Science for *Sustainable Development*

Max Paoli
Programme Coordinator
The World Academy of Sciences

What is Sustainable Development?

"Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs."

From the World Commission on Environment and Development's (the Brundtland Commission) report 'Our Common Future', 1987.

COMMENTARY

PNAS PNAS

What kind of a science is sustainability science?

Robert W. Kates[1]
Independent Scholar, Trenton, ME 04605

Sustainability science, as described by the PNAS website, is "…an emerging field of research dealing with the interactions between natural and social systems, and with how those interactions affect the challenge of sustainability: meeting the needs of present and future generations while substantially reducing poverty and conserving the planet's life support systems." Over the past 7 y, PNAS has published over 300 papers in its unique section on sustainability science and has received and reviewed submissions for many hundreds more. What kind of a science is sustainability science?

The article by Bettencourt and Kaur (1) on the evolution and structure of sustain-

pressive thing about the very large number of papers and authors is where they were written and the disciplines from which they were drawn. Sustainability science, as represented by the authors' addresses and institutions, is widely distributed and includes many authors beyond the normal concentration in such centers of traditional science as Japan, the United States, and Western Europe. These include almost all the emerging BRICS (Brazil, Russia, India, China, South Africa) economies but also such developing countries as Kenya and Nigeria. Home cities and institutions for papers also differ from traditional centers, with many originating in political centers (e.g., Beijing, Canberra,

One such dimension is the balance in sustainable development papers between those that emphasize research on environment and those that emphasize research on development. Most insiders I know have backgrounds originally in the environmental sciences, and their research topics often reflect this despite their commitment to a science of both environment and development. In an analysis of titles of 232 research papers in the sustainability section of PNAS, 62% had a major focus on sustaining environmental life support systems, as contrasted with 38% that primarily addressed human well-being and a few that addressed poverty alleviation (7).

PNAS | December 6, 2011 | vol. 108 | no. 49 | 19449–19450

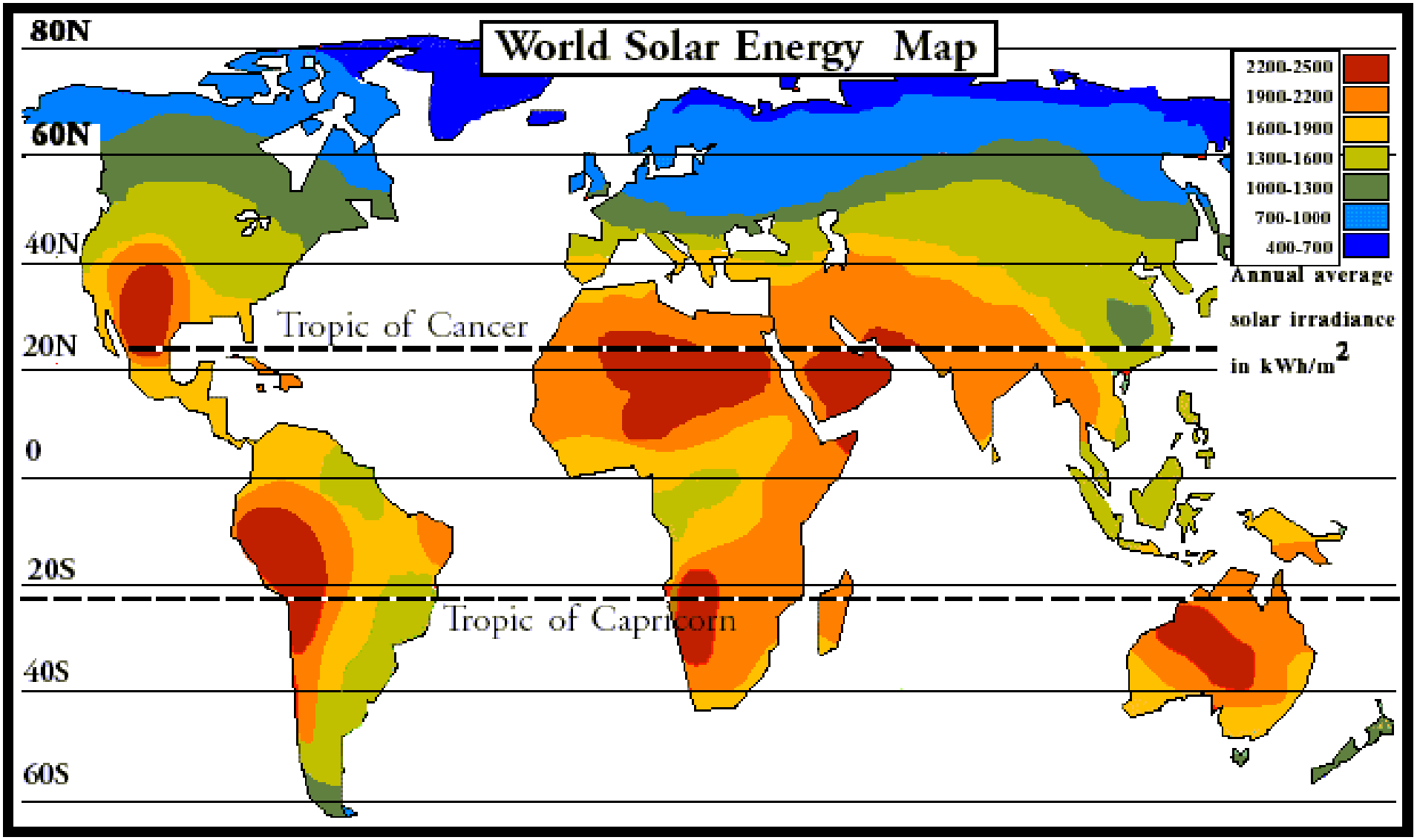
GLOBAL CHALLENGES

- **Population growth**
- **Energy demands**
- **Biodiversity loss**
- **CO_2 emissions and climate change**
- **Air and water pollution and environmental degradation**
- **Limited resources**
- **Urban sprawl and mega-cities**
- **Infectious diseases, epidemics, antibiotic resistance**

