Smoke composition and flammability of tropical and temperate grasses

FACULTY OF AGRICULTURE & ENVIRONMENT

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bushfire CRC

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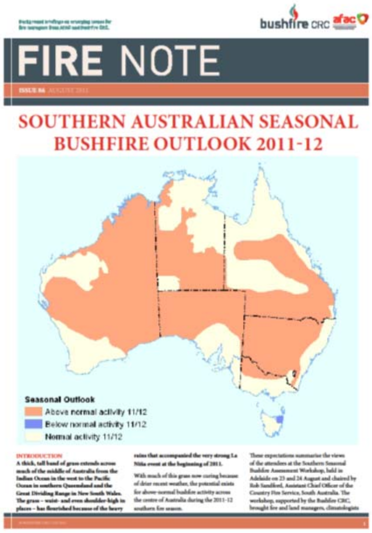
Risk of grass fires



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Previous studies

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 115, D16314, doi:10.1029/2009JD013309, 2010

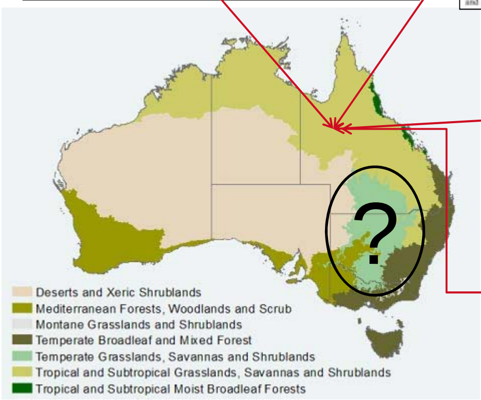
Trace gas emissions from savanna fires in northern Australia

C. Paton-Walsh,[1] N. M. Deutscher,[1] D. W. T. Griffith,[1] B. W. Forgan,[2] S. R. Wilson,[1] N. B. Jones,[1] and D. P. Edwards[3]

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 108, NO. D3, 8406, doi:10.1029/2001JD000841, 2003

Emission estimates of selected volatile organic compounds from tropical savanna burning in northern Australia

T. Shirai,[1] D. R. Blake,[2] S. Meinardi,[2] F. S. Rowland,[2] J. Russell-Smith,[3] A. Edwards,[3] Y. Kondo,[4] M. Koike,[5] K. Kita,[6] T. Machida,[7] N. Takegawa,[8] N. Nishi,[9] S. Kawakami,[1] and T. Ogawa[1]



http://www.environment.gov.au/parks/nrs/science/bioregion-framework/terrestrial-habitats.html

Journal of Atmospheric Chemistry **18**: 33–56, 1994.
© 1994 *Kluwer Academic Publishers. Printed in the Netherlands.*

Measurements of Trace Gases Emitted by Australian Savanna Fires During the 1990 Dry Season

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JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 99, NO. D8, PAGES 16,441–16,456, AUGUST 20, 1994

Trace gas emissions from biomass burning in tropical Australian savannas

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CSIRO Tropical Ecosystems Research Centre, Darwin, Northern Territory, Australia

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Study locations

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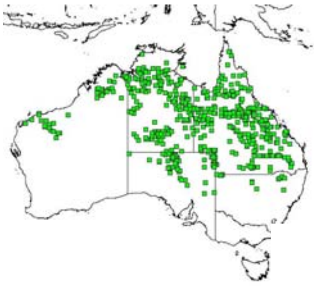
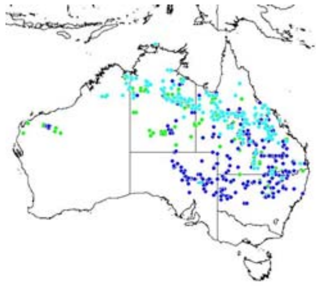
Distribution of NT material

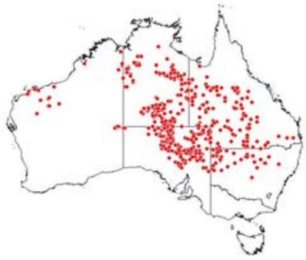
Aristida latifolia



Astrebla spp



Astrebla pectinata



Figures: http://www.anbg.gov.au/avh/index.jsp 5

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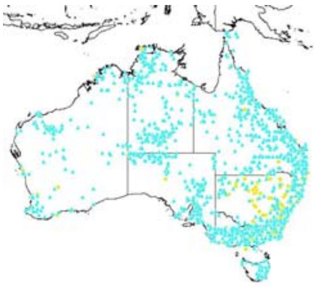
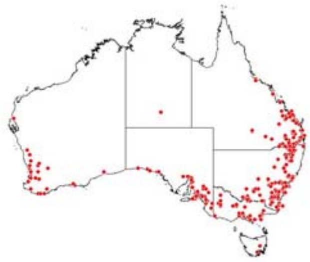
Distribution of ACT material

