

Ecosystem adaptation

Fire, invasive species and ecosystem services

Bob Scholes

Brian van Wilgen and Guy Preston

2 December 2011

CoP17, Durban



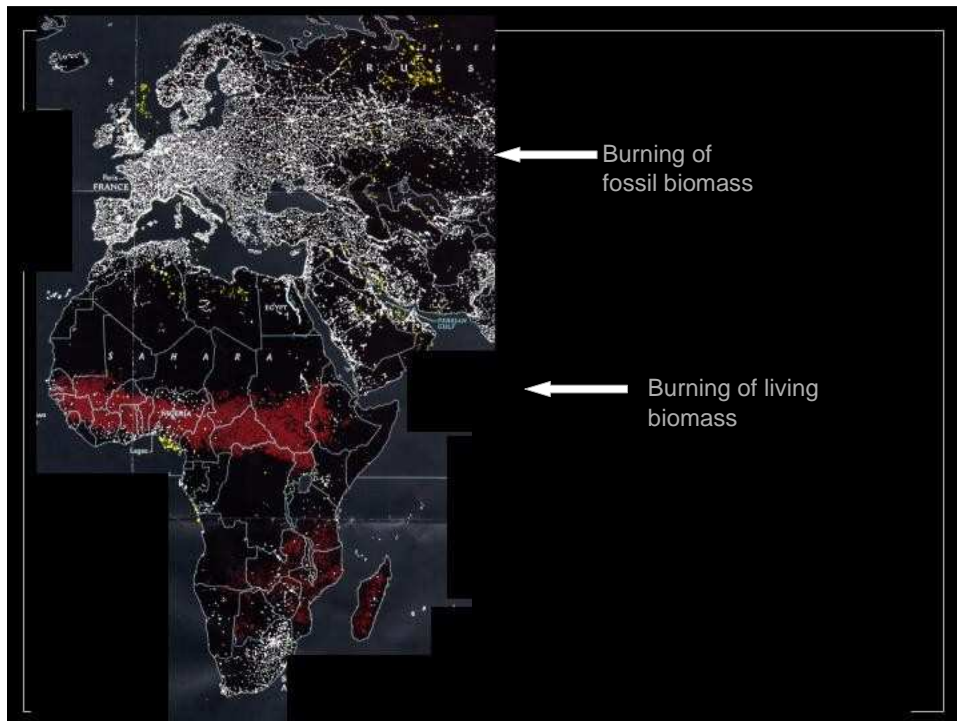
Topics to be addressed

- Ecosystems as the focus of adaptation strategies
- Two practical examples:
 - Wildfires
 - Invasive alien plants
- The 'perfect storm' when several Global Change factors interact



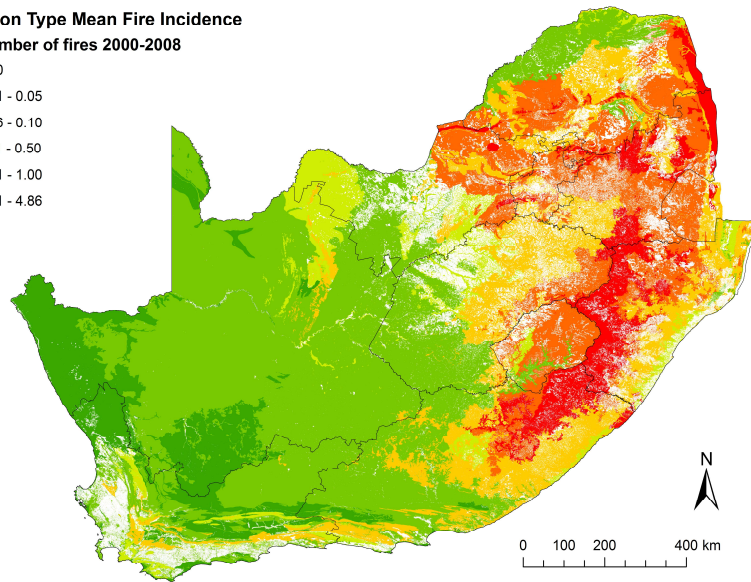
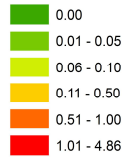
Why an ecosystem-based approach?

- We can't deal with 30 000 species individually
- A more integrated approach is needed if we wish to minimise unintended consequences
- Must work with the natural adaptive capacity and not undermine it
- A utilitarian approach (ecosystem services are the benefits which people get from nature) is complementary to aesthetic and ethical motivations



Veld fire risk in South Africa (CSIR 2010)

Vegetation Type Mean Fire Incidence
Mean number of fires 2000-2008



Fire regimes in South Africa: a good understanding

Journal of Applied Ecology

Journal of Applied Ecology 2010, 47, 431-438

doi: 10.1111/j.1365-2656.2010.01800.x

Fire management in Mediterranean-climate shrublands: a case study from the Cape fynbos, South Africa

Brian W. van Wilgen¹, Gregory G. Forsyth¹, Helen de Klerk², Sonali Das¹, Sibusiso Khuliso³ and Peter Schmitz²

Water, Journal of Ecology & Hydrology 2007, 19, 43-51
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AFRICAN JOURNAL OF
RANGELAND & WILDLIFE SCIENCE
2008, 10(2), 219

Spatial and temporal variation in a mesic savanna fire regime: responses to variation in annual rainfall

DA Balfour¹ and OE Howison

Research Articles

South African Journal of Science 96, April 2000

A fire history of the savanna ecosystems in the Kruger National Park, South Africa, between 1941 and 1996