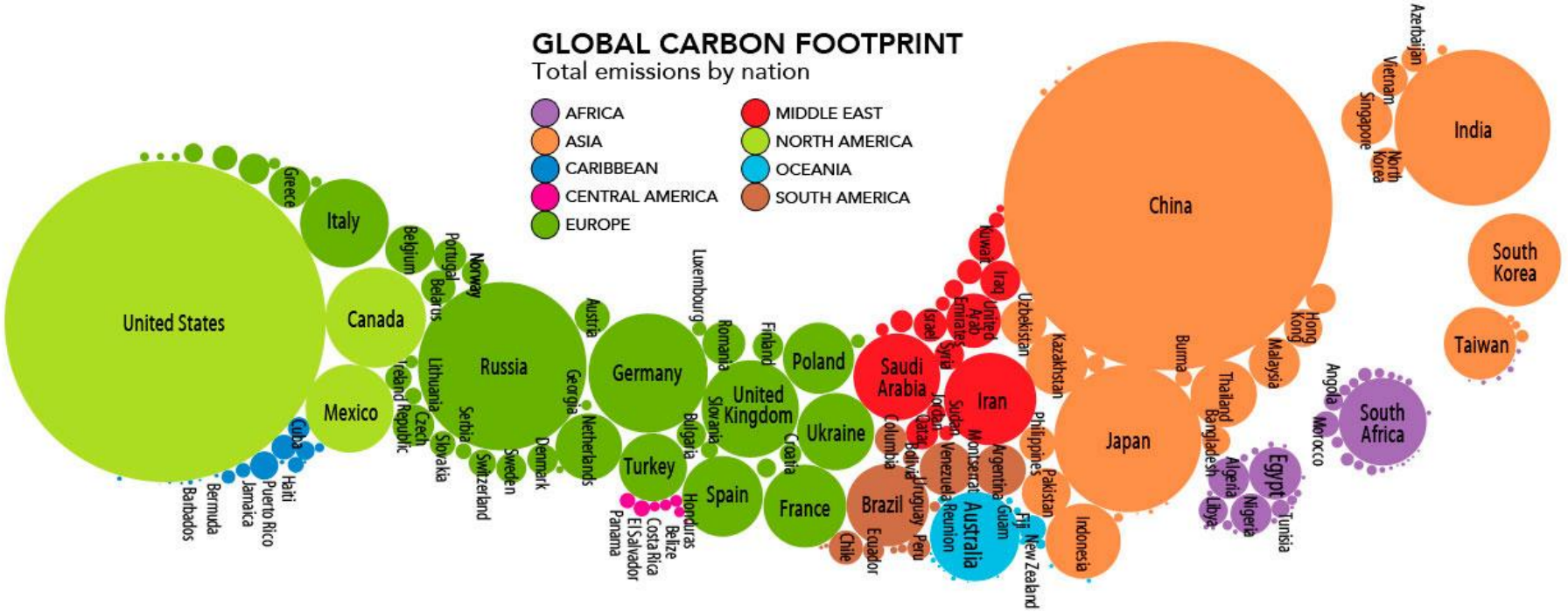
Sci Dev Net

Bringing science and development together through news and analysis

Green energy dropping out of mix in developing world

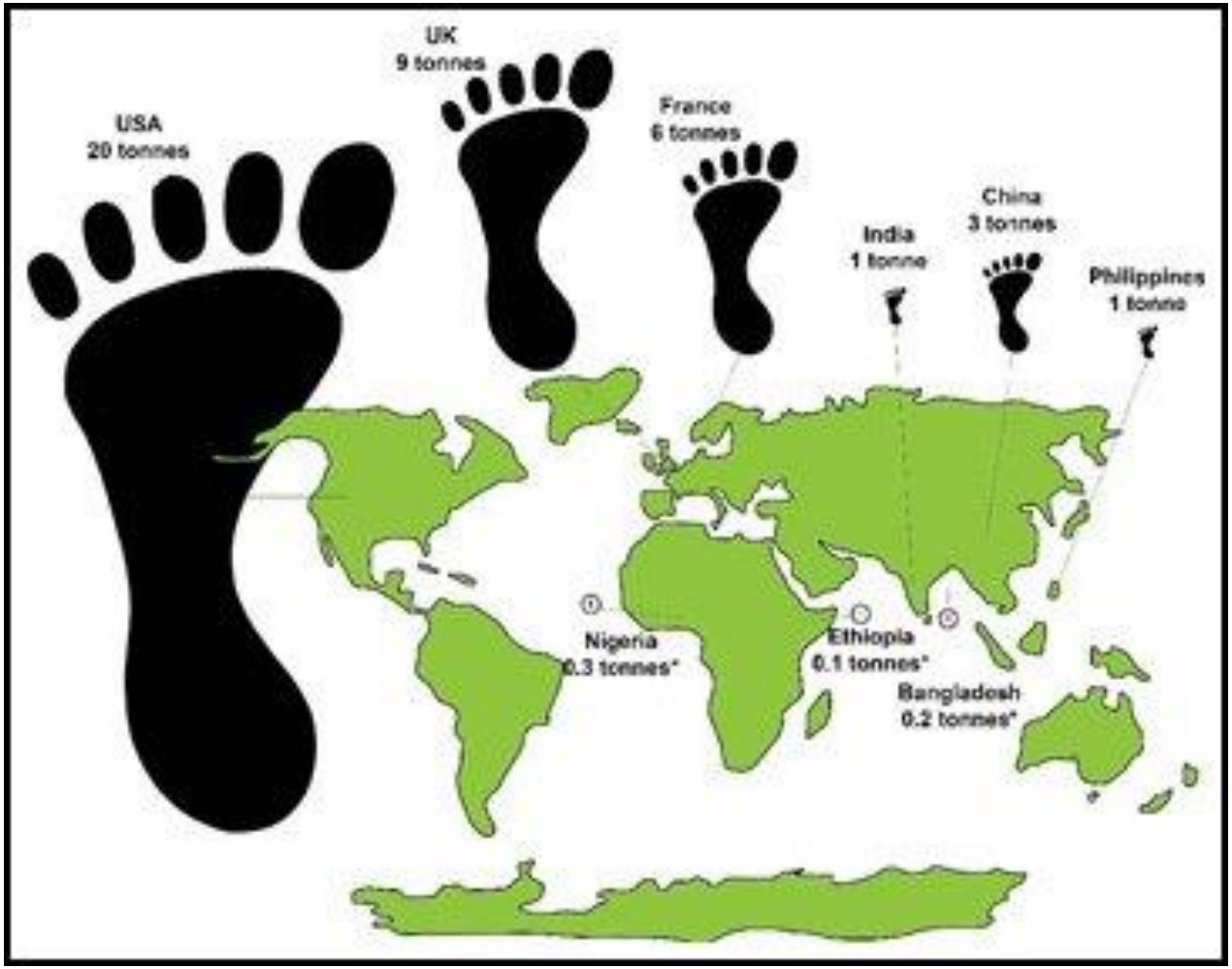

World Solar Energy Map
80N
60N
40N
20N
0
20S
40S
60S
Tropic of Cancer
Tropic of Capricorn
2200-2500
1900-2200
1600-1900
1300-1600
1000-1300
700-1000
400-700
Annual average
solar irradiance
in kWh/m2

Carbon Footprints



Governments need to make a better effort to identify ways to reduce their carbon footprint.

Carbon Footprints – *per capita*



Credit: http://www.transitionbelper.org/carbonfootprints.html

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Your flight:

From: Venezia (IT), VCE to: Rio de Janeiro (BR), RIO via: LIS, Lisboa (Lisbon) [Aeroporto da Portela de Sacavem], Portugal, PT, Roundtrip, Economy Class, ca. 19,300 km, 1 traveler

CO_2 amount: 3.7 t

If you would like to compensate in another currency, please choose from the following: **EUR CHF GBP USD**

Support international projects and sustainable development worldwide:

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CO_2 amount: 3.7 t

If you would like to compensate in another currency, please choose from the following: EUR CHF GBP USD

Support international projects and sustainable development worldwide:

How much is 3.7 tons of CO_2 released?

driving a medium-sized diesel car
(8 liters per 100km) for approx. 10,000km

A 13-watt CF lightbulb could be lit for 32,5 years continuously

A 42 inch LCD TV could be used for 295 days continuously

TYAN Meeting carbon footprint...?

Travel of participants: in excess of 100 tons of CO_2 released

Airport transfer: ?

