DIFFERENCES BETWEEN RECENT HORSE SURVEY RESULTS

Supplementary notes by D Fletcher

for the Animal Welfare Committee hearing

on 27 March 2024

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Background

An 'independent recount' of horses has recently been completed by Rocky Harvey with design assistance from Claire Galea, for the stated purpose to 'prove' there are fewer horses than the number reported in official counts. Experienced ecologists expected the survey design to count fewer horses than the official surveys, and it has done so.

The recent survey was funded by public donation and has attracted considerable interest from protestors against feral horse control in Kosciuszko National Park (**KNP**) who are using it to lobby for horse control operations to be stopped. This note explains differences between the three most important surveys, which are:

(i) The official Helicopter Line Transect Distance Sampling (**HLTDS**) surveys of horses in KNP carried out since 2001 by Walter, Montague-Drake, Dawson, Laake, and Cairns; and their co workers; the latest example of which is Cairns (2023).

(ii) A near-annual Horse Helicopter Index (**HHI**) of the Northern Plains of KNP carried out between 1998 and 2021 by KNP staff; and

(iii) The recent 'independent recount', i.e. an air photo survey (**APS**) by AirborneLogic, a contractor working to directions from Rocky Harvey and Claire Galea https://www.gofundme.com/f/independent-wild-horse-recount.

Previous alternative horse counts

Four previous alternative counts in KNP by horse protestors share their most important characteristics with the recent APS by Rocky Harvey and Claire Galea. In all five cases, the horse protestors acted independently of the science. Estimating abundance is one of the most challenging elements of field ecology, however there is a great deal of expertise available in how to do it right, and many accepted methods. However none of the five alternative horse counts used any standard accepted method. Details of the four previous alternative counts are in Appendix 1.

Year	Population estimate	Leader	Method
2021	838	Snowy Mountain Brumby Sustainability and Management Group	'Spotting' from a helicopter
2021	1000	Peter Cochran	One rider visiting frequently
2023	238 - 731	Di Hardley, Karen Summers, Claire Galea	Many riders.
2023	3-4,000	Peter Cochran	One rider guessing

Indexes of relative abundance V estimates of absolute abundance

'Absolute abundance' is the total number of animals of a species in an area, expressed either as the estimated number in the population, or as a density, the number/unit area, e.g. wild horses km^{-2} (Caughley 1977; Krebs 2001). Estimates of absolute abundance are more difficult and expensive to obtain than indexes of abundance because both the seen and unseen components of the population need to be estimated. This is the definitive difference between estimates of absolute abundance and indexes of relative abundance.

Only three well known families of methods measure absolute abundance:

(i) mark-recapture type methods;
(ii) distance sampling methods including the official Helicopter Line Transect Distance Sampling (**HLTDS**) surveys of horses in KNP; and
(iii) area counts such as quadrat methods and corrected aerial strip count methods.

Because of the challenges and costs involved in estimating absolute abundance, most wildlife management is instead based on indexes. An index of abundance is a somewhat arbitrary number obtained by a repeatable wildlife survey, which (hopefully) increases and decreases in proportion to population size (Caughley 1977; Krebs 2001). The index provides both the magnitude of population growth rate and its direction (+/-). Examples of indexes of relative abundance include tonnes of fish per trawl, trapcatch per week, number of animal tracks on a road overnight, and number of dung per hectare. The Horse Helicopter Index (**HHI**) of the Northern Plains is one example. The APS apparently is assumed by its supporters to be an estimate of absolute abundance but as stated on Rocky Harvey's web page well before the count was carried out, the air photo method lacks any way to estimate the proportion of horses under trees. Nor does the method have any way to estimate the proportion of animals undetected for any other reason. Therefore the API too is an index of relative abundance.

