

An Evaluation of Saltwatch: A School and Community Action Research Environmental Education Project



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A B S T R A C T

The Saltwatch environmental education program aims to increase awareness and understanding of salinity and thereby to stimulate remedial and preventative action. An evaluation of the program in Victoria in 1995 revealed its wide use across school curricula, and subsequent practical environmental action in 53% of schools. Participation in Saltwatch and subsequent environmental activities were more restricted in community groups. The paper concludes with a discussion of Saltwatch's success and possible improvements.

their communities (Wills 1987) Saltwatch in Victoria currently links school students and landholders through co-ordinated state-wide water sampling. Its objectives are to encourage participants to become aware of their environment, to assist them in gaining information and understanding of the process of salinisation through real life research experiences and to develop and expand both rural and urban community links in order to promote cooperative action to address land degradation (White 1987).

Saltwatch was developed and managed by State Salinity Education Officers and the Country Education Project, with support from other government agencies including the Department of Natural Resources and Environment (DNRE), the Department of Education, the Rural Water Commission and the Department of Agriculture. The program in Victoria is funded by government agencies and is currently managed by DNRE.

In 1988–89 registrations of groups with the program increased rapidly and water samples were collected in both autumn and spring. In 1990 the program expanded to South Australia and Queensland and, in Victoria, a special "Saltwatch Week" was developed. In 1992 New South Wales and the Australian Capital Territory joined Saltwatch.

The program is co-ordinated by a range of personnel: one hundred and ten local co-ordinators who are staff of either State government departments, the Rural Water Corporation or municipal government or are Landcare co-ordinators. Their responsibilities include visiting Landcare and conservation groups and schools, assisting with salinity measurement and maintaining a local network for any subsequent action programs. Ten regional co-ordinators organise local co-ordinators and also visit groups. A State co-ordinator manages the program, produces educational materials and liaises with key people in regions.

Much environmental education has been criticised because although it has incorporated environmental content into existing curricula it has not involved participation in social action with community agencies (Greenall Gough & Robottom 1993). Such participation allows students to experience nature for themselves, to explore problems created by human activities and to generate and take part in their solution. This type of multidimensional personal involvement is more likely to create environmental awareness, increase knowledge and to foster lasting commitment to environmentally responsible behaviour (Hawkins 1987, De Young 1993). During the last decade a number of environmental programs which encapsulate these principles and link educational institutions and the broader community have emerged, such as those described by Greenall Gough and Robottom (1993), Wals et al (1990) and Schreuder (1994). The Global Rivers Environmental Education Network (GREEN) which started at the University of Michigan's School of Natural Resources is now a worldwide program. In Australia Saltwatch, focussing on salinity, was initiated in Victoria in spring 1987 and with other state-based water quality monitoring programs came under the umbrella of the federal Waterwatch program in 1993 (Pfueller 1995).

Inspired by the British Domesday project in which schools throughout Britain collected a range of information about

Prior to each Saltwatch Week or fortnight when water sampling occurs, resource materials are sent to groups and briefings are held for local co-ordinators and groups. These resources are sent to each registered participant group as a kit which includes maps, posters, computer disks and other curriculum material, including games, background activities, experiments, overhead masters, quizzes and puzzles, to support schools classes. During Saltwatch Week students, teachers, farmers and other members of the community collect water samples from rivers, creeks, bores, channels, drains and dams on both public and private land. A local agency coordinator visits schools to assist in testing its salt content. Results are sent via either formatted computer disk or electronic mail to DNRE for collation and the production of salinity maps which are then returned to the schools or landholder groups to serve as a basis for further research and education on salinity and groundwater throughout the year.

