INTERNATIONAL SAVANNA FIRE MANAGEMENT INITIATIVE

ISFMI *Revitalising Indigenous Fire Knowledge Globally*

Background to ISFMI Projects – Prospects and Challenges

Wildlands Fire Conference, Porto 17 May 2023

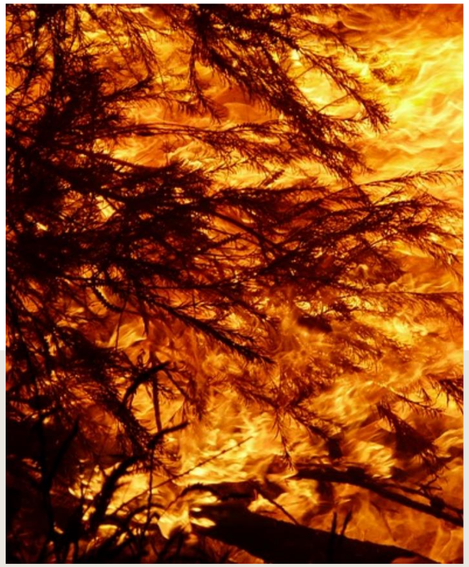
Afternoon session – Incentivising Savanna Fire Management: Opportunities and Challenges

ISFMI

International Savanna Fire Management Initiative

Revitalising fire management traditions globally for climate, biodiversity and communities.

The Problem



Global Wildfire Crisis

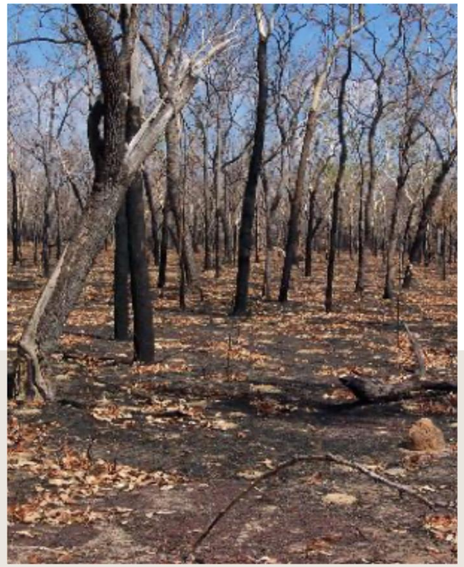
- Characterised by high intensity, late dry season destructive fires that travel fast, covering large areas.

Contributes to CC

- Late Dry Season Wildfires generate globally significant GHG emissions.

Exacerbated by CC

- Increasing temperatures, dryer conditions and higher anticipated number of very high temperature days expected to exacerbate wildfire crisis.



Costs

- High intensity wildfire destroys biodiversity. Leads to forest degradation and deforestation.
- Destroys infrastructure, livelihoods, high overall economic cost.

ISFMI

This Approach…

Early dry season (EDS), pre-August, prescribed fires

Scorch mostly <2 m

Patchily burnt

Late dry season (LDS), after August, unplanned / wildfires

Tree canopy scorched

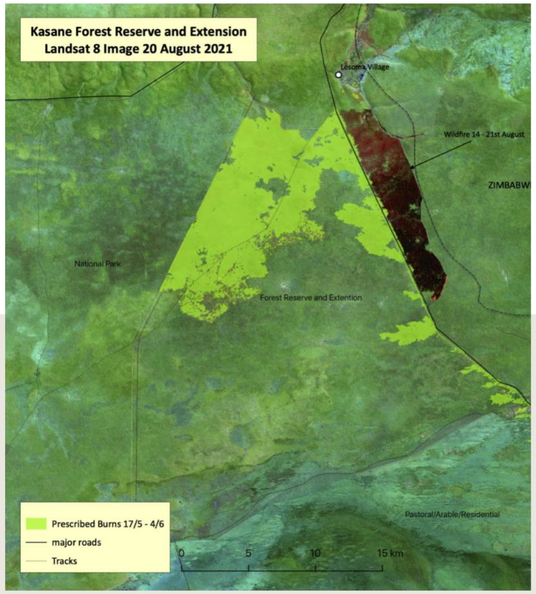
Not Patchy

ISFMI

… Provides a Solution

Harnessing Traditional Practice

- Similar traditions globally in savanna/tropical dry forests
- Involved EDS Burning
- Interrupted through colonisation



Prevents Late Dry Season Destructive Wildfire

- EDS managed fires gentle, patchy
- Generate lower volume emissions
- Prevent LDS wildfires

Contributes to Both CC Mitigation and Adaptation

- Annual emissions reduction 50%
- Carbon stored in above and below ground biomass (i.e. trees and soil)
- Multiple adaptation benefits

Protects Biodiversity, Supports Communities

- Tools to quantify emissions reductions and measure other benefits incentivises fire practice

