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Panel on
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Mixing methods and data to evaluate the biophysical and socioeconomic impacts of a large-scale common land restoration program in India



Karl Hughes, Himani Sharma, Pratiti Priyadarshini, Ruth Meinzen-Dick, Tor Vågen, Leigh Winowiecki, Aida Tobella, Varsha Metha, Atul Dogmar, Rahul Chaturvedi, Tenzin Chorrán, Anil Sarsavan, Sanoop Iissah

Outline

- 1. The intervention challenge**
- 2. Intervention model to be evaluated**
- 3. Linkages to CGIAR research**
- 4. Evaluation challenge**
- 5. Study context**
- 6. Identification strategy**
- 7. Data collection**
- 8. Results**
- 9. Discussion**
- 10. Conclusion**

1. The Intervention challenge

- **≈25% of India's land area comprises common pool resources (Chopra and Gulati 2001)**
- **Livelihoods > 300 million depend to varying degrees (Basu 2014)**
- **Systematic review identified 34 ecosystem services, est. \$90.5 billion/year (\$2108/ha) (Sandhu et al. 2023)**
- **Since mid-20th century, the commons in India in a state of decline, both in terms of area and quality**
- **Key drivers: population pressure, mechanization, land privatization, undermining of customary common property mgt. systems (Narain and Vij 2016; Thapliyal, Mukherji, and Malghan 2019)**



2. Intervention model to be evaluated

The Core Model



Secure
Community Land
Rights

+



Collective action for resource
management & responsive local
governance

+



Access to Resources &
finance for restoration &
action

=



Ecological
Health

+



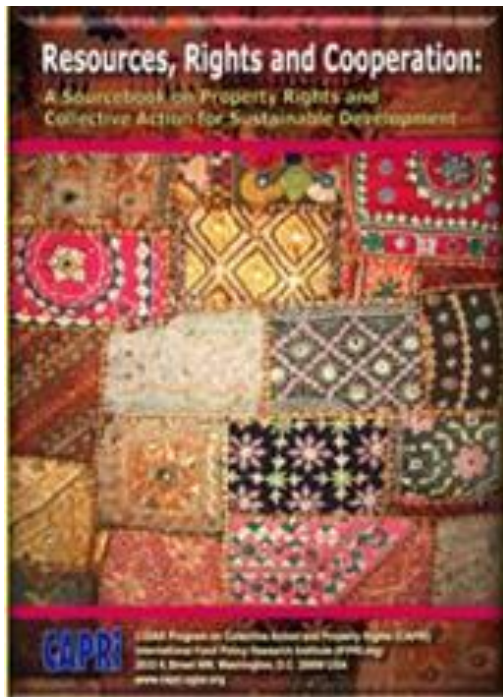
Resilient
livelihoods

Foundation of Ecological Security's Core Intervention
Model (FES, 2021)

- Yet, evidence that “tragedy of the commons” is not inevitable (Elinor Ostrom)
- “Core Model” implemented in $\approx 20,000$ villages (habitations) to date, comprising over 5.5M ha.
- FES directly intervened in $\approx 7,000$ of these villages

3. Linkages to CGIAR research

CAPRI Sourcebook: Resources, Rights, and Cooperation



<https://capri.cgiar.org/sourcebook/>

Secure property rights are an important incentive for farmers to adopt certain technologies or invest in natural resources management



COLLECTIVE ACTION AND PROPERTY RIGHTS PROGRAM (CAPRI)

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International Food Policy Research Institute
2033 K Street NW, Washington DC, 20006-1002 USA
www.capri.cgiar.org

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Collective action involves more than just organizing a meeting or forming a group



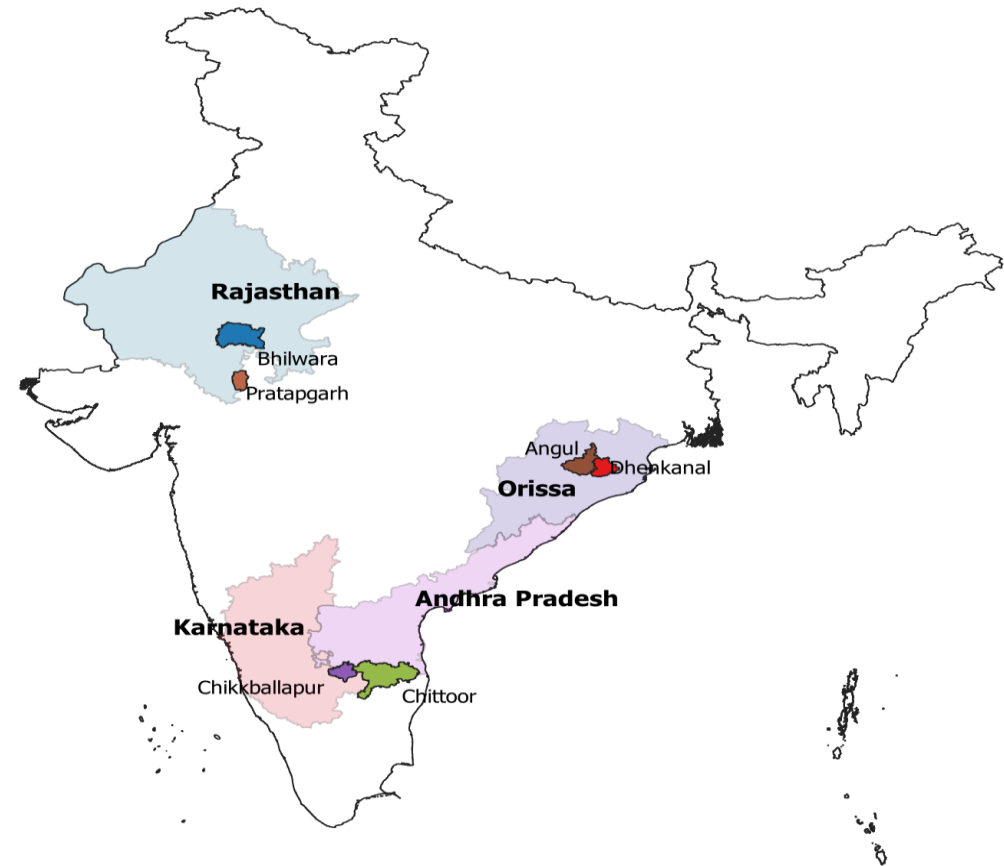
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4. Study context

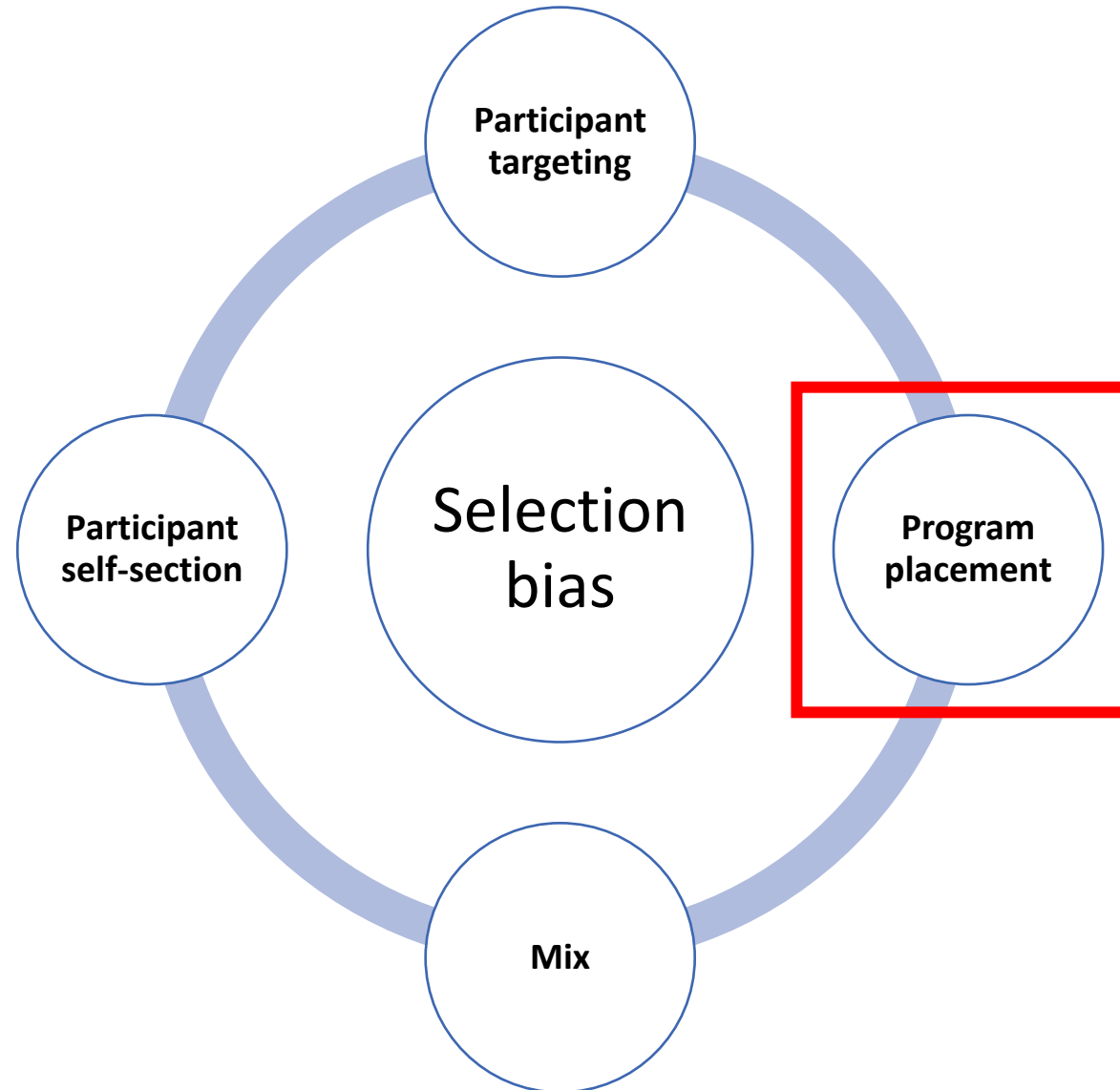
Study locations: 6 districts; 3 sites



Map of study districts (Source, Study Team)

