The 2001 International Ecological Engineering Conference at Lincoln University, New Zealand

Post-Conference Report

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Overview

The conference programme offered ten international and local keynote speakers, about 60 oral and poster papers, 7 workshops, and a half-day tour of some of Christchurch's ecologically designed stormwater and wastewater projects.

The conference was attended by about 130 delegates from 14 different nations.

The conference was a blend of "big picture" and specialised technical presentations which then flowed into workshop discussions. Many of the keynote speakers encouraged specialists to think about ecosystem fit. (Ecosystems, by definition, are inclusive of human society). **Hirini Matunga**, Centre for Maori Studies, Lincoln University, in his welcome to delegates on behalf of the tangata whenua, indigenous peoples of Aotearoa (New Zealand), recognised the holistic nature of ecological engineering and challenged all ecological engineers to listen to the voice of indigenous peoples in their own nation. In her welcome address, **Chrissie Williams**, Councillor for the city of Christchurch, urged that we need to reawaken in us the wisdom of Maori and other indigenous cultures – who think holistically as a matter of course, and think less in the way of breaking everything down mechanistically. In recognising the need to treat our cities as ecosystems, of which the people are an integral part. Chrissie acknowledged that this means changing management from end-of-pipe thinking to closed-loop thinking, with an increased focus on efficient use of resources and the reuse of waste. To achieve these goals she urged the delegates that while we do need people with specialist knowledge and skills, we also need to have others able to integrate the valuable input from these specialists and come up with creative ecological solutions to sustainable development.

John La Roche, President of Engineers for Social Responsibility (NZ), pointed out that engineers make things happen and stressed the need for a greater understanding of the links between ecology and engineering.

Johannes Heeb, President of IEES, in his keynote address, stressed that we are facing a situation where our resources and environmental problems are hardly any longer "solvable" by conventional technological means. Advocating for ecological engineering, he gave the conference a global perspective of this discipline, pointing out that it was being implemented widely in both the so-called developing and developed nations. He gave examples where ecological engineering was providing integrated solutions to food and fibre production, community services and infrastructure, transformation of wastes to resources, creation of employment and economic security, and producing eco-friendly products while respecting ecosystem constraints.

A number of speakers recognised the wider implications of human societies, with their engineered projects being subsystems of an ecosystem. Johannes stressed that the discipline of ecological engineering, with its goal to benefit both people and nature, necessarily requires an interdisciplinary, multi-stakeholder approach, leading to multi-functional landscapes. The New Zealand Commissioner for the Environment, **Morgan Williams**, reinforced the value of systems thinking for the design of engineering services. As an example, he referred to the need for a better understanding of urban ecology, saying that in New Zealand we know a lot more about how rye grass grows than we do about how cities grow. He queried the ecological competency of engineers in general while **Dr Bill Mitsch**, Ohio State University, was concerned that ecology as a science is not routinely integrated in engineering curricula, even in environmental engineering programs. Bill Mitsch, with considerable experience in ecosystem restoration, believes that there is a growing role for ecological engineering.

John Peet, from the School of Engineering, University of Canterbury, was concerned about the ethical positions that underlie the way in which our societies respond (or do not respond) to the challenge of sustainability. He is clear that "If something is not physically possible, then it cannot be economically or socially possible." He went on to say, "Physics is the science of the possible, and engineering obeys the laws of physics. Our professional practice must be firmly based on a

coherent, whole-system understanding of the physical behaviour of a complex social and environmental system. We then have to address issues of social responsibility and ethics, including questions such as what engineers—ecological or other—should actually do about sustainability, and why. In doing so, we may discover how the different facets of sustainability are related."

Sharon Beder, Associate Professor and Head of Science and Technology Studies at the University of Wollongong, Australia, was concerned about the ethics of the public relations industry. She believed that ecological engineering innovations were being undermined by this well-resourced industry and presented some specific examples of how it can oversell outdated, inappropriate, environmentally damaging engineering systems.

