

**ENVIRONMENTAL IMPACT OF AN ORIENTEERING EVENT
ON EUCALYPT FOREST AND WOODLAND IN AUSTRALIA
IN RELATION TO COMPETITOR NUMBERS**

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CONTENTS

	Page
SUMMARY	S/1
1. INTRODUCTION	1
2. THE STUDY AREA	2
3. STUDY RATIONALE AND METHODOLOGY	3
4. RESULTS	6
5. DISCUSSION	9
6. CONCLUSIONS	11
REFERENCES	11
ACKNOWLEDGEMENTS	11
APPENDIX. CONTROL SITE PHOTOGRAPHS, VEGETATION COVER DATA AND SUMMARY ASSESSMENTS	

FIGURES

1. Control locations
2. Field recording sheet
3. Sample field sketches

SUMMARY

The following report presents the results of an environmental monitoring study undertaken for a national orienteering event held in Namadgi National Park in the Australian Capital Territory. The study examined the impacts on vegetation and litter cover immediately adjacent to control stands and compared these impacts with the number of competitors visiting controls.

The main objective of monitoring these areas was to correlate the level of impact with the number of orienteers visiting the control site, with a view to applying this information to the planning of future events and minimising the risk of immediate impacts at a level which critical observers may consider to be 'significant'. A further objective was to assess the extent to which affected sites would recover following a spring/ summer growing season.

Monitoring was undertaken at 25 control sites which were visited by varying numbers of orienteers during the event. The least visited site had 66 visits (determined from the SportIdent electronic checking system) and the most visited control had 429 visits. Impacts were assessed through quantitative estimates of groundcover and descriptive assessments of groundcover changes, supported by photographic records of the control sites. The assessments were undertaken before the event, immediately after the event and about one year later, following a full growing season. Based on the above records, the relative impacts were assessed subjectively based on a descriptive scale which ranged from negligible to major.

While impacts of human activity were evident immediately after the event at most controls, in most cases these impacts were reduced to a negligible level after one year. The most common impact was scattering of leaf and bark litter, exposing bare ground. Where grass was present at the control, this was generally flattened but groundcover was generally not damaged. At most controls the vegetation and litter cover recovered naturally after one year to the point where no impacts were evident.

In terms of immediate post-event impacts, the observations suggest that a control site in the type of terrain studied can accommodate of the order of a hundred orienteers with only minimal to minor impact, while more than 300 orienteers need to pass through a control to cause a level of impact described as 'major' in the context of this study. It is therefore recommended that for events conducted in typical Australian orienteering terrain in areas managed with nature conservation as a primary objective, courses should be planned so that the number of orienteers passing through a given control is limited to no more than 300. This figure should be reduced in more sensitive terrains or may be increased in situations where existing development or land uses mean that the impacts of orienteering are unlikely to be of concern.

1. INTRODUCTION

Numerous scientific studies undertaken in recent years have concluded that the sport of orienteering has a relatively low impact on the natural terrain that is widely used for events (Ref. 1). There is nevertheless a perception among some natural resource managers and some members of the community that its impacts must necessarily be high, based on the large numbers of participants in high profile events.

Such concerns led to a requirement by the ACT Government for a monitoring study to be undertaken in Namadgi National Park for an event that formed part of the 2010 Australian Three-days competition. That study was undertaken by an independent environmental consultant, Aurecon Australia Pty Ltd, and its results are reported separately (Ref. 2). The Aurecon study focused on the effects on soil properties of sites surrounding controls, as well as other locations on the course and in the event area.

To extend the information available for assessing the impacts and particularly in guiding the planning of future events to minimise any impacts, a complementary study was undertaken by members of Orienteering ACT (OACT) who are also professional ecologists. The OACT study as presented in this report examined the impacts on vegetation and litter cover on the areas immediately adjacent to control stands and compared these impacts with the number of competitors visiting control sites.

