Plant diversity at the turning point

Stephen D. Hopper
Royal Botanic Gardens, Kew, Richmond, Surrey UK

Sir John Crawford Memorial Address

Kew
PLANTS PEOPLE POSSIBILITIES

Crawford Fund 2010 Annual Development Conference
Biodiversity and World Food Security: Nourishing the Planet and its People
The Mural Hall, Parliament House
Canberra
30 August 2010







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

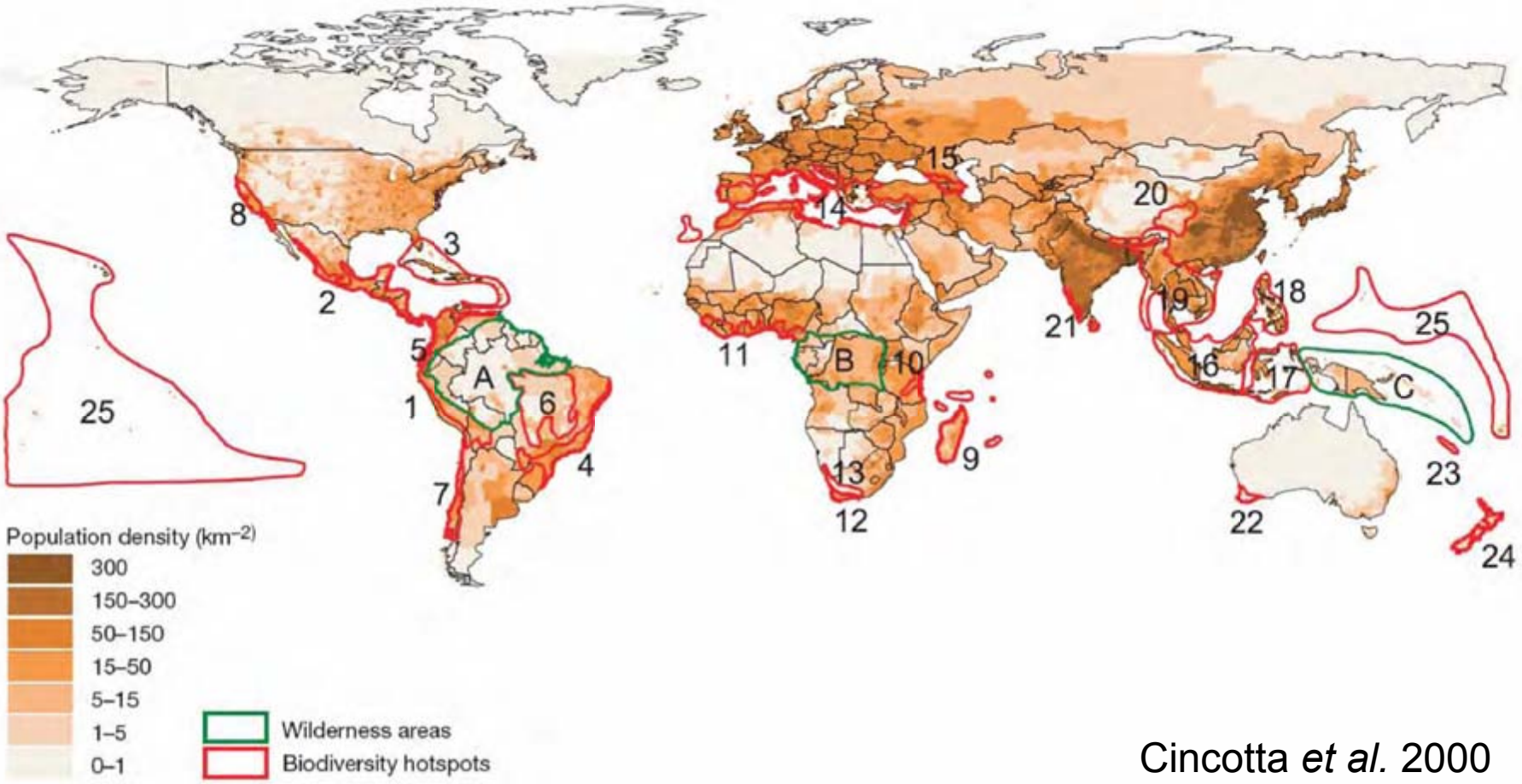
Environmental change for the worse

Declining plant diversity

Declining quality of life

