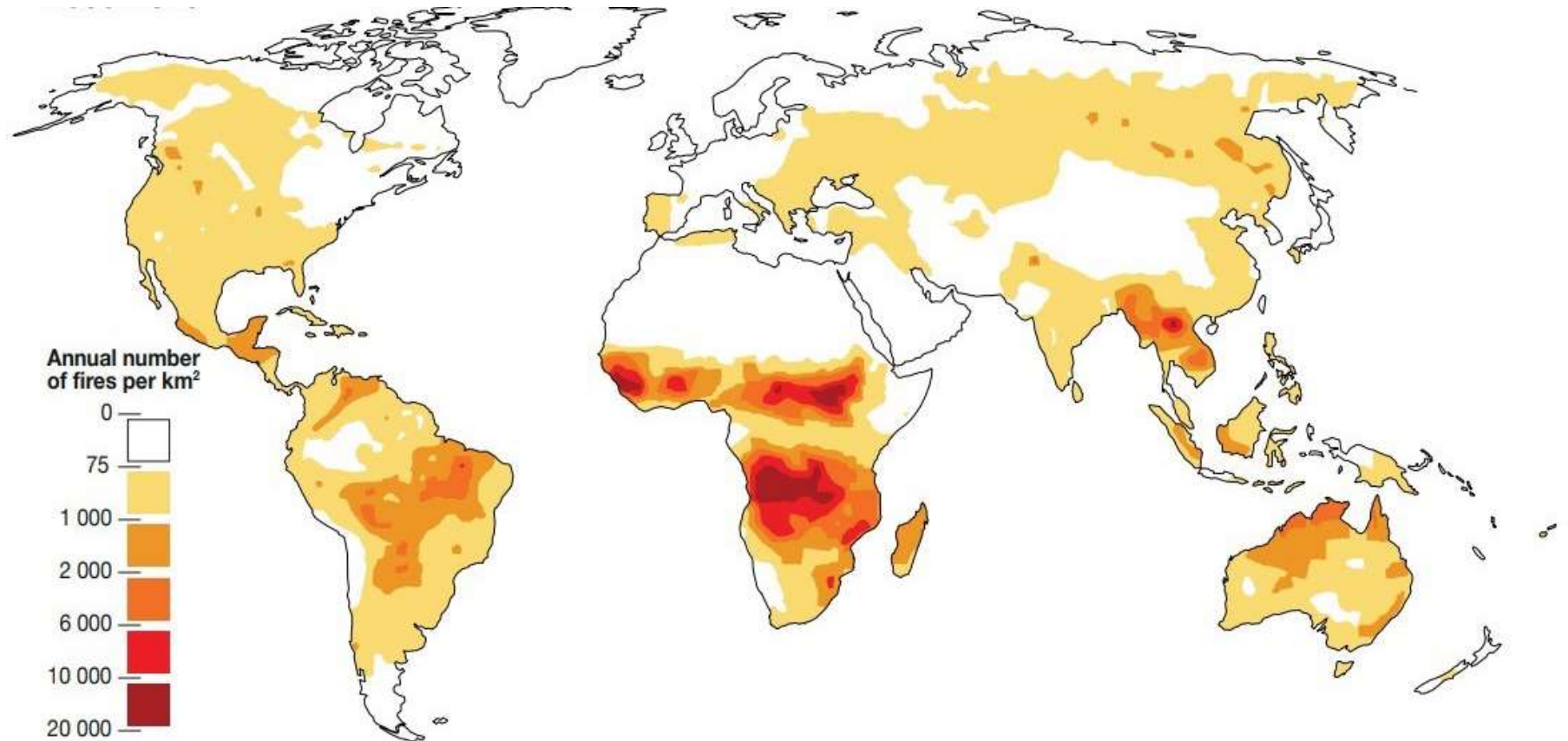
The Good, The Bad, and The Ugly





# Africa— the Fire Continent

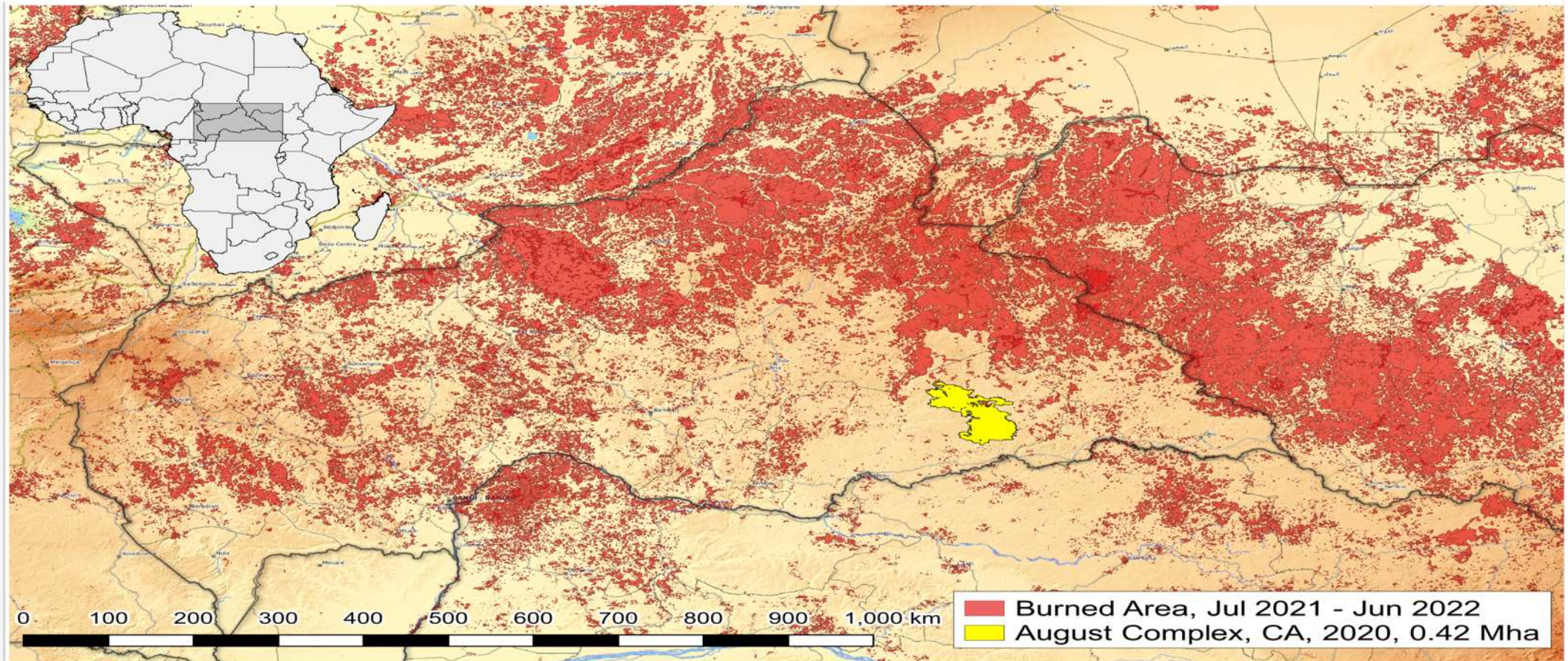
Annual average fire density  
2000—2020





# Africa– the Fire Continent

## For Context



Source : Jolly & Freeborn



# Forest Service Partnership Programs | **Africa**

## Training

ICS | Introduction to Advanced

ICS Teams & Position Specific (Operations, Logistics, Etc.)

Wildland Firefighter | Basic - Advanced

Investigation

Fire Prevention | Firewise

Equipment | PPE, Tools, Pumps, Etc.

Technical and Scientific Support | Robotics, Air Attack, FDI, Prescribed Fire, Etc.

