

The Great Green Wall, a bulwark against food insecurity? Evidence from Nigeria

Pauline Castaing, Antoine Leblois

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The Great Green Wall, a bulwark against food insecurity? Evidence from Nigeria

Pauline Castaing¹

Antoine Leblois²

Journées micro appliquée, 2021

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¹CERDI / Université Clermont - Auvergne ²INRAE / C-EEM, Montpellier

The Great Green Wall, a bulwark against food insecurity? Evidence from Nigeria

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Overview

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Context

Desertification in Sub-Saharan Africa:

- Pressure exerted by human activities
- Aggravated by climate fluctuations
- Both phenomena generated land degradation
- Harmful consequences on local livelihoods: food insecurity, water shortage, poverty, health issues and conflicts.

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Context

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- Both phenomena generated land degradation
- Harmful consequences on local livelihoods: food insecurity, water shortage, poverty, health issues and conflicts.

The Great Green Wall, an environmental restoration program:

- Eleven countries committed to the creation of the Great Green Wall in 2007
- A goal of 8,000 km wall of vegetation from West to East
- Mosaic of interventions to address the needs of local populations

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Research Question

- Has the Great Green Wall led to an improvement of standards of living for local population?
- Focus on Nigerian Case
 - African country with the highest deforestation level between 2000 and 2013
 - The country with the largest population along the Great Green Wall



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At the crossroads of two streams of literature

Causal impact of environmental areas/forests on livelihoods

- Direct channels (medium / long run): addressing basic needs (mainly food), improving soil quality, limiting soil erosion, water retention & water flow regulation, biodiversity, changing local micro-climates thus improving agricultural productivity and labor productivity.
- Indirect channels (short run): creating new income-generating activities and boosting local demand temporarily

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Importance of early life conditions for individual development

- Long term consequences of malnutrition in early childhood on human capital attainments (height)
- No literature on how environmental programs could mitigate the deficits during early childhood

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Information on Great Green Wall in Nigeria

The project

- GGW started during late 2013
- Spread over 11 northern States in Nigeria
- Two main types of intervention : Vergers communautaires (300ha) et Brise-vent (642km)
- 20,000 jobs created

Data:

- Provided by the National Council on the Great Green Wall
- GPS coordinates of the projects
- Information on year of implementation & on the type of intervention

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Health of Nigerian Children

Fact: 37% of Nigerian children are stunted in 2018. **Data**:

- Nigerian Demographic and Health Survey (DHS)
 - two pre-treatment waves: 2003 & 2013
 - one post-treatment wave : 2018
 - cluster gps coordinates
- Sample selection
 - children below 5 years old
 - restriction to the 11 eleven northern states of Nigeria
 - rural clusters only
- Health outcome
 - Height-for-age standard deviation
 - Derived from anthropometric measurements

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Difference-in-Difference Estimation

$Y_{i} = \alpha + \beta POST_{i}.TREAT_{i} + \gamma POST_{i} + \delta TREAT_{i} + \nu X_{i} + \theta X_{i}.POST_{i} + \epsilon_{i}$ (1)

- $TREAT_i = 1$ if the child is less than 20km far from the project
- ▶ *POST_i* =1 for post-treatment period (2018)
- X_i : gender/age/education of hh head , religion/marital status/body mass index of the mother, time to the nearest water source, past drought conditions
- X_i.POST_i : time varying effects
- Standard errors clustered at the municipality level
- Exclusion of children located between the 'treatment' distance and 2× 'treatment' distance: 15-30 km far from the project for main specifications.

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Difference-in-Difference Estimation: limitations

Identifications issues: Location of projects is not random

- Propensity Score Reweighting
- Placebo Checks (2003 2013)

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Evolution of the outcomes

Change in Height-To-Age standard deviation over time: Graph1

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Main results for orchards

Table: DiD regressions on height-to-age for Orchard Treatment

		Orc	hard Treatn	nent	
	(1)	(2)	(3)	(4)	(5)
Period of Interest : 2013 - 2018					
Post × Treat	0.438***	0.683***	0.717***	0.589***	0.555***
	(0.157)	(0.174)	(0.175)	(0.147)	(0.147)
Observations	8,726	7,859	7,856	7,856	7,856
R-squared	0.022	0.025	0.157	0.179	0.181
Placebo Period : 2003 - 2013					
Post × Treat	-0.0763	-0.0763	0.142	-0.277	-0.269
	(0.290)	(0.290)	(0.203)	(0.200)	(0.191)
Observations	7,043	7,043	6,864	6,864	6,864
R-squared	0.022	0.022	0.165	0.182	0.185
Individual Controls X_i	Yes	Yes	Yes	Yes	Yes
PS Reweighting	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes
Birth Month FE	No	No	Yes	Yes	Yes
Birth Month × Birth Year FE	No	No	Yes	Yes	Yes
State fixed effect	No	No	No	Yes	Yes
$POST_i \times X_i$	No	No	No	No	Yes

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Main results for shelterbelts

