

How land tenure and labor relations mediate charcoal's environmental footprint in Zambia: implications for sustainable energy transitions



Johanne Pelletier, PhD

International Conference on Sustainable Woodfuel Value Chains in Africa

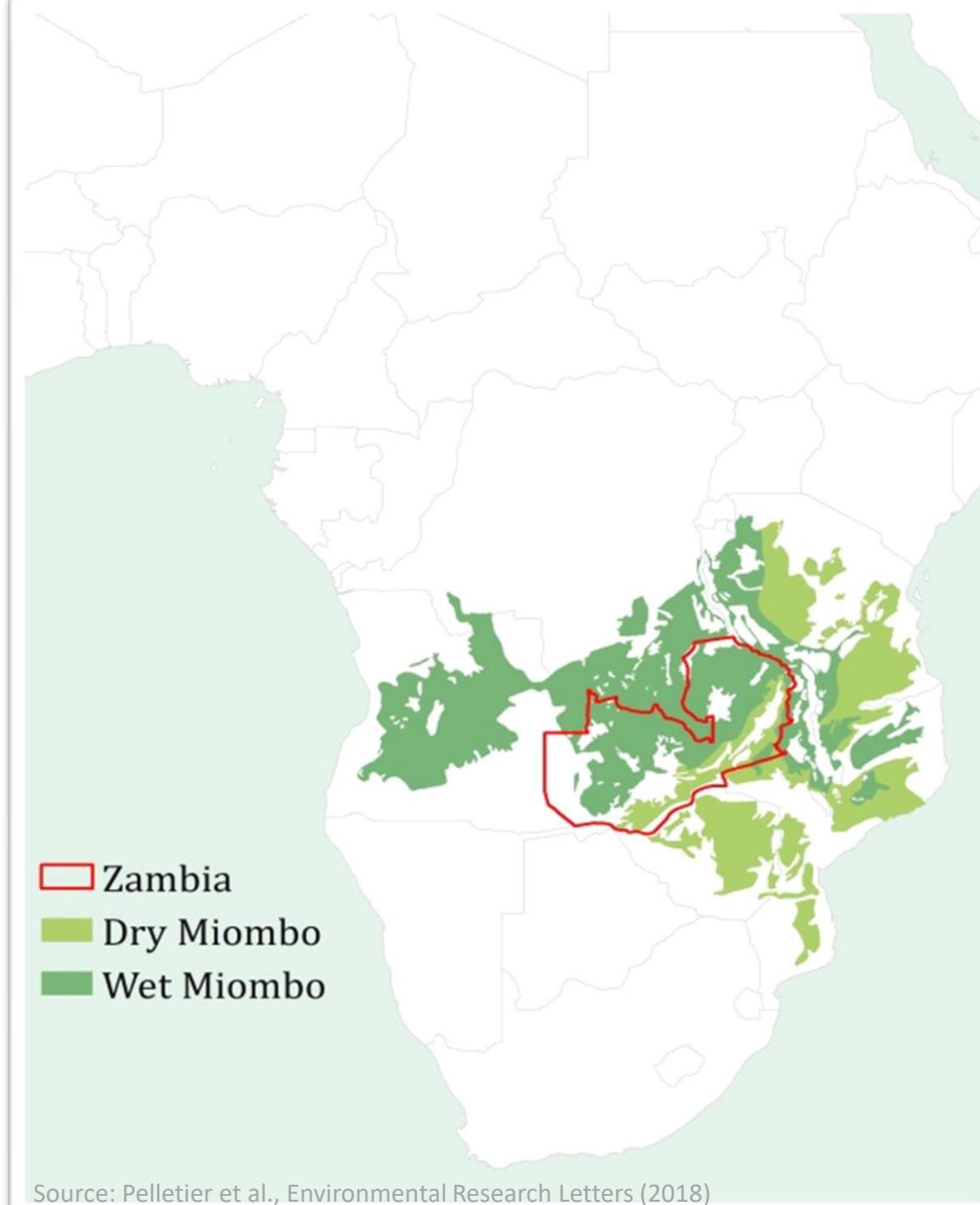
November 24th 2021



Different steps to the charcoal production and trade



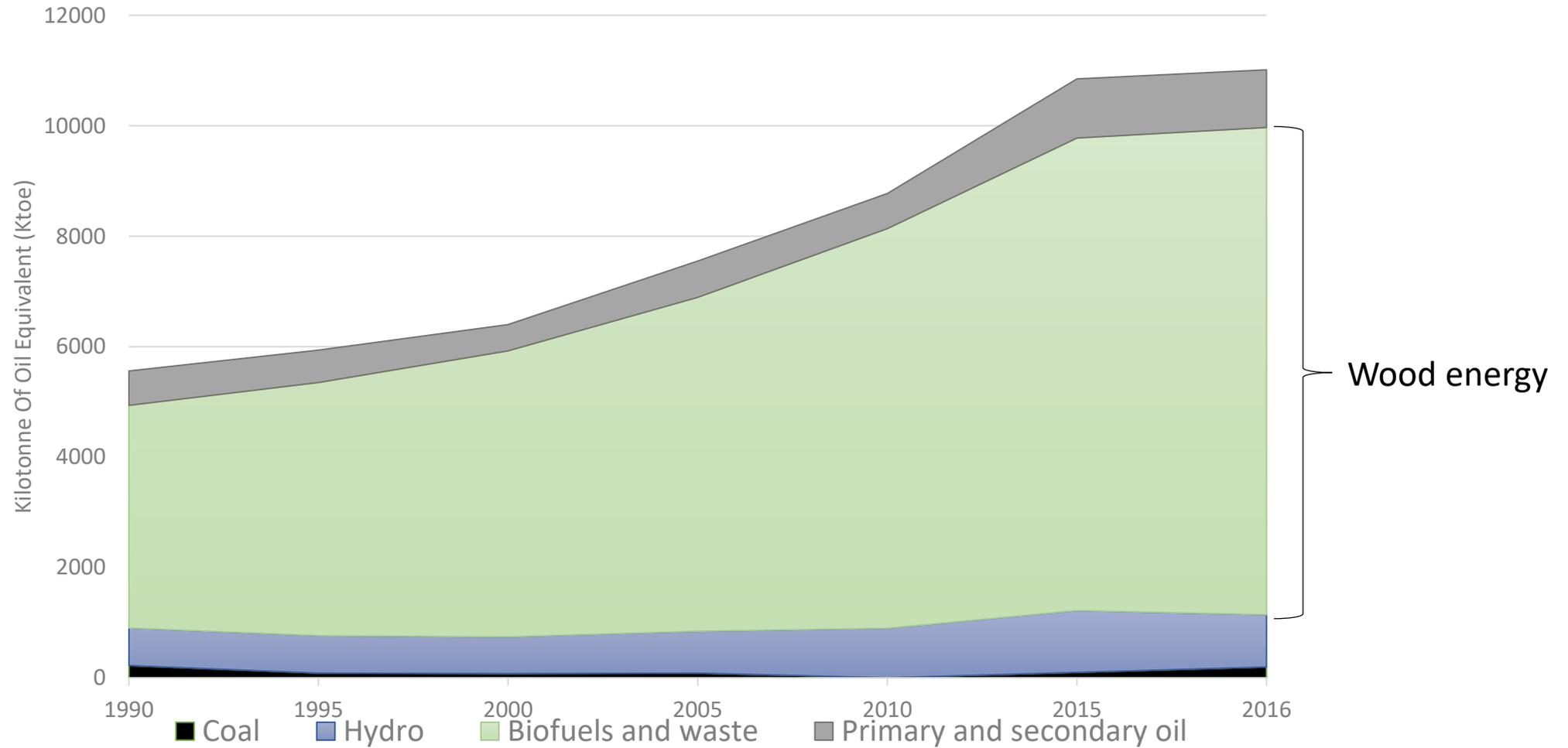
Case study for Zambia: ecological context



