



Department of
Agriculture and Food



Climate Change - Biosecurity implications

Dr David Bowran

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Last decade has seen lowest on record rainfall for winter months over the SWWA in some years, record monthly temperature highs in summer and some winter months.

Surface air pressure changes started in the 1970's and have been coincident with the reduction in rainfall

With climate considered to be the average for the last 30 years, the current trends of annual and seasonal rainfall or temperatures in the last 14 years have become more pronounced especially in the south west

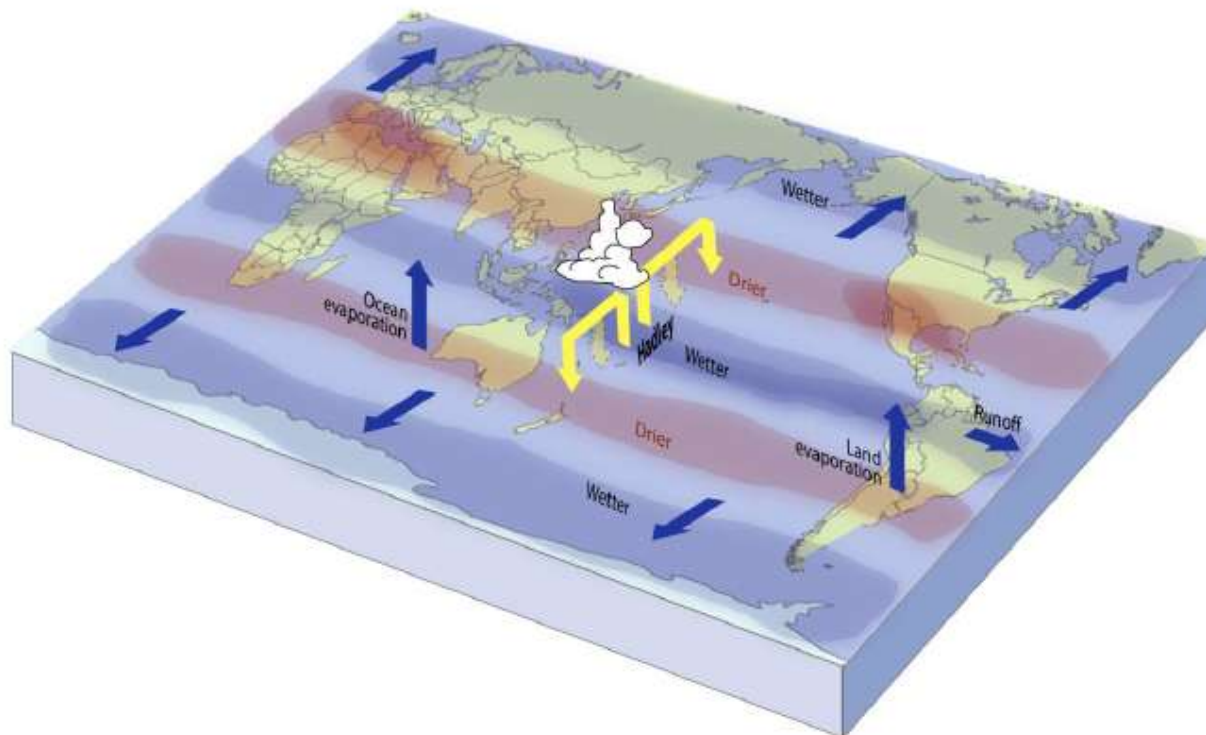
Warmer oceans are being seen to the west of Perth, and the Indian Ocean is warming more consistently than any other major ocean

Global modelling at the regional scale for WA and Australia suggests that this trend may intensify from 2020 to 2060 as the storm tracks move further south and the Hadley cell expands.

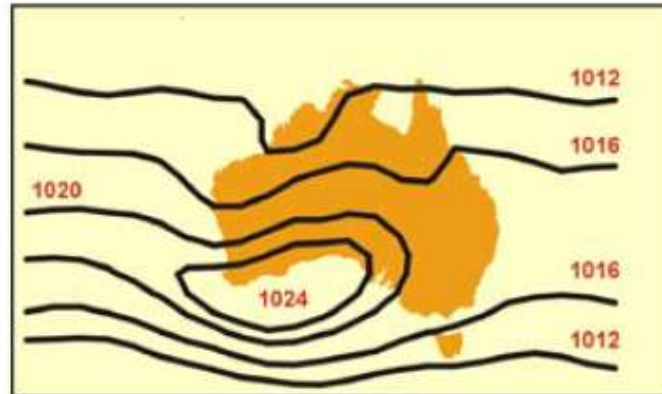
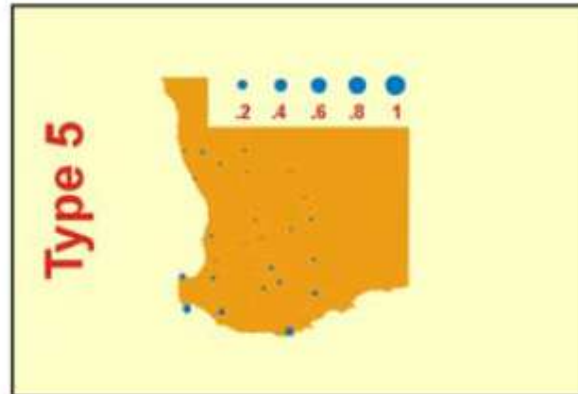
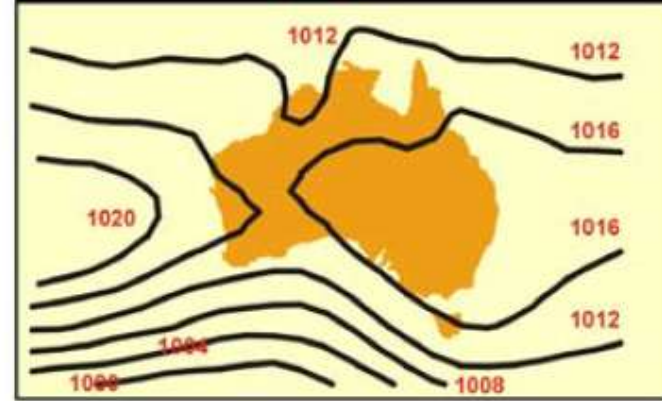
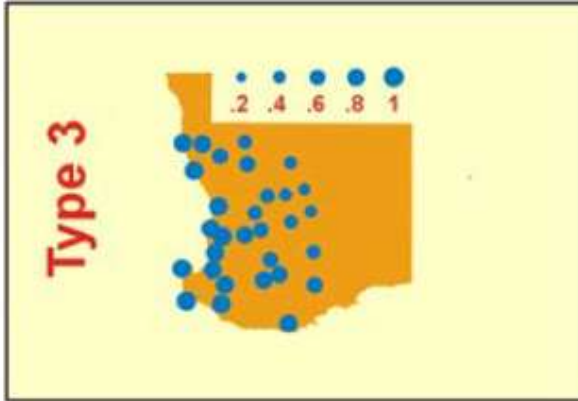
Meanwhile the north has been getting wetter! And warmer air holds more water, which may intensify rainfall events – fewer but heavier?



