Plant diversity at the turning point

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Sir John Crawford Memorial Address

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Biodiversity and World Food Security: Nourishing the Planet and its People
The Mural Hall, Parliament House
Canberra
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Propositions for plant diversity and people

- **Global change is evident**, including warming climate and loss of biodiversity, accelerated by human action, especially to do with unsustainable use of land and water.
- **We are at a turning point** – at no other time in history has plant diversity been more important to people.
- **It’s time to rethink, and deliver, on a new relationship between plants and people** through scaling up plant diversity science and using plants sustainably.
- **The next decade is critical**
- **A message of hope** – emerging solutions based on plant diversity helping achieve sustainable living and livelihoods.
The future

• ‘conservation is … about negotiating the transition from past to future in such a way as to secure the transfer of maximum significance’. Holland and Rawles (cited in O’Neill and Holland 2000)

• ‘Why should I care about future generations? What did they ever do for me?’ Groucho Marks

• Is plant biodiversity of significance? Worth transferring to the future?
The global issue

Inappropriate human use of land and water

Declining quality of life

Environmental change for the worse

Declining plant diversity

Under-appreciated
World human population density (1995) and 25 global biodiversity hotspots

Cincotta et al. 2000
Nature 404, 990-992

- Population density in km²
- Color coding for population density
- Wilderness areas
- Biodiversity hotspots

Map showing the distribution of human population density and biodiversity hotspots around the world.
Crisis ecoregions disturbed by unsustainable pastoralism and agriculture

Despite a small population

Hoekstra et al. 2005
Ecology Letters 8, 23–29
Global warming – beyond reasonable doubt

Ten Indicators of a Warming World

- Air Temperature Near Surface (Troposphere)
- Humidity
- Temperature Over Oceans
- Sea Surface Temperature
- Sea Level
- Ocean Heat Content
- Temperature Over Land
- Glaciers
- Snow Cover
- Sea Ice

Seven of these indicators would be expected to increase in a warming world and observations show that they are, in fact, increasing. Three would be expected to decrease and they are, in fact, decreasing.

Source: USA State of the Climate 2009 report
A turning point

The NASA global temperature data, separated into Northern and Southern Hemisphere curves. Note the greater variation in the North. (Warming was especially pronounced in the Arctic, as predicted.)

For latest figures see the NASA-GISS site

http://www.aip.org/history/climate/xmillenia.htm

2011-2020 – the turning point decade?
No protection for 85% of carbon on land

Carbon Stock in Terrestrial Regions:
total (proportional pie-charts), and stored within the protected areas network (green segments)
Unprecedented importance of plant diversity, and yet …?

• ABC of first aid. Plant diversity helps us:
  - breathe
  - seek shelter and maintain health
  - consume water and food
  - manipulate our habitat for positive individual and social benefit by clearing space, creating shelter, growing and gardening plants, inventing culture
  - mitigate and adapt to global change

• And yet we are ambivalent – we create and destroy, socialise and alienate, love and hate, celebrate and mourn, revere and denigrate, imagine and turn off, explore and fear the unknown, tell the truth and lie, collaborate and cheat, help and ignore, hypothesize but do not seek evidence, resist change and rise to challenge
Australia at night – sustainable?

What are the critical environmental thresholds over which we should not transgress?
An extinction crisis is looming, fuelled by land use conflict

- 12 crops provide 80% of the plant food consumed globally
- Yet 30,000 species are known to be edible
- We continue to bulldoze and burn marginal lands to grow mainstream crops, destroying the plant diversity that may be part of our salvation in a rapidly changing world

Conservation & sustainable utilisation of yam wild relatives in Madagascar
Noongar Aboriginal carbohydrate staples from southwest Australia

Yook (*Platysace*) – a future crop?

Yanjit (*Typha*)

Warrine (*Dioscorea yams*)

Mean (*Haemodorum*)
A fifth of emissions is due to ongoing deforestation.
A steep learning curve
Up-scaling needed on the science of climate change and biodiversity

• Destruction and burning = 18% of global carbon emissions
• Biodiversity inventory is significantly incomplete
• Even less is known of the influence of climate on biodiversity
• Biophysical predictive tools are embryonic
• Fossil record – significant turnover of biodiversity, but present rates are accelerated
• Already evident biodiversity responses are stress, geographical range changes, phenological change, new invasives, new diseases – an extinction cascade next?
Where is plant diversity richest?
Tropics, and temperate regions of Mediterranean climate
Ongoing taxonomic synthesis
– 2000 new species per annum globally

DNA revolution, future barcoding

Wollemi Pine (Wollemia nobilis)

First global checklist of plant species in 2010?

Source: International Plant Name Index, Kew
Why does it matter? Food security
Of 30,000 edible species, only 12 are major crops providing 80% of food consumed

“We’re still finding new species of coffee, including those directly related to crop plants.” Dr Aaron Davis
Royal Botanic Gardens, Kew’s coffee expert

“Coffee is the world’s second most traded commodity, after oil, with at least 25 million farming families dependent on its production for their livelihoods, yet we still have much to learn about its wild relatives.