ISFMI

Comparative Advantage

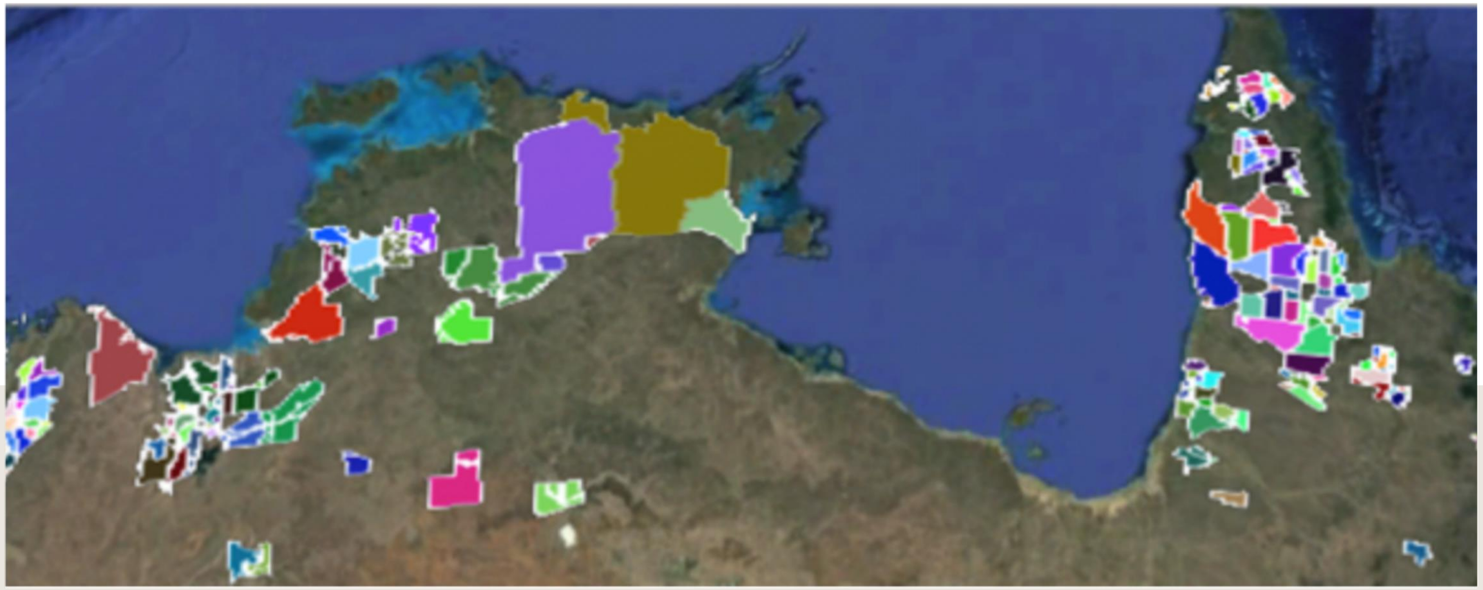
- Remote communities have an incentive to undertake fire management, taking pressure off state resources.
- Once enabling environment in place, represents low input, low technology approach.
- Sustainability through community led enterprises.
- Co-benefits – social, economic, cultural.
- Can also be used by other land holders.
- Supports range of global goals – mitigation, adaptation, biodiversity etc.

ISFMI

Building from the Australian Experience

From First Savanna Fire Management Projects

- Conoco Phillips initial investor in West Arnhem Land.
- Individual projects spread across north of Australia monitoring and verifying emissions reductions from savanna fire management.

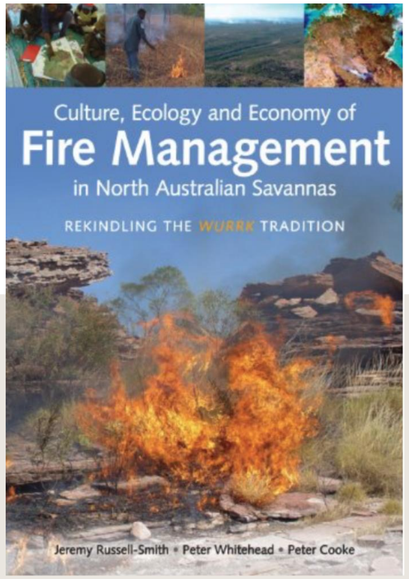


Leading to Development Strong Economic Sector across North of Australia

- Now more than 75 projects across the north, 25 Indigenous led, generating significant economic and other benefits for remote Indigenous communities.