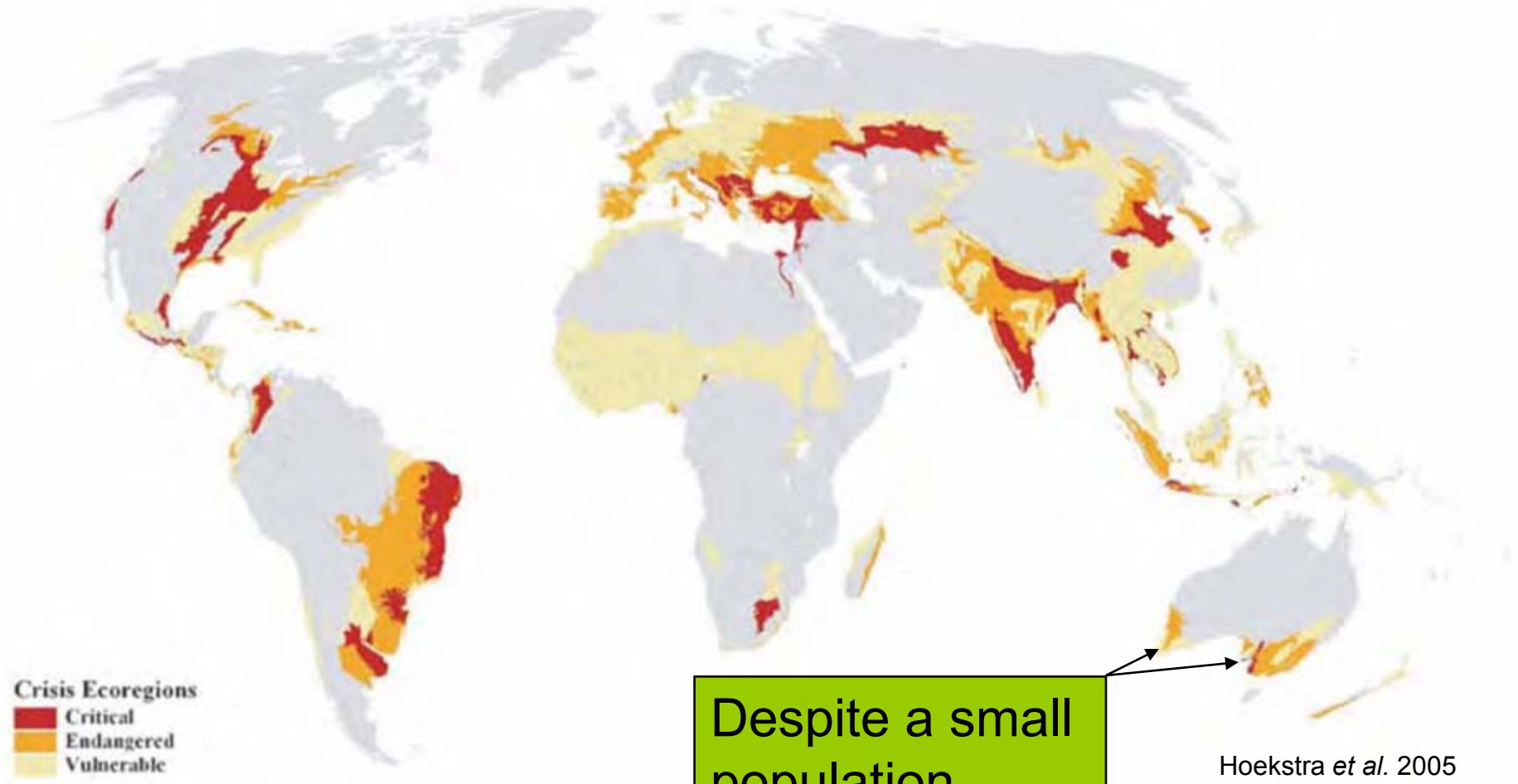
Under-appreciated

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



Cincotta *et al.* 2000
Nature 404, 990-992

Crisis ecoregions disturbed by unsustainable pastoralism and agriculture

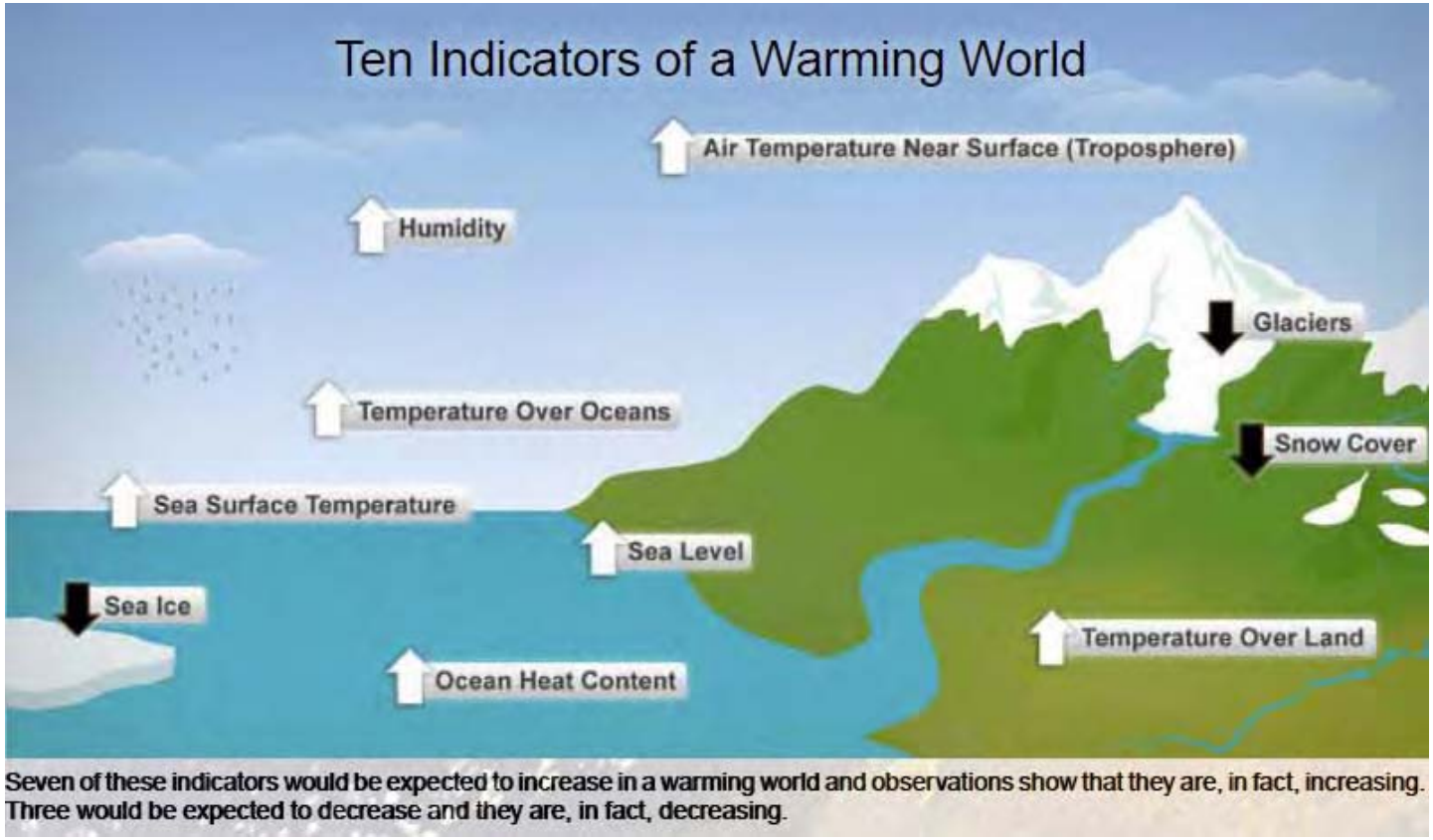