Winfried Blum, Professor from the University of Agricultural Sciences (BOKU), Vienna, and Secretary General of the International Union of Soil Sciences, said that ecological engineers must integrate their activities with the six essential governing principles of the biosphere. He believes these are the key for understanding the functioning of natural terrestrial and aquatic ecosystems. He named these as:

- solar orientation, thus reducing entropy;
- closing material cycles, use of energy and materials in cascades and concentration of surplus, avoiding dissipation, thus minimizing entropy production;
- maximum variety (maximum of biological, chemical, mechanical and other options) and networking in decentralized systems, thus enhancing ecologic stability.

While Winfried, in his keynote address, focussed on the importance of soils in supporting ecosystems, **Björn Guterstam**, Network Officer for the Global Water Partnership Secretariat in Stockholm, argued that water is one of the key connecting elements between nature and human societies. Consequently ecological engineering will also be about integrated water resource management.

One of the more traditional areas of civil engineering is the provision of roading and transport services. **Hein van Bohemen** works for the Ministry of transport, Delft, Netherlands, where motorways, provincial roads, railways, telecommunication facilities, waterways, and airports are becoming an increasingly important characteristic of the landscape. Like others, he argued that ecologists need to work with civil engineers and architects, not only in roading projects, but also in construction, to increase the biological value and social enjoyment of engineering projects. Hein suggested that it "is important that the assumptions upon which much infrastructure and other construction work is carried out are made more explicit, expanded and combined with the characteristics and properties of living systems, whilst taking into account plants, people and animals in all their diversity."

One of the key features of the half-day conference tour organised by the Christchurch City Council was introduced by keynote speakers, **Ken Couling** and **Dennis Preston**. They introduced the Wigram stormwater sedimentation basin, which was designed as a multi-purpose flood retention and storm-water treatment structure which enhanced wildlife habitat and was also a public amenity. Drawing on this particular City Council experience, the speakers urged the importance in urban infrastructure design of a robust vision, which can accommodate changes and allow new opportunities to be taken advantage of as they arise.

The oral papers included technical papers on the traditional ecological engineering topics of wetlands for wastewater and storm-water management and treatment. Other topics included the role of the market in achieving (or not achieving) sustainability, composting toilets, biogas production, modelling riparian shade, integrated catchment management, urine separation and health risks, ecological design of motorways and educational programmes in ecological engineering.

The conference included a diverse range of technical topics alongside presentations that were more philosophical and "big picture" in content. However, this did not seem to detract from the success of the conference but instead enhanced its value. It was clear that the seven workshops were successful in synthesising the diverse range of subject material for practical and useful outcomes in the context of an ecological engineering framework.

A summary of the seven workshops follows:

Workshop 1: Wetlands and aquatic systems for wastewater and stormwater management

Chaired by Dr Chris Tanner, NIWA, Hamilton.

This workshop agreed that constructed wetlands and a range of other aquatic-based "natural" systems are now widely accepted in many regions of the world as viable, cost-effective treatment technologies. Overly optimistic performance expectations have been dispelled and general principles of design, ecosystem establishment and operation have been drawn together into engineering guidelines. However, much of the accumulated knowledge of treatment efficiencies derives from simple "green box" input/output monitoring studies, where hydraulic flow data are absent or of poor quality. This limits our understanding of the relative importance of the constituent processes operating and thus the basis for future innovation.

The workshop worked through engineering, ecological, political, and social factors influencing the utilisation of wetland and aquatic-based treatment systems, and also asked where we should be heading in the future (including research questions that need to be answered) and what is holding progress back.

The workshop noted the need for scientists and engineers in different areas of the world to work collaboratively to effectively answer remaining fundamental and applied research questions on treatment wetland functioning and performance. Initiation of joint international or regional conferences with other groups working on wetland treatment (e.g. IWA specialist group on the use of macrophytes in water pollution control, Society of Wetland Scientists) was suggested as a means to promote and coordinate such collaboration.