Changes in water cycle over next century



IPCC 5, 2014.



Type 3: Wet West & Central

Bates et al., 2007

Type 5: Dry Everywhere

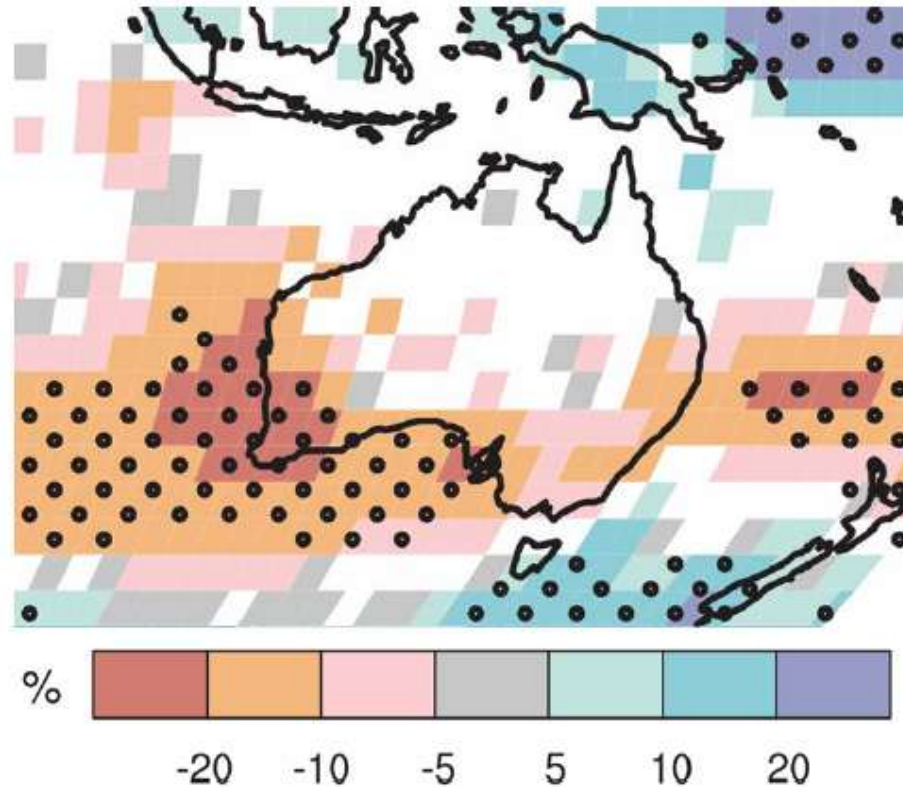
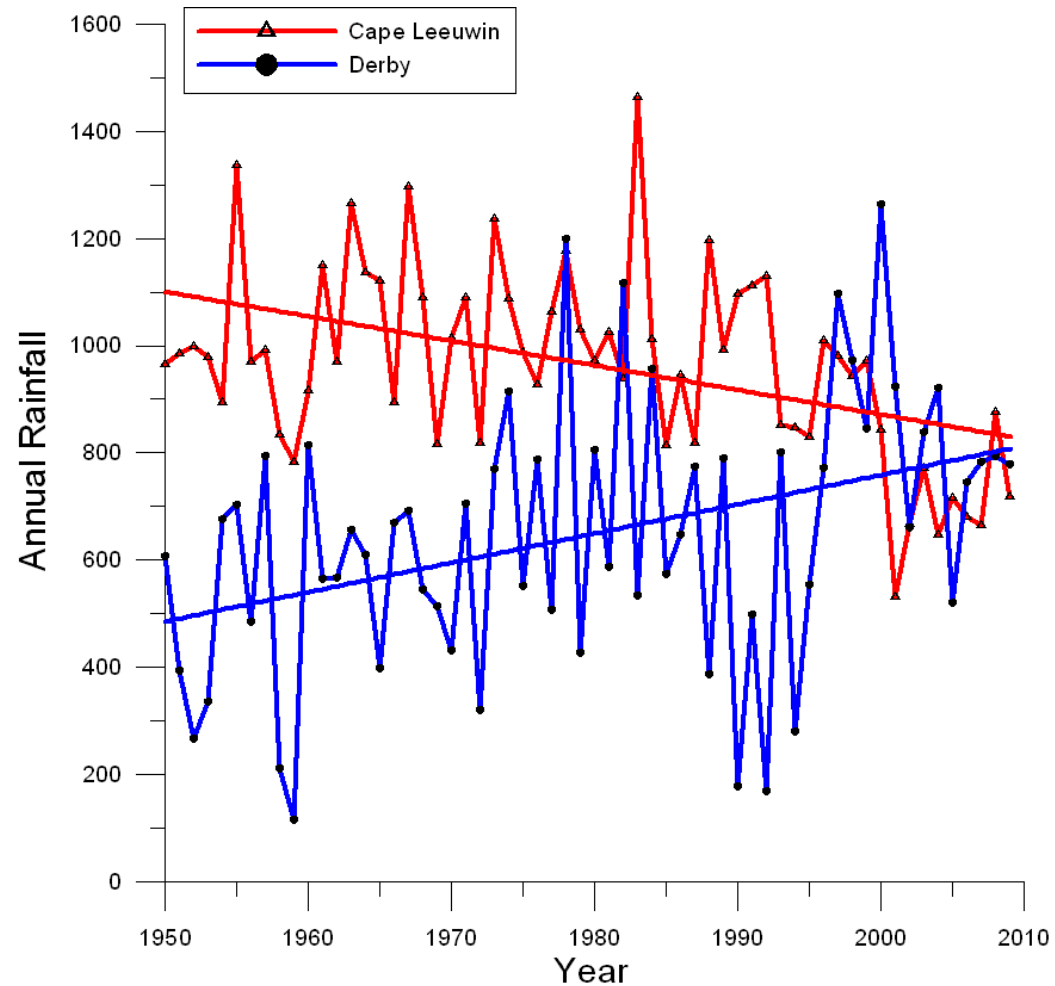
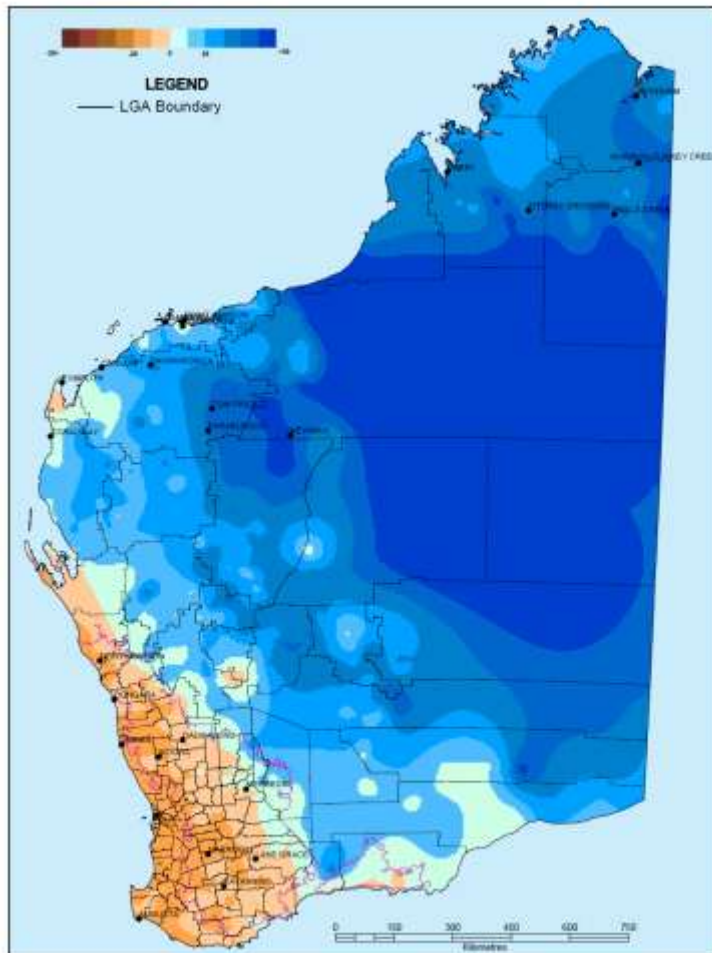