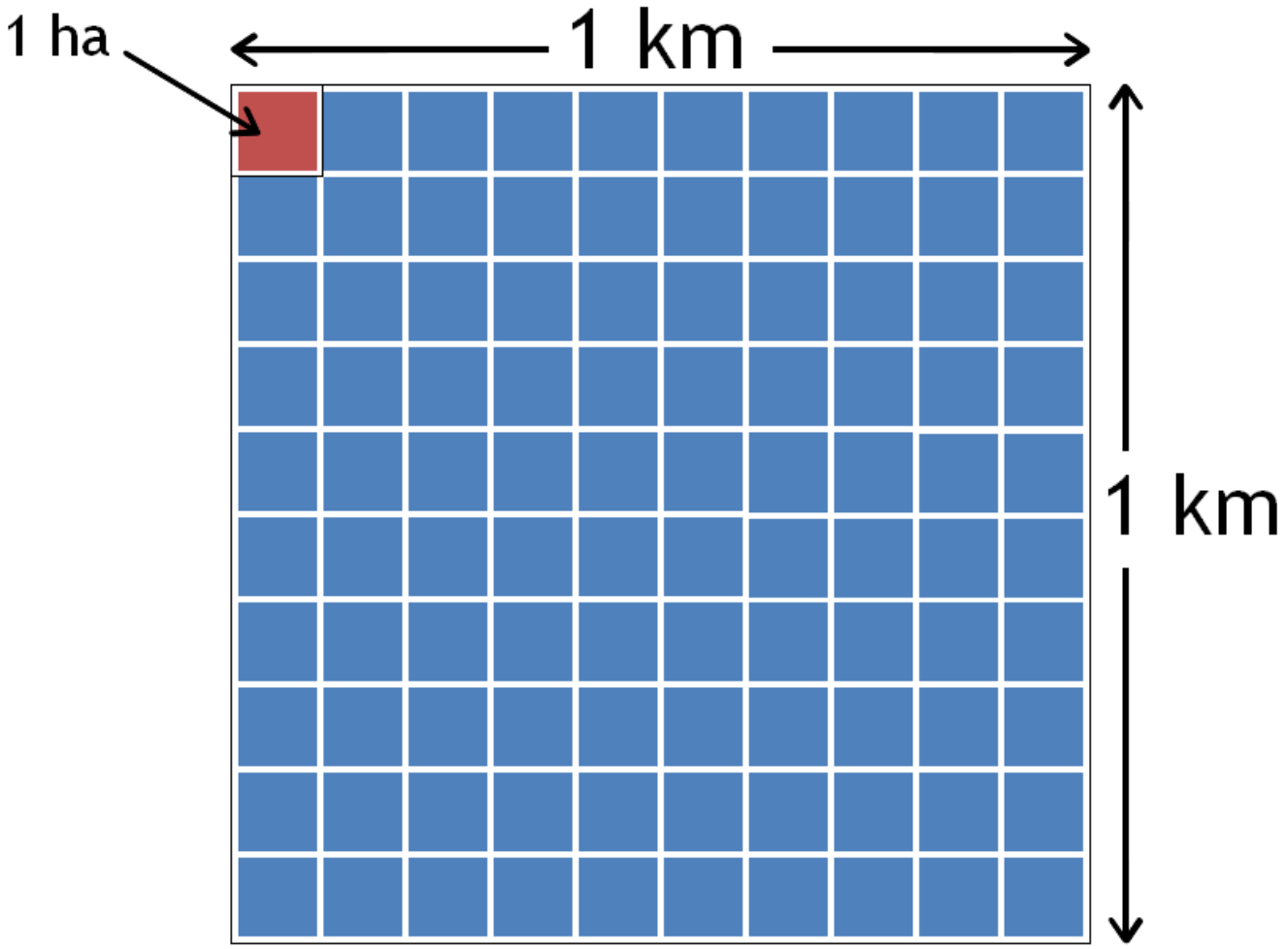
Air-conditioning and power: ??

Organization and satellite activities: ???

100 tons of CO_2 could be captured over the course of a year by 18-22 hectares of forest (depending on the type of forest)

One hectare of forest can capture 4-6 tons of CO_2 per year,
depending on the type of forest – age, species, temperate, etc.

One hectare is one hundredth of 1 km^2



100 tons of CO_2 could be captured over the course of a year by 18-22 hectares of forest (depending on the type of forest)

How many Earths do we need?

By Charlotte McDonald
BBC News

16 June 2015 | Magazine

Share

It has been suggested that if everyone on the planet consumed as much as the average US citizen, four Earths would be needed to sustain them. But where does this claim originate, and how is it calculated?

The world's seven billion people consume varying amounts of the planet's resources. Compare the lifestyle of a subsistence farmer with that of a wealthy

In today's Magazine

Me and my scar

Invasion of the jellyfish: Is it time to get frying?

Is there a lost Scottish clan in northern Italy?

EARTH OVERSHOOT DAY

#movethedate Newsroom Blog For Kids & Teachers About Subscribe

Earth Overshoot Day 2017 lands on August 2.

By August 2, 2017, we will have used more from nature than our planet can renew in the whole year.

We use more ecological resources and services than nature can regenerate through overfishing, overharvesting forests, and emitting more carbon dioxide into the atmosphere than forests can sequester.

"Human influence on Earth can be positive or negative, benign or catastrophic. Recognizing this responsibility is the first step each of us can take to transform the human footprint and save the last of the wild."

– Dr. Eric W. Sanderson

Director, Human Footprint Project
Wildlife Conservation Society/Columbia University

Millennium Development Goals – 2000-2015

UN Headquarters, New York:

25 September 2015

SDGs agreed


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

Panda Green Energy — formerly known as United Photovoltaics — connected a 50 MW solar array to the grid this week in northwestern China.

China Merchants New Energy Group (CMNE) — Panda Green Energy's largest shareholder — signed an agreement with the UNDP last September to build panda-shaped PV projects, as part of efforts to raise awareness about sustainable development among young people in China.

Image: UNDP *United Nations Development Programme* *30 June 2017*

Sweden is Turning Trash into Electricity So Fast It's Now Importing Garbage From the UK

The country recycles over 99% of waste and imports over 800,000 tonnes more each year...

UNLIMITED CLEAN ENERGY with The Wavestar machine

Article

Biodegradation and Mineralization of Polystyrene by Plastic-Eating Mealworms: Part 1. Chemical and Physical Characterization and Isotopic Tests

Yu Yang†, Jun Yang*†, Wei-Min Wu‡, Jiao Zhao§, Yiling Song∥, Longcheng Gao†, Ruifu Yang§, and Lei Jiang*†

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§ Shenzhen Key Laboratory of Bioenergy, BGI-Shenzhen, Shenzhen, Guangdong 518083, People's Republic of China

Environ. Sci. Technol., **2015**, *49* (20), pp 12080–12086
DOI: 10.1021/acs.est.5b02661
Publication Date (Web): September 21, 2015

