Research into Equine Welfare Problems on Bodmin Moor

Bodmin Moor is located in Cornwall – the most South-Westerly county of the UK. The "Moor" is made up of small, fully enclosed Commons separated by farmland. On the commons cows, sheep, and ponies are grazed. The ponies are semi-feral but they are all owned by local farmers/residents who have grazing rights on the moor – the farmers/ residents are known as Commoners.

There is a long history of equine welfare problems on the moor. People4ponies has conducted research into the welfare problems on the moor—to establish whether the previous mining activity could be affecting the ponies on the moor and to look at the local environment on two moorland areas which have annual welfare problems. The two areas investigated are East Moor and Minions/Caradon Hill.

East Moor

East Moor is located to the North East of Bodmin Moor. It is an enclosed area of moorland, approximately 3 miles in area. The scale of its equine welfare problems has received media attention in recent years. Each year there are equine welfare problems on Bodmin Moor and in 2016 it has received particular focus. Approximately one third of the equine population on East Moor were effected by the welfare crisis. At least 23 ponies died, and at least 42 ponies in emaciated or severely emaciated condition were removed from the common between February and June 2016.

In 2011, at least 5 ponies died on East Moor and 19 emaciated ponies were seized. Defra made assurances that the situation would never be allowed to happen again. In 2013, 20 ponies died and 30 ponies in poor condition were reported to be under monitoring by the authorities. Lord de Mauley (who was in charge of Defra) made assurances at a Parliamentary meeting that another crisis would not be allowed to happen again. A large burial pit on site with horse bones in it is believed to relate to 2014.

The welfare of horses and ponies on Bodmin Moor is covered under the jurisdiction of the UK Animal Welfare Act 2006. Defra (the UK government Department for the Environment, Food, and Rural Affairs) and their agency AHVLA (Animal Health Veterinary Laboratory Agency) have jurisdiction over the ponies on Bodmin Moor because the ponies are considered to be "farmed animals" and are passed into the human food chain. The owners of ponies have a legal responsibility to microchip and passport their animals. This has not been enforced by the authorities and so ponies grazing on the Common cannot usually be linked to an owner, particularly the ponies in poor bodily condition. There are no prosecutions brought by the authorities under the Animal Welfare Act because owners cannot be traced. When there are welfare problems on the moor it is usually claimed that the ill or emaciated animals have been abandoned on the moor. In these situations it is rare for anyone to claim responsibility of ownership.

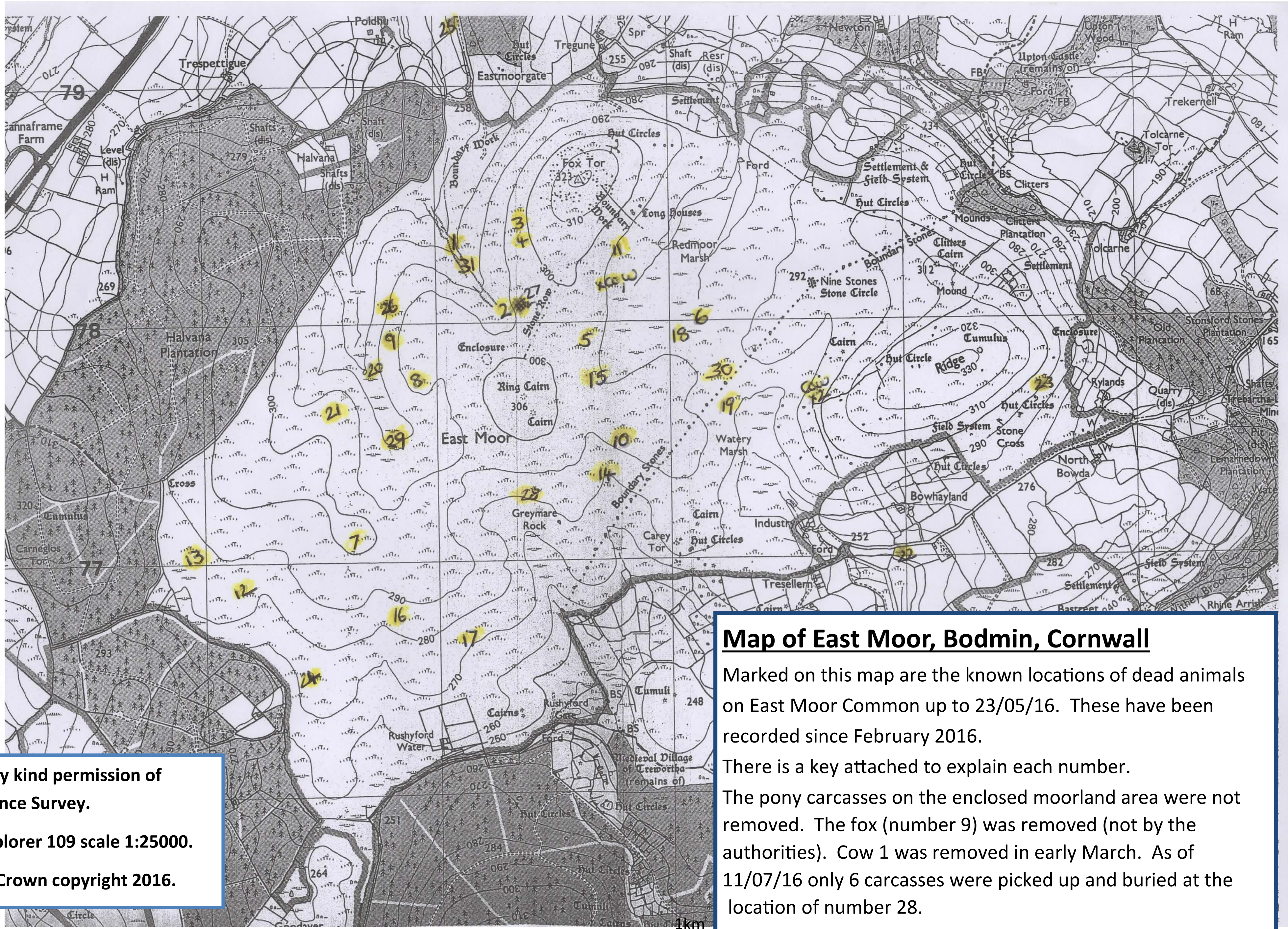
There is no routine supplementary feeding of ponies on East Moor throughout the winter.

It should be noted that Bodmin ponies are not a native UK breed of pony.

Regarding the 2016 equine welfare crisis on East Moor it was noted that: there was no real snow during the winter - the last harsh winter was 2010; the ponies that died were not old; there were also dead cows, sheep, and scavenging wildlife found on this site; ponies on Dartmoor and Exmoor thrived in their environments without the need for supplementation; this was the worst crisis so far and promises from Defra to prevent these situations have not come to fruition.

Testing has been conducted to establish whether the environment or previous mining activity could be detrimentally effecting ponies grazing on East Moor.

The map on page 2 displays the location of dead animal carcasses on East Moor recorded between February 2016 and 23rd May 2016. The map demonstrates not only the scale of the problem but also the distribution of carcasses. Deaths are not restricted to one particular area of East Moor. One further pony died after this map was published—the carcass was removed during an AHVLA intervention on the 16th and 17th June 2016. Page 3 contains a key for the map. Pages 4 and 5 contain photos of many of the carcasses recorded.



Map of East Moor, Bodmin, Cornwall

Marked on this map are the known locations of dead animals on East Moor Common up to 23/05/16. These have been recorded since February 2016.

There is a key attached to explain each number.

The pony carcasses on the enclosed moorland area were not removed. The fox (number 9) was removed (not by the authorities). Cow 1 was removed in early March. As of 11/07/16 only 6 carcasses were picked up and buried at the location of number 28.

Map by kind permission of Ordnance Survey.

OS Explorer 109 scale 1:25000.

East Moor Map Key

1. Black foal, head by tiny rock, recorded 30.03.16.

2. Grey (white) stallion, recorded 30.03.16.

3. Grey adult pony, recorded 30.03.16.

4. Dark grey yearling, head by huge rock (pony 3 may have been its mare).

5. Small, light brown skewbald pony, recorded 30.03.16.

6. Skewbald pony, lighter colouring, recorded 30.03.16.

7. Skewbald pony, dark colouring, recorded 30.03.16.

8. Small, black yearling pony, recorded 30.03.16.

9. Dead fox (not shot), removed (not by authorities).

10. Grey pony, recorded 04.04.16.

11. Dun yearling pony, recorded 14.04.16.

12. Bogged, brown mare, shot, recorded 20.04.16.

13. Grey (white) stallion, recorded 20.04.16.

14. Grey mare, shot, recorded 26.04.16.

15. Grey pony, recorded 29.04.16.

16. Hair outline with skull, bones scattered, recorded 02.05.16.

17. Chestnut pony corpse, recorded 02.05.16.

18. Bones of pony that died in the summer of 2015.

19. Skeleton of a pony, some black hair remaining on parts, recorded 12.04.16.

20. Dying calf reported to RSPCA August 2015, body not removed.

21. Newly dead calf, found March 2016.

22. Skewbald pony, recorded 04.03.16.

23. Skewbald pony on the "Ridge", recorded mid March.

24. Pony skeleton, recorded mid March.

25. Pony shot in field, colt, 04.03.16.

26. Dead calf found 08.05.16.

27. Burial pit with horse bones sticking out of it (believed to be from 2014).

28. Dead grey pony found 20.05.16.

29. Dead sheep found 20.05.16.

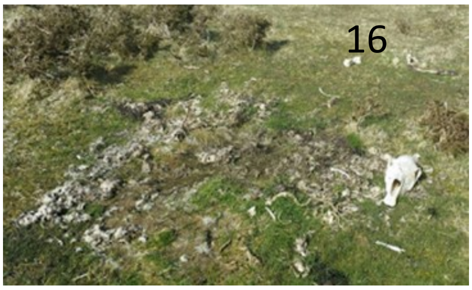
30. Dead calf found 22.05.16 - ear tag had been removed, body left on moor.

31. Dead sheep found 23.05.16.

x1, x2 = Cows. Cow x1 was removed from the moor (possibly by its owner) by the 4th March 2016. It had been reported to the police 21st February 2016.

Photographs relating to the Key on page 3. Numbers on each photo correspond to the numbers in the key

13


15

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31

Cow x1

Cow x2

Previous Land Use

East Moor is currently open rough grassland used for grazing cows, sheep, and ponies. The general public can access East Moor under the Countryside and *Rights* of Way Act 2000 also known as the “Right to Roam”.

East Moor archaeologically contains evidence of prehistoric and medieval settlements and field systems, prehistoric ceremonial and ritual sites, and medieval streamworks. Archaeological reports also make reference to Redmoor Marsh having been disturbed by tin streaming activity (Gearey, B. 1996: Human-Environment Relations on Bodmin Moor During The Holocene. Plymouth, page 288).

Archaeological Surveys showed that Redmoor Marsh on East Moor formed during the Holocene period circa 12,000 years ago. Archaeological pollen surveys showed that East Moor was wooded in the “Early Holocene the high slopes being dense hazel with oak and perhaps some elm present locally. The valley was dominated by hazel and probably oak on the valley sides with alder spreading later onto the mire areas. Clearance in the Neolithic resulted in the spread of alder on the higher slopes and birch on the mires. Further clearance in the Bronze Age resulted in the demise of most of the tree and shrub cover and the spread of grass and heathland” (Gearey, B. 1996: Human-Environment Relations on Bodmin Moor During The Holocene. Plymouth, abstract page).

Seven Bronze Age settlements lie within the area (c 300ha) on East Moor (Johnson. N, and Rose, P. 2008: Bodmin Moor, An Archaeological Survey, Volume 1: The Human Landscape to c 1800. Swindon. Page 63). It is described as a very organised layout with gateways, houses and paddocks within the settlement enclosure. Suggests grazing activity at this time.

“Clearance intensified in the Romano-British period. Land use was pastoral, although limited cultivation in Tresellern valley was possible. Grazing activity continued on the moor, with some cultivation near to Watery Marsh. Intensified activity in the medieval period was apparent in the form of increases in pastoral indicators in the pollen record and the presence of arable land indicated through the record of cereal pollen” (Gearey, B. 1996: Human-Environment Relations on Bodmin Moor During The Holocene. Plymouth, abstract page). There is extensive evidence for the medieval settlement of the East Moor and Witheybrook valley between the 11th to 14th centuries. There is also evidence of ploughing in the medieval period (Johnson. N, and Rose, P. 2008: Bodmin Moor, An Archaeological Survey, Volume 1: The Human Landscape to c 1800. Swindon. Page 64).