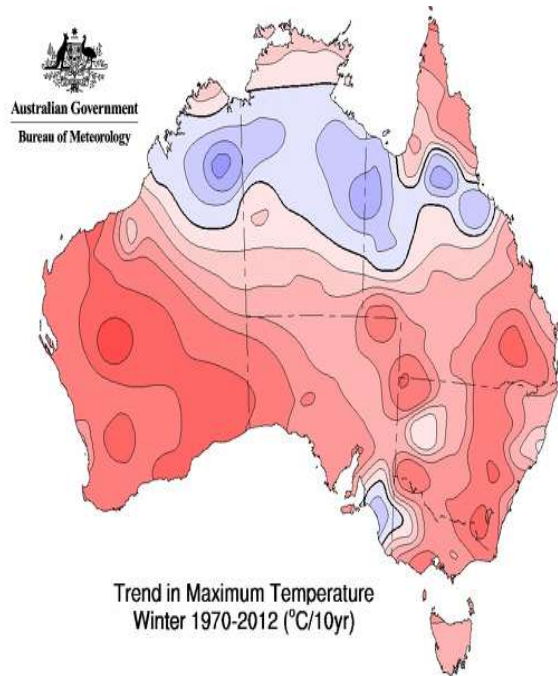
Figure 4.6 June to August rainfall is projected to decrease by more than 20% across SWWA at the end of this century (2080 to 2099) compared to the model mean value in 1980 to 1999, under the SRES A1B (intermediate) greenhouse gas emissions scenario. The black stippling indicates areas for which more than 90% of models agree on trends shown. From: IPCC Summary for Policy Makers (Figure 7).