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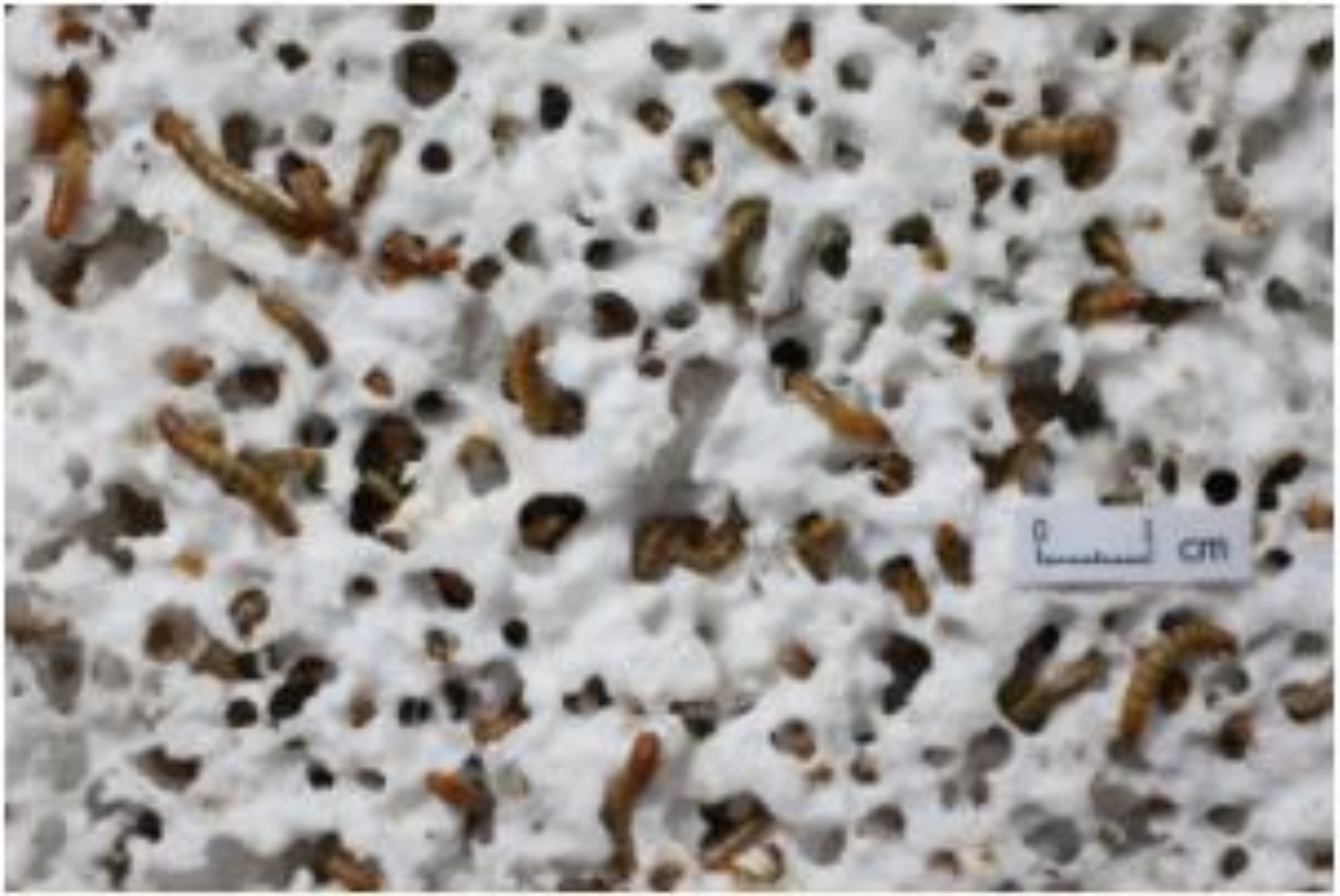

Mealworms munch on Styrofoam, a hopeful sign that solutions to plastics pollution exist. Wei-Min Wu, a senior research engineer in the Department

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SERVICES

Tuesday, 20 August, 2002, 14:36 GMT 15:36 UK

Irish bag tax hailed success

Stores including Tesco have welcomed the tax

A tax on plastic shopping bags in the Republic of Ireland has cut their use by more than 90% and raised millions of euros in revenue, the government says.

The tax of 15 cents per bag was introduced five months ago in an attempt to curb litter, and the improvement had been immediate and "plain to see", said Environment Minister Martin Cullen.

He said that the 3.5 million euros in extra revenue raised so far would be spent on environmental projects.

> **"The levy has been an outstanding success in achieving what it set out to do"**
>
> **Environment Minister Martin Cullen**

The "plastax" is being closely watched by other countries, particularly neighbouring Britain.

