A Negative Fire Feedback in a Transitional Forest of Southeastern Amazonia

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Predominant paradigms…

Fire begets more fire in Amazon forests.

&

Moisture dynamics control fire behavior.

Objectives & Hypotheses

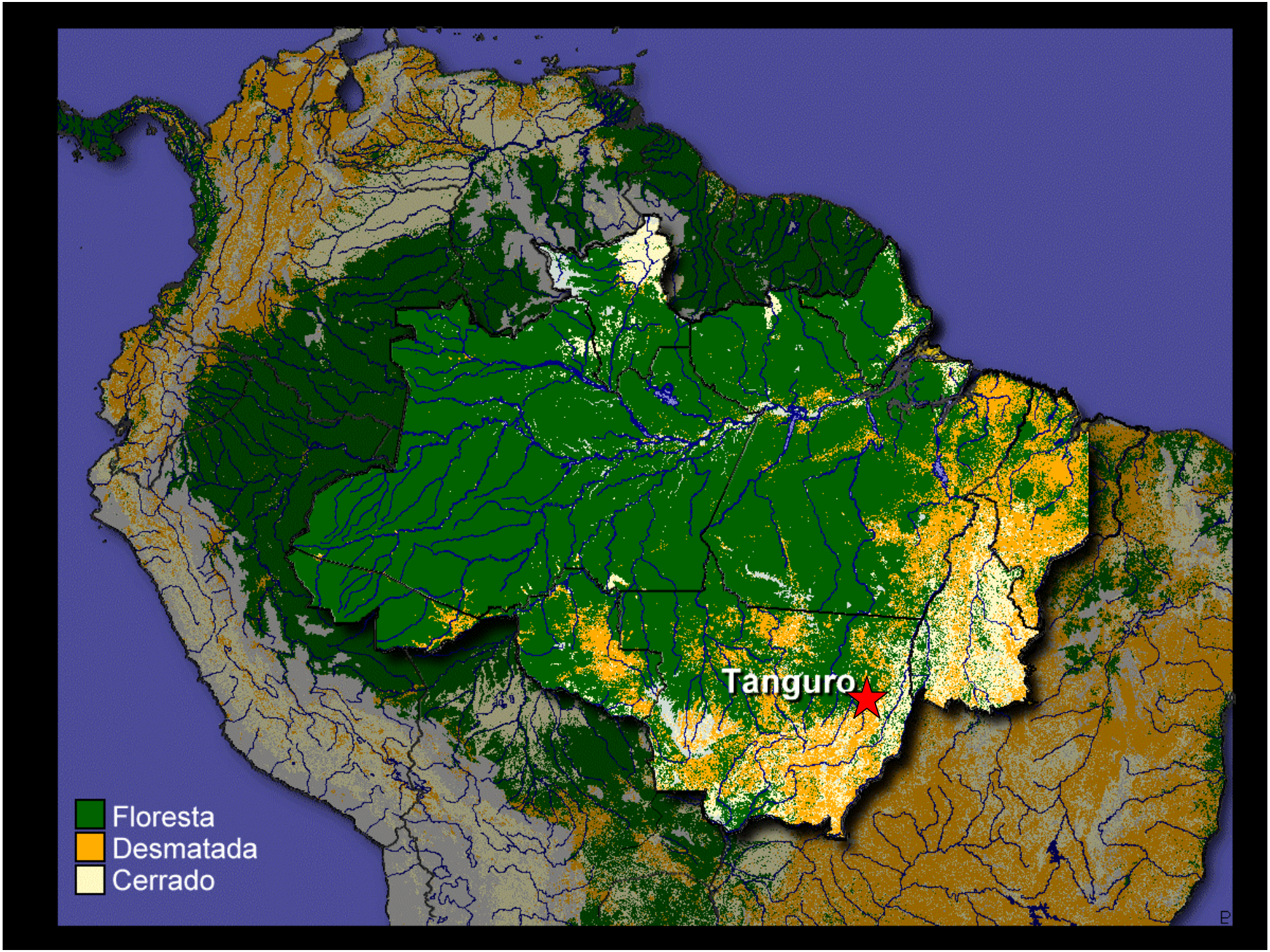
- Compare fuel loads & moisture, microclimate, and fire behavior in an annually burned plot after 1, 2, and 3 prescribed burns

Expect an **increase in fuels** and **drier understory** leads to increased burned area and fire intensity

Objectives & Hypotheses

- After two burns test the effects of fuel additions, in canopy gaps and non-gaps, on fire intensity, fire spread rate, and burn extent