The Halvana mine was started c. 1843 and Fox Tor mine is believed to have started at the same time (Jones, R. and Beer K. 1990: Mineral Investigations at Tredaule, nr Launceston Cornwall, British Geological Survey Technical Report, page 4). The Halvana and Fox Tor mines were at one time worked separately but later combined. Tin and Wolfram were mined here. The mines exposed lodes of thin vein quartz with sporadic casserite and wolframite. The mines closed in 1918. References are made to an adit reaching 29m below the surface. Records suggest tin mining at Halvana/Fox Tor mines from pre 19th century to 1900 and mining for Wolfram after this. (Herring, P., Sharpe, A., Smith, J. and Giles, C. 2008: Volume 2: The Industrial and Post Medieval Landscapes. Swindon, Page 189).

Heavy Metals

“The term heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Examples of heavy metals include mercury (Hg), cadmium (Cd), arsenic (As), chromium (Cr), thallium (Tl), and lead (Pb).

Heavy metals are natural components of the Earth's crust. They cannot be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. As trace elements, some heavy metals (e.g. copper, selenium, zinc) are essential to maintain the metabolism of the human body. However, at higher concentrations they can lead to poisoning. Heavy metal poisoning could result, for instance, from drinking-water contamination (e.g. lead pipes), high ambient air concentrations near emission sources, or intake via the food chain” (http://www.lenntech.com/processes/heavy/heavy-metals/heavy-metals.htm#ixzz4HdOtRa00) .

Grasses and plants uptake heavy metals from soils that have been exposed to mining operations, pollutants, and contaminants (such as petroleum and associated by-products).

“Heavy metals are dangerous because they tend to **bioaccumulate**. Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted. Heavy metals can enter a water supply by industrial and consumer waste, or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers, and groundwater” http://www.lenntech.com/processes/heavy/heavy-metals/heavy-metals.htm#ixzz4HdOtRa00 .

Testing

Testing was conducted in order to investigate whether heavy metal poisoning, mineral deficiencies, or perhaps a combination of these are contributing to the welfare issues on East Moor. Both hair testing and environmental testing were conducted.

Hair Tissue Mineral Analysis

Hair Tissue Mineral Analysis testing is the only accurate method for detecting heavy metals as toxic metals are not found in blood except immediately after acute exposure. “Hair has been accepted as an effective tissue for biological monitoring of toxic heavy metals by the U.S Environmental Protection Agency and is being used for this purpose throughout the world”. “Hair tissue mineral analysis (HTMA) has been used to determine the impact of minerals found in the environment as well as studying archaeological or historical specimens, pollution and correlation of soil mineral content in local populations, pre and postnatal effects of mercury exposure, the effects of dietary changes in healthy populations and industrial pollution from accidental and intentional dumping” http://www.traceelements.com/docs/NewsletterMarch-April2016.pdf. The Journal of Equine Veterinary Science, vol. 35 Issue 4, April 2015, states that hair mineral analysis is a suitable tool for evaluating the mineral status in the horse and that hair is a better biological indicator than serum in assessing mineral status.

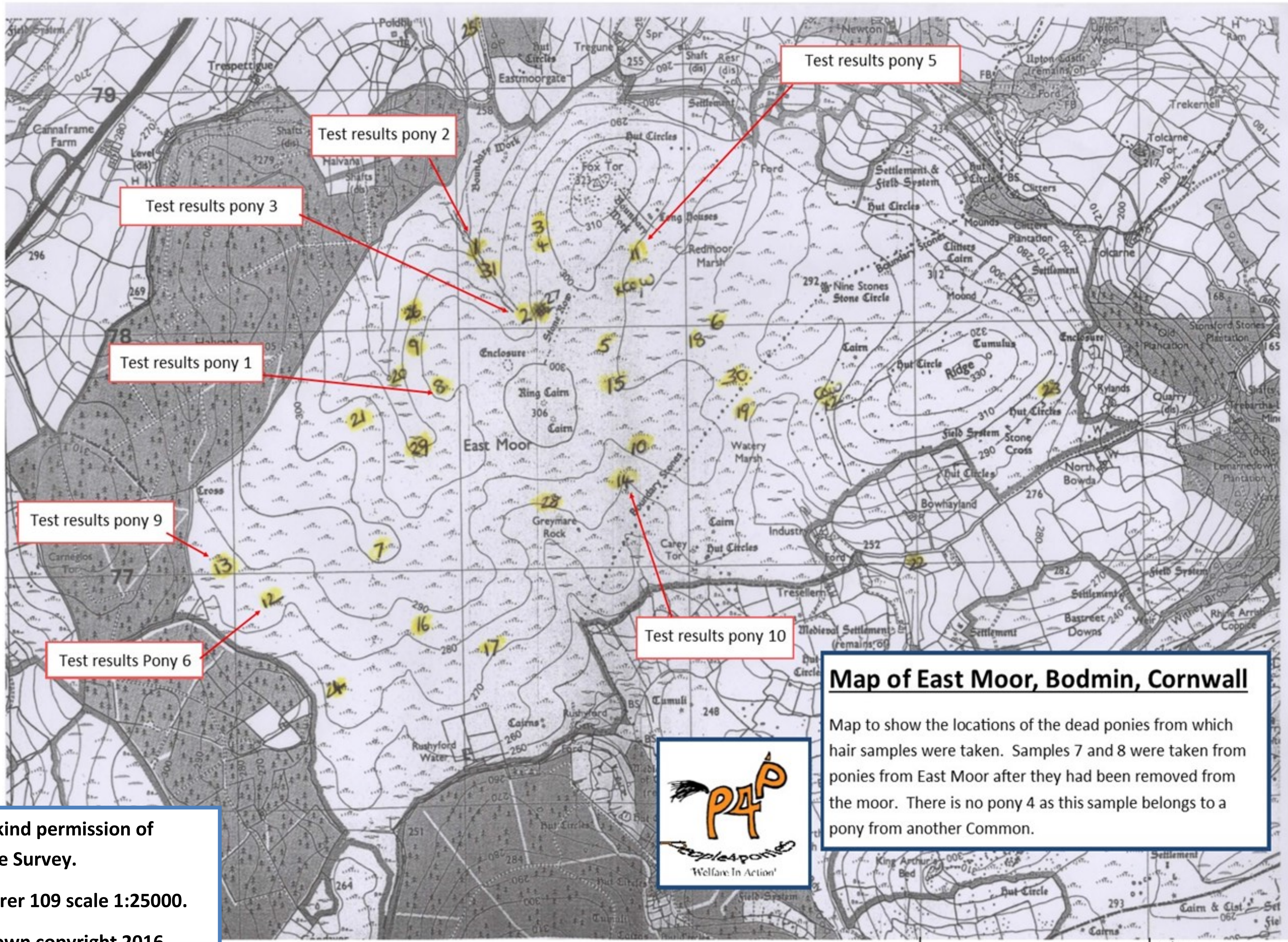
Toxic metals accumulate in soft tissues not blood or urine. Once exposed to heavy or toxic metals, they remain in the blood for approximately 24 hrs. They then leave the blood and deposit in the soft tissues where they remain until exposure is discontinued or procedures are taken to remove them from the system. Once the source of toxicity is identified, a mineral balancing program is recommended and it takes between five to seven months to bring elevated heavy metals to an acceptable level.

As carcasses were not removed from East Moor by the authorities, mane hair samples could be taken from dead ponies. Of the 9 samples obtained from ponies on East Moor, 7 samples were taken from deceased animals. Two were taken from living animals which were removed from the moor, one of which died 13 days after rescue. Three of the dead ponies tested had been shot – one had collapsed on the moor after being attacked by other stallions, one became stuck in a bog, and the circumstances that led to the shooting of the third pony are unknown. Sample 8 came from a yearling which had received some supplementary feeding a week before it was removed from the moor but this was the only pony to have received supplementary feeding on the moor. The samples were taken from animals of different ages, and from different locations on East moor. A map displaying the locations of the pony carcasses that were sampled is available on page 8.

The results of the hair tests were interpreted by agricultural scientist Kerry Marsh (B.Ed.B.Ag.Sc.), who specialises in heavy metal toxicities and poisonings in horses, and produced written reports for each animal.

	Gender	**Estimated Age**	**Approx. Height**	**Details**
Pony 1	Filly	Yearling (9-10 months)	c.10-11hh	Died out on moor
Pony 2	Filly	Yearling (9-10 months)	c.10-11hh	Died out on moor (mining channel)
Pony 3	Stallion	Estimated c 10 years old	c. 13hh	Shot on moor (mining channel)
Pony 5	Filly	Yearling (9-10 months)	c. 10-11hh	Died out on moor - poor condition, found stuck in bog
Pony 6	Mare	Estimated 7-8 years old	c. 12-12.2hh	Shot on moor - stuck in bog
Pony 7	Mare	Estimated 5 years old	c. 11hh	Died 13 days after rescue
Pony 8	Filly	Yearling (9-10 months)	c. 9.3-10hh	Rescued. Had supplementary feeding a week before rescue
Pony 9	Stallion	Estimated 10 years old	c. 13hh	Died out on moor - stuck in bog
Pony 10	Mare	Estimated 5- 6 years old	c. 12hh	Shot on moor

Table of details for ponies Hair Tissue Mineral Tested on East Moor. There is no “Pony 4” sample for East Moor. Pony 4’s results can be seen in the Minions/Caradon report.



Map of East Moor, Bodmin, Cornwall

Map to show the locations of the dead ponies from which hair samples were taken. Samples 7 and 8 were taken from ponies from East Moor after they had been removed from the moor. There is no pony 4 as this sample belongs to a pony from another Common.

Map by kind permission of Ordnance Survey.

OS Explorer 109 scale 1:25000.

Hair Testing Results - From the Reports Produced by Kerry Marsh.

Pony 1's tissue profile shows a severe imbalance of essential minerals required for good health and performance in the horse. Pony 1 is low on almost all the nutritional minerals except for magnesium, chromium and phosphorous. Zinc is at a critically low level. There are no toxic metals present and additional elements are within range. As this pony is a yearling, it would be expected that she would have been receiving milk from the mare for a period of time given that the mare was lactating adequately. Generally the mare's milk would have delivered adequate levels of minerals provided that the mare was able to source enough nutritious feed. Clearly that is not the case here as in my experience, yearlings (from relatively healthy mares) receive and retain enough nutrients delivered from the mare for several months. A foal receives all its nourishment and nutritional needs from the lactating mare. I think it is safe to assume that the mare was nutritionally starved and the foal has not received adequate minerals from the mare. Horses grazing pasture alone generally always have adequate levels of manganese but Pony 1 is low on this mineral which indicates a lack of grazing. If Pony 1 had access to viable and or enough forage, she may have survived. It is my opinion that Pony 1 has most likely died as a result of starvation due to the fact that: she had severe nutritional deficiencies, there are no toxic metals present on the profile, she was anaemic possibly due to a worm burden, the low level of manganese indicates lack of grazing or ability to graze. Forage plants/grasses derive mineral content from the soil in which they grow and horses that have free access to adequate grazing will ingest small and often adequate amounts of micro minerals particularly manganese and Pony 1's level was below the reference range. It must also be taken into account that a large worm burden can cause organ damage and may also have contributed to her death.

Pony 1 had borderline low levels of boron and selenium, low levels of calcium, cobalt, copper, iron, manganese, molybdenum, sodium, and sulphur. Pony 1 had a very low level of potassium and a critically low level of zinc. Pony 1 had good levels of chromium, magnesium and phosphorus.

The significant ratio graph is more indicative about the state of health of the horse than mineral levels alone. Each ratio relates to a specific metabolic function and Pony 1 has: kidney and liver stress, inflammation, acute stress, a significantly underactive thyroid function, significant loss of calcium from bone, underactive adrenal gland function and was anaemic which may possibly be a result of a worm burden. Pony 1 had a good balance of sugars/starches and good levels of hormone balance.