See also:

- 04 Mar 02 | Europe
  Shoppers face plastic bag tax
- 04 Mar 02 | N Ireland
  NI shoppers 'would bring their own bags'
- 04 Jan 02 | Business
  Bangladeshi jute bag demand soars
- 04 Mar 02 | Europe
  A world drowning in litte
- 03 Oct 01 | Asia-Pacific
  Taiwan to ban free plastic bags
- 14 May 01 | South Asia
  Bombay gets tough on plastic bags

Internet links:

- Irish Government

Top Europe stories now:

- Prominent Kosovo suspect held
- Turkey ups stakes on US troops
- 'New Europe' backs EU on Iraq
- Omagh detectives make arrest
- Beckham forgives Ferguson
- Blair keeps euro options open
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- Democratic test for


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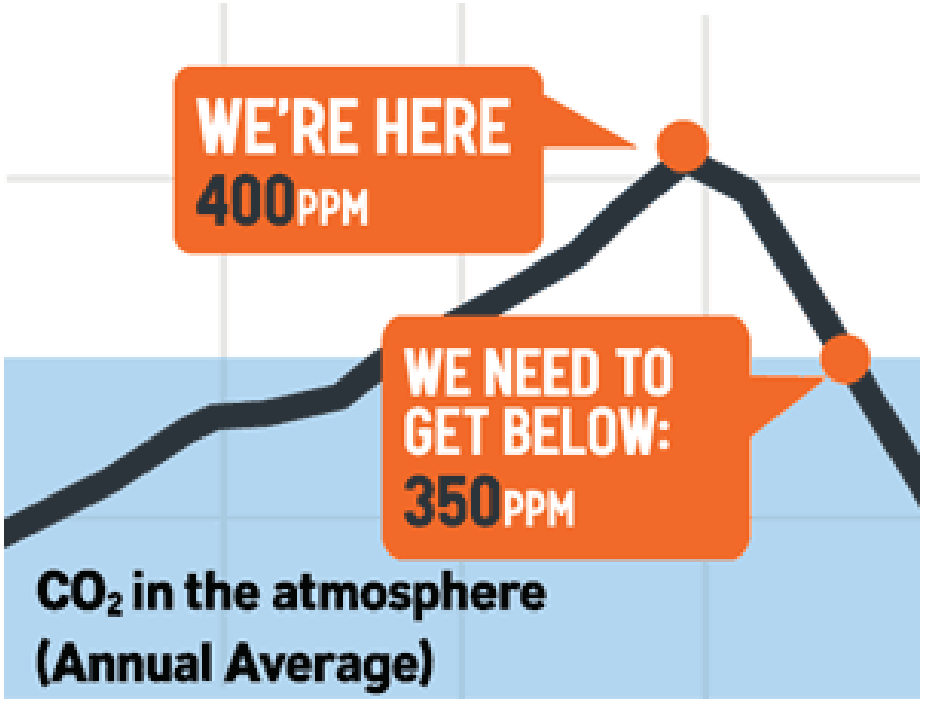
Climate Change

Why is 450 ppm dangerous and 350 ppm safe?



The answer is complex:

- runway greenhouse effect and irreversible conditions;
- associated temperature increases and consequences on adaptability of organisms.

