WARWICK
THE UNIVERSITY OF WARWICK

Academic Promotion Application Form

This should be completed by the member of staff who is applying for promotion with comments from the Head of Department, and **submitted with an up-to-date CV** to the Academic Processes Team in Human Resources.

Prior to completion of this document, please read the document providing details on criteria and evidence and the standards matrix.

Name of Employee	Matt Keeling	Department	Mathematics & Biological Sciences
Current Appointment	Reader	Level of Promotion applying for?	Professor
FTE	100%	Career track (R&T-focused, R-focused)	R & T
Previous Appointments Held at Warwick (please indicate if any of these appointments were part time)	Lecturer, joint between the Mathematics Institute and the Department of Biological Sciences, 2002-05 Reader, joint between the Mathematics Institute and the Department of Biological Sciences, 2005-		
Please detail any significant periods of leave (e.g parental, sickness)	None		

Please summarise achievements in the following areas of activity.

Research and Scholarship
Minimum threshold requirement for the level of promotion for which you are applying:
Score which you believe your experience demonstrates: Band 8
Please submit a written summary of your achievements below, using a maximum of 600 words **Research Outputs** In the past 3 years, since my application for a Readership, I have been awarded 10 grants (with a total income to Warwick of around £1 million) and have had 17 papers published – many in leading journals, including 2 in Nature. In this period I have also successfully co-authored a research-level textbook of over 400 pages ("Modelling Infectious Diseases"), which is now with Princeton University Press and should appear in October 2007. My research group will comprise 2 research fellows (funded by EPSRC and NSERC), 6 PDRAs, 1 jointly supervised PDRA and 2 PhD students. As such this is one of the largest groups within either Mathematics or Biology and reflects my recent success with a variety of grant applications. The next few years will hopefully see me consolidate this group, and should see a sharp rise in publications as the research progresses. **International Recognisation**

I feel that my research is now recognised both nationally and internationally. I am a frequent reviewer for the major journals in my subject area, including Science, Nature, Proc. Nat. Acad. Sci., Proc. Roy. Soc. Lond., and many other more specialist journals. I am also regularly asked to review grants for UK research councils and other funding agencies both within and outside the UK. I am one of four senior editors for Theoretical Population Biology (impact factor 2.5), and one of seventy associate editors for The American Naturalist (impact factor 4.5). In the past two years I have been delighted to become a member of the Wellcome Trust Basic Immunology and Infection panel (which determines the funding status of grants worth around £20-30 million per year) and the Scientific Advisory Board for the Wellcome Trust Conference Centre (which helps to direct and plan future events at Hinxton). Late in 2004 I was award a Philip Leverhulme Prize in Mathematics, one of only six in the UK. Finally, during
2004-2005 I was one of ten UK researchers asked to compile a science summary of state-of-the-art techniques in "The Detection and Identification of Infectious Diseases" for the Home-Office Foresight project: see http://www.foresight.gov.uk/Detection_and_Identification_of_Infectious_Diseases/Index.htm Over the past 3 years I have also received requests to apply for professorial positions at several UK Universities. I believe that these awards and requests for participation are strong indicators of my current standing in the fields of epidemiology and mathematical modelling.

I have been invited to several major international conferences and workshops in the past three years; however, following the birth of my daughter in 2004 I decided to take a break from such international events. This break has had the unforeseen advantage that it has given many in my research group the chance to present their findings at some high-profile workshops and conferences. I plan to start attending shorter conferences next year and am likely to attend 2-3 international conferences in the next year. During this period, I have however participated in several events in the UK, including giving talks at UK universities.

Learning and Teaching

Minimum threshold requirement for the level of promotion for which you are applying:

Score which you believe your experience demonstrates: Band 4

Please submit a written summary of your achievements below, using a maximum of 600 words

Since coming to Warwick in 2002, I have consistently given 30 lectures in Mathematics (to fourth-year students) and 17 lectures in Biology (15 to third-years and a further 2 to first-years). This is far in excess of what was expected of me, given that I was funded by a Royal Society URF. However, I generally enjoy teaching and was happy to undertake these lectures.
My general philosophy with lectures is to provide the students with a solid workable understanding of the subject area, in addition to the ability to answer exam questions. I also feel that the students get far more out of lectures if they are able to simply listen rather than having to copy copious amounts of information. For this reason I produce comprehensive lecture notes for each course, which cover all the necessary material, but which can be enhanced by the examples and explanations given in the lectures.

