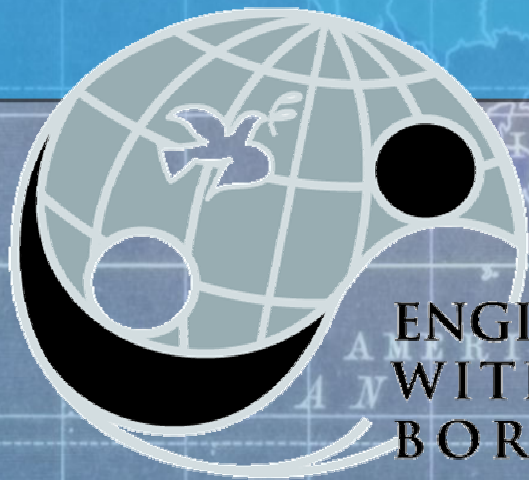


Developing Another World

Sustainable Development in Rwanda

Engineers Without Borders-USA
Johnson Space Center Chapter



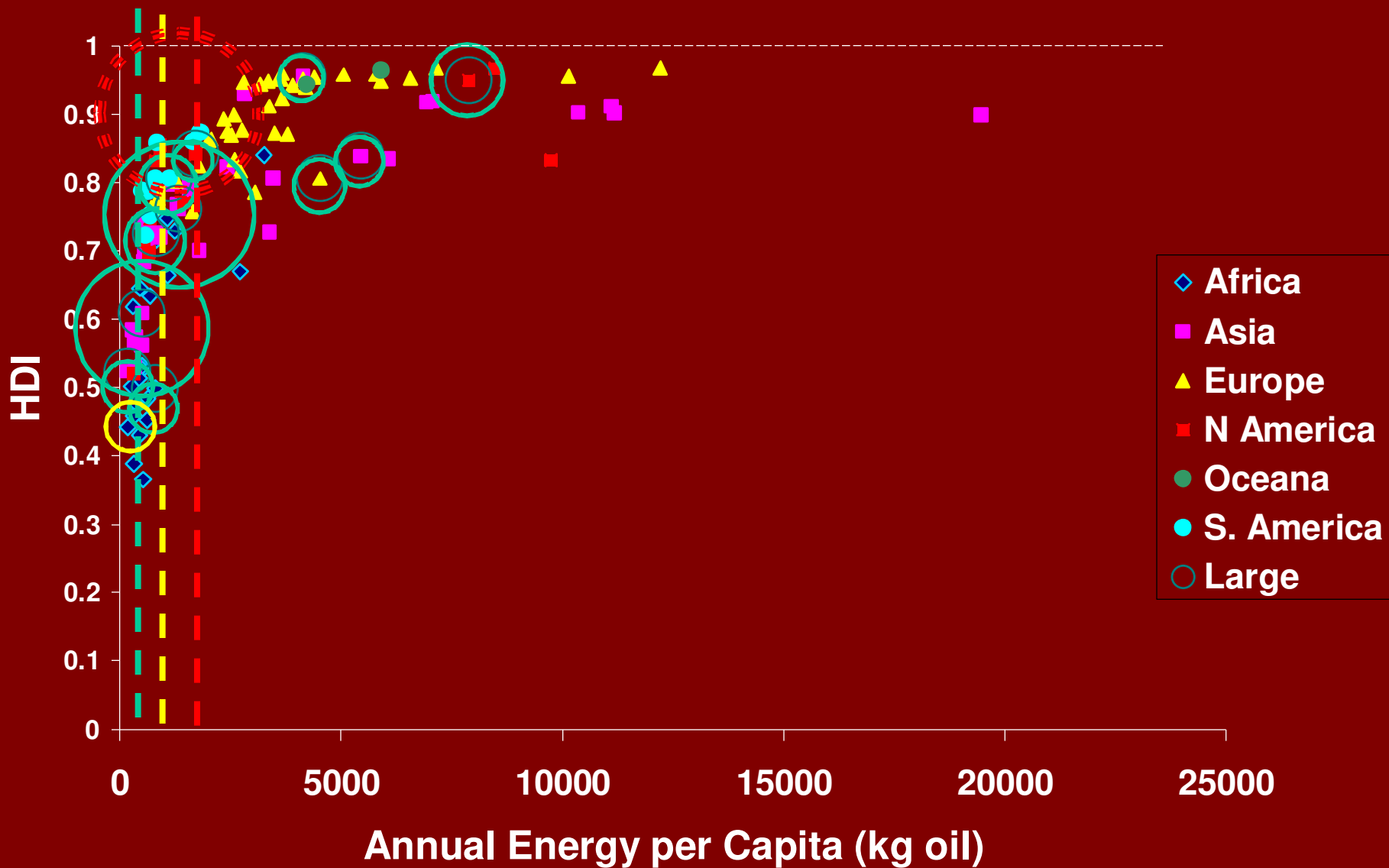
ENGINEERS
WITHOUT
BORDERS
USA



UN Millennium Goals

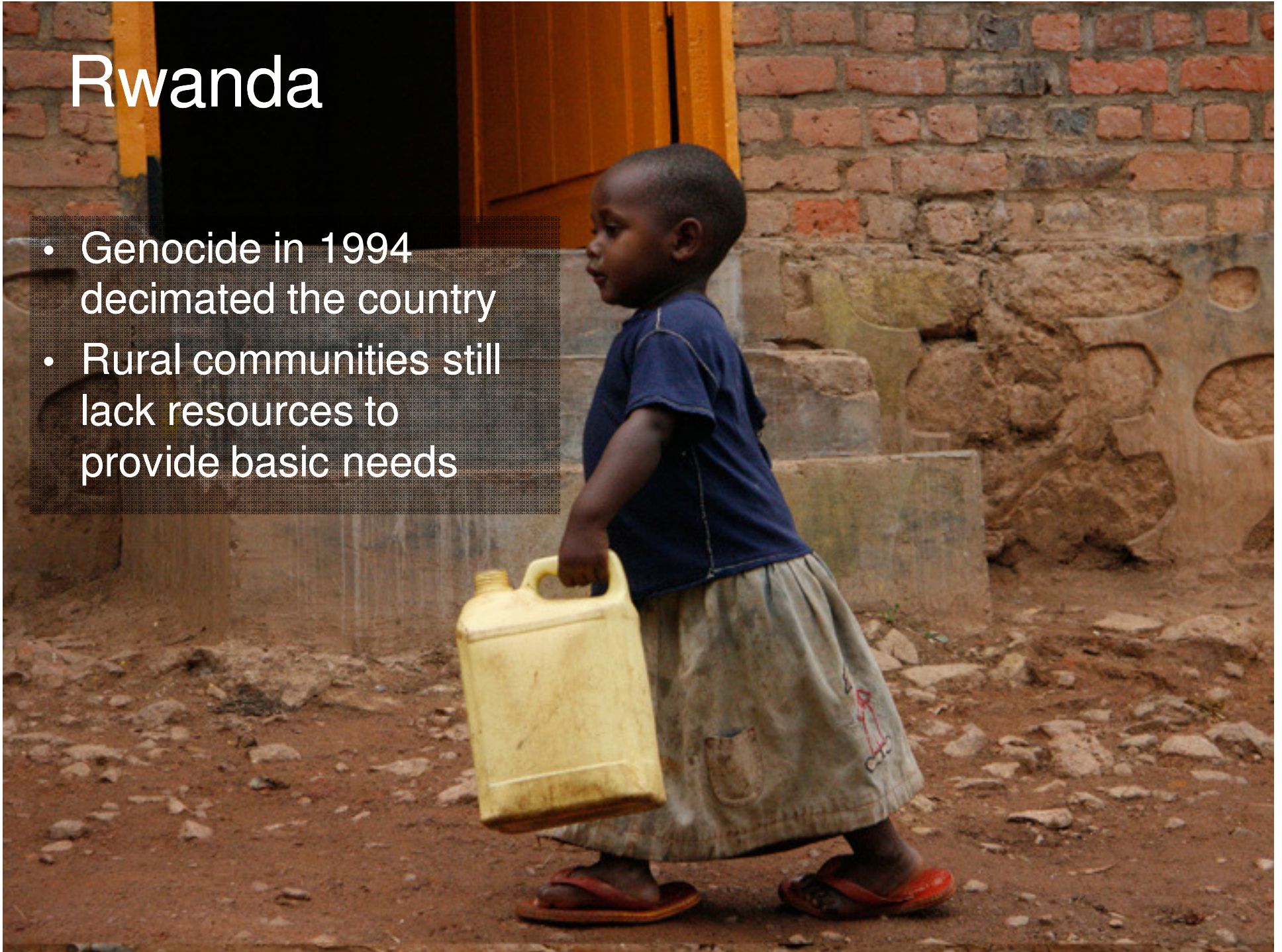
- 1) Eradicate Extreme Poverty and Hunger
- 2) Achieve Universal Primary Education
- 3) Promote Gender Equality and Empower Women
- 4) Reduce Child Mortality
- 5) Improve Maternal Health
- 6) Combat HIV/AIDS, Malaria, and other Diseases
- 7) Ensure Environmental Sustainability
- 8) Develop a Global Partnership for Development
 - <http://www.un.org/millenniumgoals/index.html>