Climate change scepticism

Climate Consensus - the 97%

Scientists understood the climate 150 years ago better than the EPA head today

Scott Pruitt denies basic science that we've understood for over a century

John Abraham

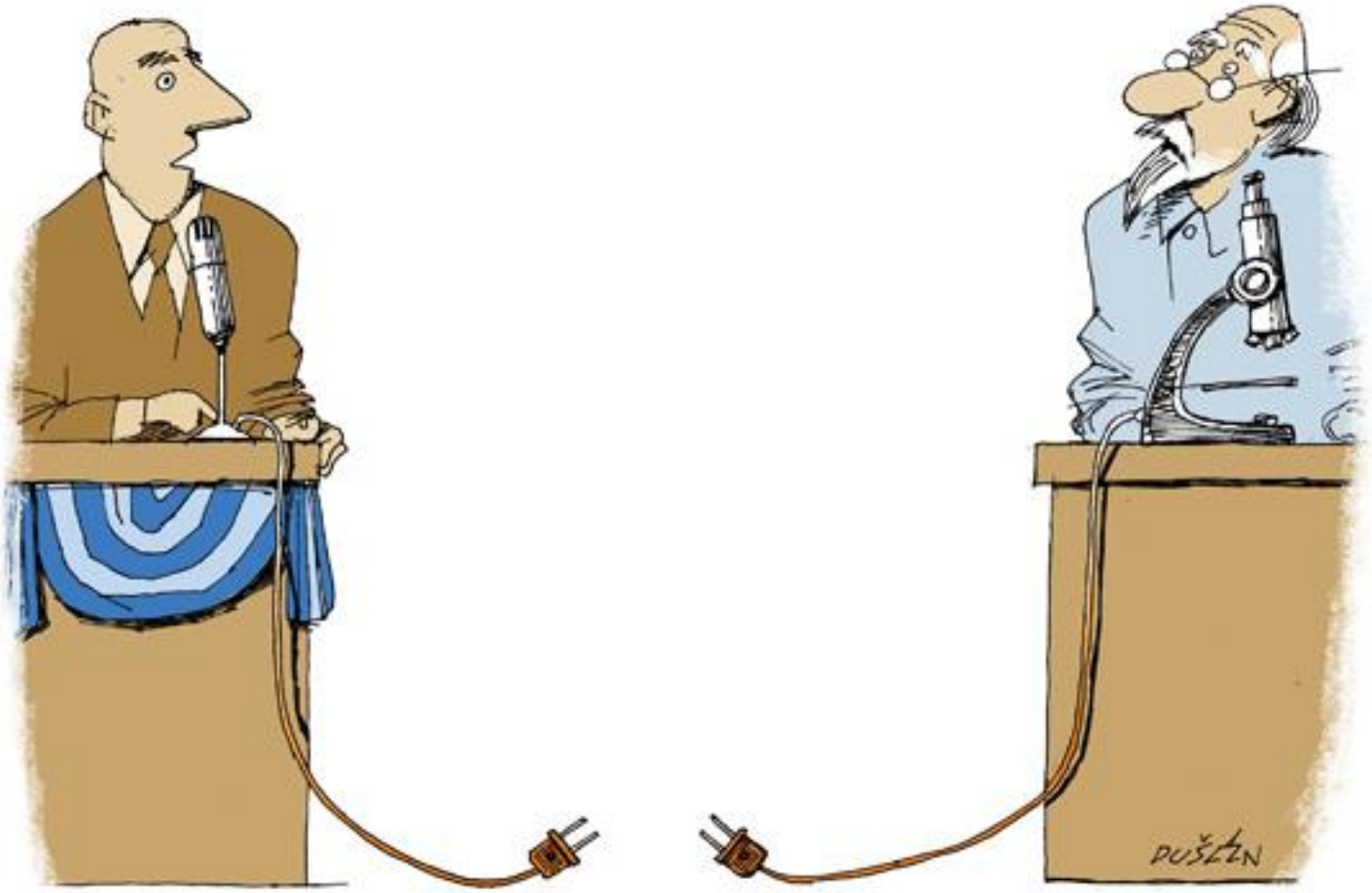
Friday 31 March 2017 11.00 BST

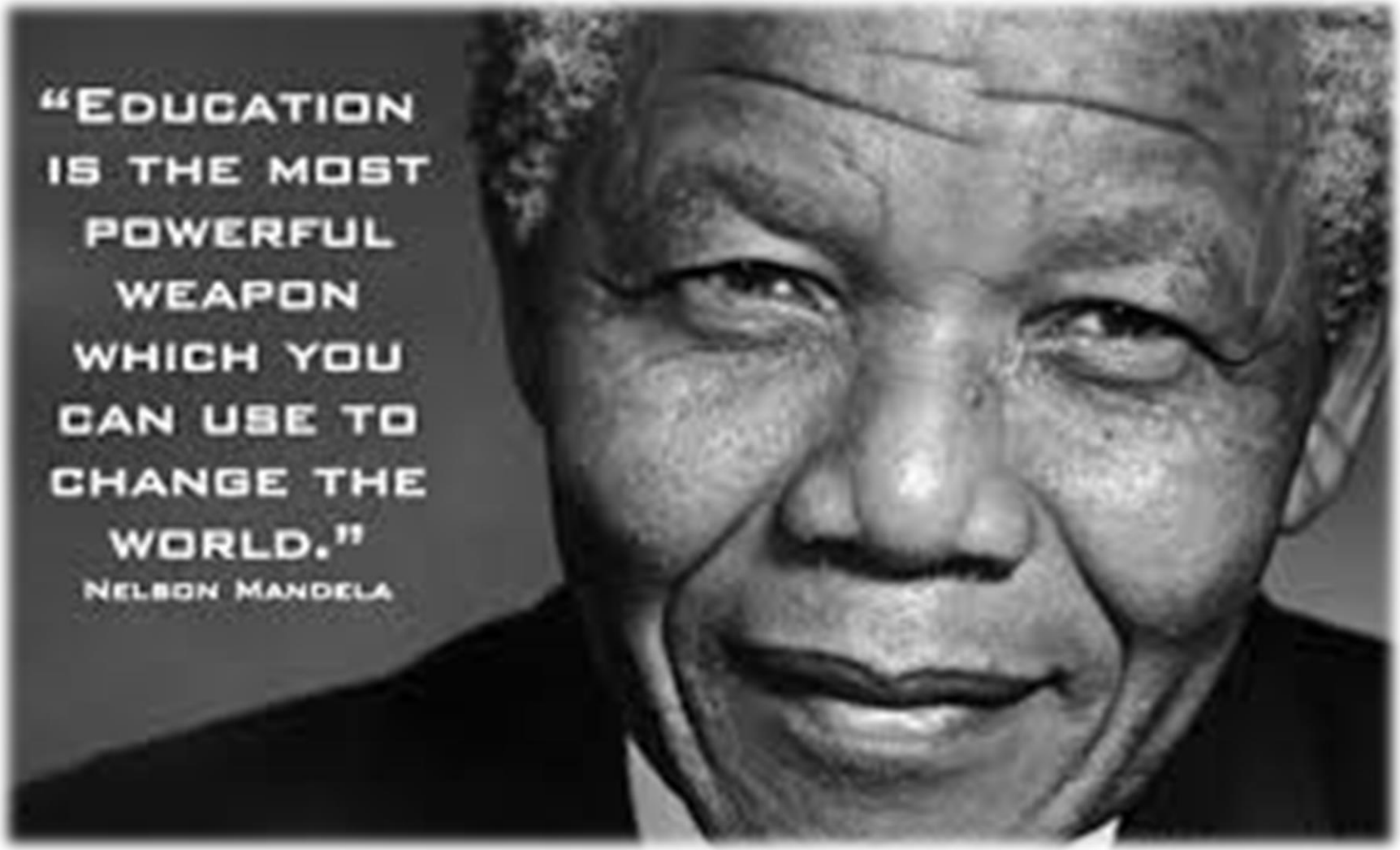
President Donald Trump and his EPA administrator Scott Pruitt shake hands at the signing of an executive order

The Great Divide

A two-way bridge between science and policy is desperately needed.