Annual deforestation:
250,000 ha/yr from 2000-2010
341,067 ha/yr from 2010-2014

Source: ILUA report (2018)

Energy supply in Zambia

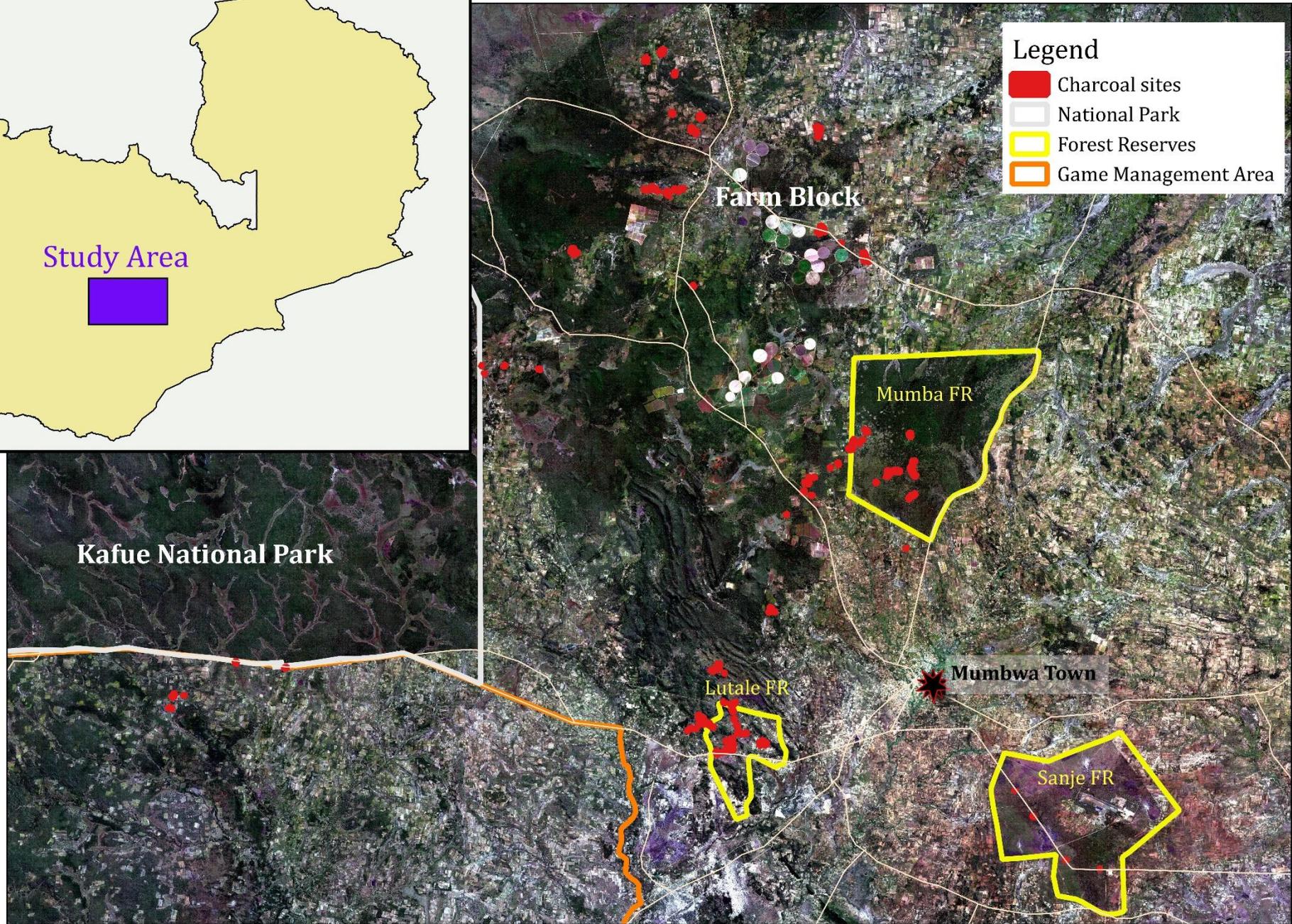
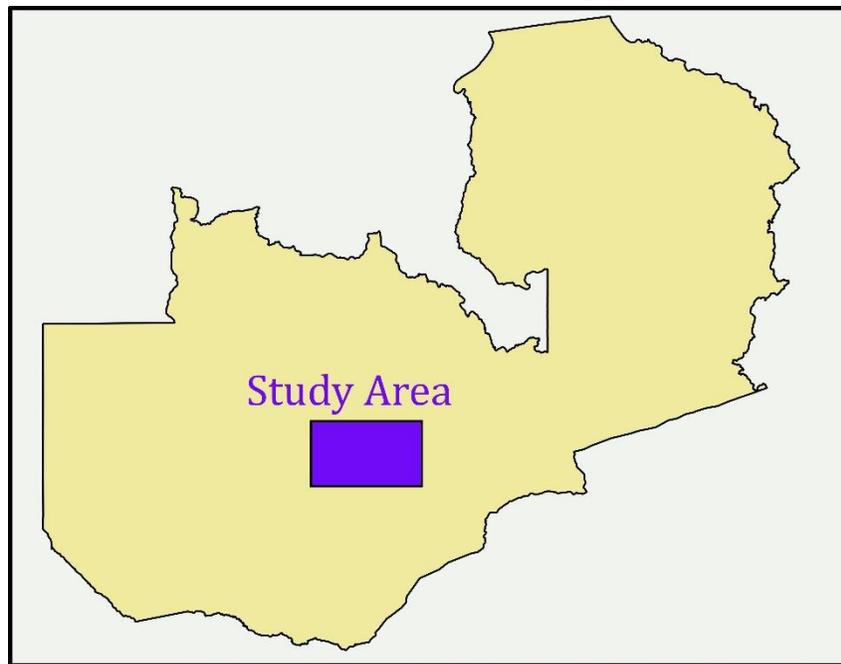