Annual rainfall change last 20-60 years

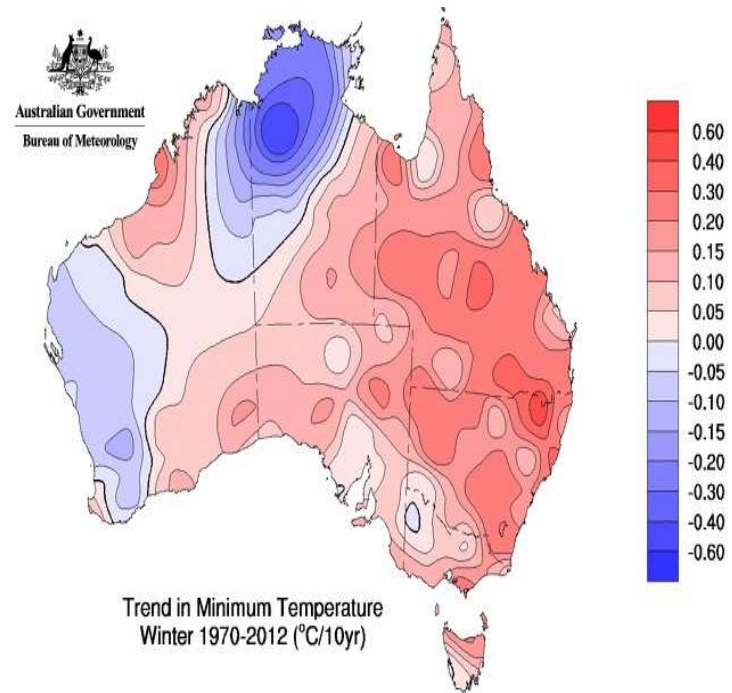
Western Australia
Percentage Change in Average Annual Rainfall
1993-2012 compared to 1910-1992





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Issued: 05/02/2013

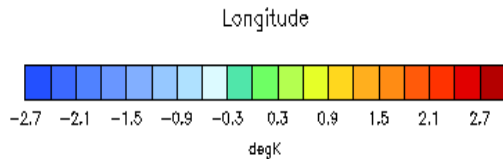
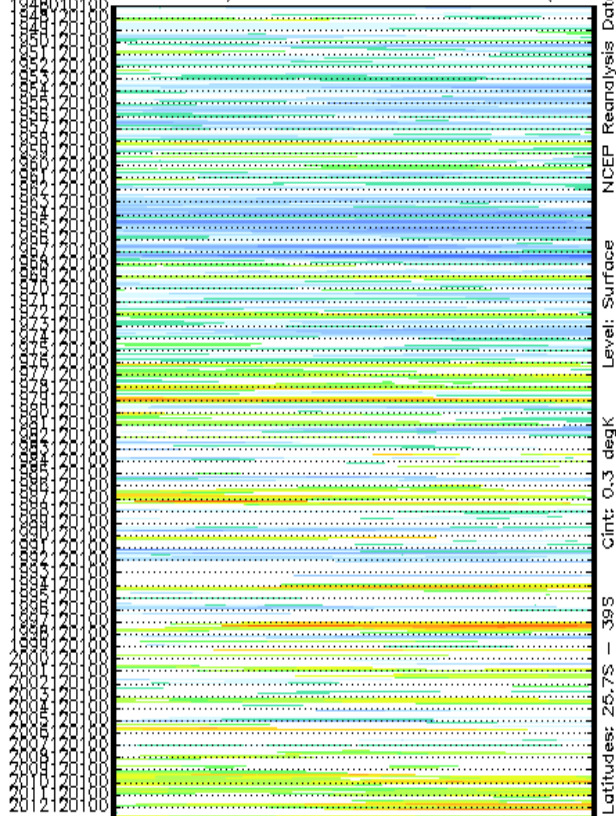


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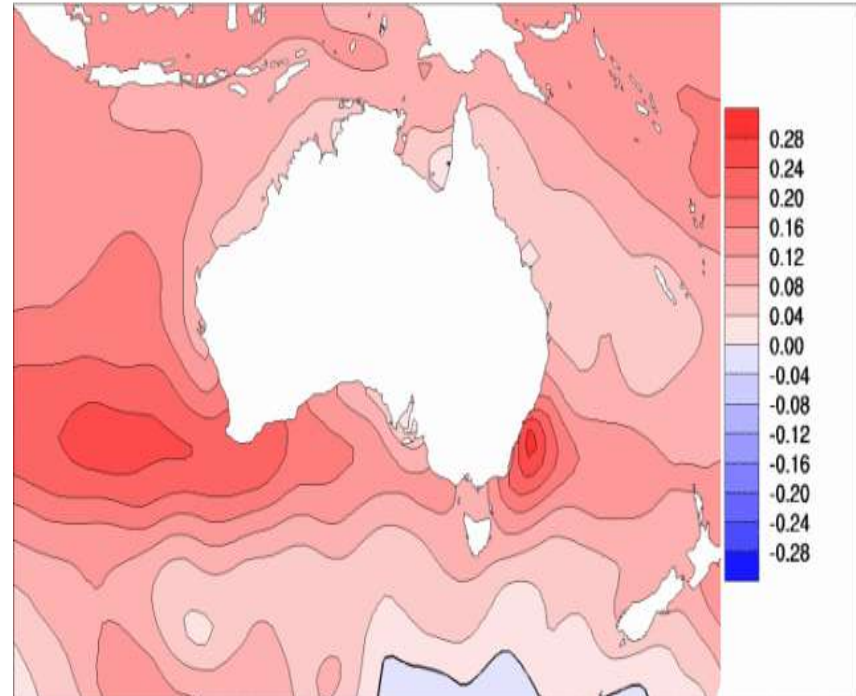


MEAN DAILY SST/LAND SKIN TEMPERATURE (ANOMALY)



NOAA/ESRL Physical Sciences Division

Trend in SST for the Australian Region ($^{\circ}\text{C}/10 \text{ yr}$) winter 1970-2013