2. THE STUDY AREA

The study area is located in Namadgi National Park in the south of the Australian Capital Territory. It lies to the west of Boboyan Road in the vicinity of Rendezvous Creek and Gudgenby Homestead (see Figure 1).

The most significant feature of the study area from an orienteering perspective is its geology, being based on acid volcanic rocks (particularly granodiorite) which give rise to deeply weathered, potentially erodible soils, while retaining numerous outcrops and boulders which create much of the navigational challenge for orienteering. This type of terrain, described as 'granite' terrain by orienteers, is widespread throughout Australia, and is the most common type of terrain used for major orienteering events.

The vegetation in the study area consists partly of open grassy woodland, dominated by snow gums (*Eucalyptus pauciflora*) and partly of montane forest, where the common trees include snow gum, broad-leafed peppermint (*E. dives*), mountain gum (*E. dalrympleana*) and ribbon gum (*E. viminalis*). Parts of the forest contain dense understorey. The elevation of the study area is between about 960 and 1020 metres.

All of the area is within Namadgi National Park, but the southern part was previously part of a large grazing property and had been extensively cleared. While grazing of the property depended largely on native grasses, there has been some pasture improvement with weeds introduced in some places. Most of the sites used in the study, however, contained native groundcover.

Parts of the area are visited by bushwalkers but, in general, the area experiences a low level of recreational use. Small to medium-sized orienteering events have been conducted in the area in recent years, with an event held typically once every two to three years.

3. STUDY RATIONALE AND METHODOLOGY

The focus on the areas immediately adjacent to control stands was based on the assumption that such areas which, in some cases, would be visited by several hundred orienteers during the course of the event, would be the areas most likely to show the impacts of high use levels within the course area. The main objective of monitoring these areas was to correlate the level of impact with the number of orienteers visiting the control site, with a view to applying this information to the planning of future events and minimising the risk of immediate impacts at a level which critical observers may consider to be 'significant'. A further objective was to assess the extent to which affected sites would recover following a spring/ summer growing season.

Monitoring was undertaken at 25 control sites which were visited by varying numbers of orienteers during the event. The least visited site had 66 visits (determined from the SportIdent electronic checking system) and the most visited control had 429 visits. The locations of these controls are shown in Figure 1. The sites were assessed on three occasions, as follows:

Pre-event assessment – 31 March 2010

Event conducted – 3 April 2010

Immediate post-event assessment – 6 April 2010

One year post-event assessment – 30 March 2011

The assessments were undertaken using the following methods:

1. **Quantitative assessment of surface characteristics.** A circular quadrat 1.0 metre in diameter, was placed around the control stand after the stand had been positioned. This quadrat, shown in the photographs in the appendix, was constructed from flexible irrigation tubing, and was tensioned with adjustable nylon cords set at right angles to maintain its circular shape. The quadrat was placed with the intersecting cords against the shaft of the control stand, and with one of the cords aligned with magnetic north. Within each quarter of the quadrat, an estimate was made of the respective areas of:

- groundcover;
- shrubs;
- litter;
- bare ground; and
- rock.

These figures were used to calculate the percentage of each type of cover within the quadrat as a whole. The use of quarters to collect that information was considered more accurate than a single estimate for the whole quadrat. If the quadrat was not aligned correctly on subsequent measurements, this did not affect the overall result as any errors would be corrected by combining the estimates for the four quarters.

Backup vertical photographs (two per quadrat) were taken in case there was a need to check the estimates more accurately, but this proved to be unnecessary.

Where lichen was present on rocks at the control sites, this was assessed visually for signs of damage in the post-event inspection. Other comments were noted as appropriate.

2. **Sketch records of quadrats and surrounding area.** A sketch was made of the surface characteristics within each quadrat and for a further 0.5 metre surrounding the quadrat, using the same categories as in the quantitative assessment. This was done initially for the pre-event assessment, with any changes noted for the post-event and one-year assessments. This information was used to confirm or clarify the quantitative assessments where necessary. The pre-event sketches were useful also in confirming that the quadrats were correctly positioned in the subsequent assessments.

