

Bob Sutherst

Title: Synoptic modelling of biological responses to climate change

Researchers: Robert Sutherst

Research summary: Climate change endangers endemic species with narrow climatic needs and helps pests with wide tolerances. The twin risk assessment tools - CLIMEX and DYMEX – define these risks on geographical and field scales. They are rated as world leaders and underpin Biosecurity programs in many countries. I am currently focused on improving the Biodiversity community's risk assessment methods for beneficial species.

CLIMEX provides rapid and rigorous assessments of the role of climate in the biogeography of species. In so doing it defines the global climatic context within which species operate. It is unique in biosecurity and biodiversity sectors in that it captures species' responses to climate and explains how they respond in different regions. All other approaches match seasonal climatic patterns with the geographical distribution of the species, which makes quarantine and climate change risk assessments unreliable. Species often prosper in quite different climates to those that they emanate from. A good example is temperate species introduced into high altitude tropical regions. DYMEX is a modular modelling program that allows users to assemble population models from a library of functions. In so doing it brings modelling into the reach of many more students, biologists and resource managers. I aim to enhance these tools and support their use in the biodiversity and biosecurity sectors, with emphasis on risk assessments under climate change.

Grants: Honorary with collaboration with various partners

Key publications:

1. Sutherst, Bob, Szabo, Judit & Cleland, Evan (2007) Research and management needs. The State of Australia's Birds 2007. Birds in a Changing Climate. Supplement to *Wingspan* 17 (4) 21-22.
2. Sutherst, R. W., Maywald, G.F. and Bourne, A.S. (2006). Including species-interactions in risk assessments for global change. *Global Change Biology* in press.
3. Sutherst, Robert W & Gunter Maywald. (2005). A climate-model of the red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae): implications for invasion of new regions, particularly Oceania. *Environmental Entomology* 34:317-335.
4. Sutherst, R.W. (2004). Global change and human vulnerability to vector-borne diseases. *Clinical Microbiology Reviews* 17:136-173.
5. White, N., Sutherst, R. W., Hall, N. and Whish-Wilson, P. (2003). The vulnerability of the Australian beef industry to impacts of the cattle tick (*Boophilus microplus*) under climate change. *Climatic Change*, 61:157-190.
6. Sutherst, R. W. (2003). Prediction of species geographical ranges. A critical comment on M. J. Samways, R. Osborn, H. Hastings & V. Hattings (1999) Global climate change and accuracy of prediction of species geographical ranges:

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establishment success of introduced ladybirds (Coccinellidae, *Chilocorus* spp.) worldwide. *Journal of Biogeography*, 26, 795–812. *Journal of Biogeography*, 30:805–816.

7. Kriticos, D.J., Sutherst, R.W., Brown, J.R., Adkins S.W. & Maywald G.F. (2003) Climate change and the potential distribution of an invasive alien plant: *Acacia nilotica* ssp. *indica* in Australia. *J. Applied Ecology* **40**:111-124.
8. Sutherst, R.W. (2001). The vulnerability of animal and human health to parasites under global change. *International Journal for Parasitology* **31**:933-948.

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(ii) list of publications, research grants and conference presentations/other invited talks (over the past five years)