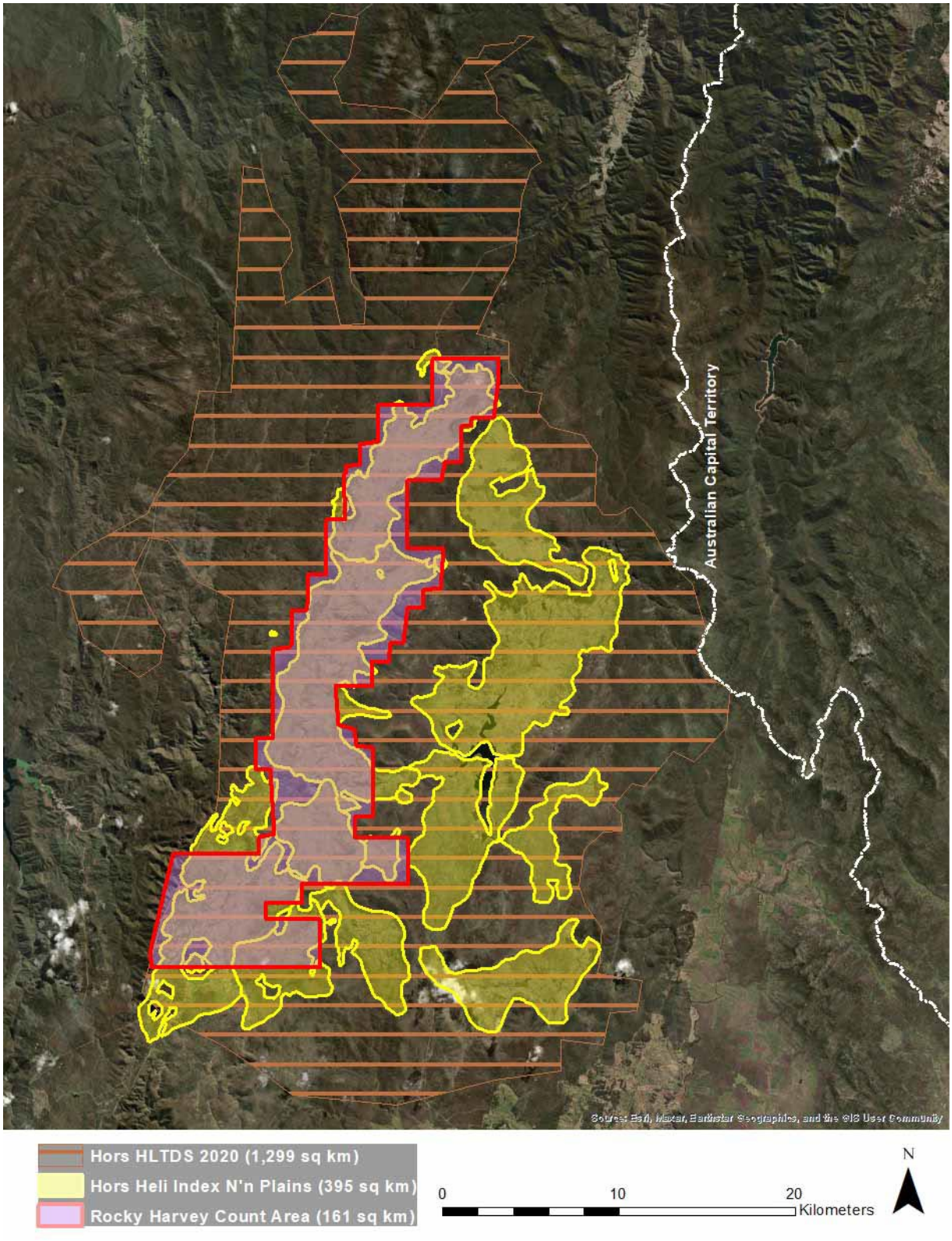
The validity of an index depends on consistency in how it is conducted on each occasion. In particular, careful attention is often needed to seasonal and diel (i.e. day-related) factors such as time of year and time of day for conducting the survey, length of vegetation, etc, as well as to the recording method such as who is the observer, how long is spent observing, type of survey platform, etc.

What types of comparisons between surveys are valid?

The HLTDS surveys estimate absolute abundance, whereas the other two surveys provide indexes of relative abundance. There is no valid means to compare the index counts to the estimate of absolute abundance. However it is reasonable to compare the merits of the two index methods.

Each of the three methods has been applied to different areas (Figure 1).

Figure 1: Three different types of horse surveys in northern KNP cover different areas



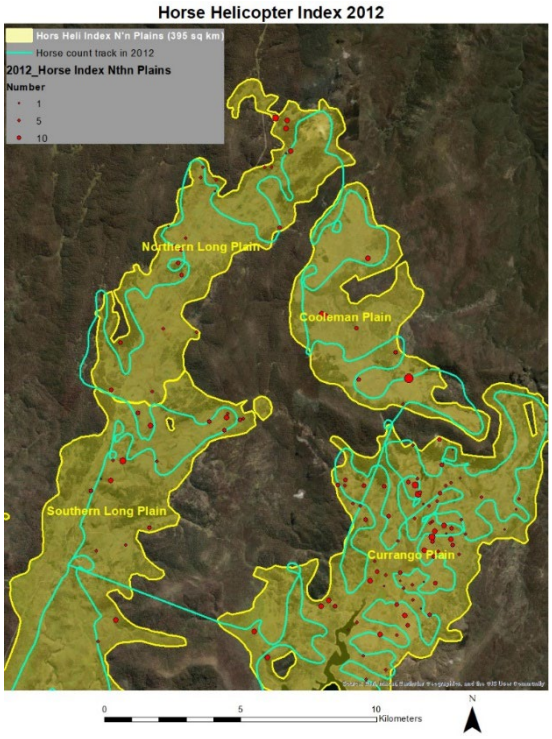
The Horse Helicopter Index (HHI)

The HLTDS has been previously described in my submission. In the following notes I describe the HHI and the APS.

In 1998 KNP staff started mapping all groups of horses they could see from a helicopter in the open plains of north KNP. The activity was then abandoned for nine years before commencing again in 2008. Thereafter it was repeated annually in September most years until it stopped in September 2021. In some years the HHI was also conducted in June.

To do the count, the helicopter flew relatively low, recording the location of each group of horses and the number in the group. There was no consistent track for the helicopter. It simply flew where necessary to search each of the twelve named plains (Figure 2) so the track was different each year. Movement by horses attracts the eye, and so, combined with the low angle of observation, some horse groups were detected under the trees fringing each of the open plains.

Figure 2: Some of the open plains, with the track of the 2012 helicopter survey and locations of horse groups, with size of dot indicating the number of horses in the group.



In the first year, 75 horses were recorded, an alarming number to some people who had foreseen the potential for future problems from as early as 1959. But ten years later, in 2008, the number had increased to 558 (a 7x increase) and ten years later again, in 2018 it was 2,791 (a 5x increase).