ISFMI

Enabling Environment



For methane, CH_4

$$E_{oc} = M_o \sum_{pk} \left(A_{pk} P_k \sum_l \left(EF_{pl} FL_{npl} CC_l \sum_m \left(S_m BEF_{klm} \right) \right) \right)$$

For nitrous oxide, N_2O

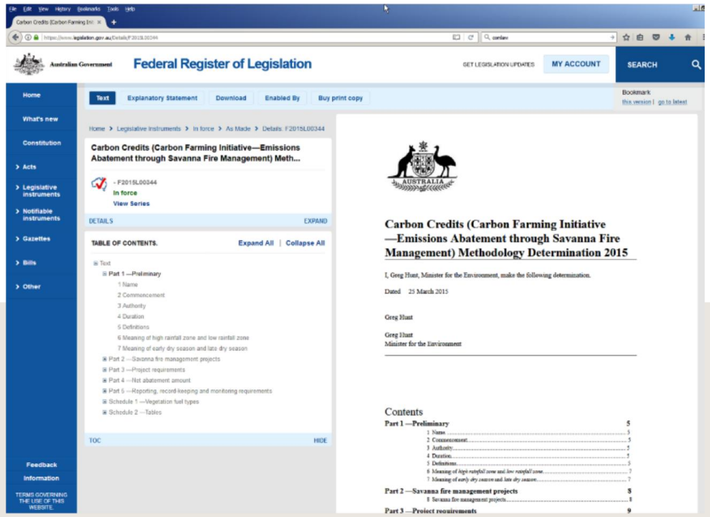
$$E_{on} = M_o \sum_{pk} \left(A_{pk} P_k \sum_l \left(EF_{pl} FL_{npl} CC_l NC_l \sum_m \left(S_m BEF_{klm} \right) \right) \right)$$

Where the subscripts:

o = *greenhouse gas species o (oc*= CH_4, *on*= N_2O);
p = *vegetation class*
k = *fire season*
l = *fuel size class*
m = *fire severity class*
n = *number of years since the patch of land was last burned*

and parameters:

E_{oc} = Emission (Gg) of CH_4;
E_{on} = Emission (Gg) of N_2O;
M = Ratio of molecular mass to the elemental mass
A = Fire affected (scar) area (ha)
P = Patchiness
EF = Emission factor (% of fuel elemental content released in fire)
FL= Fuel load (t dry matter ha^{-1})
CC = Carbon content of fuel (gram of carbon per gram of dry fuel)
NC = Elemental nitrogen to carbon ratio
S = Severity class (fraction of fires of severity class *m* in fire season *k*)
BEF = Burning efficiency



Recognition Value Traditional Fire Management

- For Culture, Climate, Communities, Biodiversity

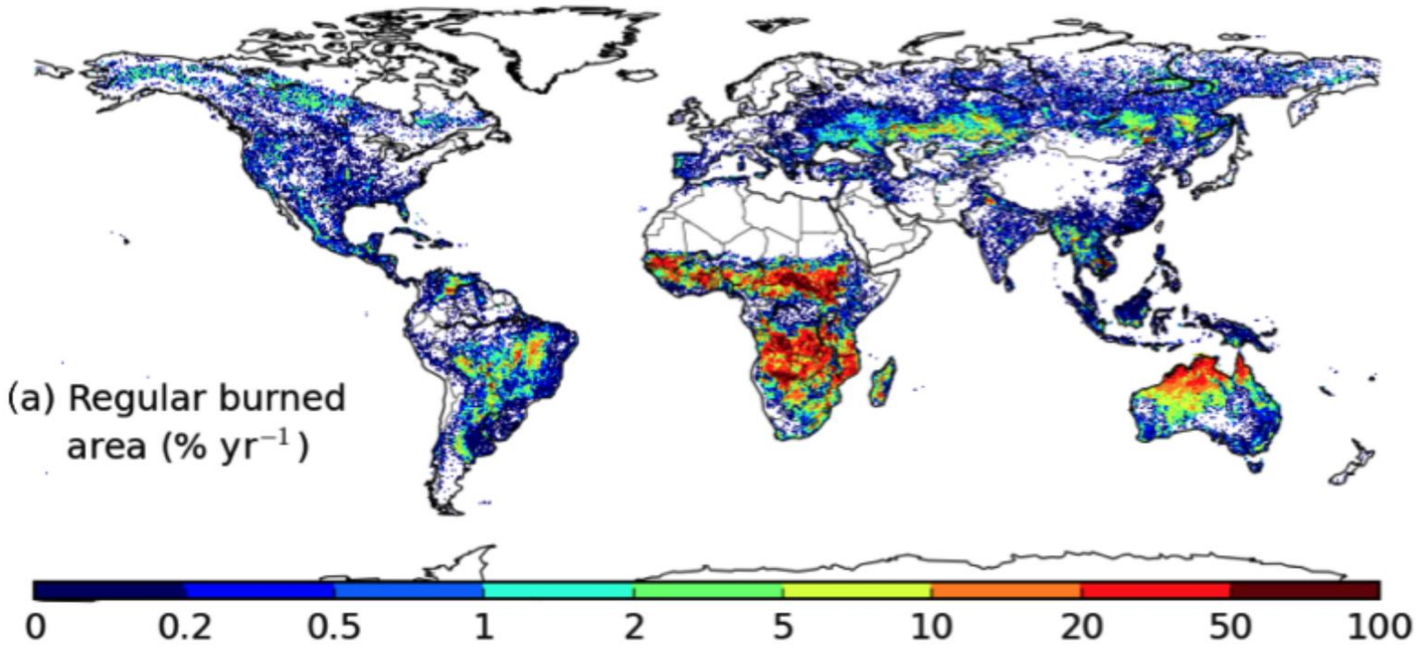
Strong Enabling Environment

- Recognised Emissions Methodologies - (Methane, Nitrous Oxide, (Sequestration))
- Satellite Monitoring i.e NAFI
- Accounting Tools (i.e. SavBat)

