



FACULTY OF COMPUTING HEALTH AND SCIENCE

Centre for Ecosystem Management



Level II

Annual Report 2008

Overview 2008

The Centre for Ecosystem Management underwent substantial changes in its structure, membership and focus during 2008. With the departure of a number of marine scientists, who formed a new Centre for Marine Ecosystems Research, the CEM took the opportunity to restructure. The new CEM is no longer the research arm of the School of Natural Sciences but has members from across ECU who focus their research on the broad themes of sustainability, biodiversity and health and ecology.

Despite all the changes experienced with the rebirth of the CEM, members had an outstanding research year. Some \$1.27 million was raised for research during 2008. The magnitude of the research funding is a consequence of constructive engagement and research links between the researchers in the CEM and State, National and International government organizations and research agencies. Members of the CEM also continued to produce high quality outputs in the form of refereed papers (34), reports (32) and conference proceedings (3). The breadth of research interests in the CEM can be seen from the published outputs given later in this report. Centre members also made significant contributions to professional and community activities outside ECU. CEM members were invited to referee over 20 papers for national and international journals, were editors of 2 journals, sat on 3 editorial boards and contributed to 26 professional or advisory boards or committees. The breadth and scope of the contributions made by members of the CEM is remarkable and reflects the strong research culture of the Centre and its members. During the year 3 PhD students and 2 MSc students completed their studies under the supervision of CEM members.

This report acknowledges the continued high quality and quantity research efforts of the members of the CEM and I look forward to the growth and evolution of the reborn CEM over the next few years.

Will Stock, Head: CEM, May 2009

CEM Members

Associate Professor Ray Froend

Ray's interests focus on ecological water requirements and ecosystem management. Specific interests include the water regimes required to maintain and enhance conservation values of terrestrial, aquatic and riparian ecosystems. Management of aquatic and groundwater dependent ecosystems are key issues as is allocation planning of water resources to meet environmental requirements. Much of his research involves the development of monitoring strategies and programmes for assessing effectiveness of environmental water provisions. He also studies the impacts of altered groundwater regimes on native plants including the ecophysiology of phreatophytic vegetation and the response of these plants to long-term changes in groundwater regime and climate. Other interests include the ecology and biology of wetlands and plant responses to altered water quantity and quality.

Dr David Goodall

David, a botanist by training, has for many years concentrated his interest on vegetation particularly in arid areas. He was Editor-in-Chief of "Ecosystems of the World", a series of 38 volumes which was completed at the end of 2005. He also has a long-term interest in the use of numerical methods to classify

entities described by a great variety of attributes, such as plants, and areas of bushland. For this purpose he has developed a series of interlinked computer programs, which are still being improved and expanded.

Dr Andrea Hinwood

There has been little work in Australia exploring the relationships between environmental contaminants and human health. One of the major impediments is our inability to determine how much individuals are actually exposed to and how this information can be used to improve current health studies. Specific areas of interest relate to: the assessment of biomarkers for use in health studies, the development of novel exposure metrics, and the investigation of the relationships between environmental exposures and health effects. Andrea is actively involved in several projects to investigate the relationship between pollutants and health including the health effects of heavy metal contaminated soil and drinking water. Andrea is interested in the role of community perception and engagement in the EIA process as well as the development of methods to assess environmental and human health risks associated with multi media exposure and complex mixtures and the role of health impact assessment.

Associate Professor Pierre Horwitz

Pierre's primary research interests encompass the inter-relationship between human health, community well-being and ecological integrity, developing participatory approaches for the management of aquatic systems and the conservation of natural resources in general. Sustainability and health; social and ecological resilience; poverty and health inequalities are also issues of concern. He has interests in freshwater, inland saline and estuarine fauna and flora as indicators of environmental change, the effects of fire, forestry, agriculture and urbanisation on inland aquatic systems and the contribution of flagships, keystones and other icon species to biodiversity conservation and the well-being of human communities.

Associate Professor Adrienne Kinnear

Adrienne researches the biodiversity and community structures of Western Australia's soil and litter fauna, and the impact of our land-use practices on these communities. Adrienne is researching Western Australia's soil mite (acari) fauna by adding to our rudimentary knowledge of the distribution, taxonomy and community structure of these little-known, but biodiverse soil and litter dwellers. Adrienne also has a strong interest in teaching and learning: assessment strategies to improve students' learning in science and to aid in student skill development.

Dr Annette Koenders

Annette's interests focus on the conservation and systematics of freshwater crayfish in the south-west of Western Australia. She also has projects investigating the groundwater dependence of freshwater invertebrates and the molecular genetics and systematics of crustaceans. Other interests include the molecular mechanisms of growth and regeneration of muscle tissue in crustaceans and the molecular genetics of native trees.

Dr Kristina Lemson

Kristina uses phylogenetic methods to document and describe the diversity and evolution of plants. She is particularly interested in evolutionary patterns of diversity among species in the high rainfall south-west region and the semi-arid Coolgardie interzone. Kristina's research uses the methods of phylogenetic

analysis to investigate diversity, and to complement ecologically based work. Her systematics research uses morphological methods, with an emphasis on plant architecture and inflorescence structure, floral morphology, and anatomy, and seeks to integrate morphological and molecular approaches to phylogeny reconstruction. Dr Lemson also curates the Robert Brown Herbarium (ECU), a facility that supports research and teaching activities within the School of Natural Sciences.

Associate Professor Mark Lund

Wetland ecology covers the ecology of inland water bodies (rivers, lakes and swamps). Mark's particular interests are in how wetlands work and how this knowledge can be used to conserve and rehabilitate wetlands.

Dr Clint McCullough

Clint has broad environmental science research interests that include general aquatic ecology and ecotoxicology, and has an area of specific interest in the remediation, chemistry and ecology of mine pit lakes. He is particularly interested in lake and wetland biota such as macroinvertebrate communities and the effects that pollutants may have on these organisms, and how these affects may then be mitigated or remediated.