B.W. van Wilgen¹, H.C. Biggs², S.P. O'Regan¹ and N. Maré³

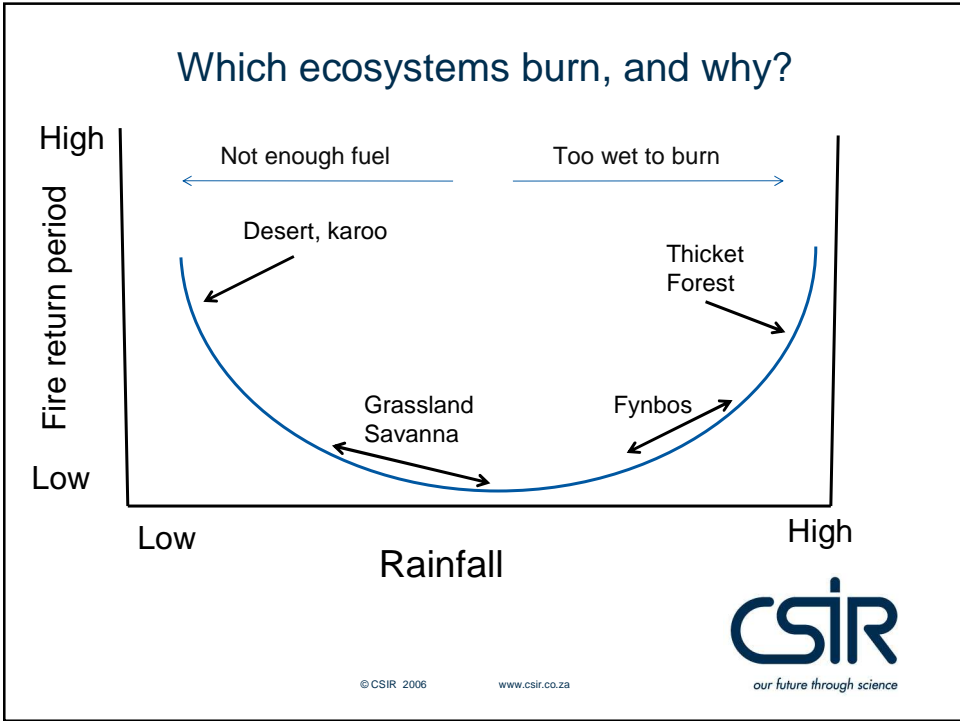
CSIRO PUBLISHING

International Journal of Wildland Fire 2011, 20, 540-549

www.publish.csiro.au/journals/ijwf

Determinants of spatial variation in fire return period in a semi-arid African savanna

T. G. O'Connor^{A,B,D}, C. M. Mulqueeny^{A,C} and P. S. Goodman^C





Grazing lands need fire to stay palatable and bush-free



Business Day 16th February 2006

NATIONAL NEWS

Fires cost Western Cape R650m

Tough new laws will force offenders to pay for the damage they cause, even unintentionally

Chris van Gass

Cape Correspondent

CAPE TOWN — The devastating fires that have raged through Western Cape since December and ravaged tracts of Table Mountain, the Overberg and the Cape winelands have caused damage worth more than R650m, premier Ebrahim Rasool said yesterday.

The fires caused losses of about R6.5m to the agricultural sector, R391m in fynbos and R266m in tourism.

More than 100 000ha of land, including fynbos and timber plantations, were destroyed, resulting in a significant loss in biodiversity and extensive damage to the province's wildflower industry.

More than 4 000 people lost their jobs as a result of the fires and the industry also lost market share by being unable to honour export orders.

Rasool said that, despite the calls for the affected areas to be

declared disaster zones, his committee had decided not to approach President Thabo Mbeki to seek such a declaration. To do this would compound the problem and might unintentionally worsen the situation, Rasool said.

It would send out the wrong signal that Table Mountain, the fynbos in the Overberg and the winelands in the province were "disaster areas" and this would harm tourism in the Western Cape and SA, he said.

Rasool said the province would make representations to Mbeki and Provincial and Local Government Minister Sydney Mufamadi to unlock funds at local, provincial and national level to help lessen the impact of the fires.

One such request would be for R17m to help with action to start eliminating the quicker-growing alien vegetation in the fire-ravaged areas controlled by Cape Nature.

He said this approach, which

aimed to achieve the same result as a declaration of a disaster, was more responsible.

Rasool said once the Disaster Management Act came into effect on April 1, public and private land owners would be held responsible for clearing alien vegetation, considered the biggest fire hazard, from their land.

He said government would no longer "pussyfoot" around this issue and would have to get tough. "Otherwise, we will face a R650m bill every season."

Rasool also warned that government would establish a toll-free hotline enabling people to report others who either intentionally or unintentionally started fires by carelessly discarding lit cigarettes, for example. He said municipalities would be presented with draft by-laws making such acts illegal.

The penalties for transgressions would be in line with the extent of the damage caused.



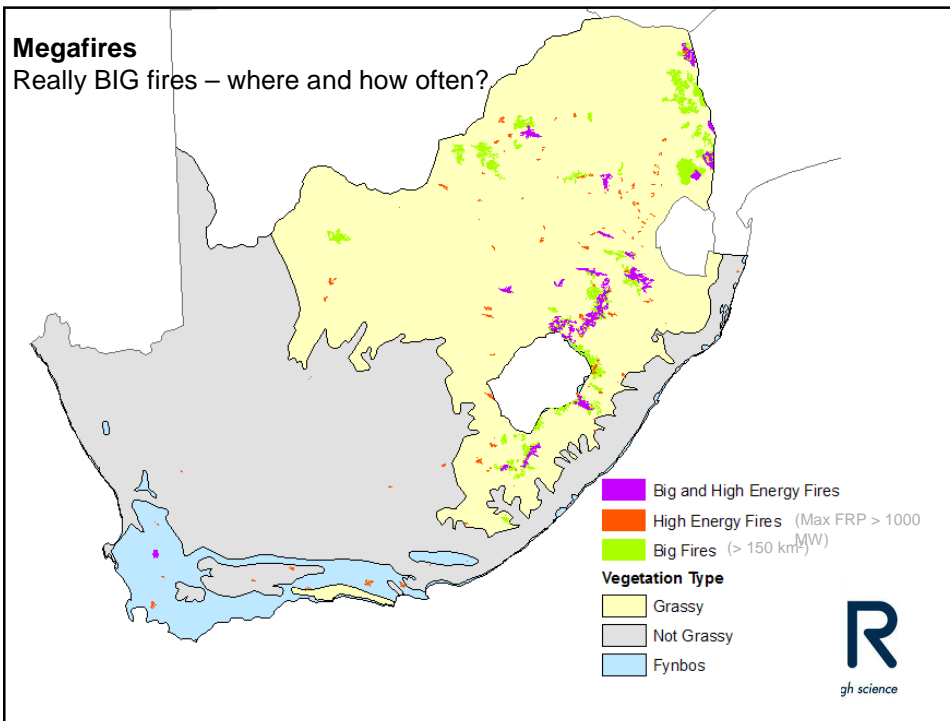
Despite fire damage of more than R650m, affected parts of Western Cape will not be declared disaster areas, premier Ebrahim Rasool said yesterday. Picture: MARK WESSELS/SUNDAY TIMES

our future through science

Cost of wildfires in South Africa (CSIR 2006)

Table 5.4. Summary of annual costs of veldfires in South Africa.

Source of cost	Estimated annual cost (R millions per year)	Notes
Timber from plantations	63	Based on average value of pines, eucalypts and other species.
Downstream timber processing	252	Assuming that processing value is four times the value of timber lost.
Livestock and grazing	155	Based on untested assumptions of the proportion of fires that are destructive.
Harvested products from savannas	61	Based on patchy estimates of value of products
Harvested products from grasslands	69	Based on patchy estimates of value of products
Harvested products from fynbos	5	Good economic data on value of products available from some areas.
Disruptions to power supply	36	Based on rough estimates of economic costs of power dips
Houses and structures	2	Conservative estimate. No reliable data available.
Smoke hazards	?	No estimates possible
Alien plant control	100	Assuming that plant control takes place. Negative impacts if no control takes place could be substantially higher.
Total	743	



Fire and climate change

Contents lists available at ScienceDirect

Ecological Modelling

journal homepage: www.elsevier.com/locate/ecolmodel

A Hierarchical Bayesian model of wildfire in a Mediterranean biodiversity hotspot: Implications of weather variability and global circulation

Adam M. Wilson^a, Andrew M. Latimer^{b,*}, John A. Silander Jr.^a, Alan E. Gelfand^c, Helen de Klerk^d

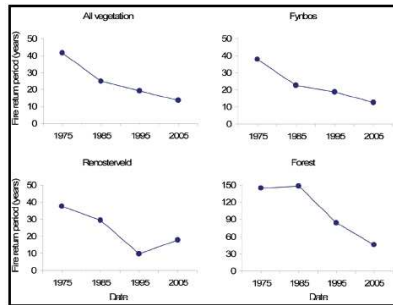
“If, as currently forecasted, climate change in the region continues to produce higher temperatures, more frequent heat waves, and/or lower rainfall, our model thus indicates that fire frequency is likely to increase substantially.”