Pony 2 had adequate levels of calcium, sodium, copper, phosphorous, iron, manganese, and boron. Magnesium is in the high range. There are no toxic metals present except for a low level of aluminum which is not significant. Of the additional elements, strontium is at a high level. This foal seems to have absorbed many adequate nutrients from the mare. Her manganese level is within range which indicates that she most likely has had access to adequate forage. So the question of cause of death is not entirely clear in this particular pony. Foals are particularly susceptible to botulism as they have immature digestive tracts unable to protect them from the bacteria. If this filly had been eating or drinking near dead horses or animals, it is possible she may have picked up botulism spores. To know what symptoms this filly had before death may provide answers in relation to botulism. Pony 2 had good levels of boron, calcium, copper, iron, manganese, phosphorus, and sodium. Pony 2 had low levels of chromium, molybdenum, sulphur and zinc. She had borderline low levels of selenium and a high level of magnesium and strontium.

Mineral ratio results for Pony 2 indicate: severely underactive thyroid and adrenal gland function, a good balance of starch/sugars, good hormone balance, an anaemic condition, loss of bone strength and integrity, significant stress on kidney and liver functions, acute stress and inflammation.

Pony 3's hair tissue shows severe imbalance of essential minerals. There are no toxic metals present and the additional elements are all in range. This stallion has critically low levels of calcium and zinc. He does not have a cobalt reading. Potassium, iron, manganese, boron, and sulphur are at very low levels. Sodium and copper are low. This horse is clearly nutritionally starving meaning he lacks many of the nutritional elements to remain in good health. When many nutritional elements remain low for a period of time, blood is not supplied with the nutrients it requires and to simplify, organ damage occurs. Once again, the manganese level is low which suggests lack of adequate grazing/forage. I would suggest, this pony has done well to reach 10 years of age. The very low Fe/Cu indicates a chronic anaemic condition. This may or may not be combined with kidney disease but he does have stress on kidney and liver function. I would suggest that lack of adequate nutrition and long standing anaemia combined with lack of forage is the cause of death for this pony. Pony 3 had very low levels of boron, copper, potassium, sodium. He had very low levels of iron, manganese, molybdenum and sulphur. He had good levels of chromium, magnesium, phosphorus and selenium. Pony 3 had critically low levels of calcium and zinc, and the level of cobalt was non-existent.

Mineral ratio results for Pony 3 indicate: severely underactive thyroid function, underactive adrenal gland function, a decrease in insulin release, a good level of hormone balance, a long standing anaemic condition (could be caused by low nutritional levels, kidney disease and to a lesser extent worm burden), significant loss of bone strength and integrity, kidney and liver stress, and inflammation.

Pony 5's profile is similar to pony 1. The nutritional mineral levels are mostly in the low range but not at critically low levels that would indicate starvation as a possible cause of death. It needs to be mentioned that horses under one year of age (depending on how long they were nursed) have often absorbed some minerals from the lactating mare. This may be a factor in this case. However, the similarities to Pony 1 are more obvious on the significant ratio graph. This pony is not anaemic in comparison to ponies 1 and 3. Now that you have provided me with some of the symptoms that some of the ponies displayed before death, I still believe that botulism needs to be investigated as a causative factor to death. Pony 5 had a good level of boron, chromium (just), copper, iron, phosphorus, selenium and sulphur. She had low levels of calcium, cobalt, molybdenum and zinc. Pony 5 had a borderline low level of magnesium and manganese, and a very low level of potassium and sodium.

Mineral ratio results for Pony 5 indicate: severely underactive thyroid function, underactive adrenal gland function, a good balance of sugar/starch, good hormone balance, no anaemia, loss of bone strength and integrity—calcium is being drawn from bone to supply blood and tissues, acute stress, inflammation, kidney and liver stress.

Pony 6 has the toxic metals uranium, beryllium, and aluminium on her profile. Both uranium and beryllium are found (in relation to horses) in mining operations, contaminated soils and water supplies. There is also a level of arsenic but it is below the reference range. This pony also has low levels of many of the nutritional minerals required for adequate health. She has a toxic level of iron which may be from soil with a high concentration of iron, or water supplies, or combination of both. This pony like many of the others tested, is below the reference range for what constitutes a healthy hair tissue profile. She is lacking adequate levels of nutritional elements and I would state this as nutritionally starving. However, such low levels would not be fatal nor would the level of iron be fatal. Given that the heavy metal uranium is present, it is not at high enough concentrations to cause death. Beryllium, although the level is not in the high range, has the potential to cause pneumonia. Aluminium (depending on the form) is generally found in contaminated water, poor, acidic soils, coal fired power plants, bauxite mining, some horse wormers as an anti caking agent and ulcer treatments. Symptoms may include: kidney and liver dysfunction, colics, dry skin and coat, hind incoordination neurological disturbance. Beryllium is present in localized deposits of beryl of which some is mined. It is also converted through processes to beryllium metal. Beryllium compounds affect respiratory function and pneumonia is common. Uranium in this case is non radioactive. Sources of uranium include water supplies, soil and mining operations. At this level, health effects are not significant.

Pony 6 had low levels of boron, cobalt, manganese, molybdenum, phosphorus, sulphur. She had very low levels of calcium, potassium, sodium and zinc. Pony 6 had good levels of chromium and copper and a toxic level of iron. She also had high levels of aluminium, beryllium and uranium.

Mineral ratio results for Pony 6 indicate: underactive thyroid function, underactive adrenal gland function, a good balance of sugar/starches, good hormone balance, excessively high Fe/Cu ratio could be an infection present (or a high level of iron skewing results), loss of bone strength and integrity, some kidney and liver stress.

Pony 7 has similarities in nutritional levels to that of the older horses – ponies 3 and 6 which may be due to the fact that they were well weaned as opposed to the younger ponies. Pony 7's mineral levels are also below the acceptable range. Once again, it is difficult to state categorically the cause of death in this pony. Starvation has to be considered, there are no heavy metals present. Pony 7 had low levels of boron, cobalt, copper, iron, selenium, and sodium. Pony 7 had very low levels of calcium, manganese, molybdenum, phosphorus, potassium, and sulphur. Zinc was at a non-existent level.

All of the ponies from East Moor so far have an elevated sodium/potassium ratio which relates to inflammation and acute stress. I work from the significant ratio graph as mineral levels alone do not reveal nutritional deficiencies or excesses. Ratios indicate disease but are not diagnostic. Mineral ratio results for Pony 7 indicate: underactive thyroid and adrenal gland function, a good balance of sugar/starch, good hormone balance, no anaemia present, loss of bone strength and integrity, kidney and liver stress, acute stress and inflammation.

For **Pony 8**, given her young age and the fact that she may have been weaned not too long ago and fed since rescue, her mineral levels are only slightly imbalanced. The stark difference with this pony, is that she does not have the stress nor inflammation indicators that the dead ponies displayed. For this pony to acquire nutritional health she will need to be fed some supplements, particularly some calcium to prevent loss of calcium from bone and associated bone deformities. She had good levels of boron, calcium, chromium, iron, magnesium, phosphorus. She had a borderline level low level of selenium. Pony 8 had low levels of cobalt, manganese, sodium, and sulphur. She had very low levels of copper, molybdenum, and zinc.

Mineral ratio results for Pony 8 indicate: underactive thyroid and adrenal gland function, a good balance of sugar/ starch, a good level of hormone balance, a high Fe/Cu ratio indicates a possible infection, loss of bone strength and integrity, adequate liver and kidney function.

Pony 8's worm count test returned a result of 3750 eggs per gram. Results above 1200 eggs per gram are considered to be a high count.

Blood tests confirmed adequate liver and kidney function. Her protein levels were considered to be low.

people4ponies
'Welfare In Action'

Pony 9’s hair tissue profile, being an older pony is similar to the older ponies on this Moor. The only difference to the other East Moor ponies is that he has a high magnesium level. Pony 9 has suffered critical calcium loss from bone meaning calcium is being drawn from bone to supply blood and tissue. Such a low calcium/phosphorous ratio is often seen in horses with fractures and or bone deformities. His insulin levels were critically (Ca/Mg) low indicating lack of forage or food for some period of time. This is very rare in the horse as insulin levels rise quickly once the horse has eaten. He too, is what I term nutritionally starving as many of his mineral levels are very low indeed. This pony has all the indicators that relate to nutritional starvation and given that the Ca/Mg ratio is very, very low also points to lack of forage. Due to the fact that he had significant calcium loss from bone, he may have had a fracture, went down and starved to death. Regardless, this pony would not have been healthy enough to survive into old age. It would be interesting to know if any of the ponies have lived above 12 years of age in recent years. He had a high level of aluminium which is not significant at this level. Boron levels would rise with added calcium.

Pony 9 had good levels of chromium and iron. He had low levels of boron, cobalt, copper, selenium, sodium, sulphur and zinc. Pony 9 had very low levels of manganese, molybdenum, and potassium. He had critically low levels of calcium and phosphorus. He had high levels of magnesium and aluminium.

Mineral ratio results for pony 9 indicate: adequate thyroid function, underactive adrenal gland function, critically low insulin levels (symptoms may include weakness, seizures, and collapse), good hormone balance, the possible presence of an infection, loss of bone strength and integrity, adequate kidney and liver function.

Pony 10, a 5 or 6 year old mare was shot on East Moor. The hair tissue profile of this pony is similar to ponies 7 and 9 in as much as she has many low levels of essential minerals. Her calcium level is actually lower than Pony 9. This condition is known as hypocalcaemia. I would suggest that this mare may have suffered a fracture, went down and was unable to rise. It would be interesting to know why she was shot and if a rudimentary examination was done by the vet who shot her. The pony had good levels of boron, chromium, iron and phosphorus. She had low levels of cobalt, copper, magnesium, selenium, sodium, and sulphur. Pony 10 had very low levels of potassium and molybdenum. She had a critically low level of calcium and a non existent level of zinc.

Mineral ratio results for pony 10 indicate: adequate thyroid and adrenal gland function, a good balance of sugars/ starches, good hormone balance, no anaemia, loss of bone strength and integrity, adequate kidney and liver function.

Pony 3’s results are included on the following page to demonstrate the graphical format of the hair results. The results of pony 6, have also been included as these were anomalous to the rest of the results.

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LABORATORY NO.:	1305319		
PROFILE NO.:	16		
EQUINE: PONY 3,	AGE: 10	SEX: G	
REQUESTED BY: MARSH, K	ACCOUNT NO.: 2216	DATE: 20/04/2016	

NUTRITIONAL ELEMENTS

Range	Ca Calcium	Mg Magnesium	Na Sodium	K Potassium	Cu Copper	Zn Zinc	P Phosphorus	Fe Iron	Mn Manganese	Cr Chromium	Se Selenium	B Boron	Co Cobalt	Mo Molybdenum	S Sulfur
HIGH	443	99.0	132	172	2.1	24	77	17.0	2.000	0.25	0.35	1.77	.055	.088	6650
	357	78.5	102	134	1.7	21	66	13.3	1.560	0.20	0.28	1.37	.042	.068	5750
REFERENCE RANGE	270	58.0	72	95	1.3	18	55	9.6	1.120	0.15	0.20	0.96	.029	.048	4850
	184	37.5	42	57	0.9	15	44	5.9	.680	0.10	0.13	0.56	.016	.028	3950
	97	17.0	12	18	0.5	12	33	2.2	.240	0.05	0.05	0.15	.003	.008	3050
LOW	11				0.1	9	22			0.00					2150
Result	46	40.9	10	5	0.5	9	38	1.1	.176	0.07	0.07	0.07	.001 <<	.004	2923

TOXIC ELEMENTS

Range	Sb Antimony	U Uranium	As Arsenic	Be Beryllium	Hg Mercury	Cd Cadmium	Pb Lead	Al Aluminum
HIGH	.032	.0245	.245	.0070	0.28	.105	1.4	16.8
	.027	.0210	.210	.0060	0.24	.090	1.2	14.4
	.023	.0175	.175	.0050	0.20	.075	1.0	12.0
	.018	.0140	.140	.0040	0.16	.060	0.8	9.6
	.014	.0105	.105	.0030	0.12	.045	0.6	7.2
REFERENCE RANGE	.009	.0070	.070	.0020	0.08	.030	0.4	4.8
	.005	.0035	.035	.0010	0.04	.015	0.2	2.4
Result	N/A	.0028	.004	.0010 <<	0.01 <<	.001	0.1 <<	2.0

ADDITIONAL ELEMENTS

Range	Ge Germanium	Ba Barium	Bi Bismuth	Rb Rubidium	Li Lithium	Ni Nickel	Pt Platinum	Tl Thallium	I Iodine	V Vanadium	Sr Strontium	Sn Tin	Ti Titanium	W Tungsten	Zr Zirconium
HIGH	.022	0.81			.029	.14	.015			.093	1.12	0.03		.015	0.08
	.016	0.56			.020	.10	.010			.068	0.76	0.02		.010	0.05
REFERENCE RANGE	.010	0.31			.011	.06	.005			.043	0.41	0.01		.005	0.03
LOW	.004	0.06			.002	.02	.000			.018	0.05	0.00		.000	0.00
Result	.002	0.01	N/A	N/A	.001	.01 <<	.001 <<	N/A	N/A	.015	0.09	0.01 <<	N/A	.001 <<	0.01

"<<": Below Calibration Limit; Value Given Is Calibration Limit

"QNS": Sample Size Was Inadequate For Analysis.

