

## **Cultivating a New Cattle Culture: Lifelong Learning and Pasture Land Management**

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*I suppose it would be better for the wildlife if we weren't here at all.  
But we are here and I think there's a place for beef cattle in this environment.  
Bob Dobson (Canadian Cattlemen 1995, 15)*

'Pasture land management' implies the planned and sustainable use of a grass-covered landscape by humans to feed and accommodate livestock. Pasture land may be found in a true 'grassland ecozone' that characterizes much of North America's Great Plains or it may be tame pasture and seeded to grass. In the latter case, grass is not the natural vegetational climax but it grows well where the natural forest cover has been cleared by human hands. Thus pasture land (a term used interchangeably with 'grazing land') is a social construction, created both as a conceptual land use category and as an area of land, that supports grazing activity. Grazing implies feeding domestic livestock such as cattle and sheep on standing grass, whether native or tame. Pasture land is an economic land use, driven by a profit motive to nourish animals and create value in human terms. Given the artifice and self-interest that is an integral part of the pasture land concept, it may seem paradoxical that sustainable pasture land management is concerned with restoring the biotic diversity and biomass productivity in a tangible and deliberate mimesis of the natural climax vegetation that once characterized the grassland and boreal forest ecozones. But we must also acknowledge that the notion of a pristine preindustrial landscape is no less a social construction than large-scale factory farms or, for that matter, current models of sustainable agriculture. Pasture land is a constructed landscape that has been subjected to human interventions that range from aggressive clear-cutting and a total change in vegetative cover, to the extensive use of rangeland in which animal activity, mediated through stocking density, has the greatest impact on the ecosystem.

This chapter illustrates how views about pasture land management have developed in Canada. Farmers and ranchers are growing aware of the environmental hazards posed by livestock grazing and they are increasingly looking at the landscapes they manage from an ecological perspective. They are applying new techniques to increase biodiversity and to reduce the impact of ruminant grazing on both upland and riparian zones. This process, which includes both the acquisition of knowledge about grassland ecosystems and changes in methods of grazing management, is presented here as a new cattle culture driven by a process of lifelong learning, leading to positive environmental outcomes that imitate the diversity and quality of the natural environment.

The chapter begins with a discussion of the importance of cattle grazing as a contemporary land use and as a potential agent of environmental degradation. The second section of the chapter reviews the literature describing the effect of various programmes intended to encourage sustainable agricultural practices. The third section discusses lifelong learning applied to agriculture with a selective review of efforts to transmit knowledge and induce behavioural change in those making grazing management decisions. To illustrate these processes, two case studies are presented. The first case study features informal learning by an Ottawa Valley farmer who is leading by individual example and sharing his methods with others. The second case study concerns a more structured but voluntary programme called 'Cows and Fish', operated by the Alberta Riparian Habitat Management Society, which works with community members across Canada to increase awareness about riparian zones.

### **Cattle Grazing as Land Use and Agent of Environmental Change**

Agricultural activity is an extensive land use, subjecting a larger area of Canada's ecumene to the environmental impact of human activity than any other economic sector. Cattle production is a vitally important component of Canadian agriculture. Of Canada's 230,000 farms, 30 percent are classified as beef cattle operations<sup>1</sup> and a further 8 percent are dairy farms. Notwithstanding the use of intensive and confined feeding techniques at some times of the year and for some classes of cattle, 38 percent of Canada's farms rely on the grazing of standing grass as a feed source. Of all agricultural land uses, tame and natural pasture represent 30 percent of Canada's agricultural land area, ranging from a low of about 10 percent in Prince Edward Island and Quebec to a high of 56 percent in British Columbia (Statistics Canada 2004). With this considerable land area subject to grazing activity, pasture land management plays a key role in the environmental sustainability of Canadian agriculture and in Canada's ecumene as a whole. The land area subject to grazing is vast. Cattle farms are dispersed across the country from the Avalon Peninsula of Newfoundland to Vancouver Island. Just as grazing affects a very large land area, any effort to promote

sustainable practices or to enhance lifelong learning about pasture land management must be conveyed over a very large area, presenting an administrative and communications challenge to information dissemination and technology transfer.

