FUTURE FIRE CARBON EMISSIONS IN MIOMBO WOODLANDS

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Population dynamics in Africa



Population dynamics in Africa



(UN-Habitat, 2010).

Population dynamics in Africa

- Causes of urban growth
 - Rural Urban migration
 - Natural urban growth
 - Conflict migrations
 - Eco migrations (climate change)

- Urban growth:
 - Cities over one million: 27.1%
 - Cities under one million: 72.9 %

Population Dynamics in Miombo Region

- Rural Urban migration slowing down
- Natural growth & in-situ urbanization main contributor



Population Dynamics in Miombo Region



Population Dynamics in Miombo Region

City	2005-10* Proportional Growth (%)
Abuja	51.7
Ouagadougou	43.7
Luanda	35.0
Lomé	27.2
Nairobi	25.2
Mbuji-Mayi	25.0
Dar es Salaam	24.9
Bamako	24.1
Niamey	23.5
Maputo	23.4

City	2010-20* Proportional Growth (%)
Ouagadougou	81.0
Niamey	56.7
Kampala	56.6
Dar es Salaam	52.3
Mbuji-Mayi	50.0
Lubumbashi	49.3
Abuja	49.2
Luanda	48.3
Bamako	47.9
Nairobi	47.3

Population Dynamics in Miombo Region Annual rate of change (%)

	90-95	95-00	00-05	05-10	10-15	15-20	20-25
Luanda	6.17	5.25	5.87	5.78	4.64	3.46	2.85
Huambo	4.39	5.66	6.20	6.01	4.62	3.27	2.63
Kananga	4.92	4.03	4.89	4.40	4.26	3.95	3.57
Lubumbashi	4.62	3.37	4.60	4.17	4.15	3.87	3.49
Mbuyi-Mayi	5.09	4.20	5.06	4.48	4.22	3.88	3.50
Dar es Salaam	4.75	4.75	4.73	4.46	4.30	4.12	3.90
Matola	4.55	4.56	4.68	4.41	3.34	3.89	3.04
Lilongwe	6.17	6.17	5.89	5.35	5.08	4.87	4.54

Impacts of Urban Growth



Grimm et al., Science, 2010

- 72% of global burned area
- Fire return interval of 2-5 years
- Seasonal regime
- Human-induced fires (Fire as management tool)

van der Werf, Atmos. Chem. Phys. Discuss, 2010

Changes in Fire Regime

• How is going to change the fire regime?

- Recent Historical Precedents (Southern Europe)
- How will it affect fire carbon emissions?
- Can we monitor changes in fire carbon emissions?

Carbon Emissions

E= BA x AGB x CC x EF

Fuel Consumption = *f*(*AGB*, *CC*, *Tree Mort*.)

- Remote Sensing + Literature + Field data
- Remote Sensing + Biogeochemical model

Carbon Emissions





Carbon Emissions

- Fine spatial scale processes
- Reversible processes (shifting cultivation)
- Fire regime characterization
- Mostly maintenance fires (tree mortality)

Land use pathways





Randerson et al., Journal of Geophysical Research, 2012

Active Fires inside Burned Areas



10

Active Fires outside Burned Areas



Active Fires outside Burned Areas



Active Fires outside Burned Areas (May – July)



0 2 4 6 8 10 12 14 16 18 2

Active Fires inside Burned Areas

Active Fires outside Burned Areas



ALBEDO (MOD43B) vs. Fire Return Interval









Dominant narrative: Fire reduces tree density

Alternative narrative: Fire controls recruitment

"Fire-driven demographic bottleneck"



Hanan et al., American Nat., 2008

Ikonos 2009







Conclusions

- Rapid urban growth
- Expected changes in fire regime & fire carbon emissions
- Global Models do not characterize African processes
- Future scenarios of fire Carbon Emissions





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