Human Development Index vs. Energy Consumption



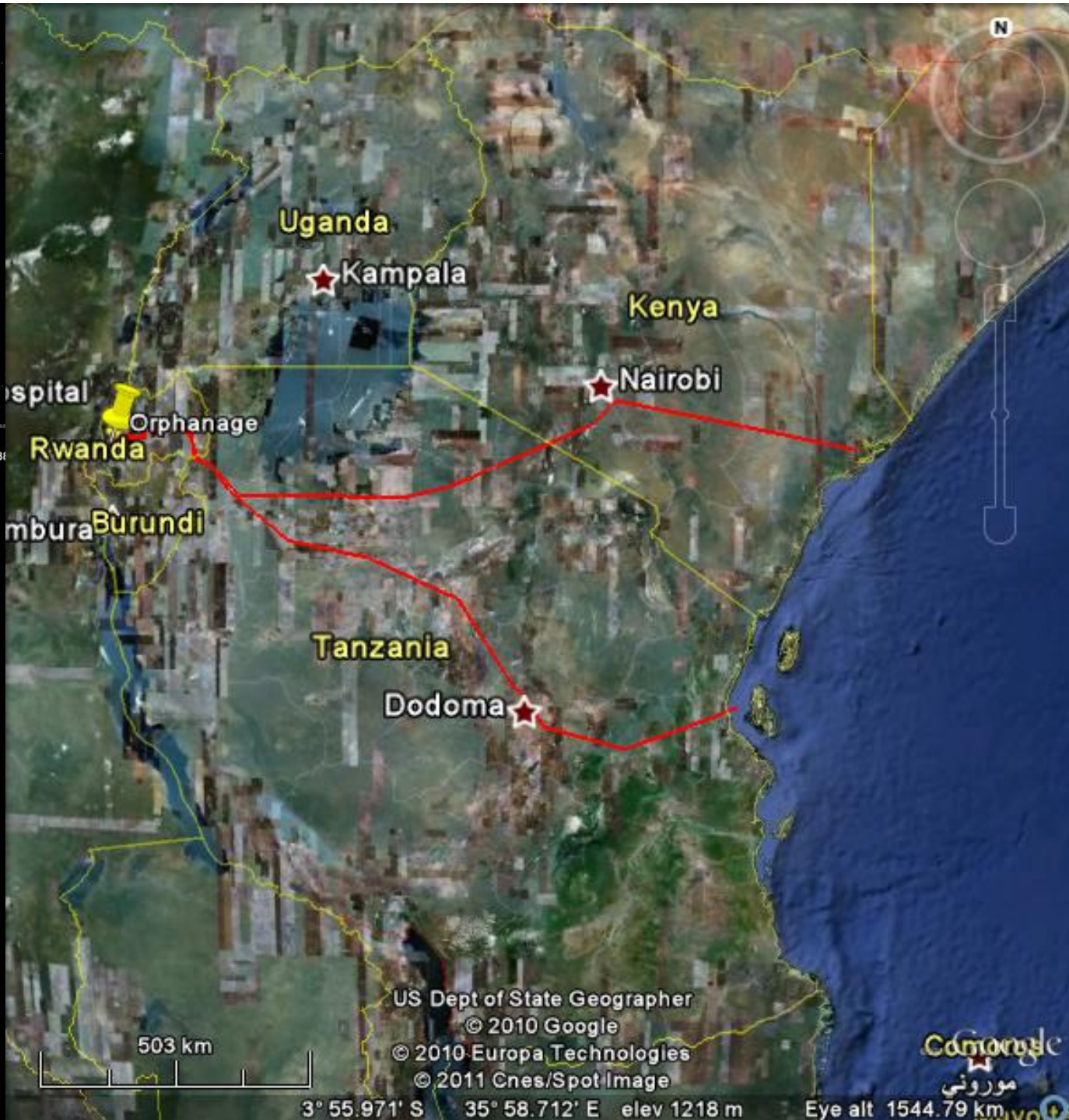
Rwanda

- Genocide in 1994 decimated the country
- Rural communities still lack resources to provide basic needs





US Dept of State Geographer
© 2010 Google
© 2010 Europa Technologies
© 2010 Tele Atlas
28° 45.807' N 35° 1.630' E elev 24 m Eye alt 1108

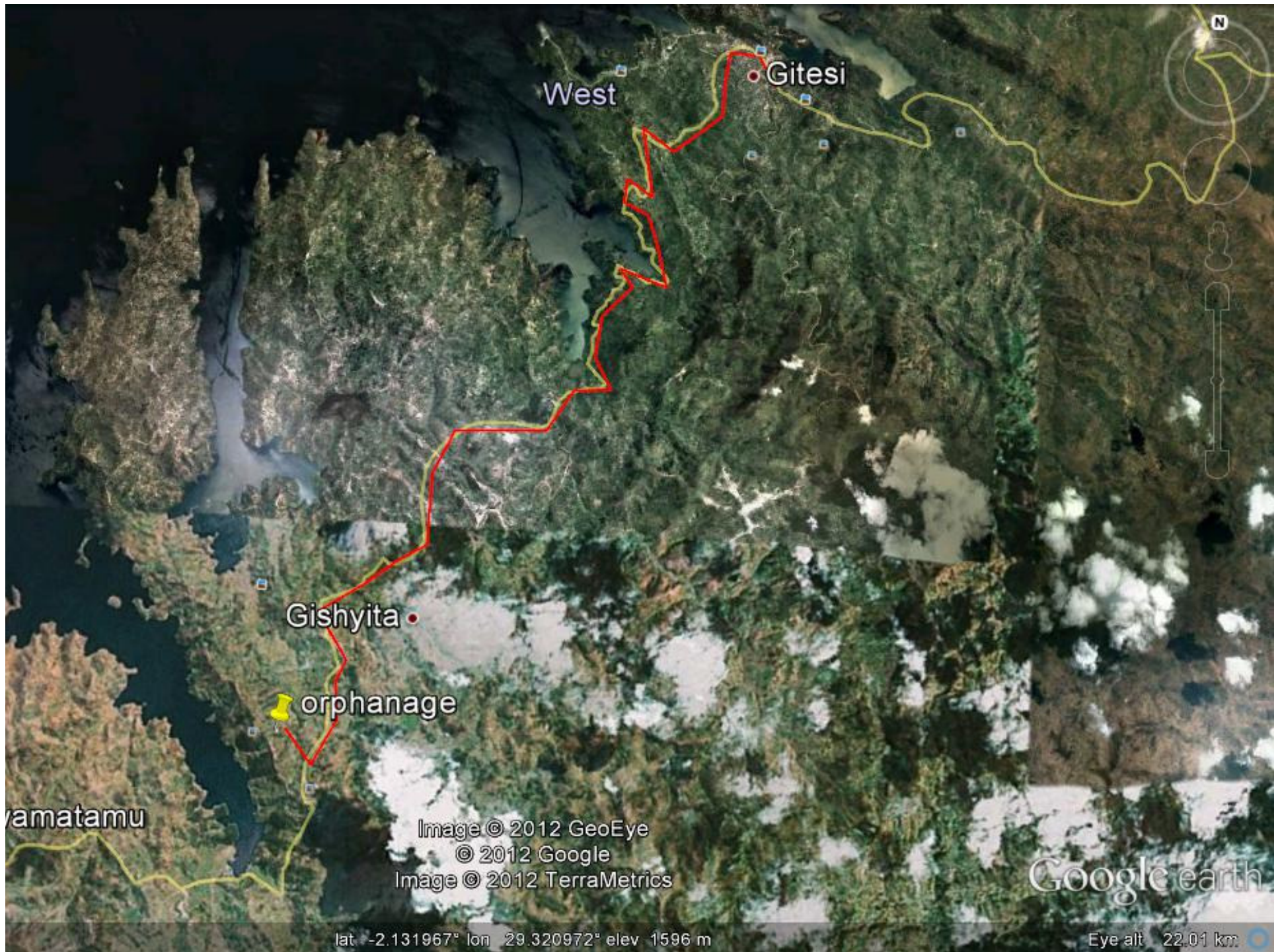


US Dept of State Geographer
© 2010 Google
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© 2011 Cnes/Spot Image



