



# Cool Roofs and Pavements

November 1, 2011



## Global Cool Cities Alliance (GCCA)

The Global Cool Cities Alliance is dedicated to advancing policies and actions that increase the solar reflectance of our buildings and pavements as a cost-effective way to promote cool buildings, cool cities, and, most importantly, to mitigate the effects of climate change through global cooling.

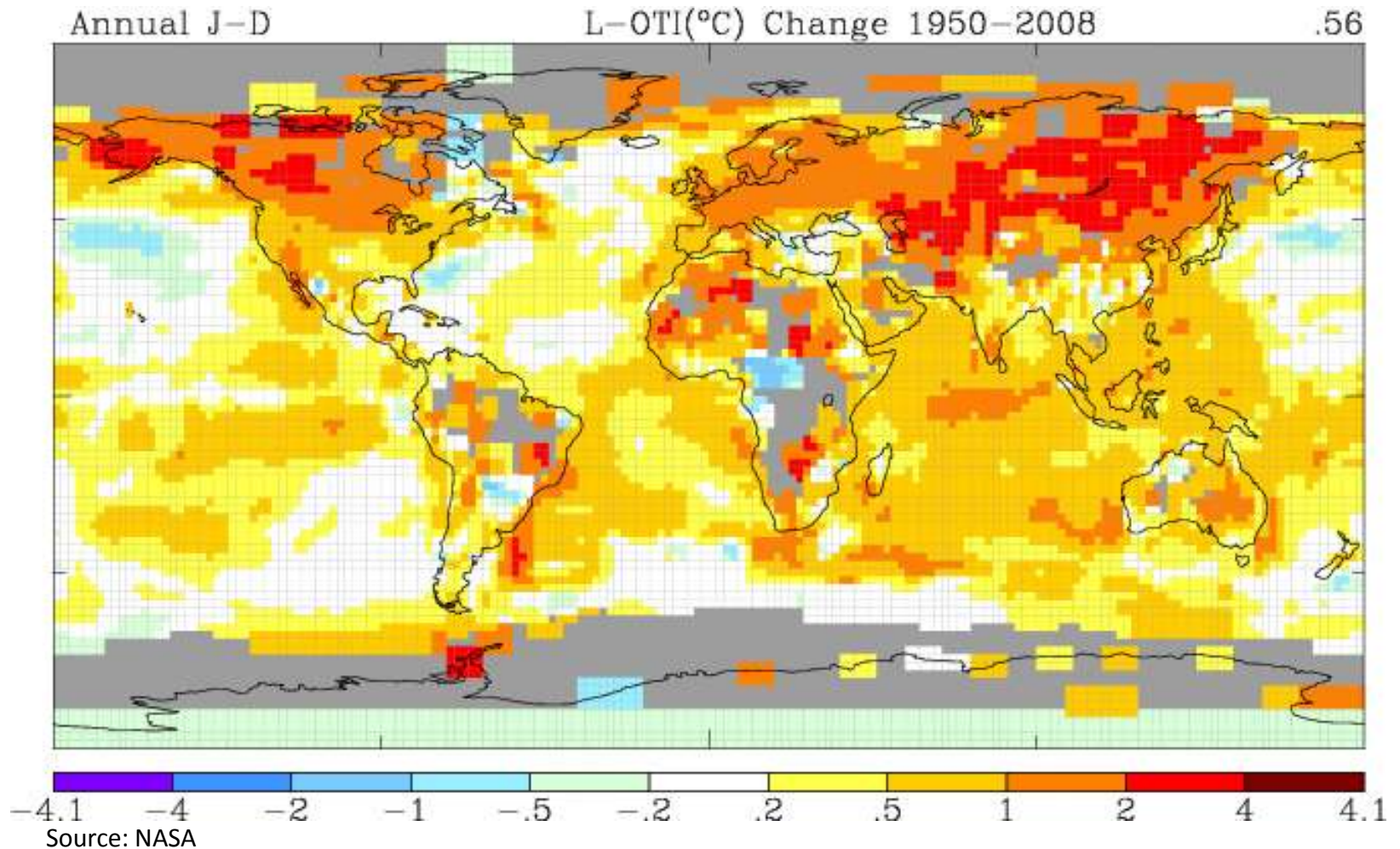
## GCCA Objectives & Programs

- Outreach to cities, regions and national governments
  - *New York, Chicago, Taipei, Athens, Singapore, R20, Clean Energy Ministerial GSEP Working Group (India, Japan, U.S., Mexico)*
  - *Technical support, information sharing, best practices*
- Corporate outreach
- Connecting implementers with resources
- Disseminating new research
- Policies, codes and programs

