Adult Environmental Education and Ecology

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A B S T R A C T

Land management is often a three-way partnership between management agencies, scientists and community members. Co-operation between these three sectors in working for better environmental outcomes has a long history in Victoria, and nature conservation has often previously been achieved through successful adult environmental education. The recent development of an ecology course on the Box and Ironbark forests continues this tradition. It was organised by the Department of Natural Resources and Environment (DNRE) for community interest groups and was taught by scientists.
This article presents the results of qualitative research into some participants' view of their learning on the course. It suggests significant directions for adult learning in environmental education. An intensive experience of field-based scientific inquiry appeared to prompt not only ecological learning but also development of aesthetic, moral and action dimensions for the interviewees. The article suggests that environmental education needs to embrace fruitful elements of various learning methods for adults, including scientific learning about ecology. The process of enabling people to extend their knowledge of natural settings and processes can also enhance their relationship with and commitment to these places.

The Federal Government discussion paper on the future of environmental education *Today Shapes Tomorrow* (Environment Australia 1999), recognises the need for integrating knowledge and understanding of the natural world with that of the social and political world. Further, it recognises the need for lifelong environmental education through continual refreshment of adults' knowledge and skills, particularly through community organisations and the workplace. It also calls for closer links between government agencies to enhance their commitment to environmental education.

These three aims should prompt reflection on adult environmental education and the agencies that have a role to play in its delivery. Citizens who make or influence decisions about nature conservation, both in the community and in government agencies, need to do so from a grounding in knowledge and skills *as well as* in attitudes and understanding. The absence of the former qualities may lead to ill-informed or inadequate decisions, whilst the absence of the latter qualities often prompts social and political problems, as decisions made on predominantly scientific grounds are rejected because they do not accord with people's perception of their interests and needs (Benson 1998). Hence it seems desirable that to achieve effective nature conservation through community involvement, adult education should develop the full range of qualities considered as part of environmental education since the Tbilisi Declaration (1977).

Scientists and environmental education

In nature conservation there is a long, solid history in Victoria of close cooperation between 'the three corners of the conservation triangle'. At the 'corners' are scientists, government land management authorities and 'the community', who have learnt from each other and often worked together for nature conservation (Robin 1994, p.156). Natural scientists have made a three-fold contribution to such cooperative efforts: knowledge of natural history, leadership as environmental educators, and as senior administrators or advisers with land management agencies. Hence a tradition has developed in which some scientists are active participants in developing and enhancing community awareness and participation through scientific knowledge and understanding.

Key figures in this tradition, such as von Mueller (director of the Botanical Gardens in Melbourne in the 1850s) and Baldwin Spencer (Professor of Botany at Melbourne University around the turn of the century), used a mixture of their official roles, education and activism to fight for nature conservation (Bardwell 1974, Mulvaney & Calaby 1985).

More recently, Professor J. S. Turner advocated a broad view of science as 'an essential humanity' and therefore a means to realising the moral imperative of nature conservation (Robin 1994). He and his contemporary, Crosbie Morrison, contributed to school curriculum, environmental activism, broadcasting and journalism as well as holding professional roles as scientists and land managers. Morrison's conviction that a society that valued scientific literacy could be enriched by it, particularly through the celebration of Australian flora and fauna and the protection of local natural places, was demonstrated to be effective by his household name status as an environmental educator (Griffiths 1996, Robin 1994, Pizzey 1992).

Field studies, ecology and environmental education

Such people were pioneers of environmental education as they used scientific tools to develop people's knowledge and awareness of natural places, and to achieve lasting nature conservation benefits. They communicated their knowledge, love and pride in the unique value of the bush to fellow scientists and a wide range of ordinary people. Their approaches were grounded in the field naturalist tradition, from which the current science of ecology has largely emerged. This tradition arose from people's close association on a daily basis with their local version of nature. The approach encouraged practical field-based development of awareness, curiosity, close observation and the habit of personal collection

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of detail about the natural world. Such skills have only relatively recently been extended to include the emphasis on data collection, the definition of processes and the generalising capacity of ecology.

