Supplemental Information

Seasonal Fuel Consumption, Stoves, and End-Uses in Rural Households of the Far-Western Development Region of Nepal

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Figure S1. Typical devices using wood fuels found in the study population. (A & B) traditional mud chulo, (C) makal heating pan, (D) mud rocket stove (E) three stone fire.

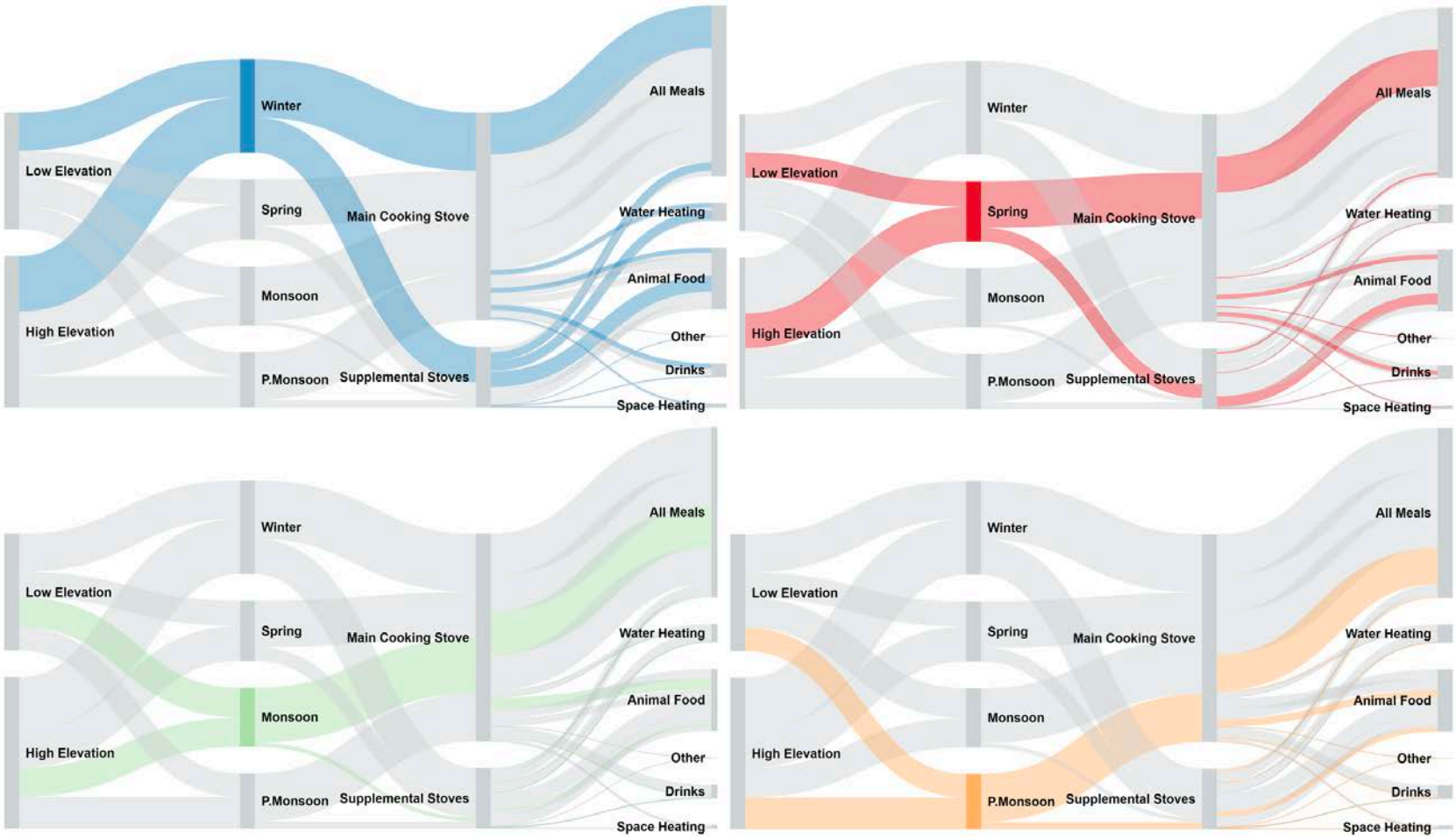

Figure S2. Annual fuel flows of dry fuel (kg dry fuel) for the average household in each elevation, disaggregating across elevation region, season, stove, and end-use designations. Colors reflect season-specific fuel use and other seasons are deemphasized for ease of interpretability and to maintain the context of annual trends.