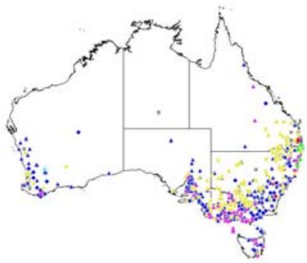
Themeda triandra



Eragrostis curvula



Phalaris spp.



Figures: http://www.anbg.gov.au/avh/index.jsp 6

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Smoke composition and flammability measurements

IRGAs:
CO_2 and CO concentrations

PTR-MS:
VOC measurements

Mass-loss calorimeter:
Energy release and mass loss under a fixed irradiance

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Definitions

Flammability (Anderson, 1970; Martin *et al*. 1994)

1. Ignitability: time taken until ignition on exposure to a heat source
2. Sustainability: the ability to maintain fire once it is ignited
3. Combustibility: rate of burning after ignition
4. Consumability: proportion of mass or volume consumed by fire

Emission factor

- The amount of a given compound released per amount of dry fuel consumed

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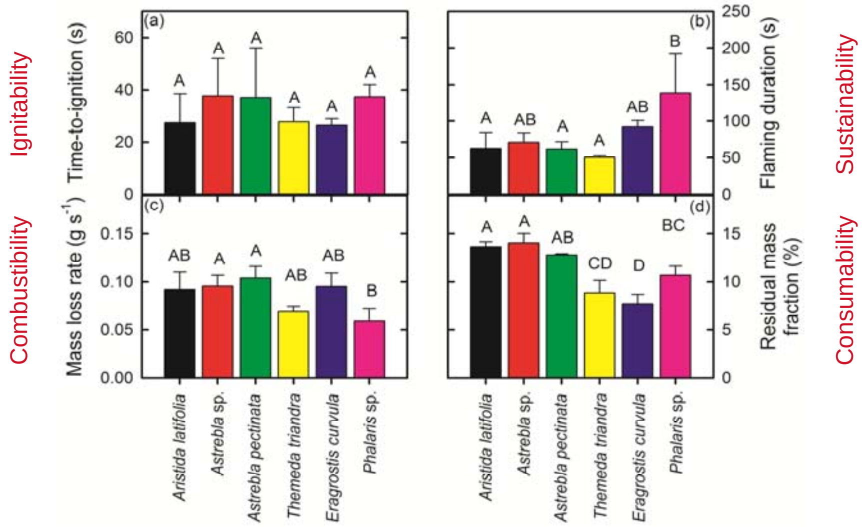
Flammability components



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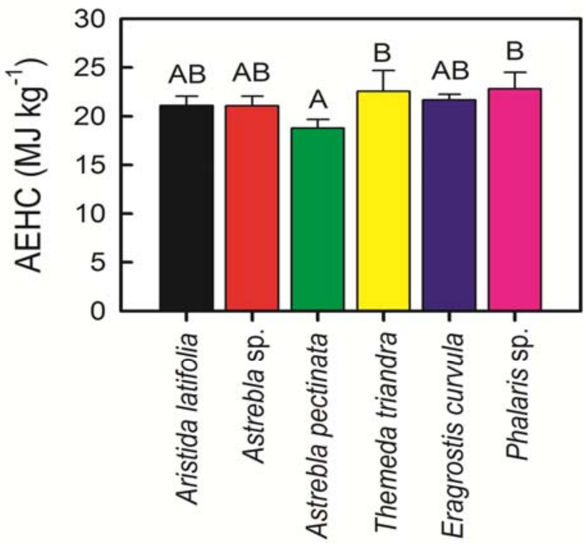
Energy of combustion