Dr Pascal Scherrer

Pascal has a background in environmental science and ecotourism, his main research interest is in sustainable tourism and alpine ecology, addressing the areas of environmental and social impacts and their relationship. Recent projects include an assessment of environmental and social impacts of Kimberley coastal tourism; an assessment of long-term vegetation changes in the Kosciuszko alpine area relating to land-use change; and collaborative projects with social marketing and leisure researchers on health aspects of tourism.

Emeritus Professor Harry Recher

Harry's interests lie in the structure of vertebrate communities, avian foraging ecology, the effects of fire on vertebrate populations, habitat fragmentation and the restoration of degraded landscapes, and the management and conservation of forest ecosystems. He has worked extensively with birds, mammals and forest invertebrates, but is primarily an avian ecologist. All projects are designed to provide guidelines for the management of natural ecosystems.

Dr Bea Sommer

Bea researches wetland sediment/water interactions. She has broad interests in wetland ecology, aquatic macroinvertebrates and the impacts of climate change on these systems. Her particular interests include groundwater/surface water interactions, ecological water requirements of aquatic fauna and flora, wetland management and acid sulfate soils (particularly in relation to drought-induced acidification of wetlands). Other interests include the impact of mining operations (mainly de-watering) on aquatic ecosystems, nutrient and carbon cycling in wetlands and the impacts of fire on the chemistry and ecology of humic wetland systems,

Professor William Stock

Will's research is focused on understanding the structure and functioning of natural and human impacted terrestrial ecosystems in order to improve our ability to manage such systems. He has particular interests in biogeochemical cycling, ecological applications of stable isotopes, nitrogen pollution, ecosystem impacts of invasive species and global change biology. Will has worked in systems ranging from heathlands, savannas, warm deserts, cold deserts (Antarctica) to commercial forestry plantations and agricultural plant selection.

Dr Graham Thompson

Graham's recent research has focused on improving terrestrial fauna assessments and surveys to support environmental impact assessments. In this context, most of his research has addressed questions on the efficacy of trapping and survey protocols for mammals and reptiles in mesic, arid and semi-arid habitats and determining the adequacy of fauna survey effort. Graham also has a long standing interest in the ecology and physiology of goannas and the effects of body size and shape on the ecology and performance traits of reptiles.

Dr Eddie Van Etten

Eddie is interested in terrestrial plant ecology and management in arid zones, urban bushland remnants and forested ecosystems. He is particularly involved in research in fire ecology and restoration of terrestrial ecosystems.

Operational Grants

Members of the CEM received a total of 1.27 million during 2008 for research to be undertaken on the grants listed.

- Wetland Macroinvertebrates and Water Quality (Northeast Gngangara Mound) (HORWITZ)
- Project 4.1 - Wetland Macroinvertebrates and Water Quality (Gngangara Mound) (HORWITZ)
- Can Mulching and Planting of the Riparian Zone of an Acid Sulphate Affected Wetland Improve Water Quality or Enhance Aquatic Ecological Value? (MCCULLOUGH, LUND)
- Midge and Related Research at Lake Joondalup (LUND, MCCULLOUGH)
- Structural Characterization of Suspended Detrital Floc in the Yanchep Wetland Suite, Swan Coastal Plain, Western Australia (SOMMER)
- Eco-Hydrological Study - Gngangara Mound (FROEND)
- Impact of Pine Removal on Carnaby Cockatoo Feeding and Future Populations on the Gngangara (STOCK)
- Assessment of Wetland Invertebrate & Fish Biodiversity for the Gngangara Sustainability Study (SOMMER, HORWITZ)
- Macroinvertebrate Sampling in the KSS Project Area Wetlands (LUND, MCCULLOUGH)
- Management Framework for Groundwater Dependent Vegetation - South West (FROEND)
- Surface and Interstitial Invertebrate Communities in and near Spearwood Creek, a Tributary of the Lower Blackwood River (KOENDERS, HORWITZ)
- Literature Review of the Ecophysiology of Riparian Plants (FROEND, BOYD)
- Investigation of the Relationship between Maternal Exposure to Metals and Adverse Birth Outcomes (HINWOOD)