Contemporary concerns over the environmental impact of cattle grazing have a long pedigree in Canada. The British landscape painters of the romantic period offered bucolic images of rural landscapes featuring pastoral scenes of livestock grazing peacefully on rough pasture, providing a counterpoint to the environmental horrors of an urban-industrial age. In Canada, the link between domestication, animal husbandry and the rustic charm of rural landscapes was decisively broken in the late nineteenth century when the folly of Texas-style cattle ranching was first exposed on the Prairies. The early ranching industry in southern Alberta was an extension of a cattle culture and stock-raising technology that may be traced to the Gulf coast of Texas (Morton 1938, 91). And as in Texas, overgrazing mixed with periodic climatic calamities such as drought and winter kill signalled that an extensive and unregulated ranching system was unsustainable. In 1899, the Commissioner of Public Works for the North-West Territories observed: 'in the Pincher Creek District, which was at one time looked upon as one of the best grazing areas in the Territories, the range has become so eaten out owing to want of any regulations regarding the grazing of cattle at large, that some of the Ranchers there have had to move their cattle away to other and less crowded portions of Alberta' (Ross quoted in Breen 1983, 120). Jordan (1993) has argued that while climatic conditions alone would have eventually destroyed the Texas ranching system, overgrazing and competition with crop agriculture and sheep ranching in the U.S. hastened the demise of ranching on the open range. Free grass encouraged over-stocking in the rangeland states and so damaged the short-grass prairie that there was nothing left for cattle to eat. Jordan (1993, 239) concludes: 'The Texas system was not merely maladapted to the Great Plains; it was not sustainable in any environment and would have collapsed even in the lushest and mildest of settings.'

Contemporary grazing management has responded to the environmental fiascos of the late nineteenth and early twentieth centuries. Stocking densities are more closely controlled and monitored by grazing leases, stock raisers can reach their animals and deliver winter feed when it is required, and water can be supplied more reliably than was the case on the open range. Cattle grazing is perceived as a comparatively benign agricultural land use, unlike wheat monoculture or intensive livestock operations. Perhaps because pastoralism using standing grass seems like such a natural and traditional use of land, there has been a tendency to underplay its environmental impact until comparatively recently.

However, the environmental consequences of livestock grazing have attracted substantial scientific interest in recent years (see, for example, Fleischner 1994), and have led to mounting conflict within rural communities (Chilson 1997). The environmental threat from cattle grazing is becoming a contentious item on the policy agenda of rangeland states and provinces. Evans has observed the 'new range wars' in which the overgrazed public lands of the western United States are described as 'cow burnt.' Environmental activists argue that, 'Livestock ranching is the single most ecologically damaging activity we engage in' and that its environmental impact should be equated with clear-cut logging and strip mining of coal (Evans 2001, 69). The growing concern about the environmental impact of livestock has not been confined to the west. Increasing accumulations of soil nutrients and the threat they pose to water quality in central Canada point to a more generalized need for improved livestock management practices (Commissioner of the Environment and Sustainable Development 2001, 145).

Yet by incorporating fundamental grazing principles – rest, seasonality, intensity, timing, rotation and stocking rates – modern-day cattle grazing management can fill the ecological niche vacated through the extirpation of the plains bison during the nineteenth century. Bison are recognized as one of the key influences in the development of North America's grassland ecozone (Bradley and Wallis 1996). Unlike bison, which wandered over an extensive territory of thousands of square kilometres on an annual basis, domestic cattle are now more closely controlled and their movement constrained by fences. Thus, cattle grazing may be managed as an act of environmental mimesis, in which a domestic species imitates the impact of an indigenous species. The promotion of such mimetic practices points to the need for an improved understanding of the link between lifelong learning about the environment and motivating sustainable grazing management practices among cattle producers.

### **The Effect of Financial Incentives and Promotional Programmes for Agriculture on Environmental Quality**

Considerable research has evaluated the factors associated with the adoption of sustainable and environmentally responsive agricultural practices. Brotherton (1989; 1991) classifies participation in agro-environmental

programmes under ‘farmer factors’ (characteristics of producers that predispose them to participate) and ‘scheme factors’ (attributes of the programme that encourage participation). As an example of the former, farmers using environmentally sustainable practices in the United States tended to be younger and had higher incomes than conventional farmers (Comer, Ekanem, Singh and Tegagne 1999).

Wilson (1997) used Brotherton’s (1989) classification to assess participation in the Cambrian Mountains Environmentally Sensitive Areas (ESA) scheme in central Wales. The ESA is considered to be the ‘flagship of agri-environmental policy’ in the European Union, yet the principal motive for participation appears to have nothing to do with the inherent advantages of sustainable practices or any ethical commitment to the environment. Instead, cash payments were the principal motive for sustainable practices; Wilson’s survey revealed that for 69% of scheme participants, financial factors were the primary reasons for joining the programme. Conservation, as an intrinsic motive, was mentioned by only 6% of respondents (Wilson 1997, 77).