The first-year biology lectures are aimed at providing background and motivation for the "Agents of Infectious Disease" course. As such I talk about my research on Bubonic Plague and Foot-and-Mouth disease – although obviously tailored to an undergraduate audience. I generally find that the students readily understand these topics and the lectures are well received, reflected by high student feedback scores. Next year, to keep the information contemporary I am considering preparing a lecture on H5N1 (avian influenza), its spread and control.
In general the summary from the students was positive. They found the course interesting, stimulating and well-prepared. The areas which several students complained about were the clarity of my hand-writing and the examples on overheads. I hope to over-come the problem of my hand-writing my having more of the long (but repetitive) on overheads. The examples are more of a problem as many come from scientific journals, however I will attempt to read the axis-labels and legends clearly to the students.

The lecture course I give in mathematics ("Population Dynamics: Ecology and Epidemiology") is a real pleasure to teach. I generally have about 30-40 students attending, which is a relatively large number for a course at this level; there is usually a core of around 5-10 students who really take to this subject area and often consider a PhD in this field.
Students generally found the course to be of a similar standard to others, and the majority of students thought that "the purpose and direction of the lectures were clear" and "would like to take the subject further". The vast majority of students graded the lectures as being interesting and well-organised (rating 4 or 5 out of 5). Some students complained that the material covered in class was not identical to the lecture notes – I will endeavour in future to make it clear that the lecture notes provide the minimum necessary information. Few students commented on the example sheets. I hope to incorporate these as part of the printed lecture notes, and give out sample answers at the end of each section.
The lecture notes for "Population Dynamics: Ecology and Epidemiology", and the experience gained lecturing the course, have been very useful in the development of a research-level textbook I have recently co-authored. In conjunction with the textbook we have written a number of sample example programs, I hope to make use of these to enhance all my lecture courses and provide the students with an opportunity to investigate the model behaviour for themselves.

Impact, Outreach and Engagement
Minimum threshold requirement for the level of promotion for which you are applying:
Score which you believe your experience demonstrates: Band 6
Please submit a written summary of your achievements below, using a maximum of 300 words

Impact and outreach form an integral part of my research commitments. This began in 2001 when I was one of two teams actively modelling the spread and control of foot-and-mouth disease in real time, and providing direct policy advice to MAFF/Defra. It was inspirational to see how model predictions and statistical analysis could feed into policy decisions, which were having a real and noticeable impact on the devastating outbreak. Since 2001, much more of my research efforts have been focused towards research that can have a direct impact of policy. These impact activities can be split into those involving animal pathogens and those involving human diseases.

Animal Diseases.
From 2001-2005 (when the group was disbanded) I was a member of the UK government's scientific advisory group on foot-and-mouth disease – following my role in the 2001 outbreak. In 2002, I undertook research on behalf of Defra to examine the potential of West Nile virus to invade and colonise the UK, due to concerns following its invasion of the USA in 1999. In 2003, I was a member of the UK government's scientific advisory group on avian influenza. Finally, from 2003, I have been part of Defra's modelling consortium, available to provide predictive modelling and advice in the event of any future outbreaks.

Human Diseases.
In 2002, based on work and collaborations with HPA, I was invited to speak at the G8 scientific advisory meeting on smallpox modelling. This considered state-of-the-art-predictions amid fears of bio-terrorist activity using smallpox as a bio-weapon. In 2004, I joined the Science Advisory Board of the CBRN panel for the UK Home Office, which provides policy advice in preparation for Chemical, Biological, Radiological or Nuclear emergencies. From 2004-2005, I provided detailed reports for the Home Office Foresight Review on "Detection and control of disease".