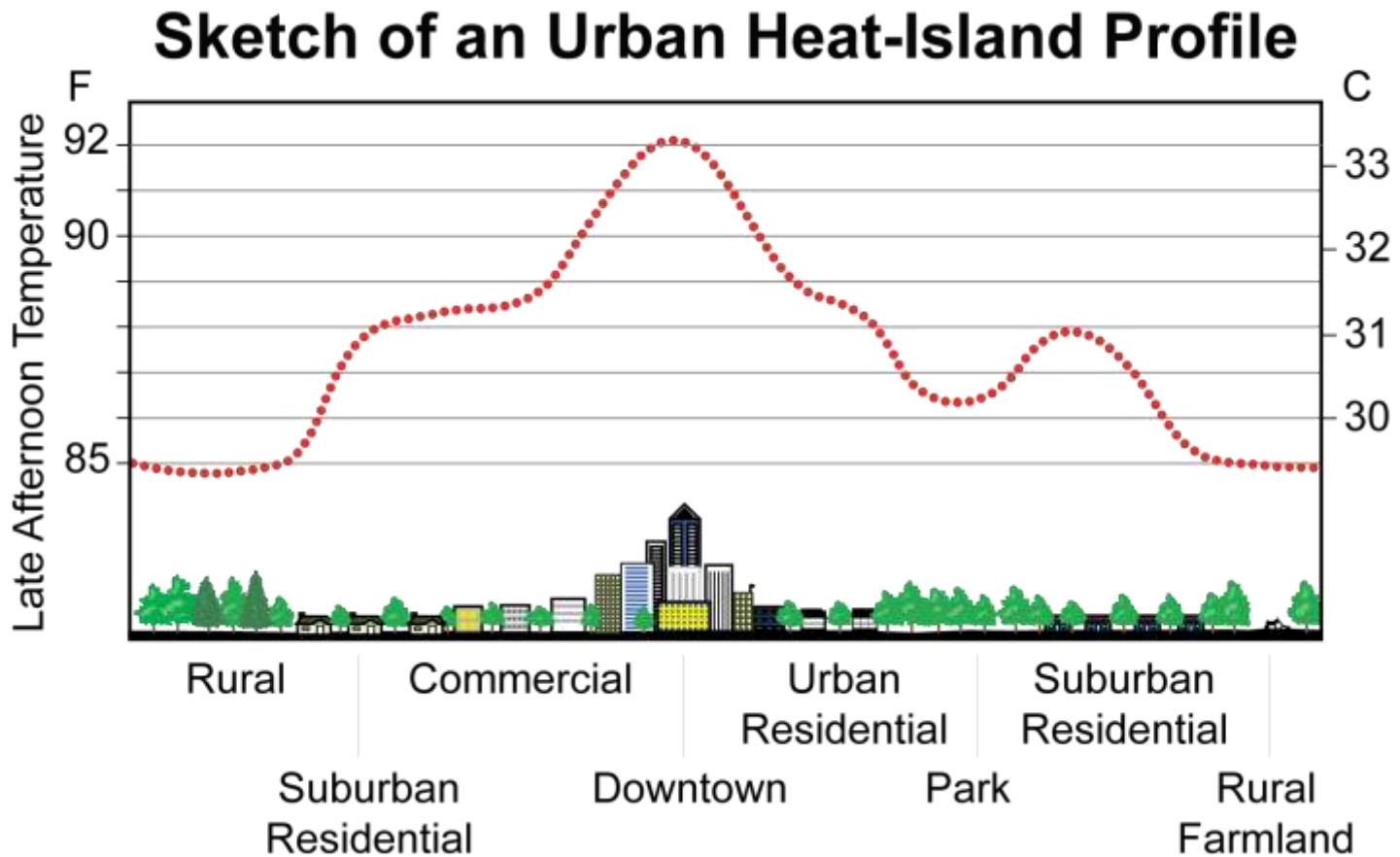
“In response to the sweeping climate change issues, and actions to curb the urban heat island effect, Taipei City is honored to be part of this Cool Cities program.”