Fire and climate change

Koedoe: African Protected Area Conservation, 2008, 50 (1)

THE RECENT FIRE HISTORY OF THE TABLE MOUNTAIN NATIONAL PARK AND IMPLICATIONS FOR FIRE MANAGEMENT

GREG G. FORSYTH
BRIAN W. VAN WILGEN

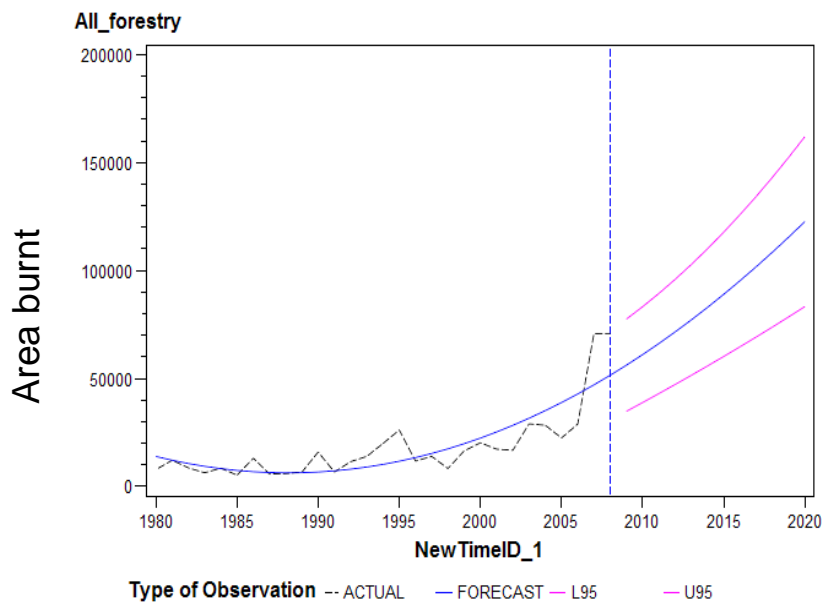


© CSIR 2006 www.csir.co.za

“In fynbos vegetation, mean fire return periods declined by 18.1 years from 31.6 years in the 1970s to 13.5 years between 2000 and 2007”



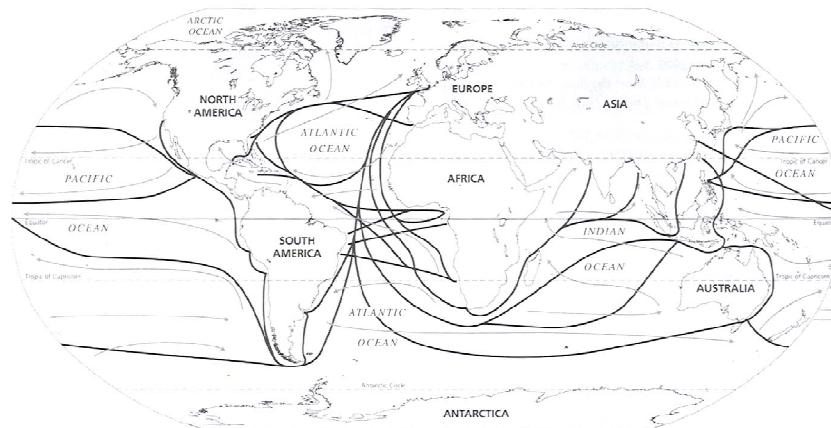
Area burnt in forestry plantations in South Africa – actual data up to 2008, and forecasts from Stepwise Autoregressive Method

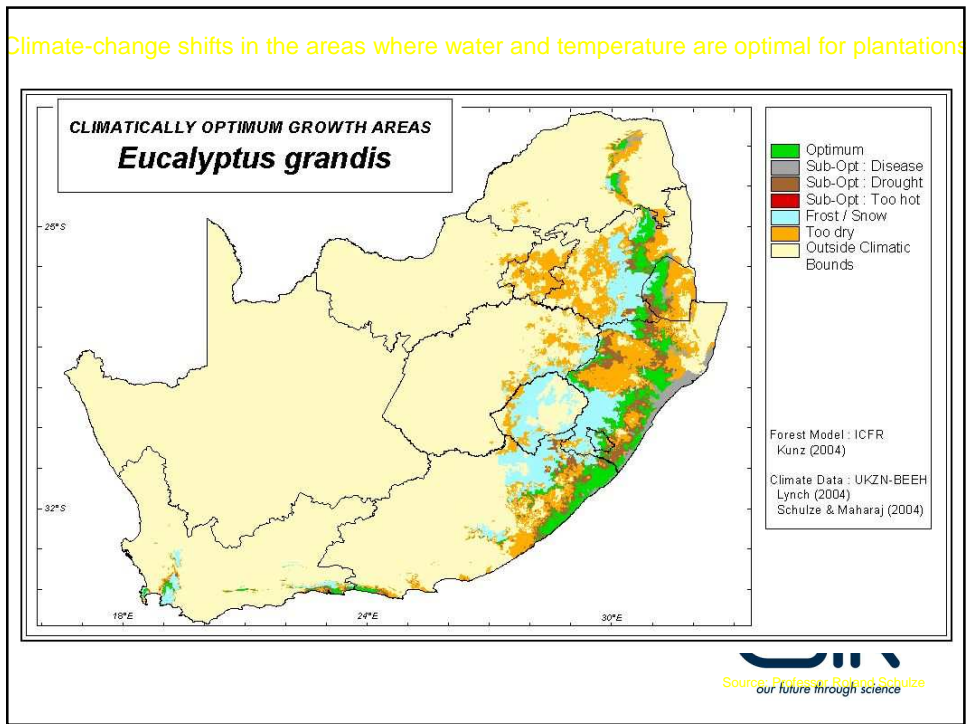
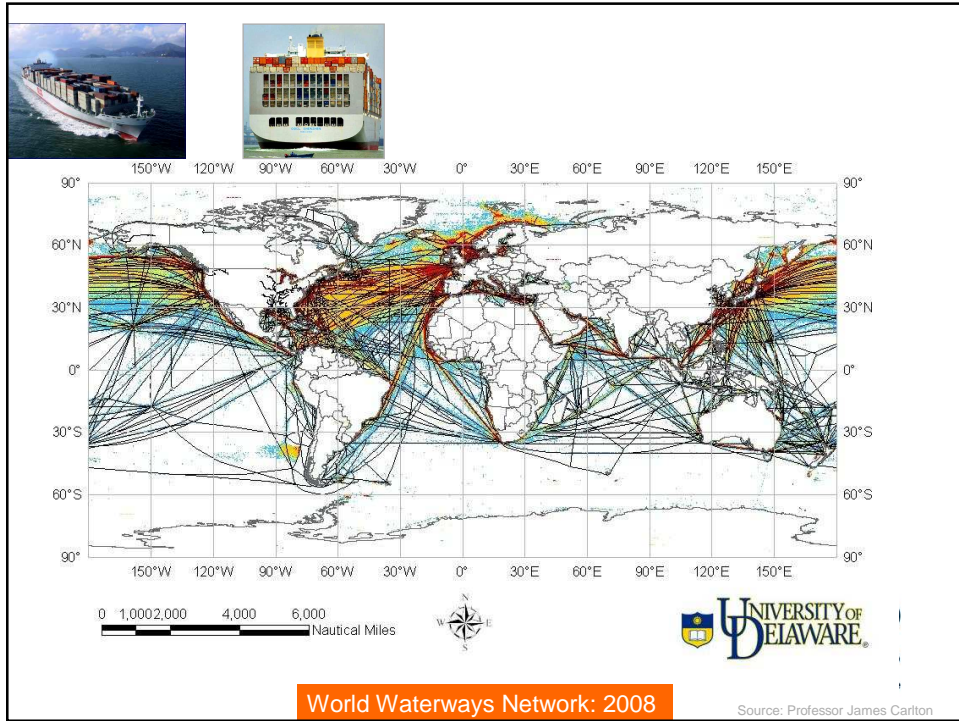