A blank field recording sheet is shown in Figure 2. The inner circle represents the quadrat for which numerical data were compiled, while the outer circle extends 0.5 metre further. Figure 3 shows a series of completed field sketches with the boundary changes and notes recorded in different colours.

3. **Photographic records.** In addition to the vertical photographs taken as backup for the quantitative assessments, oblique photographs were taken of the whole quadrats and part of the immediately adjacent area. As well as giving an overview of any changes, these were useful in positioning the quadrats in the subsequent assessments, particularly the one-year assessments when there was no control stand in place.

The control stands were still in place for the immediate post-event assessment but were then removed and replaced with a steel peg with a piece of plastic (approx. 3 cm square) and a strip of flagging tape attached to assist in relocating the centre of the quadrat for the one-year assessments. The relocation of these pegs proved to be difficult in many cases due to the accumulation of litter and, in some cases, removal of the pegs or tape by wildlife. In those cases, it was necessary to rely on the previous photographs and sketches. All quadrats were reliably positioned by one or other of these methods.

Based on both the quantitative data and the sketches, the relative impacts at each control site compared with the pre-event situation were assessed subjectively according to the following descriptions and criteria:

- | | |
|-------------------|---|
| Negligible | • No apparent sign of disturbance |
| Minimal | • Flattening of grass or litter, but with no damage to vegetation
• No significant changes in areas of bare ground |
| Minor | • Small areas of bare ground due to litter disturbance
• Minor changes to the relative areas of the various types of cover |

- Moderate**
- Moderate areas of bare ground due to litter disturbance
 - Minor damage to groundcover or low shrubs
 - Major changes to the relative areas of the various types of cover
- Major**
- Large areas of bare ground
 - Groundcover disturbed at base, giving rise to bare ground
 - Extensive damage to low shrubs
 - Movement of loose rocks.

Disturbance in the 'major' category was considered likely to be obvious to anyone who was critically concerned about the impact of the event, while the other categories of disturbance are probably unlikely to be noticed or to cause concern.

4. RESULTS

The appendix summarises the main results from each of the controls, and contains the following information:

- Control number
- Number of competitors visiting the control.
- A photograph of the general control location, which can be used together with the map in Figure 1 to relocate the control, should this be required.
- Oblique photographs of the quadrat showing the pre-event, post-event and one-year conditions.
- The measurement of the different types of cover for each survey occasion.
- A description of the changes observed immediately following the event and after one year, compared with the pre-event condition.
- A subjective assessment of the overall post-event and one-year impact using the descriptor scale of 'negligible' to 'major'.

Table 1 presents a summary of the overall post-event and one-year impact assessments, while Table 2 identifies the nature and extent of the post-event impacts in further detail. Both tables list the controls in increasing order of the number of competitors passing through them.

Some general observations with regard to the post-event impacts are as follows:

- In the immediate post-event observations, all controls showed some evidence of having been visited by people, although in some cases the only such evidence was flattening of grass around the control.
- The most common impact, which was observed at most of the controls, was disturbance to litter. This commonly resulted in a reduced litter cover and exposure of bare ground, although in some cases litter was pushed into the quadrat, increasing the litter cover or covering rocks.
- Where grass was present at the control, this was generally flattened, but groundcover was generally not damaged.
- In a few cases, there was some damage to low shrub vegetation, although shrubs were absent from many of the sites.
- While it was not recorded systematically, minor damage to lichen on rocks was noted at some controls, although at other controls, no such damage was evident.
- There was a broad correlation between the level of impact and the number of competitors, although there were some exceptions with only minor impacts experienced at some control sites which had relatively large numbers of competitors.

