

Mountain bike rider preferences and perceptions in the south-west of Western Australia

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ABSTRACT

A mail-back survey of mountain bike riders in the south-west of Western Australia revealed that riders prefer natural settings and trails with a firm surface. Riders support a code of conduct and are aware of environmental and management issues associated with trail use. Differences between racing and recreation riders' preferences for trail features and facilities were detected. Riders who race prefer technically challenging trails with downhill sections, curves and jumps, whereas recreation riders prefer trails that are less challenging, but well marked and have drinking water provided.

The issue of riders spreading dieback needs more attention. There is some evidence of spread of dieback by recreation, however, the spread between locations by mountain bikes may be limited since the majority of riders clean their bikes regularly, some clean their equipment after every ride. Many respondents revealed a poor understanding of dieback and where dieback risk areas are located. There is a need for raising rider awareness and understanding of this disease.

Several respondents indicated that a bike trail similar to the Bibbulmun Track walking trail should be established in Western Australia. The development of long distance mountain bike trails would provide tourism opportunities. All riders agreed that more mountain bike trails are needed in the south-west of Western Australia.

INTRODUCTION

An increase in leisure has seen a corresponding increase in outdoor pursuits as part of nature based tourism world-wide. In Western Australia (WA), nature based tourism has increased annually by 25 to 30 per cent (Western Australian Tourism Commission 1997). Mountain bike riding is an outdoor pursuit that is also growing in popularity, especially in natural settings. Between 1984 and 1989, the number of mountain bikes in the United States of America increased from 200 000 to 5 million

(Blahna *et al.* n.d.) and mountain bike riding is the eighth most popular outdoor activity there (SGMA 1997). According to CALM (1999b), over 90 per cent of all bikes currently sold in WA are mountain bikes.

Corresponding with the increasing popularity of mountain biking is a growing demand for new trails and an expansion of existing trail systems. Meeting this demand is not easy since most trails throughout the world are established and maintained by agencies and organisations with insufficient resources. WA is no exception to this and the managing agencies, Trailswest and the Department of Conservation and Land Management (CALM), plan to expand the trail system in the State. This expansion will mean an investment of public funds in the establishment of trails and their ongoing maintenance. It is important that both mountain bike specific and multiple use trails are environmentally sustainable, and meet the needs of users (Goefelt and Alder, submitted).

In the case of mountain biking, meeting rider needs helps to ensure, firstly, that trails are used and therefore public money to meet the demand is well spent and, secondly, that trails are less likely to be modified by riders, or informal tracks established. In Marin County, California, only wide trails and fire tracks were open to mountain bike riders who subsequently established illegal trails that suited their preferences (Edger 1997). Obtaining information on rider preferences is an integral part of locating, establishing and managing sustainable trails. Such information, however, is often not readily available for trail designers and managers owing to a lack of resources or time constraints: a situation existing in WA where the only study on rider preferences was an unpublished study undertaken by Brindal and CALM (1995) that examined some aspects of trail design (such as encounters with other trail users, amenities and trail surface) in relation to a long distance mountain bike trail. Clearly there was a need to gather more specific information on rider preferences in WA.

Managers need to integrate information on the trail features and settings that mountain bike riders actually want if mountain biking is to continue to grow in an environmentally sustainable manner. Until recently little information was available on rider preferences and none of this related to Australia. This paper presents the findings of a mail-out survey designed to determine preferences and

perceptions of mountain bike riders in the Perth metropolitan area and the south-west of WA in 1998/99. Specific information on rider demographics, preferred trail features and facilities, and perceptions of trail management and environmental issues was collated and analysed. This information is used to provide broad recommendations for trail designers and managers on the location, design and management of trails in the south-west of WA.

RIDER PREFERENCES AND PERCEPTIONS

Overseas research on the impacts and design of mountain bike trails has been of limited relevance to WA because of differences in the environments studied. The same may be true for user expectations, preferences and perceptions, hence local investigation was needed (MacGregor¹, personal communication, 13 August 1998). Nevertheless, the overseas studies provide a useful framework for designing mountain bike research programs in WA.

Research to explore various aspects of mountain bike rider behaviour, preferences, perceptions and demography was undertaken in the United Kingdom by Ruff and Mellors (1993) and in New Zealand by Cessford (1995c). In the United States of America Watson *et al.* (1991), Chavez (1993, 1996), Blahna *et al.* (1994), Blahna, *et al.* (n.d.) and Hollenhorst *et al.* (1995) investigated the same aspects. In Germany Wöhrstein (1998) carried out an extensive survey of mountain bikers through a mountain bike magazine.

Results of these studies found that males around the age of 30 years dominated mountain biking, with slightly younger participants in New Zealand and Germany compared with those in the USA and the UK. This reflects the image of mountain biking as adventure recreation (Priest and Dixon 1990) where participants look for a certain element of risk, excitement and peak experiences (Ewert 1989; Hollenhorst *et al.* 1995). Cessford (1995b) points out that trail design that takes into account surroundings, incline, and length of a trail, as well as difficulty and variation of a course, plays an integral part in satisfying these user expectations.

Cessford (1995c) found a variety of preferences that were important to riders of all levels, such as exploration of new areas, scenery and nature (including native forest and undulating terrain), speed and excitement, as well as socializing. Preferences for other features depended on the level of experience where technical challenges of speed, racing, single track, fast difficult downhill and long steep uphill with rough hard surfaces became more important to more experienced riders. Obstacles and difficulties on the tracks were also preferred by these riders. All riders preferred natural settings for riding, but more experienced riders were more tolerant of pine forest and farmland than new riders were. Racing was not very important to most riders in Cessford's study, while many experienced riders had done overnight tours.