'Field naturalist skills and practices have declined in both our private lives and in school curriculum, as urbanisation has removed most people from close proximity to natural settings'

Field naturalist skills and practices of have declined in both our private lives and in school curriculum, as urbanisation has removed most people from close proximity to natural settings. Yet both adults and schools continue to seek enjoyment and education through spending time in the bush. It would be unfortunate if the strengths of a respected tradition were overlooked by environmental educators, as these strengths have an important role to play in developing people's relationship with the environment.

Environmental education for adults

At present there are few opportunities for environmental education for adults (Brennan 1994, Benson 1998, Clover 1998). The prevailing logic has been that the education of children is a more effective tool for long term change. But adults can also be an effective target audience for education programs, as adults often reach many others (including children), or can be significant players in a community, group or locality. Such people are able to enthuse and organise, to offer skills and information. Adult learners have several advantages for educational outcomes. Apart from their capacity to influence and educate others, they are already motivated, they feel a strong, practical and directed need to know, and they often already have high levels of expertise which enriches shared learning experiences for all involved (Knowles 1978).

Many current government strategies in nature conservation and land management call for community consultation and participation as a means to make the role of the responsible agency more effective. If these processes are to be productive, there is a significant need for programs that address community knowledge, attitudes, values and skills. As Clover (1998) points out, although many adults are now aware of the dimensions of environmental problems in the broad sense, this is an insufficient basis for action. What is needed is 'to take non-formal environmental education beyond the simple notion "public awareness" ... into a realm of active critical and creative engagement and support them [adults] in the process of change'. As the Federal discussion paper develops into policy and reaches implementation, environmental educators will need to search for ideas and models for successful detailed learning opportunities for adults and community groups as well as for school students.

But in environmental education there is considerable diversity of opinion about what should be taught, and how, especially the role of natural science teaching, which has been seen as part of the dominant 'scientific paradigm', and therefore compromised as a tool. Some researchers continue to explore ways in which a better grounding and relationship can be achieved through scientific concepts and encounters with nature (Cobb 1998, Caduto 1998, Ferreira 1998, Munson 1994, Weilbacher 1993). But others tend to encapsulate 'science' as the problem 'which has caused the ecological crisis', therefore the epitome of bad practices. To these analysts, science often lacks an adequate ethical foundation or affective basis. It is relevant more as a subject for critique by students on their way to finding more 'holistic' paradigms than as a valuable tool with wide-ranging benefits (Bell, Russell & Plotkin 1998, Fien 1997, St Maurice 1996, Greenall Gough 1994).

A recent innovative course developed by the Victorian Department of Natural Resources and Environment offers an example of adult, community education in the Box-Ironbark country of north-central Victoria. As it is run by the government land management agency, the course's style is determined by that agency's predominantly scientific outlook and expertise and by considerations arising from its role in managing public land for many stakeholders with diverse values and attitudes to it. Consequently, the course focuses its methods and content squarely on ecology, and is taught by scientists. This paper is an account of some aspects of a qualitative research inquiry into what and how several participants learned at it.

Ecology Course

The first six-day-long residential Box-Ironbark Ecology Course was run in October 1998 for thirty participants by the Flora and Fauna Program of DNRE. It was part of the implementation of the Biodiversity Strategy (DNRE 1997).

Its aims were:

- to extend community knowledge of this much depleted and degraded ecosystem;
- to make available some of the scientific work that has been done in the area;
- to develop understanding and skills in data collection, analysis and interpretation for the participants.

The teaching was led by scientists and no particular expertise y participants was assumed in the Course program.

Profile of the participants

DNRE encouraged participation by members of organised 'user' and other interest groups that were important from a land management perspective. These included teachers, scientists, local government officers and land managers, (both

land owners and employees of land management agencies). There were also participants from associated industry uses, such as mining, and those with volunteer or recreational interests. Their educational and professional background was diverse.

Considering this diversity of interest and experience, the success of the Course for both the Department and the participants depended on a crucial element - communication between the 'corners' of the 'triangle'. The expectation was that scientific knowledge, observation and skills would be made clear and relevant to community members to encourage their wider involvement with the management issues which concern the Department and others.