While attempts to reverse environmental damage with state subsidies to promote conservation behaviour have been effective, these efforts tend to produce short-term behavioural change. When the subsidies end, so too do the ameliorative farm practices (Jacobson, Sieving, Jones and van Doorn 2003, 603). Environmental education leading to progressive attitudes and changes in farmer behaviour and agricultural management practices would seem to be more effective in long-run environmental improvement. One step in this direction is to provide informative and pragmatic educational materials to teach farmers how they may make these improvements. (Jacobson, Sieving, Jones and van Doorn 2003, 603).

In a New Zealand context, Rhodes, Leland and Niven (2002) surveyed 718 pastoral farmers in Otago and Southland to explore the effect of the provision of information about riparian management. Reassuringly, they found that the level of exposure to information was positively associated with more positive attitudes, greater levels of knowledge, intentions to take actions to improve riparian health and the actual adoption of best management practices for riparian zones. However, all associations were relatively weak and in some cases respondents who received no information had actually adopted quite progressive attitudes and practices. Financial barriers inhibited investment in environmental impact mitigation such as riparian fencing. Thus, the provision of even minor financial incentives could increase rates of adoption of best management practices.

While some level of compensation may be an effective means of priming the pump and encouraging farmers to experiment with progressive management strategies, it appears that long-term changes in attitudes, behaviour and technique are required to ensure that sustainable practices remain consistent and integral aspects of management. One approach to inculcating such an outlook could be based on a lifelong learning ethic in which farmers internalise sustainable management techniques and apply them of their own volition.

### **Cattle Producers, Lifelong Learning and the Information Economy**

Although some aspects of the cattle producer’s lifestyle seem traditional and proudly based on a family farming legacy that dates to the nineteenth century, cattle raising, livestock husbandry and pasture land management are integral parts of the new economy and are profoundly influenced by the information revolution that continues into the twenty-first century. Cattle producers are deluged with information about cattle prices and market trends, farm financing, pharmaceuticals and nutraceuticals, environmental impacts and, of course, grazing land management practices. Based on the enthusiasm and rapidity with which many of these innovations are adopted, farmers and ranchers are learning about new methods and applying this knowledge in their day-to-day operations.

A growing proportion of farmers have had some form of traditional post-secondary agricultural education which is likely to influence their understanding, acceptance, and rate of adoption of sustainable practices (Comer, Ekanem, Singh and Tegagne 1999). However, much of the continuing process of technological change in agriculture may be understood as a lifelong learning process. The left-hand column of Table 1 portrays a top-down model of learning in which the agenda is set by the teacher while the student is a passive recipient and performer, progressing incrementally according to a hierarchically imposed system of performance, assessment and promotion. The lifelong learning paradigm represented in the right-hand column approximates the on-the-job training and ethic of continuous quality improvement that characterises the application of knowledge to contemporary agricultural production. Educators in a lifelong learning scenario seldom have the authority to judge and grade learning outcomes while the pedagogical environment is more likely to include informal group learning and a strong applied

component in a trial and error process. Trial and error suggests that it is the student who does the assessment and grading, promoting the concept, theories and techniques that appear to work, while failing those that prove less effective. To some degree, every farm functions as a laboratory and every farmer acts as scientist, student, and teacher.

Expanding on the contrast between traditional and lifelong learning, Table 2 presents a two-dimensional classification grid of learning modes. Structured learning modes include formal schooling and the informal instruction that takes place on the farm as an intergenerational transfer of technology, a socialisation process that features learning-by-doing with supervision by parental or community mentors. Unstructured learning may take place under the formal auspices of agricultural extension programmes operated by provincial departments of agriculture or by a host of promotional farm programmes such as the Canadian Cattlemen's 'Quality Starts Here'.<sup>2</sup> The latter are conspicuous by design, with a high media profile. But a less conspicuous form of self-paced and self-driven learning takes place informally in an unstructured environment every time a farmer observes some form of grazing behaviour or pattern of erosion, tries some new technique, no matter how trivial the change or how slight the advance, and then tells someone else about it in a chance meeting at the implement store or over coffee.

It is difficult to assess which of these lifelong learning modes, structured or unstructured, is the most effective in transmitting innovative agricultural practices or to measure which type of information and technology transfer is dominant. As an exploratory step in this direction, this chapter offers two case studies of environmental stewardship to promote sustainable grazing in Canada. The Dobson farm illustrates unstructured and informal lifelong learning by a single farm operator. 'Cows and Fish,' on the other hand, is a structured programme with funding from government agencies, conservation organizations and producer groups that is intended to foster lifelong learning and behaviour change with respect to grazing management decisions of thousands of producers throughout Canada.