3° 55.971' S 35° 58.712' E elev 1218 m Eye alt 1544.79 km





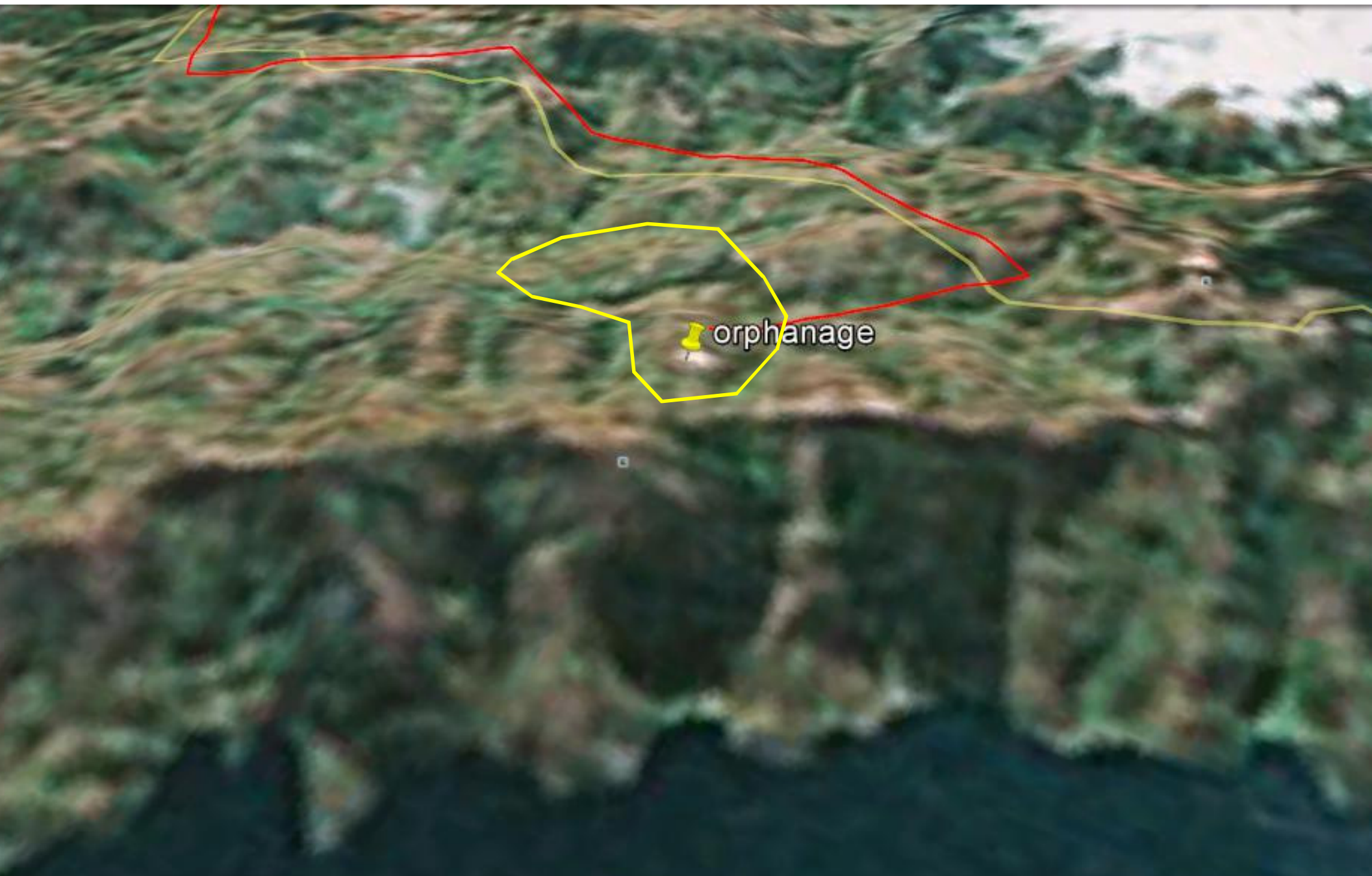
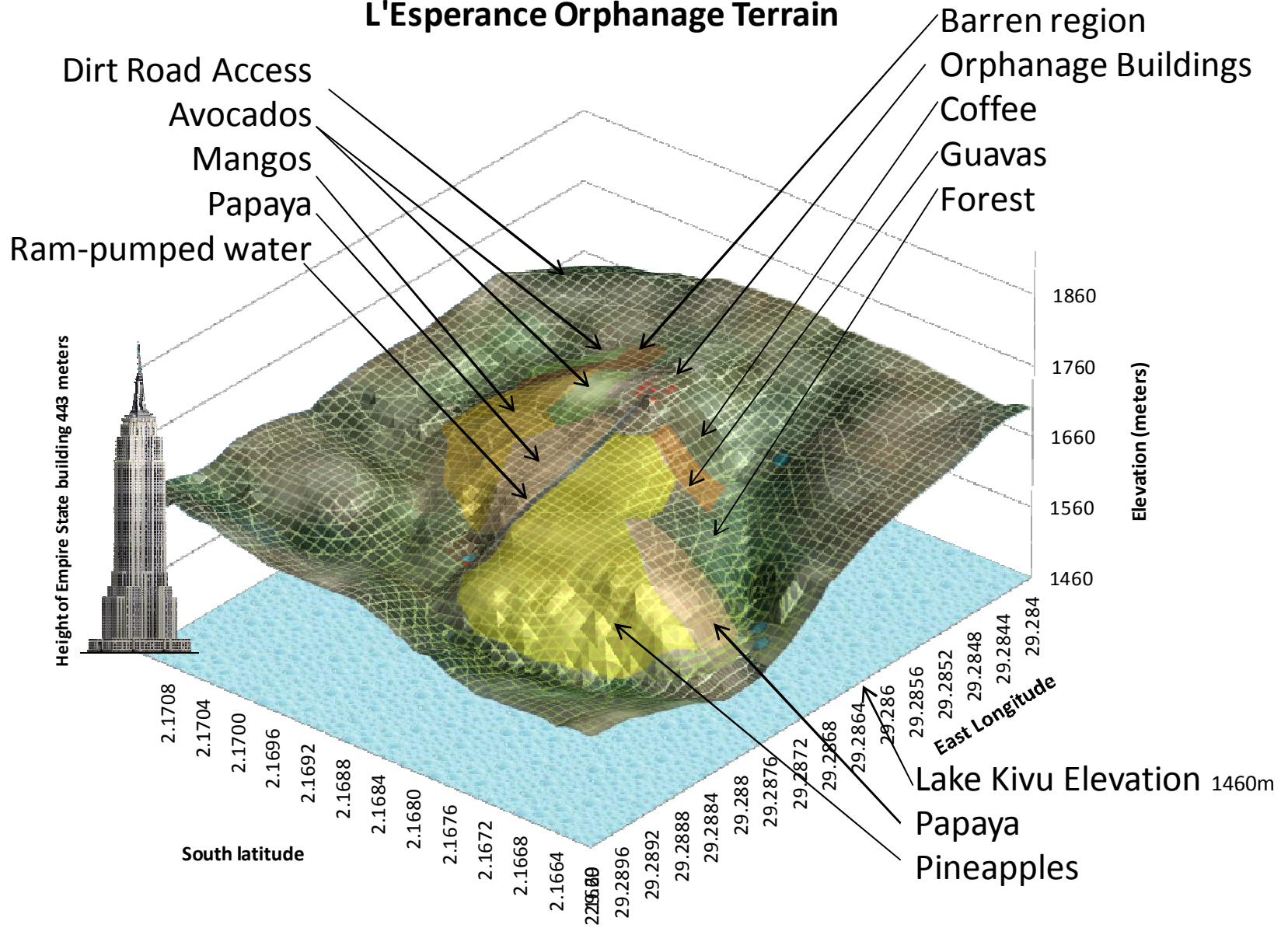