Course Program

The program used good adult education practice in that it followed an educational sequence, beginning with a general overview of broad landscape considerations in the field, followed by opportunities to practice skills and data collection techniques. These were then used to address 'typical' problems.

Basic skills, terminology and concepts were introduced, and reiterated by practice, for example in soil texturing and pH testing. The course was field-based, involving small groups working on different aspects of the same area, under guidance from scientists. Groups explored a range of ecologically varied sites and land use situations covering geology, soils, flora and fauna, practising systematic observation and questioning, applying terminology and data collection techniques.

Participants conducted mini research exercises, structured by the instructors. These emphasised problem solving, involving small groups determining method, collecting and processing data and communicating findings, with 'expert' assistance.

Methods used were 'scientific' in that they mirrored the processes that ecologists would usually use in assessing a landscape or a site, asking the same kinds of questions, gathering the same kinds of data. (Modifications of scale, time frame and simplification of method were used in the tasks.)

Research Method

The research aim was to investigate the Box-Ironbark Ecology Course in order to understand the nature and extent of participant learning in the short term, and to determine any action outcomes in the long term. This paper reports on the outcomes of the first two of three interviews. The third, held some months after the course, will be the subject of another paper on the relationship between learning and action.

The interviews were individual, with eight of the thirty participants (limited to this number for practical reasons). The interviewees were selected to cover:

- a range of educational and professional backgrounds;
- a range of the interest groups that attended;
- a balance of men and women of different ages.

They were not representative of the community at large, but rather of interests in this area and its future. They were approached by phone and by letter, and informed that the purpose was to explore their learning about ecology, not course evaluation, which was a matter for the course organisers. Ethical considerations included ensuring interviewees' anonymity from the Course organisers and instructors, as well as from other participants.

Interviews were tape-recorded and transcribed. Each was about an hour long, one held the week before and the other the week after the course. I chose to conduct extended personal interviews because I wanted to encourage flexibility and development of the interviewees' ideas, and to ensure opportunity for clarification. In particular, the use of prompts gained from the first interview as a follow up to material volunteered in the second one enabled the interviewees to compare, develop and reflect on the ideas articulated at the first interview.

Questions were open ended and sought to establish at each interview:

- the participant's background in relation to the course aims and content, reasons for interest, expectations, and intended outcomes;
- awareness and understanding of some basic ecological ideas and how these could be seen or applied in this particular ecosystem;
- participants' ideas and intentions for further use of this experience.

In undertaking this research I was interested to find out what the effects of a thorough engagement with the scientific method in natural settings meant to participants in the process. What and how did they learn, how did they value what they learnt, and how would they use it?

In the context of environmental education, these questions have something to offer in response to the questions: Can effective environmental education occur in the overall context of the scientific paradigm? What can 'science' offer in understanding our relationship to the natural environment? Just a narrowly defined set of analytical knowledge and skills, or a means to a range of personal and social responses? In the research into participants' learning and attitudes, I hoped to address these questions.

The interviews were transcribed and grouped around key ideas relating to those areas where the participants felt they had gained the most significant learning (Erlandson, Harris, Skipper & Allen, 1993). Their validity was checked against brief verbal responses recorded from all the participants at a plenary session held at the course and against a post-course evaluation conducted by DNRE. The interviewees' responses were surprisingly similar in emphasis and focus, and I found

no reason, post-interview, to assume that any other combination of participants would have strongly altered the findings.

The research indicated development in interviewee's understanding and attitude after a week's practical, field-based ecological education, as described below. A further outcome, beyond understanding and appreciation, of accommodating this into appropriate behaviour, is more likely to occur when the person involved has knowledge and skills to generate options or choices for action (Slattery 1994a, 1998, Hungerford & Volk 1991). After the first two interviews, interviewees were also able to describe actions that they thought would be helpful in implementing their growing understanding and attitude. Whether these actions will actually happen is the subject of the third interview, held five or six months after the course.

'It cannot be taken for granted that people understand or appreciate the ecological basis for nature conservation'

Research findings: an ecological basis for learning about the environment

It cannot be taken for granted that people understand or appreciate the ecological basis for nature conservation. Some of the participants' experiences and ideas about this aspect of their learning are described below.

