

Off-Grid Groundwater Irrigation in Sub-Saharan Africa

2020 Internship Showcase

Aaron Schwartz

NC State

internships@rti.org



Background

- Less than half of the >1 billion people living in Sub-Saharan Africa (SSA) lack access to electricity.
- Most agriculture in SSA is rainfed and susceptible to climate variation.

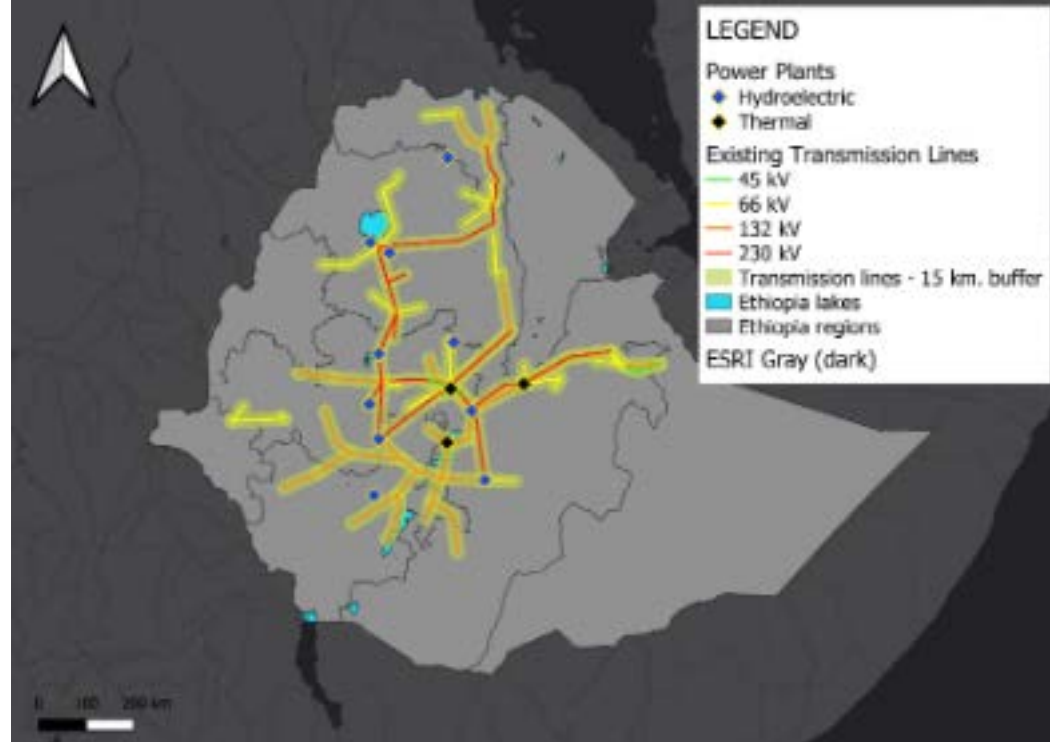


Figure 1. Ethiopia's Existing Electrical Grid and Estimates of Areas with Access to Electricity