The chart (Figure 3) shows that the HHI performed its role well as an index of relative abundance. It clearly demonstrated the direction and rate of change in horse abundance. Population growth rate averaged just under 14% per year, close to the 15% growth recorded from the HLTDS surveys. If at some stage the horse population were to decline for biological reasons such as disease or food shortage, that could be detected by such a survey and would likely prompt a cessation of any control activity, such as trapping or helicopter shooting, until the matter had been investigated and plans adjusted if necessary.

Figure 3: Results of the HHI on the Northern Plains. (Not to be confused with a similar chart in my submission, which is for the HLTDS and the whole of KNP). The trend line is for 14% annual growth. Maps have been provided in Figures 4 and 5 for surveys indicated by enlarged dots.

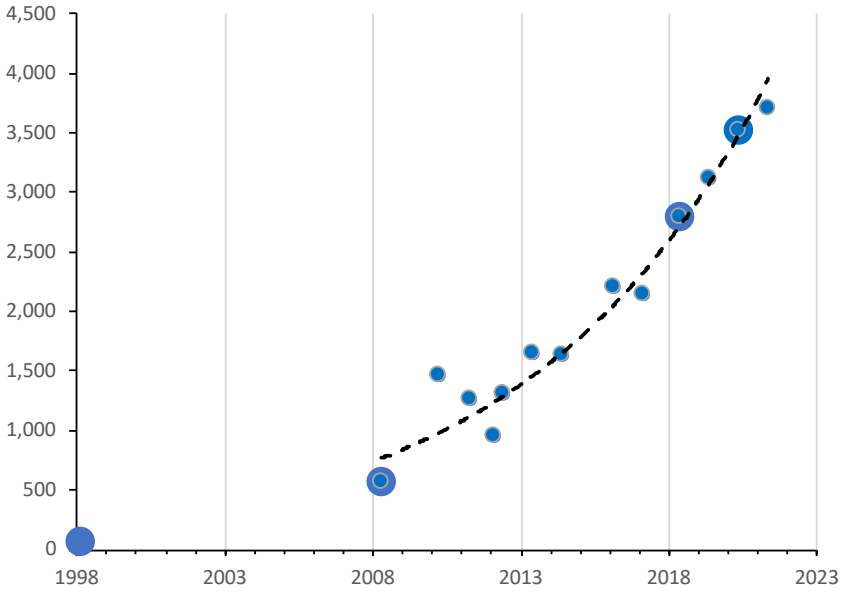


Figure 4: Horse Helicopter Index in 1998 and 2008

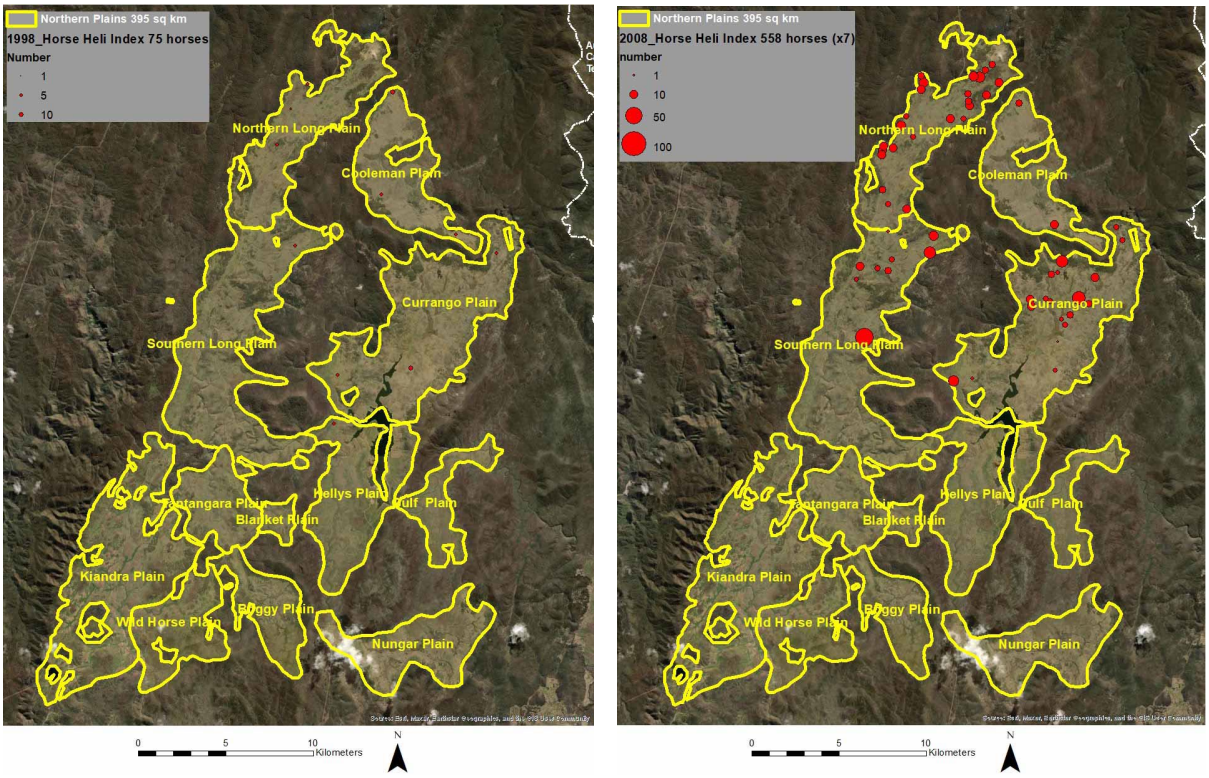


Figure 5: Horse Helicopter Index in 2018 and 2020

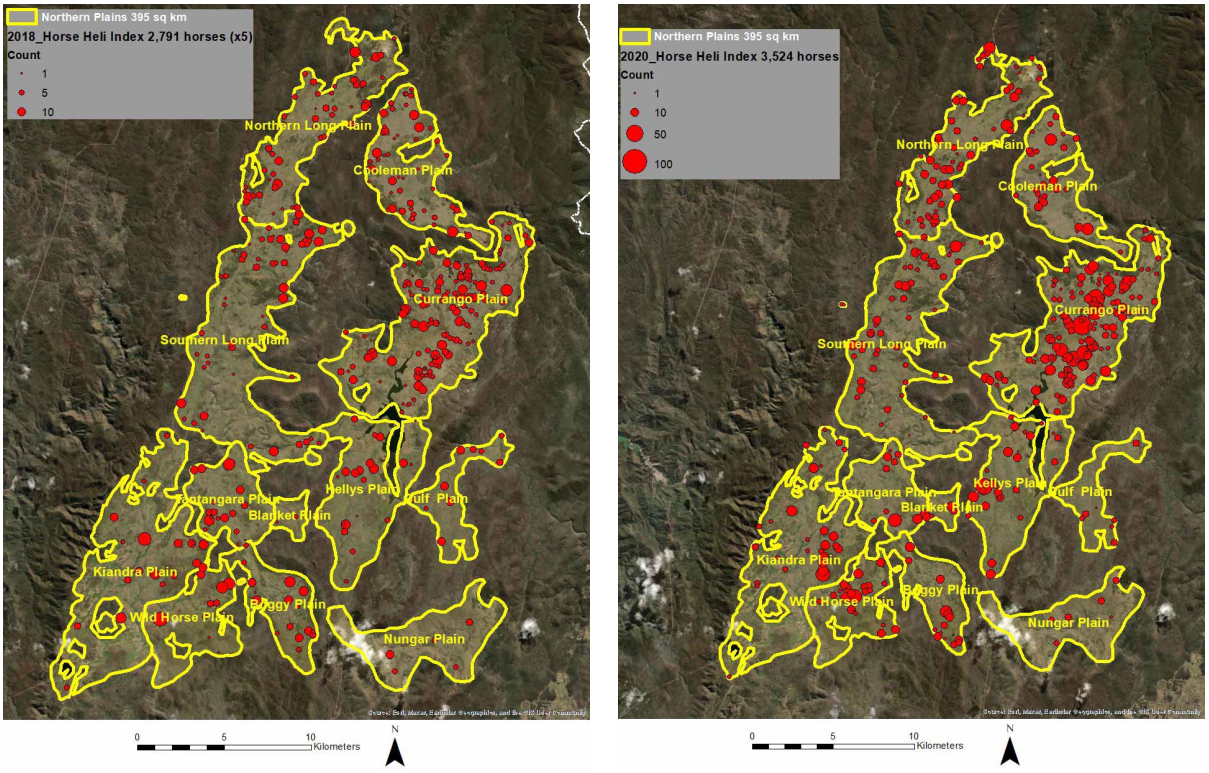
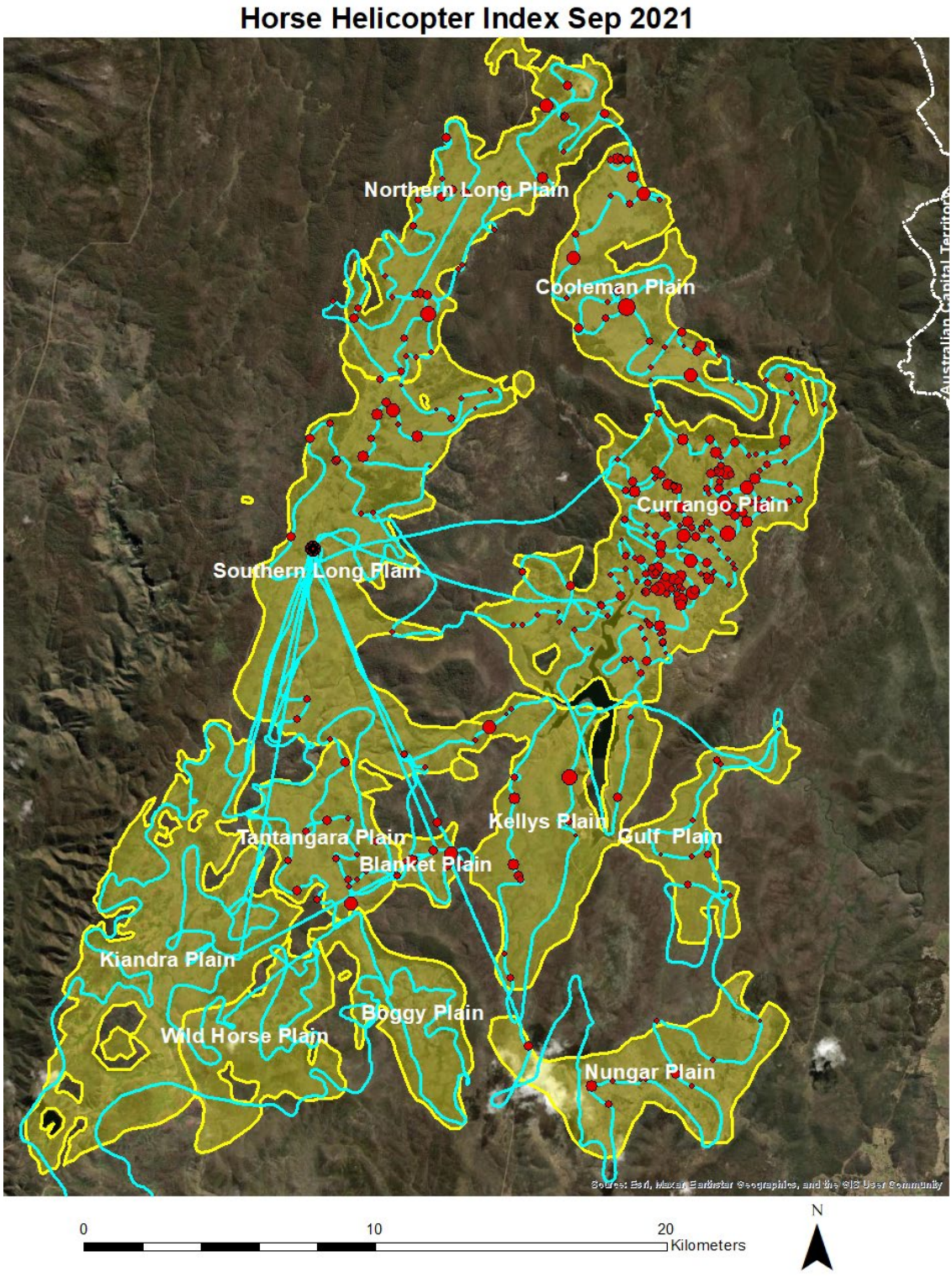