Cessford (1995c) found that overall riders did not like to meet motorized vehicles and had a somewhat negative attitude towards meeting walkers. More experienced riders were more accepting of other mountain bikers than were less experienced riders. When the attitudes of riders toward management issues were explored, riders believed that most walking trails should be available for riding and that damage done by mountain biking is overrated. Voluntary codes of conduct were seen as a preferred management option.

Chavez (1993) found that most respondents to a mountain bike rider survey in the San Jacinto region (USA) were riding with friends and fewer rode alone or with family. On average, mountain bikers had been riding a mountain bike for 4.6 years, had ridden 42 times in the previous year, and their rides averaged 14.2 miles (22.7 km). Membership with various mountain bike organisations was low. Opinions on trails and trail use were also explored, with most riders agreeing with the need for trail etiquette and environmentally responsible behaviour. When asked about the desirability of various items at the trailhead, riders indicated that a map of the trail showing distances, signs showing permitted and prohibited trail uses and drinking water were the most desired items. Toilets and parking facilities were of medium importance.

Hollenhorst *et al.* (1995) also found that most mountain bikers in his survey of five USA National Forests rode with friends and that they preferred trails to roads. Average riding experience in years was 3.75 and in the previous 12 months they rode a mountain bike on average 67 times for about 15 miles (24 km) per ride. Reasons for riding a mountain bike were given as enjoyment/fun (30.5 per cent), exercise (23 per cent) and being in nature (10.8 per cent).

Wöhrstein (1998) found that only 15 per cent of mountain bikers in Germany were club members. The bikers rode their bikes on average about four times a week and close to 3500 km a year. The average ride distance was calculated as 16.5 km. Forty-three per cent of the riders indicated that they did tours and close to 37 per cent used their bikes to ride around the city or to work. Ninety-six per cent of the respondents used their mountain bike for rides in the countryside. Gravel roads were most frequented, followed by trails between 1 and 2 m wide. Sealed roads and footpaths less than 1 m width followed this. Very few mountain bikers did not ride on trails. Overall, riders experienced few problems with walkers, although women had slightly more problems than men did and young riders had more problems than older ones. When asked to compare the impacts of mountain bikes with those of hiking, mountain bikers estimated the impacts to be the same.

MOUNTAIN BIKE RIDING IN WESTERN AUSTRALIA

Western Australia's first mountain bike club, the Perth Mountain Bike Club, was formed in 1989. Membership

¹ Ewen MacGregor, Trailswest, Perth, Australia.

increased rapidly and now totals over 200 (Gaul², personal communication, 1998). Other clubs were formed. In 1995 the Western Australian Mountain Bike Association (WAMBA) was founded, which incorporates 10 Western Australian mountain bike clubs. In the last two years membership of WAMBA has stabilized at about 400 members (Ahrens³, personal communication, 20 August 1998), with not all mountain bike club members being WAMBA members and vice versa (Gaul, personal communication, 14 December 1998). Most clubs are racing orientated, catering mainly for the racing community. Many mountain bike riders who pursue the sport only recreationally do not appear to be affiliated with any clubs, making it difficult to estimate the total number of mountain bikers.

The two major forms of mountain biking are recreational riding and racing. The most popular forms of mountain bike racing in WA are cross country and downhill. In cross country racing an undulating course with obstacles is ridden repeatedly; downhill racing entails racing down a course with obstacles. Other forms of mountain bike racing are dual slalom, where two riders race down a hill on parallel tracks; hill climb, where riders race uphill; observed trials, involving the negotiation of a natural or constructed obstacle course without setting a foot on the ground or leaving the course; and stage races, which are held over two or more days (UCI, 1998–1999).

In WA, most mountain bike racing trails are also used for recreational riding: they are cordoned off for racing events. There are few 'mountain bikes only' trails in WA and these are mainly confined to the south-west of the State (Fig. 1). Most of the mountain bike trails can be used by other types of recreationists and few of the trails that are

used by mountain bikers are marked as such. John Forrest National Park has produced a leaflet describing the appropriate use of mountain bikes in the Park (CALM n.d.).

RESEARCH METHODS

A mail-back questionnaire was used, with questions based on a review of similar studies as discussed above (see Appendix). Interviews with trail managers on the nature of information they sought for designing trails were also taken into consideration. The survey was pilot-tested by 15 mountain bike riders to identify problems with the design and delivery of the questionnaire, and any ambiguity over the questions' response clarity. Appropriate changes in wording and sequencing were made to the survey instrument prior to commencement of the survey.

Nine-hundred-and-eighty questionnaires were distributed during the period December 1998 and February 1999. Two hundred of these were distributed through a mailing list (Western Australian Mountain Bike Association), and the remainder through bike shops, CALM offices and personal contact with riders. The respondents either returned the completed form to the researcher in person or posted it in a reply paid envelope. The managers of shops and offices were asked to collate the questionnaires and either send them back in the reply paid envelopes provided or to await collection by the researcher. All shops and offices were reminded in early February to send the forms back by 15 February 1999.

The questionnaire was designed for easy and quick completion (8–10 minutes) and contained a mix of open, closed and Likert scale questions. It comprised four parts.

The first part provided a profile of riders: information was collected on rider participation in mountain bike clubs, reasons for undertaking the sport, equipment used, rider experience, frequency and length of rides, and favourite trails.

The second part of the survey, which was the primary focus of the study, explored rider preferences for trail features (e.g. downhills, curves, surfaces, logs, etc.), trail facilities (e.g. drinking water, trail markers, brochures, etc.), settings (natural and built), demand for touring trails, and encounters (e.g. wildlife, other trail users). In this section respondents assigned an importance rating to each item in a list of trail features, facilities and settings. Items relating to encounters were assigned a level of amenity (love it to hate it) by respondents. These items are of particular interest to trail managers.