We estimate that 70% of wild coffee species are in danger of extinction due to habitat loss and climate change.”
Natural capital: making information available

- Propagation protocols
- *Schinziophyton rautanenii* Mongongo nut
- Highly nutritious nut in Southern Africa
- Staple diet of San Bushmen
- No need to irrigate or fertilize
- Difficult to germinate
- Protocol developed by Kew’s Millennium Seed Bank gave >80% germination

[www.phytotradeafrica.com/products/mongongooil.htm](http://www.phytotradeafrica.com/products/mongongooil.htm)
[www.blueplanetbiomes.org](http://www.blueplanetbiomes.org)
Why does it matter?

Accurate systematics avoids costly failures in human use of plants

Conservation disaster.
In mangrove-restoration sites in the Philippines, more than 90% of the seedlings died within a year of planting.
CREDIT: MARICAR S. SAMSON

“IT WOULD BE BETTER IF PNEUMATOPHORE-PRODUCING TAXA AND THOSE BETTER ADAPTED TO SEAFRONT CONDITIONS (E.G., AVICENNIA, SONNERATIA, ETC.) WERE PLANTED BEFORE OTHER SPECIES.”

SAMSON & ROLLON AMBIO 37, PG 239 (2008)
Why does it matter?
Clean water
discriminating *Eucalyptus salicola* from *E. salmonophloia*

... systematics enabling tomorrow's solutions to adapting to climate change
Water – potential future stress for cities due to more people, per-capita use, climate change, instream uses
Why does it matter?
Aesthetic pleasures and wonderment.

New quillwort (*Isoetes eludens*) discovered on mountain top in South Africa 2007

Roux, Hopper & Smith 2009 *Kew Bulletin* 64, 123-128
It’s time to rethink the biodiversity-people relationship, especially for plants. Why?

• Importance – every breath …
• Urgency – at no other point in history
• Values – greed v/s need
• Hope, aspirations and sustainable livelihoods – cities & countryside

Photos: S.D. Hopper
A step change in scientific plant-based solutions
Kew’s Breathing Planet Programme with global partners

1. Accelerated scientific discovery, collections, and digitisation
2. Mapping plant diversity and conservation priorities

3. Better conservation on the ground

4. Enhanced seed banks for insurance and sustainable use
5. Scientific restoration of wild vegetation

… to help retain the Earth’s major remaining wild biodiversity

6. Greater informed use of locally-appropriate plant species

… to help recover lost plant productivity, diversity and carbon sequestration

7. Botanic Gardens as inspirational shop-fronts for plant diversity, sustainable living and innovative digital hubs

… to help plant-based adaptation to global change
Sustainable solutions: cities of hope

It can be done:

London – cleaner air, water and soil than 100 years ago

… so too for many other cities
Sustainable solutions: gardens of hope

Worldwide distribution of 2574 botanic gardens in 168 countries in 2008 (courtesy of BGCI)
Sustainable solutions: seeds of hope

Kew’s Millennium Seed Bank
25% of plants by 2020

http://www.kew.org
Seeds of global crop wild relatives
an emerging priority

Hibiscus huegelii. Image courtesy Of Wolfgang Stuppy.
Seeds – Time Capsules of Life © Rob Kesseler,
Wolfgang Stuppy & www.papadakis.net.
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Hope – against seemingly impossible odds
"Green New Deal" For South Korea: $38.1 Billion
6 January 2009

• 960,000 jobs (2009-2012)
• includes river cleaning ($2.6b), reforestation ($1.8b), water resources management ($700m) etc.
• From the green fringe to sustainable mainstreaming
Guyana and Norway yesterday hailed a historic agreement that will see the Scandinavian country invest $250m (£150m) to preserve the rainforests of the Latin America nation.

In 2007 Guyana's president Bharrat Jagdeo made an unprecedented offer.
Collectively, we can do it!

How Might a Sustainable Society Operate?

A HEALTHIER society
A stable population
Stable consumption
Zero waste
No loss of natural areas
Restoration
A low-carbon society
Greater equity
Better decision-making processes
A more mature politics

…but will we?
Conclusion - Why rethink agriculture and biodiversity?

• High quality agricultural land is limited because of expanding demand for crops and urbanisation.

• Conventional cropping models deliver climate change and biodiversity loss.
Conclusions – What to do?

- Adapting conventional crops
- Broadening the plant biodiversity used for crops (intercropping and under-utilised crops)
- Giving back to nature by restoring biodiverse carbon sinks on marginal lands
- Seed banking
- Increase research funding and new innovative collaborations
- Conserve local knowledge, empower local people and conserve biodiversity
Great historical moments such as the abolishishment of slavery or democratising South Africa demonstrate that we are capable of enlightened transformation as a global society, despite the economic and political difficulties.

We owe it to ourselves, our families and the future to ensure today’s new deal for the environment and biodiversity becomes such a transformation.
Summary

Plant diversity underpins human lives and livelihoods, from the air we breathe to sheer wonderment – yet the world continues to destroy wild plants at an alarming rate.

We are at a turning point for plant diversity, of unprecedented importance to people in a rapidly changing world.

We face a steep learning curve.

Targeted plant diversity science, in botanic gardens and elsewhere, offers solutions to global problems and an important message of hope.

We can feed the world through sustainable use of biodiversity – but will we?