Despite a small population

Hoekstra *et al.* 2005

Ecology Letters 8, 23–29

Global warming – beyond reasonable doubt

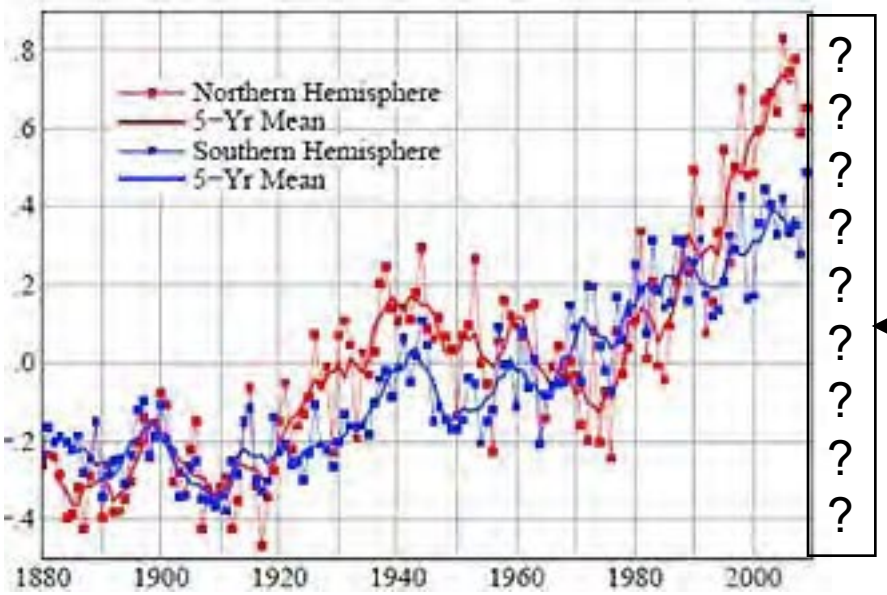


Source: USA State of the Climate 2009 report

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