Because of the very low level of post-event impact, no further monitoring was considered to be warranted at six of the controls (see Table 1). The one-year monitoring of the remaining 19 controls resulted in the following observations:

Table 1. Summary of impacts in relation to competitor numbers

Control no.	No. of competitors	Impact assessment	
		Post-event	One-year
147	66	Minimal	Not monitored
170	100	Minimal	Not monitored
146	105	Minor	Negligible
157	112	Moderate	Negligible
138	123	Minor	Not monitored
168	135	Minimal	Not monitored
132	167	Moderate	Negligible
114	175	Moderate	Minor
155	184	Moderate	Negligible
106	198	Minimal	Not monitored
116	216	Moderate	Minor
160	226	Minor	Negligible
148	230	Moderate	Negligible
144	253	Minor	Negligible
161	254	Minor	Not monitored
128	271	Minor	Negligible
129	295	Moderate	Negligible
134	315	Moderate	Negligible
120	320	Major	Minor
117	321	Major	Negligible
122	324	Major	Minor
166	328	Moderate	Negligible
133	356	Major	Minor
145	390	Moderate	Negligible
123	429	Moderate	Minor

- At 13 of the 19 controls, the vegetation and litter cover had recovered to the point where no impacts were evident (i.e. the impact was assessed as negligible).
- At the remaining six controls, the residual impacts were assessed as minor. This assessment reflected a noticeable change in percentage cover for some attributes although, in all cases, the main change was a substantial increase in the area of either groundcover or litter. In one case (control 120), damaged heath had not fully recovered and in another (control 122), the exposure of bare ground during the event was still evident, but to a reduced extent.

In no case, however, was the extent of residual disturbance after one year so great that a casual observer would consider it to be unnatural.

Table 2. Nature of impacts immediately post-event

Control no.	No of competitors	Flattening of grass	Litter disturbance/ exposure of bare ground	Damage to groundcover	Damage to low shrubs	Movement of loose rocks or sticks	Lichen damage
147	66	+					
170	100	+	+				
146	105		+				
157	112		++		++		
138	123		+				
168	135		+				
132	167	++	+			++	
114	175	++	++	#			
155	184				++		
106	198	+		#			
116	216		++	#	+		
160	226	+	+	+			
148	230		++				o
144	253		+	+/#	+		
161	254	+	+				o
128	271		+				+
129	295	++	+	++			+
134	315	++	++				
120	320				+++		o
117	321		++	#	#	++	o
122	324		+++				
166	328		++				o
133	356		+++	++		++	
145	390	++					o
123	429		++				

- +++ Major impact
 ++ Moderate impact
 + Minor/ minimal impact
 # Change but not adverse (e.g. due to litter being spread over groundcover)
 o No impact on lichen

5. DISCUSSION

The general results of this study were consistent with previous (mainly overseas) studies in demonstrating that:

- (a) following a large orienteering event, the impacts of human activity around control sites are evident; and
- b) following a reasonable period of time (i.e. one growing season), the evidence of those impacts are largely obliterated by natural processes.

In terms of immediate post-event impacts, the observations suggest that a control site in the type of terrain studied can accommodate of the order of a hundred orienteers with only minimal to minor impact, while more than 300 orienteers need to pass through a control to cause a level of impact described as 'major' in the context of this study. As stated in Section 3, disturbance in the major category was considered likely to be obvious to anyone who was critically concerned about the impact of the event. In the interests of avoiding perceived adverse impacts, it is desirable to avoid the immediate post-event impacts reaching the 'major' category.

The separate study undertaken independently by Aurecon (Ref. 2) also found it was necessary for approximately 300 orienteers to pass through a control in order to demonstrate a clear impact using the Land Function Analysis technique developed by CSIRO (Ref. 3). Thus there are two studies using different techniques which indicate that 300 orienteers is an appropriate upper limit guideline to aim for in setting courses in dry Australian forest or woodland if the possible perception of significant impacts is to be avoided.

Most club or state/ territory level orienteering events in Australia attract less than 300 participants, and these are usually spread over several different courses of widely different standards to cater for young children as well as experience adult orienteers. The need to disperse competitors to avoid concentrated impacts would therefore not arise at most Australian events. Numbers in excess of 300 are usually experienced only at some state championships or events held as part of a national carnival. It is when setting courses at these events that the case for deliberately avoiding high numbers at individual controls becomes most relevant.