Collegiality, Leadership, Management

Minimum threshold requirement for the level of promotion for which you are applying:

Score which you believe your experience demonstrates: Band 4

Please submit a written summary of your achievements below, using a maximum of 300 words

I am an active and enthusiastic member of both departments (Biological Sciences and Mathematics). In particular, I have taken a substantial role since arriving in Warwick to help organise activities and shape the future for the Ecology and Epidemiology Group. This has involved organising internal and external seminars, acting as an informal mentor for PhD students and PDRAs, and planning future teaching and other departmental activities.
In addition, I undertake a number of activities for the departments. These include:
Member of the Biological Sciences Computer Committee
Member of the University Computer Committee
Member of the Biological Sciences Research Initiative Group (2006/07 only)
Member of PhD Committee for five PhD students.
Chair of PhD Committee for a further two PhD students.

Recommendation from Head of Department (this should include comments on each of the four areas of activity outlined above and a statement about whether or not the claimed score is agreed.)

Signed		Date	
Print Name			

To be signed by the member of staff applying for promotion

Signed		Date 1/1/07	
Print Name	Matt Keeling		

For applications to Professorial level only, please complete at least one of the boxes below.

Research

Please provide details of four publications you consider to be you major contributions since your last promotion (or since your appointment at Warwick), indicating the scholarly impact each of these has had within the field. (maximum 600 words)

1. Keeling, M.J., Woolhouse, M.E.J., May, R.M., Davies, G. and Grenfell, B.T. 2003 Modelling Vaccination Strategies against Foot and Mouth Disease. *Nature* **421** 136-142
[This paper extends the work done during the 2001 FMD outbreak, and discusses the potential role of vaccination in any future epidemic. It also considers the novel concept of utilising accurate models to target vaccination more efficiently. As such this paper is helping to shape UK and international policy relating to the control of foot-and-mouth disease; it illustrates how real-time modelling could be used to effectively direct vaccination targeting.]

2. Ferguson, N., Keeling, M.J., Edmunds, J., Gani, R., Grenfell, B., Anderson, R., Leach, S. (2003) Risk assessment and vaccination planning for smallpox outbreaks. *Nature* **425** 681-685

[This publication arose from a collaborative assessment of bio-terrorist use of smallpox (and other agents) with the Health Protection Agency to help inform UK and international policy. It brings together the existing evidence and parameter inference on smallpox to generate definitive statements about multiple aspects of smallpox epidemiology and how these impact its control.]

3. Tildesley, M.J., Savill, N.J., Shaw, D.J., Deardon, R., Brooks, S.P., Woolhouse, M.E.J., Grenfell, B.T. and Keeling, M.J. 2006 Optimal reactive vaccination strategies for a foot-and-mouth outbreak in the UK. Nature 440 83-86.

[This is the third in a series of high-profile pieces of modelling work following from the 2001 FMD epidemic, and the first I've led as PI. In this paper we consider ring-vaccination against FMD, in line with recent DEFRA and EU policy. We show that ring-vaccination can be very successful, but that other means of targeting vaccine stocks can bring far greater efficiency. This paper has helped reshape vaccination policy against foot-and-mouth disease]

4. Keeling, M.J. and Rohani, P. 2007 *Modelling Infectious Diseases*, Princeton University Press.

[This book represents a large investment of time and energy. It is a joint publication of over 400 pages and provides a comprehensive guide to the field of epidemiological modelling of infectious diseases. I believe that this book will (a) raise my international profile (b) provide a wealth of suitable teaching material for future courses.]

Teaching

Please provide details of achievements you consider to be your major contributions since your last promotion (or since your appointment at Warwick), indicating the impact each of these has had on students or the teaching and learning practices of your colleagues. It is important to state clearly what your contribution was in the case of collaborative efforts (maximum 600 words).

PERSONAL DETAILS

Full Name and Title: Matthew James Keeling (Dr)

Department: Mathematics and Biological Sciences

Title of current appointment: Reader

Education/Qualifications: First class Maths honours degree (Cambridge University, 1988-91)

Certificate of Advanced Study in Mathematics, Part III. (Cambridge University, 1991-92)

PhD "The Ecology and Evolution of Spatial Host-parasite systems" (Warwick, 1992-95)

Appointments held: Wellcome Trust Post-Doctoral Research Training Fellowship in Mathematical Biology. (Department of Zoology, Cambridge University, 1995-98)