- Lung-Bin Hau, Mayor of Taipei

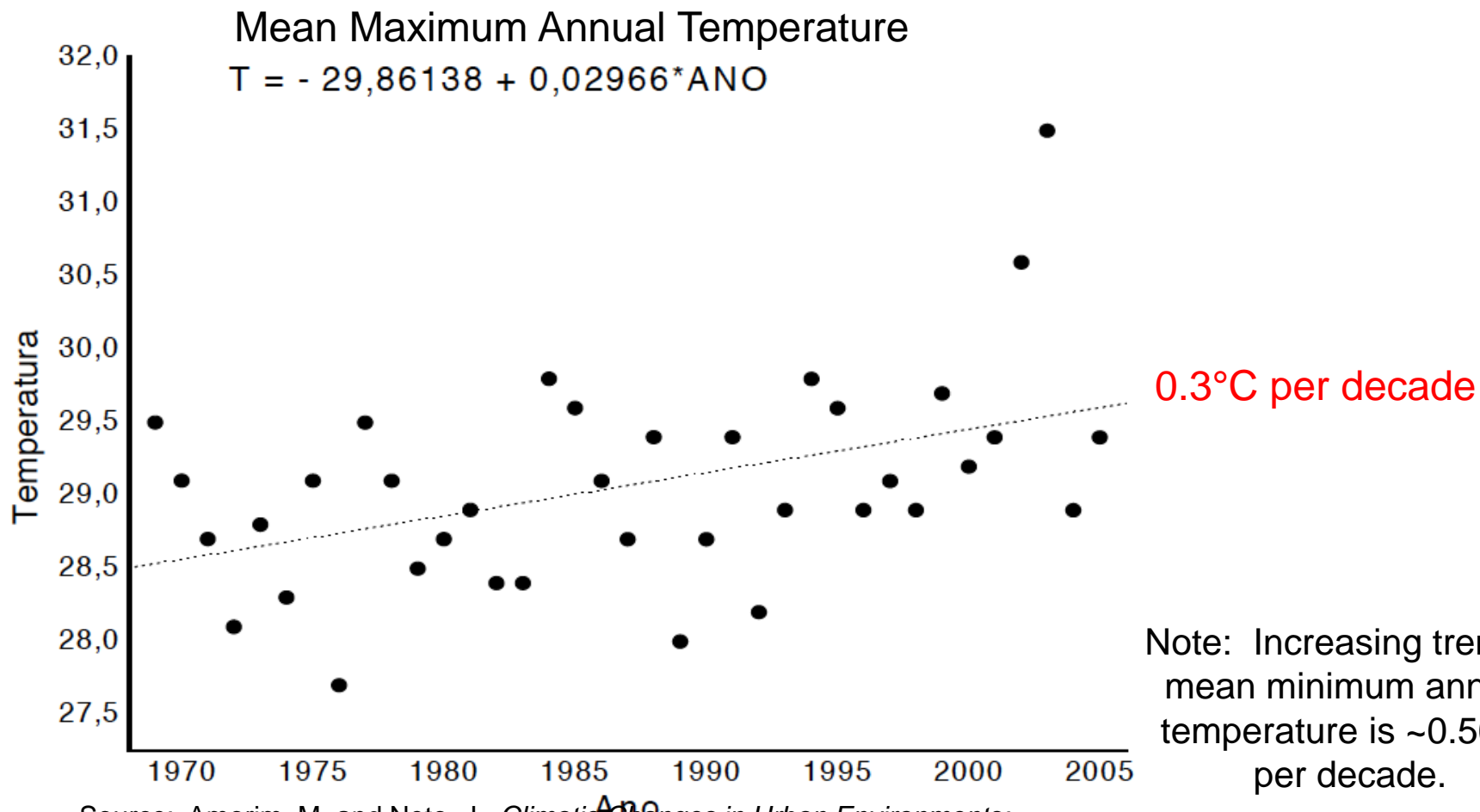
# The Planet is Warming



# Especially in cities – thanks to urban heat islands



# Presidente Prudente – Sao Paulo State

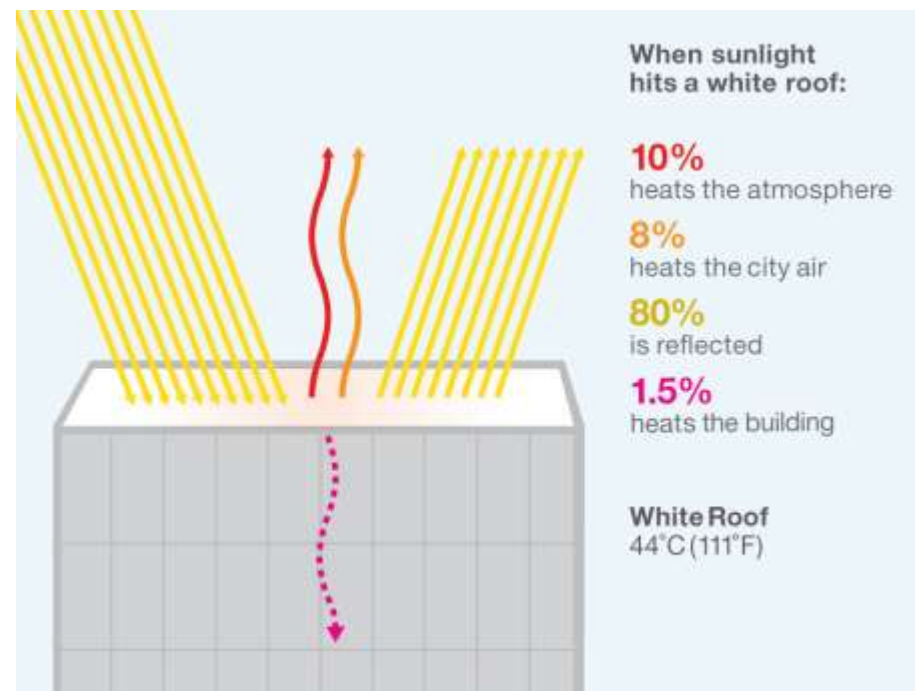
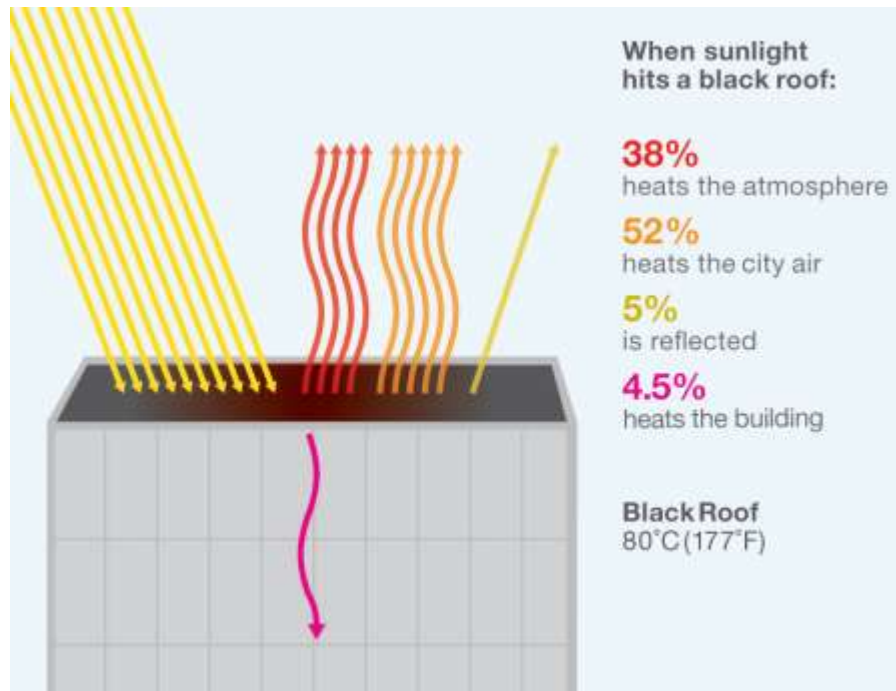


Source: Amorim, M. and Neto, J. *Climatic Changes in Urban Environments: trends and generations of urban heat islands in Presidente Prudente, Brazil*. 2008.

## Cool surfaces are a high-impact, short-payback investment that:

- Improves buildings by cutting net energy use, help roofs and the equipment on them last longer, and improve the comfort of unconditioned buildings.
- Generates significant economic and societal benefits by reducing heat and pollution related illness and death in urban areas.
- Helps us both mitigate and adapt to climate change risks.

## How Cool Roofs Work



Cool surfaces are measured by how much light they reflect (Solar Reflectance) and how long they hold heat (Thermal Emittance).



## The Benefits: Cooler Buildings

- Cool roofs can cut net energy use by 10 to 20 percent in conditioned buildings – often avoiding cooling load at the most expensive times of the day.
  - *UHI accounts for 5 – 10% of U.S. peak electricity demand for A/C.*
  - *Bauru, SP – Areas with higher than average UHI of 4°C corresponded to a 20% increase in electricity use, despite the influence of income.*
  - *\$735 million in energy costs savings in the U.S. commercial buildings.*
- Cooler surface temperatures help the roof and the equipment on it last longer.
- Cool roofs improve the comfort and “live-ability” of unconditioned buildings.