In practice, course planners for large events tend to distribute competitors among different courses to reduce crowding at controls and following on common legs. This is done primarily for technical reasons but is consistent also with reducing environmental impacts. The figure of 300 competitors per control is therefore recommended as an upper limit guideline for avoiding relatively major impacts and, at most events, may be well above the figure that a course planner would desire in terms of the technical quality of the courses. If there is any concern about the sensitivity of the terrain (or parts of it), it would be prudent for environmental reasons to apply a lower figure.

The type of terrain used in the present study is typical of much of the orienteering terrain in Australia in having a cover of eucalypt forest or woodland with an understorey of scattered shrubs, a variable groundcover with bare patches and

significant accumulation of leaf and bark litter. The impacts commonly observed immediately after events in other areas include flattening of grass, scattering of litter and minor damage to low woody shrubs. This is the case whether events are held in 'granite' terrain, which is present throughout Namadgi National Park, or in areas of different geology, as occur in the Canberra Nature Park areas close to Canberra.

It is considered that the results of this study can reasonably be applied to the majority of orienteering areas throughout Australia, where the broad environmental characteristics are similar. It may not be valid, however, to apply the results to some specialised terrains such as coastal sand dunes, alpine areas or arid areas where environmental conditions are significantly different. As conditions affecting vegetation recovery in these environments are relatively stringent, it would be appropriate to adopt more conservative figures in the absence of better knowledge.

Irrespective of the above discussion, the environmental code of conduct adopted by Orienteering Australia (Ref. 4) places an obligation on course planners to avoid areas of particular sensitivity as far as is practicable. This is a consideration in the siting of controls and the assessment of likely routes between controls. In some situations, areas may be declared out of bounds and be marked accordingly in the terrain. Such areas would not contain control sites or be traversed by orienteers.

On the other hand, there are some situations, such as on the edge of a road or in other constructed areas, where a much larger number of competitors could visit a control with negligible impact. Placing controls in such locations may be desirable for 'high volume' controls such as a common final control for all courses, if circumstances permit.

The weather conditions under which the current study was undertaken were generally favourable from the viewpoint of limiting impacts on the competition day and encouraging recovery over the year following the event. While more extreme weather conditions (e.g. heavy rain on the day or severe drought during the following year) may have resulted in somewhat greater impacts or slower recovery, it is considered unlikely that these would have altered the main conclusions of the study, namely that large numbers of orienteers passing through a control site on one occasion do not lead to significant long term damage. This is consistent with the conclusion of numerous overseas studies.

6. CONCLUSIONS

While large orienteering events may lead to observable impacts in the vicinity of control sites immediately following the event, natural processes generally lead to recovery from those impacts after a full growing season (nominally one year). For events conducted in typical Australian orienteering terrain, where it is desirable to avoid the immediate impacts reaching a level which could be regarded as significant by a critical observer, it is recommended that courses should be planned so that the number of orienteers passing through a given control is limited to no more than 300.