Geographically Diverse Engagement

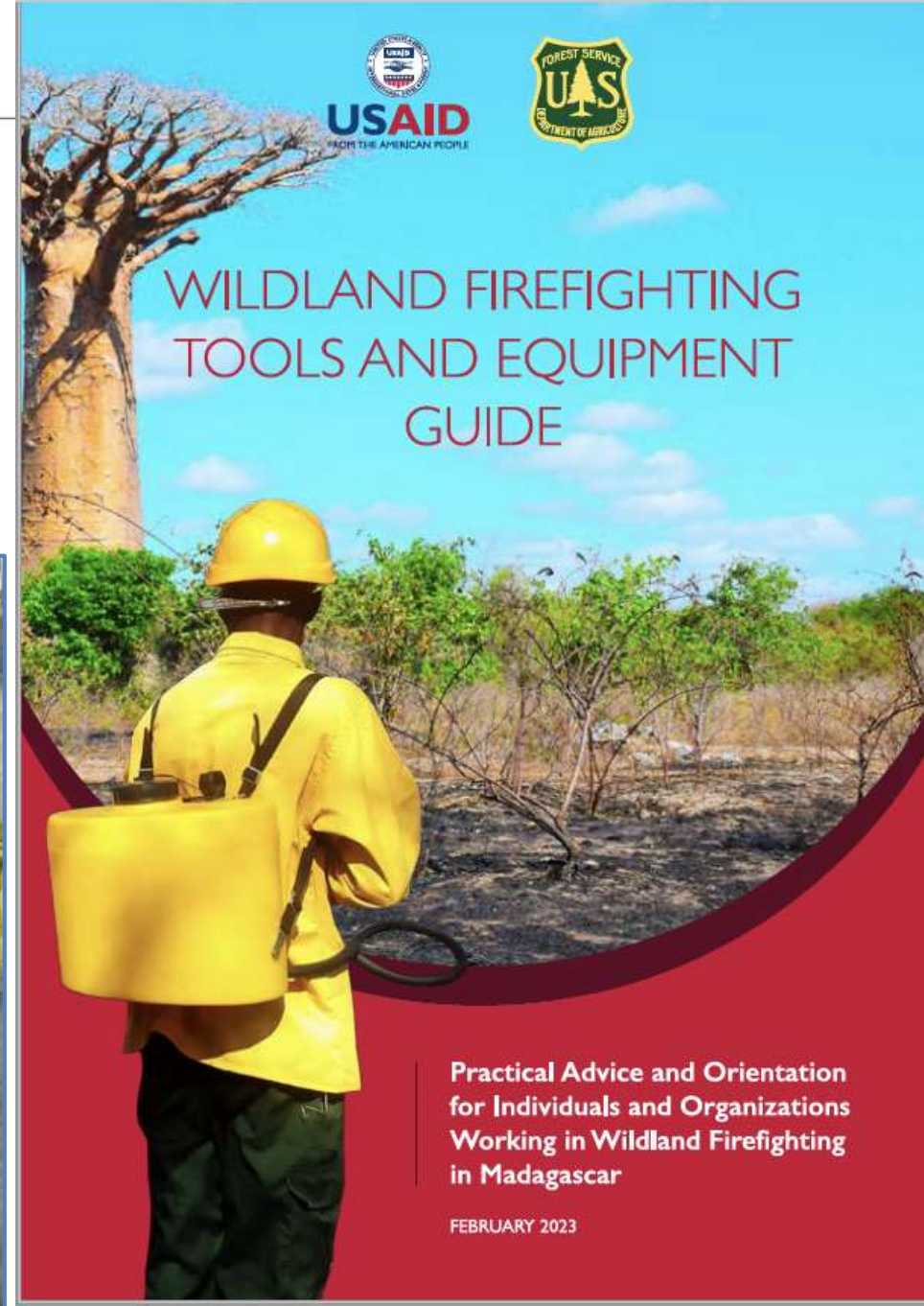
Africa Fire Assessment | April 2023 – 2025 | Questionnaire



# The Good

Start with an Assessment

Simple Things:  
Firefighting Tools and PPE





# The Good

## Sand Tables Tactical Decision Games



Botswana |  
Community Fire  
Brigade



South Africa |  
Aviation



South Africa | Incident  
Management Teams



Ethiopia | Incident  
Command

# The Good

## Study Tours

USFS Disaster Management Seminar | August 2023 California



Community Based Programs



Fire Department New York ICS Shadowing



Great Northern Type 2 Crew Exchange



Cultural Exchange



# The Good | Ultimate Exchange



Montana | Rattlesnake Fire 2018



Glacier National  
Park | Howe Ridge  
Fire 2018



Idaho | Moose Fire  
2022



Montana | Murray Fire 2022



# The Good | Gentle Pressure, Relentlessly Applied

- Find the Jedi's ( Train the Trainers)
- Feed the Jedi's (Exercises & Study Tours)
- After Action Reviews



Namibia | IC  
Training



South Africa | T1  
Helitack Crew



Ethiopia | ICS Training

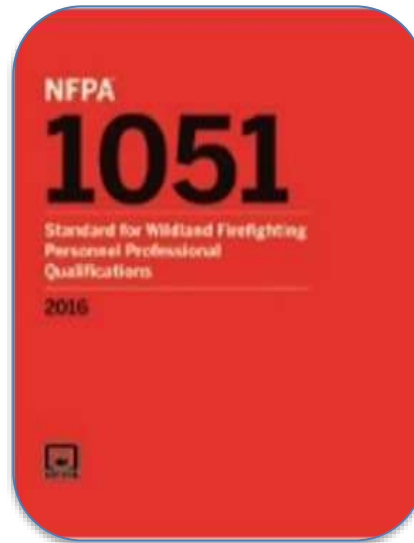


South Africa | IMT  
Exercise



# The Bad

- International Fire Arrangements | Govt to Govt
- Continental / Regional Coordination
- International Standards
- Strategic Goals
- National Working Team



# The Ugly

- We are still killing a lot of firefighters
- Civilian losses on the rise
- Algeria 3% of the country can burn
- 2021 – 90 killed in wildfires (33 responders & 57 civilians)
- 2022 – 43 killed in wildfires





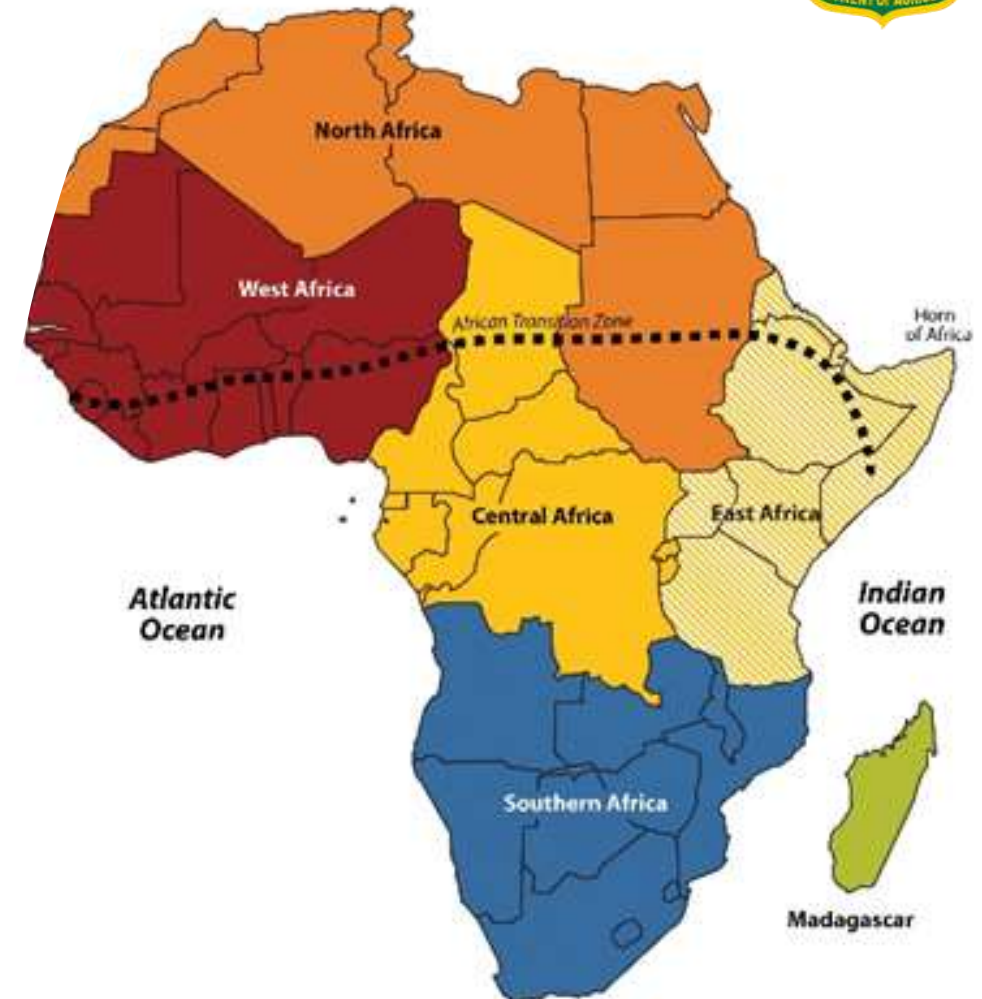
# Africa Regional Fire Program

April 2023–December 2025



## Objective: Assessment of Wildfire in Africa

- Including strategy for future program implementation
- Resource data collection
  - 5 R's: Reduction, Readiness, Response, Recovery, Research
  - Engage stakeholders
- Reporting
  - Prepare Integrated Fire Management Assessment for each country
    - Fire History
    - Seasonality
    - Fire Cause
    - Use Of Fire (“Good Fire”)
    - Fuel Types
    - State Of Fire Science
    - Summary Of Fire Management Capacity