### **The Dobson Farm: Unstructured Lifelong Learning and Environmental Stewardship**

Bob Dobson is the fourth generation operator of a family farm that has existed at the same location since 1857. Located between Cobden and Pembroke, in the heart of the Ottawa Valley, Dobson's operation is typical of Ontario's mid-sized cattle farms. He owns 250 acres of land, mainly in pasture, and he usually rents about the same amount of land to harvest hay and provide winter feed to his stock. Like many cattle producers, Dobson practises a form of adaptive management, shifting from one product and market segment to another based on his assessment of market trends and best use of the resource base. In 1989-90, Dobson transformed his farm-based business from cow-calf production to building up a calf weaning centre and backgrounding of stocker cattle, feeding them tame grass to build frame size in preparation for high protein grain finishing on an Ontario feedlot. Since that time he has shifted back into cow-calf production and is now developing his business as a specialty grass-fed beef producer. He now feeds his own stock to slaughter weight without the use of supplemental growth hormones or antibiotics and after having the animals custom slaughtered, he sells beef direct to consumers in the Cobden-Pembroke area and at the Carp Farmer's Market, in Ottawa's rural-urban fringe.

However, Dobson has become best known for his work in sustainable grazing land management and stewardship of the riparian zone of the creek that runs through his property. He was the first recipient of the Ontario Cattlemen's Environmental Stewardship Award in 1994. In 2003, he was inducted into Renfrew County's Agricultural Hall of Fame. His farm has been featured in *Harrowsmith* magazine (Webster 1994) and his achievements warranted cover story treatment in *Canadian Cattlemen* (1995), the trade magazine for cattle producers in Canada.

When he took over the farm from his father in 1967, best management practice called for maximum field size to accommodate large farm machines. Many fences, together with the vegetation and animal habitat that develops along fencelines, had been removed, and few trees or shrubs remained. The farm had been made as featureless and denuded of natural vegetation as possible to capitalise on the large-scale monoculture philosophy of the 1960s. Concerned with a shortage of water in the farm's stream during the summer months, Dobson began a long-term programme to regenerate the farm's natural habitat with a variety of trees and shrubs, particularly in the

riparian zone. He re-established fencing to subdivide pastures into the smaller units required to implement rotational grazing, restoring the smaller fields and linear fenceline strips of vegetation that characterised traditional Ottawa Valley agriculture in the nineteenth century.

Rotational grazing requires a reliable, year-round source of water that is accessible from each separate pasture unit. However, cattle can trample bank vegetation, accelerate erosion and, through their manure, contribute a heavy nutrient load to natural watercourses. The nutrients from manure encourage rapid growth of aquatic vegetation that then causes eutrophication and an increase in biological oxygen demand, reducing the capacity of the stream to support desirable species of fish, amphibians and aquatic invertebrates. As part of his rotational grazing plan and to protect his riparian zone, Dobson implemented the technique of off-stream watering to provide an alternate upland water supply. He built a 1,000 gallon (4,500 litre) watering trough of reinforced concrete, situated well away from the stream yet located so that it could water cattle in different pastures. To pump stream water 300 metres to the trough site, Dobson dug a shallow well and installed a floating pump powered by marine batteries that are recharged by a solar panel. The solar-powered distribution system was installed below the frost line and has operated at temperatures of -20°C and even colder with only one change in batteries between 1996 and 2004. The stream is now in much better ecological health than previously, supporting a vigorous community of fish and other aquatic life.

By 2004, Dobson had planted some 20,000 trees and shrubs, selecting species that provide the best and most varied habitat for birds and wildlife. The trees and shrubs also create shelter-belts to block the wind, protect wintering areas for cattle, catch the snow and retain spring runoff. Shrubs such as elderberry were planted between the trees along stream banks and fencelines to provide the varied habitat required for a balanced ecosystem to develop. Bird species such as loggerhead shrike now control the field mice, impaling their prey on the long spikes of hawthorn trees that shelter cattle in areas that were once open ground. Before and after photographs taken by Dobson as a simple but reliable on-site monitoring tool show the once denuded landscape in the 1970s and how it had been transformed by 2004 (Dobson Farm 2004).

How did Bob Dobson acquire his biodiversity ethic and learn the methods he applied in the award-winning redevelopment of his farm? He is a modest man who does not dwell on his achievements or how he learned the methods that have proven to be so successful. He 'read a few things here and there' and learned-by-doing. This self-directed informal and unstructured learning programme is well illustrated by a comment he made in 1996.