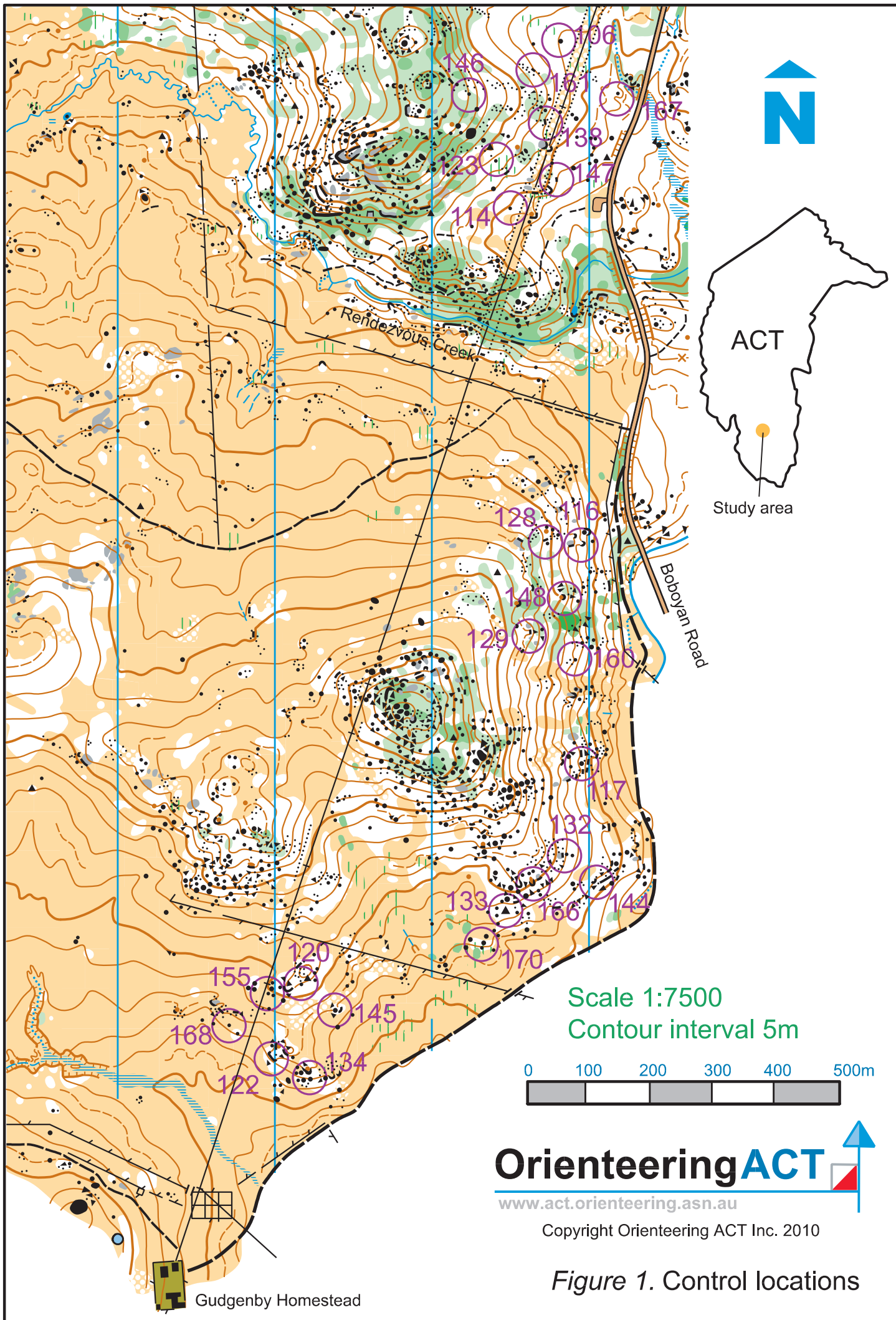
This guideline is relevant particularly to events conducted in national parks and other areas managed with nature conservation as a primary objective. It is not necessarily applicable to areas where other land uses, such as forestry or grazing, have potential to cause impacts which would mask those resulting from orienteering. Course planners and controllers should use their judgement in adopting a lower figure in sensitive terrain or relaxing the limit at sites where the terrain is more resilient.