Figure 6: The latest Horse Helicopter Index, conducted in September 2001. 3,699 horses were counted. Compare the distribution of horses to the survey in September 2020 (Figure 5). The blue line is the track of the helicopter.



The recent 'independent' recount using an Air Photo Survey (APS) method

Rocky Harvey organised crowd funding to enable employment of a contractor to survey part of the northern plains for horses, initially in partnership with Claire Galea. The work was contracted to AirborneLogic, a company which has previous experience with agricultural surveys.

The following description is based on an online video of a meeting between Harvey, Galea and other protestors about plans for the survey, and updates posted on the internet by Rocky Harvey and AirborneLogic. See https://www.gofundme.com/f/independent-wild-horse-recount

AirborneLogic photographed 212 km^{-2} of the open plains and adjoining woodland from a fixed wing aircraft at 1,000 m above ground level, then made an orthophoto coverage of the area, with ~5 cm pixel size. Horses in the open sunlit plains were easy to identify from this detailed imagery. The company had earlier advised that the method was unable to detect a horse under the tree canopy. Therefore the APS is generally unable to count those horses which were withing the woodland areas. AirborneLogic had also advised against attempting to use thermal imagery (which has greater potential to see through vegetation but comes with other problems).

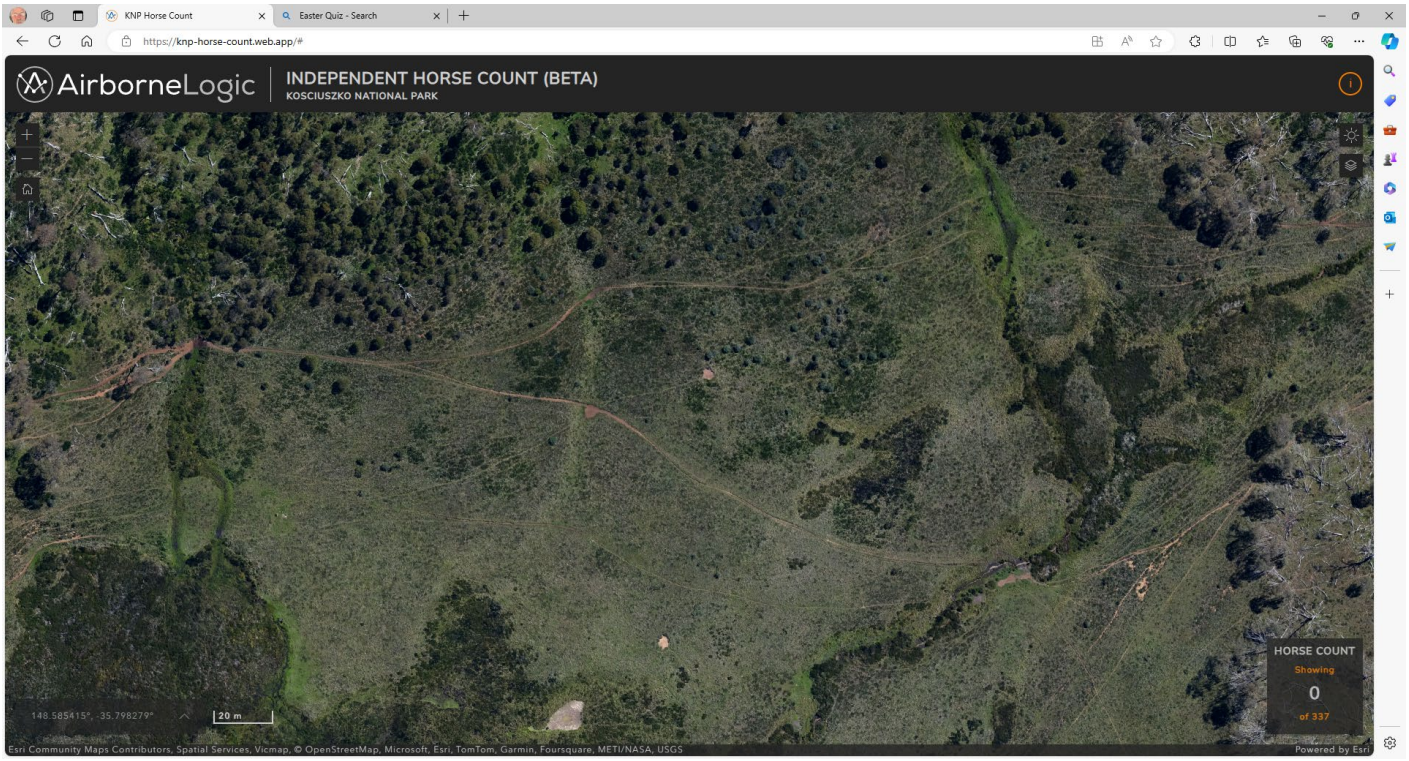
The survey was flown on 25th February 2024. It is uncertain what disturbance factors may have operated at the time although the imagery shows work underway to instal powerlines for Snowy 2 along roads through the counted area (Figure 7) and also some road maintenance work on Long Plain. Disturbance could cause some horses to move further into wooded areas or to move to other open plains that were not surveyed.

Figure 7: Example of disturbance at frequent intervals along roads through Blanket Plain, Tantangara Plain, Southern Long Plain and Northern Long Plain on the day of the APS. There were dozens of disturbance sites along these roads. The arrowed item is a person. They are standing opposite a track-mounted excavator. A vehicle is parked nearby.

The resulting imagery has been placed on the internet https://knp-horse-count.web.app/#info. It is of excellent quality. When zoomed in sufficiently, it shows an astonishing density of horse tracks (Figure 8), and other horse damage, such as patches of bare ground (aka 'roll holes'). According to the latest update (No 26), 337 horses have been counted in the image. https://www.gofundme.com/f/independent-wild-horse-recount.