5. Evaluation challenge

- **Key challenge**— FES rolled out core model to non-randomly (i.e. purposively targeted habitations)



• **Units of analysis:**
HHs + common land

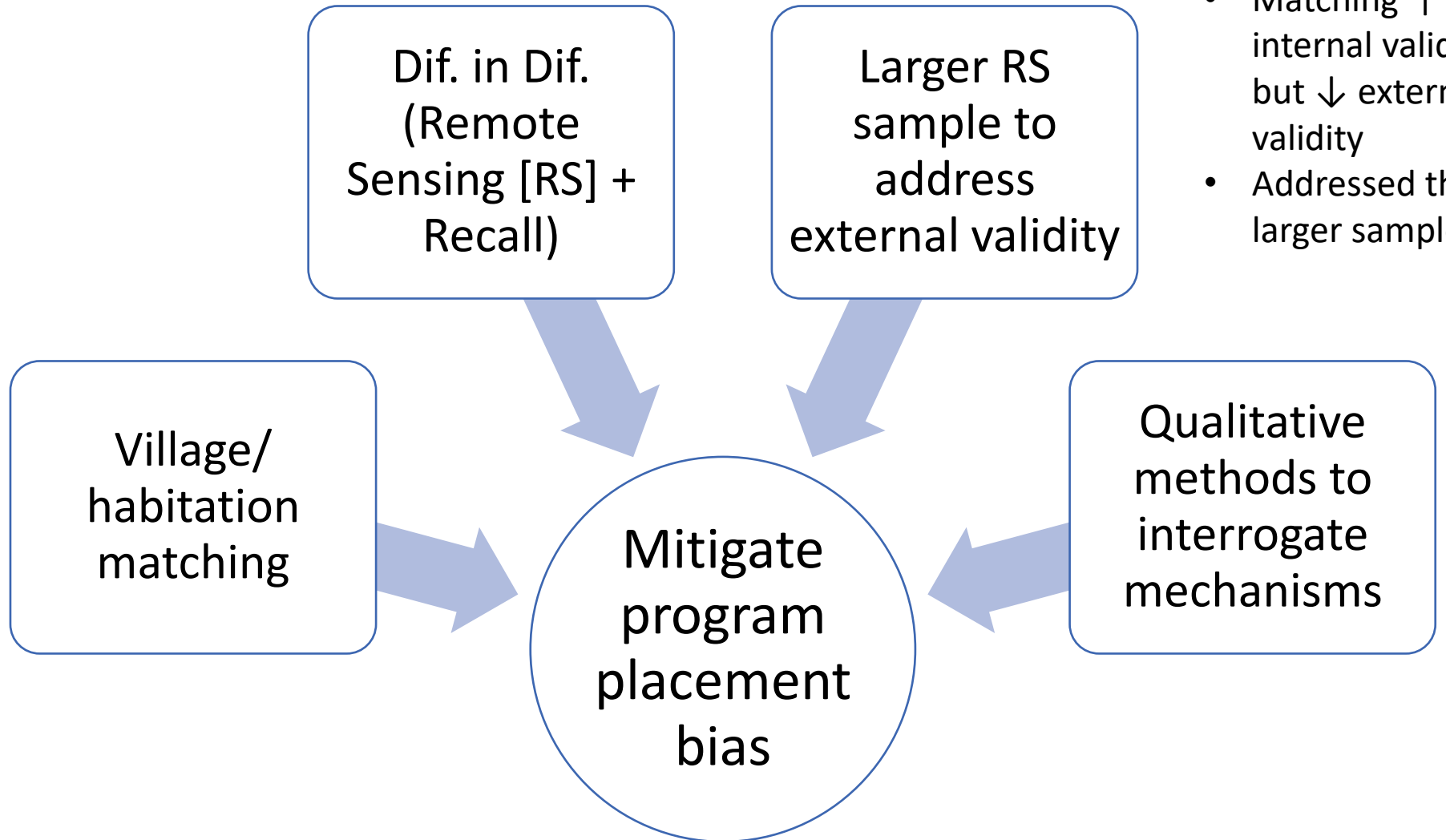
• **Units of treatment:**
habitation +
common land in
habitation



• **Quasi unit of assignment:**
habitation

6. Identification strategy

- Matching based on FES' village targeting criteria
- 2 rounds – first with secondary data to narrow in on 288 villages – 72 treated; 216 comparison
- Second round based on primary data to obtain 1 to 1 habitation matching



- Matching \uparrow internal validity but \downarrow external validity
- Addressed through larger sample

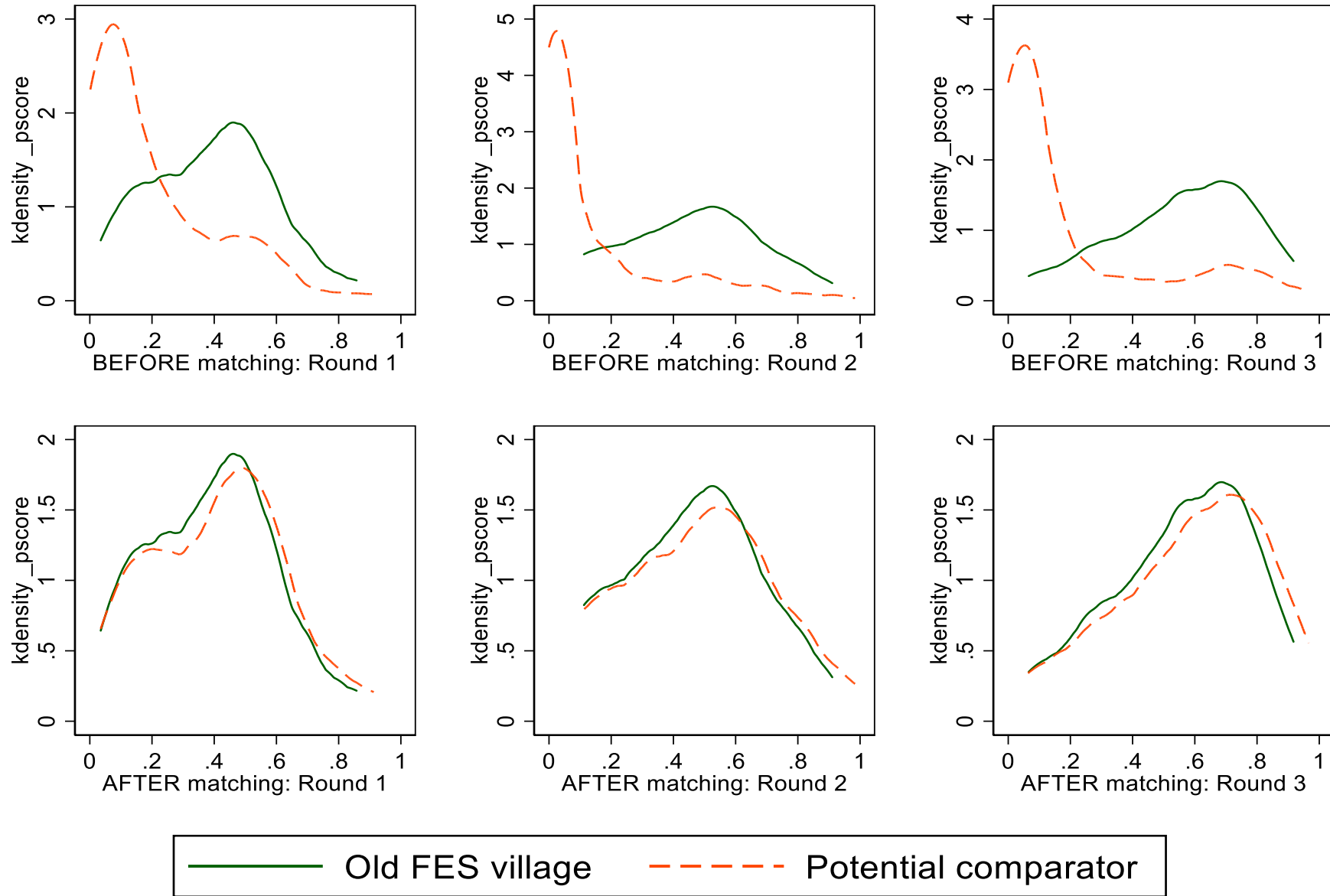
Stage 1 Matching:
Secondary data, e.g., 2001 India Census

72 “treated” & 216 new villages

DATA COLLECTION IN ALL 288 HABITATIONS

Stage 2 Matching:
Matched with primary & GIS data (habitation specific)

Same 72 “treated” & 72 “best matched” new villages



Example of the three-round secondary data matching for Pratapgarh District, Rajasthan

Habitation-level covariate comparison both before and after second round matching (primary data)