"NA": Currently Not Available

Laboratory Analysis Provided by Trace Elements, Inc., an H. H. S. Licensed Clinical Laboratory. No. 45 D0481787

20/04/2016
CURRENT TEST RESULTS

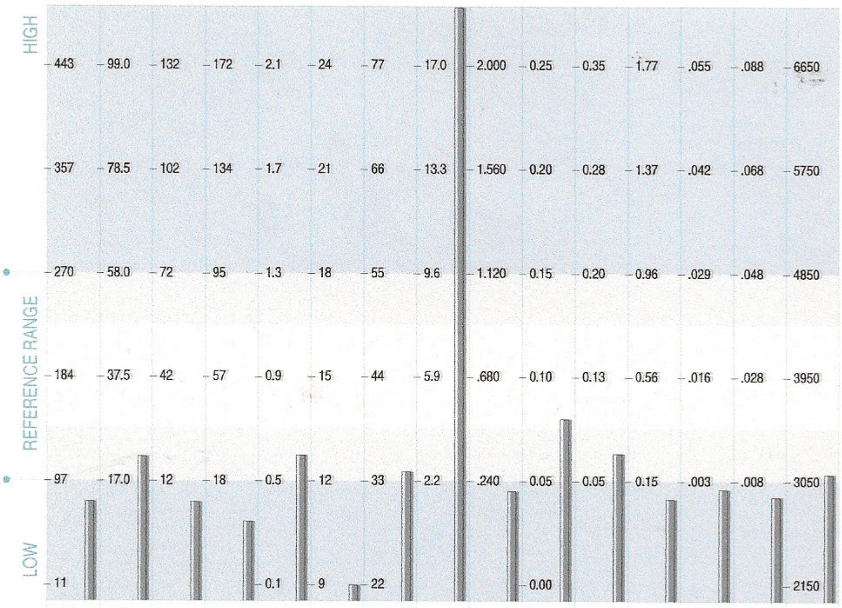
PREVIOUS TEST RESULTS

people4ponies
'Welfare In Action'

InterClinical Laboratories Pty Limited
ABN 89 076 386 475
PO Box 6474, Alexandria NSW 2015 Australia
Ph: 02 9693 2888 Fax: 02 9693 1888
Email lab@interclin 4501 Sunbelt Drive · Addison, Tx · 75001 · U.S.A.

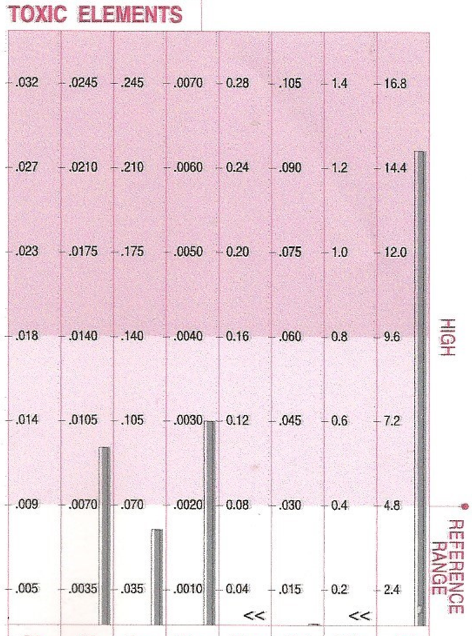
LABORATORY NO.:	1310106		
PROFILE NO.:	16		
EQUINE: PONY, 6	AGE: 8	SEX: M	
REQUESTED BY: MARSH, K	ACCOUNT NO.: 2216	DATE: 18/05/2016	

NUTRITIONAL ELEMENTS



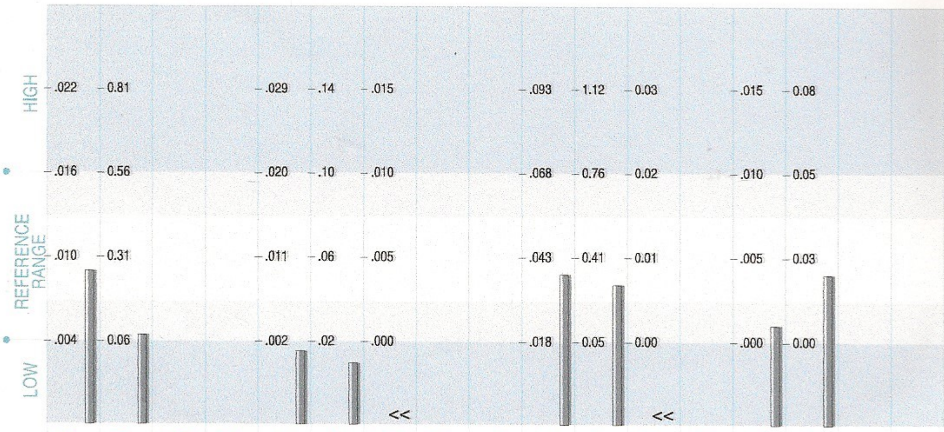
Ca	Mg	Na	K	Cu	Zn	P	Fe	Mn	Cr	Se	B	Co	Mo	S
Calcium	Magnesium	Sodium	Potassium	Copper	Zinc	Phosphorus	Iron	Manganese	Chromium	Selenium	Boron	Cobalt	Molybdenum	Sulfur
80	21.9	6	3	0.6	9	34	30.3	.197	0.08	0.07	0.08	.002	.005	3113

TOXIC ELEMENTS



Sb	U	As	Be	Hg	Cd	Pb	Al
Antimony	Uranium	Arsenic	Beryllium	Mercury	Cadmium	Lead	Aluminum
N/A	.0094	.060	.0030	0.01	.001	0.1	14.9

ADDITIONAL ELEMENTS



Ge	Ba	Bi	Rb	Li	Ni	Pt	Tl	I	V	Sr	Sn	Ti	W	Zr
Germanium	Barium	Bismuth	Rubidium	Lithium	Nickel	Platinum	Thallium	Iodine	Vanadium	Strontium	Tin	Titanium	Tungsten	Zirconium
.009	0.08	N/A	N/A	.001	.01	.001	N/A	N/A	.038	0.29	0.01	N/A	.001	0.02

"<<": Below Calibration Limit; Value Given Is Calibration Limit

"QNS": Sample Size Was Inadequate For Analysis.

"NA": Currently Not Available

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18/05/2016
CURRENT TEST RESULTS

PREVIOUS TEST RESULTS

People4ponies
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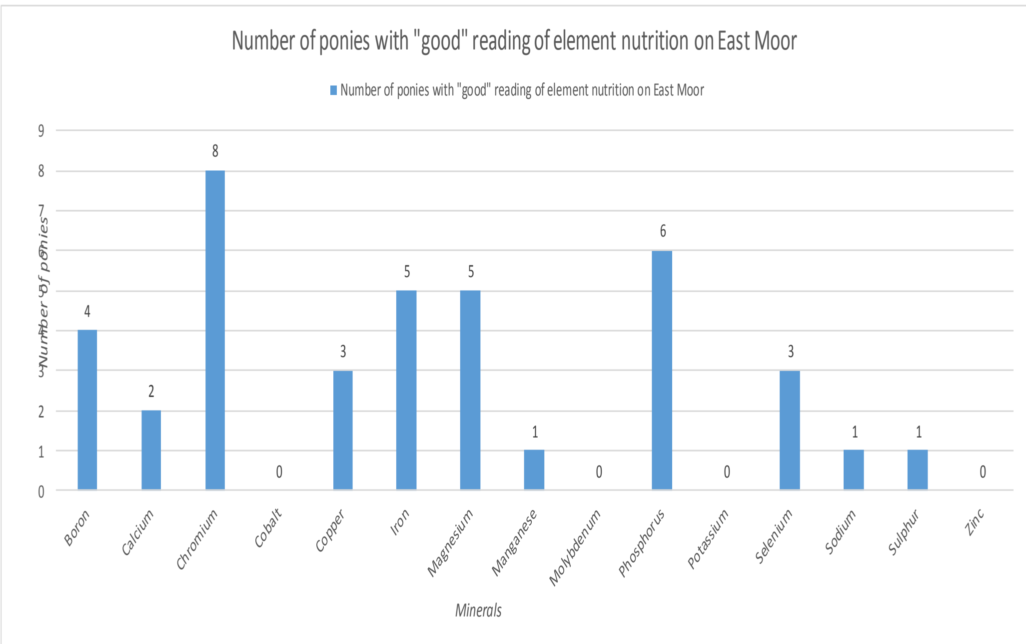
The table below displays the results of the hair samples based on the interpretation of the laboratory results by Kerry Marsh. Her interpretations have been mapped on a spreadsheet to help show similarities, correlations and differences between the results. There is a key to explain colour coding.

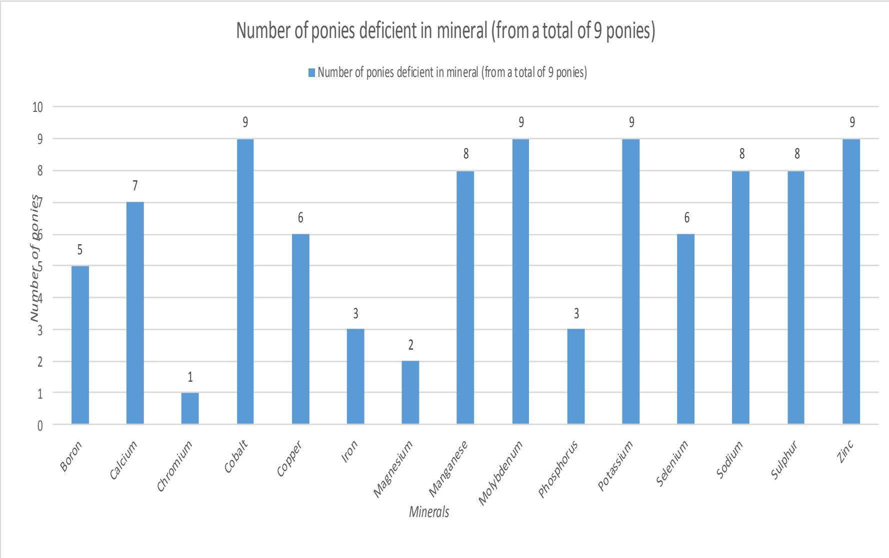
	B	Ca	Cr	Co	Cu	Fe	Mg	Mn	Mo	P	K	Se	Na	S	Zn				
Pony 1	*											*							
Pony 2												*				Sr	Al		
Pony 3																			
Pony 5			*				*	*											
Pony 6						Toxic										Al	Be	U	As
Pony 7																			
Pony 8		*										*							
Pony 9																Al			
Pony 10																			

* Borderline

High		B	Boron	K	Potassium
Low		Ca	Calcium	Se	Selenium
Good		Cr	Chromium	Na	Sodium
Critically low		Co	Cobalt	S	Sulphur
Non existent		Cu	Copper	Zn	Zinc
		Fe	Iron	Al	Aluminium
		Mg	Magnesium	Be	Beryllium
		Mn	Manganese	U	Uranium
		Mo	Molybdenum	As	Arsenic
		P	Phosphorus	Sr	Strontium

There are many deficiencies across the spectrum of minerals and some of the deficiencies were at a severe level - three ponies had critically low levels of calcium, one had a critically low level of phosphorus, one pony had a non existent level of cobalt, two ponies had a critically low level of zinc and two ponies had non existent levels of zinc. Only one pony showed a spectrum of heavy metals being present. Within the main 15 mineral groups— 93 results were deficiencies, 39





were of a good level, 3 were high levels, one of which was considered toxic. The graph on page 15 demonstrates the levels of "good" readings—of which there were none for the minerals cobalt, molybdenum, potassium, and zinc. Chromium had the best result with 8 ponies returning "good" levels. The graph above shows that there are clearly more deficiencies. There will be further analysis in the interpretation section.