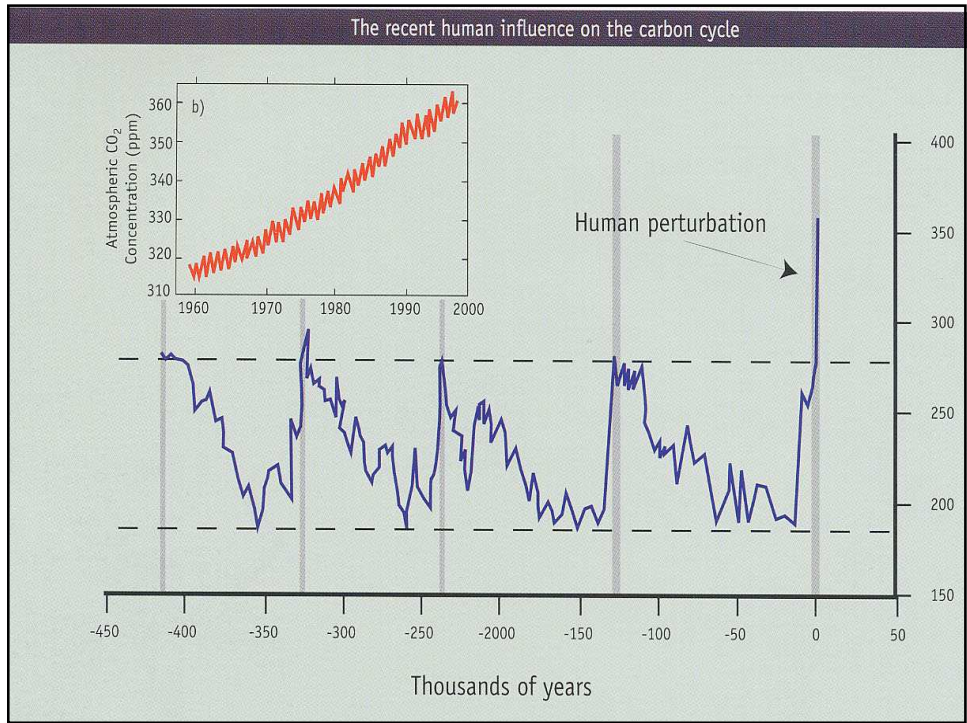
Invasive alien species and global change

- Climate change destabilises ecosystems, opening gaps for weedy species, especially those with no local predators
- Climate change opens opportunities for invasion beyond the limits of previous distribution
- Changes in the atmosphere change the competitive balance between groups of organisms
- Increasing global connectivity is also an aspect of global change, and drives invasions

Main Ocean Sailing Routes, 1500s to mid-1800s



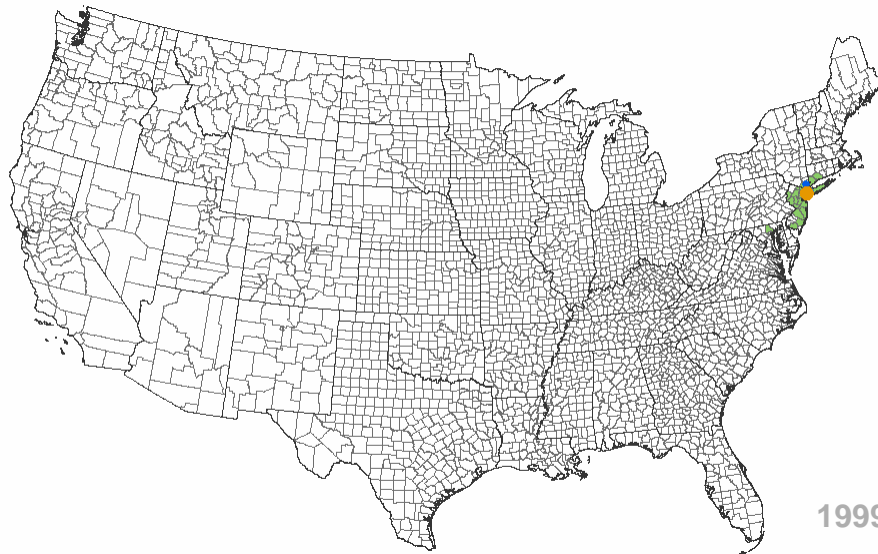




The already problematic mesquite (*Prosopis* species) in the Northern Cape appear to be well-adapted to take advantage of climate change.