- Characterisation of Fish Usage of Yarragadee Discharge Based on Water Chemistry (KOENDERS, HORWITZ)
- Kemerton Silica Sand (KSS) Terrestrial Invertebrate Survey (KINNEAR)
- Liege Street Wetland Aeration Trial (LUND, MCCULLOUGH)
- Extension of the Monitoring Program for the Collinsville Pit Lake Remediation Experiment (LUND, MCCULLOUGH)
- How do Acid Sulphate Soils Interact with Stormwater and Wetlands Constructed to Reduce Nutrient Loading: A Case Study of Brushfield Constructed Wetland in City of Stirling (LUND, MCCULLOUGH)
- Vegetation Monitoring - Swan Coastal Plain (FROEND, LOOMES, DAVIES)
- Environmental Monitoring and Investigations for Gngangara Mound - Wetland Macroinvertebrate Monitoring (HORWITZ)
- Study of migration patterns, habitat and water requirements of fish and invertebrates in the Blackwood River (HORWITZ, KOENDERS)
- Field studies into the reproduction biology and conservation requirements of Hairy Marron in the South West DEC region (HORWITZ, KOENDERS, BUNN)
- Rehabilitation of Kemerton Silica Sands Dredge Ponds: Natural Wetland Characterisation (LUND, MCCULLOUGH, VAN ETTEN)
- Rehabilitation of Kemerton Silica Sands Dredge Ponds: Rehabilitation Assessment & Improvement (VAN ETTEN, LUND, MCCULLOUGH)
- Evaluation of post-mining rehabilitation at the Kemerton Silica Sands Project in November 2008 (VAN ETTEN, MCCULLOUGH, LUND)
- Vegetation classification and mapping at Mt Gibson Wildlife Sanctuary (VAN ETTEN)
- Black cockatoo use of extensive post-mining revegetated and agriculturally transformed landscapes (STOCK)
- Mitigation of impacts on groundwater dependent vegetation through adaptive abstraction regimes (FROEND, STOCK)
- Impact of Disturbed Acid Sulphate Soils on Freshwater Ecosystems, Western Australia (HORWITZ)
- Environmental water requirements of priority water resources in the South Coastal Region (FROEND, LOOMES, HORWITZ)
- Field studies into the biology and conservation requirements of Engaewa species in the South West and Warren DEC regions (KOENDERS, HORWITZ, BURNHAM)
- Vegetation Monitoring of Groundwater Dependent Ecosystems on the Southern Blackwood Plateau and Eastern Scott Coastal Plain (FROEND, LOOMES, DAVIES)
- Development of a Rehabilitation Plan for the Dredge Ponds of the Kemerton Silica Sand Pty Ltd Operational Site (LUND, VAN ETTEN, MCCULLOUGH)
- EWR Framework Development (FROEND, LOOMES)
- Mitigation of impacts on groundwater dependent vegetation through adaptive abstraction regimes (FROEND, DAVIES, STOCK)
- Fire and establishment of Jarrah seedlings in shelterwood (VAN ETTEN, STOCK)
- Development of an innovative treatment system for acidity problems in an urban lake (Spoonbill Lakes) resulting from acid sulfate soils (MCCULLOUGH, LUND)
- Fire management implications for the wetlands on the Swan Coastal Plain (HORWITZ, BLAKE, HINWOOD, FROEND, VAN ETTEN)
- Fire, organic soils and acidification (HORWITZ, BLAKE)
- Wetland Vegetation Monitoring: Environmental Monitoring and Investigations for Gngangara Mound (FROEND)
- Fish migration patterns in the Blackwood River (KOENDERS, HORWITZ)
- Stygofauna research monitoring (HORWITZ)

- Investigation of Yate Swamp Hydroperiod requirements within the Lake Bryde recovery catchment (FROEND, LOOMES)
- Remediation of acid coalmine lakes using biological processes and organic matter (LUND, MCCULLOUGH)
- The Social Ecology of Ningaloo Tourism (HORWITZ, SCHERRER)
- Biology and Habitat Requirements of Blackstriped Jollytail (MCCULLOUGH, LUND)
- An Assessment of Rottnest Island's Sustainable Visitor Capacity (NORTHCOTE, SCHERRER, MACBETH)

Publications

Journal Articles

- Adolphson, H. and **Kinnear, A.** (2008). Acari (mite) assemblages under plantations of bluegum, *Eucalyptus globulus*, in southwestern Australia. *Pedobiologia* **51**: 427-437.
- Alonso, A., Sheridan, L. and **Scherrer, P.** (2008). Importance of tasting rooms for Canary Islands' wineries. *British Food Journal* **110**: 977-988.
- Alonso, A., Sheridan, L. and **Scherrer, P.** (2008). Wine tourism in the Canary Islands: An exploratory study, PASOS. *Revista de Turismo y Patrimonio Cultural* **6**: 291-300.
- Atkinson, C.A. Lund, M.A.** and Morris, K.D. (2008) BiblioRakali: the Australian water rat, *Hydromys chrysogaster* Geoffroy, 1804 (Muridae: Hydromyinae), a subject-specific bibliography. *Conservation Science Western Australia* **7**:65-71.
- Clemente, C. Withers, P.C. and **Thompson G.G.** (2008) Why go bipedal? Locomotion and morphology in Australian agamid lizards. *Comparative Biochemistry and Physiology A-Molecular & Integrative Physiology* **150**: 86-87.
- Clemente, C.J., Withers, P.C. and **Thompson G.G.** (2008) Higher than predicted endurance for juvenile goannas (Varanidae; Varanus). *Journal of the Royal Society of Western Australia* **91**: 265-267.
- Cousin, J.A.** and Phillips, R.D. (2008) Habitat complexity explains species-specific occupancy but not species richness in Western Australian woodland. *Australian Journal of Zoology* **56**: 95-102.
- Craine, J.M., Morrow, C. and **Stock, W.D.** (2008) Nutrient concentration ratios and co-limitation in South African grasslands. *New Phytologist* **179**: 829-836.
- Goodall, D.W.** (2008) Human Evolution – Where from Here? *Rendiconti Lincei* **19**: 353-375.
- Hinwood, A.L., Horwitz, P.** and **Rogan, R.** (2008) Acid Sulphate Soil Disturbance, Metals and Human Exposure. *Archives of Environmental Contamination and Toxicology* DOI 10.2007/s00244-007-9076-3.
- Hinwood, A.L., Horwitz, P.** and **Rogan, R.** (2008) Human exposure to metals in groundwater affected by acid sulphate soil disturbance. *Archives of Environmental Contamination and Toxicology* **55**: 538-545.