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# Africa Workshop:

## Using Fire Science for Integrated Fire Management

Oporto, Portugal  
17 May 2023

W.J. (Bill) de Groot





# Africa: the fire continent <sup>1</sup>

- Africa accounts for 67.0% of all global vegetation fire, although it has <20% of global vegetation cover
- 82% of global forest fire occurs in Africa, even though it has only 17% of global forest cover (forests defined as >10% tree cover)
- Africa has 51% of global cropland fire, but only 16% of global cropland cover
- The vegetation burning rate in African Least Developed Countries (UN 2021) is almost 2½ times greater than the rest of Africa
- Recent forest cover loss is highly correlated with fire in African LDCs

<sup>1</sup> Data provided by the Global Wildfire Information System  
(fire data: 2002-2019, landcover change data: 2015-2019)



# Using Fire Science for Integrated Fire Management

- Integrated Fire Management ~ a holistic approach that considers social, economic, ecological and cultural values.
- Fire Management = *Decision-making*
  - Tools have useful limits
  - Early decision-making prevents wildfire disasters
- Need to use science to develop simple, operationally useful decision-aid tools
  - Important for *Community-Based Fire Management*



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# Using Fire Science for Integrated Fire Management

Five R's of Fire Management:

Review and analysis (identify fire issues)

Risk Reduction

Readiness

Response

Recovery (building back better)



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Key components: early warning, advanced  
planning, community involvement

# Fire Danger, Early Warning and Fire Management

- **Fire Danger** is a measure of the potential for fire to start, spread, and do damage
- **Fire Early Warning** is advanced knowledge of future fire danger conditions
- **Fire Danger Rating** is the cornerstone of fire management decision-making







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# Example of Prevention and Detection Planning Guides

Potential Ignition Level		Prevention Activity	Detection	
Potential Ignition Level		Prevention Activity	Activity	Period
<b>Low</b>		None	None	None
<b>Moderate</b>		Post local warning signs	towers	mid-day
<b>High</b>		Local media warnings Prescribed fire restrictions	towers vehicle patrol	all day mid-day
<b>Extreme</b>		TV and radio warnings Prescribed fire exclusion Local community meetings	towers vehicle patrol aircraft patrol	all day all day mid-day



# Example of using Fire Danger to quantify a Detection Decision-Aid

---

Probability Of Fire Start	Detection Activity
<30%	No detection
30-60%	Towers 1-4pm
60-80%	Towers all day Patrols 1-4pm
80+%	Towers all day Patrols am, pm

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# Example of using Fire Danger to quantify a Detection Decision-Aid

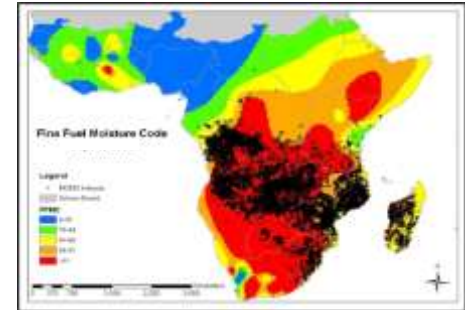
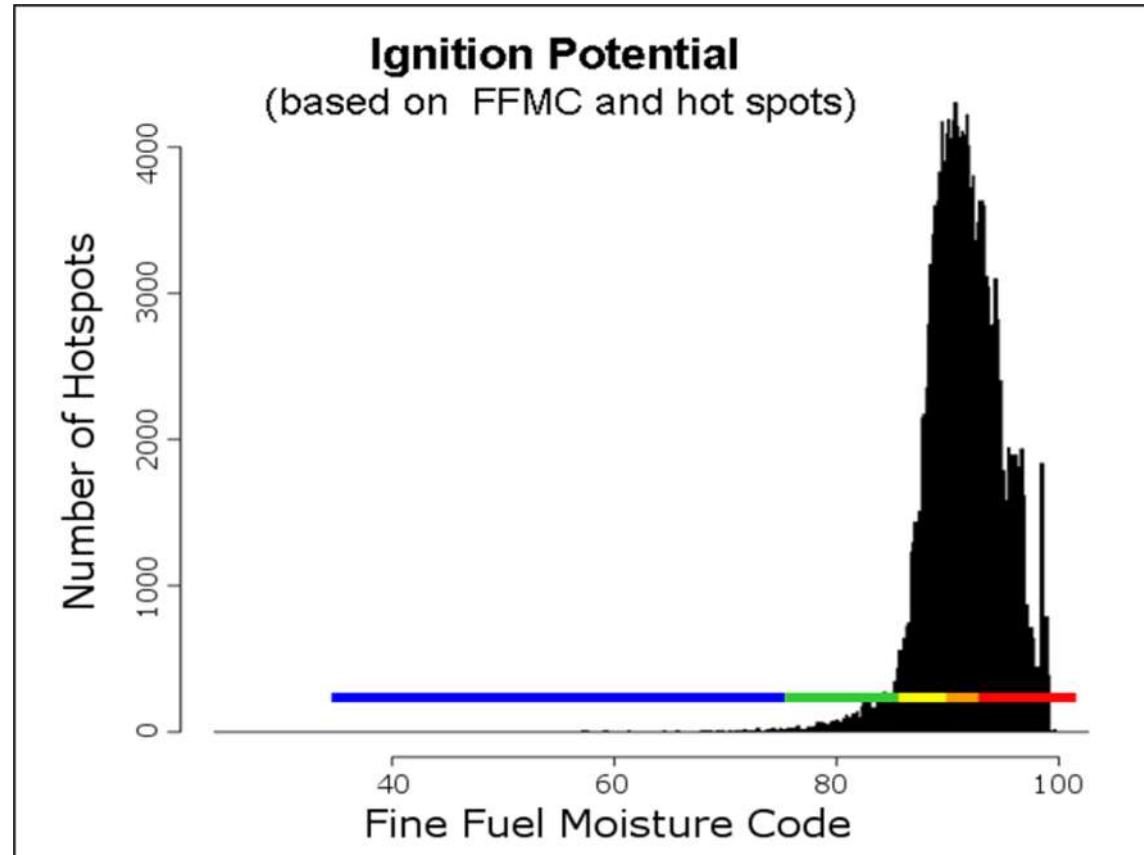
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Probability Of Fire Start	FFMC	Detection Activity
<30%	<70	No detection
30-60%	70-80	Towers 1-4pm
60-80%	80-86	Towers all day Patrols 1-4pm
80+%	87+	Towers all day Patrols am, pm





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# Calibration example of Ignition Potential



# Example of a Suppression Planning Guide

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





# Head Fire Intensity Limits of Control

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



Photo: Working on Fire



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# Fire Early Warning

There are many possible components of a Fire Early Warning System:

- **Fire Danger – primary driver of early warning info!** (Early warning is provided by forecasted weather)
- Hot spots (new and on-going fires)
- Fuels/vegetation, and topography
- Travel corridors and people: roads, railways, waterways, buildings, population locations
- Fire mgt. info: detection towers, aircraft patrol routes, fire crew bases, equipment locations



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# Using Fire Science for Integrated Fire Management

Obrigado!