‘As a participatory environmental education program, Saltwatch in Victoria has become a model for other states’

As a participatory environmental education program, Saltwatch in Victoria has become a model for other states for the development of similar programs which address either salinity or broader water quality issues. Its popularity and rapid growth in schools and landholder groups have been seen as indicators of success. However, although the usefulness to Victorian schools of the Saltwatch material was assessed in 1993 (Marshall 1993), no formal evaluation of the ability of the program to achieve its broader educational goals has been conducted. This study has, therefore, been directed towards an examination of the extent and nature of participation in Saltwatch week, the perceived adequacy of the program’s structure and the extent to which the program has resulted in behaviour directed at further increasing environmental awareness and addressing environmental problems through remedial or preventative action.

Method

The following indicators of the Saltwatch’s performance have been derived from the original objectives of the project (White 1987):

- Understanding of the purpose of the program.
- Nature and extent of participation
 - total number of people and groups involved.
 - the number of water samples collected and the frequency of sampling.
 - the level of use of Saltwatch material.
- The adequacy of educational processes and material.

- Action arising from the program that indicated greater environmental understanding and concern
 - increases in communication about water quality and land management issues—between government departments or between the lead department (Natural Resources and Environment) and outside bodies.
 - media coverage of the program and associated issues.
 - numbers of new landholder groups established.
 - number and types of new environmental projects associated to address salinity.
 - number of joint activities conducted by schools, landholder and other community groups related to transferring information about salinity or to conducting ‘on the ground’ projects.
 - land management changes.
- the nature of improvements to Saltwatch suggested by participants.

On the basis of these performance indicators three different questionnaires were prepared for coordinators, schools and landholder groups. The questionnaire for coordinators was trialled by the regional coordinators but due to time constraints the other questionnaires could not be pretested. In September 1994 questionnaires were posted with postage-paid and addressed envelopes to 277 primary and secondary schools, 18 landholder groups and to co-ordinators, 146 of whom operated at the local level and 10 at the regional level.

Questionnaires were returned from 155 (56%) of the 276 schools involved, 6 (33%) of the 18 landholder groups, 66 (45%) of the 146 local coordinators, and 8 of the ten regional coordinators. The low response rate from landholders and failure of some respondents to complete the questionnaires imposed some limitations on the interpretation of results. For example, some responses to questions which asked for a numerical response, such as “How many conservation groups have been established in your area over the last 2 years?” were answered with a tick or “unsure”, making it difficult to give clear numerical results. With such questions, direct numerical results have not been reported, but rather percentages of respondents who gave a positive response. Responses to open-ended questions about the purpose of Saltwatch and possible improvements were grouped around themes.

Results

Saltwatch participants

The number of groups involved in Saltwatch has increased since 1987, peaking in 1990 as shown in Table 1.

Table 1: Registrations, data return* and total samples for 1987–94

No.	Year	Groups	% Return	Samples
1	Sep 1987	92	NA	4843
2	Mar 1988	115	NA	4342
3	Sep 1988	300	83	7210
4	Mar 1989	392	73	7430
5	Oct 1989	264	63	6037
6	May 1990	496	76	7431
7	Mar 1991	340	85	7327
8	May 1992	429	82	8096
9	May 1993	290	93	6284
10	May 1994	306	83	2449

*The % of groups who returned their data to the central office of DNRE

In 1994 at the commencement of this study, 296 groups were participating in Victoria. These included 210 primary and 68 secondary schools and colleges—both government and private, 15 Landcare groups and 3 other community groups. Twenty-three percent of the schools had acted as the regional sampling centre. The number of groups involved reached a maximum in 1990, oscillating between 300–400 subsequently. The reasons for this decline and variability are not clear, but numbers involved may have been influenced by the introduction of a fee for registration in 1993. The focus for Saltwatch participation ranged from education about the environment and sustainable agriculture, to revegetation and land rehabilitation.