- Hinwood, A.L.**, Trout, M., Murby, J., **Barton**, C. and Symons, B. (2008) Assessing urinary levoglucosan and methoxyphenols as biomarkers for use in woodsmoke exposure studies. *Science of the Total Environment* **402**: 139-146.
- Horwitz, P.**, Bradshaw, D., Hopper, S.D., Davies, P.M., **Froend, R.H.**, and Bradshaw, F. (2008) Hydrological change escalates risk of ecosystem stress in Australia's threatened biodiversity hotspot. *Journal of the Royal Society of Western Australia* **91**: 1-11.
- Lunney, D.H., Lunney, H.W.M. and **Recher, H.** (2008) Bushfire and the Malthusian guillotine: survival of small mammals in a refuge in Nadgee Nature Reserve, southeastern New South Wales. *Pacific Conservation Biology* **14**: 263-278.
- McCullough, C.D.** (2008). Approaches to remediation of acid mine drainage water in pit lakes. *International Journal of Mining, Reclamation and Environment* **22**: 105-119.
- McCullough, C.D. Lund, M.A.** and May, J. (2008). Field scale demonstration of the potential for sewage to remediate acidic mine waters. *Mine Water and the Environment* **27**: 31-39.
- Recher, H.F.** (2008) Conservation, natural history and science: the challenge too great, the time too short. *Pacific Conservation Biology* **14**: 5-6.
- Recher, H. F.**, Lunney, D., O'Connell, M. and Matthews, A. (2009). Impact of fire and drought on populations of forest-dwelling small mammals in Nadgee Nature Reserve, south-eastern New South Wales. *Wildlife Research* **36**: 143–158.
- Recher, H. F.** (2008). Good English, God's Nature: Science Education. *Pacific Conservation Biology* **14**: 3-4.
- Recher, H. F.** (2008). 2020 Hindsight: An Ecologically Sustainable Australia. *Pacific Conservation Biology* **14**: 78-79.
- Scherrer, P.**, Henley, N., Sheridan, L., Sibson, R. and Ryan, M. (2008). Maintaining Momentum: The challenge of a workplace physical activity program to sustain motivation and activity. *Journal of Research for Consumers* **14**.
- Schultz, M.B., Smith, S.A., Richardson, A.M.M., **Horwitz, P.**, Crandall, K.A. and Austin, C.M. (2007) Cryptic diversity in *Engaeus erichson*, *Geocharax* Clark and *Gramastacus* Riek (Decapoda parastacidae) revealed by mitochondrial 16S rDNA sequences. *Invertebrate Systematics* **21**: 569-587.
- Syme, G.J., Porter, N.B., **Goeft, U.** and Kington, E.A. (2008) Integrating social well being into assessments of water policy: meeting the challenge for decision makers. *Water Policy* **10**: 323-343.
- Thompson, G.G.**, Clemente, C.J., Withers, P.C., Fry, B.G. and Norman, J.A. (2008) Is body shape of varanid lizards linked with retreat choice? *Australian Journal of Zoology* **56**: 351-362.
- Thompson, G.G.** and Thompson, S.A. (2008) Abundance and spatial distribution of five small mammals at a local scale. *Australian Mammalogy* **30**: 65-70.
- Thompson, G.G.** and Thompson, S.A. (2008) Greater bilby (*Macrotis lagotis*) burrows, diggings and scats in the Pilbara. *Journal of the Royal Society of Western Australia* **91**: 21-25.

- Thompson, G.G.** and Thompson, S.A. (2008) Spatial variability in terrestrial fauna surveys; a case study from the goldfields of Western Australia. *Journal of the Royal Society of Western Australia* **91**: 219-228.
- Thompson, S.A. and **Thompson, G.G.** (2008) Range extension for the Black-headed Worm-lizard, *Aprasia picturata* (Squamata: Pypopodidae). *Journal of the Royal Society of Western Australia* **91**: 51-52.
- Thompson, S.A. and **Thompson, G.G.** (2008) Vertebrate by-catch in invertebrate wet pitfall traps. *Journal of the Royal Society of Western Australia* **91**: 237-241.
- Thompson, S.A., **Thompson, G.G.** and Oates, J.E. (2008) Range extension for the Western Heath Dragon, *Rankinia adelaidensis adelaidensis* (Squamata: Agamidae). *Journal of the Royal Society of Western Australia* **91**: 207-208.
- Thompson, S.A., **Thompson, G.** and Withers, P.C. (2008) Rehabilitation index for evaluating restoration of terrestrial ecosystems using the reptile assemblage as the bio-indicator. *Ecological Indicators* **8**: 530-549.
- Unno J.** and Semeniuk V. (2008). Ichnological studies of the Western Australian soldier crab *Mictyris occidentalis* Unno 2008: correlations of field and aquarium observations. *Journal of the Royal Society of Western Australia* **91**: 175-198.
- Unno J.** (2008). A new species of soldier crab, *Mictyris occidentalis* (Crustacea: Decapoda: Brachyura: Mictyridae) from Western Australia, with congener comparisons. *Journal of the Royal Society of Western Australia* **91**: 31-50.
- Waldram, M.S., Bond, W.J. and **Stock, W.D.** (2008) Ecological engineering by a mega-grazer: White Rhino impacts on a South African savanna. *Ecosystems* **11**: 101-112.

CEM Reports

- 2008-01: T Boyd, R Loomes and RH Froend.** Wetland Vegetation Monitoring 2007 – Survey of Gngangara Wetlands. Western Australian Department of Water.
- 2008-02: WRA Sawyer, CD McCullough and MA Lund.** Analysis of Delwaney Drain Acid Sulfate: Soil treatment with calcite pellets. Commercial-in-confidence report to Water Corporation.
- 2008-03: CD McCullough, MA Lund and JM May.** Treating acidity in coal pit lakes using sewage and green waste: microcosm and field scale trials at the Collinsville Coal Project (Queensland). ACARP Project Report C14052.
- 2008-04: R Loomes, J Wilson and RH Froend.** End of Summer Assessment of Condition of Gngangara and Jandakot Criteria Groundwater Dependent Ecosystems. Western Australian Department of Water.
- 2008-05: R Loomes, J Wilson and RH Froend.** 2007 Monitoring of Groundwater Dependent Vegetation - Southern Blackwood Plateau and Eastern Scott Coastal Plain. Western Australian Department of Water.
- 2008-06: DM Galeotti, and CD McCullough.** The effect of bioremediation of acid sulfate soil affected wetlands on benthic macroinvertebrate assemblages and water quality. City of Stirling.