ISFMI

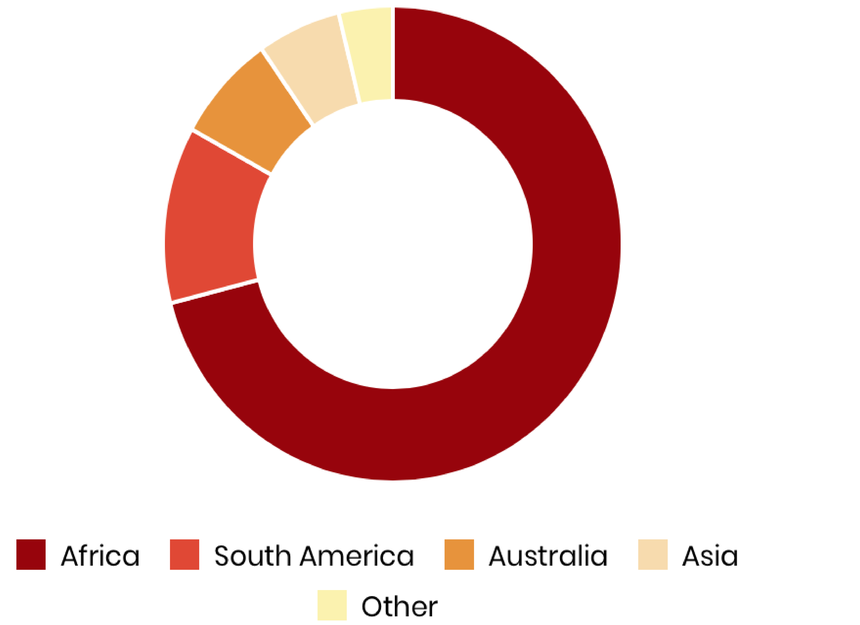
ISFMI Story – Can this Approach Work Globally?

Proportion of area burnt, 2003-2016, per 0.25^0 cells



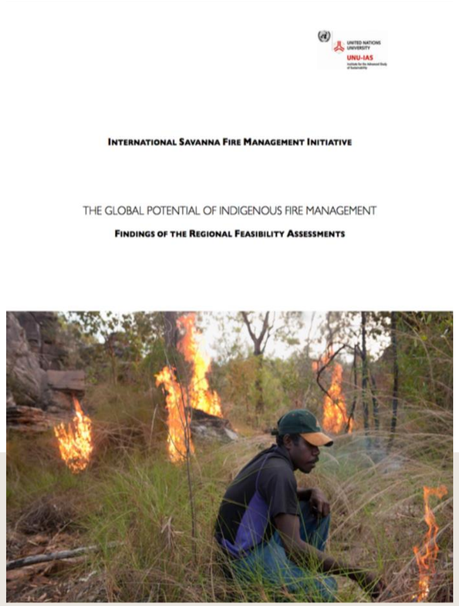
ISFMI Story – Can this Approach Work Globally?

- Savanna fire emissions are predominantly sourced from Africa (71%), followed by Central and South America (12%), Australia (7.3%), Asia (5.9%), Other (3.8%).
- Net emissions from fire represent approximately 3.8% of annual GHG emissions from all sources.



Approximate Regional Contribution to Total Global Fire Emissions

International Savanna Fire Management Initiative (ISFMI)



1st Phase 2012 - 2015

- Global Feasibility Study establishes potential of Emissions Reductions Traditional Fire Management across savanna and tropical dry forests of world.
- Building international interdisciplinary multi-stakeholder network