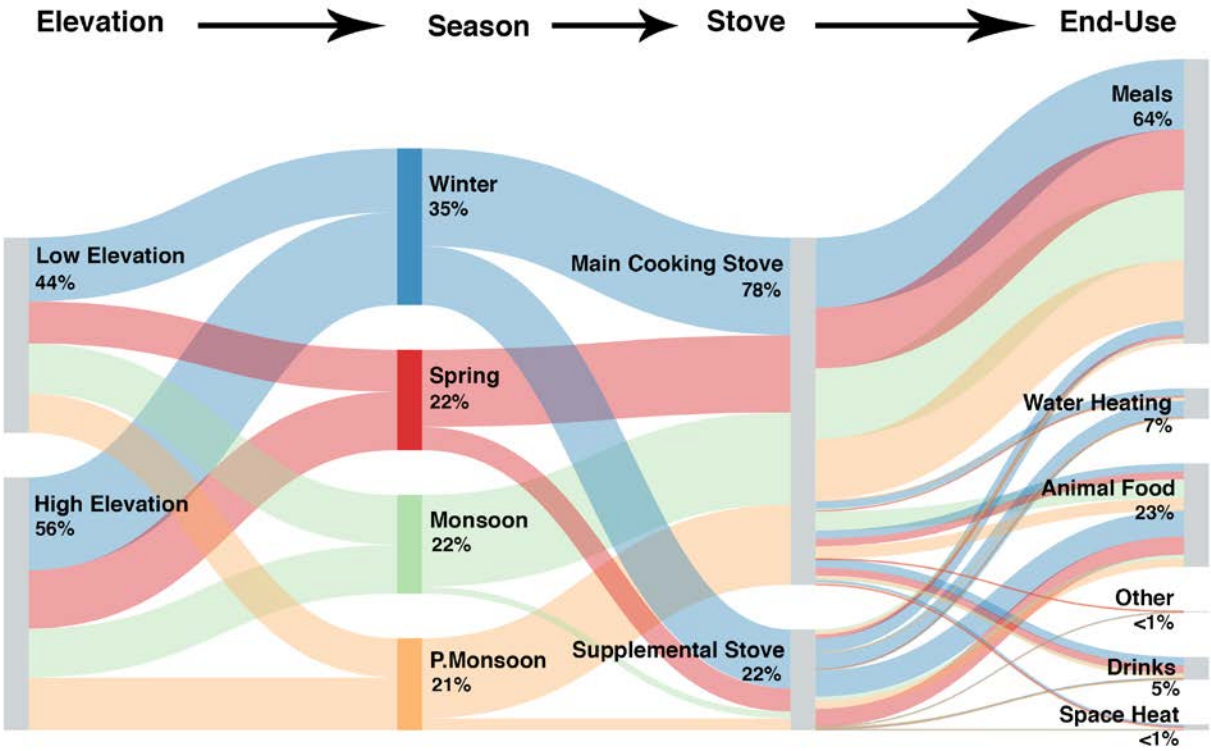

Figure S3. Household fuel use (kg dry wood per year) for the average home in each elevation, distributed across fuel designations. Percentages correspond to the percent of total fuel use.