REDD+ strategy, Nationally Determined Contribution

Objective No. 5: By 2030,
regulated production of wood
fuel and improved utilization
in place

Objective No. 6: By 2020,
appropriate and affordable
alternative energy sources
widely adopted





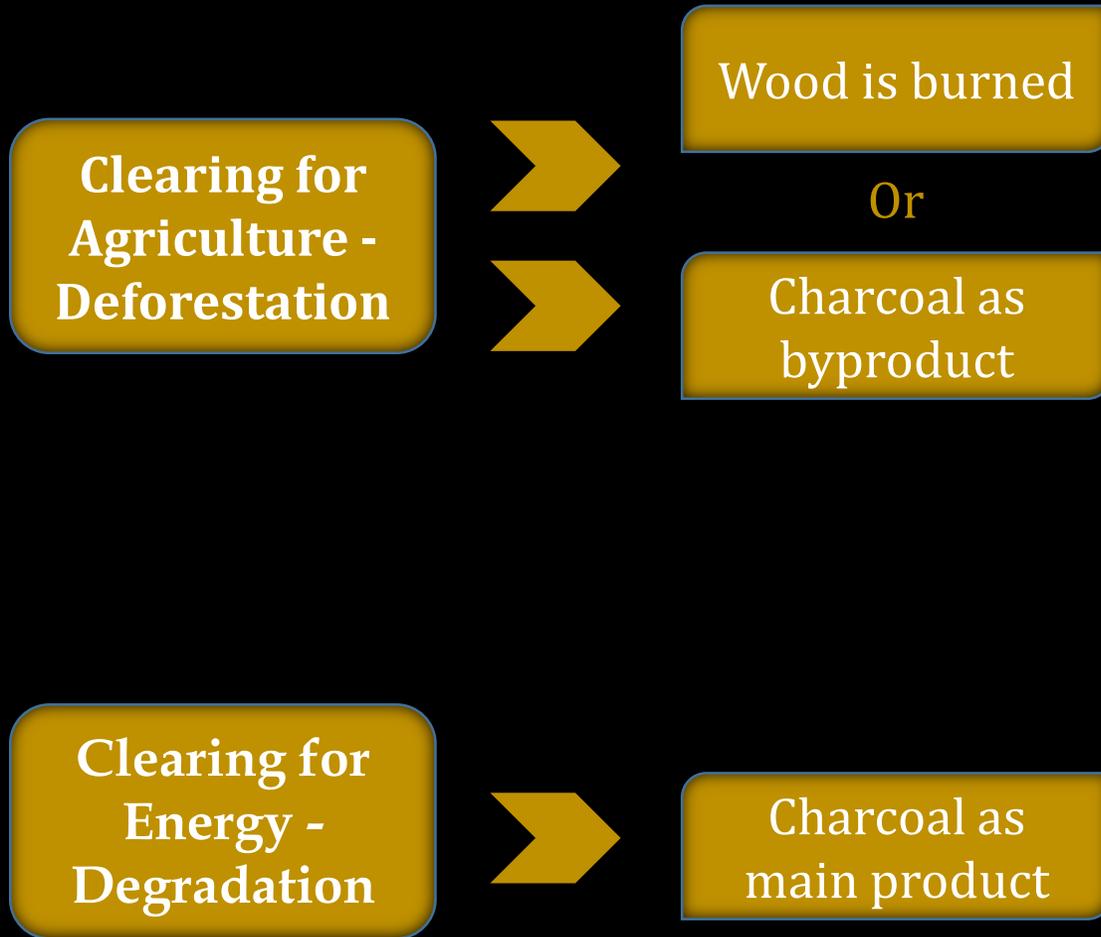
0 10 20 30 km



Methods:

1. Field vegetation survey
2. Survey to charcoal producers
3. Remote sensing analysis

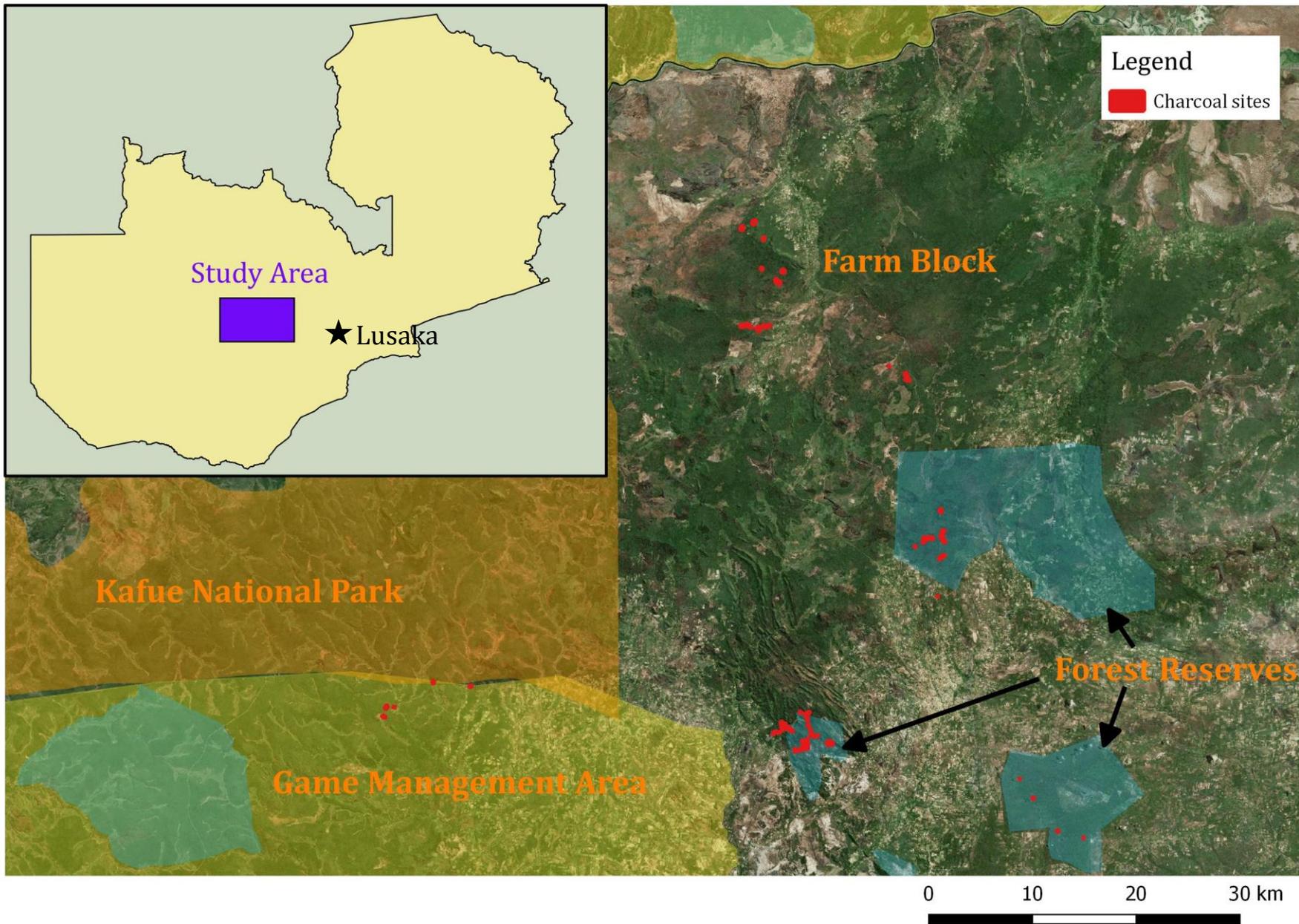
Important to understand the drivers of forest clearing in order to develop meaningful policies



No additional emissions

Additional emissions





Our field survey covered an area of 425,000ha (4,250 km²) including land under different tenure/protection status (customary, private and State lands) near the Kafue National Park.