2nd Phase 2018 - 2021

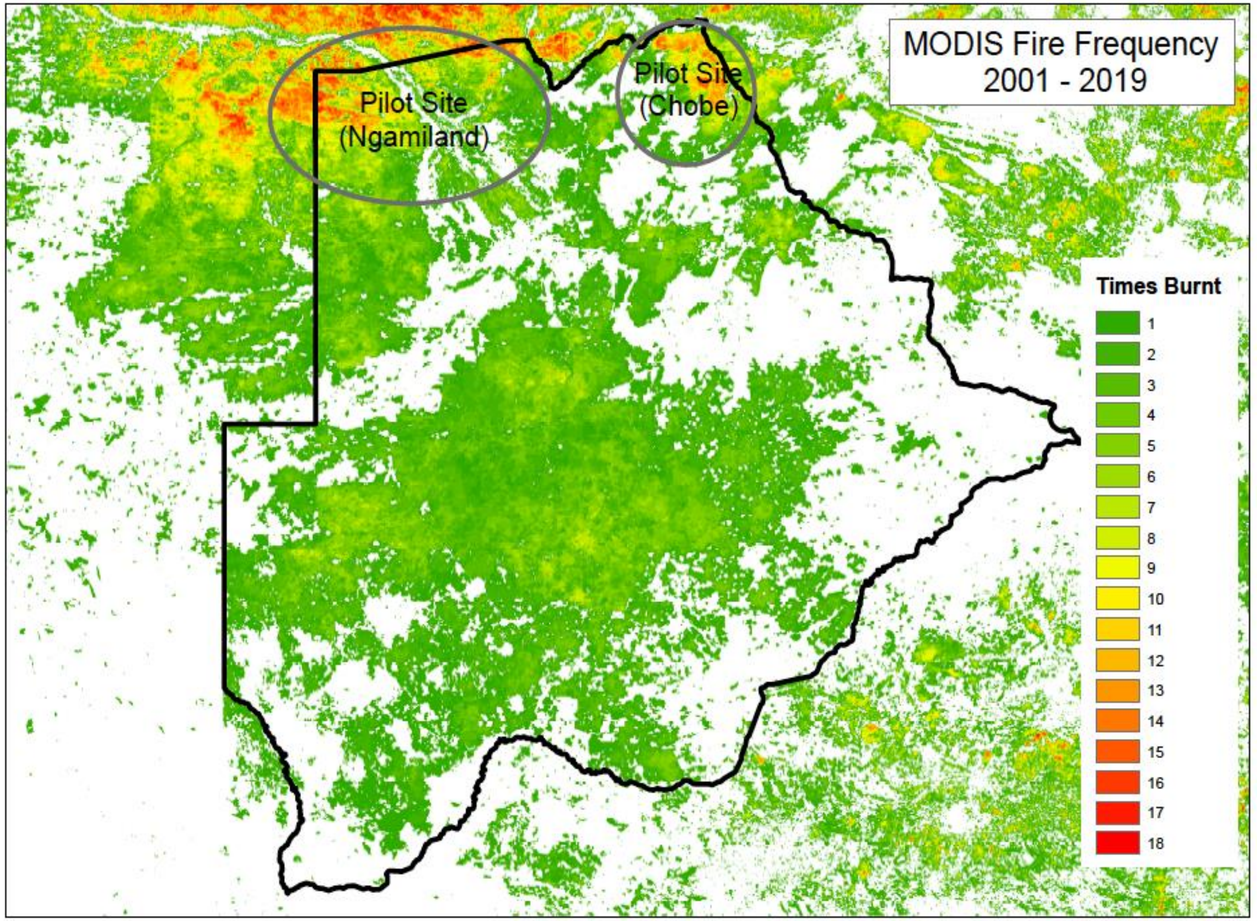
- Proof of Concept - Pilot Sites Botswana
- Proved Technical Viability of Emissions Reductions Savanna Fire Management outside Australia

Next Steps

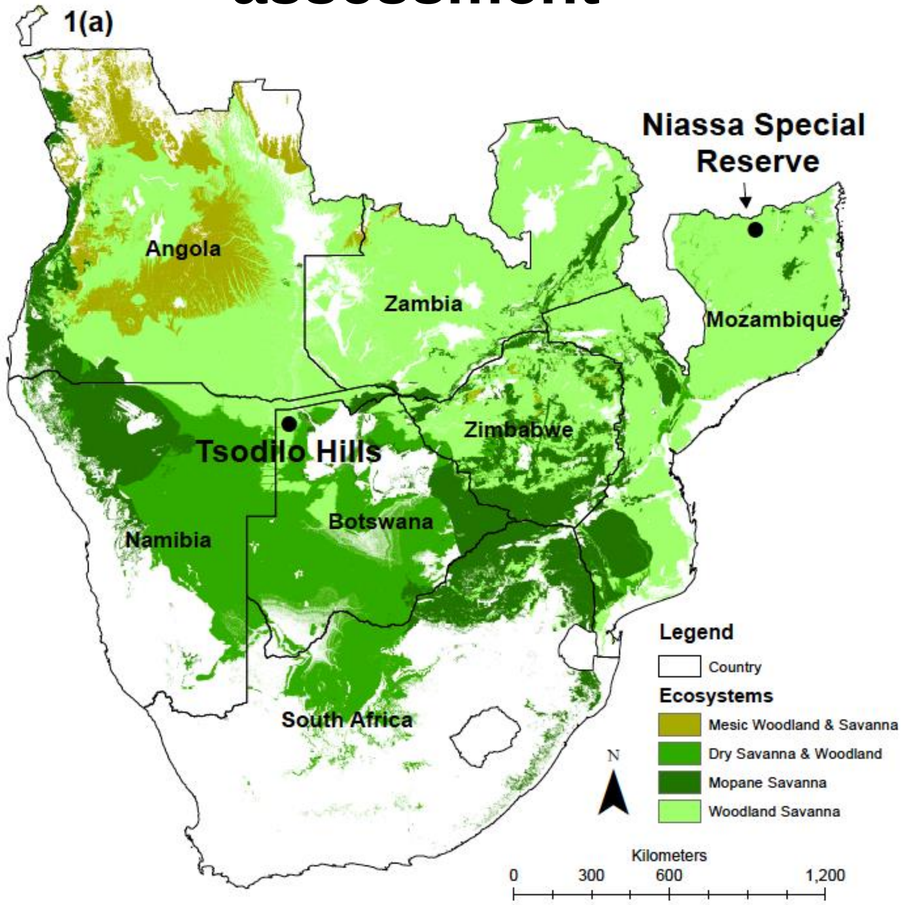
- Building enabling environments at national/regional level
- Working towards First ER TFM Carbon Offsets in Southern Africa