Habitation Covariate	AP/Karnataka Study Site										Rajasthan Study Site									
	Before matching					After matching					Before matching				After matching					
	T	C	Diff.	SD	VR	T	C	Diff.	SD	VR	T	C	Diff.	SD	VR	T	C	Diff.	SD	VR
% HHs from Scheduled Caste community	0.18	0.18	-0.0050 (0.059)	-0.006	0.783	0.18	0.25	-0.063 (0.085)	-0.214	1.012	0.08	0.10	-0.013 (0.034)	-0.099	0.343	0.08	0.12	-0.030 (0.043)	-0.201	1.095
% HHs from Scheduled Tribe community	0.19	0.12	0.071 (0.052)	0.310	1.012	0.19	0.17	0.025 (0.074)	0.093	1.012	0.55	0.48	0.073 (0.075)	0.163	1.095	0.55	0.47	0.081 (0.069)	0.180	1.095
Homogenous caste in village	0.08	0.18	-0.089 (0.079)	-0.546	0.653	0.08	0.13	-0.042 (0.085)	-0.167	0.653	0.38	0.33	0.047 (0.11)	-0.051	1.244	0.38	0.29	0.083 (0.13)	-0.047	1.244
% HHs dependent on rainfed agriculture at baseline	0.21	0.21	-0.0043 (0.024)	0.019	1.186	0.21	0.20	0.018 (0.030)	0.089	1.186	0.27	0.33	-0.051 (0.053)	-0.225	0.699	0.27	0.31	-0.037 (0.066)	-0.159	0.699
% HHs dependent on commons resources at baseline	0.82	0.85	-0.027 (0.027)	-0.198	1.300	0.82	0.85	-0.034 (0.034)	-0.207	1.300	0.60	0.52	0.084 (0.057)	0.306	0.970	0.60	0.56	0.043 (0.064)	0.149	0.970
Baseline asset wealth index	0.70	0.86	-0.16*** (0.057)	-0.653	1.490	0.70	0.77	-0.067 (0.055)	-0.349	1.490	0.34	0.41	-0.067 (0.051)	-0.293	0.706	0.34	0.41	-0.071 (0.049)	-0.333	0.706
HH livestock holdings at baseline	13.82	12.18	1.56 (1.92)	0.206	0.430	13.82	13.65	0.17 (2.74)	0.018	0.430	13.86	12.11	1.75 (1.48)	0.256	0.686	13.86	13.02	0.85 (1.87)	0.113	0.686
Size of prioritized common land in acres	63.36	77.61	-13.9 (13.0)	-0.259	0.731	63.36	74.97	-11.6 (17.3)	-0.194	0.731	78.72	93.77	-15.0 (19.6)	-0.187	0.699	78.72	78.16	0.57 (22.7)	0.007	0.699
Number of households in habitation	74.10	90.00	-16.8 (12.5)	-0.282	1.461	74.10	78.04	-3.94 (14.4)	-0.076	1.461	106.00	85.75	20.3* (11.6)	0.361	1.584	106.00	91.17	14.8 (15.9)	0.257	1.584
Distance of habitation to block HQ	17.56	15.10	2.30 (2.26)	0.239	1.049	17.56	18.75	-1.19 (2.49)	-0.113	1.049	21.54	19.75	1.79 (2.47)	0.159	3.004	21.54	19.00	2.54 (3.07)	0.236	3.004
Altitude of habitation (meters about sea level)	593.10	604.89	-16.2 (15.6)	-0.098	1.374	593.10	604.48	-11.4 (22.0)	-0.097	1.374	402.36	384.46	17.9 (20.6)	0.213	0.838	402.36	409.98	-7.62 (23.1)	-0.095	0.838
Terrain Ruggedness Index (TRI)	1.97	1.91	0.060 (0.16)	0.076	1.273	1.97	1.90	0.066 (0.19)	0.097	1.273	1.64	1.84	-0.21 (0.20)	-0.243	0.722	1.64	1.70	-0.062 (0.17)	-0.083	0.722
Population per square 100 meter	2.67	2.76	-0.084 (0.055)	-0.327	2.137	2.67	2.73	-0.059 (0.077)	-0.224	2.137	2.01	1.98	0.031 (0.14)	0.046	1.352	2.01	1.86	0.15 (0.16)	0.242	1.352
% of land under tree cover (2000)	25.88	26.22	-0.45 (1.01)	-0.075	0.719	25.88	26.50	-0.63 (1.19)	-0.137	0.719	21.58	21.59	-0.010 (0.79)	-0.001	1.009	21.58	22.33	-0.75 (1.01)	-0.098	1.009
Predicted % of soil erosion prevalence (2000)	47.71	50.24	-2.37* (1.24)	-0.413	1.111	47.71	48.63	-0.92 (1.58)	-0.162	1.111	66.88	66.63	0.25 (1.57)	0.037	1.291	66.88	66.04	0.83 (1.70)	0.136	1.291
Chi-square test of joint orthogonality											16.22				6.62					
P-value											0.3679				0.9674					
Number of habitations	24	67	91		24	24	48				24	64	88		24	24	48			

Standard errors in parentheses; * p<0.1 ** p<0.05 *** p<0.01

Household- and individual-level covariate mean comparison after habitation-level (second stage) matching

	Overall			AP/Karnataka					Odisha					Rajasthan				
	T	C	Diff.	T	C	Diff.	SD	VR	T	C	Diff.	SD	VR	T	C	Diff.	SD	VR
HH from Scheduled Caste community ($\hat{\rho}$)	0.12	0.16	-0.038 (0.037)	0.18	0.25	-0.065 (0.084)	-0.154	0.806	0.07	0.07	-0.0060 (0.035)	-0.023	0.926	0.09	0.11	-0.029 (0.042)	-0.092	0.780
HH from Scheduled Tribe community ($\hat{\rho}$)	0.36	0.32	0.039 (0.046)	0.20	0.17	0.025 (0.075)	0.074	1.130	0.29	0.32	-0.033 (0.12)	-0.072	0.940	0.55	0.46	0.078 (0.065)	0.172	0.995
HH dependent on rainfed agriculture at baseline ($\hat{\rho}$)	0.30	0.31	-0.013 (0.030)	0.16	0.16	-0.0014 (0.025)	0.015	1.028	0.69	0.64	0.048 (0.071)	0.101	0.929	0.26	0.31	-0.051 (0.063)	-0.109	0.901
HH dependent on commons resources at baseline ($\hat{\rho}$)	0.75	0.75	-0.00031 (0.029)	0.81	0.85	-0.040 (0.033)	-0.100	1.195	0.95	0.95	0.00094 (0.035)	0.004	0.983	0.60	0.56	0.040 (0.062)	0.088	0.973
Primary respondent is female ($\hat{\rho}$)	0.48	0.47	0.0093 (0.011)	0.46	0.46	-0.00077 (0.017)	-0.001	1.000	0.50	0.46	0.042 (0.034)	0.084	1.007	0.49	0.48	0.0046 (0.014)	0.010	1.001
HH farmed at baseline ($\hat{\rho}$)	0.96	0.97	-0.0030 (0.0083)	0.95	0.94	0.012 (0.017)	0.053	0.810	0.94	0.96	-0.022 (0.024)	-0.103	1.558	0.99	0.99	-0.0078 (0.0070)	-0.083	2.347
HH engaged in agricultural labor at baseline ($\hat{\rho}$)	0.24	0.25	-0.013 (0.024)	0.18	0.20	-0.020 (0.038)	-0.050	0.923	0.45	0.49	-0.036 (0.067)	-0.073	0.991	0.21	0.20	0.0034 (0.035)	0.012	1.018
HH engaged in off-farm activities at baseline (any) ($\hat{\rho}$)	0.73	0.74	-0.0031 (0.027)	0.62	0.70	-0.069* (0.040)	-0.162	1.117	0.94	0.87	0.062 (0.041)	0.212	0.545	0.74	0.71	0.028 (0.049)	0.065	0.936
HH without agricultural land ($\hat{\rho}$)	0.10	0.11	-0.0020 (0.019)	0.09	0.09	-0.0036 (0.024)	-0.012	0.967	0.16	0.17	-0.017 (0.074)	-0.046	0.920	0.09	0.09	0.0056 (0.027)	0.019	1.055
Baseline asset index	0.48	0.54	-0.054* (0.032)	0.70	0.77	-0.073 (0.053)	-0.123	1.013	0.33	0.31	0.021 (0.070)	0.047	1.115	0.34	0.41	-0.070 (0.048)	-0.171	0.757
Livestock holdings at baseline	13.49	13.09	0.43 (1.46)	14.01	13.69	0.27 (2.85)	0.010	0.394	11.62	11.66	-0.040 (2.67)	-0.002	1.413	13.82	13.12	0.79 (1.85)	0.035	0.924
Total number of dependents	1.39	1.36	0.021 (0.059)	0.85	0.92	-0.078 (0.079)	-0.070	0.941	1.38	1.15	0.23* (0.13)	0.198	1.092	1.91	1.89	0.027 (0.10)	0.017	0.836
Highest years of schooling of adult in household	8.74	8.91	-0.18 (0.32)	9.85	9.91	-0.083 (0.48)	-0.011	1.067	8.46	8.50	-0.032 (0.74)	-0.007	0.725	7.78	8.10	-0.33 (0.53)	-0.060	0.956
Highest years of schooling of female adult in household	5.18	5.51	-0.36 (0.31)	5.89	6.24	-0.38 (0.49)	-0.059	1.034	6.20	6.41	-0.21 (0.69)	-0.043	0.869	4.01	4.41	-0.41 (0.49)	-0.075	1.123
Land holding size at baseline (acre)	3.03	3.04	-0.0021 (0.24)	3.02	2.99	0.030 (0.35)	0.009	0.989	1.49	1.47	0.027 (0.30)	0.012	1.003	3.73	3.78	-0.046 (0.44)	-0.010	0.599
Chi-2 test of joint orthogonality			18.39			20.36					16.08					20.33		
P-value			0.2429			0.1586					0.377					0.1597		
Number of Households	1174	1181	2355	474	478	952			218	214	432			482	489	971		

* p<0.1 ** p<0.05*** p<0.01; Standard errors in parentheses and clustered at habitation level (pseudo unit of assignment);