Expect **microclimate** rather than fuels controlling fire behavior

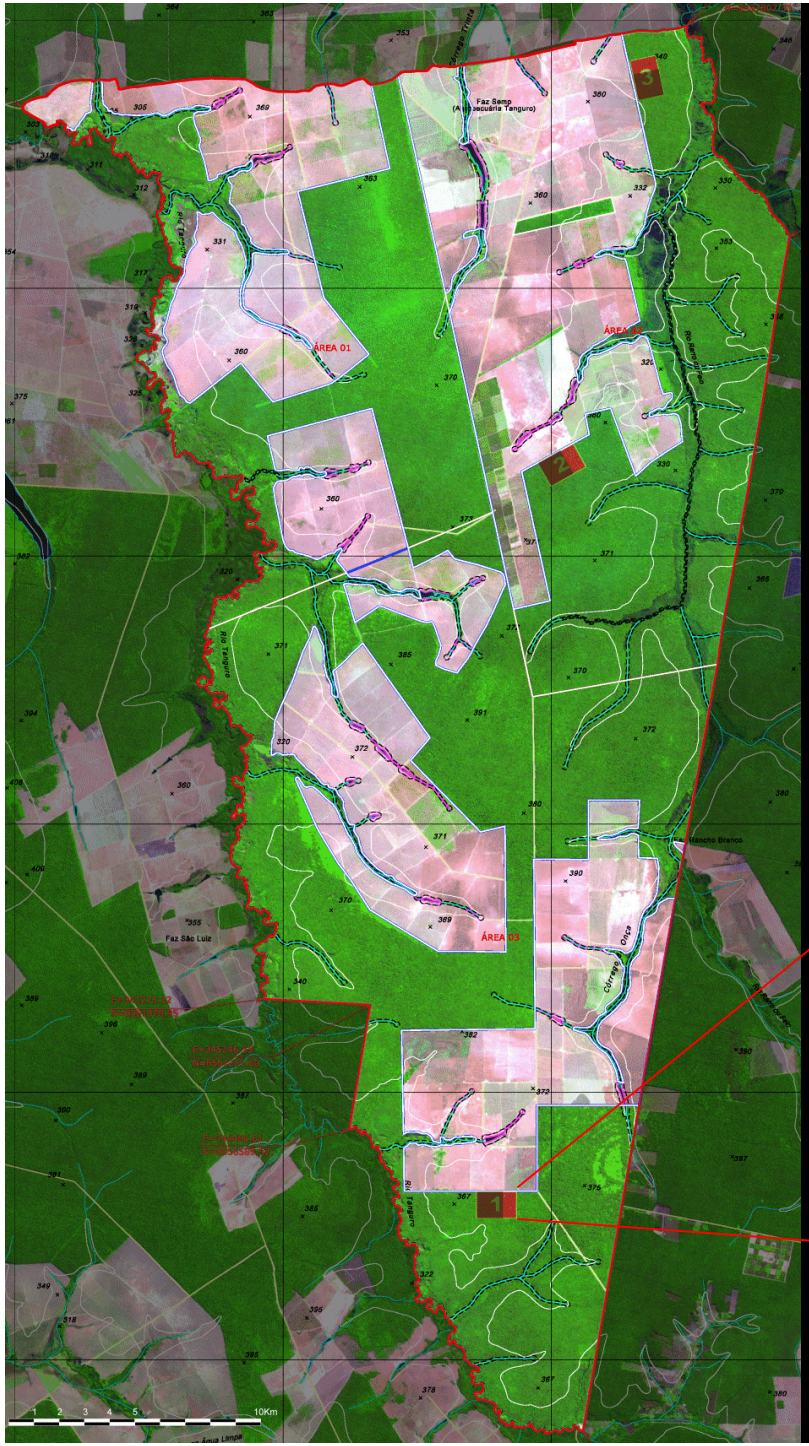

Tanguro
Floresta
Desmatada
Cerrado

Transitional forest ~400,000 km²

Rainfall: 1740 mm yr^{-1}
Severe 5-mo dry season:
(< 10 mm 3 mo, < 50 mm 2 mo)
Soils: Oxisols (Haplustox)

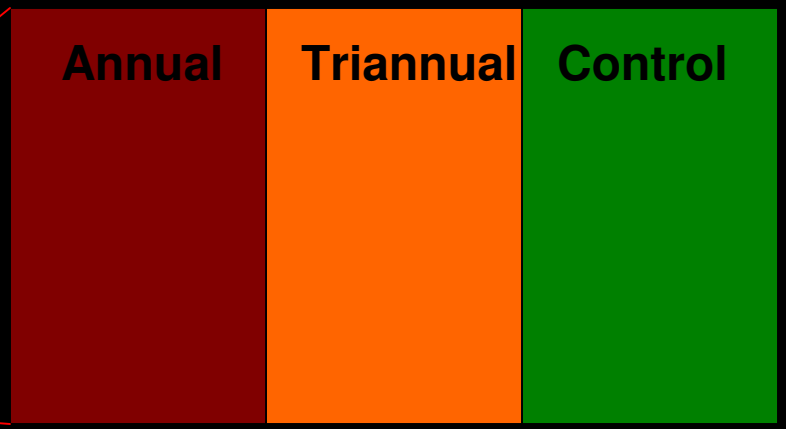
Leaf litter production: 4.3 Mg $ha^{-1}yr^{-1}$
Biomass: 191 ± 6 Mg ha^{-1}
Canopy height: 20 ± 1 m
LAI max: ~5 m^2 m^{-2}