Image © 2012 GeoEye
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Image © 2012 TerraMetrics

Go

L'Esperance Orphanage Terrain



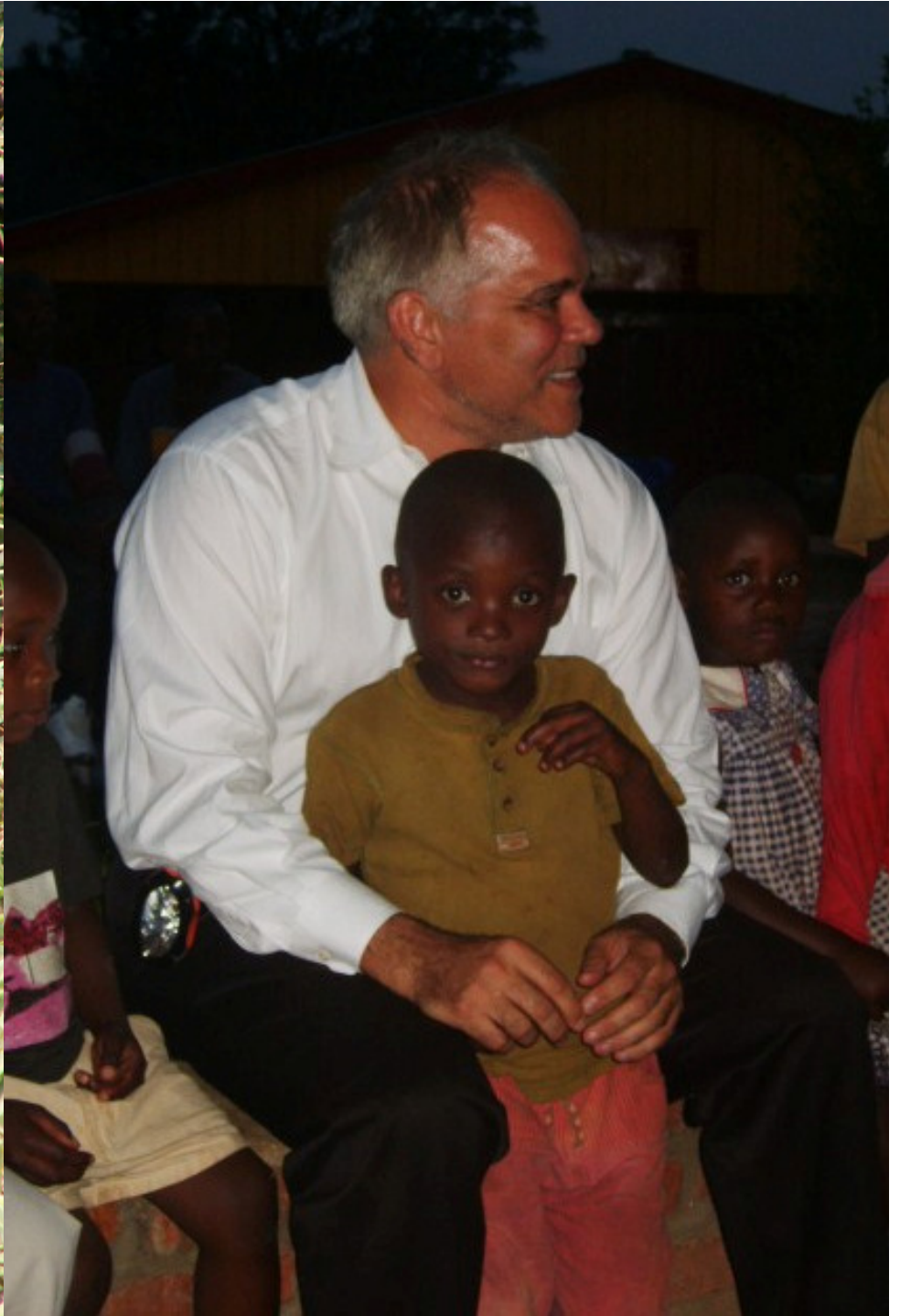




Solar Lighting, January 2006

- **Muramba**
 - 102 Watt solar panel and five CFL lights at Muramba Clinic for delivery and patient rooms
 - Installed identical system at Muramba College for school girls to be able to study at night
 - Muramba College headmistress hopes to increase pass rate from 35% to 50% now that girls don't have to carry water during the day, and can study at night
- **Mugonero**
 - Installed 408 Watts and 16 CLFs for hospital complex
 - Two lights for surgery, three for nursing station, one for surgery prep, two for delivery rooms, one for dentistry, four for hallways, two for offices, one for internet café