Importantly, not even one individual of another large animal species such as a Sambar, a Fallow Deer or a Feral Pig has been seen or reported in the survey, presumably because they are all hidden under the trees (as well as being at lower density than horses). See below and Figure 9.

Figure 8: Numerous horse tracks are visible if the image is zoomed in closely, and bare areas also.



It is clear why AirborneLogic advised that the method could not count horses under trees. For example in Figure 9 is an arrowed object standing in open short grass under the shade of a tree, which might be a horse, a deer or a pig, or it may not be any kind of animal, but the shade of the tree is sufficient to make it difficult to decide what it is. Thus, as well as wooded areas, even shaded parts of the open plains can not be reliably counted with the APS method in its current form.

This is one of several reasons why the APS has recorded fewer horses than the HHI. The APS is counting horses in still colour photos taken from 1000m vertically above while the HHI is counting live animals as they move. So as well as counting the open plains, the HHI also works under the fringing trees to some extent.

Figure 9: Screenshot from the AirborneLogic web app. Seven horses are clearly visible out in the open but it is difficult to decide whether the long black arrowed object in the shade of a tree, which has a shadow just like the horse on the left, is a horse, a deer, two pigs, or not an animal. Incidentally, older imagery recorded as recently as 2022, shows only three of these seven patches of bare ground. Also, in earlier imagery there were small shrubs, which are no longer present.

The area photographed by AirborneLogic is 212 km^{-2}. It includes some wooded areas where horses can not be detected. When these are subtracted, the size of the surveyed area is approximately 161 km^{-2}. Therefore if the entire open plains area of 395 km^{-2} had been surveyed under identical conditions, the number of horses predicted to have been visible in the imagery would be 337/161 x 395, i.e. 827 horses. This is far less than the number counted in the last iteration of the HHI in September 2021, which recorded 3,699 horses.

A suggestion has been made by Rocky Harvey that a calculation for the entire northern plains should include allowance for the fact that the unsurveyed plains contain more horses than the surveyed ones in the HHI surveys (e.g. see Currango Plain in Figures 5 and 6). (This would significantly increase the predicted count above 827.) I have not adopted Mr Harvey's suggestion because horse densities calculated for the two areas are little different (8.0 horses km^{-2} on the east and 8.3 km^{-2} on the west using data from the 2020 HHI), therefore I used simple proportions based on area.

This instance of the APS method appears to lack a way to estimate a 95% confidence interval. If so it is a major deficiency.

