

## Reflections

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# UNDERGRADUATE ENVIRONMENTAL SCIENCE THE MURDOCH STORY

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### Abstract

The undergraduate degree in Environmental Science at Murdoch University has been a 14 year experiment in providing a new kind of disciplinary training and profession. Some achievements are examined and possible directions for the future reviewed.

This paper is about an experiment in environmental education in Western Australia - the establishment of an undergraduate degree in Environmental Science. The experiment has hardly been discussed before, mainly because the experiment was still going on, but 1989 represents a new phase of that experiment after the retirement of the Foundation Professor Des O'Connor. Some perspective is thus attempted on its achievements and possible directions for the future are examined.

It has been an important experiment because there are very few places in Australia or overseas where there has been such a commitment and vision to seeking solutions to environmental problems through education. This is mainly because there are not many places where a new University has been founded in the past 15 years with Environmental Science as a foundation discipline.

### Personal Background

I caught the environmental bug in 1970 from Paul Ehrlich's "Four Corners Show" whilst completing a very regular single discipline education - a chemistry degree and PhD at the University of Western Australia. I became aware that the environmental challenge would be the great issue in which to be involved for the next few decades and so sought to do further study. Nowhere in Australia could

I find a course in which to study Environmental Science so I packed up my bags and went to the Netherlands and then California. Fortuitously, Murdoch University was being established while I was away so I was able to return and help set up this new degree. Now you can obtain an environmental qualification in every Australian University and in many CAE's. However, most of these new courses or programs are postgraduate qualifications which build onto a first degree in one of the sciences or in engineering.

### Undergraduate Program

At Murdoch (and Griffith) we have an undergraduate program as our base and several postgraduate offerings that build on this. There are two major implications in how Murdoch has developed:

1. Full-time staff: Those courses that build on present degrees and hence present department structures, inevitably have small full time staff numbers and depend on the goodwill and commitment of isolated lecturers and their courses buried in various disciplinary structures. These people are very important in any team and we have many useful inputs from other staff but it is not their main task in the University. One thing that has become very obvious in the past 15 years is that central issues are not solved as hobbies. We now have 12 full time staff at Murdoch University in Environmental Science who provide the backbone to the teaching and, of course, the research in Environmental Science.

2. New Discipline: What is also very obvious when you face the environmental problems of our day, particularly the apparently intractable global problems, is that we must have interdisciplinary solutions. This almost goes without saying these days, although it certainly did not in 1970. Thus when Murdoch and Griffith started the opportunity existed to establish a new discipline: Environmental Science. This discipline would address environmental issues directly and be structured in a new way without the strictness of a traditional university carve-up of the physical sciences, life sciences, engineering sciences and social sciences.

Thus at Murdoch University the opportunity arose to establish a genuine experiment in environmental education, with many implications for education in general and for the future of our state and nation.

I would say from the outset that I think the experiment has had a successful outcome but that the real fruits of our experiment will be borne in the next 10 to 20 years when the graduates it has produced leave their mark on our society. The first signs are encouraging.

### History

To describe the experiment I should go back to the start. In the early 70's Western Mining endowed a Professorial position in Environmental Studies to give the first impetus. The story goes that it was offered to the University of Western Australia but they turned it down because they did not know what it was. So Murdoch University, which was much more entrepreneurial, grabbed it as it set about establishing its own distinctive programs. Thus in February 1972 an advertisement appeared in the *West Australian* saying:

The Chair of Environmental Studies has been established through an endowment from the Western Mining Corporation. No conclusions have yet been reached on the particular aspects of environmental studies which should be stressed or on the nature of any undergraduate or postgraduate courses and these together with the administrative

arrangements will be matters for discussion with prospective appointees.

Obviously Murdoch University did not know what environmental science or studies was either!

Professor O'Connor was appointed to tell them what it was and see if they could do something. The Murdoch Foundation Professors wanted the Professor of Environmental Studies to be a sort of resource that could come in and do a bit of their programs, i.e. give a few lectures in chemistry or biology or social sciences with an environmental flavour and maybe run a few community courses ... But that was not what he saw. He wanted to establish an undergraduate program which would build interdisciplinary thinking and real world problem solving into its very structure. It was to be a degree to produce practitioners.

The full degree structure as first envisaged by us back in 1974 when we began the experiment has taken a long while to complete; it obviously is not fully there yet, but the basic approach has been in place over most of the past 14<sup>1/2</sup> years since our first year began.

The first and major commitment was to establishing an Environmental Science degree rather than Environmental Studies to ensure that the degree was oriented to solving the practical environmental problems facing government and industry. This was also to ensure that our graduates soon developed reputations as being employable professionals and probably also reflected an attempt to combat the 70's attitude in Western Australia that environmentalists were just a bunch of stirrers who talked a lot but did little.