In the responding schools, 6489 students participated in Saltwatch in 1994. Of these, 4014 collected water samples. On the assumption that the responding schools—56% of the total in the state—were representative, these figures suggest that total student participant numbers were approximately 11000, of whom around 7000 collected samples. Participation was greatest in Years 5 and 6, the last two years of primary school as shown in Figure 1. Primary School year levels (Prep to Grade 6) and secondary levels (years 7 to 12) are referred to in the terminology currently used in schools in Victoria.

In the 6 responding landholder and conservation groups, one hundred and twenty six people were involved. This suggested that around 370 people belonging to such groups participated in Saltwatch.

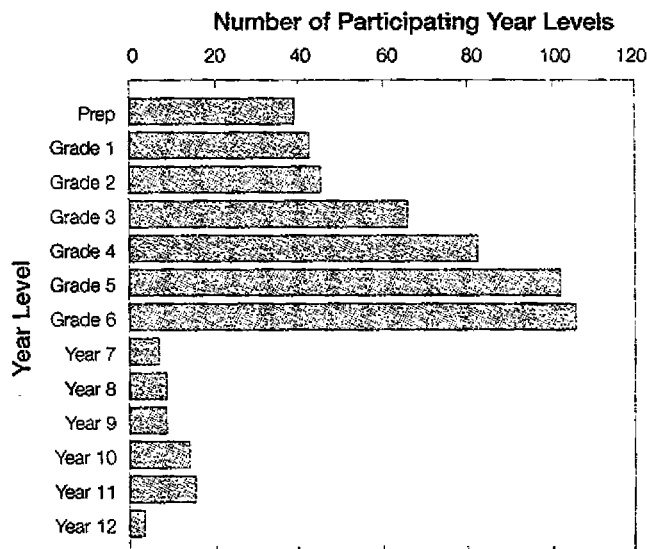


Figure 1: Year levels of school students participating in Saltwatch

Approximately half of Saltwatch participants were recruited through the activities of coordinators; others were contacted through conservation or community groups, individual landholders, television, the Country Education Project, Education News, each of which was nominated by 5% or less of respondents. Most of the coordinators (78%) had become aware of Saltwatch through the lead agency DNRE, although 31% of the respondents had also learnt of it through newspaper or television reports, other agencies or conservation groups. Just over half the participants saw the aim of Saltwatch as raising awareness of the causes and effects of salinity. Others saw the aim as gathering data, improving community involvement in environmental management or improving the environment through community action.

Nature and frequency of sample collection

A total of 4521 water samples were collected by the responding 56% of schools, suggesting an overall total across the state of around 8000. In the 6 responding landholder groups, 89 individuals had taken water samples and of these, 54 sampled from their own land with a total of 115 samples being collected, suggesting a total of around 340 samples for the 18 participating groups. These figures indicate a total of samples greater than the number reported by DNRE and shown in Table 1. A major factor in this discrepancy would be the restriction of samples recorded by DNRE to only those more than 2 kilometers apart such that many collected were not reported to the agency. Most samples were from privately owned land—Figure 2 over the page.

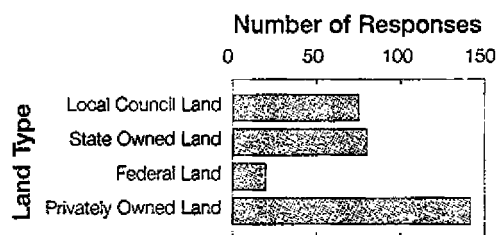


Figure 2: Types of land on which water samples were collected

In schools, data was managed by class teachers (67%), science coordinators (28%) or those responsible for computing, geography, environmental studies, the head teacher or by students (each 10% or less).

Adequacy of the educational process and material and its level of use

Training sessions for local coordinators were organised by 7 of the 8 responding regional coordinators. Staff from only 23% of schools had, however, attended professional development sessions. The most useful time for such sessions was suggested to be either 2–4 weeks prior to the sampling week (79%) rather than 1 week (15%) and preferably between 4–6 pm.