 - During visit, power went out and surgeons used EWB provided lights to finish work





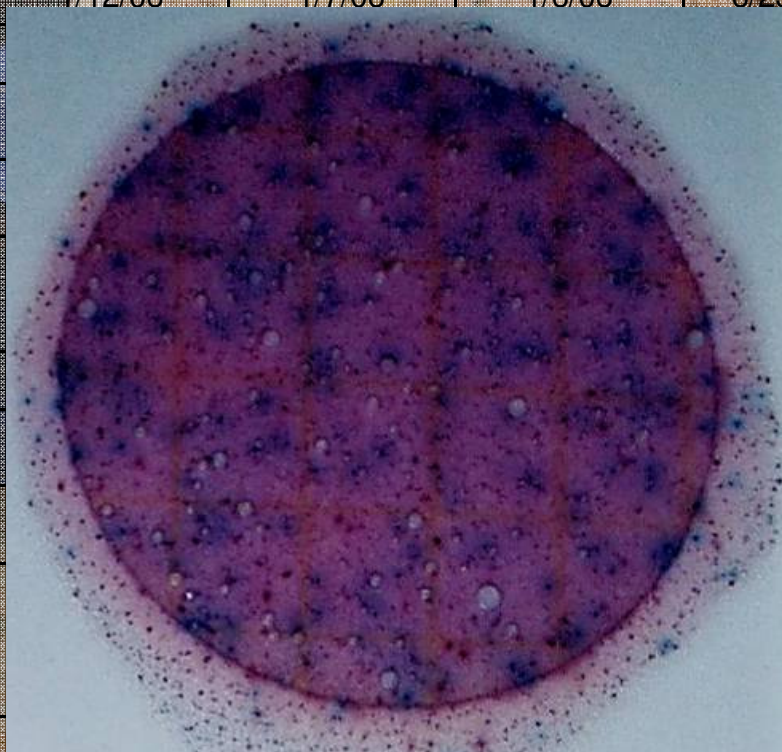
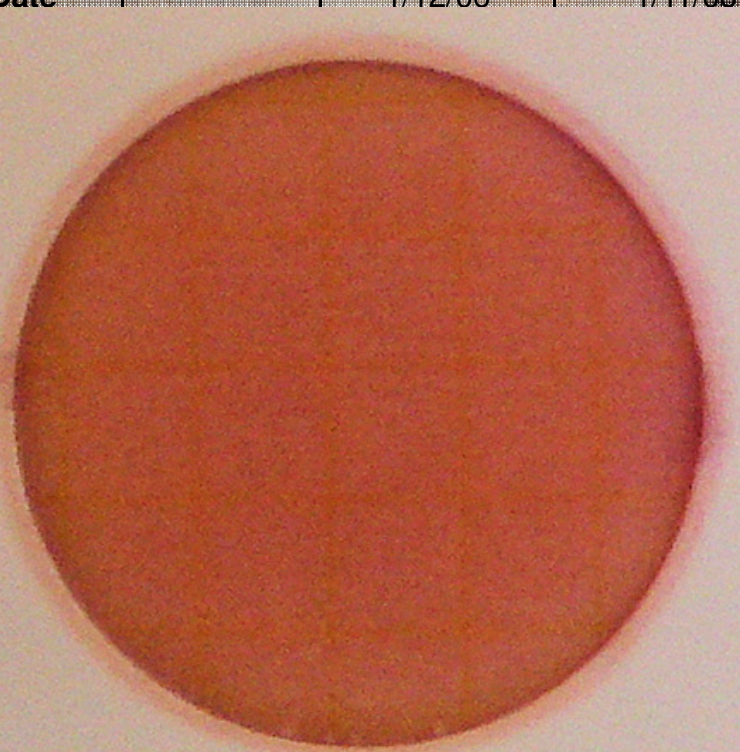


Orphanage Surveying



Water Quality Assessment

	WHO Standard	Mugonero Orphanage house rainwater	Mugonero Orphanage community water collection tank	Orphanage Pumping Source	Muramba Clinic water without chemical treatments	Muramba Clinic water with chemical treatments	Clinic Tap
Test Date		1/12/06	1/11/06	1/12/06	1/7/06	1/6/06	6/23/06
Temp (C)							
Alkalinity Ca							
TDS							
Turbidity							
Nitrate NO ₃							
Nitrite NO ₂							
Total Hardness (mg CaCO ₃ /l)							
Conductivity (microS/cm)	the hardness	39.3	80	120	172	100.1	52
E. Coli (CFU/100 ml)	0	0	0	12,500 (2,200 retest)	500	800	0 (3M Petrifilm)
Total Coliforms (CFU/100 ml)	0	900	500	(15,000 retest)	30,000	20,000	1 (3M Petrifilm)