### Environmental Science

I will outline the basic structure of the degree in Environmental Science. The degree can be either a 3 year B.Sc or a 4 year B.Env.Sc. In 1988 there were 121 students in the 3 year degree and 11 students in the 4 year degree with the last 3 years showing substantial growth in the program.

The first year is basic science (Physics, Chemistry, Maths and Biology) plus one introductory overview course in environmental

science related to the Swan Coastal Plain.

The second and third years are applied environmental science courses in four major areas:

Atmospheric Science; Waste Management; Applied Ecology; and Field Courses.

These are filled out with an overview course in each year - one related to global issues and the other State issues.

The fourth year is a professional year in which courses are given in Environmental Law, Impact Assessment and the Occupational Environment.

Thus there are disciplinary orientations at the start with one small attempt at bringing things together and then the degree comes more and more into applied areas in which the disciplines become less distinct, although the material is still hard science and engineering and the interdisciplinary "drawing together" becomes more and more apparent. The final professional courses equip people to solve problems and relate to real practical issues.

As well, Murdoch University has a flexible degree structure and thus social science courses from the other side of the University can be done and indeed two courses are essential. The most popular courses taken are in environmental history, environmental economics and environmental ethics.

At the end our students know quite a bit of the following core disciplines:

Chemistry, e.g. how it relates to soils, water quality and pollution.

Physics, e.g. how the atmospheric and hydrologic processes can be described using physics and thus for instance the dispersion of pollutants can be calculated.

Mathematics - a background in both statistics and calculus (and of course computer science) is provided but in particular the emphasis is on how they can be used to model a pollution problem or a biological system.

Biology - particularly ecosystem structure and function, and how inter-related changes occur, also the toxicology of chemicals in ecosystems and humans.

Social Science - the legal system in relation to environmental matters, how decisions are made about new projects, cost-benefit analysis, the history of environmental management, the political system and how it functions on environmental issues, departmental structures, and how human values relate to the problems we face.

The above is a tall order to try to do in three or four years. The reaction from outsiders usually is: surely it is better to get a good grasp of one discipline first and then add on some of this environmental activity?

I believe it is quite possible to do an undergraduate environmental science which does justice to the core disciplines. Most disciplines do not have to be studied for three or four years before you can take from them the useful areas for environmental science. I studied chemistry for 8 years but I think that 6 months could have given me most of the major themes and insights which I have used since. My observation of how our graduates perform as professionals indicates to me that an integrated undergraduate science degree does provide sufficient training in the basic sciences as well as in their application to environmental problems. There are also strong education advantages in having to teach the sciences in a context which is applied and relevant - it is not difficult to motivate students in environmental science.

However, it is also useful to do it the other way and add an integrated environmental approach at the end of a straight science degree. Thus, we also cater for the add-on student at Murdoch University with two diplomas:

- We have a Diploma in Environmental Science for graduates in other disciplines looking for a broad coverage of the scientific basis of environmental matters. The Diploma is made up of our key undergraduate courses in the three year degree and can be done in one year. This option at present has 33 students.

- We also have a Diploma in Environmental Impact Assessment which is a fourth year level qualification and is thus a

professional diploma which emphasises management, assessment and law. This began in 1988 and has 26 students. There is a big demand in this area in Southeast Asia and so it will be made available over there shortly. Its major orientation is to the assessment of new projects.

I should also say that all of these courses are available externally, i.e. you can do them at home with occasional campus sessions in field and laboratory courses. Around about a third of our students are external though for many their degree is a combination of internal and external modes which gives them flexibility in their employment and timetabling. External students in surveys have generally found the courses to be satisfactory though most would prefer to be on campus.

When I said at the start that the experiment had been a success I did not mean this to be judged merely because we have been able to attract some students - although this is some part of the success as students would not be enrolling unless they could see it had something to offer.

The real success of an educational program must be in:

- (a) whether it is making better citizens in general who can participate in solving environmental problems; and
- (b) whether it is making better professionals who can play an active role in solving environmental problems.

#### Better Citizens

Every year there are several hundred graduates who leave Murdoch having taken at least one of our environmental courses - in our flexible structure these courses are available across the University and the overview courses in particular are very popular. It gives me considerable pleasure to see such graduates popping up all over the place, e.g. interviewing on the TV and actually knowing what to ask, making sensible comments in the "Letters to the Editor", contributing to the impact assessment process on general and specific issues as they relate to them, leading conservation groups etc.

We have a well-informed public today on environmental matters. From my involvement in the EPA I can say that there is absolutely nothing that governments and companies can get away with today on environmental matters. They have to face up to their environmental responsibilities, or be torn to shreds by the public.

