



**Institute of Science
and the Environment**

ANNUAL REPORT ON RESEARCH-RELATED ACTIVITIES, 2007- 2008

Introduction

This report summarizes research-related activities within the institute over the period 1 September 2007 to 31 October 2008.

Staffing changes

The period under review has seen the retirement from academic staff of Dr Peter Alma. However, the Institute has benefited for the appointment of Prof. John Newbury (as Head of Institute), Dr Chris Brown as Senior Lecturer in Animal and Human Physiology, Alan Dixon as Senior Lecturer in Geography and Kate Hiles as Lecturer in Forensic Science; the former two appointees have strong backgrounds in research and between them have authored or co-authored around 160 peer-reviewed publications. John Newbury took over the Headship of the Institute from Dr John Fagg who maintains an active role within the Institute and across the University. The Institute was also able to welcome Dr Peter Carruthers on a three-year secondment from the Commission for rural communities; he is working as a Senior Fellow in the Centre for Rural Research. The current academic/research staff list in Appendix 1 includes members who have engaged in research and/or publishable scholarly activity in recent years.

General overview

A key feature of the last year (and the previous year) has been the increase in the number of research active staff members. These appointments strengthen and broaden existing research experience and potential in the Institute. Some of the appointees already have strong track records in research and knowledge transfer while others are currently establishing themselves and will be increasing their research output in the near future. The new appointments have already had a positive effect on some of our research indicators. For example, the number of primary publications has increased from 16 to 21 this year and the number of students studying for PhD degrees has also significantly increased. Other measures, such as research and consultancy income and conference presentations are at similar levels to last year.

Summary of Work of Research Centres

In summary, the year 2007/8 has been one of contrasts. On the one hand, a Senior Research Fellow (Dr. Peter Carruthers) was appointed on secondment from the Commission for Rural Communities (CRC) in April 2008, adding much-needed senior experience to the team. Cheryl Jones also rejoined the CRR team following her stint as Director of the Abberley and Malvern Hills Geopark, now being able to devote time to CRR-related activities. On the other hand, both full-time project-based Research Assistants left to take up employment elsewhere. Similarly, a quiet start to

the year was followed by a period of intense activity. CRR continued to deliver successfully client contract work and completed one major project in the form of *'Polytunnels and Rural Communities'*, completed a rapid overview of *'Hill Farming and Rural Communities'* and made a significant contribution to a project on *'Rural Identity and the Land'* run by the University of Wales, Aberystwyth. All three pieces of work were undertaken for the Commission for Rural Communities (CRC), with whom a good working relationship was established. Indeed, the secondment (above) came about largely as a result of such work. Other projects undertaken, either as preliminary work to gain future contracts or carrying forward from the previous reporting period (for full details, see the CRR Annual Report 2007/8). CRR remains highly active as a University of Worcester research centre, continuing to raise the research profile of the institution in the academic and regional community. Rural Geography was identified as a specialist area of research within the Geography Unit of Assessment submission to the latest Research Assessment Exercise. Key staff continued their record of attending international, national and regional conferences to give research presentations. They also witnessed an increase in demand to act as referees for international journals / research councils and continued to publish research papers in high calibre international peer-reviewed journals. All this activity amounted to a busy year for CRR and its staff. As in previous years, this successful output was achieved with no adjustment in the teaching workloads of the main researchers.

Research publications

Research papers by Institute staff are listed in Appendix 2. This represents only papers published and those that have been formally accepted for publication (in press). Publishable output has increased significantly compared to last year largely as a result of new appointments. The notable increase in publications in biology, in particular, reflects the increased staffing in this area.

Conferences: Presentations and Attendance

Numerous staff members have attended conferences over the period under review although the number of papers presented and active participation was lower than last year. In some cases the value of participation was related to subject-specific information and concepts whilst in many others it lies directly in the enhancement of the teaching/learning process. Several staff attended the Learning and Teaching Conference held at the University of Worcester in June and it is clear that the benefits of such attendance will inform their teaching activities.

Income from Research and Consultancy

Research and consultancy income over the review period was approximately £25,000. Research income does not, however, include that derived by the Centre for Rural Research or the Ceramics Research Centre, which are associated with the Institute but which operate independently. Their research and consultancy income is detailed in their annual reports.