Workshop 2: Integrated riparian engineering

Chair, Dr Kit Rutherford, NIWA, Hamilton

This workshop discussed the management of riparian areas for multiple objectives notably: diffuse-source pollution, aquatic and terrestrial ecosystems, drainage, and amenity values. Sixteen to twenty people attended over the three days. The workshop discussed what role ecological engineers have, whether they can/do design riparian buffer zones adequately, whether they use available information and/or monitor performance effectively, and how they interact with the community. One major gap is a tool kit that addresses the complexity of riparian management.

The tool kit should allow the benefits of local initiatives to be integrated up to the catchment scale and vice versa, since this will help convince local landowners that small scale remediation can help and help regional planners focus their effort. The ecological engineer was seen as having a key role: helping set realistic goals for landowners and planners. Finally, the workshop felt that landowners sometimes had knowledge and understanding that were poorly utilised during planning, and that little effective monitoring was done from which to refine methods.

Workshop 3: Ecological engineering for sustainable regional development: Banks Peninsula case study

Chair, Andrew Dakers, Natural Resources Engineering, Lincoln University, Christchurch

The focus of this workshop was Banks Peninsula, which is a 107 600 ha volcanic peninsula close to the city of Christchurch. The purpose was to prepare an ecological engineering approach to a development strategy for the region.

It was recognized that the Banks Peninsula region was unique. There was concern that if the region and its resources are not managed and developed in a strategic and ecologically integrated manner, the ongoing opportunities and benefits may not be realized and sustained.

The workshop looked at how to move beyond the “talk“ to make this happen. The key interconnected recommendations were:

- i. Facilitated identification of local issues and problems and formulation of ecologically integrated development ideas - using informed community participation processes such as the stakeholder platform.
- ii. Education through the demonstration of real ecologically engineered projects.
- iii. The establishment of innovation networks.
- iv. The establishment of an appropriate financing structure for ecologically integrated initiatives.

Workshop 4: Urban eco-technology and infrastructure

Chair, Walter Lewthwaite, Christchurch City Council

This workshop agreed that the overall aim for urban ecotechnology and infrastructure is to “provide an urban environment that meets the physical, social and cultural needs of the community in a manner that is cost effective and compatible with past, present, and future ecosystems”.

The purpose of urban infrastructure is to establish and maintain an urban environment that will accommodate desirable human activities and provide:

- an acceptable living environment
- systems to effect movements of goods and people
- effective services for solid and liquid wastes
- water of sufficient quantity and quality

They concluded that, to achieve this, it was necessary to understand the urban ecology, the social and cultural nature of the community and processes for engagement, the availability and performance of developing technologies and the assessment and management of risk and economic realities. They identified many techniques, details and examples to help achieve these aims.

Workshop 5: Ecological engineering education

Chair Dr Hugh Thorpe, Civil Engineering, University of Canterbury, Christchurch

This workshop looked at the desirable qualities (attitude, knowledge and skills) of the ideal ecological engineer and then considered the achievable. They concluded that the ecological engineering team should collectively have the attributes identified for the ideal ecological engineer and that the members needed to be able to communicate effectively and work together to apply their skills and knowledge to the problems we face now and in the future

The workshop adopted the quotation from Henryk Skolimowski, the Polish philosopher: *"Knowledge is structured information. Wisdom is structured knowledge."* It concluded that ecological engineering education must provide the information and assist the student to begin structuring it into a personal knowledge base. Experiential learning will assist with skills development. Committed teaching will encourage humble attitudes to ecological issues and problems.

Workshop 6: Ecological engineering and decision-making

Chair, Dr John Peet , Chemical and Process Engineering, University of Canterbury

The aim of this workshop was to address the question of how Ecological Engineering (EE) can contribute to decision making, especially in the context of policy development by government—local and national.