Lower diversity: ~100 tree species
Dominance: Lauraceae

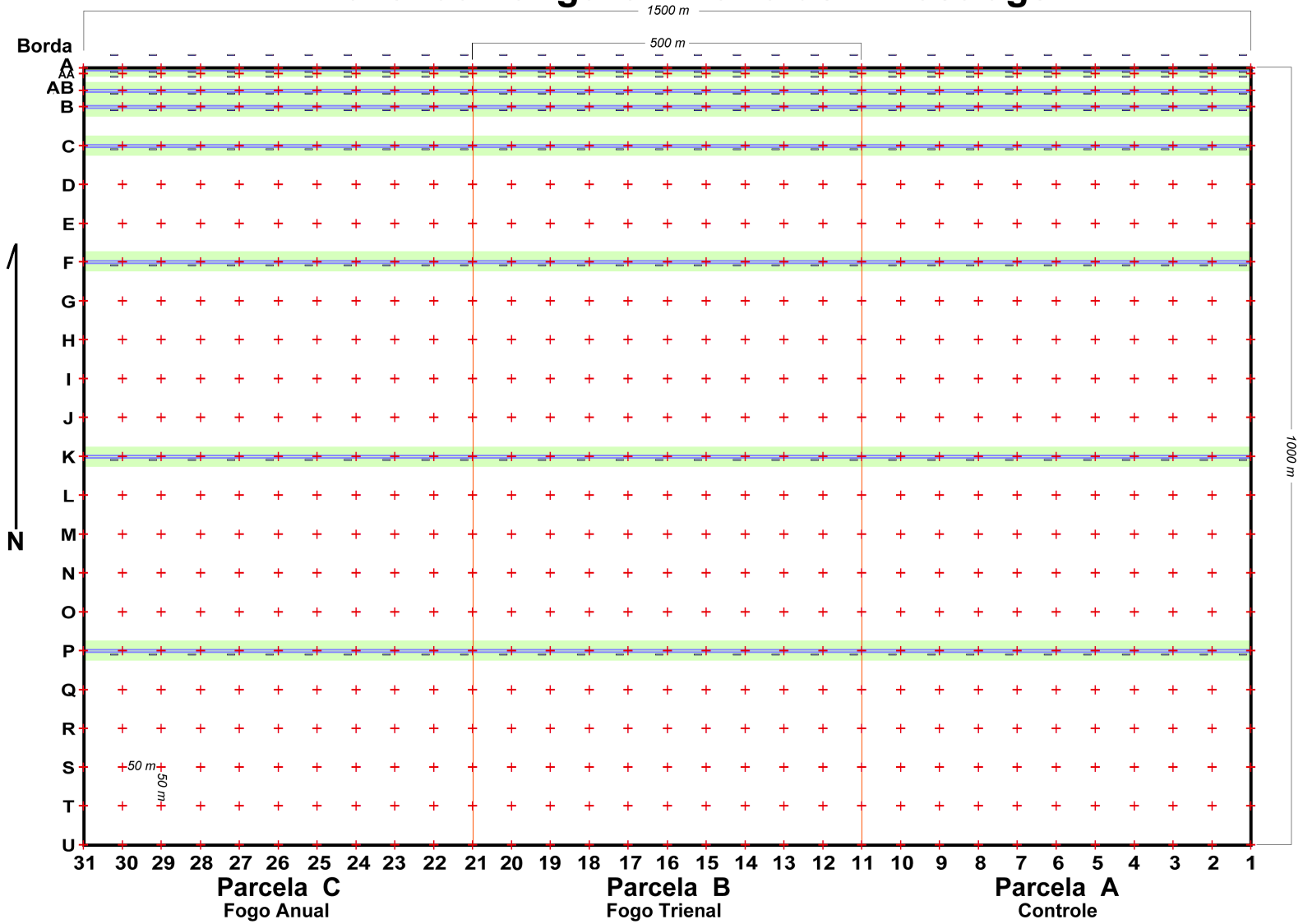


Experimental Design:

- Two fire regimes
- 1st 100-ha burn Aug. 2004
- 2nd 50-ha burn Sept. 2005
- 3rd 50-ha burn Aug/Sept. 2006
- 4th 100-ha burn Aug. 2007



Fazenda Tanguro: Plano de Amostragem



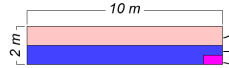
Inventários:

Area Total — > 40cm DAP

> 20cm DAP

>10cm DAP

Sub-Parcelas:

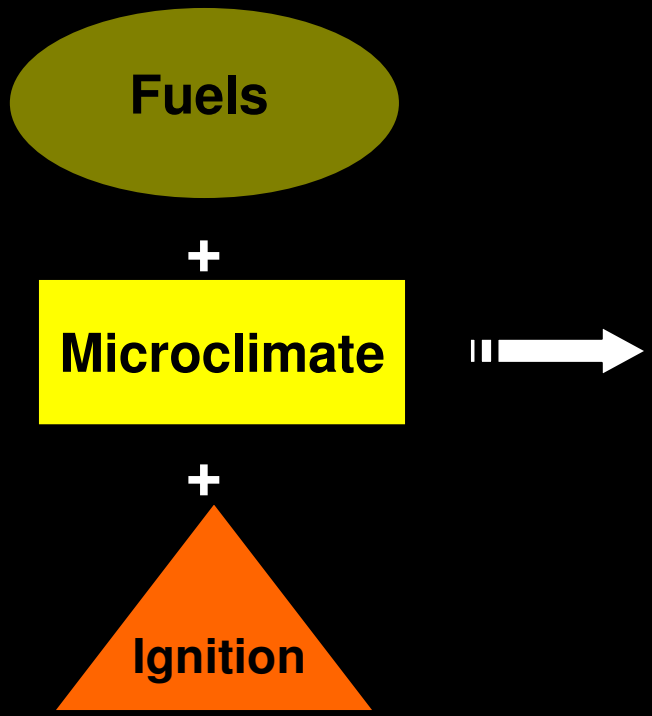


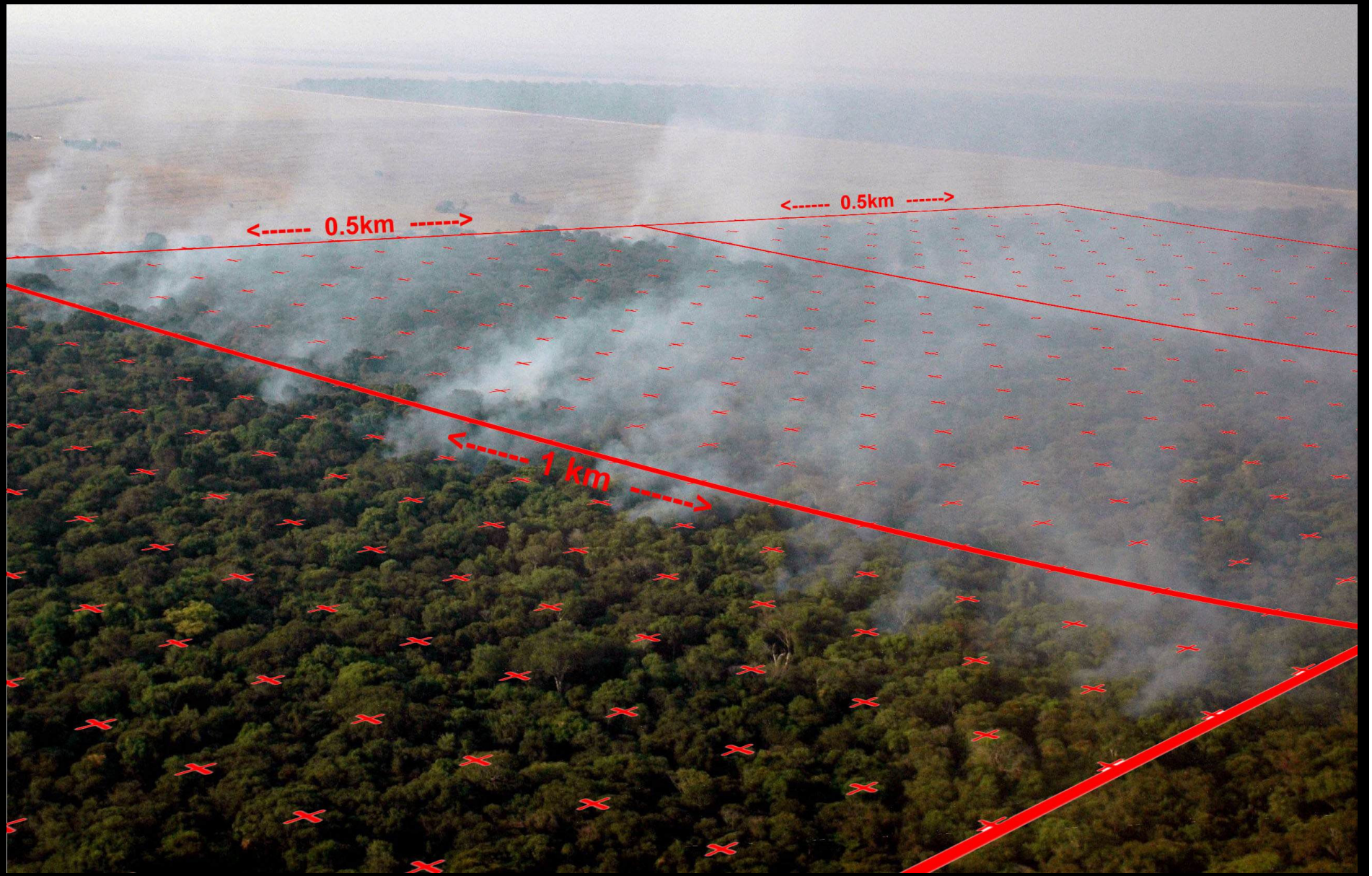
< 10 cm DAP