- 2008-08: K McKay, R Loomes, P Horwitz, RH Froend and J Wilson.** Environmental Water Requirements of Wetlands within the Torbay Catchment, South Coast Region. Western Australian Department of Water.
- 2008-09: MA Lund and CD McCullough.** Recommendations for water quality sampling of Kemerton Silica Sand Pty Ltd's dredge ponds and wetlands. Commercial-in-confidence report to Kemerton Silica Sands Pty Ltd.
- 2008-10: EJB van Etten, CD McCullough and MA Lund.** Evaluation of rehabilitation efforts at the Kemerton Silica Sands Pty. Ltd. project area, June 2007. Commercial-in-confidence report to Kemerton Silica Sands Pty Ltd.
- 2008-12: DM Galeotti, CD McCullough and MA Lund.** A synthesis of Black-striped Minnow (Pisces, Galaxiidae: *Galaxiella nigrostriata*) ecological requirements, south-western Australia. Kemerton Silica Sand Pty Ltd.
- 2008-13: MA Lund and CD McCullough.** Aquatic macroinvertebrates in wetlands within the proposed Kemerton Silica Sand Pty Ltd Project expansion area. Kemerton Silica Sand Pty Ltd.
- 2008-14: T Boyd, M Bertuch, G Ogden and RH Froend.** Investigation of *Eucalyptus occidentalis* Hydroperiod Requirements at Yate Swamp. Western Australian Department of Environment and Conservation.
- 2008-15: CD McCullough, MA Lund, A Das, and R Watkins.** Development of an innovative treatment system for acidity problems in an urban lake (Spoonbill Lakes) resulting from acid sulfate soils (ASS). City of Stirling.
- 2008-16: CD McCullough and MA Lund.** Aquatic macroinvertebrates in seasonal and rehabilitated wetlands of the Kemerton Silica Sand Pty Ltd project area (2007). Kemerton Silica Sand Pty Ltd.
- 2008-17: EJB van Etten, CD McCullough and MA Lund.** Riparian vegetation characteristics of seasonal wetlands in Kemerton, south-western Australia. Kemerton Silica Sand Pty Ltd.
- 2008-18: N Somesan, CD McCullough and MA Lund.** Riparian mulching as mitigation of in an urban acid sulphate affected wetland. City of Stirling.
- 2008-19: R Gunner, MA Lund and CD McCullough.** (Factors controlling the release of sediment bound phosphorus from a seasonal wetland (Beenyup swamp). Cities of Wanneroo and Joondalup and Western Australian Department of Environment and Conservation.
- 2008-20: K Goldsmith, MA Lund and CD McCullough.** Nutrient loading in the sediment of Beenyup Swamp (Yellagonga Regional Park Cities of Wanneroo and Joondalup and Western Australian Department of Environment and Conservation.
- 2008-22: R Loomes, J Wilson and RH Froend.** 2008 Monitoring of Groundwater Dependent Vegetation – Southern Blackwood Plateau and Scott Coastal Plain. Western Australian Department of Water.
- 2008-23: R Loomes, J Wilson and RH Froend.** 2008 Vegetation Monitoring – Swan Coastal Plain (Bunbury, Busselton/ Capel Groundwater Areas). Western Australian Department of Water.
- 2008-24: LE Valentine and WD Stock.** Food resources of Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) in the Gnaragar Sustainability Strategy study area. Forest Products Commission.

- 2008-25: P Horwitz, D Blake, J Cargill, RH Froend, A Hinwood, R Loomes, H McQueen, R Rogan and EJB van Etten.** Fire Management Implications for Wetlands on the Swan Coastal Plain, Western Australia. Fire and Emergency Services Authority of Western Australia.
- 2008-26: P Horwitz.** Stygofauna Taxonomy. Newcrest Mining Limited (NCM), Telfer Operations - Stygofauna Monitoring.
- 2008-27: B Sommer, P Horwitz and CD McCullough.** Impact of Acid Sulfate Soils on Freshwater Ecosystems of Southwest WA. Western Australian Department of Water.
- 2008-29: S Judd and P Horwitz.** Gngangara Mound Macroinvertebrate Monitoring Program Interim Report Spring 2008. Western Australian Department of Water.
- 2008-30: K McKay and P Horwitz.** Annual Report for the Wetland Macroinvertebrate Monitoring Program of the Gngangara Mound Environmental Monitoring Project – Spring 2007 to Summer 2008. Western Australian Department of Water.

Other Reports

- Burnham, K., Byrne, M., **Koenders, A** and **van Etten, E.J.** (2008). Genetic and Morphological Analysis of the Tuarts (*Eucalyptus gomphocephala*) of the Lower Moore River. Lower Moore River Working Group and the Tuart Response Group, Dept of Environment and Conservation.
- Evans, L., Ivey, G., Oldham, C., **Lund, M., McCullough, C.,** Tsvetnenko, Y. and Scott, D. (2008). Centre for Sustainable Mine Lakes. ACARP Report C11053. Centre for Sustainable Mine Lakes.
- Evans, L., Ivey, G., Oldham, C., **Lund, M., McCullough, C.,** Tsvetnenko, Y. and Scott, D. (2008). Centre of Excellence for Sustainable Mine Lakes: Final Report to State Government Jan 2002 to March 2007. Perth, Australia, Centre of Excellence for Sustainable Mine Lakes (CSML): 262.
- Kinnear, A., Sparrow, H., Boyce, M. and Middleton, S.** (2008) Perceptions of successful students: lessons for the First Year Experience. Edith Cowan University, Perth.
- Sommer, B., Horwitz P.,** and Hewitt, P. (2008). Assessment of wetland invertebrate and fish biodiversity for the Gngangara sustainability strategy (GSS). Final report to the western Australian Department of Conservation and environment. Joondalup, Centre for Ecosystem Management, Edith Cowan University.
- Van Etten, E.J.** (2008). Wadderin Water Reserve and Wildlife Sanctuary: Environmental Management Plan 2008-2018. Report prepared for Wadderin Wildlife Nature Reserve Committee and the Shire of Narembeen.
- Scherrer, P.,** Smith, A.J. and Dowling R. (2008). Tourism and the Kimberley Coastal Waterways: a review of environmental and cultural aspects of expedition cruising along the Kimberley coast, Western Australia. STCRC Press, Gold Coast, Australia.
- Henley, N., **Scherrer, P.,** Sibson, R., Sheridan, L., Bahn, S., Ryan, M. and Ganeshasundaram, R. (2008). Global Corporate Challenge Qualitative Research Project. The effect of a workplace team initiative on participants' motivation to sustain a physical activity program. Edith Cowan University, Perth, Australia.