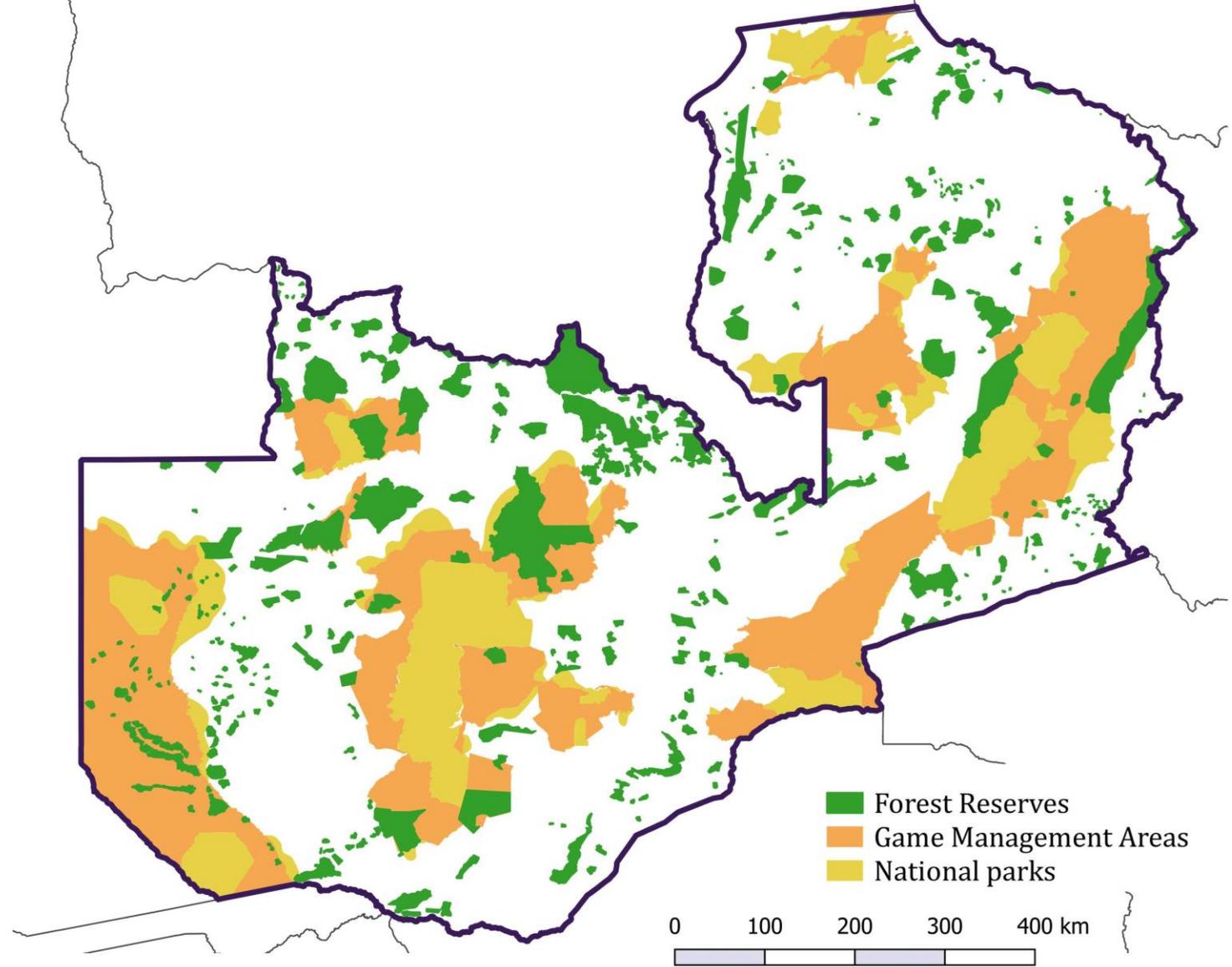
In Forest Reserves (State lands) where agriculture is prohibited, charcoal is the main driver.

	Customary	Private	State
Energy	-2.23	-2.98	2.79
Agriculture	2.02	2.45	-4.07

There is a significant dependence relationship between land tenure and the driver of forest clearing.

Multivariate Chi-square test
($X^2 = 37.09$, $df = 2$, $p\text{-value} = 8.833e-09$)

Freeman-Tukey Statistic (critical value= 1.79)