## The Benefits: Cooler Cities

- Cooling effect will vary by city, but studies of several cities indicate a cooling potential of 2 to 4 degrees Celsius.
- Cooler urban air temperatures mean fewer days with smog (ozone) formation that are a burden on city services.
  - *A study of Los Angeles found that lighter surfaces and shade trees could cut exposure to unhealthy air by 10 percent.*
- Fewer heat and pollution related illness and death has great societal and economic benefits.
  - *There were 739 deaths in the Chicago heat wave of 1995. Virtually all of them occurred in the top floors of buildings with dark roofs.*

# Temperature Disaster Trends

Global Deaths	Deaths per year	
	1900 – 1989	1990 – 2006
Drought	130,042	185
Floods	75,212	7,637
Windstorms	10,856	13,650
Slides	469	868
Waves/Surges	128	207
<b>Extreme Temperatures</b>	<b>110</b>	<b>5,671</b>
Wild Fires	21	47
Total	216,839	28,266

Heat Event	Deaths	Year
Russia	56,000	2010
France	19,490	2003
Spain	15,090	2003
Germany	9355	2003
Portugal	2696	2003
France	1388	2006
India (Andhra Pradesh)	1210	2003
Belgium	1175	2003
Switzerland	1039	2003
India (Madhya Pradesh)	1030	2002

Source: EM-DAT: The OFDA CRED International Disaster Database and World Resources Institute

## The Benefits: Cooler Planet

- The cooling effect of installing of cool roofs and pavements in tropical and temperate climates is equivalent to offsetting the emission of 44 billion tonnes of CO<sub>2</sub> – about 1 year’s worth of global emissions.
- Cool roofs offset 24 billion tonnes over their lifetime (approximately 1.2 billion tonnes annually)– the same as turning off 500 medium-sized coal plants for 20 years.
- Low-cost, quick payback climate mitigation and adaptation investment strategy.

# Corroborating Global Cooling Research

	Study (available at <a href="http://CoolWhitePlanet.org">CoolWhitePlanet.org</a> )	Method	Cloud cover esti- mation	CO <sub>2</sub> offset (atmos- pheric) per 100 m <sup>2</sup>	CO <sub>2</sub> offset (emitted) per 100 m <sup>2</sup>	World-wide potential CO <sub>2</sub> offset (emitted) from cool roofs	CO <sub>2</sub> offset compared to Akbari et al. 2009
1	Akbari et al. 2009 (LBNL)	calculation	~ 50%	5.5 t	10 t	24 Gt	100%
2	Menon et al. 2010 (LBNL)	GCM + land use model (summer only)	GCM	7 t	13 t	30 Gt	130%
3	Oleson et al. 2010 (NCAR) [CO <sub>2</sub> values from private communication between Oleson & Menon]	GCM + urban canyon model	GCM	7 t	13 t	30 Gt	130%
4	VanCuren et al. 2010 (CARB)	measured solar radiation	not needed	3 t	5 t	Addresses CA only; coastal CA is foggy.	50%

Not Shown: Cotana, Rossi and Pisello of CIRIAF, Interuniversity Research Center on Pollution from Physical Agents, University of Perugia, Italy found a similar result of 10 tons CO<sub>2</sub> offset per 100m<sup>2</sup>.

## Trends in Cool Materials

- **More “cool” colors** - expanding the broad set of available reflective color options
- **Staying cleaner, longer** – improved aged material values
- **Directional reflectivity** - good for sloped roofs
- **Clear reflective coatings** – an option that balances reflectivity and aesthetics

## Trends in Cool Materials – continued

- **Color-shifting materials** – thermo- and electro-chromic
- **Advances in testing** – accelerated aging processes
- **Pavements** – longevity by material and application.
- **Research** – broaden geographic diversity of data, field testing, additional modeling and testing of large-scale climate benefits.

# Opportunities for Engagement

- **Participate in the Clean Energy Ministerial Cool Roof and Pavement Working Group**
  - India, Japan, Mexico, and U.S.
  - Collaborative efforts to facilitate implementation.
  - Update call in mid-January
  - More details:  
[http://www.globalcoolcities.org/?page\\_id=638](http://www.globalcoolcities.org/?page_id=638)
- **Join GCCA's Cool Cities program**



GCCA envisions a future in which our urban environments are cooler, more resilient and more efficient. Join us!

Kurt Shickman  
[kurt@globalcoolcities.org](mailto:kurt@globalcoolcities.org)  
001-202-550-5852  
GlobalCoolCities.org