Kings College Fellowship in the Spatial Extended Dynamics Group (Kings Research Centre, Cambridge University, 1998-2002)

Royal Society University Research Fellowship. (Initially held at Dept. of Zoology, Cambridge, transferred to University of Warwick, 1998-2006)

Lecturer, joint between the Mathematics Institute and the Department of Biological Sciences, University of Warwick, 2002-05

Reader, joint between the Mathematics Institute and the Department of Biological Sciences, University of Warwick, 2005-

Membership of learned or professional societies: None

TEACHING

Departmental Duties:

	Length of Course (Contact hours)	*Number of Students (approx)* ug	pg
Lecture Courses	MA4E7 Population Dynamics (30 hours, Maths)	20	10
	BS262 Epidemiology & Public Health (10 hours, Biological Sci)	180	
	Agents of Infectious Disease (2 hours, Biological Sciences)	100	
Tutorials/Seminars etc.			
Taught Masters Classes			
TOTAL			

Research Supervision:

Current Research (MPhil/PhD) Students *

Individual (unnamed)	Start Date	Qualification aimed for	Anticipated Completion Date	Individual/Joint Supervisor
Jim MacDonald	Jan 2003	PhD	Jan 2007	Individual
Ellen Brooks-Pollock	Oct 2004	PhD	Apr 2007	Individual

Number of successful research students since 2000: 1
Number of unsuccessful research students since 2000: 0

Other Teaching: None

RESEARCH *(optional for Teaching only promotion cases)*

Publications:

1. Webb, S.D., Keeling, M.J. and Boots, M. 2006 Spatially extended host-parasite interactions:

the role of recovery and immunity. *Theo. Pop. Biol.* **71** 251-266

[20%]

2. Savill, N., St. Rose, S., Keeling, M., Woolhouse, M. 2006 Silent spread of H5N1 in vaccinated poultry. *Nature* **442** 757-757

[20%]

[This paper shows how vaccination of a flock against Avian Influenza can actually lead to an increased risk of transmission. This is because vaccination is generally only partially successful, and spread in the remaining susceptible birds is consequently much slower and can readily escape detection.]

3. Read, J.M. and Keeling, M.J. 2006 Disease Evolution across a Range of Spatial Scales. *Theo. Pop. Biol.* **70** 201-213.

[50%]

4. Eames, K.T.D. and Keeling, M.J. 2006 Coexistence and specialisation of disease strains on contact networks. *Am. Nat.* **168** 230-241

[50%]

5. Keeling, M., Tildesley, M., Savill, N., Woolhouse, M., Shaw, D., Deardon, R., Brooks, S. and Grenfell, B. 2006 FMD control strategies. *Vet. Rec.* **158** 707-708.

[50%]

6. Hancock P.A., Milner-Gulland E.J., Keeling M.J. 2006 Modelling the many-wrongs principle: The navigational advantages of aggregation in nomadic foragers. *J. Theo. Biol.* **240** 302-310.

[10%]

7. Savill, N.J., Shaw, D.S., Deardon, R., Tildesley, M.J., Keeling, M.J., Woolhouse, M.E.J., Brooks, S.P. and Grenfell, B.T. 2006 Topographic Determinants of Foot and Mouth Disease Transmission in the UK 2001 Epidemic. *BMC Vet. J*. **2:3**

[10%]

8. Tildesley, M.J., Savill, N.J., Shaw, D.J., Deardon, R., Brooks, S.P., Woolhouse, M.E.J., Grenfell, B.T. and Keeling, M.J. 2006 Optimal reactive vaccination strategies for a foot-and-mouth outbreak in the UK. *Nature* **440** 83-86.

[50%]

[This is the third high-profile piece of modelling work following from the 2001 FMD epidemic. In this paper we consider ring-vaccination against FMD, in line with recent DEFRA and EU policy. We show that ring-vaccination can be very successful, but that other means of targeting vaccine stocks can bring far greater efficiency.]

9. Wearing, H.J., Rohani, P., Keeling, M.J. 2005 Appropriate models for the management of infectious diseases. *PLOS Medicine* **2** 621-627.