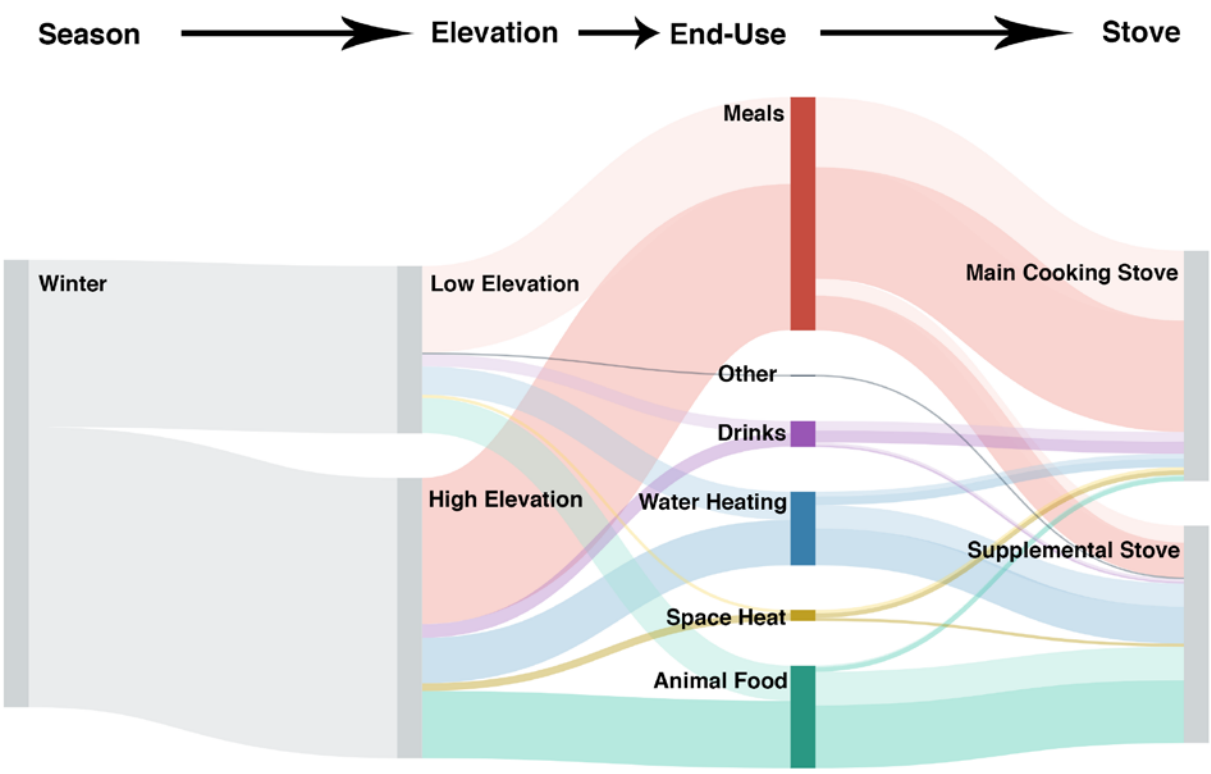

Figure S4. Fuel flows in the winter season for the 68% of houses that use at least one supplemental stove. Colors emphasize end-uses, while color saturation corresponds to elevation (low saturation = low elevation).

Table S1. Fuel consumption over season and stove designation for all households with complete data for all seasons.

Season	All Stoves				Main Cooking Stove	Supplemental Stoves (Users)		
				Winter Difference				
	N	*kg/HH-day*	*kg/capita-day (sd)*	*kg/capita-day (95% CI)*	*kg/capita-day (sd)*	*N (%HH)*	*kg/capita -day*	*% Wood (sd)*
Winter	96	9.6 (5.0)	1.7 (1.0)	----	1.1 (0.8)	67 (68%)	0.9 (0.5)	47% (14%)
Spring	96	6.4 (3.3)	1.1 (0.7)	0.6 (0.4, 0.7)**	0.9 (0.6)	50 (52%)	0.5 (0.4)	34% (21%)
			%Difference[1]	*53%*				
Monsoon	96	6.1 (3.0)	1.2 (0.7)	0.5 (0.3, 0.7)**	1.1 (0.7)	17 (17%)	0.4 (0.4)	32% (27%)
			%Difference[1]	*43%*				
P.Monsoon	96	5.7 (2.8)	1.0 (0.7)	0.7 (0.5, 0.8)**	0.9 (0.5)	22 (22%)	0.6 (0.5)	45% (22%)
			%Difference[1]	*65%*				

** Significantly different at alpha = 0.05 (Paired Student's t-test)

[1] Paired household differences

[2] 51 houses in the low elevation, 45 houses in the high elevation

Table S2. Household fuel consumption by season and supplemental stove status

	Homes w/Multiple Stoves	Main Cooking Stove Only	Main Cooking + Supplemental Stove(s)	Group Difference[1]	
		kg/capita-day (SD)	*kg/capita-day (SD)*	*kg/capita-day (95% CI)*	% (95% CI)
	%				
Winter	68%	1.25 (1.08)	1.88 (0.89)	0.63 (1.03, 0.22)**	-3% (28%, -35%)
Spring	52%	0.96 (0.68)	1.24 (0.73)	0.28 (0.57, 0.00)**	38% (70%, 5%)
Monsoon	17%	1.17 (0.67)	1.13 (0.85)	-0.04 (0.33, -0.41)	50% (83%, 17%)
P.Monsoon	22%	0.94 (0.52)	1.29 (0.94)	0.36 (0.66, 0.05)**	30% (60%, 0%)

** Significantly different at alpha = 0.05 (Two Sample t-test)

Rocket Stoves

At the time of enrollment, thirty-three households in the low (26) and high (7) elevations reported having a rocket stove. In the low region, it was identified as the main cooking stove in 40% of homes. Its designation as the main or supplemental stove was more evenly divided in high elevation homes. A separate study estimated wood savings for a similar rocket stove design as 30% based on a single-season KPT in the Kavrepalanchowk district of Nepal (*2*). A simple power calculation showed that the sample size available in this study would be sufficient to detect a mean difference in fuel use of 50-60% from a cross-sectional comparison (*1*); thus, we cannot make firm conclusions about the expected savings. Regardless, fuel use comparisons were performed between homes with and with the rocket stove. At both elevations and across all seasons, mean per-capita fuel use for families using rocket stoves versus traditional stoves did not differ significantly within the same VDC (all $p > 0.05$). The same was true when excluding homes where rocket stoves were used as supplemental stoves.