< 5 cm DAP

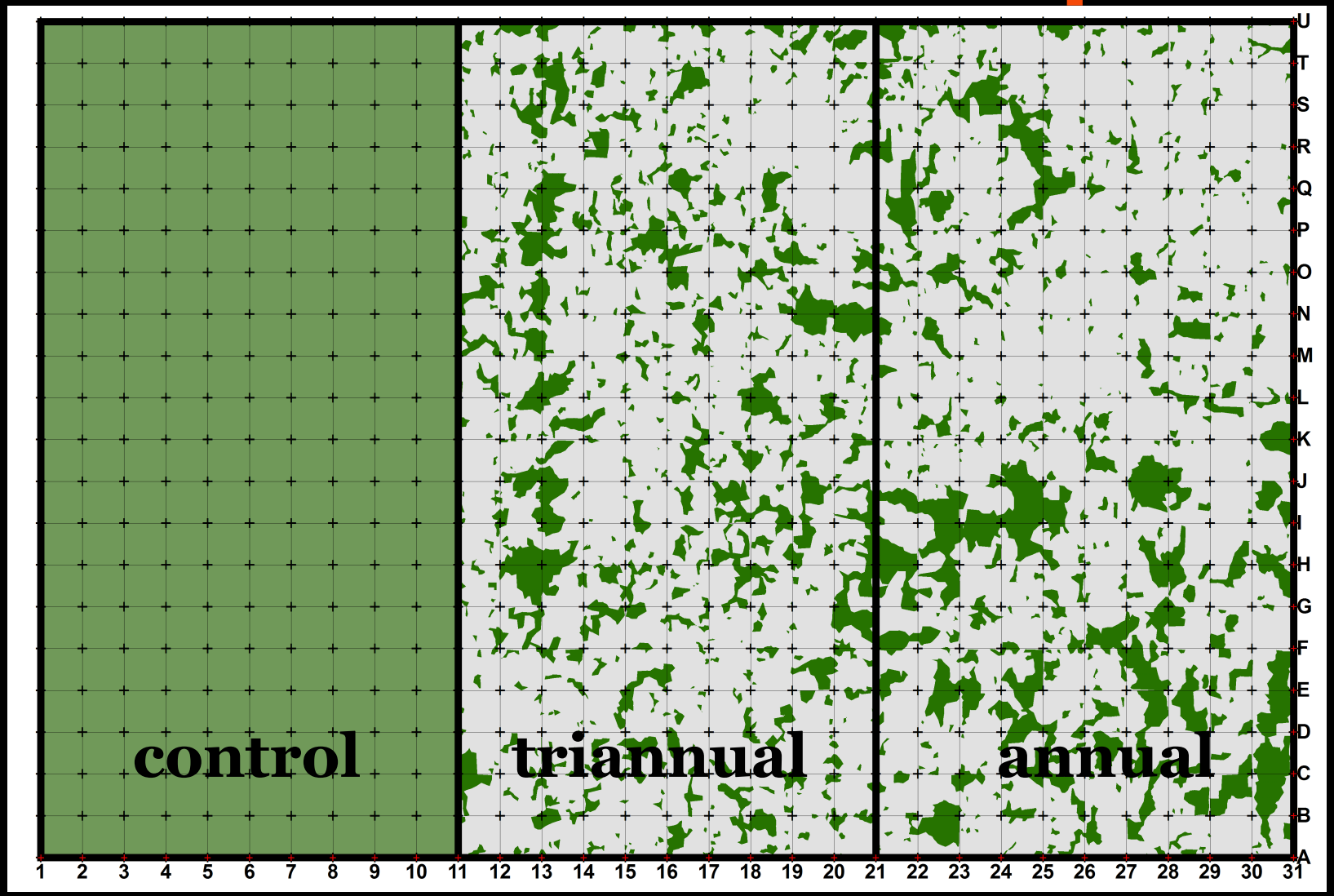
< 1 cm DAP

Forest flammability:



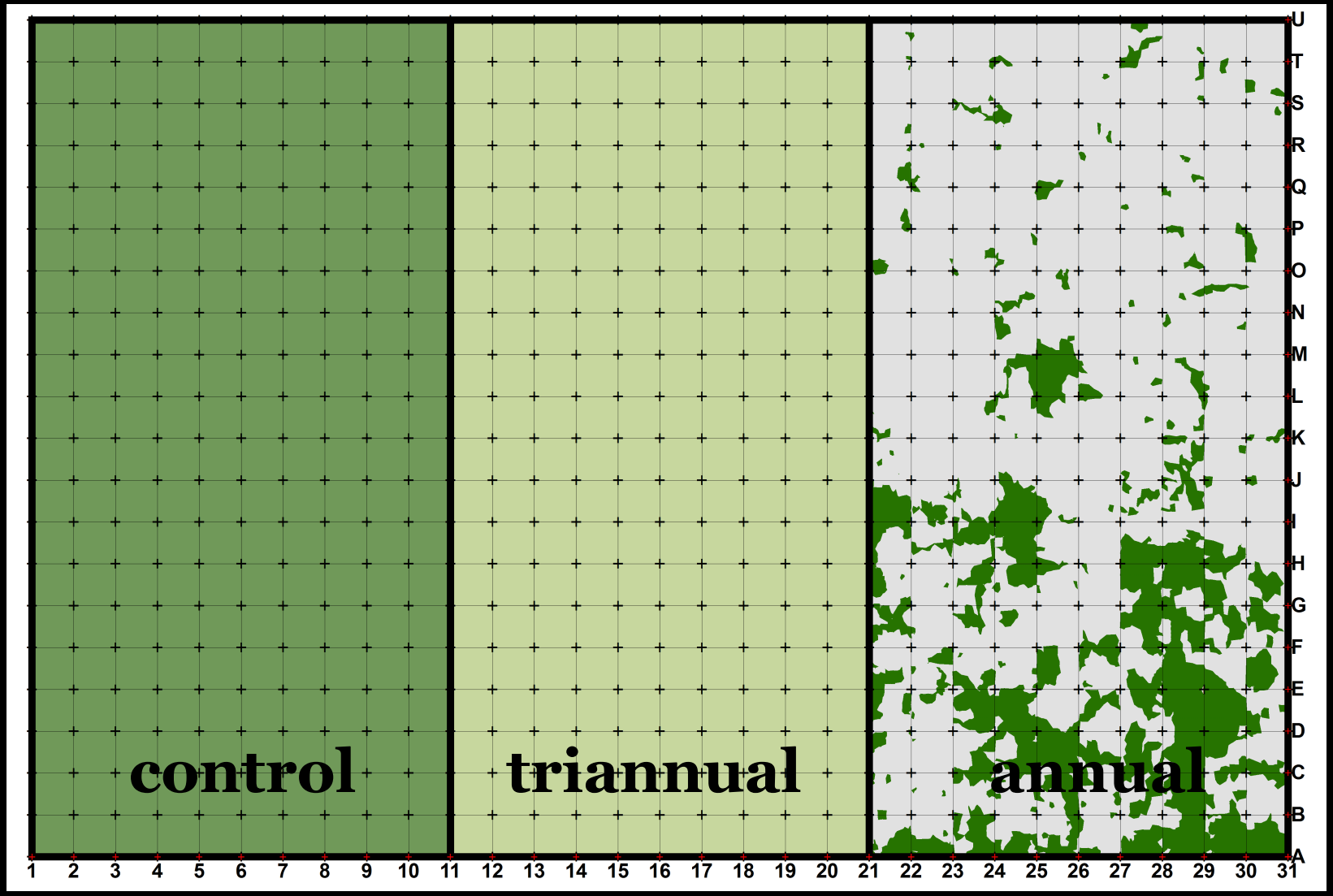

<------ 0.5km ------>
<------ 0.5km ------>
<------ 1 km ------>

1st Burn - 2004



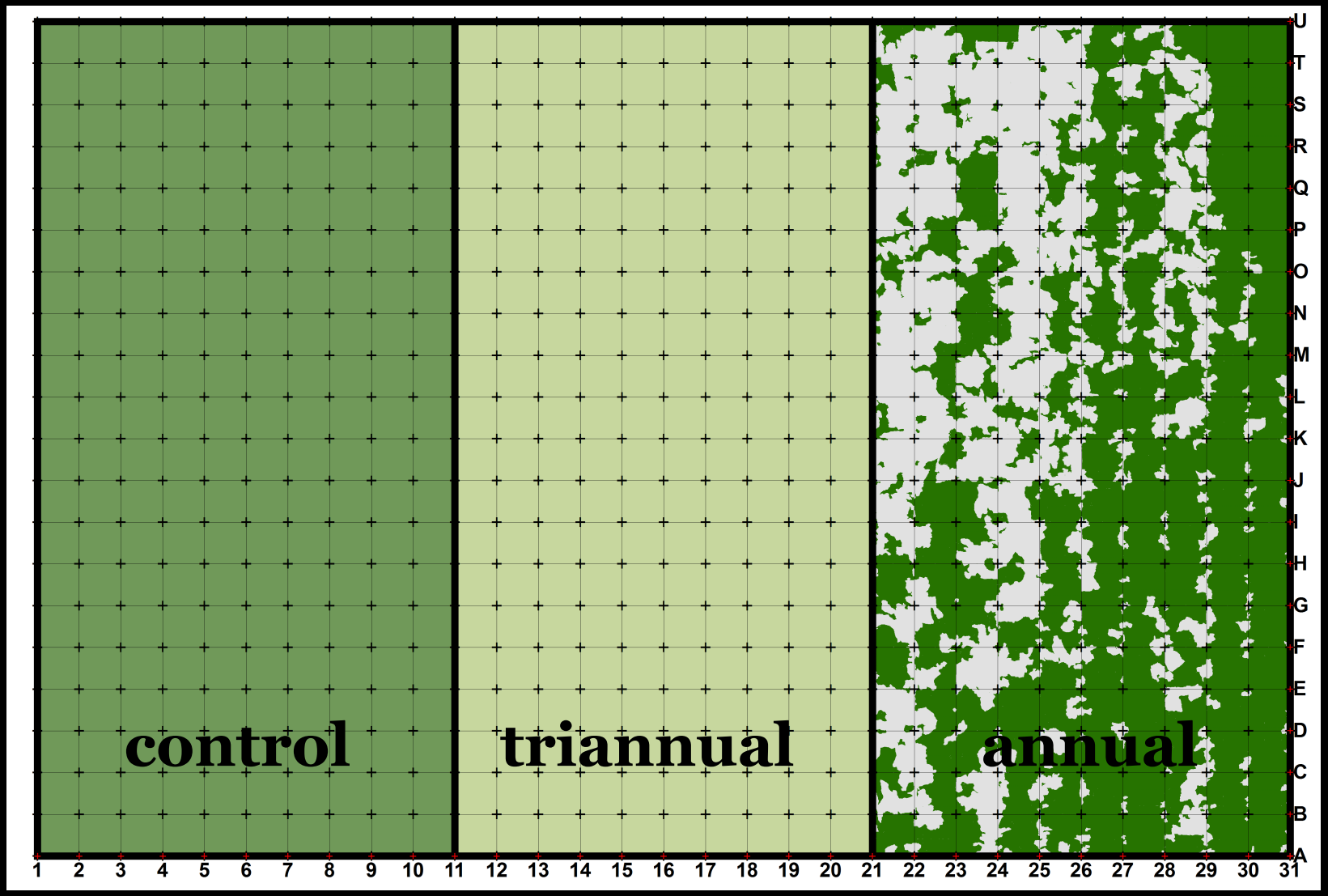
80% burned

2nd Burn - 2005