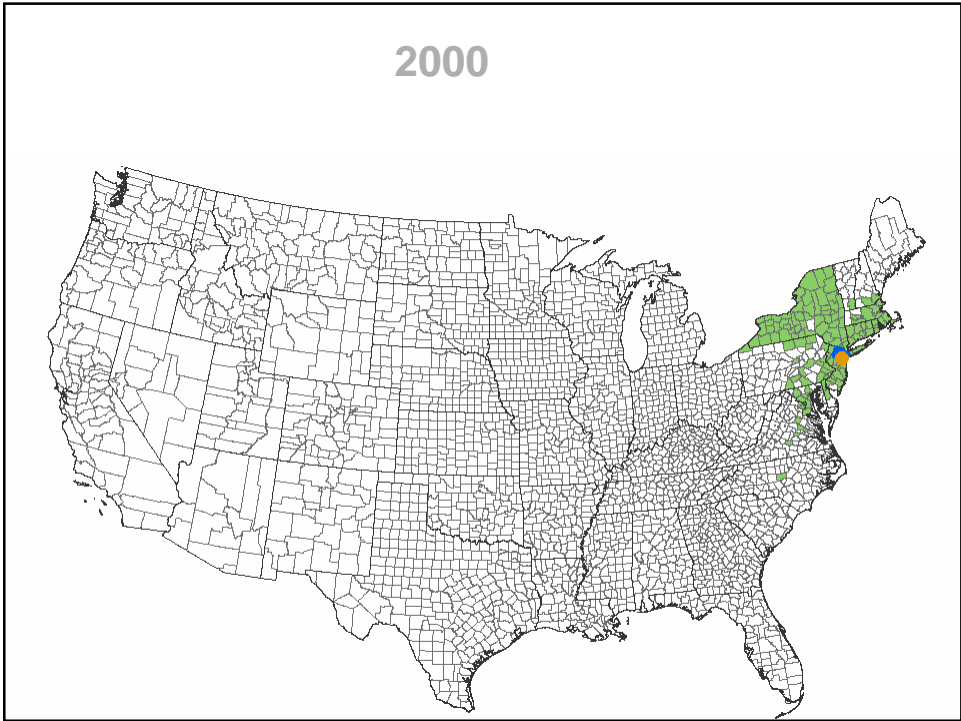


West Nile Virus Neuro-invasive Disease Incidence, by County

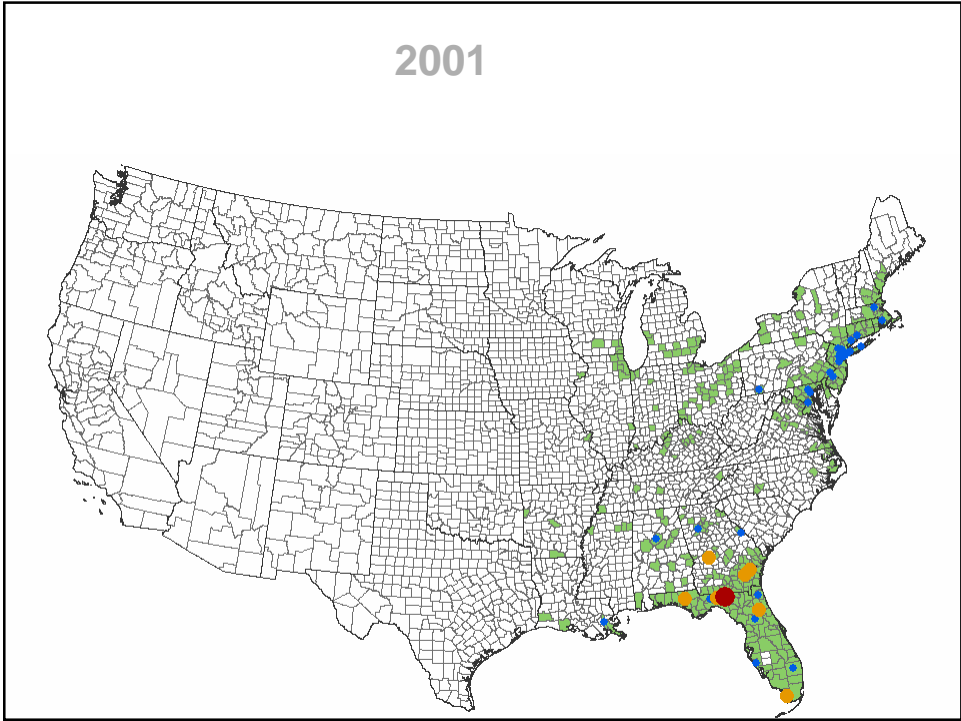


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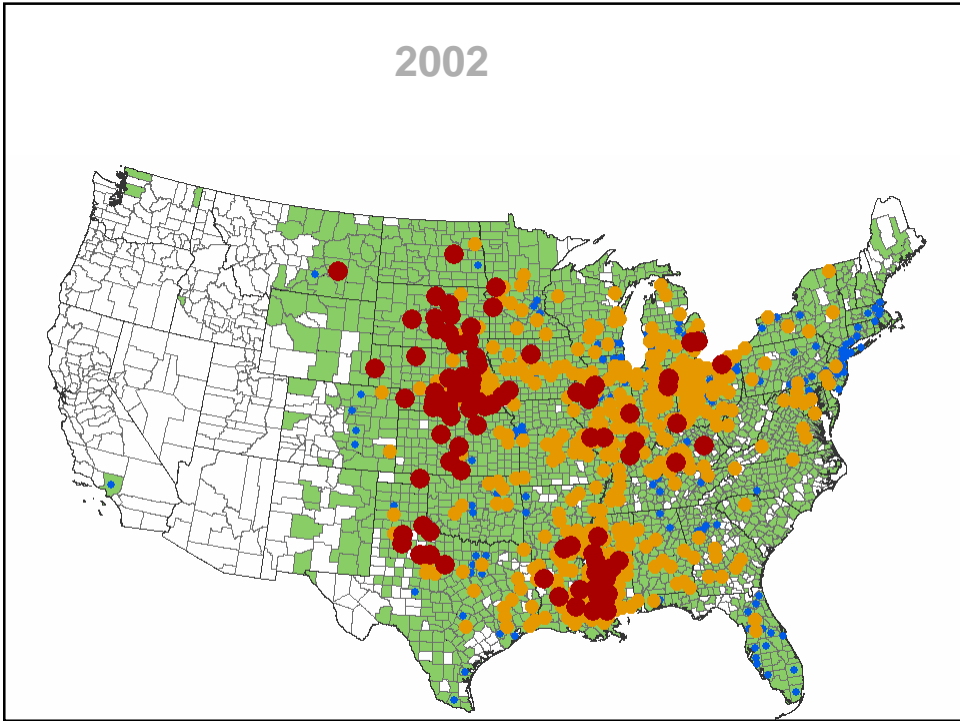
2000