‘maps of salinity were used broadly across school curricula’

Nearly all schools (90%) and all six landholder groups received maps of Saltwatch data after sampling. These maps of salinity were used broadly across school curricula—Figure 3. In many schools their use was more focussed in science, geography, maths or environmental studies and in some instances—grouped as “Other” in Figure 3—they were used in a variety of other classes such as rural or integrated/general studies, or for community discussions and displays. Landholder groups used the data mostly for publicity and education for either the local school or the general community.

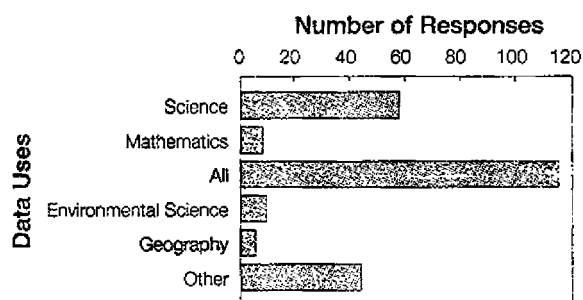


Figure 3: Subject areas in which data collected during Saltwatch are used in schools

Exercises supplied to schools were used by 90% of the respondents in a range of disciplines, with science and environmental studies predominating—Figure 4—but with one school using them in art and another in health studies.

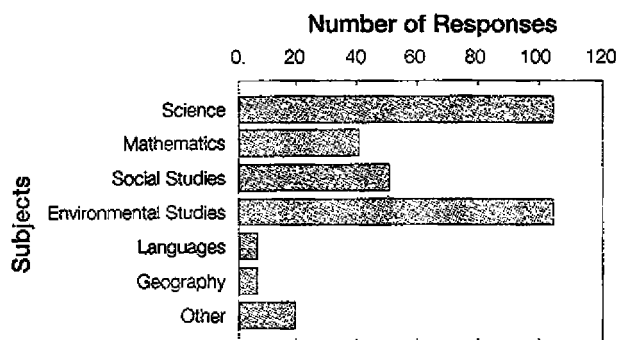


Figure 4: Subject areas in which materials supplied in the Saltwatch kit are used in schools

Background activity material and experiments were most useful—Figure 5.

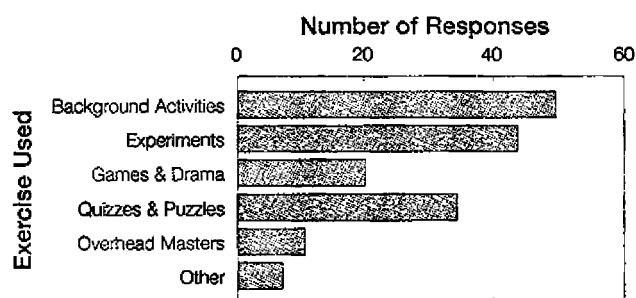


Figure 5: Frequency of use of Saltwatch kit materials

Most schools were satisfied with the quality of the materials provided but, of the responses which indicated a need for improvement, quizzes, puzzles and experiments were thought to require most attention—Figure 6.

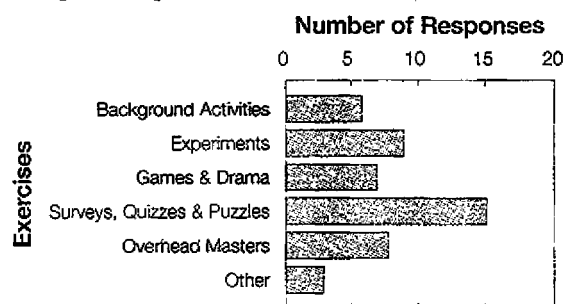


Figure 6: The need for improvement in Saltwatch kit materials

A range of additional education material was requested, mostly for visual representations of salinity and its effects—Figure 7.