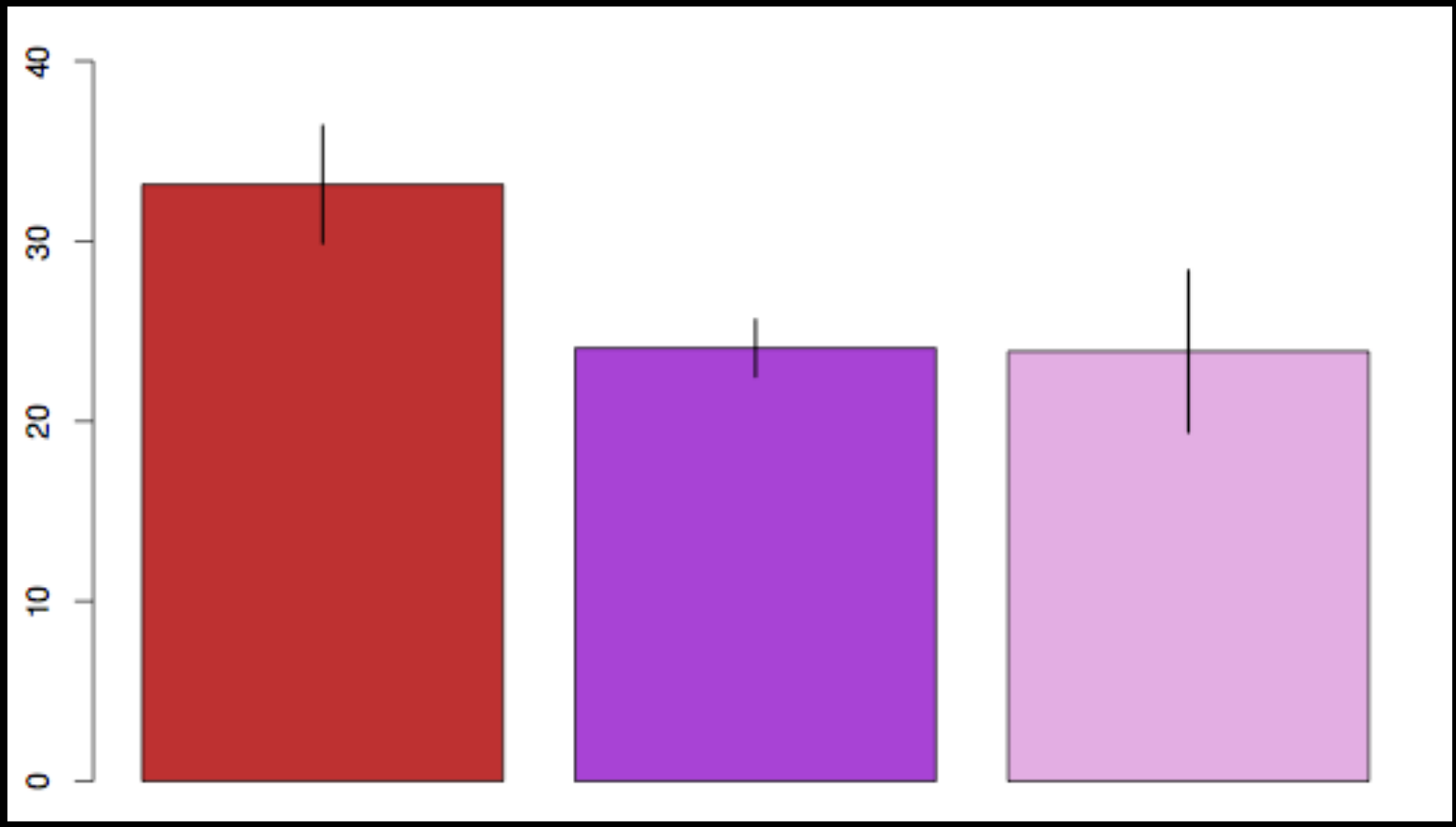
80% burned

3rd Burn - 2006



40% burned!

Flame Height (cm)



1st, 2nd, and 3rd burn

CARBON CONSEQUENCES:

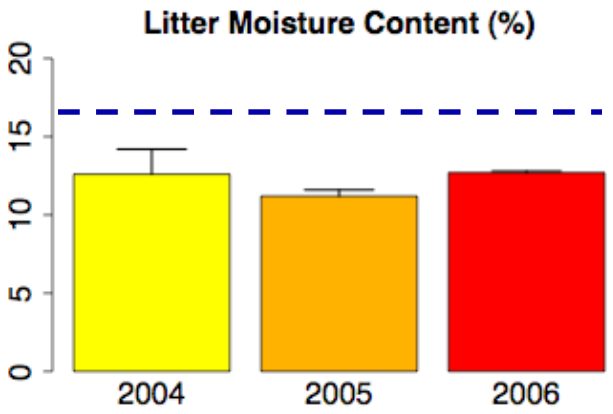
Dead biomass combustion (± SE)