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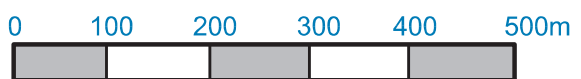
Study area

Rendezvous Creek

Bobyan Road

Gudgenby Homestead

Scale 1:7500
Contour interval 5m

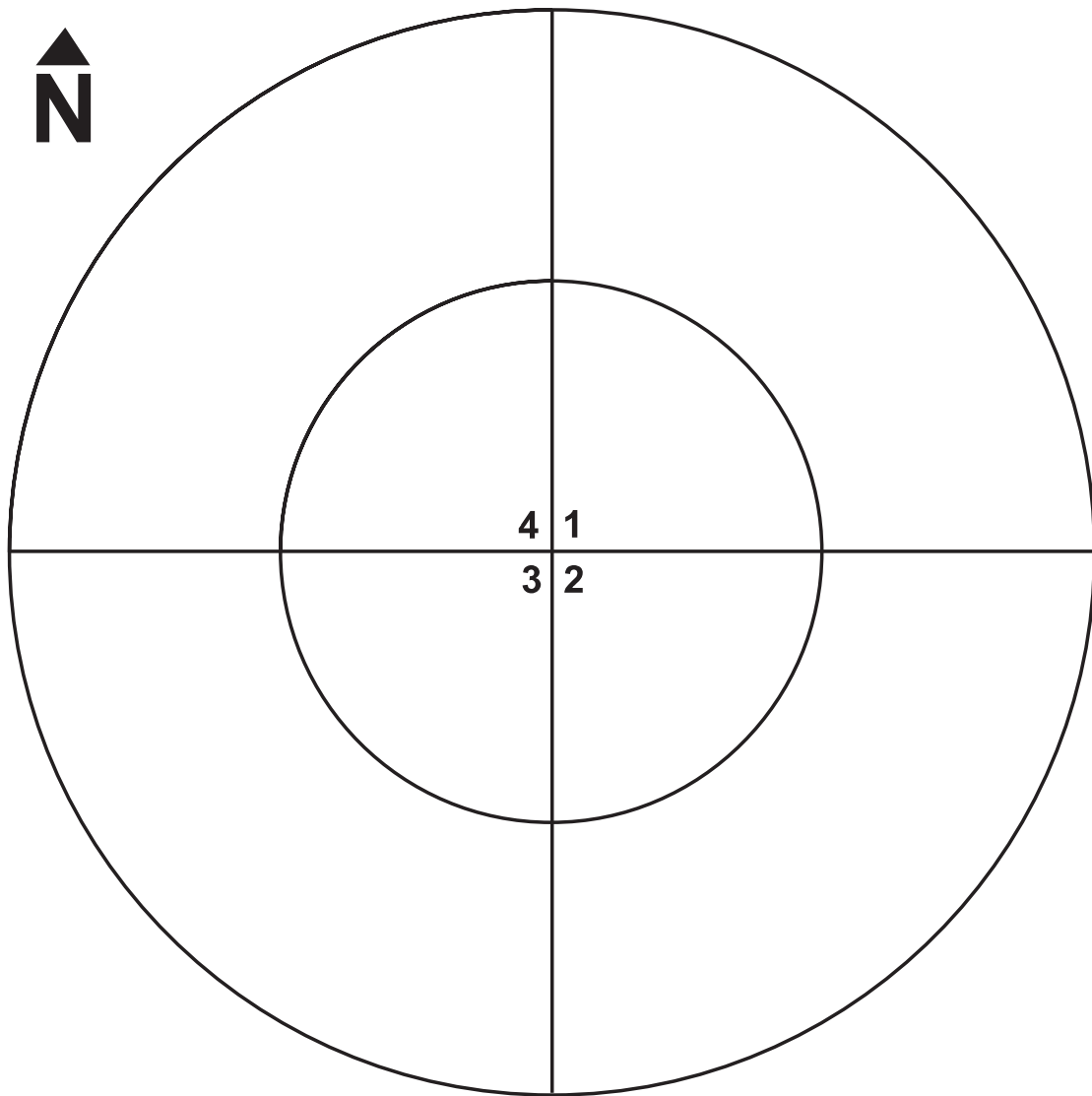


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Figure 1. Control locations



Date

Control number

Comments

Quadrant	Groundcover	Shrubs	Litter	Bare ground	Rock	Comments
1						
2						
3						
4						
Total						
Percentage						

Figure 2. Field recording sheet