Research income was made up predominantly from funding and consultancy in the areas of Geography and Archaeology. It also includes funding to Dr Ian Maddock from the Worcestershire County Council and the Earth Heritage Trust for a county survey of the fluvial geomorphology of Worcestershire rivers, which came to an end in September 2007.

Dr Maddock also received funding as a consultant to CDM, Ireland on an ongoing project, on the 'Integrated Water Resource Management System for the Eastern River Basin District in Ireland' (£3453). Cheryl Jones was awarded a £9225 grant for by Natural England for a Geology and Arts feasibility study.

Dr David Storey was involved in two projects carried out as member of Centre for Rural Research. The first of these, *Land and identity*, is part of a wider project on Rural People and the Land, commissioned by the Commission for Rural Communities and sub-contracted by the University of Aberystwyth (£1,000). The second, *Social and Community Impacts of Changes in the Hill Farming Economy*, was commissioned by the Commission for Rural Communities and involved David Storey, Elizabeth Connolly, Katie Milburn and Nick Evans.

Dr Susanne Prankel was granted a contract and is project leader for developing an extended induction/bridging course for direct-entry students to University of Worcester Science courses by LLN Hereford & Worcester. Kate Hiles acted as an expert witness in the forensic science area on three occasions at Courts in Leeds and Bradford.

Postgraduate Research and Supervision

Anne Lentz (supervised by Rob Herbert), Miriam Daniels (supervised by John Newbury) and David Maund (supervised by David Storey) completed their PhD degrees during the review period. Two further students have submitted their theses and three more are in the process of writing up. One of these is expected to complete before the end of the year. A further five students are registered and there was only one withdrawal.

Postgraduate registrations and joint funding reflect the value of continuing links with Birmingham and Cardiff Universities. So far every student under these arrangements have been awarded their PhDs. Rob Herbert was awarded a further jointly funded PhD studentship with Cardiff University that commenced in September 2008. Appendix 4 lists current postgraduate research students and their status as of the end of October 2008.

Collaborative Research

Collaborative research of an intra- or interdisciplinary nature broadens the range of activities and experience of Institute staff and continues to provide benefits in terms of postgraduate student supervision and funding, access to facilities and research output. Collaborations involving postgraduate student supervision are covered elsewhere in this document. Apart from these, there are numerous examples of collaboration both between staff within the Institute and with other institutions and organisations.

Nick Evans continues his research collaboration with Dr. Linda Price (Queen's University, Belfast) and with Dr. Richard Yarwood (University of Plymouth). Ian Maddock is enjoying continuing collaboration (joint research and publications) on river habitat dynamics with Dr Smolar-Žvanut from the Institute for Water of the Republic of Slovenia, Ljubljana, Slovenia. Chris Brown continues to collaborate with former postgraduate student, Zanell Brand (Department of Animal Sciences, University of Stellenbosch and Klein Karoo Ostrich Experimental Farm, South Africa) and with Prof. Schalk Cloete (Institute for Animal Production, Elsenburg, South Africa) writing up for publication results from earlier collaborative research projects on aspects of ostrich biology.

Susanne Prankel is engaged in research into teaching practices in collaboration with members of the Institute of Education and has begun an initial collaboration with Motion Analysis and Research and Rehabilitation Centre. Outside the institution, she is working on joint papers with Dr C.J.C. Phillips, Director of the Centre for Animal Welfare (School of Animal Welfare & Ethics, University of Queensland, Australia). Susanne also sits on the Southwest Regional Board and the Steering Committee of VETNET LLN (a Lifelong Learning Network covering veterinary and allied courses).

David Storey is collaborating with colleagues at Aberystwyth University and the University of Cumbria on a project for the CRC on connections between people and land and, in collaboration with Dr. Adrian Barton (University of Plymouth) is exploring geographies of rural drug use. They are currently preparing a book chapter on the subject. In collaboration with Dr. Michael Holmes (Liverpool Hope University), David is also involved in a project examining the 'diasporic' composition of the Republic of Ireland football team and its intersections with issues of Irish identity. They are currently completing revisions to a paper to be published in *Sport in Society*. David is also a member of an AHRC-funded 'Sport, Heritage and History Research Network' (based at De Montfort University), which has involved participation in a series of seminars and, within the Institute, regularly collaborates with Dr. Nick Evans on a range of CRR projects.