BYOW-II, August 2007

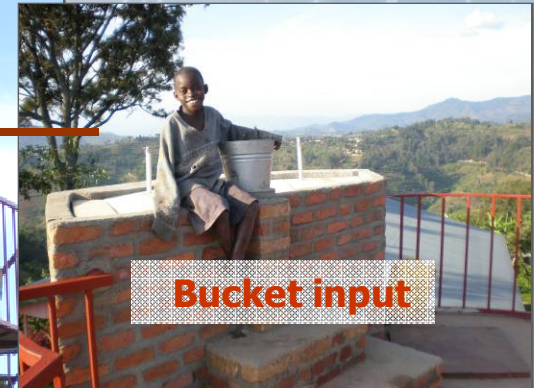
Roughing Filter



Auto-fill Backwash Tank



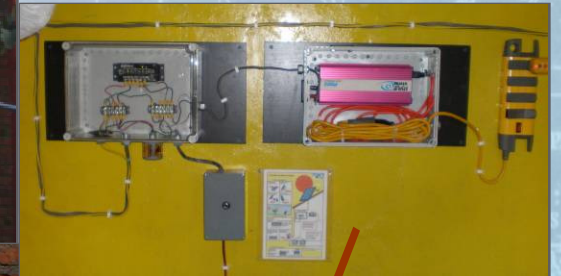
Bucket input



Rapid Sand Filter



PV power supply



Cistern stairs



UV Disinfection unit





Carbon Emission Reductions

- Partnered with UNDP, Rwandan Government and Clinton Foundation to install 500 systems in next two years.
- Funded by Kyoto CERs
 - Each liter of water treated by BYOW or boiled on cookstoves is a measurable reduction in wood burning emissions
 - Systems will fund themselves and provide business opportunities for Rwandans while addressing critical public health concerns







07.12.2009 12:40

High Efficiency Cookstoves

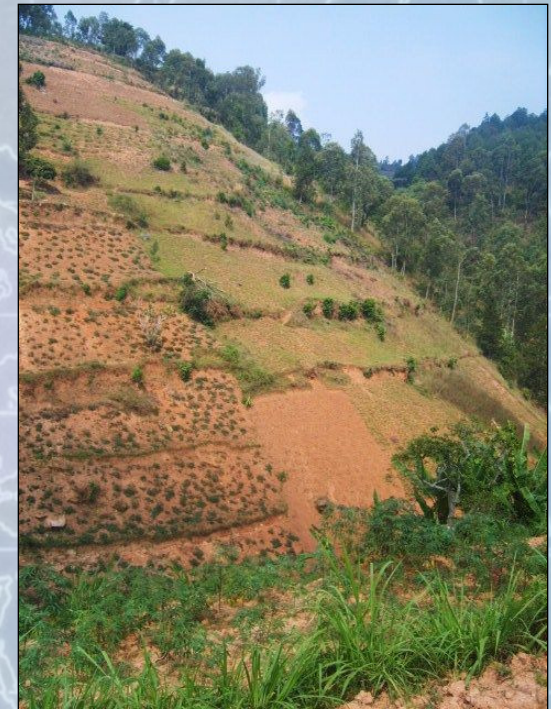


Orphanage Economic Sustainability

- **L'Esperance Children's Aid Orphanage working to obtain economic self-sufficiency**
 - **Building an eco-lodge with a Colorado based NGO**
 - **Developing an agricultural vocational school**
 - **Growing and selling dried fruit abroad**