The third section of the survey was used to examine rider perceptions of a range of statements on mountain bike management (e.g. the need for more trails, multiple-use trails, trail damage, rider techniques, bike cleaning) and environmental awareness (e.g. dieback, soil erosion). Dieback is a disease that attacks and kills many plants in the forests and heathlands of south-west WA (CALM 1999a). The disease can be spread by vehicles, such as logging machinery (Batini 1973), and some evidence exists

² Peter Gaul, former President, Perth Mountain Bike Club, Perth, Australia.

³ Mick Ahrens, former Secretary, Western Australian Mountain Bike Association, Perth, Australia.

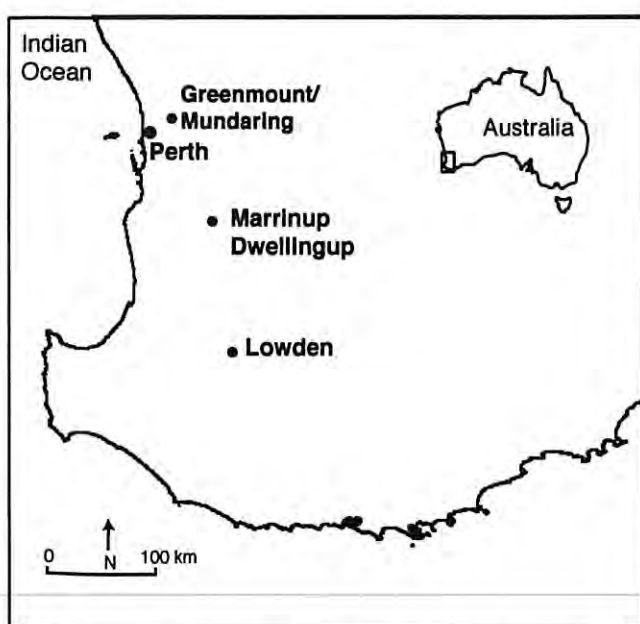


Figure 1. Locations of research sites and popular mountain biking trails.

that recreationists can also spread the disease (Wills 1993). The bike cleaning practices of riders were explored as mountain biking may contribute to the spread of dieback. This section also queried respondents' attitudes towards a voluntary code of conduct.

Part four gathered basic demographic information (e.g. age, gender and place of residency) of respondents.

Survey data were collated and analysed using SPSS (7.5 for Windows) for non-parametric statistics appropriate to the style of question. Percentages were used for closed questions, means and modes for Likert scale questions and counts for the open questions. In some cases, cross tabulations with Chi squared tests were conducted. Specific comments made by respondents were typed out in full and collated. Some adjustments in the data analysis were made when respondents did not answer a question or when they answered single-answer questions twice. Analysis focused on general statistics such as rider profiles, rider preferences for trail features and facilities as well as the perceptions of riders towards management of environmental issues.

RESULTS

Response Rate

The survey response rate was 18.7 per cent (183 people). The response rate of the mail-out to the WAMBA members was over 50 per cent. The high response rate for WAMBA members was achieved because forms were mailed to individuals with reply paid envelopes attached. The response rate for questionnaires from bike shops and CALM offices was lower because some of these shops and offices were frequented by few mountain bike riders or the questionnaires were given out to riders but were not returned to the shops. Consequently, some responses may be biased and represent the views of people who belong to clubs more so than those of the general mountain bike population. Nevertheless sufficient information was obtained to compare the findings with those of other studies and to examine the implications of this study on trail design, especially in the south-west of WA.

Rider Profile

The majority of respondents were male (88 per cent) aged between 25 and 39 years (39 per cent), resident within the Perth metropolitan region (77 per cent) and had an average of 6 years of riding experience. Many of the respondents (72 per cent) were members of a mountain bike club. Most respondents ride mountain bikes for enjoyment and fun (91 per cent), followed by fitness and training (81 per cent). Many respondents (77 per cent) also indicated that they raced. This may be an overestimate since many respondents were mountain bike club members and racing is a major activity in many clubs. Five respondents specified 'adrenaline rush' as a reason for riding.

Most respondents (84 per cent) ride at least two to three times per week and their rides are at least 20 to 50 km long (46 per cent). More than half of the respondents (68 per

cent) indicated that they had never participated in overnight tours, but more than half of these respondents (59 per cent) were interested in overnight touring. The respondents (30 per cent) who had toured, averaged 2.6 tours with four nights per tour. The most popular destinations for riding among the respondents were Mundaring, Dwellingup, Greenmount, Kalamunda and Helena Valley, which are mostly State forest settings (Fig. 1). A general trend of riders preferring to ride close to their place of residence was detected in the study ($p = 0.03$). Riders from the Perth metropolitan area prefer to ride close to Perth and respondents from country centres prefer to ride there.

Rider Preferences

Downhill (long, medium or short) sections, curves, short uphill sections, jumps, logs and slopes (moderate or steep) were the trail features that riders considered most desirable (Table 1). Respondents indicated that drinking water, route markers and parking facilities were highly preferred trail facilities (Table 1).

Respondents preferred single track, native bush or forest settings for riding (Table 2). Other settings such as plantation forests (mode = 2) and farmland (mode = 2) were tolerated by riders but built environments, urban areas (mode = 4) and sealed roads (mode = 3) were not desired (Table 2).

The preferences for trail features and facilities varied with the type of rider (recreational only, or a mix of racing/recreation). A majority of racing/recreation riders indicated that trail features such as downhill sections, curves and jumps were essential in trail design, whereas recreation riders indicated trail facilities such as drinking water and route markers were essential (Table 3). Recreation riders considered the above trail features to be good, except jumps, which they clearly dislike and avoid. The preferred setting also varied with the type of rider (Table 4). Recreation riders rated gravel roads and plantations essential or good, whereas racing/recreational riders considered single tracks as essential and were neutral towards or disliked gravel and sealed roads.