John Newbury has strong collaborative links with Birmingham University (where he is an Honorary Professor) involving joint research projects and PhD student supervision. He works with Jerry Pritchard on the molecular biology and physiology of plant/insect interactions, on cation transporters in plants and on planning a series of events to celebrate Charles Darwin's bicentenary celebrations in 2009. There has also been a long-standing research relationship with Brian Ford-Lloyd most recently involving the production and exploitation of transcriptional profiling data to characterise local adaptation of plant genotypes.

External examination

Dr Maddock acted as external examiner for a PhD thesis submitted to the University of Canberra, Australia, in March 2007. Susanne Prankel was external examiner for Hartpur College and the University of the West of England. David Storey was external reviewer for the Research Fellowship Scheme, Mary Immaculate College, (University of Limerick, Ireland).

Other research-related activities and notable achievements

David Storey acted as referee for the *Journal of Rural Studies*, *Crime Prevention and Community Safety* and *Children's Geographies*. John Newbury acted as referee for the Biotechnology and Biological Research Council and for the journals *Plant*, *Cell and Environment*, *Plant Cell Reports* and the *Journal of Experimental Botany*. Susanne Prankel was awarded a Teaching Fellowship at the University of Worcester.

Research into Teaching

ISE staff routinely integrate their developing research expertise into their teaching activities. Only a few examples are mentioned here.

Derek McDougall is running a third year module on mountain glaciation in the Lake District this year; this exploits newly developed desk-based mapping to prepare students for their eventual actual field-based mapping work.

Ian Maddock and Fleur Visser use the 'County Survey of the Fluvial Geomorphology of Worcestershire Rivers' research project as a case study for a 'mock consultancy exercise' in their 2nd year River Processes module and Ian regularly uses research projects as case study material in his 3rd year River Conservation and Management module.

Lorraine Weaver uses information from her research into the Bryophytes of Worcestershire in her level 5 Botany module and also in her Field Techniques in Ecology module. Since these organisms form an important part of the National Vegetation Classification it is of great benefit to have an expert teaching basic identification skills for this group.

Susanne Prankel has been particularly active in researching educational processes (see publication list) and applies her findings throughout her teaching activities.

David Storey uses his book on aspects of citizenship for a theme in one of his geography modules that deals with global citizenship and another dealing with hybrid identities, for which he draws on his research into sport and identity. Some of his specific research activities into rural social change and development directly informs his teaching in a further geography module where students are taken on a field visit to Cleobury Mortimer. Expertise in this locality arises from a CRR research project on socio-economic change in the town and surrounding area and this greatly enhances the student learning experience. Sections of his GEOG3021 module are based closely on a book he published dealing with territoriality. Teaching on the ARCH2021 module initially led to research into aspects of rural place promotion; the results of the research have in turn fed back into teaching of the module in subsequent years.

Diana Dine's students investigate in a practical session the lead contaminated soils at Snailbeach Mine and lead uptake by grasses. Helen Loney's research into Iron Age and Roman Period Cumbria informs her archaeology module on Iron Age and Roman Britain), which was run for the first time September 2008. The Stage 1 preparation for an archaeological survey project in Aglionby, Cumbria, will include student experience placements.

Appendix 1
Academic/research staff in the Institute

Note: the list below includes only permanent academic staff.

Heather Barrett, BA PhD	Urban Geography and Conservation, PDP in Higher Education
Chris Brown, BSc, PhD	Animal physiology, ostrich biology
Alan Dixon, BSc PhD	Third World Development, Wetland Management, Sub-Saharan Africa
Diana Dine, BSc PhD	Soil and Water Pollution
Nick Evans, BSc PhD	Agricultural Geography
John Fagg, BA PhD	Economic Geography, Retention in Higher Education
Rob Herbert, HND BSc PhD	Plant Cell and Molecular Biology
Debbie Holmes, BSc DPhil	Plant Biology
Kate Hiles, BSc	Forensic Science
Ray James, BSc MSc	Microbiology
Cheryl Jones, BSc PhD	Unstable Landscapes, Geoconservation
Jodie Lewis, BA MA PhD	Prehistoric Britain, Landscape Archaeology
Helen Loney, BA MA PhD	British and European Archaeology, Ceramics
Derek McDougall, BSc PhD	Glacial and Quaternary Geomorphology, e-learning
Ian Maddock, BSc PhD	Hydroecology, River Conservation and Management
Denise Mortimore, BSc PhD	Human Nutrition
John Newbury, BSc, PhD	Molecular Genetics and Plant Biology
Susanne Prankel, MPhil PhD	Animal Welfare and Ethics, Veterinary Science
David Storey, BA MSc PhD	Rural and Political Geography
Laurence Trueman, BSc PhD	Plant Biology, Human Nutrition