We used to wean our calves in the barn yard...in the weaning pen... We used to treat a fair number of cattle [for illness] like too many, too high a percentage. When – I think somebody suggested to me you know – and maybe it was that year also that we had some real good grass, real good pasture in October. So, it was too late to cut and try to make hay and the only animals I had to use it,... were these new calves that were coming in and I really was hesitant about letting calves out on to any pasture because we had to treat so many it was too hard to get them in. Once you put them out into a 50 acre field it's too hard to separate one to bring it in, [for treatment]. So, I had a bit of a ...what do they call it, a paradigm shift and all of sudden I thought I would try it. So as soon as we started weaning the calves in the field rather than into the barn yard, ... we immediately reduced the number of animals that got the sniffles and that we had to treat for shipping fever. We had healthier animals and any we treated bounced back the next day, you wouldn't know they were sick. So, once we got them out into the field they were much healthier. So, we now ... put a bit more fertilizer on towards the end of July or the first week of August to get a good flush of growth through the end of August...And we'll aim for about 150 acres of good 3rd or 4th grazed pasture fields for the months of October and November. And they [weaned calves] stay there until the snow comes. I mean we even leave them out there, there's the odd night you feel a little bit sorry for them and I've tried bringing them in, put them in the barn, but they are much healthier out there, even on a night when there are a few ice pellets coming and a little bit of freezing rain coming in November. (Interview with Bob Dobson, 31 July 1996)

This extended quotation gives a realistic sense of how a farmer develops an idea out of a suggestion with no certainty of whether it will work better than current methods. Dobson developed a new technique for feeding weaned calves on open pasture instead of in the barnyard where they were handy for diagnosis and treatment of disease. The field was a healthier environment so that less observation and treatment was needed. A mixture of a suggestion, a paradigm shift, and a successful experiment led to the development of a new grazing regimen. This is how Bob Dobson learned about pasturing newly-weaned stocker cattle and by using that same trial and error, learn-by-doing process, he has developed the many management innovations that contribute to the long-term economic and environmental sustainability of his farm. A firm believer in sharing what he has learned, Dobson now hosts a number of farm tours each year that welcome farmers and other visitors who want to learn about sustainable farm practices.

### **How Does a Structured Education Programme Foster Lifelong Learning and Behavioural Change?**

Riparian zones are vulnerable to disturbance from unmanaged cattle grazing (Belsky, Matzke, and Uselman 1999). If access to waterbodies is not restricted, livestock will spend a disproportionate amount of time there, attracted by easy access to water, shade and shelter (Fitch and Adams 1998). This may result in the degradation of the riparian zone's physical form and hydrologic functions and can lead to changes in the composition of both vegetation and wildlife communities.

In Alberta, where the riparian transition zone between upland areas and aquatic systems accounts for approximately 1.3 million hectares of rangeland, a partnership of government agencies, conservation organizations and producer groups combined forces in 1992 to establish what is now the Alberta Riparian Habitat Management Society. Also known as 'Cows and Fish', the programme's goal is to work with communities on riparian awareness, in order to improve the way that riparian zones are managed, and to enhance environmental quality and overall ecological function of riparian zones (Cows and Fish 2004a). In 2003, Cows and Fish was awarded the Canadian Environment Award for Environmental Learning. Cows and Fish is an example of a voluntary resource stewardship and conservation programme, designed to achieve its aims through a combination of education and information provision, along with community and social-capital development initiatives. The programme's approach, referred to as the 'Cows and Fish Process', comprises five elements – awareness and education, team building, tool building, community-based action and monitoring (Cows and Fish 2004b). Consistent with the lifelong learning model outlined in Table 1, the programme employs a variety of tools intended to increase awareness and promote sustainable management decisions in relation to riparian zones. The tools include community presentations given by Cows and Fish staff, riparian demonstration and profile sites, the use of profile producers and other local landowners as leaders of change, riparian health inventories and assessments, intensive field courses, workshops, a series of topic-specific fact sheets, technical liaison to assist landowners, guidance on forming and networking of local community groups, and a core document entitled, *Caring for the Green Zone: Riparian Areas and Grazing Management* (Fitch, Adams and O'Shaughnessy 2003).

It is not yet well understood within the general population that a degraded riparian zone can lead to declining water quality, increased erosion, more extreme flood events and loss of both aquatic and terrestrial habitat (see, for example, Fitch and Adams 1998). Therefore, the first element in the Cows and Fish Process, awareness and education, is meant to enhance ecological literacy about the benefits of healthy riparian systems. Ecological literacy means increasing an individual's knowledge about the ecological functions of riparian zones and supporting it with information on management options that may be suitable for a given site, enabling the individual to develop more positive attitudes and make independently informed decisions about management of that riparian zone. As observed by Bateman (2001, 77-80), ecological literacy is a precursor to the adoption of sustainable management practices and, equally important, continuing to apply informed management decisions over the long-term. This first element of the Cows and Fish Process is based on the premise that acquiring accurate information and positive attitudes are necessary conditions before a change in behaviour can occur.