Rider Perceptions

Most respondents answered the questions relating to their perceptions of the environmental damage caused by mountain biking (Table 5). Most riders (mode = 4) disagreed with the statement that mountain biking damaged trails. Many respondents (mode = 1) indicated that 'trail damage by mountain bikes is overrated'. Respondents' awareness of specific environmental issues was weak as indicated by the number of 'don't know' responses (Table 5). Few respondents were sure whether trail damage varied with soil type (15 don't know responses) or with downhill curves (22 don't know responses), and whether mountain bike racing has more impact than touring (22 don't know responses).

Even fewer respondents were knowledgeable about dieback (37 don't know responses) and how it is spread

TABLE 1
 Respondents' preferences for trail features and facilities (1 = essential, 2 = good, 3 = neutral, 4 = don't like and 5 = total rejection).

FEATURE	MEAN	MODE
Long downhill	1.47	1
Medium length downhill	1.56	1
Long curves	1.71*	1
Tight curves	1.75	1
Short downhill	1.92	1
Short uphill	1.93	2
Jumps	1.96	1
Moderate slopes	1.99	2
Steep slopes	2.06	1
Rocks/logs	2.10	1
Firm surface	2.14	2
Straight stretches	2.16	2
Setting up area	2.17	2
Easy slopes	2.20	2
Rough surface	2.25	2
Medium length uphill	2.34	2
Ditches	2.54	2
Long uphill	2.67	2
Smooth surface	2.87	3
Overhanging branches	3.07	3
Muddy/boggy areas	3.09	3
Loose sand/gravel	3.10	3
FACILITY		
Drinking water	1.81	2
Route markers	1.90	1
Parking facilities	2.08	2
Toilet facilities	2.12	2
Brochures	2.25	2
Interpretive signs	2.30	3
Information shelters	2.32	3

TABLE 2
 Respondents' preferences for trail settings (1 = essential, 2 = desirable, 3 = okay, 4 = try to avoid and 5 = total rejection).

SETTING	MEAN	MODE
Native bush/forest	1.59	1
Plantation forest	2.32	2
Wide trail	2.54	2
Gravel road	2.72	3
Farmland	2.73	3
Sealed road	3.55	3
Built up areas/suburbs	3.62	4

(38 don't know responses). Nevertheless, 59 per cent of respondents indicated that they were aware of dieback risk areas and 85 per cent of these respondents could either define a dieback risk area or identify where they are found. Many respondents (40 per cent) indicated that they clean their bike after every race or ride and another 15 per cent indicated that they clean their bikes at least once per week.

Perceptions of mountain bike management issues were varied among respondents. There was agreement with the issues related to reducing trail damage such as good riding technique, trail design and education (Table 5). The mean response and mode was approximately 2 for these statements. There was less agreement on management issues relating to riders accessing all trails. Although the mode equalled 1, the mean score was 2.2. Respondents also indicated that they were satisfied with using trails repeatedly (mode = 2), but they did not agree with the statement that there are enough trails (mode = 4) (Table 5).

Respondents' perceptions of trail damage and riding technique varied with the type of rider (Table 6). Racing/recreational riders disagreed more strongly ($p = 0.018$) that mountain bike riding causes trail damage than recreational riders who tended to agree. Similarly racing/recreational riders in contrast to recreational riders strongly agreed ($p = 0.000$) that trail damage by mountain biking was overrated. Overall, there was agreement that good riding technique can reduce trail damage, with stronger agreement from racing/recreational riders ($p = 0.035$).

Ninety-one per cent of respondents indicated that they would be prepared to accept a voluntary code of conduct or trail etiquette. These respondents also indicated that concepts such as 'respecting other trail users', 'safety', 'respect for the environment', and 'minimizing damage' should be included in the code. Reasons for rejecting the code were loss of freedom or no need (4 respondents).

DISCUSSION

The preferences of mountain bike riders in terms of trail design and setting, as well as their awareness of mountain bike management issues, are important for the appropriate management of mountain biking and the design of mountain bike trails (Cessford 1995a).

The profile of mountain bike riders in this study coincides with that of other studies, that is, young males seeking fun and adventure with a high level of excitement and risk (Ewert 1989; Priest and Dixon 1990; Hollenhorst *et al.* 1995; Cessford 1995c). They ride at least two to three times per week and travel at least 10 km each ride. These findings compare with those of Wöhrstein (1998) who found that German mountain bikers rode their bikes on average four times a week and for 16.5 km. Hollenhorst *et al.* (1995) also noted that riders in their survey travelled an average of 15 miles (24 km). Mountain biking also has female participants (11 per cent in this study) and riders range from the very young to 60+ years who ride for fitness and enjoyment. Riders also tend to ride near their place of residence and, as in this study, they often live in urban centres (Horn *et al.* 1994).

TABLE 3

Significant ($p < 0.5$) cross tabulations of rider motivation with trail features.

TRAIL FEATURE	CATEGORY	RECREATION ONLY RIDERS	RACING AND RECREATION RIDERS
		n=38	n=128
Long downhill	essential	39.5%	72.7%
	good	44.7%	18.8%
	neutral to dislike	15.8%	8.6%
Medium downhill	essential	39.5%	62.5%
	good	47.4%	28.1%
	neutral to dislike	12.8%	9.4%
		n=39	n=129
Long curves	essential	30.8%	49.6%
	good	56.4%	34.9%
	neutral to dislike	12.8%	15.5%
Tight curves	essential	30.8%	57.4%
	good	30.8%	30.2%
	neutral to dislike	38.4%	12.4%
Water	essential	41.0%	37.2%
	good	53.8%	38.8%
	neutral to dislike	5.1%	24.0%
Route markers	essential	51.3%	30.2%
	good	35.9%	41.1%
	neutral to dislike	12.8%	28.7%
Short uphill	essential	25.6%	35.7%
	good	66.7%	41.9%
	neutral to dislike	7.7%	22.5%
Jumps	essential	28.2%	49.6%
	good	10.3%	34.9%
	neutral to dislike	61.5%	15.5%
		n=39	n=128
Short downhill	essential	20.5%	46.1%
	good	51.3%	32.0%
	neutral to dislike	28.2%	21.9%

TABLE 4

Significant ($p < .05$) cross tabulations of rider motivation with settings.