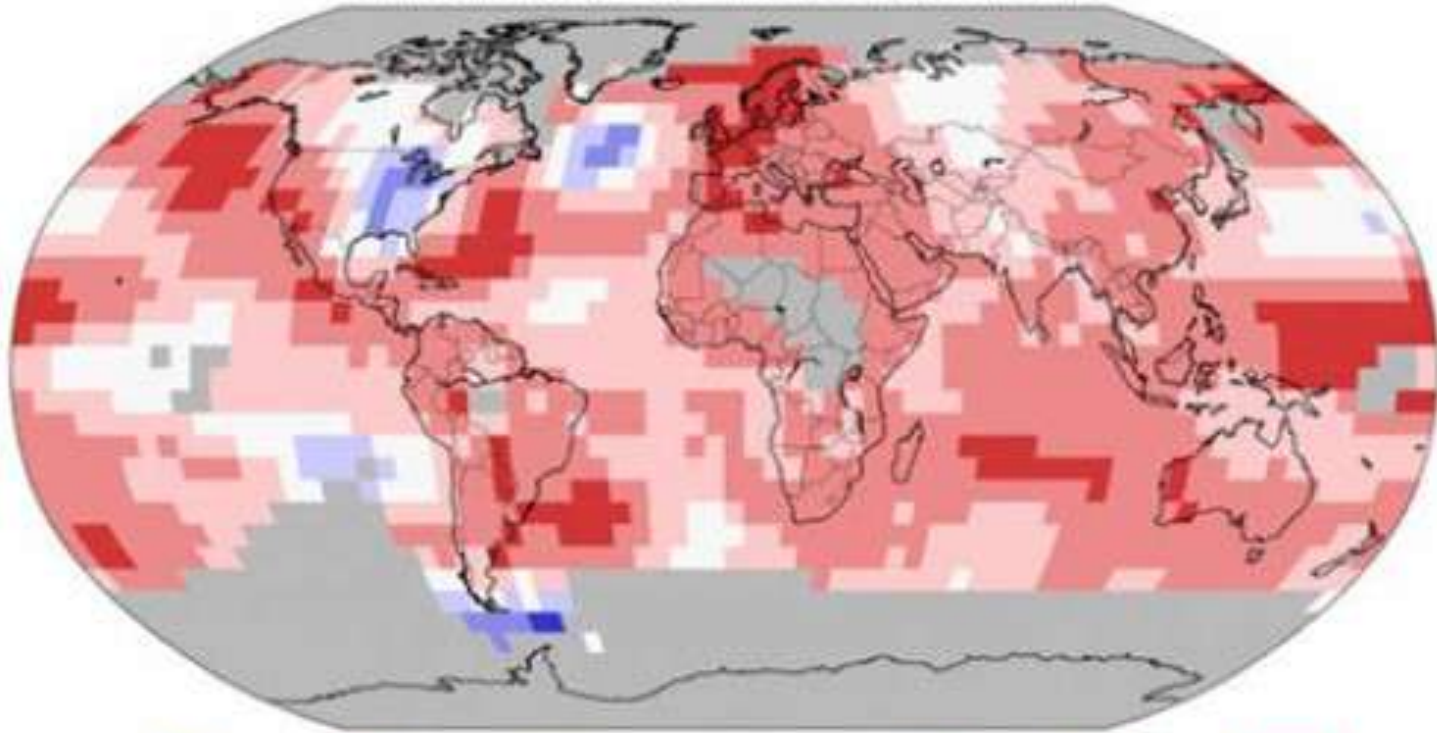
Bureau of Meteorology



Land & Ocean Temperature Percentiles Jan–Oct 2014

NOAA's National Climatic Data Center

Data Source: GHCN–M version 3.2.2 & ERSST version 3b



Record
Coldest

Much
Cooler than
Average

Cooler than
Average

Near
Average

Warmer than
Average

Much
Warmer than
Average

Record
Warmest



Fri Nov 14 09:00:46 EST 2014

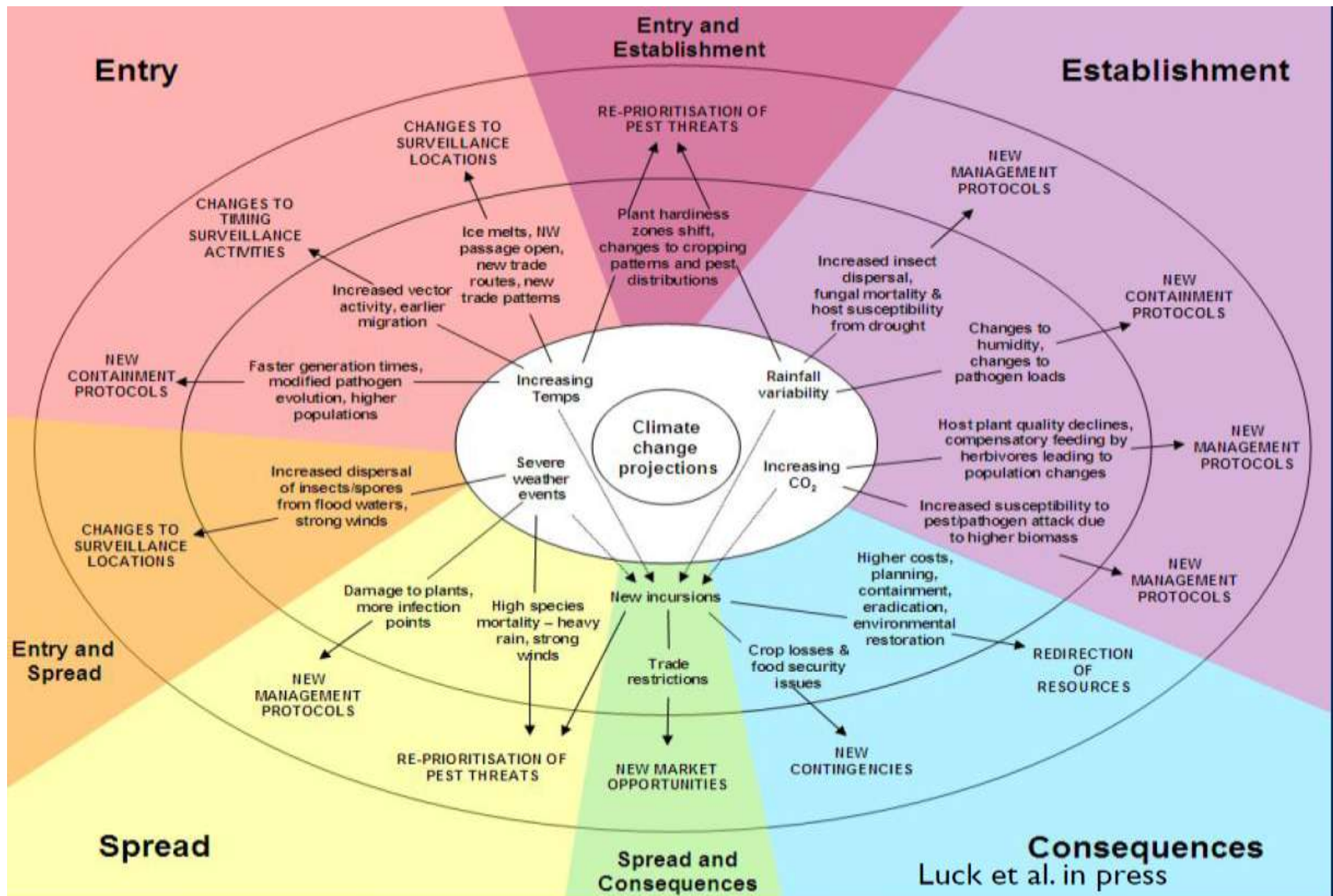


Globally assessments of the implications of climate change on biosecurity and the changes that might be experienced in natural or managed ecosystems is ramping up