Issues were discussed and a case used to clarify goals at the local level, and then to identify tools that will help us meet the goals. The workshop accepted the principle of subsidiarity, namely that decisions should be, as far as possible, made by those most affected by the outcome.

The workshop concluded that

- There may be no such thing as a simple "decision maker".
- The process of decision making is often strongly influenced by NGOs, pressure groups, powerful businesses, etc., perhaps more than traditional political groups. NGOs are often more powerful at a local level.
- We in ecological engineering are "weak" relative to those powerful groups.
- Globalisation is a problem, in that it can strongly affect (often negatively) national and local environmental and related initiatives, and bypass or ignore the interests of local stakeholders.
- The criteria that are really used to make decisions are often not those that are obvious to onlookers.
- Multi-stakeholder dialogue is essential, but seldom occurs. Without it, democracy is decreased.

Workshop 7: Planning an ecotechnology park for the city of Christchurch

Chaired by Murray Griffin, Community Employment Group, Christchurch

The Christchurch City Council is seeking ideas for the development of about 100 ha of land within the city boundaries. This workshop developed a proposal that built on the Council's commitment to "a sustainable Christchurch". The project is known as the Nga Puna Wai Eco-City Farm and is founded on the principles of permaculture, appropriate technology and ecological engineering and promotes an ecologically integrated management and planning approach for the land.

The workshop recommended applying ecological engineering to stormwater, water supply, energy, building construction and materials, transport, maintenance systems, and sustainable landscape services and products – including innovative food and fibre production systems that could be used for community education and research. The workshop also recommended the design of services that facilitated ecological connections with ecological corridors, pedestrian/ cycleways and appropriate planting.

NOTE: The full reports for the above workshops are now available on the IEES website: www.iees.ch/archive_publications.html#Anker-NZ

The Conference organising committee members were

Fiona Cox, Pattle Delamore Partners Ltd
Andrew Dakers (Chair), Natural Resources Engineering Group, Lincoln University and Private Consultant
Andrew McCarthy (IBSnet Co-ordinator), Christchurch City Council
Dr Colin Meurk, Landcare Crown Research Institute and Christchurch City Council
Dr David Painter (Editorial Committee), Civil Engineering, University of Canterbury and Natural Resources Engineering Group, Lincoln University
Dr John Peet (Editorial Committee), Chemical and Processing Engineering, University of Canterbury
Dr Chris Phillips, Landcare Research
Dr Hugh Thorpe, Civil Engineering, University of Canterbury

Lyn Torgerson, Natural Resources Engineering Group, Lincoln University.
Chrissie Williams, City Councillor , Christchurch City Council

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Workshop Chairs (C), Facilitators (F) and Rapporteurs (R)

Wetlands and aquatic systems for wastewater and stormwater management: Chris Tanner (C) Clive Howard-Williams (F), Otto Stein and Brian Sorrel (R)
Integrated riparian engineering: Kit Rutherford (C,R), Don Ross (F)
Ecological engineering for sustainable regional development: Banks Peninsula case study: Andrew Dakers (C) Johannes Heeb (F), Ali Arshad (R)
Urban eco-technology and infrastructure: Walter Lewthwaite (C). Lynn Torgerson (F), Eric van Toor (R)
Ecological engineering education: Hugh Thorpe (C), David Elms and David Painter (F), John La Roche (R)
Ecological engineering and decision-making: John Peet (C,F, and R)
Planning an ecological farm-park for the city of Christchurch: Murray Griffin (C and R), Chris Freeman (R)

Sponsors...

...included the National Institute for Water and Atmosphere (NIWA), Environment Canterbury, transit New Zealand, Ministry for the Environment, Montgomery Watson Harza (MWH), Landcare Research, and Lincoln University. The conference was also supported by the New Zealand Hydrological Society, Institute of Geological and Nuclear Sciences, and considerable support and co-operation from the Christchurch City Council.

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