1. 1. Sutherst, Bob, Szabo, Judit & Cleland, Evan 2007 Research and management needs. The State of Australia's Birds 2007. Birds in a Changing Climate. Supplement to Wingspan 17 (4) 21-22.
2. 2. Senaratne, K. A. D. W., Palmer, W. A. & Sutherst, R. W. (in press). Case Study: Use of CLIMEX modelling to identify prospective areas for exploration to find new biological control agents for prickly acacia. *J. Aust Ent Soc*
3. 3. Sutherst, R.W., Baker, R., Coakley, S.M., Harrington, R., Kriticos, D., Scherm, H. (2007). Pests under global change – meeting your future landlords? In Canadell JG, Pataki D, Pitelka L (editors) (2007) *Terrestrial Ecosystems in a Changing World*. The IGBP Series, Springer-Verlag, Berlin Heidelberg, p. 336
4. Sutherst, R. W., Maywald, G.F. and Bourne, A.S. (2006). Including species-interactions in risk assessments for global change. *Global Change Biology* 13: 1843–1859.
5. Sutherst, R.W., Bourne, A.S., Maywald, G.F. & Seifert, G.W. (2006) Prevalence, severity and heritability of *Stephanofilaria* lesions on cattle in central and southern Queensland. *Australian Agricultural Research* **57**: 743–750.
6. Sutherst, R.W. & Bourne, A.S. (2006). The effect of desiccation and low temperature on the viability of eggs and emerging larvae of the tick, *Rhipicephalus (Boophilus) microplus* (Canestrini) (Ixodidae). *International Journal for Parasitology* 36:193–200.
7. Richard C. Russell, Craig R. Williams, Robert W. Sutherst and Scott A. Ritchie. (2005). *Aedes (Stegomyia) albopictus* – a dengue threat for southern Australia? *Communicable Diseases Intelligence (Commun Dis Intell)* **29**:296-298.
<http://www.health.gov.au/internet/wcms/publishing.nsf/Content/cda-cdi2903j.htm>
8. Sutherst, Robert W & Gunter Maywald. (2005). A climate-model of the red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae): implications for invasion of new regions, particularly Oceania. *Environmental Entomology* 34:317-335.
9. Goolsby, John A., De Barro, Paul J., Kirk, Alan A., Sutherst, Robert, Canas, Luis, Ciomperlik, Matthew, Ellsworth, Peter, Gould, Juli, Hartley, Diana, Hoelmer, Kim A., Naranjo, Steven J., Rose, Mike, Roltsch, Bill, Raul Ruiz, Pickett, Charlies and Vacek, Don (2005). Post-release evaluation of the biological control of *Bemisia*

- tabaci* biotype “B” in the USA and the development of predictive tools to guide introductions for other countries. *Biological Control*. **32**:70–77.
10. Sutherst, R.W. & Rowland, P. (2004). Pest management 2002 – beyond Silent Spring. Pp145-170, In Rickert, K. (Ed) Emerging Challenges for Farming Systems. RIRDC, Canberra.
 11. Yonow, T., Zalucki, M.P., Sutherst, R.W., Dominiak, B.C., Maywald, G.F., Maelzer, D.A., Kriticos, D.J. (2004). Modelling the population dynamics of the Queensland fruit fly, *Bactrocera (Dacus) tryoni*: a cohort-based approach incorporating the effects of weather. *Ecological Modelling*. **173**: 9-30.
 12. Sutherst, R.W. (2004). Global change and human vulnerability to vector-borne diseases. *Clinical Microbiology Reviews* **17**:136-173.
 13. White, N., Sutherst, R. W., Hall, N. and Whish-Wilson, P. (2003). The vulnerability of the Australian beef industry to impacts of the cattle tick (*Boophilus microplus*) under climate change. *Climatic Change*, **61**:157-190.
 14. Kriticos, D.J., R.W. Sutherst, J.R. Brown, S.W. Adkins and G.F. Maywald (2003). Climate change and biotic invasions: a case history of a tropical woody vine. *Biological Invasions* **5**:145–165.
 15. Sutherst, R. W. (2003). Prediction of species geographical ranges. A critical comment on M. J. Samways, R. Osborn, H. Hastings & V. Hattinng (1999) Global climate change and accuracy of prediction of species geographical ranges: establishment success of introduced ladybirds (Coccinellidae, *Chilocorus* spp.) worldwide. *Journal of Biogeography*, **26**, 795–812. *Journal of Biogeography*, **30**:805–816.
 16. Kriticos, D.J., Sutherst, R.W., Brown, J.R., Adkins S.W. & Maywald G.F. (2003) Climate change and the potential distribution of an invasive alien plant: *Acacia nilotica* ssp. *indica* in Australia. *J. Applied Ecology* **40**:111-124.
 17. Kriticos, D.J., Brown, J.R., Maywald, G. F., Radford, I. D., Nicholas, M., Sutherst, R. W. & Adkins, S. W. (2003). SPAnDX: a process-based population dynamics model to explore management and climate change impacts on an invasive alien plant, *Acacia nilotica*. *Ecological Modeling*. **163**:187-208.
 18. Vera, M. T., Rodriguez, R., Segura, D. F., Cladera, J. L. & Sutherst, R. W. (2002). Potential geographical distribution of the Mediterranean fruit fly, *Ceratitis capitata* (Diptera: Tephritidae), with emphasis on Argentina and Australia. *Environ. Entomol.* **31**:1009-1022.

Conferences etc

FAO Expert Panel: Climate-Related Transboundary Pests And Diseases Including Relevant Aquatic Species. March 2008