Refereed Conference Proceedings

Bunn, J.J.S., Koenders, A., Austin, C.M. and Horwitz, P. (2008) Identification of hairy, smooth and hybrid marron (Decapoda: Parastacidae) in the Margaret River: morphology and allozymes. *Freshwater Crayfish* **16**: 113-121.

Kinnear, A., Sparrow H., Boyce M. and Middleton S. (2008). Perceptions of successful students: lessons for the First Year Experience. Proceedings of the First Year Experience Conference, FYHE Hobart, June 31-July 3.

Kinnear, A., Middleton S., Boyce M., Sparrow H. and Cullity M. (2008). Success and persistence in academic study: a comparison of student and staff perspectives. E-Culture Conference, Edith Cowan University.

Non Refereed Papers/Proceedings/Forewards

Davis, W.E. Jr., **Recher, H.F.**, Boles, W.E. and Jackson, J.J. (eds) (2008) 'Contributions to the History of Australasian Ornithology'. *Memoirs of the Nuttall Ornithological Club*, No. 14, Cambridge, Mass., U.S.A.

Horwitz, P. (2007) Environmental impact assessment in Australia: Theory and practice, 4th Edition. *Geographical Research*, **45**: 110-112.

Lund, M.A. and McCullough, C.D. (2008). Limnology and ecology of low sulphate, poorly-buffered, acidic coal pit lakes in Collie, Western Australia. Proceedings of the 10th International Mine Water Association (IMWA) Congress. Karlovy Vary, Czech Republic. Rapantova, N. & Hrkal, Z. (eds.), 591-594pp. ISBN 978-80-248-1767-5.

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Van Etten, E.J.B. (2008). Changing land use and management ethos in Western Australia's rangelands: how mining companies may contribute to landscape to regional scale land management and conservation. Goldfields Environmental Management Workshop 2008 Proceedings, pp. 34-42. Goldfields Environmental Management Group Inc., Boulder, W.A.

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Recher, H. F. (2008). Forum on Conservation. *Pacific Conservation Biology* **14**: 228-229.

- Sommer, B.** (2008). Impact of Acid Sulfate Soils on freshwater ecosystems, WA. Presented at the Technical Working Group for the W.A. Strategic Reserve Project TWG workshop, Bunbury, on 27-28 March 2008.
- Sommer, B.** (2008). *Ground- and surface water acidity on the eastern Scott Coastal Plain: mineral or organic?* Poster presented at the 47st Annual Conference of the Australian Society for Limnology at Mandurah, WA, 29th September to 4th October 2008.
- Horwitz, P.** (2008). Keynote Address: Freshwater crayfish, conservation lists and passionate associations. International Association of Astacology, Kuopio, Finland. August 2008.
- Pickering, C. and **Scherrer, P.** (2008). Managing tourists on the top of Australia: past, present and future challenges. Pp. 319-325. In: R. Dowling & D. Newsome (Eds.). Proceedings of the Inaugural Global Geotourism Conference, 17-20 August 2008, Fremantle, Australia. ISBN 1 86308 146 1.
- Scherrer, P.,** Smith, A.J. & Dowling R. 2008. Tourism and the Kimberley Coastal Waterways: a review of environmental and cultural aspects of expedition cruising along the Kimberley coast, Western Australia. Photobook, Edith Cowan University.
- Scherrer, P.** 2008 Kimberley Cruising: Environmental and Cultural Aspects of a Growing Industry, Tourism Research Report, FACET News, Winter 2008, p. 16.
- Thompson, S.A. and **Thompson, G.G.** (2008) Searching and monitoring for malleefowl; ground, aerial and thermal surveys. In 'Goldfields Environmental Management Workshop 2008'. Kalgoorlie pp. 17-28. (Goldfields Environmental Management Group).

Post Graduate Students

The following PhD and Masters students were supervised by members of the Centre – * **Completed 2008**

PhD

David Blake - *P Horwitz/W Stock/M Boyce*. Fire induced hydro-biogeochemical responses in wetland sediments of the northern Swan Coastal Plain.

John Bunn – *P Horwitz/A Koenders*. Mechanisms affecting the replacement of *Cherax tenuimanus* (Smith 1912) by *Cainii* Austin 2002 from the Margaret River.

Quinton Burnham – *A Koenders/P Horwitz*. Biogeography of the Australian burrowing freshwater crayfish genus *Engaewa* (Decapoda : Parastacidae).

Caroline Canham – R Froend/W Stock. Phreatophyte root growth dynamics and relationships between growth phenology, plant water relations and groundwater.

Zoe Car – *P Horwitz*. Seeing with other eyes: Exploring western scientific and indigenous environmental knowledge.

Jeffrey Cargill – *W Stock / E van Etten*. Fate of *Eucalyptus marginata* seed from canopy-store to emergence in the northern jarrah forests of Western Australia: a comparison between spring and autumn burns in shelterwood (retained overstorey) treatments.