SETTING	CATEGORY	RECREATION ONLY RIDERS	RACING AND RECREATION RIDERS
		n=39	n=128
Single trail	essential	25.6%	70.3%
	good	35.9%	25.0%
	neutral to dislike	38.5%	4.7%
Gravel road	essential to good	51.3%	34.4%
	neutral to dislike	48.7%	65.6%
		n=39	n=129
Plantation	essential to good	46.2%	66.7%
	neutral	41%	26.4%
	avoid to dislike	12.8%	6.9%
		n=39	n=127
Sealed road	essential to good	17.9%	9.4%
	neutral	59.0%	32.3%
	avoid to dislike	23.1%	58.3%

TABLE 5

Respondents' perceptions of environmental and mountain bike management issues (1 = agree strongly, 2 = agree, 3 = neutral, 4 = disagree and 5 = strongly disagree, N = 183).

STATEMENT	MEAN	MODE	DON'T KNOW
ENVIRONMENTAL ISSUES			
Mountain bike riding damages trails	3.82	4	6
Trail damage by mountain bikes is overrated	1.73	1	19
Trail damage varies with soil type	1.94	2	15
Mountain bike racing has more impact than touring	2.34	2	22
Dieback is an environmental problem in WA	2.03*	2	37
Mountain bikes can spread dieback disease	2.75	2	38
Most trail damage occurs in downhill curves	2.46	2	22
MANAGEMENT ISSUES			
Good riding technique reduces trail damage	1.86*	2	7
Good trail design can reduce trail damage	1.75*	2	9
Rider education could reduce trail damage	1.92*	2	3
Mountain bikes should be allowed on all trails	2.20	1	2
It is enjoyable to ride the same trail repeatedly	2.48	2	1
There are enough mountain bike trails	4.05	4	3

Racing, and therefore speed and excitement, is also a popular reason for mountain biking in the south-west of WA. This study, and those of Cessford (1995c) and Ruff and Mellors (1993), noted that racers are often associated with clubs. The level of membership with a mountain bike club in this study was much higher than that found in studies in Germany (Wöhrstein 1998) and the United States (Chavez 1993). In Germany only 15 per cent of respondents were club members. The higher level of membership in this study may be attributed to the good response rate from mountain bike club members compared with that of non-members.

Nearly 30 per cent of respondents had done overnight tours and another 30 per cent were interested in doing these tours. In Wöhrstein's (1998) survey, 43 per cent of the riders indicated that they had done tours. Cessford (1995c) found a relationship of greater rider experience with number of overnight tours, which is comparable to the findings of this study, with more racers than recreational riders participating in overnight tours. This is reinforced by specific comments for the provision of mountain bike touring trails like the Bibbulmun Track walking trail in the south-west of WA.

Mountain bike riders in this study prefer to encounter wildlife and other cyclists on their rides. Cessford (1995c) found a similar preference of more experienced riders for meeting other cyclists. Respondents in this survey were neutral towards walkers and horses, which is not directly comparable with the findings of Watson *et al.* (1991) who found that few mountain bikers disliked hikers, and Wöhrstein (1998) who noted that few mountain bikers experienced problems with walkers. Cessford (1995c), however, found that riders were tolerant-to-negative towards walkers. Brindal and CALM (1995) found a mixed response by mountain bike riders towards walkers.

Many respondents of their survey were happy to meet walkers on bush tracks but not horses.

Riders in Cessford's (1995c) study and in this study disliked motorized vehicles. Brindal and CALM (1995) also found that riders did not want to share trails with trail bikes. This concurs with Devall and Harry (1981, p. 399) who stated that: 'Users of less obtrusive technologies seem to dislike the more obtrusive much more than the latter dislike the former'. Mountain bike riders dislike trail bikes. This may be owing to competition for trails, since trail bikes can use narrow mountain bike trails, and to their potential to physically impact the trail (Weaver and Dale 1978; Wilson and Seney 1994).

Long and medium length downhill sections were the most preferred trail features in this study. They were closely followed by long as well as tight curves. These features create a challenging and technically demanding trail for riders, especially racers. Short downhill sections, jumps, steep slopes and short uphill sections are features that racers want, but recreational riders did not see these as important features in this study. Cessford (1995c) found essentially the same trends, with more experienced riders being more interested in technical difficulties, fast downhill sections and steep slopes as well as in racing.

Recreation-only riders in this study and in that of Brindal and CALM's (1995) study preferred drinking water and route markers. Chavez (1993) also found that riders wanted to have drinking water available at the trailhead. In addition, Chavez (1993) found that toilets and parking were amenities that were of medium importance to riders as did Brindal and CALM (1995), which is comparable to results of this study.

Overall, respondents in this study and in that of Cessford (1995c) did not like smooth surfaces, overhanging branches, muddy or boggy areas and loose

TABLE 6

Significant ($p < .05$) cross tabulations of rider motivation with opinion statements.

STATEMENT	CATEGORY	RECREATION ONLY RIDERS	RACING AND RECREATION RIDERS
Mountain bike riding damages trails	strongly agree – neutral	n = 35 51.4%	n = 128 28.8%
	disagree to strongly disagree	48.6%	71.2%
Good riding technique reduces trail damage	strongly agree	n = 36 33.3%	n = 126 36.5%
	agree	36.1%	50.8%
	neutral – strongly disagree	30.6%	12.7%
Trail damage by mountain bikes is overrated	strongly agree	n = 28 28.2%	n = 119 53.2%
	agree	18.0%	34.1%
	neutral – strongly disagree	53.8%	12.7%

sand or gravel surfaces. For smooth surface, Cessford (1995c) found differences in opinion and many riders actually preferred this condition. In this study, some respondents remarked that a 'good' mountain bike trail has to have a variety of features to be interesting to ride.