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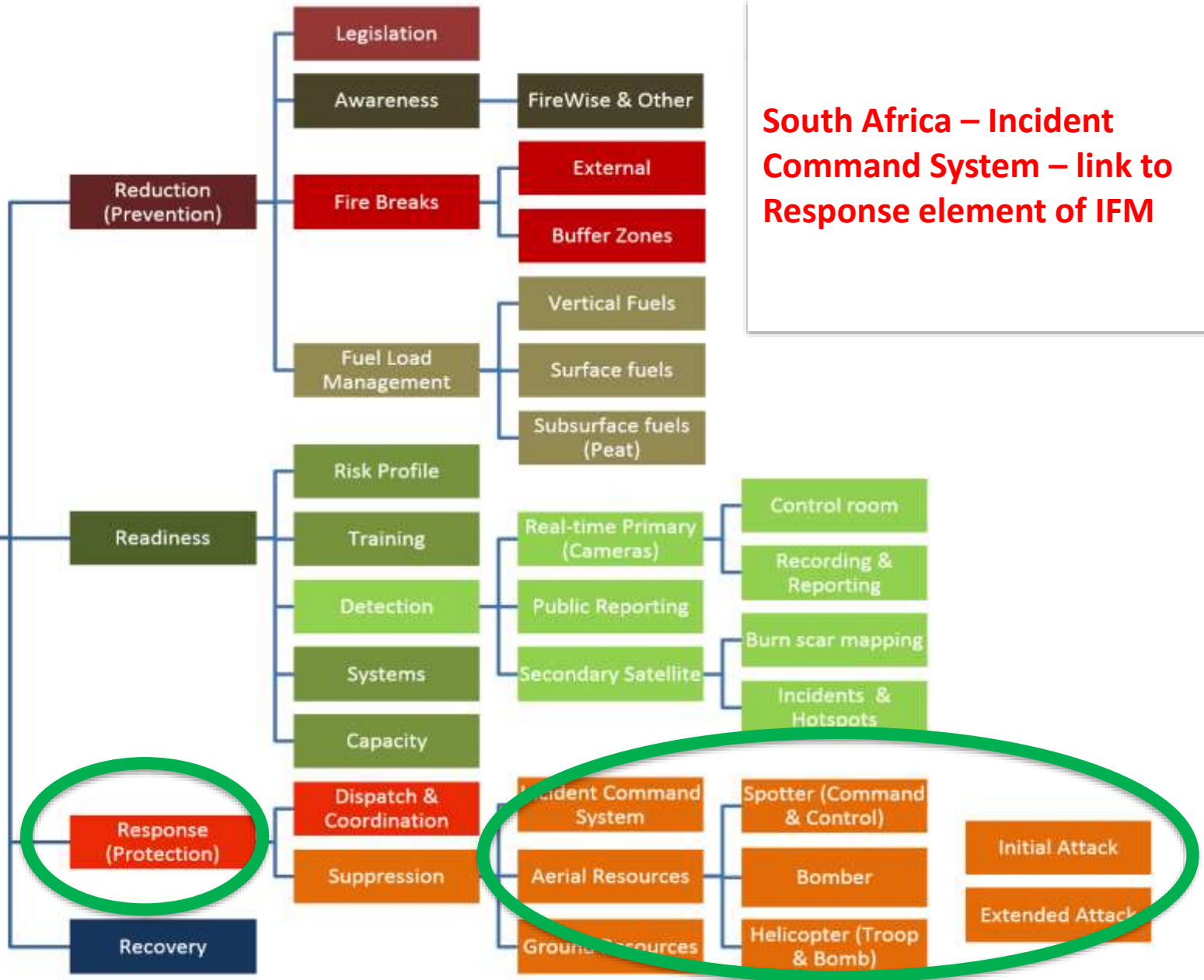
# Can IFM Practices be applied in resource poor countries?

The Incident Command System: A South African Perspective



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# INTEGRATED FIRE MANAGEMENT



## Current status

- 3000+ persons trained in I 100/200/300/400,
- Training attrition rate 80%+,
- 5 Functional IMT's,
- All Hazard Incident Command,
- Major event-2011 Wildfire Conference ICS used to manage entire event including demonstrations
- 2017 and 2018 Major Wildfires in Knysna and George-IMT'S,
- Type 1/2/3 incident- Local IMT's.

One of the major challenges is the inability of some personnel to recognize the need to activate organizational elements when assessing an incident's potential.

Second, the number of personnel trained in intermediate (ICS-300) and advanced (ICS-400) ICS are inadequate to ensure that trained and experienced staff will be available to assume the leadership roles needed for many instances.



Is the programme realistic, scale-able, replicable to other countries?

**Possible** :Yes

**Probability** of implementation success depends on the following:

- “Champion” to drive the project,
- Project management approach,
- Clear Mandate-political as well as administrative,
- Institutional arrangements/enabler- legislation, regulations,
- Awareness at all levels.

### **Training**

- Retraining,
- Specialist/specific training,
- Training for ICS is not a single occurrence, but should instead be an ongoing process of expanding knowledge, exercising skills, and passing on these skills for the benefit of future leaders.

## Summary

Although ICS is a valuable tool for managing significant incidents, it requires a clear mandate, attention must be focused on developing and extending training for enough personnel to ensure that adequate numbers of qualified and experienced personnel for potential needs are locally available.

This includes addressing how to provide mechanisms for maintaining competencies, to ensure that succession planning is in place, and to remove any inherent misunderstandings and distrust in the system.

# Fire management in Ghana: link to integrated fire management

Lucy Amissah

*CSIR-Forestry Research Institute of Ghana*



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Porto-Portugal  
May 16-19<sup>th</sup>  
2023



# Background

- Wildfire management in Ghana occurs within the framework of a national wildfire policy (National Wildfire Management Policy 2006) and the PNDC law 229 (the control and prevention of bush fire Act, 1990).
- The policy and law recognize fire as a useful tool in farming systems and the management of vegetation for wildlife.
- The legislation also recognizes the detrimental effects of fire on livelihoods and biodiversity and the need for prevention and control.



# Past fire management projects

- Past projects implemented in the period **1990-2010** were focused on wholistic approach to fire management by incorporating the ecological, socio-economic and technical aspects.
- Projects developed fire management systems based on baseline information on the direct and underlying causes of fire, socio-economic and ecological impacts.
- Projects developed mechanisms for restoration of fire degraded landscapes
- Coordination among stakeholders whose mandates and operations relate to fire issues.



# Past fire management projects outputs

- Socio-economic information has served as basic for development of fire prevention education and awareness creation programmes including enforcement of byelaws at the local community level.
- Effective forest fire control systems developed include assessment of fire risk, use of early burning to reduce fire hazards and ground patrols for early fire detection.



# Past fire management projects outputs

- A network of trained community fire volunteers are at the for front of fire prevention and suppression in local community across the forest savannah transition zones.



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# Past fire management projects outputs

- These are also embedded in community governance structures (local byelaws for ) for fire prevention and control.
- Fire suppression in most communities in Ghana are carried out with basic tools which are usually provided by various projects and ends with project cycle. This is in sharp contrast to high-technology fire suppression by developed countries.



# Challenges

- Past projects have clarified roles and responsibility of various stakeholders in fire management to facilitate interagency coordination. However, till today interagency coordination remains a challenge and fire management programmes are implemented by institutions with little reference to past projects outputs.
- Mainstreaming of fire management in operations of institutions whose mandates relate to land management is weak.
- Lack of mechanisms for sustainable funding for fire management in Ghana.