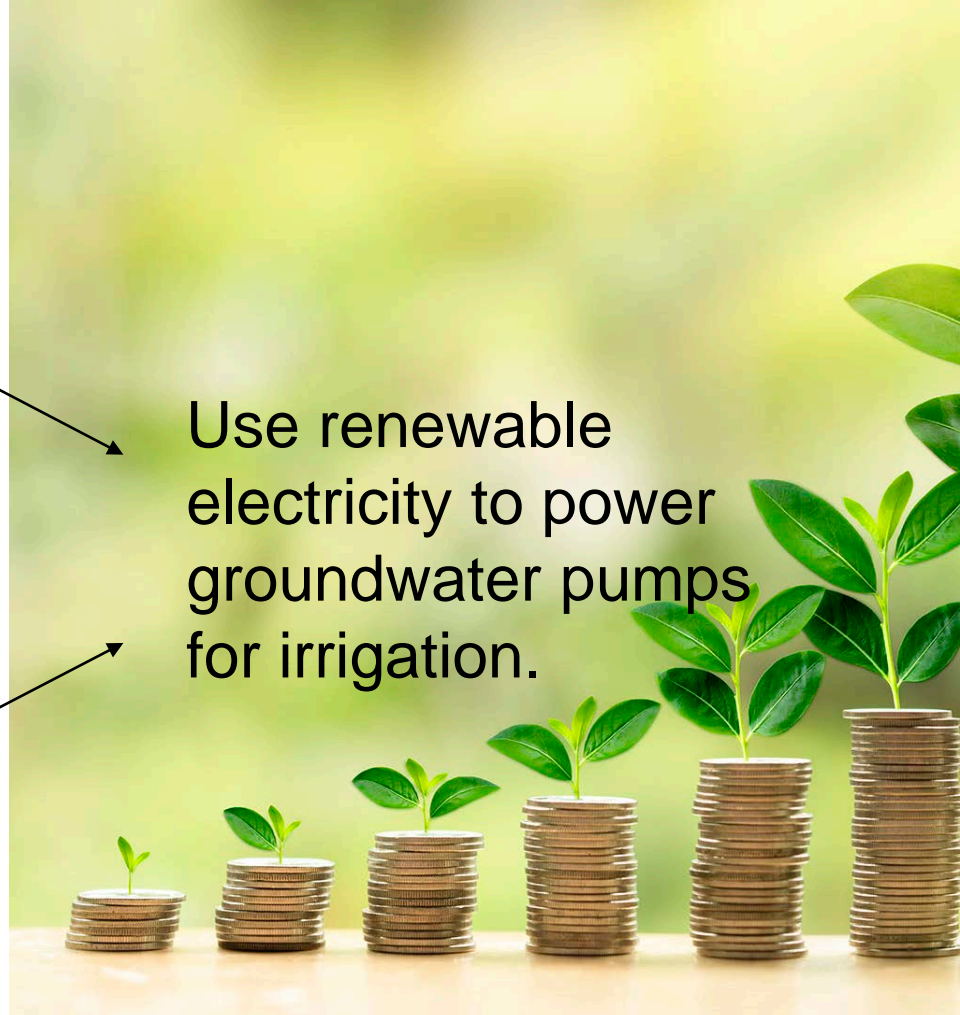
So What?

- Grid connections are too costly, especially for farmers.
- Rainfed agriculture is susceptible to drought and changes in rainfall patterns.



So What Can We Do?

- Electricity may be adopted at greater rates if it can support income-generating activities.
- Agricultural productivity and food security can be increased by irrigation.



Use renewable electricity to power groundwater pumps for irrigation.

Analysis Findings

Table of Spatial Data associated with relating to administrative zones in Ethiopia

Ethiopia Admin Zones with Crop Data :: Features Total: 79, Filtered: 79, Selected: 0