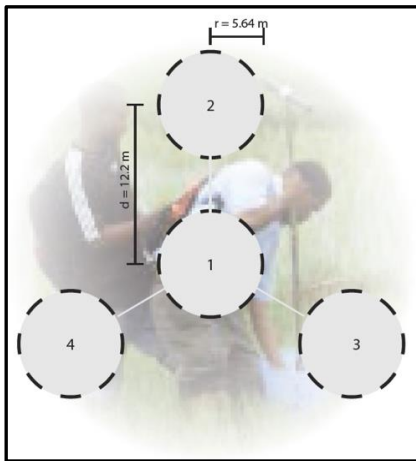
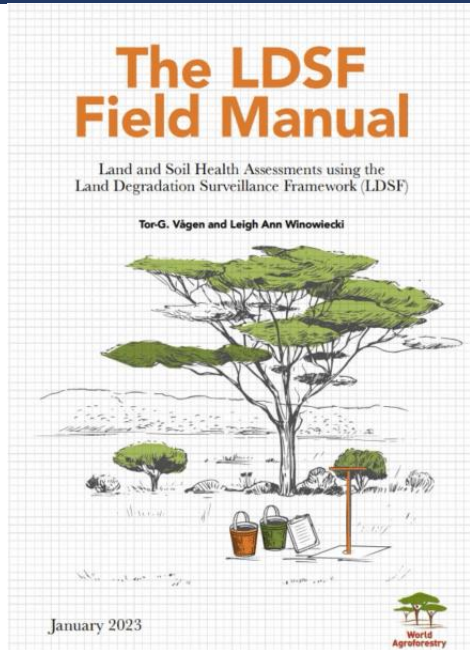
District-level fixed effects used in testing overall differences between treatment and comparison units (strata used in habitation matching);

Probit regression used to test binary variable and Ordinary Least Squares (OLS) regression for continuous variables;

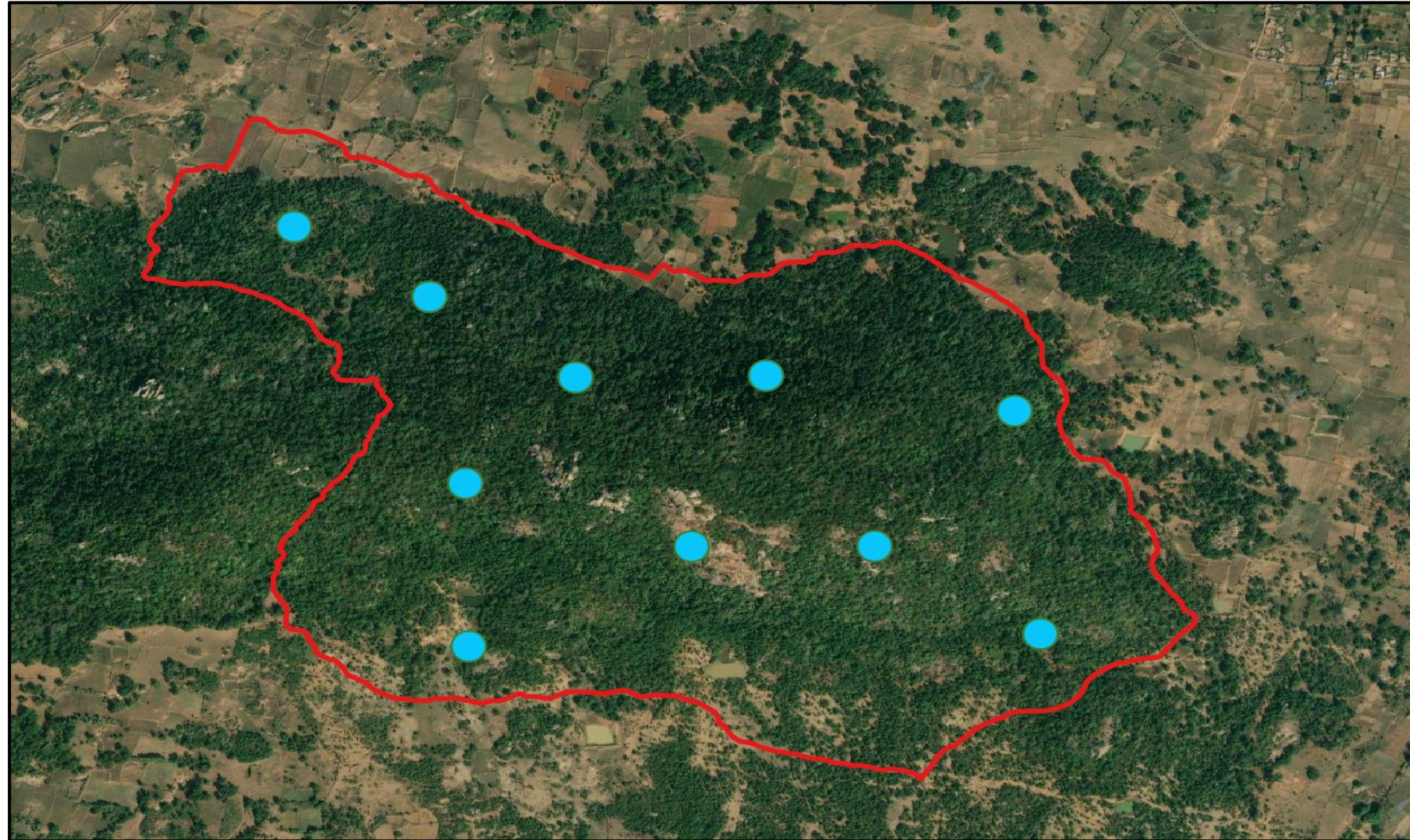
T = HH or individual in treated habitation; C = HH or individual in matched comparison habitation; Diff. = Difference between units in treated and comparison habitations;

SD = Standardized Difference of this difference; VR = Variation Ratio

7. Data collection



LDSF Plot Layout



Example LDSF plots , Uchkuram Village, Angul District, Odisha

Habitation leader & HH surveys (10 men; 10 women per habitation)



orsel

3 data collection teams administered survey (14 January to 15 April, 2022)

- Plus multiple data quality checks by research team



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icraf > PoC_IA...

కుటుంబ జాబితా (1)

Himani Sharma యొక్క ప్రధాన వృత్తి ఏమిటి?

గడిపిన సమయం ఆధారంగా.

వ్యవసాయం (వ్యవసాయం మరియు / లేదా పశువులు, పౌల్ట్రీతో సహా)

అధికారిక ఉద్యోగం

బిజినెస్

సాధారణ పని/కూలీ

గృహిణి

వయస్సు లేదా ఆరోగ్య కారణాల వల్ల ప్రొడక్టివ్ పనిలో నిమగ్నం కాకపోవడం

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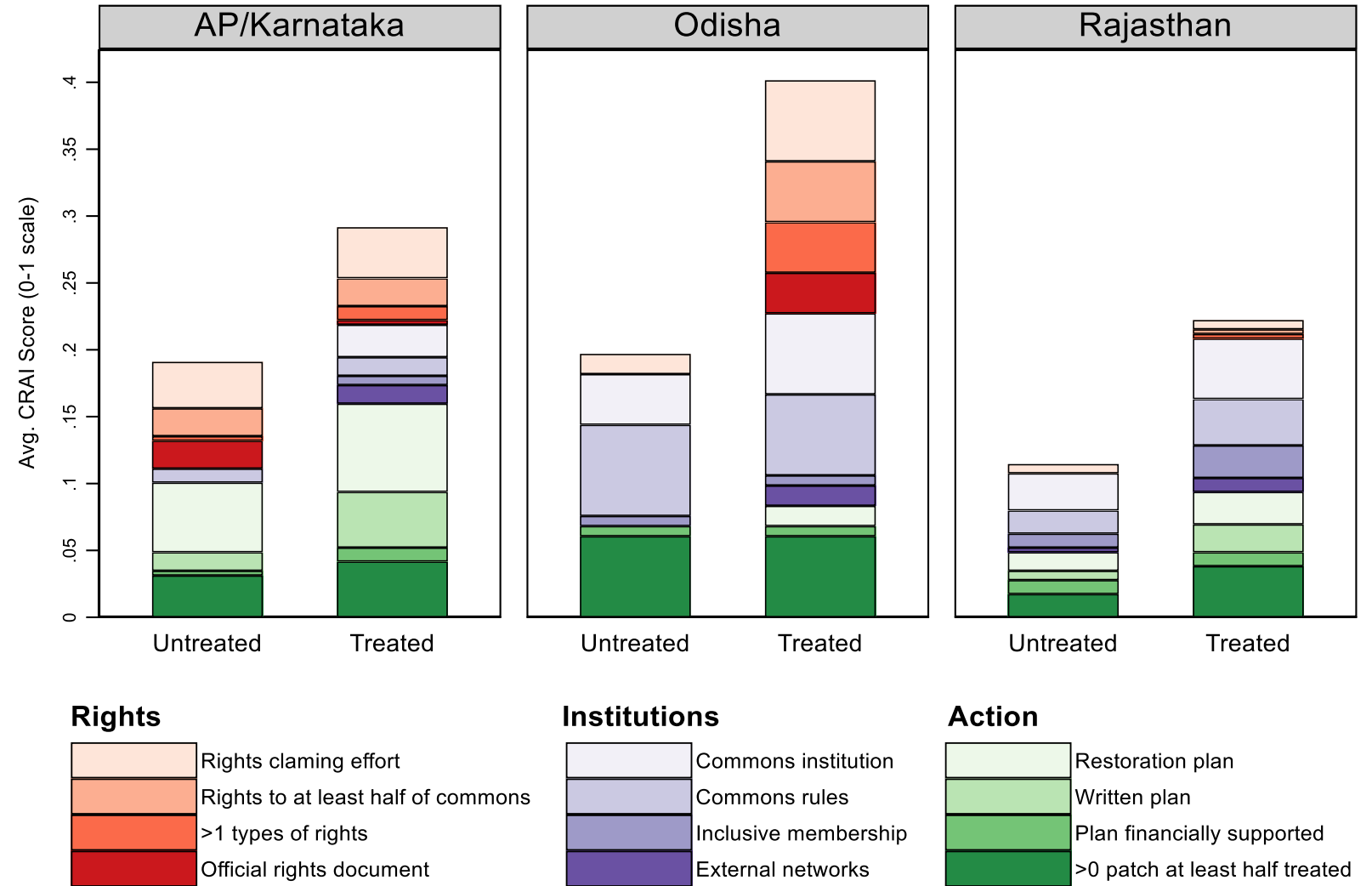
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- In Odisha study site, only realized during qualitative follow-up that only 11 of the 24 matched intervention habitations were fully treated.
- 13 of the 24 habitations were only targeted for FES' rights claiming work – not the full core model
- Matching redone with 11, so sample reduced to 22 habitations



8. Results (highlights)

Commons Restoration Action Index (CRAI) by study site



Each stacked bar indicates an average score on the index, as well the weighted contribution of each dimension and indicator. The greater the height of an individual sub-bar, the greater the indicator's contribution to the index.