Team building, tool building and community-based action continue to build ecological literacy, and are designed to construct local social capital, enhancing the probability that environmentally sustainable grazing and riparian zone management practices will be adopted. Team building creates partnerships among community

members including producers, interested individuals in the community, conservation and community groups, resource managers and local-area authorities. This is achieved by bringing together those who share common interests and perspectives on riparian health in the hope that local networks will emerge. This element is consistent with the view that educators are guides to a learning process as opposed to founts of wisdom (Table 1).

Tool building places practical information about sustainable riparian zone management and various grazing systems before producers and resource managers. Here again, programme staff act as conduits, co-ordinating tours of on-farm examples of management options. Demonstration site tours are often hosted by the producer who has implemented a particular strategy, who can explain how they decided to incorporate it into their management regimen, and share the benefits and any pitfalls so that others may learn from their experience. Fundamental to tool building is understanding that any strategy can be modified to suit conditions on any given operation.

The illustration and discussion of management options at a demonstration site tour highlights the important link between group learning and individuals applying what they learned.

It becomes a learning thing over time...my own approach to grazing management has changed completely. ... Seeing what did work, [I was] able to incorporate it into my own operation, to better my place... I did [this] right from the grasses, to the water quality, to the preservation of the creek bank, those are the real things I saw, that's what I'm working on right now. (Quoted in Bateman 2002, 5).

Community-based action incorporates locally-specific team building and tool building into communities that express an interest in working on riparian issues, allowing individuals and groups to set the direction and priority of their efforts, for example determining which reaches of a river could be inventoried to determine a health status, how neighbours can pool labour and resources to obtain new technology such as shared pumps for off-stream watering, or identifying sites they can use for demonstration purposes to show others the steps being taken locally to improve riparian zone management. Here, the role of Cows and Fish is to liaise, co-ordinate, guide and link people to each other and to technical/financial resources, as well as to assist with the formation of structured community groups where appropriate. All of these activities enable communities to take direct interest in and responsibility for learning about and managing their riparian zones. In describing the essence of Cows and Fish, a programme participant said: 'Thinking about the Cows and Fish programme as a whole... the key would definitely be the rancher grassroots involvement...without the rancher community, I don't think there would be a Cows and Fish programme, I think we'd be in the same place we are in the States.' (Quoted in Bateman 2001, 107.)

The fifth element in the Cows and Fish Process involves ongoing monitoring of the ecological health of riparian zones, evaluation and adjustment. Grounded in adaptive management principles, a key monitoring tool is the riparian health inventory which, once demonstrated, allows a producer to assess the status of several ecological functions and identify an overall health category for a given riparian zone (Cows and Fish 2004c). Various management and grazing strategies can then be contemplated and the most appropriate implemented. Producers are encouraged to monitor their efforts, repeating the inventory and assessment as necessary to adjust their management strategy.

A formal evaluation of the Cows and Fish programme (Bateman 2001) examined the effectiveness of its awareness tools aimed at promoting the concept of ecological literacy, as well as the attitude-behaviour relationship that underlies it. Focus group participants gave the highest effectiveness ratings to awareness tools that were field-based, hands-on, personalized and specific to local landscapes (e.g. field events, program staff, profile producers, and demonstration site tours). These tools provided opportunities for producers to observe riparian function and management options and exchange information about those topics in familiar surroundings. Maximising opportunities for family members and neighbours to share management information in a variety of interactive field settings was essential for learning. These tools, when delivered as part of a locally-driven and appropriately-paced process, had the most impact in developing ecological literacy, in particular when they provided flexibility for producers in choosing management options. These results reflected the community-based core value that frames the Cows and Fish programme.

Telephone interviews with 91 southern Alberta ranchers were then conducted to assess the development of ecological literacy. The interviews were conceptualized around the Theory of Planned Behaviour (TPB) (Ajzen 1991), a psychological model that explains the attitude-behaviour relationship. TPB posits that a change in one's behaviour will not occur in the absence of an intent to modify one's behaviour. Intent, in turn, is underpinned by three distinct components: attitudes (which include knowledge), subjective norms and perceived behavioural control, components that mirror the elements of the Cows and Fish Process.