# what has worked

- Community fire management using local governance structures
- A net work of trained community fire volunteers
- Enforcement of byelaws at the community levels.
- Engagement of the local communities in post fire landscape restoration activities has sustained interest in fire management



# Replicability of Ghana's fire Management programmes to other countries

- Many of the concepts of fire management developed and implemented in Ghana can be adopted by other west African countries and modified to suit each country's socio-economic and cultural conditions



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# Thank You



A section of fire volunteers at Twumkrom near Dormaa Ahenkro trained in 2007



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# REGIONAL EASTERN AFRICA FIRE MONITORING RESOURCE CENTER (REAFMRC)

## REAFMRC Mandates

The Regional Eastern Africa Fire Management Resource Center (REAFMRC) is serving countries of the Sub-Saharan Africa, notably East Africa, by provision, archiving and interpreting scientific-technical information and satellite-derived near-real time and historic data on landscape fires. Furthermore, the Center contribute to close interaction between all departments in wildfire monitoring for early warning information on active burning, fire danger and burned area monitoring. In this scope, the REAFMRC will

- generate, archive, interpret and disseminate scientific-technical and satellite-derived near-real time and historic data and information on landscape fires.)
- organize consultations aimed at generating awareness and foster cooperation among decision-makers of all concerned



# [www.rfmrc-ea.org](http://www.rfmrc-ea.org)

- Madagascar
  - Erythrea
  - Ethiopia
  - Kenya
  - Uganda
  - Burundi
  - Djibouti
  - Malawi
  - Mozambique
  - Rwanda
  - Tanzania
  - Zambia
  - Zimbabwe
- Active Fire
  - Monthly burnt area
  - Annually burnt area
  - Fire forecast
- Historical data (2016 - ...)
  - Near Real time for Fire forecast (on demand basis)



# REGIONAL EAST AFRICA FIRE MANAGEMENT RESOURCE CENTER

1 Day Fire Danger Forecast | [Active Fire Data](#) | [Monthly Burned Area Monitoring](#) | [Annually Burned Area Monitoring](#)

## 1 Day Fire Danger Forecast

[Madagascar](#) | [East-Africa](#)

Note: Beta version map, for any suggestion, please send your comments at [fire.medd@environnement.mg](mailto:fire.medd@environnement.mg), cc: "lab\_llanddev@moov.mg"

## EAST-AFRICA















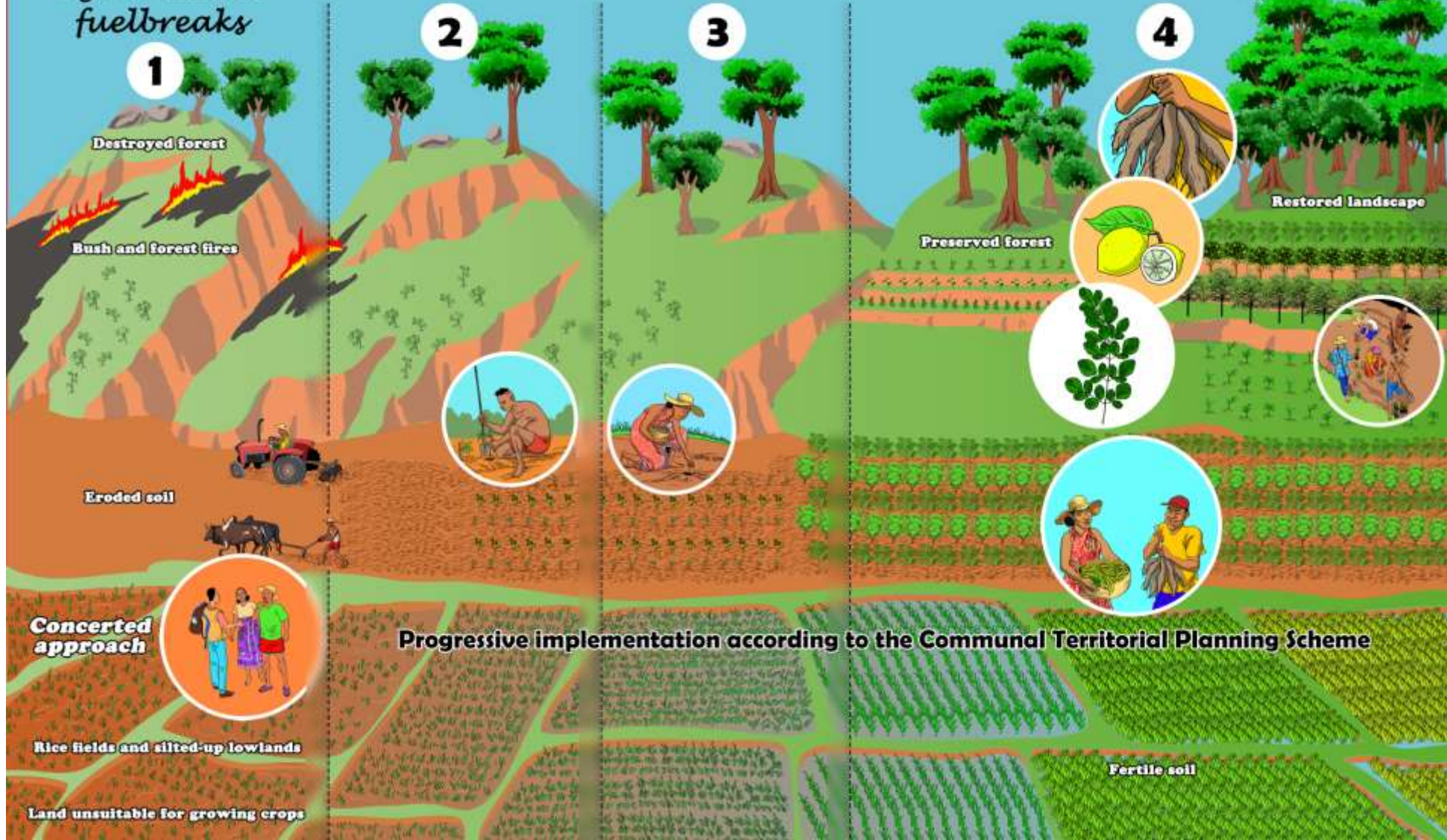


# Agricultural fuelbreaks

(Fire spread controlled - Cultivated land – Enhanced food security)

Without agricultural fuelbreaks

With agricultural fuelbreaks





# MOZAMBIQUE

## SUPPORT TO CONSERVATION PARTNERS IN NATURAL RESOURCES AND FIRE MANAGEMENT



**USAID**  
FROM THE AMERICAN PEOPLE

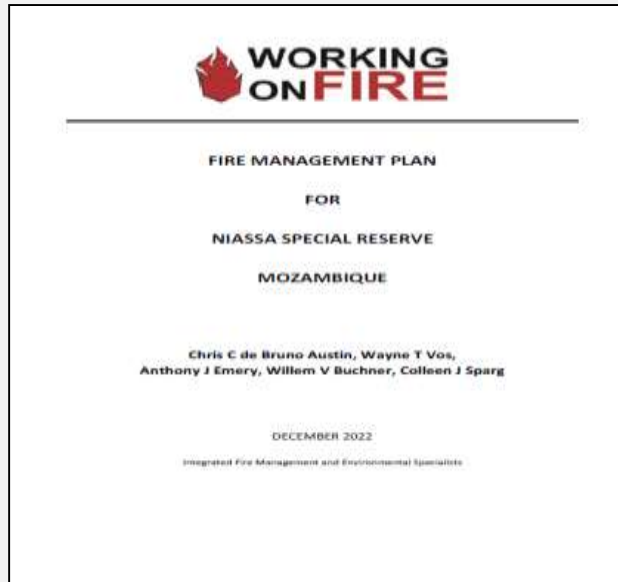
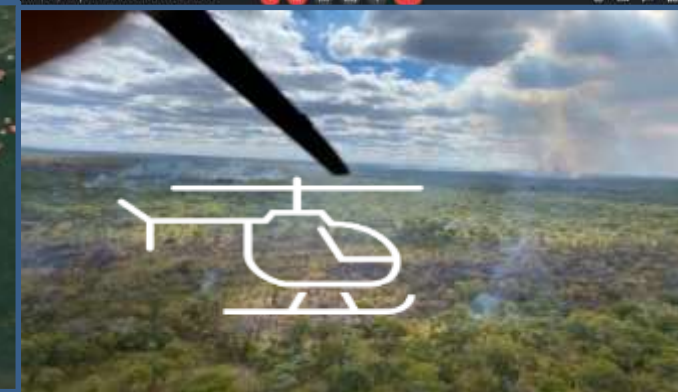
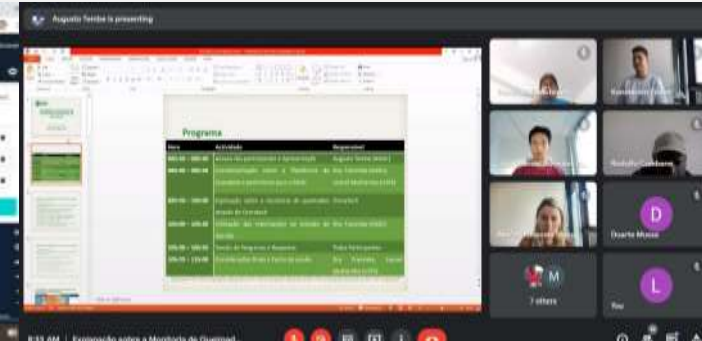
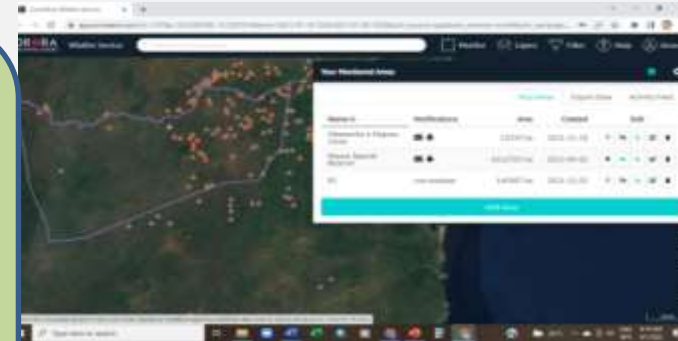