Place contextualises abstract understanding

Interviewees had limited understanding of the big organising ideas of ecology and found it difficult to describe them in terms of the bush. They seemed to have had little previous inclination to apply, expand or extend the basic principles they acquired at school age to actual places.

Such concepts — what is a soil made of, what do insects 'do', why are plants and animals distributed the way they are, how does climate affect living things and so on — were limited in the first interviews. Ecology seemed to be a matter of recall of abstract analytical diagrams in scientific text books, descriptive of an idealised world, not applied to anywhere in particular, and not directly observable: 'We probably learned more about the actual area than I thought' suggests this participant's post-Course observation that ecology is about practical observations of real places.

This application of abstract knowledge extended even to those with quite sophisticated knowledge. One participant, the author of Biology textbooks, still learned to apply his knowledge: 'Certainly you know there are invertebrates, insects, termites, turn over a log and you might see a flatworm, earthworm, ants and so on. I'm aware that they exist but I just hadn't put them in a context, and I know I should have because they have an important role in recycling nutrients and so on'. He later indicated that he would now place logs and sticks around the contours to encourage leaf litter to accumulate on steep slopes on his land.

Interviewees expanded their general concepts through using the opportunity to apply them immediately. This led to a heightened awareness of detail:

> I've never looked at ground litter, logs, stumps, stuff like that. There were two logs in a V and all around it was bare. But in between those logs and under them were a lot of critters, in that little area, such diversity, look outside it and there was nothing. The amount of vegetation that was there, the invertebrates, just because those two logs were there, soil was there. I've never looked that hard before.

Thus this participant applies his recognition of the value of soil for plant and animal diversity and the processes needed to allow soil development in eroded and degraded areas.

So it seems that while adults may have abstract knowledge, it can be enhanced through practice in applying it to real places and processes.

Acquisition of vocabulary as an aid to observation

Overuse of technical terms or scientific nomenclature is described as limiting or narrowly focussing inquiry (Gough 1994), but acquisition of terminology can also go hand in hand with the need to describe a new idea. With directed observation and inquiry, both processes are stimulated and can be mutually beneficial in development of understanding. 'I just didn't have the language clear in the head to think about the processes and how to describe the landscape or landform.'

'Plant community' is a common ecological concept, but few interviewees were able to describe it confidently or broadly before the course (they saw a community as trees only, and in very general terms such as 'Eucalypts'). The concurrent acquisition of the term and concept changed the way one person looked at the landscape:

> That plant communities are diverse within a landscape type and can be predicted/recognised by applying different aspects of ecological understanding. It's changed how I look at the bush, its much broader now, every 100 metres may be a different vegetation community (he went on the describe detailed observations of the diversity of individual plants on a trip to the bush).

Here acquisition of language does not narrow the experience, as in naming; nor does it distance the learner as jargon does. Instead it accompanies and enlarges thought and observation.

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Misunderstanding is addressed

Media presentations and education for children often focus on simplified ideas, whilst adults need more subtle and complex understanding (Munson 1994). For example, 'the bland understanding that 'if there's bush, there's habitat' was replaced by heightened appreciation of the complexity of habitat values. Interviewees variously assumed that trees necessarily offer good habitat; that hollows are all big and high in trees; that many small young trees are more valuable than one old hollow one. More precise knowledge about the needs of a range of animal life showed them that a rapidly growing stand of uniformly aged, uniform species trees may look green and dense but offers limited opportunities for food or shelter for arboreal mammals, ground dwelling invertebrates and reptiles, or thicket-loving birds.

For this reason, environmental education that does not include a firm grounding in thorough, accurate ecological knowledge and understanding could lead to 'action' responses which are likely to exacerbate the problem. Of particular relevance are community-based land protection programs, where ignorance may result in such activity as planting trees on natural grasslands, rapid removal of blackberries which are shelter for many small animals, or pulling out 'weeds' which are actually native plants. The needs of wildlife or native plants may not match simplistic assessments, based on various utilitarian and aesthetic concepts.