ISFMI

Botswana Pilot Study



Tsodilo & Niassa assessment



Publication of technical assessment, early 2021:

"*Our assessment demonstrates that application of a savanna burning emissions abatement method focused on the undertaking of strategically located early dry season (EDS) burning to reduce LDS wildfire extent and resultant emissions meets key technical criteria, including: LDS fine fuels tend to be markedly greater than EDS fuels given seasonal leaf litter inputs; LDS fires tend to be significantly more severe and combust more fuels; methane and nitrous oxide emission factors are essentially equivalent in EDS and LDS periods under cured fuel conditions*."

Journal of Environmental Management xxx (xxxx) 112414

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Research article

Opportunities and challenges for savanna burning emissions abatement in southern Africa

Jeremy Russell-Smith [a, b, *], Cameron Yates [a, b], Roland Vernooij [c], Tom Eames [c], Guido van der Werf [c], Natasha Ribeiro [d], Andrew Edwards [a, b], Robin Beatty [b, e], Othusitse Lekoko [a, b, f], Jomo Mafoko [g], Catherine Monagle [b], Sam Johnston [b]

[a] Darwin Centre for Bushfire Research, Charles Darwin University, Darwin, 0909, Northern Territory, Australia
[b] International Savanna Fire Management Initiative (ISFMI), Level 4, 346 Kent Street, Sydney, 2000, New South Wales, Australia
[c] Department of Earth Sciences, Faculty of Science, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands
[d] Faculty of Agronomy and Forest Engineering, Eduardo Mondlane University, P.O. Box 257, Maputo, Mozambique
[e] 321 Fire, Praia Do Tofo, Inhambane, 1300, Mozambique
[f] Department of Environmental Science, University of Botswana, Private Bag UB, 0022, Gaborone, Botswana
[g] Department of Forestry and Range Resources, Private Bag BO 199, Gaborone, Botswana

ARTICLE INFO

Keywords:
Fire management
Biomass burning
Emission factors
Botswana
Mozambique
Livelihood benefits