Fleur Visser, MSc PhD Hydrology, Fluvial Geomorphology, GIS

Lorraine Weaver, BSc Plant and Animal Biology

Senior Fellow

Peter Carruthers, BSc PhD. Rural communities

Research Assistants

Katherine Milburn, BSc MSc Rural Geography

Elizabeth Connolly, BSc Human Geography, GIS

Associate Staff (WHEAS)

Malcolm Atkin, BA Archaeology of the Civil War

Victoria Bryant, BA MA Medieval Pottery

Hal Dalwood, BA Urban and Medieval Archaeology

Derek Hurst, MA Industrial Archaeology, Roman Pottery

Appendix 2

List of publications

Institute authors are indicated in bold.

Brown, C.R., Malecki, I.A., Brand, Z., and Cleote, S.W.P. (2008). Genetic relationships between water loss and shell deaths in ostrich eggs, assessed as traits of the female. *Australian Journal of Experimental Agriculture* 48:1326-1331.

Brown, C.R., Malecki, I.A., Brand, Z., & Cleote, S.W.P. (2007). Factors related to shell deaths during artificial incubation of ostrich eggs. *Journal of the South African Veterinary Association* 78:195-200.

Buch, A. and **Dixon, A.B.**, (2008) South Africa's Working for Water programme: searching for win-win outcomes for people and the Environment. *Sustainable Development*, 16, 6, 386-399.

Couldridge C.E., **Newbury H.J.**, Ford-Lloyd B.V., Bale J.S. and Pritchard J. (2007) Exploring plant responses to aphid feeding using a full *Arabidopsis* microarray reveals a small number of genes with significantly altered expression. *Bulletin of Entomological Research* 97, 523-532.

Dixon, A.B., and Wood, A.P. (2007). Local institutions for wetland management in Ethiopia: sustainability and state intervention. In: van Koppen, B., Giordano, M. and Butterworth, J. (Eds) *Community -based water law and water resources management reform in developing countries*. Comprehensive Assessment of Water Management in Agriculture Series 5. CABI International, Wallingford.

Dixon, A.B., Wood, A.P., Finlayson, M. and Halsema, G.E. (2008) Exploring agriculture-wetland interactions: a framework for analysis. In: Wood, A P and Halsema, GE (Eds) *Scoping agriculture-wetland interactions: Towards a sustainable multiple response strategy*. pp. 5-28 FAO, Rome.

- Dixon, A.B.**, (2008). Wetlands and indigenous knowledge in the highlands of western Ethiopia. In: Wiegandt, E (Ed). *Mountains: Sources of water, sources of knowledge*. pp197-210. Springer, Dordrecht.
- Evans, N.** and Yarwood, R. (2008). Farm animals and rural sustainability. In Robinson, G. (Ed.). *Sustainable Rural Systems: Sustainable agriculture and rural communities*. pp. 83-98. Ashgate, Aldershot.
- Evans, N.** (2008). Contextualising agricultural change: Agricultural change in the Welsh Marches. In Winchell, D., Ramsey, D. and Robinson, G. (Eds.) *The Global Rural*. Eastern Washington University Press, Spokane, USA.
- Gattolin S., **Newbury, H.J.**, Bale, J.S., Tseng H.-M., Barrett, D.A., Pritchard J. (2008) Analysis of amino acid composition reveals significant variability between the sieve tube contents in wheat (*Triticum aestivum* L.). *Plant Physiology*.147, 912-921.
- Jones, C.V.** (2008). History of Geoparks. Geological Society, London. Special Publication v. 300; pp 273-277.
- Kerton, M., **Newbury, H.J.**, Hand D. and Pritchard J. Accumulation of calcium in the centre of leaves of coriander (*Coriandrum sativum* L.) is due to an uncoupling of water and ion transport across the leaf. *Journal of Experimental Botany*, In press
- Kiambi, D.K., **Newbury H.J.**, Maxted N. and Ford-Lloyd B.V. (2008) Molecular genetic variation in the African wild rice *Oryza longistaminata* A. Chev. et Roehr. and its association with environmental variables. *African Journal of Biotechnology* 7, 1446-1460.
- Maddock, I.P.**, Smolar-Žvanut, N. & Hill, G. (2007). A comparison of the channel geomorphic unit (CGU) composition of regulated and unregulated reaches in the Soča River, Slovenia. *Revija Za Geografijo*. 1-2: 23-38.
- Price, L., **Evans, N.** (2008). From stress to distress: Conceptualizing the British family farming patriarchal way of life. *Journal of Rural Studies* 24: (In press).
- Razi, H, Howell E.C, **Newbury H.J.** and Kearsey M.J. (2008) Does sequence polymorphism of *FLC* paralogues underlie flowering time QTL in *Brassica oleracea*? *Theoretical and Applied Genetics* 116, 179-192.
- Storey, D.** (2007). Europe's shifting borders: rhetoric and reality, *Chimera* 22, 12-20.
- Storey, D.** (2008) Territory, space and society, In: Daniels, P., Bradshaw, M. Shaw, D. & Sidaway, J. (Eds). *An Introduction to Human Geography. Issues for the 21st Century* (3rd edition), pp. 399-416. Harlow: Prentice Hall.