Heavy Metals and Toxicity

The levels of toxic elements returned the following results:

- Aluminium - 6 ponies had levels below the reference range. Pony 2 had a level on the limit of the reference range. Pony 9 had a level above the reference range and Marsh stated it was at a level not considered to cause health problems. Pony 6 had a high level of aluminium.
- Arsenic - 8 ponies returned very low levels. Pony 6 returned a level just below the reference range.
- Beryllium - 5 ponies returned no trace of Beryllium. Three ponies had low level well within the reference range. Pony six had a level beyond the reference range.
- Cadmium - trace or very low levels.
- Lead - trace or very low levels.
- Mercury - trace or very low levels.
- Uranium - 8 ponies had either no trace or very low levels. Pony 6 had a level beyond the reference range.

Other elements:

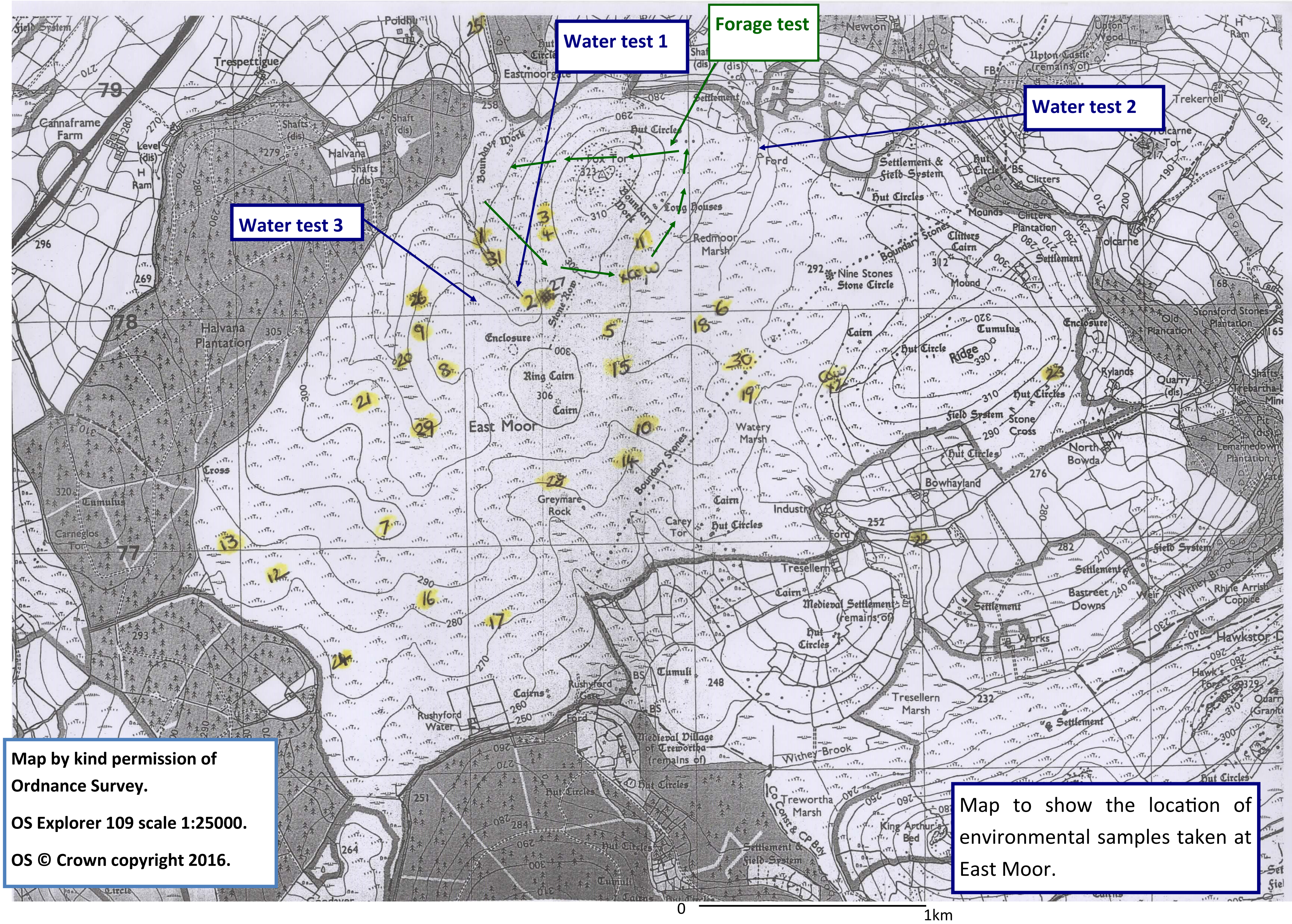
- Strontium - only pony 2 had a high level of strontium.
- Lithium - no ponies had a high level of lithium - all were within or below the reference ranges.

Environmental Testing

To see whether the deficiencies and toxicities are present on East Moor, environmental testing was conducted. The map on page 17 shows the location of the water and forage tests.

Water testing

There are multiple water sources available on East Moor. Livestock are seen to drink from water channels, marshy areas, and pools of rainwater that accumulate on the moor. Financial budget was a consideration. Three water samples were taken on site. Sample 1 was taken from a channel with earthworks recorded on the Historic Environment Records as early Medieval streamworks. Sample 2 was taken from the water channel at Redmoor Marsh. Sample 3 was taken from a pool of water on East Moor. All water samples were taken with sterile bottles.



Map to show the location of environmental samples taken at East Moor.

Water samples 1 and 2 were analysed by NRM laboratories in Berkshire. Water sample 1 was tested to a level which included the heavy metals arsenic, beryllium, and uranium. The 3rd water sample was tested by Lancrop Laboratories in York.

Livestock water quality reports measured levels of calcium, phosphorus, magnesium, sodium, potassium, chloride, copper, iron, sulphate, lead, manganese, zinc, aluminium, ammonium nitrogen, nitrate nitrogen, electrical conductivity and pH.

Forage testing

Bags were supplied for forage sampling by ForagePlus. Analysis and interpretation of results was also undertaken by ForagePlus. Grass samples were taken from the moorland, including the area of Fox Tor - please see the location area marked on the map on page 17. Forage tests do not measure the presence of toxic elements such as arsenic or beryllium. The forage tests measure levels of the following minerals - phosphorus, magnesium, calcium, sodium, potassium, chloride, manganese, copper, zinc, selenium, cobalt, iodine, lead, iron, aluminium, molybdenum, and sulphur.

Soil testing

A soil sample consisted of soil from multiple locations on East Moor. The soil was tested for a range of heavy metals by Lancrop Laboratories in York.

Other testing possibilities

On the basis that carcasses were left out on the moor and that ponies did exhibit some characteristics of a neurotoxin being present (difficulty walking, muscle weakness, flaccid tails, poor appetite, and difficulty rising,) botulism, or equine grass sickness was a concern. Veterinary advice recommended that this would be difficult to test for environmentally. Research states "The bacterium and its spores are widely distributed in nature. They are found in soil, sediments of streams and lakes, and in the intestinal tracts of fish and mammals. The bacteria will produce toxins under conditions of decaying plants and animals" (http://www.uky.edu/Ag/Forage/asc173.pdf, page 1). "The decomposing carcass is an excellent anaerobic incubator for botulism spores present in the intestinal tract of the dead animal or bird. Once toxin is formed in the carcass, it leaches out and contaminates the hay or other feed material". (http://www.uky.edu/Ag/Forage/asc173.pdf, page 2). Monitoring some of the living ponies displaying the characteristics mentioned above, they continued to present these symptoms over a long period of time. General medical consensus was that the ponies would have died within a quick timescale once symptoms were displayed if they had been suffering from botulism. We cannot conclusively say whether botulism has or has not led to the death of any animals out on the moor. We can only state that the lack of carcass removal is known to present a disease risk to equines.

'Welfare In Action'

Water sampling results

	Livestock Limit	Human Limit	Sample 1	Sample 2	Sample 3
Iron (mg/l)	0.3	0.2	0.09	**0.5**	0.1
Manganese (mg/l)	0.05	0.05	0.01	0.02	<0.05
Aluminium (mg/l)	0.5	0.2	0.1	0.18	0.175
Arsenic (ug/l)	25-200 depending on text/research	10	0.3	N/A	N/A

Table displaying a selection of water sample results returned for East Moor. Limits for humans obtained from Defra guidelines http://dwi.defra.gov.uk/consumers/advice-leaflets/standards.pdf . Livestock limits obtained from David K. Beede Phd, 2006: Evaluation of Water Quality and Nutrition for Dairy Cattle. Michigan State University and table 2 of http://sheboygan.uwex.edu/files/2010/08/UMWaterQuality.pdf

Water sample 1 was taken from a flowing water source which is recorded on the Historic Environment Records as early Medieval streamworks. Sample 1 returned a pH reading of 6.2, which and is considered to be a neutral reading. The guidelines on acceptable limits for pH are 5.6 to 9.0 (David K. Beede Phd, 2006: Evaluation of Water Quality and Nutrition for Dairy Cattle). All measured levels were low and the laboratory interpreted that no problems were likely for livestock from the results. Levels of arsenic, beryllium, uranium, and aluminium were returned but were at low levels and therefore within acceptable ranges.

Total Arsenic	0.30	ug/l
Total Beryllium	0.1	ug/l
Total Uranium	0.14	ug/l
Total Aluminium	0.10	mg/l

Results of water testing for arsenic, beryllium, uranium, and aluminium from sample 1.

Water sample 2 from Redmoor Marsh returned a pH reading of 5.9 and is classified as acidic. The guidelines on acceptable limits for pH are 5.6 to 9.0 (David K. Beede Phd, 2006: Evaluation of Water Quality and Nutrition for Dairy Cattle) therefore it is still within acceptable ranges. The iron level result of 0.50 mg/l is above the recommended livestock limit of 0.3 mg/l and the human limit of 0.2mg/l. The laboratory stated the iron level of 0.5 mg/l would affect the taste and may cause staining but would not cause health issues. All other readings were within acceptable ranges with no problems highlighted.

Sample 3 returned a pH reading of 6.2 which is a neutral reading. The remaining results were similar to that of sample 1 and no levels were returned that were considered cause for concern.

Soil Sample

A soil sample, consisting of soil taken from multiple locations across the site, was tested by Lancrop Laboratories in York. The sample was tested for a selection of elements. All tested elements were present on site but at relatively low levels (see table on the right). Page 37 of a document produced by The Environment Agency entitled UK Soil and Herbage Pollutant Survey: Environmental Concentrations of Heavy Metals in UK Soil and Herbage contains a table of mean levels of soil metal concentrations at rural, urban and industrial sites in the UK. In these results, lead ranged from 52.5 to 145 mg/kg, nickel ranged from 21.1 to 37.1 mg/kg, zinc from 81.2 to 211 mg/kg, copper from 20.6 to 59.9 mg/kg, arsenic from 10.9 to 18.1 mg/kg, cadmium 0.39 to 1.33 mg/kg, mercury 0.13 to 0.35 mg/kg, and chromium 34.3 to 41.1 mg/kg. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291161/scho0607bmta-e-e.pdf