Comparing the HHI with the APS

Both indexes have significant deficiencies which could easily be remedied. First, any index is improved by repeating the measurement on each occasion to evaluate its consistency. For example the high variability between the four horseback counts that were attempted in two days by the independent recount in June 2023 (Appendix 1), showed that the method needed improvement before its results could be trusted. There is less need to repeat the HHI because after 14 surveys over

23 years the HHI can be seen to have provided remarkably consistent results, but it is still preferable to do so. The APS does not have the advantage of a long history, so if the APS is ever carried out again, it is strongly recommended to repeat it, e.g. at weekly intervals, until there are at least three replicates, enabling its consistency to be evaluated. Survey effort and method should also be carefully defined and made consistent. An experienced wildlife ecologist can suggest other improvements.

The better index of the two is clearly the HHI, by a long margin, because it:

- cost much less;
- covered all of the open plains; and
- was capable of detecting many more horses in each of the plains than the APS (total 3,524 in 2021, compared to 827). See below for comment on how much of this difference could be attributed to horse removals and how much to different methods.

An advantage of covering all twelve of the open plains is that this reduces the potential variation between survey iterations due to horses moving between plains. For example we have no way to know whether the disturbance caused by the Snowy Hydro powerline installation seen in progress in the APS survey photography was sufficient to cause horses to move across to other plains that were not included in the APS. Another advantage of the HHI is that all horses in the open plains are counted directly, with no calculation needed to extrapolate to other parts of the open plains. Also we do not know the effect of different times of year on how the horses are distributed between the plains.

The HHI is carried out in September, a time of year when the number of horses out in the open is thought to be at its greatest. The APS was carried out in February, a time when some horses are thought to seek shade under trees to escape insects or heat. This is another reason the APS recorded fewer horses than the HHI. It would have been a fairer and more appropriate comparison if the APS had been run at the same time as the HHI, or at least the same time of year.

An advantage of the APS over the HHI is that it records the vegetation. In the 5cm pixel imagery provided by AirborneLogic, horse damage is plainly evident, including an amazing density of tracks, and numerous small patches of bare ground. Also, comparison of imagery over time shows changes such as the disappearance of some small shrubs. This leads to the thought that perhaps in future, similar aerial surveys as carried out by AirborneLogic (but perhaps using LIDAR as well as RGB imagery) could be used to cheaply monitor vegetation in horse retention areas, and vegetation recovery in horse removal areas.

Where are the 'missing' horses?

In one recent update Rocky Harvey challenges Penny Sharpe (Environment Minister) to explain the so-called 'missing horses', referring to the difference between the 337 counted by AirborneLogic and the 13,163 (95% CI 9,025 to 17,371) estimated by Cairns (2023) for the North Kosciuszko Survey Block.

Comparison between an index of relative abundance and an estimate of absolute abundance is invalid. The question is asking Ms Sharpe to compare incompatible entities.

Nothing at all was done in the 'independent recount' exercise to quantify the horses unseen in the North Kosciuszko Survey Block. Therefore an answer to the question is that the missing horses are not missing.

Rocky Harvey and Claire Galea chose not to consult experts in the estimation of wildlife abundance when planning their independent recount. The result is the same as if I installed the wiring for a large factory, with no electrical training, i.e. it would be unwise to trust it.

In order to trust an estimate of abundance obtained by a novel method, what is needed is evidence published in a recognised, peer reviewed ecology or statistics journal that deals with abundance estimation methods, showing that the new method has produced population estimates that are no more biased than established methods and of similar precision for the relevant species and habitat. New methods in science must prove themselves before they obtain acceptance.

In this case there has not even been any replication of the count, and there has been no trial on a known population. The result is far different than the results of surveys of a type which is widely accepted by scientists. The conclusion is obvious, that on current evidence, the APS has not provided a useful estimate of horse abundance.