May Carter – *P Horwitz*. Urban design, contact with nature and population health.

Kelly Chapman – *P Horwitz / P Scherrer / J Northcote*. Tourism research to tourism practice: working to build adaptive institutions in Western Australia's Ningaloo Region.

Graham Fulton – *P Horwitz / T Perkins*. The nesting ecology of an endangered woodland avifauna.

***Ute Goeft** – *R Froend / P Horwitz*. Identification of Social Water Requirements (SWR's) for water resource planning.

Pat Karatna – *P Horwitz*. Mangrove forest communities in south-eastern Thailand.

***Sumitra Moopayak** – *A Kinnear*. Biofertilisers: The biotechnology and soil conditioning properties of polysaccharide-producing soil algae.

Craig Pentland – *A Kinnear*. Behaviour and population dynamics of translocated populations of the black-flanked rock wallaby, *Petrogale lateralis lateralis*.

Malarvili Ramalingam – *A Hinwood / M Boyce*. Maternal Exposure to Metals and Contribution of Environmental Sources

MSc

Muriel Bertuch – *E van Etten*. Mulga (*Acacia aneura* F.Muell.Ex Benth.) death adjacent to haul roads in the northern Goldfields.

Rob Campbell – *P Horwitz*. Perceptions of soil health in the Bremer River Catchment.

Stephen Danti – *A Kinnear*. The influence of different silvicultural treatments on saproxylic beetles in southwest forests of Western Australia.

David Galeotti – *C McCullough / M Lund*. Biology and Habitat Requirements of Blackstriped Jollytail.

Victoria Lazenby – *A Hinwood*. Personal Exposure of Children to Formaldehyde

Heather McQueen – *A Hinwood*. Estimating prenatal exposure to glyphosate formulations using maternal exposure assessment techniques - a preliminary investigation.

***Wesu Ndilila** – *A Hinwood*. Investigating Heavy Metal Exposure on the General Populace of the Copper Mining Town of Kitwe, Zambia.

William Phelps - *M Lund / B. Sommer / C McCullough*. Structural characterization of suspended detrital floc in the Yanchep Wetland suite, Swan Coastl Plain, Western Australia.

Marie Raphael – *A Hinwood, E van Etten*. Defining appropriate options for post-closure land-use of Tamala Park: A community participation process

***Monica Russell** – *A Kinnear*. Abundance, distribution and habitat requirements of the Tree-Stem Trapdoor *A. castellum* in the West Australian wheatbelt.

Ryan Sawyer - *C McCullough / M Lund*. The Impact of Acid Sulfate Soils on Water Quality Treatment in a Constructed Urban Stormwater Treatment Wetland in Gwelup, Western Australia.

Joy Unno – *A Kinnear / V Semenuik*. Biology and ecology of the Western Australian soldier crab, *Mictyris occidentalis*

***Marieke Weerheim** – *W Stock*. How Black Cockatoos use their landscape: Habitat Characteristics at Multiple Spatial Scales.

Visitors

Dr Isabelle Schön, Principal Researcher Freshwater Biology, Royal Belgian Institute of Natural Sciences, Brussels, Belgium. Dr Schön works on the genetics, morphological taxonomy, systematics and biogeography of non-marine ostracods

Research Links and Collaborations

- Chemistry Centre, (WA)
- University of Western Australia
- National Measurement Institute
- Arctic Assessment and Monitoring Program
- Department of Water, (WA)
- CSIRO
- The University of Western Australia
- Water Corporation
- Curtin University of Technology
- Griffin and Wesfarmers Coal (CSML)
- Department of Fisheries (WA)
- Colorado State University
- Worldwide Fund for Nature (WWF)
- Consortium for Conservation Medicine
- WA Museum
- Greening Australia (WA)
- University of Tasmania
- Bush Heritage Australia
- ALCOA
- Main Roads, WA
- Kemerton Silica Sands
- Royal Botanic Gardens, Sydney
- Florida State University (USA)
- University of Cape Town, South Africa
- The Australian Museum, Sydney
- Fortescue Metals Group
- Paddington Gold Pty Ltd
- Murray Shire
- Wunambal Gaambera Aboriginal Corporation
- Kemerton Silica Sands
- GhG-SSCP Research Group, Ministry of the Environment, Government of Japan
- The Norwegian University of Science and Technology, Trondheim, Norway
- Aquatic Eco-Technology, Hogeschool Zeeland Netherlands
- UFZ – Centre for Environmental Research, Germany
- *eriss* (Environmental Research Institute of the Supervising Scientist, NT)
- Australian Tropical Herbarium, James Cook University
- Manaaki Whenua Landcare Research, New Zealand
- Department of Environment and Conservation, (WA)
- United States Environmental Protection Agency
- Flinders University
- Australian Research Council
- Cable Sands (WA) Pty Ltd
- Murdoch University
- University of Technology, Western Sydney
- Tiwest Joint Venture
- Midge Research Group (City of Cockburn)
- Cities of Joondalup, Stirling and Wanneroo
- Deakin University, Victoria
- University of Hawaii
- University of British Columbia
- University of Sunshine Coast, Queensland
- The Wilderness Society
- Friends of Fitzgerald River National Park
- Forest Products Commission
- Australian Wildlife Conservancy
- Mindarie Regional Council
- Fire and Emergency Services Authority
- Western Australian Herbarium
- Charles Darwin University
- Lane Community College, Oregon (USA)
- Australian National University
- Coffey Environments
- Norilsk Nickel Pty Ltd
- Rottneest Island Authority
- Kimberley Land Council
- Chevron Australia
- GME Resources

- Sustainable Tourism Cooperative Research Centre (STCRC)
- Australian Wilderness Society (Wild Country Project)
- Macauley Land Use Research Institute, Aberdeen, Scotland