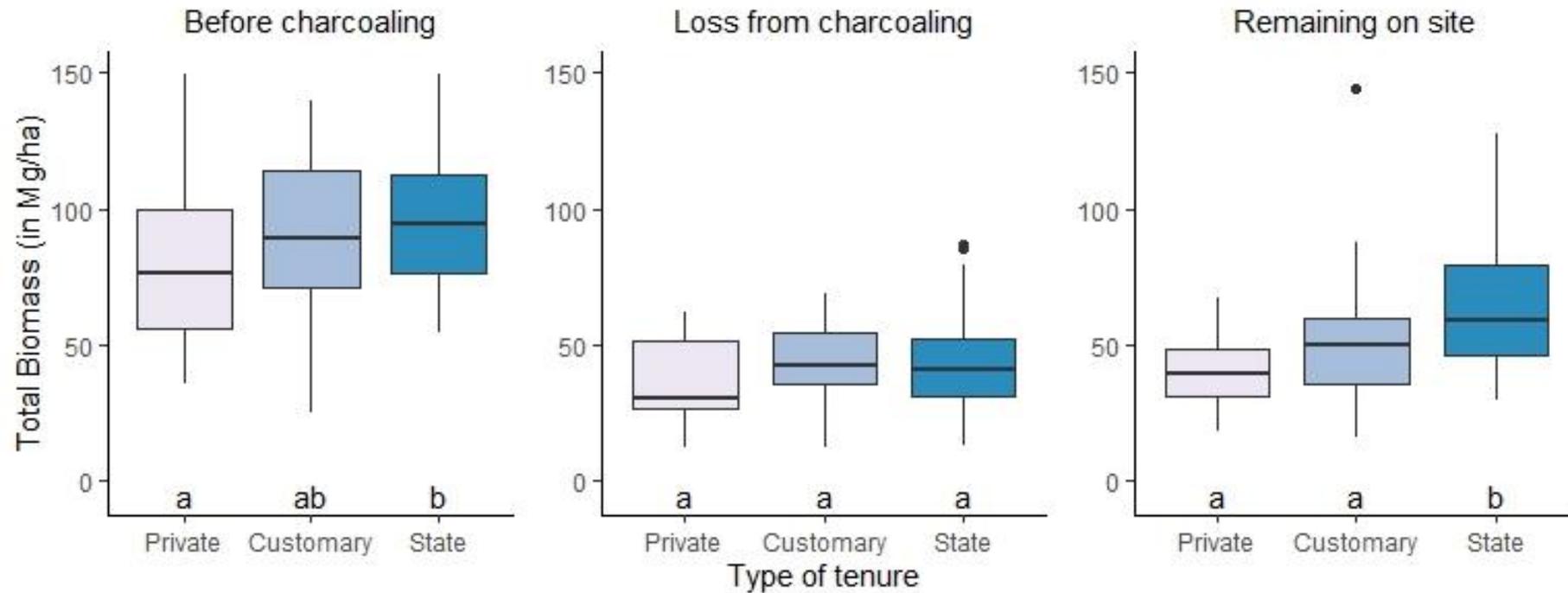


Forest Reserves (shown in green) are under the mandate of the Zambia Forestry Department for protection and law enforcement. They cover a large area of the country, with GMAs and NP also State lands

We found that agriculture expansion is the main driver of forest clearing on customary and private lands, charcoal is a by-product.