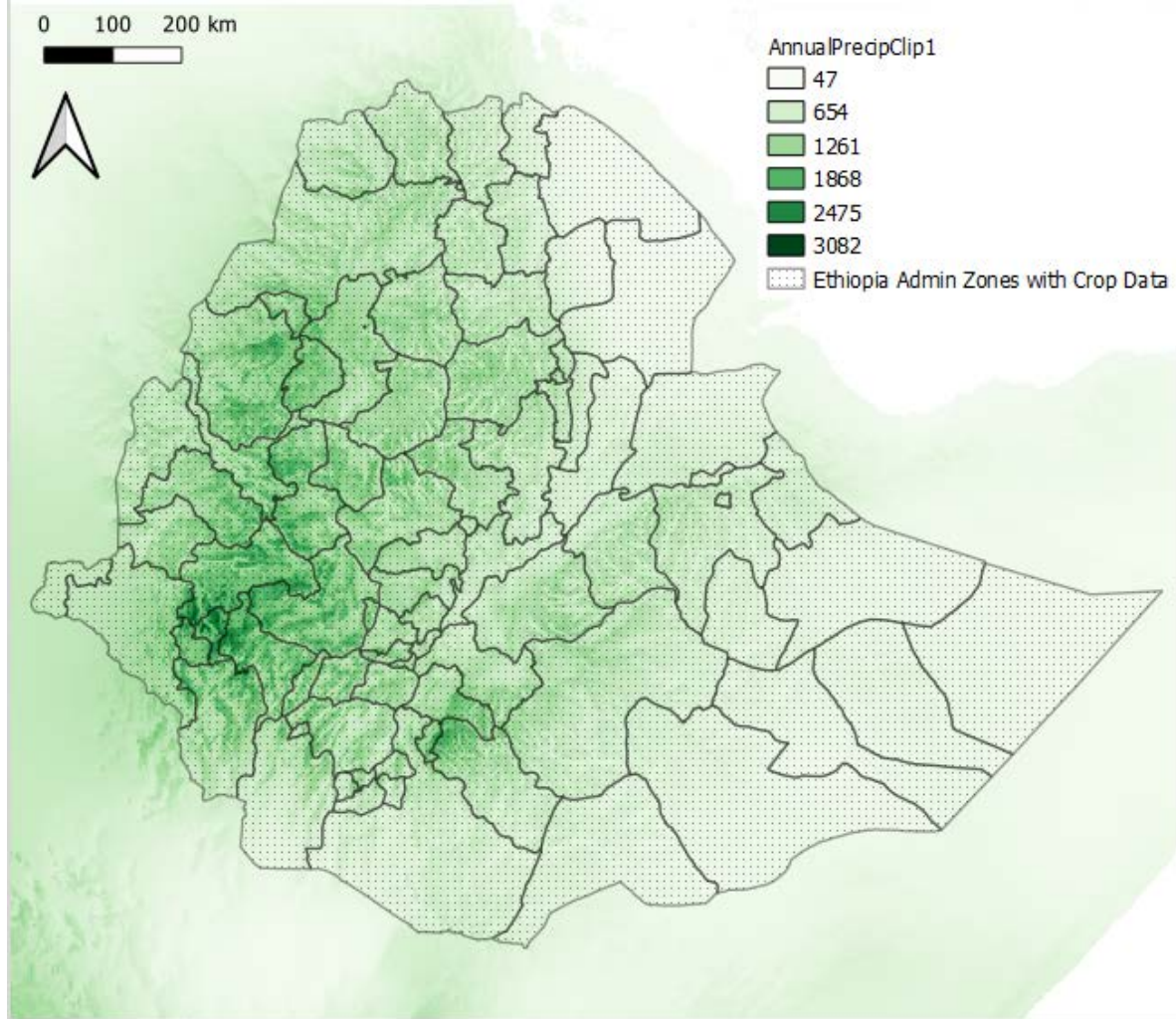
2	AnnualMean	MinPrecip	MaxPrecip	AgriArea	AgriCount	IrrigCount	%Croplrrig	area	Area%Crops
1	394.9810939080...	165.0000000000...	896.0000000000...	9437500	151	120	0.79	10736391928.26...	0.001
2	706.0166097485...	388.0000000000...	1048.000000000...	20125000	322	322	1.00	5400122826.781...	0.004
3	1587.029850746...	992.0000000000...	2423.000000000...	4700000000	75200	31175	0.41	8958448749.219...	0.525
4	1014.297814207...	756.0000000000...	1344.000000000...	121187500	1939	1687	0.87	309395002.9127...	0.392
5	1183.400000000...	1156.000000000...	1209.000000000...	3062500	49	2	0.04	8661217.584045...	0.354
6	1188.963675087...	632.0000000000...	1797.000000000...	12673187500	202771	32542	0.16	14142260935.04...	0.896
7	1180.964705308...	601.0000000000...	1832.000000000...	14217062500	227473	118566	0.52	17212301494.68...	0.826
8	1312.156591442...	748.0000000000...	2216.000000000...	11411875000	182590	71799	0.39	16418702397.10...	0.695
9	1275.160500383...	721.0000000000...	1928.000000000...	12413000000	198608	67766	0.34	14247857863.48...	0.871
10	962.4231089376...	516.0000000000...	1658.000000000...	12540562500	200649	99346	0.5	16172342953.68...	0.775
11	936.6102335928...	566.0000000000...	1494.000000000...	1259437500	20151	15328	0.76	3779391871.421...	0.333
12	1114.563912553...	605.0000000000...	1978.000000000...	17888250000	286212	38175	0.13	42929252133.80...	0.417
13	495.8732646242...	245.0000000000...	842.0000000000...	81000000	1296	1222	0.94	36207111303.16...	0.002
14	555.5036997255...	360.0000000000...	823.0000000000...	92187500	1475	608	0.41	14228778105.99...	0.006
15	352.7475785373...	187.0000000000...	698.0000000000...	410437500	6567	3670	0.56	33365283108.92...	0.012
16	506.7019414517...	211.0000000000...	1136.000000000...	207625000	3322	1024	0.31	30425206117.20...	0.007
17	1079.266601562...	759.0000000000...	1465.000000000...	836562500	13385	13157	0.98	862866057.5385...	0.97
18	890.1277461350...	632.0000000000...	1559.000000000...	562750000	9004	7714	0.86	1048744292.412...	0.537
19	1062.403480152...	684.0000000000...	1725.000000000...	630250000	10084	9205	0.91	1561094139.521...	0.404