**ANAC**  
ADMINISTRAÇÃO NACIONAL  
DAS ÁREAS DE CONSERVAÇÃO



# SUPPORT TO MOZAMBICAN PROTECTED AREAS NETWORK

- Wildfire monitoring in Mozambique's Conservation areas using **Ororatech Wildfire Service**
- ANAC's Capacity building (Training, equipment)
- On-ground activities in NSR (Prescribed burn/community sensitization)
- Support for IFMP design for Niassa Special Reserve



Name	Notifications	Area	Created			
Banlima	🔔	7256 km²	2021-10-12	📄	📅	🗑️
Costeada Oficial N° 9	🔔	5765 km²	2021-10-12	📄	📅	🗑️
Gorongosa	🔔	3675 km²	2021-10-12	📄	📅	🗑️
Honey, Mpungu	🔔	64 km²	2022-07-18	📄	📅	🗑️
Honey, Missapa	🔔	466 km²	2022-07-18	📄	📅	🗑️
Limpopo	🔔	11016 km²	2021-10-12	📄	📅	🗑️
Limpopo NP	🔔	13184 km²	2021-10-05	📄	📅	🗑️
Magoé	🔔	5560 km²	2021-10-12	📄	📅	🗑️
Magoé Bufferzone	🔔	1784 km²	2021-10-12	📄	📅	🗑️
Mispoto	🔔	1040 km²	2023-10-12	📄	📅	🗑️
Parque Nacional de Gorongosa	🔔	9404 km²	2021-10-12	📄	📅	🗑️
RESERVE/Parque Nacional de Limpopo	🔔	6952 km²	2021-10-05	📄	📅	🗑️
Serra de Gorongosa	🔔	367 km²	2021-10-12	📄	📅	🗑️
Zirave	🔔	4092 km²	2021-10-12	📄	📅	🗑️



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## Ongoing Project elements

- ✓ Wildfire monitoring in Mozambique's CA
- ✓ ANAC capacity building
- ✓ Support to IFMP design for Niassa Special Reserve

## Lessons learned

- ✓ Fire as a proxy
- ✓ Fire monitoring using Ororatech ↔ Support for law enforcement activities
- ✓ Conservation area personnel need training
- ✓ Lack of information on fire occurrence and patterns

## Challenges

- ✓ Fire prevention and suppression equipment for the protected areas
- ✓ Community engagement
- ✓ The need for a National Fire Management strategy for protected areas
- ✓ Replicable



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# Africa Workshop:

Applied Research - progress and challenges

Porto, Portugal  
17 May 2023

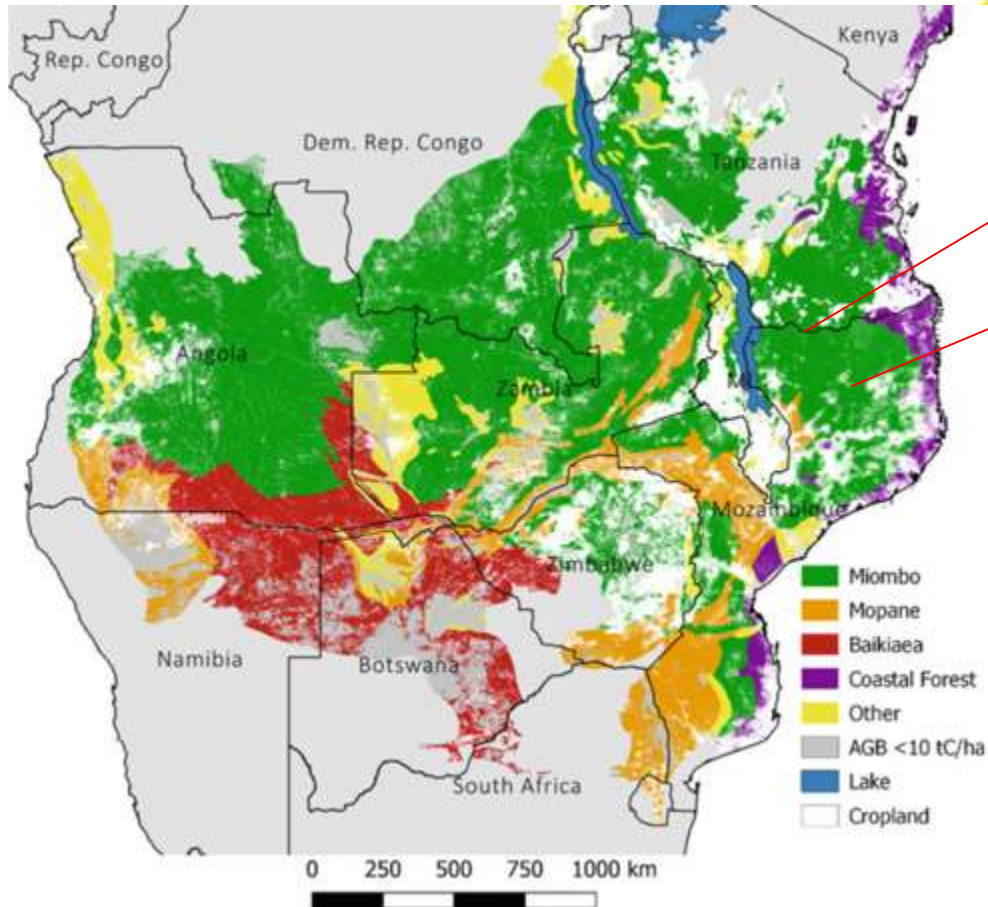
N.S. Ribeiro  
Eduardo Mondlane University



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# 18-years of fire related research in Niassa Special Reserve: Linking Research to Conservation Action



Dziba et al. (2020)



- NSR is largest protected area of MW worldwide; represents 31% of the protected areas in Mozambique

NSR management:

- **1954:** Hunting Reserve
- **1981-1997:** “abandoned” due the Civil War
- **1998 – 2012:** Managed through a Private Public Partnership (SGDRN)
- **2012-to date:** Government management with support from WCS.



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# Niassa Special Reserve biodiversity value



Historic Disturbances (fires, agriculture, etc)



~ 60,000 people (INE, 2018)  
An increase of more than 70% in 10 years



Miombo woodlands (72% of the area) and repository of key wildlife sp.