Some countries eg USA and some individual regions eg South Australia have begun the task of identifying when, where and how threats might originate or change as climate changes, and what to do about them

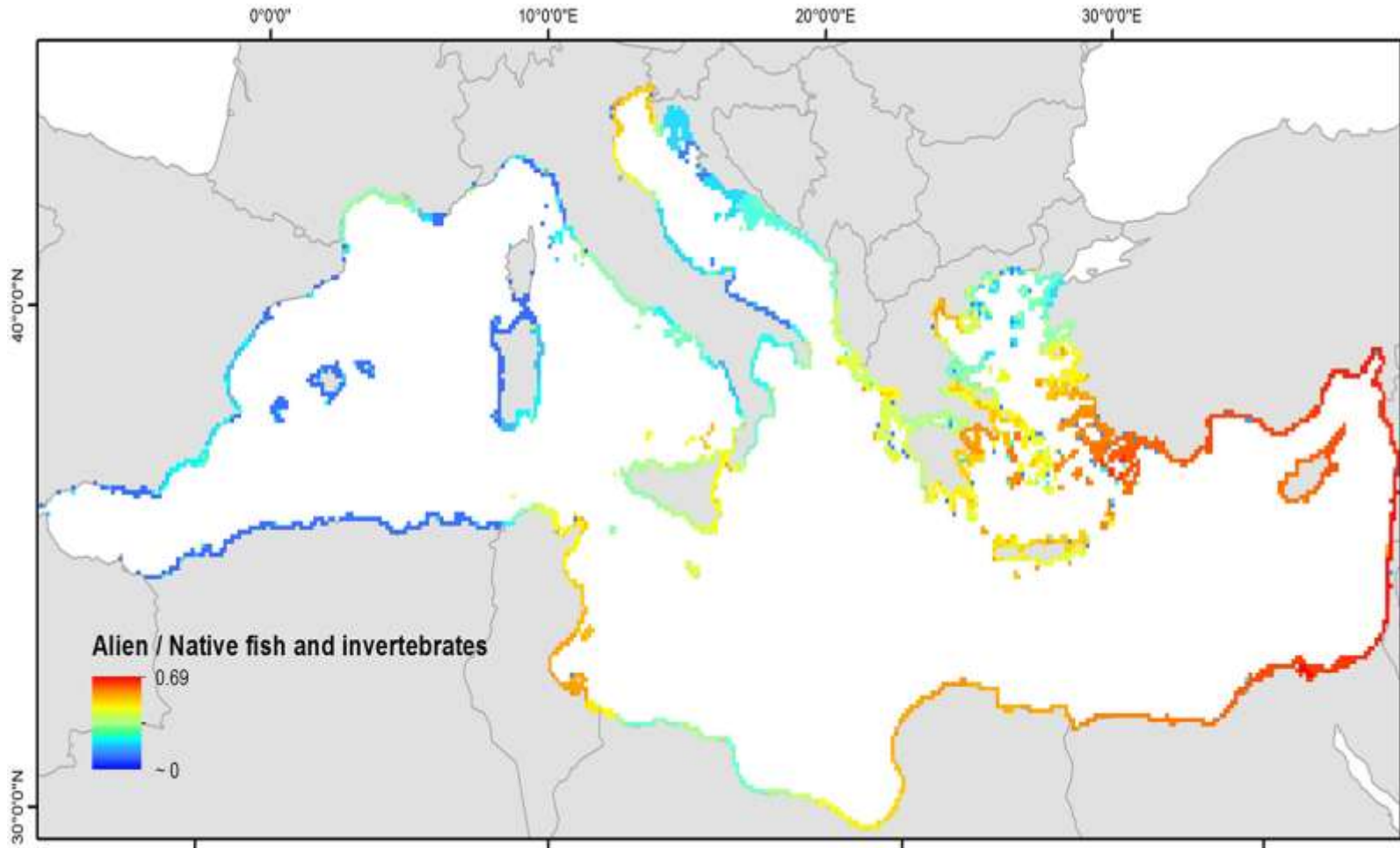
The literature highlights the importance of numerous interactions, some of which are positive for biosecurity, some neutral and some negative.

In many cases CO₂ increases, ocean acidity, intensification of wind and rainfall extremes are highlighted as drivers. Fire is a significant factor in many models of change in natural ecosystems as humidity drops and temperatures increase.