Cliches and stereotypes are reconsidered

Some conventional understanding about ecological needs is based on emotional or political grounds but not on knowledge of the actual urgency for biodiversity conservation. For this reason, in Victoria tall wet forest conservation issues are better known than short dry forest (or grassland) issues. Interviewees were surprised and upset to find that for Box-Ironbark forests 'There's only 15% of it left'. They re-adjusted their sense of the need for conservation and their view of where the issues lie.

The common assumption that some landscapes have more significant and valuable meanings than others is also conveyed by land management classification practices that create an apparent dichotomy: land is either 'wilderness' (National Park) or urban/rural. The corollary is that most effective nature conservation lies in work with the former and little in the latter. In this dichotomy, native vegetation on private land is hardly seen to be relevant, as it's a private matter what someone chooses to grow, hardly a matter for public concern at all. In the Box-Ironbark country such distinctions are blurred: the whole landscape has been profoundly altered by human activity. Participants found themselves challenged by their previously held assumptions that ecology was somehow separate from social, economic and political dimensions, in contradiction to those criticisms of science that suggest that it emphasises these conveniently separate categories.

One interviewee described this new perception: 'That all of the landscape is cultural product, a continuum, not one of different meanings.' In this way he demonstrated the link between his ecological and socio-cultural understanding. This understanding enriched participants' appreciation of the landscape, as they reflected on the struggle between the natural and human elements, which had led to the current scene. They saw a more flawed vision than the conventional 'pristine' image, which many Australians like to apply to 'natural' places, but this new vision enhanced their respect for the natural elements and processes which had survived extremely damaging past uses.

A common complaint against 'science' is that it operates on hierarchies of life forms and propagates human-nature dualisms (St Maurice 1996, N. Gough 1987, 1991). But science can also prompt ecocentric responses. On the Course, a process of careful, 'objective' observation and recording at a site made interviewees question elements they had previously ignored or assumptions that some vegetation or animal types are more significant, more interesting than others. They became aware of their ignorance of soils, mosses, lichens and invertebrates through learning with experts in those disciplines. 'To think that the soil is, in places, covered with a 100% layer of bryophytes and that I just didn't see any of them or even know they were there, protecting the soil.' was an idea with substantial implications for land use to a National Park Ranger.

'Doing nothing is conserving'

New ideas are introduced

A bush block owner re-assessed her sense of time and desire for control, absorbing the idea of leaving a place alone. 'Doing nothing is conserving. Observing and seeing how nature does it. In our enthusiasm, we're so keen to be doing, doing.' Instead, she began considering the useful, enriching but non-interventionist things to 'do' such as listing birds or mapping plants on the property, or fencing an area out and monitoring the effects.

For others, 'seeing at a finer scale' and understanding processes led them to see 'that revegetation of disturbed sites cannot duplicate biodiversity'. This arose from a morning spent comparing habitat opportunities between two adjacent sites, one a superficially healthy looking recently rehabilitated mining site, the other a far from healthy looking, but much more diverse area of State Forest.

Several interviewees began to recognise the value of corridors and remnants, in addition to the larger scale stretches of bush, for nature conservation. For instance, the simple realisation that even isolated trees can still be valuable to animals that can fly changed the interviewee's appreciation of the value of big solitary old trees in paddocks (for bats). In response to new ideas, interviewees began to clarify their values about alternative ways of relating to the land, as shown in these examples.

Learning about ecology offers a method of observation and inquiry

The use of a sequence of systematic observation and data collection on different elements in the landscape gave interviewees confidence in their capacity to consider a range of factors and to ask themselves useful questions based on these. The scientific method is usually attacked because it is a method and therefore involves selection of what is observed, classification, application of general principles and transfer of knowledge from one place to another. These skills can also be strengths, opening up new opportunities for interest to those who were limited by previous habits and knowledge in their perceptions and observations.This process renewed and sharpened interviewees' skills of observation and seemed successful in opening up a learning process:

> The rocky outcrops still fascinate me - why are they so rocky? Were they rocky because it had been cleared or were they always that way? Was the soil in the process of forming? Would there be more soil there if we hadn't taken the trees away. I haven't made up the mind either way on that one, maybe both.