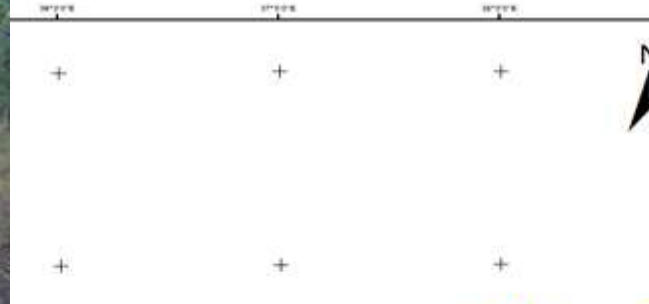


# Woody composition linked to fires and elephants

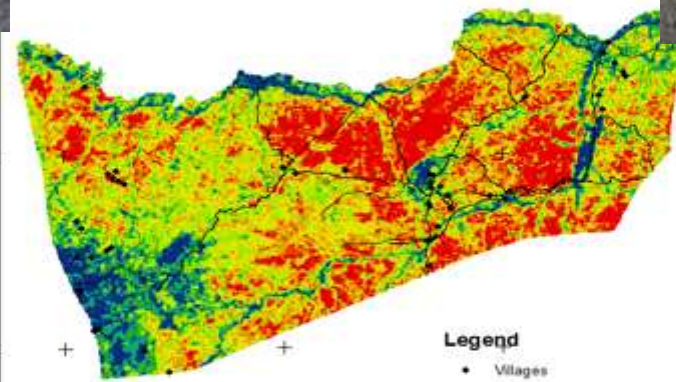


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- > Woody biomass
- < grass biomass
- True miombo



- < Woody biomass
- > grass biomass
- Combretaceae- miombo



Ribeiro et al. (2017)



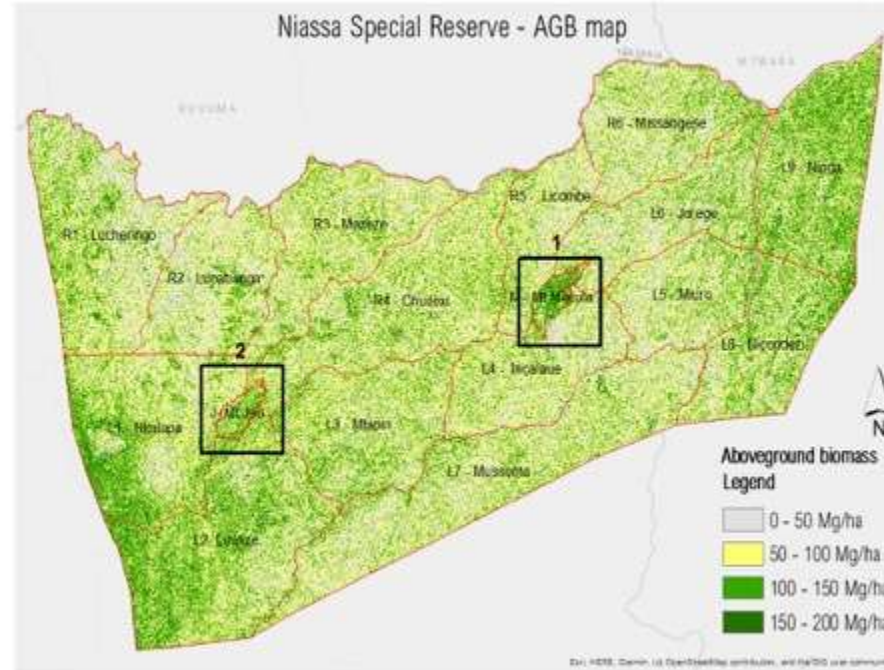




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# Fires and carbon stocks in NSR



$$\text{AGB} = 126.5 - 152 \text{ NDVI1} + 250 \text{ NDVI2} + 6.63 \sigma\text{HV} + 2.83; r^2=0.82$$

NSR is an important C sink (15-47 MgC/ha; Macave et al. 2022).

- Fire regime affects C sequestration:
  - Low FF:  $0,48 \pm 0,15$  Mg/ha/Year
  - High FF:  $0,15 \pm 0,02$  Mg/ha/Year
- Decrease from annual (45% of NSR) to fires every 3 years (average for NSR) may increase C sequestration by 4 MgC/ha/year (Ribeiro et al., 2021)

# Fire is part of miombo woodlands ecology

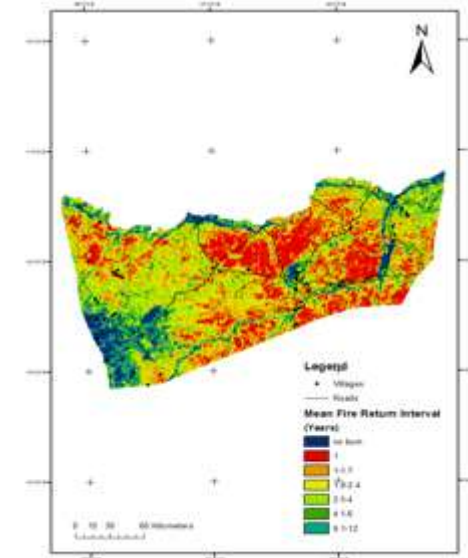


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- Have long existed in MW (probably ~200,000 years ago; Morris, 1970)
- A major management tool for rural people, dependent on forest resources.
- Most plant species are adapted and other depend on fires to survive.

**=> Fire regimes are important to maintain the ecosystem, but very few IFM programs exist.**







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# One of the most resilient ecosystems in the world

- Recover relatively fast (10-15 years; up to 1.4 cm/year) especially after:
  - Agriculture
  - Charcoal production
  - Timber harvesting.
- Trees recover especially from stumps and roots

Most species of roots  
and stumps



Source: Geldenhuys (2016)





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# IFM is key to sustain miombo woodlands

## Progress:

- Ecosystem well adapted to particular fire regimes
- Wealth of traditional knowledge and experience in FM
- Sufficient scientific knowledge on fire regimes in relation to ecosystem dynamics and ecology
- The REDD+ system is a pathway to mitigate the effects of CC and woodland restoration and as a finance mechanism, but there should be a balance between C and non-C benefits (other ES/biodiversity) and consider IFM.



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# IFM is key to sustain miombo woodlands

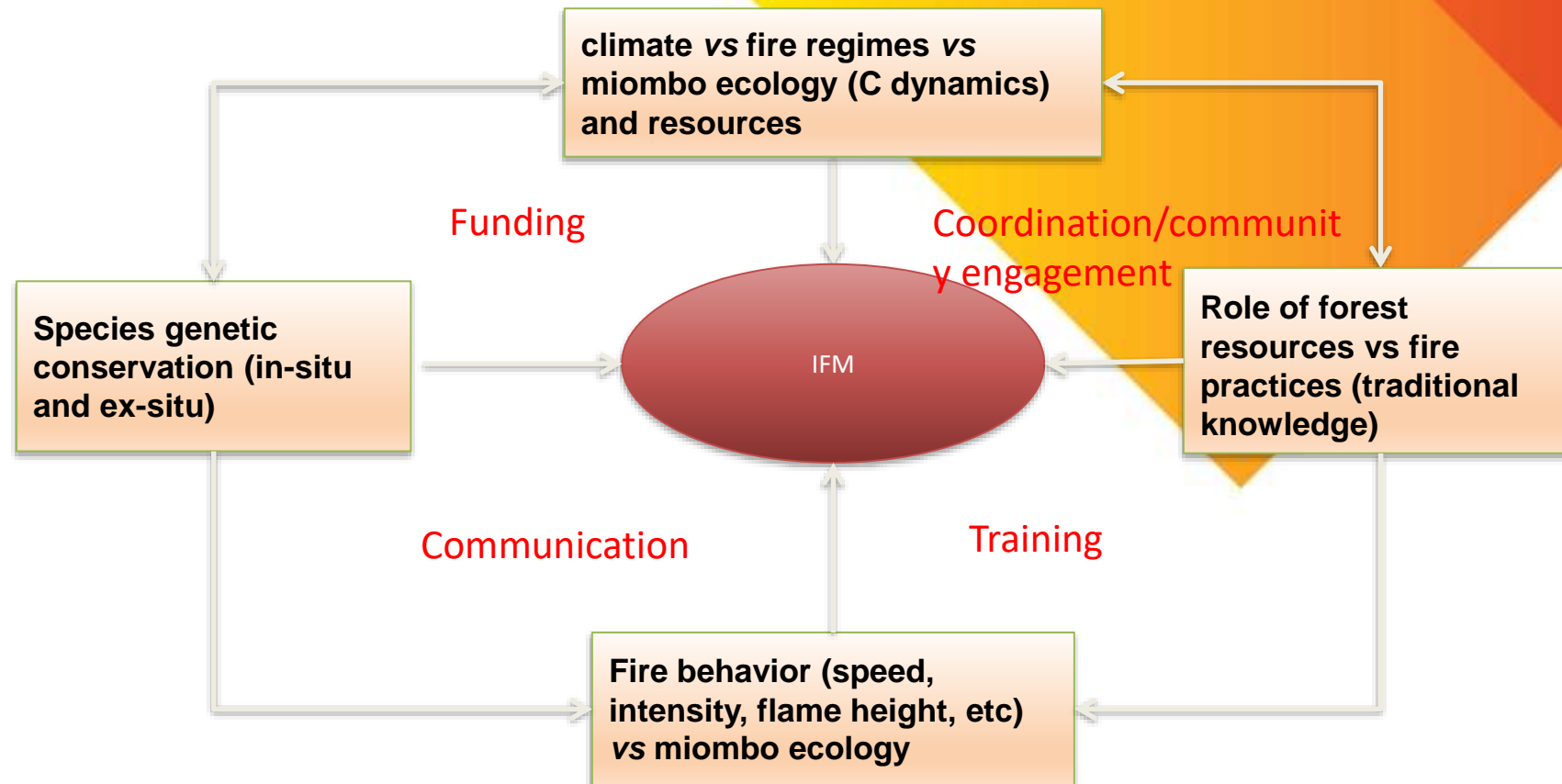
## Challenges:

- National forest policies and governance **do not support** fire management action as they do not fully account the role of fire (e.g. resprouting, germination, cultures, etc.)
- Limited engagement of local communities and key stakeholders in FM
  - => risk of losing traditional knowledge and buy-in of “new” IFM approaches
  - => risk of designing unfit IFM approaches
- Lack of integration of research outputs into decision-making



# Moving towards science-based IFM in Africa

Integrated Fire Management ~ a holistic approach that considers social, economic, ecological and cultural values (From Bill's PPT)








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# Moving towards science-based IFM in Africa

- Build/promote community of practices (e.g Miombo Network)
- Pilot a community-based IFM program in the miombo region (e.g NSR)
- Promote exchange visits between communities in different regions (e.g. Africa and Latin America)
- Advocate for *fire policy* instead of *zero-fire policy*
- ....what else??...



Those that  
plan without  
the help of the  
spirit must  
plan again.

-Zulu Proverb

**OBRIGADA**

# Applied Research - progress and challenges

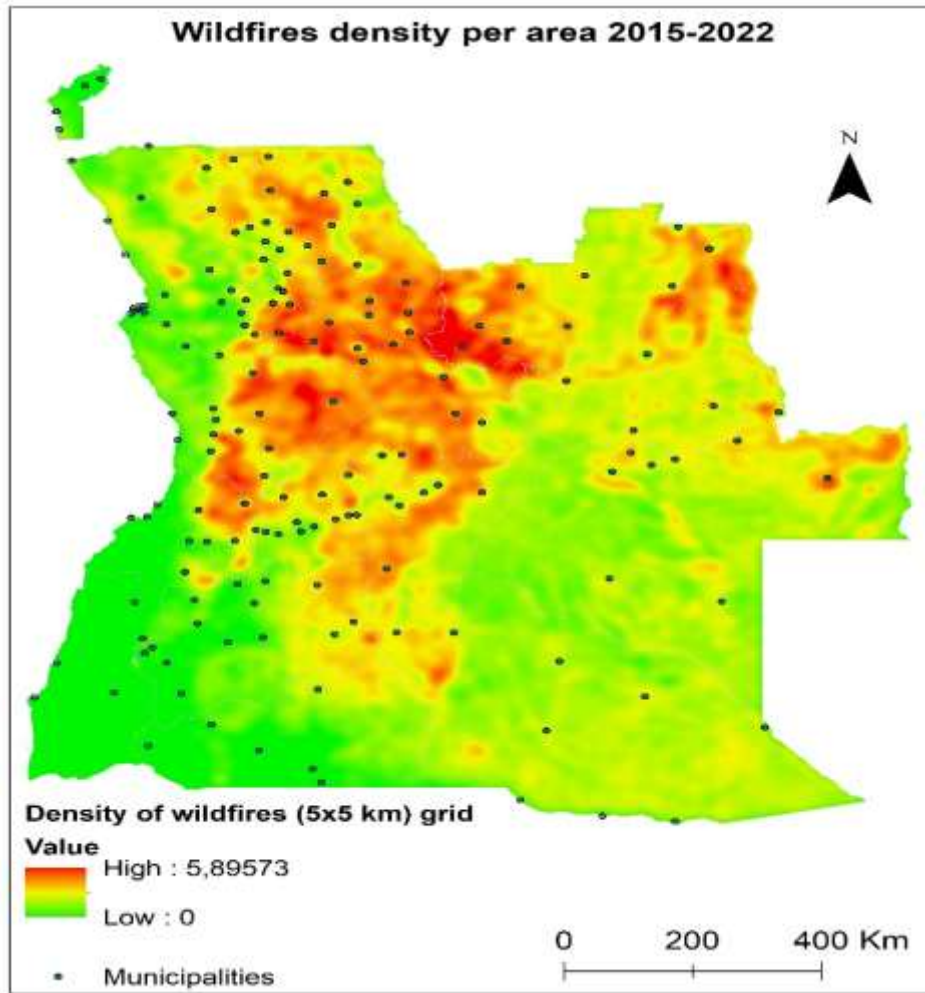
Obrigada!



# ANGOLA WILDFIRE MANAGEMENT ASSESSMENT

## Country figures

- INPE Global Ranking for Wildfires 2020 – Angola has 16.6% of world's wildfires.
- 313,807 wildfires/year ( 2015-2022).



## What elements of the project are continuing?

The assessment was done to determine the current state of wildfire management capacity in Angola and then to recommend and prioritize opportunities for capacity building aimed at improving integrated wildfire management (IFM) in Angola at both institutional and community levels.

## Is it working?

The team carried out an Angola wildfire survey which was answered by about 190

Individuals, professionals from various areas of activity to learn more about the challenges of the implementation of IFM in Angola.

## Why – or why not?

The study will provide information to help the decision-making process in Angola, and to show the future actions that can be made.

## Top lesson learned ?

- More than 80% of survey respondents agree that wildfires are a big problem in Angola;
- Almost 90% of survey respondents suggest that wildfires are mostly caused by humans, being arson, waste/debris burning, and land preparation for agriculture are the top three causes.



## What would you change?

- Institutionalization of Municipal Fire Management Offices with IFM plans for the rural communities;
- Improve investment in fire management and develop Community based Fire Prevention ( Firewise) Committees and Community Fire Brigades.

## What are the challenges?

- Communities lack access to fire knowledge, according to the respondents of the fire survey, more than 50% said that communities do not use fuel barriers to protect against wildfires. We will need to do a great effort to reach much of the communities and partnerships with NGO and Academia to improve the knowledge about IFM.



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May 16-19<sup>th</sup>  
2023



## National Incident Management System (NIMS)

### E-Learning for efficient capacity building

Course Library includes:

- NIMS – National Incident Management System (Basic)
- ECC - Emergency Coordination Centre
- MAC - Multi Agency Coordination
- ICS - Incident Command System ( Introduction)
- AAR – After Action Review
- IAP - Incident Action Plan
- PTB - Position Task Books
- Exercise Design



## What elements of the project are continuing?

- The project handed over to the GoE and serves as a capacity building platform

## Is it working?

- Yes, very well

## Why – or why not?

- It was designed for COVID era but still found to be working
- Foundation to virtual learning courses ( Intermediate ICS, Logistics Section Chief, etc.)

## Top lesson learned ?

- It requires strong connection but managed to be downloadable
- Self pace and no time restriction,
- Overwhelming disaster response during the past couple of years disabled trainees to take lessons

## What would you change?

- Platform that doesn't need strong connectivity,
- Time restricted courses with constant reminders

## What are the challenges?

- Sustainability of hosting the platform
- Proportion of enrolment to completion

## Is the project / programme / effort realistic, scale-able, replicable to other places/ countries? Why ?

- Yes, some countries already requested the platform. It is a cost effective and self paced course where trainees can use their time flexibly





# The Way Forward

- Adapt all 8 eLearning courses to be Generic for all of Africa in 2023.
- Add “ICS for Executives” course.



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- Burning issues.
- Travelling microphone
- Questions from the chat on line.
- Complete Questionnaire
- Contact details if you wish to have the short report compiled.



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# Lessons learned

## POLL 2

Using ZOOM whiteboard online , notelets

Top three lessons or critical success factors that support  
Integrated Fire Management practice.





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Close  
and  
Thank you