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J. Luck, I.D. Campbell, R. Magarey, S. Isard, J-P. Aurrabout and K. Finlay, 2014



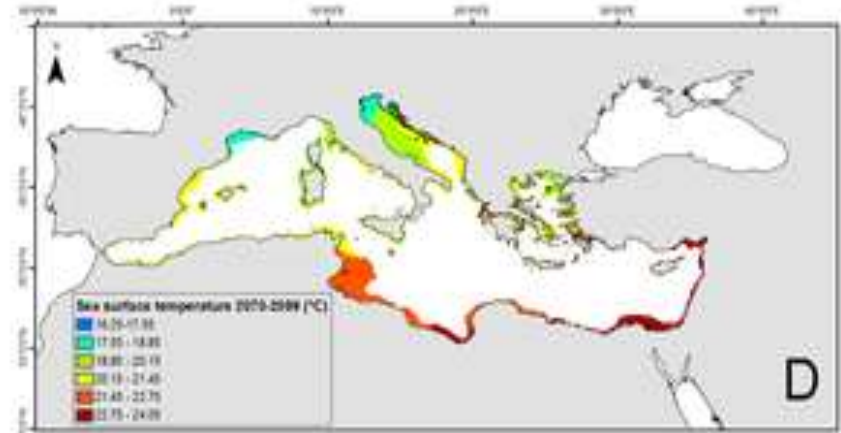
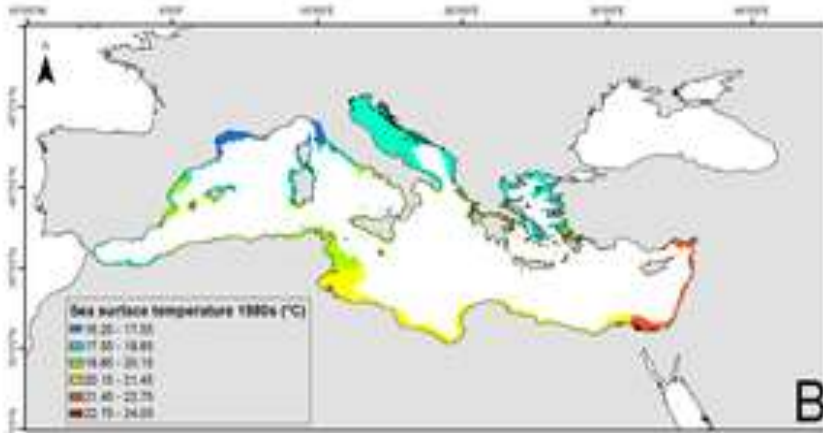
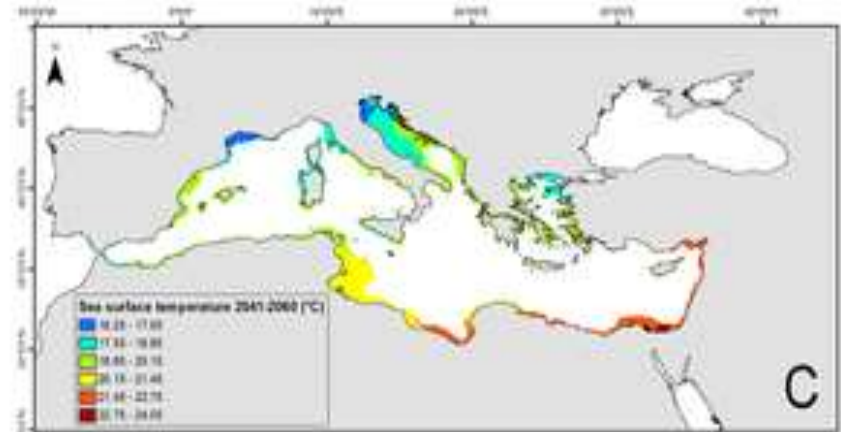
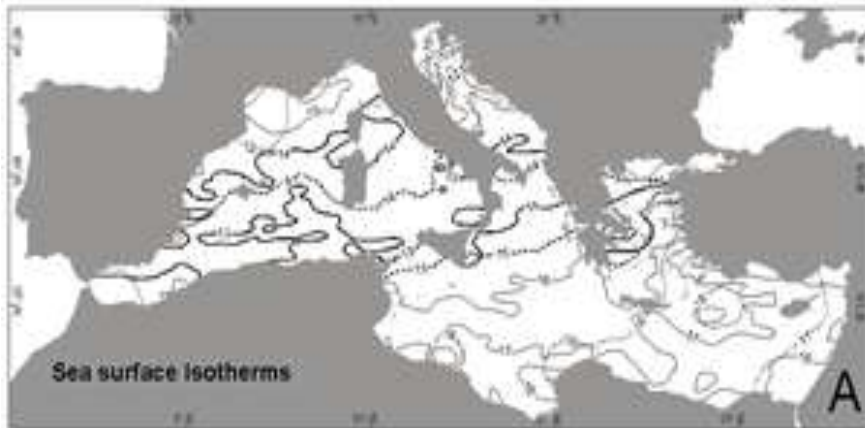
Katsanevakis et al , 2014

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Alien-to-native ratio of fish and invertebrates richness in the coastal areas of the Mediterranean Sea



Past changes in seawater temperature and future projections in the Mediterranean Sea.

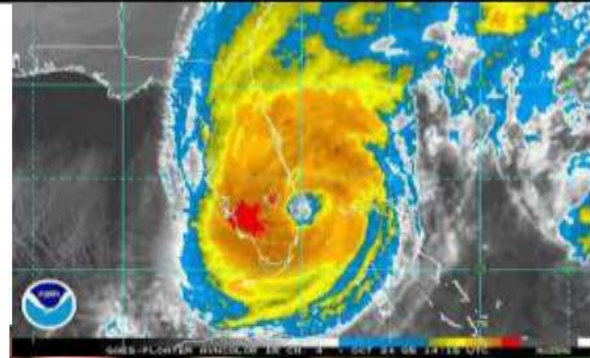


Coll M, Piroddi C, Steenbeek J, Kaschner K, et al. (2010) The Biodiversity of the Mediterranean Sea: Estimates, Patterns, and Threats. PLoS ONE 5(8): e11842. doi:10.1371/journal.pone.0011842



Spread – Natural Dispersal

- In 2005, winds and rain associated with Hurricane Wilma rapidly spread *Xanthomonas citri* subsp. *citri* destroying 170,000 acres of commercial citrus groves.
- Apart from fruit drop and physical damage, the movement of the bacterium breached the pre-existing 579 metre (1900 feet) quarantine zone for Citrus Canker management (Gottwald *et al.* 2001). After Wilma, eradication was not feasible.
- Severe weather events had not previously been accounted for in containment strategies (Irey *et al.* 2006; Gottwald & Irey 2007).