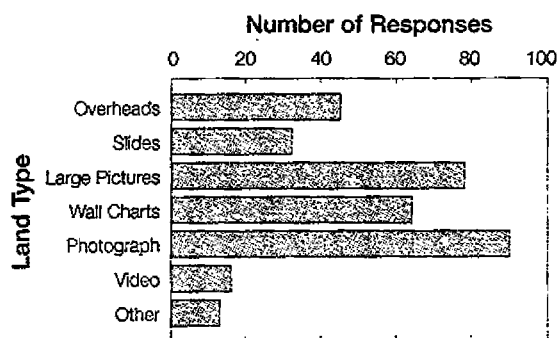


Figure 7: Additional education material required for use in schools

New community interactions and projects arising from Saltwatch

An attempt to assess whether action resulted from the environmental awareness engendered by Saltwatch was made by examining interactions between community sectors and by determining the number of new community or conservation groups, new projects to address land management problems and applications for project funding.

Although only 12% of schools shared salinity data with other schools 58% have established communication with a range of community and conservation groups, government departments and private landholders—Figure 8—mainly in the form of telephone calls, meetings and letters. This pattern was reflected in responses from landholder groups.

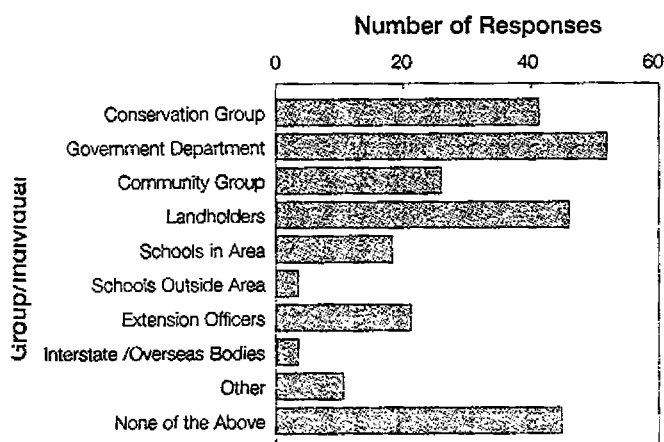


Figure 8: Kinds of communication established between schools and other community groups

In forty seven percent of schools, Saltwatch has received media publicity. This was almost entirely in local newspapers with only occasional schools reaching television, radio or national newspapers. Only two of the landholder groups had received any publicity and this was in the local newspaper or a school newsletter.

Sixty one new conservation or environmental groups were reported with 24% of these being formed in response to approaches by the regional coordinator.

Fifty three percent of the responding schools reported new cooperative projects arising from Saltwatch. Eighty percent of these projects involved treeplanting, sometimes in conjunction with seed collection and tree-growing. Sixteen percent involved water monitoring, often through Waterwatch, and the remainder involved an excursion to salt-affected property or participation in planning exercises. A number of schools participated in a range of activities with various government departments or community groups. The groups with whom these projects were conducted are shown in Figure 9. Among the groups labelled "Other" were two which were planting trees in their own school.

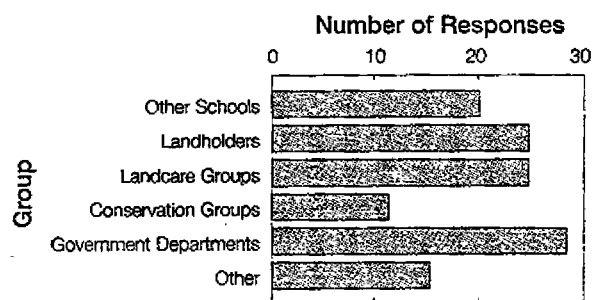


Figure 9: Cooperative salinity projects established between schools and other community groups

Three landholder groups had collaborated in a salinity project with either another landholder group, a conservation group or an individual landholder outside the group; four had undertaken projects on their own.

According to the 8 responding regional coordinators 133 applications for funding for projects had been made of which 70% were successful.