In terms of settings, respondents clearly preferred single tracks and native bush or forest with a lesser preference for plantation forest and wide trails. Farmland and gravel roads were more acceptable than sealed road. Most respondents avoid built up areas or suburbs. Similar preferences for natural settings were found by others (Ruff and Mellors 1993; Cessford 1995c; Hollenhorst *et al.* 1995). By contrast with these studies, respondents in the Brindal and CALM (1995) study preferred compacted or hard soils over gravel, sealed and rock surfaces.

Interestingly, racing riders rate plantation forests quite highly as a setting in contrast to recreational riders: this was also noted by Cessford (1995c). A possible explanation for this could be that racers ride mainly for sport and not for sightseeing and as long as the requirements for a 'good' mountain bike trail (see above) are fulfilled, racers do not care as much as recreational riders do about the surroundings.

The statement that mountain biking should be allowed on all trails attracted a range of responses from strong agreement to disagreement. This same wide spread in opinion was observed by Cessford (1995c). Respondents were quite united in their disagreement with the statement that there are enough mountain bike trails, especially overnight touring trails. Locally, there is an order of magnitude between the length of dedicated walking trails (1000s of kilometres) and dedicated mountain bike trails (a few hundred kilometres). Meeting this shortfall is important in minimizing environmental impacts and reducing trail user conflicts. Bjorkman (1996) implied that more mountain bike trails would disperse riders over a greater area and result in less damage to trails in Wisconsin.

Both this and Cessford's (1995c) studies noted that riders do not agree that mountain bike riding damages trails

and that they agree that trail damage by mountain bikes is overrated. An experimental study by Wilson and Seney (1994) in the USA and a three-year study by Wöhrstein (1998) in Germany both found little damage by mountain bikes. Keller (1990, cited in Cessford 1995b) associated mountain bikes with trail damage, although he conceded that the extent of damage depended on riding technique.

Good trail design, as well as good riding technique, was seen by respondents as a way to reduce trail damage. Chavez *et al.* (1993) found that trail erosion depended on site conditions and rider behaviour. Riders in this survey saw rider education as a means to reduce trail damage. These findings suggest awareness by mountain bikers of these issues in accordance with the findings of various researchers. Widmer (1997) points to the importance of education to reduce trail damage because aware riders ride more responsibly. He recommends a code of conduct.

Nearly all respondents in this survey supported a code of conduct. The most important aspects of such a code were cited as respect for other trail users, safety, respect for the environment and respect for the trail. Chavez (1993) also found that most riders supported trail etiquette and environmentally responsible behaviour, and Cessford (1995c) found that voluntary codes of conduct were seen as the preferred management option for mountain biking by riders.

Dieback was acknowledged as a serious environmental problem in WA, but mountain bikers were not as readily accepting of the notion that their bicycles are potential disease carriers. Many respondents pointed out that walkers and wildlife are also potential carriers of the disease. Under the existing management guidelines of CALM, given the limited knowledge and lack of research into the potential spread of dieback by mountain bikes, walkers or wildlife, a change in the current situation seems unlikely.

The notion that trail damage by mountain bikes is overrated found greater support among racers than among recreational riders in this study. Racers also disagreed more with the statement that mountain bikes cause trail

damage. This difference was not found by Cessford (1995c). Factors leading to these differences in opinion may be owing to racers riding more often than recreational riders and racers observing how little the trails change over time. Alternatively, racers may be accustomed to the impacts of mountain bikes, not noticing them any more or accepting them as part of the sport. For an occasional recreational rider a worn curve, an eroded downhill section or skid marks may be more noticeable.

The statement that good riding technique reduces trail damage was strongly supported by both groups of mountain bikers, with racers agreeing more strongly than recreational riders. This discrepancy may reflect the greater knowledge of riding techniques and the better riding skills of racing riders. Observations at racing events support this statement. Riders who appeared to have great mastery over their bicycles were skidding very little in or before curves, thus reducing damage to the trail surface.

Among the racing community there seems to be more support for the notion that all trails should be open to mountain bikes whereas among recreational riders many disagree with the idea. This may reflect the perception by racers that mountain bikes do little damage to trails especially when good riding technique is employed. Furthermore, racers would like access to walking trails because they often meet racers' preferences for narrow single tracks.

Since the majority of riders clean their bicycles at least monthly and 40 per cent of riders indicated that they clean their bikes after every race or ride, the risk of the spread of dieback by mountain bikes between areas is perceived to be low. Riders also remarked that they clean their bikes after muddy rides: wet conditions are conducive to the spread of *Phytophthora* spores (Shearer and Tippet 1989). However, it is likely that mountain bikes can spread dieback along tracks, similar to the spread of the disease observed on recreational (walking) tracks in the Stirling Range National Park (Wills 1993). Clearly this subject needs further investigation.

Over half of the survey respondents indicated that they were aware of dieback risk areas (DRA), however, they also indicated a lack of knowledge and information, as well as confusion over the DRA system. This lack of understanding is supported by the high number of 'don't know' answers, especially among young respondents, to the statements that related to dieback.

MOUNTAIN BIKE MANAGEMENT IMPLICATIONS

Trail Development

The survey has clearly shown that riders want more trails. These should be provided in close proximity to where riders live, especially within the Perth metropolitan area. This would meet the needs of young riders who have limited access to the trails.

A long distance trail may provide tourism opportunities. Overnight mountain bike touring through

natural settings is limited in Europe despite the high demand (Wöhrstein⁴ personal communication, 1999) and the provision of long distance trails would greatly add to the already substantial attractiveness of Australia to European and especially German tourists. Mountain bike tours are popular with visitors to New Zealand. Their availability in the south-west of WA could provide substantial economic gains for local communities.