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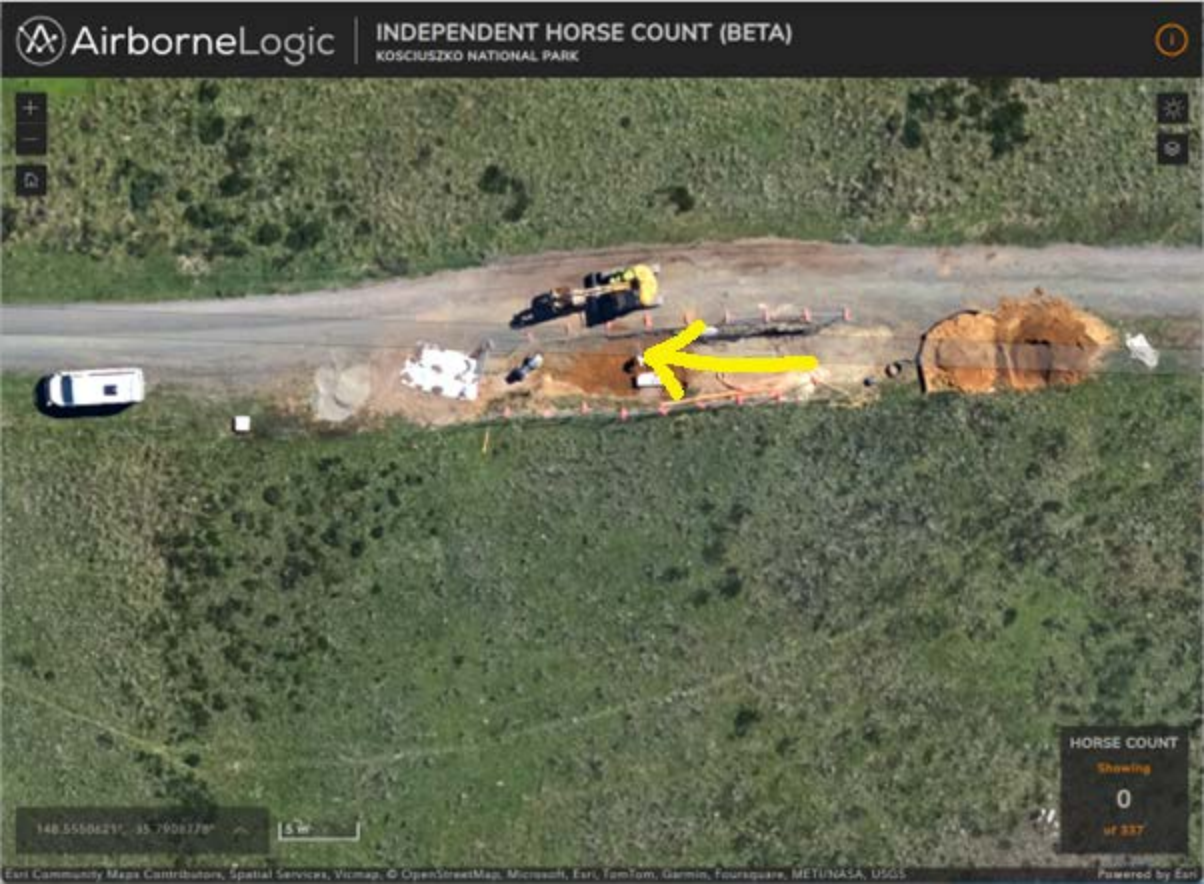
APPENDIX 1: ***PREVIOUS ALTERNATIVE HORSE COUNTS***

Year of count	Description
2021	In September 2021 a 'helicopter spotting count' was undertaken by the Snowy Mountain Brumby Sustainability and Management Group (SMBSBG) in the North Kosciuszko Region. During this spotting count, the number of horses seen was **838** https://brumbiesforever.org/page3.html
2021	In October 2021 Peter Cochran, former National Party Member for Monaro and now a member of Pauline Hanson's One Nation, said that he rides in the northern plains five days per week, and that in doing so he estimated the population at approximately '**1000 or a bit more**', a figure he said was endorsed by a senior NPWS ranger (Hadley 2021).
2023	On 3-4 June 2023 a 'headcount' was conducted involving several tens of riders led by Di Hardley and Karen Summers with advice from Claire Galea. They sought to retrace the path of the 2021 helicopter flight in the HHI and to count all of the open plain areas in each of four count sessions (two per day). Unfortunately there were practical problems. The counters were not coordinated by portable radio to help them deal with horse movements between areas. Only six of fifteen count areas could be visited for each count. The results (detailed on next page) provide evidence of substantial movement of horses between areas, e.g. the count on Currango Plain varied from 255 on the first morning to 17 that afternoon, then back up to 119 on the second afternoon. Consequently the total count ranged **from 238 to 731,** thus undermining credibility of the result. No attempt was made to repeat the exercise with the benefit of learning from the first attempt.
2023	In August 2023 Peter Cochran said he estimated the feral horse population in KNP as approximately '**3,000 to 4,000 if that**' (Mason 2023)

APPENDIX 1 cont: Results of an alternative count of horses on the Northern Plains in June 2023 by Di Hardley and Karen Summers plus volunteers, with advice from Claire Galea.

Horseback Count Data from Karen Summers. Two count sessions per day on 3rd and 4th June 2023.

Area counted	Count session 1	Count session 2	Count session 3	Count session 4	Complete?	Min	Max	Mean	SD	Range %
Blanket Plain			21		No	21	21	21	-	-
Boggy Plain					No	-	-	-	-	-
Coolamine HS	14	33	37	36	YES	14	37	30	10.80	77%
Cooleman Plain &17 flat	120				No	120	120	120	-	-
Currango Plain Nth	108	17	80		No	17	108	68	46.61	133%
Currango Plain Sth	147	0	0	119	YES	0	147	67	77.63	221%
Dairymans Gap	114		4		No	4	114	59	-	186%
Kiandra Plain and Gooandra Plain	20	48	70	80	YES	20	80	55	26.60	110%
Northern Long Plain	27	23	52	29	YES	23	52	33	13.07	89%
Nungar Plain	0				No	0	0	0	-	-
Oldfields and Pockets Huts		41			No	41	41	41	-	-
Port Philip Trail	57	33	38	33	YES	33	57	40	11.41	60%
Southern Long Plain	39	35	14	20	YES	14	39	27	11.92	93%
Tantangara Plain		8			No	8	8	8	-	-
Wild Horse Plain	85				No	85	85	85	-	-
COMPLETE?	No	No	No	No						
TOTAL	731	238	316	317	0	400	909	653	28	121%
Currango Combined	255	17	80	119	YES	17	255	118	100.69	202%


AirborneLogic
INDEPENDENT HORSE COUNT (BETA)
KOSCIUSZKO NATIONAL PARK
HORSE COUNT
Showing
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