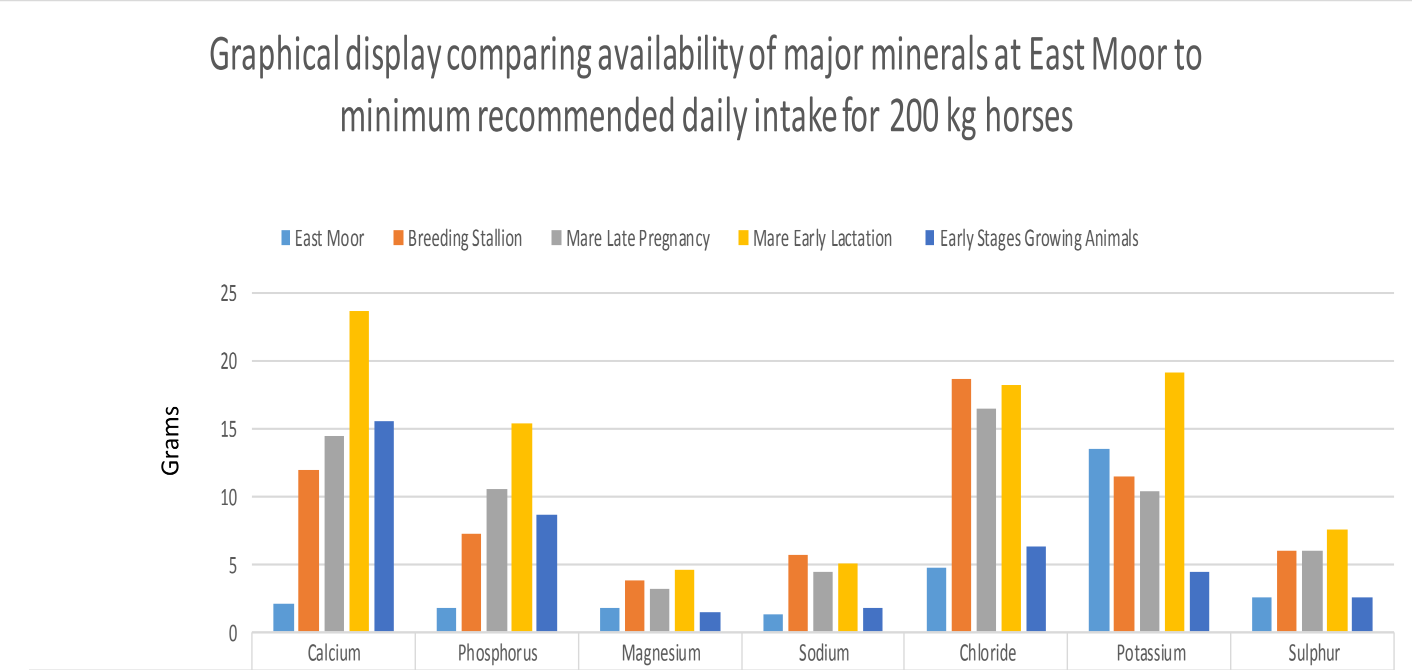
East Moor Soil Results

Analysis	Result
Lead (mg/kg)	19.04
Nickel (mg/kg)	6.70
Zinc (mg/kg)	20.78
Copper (mg/kg)	7.47
Arsenic (mg/kg)	12.64
Cadmium (mg/kg)	0.11
Mercury (mg/kg)	0.44
Chromium (mg/kg)	12.20

Forage Results East Moor

ForagePlus forage site results are published alongside graphs displaying the recommended daily allowance recommendations for a 500kg horse in light work. The ponies in our area of interest are smaller in weight, and are working stallions, pregnant/lactating mares, or youngsters. The ForagePlus site results have been reproduced below alongside graphs displaying the recommended daily minimum mineral uptake of horses within the weight range of the ponies that reside on East Moor. The minimum recommended daily intake figures for 200kg and 400kg horses were gained from the published tables "Daily Nutrient Requirements of Horses", "Nutrient Requirements of Horses: Sixth Revised Edition, 2007, chapter 16, published by the National Research Council". No chart was available for 300kg horses. As the ponies on East Moor are approximately between 12 to 13 hands high they would fit within the 200-400kg weight range. The tables also show that the daily minimum mineral requirements for non-breeding horses, not in work, are the same as those for breeding stallions in each height range.

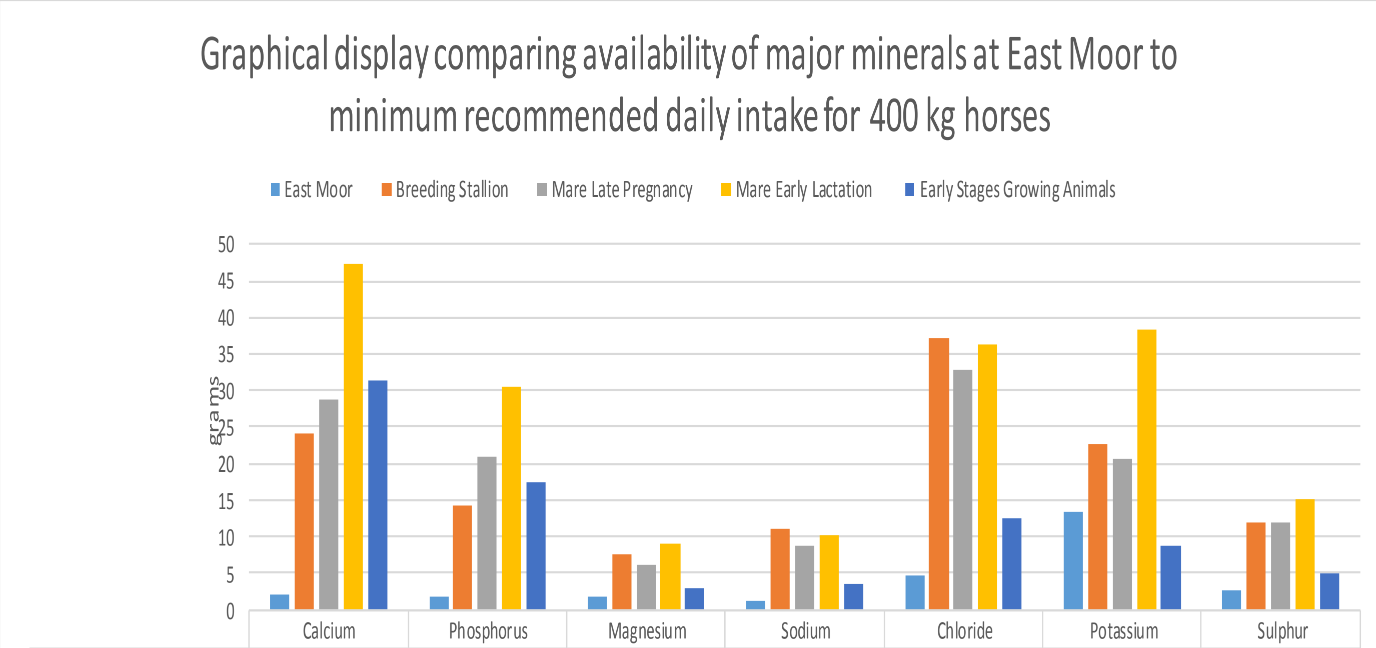
Although the graphs display the results for minimum recommended daily intake, ForagePlus recommends that values of 1.5 times each figure should be aimed for to achieve a healthy horse. One forage sample has been taken on-site and it has to be acknowledged that there may be variations in mineral levels in areas that were not sampled.



	Calcium	Phosphorus	Magnesium	Sodium	Chloride	Potassium	Sulphur
East Moor	2.1	1.7	1.7	1.2	4.7	13.5	2.6
Breeding Stallion	12	7.2	3.8	5.6	18.7	11.4	6
Mare Late Pregnancy	14.4	10.5	3.1	4.4	16.4	10.3	6
Mare Early Lactation	23.6	15.3	4.5	5.1	18.2	19.1	7.5
Early Stages Growing Animals	15.6	8.7	1.4	1.7	6.3	4.4	2.5

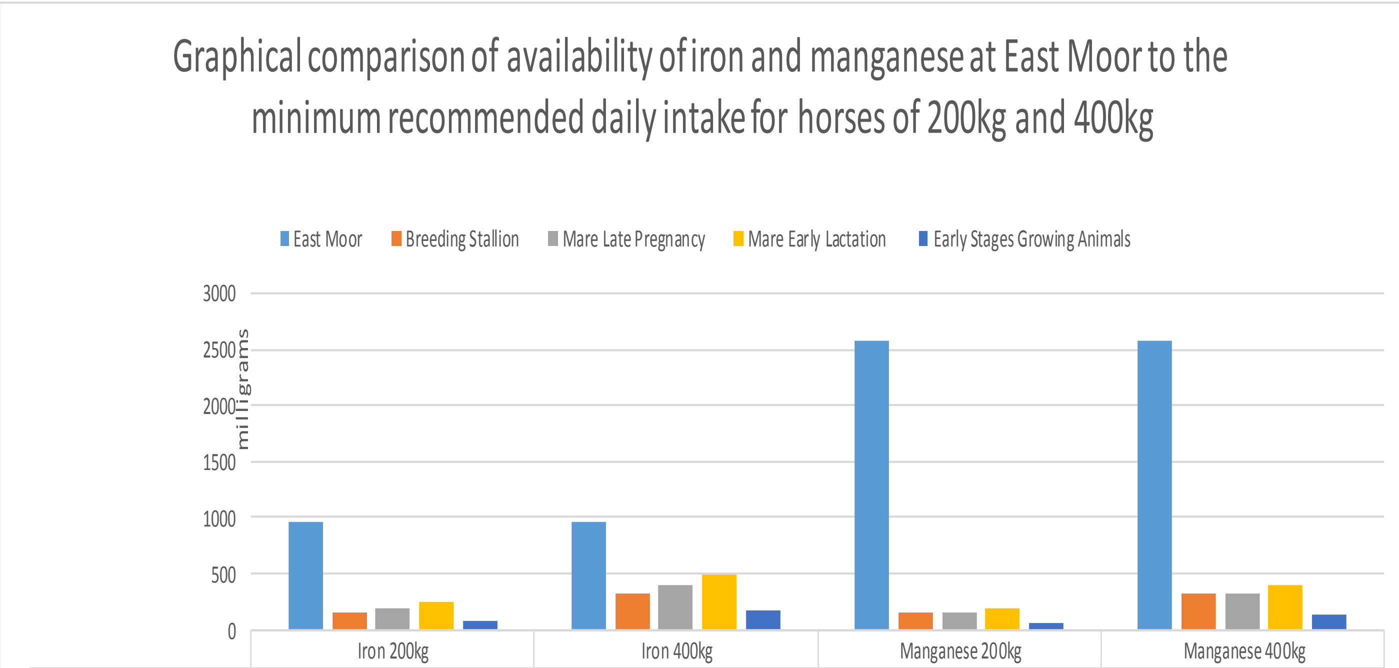
The forage results show considerable deficiencies in the availability of calcium, phosphorus, sodium, chloride and sulphur for horses of 200kg. Magnesium is also deficient. There is an above minimum availability level of potassium for mares in late pregnancy, breeding stallions and very young animals but not for mares in the early stages of lactation. If the 1.5x figures had been used which are recommended by ForagePlus for optimum health then the East Moor availability level would not have been enough for the breeding stallions and mares in late stages of pregnancy.

People4ponies 'Welfare In Action'



	Calcium	Phosphorus	Magnesium	Sodium	Chloride	Potassium	Sulphur
East Moor	2.1	1.7	1.7	1.2	4.7	13.5	2.6
Breeding Stallion	24	14.4	7.6	11.1	37.3	22.8	12
Mare Late Pregnancy	28.8	21	6.1	8.8	32.8	20.7	12
Mare Early Lactation	47.3	30.6	8.9	10.2	36.4	38.3	15
Early Stages Growing Animals	31.3	17.4	2.9	3.4	12.5	8.8	5.1

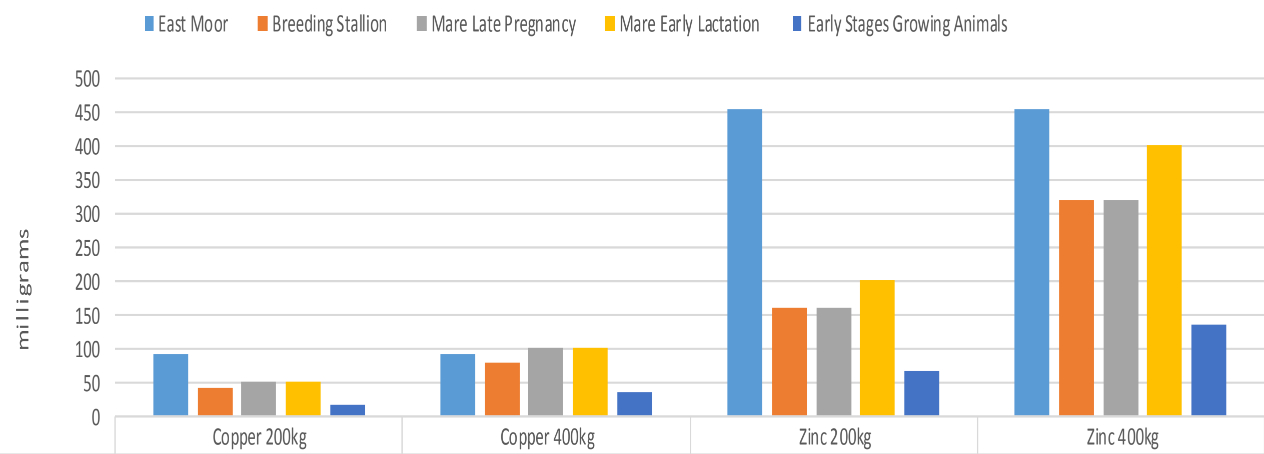
When the 400kg weight range of minimum daily intake requirements is compared to availability at East Moor, there are clear deficiencies in all mineral groups. Availability at East Moor falls very short of the mineral requirements of the horses. The only acceptable level is the level of potassium for young horses.