ABSTRACT

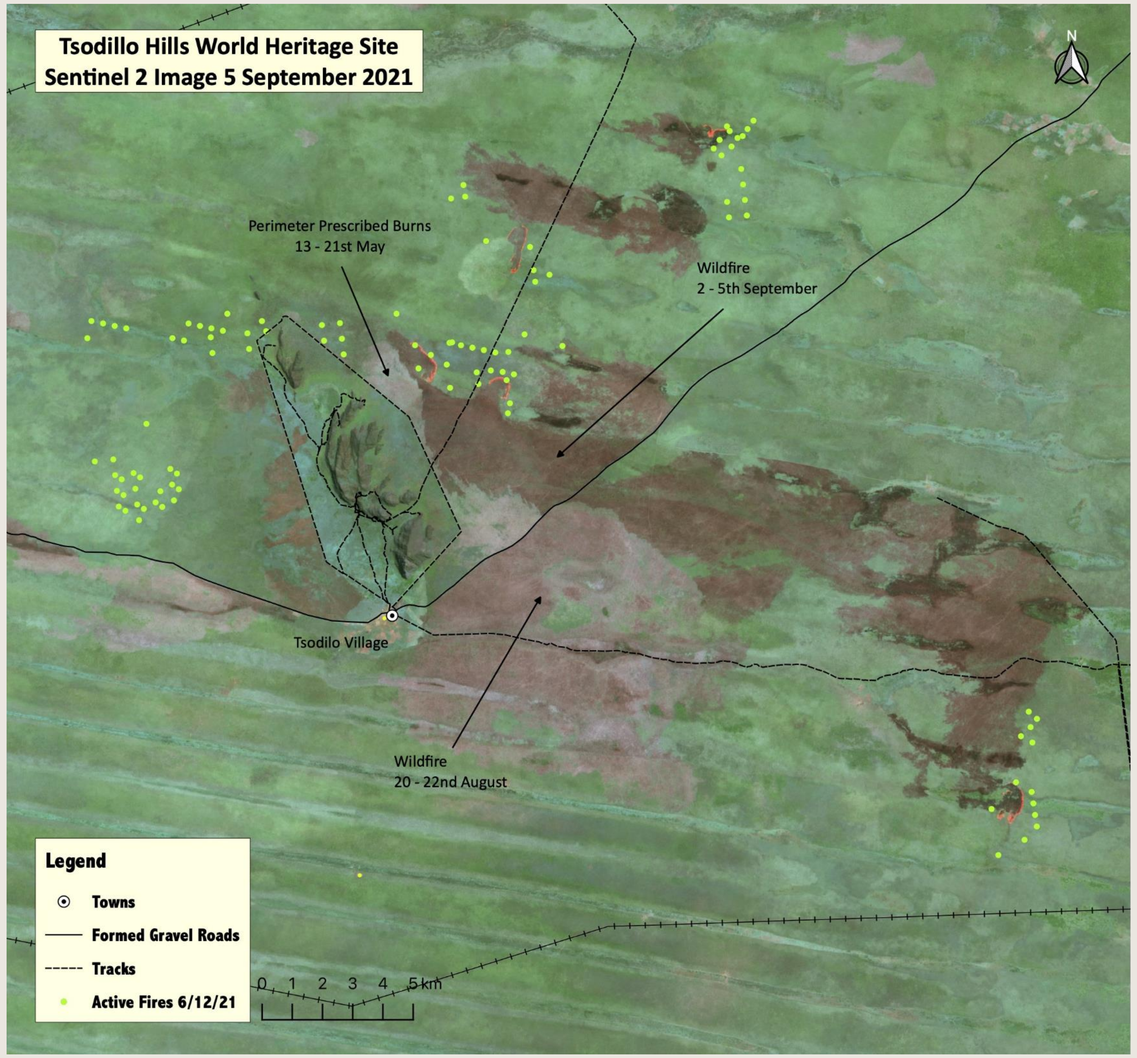
Savanna fires occurring in sub-Saharan Africa account for over 60% of global fire extent, of which more than half occurs in the Southern Hemisphere contributing ~29% of global fire emissions. Building on experience in reducing savanna fire emissions in fire-prone north Australian savannas through implementation of an internationally accredited 'savanna burning' emissions abatement methodology, we explore opportunities and challenges associated with the application of a similar approach to incentivise emissions reduction in fire-prone southern African savannas. We first show that for a focal region covering seven contiguous countries, at least 80% of annual savanna large fire (>250 ha) extent and emissions occur under relatively severe late dry season (LDS) fire-weather conditions, predominantly in sparsely inhabited areas. We then assess the feasibility of adapting the Australian emissions abatement methodology through exploratory field studies at the Tsodilo Hills World Heritage site in north-west Botswana, and the Niassa Special Reserve in northern Mozambique. Our assessment demonstrates that application of a savanna burning emissions abatement method focused on the undertaking of strategically located early dry season (EDS) burning to reduce LDS wildfire extent and resultant emissions meets key technical criteria, including: LDS fine fuels tend to be markedly greater than EDS fuels given seasonal leaf litter inputs; LDS fires tend to be significantly more severe and combust more fuels; methane and nitrous oxide emission factors are essentially equivalent in EDS and LDS periods under cured fuel conditions. In discussion we consider associated key implementation challenges and caveats that need to be addressed for progressing development of savanna burning methods that incentivise sustainable fire management, reduce emissions, and support community livelihoods in wildfire-dominated southern African savannas.