Trail Design

Trails need to have a variety of features, be of varying distances and in a range of natural settings. Riders who use trails are seeking different experiences that range from adrenaline rush to a peaceful ride in the bush. Racers seek single tracks that are technically challenging with steep downhill sections of varying lengths and short uphill sections. Although recreational riders enjoy some of these features, other features favoured by racers such as jumps and tight curves are not desired.

Ideally, an interconnected system of mountain bike circuits or loops of differing length and difficulty with obstacles and difficult trail sections reserved for the trail loops should be developed for WA. The main trail should be of a difficulty level that allows for relaxed riding and is suitable for riders with relatively little experience. The trail(s) should be clearly marked and the level of difficulty (rating) and the presence of obstacles should be clearly stated at the trailhead. A rating system could be based on the length of trail, technical difficulty including obstacles, and the number of steep slopes. The provision of trail markers and drinking water is important to recreational riders. Adequate access to drinking water, parking facilities and setting-up areas, toilets and shelters as well as emergency access should be considered when siting a trail.

Mountain bike riders indicated a willingness to share trails. Other users, especially walkers, may be reluctant to do so. This survey and other studies also clearly show that riders do not want to share the trail with motorized vehicles. Conflict with other users can be avoided if the trail system consists of mountain bike only trails. This is highly unlikely given the limited resources of most agencies responsible for trails. Nevertheless, some of the problems of sharing trails can be addressed through rider education and awareness (Moore 1994). A code of conduct for mountain bike riders can also add to an improved understanding between trail users.

Practices

The support of a code of conduct was clearly indicated by the vast majority of respondents and should be developed as planned by WAMBA (Machin⁵, personal communication, 1998). The code should include aspects of safety, respect for other users and respect for the environment. Low impact riding behaviour should also be included. Riders also expressed confusion about right of

⁴ Dr Thomas Wöhrstein, An der Steige 132, 78713 Schramberg, Germany.

⁵ Les Machin, former Trails Coordinator, WAMBA, Perth, Australia.

way issues. Rules that are acceptable to the majority of trail users could reduce conflict and increase safety. Irrespective of a code of conduct, riders should be encouraged to wash their bikes after every ride to reduce the potential to spread dieback.

Information

Signs at the trailhead should show a map of the trail, state the length of the trail as well as its difficulty rating. The signs should also clearly state the users allowed on the trail (preferably explaining why use is restricted if it is) and state whether it is a one-way track. Especially at multiple-use trails the appropriate trail etiquette should be stated. Trail markers should be clearly visible along trails. Warning signs should be placed at road crossings or other features that require extra caution.

Off the trail, maps and brochures can be used to disseminate information through bicycle retail outlets, mountain bike clubs and appropriate agencies (Trailswest, Bikewest, CALM). The maps should contain information about the trail (length, difficulty) and how to access it as well as the location of telephones and the nearest bicycle shops. These publications should contain a code of conduct and information on low impact mountain biking.

Many respondents were not aware that dieback is a major environmental problem in WA. There is a need for more information about dieback and dieback risk areas, in particular what a DRA is and why they are there. Mountain bike specific publications could be used to disseminate information about DRAs and why mountain bikes are not allowed in these areas. Awareness programs should increase the understanding of dieback among riders including the younger riders.

Education

High schools, technical and further education colleges and universities could provide courses for the public on mountain bike riding. These should include aspects of rider safety, trail etiquette, riding techniques, dieback awareness and bicycle maintenance. The courses could be tailored to suit the skill levels of participants and the capability of their bicycles. Some educational institutions provide courses for their students but these are not open to the public. These institutions could consider providing public courses, utilizing their resources and knowledge base during holiday periods. Some operators conduct mountain bike tours but these allow for limited instruction only. However, as a service to customers they could consider specific courses. Bike shops could hold workshops or sponsor such events.

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APPENDIX - Questionnaire

Dear Mountain Bike Rider,

This questionnaire is part of a research project designed to help improve mountain bike trails and facilities in Western Australia.

The project is run by Ute Goeft, an Environmental Management honours student at Edith Cowan University in Joondalup. The research will help Trailswest, the Department of Conservation and Land Management (CALM) and Western Australian mountain bike clubs to locate, construct and maintain better and environmentally sound mountain bike trails and facilities. To achieve this aim it is important to know what mountain bike riders actually want in a trail and therefore **we need your help!**

The information you provide will be completely confidential.

Please take a few minutes and **fill in this form**. Thank you. ✉



1. Do you belong to a mountain bike club? Yes No

2. Why do you ride a mountain bike? (tick as many boxes as you like)

<input type="checkbox"/> enjoyment/fun	<input type="checkbox"/> relaxation	<input type="checkbox"/> exercise/training
<input type="checkbox"/> to appreciate nature	<input type="checkbox"/> to be with friends	<input type="checkbox"/> family outing
<input type="checkbox"/> for a challenge	<input type="checkbox"/> racing ⇔ DH <input type="checkbox"/> ; XC <input type="checkbox"/> ; DS <input type="checkbox"/> ; Trials <input type="checkbox"/>	
<input type="checkbox"/> transport	<input type="checkbox"/> other (please specify).....	

3. How often do you ride a mountain bike? (please tick one box only)

<input type="checkbox"/> once a day	<input type="checkbox"/> 2 - 3 times a week	<input type="checkbox"/> once a week
<input type="checkbox"/> 2 - 3 times a month	<input type="checkbox"/> once a month	<input type="checkbox"/> other (specify).....