[30%]

10. Keeling, M.J. and Eames, K.T.D. 2005 Networks and Epidemic Models *Interface* **2** 295-307.

[50%]

11. Keeling, M.J. 2005 Models of Foot-and-Mouth Disease. *Proc. Roy. Soc. Lond. B* **272** 1195-1202.

[100%]

12. Keeling, M.J. 2005 The Implications of Network Structure for Disease Dynamics *Theor. Pop. Biol.* **67** 1-8.

[100%]

13. Hancock, P.A., Milner-Gulland, E.J., Keeling, M.J. 2005 An individual based model of bearded pig abundance. *Ecological Modelling*. **181** 123-137.

[25%]

14. Rohani, P., Miramontes, O. and Keeling, M.J. 2004 The colour of noise in short ecological time series data *Math Med and Biol* **21** 63-72.

[25%]

15. Eames, K.T.D. and Keeling, M.J. 2004 Monogamous Networks and the Spread of Sexually Transmitted Diseases. *Math. BioSci.* **189** 115-130

[50%]

16. Keeling, M.J., Gilligan, C.A. and Brooks, S.P. 2004 Using Conservation of Pattern to Approximate Spatial Parameters from a Single Snapshot. *P.N.A.S.* **101** 9155-9160.

[60%]

17. Eames, K.T.D. and Keeling, M.J. 2003 Contact Tracing and Disease Control. *Proc. Roy. Soc. Lond. B,* **270** 2565-2571.

[50%]

18. Ferguson, N., Keeling, M.J., Edmunds, J., Gani, R., Grenfell, B., Anderson, R., Leach, S. (2003) Risk assessment and vaccination planning for smallpox outbreaks. *Nature* **425** 681-685

[20%]

19. Matthews, L., Haydon, D.T., Shaw, D.J., Chase-Topping, M., Keeling, M.J. and Woolhouse, M.E.J. 2003 Neighbourhood control policies and the spread of infectious diseases. *Proc. Roy. Soc. Lond. B* **270** 1659-1666

[10%]

20. Keeling, M.J., Jiggins, F.M. and Read, J.M. 2003 The invasion and coexistence of competing *Wolbachia* strains. *Heredity* **91** 382-388

[50%]

21. Keeling, M.J., Woolhouse, M.E.J., May, R.M., Davies, G. and Grenfell, B.T. 2003 Modelling Vaccination Strategies against Foot and Mouth Disease. *Nature* **421** 136-142

[75%]

[This paper extends the work done during the 2001 FMD outbreak, and discusses the potential role of vaccination in any future epidemic. It also considers the novel concept of utilising accurate models to target vaccination more efficiently.]

22. Read, J.M. and Keeling, M.J. 2003 Disease evolution on networks: the role of contact structure. *Proc. Roy. Soc. Lond. B* **270** 699-708.

[50%]

23. Eames, K.T.D. and Keeling M.J. 2002 Modelling Dynamic and Network Heterogeneities in the Spread of Sexually Transmitted Disease. *P.N.A.S.* **99** 13330-13335.

[50%]

24. Keeling, M.J. and Grenfell, B.T. 2002 Understanding the Persistence of Measles: Reconciling Theory, Simulation and Observation. *Proc. Roy. Soc. B.* **269** 335-343

[70%]

25. Keeling, M.J. 2002 Using Individual-Based Simulations to Test the Levins Metapopulation Paradigm. *J. An. Ecol.* **71** 270-279

[100%]

26. Rohani, P., Keeling, M.J. and Grenfell, B.T. 2002 The Interplay Between Determinism and Stochasticity in Childhood Diseases. *Am. Nat.* **159** 469-481

[40%]

27. Keeling, M.J. and Rohani, P. 2002 Estimating Spatial Coupling in Epidemiological Systems: A Mechanistic Approach. *Ecological Letters* **5** 20-29.