Changes in land practice

Whether any of the increased understanding of salinity resulting from Saltwatch stimulated changes in land practice other than the projects indicated above was uncertain. This could not be judged in schools and, of the small number of respondent landholder groups, only one indicated any change; this was related to the creation of wildlife corridors rather than to means for reducing the salinisation process.

Improvements to Saltwatch

Participants

Potential improvements were suggested by 53% of responding schools. The most frequently cited improvements were:

- allowing more samples to be entered on disk (12 schools). Limitations on the distances between samples meant that many students were disappointed because their salinity readings were rejected.
- a greater involvement of Saltwatch coordinators in training, sampling and follow up activities—staff in

schools were very pressured and often did not have the time or expertise to either conduct the monitoring properly or to interpret data (12 schools). Projections into the future were one suggestion for follow-up activities.

- a greater variety of educational material (8 schools). Many schools had participated for a number of years and students were becoming bored. Material targeted more appropriately to years 7–10 was needed, perhaps involving practical activities or specific projects that could be conducted throughout the year.
- more audio-visual material related to salinity reduction and remediation programs (6 schools).
- a greater emphasis on enlisting participation of landholders and community groups with school activities (5 schools).

Other suggestions from smaller numbers of schools were:

- earlier provision of material to increase preparation time (4 weeks, if possible).
- provision of guest speakers.
- travel subsidies to enable students to visit salt-affected areas.
- simpler maps of river and creek systems.

Coordinators

Fifty three of the 74 respondents made suggestions for improvement. These were, in order of frequency:

- a broadening of the focus of Saltwatch to include, for example Waterwatch or Frogwatch (12).
- better organisation to ensure that coordinators received material far enough before Saltwatch Week to plan activities, and results reached coordinators and schools while the issue was still current (11).
- development of stronger links with local Landcare and community groups (10).
- increased provision of training sessions (8).
- follow up sessions immediately after Saltwatch Week while issues were still fresh.

It was also suggested that the following be provided:

- certificates to students who participated (6).
- more promotion in the media (5).
- simpler computer software (5).
- smaller, simpler maps showing spatial distribution of salinity to facilitate comprehension by the public and graphs showing long-term trends (5).
- more frequent sampling (3).
- Saltwatch kits updated with new activities and them easier to use (3).
- lower costs of involvement (2).

Landholders

Only one of the 6 landholder groups suggested improvements; one expressed such dissatisfaction with the program that members would probably not participate again believing that monitoring was done only in 'hot spots' where results were predictable. Suggested improvements were:

- availability of more salt meters.
- more frequent sampling.
- broader publicity.
- provision of material for media releases.
- faster, more coordinated feedback on results.

Discussion and conclusions

For a thorough evaluation of Saltwatch questions relating to knowledge of the causes of salinity and its remediation and to the extent to which preventative and remedial activities have been undertaken would need to be put to a randomly selected population of school students and representatives of the broader community both before the inception of Saltwatch and after several years of operation. Because this has not been possible the success of Saltwatch had to be inferred by other means. The objectives of the program seem to have been clearly understood by those responsible for coordinating it. Information provided by Saltwatch about salinity was reaching in excess of 11000 school students and 300–400 adults directly, and the families of these participants indirectly; a wider spread of information has been achieved through media coverage of activities in nearly half the schools across most regions. The data and resulting maps were perceived as useful for educational purposes by schools and landholders, and as aids for talks or for media releases. They were used across a range of disciplines in school curricula indicating that salinity was recognised as being a problem which included a complex set of social and political issues, a characteristic of environmental education that has been reported to be often lacking at primary and secondary levels in the USA (Corcoran & Sievers 1994). Saltwatch educational kits were extensively used and well accepted. Therefore, in the light of a recent USA study showing that there is less environmental educational material available for teachers in the USA in educational journals now than 20 years ago (Wilson & Smith 1996), Saltwatch fills an important need.