Storey, D. Political Geography. In Kitchin, R. and Thrift, N. (Eds.). *International Encyclopedia of Human Geography*: Elsevier, Oxford. (In press)
Storey, D. Rural economic development. *In Kitchin, R. and Thrift, N. (Eds.). International Encyclopedia of Human Geography. Elsevier, Oxford. (In press)*

Tudoreanu, L., **Prankel, S.**, Enache, L., Akhmetova, B., Omarova, A., Kovacs, B., Gyori, Z. and Phillips, C.J.C. (2007). The EU Metal Project – Metals in the Environment, Toxicity and Assessment of Limits: Cadmium. In: Clarkson, P.A. (Ed.), *Environmental Research Advances*. pp184-196. Nova Science Publishers, New York. (Published without permission or consultation).

Other research-related publications

Book reviews

Storey, D.

Review of B.A. Brower and B.R. Johnston (Eds.). Disappearing Peoples? Indigenous Groups and Ethnic Minorities in South and Central Asia, *Journal of International Development* (in press).

Review of S. Gupta and T. Omoniyi (Eds.). Cultures of Economic Migration: *International Perspectives, Gender, Place and Culture* (in press).

Review of P. Getimis and G. Kafkalas (Eds.). Overcoming Fragmentation in Southeast Europe. Spatial Development Trends and Integration Potential, *Geography* 93 (2), 2008.

Review of C. Hartman and G.D. Squires (Eds.). There is no such thing as a Natural Disaster. Race, Class, and Hurricane Katrina, *Geography* 93 (2), 2008.

Review of A. Church and T. Coles (Eds.). Tourism, Power and Space, *Journal of Tourism and Cultural Change* 5 (3), 2007.

Review of N. Kabeer (Ed.). Inclusive Citizenship. Meanings and Expressions, *Progress in Development Studies* 7 (3), 2007.

Appendix 3

Conferences attended, conference participation and/or organisation

Brown, C.R. *Preliminary results on the effect of genotype on embryonic position in dead-in-shell ostrich eggs.* 4th International Ratite Science Symposium, June 2008, Brisbane) Not attended – paper presented by co-author.

Loney, H. *Briton in the Celtic World - Contrasting Perspectives:* May 17, 2008. Oxford. University.

Prankel, S., *Playing with Learning – unlocking the learning experience.* Conference of the Higher Education Academy, 5 June 2008.

Maddock, I.P., Smolar-Žvanut, N. & Hill, G. (2008) *The effect of flow regulation on the distribution and dynamics of channel geomorphic units (CGUs) and implications for marble trout (Salmo marmoratus) spawning habitat in the Soča River, Slovenia.* 24th Conference of the Danubian Countries on the Hydrological Forecasting and Hydrological Bases of Water Management, Bled, Slovenia, 2-4 June 2008.

McDougall, D. *Mountain Hazard Mapping Virtual Fieldwork.* Higher Education Academy Annual Conference, Harrogate, July 2008.