'It gave me the discipline to take the blinkers off, to look at the ground and in the trees, to look in the hollows, back in time, under the ground.' This process then became a basis for extending random observations:

> ... How it all fits together. In the Field Naturalists we look at a pretty orchid or a rare bird and not on ... explaining principles. ... a new thread of understanding that seemed to pull it all together, applied across a range of sites. So, principles of how to investigate a site and then how they all piece together to form the whole landscape... I can't say I know the answers but I know there must be some reason, and it's very interesting and I'd certainly be happy to try and investigate why and feel that I've got a few tools to do so.

The capacity to transfer this method to other places also helped to enrich participants' experiences: 'In my travels since then I've become aware of the different types of box trees in different places', or 'Now I notice the Grey Box and where they are in the landscape'.

Ecology provokes an urge for conservation

Close contact and detailed observation for a few days in an area that had been degraded had a three-fold effect in relation to conservation. Firstly it opened interviewee's eyes to the extraordinary diversity and resilience of the forest through connecting them with a range of powerful sensory and intellectual experiences. They described the highlights of the course as 'Seeing falcon take a rabbit', and 'Hearing an owl calling at night'.

Secondly, it increased awareness of the wanton destruction of the last two hundred years and removed any certainty that 'they' know what they are doing in the area's current management. A visit to an area of 300-year-old large Ironbarks stirred this realisation: 'I didn't realise how much timber they'd harvested. Until you've seen those large trees and possibly bigger ones, just the waste, the lack of management'. Ethical arguments about relative need and alternative value systems were stimulated: 'For a few thousand dollars all this could be razed.' or 'Do we really need to mine it, or do we just take it because it's there?' It is difficult to study ecology in a cultural or ethical void, so the critique that science uses a narrowly instrumental approach may be better explained as a limitation of particular teaching methods, than as a criticism of the intrinsic possibilities of ecology.

It is difficult to study ecology in a cultural or ethical void

Thirdly, it gave interviewees a strong sense of choice, and some of the tools of empowerment. Many people working in this endangered ecosystem have a general sense of concern or frustration, but all of the interviewees gained confidence that there were useful things they could do, knew where to go for further development of their skills and activities, and were reassured that others shared their commitment. Some interviewees reassessed their work priorities: 'A central issue for the city council now is to see how we can encourage private landholders to manage remnants'. A land manager valued her capacity to demonstrate problems to her managers, to enlist more effective support:

> It has enabled me to work to a different depth, to be able to evaluate the effects of those uses more systematically rather than just leaping to an emotional response 'Oh how terrible that that's happened, its wrecked the bush'. I can now go through in a systematic way and demonstrate why it has damaged the bush, a very good tool to have.

Whereas for a landowner, a practical project was suggested: 'Now I'd like to fence off some bigger areas and rabbit proof them and just see what happens'.

Understanding how ecological processes are related to time and to human actions also intrigued some participants. A teacher, needing to explain it all to others, valued an insight into how the processes happen: 'The problem for biodiversity is one of death by a thousand cuts, loss of habitat and ongoing disturbance.' Another person reflected on the need for patient, effective work with the landscape, rather than dominating it with short-term band-aid solutions: in one hundred years time, 'How much of the work we do now will make a difference?'

Discussion

The value of adult learning

Participant interviews from the Box-Ironbark Ecology Course confirm that in environmental education, learning is not a simple linear process either in time from childhood to adulthood or in the qualities involved. Rather, it follows a more complex interaction of variables such that an infusion of new knowledge into a person's framework may work synergistically with other aspects of their attitudes and understanding, leading them to new ground (Hungerford & Volk 1991).

This suggests that environmental education for adults:

- extends ecological learning acquired at school to act as more adequate basis for understanding or behaviour in adult life;
- can fill important blanks in people's knowledge of natural processes;
- develops tacit knowledge to become more explicit and practical;
- matches people's developing needs and interests with new theoretical understanding;
- offers skills and suggests actions needed to focus and advance new needs and interests;
- makes processes and elements of the landscape relevant that were not previously important;
- challenges people's assumptions that they know enough, and provokes them to redefine values by extending their capacity to observe;
- can develop 'community', through people sharing perspectives and experiences, clarifying values;
- provides the beginnings of a network, not only between participants but also with the scientists, by generating working relationships and shared purpose.
- can lift the quality of a person's enjoyment of place out of the humdrum by showing the excitement and fascination of 'discovery';
- extends 'community' skills' for scientists - communication skills, clarified understanding of what can be achieved, and new skills in presenting their observational methods and data gathering techniques in ways that interviewees could understand and enjoy.