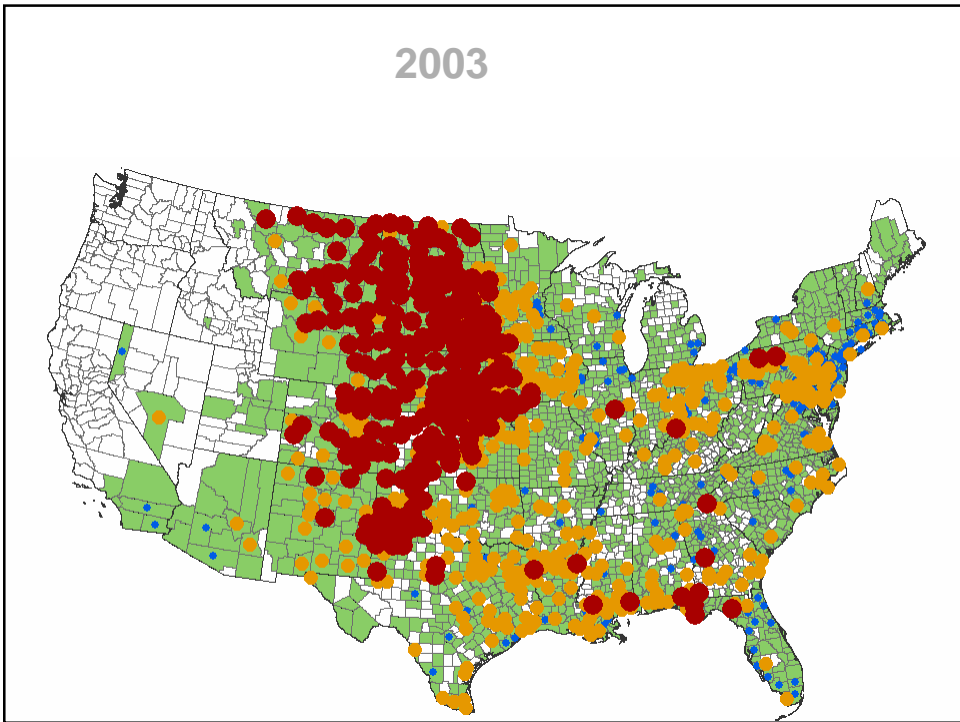
2001



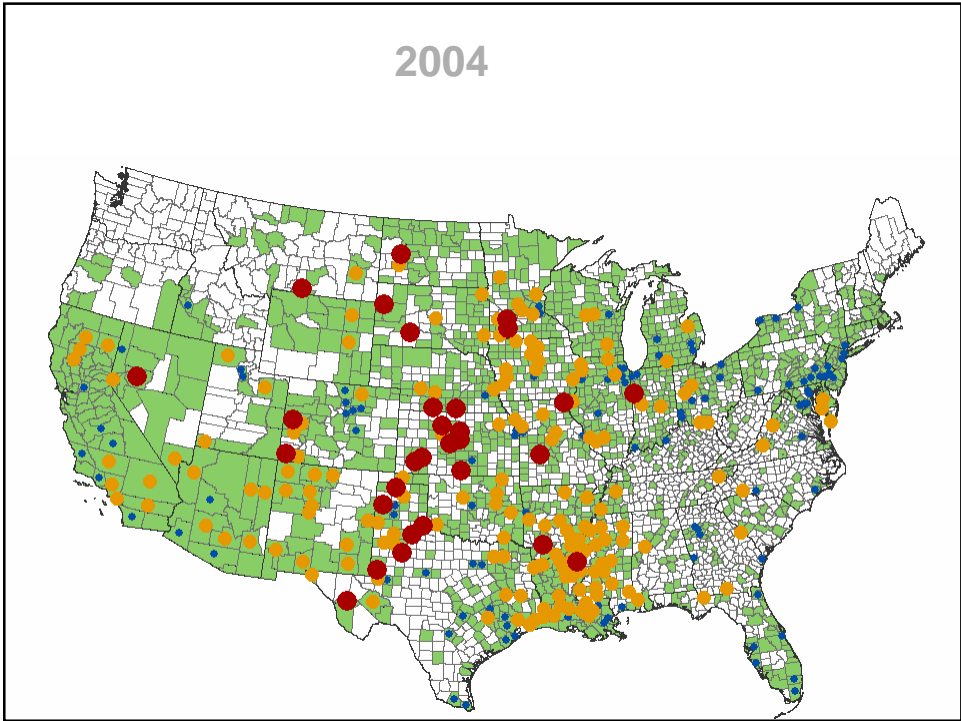
2002



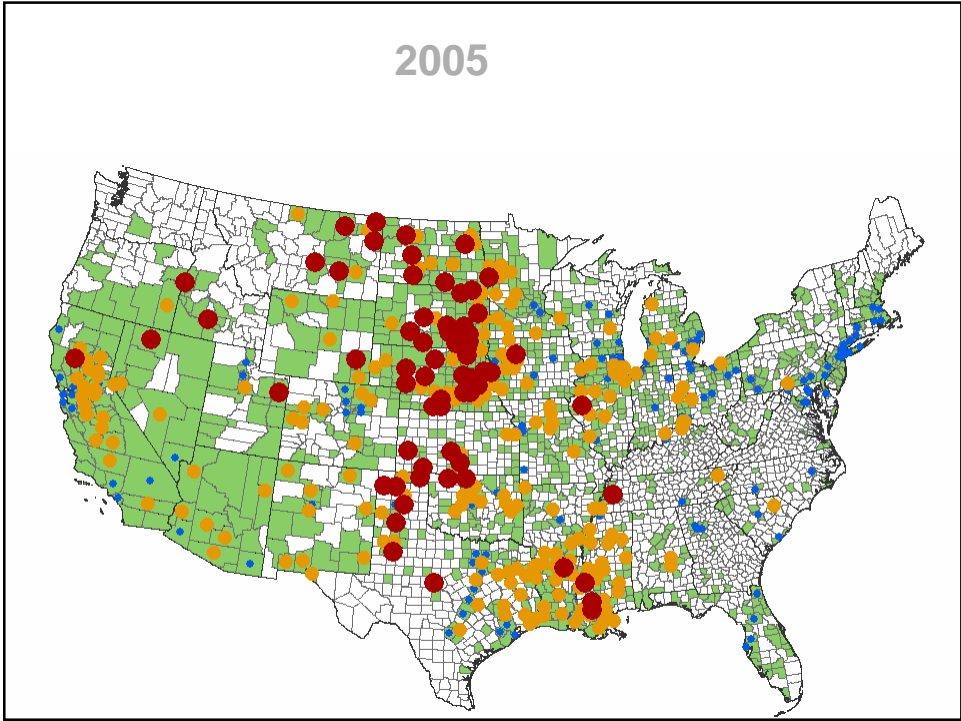
2003



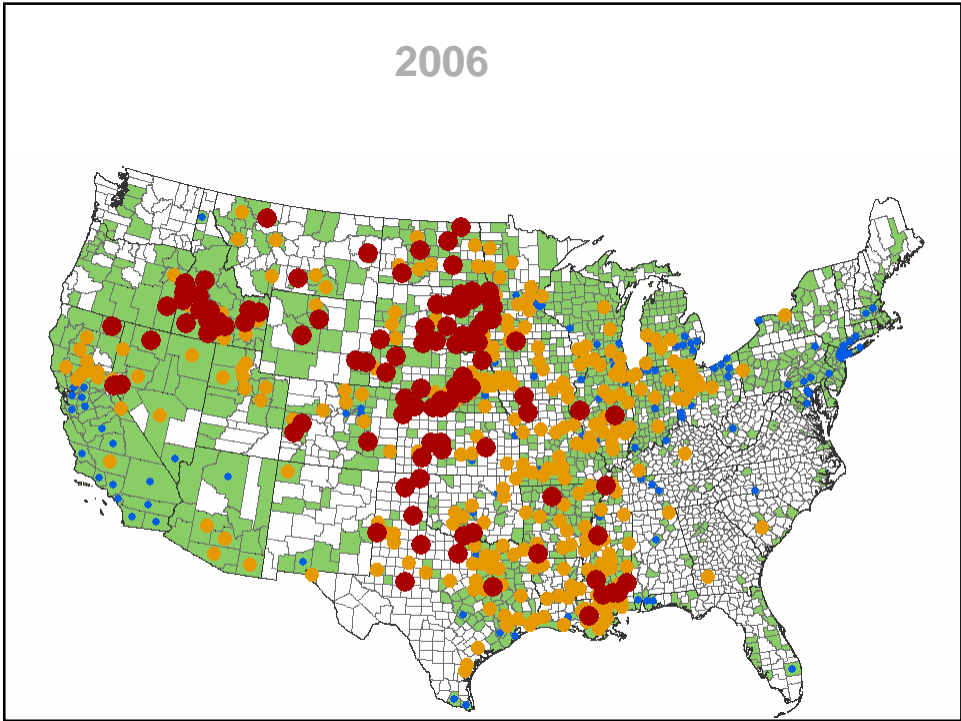
2004



2005



2006





Dead albatross chick eaten by invasive mice on Tristan Island

Photo: Professor Peter Ryan

*Prior to human arrival, a new species
successfully colonized Hawaii once
every 25,000 to 50,000 years.*



*Nowadays a foreign species
becomes established in Hawaii
about once every 18 days.*

Pat Bily (The Nature Conservancy)



Plant Pathology (2008) 57, 715–727

DOI: 10.1111/j.1365-3059.2008.01893.x