Community Engagement

Committee contributions

- State Wetland Coordinating Committee
- Aquatic Ecosystem Advisory Group of the National Water Commission
- Advisory Committee for the Institute of Water and Environmental Resource Management, University of Technology, Sydney
- Western Australian EPA Reference Panel on Natural Resource Management
- Western Australia Sustainable Diversion Limit Expert Panel by the Department of Water
- Environmental Protection Authority WA (Deputy Chair)
- Pacific Basin Consortium for Health and Environment
- Clean Air Society –Deputy Chair SIG – Risk Assessment
- Member, Rottnest Island Environment Advisory Committee
- Organising Committee Asia Pacific Ecohealth Conference 2007, Deakin University, Melbourne
- Department of Environment and Conservation Gnamagara Sustainability Strategy Scientific Advisory Committee
- WA Threatened Species Scientific Committee
- Regional Councillor, Ecological Society of Australia
- Minerals Research Advisory Committee
- WA Threatened Ecological Communities Scientific - Committee
- Stakeholder Steering Committee for ALCOA's 2nd Mining Environmental Plan
- Convenor of the local chapter of the Australian Systematic Botany Society
- Department of Environment and Conservation's Guidelines for Terrestrial Biological Survey Group
- Environmental Advisory Committee of the City of Wanneroo
- Advisory Committee for Yanchep National Park
- Yellagonga Regional Park Advisory Committee
- Sustainability Sub-committee, City of Joondalup
- Science ambassador, SCITECH (WA)
- Honorary Senior Fellow, The Australian Museum, Sydney
- Brooklyn and Lower Hawkesbury Estuarine Management Committee, NSW
- Scientific Reference Group, Bell Miner Associated Dieback Working Group, NSW
- Birds Australia, Common Names Committee

Editorial positions

- Editor, *Pacific Conservation Biology*
- Co-editor of *Ecohealth*
- Editorial Board International Society Environmental Forensics
- Associate Editor of *Austral Ecology*
- Editorial Board of the *African Journal of Range and Forage Science*

Refereed papers for

Perspectives in Plant Ecology, Evolution and Systematics, Scientia Horticulturae, Rangeland Ecology and Management, Ecosystems, Journal of Biogeography, Biological Invasions, Journal Toxicology and Environmental Health, Pacific Science, Journal of Vegetation Science, Plant and Soil, New Phytologist, Austral Ecology, Nuytsia , Aquatic Ecosystem Health and Management, Ecological Management and Restoration, Hydrobiologia, Chemosphere, International Journal of Mining, Reclamation and Environment, Ecohealth, Journal of Crustacean

Biology, Journal Environmental Management, Natural Areas Journal, Restoration Ecology, Web Ecology, Conservation Science Western Australia.

Future Plans and Directions

The **Centre for Ecosystem Management** is a centre of research excellence within Edith Cowan University that exists to assist its members and their postgraduate students develop and undertake high quality research in the broad discipline areas of biodiversity science, sustainability studies and health and ecology. Members engage with community agencies to apply good science and ecologically sustainable principles to addressing and solving environmental problems and sustainability issues with a West Australian focus. The CEM is guided by a Business Plan (developed in 2008) and the 2009 to 2011 period is critical for growing the research endeavours of the newly configured CEM.

The objectives of the Centre are:

- To encourage, facilitate and support research in Western Australia that leads to a better understanding of our biota, ecological systems, preservation of biodiversity and sustainable management strategies for the natural environment by its members and affiliated postgraduate students.
- To promote and enhance the quality of education offered to Centre affiliated postgraduate students.

The Centre uses the following strategies to achieve its goals:

- Provide grants and equipment to its members and affiliated postgraduate students to undertake research.
- Offer postgraduate scholarships and postdoctoral fellowships to increase the quality and quantity of research undertaken in the Centre.
- Host conferences and seminars that disseminate research findings; debate issues and promulgate best practice in environmental management.
- Promote co-operation and collaboration among Centre members and affiliated postgraduate students.
- Promote and facilitate innovation, enquiry and a commitment to excellence by members and affiliated postgraduate students in their research.
- Develop collaborative arrangements and programs with other universities, research agencies and individuals with similar interests and objectives.
- Provide financial support and encouragement for members and affiliated postgraduate students to disseminate the findings of their research in journals, reports, books and at conferences.
- Seek financial support for research programs undertaken by its members and affiliated postgraduate students from within and beyond the University.
- Manage the finances of all research grants held by members of the Centre

Date of Next Formal Review: 2010

CENTRE FOR ECOSYSTEM MANAGEMENT
Income and Expenditure Statement
January to December 2008
25131 9256 RG 06 01

Income

FCHS Contribution	\$ 40,000
Total Income for 2008	\$ 40,000

Expenditure

Advertising Costs		\$ 1,640
Entry in Nationwide Business Directory	\$ 735	
Entry in Commerce and Trade	\$ 905	
Equipment		\$ 22,613
Contribution towards GC-Mass Spectrometer	\$ 22,613	
Printing and Photocopying		\$ 3,214
Printing of 2007 CEM Annual Report	\$ 3,214	
Postgraduate Student Support		\$ 12,500
Travel, Equipment and Fieldwork Support	\$12,500	
Entertainment for Reviews, Seminar Series		\$ 33
Refreshments	\$ 33	
Total Expenditure for 2008		\$ 40,000

EXCESS OF INCOME/EXPENDITURE \$0

CENTRE FOR ECOSYSTEM MANAGEMENT
25131.9256.RG.06.01

NOTES ON INCOME & EXPENDITURE

INCOME :

The Centre received funds from the Faculty of Computing, Health & Science (\$40,000).

EXPENDITURE:

Entertainment:

The costs of refreshments for the Seminar Series was taken over by the School of Natural Sciences after the first two seminar afternoons.