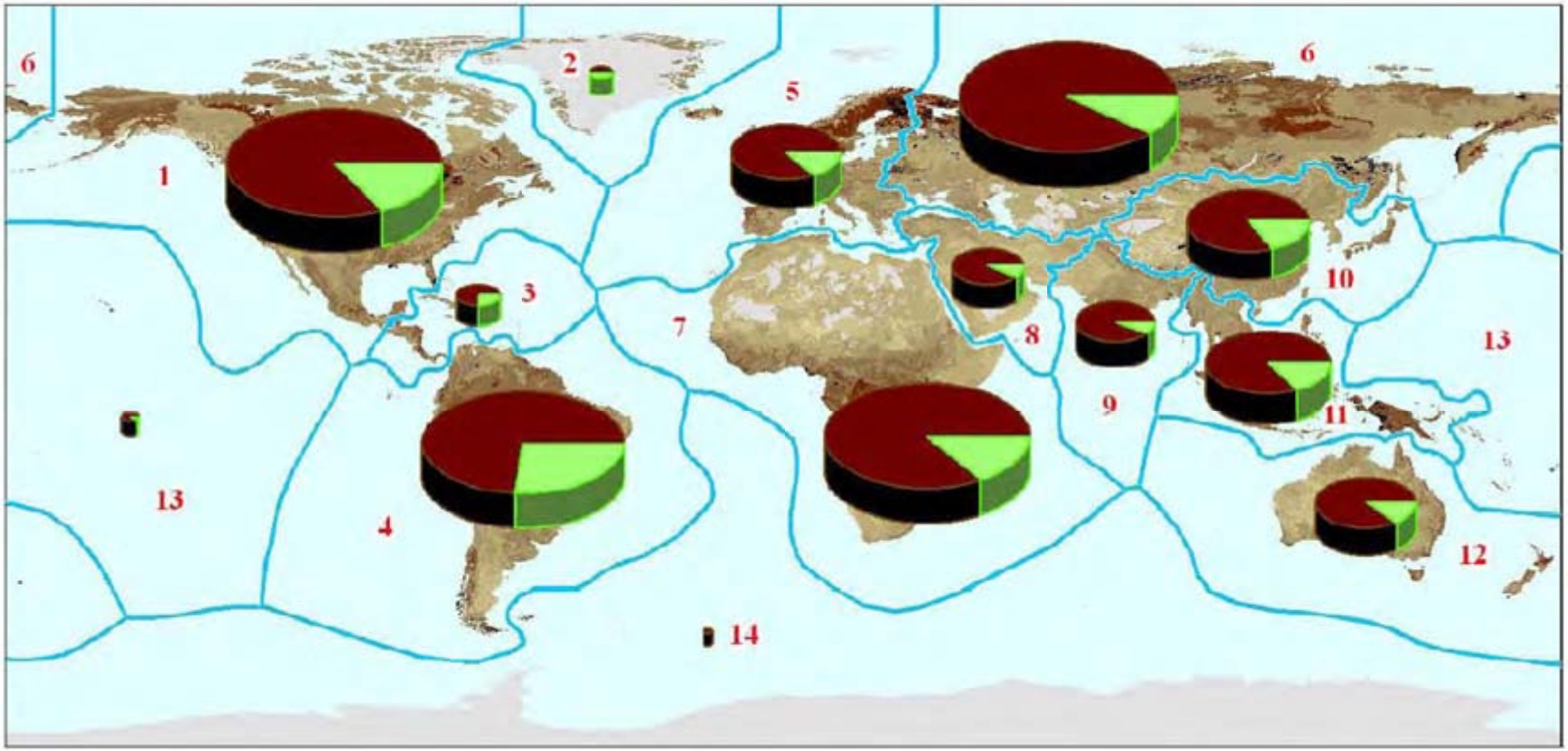
2011-2020 – the turning point decade?

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

UNEP WCMC

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

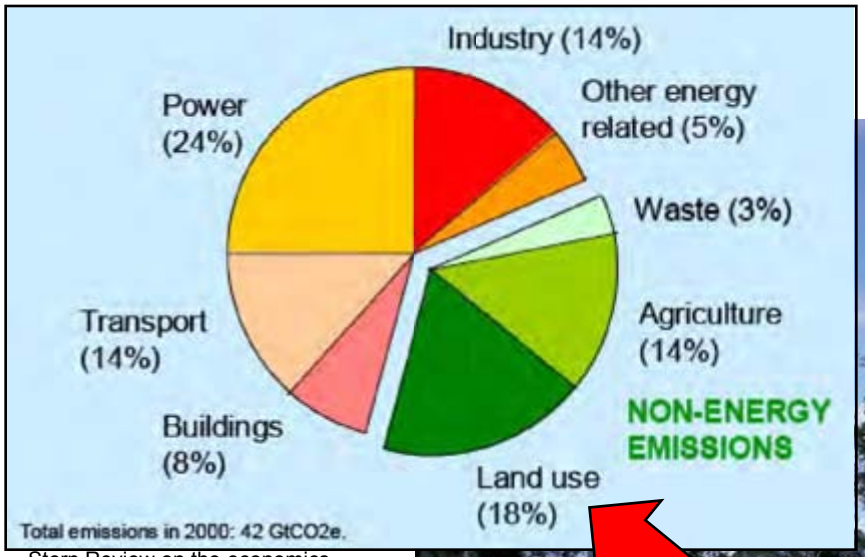
Yook *(Platysace)*
– a future crop?