***Phytophthora pinifolia* sp. nov. associated with a serious needle disease of *Pinus radiata* in Chile**

A. Durán^{1,2*}, M. Gryzenhout¹, B. Slippers³, R. Ahumada^{1,4}, A. Rotella¹, F. Flores¹, B. D. Wingfield¹ and M. J. Wingfield³

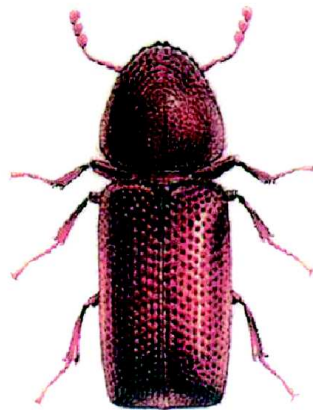
¹Department of Microbiology and Plant Pathology and ²Department of Genetics, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria 0002, South Africa; and ³Biological S.A., Casilla 70-C, Concepción, Chile

RESEARCH LETTER

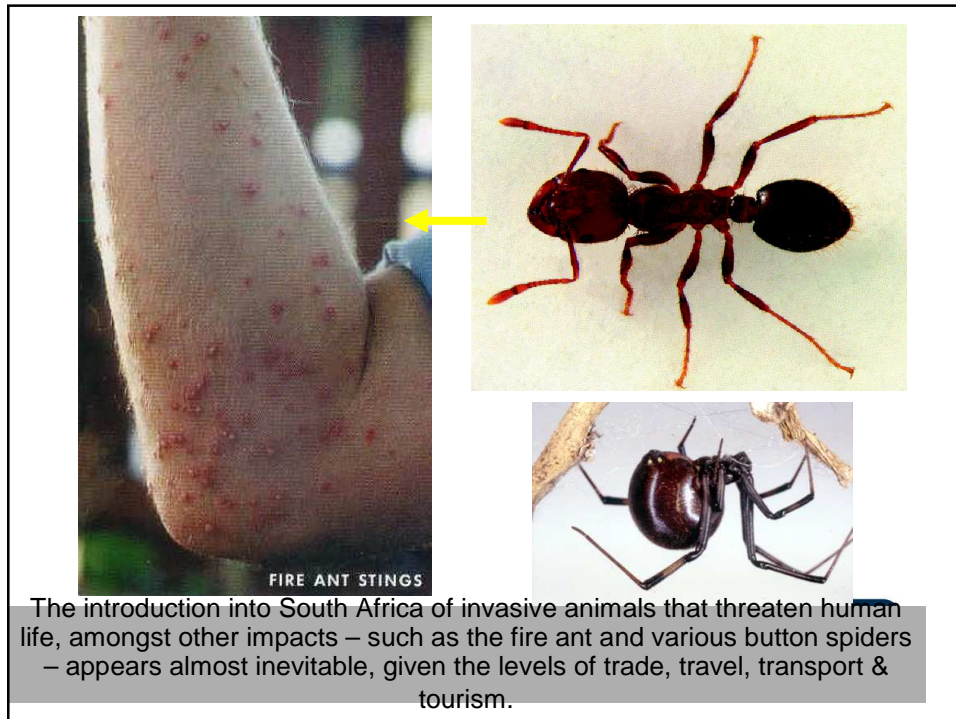
DNA-based method for rapid identification of the pine pathogen, *Phytophthora pinifolia*

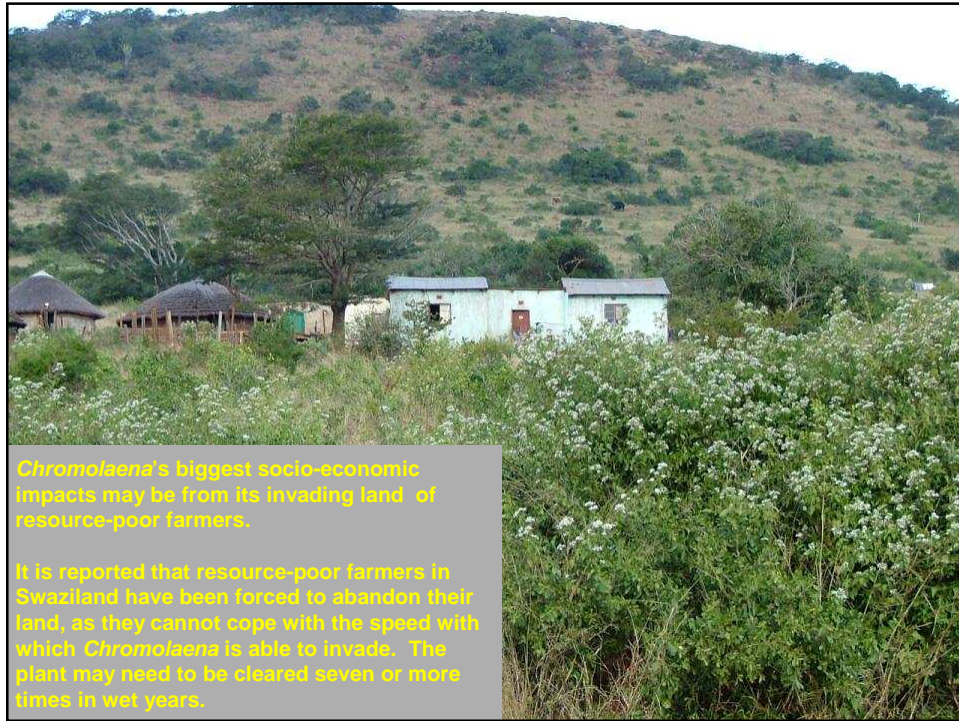
Alvaro Durán¹, Bernard Slippers³, Mariëka Gryzenhout¹, Rodrigo Ahumada¹, Andre Drenth³, Brenda D. Wingfield¹ & Michael J. Wingfield³