Show All Features



Analysis Findings

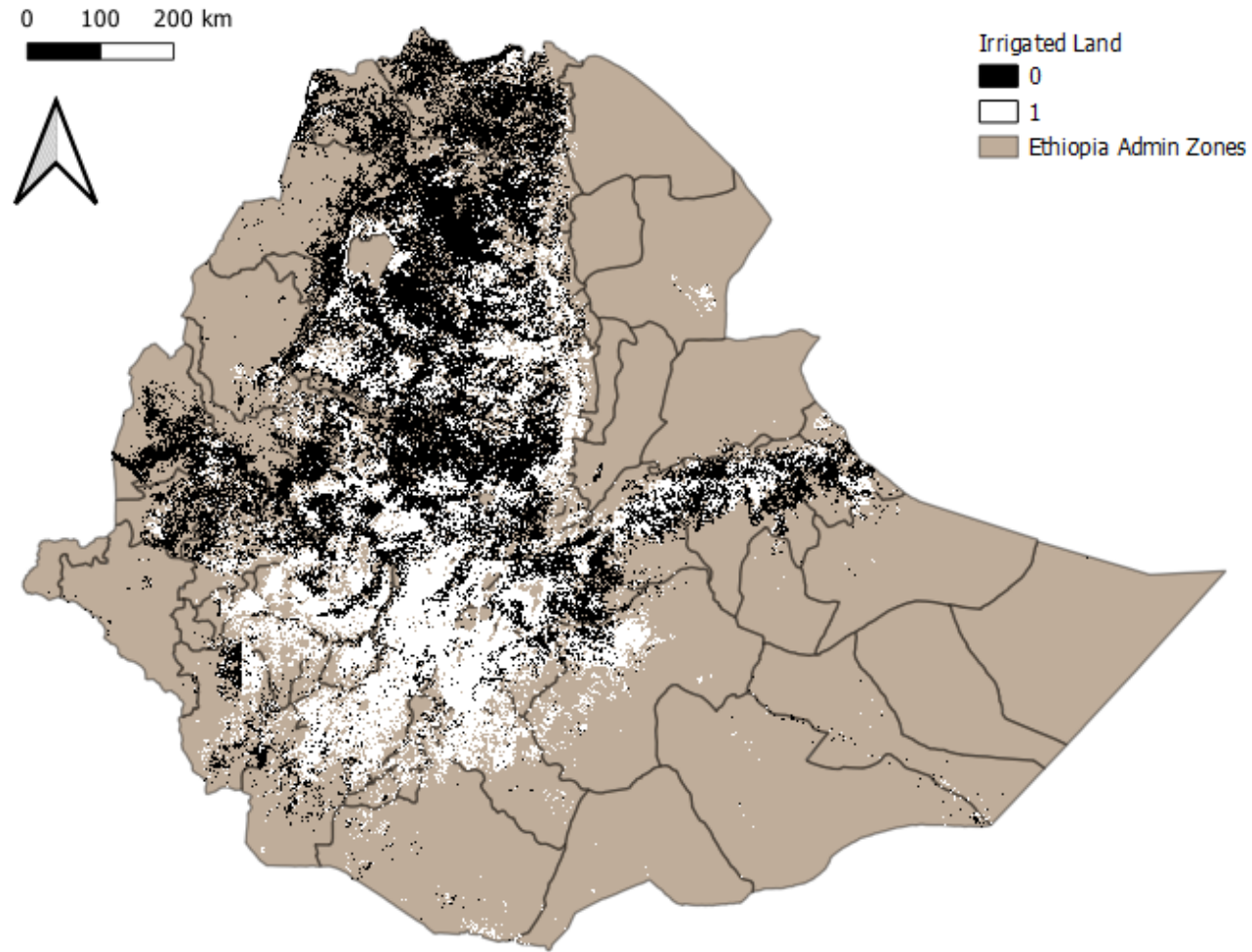
Map depicting the annual precipitation in mm across Ethiopia