Orphanage Fruit Plantations







Plantation Irrigation



Solar Fruit Dryer Prototype, August 2008



- **Dryer box construction**





Eco-Lodge



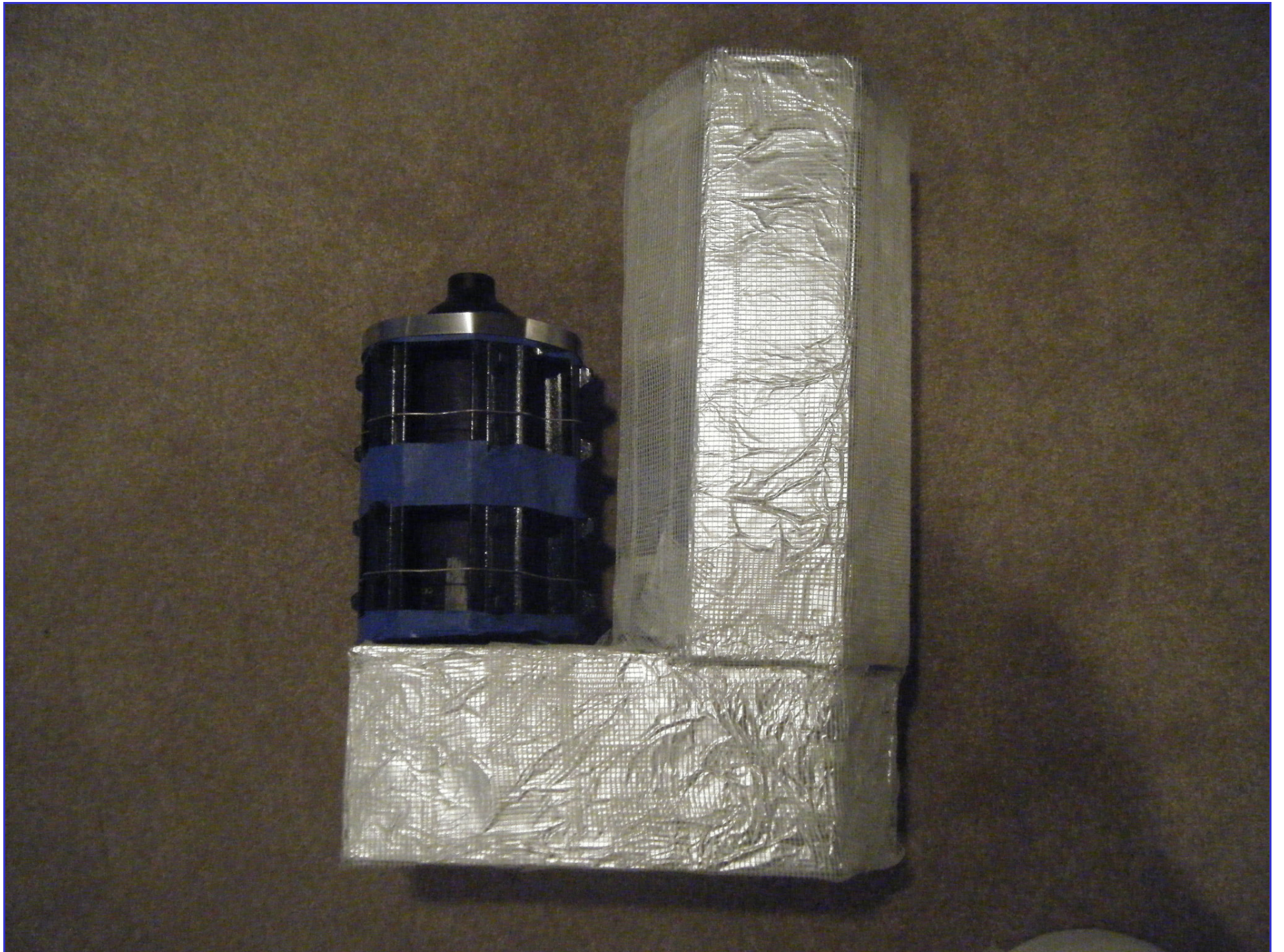








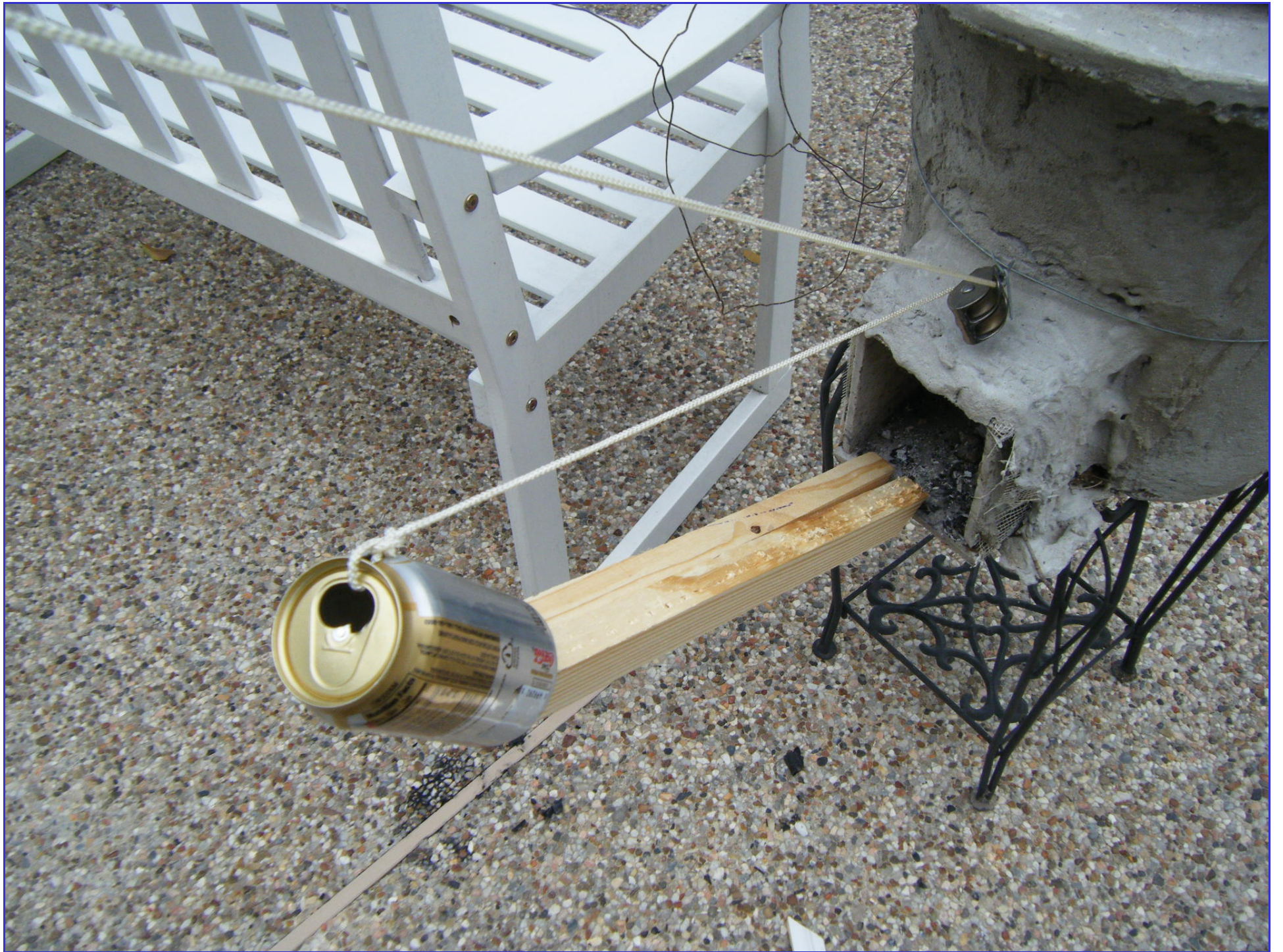












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OFFENDING COMMAND: ~

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