[60%]

28. Keeling, M.J., Wilson, H.B. and Pacala, S.W. 2002 Deterministic limits to stochastic, spatial models of natural enemies. *Am. Nat.* **159** 57-80

[70%]

29. Keeling, M.J., Woolhouse, M.E.J., Shaw, D.J., Matthews, L., Chase-Topping, M., Haydon, D.T., Cornell, S.J., Kappey, J., Wilsmith, J. and Grenfell, B.T. 2001 Dynamics of the 2001

UK Foot and Mouth Epidemic: Stochastic Dispersal in a Heterogeneous Landscape *Science* **294** 813-817

[50%]

[Results of a very long and detailed modelling study of the 2001 outbreak of foot-and-mouth. This paper shows the accuracy of the model used and explores the effects of other control policies. As such it is the science that helped to define the government policy during the outbreak.]

30. Woolhouse, M., Chase-Topping, M., Haydon, D., Friar, J., Matthews, L., Hughes, G., Shaw, D., Wilesmith, J., Donaldson, A., Cornell, S., Keeling, M. And Grenfell, B. 2001 Foot-and-mouth disease under control in the UK. *Nature* **414** 258

[5%]

31. Keeling, M.J., Rohani, P. and Grenfell, B.T. 2001 Seasonally-forced Disease Dynamics Explored as Switching Between Attractors. *Physica D* **148**, 317-335

[50%]

32. Keeling, M.J., Wilson, H.B. and Pacala, S.W. 2000 Re-interpreting space, time-lags and functional responses in ecological models. *Science* **290**, 1758-1761

[50%]

[A rather theoretical paper which unifies some very basic concepts in population dynamics, showing that at a fundamental level it is difficult to distinguish between spatial effects, time-lags and functional responses.]

33. Keeling, M.J. and Gilligan, C.A. 2000 Metapopulation Dynamics of Bubonic Plague. *Nature* **407**, 903-906

[70%]

[A high profile paper which considers the historical dynamics of bubonic plague from a modelling perspective. It shows that the irregular outbreaks of bubonic plague in humans could be attributable to internal dynamics rather than new imports of infection. The paper also highlights the danger of killing rodents during an epidemic without controlling the fleas.]

34. Keeling, M.J. and Gilligan, C.A. 2000 Bubonic Plague: An Epizootic Model. *Proc. Roy. Soc. Lond. B* **267**, 2219-2230

[75%]

35. Keeling, M.J. 2000 Metapopulation moments: coupling, stochasticity and persistence. *J. Animal. Ecol.* **69**, 725-736

[100%]

36. Keeling, M.J. 2000 Simple Stochastic Models and their Power-law Type behaviour. *Theo. Pop. Biol.* **58**, 21-31

[100%]

37. Keeling, M.J. 2000 Multiplicative Moments and Measures of Persistence in Ecology. *J. Theor. Biol.* **205**, 269-281

[100%]

38. Keeling, M.J. and Grenfell, B.T. 2000 What is R_0? : individual-based perspectives on the transmission dynamics of infection. *J. Theo. Biol.* **203** 51-61

[80%]

39. Keeling, M.J. 2000 Evolutionary Trade-Offs at Two Time Scales: Competition v Persistence. *Proc. Roy. Soc. Lond. B* **267**, 385-391

[100%]

40. Keeling, M.J. and Grenfell, B.T. 1999 Stochastic Dynamics and a Power Law for Measles Variability. *Phil. Trans. Roy. Soc. Lond. B* **354**, 769-776

[80%]

41. Keeling, M.J. 1999 Correlation Equations for Endemic Diseases: Externally Imposed and

Internally Generated Heterogeneity. *Proc. Roy. Soc. Lond. B* **266**, 953-961

[100%]

42. Keeling, M.J. 1999 The Effects of Local Spatial Structure on Epidemiological Invasions. *Proc. Roy. Soc. Lond. B* **266**, 859-869

[100%]

[Based on work begun in my thesis, this paper sets out the ground-work for exploring the dynamics of diseases on networks by using the pair-wise approximation techniques.]

43. Price, A.R.G., Keeling, M.J., and O'Callaghan, C.J. 1999 Ocean-scale patterns of 'biodiversity' and community structure: Analysis of data for Atlantic *Asteroids*. *Biol. J. Linnean Soc.* **66**, 187-203

[40%]

44. Keeling, M.J., Milner-Gulland, E.J. and Clayton, L. 1999 Spatial dynamics of two harvested wild pig populations. *Natural Resource Modelling* **12**, 147-169

[30%]

45. Finkenstädt, B., Keeling, M.J. and Grenfell, B. 1998 Patterns of density dependence in measles dynamics. *Proc. Roy. Soc. Lond. B* **265**, 753-762

[20%]

46. Keeling, M.J. and Grenfell, B.T. 1998 Impact of Variability in Infection Period on the Persistence and Spatial Spread of Infectious Diseases. *Math. BioSci.* **147**, 207-226.