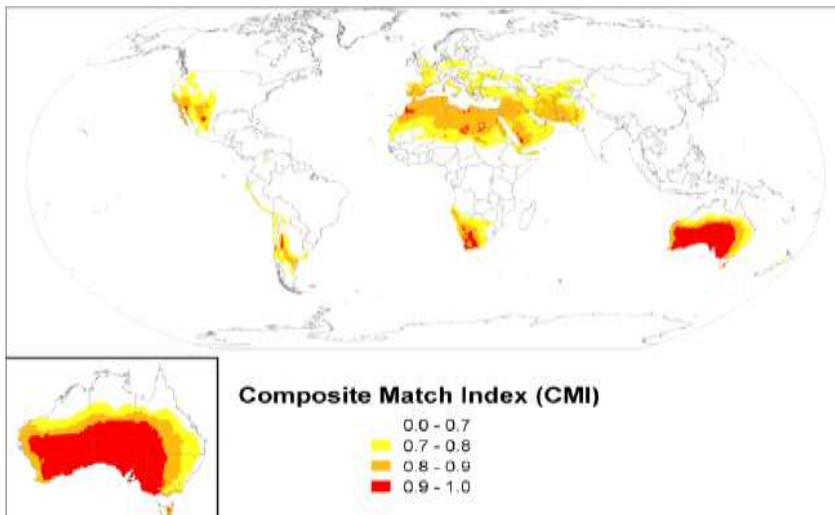
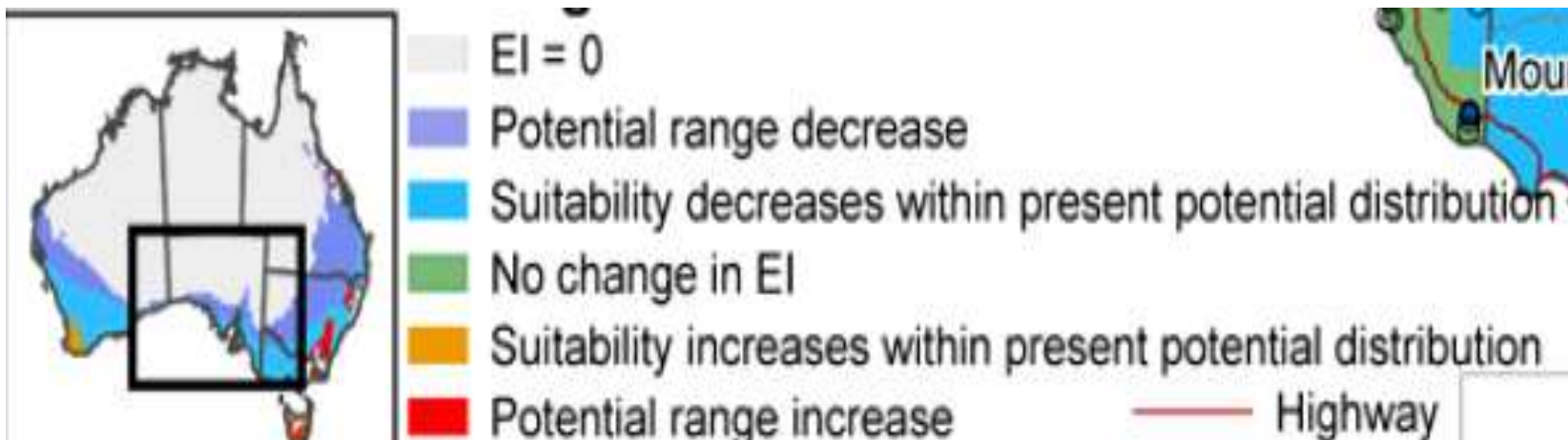


Figure 5.3-1 World showing the climatic similarity between South Australia's future climate as projected for 2080 using the CSIRO3 global climate model running the A1B greenhouse gas emissions scenario with the rest of the world using the same dataset.

Climate change and invasive plants in South Australia

Darren J. Kriticos, Neville D. Crossman, Noboru Ota and John K. Scott (2010).

Eco-climatic Index for Bridal creeper range change





Consequence - Spread of blue tongue



Bluetongue Disease, which started in Africa, has spread in the last decade to Europe and killed more than 1.5 million sheep there.

Bluetongue is transmitted by a tiny biting midge, *Culicoides immitus*, similar to the way that malaria is spread by mosquitoes.

Sheep with swollen, bright blue tongues: it is a surreal sight only recently spotted in Germany.

Climate change is not only speeding up the rates of reproduction, development, survival and biting of blood-feeding pests, but is also shortening the parasite development time inside these disease-transmitters, and increasing the range of the midge.

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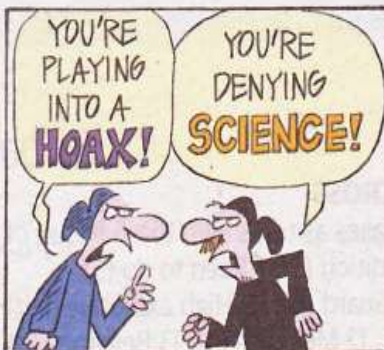
- There remains an increasing need to have better data/science on how species respond to climate change eg phenology with introduced species flowering earlier than natives, fish spawning in areas outside their normal range
- The likely pervasiveness and complexity of vegetation/animal disequilibrium under climate change is a major challenge for forecasting ecological dynamics and also constitutes a major challenge for future nature conservation.
- Alien species may be successful invaders because they are more phenologically flexible than native species and track climate change more closely. Either phenotypic plasticity or genetically based local adaptation may contribute to phenological flexibility.
- Integrative approaches that combine elements of the above with climate change and biosecurity analysis may be an area for consideration for hazard identification and mitigation of current and future biosecurity threats.



An apolitical view of the weather

WIZARD OF ID

by parker and hart





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Thank you

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