	Iron 200kg	Iron 400kg	Manganese 200kg	Manganese 400kg
East Moor	960	960	2575	2575
Breeding Stallion	160	320	160	320
Mare Late Pregnancy	200	400	160	320
Mare Early Lactation	250	500	200	400
Early Stages Growing Animals	84.2	168.5	67.4	134.8

The availability of iron on site is above the minimum and 1.5x values recommended for horse health at both the 200kg and 400kg range. Manganese is also in excess and is far beyond the requirements of a 200kg or a 400kg horse.

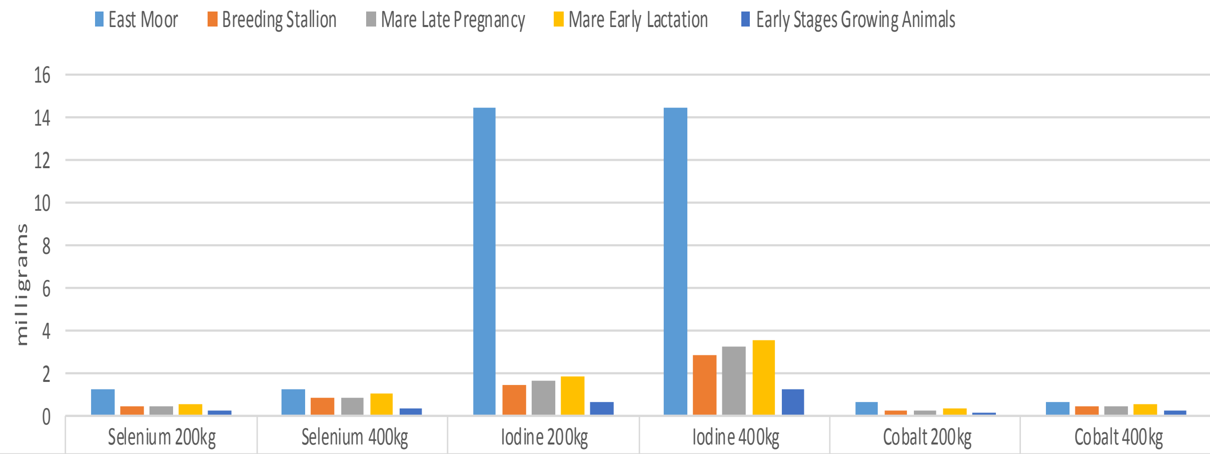
Graphical comparison of availability of copper and zinc at East Moor to the minimum recommended daily intake for horses of 200kg and 400kg



	Copper 200kg	Copper 400kg	Zinc 200kg	Zinc 400kg
East Moor	90	90	456	456
Breeding Stallion	40	80	160	320
Mare Late Pregnancy	50	100	160	320
Mare Early Lactation	50	100	200	400
Early Stages Growing Animals	16.8	33.7	67.4	134.8

The level of available copper at East Moor is above the minimum requirements of horses of 200kg. The level of copper for 400kg horses is above that for horses that are growing, and breeding stallions (not at the 1.5 x level) but is below the level for mares in late pregnancy or early lactation. The zinc level is well above the minimum requirements for 200kg horses. Whilst the level of zinc does appear to be sufficient for 400kg horses, it would fall short if the 1.5x figure for optimum health was used.

Graphical comparison of availability of selenium, iodine, and cobalt at East Moor to the minimum recommended daily intake for horses of 200kg and 400kg



	Selenium 200kg	Selenium 400kg	Iodine 200kg	Iodine 400kg	Cobalt 200kg	Cobalt 400kg
East Moor	1.2	1.2	14.5	14.5	0.6	0.6
Breeding Stallion	0.4	0.8	1.4	2.8	0.2	0.4
Mare Late Pregnancy	0.4	0.8	1.6	3.2	0.2	0.4
Mare Early Lactation	0.5	1	1.8	3.5	0.3	0.5
Early Stages Growing Animals	0.17	0.34	0.6	1.2	0.1	0.2

The level of selenium on site is above the level required for 200kg horses. It is also above the minimum requirement for 400kg horses. It would meet the 1.5x level for breeding stallions and mares in late pregnancy and would just fall short of that for mares in the early stages of lactation. The level of iodine is far in excess of the requirements of 200kg and 400 kg horses. The cobalt level is above the minimum requirements for 200kg horses. It is above the requirement for 400kg horses and would also meet the 1.5x level for breeding stallions and mares in the late stages of pregnancy. The ForagePlus report states "Levels of iodine are commonly low in forage. The level in your forage is high and extra supplementation will not be necessary. Caution should be exercised if breeding mares are on this pasture, as high levels of iodine can result in foetal abortion and abnormalities".

	Ca	P	Mg	Na	Cl-	K	S	Fe	Mn	Cu	Zn	I	Se	Co
Minions	2	2	1.7	1.6	7.6	18.8	2.7	3380	3418	125	369	11.8	1.6	4.5
Caradon	3.1	3.2	1.8	1.9	8	23.9	2.6	1280	4524	117	676	7.9	1.8	0.9
East Moor	2.1	1.7	1.7	1.2	4.7	13.5	2.6	960	2575	90	456	14.5	1.2	0.6

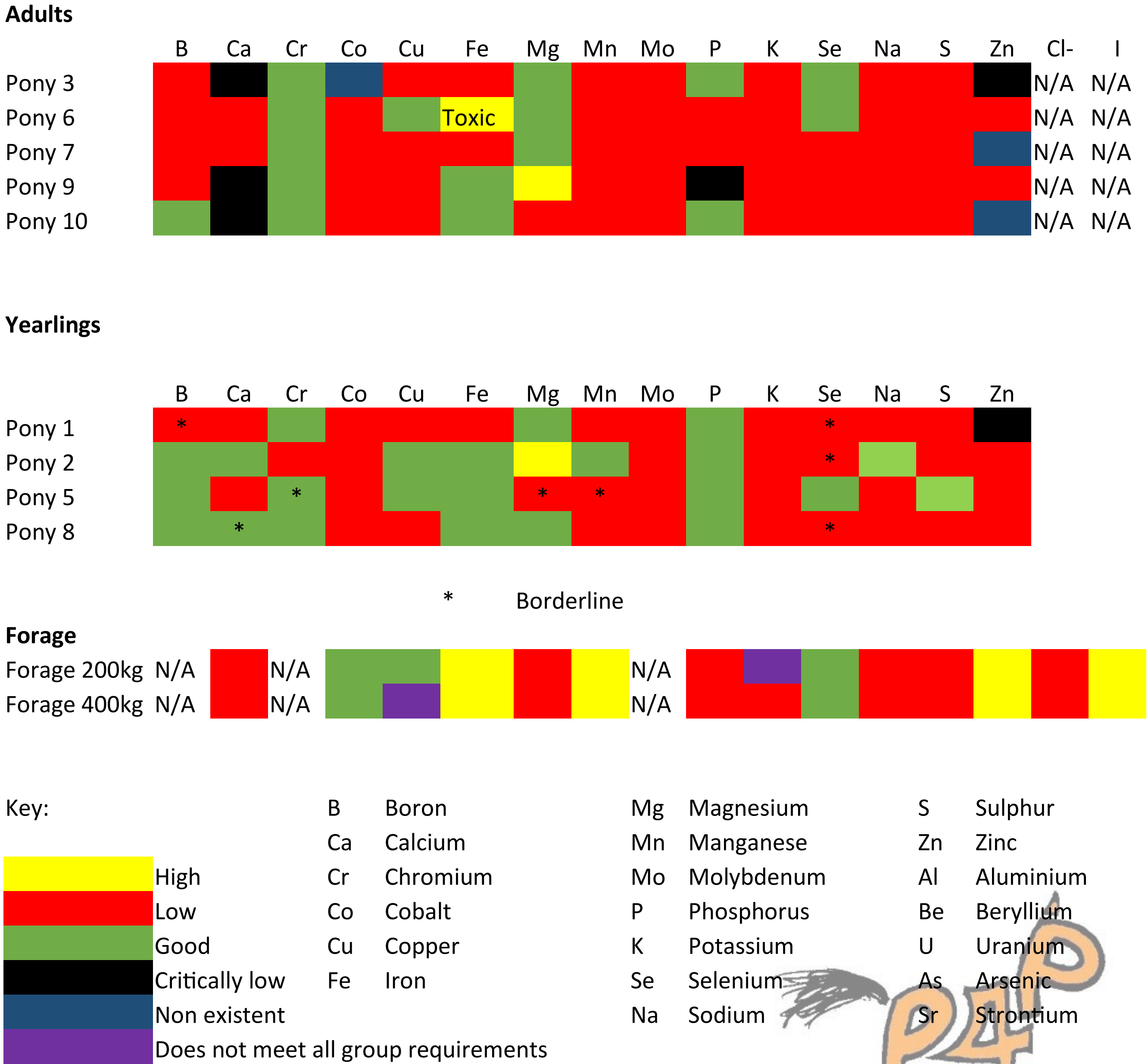
Table comparing forage mineral levels from Minions, Caradon, and East Moor. Results for calcium, phosphorus, magnesium, chloride, sodium, potassium and sulphur are measured in grams. Results for iron, zinc, copper, manganese, cobalt, selenium, and iodine are measured in milligrams.

The forage results from East Moor can be compared to the forage results that were obtained from Minions and Caradon on Bodmin. East Moor is more deficient than Caradon in calcium, phosphorus, magnesium, sodium, chloride and potassium. East Moor has the same amount of sulphur as the Caradon site. East Moor has similar levels to Minions of calcium, magnesium and sulphur but East Moor is more deficient in phosphorus, sodium, chloride and potassium. There are much greater amounts of iron and manganese at Minions and Caradon. The zinc level at East Moor is lower than Caradon but higher than Minions. The level of available copper level is lowest at East Moor. The levels of selenium and cobalt at East Moor are lower than Minions and Caradon. The level of iodine at East Moor is higher than that at Minions or Caradon.

Interpretation

The soil, water, and hair tests from East Moor all showed that toxic elements arsenic, beryllium, uranium, mercury, cadmium, and lead (which can all be associated with mining operations) are not featuring at East Moor. Aluminium also does not seem to be an issue at East Moor. The anomaly in the pony hair results is Pony 6 and its results profile suggests that it has not gained its toxicity of aluminium, beryllium, uranium, and level of arsenic at East Moor. This pony may have been brought to East Moor from another area, or it may have inherited toxicity from its mare. Particular antagonists are required to reduce/remove toxicity and it is not something that would be removed by changing pasture alone. To read more about this, please see our report into the results of testing at Minions on Bodmin Moor.

Looking at the hair testing results, the most interesting analysis comes from splitting the results into adults and youngsters. The following table contains the hair mineral tissue testing results interpretation from Kerry Marsh and compares these results to the forage testing. The colours of the forage testing results are based on whether the levels are low, acceptable, or higher than the minimum recommended daily intake values for the adult ponies in the 200kg and 400kg pony categories. The abbreviation N/A means that this information is not available.



The adult ponies returned more deficiencies than the youngsters and more severe levels of deficiency. The youngsters have benefitted from being supplemented by their mares. The youngsters are the only ponies which have borderline results. All ponies in both groups are deficient in cobalt, molybdenum, potassium and zinc. Chromium and magnesium were the best represented across the groups.

The adult ponies were particularly deficient in boron, calcium, cobalt, copper, manganese, molybdenum, phosphorus, potassium, selenium, sodium, sulphur and zinc. The worst deficiencies recorded were levels of calcium and zinc. Eight mineral readings from the adult group were either critically low or non existent. Three of the five adult ponies were considered to be critically low in calcium, one pony returned a non existent level of cobalt, one pony returned a critically low level of zinc and two ponies had a non existent level of zinc in their bodies. One of the yearlings also had a critically low level of zinc. Three of the five adults only achieved "good" readings in 4 out of the 15 elements and these were the highest mineral scoring results for individuals of the group sampled. The two other adult ponies tested only had two "good" readings out of the possible 15. All adult ponies were deficient in calcium, cobalt, manganese, molybdenum, potassium, sodium, sulphur and zinc.