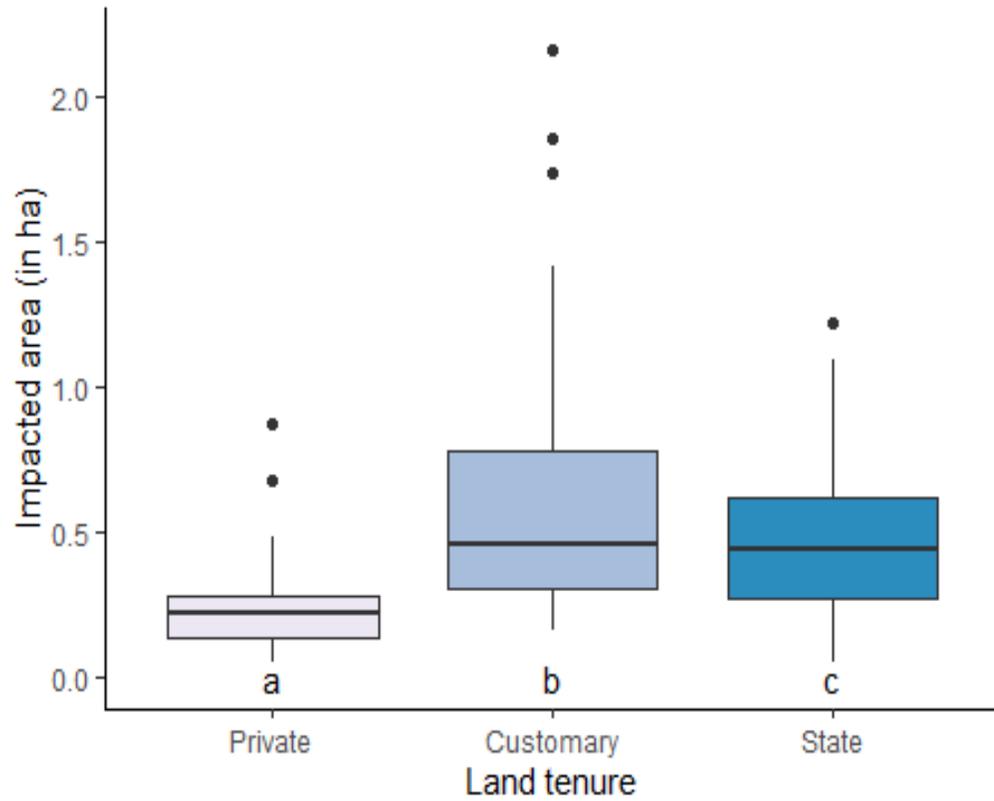


Impacts

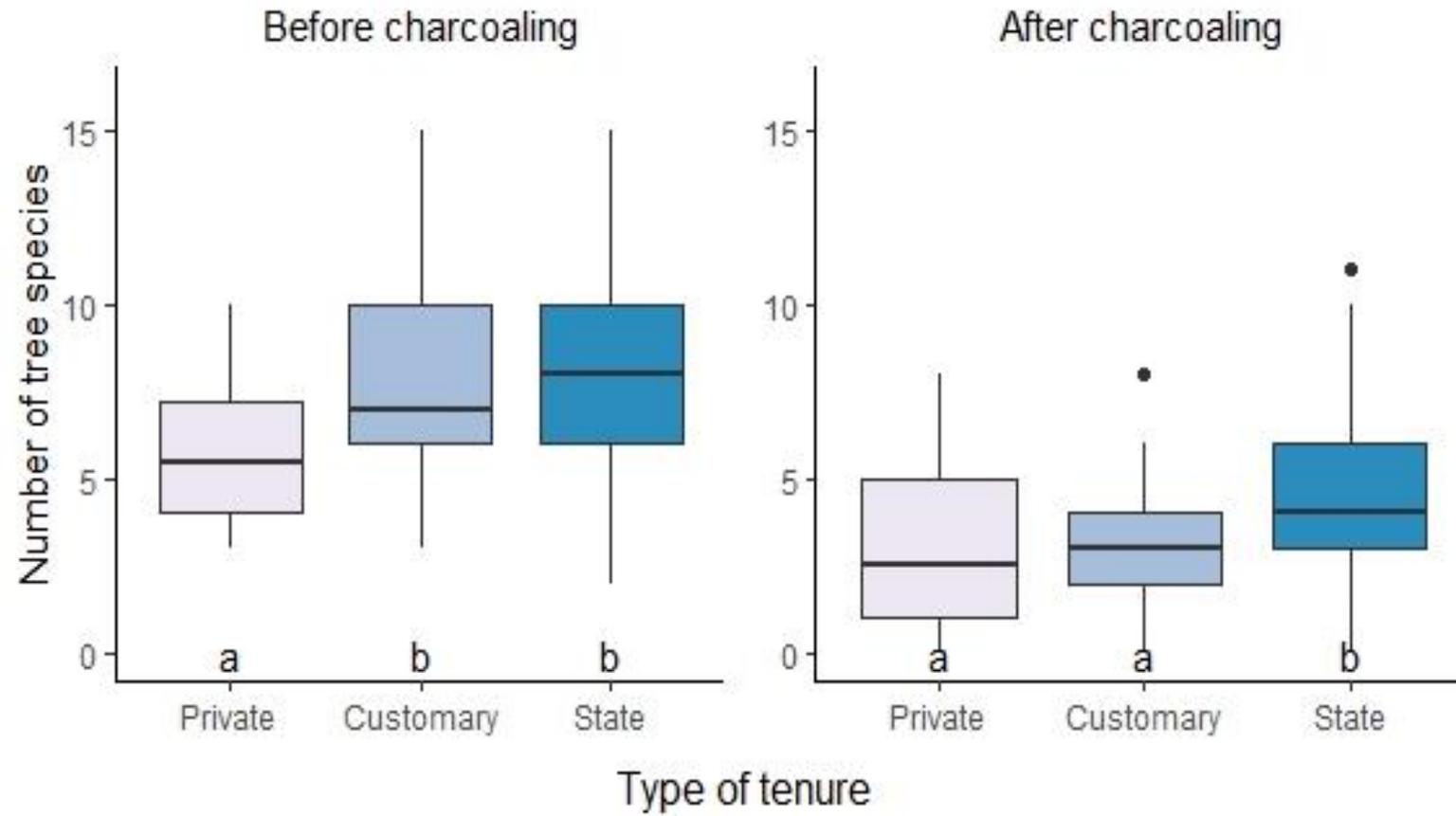


Total biomass per land tenure type. We compare A) the estimated before charcoal production, B) the loss by charcoal production and C) the remaining biomass on site.