Comparison of treated and untreated habitations vis-à-vis CRAI, dispute incidence & encroachment

	Overall			AP/Karnataka			Odisha			Rajasthan		
	T	C	Diff.	T	C	Diff.	T	C	Diff.	T	C	Diff.
CRAI	0.28	0.16	0.12*** (0.031)	0.29	0.19	0.10* (0.050)	0.40	0.20	0.20** (0.080)	0.22	0.11	0.11** (0.044)
Dispute (\hat{p})	0.03	0.12	-0.094** (0.040)	0.02	0.00	0.021 (0.021)	0.00	0.12	-0.12 (0.090)	0.04	0.24	-0.19** (0.084)
Encroachment (\hat{p})	0.15	0.34	-0.19*** (0.060)	0.11	0.08	0.030 (0.071)	0.08	0.13	-0.052 (0.097)	0.22	0.69	-0.47*** (0.11)
Observations	59	59	118	24	24	48	11	11	22	24	24	48

* p<0.1 ** p<0.05*** p<0.01;

District fixed effects used in testing overall differences between treatment and comparison units (strata used in habitation matching);

T = treated habitation; C = comparison habitation; Diff. = Difference

Robustness testing

Outcome variable	Kernel matching				Inverse Probability Weighted Regression (IPWRA)			
	Overall <i>coef.</i>	AP/Kar. <i>coef.</i>	Odisha <i>coef.</i>	Rajasthan <i>coef.</i>	Overall <i>coef.</i>	AP/Kar. <i>coef.</i>	Odisha <i>coef.</i>	Rajasthan <i>coef.</i>
CRAI	0.14*** (0.030)	0.13*** (0.047)	0.15* (0.088)	0.11** (0.043)	0.13*** (0.027)	0.16*** (0.042)	0.16 (0.10)	0.12*** (0.038)
Disputes	-0.16*** (0.055)	0.012 (0.049)	-0.13 (.)	-0.31*** (0.12)	-0.19*** (0.054)	0.0080 (.)	-0.29 (0.18)	-0.39*** (0.100)
Encroachment	-0.14* (0.081)	0.015 (0.11)	0.12 (0.20)	-0.50*** (0.12)	-0.16** (0.077)	0.070 (0.100)	0.17 (0.16)	-0.48*** (0.11)
Total	224	73	56	77	236	91	57	88

* p<0.1 ** p<0.05 *** p<0.01; Exact matching at district-level for kernel matching; district dummies used in IPWRA models

Tree-related indicators in sampled common land LDSF plots in treated and comparison habitations

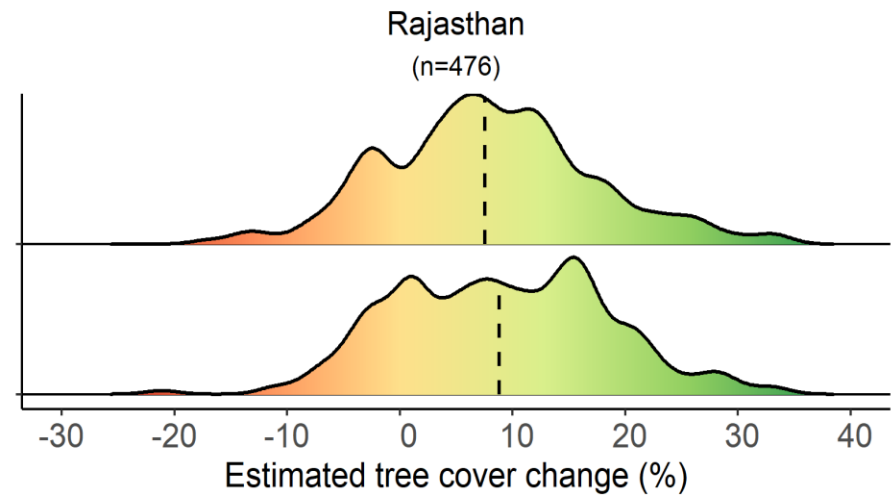
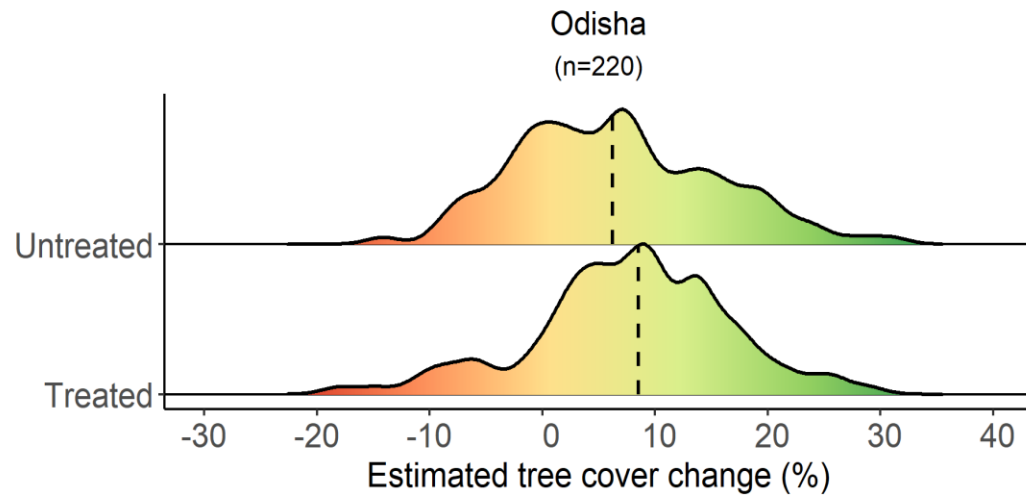
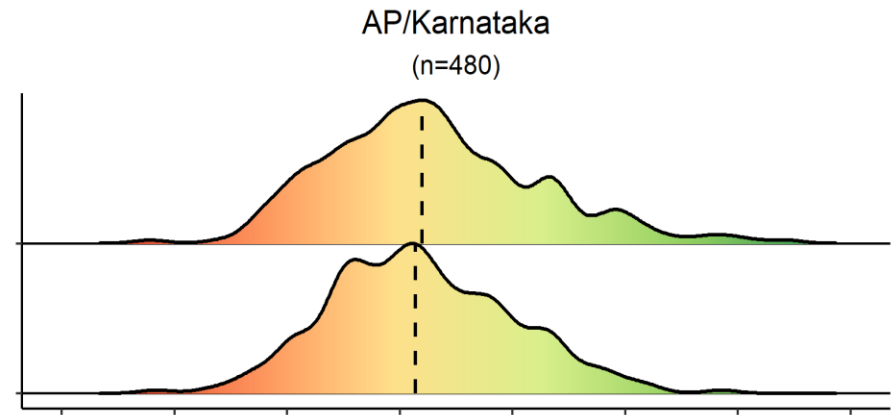
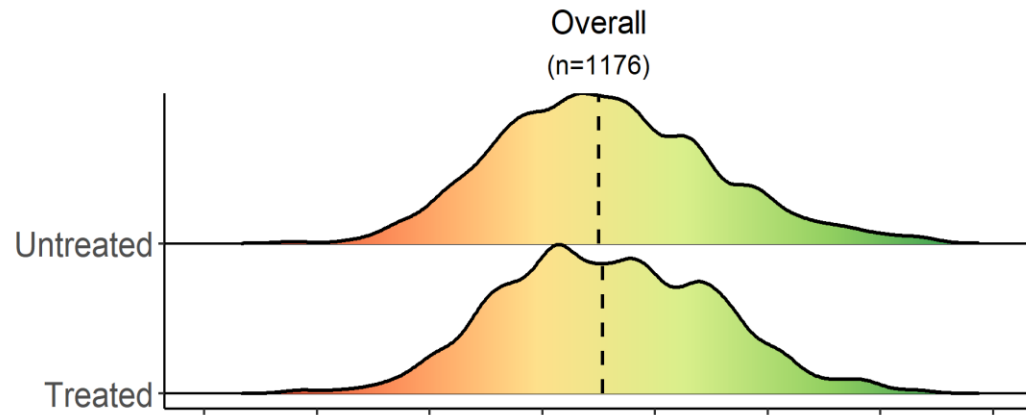
	Overall			AP/Karnataka			Odisha			Rajasthan		
	T	C	Diff.	T	C	Diff.	T	C	Diff.	T	C	Diff.
Shannon tree diversity index	0.66	0.52	0.14** (0.065)	0.35	0.38	-0.032 (0.089)	1.99	1.54	0.45* (0.22)	0.37	0.19	0.18** (0.079)
Tree density (trees/hectare)	262.58	176.99	85.6*** (29.5)	96.88	80.94	16.0 (24.7)	957.50	615.68	341.8*** (119.2)	109.79	71.98	37.8 (30.4)
Invasive species (#/hectare)	1.88	2.60	-0.72 (0.69)	3.38	4.30	-0.92 (1.55)	0.77	0.95	-0.17 (0.52)	0.89	1.65	-0.77 (0.49)
Observations	590	590	1180	240	240	480	110	110	220	240	240	480

* p<0.1 ** p<0.05*** p<0.01; Differences computed using OLS regression;

Standard errors in parentheses and clustered at habitation level (pseudo unit of assignment);

Study site fixed effects used in testing overall differences between treatment and comparison units (strata used in habitation matching);

T = Measurements taken from LDSF plot in prioritized common land of treated habitation; C = Measurements taken from LDSF plot in prioritized common land of matched comparison habitation; Diff. = Difference between units in treated and comparison habitations.