One of the characteristics of Saltwatch is the establishment of links between government agencies with conservation responsibilities, schools and landholder groups. However, a critical element in evaluating the program is the extent to which these links have resulted in activities directed towards redressing salinity. The numbers of tree-planting projects and applications for funding indicate significant effort to take practical action. However, the lack of changes in land practice reported by landholders might suggest either that actions other than tree planting, such as the use of different pasture species or irrigation regimes, were not

recognised as being important or that land managers were not prepared to undertake them. On the basis of a study of landowners in the Loddon and Avoca catchments in central Victoria, which showed that the numbers of trees being planted as a result of Landcare activities were too low to have any effect on salinity (Carey et al 1993), it is vital that more fundamental changes in land management are undertaken than just planting trees.

Stimulation of environmentally responsible behaviour by education programs is known to require a complex interaction between increased knowledge, concern and motivation about environmental issues (Borden & Schettino 1979, Zimmerman 1996). Therefore, although Saltwatch had achieved high participation rates and stimulated considerable subsequent activity directed towards reducing salinity, increasing its ability to promote action would require attention to its content and to maintaining interest and motivation through organisational improvements. Responses of schools, coordinators and landholder groups indicate that its content could be improved by the provision of more extension activities like quizzes and puzzles, more visual aids like photographs and videos and the development of a greater variety of activities especially for older students. Such activities would provide further information, and reinforcement of the meaning and implications of the data gathered during Saltwatch weeks. Its organisation requires longer lead times between provision of materials and monitoring activities, more training sessions for local coordinators and school teachers, better feedback of results and their interpretation to participants and greater involvement of coordinators in monitoring activities. These requirements suggest the need for more staff in the central coordinating agency to provide materials and shorten data processing times. Failure to provide adequate resources risks creating frustration and disillusionment among participants and not only reduces the educational value of the program, but undermines the importance of the environmental lessons that are learnt (Australian Nature Conservation Agency 1995). Recent changes to the program include the distribution of a magazine *Snapshot*, which summarises the salinity results of each participating catchment, and an initiative to shorten feedback times by transmitting results by E-mail.

Although Saltwatch was widely used in schools and provided information to a range of age groups in the school population, it should be made more applicable to children older than Grade 5 and 6, so that it is not undervalued as something just for Primary School students. At the time of the study, the small number of senior school students involved, the low numbers of responses from landholder groups and the nature of their answers indicated that Saltwatch's potential was being realised in primary schools but not in the age brackets where career choices are made and where land management decisions are taken. Like much environmental education (Spork, 1992), it appears that Saltwatch had difficulties, in moving from a focus that was primarily towards imparting knowledge, awareness and

skills to one which included values, behaviours and actions. The improvements suggested by many of our respondents—to develop project-like activities for older students, incorporating Saltwatch within broader “environmental watch” programs and increasing joint activities between schools landholder/community groups—may be ways of shifting this focus and bridging the gap between students and land managers. Such cooperative projects between landholders and the rest of the community are also important in changing the commonly held perception that it is only landholders, rather than the community at large (Hartley et al 1992), who are responsible for both causing and solving land degradation problems. Similarly, there could be a greater emphasis on following up salinity measurements with projections of consequences to the land of continuing with present management practices, and on providing more practical opportunities for salinity reduction. Such modifications could make the social, political and economic context of salinity more visible to students and landholders and may establish pathways to prompt translation of knowledge into action. ☺