Impacts



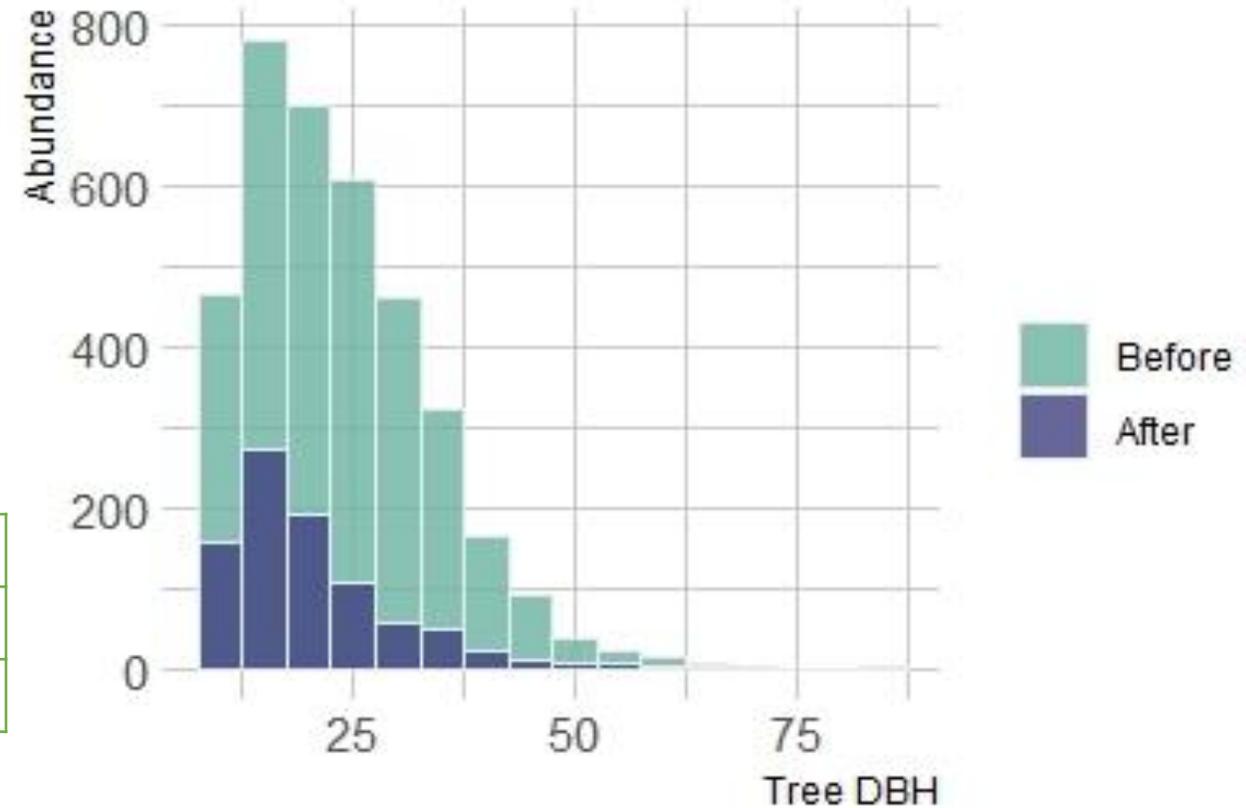
Impacts



Tree species extraction not so selective

	Customary	Private	State
Clearcut	-1.16	1.25	-0.02
Selective	1.85	-3.11	0.16

Multivariate Chi-square test is significant; Freeman-Tukey critical value = 1.79

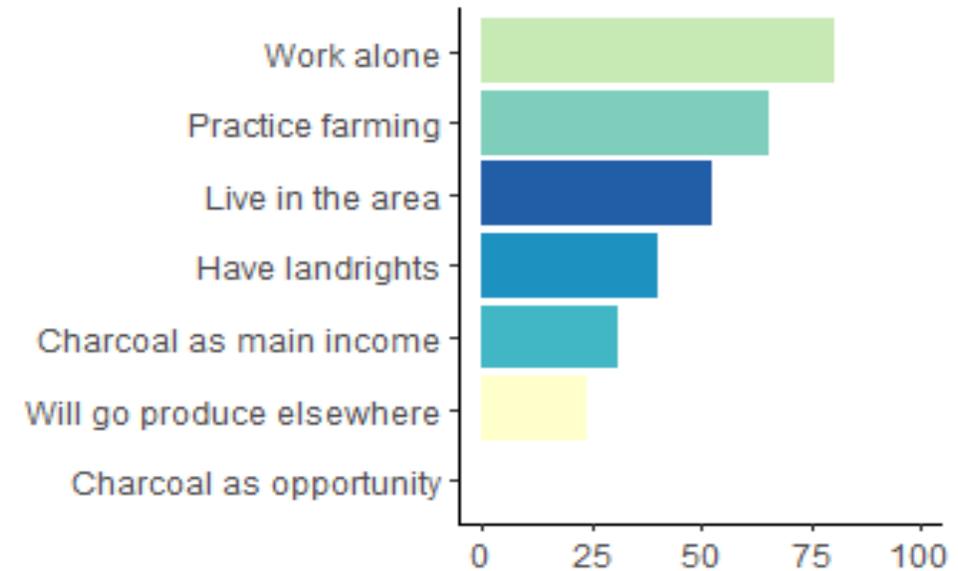


Source: Pelletier et al., 2021

Who are the producers?



Producers' characteristics



New producers

- Started on average 1.5 years ago
- Make about 2 kilns per year with variation in kiln size.
- About 80% of producers are also farmers or work other jobs
- Farmers produce charcoal off-season



Main difference in strategy use to sell charcoal



Trading strategy	Costs*	Revenues	Net gain	Standard deviation net gain	Minimum net gain	Maximum net gain
Sell to buyers	678	9,635	8,957	7,754	750	35,400
Sell by themselves	5,885	15,735	9,850	10,770	675	38,350

* Amounts are in Zambian Kwacha.

Main income & land rights	
Have landrights where they produce?	
No	Yes
-1.00	1.19
1.41	-2.16
Main income & after where	
Will go produce elsewhere when trees are cut down in the area ?	
No	Yes
0.93	-1.84
-1.45	2.03
Landright & after where	
Will go produce elsewhere when trees are cut down in the area?	
No	Yes
-0.60	1.11
0.80	-1.52
Living & after where	
Will go produce elsewhere when trees are cut down in the area?	
No	Yes
1.09	-3.25
-1.06	1.70



Charcoal producers' effort responds to un(der)employment, specially during the season when agricultural labor demand wanes.



Child on a smallholder farm, where her father is expanding the field for cultivation. Charcoal is produced and sold to buy seeds, fertilizers and farming tools. All the dominant trees in the miombo woodlands can re-sprout from stumps.





Land tenure and labor market conditions structure charcoal production's environmental footprint in Zambia.



Land tenure and labor market conditions structure charcoal production's environmental footprint in Zambia.

Charcoal is a one-off byproduct of agricultural conversion on customary and private lands, so from an unsustainable source.



Land tenure and labor market conditions structure charcoal production's environmental footprint in Zambia.

Charcoal is a one-off byproduct of agricultural conversion on customary and private lands, so from an unsustainable source.

Charcoal drives forest degradation in Forest Reserves (State Lands), with low regeneration potential.



Pre-requisites for energy transition

- Enhanced enforcement of existing land use restrictions
- Improved labor market conditions
- Support for sustainable agricultural intensification
- Devolution of forest management
- Adoption of alternative fuels



Acknowledgements

- ❖ Coauthors: Chris Barrett, Anne Trainor, and Boniface Hamalambo
- ❖ Zambia Forestry Department: Dir. Ignatius Makumba, Abel Siampale, Patrick Lishomwa Mulongwe, Keddy Mbindo, and other support staff
- ❖ TNC Zambia: Victor Mukulule Siamudaala, Moses Nyoni, Willie Phiri, Yvonne Mhango.
- ❖ Collaborators: Prof. Emmanuel Chidumayo
- ❖ Field crew: Victoria Kawangu, Humphrey Kabinda, Beauty Muke.

Funding and collaborating institutions:



Cornell University



Ministry of Lands
Forestry Department