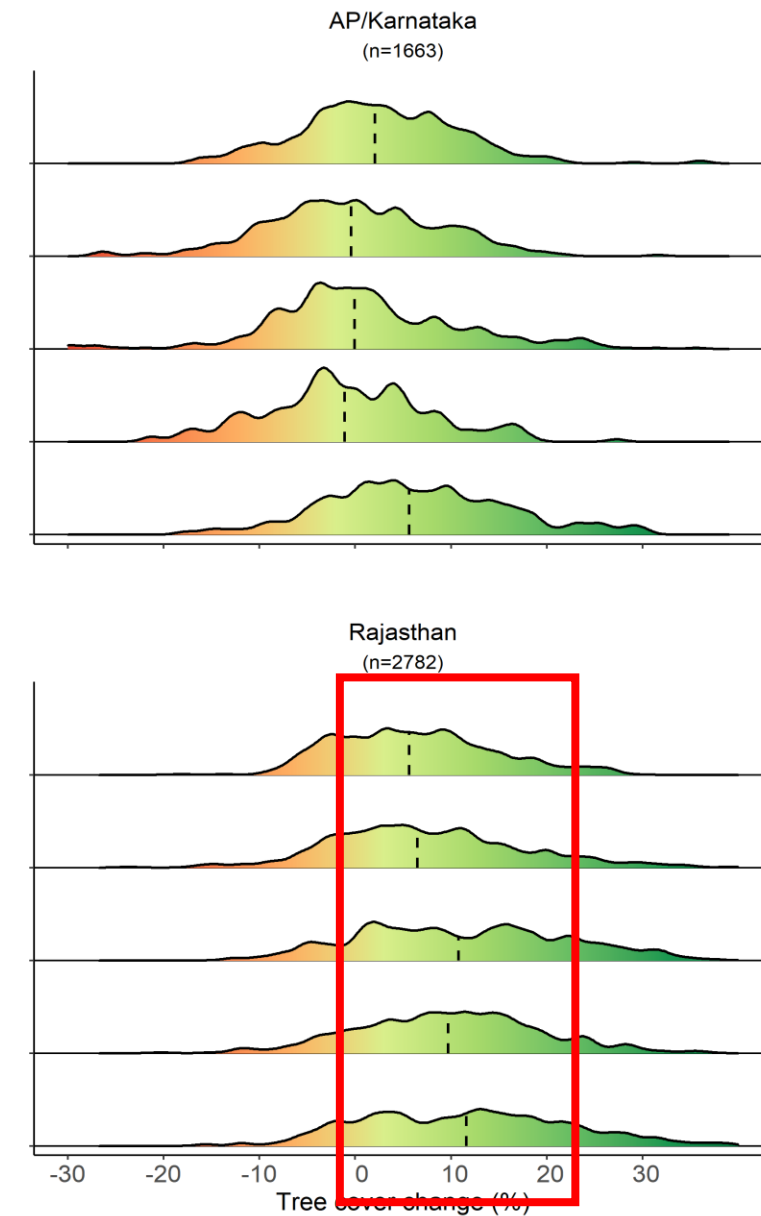
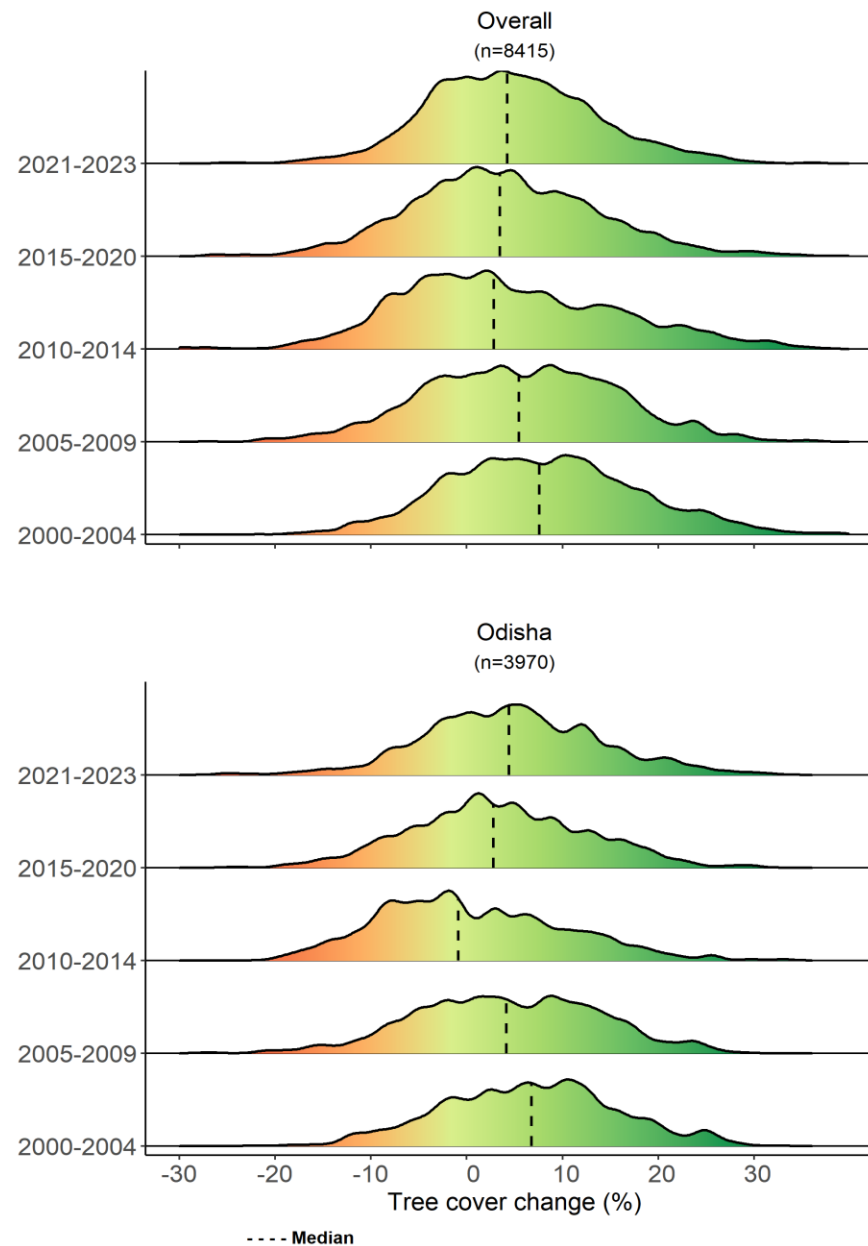


---- Median

Density plots for estimated changes in tree cover among matched treated and untreated habitations derived through LDSF predictive models run on 2000 and 2020 Landsat 7 satellite imagery

External validity

- Listed all other habitations FES worked, plus those targeted after 2000.
- Grouped them into 5 time cohorts and attempted to randomly section 40 per study site per time period.
- Geotagged polygons taken for all common land areas in these sampled habitations