Storey, D. *Contemporary approaches to rural development: Lauding the local.* Space to Place: The Next Rural Economies workshop, University of Northern British Columbia, Prince George, Canada, May 2008. (Invited participant).

Storey, D. *Ireland's Call: Allegiances, Acrimony and Anthems.* Political Studies

Association Sport and Politics Study Group Annual Conference, Liverpool, February 2008. (Presented paper)

Storey, D. Sport, Heritage and History Research Network seminars, (held at De Montfort University, All England Lawn Tennis Club, Wimbledon and Liverpool FC. (Participated in a series of seminars).

Two PhD students, Natasha Spadafora and Anne Lentz contributed talks to the Plant Science Wales meeting in Aberystwyth in December 2007.

Conference attendance without presentation

Dine, D., Institute of Ecology and Environmental Management Conference 'Moving to an Ecological Economy', June 2008, London.

Dine, D. 7th Annual Learning and Teaching Conference 'Supporting Student Learning', University of Worcester, June 2008.

Fagg, J. University of Worcester Learning and Teaching Conference, June 2008.

Loney, H. Italian Archaeology Seminar Series: Cambridge University, 14 December 2007.

Loney, H. Italian Archaeology Seminar Series: UCL, 28 May.

McDougall, D. Quaternary Research Association Annual General Meeting, RSGS, Kensington Gore, London, January 2008.

Prankel, S. University of Worcester Learning and Teaching Conference, June 2008

Prankel, S. Away day for Learning and Teaching Co-ordinators and UW Teaching Fellows, July 2008..

Prankel, S. University of Hertfordshire CABLE Project event on Stimulating Divergent Thinking, 4 October 2008.

Prankel, S. Animal Welfare Science, Ethics and Law Veterinary Association (AWSELVA) conference, 29.October 2008.

Storey, D. Conference of Irish Geographers, Liverpool, May 2008.

Weaver, L. 7th Annual University of Worcester Learning and Teaching Conference. Presentation entitled 'Enhancing students' engagement and learning through embedding PDP in the curriculum, tutorial and assessment processes', June 2008).

Weaver, L. Institute of Ecology and Environmental Management summer conference – Moving to an Ecological Economy.

Appendix 4

Postgraduate students & postgraduate student supervision

Dine, D. (second supervisor)
Jeremy Cox - MPhil/PhD (Registered)

Evans, N.
Jayne Thatcher – withdrew September 2008.

Herbert, R. (Director of studies)
Natasha Spadafora - PhD. (Writing up).
Gemma Cook – PhD. (Registered September 2008)
Anne Lentz – PhD *Regulatory Mechanisms of the Plant G2/M Transition* (Completed 2008).

Lewis J.
Beck Williams PhD. (Registered 2008; second supervisor Helen Loney). *From Malvern to Mendip: Bronze Age Funerary Landscapes of the Southern Severn Uplands*
Rona Davis (PhD) *The nature of Mesolithic activity at selected spring sites in south-west Britain.*
Bob Ruffle (PhD) *Pottery in the material culture of early modern England: a model from the archaeology of Worcester*

Maddock, I. P.
Marie-Pierre Gosselin – PhD. *Hydraulic Habitats and Fish Populations* (Submitted)
Megan Klaar – PhD. *Geomorphology and Fish Populations (Alaska)*. (Registered 2006 with University of Birmingham; jointly funded).
Graham Hill – PhD. *River Habitat Identification*. (Registered 2004)
Caroline Wallis – PhD. *Defining Hydraulic River Habitats*. (Registered 2007)

Newbury, H.J.

Alison Evans – PhD (first supervisor) *The role of CHX transporters in cation movement in Arabidopsis*. (Submitted; Registered with University of Birmingham).

Matt Kerton - PhD. (second supervisor). *Calcium uptake and distribution in herbaceous plants*. (Registered 2005 with University of Birmingham).

Miriam Daniels - PhD (second supervisor) Investigating the uptake of Thiamethoxam and its effects on *Rhopalosiphum padi* feeding behaviour. (*Successful completion 2008; Registered with University of Birmingham*).

Storey, D.

David Maund (PhD) *Moving-on from a rural parish: A multi-disciplinary longitudinal study of demographic change and migration in an area of the English-Welsh borderland*. (Successful completion 2008).