4. In what year did you start to ride a mountain bike? (please specify) 19.....

5. How long are your rides on average? (please tick one box only)

<input type="checkbox"/> under 2 km	<input type="checkbox"/> 2 - 5 km	<input type="checkbox"/> 5 - 10 km
<input type="checkbox"/> 10 - 20 km	<input type="checkbox"/> 20 - 50 km	<input type="checkbox"/> over 50 km

6. Have you done tours that included over night stays?

<input type="checkbox"/> Yes ⇔ how many tours have you done?	Please specify number of tours.....
⇔ how many nights did you stay away on your last trip?	
	Please specify number of nights.....
<input type="checkbox"/> No ⇔ are you thinking of doing overnight tours?	<input type="checkbox"/> Yes <input type="checkbox"/> No

7. Where do you like to ride? (please list your 3 favourite areas/trails according to preference)

a. b. c.

8. Do you mind if you encounter: (please circle 1 number per row)

	love it	quite good	neutral	don't like	hate it
cars/4WDs	1	2	3	4	5
motor bikes	1	2	3	4	5
horses	1	2	3	4	5
wildlife	1	2	3	4	5
walkers	1	2	3	4	5
other cyclists	1	2	3	4	5

9. How important are the following features for you when riding? (circle 1 no. per row)

	essential	would be good	neutral	don't like it	don't want at all
smooth surface	1	2	3	4	5
rough surface	1	2	3	4	5
loose sand/gravel	1	2	3	4	5
firm surface	1	2	3	4	5
muddy/boggy areas	1	2	3	4	5
easy slopes	1	2	3	4	5
moderate slopes	1	2	3	4	5
steep slopes	1	2	3	4	5
short uphill	1	2	3	4	5
long uphill	1	2	3	4	5
medium length uphill	1	2	3	4	5
short downhill	1	2	3	4	5
long downhill	1	2	3	4	5
medium length downhill	1	2	3	4	5
tight curves	1	2	3	4	5
long curves	1	2	3	4	5
straight stretches	1	2	3	4	5
jumps	1	2	3	4	5
rocks/logs	1	2	3	4	5
overhanging branches	1	2	3	4	5
ditches	1	2	3	4	5
parking facilities	1	2	3	4	5
setting up area	1	2	3	4	5
drinking water (tap/tank)	1	2	3	4	5
toilet facilities	1	2	3	4	5
route markers	1	2	3	4	5
information shelters	1	2	3	4	5
brochures	1	2	3	4	5
interpretive signs	1	2	3	4	5
other (specify)	1	2	3	4	5

10. How important are the following settings for you when riding? (circle 1 number per row)

	essential	desirable	okay	try to avoid	don't want at all
native bush/forest	1	2	3	4	5
plantation forest	1	2	3	4	5
farmland/meadows	1	2	3	4	5
built up areas/suburbs	1	2	3	4	5
sealed road	1	2	3	4	5
gravel road	1	2	3	4	5
wide trail	1	2	3	4	5
single track	1	2	3	4	5

11. Do you agree that: (circle one number per row)

	strongly agree	agree	neutral	strongly disagree	disagree	don't know
- there are enough mountain bike trails	1	2	3	4	5	6
- mountain bikes should be allowed on all trails	1	2	3	4	5	6
- mountain bike riding damages trails	1	2	3	4	5	6
- good riding technique reduces trail damage	1	2	3	4	5	6
- rider education could reduce trail damage	1	2	3	4	5	6
- mountain bikes can spread dieback disease	1	2	3	4	5	6
- trail damage varies with soil type	1	2	3	4	5	6
- most trail damage occurs in downhill curves	1	2	3	4	5	6
- trail damage by mountain bikes is overrated	1	2	3	4	5	6
- it is enjoyable to ride the same trail repeatedly	1	2	3	4	5	6
- mtb racing has more impact than touring	1	2	3	4	5	6
- good trail design can reduce trail damage	1	2	3	4	5	6
- dieback is a big environmental problem in WA	1	2	3	4	5	6

12. Would you be prepared to accept a voluntary code of conduct/trail etiquette?

Yes ⇨ What would be important to you (e.g. safety, respect other trail users)?

(please specify)

.....

.....

No ⇨ Why not? (please specify).....

.....

13. What type of mountain bike do you ride?

no suspension

front suspension

dual suspension

other.....

14. How often do you clean your bike (including tyres and treads)? (tick one box only)

- | | | |
|--|---|---------------------------------------|
| <input type="checkbox"/> once a week | <input type="checkbox"/> once a fortnight | <input type="checkbox"/> once a month |
| <input type="checkbox"/> every 3 months | <input type="checkbox"/> every six months | <input type="checkbox"/> once a year |
| <input type="checkbox"/> after every race/ride | <input type="checkbox"/> never | <input type="checkbox"/> other |

15. Are you aware of dieback risk areas? No Yes ⇒ see below

If yes, please specify below what a dieback risk area is and where they are found

.....
.....

16. What age group do you belong to?

- | | | | | |
|-----------------------------------|----------------------------------|----------------------------------|----------------------------------|------------------------------------|
| <input type="checkbox"/> under 15 | <input type="checkbox"/> 15 - 24 | <input type="checkbox"/> 25 - 39 | <input type="checkbox"/> 40 - 59 | <input type="checkbox"/> 60 & over |
|-----------------------------------|----------------------------------|----------------------------------|----------------------------------|------------------------------------|

17. Are you female or male? female male

18. Please tell us your post code

if you are visiting Australia please tell us your home country

19. Is there anything else you would like to tell us? Please do !

.....
.....
.....
.....

Please return this form to the person who gave it to you or
mail it in the reply paid envelope provided as soon as possible (latest by 15 February, 1999).

Thank you very much for your time & happy riding ! ☺

✂-----
Trailswest are currently developing a network of recreation trails around the State, for information please contact Ewen MacGregor at Trailswest: ☎ 9387 9700; FAX 9387 9726; email: emacgregor@wamsr.ausport.gov.au or visit the Trailswest website: www.msr.gov.au

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