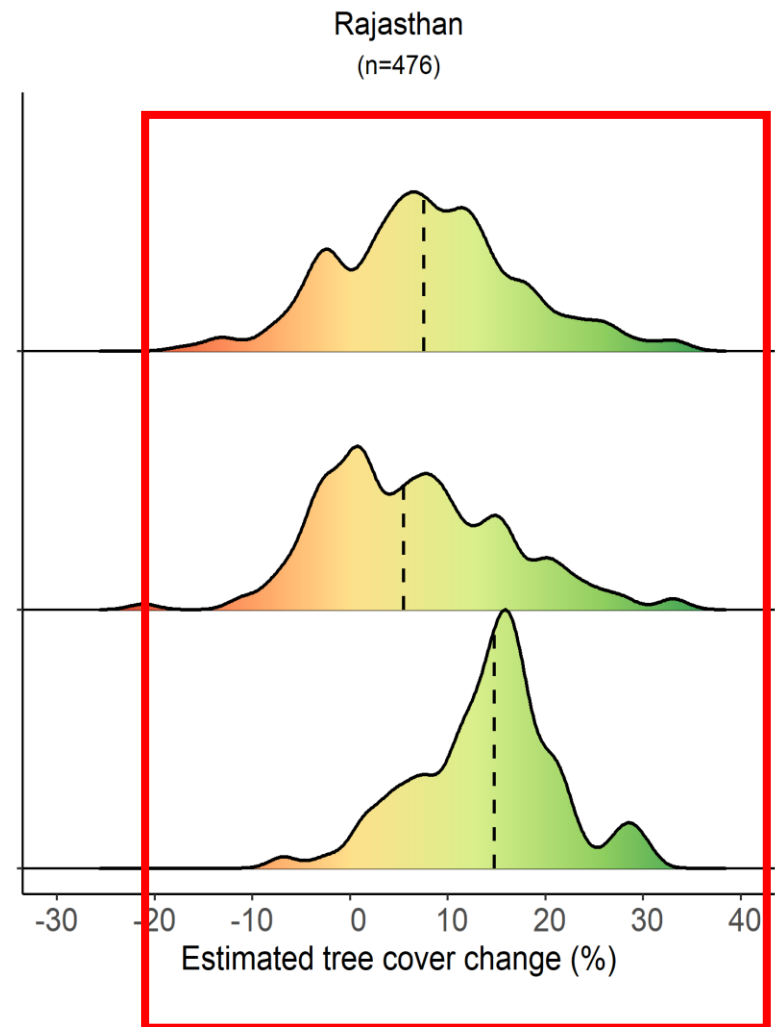
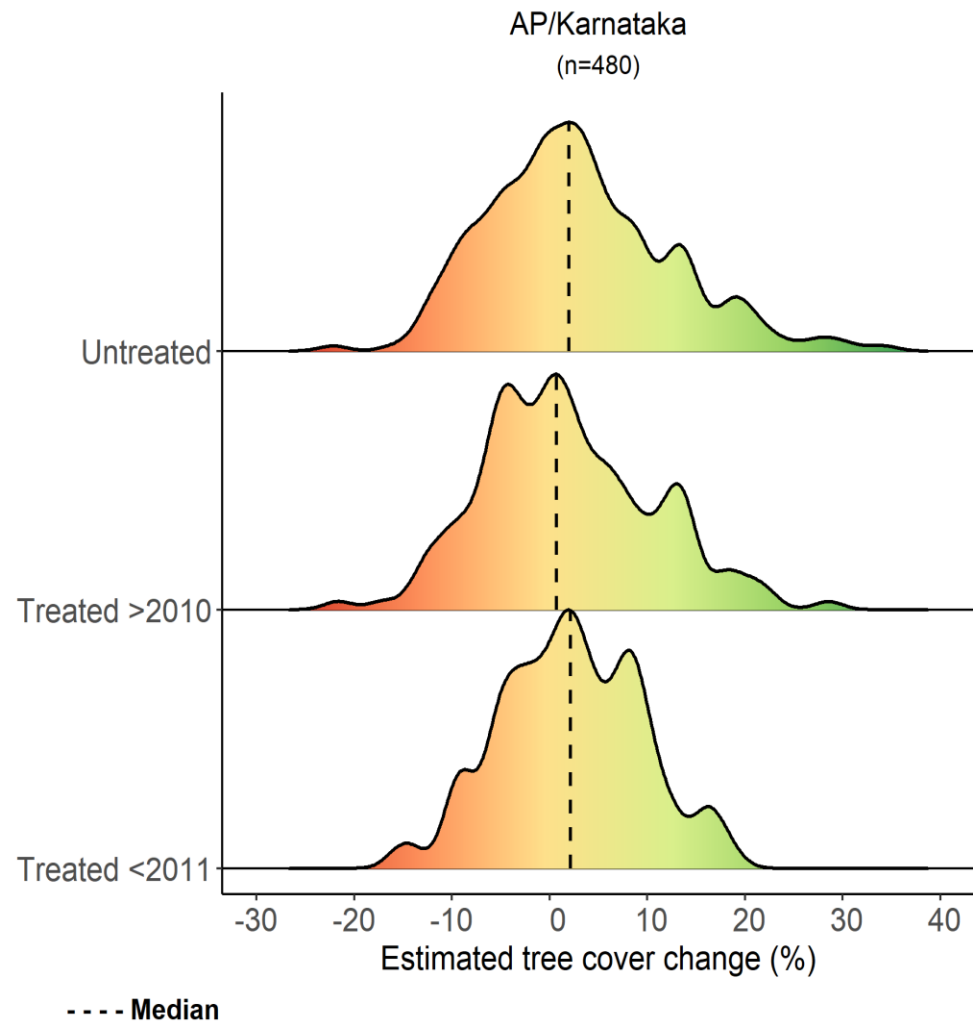


Density plots for estimated changes in tree cover among representative FES intervention time cohorts derived through LDSF predictive models run on 2000 and 2020 Landsat 7 satellite imagery

OLS coefficients for remote sensing predicted changes in tree cover (2000 to 2020) for sites treated in different time periods compared with those targeted for intervention after 2020

	Overall	AP/Karnataka	Odisha	Rajasthan
<2005 vs. >2020	3.45*** (0.84)	4.03** (1.73)	1.84 (1.13)	5.26*** (1.49)
2005-09 vs >2020	0.70 (0.83)	-3.13* (1.64)	-0.42 (1.18)	3.54*** (1.28)
2010-14 vs >2020	-0.25 (1.00)	-1.34 (1.70)	-4.25** (1.71)	5.01*** (1.58)
2015-2020 vs > 2020	-0.74 (0.86)	-2.61 (1.67)	-1.42 (1.19)	1.21 (1.45)
Observations	8415	1663	3970	2782

* p<0.1 ** p<0.05*** p<0.01; coefficients computed using OLS regression; study site fixed effects used in overall model
Standard errors in parentheses and clustered at habitation level



Density plots for tree cover change among matched treated and untreated habitations treated at differing times derived through LDSF models run on 2000 and 2020 Landsat 7 satellite imagery

OLS coefficients for remote sensing estimated changes in tree cover (2000 to 2020) for older and more recently FES treated sites

	AP/Karnataka			Rajasthan		
	(1)	(2)	(3)	(4)	(5)	(6)
Before 2011	-2.65 (2.59)	7.42** (3.23)	0.46 (2.35)	5.30** (2.44)	9.52*** (3.28)	8.49*** (2.74)
2011 to 2015	0.10 (2.03)	-1.34 (1.48)	0.072 (1.65)	-1.21 (2.24)	-1.59 (1.68)	-1.98 (1.92)
F-statistic	0.942	5.878	0.018	4.620	9.942	10.823
p-value	0.337	0.019	0.894	0.037	0.003	0.001
With covariates	No	Yes	Yes	No	Yes	Yes
Match habitations only	Yes	Yes	No	Yes	Yes	No
Observations	480	480	910	476	476	874

* p<0.1 ** p<0.05*** p<0.01; Differences computed using OLS regression; Standard errors in parentheses and clustered at habitation level (pseudo unit of assignment); district dummies included in all models

Common land, Rajasthan, site/area 35, plot 6



Year: 2000



Year: 2020

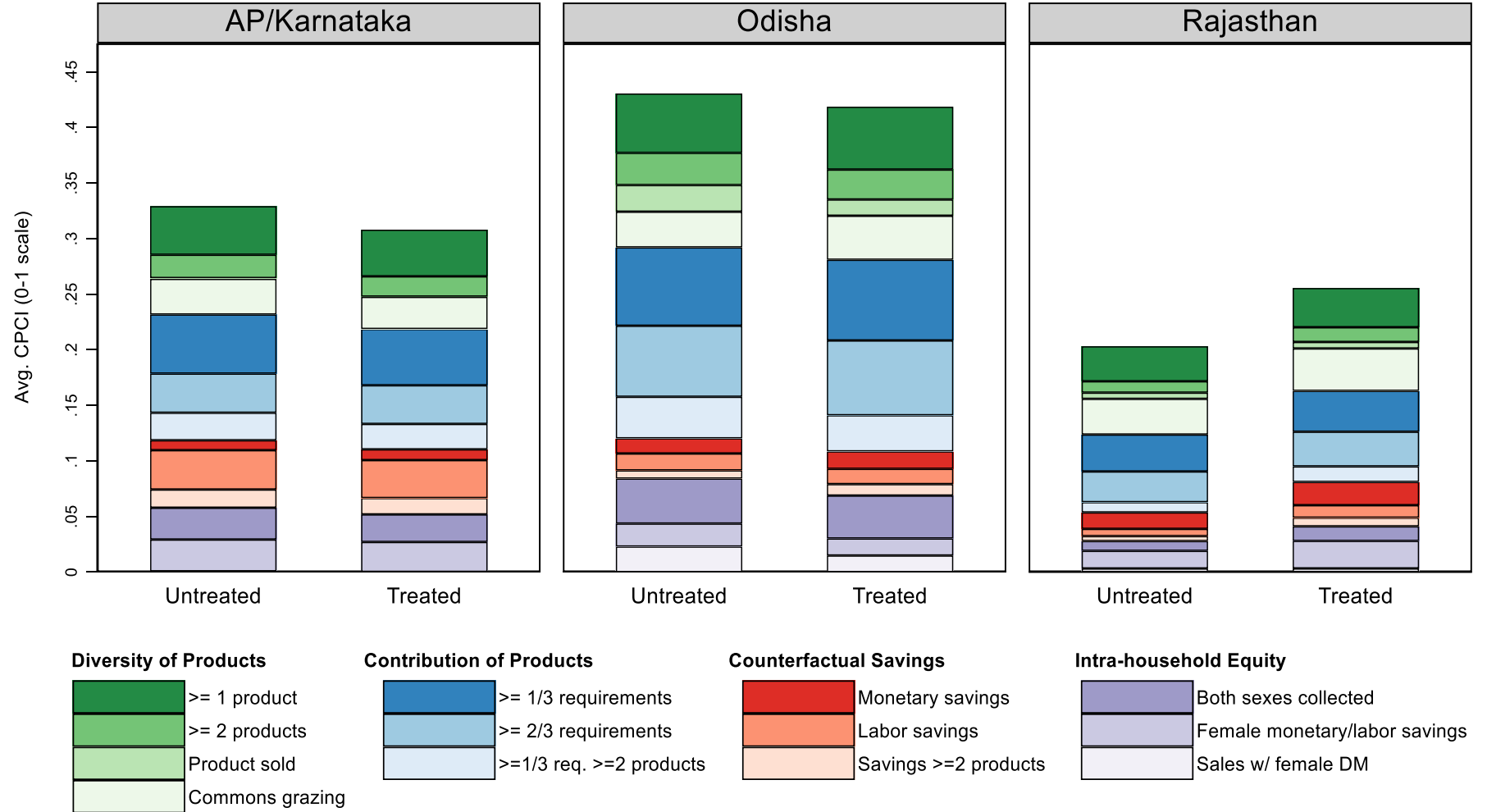
5% tree cover in 2000 and 51% in 2020, ~10-fold increase. Same plot also shows an increase in SOC from 7.72 g/kg in 2000 to 9.95 g/kg in 2020.