[70%]

47. Clayton,L., Keeling, M.J. and Milner-Gulland, E.J. 1997 Bringing home the bacon: A spatial model of wild pig harvesting in Sulawesi, Indonesia. *Ecological Applications* **7**, 642-652.

[10%]

48. Keeling, M.J. 1997 Modelling the Persistence of Measles. *Trends in MicroBiology* **5**, 513-518.

[100%]

49. Keeling, M.J., Rand, D.A. and Morris, A.J. 1997 Correlation Models for Childhood Diseases. *Proc. Roy. Soc. Lond. B* **264**, 1149-1156

[60%]

50. Keeling, M.J., Mezic, I., Hendry, R.J., McGlade, J. and Rand, D.A. 1997 Characteristic Length Scales of Spatial Models in Ecology via Fluctuation Analysis. *Phil. Trans. R. Soc. Lond. B* **352**, 1589-1601.

[30%]

51. Keeling, M.J. and Grenfell, B.T. 1997 Disease Extinction and Community Size: Modeling the Persistence of Measles. *Science* **275**, 65-67.

[60%]

[This paper answers a long-running debate about the persistence of measles in intermediate population sizes. It shows the importance of detailed understanding of the biology of infection.]

52. Keeling, M.J. and Rand, D.A. 1995 A spatial mechanism for the evolution and maintenance of sexual reproduction. *Oikos* **74**, 414-424.

[50%]

53. Rand, D.A., Keeling, M.J. and Wilson, H.B. 1995 Invasion, stability and evolution to criticality in spatially extended artificial host-pathogen ecologies. *Proc. R. Soc. Lond. B* **259**, 55-63.

[40%]

Books

1.Keeling, M.J. 1999 Spatial Models of Interacting Populations. In A*dvanced Ecological Theory. Principles and Applications* (ed. J. McGlade) Blackwell Scientific Publishing. pp 64-99

2.Keeling, M.J. 2000 Evolutionary Dynamics in Spatial Host-Pathogen Systems. In *The Geometry of Ecological Interactions: Simplifying Spatial Complexity* (ed. U. Dieckmann, R. Law, and J.A.J. Metz) C.U.P. Cambridge. pp 271-291

3.Wilson, H.B and Keeling, M.J. 2000 Stochastic models and low-dimensional, deterministic dynamics in spatially extended systems. In *The Geometry of Ecological Interactions: Simplifying Spatial Complexity* (ed. U. Dieckmann, R. Law, and J.A.J. Metz) C.U.P. Cambridge. pp 209-226

4.Keeling, M.J. and Rand, D.A. 2001 Space and Fluctuations in the Dynamics of Infection. In *From Finite to Infinite Dimensional Dynamical Systems* (ed. P. Glendinning and J. Robinson) Kluwer, Amsterdam.

5.Keeling, M.J. 2004 Extension to Mass Action Mixing. In *Paradigms Lost* (ed. Kim Cuddington & Bea Beisner) Academic Press.

6.Keeling, M.J., Bjørnstad, O.N. and Grenfell, B.T. 2004 Metapopulation Dynamics of Infectious Diseases. In *Metapopulation Dynamics* (ed Ilkka Hanski) Elsevier Press.

7.Hancock, P.A., Milner-Gulland, E.J. and Keeling, M.J. 2004 The effects of spatio-temporal habitat change on bearded pigs in Borneo. Emerging Threats to Tropical Forests (eds. William Lawrence & Carlos Peres), University of Chicago Press.

8.Keeling, M.J. and Rohani, P. 2007 *Modelling Infectious Diseases*, Princeton University Press.

[Joint publication. 50% contribution to book]

[This book represents a large investment of time and energy. It is a joint publication of over 400 pages and provides a comprehensive guide to the field of epidemiological modelling of infectious diseases. I hope that this book will (a) help to raise my international profile (b) provide a wealth of suitable teaching material for future courses.]