It must have seemed so much simpler just ten years ago but now every project is subject to a fierce debate, it is analysed back and forth, dissected by the media and then stitched together and on society goes to the next issue. I happen to think it is better even though it is more painful and that out of such pain comes a better project with more public and environmental gain.

I like to think that the past decade of slowly developing environmental awareness has been at least in part due to Murdoch University and its courses.

I should add that one of the ways that Murdoch students have learnt about environmental issues is by being involved in them and by being drawn in through staff. Murdoch University has always had a high staff involvement in community issues. This certainly makes teaching very easy as the motivation is inbuilt and hopefully the process of involvement sticks with the students.

#### Professionals

The big advance in this State has been in the growth in environmental science as a profession. We have produced some 200 graduates in Environmental Science over the past 10 years and these have found their way into industries, mining companies and government departments.

## ENVIRONMENTAL SCIENTIST AND CIVIL ENGINEER

Wood & Grieve ENGINEERS is a progressive and innovative firm with a fundamental aim to understand and serve our clients needs.

We seek an Environmental Scientist and a Civil Engineer both with a minimum of 5 years experience.

The incumbents of both positions would be working on land development projects and marine works in the metropolitan area, country, and interstate.

Our Environmental Scientist would ensure that these developments were soundly based within environmental constraints.

An attractive salary and benefits package will be negotiated with the successful candidates.

The above advertisement is typical of many today in Western Australia. Even 5 years ago such an advertisement would not have existed. I would suggest that the use of the term "environmental scientist" has largely been created in this State by Murdoch University and its graduates. The advertisement says a lot, not only because of its message of commitment to solving environmental problems but because it so clearly distinguishes the profession as distinct from the civil engineer who would normally have been used on this kind of job.

Murdoch graduates in environmental science are in very high demand. Last year's survey of graduates 3 months after graduation showed all of them in full time employment.

The other way that Murdoch University is involved professionally is through our consulting and research. Twelve staff full time makes a big difference in a small State. Our Environmental Science staff are involved in many kinds of research from basic through to applied science. Because of Murdoch University's early commitment to involvement directly in the issues of the day there has been a high profile of Murdoch University staff in the environmental issues of our State. Just as an example I have listed below a sample of the issues in which I have had research students involved in the past 13 years (mostly in joint projects with other staff):

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| <ul style="list-style-type: none"><li>. Solid waste siting and management</li><li>. The Use of Red Mud (bauxite processing waste) in agriculture</li><li>. Wetland water quality and waste management</li><li>. Environmental planning and Perth</li><li>. The re-use of Perth's waste water</li><li>. Urban energy use</li><li>. Managing remote area national parks</li><li>. The importance of rail systems in cities</li><li>. Organochlorine pesticides and their impact</li></ul> | <ul style="list-style-type: none"><li>. Traffic management</li><li>. Appropriate technology for remote area aboriginal communities</li><li>. The conservation and revitalization of Fremantle</li><li>. Environmental attitudes and public participation processes</li><li>. The impact of the America's Cup</li><li>. The North West Shelf development</li><li>. Biotechnology and its application to the upgrading of noxious industries.</li></ul> |
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Environmental Science have had no trouble attracting research funding - in 1987 we averaged over \$67,000 per staff member and the above list of issues has attracted over \$1 million in the past 13 years. Many of these issues have been possible to write up in international journals for the benefit or scrutiny of other academics around the world. However, many are local issues and have resulted only in a local report that has been part of the local decision-making process. It is difficult to say that such locally oriented research is less important than the international journal kind of research, especially in the development of a new profession locally.

There is much still to do but I believe that Murdoch University has played and is now playing a big part in providing the

answers to the environmental problems in our State.

### Hope

One of the interesting things for me in the past 14 years of involvement that I have had at Murdoch University and in the State's developing environmental conscience has been my own change in attitude. I used to be a "doom" person, I felt that the problems were out of control. Now I am a "hope" person, I see changes and hope everywhere. I edited a book in 1988 "Case studies in Environmental Hope" about the past 5 years or so in this State (Newman, Neville and Duxbury, 1988). Maybe I am just mellowing with age, but I have found 18 recent case studies where I believe we can say that problems have been reversed and issues resolved which leaves our State's environment

better off than before. Many of these issues involved Murdoch University and its graduates, and I hope in the next five to ten years there will be another 18 case studies in which they have played a further part.

### Challenges for the Future

Whatever has been done there will always be a need to change and develop to meet the new challenges of a changing society. I have suggested below that there are three levels at which environmental education needs to be involved and have outlined where I think a university like Murdoch could or should be heading to meet the challenges for the future.