Yanjit *(Typha)*

Warrine *(Dioscorea* yams*)*

Mean
(Haemodorum)

A fifth of emissions is due to ongoing deforestation



Stern Review on the economics of climate change 2006

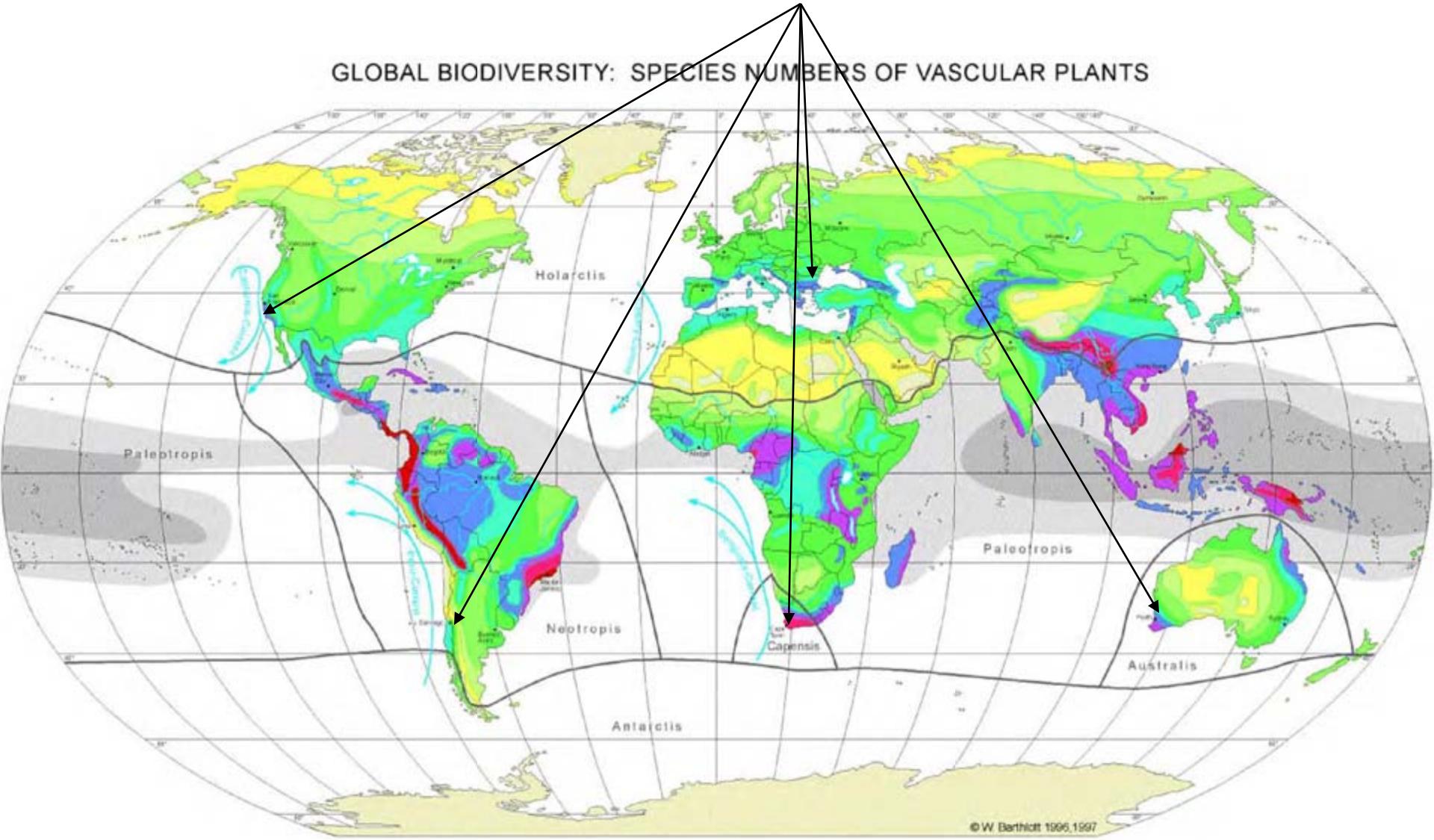
A steep learning curve

Up-scaling needed on the science of climate change and biodiversity

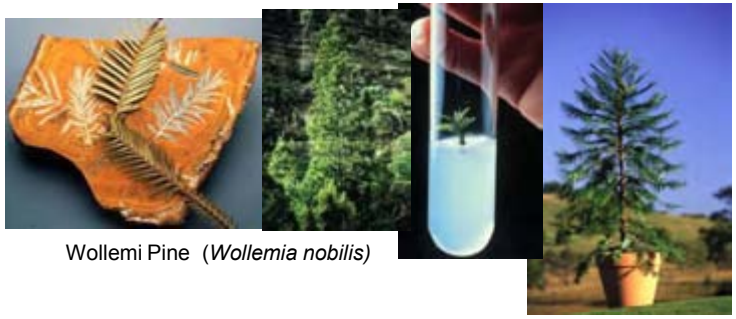
- Destruction and burning = 18% of global carbon emissions
- Biodiversity inventory is significantly incomplete
- Even less is known of the influence of climate on biodiversity
- Biophysical predictive tools are embryonic
- Fossil record – significant turnover of biodiversity, but present rates are accelerated
- 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