Research Grants and Contracts:

No.	Date Awarded	Project Title/Details Duration of Award	Funding Body	Involvement PI?	Names of Other Holders	Total Awarded	Total to University if amount split
1	Oct 98	University Research Fellowship	Royal Society	PI	-	160k	
2	Oct 00	Evolution in spatial systems: long-term changes in disease behaviour	BBSRC	PI	-	£199k	
3	Oct 02	The Effects of Spatio-Temporal Habitat Change on Nomadic Species in Borneo	Leverhulme	Co-I	Milner-Gulland (Imperial)	£125k	£10k
4	Oct 02	Social Network Characteristics of a Highly Active HIV/STD Core Group (48 months)	NIDA	Co-I	Williams (Texas)	$2,069k	$81k
5	Oct 02	Quantitative analysis of the spatio-temporal dynamics and control of foot-and-mouth disease	Wellcome Trust	PI	Grenfell, Woolhouse, Brooks	£524k	£165k
6	May 03	Mathematical Risk Modelling (6 months)	CAMR	PI	-	£20k	-
7	Sept 03	Disease evolution: future trends and current patterns (48 months)	NIH	PI	Wellington (Warwick)	$848k	-
8	Oct 03	Application of HE computing to public health (36 months)	EPSRC	Co-I	Leach (HPA)	£131k	0
9	Mar 05	The effect of social networks on the evolution of parasites and pathogens (36 months)	Leverhulme	Co-I	Boots (Sheffield)	£102k	£51k
10	Jun 05	SARS MOD (36 months)	EU	Co-I	Edmunds (HPA)	€650k	€66k
11	Jun 05	INFTRANS (36 months)	EU	Co-I	Ferguson (Imperial)	€1,400k	€301k
12	Dec 05	Preliminary modelling of AI epidemiology and control in the UK (6months)	DEFRA	PI	Woolhouse (Edinburgh)	£80k	£40k
13	Feb 06	Hierarchical models for the spatio-temporal dynamics of infectious	NIH MIDAS	Co-I	Smith (Penn State)	$634k	$276k

		diseases (48 months)					
14	Feb 06	Co-ordinated State-of-the-Art Epidemic Modelling Toolbox for Mitigating Deliberate Releases of Biological Agents (36 months)	Home Offive / DTI	Co-I	Leach (HPA)	£600k	0
15	Apr 06	Spatio-temporal dynamics of livestock infections. (36 months)	Wellcome Trust	PI	Woolhouse (Edinburgh)	£300k	£157k

Number of postdocs:

ADMINISTRATION AND OTHER SERVICE

Administration and Contributions to the University and its development:

Member of the Biological Sciences Computer Committee

Member of the University Computer Committee

Member of the Biological Sciences Research Initiative Group (2006/07 only)

Member of PhD Committee for Kay Nolan, Kath O'Reilly, Seyi Soremekun, Megan Turner, Alice MorningStar (Biological Sciences).

Chair of PhD Committee for Kerry Woodbine & Charlotte Evans (Biological Sciences).

NATIONAL AND INTERNATIONAL RECOGNITION

Prizes

2000. Awarded a Merit Increment by the Royal Society.
2002. Awarded a Merit Increment by the Royal Society.
2004. Awarded a Merit Increment by the Royal Society.
2004. Philip Leverhulme Prize in Mathematics.

Memberships

2001-2005	UK government's scientific advisory group on foot-and-mouth.
2002.	G8 scientific advisory meeting on smallpox modelling.
2003.	UK government's scientific advisory group on avian influenza.
2003-	Modelling consortium, DEFRA
2003-	Major Editor, Theoretical Population Biology.
2004-	Editor, American Naturalist
2004-	Basic Infection and Immunity Panel, The Wellcome Trust.
2004-2007	Science Advisory Board, CBRN panel, Home Office
2004-2005	Home Office Foresight Review “Detection and control of disease”
2005-	Science Advisory Board, Wellcome Trust Conference Centre.
2005-2006	Organising committee for Royal Society, Frontiers of Science meeting.

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