References

- Australian Nature Conservation Agency 1995, 'Waterwatch', *Green*, vol. 7, no. 4, p. 5.
- Borden, R. J. & Schettino, A. P. 1979, 'Determination of environmentally responsible behaviour', *Journal of Environmental Education*, vol. 10, no. 4, pp. 35–39.
- Carey, J., Wilkinson, R., Barr, N. & Milne, G. 1993, 'Establishing the basis for effective care of rural land', *Australian Journal of Soil and Water Conservation*, vol. 6, no. 1, pp. 44–49.
- Corcoran P. B. & Sievers, E. 1994, 'Reconceptualizing environmental education: five possibilities', *Journal of Environmental Education*, vol. 25, no. 4, pp. 4–8.
- De Young, R. 1993, 'Changing behaviour and making it stick: the conceptualisation and management of conservation behaviour', *Environment and Behaviour*, vol. 25, no. 4, pp. 485–505.
- Greenall Gough, A. & Robottom, I. 1993, 'Towards a socially critical environmental education: water quality studies in a coastal school', *Journal of Curriculum Studies*, vol. 25, no. 4, pp. 301–316.
- Hartley, R. E. R., Riches J. R. H. & Davis, J. K. 1992, 'A systems approach for Landcare', proceedings of 7th International Soil Conservation Organisation Conference, vol. 1, pp. 217–222.
- Hawkins, G. 1987, 'From awareness to participation: new directions in the outdoor experience', *Geography*, vol. 71, no. 3, pp. 217–222.
- Marshall, D. 1993, untitled paper presented to the Waterwatch Advisory Committee of Victoria, Melbourne.

- Pfueller, S. L. 1995, 'Community and water quality: initiatives in Gippsland', *Australian Journal of Soil and Water Conservation*, vol. 8, no. 3, pp. 26–32.
- Schreuder, D. 1994, 'The schools water project (SWAP): a case study of an action research and community problem solving approach to curriculum innovation', *Australian Journal of Environmental Education*, vol. 10, pp. 35–46.
- Spork, H. 1992, 'Environmental education: a mismatch between theory and practice', *Australian Journal of Environmental Education*, vol. 8, pp. 147–166.
- Wals, A. E., Beringer, A. & Stapp, W. B. 1990, 'Education in action: a community problem solving program for schools', *Journal of Environmental Education*, vol. 21, no. 4, pp. 13–19.
- White, T. 1987, *A Guide for School Communities: Community Education Sponsored Action Research*, Department of Conservation Forests and Lands.
- Wills, S. 1987, *An Australian Self-Portrait*, joint feasibility study for the Australian Broadcasting Corporation, Australian Computer Society, Commission for the Future, Commonwealth Schools Commission, Australian Bicentennial Authority, the Australian Bureau of Statistics & the Division of National Mapping.
- Wilson, R. S. & Smith, J. 1996, 'Environmental education and the education literature', *Journal of Environmental Education*, vol. 27, no. 2, pp. 40–42.
- Zimmerman, L. K. 1996, 'Knowledge, affect and the environment: 15 years of research (1979-1993)', *Journal of Environmental Education*, vol. 27, no. 3, pp. 41–44.

Questionnaires

Copies of questionnaires may be obtained from Sharron Pfueller, Graduate School of Environmental Science, Monash University, Clayton, Victoria, 3168, Australia.

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Ian Innes-Wardell is Environmental Management Coordinator at Moira Shire Council where his responsibilities include developing strategic policy for natural resource management within the Shire and developing educational awareness programs for the local community. His particular interest is in community education and he is involved in the Rural-Urban Links Program for primary schools in the area.

Previously a secondary geography and environmental science teacher, Helen Skondras is an environmental education officer for a waste management company in the greater City of Dandenong in Victoria. She organises community education through a range of local groups and runs an environmental education centre, including conducting educational visits of a materials recovery facility.

A community education coordinator in the fauna and flora program of the Victorian Department of Natural Resources and Environment, Dianne Marshall's responsibilities involve provision of advice and resources for biodiversity conservation. Her interests include the relationships between nature conservation and technology, and the effective use of technology and practical activities in educational activities.

Tarnya Kruger has been a secondary school teacher and is now a catchment education officer with the Victorian Department of Natural Resources working on schools' education about land and water conservation issues and in coordinating the Saltwatch program. Her interests include field and issue based education.