¹Department of Microbiology and Plant Pathology, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa; ²Department of Genetics, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa; and ³The Pathology Centre, University of Queensland, Brisbane, QLD, Australia

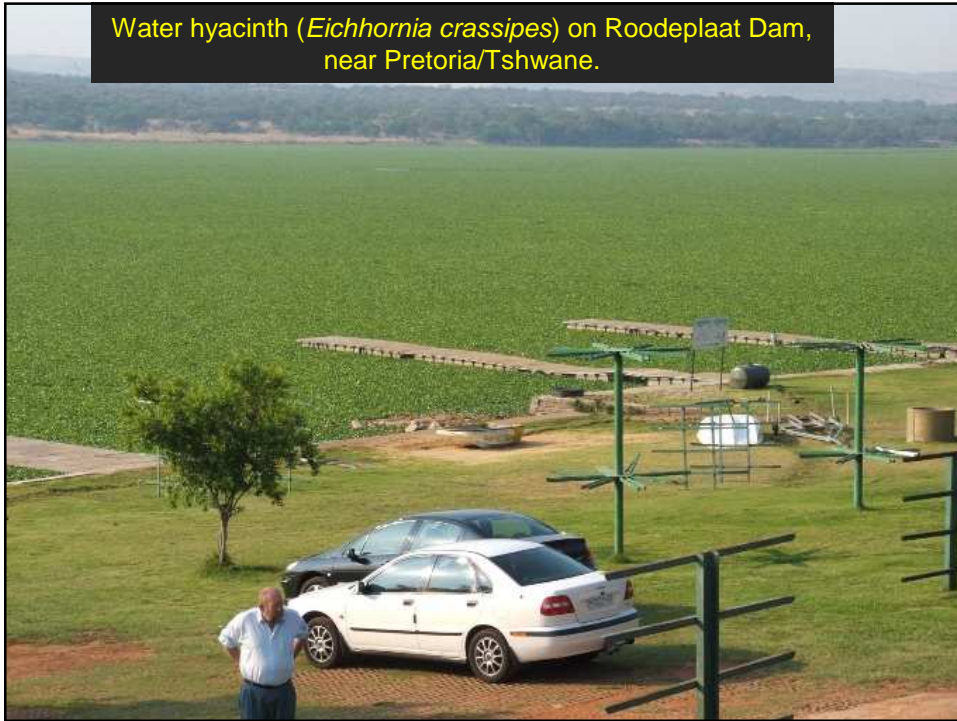


Various pest species are impacting on food security. Of particular concern are our pollinators, such as by verroa mites on honey bees

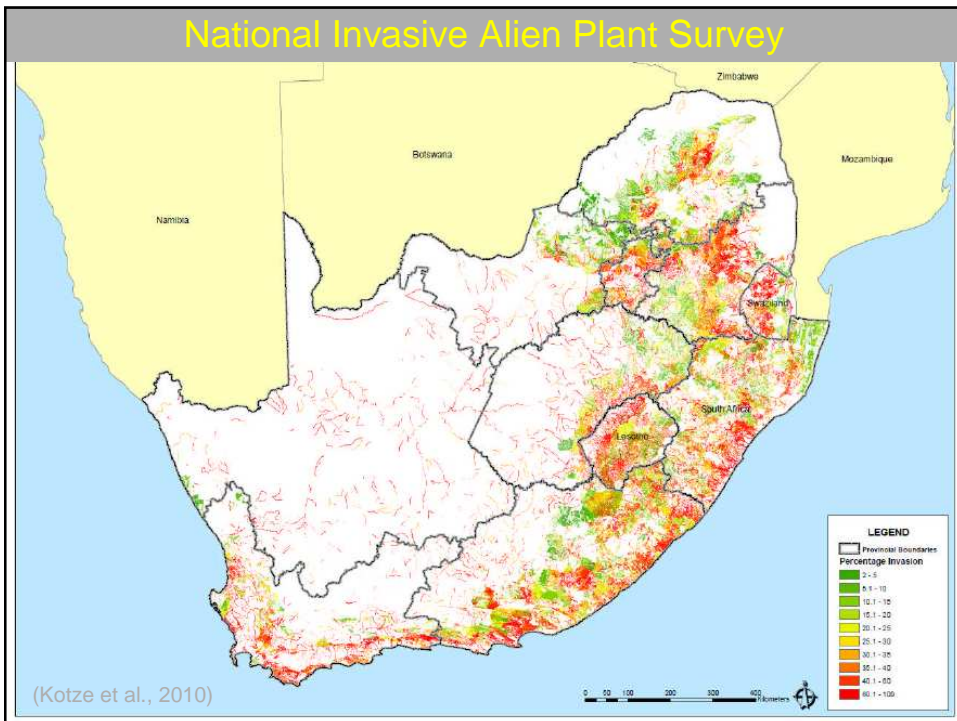




Water hyacinth (*Eichhornia crassipes*) on Roodeplaat Dam, near Pretoria/Tshwane.



National Invasive Alien Plant Survey



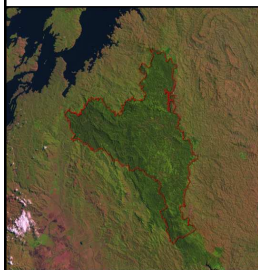
It's not whether we can afford to do it; it's whether we can afford not to do it!

“Based on an estimated \$31 trillion in world GNP, **the \$1.4 trillion in losses from invasive species** represents nearly 5% of the world economy.”

Pimentel, D (Ed). *Biological Invasions: Economic and Environmental Costs of Alien Plant, Animal and Microbe Species*. CRC Press, Boca Raton.

Even if these figures are 50% out, when using simplistic economic measures, they are unaffordable – for invasives are invading, and rapidly.
(But the resource-economic externalities – the social costs, opportunity costs, synergistic and cumulative impacts – better suggest the looming catastrophe.)

The “Lethal Cocktail” of Environmental Change



Habitat destruction:
Nyungwe National Park, Rwanda



Invasive Alien Species:
invasive grass in China



Climate Change: Melting glaciers:
Torres del Paine National Park, Chile

certain invasive alien plants exacerbate wild fires, with very significant (but as yet unquantified) impacts, including to stock.



Fire can drive invasion by fire-adapted weeds
(eg. pines in fynbos)



Alien invasive grasses could introduce fire into the karoo



Summary

- Global change, including climate change, is severely disrupting ecosystems, on which human welfare depends
- Ecosystems have a natural capacity to adapt, but are impeded from doing so by
 - Multiple, simultaneous assaults
 - Fragmentation
 - Loss of biodiversity
- There are policy and management actions we can take that reduce the threats to ecosystems and increase their ability to cope with change