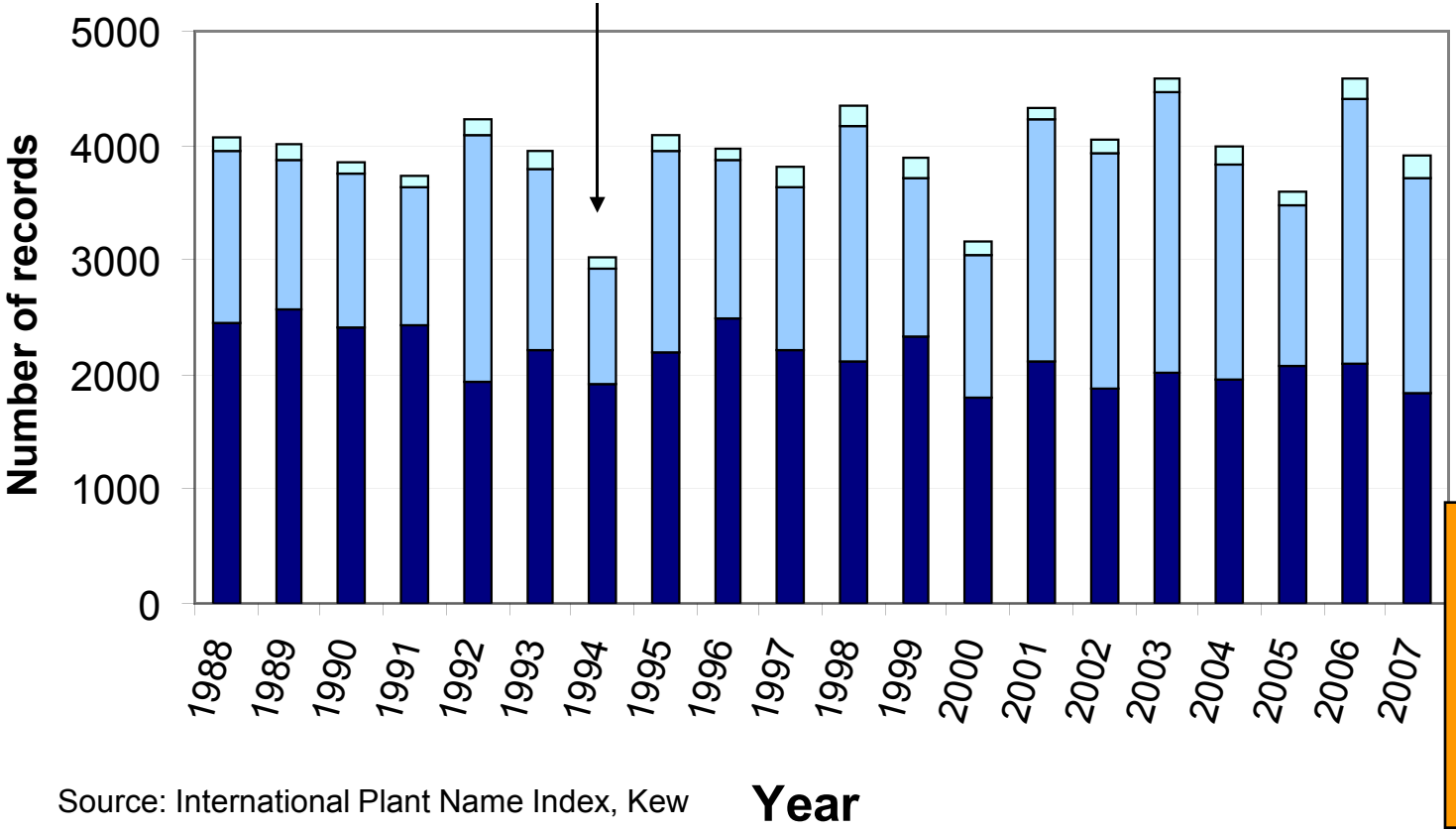


Ongoing taxonomic synthesis
– 2000 new species per annum globally



Wollemi Pine (*Wollemia nobilis*)

DNA revolution, future barcoding



Source: International Plant Name Index, Kew

First global checklist of plant species in 2010?

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.”

Coffea ambongensis 'beans' the largest seeds of any coffee species: more than twice the size of *Coffea arabica* (Arabica coffee)

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

www.blueplanetbiomes.org

Why does it matter?

Accurate systematics avoids costly failures in human use of plants

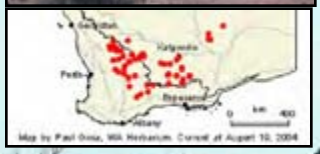
Massive Mangrove Restoration Backfires
By David Malakoff
*Science*NOW Daily News
15 July 2008

- 20 year programme
- 44,000 ha
- 440m *Rhizophora* propagules
- US $17.6m
- High mortality in non-mangrove areas e.g. mudflats, sandflats, and seagrass meadows

Ambio Vol. 37, No. 4, June 2008

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

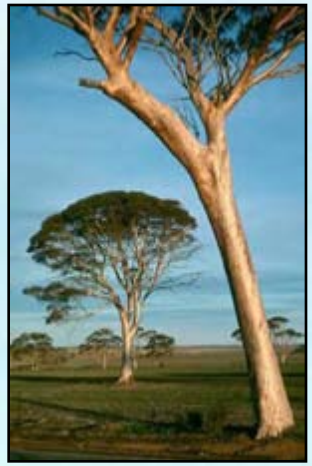
"It would be better if pneumatophore-producing taxa and those better adapted to seafront conditions (e.g., *Avicennia, Sonneratia*, etc.) were planted before other species."
Samson & Rollon *Ambio* 37, pg 239 (2008)



Why does it matter?
Clean water

discriminating *Eucalyptus salicola* from *E. salmonophloia*

Brooker (1988) *Nuytsia* **6**, 329-330



… systematics enabling
tomorrow's solutions to adapting to climate change

Niknama & McComb 2000 Salt tolerance screening of selected Australian woody species — a review Forest Ecology and Management **139**, 1-19

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

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

4. Enhanced seed banks for insurance and sustainable use

5. Scientific restoration of wild vegetation

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

6. Greater informed use of locally-appropriate plant species

… to help plant-based adaptation to global change

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

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 huegeliii. 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

Thursday, 19 November 2009

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.

Posted on November 10, 2009 by *propaganda press* 16 http://www.gina.gov.gy/archive/daily/b090829.html

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 abolishment 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?