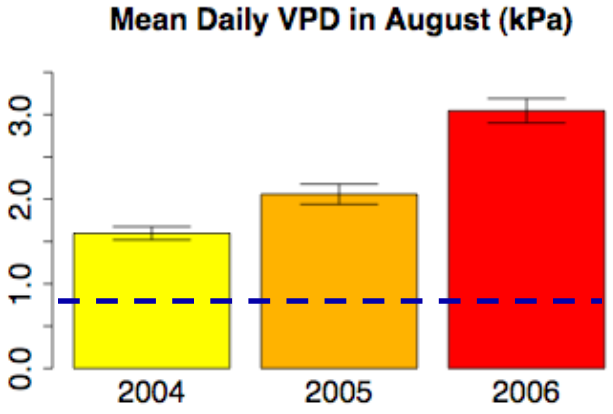
44.5 (± 21.2) Mg ha^{-1}

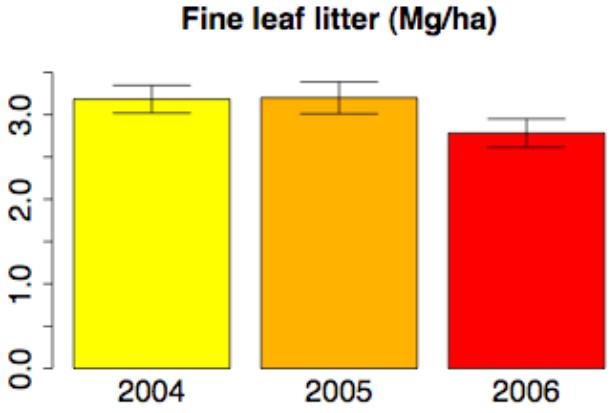
23.2 (± 9.1) Mg ha^{-1}

15.3 (± 9.3) Mg ha^{-1}

(during 1, 2, and 3
consecutive annual burns)

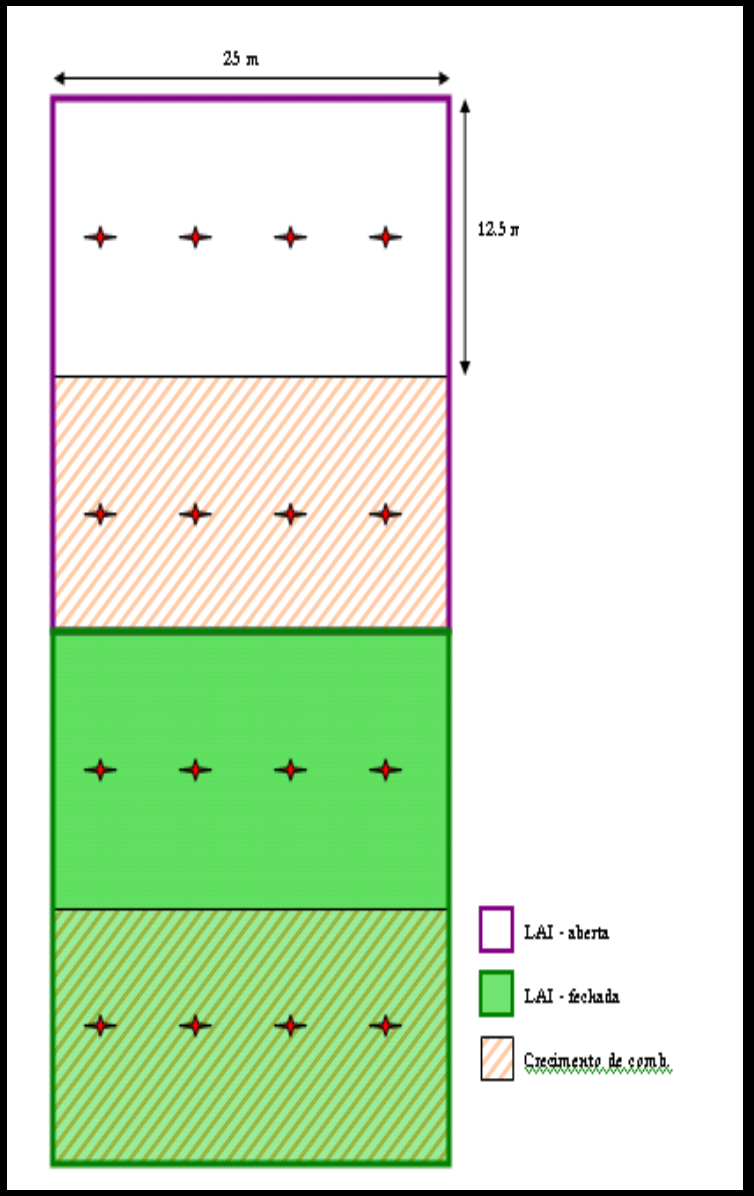

Litter Moisture Content (%)
0
5
10
15
20
2004
2005
2006


Mean Daily VPD in August (kPa)
0.0
1.0
2.0
3.0
2004
2005
2006


Fine leaf litter (Mg/ha)
0.0
1.0
2.0
3.0
2004
2005
2006

“Shouldn’t you rake those up first and *then* set them on fire?”

The New Yorker



3 tons of leaves later….

Fire behavior properties (s.e.)

	Fuel added	No fuel added
	n = 18	n = 18
Proportion of area burned	0.85 (7)	0.16 (6)
Fire spread rate (m/min)	0.18 (0.01)	0.10 (0.01)
Flame height (cm)	42 (4)	23 (4)
Flame width (cm)	27 (3)	16 (2)

Conclusions…

- Increasing fire frequency causes a negative feedback on fire in transitional forests - underscores the importance of considering the **rates of fuel inputs/outputs**
- **Fine fuels** appear to be controlling fire behavior in transitional forests - shift away from importance of microclimate & moisture witnessed in more humid forests

2007 Burn Season

Heinz Foundation

thanks...