By Didier Schmitt | December 1, 2013




"Education is the most powerful weapon which you can use to change the world."
Nelson Mandela

Unsustainable development and change of mind/behaviour

There is now widespread concern that the model of development that is evident across the globe is unsustainable. We are faced with the urgent need to recast our ways of living, away from ones that rely on the unsustainable consumption of resources, the degradation of ecosystems and the exploitation of people, towards a model that strives to enhance the well-being of all human beings within the limits of our planet.

United Nations' Competencies for Sustainable Development:

Education for Sustainable Development (ESD)

Unsustainable development and change of mind/behaviour

Education should play an important role in enabling people to live together in ways that contribute to sustainable development. However, at present, education often contributes to unsustainable living. This can happen through a lack of opportunity for learners to question their own lifestyles and the systems and structures that promote those lifestyles. It also happens through reproducing unsustainable models and practices. The recasting of development, therefore, calls for the reorientation of education towards sustainable development.

United Nations' Competencies for Sustainable Development:

Education for Sustainable Development (ESD)

THE ELSEVIER FOUNDATION twas The World Academy of Sciences for the advancement of science in developing countries

- **Travel grants for PhD students/Post-docs on sustainability-related projects**
- **Sustainability Visiting Expert Programme**
- **Sustainability Case Studies Competition**
- **Sustainability Symposium at TWAS Meeting**

Sustainability experts receive travel grants to provide training in developing countries

Monday, January 2nd, 2017

New Elsevier Foundation-TWAS program sends Visiting Experts to train researchers in sustainability science

Media Coverage

- News
- Press Releases

Recent Tweets

RT @senseaboutsci: We're really looking forward to running a workshop for government this morning on transparency of evidence. https://t.co...
57 minutes ago

RT @GenderInSITE: Incredibly moving to see all the women - and men! - who showed up around the world yesterday to fight for #genderequality...
3 days ago

RT @MalawiMedJ: Our Publisher w/o Borders, Cynthia Clark, presenting "Strategic Overview and Development of the MMJ" @ElsFoundation @AJPPEd...
3 days ago

Opportunities

- Fellowships
- Research Grants
- Scientific Meetings
- Prizes & Awards
- Visiting Scientists
- CAS-TWAS Centres
- "Sustainability Case Studies" Competition

EVENTS AND DEADLINES

1 JUNE 2017
TWAS Prizes for Young Scientists in Developing...

19 JUNE 2017
OWSD PhD fellowships for women

26 JUNE 2017
TWAS-CSIR Postgraduate Fellowship Program...

TWAS-Elsevier Foundation Sustainability Case Studies Competition

The competition is designed as a catalyst to boost the involvement of young researchers from developing countries in sustainability science as a whole. Through their case studies, early career researchers will consider how their research helps to tackle some of our greatest challenges.

Deadline
1 February 2017

Partner Organizations
The Elsevier Foundation

Eligible Nominees from
All developing countries

Field
Sustainability

Age limit
None

The Competition calls for case studies which present issues and challenges for sustainable development through real life situations. Submissions should:

- identify the roots and causes of the problem placing it into its social, national and/or international context.
- make reference to the impact of the current situation
- outline on-going or possible solution(s) explicitly specifying the role of science and/or policy making

Finally, case studies should remain focused on key principles such as sustainable future, ecosystem services and quality of life for human societies.

Panel of judges for the TWAS – Elsevier Foundation Sustainability Case Studies competition:

- *GGreen and Sustainable Chemistry*: **Prof. Klaus Kümmerer** (Director of the Institute for Sustainable and Environmental Chemistry, Germany; male)
- *EEnergy*: **Dr. Rebekah Shirley** (Director of Research, Power for All; female)
- *AAgriculture and Food Security*: **Prof. Linxiu Zhang** (TWAS Fellow, China; female)
- *WWater and Sanitation*: **Prof. Akissa Bahri** (TWAS Fellow, Tunisia; female)
- *SScience Education and the Workforce*: **Prof. Saouma BouJaoude** (TWAS Fellow, Lebanon; male)
- *CClimate Change and Disaster & Risk Reduction*: **Prof. Leban Ogallo** (TWAS Fellow, Kenya; male)

Field	Reviewer	Winner	Host country and nationality	Gender
Agriculture and Food Security	Prof. Linxiu Zhang	**Rahiel Hagos Abraha**, Graduate School of the Chinese Academy of Agricultural Sciences	China; nationality: Ethiopia	Female (OWSD)
Climate Change and Disaster & Risk Reduction	Prof. Leban Ogallo	**Brice Landry Koloko**, Centre of Excellence in Molecular Biology (CEMB)	Pakistan; nationality: Cameroon	Male (TWAS)
Energy	Dr. Rebekah Shirley	**Oscar Donde**, Key Laboratory of Algal Biology of the Chinese Academy of Sciences	China; nationality: Kenya	Male (TWAS)
Green and Sustainable Chemistry	Prof. Klaus Kümmerer	**Abiola Ezekiel Taiwo**, Cape Peninsula University of Technology	South Africa; nationality: Nigeria	Male (TWAS)
Science Education and the Workforce	Prof. Saouma BouJaoude	**No winner awarded**: the judge did not deem any entry of high enough standard		
Water and Sanitation	Prof. Akissa Bahri	**Susan Moraa Nyasimi**, Centre of Excellence for Nutrition	South Africa; nationality: Kenya	Female (OWSD)

Thank you for your attention

I wish you

1) productive and inspiring workshops to behold a vision of sustainability both in your mind and in your heart

2) an unforgettable TYAN Meeting

Max Paoli

Programme Coordinator

The World Academy of Sciences

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