OLS treatment tree diversity and density coefficients for older & recently FES treated sites

	AP/Karnataka			Rajasthan		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Tree diversity (Shannon)</i>						
Before 2011	0.094 (0.16)	0.037 (0.16)	0.047 (0.13)	0.27** (0.11)	0.33*** (0.10)	0.33*** (0.11)
2011 to 2015	-0.11 (0.084)	-0.066 (0.065)	-0.12* (0.067)	0.14 (0.096)	0.21** (0.096)	0.15* (0.085)
F-statistic	1.615	0.394	1.590	0.895	0.676	1.819
p-value	0.210	0.533	0.211	0.349	0.415	0.181
<i>Tree density (trees per ha.)</i>						
Before 2011	79.2 (47.8)	72.0* (39.7)	73.6* (40.3)	104.8*** (37.0)	134.6*** (48.0)	131.8*** (42.0)
2011 to 2015	-21.9 (16.5)	-0.18 (17.3)	-9.33 (13.2)	4.31 (35.4)	16.2 (28.3)	29.7 (22.6)
F-statistic	4.914	2.643	3.914	5.093	4.680	5.093
p-value	0.032	0.111	0.051	0.029	0.036	0.027
With covariates	No	Yes	Yes	No	Yes	Yes
Match habitations only	Yes	Yes	No	Yes	Yes	No
Observations	480	480	910	480	480	880

* p<0.1 ** p<0.05*** p<0.01; Differences computed using OLS regression; Standard errors in parentheses and clustered at habitation level (pseudo unit of assignment); district dummies included in all models

- No consistent evidence that FES' core model translated into significant socioeconomic benefits in Rajasthan or the other study sites.
- However, there are some nuances, e.g., possible more fodder available for household dependent on cut-and-are system in Rajasthan



Each stacked bar indicates an average score on the index, as well the weighted contribution of each dimension and indicator. The greater the height of an individual sub-bar, the greater the indicator's contribution to the index.

Full 2021 Commons Product Collection Index (CPCI) by dimension and sub-dimension

Light & Heavy Qualitative Follow-up

Light-qual.

- Research & FES study teams visited all study sites to discuss the results with field staff, plus visit purposively selected habitations, e.g., those scoring relatively higher and lower on the CRAI
- In Odisha and AP/Karnataka study sites apparent that significant restoration work was also taking place in many of the matched comparison villages – e.g., Forest Dept. in Odisha and via MGNREGA in AP/Karnataka

Heavy-qual.

- Sociologist—Dr Varsha Metha—engaged to conduct in-depth qualitative work in Rajasthan

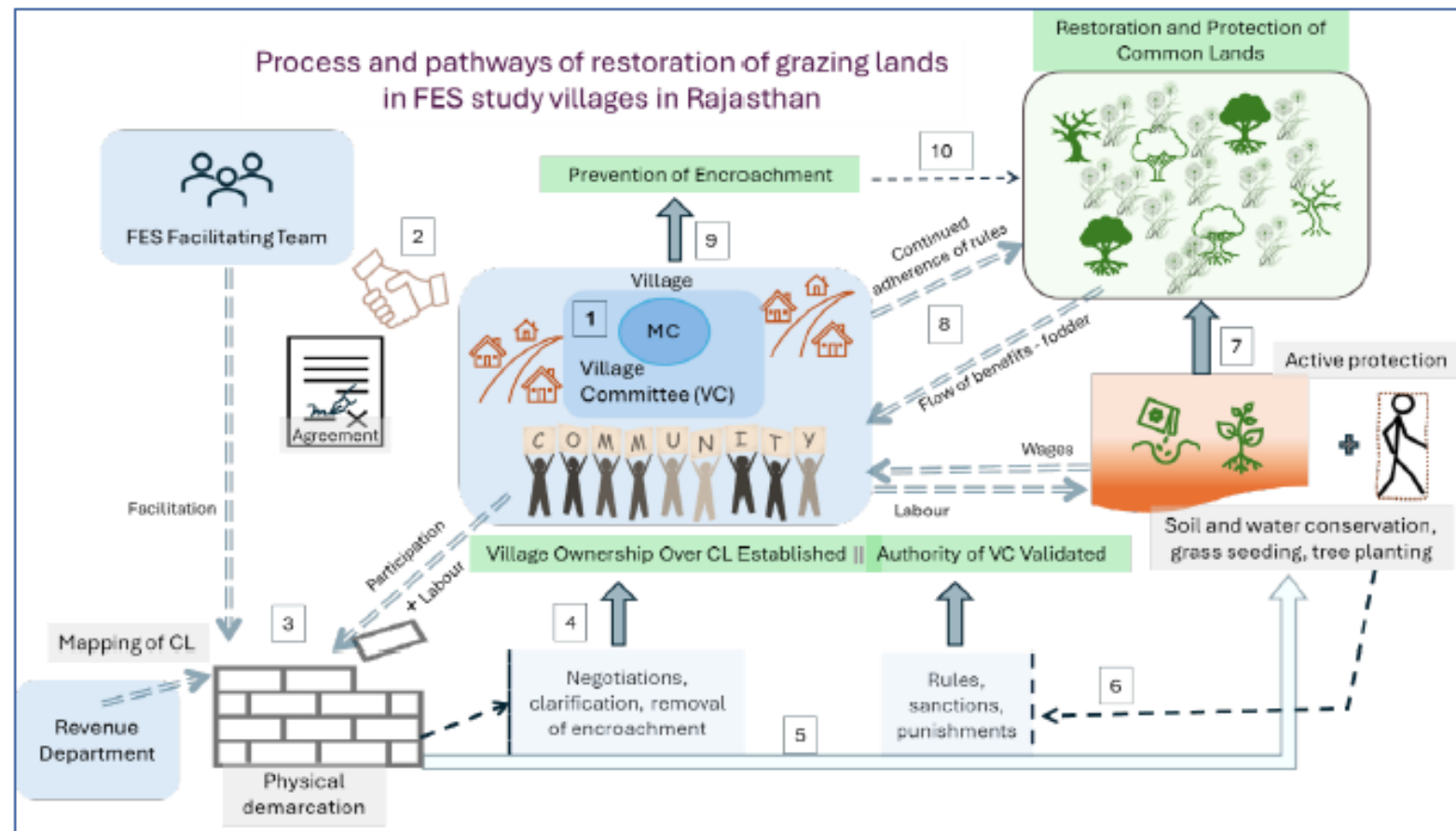
Table 1: Villages included in the study sample

Sl.	FES villages (Block)	Non-FES (control) villages (Block)
1.	Bhilwara district	
	1. Ralayta (Mandal) 2. Mehfaliyas (Asind)	1. Udairamji ka Gurha (Mandal) 2. Brahmpuri (Asind)
2.	Pratapgarh district	
	1. Bandikhari (Peepalkhoont) 2. Bellari (Pratapgarh)	1. Kanthariya Peepaliya (Peepalkhoont) 2. Baorikheda (Pratapgarh)

- Meetings with leaders of village committees (14); semi-structured interviews (24); meetings with women groups (12); and other group meetings (15)

- Generalize conceptual flow chart through which Core Model translated into greater gains in tree cover in 3 out of the 4 treated qual. drill-down villages

- 4th village forest area— land *de jure* forest but *de facto* non-demarcated private property



Legend:

1. Formation of Village Committee (VC) with a representative Management Committee (MC)
2. Agreement between FES and VC
3. Mapping and demarcation of CL boundaries
4. Removal of encroachments – village ownership of CL gets established
5. Soil and moisture conservation works undertaken on CL – community benefits through employment
6. Active protection and imposition of penalties for violation of rules – authority of VC is validated
7. Over time and with active protection, CL area is restored
8. Benefits start flowing to the community in the form of availability of fodder (and maybe firewood), encouraging adherence to rules and norms
9. Village community becomes vigilant and fresh encroachments are prevented
10. Continued protection of CL by the community

9. Discussion

Insights for Impact Assessment

Mixing data and approaches is good

- While involving, multi-data, mixed-methods approach made study more rigorous and informative

Upfront qual. important

- In hindsight, useful to have better understood treatment fidelity issues and relevant aspects of context heterogeneity early on to find ways to better address both

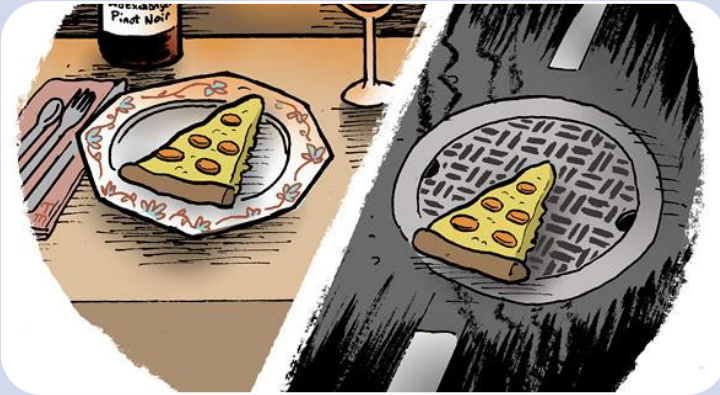
Do more to mitigate contamination

- Relatedly, failure to identify impact (e.g., in AP/Karnataka & Odisha) does not necessarily mean that FES' model was unimpactful in those contexts, given "contamination" (*late pre-emption*)

Measurement humility a must

- Measurement limitations (which may be inevitable in some cases) may lead to false conclusions about program impact, e.g., impact of increased access to fodder among CL users in Rajasthan

(Reinforced) Insights for Large Scaling Programs



Context matters!

e.g., rights claiming more relevant in common forest land in Odisha than pastoral lands of Rajasthan



Implementation matters!

Uniqueness + intensity.
Huge challenge when going to scale!



Implications for us!

How can we as researchers do more to support implementing partners address both?

10. Conclusion

- **Strong evidence that earlier implementation of FES's core model reduced encroachment & facilitated restoration (esp. tree cover) in the pastoral lands of Rajasthan**
- **But no strong evidence that this, in turn, translated into positive socioeconomic impacts, at least on average and in relation to the things we measured**
- **In other study sites, limited impact evidence of impact. Reasons appear to be due to combination of variation in implementation intensity and lack of sufficient intervention uniqueness, but more investigation is needed to substantiate**