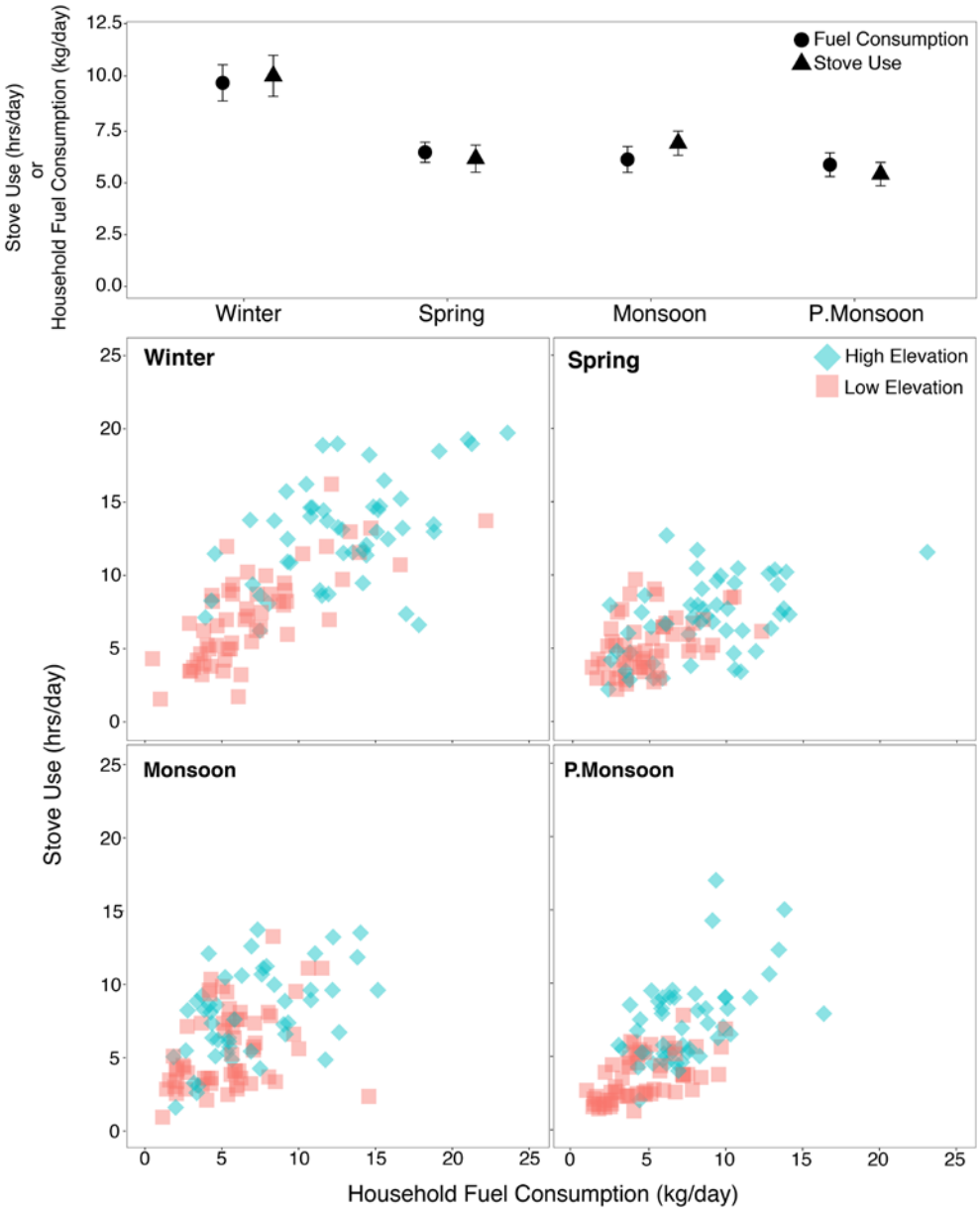

Figure S5. Top Panel: Daily household fuel consumption and reported hours of stove use across seasons. Points show the mean; error bars correspond to the 95% confidence interval of the mean. Bottom Panels: Correlations between average duration of stove use based on participant-report and measured fuel consumption for each season (N=96). Shapes and shape colors correspond to high and low elevation designation. Spearman correlation coefficients: winter (ρ=0.75), spring (ρ=0.52), monsoon (ρ=0.41), and post-monsoon (ρ=0.62).

References

1. R. D. Edwards, A. Hubbard, A. Khalakdina, D. Pennise, K. R. Smith, Design considerations for field studies of changes in indoor air pollution due to improved stoves. *Energy for Sustainable Development* **11**, 71-81 (2007).

2. M. A. Johnson, V. Pilco, R. Torres *et al.*, Impacts on household fuel consumption from biomass stove programs in India, Nepal, and Peru. *Energy for Sustainable Development* **17**, 403-411 (2013).