1. Environmental Management (day-to-day short term issues).

The major thrust of Murdoch University's work in environmental science has been towards day-to-day environmental management i.e. educating the environmental practitioner. We have thus produced a large number of people who are now working as environmental officers in the private and public sectors. This has been the most successful element of Professor O'Connor's original vision as it has become an accepted and growing profession.

In future I believe Murdoch University will move into five areas of expansion with regard to management of the environment:

*Short professional courses.* The current decade's graduates are reaching the point where short professional courses could be of advantage and we are best placed to provide that kind of help.

*Environmental Engineering.* There is no current qualification which is fully oriented to the engineering solutions of environmental management problems. Some of our courses and some at other universities in Western Australia could easily be packaged to provide a useful joint program.

*Occupational Environmental Management.* This is a rapidly growing area and although other places provide occupational health and health policy courses there is nothing on the management of the occupational environment.

*Natural Resource Management.* Strong moves are underway to centralize agricultural education at Murdoch because we have linking programs and plenty of space for expansion. The possibility then arises for us to be more closely involved in natural resource management. The possibility is there to expand into forestry and park management through this avenue - both areas of need for local tertiary training in Western Australia.

*Landscape Architecture.* A joint program has been drafted with the new Murdoch University program in Horticulture to move into landscape architecture. The design elements will need to be developed but the other basic courses are presently available and the market has been positively identified.

2. Environmental Assessment (medium term issues)

The technical aspects of environmental impact assessment are proceeding quite well through our present offerings and their potential expansion into Southeast Asia through our links there. These courses are basically approached as a technical exercise to highlight the impacts and address them.

However, there is a new challenge we have yet to adequately address: social impact.

We are not used to living near to wealth production activity. Several matters have impacts through the images that are associated with their words, e.g. for several years "marinas" were anathema in this State - the Hillarys marina and the Fremantle America's Cup Harbour were fought all the way. Technical reassurances were not enough. An enormous effort went into the physical impacts, to keep talking to people scared about the loss of sacred territory, i.e. beaches or local amenity. For many this was a very difficult period - a lot of pain was felt.

Now it is not an issue in Fremantle or Hillarys but maybe there would not have been quite so much pain if more had been known about how to

deal with the issues at a social perception level. Today the issues concern "radiation" and "toxic waste" and also "big" developments, particularly downstream processing industries.

How can such issues be resolved? Simply put, it requires 'environmental mediation'. In the United States there are now Institutes of Environmental Negotiation or Mediation. They have recognised the need for new skills in interpretation, of empathizing, of working through issues in community forums ("the butcher's paper routine") and of collective bargaining. This requires the kind of person who has technical skills as well as social and political skills. Maybe a new diploma in Social Impact Assessment is required, or maybe an enlarged section of the present EIA Diploma is required to be taught with more input from the social sciences. It is a real challenge for the State and for us at Murdoch University.

There is probably also a real niche for the establishment of an Environmental Mediation Unit within our consulting and research Institute for Environmental Science. Such a body could have a few highly trained and experienced graduates who could be used to mediate in the difficult issues which face government on many fronts at present. The neutrality and independence of Universities is a real asset in such a situation.

3. Environmental Awareness (long term issues)

The long term issues to do with energy, water, soil and forests which need constant monitoring and consciousness raising are best dealt with in university courses. The issues of greenhouse, acid rain, ozone depletion, soil degradation, loss of diversity etc., need to be constantly addressed.

Murdoch University has a number of units/courses specifically in this area as well as a broad-based undergraduate degree Population, Resources and Technology (with 64 students at present). It involves

environmental policy courses, economics, philosophy and politics. We also have a graduate Diploma in Science, Technology and Society and a Masters by Coursework in Science and Technology Policy which are new and small.

These areas will need to expand to provide perspective and policy orientations to deal with these long term issues. Further development of short community courses should also assist society in providing an insight into the issues beyond the odd sensational media article. In a society which is increasingly aging, retiring earlier and with increased leisure, the importance of such courses should not be underestimated. Also their value in making people think through where we are heading must always be asserted as who else is making these kinds of assessments and coming up with creative solutions to the thorny intractable issues mentioned above?

**Conclusions**

Murdoch has developed in a little over a decade an experiment in tertiary environmental education which has made a significant contribution to the resolution of environmental issues.

If Murdoch can expand its environmental education activities in the three areas outlined above it should continue to play an important, if not essential, role in meeting the environmental challenges of our future.

**Reference**

Newman, P.W.G., Neville, S. & Duxbury, L. "Case studies in environmental hope", Environmental Protection Authority, Western Australia, 1988, p.185.

**Footnote:**

Based on a paper to Australian College of Education Seminar on "Challenges in Environmental Education", Bunbury, July 1988.