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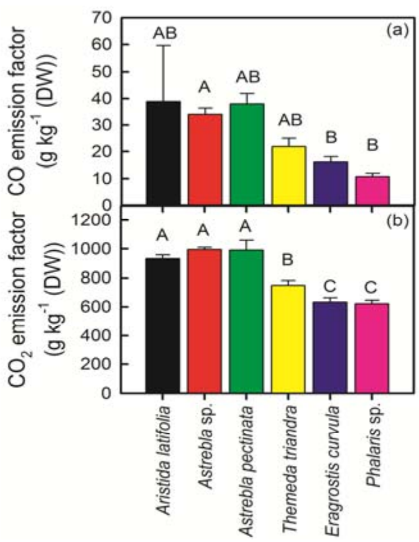
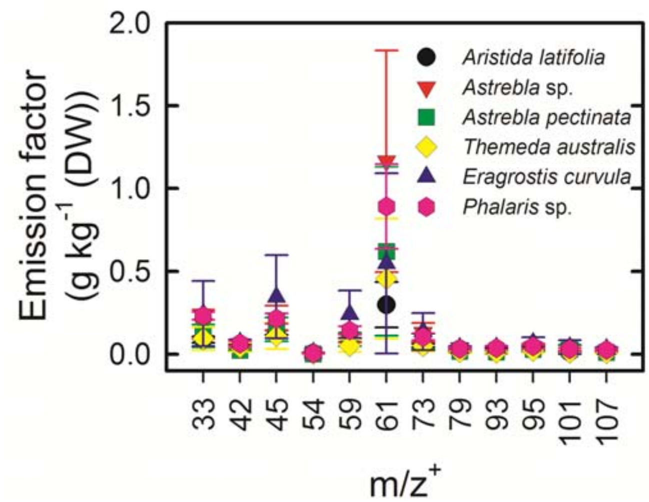
Multi-criteria analysis of flammability

Species	Normalised scores[a]					
	Time-to-ignition	Flame duration	Mass-loss rate	Residual mass fraction	Total	Rank
Aristida latifolia	91.18	13.96	73.17	6.22	46.13	3
***Astrebla* sp.**	0	23.40	81.28	0	26.17	6
Astrebla pectinata	5.88	13.21	100.00	20.12	34.80	5
Themeda triandra	88.24	0	23.04	81.98	48.32	2
Eragrostis curvula	100.00	47.17	80.02	100.00	81.80	1
***Phalaris* sp.**	2.94	100.00	0	53.31	39.06	4

CO_2 and CO emission factors



VOC emission factors



VOC emission factors

	Australian savanna and grassland		Global savanna and grassland	
Compound(s)[a]	This study	Shirai et al. (2003)	Akagi et al. (2011)	Andreae and Merlet (2000)
Methanol[b]	0.162 ± 0.107	-	1.18 ± 0.41	1.30
Acetonitrile[b]	0.049 ± 0.023	-	0.11 ± 0.07	0.11
Acetaldehyde[b]	0.198 ± 0.130	-	0.57 ± 0.30	0.50 ± 0.39
Acrylonitrile[b]	0.004 ± 0.002	-	0.05 ± 0.02	
Acetone[b]	0.120 ± 0.086	-	0.16 ± 0.13	0.25 - 0.62
Acetic acid [d]	0.684 ± 0.485	-	3.55 ± 1.47	1.30
Methyl ethyl ketone[b]	0.094 ± 0.061	-	-	0.26
Benzene[b,c]	0.028 ± 0.001	0.035 ± 0.004	0.20 ± 0.08	0.23 ± 0.11
Toluene[b,c]	0.024 ± 0.014	0.012 ± 0.001	0.08 ± 0.07	0.13 ± 0.06
Phenol[b]	0.040 ± 0.022	-	0.52 ± 0.36	0.003
Methyl isobutyl ketone[b]	0.028 ± 0.023	-	-	-
Xylenes[b,c] Ethylbenzene[b] Benzaldehyde	0.018 ± 0.001	-	-	-

Summary

- There are a number of differences in the components of flammability and emission factors between grass species.
- Except for the emission factors for CO_2, no obvious patterns between the grasses were measured.
- The invasive grass has the potential to be more flammable than the native grasses.
- More data is needed from other grass species.
- Do grasses from other grasslands behave the same?

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Acknowledgments

- Bill Harney for access to his property in the Northern Territory

- **University of Sydney**

Dr. Tina Bell	Felipe Aires
Dr. Tony Winters	Vicky Aerts
Dr. Sebastian Pfautsch	Valerie Densmore

- **ACT Parks and Conservation Service**

Neil Cooper (Lead end user)	Adam Leavesley

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