Table: DiD regressions on height-to-age for Shelterbelt Treatment

	Shelterbelt Treatment (1) (2) (3) (4) (5)					
	(1)	(2)	(3)	(4)	(5)	
Period of Interest : 2013 - 2018						
Post × Treat	0.717**	0.862**	0.902***	0.537	0.514	
	(0.348)	(0.378)	(0.328)	(0.364)	(0.355)	
Observations	10,027	6,699	6,698	6,698	6,698	
R-squared	0.021	0.020	0.148	0.153	0.155	
Placebo Period : 2003 - 2013						
Post × Treat	-0.295	-0.295	0.214	-0.251	-0.321	
	(0.471)	(0.471)	(0.311)	(0.326)	(0.339)	
Observations	8,204	8,204	3,718	3,718	3,718	
R-squared	0.018	0.018	0.150	0.157	0.158	
Individual Controls X_i	Yes	Yes	Yes	Yes	Yes	
PS Reweighting	No	Yes	Yes	Yes	Yes	
Year FE	No	No	Yes	Yes	Yes	
Birth Month FE	No	No	Yes	Yes	Yes	
Birth Month x Birth Year FE	No	No	Yes	Yes	Yes	
State fixed effect	No	No	No	Yes	Yes	
$POST_i \times X_i$	No	No	No	No	Yes	
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Main results for all treatments

Table: TOTAL PROJECTS 15 KM

		Т	otal Treatm	ent	
	(1)	(2)	(3)	(4)	(5)
Period of Interest : 2013 - 2018					
Post x Treat	0.365** (0.143)	0.615*** (0.177)	0.644*** (0.175)	0.504*** (0.142)	0.469*** (0.141)
Observations	8,828	7,972	7,970	7,970	7,970
R-squared	0.021	0.024	0.159	0.181	0.184
Placebo Period : 2003 - 2013					
Post × Treat	0.0872	0.0872	0.326	-0.179	-0.180
	(0.292)	(0.292)	(0.208)	(0.199)	(0.194)
Observations	7,051	7,051	6,873	6,873	6,873
R-squared	0.021	0.021	0.163	0.181	0.183
Individual Controls X_i	Yes	Yes	Yes	Yes	Yes
PS Reweighting	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes
Birth Month FE	No	No	Yes	Yes	Yes
Birth Month × Birth Year FE	No	No	Yes	Yes	Yes
State fixed effect	No	No	No	Yes	Yes
$POST_i \times X_i$	No	No	No	No	Yes

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Main results for orchards/shelterbelts/boreholes, 15km Table: orchards/shelterbelts/boreholes

	Or	chard/Boreh	ole/Shelter	belt Treatm	ent
	(1)	(2)	(3)	(4)	(5)
Period of Interest : 2013 - 2018					
Post × Treat	0.407***	0.638***	0.675***	0.524***	0.489***
	(0.149)	(0.176)	(0.175)	(0.141)	(0.140)
Observations	8.812	7.956	7.954	7.954	7.954
R-squared	0.021	0.023	0.157	0.179	0.181
Placebo Period : 2003 - 2013					
Post × Treat	0.0407	0.0407	0.298	-0.196	-0.183
	(0.287)	(0.287)	(0.206)	(0.198)	(0.194)
Observations	7.093	7.093	6.915	6.915	6.915
R-squared	0.021	0.021	0.161	0.177	0.179
Individual Controls X _i	Yes	Yes	Yes	Yes	Yes
PS Reweighting	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes
Birth Month FE	No	No	Yes	Yes	Yes
Birth Month × Birth Year FE	No	No	Yes	Yes	Yes
State fixed effect	No	No	No	Yes	Yes
$POST_i \times X_i$	No	No	No	No	Yes

ightarrow A 23 to 29 % health improvement

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Alternative Specifications

- ► Fake treatments (other health outcome): fever, diarrhea, cough √
- Testing short run (weight) health outcome ×
- ▶ Different distance (main identification strategy): 10 and 20km. √
- ► Controling for climate zones (rainfall: ishoyets) ✓
- Controling for migration \checkmark
- Considering specificity of joint projects (boreholes) \checkmark
- ▶ Introducing 2008 DHS for placebo checks : $\times \rightarrow \mathbb{P}$

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Heterogeneity of impacts: treatment duration







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Heterogeneity of impacts: age at treatment







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Results

- Children living next to new orchards benefit from better health conditions (14 to 19%) and food access
- Children living next to shelterbelts also enjoy better health (23 to 29%) but channel is not identified

Path for future research

- Extend the analysis to other committed countries
- On a longer term, further investigate the indirect channels

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Thank you for your attention!

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Back Mapping the GGW projects



Back GGW projects

	Year of establishment					
	2013	2014	2015	2016	Total	
Orchard	8	32	39	4	83	
Shelterbelt	45	57	114	0	216	
Borehole	0	44	29	1	74	
Solar Powered Borehole	10	3	14	0	27	
Nursery school	0	1	1	0	2	
Orchard / Nursery school	0	11	6	0	17	
Borehole / Nursery school	0	3	0	0	3	
Woodlot	1	3	14	2	20	
Skill Acquisition center	0	0	4	0	4	
Total	64	156	221	7	448	
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Table: Distribution of projects over the 2013-2016 period

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Table: Project size summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	Ν
Shelterbelts lenght (km)	1.338	0.868	0.65	5	204
Orchards size (ha)	2.829	1.228	1	7	111
Borehole field size (ha)	0.511	0.489	0.022	1	25
Woodlots (ha)	4.25	1.164	1	5	20
Other (size in ha)	0.163	0.448	0.009	2	24

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Back Satellite Views for Shelterbelts and Orchards



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Back Satellite Views for Shelterbelts and Orchards



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Parallel trends Back





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Table: Distribution of observations among treated and control groups in DHS surveys

	 10km				15km			
	2013		2018		2013		2018	
	<i>Treated</i> (after 2013)	Control	Treated	Control	<i>Treated</i> (after 2013)	Control	Treated	Control
Orchard	865	9,081	941	8,921	1,441	7,575	1,663	7,498
Total Sample	9,766		9,862		9,016		9,161	
Shelterbelt	197	10,530	326	10,329	447	10,097	472	9,522
Total Sample	10,727		10,665		10,544		9,994	
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