Analysis Findings

This map depicts the land area in Ethiopia that is irrigated





Analysis Findings

Map depicting the intersection of non-irrigated land and low-precipitation areas

0 100 200 km

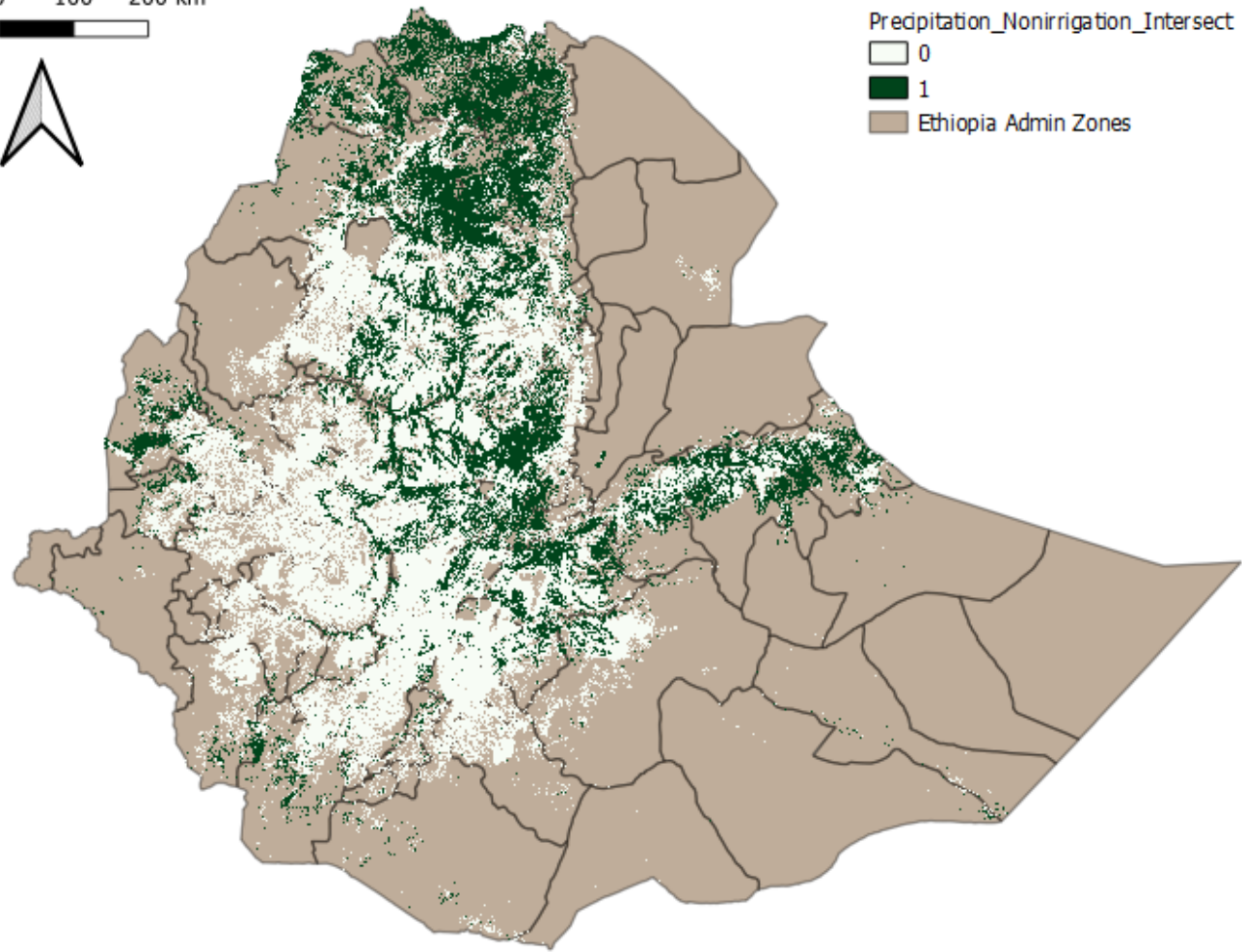


Precipitation_Nonirrigation_Intersect

0

1

Ethiopia Admin Zones





Acknowledgments

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- Dr. Mike Gallaher, Chandler Cowell
- RTI International, the PIRE program, and the Power Africa Off-Grid Project

Sources

- Image: Off-Grid Solar Groundwater Irrigation Pumping in Sub-Saharan Africa. Cowell C., Gallaher M., Larson J. RTI Working Paper
- Image: <https://www.gettyimages.com/detail/photo/growing-investment-concept-royalty-free-image/1061700868?adppopup=true>
- Image: <https://www.gettyimages.com/detail/photo/tea-farmers-royalty-free-image/628345012?adppopup=true>
- Analysis images were produced as part of my work this summer



Thank you

Contact: Aaron Schwartz | email: internships@rti.org