Interview results revealed a modest but statistically significant positive relationship between exposure to Cows and Fish awareness tools and, for example, greater knowledge about riparian function overall, as well as understanding the links between riparian zone health and both water quality and water quantity. Bateman also found a modest but statistically significant link between exposure to awareness tools and adoption of two sustainable grazing systems: time-controlled grazing, where livestock access to riparian zones is carefully manipulated through the growing season, and riparian pasturing, in which the riparian zone is defined as a distinct pasture unit, separate from upland areas. Of note, was that the subjective norm component of TPB, the influence on decisions that an individual assigns to the preferences of significant others such as family members, friends and neighbours (Fishbein and Ajzen 1975), was also associated with the use of rotational grazing. This finding reinforced the group aspect of lifelong learning described by focus group participants when they defined the characteristics of awareness tools used by Cows and Fish that had the most impact on their attitudes and behaviour.

### **Conclusions**

The seminal notion of B.F. Skinner's (1954) work on operant conditioning was that learning leads to a change in behaviour. Lifelong learning about the causes and impact of environmental degradation and methods to avoid it should therefore lead to lifelong changes in the resource management techniques that are applied to the land. This chapter has shown that opportunities for lifelong learning, whether informal and unstructured as in the case of the Dobson Farm, or more structured community-based programmes such as Cows and Fish, have both led to a change in farmer and rancher behaviour. Both formal and informal modes of unstructured learning have clearly enhanced producers' understanding of the value of biotic diversity and ecological health on the farm and ranch. They have led to new and progressive attitudes towards the riparian zone, and resulted in tangible changes in grazing land management. These changes in behaviour are clearly revealed on the agricultural landscape. In the case of Bob Dobson's farm, before and after monitoring photographs provide vivid *representations* of enhanced biodiversity over a period of years – an interval marked by a change in grazing land management practices (Dobson Farm 2004). The knowledge and attitudes of producers exposed to the 'Cows and Fish Process' have been examined in a formal evaluation and were shown to reflect the positive impact of this lifelong learning programme (Bateman 2001). Cows and Fish (2004d) demonstrates the Skinnerian 'change in behaviour' by *presentations*, most notably in the form of producer stories, vivid vignettes that show in narrative form, how individuals and groups have learned about their environment, changed the way they manage their livestock, and identified personally with the positive and tangible outcomes in the appearance of Alberta's pastoral landscape. In both Dobson's personal philosophy and the more structured Cows and Fish Process, the message and the techniques are transmitted through an active social process that is embedded in the community and made vividly experiential by sharing field-based demonstrations that enable first-hand observation and a sense of trust that is shared among fellow producers. In both of these ways, lifelong learning is helping to cultivate a new cattle culture with a direct positive impact on pasture land management.

Table 1  
Traditional and Lifelong Learning Models

<b>Traditional Learning</b>	<b>Lifelong Learning</b>
Teacher as fount of all wisdom	Educators are guides to sources of knowledge
Knowledge reception	Learn-by-doing
Learn as individuals	Learn in groups
Tests as prerequisites	Assessment to guide future learning
Good students may continue learning, bad students may not!	Lifetime access to learning opportunities

Source: Adapted from 'Lifelong Learning in the Global Knowledge Economy: Challenges for Developing Countries' accessed 10 October 2004 from [www.TechKnowLogia.org](http://www.TechKnowLogia.org).

Table 2  
Learning Modes Grid

	<b>Structured</b>	<b>Unstructured</b>
<b>Formal learning</b>	School Vocational training Post-secondary	Extension services Promotional Programmes
<b>Informal learning</b>	Socialization Intergenerational transfers	Mentorship Self-taught Trial and error