Nature – a great teacher

Far from being the value free cause of current inappropriate responses and ideologies (Gough A. 1997), the Course appeared to build not only knowledge and skills, but also positive caring attitudes, and accurate, well-founded participation. Fien (1997) suggests that the teaching of 'nature studies' or ecology is over-emphasized, and should properly take its place as a 'necessary' precursor to teaching the more overlooked areas of social justice and economic relationships. The research described above draws attention to the interconnected nature of the processes involved in successful environmental education to achieve both purposes.

Whilst it is important to apply a corrective to the dominance of narrowly instrumental scientific knowledge in addressing environmental concerns, it is also vital to keep focusing on how and why people might feel interest in and responsibility for the natural world. Connection to, knowledge of natural places and processes are the solid foundation from which people develop ethical positions. As Beringer (1990) points out, the development of a sense of moral community with animals, plants, soil and water is strongly related to the direct experience and knowledge that a person has of these. Ethical responses are developed from reflection upon these experiences and connections, rather than from an abstract sense of social or ecological ethics and justice. A higher sense of moral responsibility is also related to the person's knowledge of the matter under consideration, added reason for teaching ecology.

'Ethical responses are developed from reflection upon experiences and connections, rather than from an abstract sense of social or ecological justice'

This sense of moral community, of relationship is vital if people are to be taught positively. We cannot hope to provoke concern only through emphasizing a series of disasters: salinity, global warming, poverty and injustice leading to catastrophic loss at a global level. The desired end-product is people appreciative of the functional role of natural systems in maintaining the earth's health, convinced about the ethical and spiritual value of biodiversity, and willing and able to work towards maintenance of those values and systems (Fien 1997). To overuse negative or abstract material towards these aims is not sound motivational practice either educationally or psychologically. Regrettably, this practice of presenting the negative as a motivator to learning or action is reasonably common in both environmental education journals and popular presentations of 'the environment'.

In ignoring the dialectic that has always existed within science and between science and the community, in rejecting the value of learning through science, environmental educators run the risk of 'missing the boat', of not being part of changes in the way that science and community adult education may develop in concert with each other.

Some ecological debate is about co-operation with the community, not unilateral imposition of authority on it. It asks what indigenous and local knowledge has to teach us. How do social issues of attitudes and understanding relate to development of problems or help with their resolution? How do we develop guidelines for non-scientists working on conservation programs that assume some consistency of process whilst allowing for local variation (Klomp & Lunt 1997). Environmental educators need to communicate with

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scientists who ask these questions, rather than resorting to crude generalisations about 'science' and its simplistic educational processes and unitary claims to truth (Bell, Russell & Plotkin 1998).

Conclusion

The tradition of interaction between those involved in public land management described in the introduction has been fruitful for nature conservation in Victoria. Its effectiveness derives from the fact that people do not learn in conveniently separated paradigms, nor do they learn in isolation from the world they are learning about. The development of ideas and practice in a community is dependent on diverse and stimulating encounters between the 'real world' and people, and between people who share a desire to know or are willing to share their skills and beliefs. The involvement of science and scientists in these encounters can enrich this process and act as a means to more than just scientific outcomes.

Walker (1997) calls for a 'theory of action' which integrates and draws from various theories in order to achieve solutions. Systematic observation in close contact with the natural world, 'looking at a finer level' enhances enjoyment and appreciation; it opens new opportunities for interest and learning; it enlarges and adds specificity to tacit knowledge and enables people to make connections both within and beyond their experience. Theories of action in education involve arousing people's curiosity, extending their vision, exciting them to the possibilities, offering them support of known tools and skills and then devising ways forward. The research described above indicates some ways this might be possible and what such ways might contribute to the practice of environmental education.

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