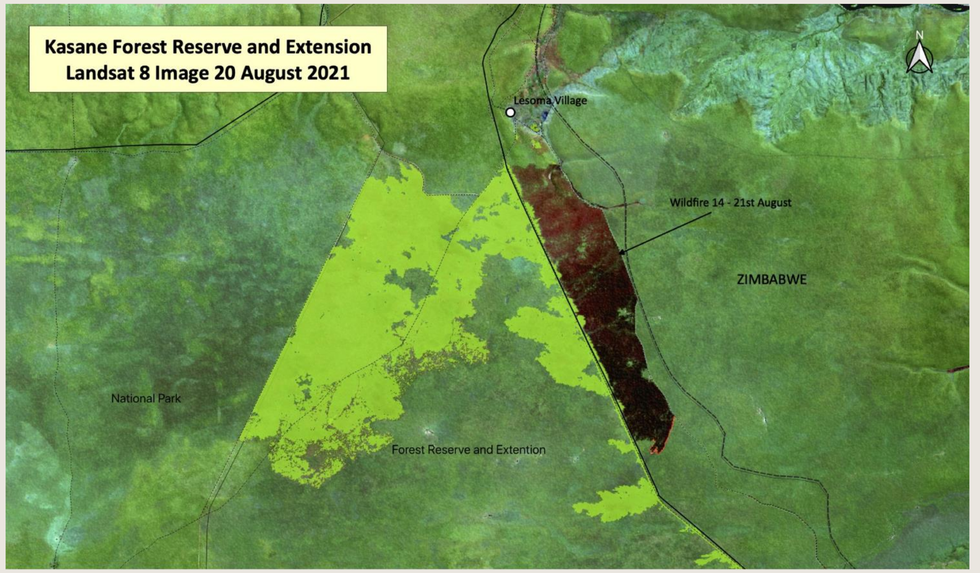
Author credits

Jeremy Russell-Smith: Supervision, Conceptualisation, Investigation, Formal analysis, Writing, review and editing. **Cameron Yates:** Conceptualisation, Investigation, Formal analysis, Writing, Review and editing. **Roland Vernooij:** Conceptualisation, Investigation, Formal analysis, Writing, Review and editing. **Tom Eames:** Conceptualisation, Investigation, Formal analysis, Writing, Review and editing. **Guido van der Werf:** Supervision, Funding acquisition, Conceptualisation, Investigation, Formal analysis, Review and editing. **Natasha Ribeiro:** Supervision, Investigation, Review and editing. **Andrew Edwards:** Investigation, Review and editing. Robin Beatty: Investigation, Review and editing. **Othusitse Lekoko:** Review and editing. **Jomo Mafoko:** Supervision. **Catherine Monagle:** Funding acquisition, Writing, Review and editing. **Sam Johnston:** Funding acquisition, Writing, Review and editing.

* Corresponding author. Darwin Centre for Bushfire Research, Charles Darwin University, Darwin, 0909, Northern Territory, Australia.
E-mail address: Jeremy.russell-smith@cdu.edu.au (J. Russell-Smith).

https://doi.org/10.1016/j.jenvman.2021.112414
Received 18 December 2020; Received in revised form 27 February 2021; Accepted 8 March 2021
0301-4797/

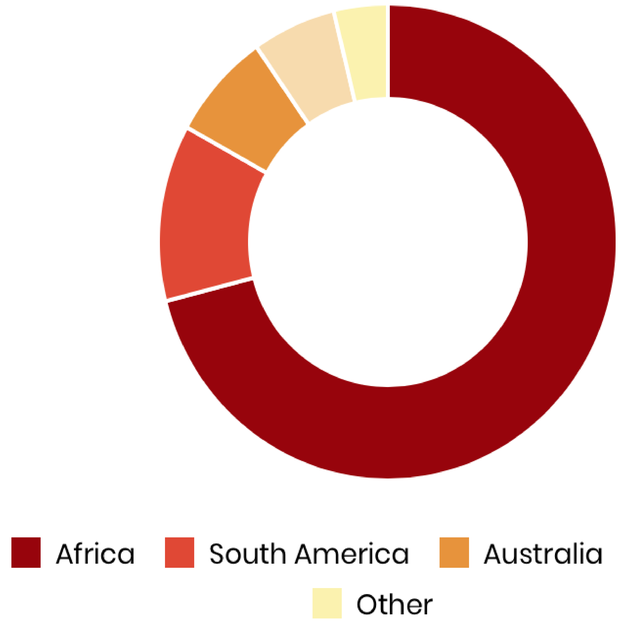

Tsodillo Hills World Heritage Site
Sentinel 2 Image 5 September 2021
N
Perimeter Prescribed Burns
13 - 21st May
Wildfire
2 - 5th September
Tsodilo Village
Wildfire
20 - 22nd August
Legend
Towns
Formed Gravel Roads
Tracks
Active Fires 6/12/21
0 1 2 3 4 5 km


Kasane Forest Reserve and Extension
Landsat 8 Image 20 August 2021
N
Lesoma Village
Wildfire 14 - 21st August
ZIMBABWE
National Park
Forest Reserve and Extention

ISFMI

Strong Global Interest, Strong Scale up Potential

- Africa: i.e. Angola, **Botswana**, **Mozambique**, Namibia, **Zambia**, Zimbabwe and others.
- Americas: i.e. **Belize,** Bolivia, Brazil, Colombia, **Guatemala,** Guyana, Paraguay.
- Asia Pacific: i.e. **Indonesia**, **Papua New Guinea**, **Timor Leste.**



Approximate Regional Contribution to Total Global Fire Emissions

Key Challenges

- **Political - Changing suppression focused paradigm.**
- **Political – Fostering regional cooperation and transboundary management.**
- **Practical – Establishing enabling environment (Methodology Development and Accreditation, MRV, Legal, Regulatory).**
- **Practical – Bridging Community and Project Governance.**
- **Rights and Ethics – Ensuring benefits flow to communities and in a way that supports self identified aspirations and priorities.**

INTERNATIONAL SAVANNA FIRE MANAGEMENT INITIATIVE

ISFMI *Revitalising Indigenous Fire Knowledge Globally*

www.isfmi.org

Catherine Monagle, Senior Programme Manager
monagle@isfmi.org