## References

- Ajzen, I. (1991) The Theory of Planned Behavior, *Organizational Behavior and Human Decision Processes* 50(1), 179-211.
- Bateman, N.G. (2001) Evaluating the Alberta Riparian Habitat Management Program, unpublished M.A. Thesis, School of Graduate Studies, The University of Lethbridge, Lethbridge, Alberta.
- Bateman, N.G. (2002) Evaluating the Effectiveness of the Cows and Fish Program: Evaluation Summary, 2002. Report prepared for Alberta Riparian Habitat Management Program. Lethbridge, Alberta.
- Belsky, A.J., Matzke, A. and Uselman, S. (1999) Survey of livestock influences on stream and riparian ecosystems in the Western United States, *Journal of Soil and Water Conservation*, 54(1), 419-431.
- Bradley, C. and Wallis C. (1996) *Prairie ecosystem management: An Alberta perspective*, Occasional Paper No. 2, Prairie Conservation Forum, Alberta Environmental Protection, Lethbridge, Alberta.
- Breen, D.H. (1983) *The Canadian Prairie West and the Ranching Frontier: 1874-1924* Toronto: University of Toronto Press.
- Brotherton, I. (1989) Farmer participation in voluntary land diversion schemes: some observations from theory, *Journal of Rural Studies*, 5(3), 299-304.
- Brotherton, I. (1991) What limits participation in ESAs? *Journal of Environmental Management*, 32(3), 241-249.
- Canadian Cattlemen* (1995) 'Awards recognize Canadian stewards of the land' 58(8), 12-16.
- Chilson, P. (1997) Tree huggers and damned cowboys: The rhetoric of an environmental conflict, *North American Review* 282(1), 38-45.
- Comer, S., Comer, E., Ekanem, S., Muhammad, S., Singh P. and Tegegne F. (1999) Sustainable and conventional farmers: a comparison of socio-economic characteristics, attitude, and beliefs, *Journal of Sustainable Agriculture* 15(1), 29-45.
- Commissioner of the Environment and Sustainable Development (2001) Annual Report Chapter 1, Section 4. Ottawa: Office of the Auditor General of Canada. <http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c101sec4e.html> (Accessed on 10 October 2004).
- Cows and Fish 2004a About Cows and Fish - Alberta Riparian Habitat Management Program <http://www.cowsandfish.org/about.html>. (accessed 14 November 2004).
- Cows and Fish 2004b The Cows and Fish Process - Alberta Riparian Habitat Management Program <http://www.cowsandfish.org/process.html>. (accessed 14 November 2004).
- Cows and Fish 2004c Riparian Health Assessment - Alberta Riparian Habitat Management Program <http://www.cowsandfish.org/health.html>. (accessed 14 November 2004).
- Cows and Fish 2004d Community and Producer Stories - Alberta Riparian Habitat Management Program <http://www.cowsandfish.org/stories.html>. (accessed 14 November 2004).
- Dobson Farm (2003) Environmental Stewardship - Dobson's Grass Fed Beef Farm <http://www.dobsonfarm.com/enviro.html>, (Accessed on 11 October 2004).

- Evans, S. (2001) Grazing the Grasslands: Exploring the Conflicts of Relationships and Futures, *Prairie Forum* 26 (1), 67-84.
- Fishbein, M. and Ajzen, I. (1975) *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Addison-Wesley Publishing Company, Reading, Mass.
- Fitch, L. and Adams, B.W. (1998) Can cows and fish co-exist?, *Canadian Journal of Plant Science* 78(2), 191-198.
- Fitch, L., Adams, B., and O'Shaughnessy K. (2003) *Caring for the green zone: Riparian areas and grazing management*, Cows and Fish Program, Lethbridge, Alberta.
- Fleischner, T.L. (1994) Ecological costs of livestock grazing in Western North America, *Conservation Biology* 8(3), 629-644.
- Jacobson S., Sieving K., Jones G., and Van Doorn, A. (2003) Assessment of Farmer Attitudes and Behavioral Intentions toward Bird Conservation on Organic and Conventional Florida Farms, *Conservation Biology*, 17(2), 595-606.
- Jordan, T. (1993) *North American Cattle-Ranching Frontiers: Origins, Diffusion, and Differentiation* Albuquerque: University of New Mexico Press.
- Morton, A. (1938) *History of Prairie Settlement*. In W. Mackintosh and W. Joerg (eds.) *Canadian Frontiers of Settlement* Vol. 2, Toronto: MacMillan of Canada.
- Rhodes, H., Leland, L., and Niven, B. (2002) Farmers, streams, information, and money: does informing farmers about riparian management have any effect? *Environmental Management* 30 (5), 665-77.
- Skinner, B.F. (1954) The science of teaching and the art of learning *Harvard Educational Review* 24(2), 86-97.
- Statistics Canada (2004) *Census of Agriculture 2001* Ottawa.
- Webster, M. (1994) Is Beef Getting a Bum Rap? *Harrowsmith: Canada's Magazine of Country Living*, Number 113,18 (5), 30-37.
- Wilson, G. (1997) Factors Influencing Farmer Participation in the Environmentally Sensitive Areas Scheme *Journal of Environmental Management* 50 (1), 67-93.

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#### **Notes**

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<sup>1</sup> Canada's 69,000 cattle farms include approximately 500 large-scale feedlots, intensive grain feeding operations that feed grain and silage to cattle confined in pens. Many of these large-scale feedlots have no pasture land thus have no grazing activity.

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2.The Canadian Cattlemen's 'Quality Starts Here' programme is designed to educate producers and to promote the implementation of on-farm food safety initiatives such as Hazard Analysis Critical Control Point.