The youngsters scored better results with more acceptable mineral readings but they were still generally mineral deficient. Two ponies have the highest number of 7 "good" mineral readings out of a possible 15 elements but this still means they are deficient in at least half of the minerals required for good health and nutrition. More than half the youngsters were deficient in cobalt, manganese, molybdenum, potassium, selenium, sodium, sulphur and zinc. All were deficient in cobalt, molybdenum, potassium, and zinc.

Whereas at Caradon and Minions the pony hair tissue results correlated very closely with the forage results, there are a combination of factors in operation at East Moor and this site is more deficient than the Minions/Caradon site.

Whilst there may be a variation of mineral levels across the site, forage results returned levels of iron and manganese above the recommended minimum daily intake levels and these would be expected to be visible in the hair analysis results, particularly the excess levels of manganese. Heavy metals such as arsenic, beryllium, and aluminium are stored in body tissues and are not removed without an antagonist. Iron toxicity is known to be reduced through blood letting (http://forageplustalk.co.uk/iron-overload-in-horses-by-dr-kellon/) and it must be considered that high worm burdens causing anaemia would be having a similar effect. Kerry Marsh stated that "Horses grazing pasture alone generally always have adequate levels of manganese but Pony 1 is low on this mineral which indicates a lack of grazing. If Pony 1 had access to viable and or enough forage, she may have survived". The ponies that were hair tested were either extremely emaciated or deceased. It would be interesting to sample ponies in good condition from this area when there is adequate grazing to see if a level of toxicity of iron and/or manganese is present. High levels of iron/manganese may have contributed to a chain of events, including onsite deficiencies, heavy worm burdens, and other factors which will be discussed below.

Excess iron was found in water sample 2 and in forage results. "Excess iron may affect many metabolic processes via a wide range of metabolic interactions. Among the physiologically significant effects are interactions with essential nutrients such as cobalt, copper, manganese, selenium, and zinc, where deficiency of these elements can be induced by high dietary iron. Antagonisms between copper and iron may have metabolic consequences (https://www.ag.ndsu.edu/waterquality/livestock/ Livestock_Water_QualityFINAL web.pdf)".

Excess iron (greater than 0.3 ppm) in drinking water is much more absorbable and available than iron from feedstuffs, and thus presents a greater risk for causing iron toxicity. If high-iron drinking water is present, an alternative water source should be found, or a method to remove the iron from water before consumption by cattle and humans should be employed" (David K. Beede, 2006: "Evaluation of Water Quality and Nutrition for Dairy Cattle" Michigan State University, Page 8).

Iron uptake into plants is higher in water saturated soils and soils with higher acidity. It should also be noted that "Elevated iron concentrations in the drinking water may be a significant risk factor promoting intestinal proliferation of Clostridium botulinum and subsequent botulism (Pecelunas et al., 1999)". (https://www.ag.ndsu.edu/waterquality/livestock/Livestock_Water_ QualityFI-NALweb.pdf)

"Manganese may adversely affect metabolism and homeostasis of several divalent metals including calcium, cadmium, cobalt, iron, phosphorus and zinc". (https://www.ag.ndsu.edu/waterquality/livestock/Livestock_Water_Quality FINALweb.pdf).

Harman considers that ""Mineral balance is perhaps even more critical than vitamin balance in the equine diet. A complex interaction occurs among many minerals; even a slight excess of one mineral in a diet may disrupt metabolism of other minerals (see the diagram on the next page). Many of the trace minerals act as catalysts to help transform the major minerals into a form that can be used. Plants are good sources of trace minerals, and horses may seek out certain plants for their trace mineral content. Chemically fertilized soils that are farmed repeatedly (as most of our farms are) become depleted of trace minerals, so the grains grown on these soils and fed to horses are also depleted (Walters, Fenzau, 1996). Mineral nutrition then becomes extremely important. (Harman, J.: Holistic Approach to Equine Practice" published in Complementary and Alternative Veterinary Medicine: Principles and Practice (ISBN: 9780815179948), "Unit 8: Integration into Veterinary Practice," Chapter 33, pg. 601, extract available http://www.abcplus.biz/Categories.aspx?Id=CEO_Corner_2-7-012_Holistic_Approach_Equine).

Both the adult ponies and the forage were deficient in calcium, phosphorus, potassium, sodium and sulphur. Forage was also

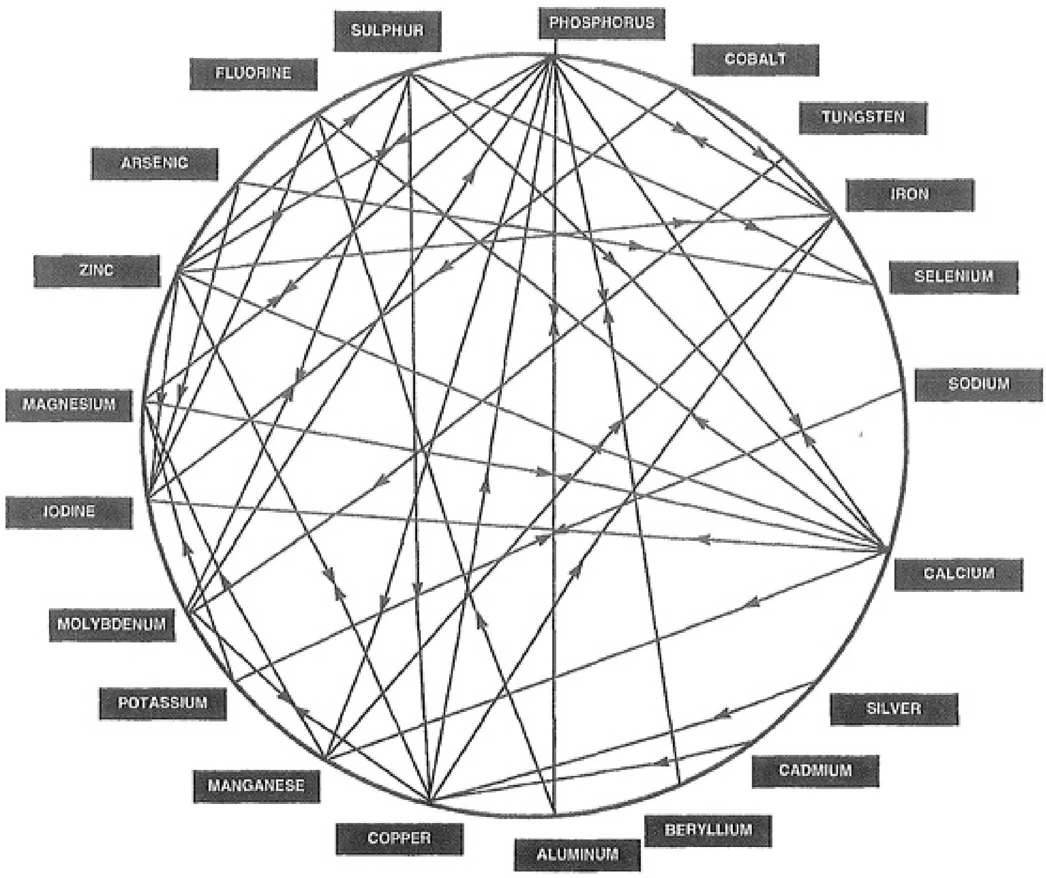


Fig. 33-1. Mineral interaction chart. Arrows pointing together mean that minerals interact; both are required for either to be available. Arrow pointing toward the other one means that the second mineral requires the first one.

Mineral interaction wheel (from (Harman, J.: Holistic Approach to Equine Practice" published in Complementary and Alternative Veterinary Medicine: Principles and Practice (ISBN: 9780815179948), "Unit 8: Integration into Veterinary Practice," Chapter 33, pg. 601, extract available http://www.abcplus.biz/Categories.aspx?Id=CEO_Corner_2-7-2012_Holistic_Approach_Equine)
"Arrows pointing together mean that minerals interact; both are required for either to be available. Arrow pointing toward the other one means that the second mineral requires the first one."

deficient in chloride (an essential component of bile and important in the formation of hydrochloric acid, a component of gastric secretions necessary for digestion https://www.nap.edu/read/11653/chapter/7#86). These are 6 of the 7 macrominerals that horses require in larger amounts to other minerals. The interaction between minerals is complex as the diagram above explains. In some cases a pair of minerals must both be present for either to be available. In other cases one particular mineral is required for the uptake of another.

The majority of the adult ponies were deficient in boron, calcium, cobalt, copper, manganese, molybdenum, phosphorus, potassium, selenium, sodium, sulphur, and zinc. The diagram on page 26 helps to explain the function of these minerals within the body. The ponies have deficiencies in minerals that are usually considered easily obtained in pasture—these include sulphur, potassium, zinc, and cobalt. Cobalt is vital for the synthesis of vitamin B12 which is not found in plants and is synthesised in the equine gut. Vitamin B_{12} needs cobalt to work and is important for energy production and is used with copper and iron in the formation of red blood cells. It is needed for carbohydrate and fat metabolism, and protein synthesis. Clinical signs of cobalt deficiency are the same as for vitamin B_{12} deficiency and include lethargy, loss of appetite, poor growth, anaemia, and weight loss.

With zinc, sulphur, calcium, manganese, and cobalt all needed for enzyme function; and sodium and potassium needed to make the nervous system function, these deficiencies may be responsible for the East Moor ponies' neurotoxic type symptoms that were witnessed (please see the available videos).

The level of magnesium in the forage samples was deficient, but only two ponies returned low levels of magnesium (one of which was borderline) in the test results. There may be a variation in magnesium levels onsite. It may be more available outside the area forage tested in this research.

Diagram illustrating the use of minerals within the body and the impact of deficiencies of minerals. **Information from "Nutrient Requirements of Horses: Sixth Revised Edition 2007", Chapter 5, published by the National Research Council, and http://www.understanding-horse-nutrition.com/minerals.html**

Cobalt—Usually enough in a typical diet.

Used with iron and copper in formation and maintenance of red blood cells.

Vitamin B12 requires cobalt to work. Is needed for carbohydrate and fat metabolism and protein synthesis. Needed for enzyme systems. Is not found in plants is synthesized by microorganisms in the gut.

Iron—Deficiency not usually a problem usually if horses have access to soil.

Excesses decrease zinc in blood and liver.

Boron

Required for bone and joint health, metabolism of key hormones. Regulates absorption of calcium, magnesium, phosphorus.

Deficiency: Joint swelling, osteoarthritis, overactive parathyroids - releases too much hormone—raises blood level of calcium releasing it from bones and teeth. Boron and magnesium deficiency is especially damaging to bones and teeth.

Zinc - Usually easy for horses to obtain.

An important part of enzymes, required for insulin, blood clotting and healing.

Deficiency: Hair loss, poor appetite, reduction in enzyme production.

Sulphur/Sulfur—Deficiency unlikely in the average horse.

For Biotin, chondroitin, insuline and methionine (on of the essential amino acids) Needed for cysteine and methionine - amino acids making up structure of every single protein in horse's body.

Are important structural compounds of every enzyme in the body.

Usually only found in plants so not difficult to obtain.

Copper

Creation and maintenance of elastic structures e.g connective tissue. Collagen requires it to develop. Moves iron to where needed. Keeps central nervous system running.

Deficiency: causes bone problems and orthopaedic disease.

Phosphorus

For bones, production of ADP and ATP energy units in horses cells. Cell membranes, affected by amount of calcium in diet.

Deficiency: Bone problems similar to rickets, softening bones.

Calcium

For bones, muscle contraction activities, potassium ion channels, cell membrane function. Regulates enzymes.

Deficiency: weakened bones, shifting lameness, metabolic bone disease.

Manganese—Deficiencies not common for most horses.

Essential for correct bone formation. Required to activate a number of important enzymes. Digestion of carbohydrates and lipids.

Deficiency causes bone abnormalities.

Potassium—Supplementation rare, usually large amounts in forage.

One of most important minerals. Maintains acid-base balance. Maintains osmotic balance. Skeletal excitability through potassium ion channels. In neurons—responsible for exciting cells—e.g. to swish tail for fly. Every time a horse uses a muscle it is using potassium. Regulates hormones.

Selenium

Detoxifies substances toxic to cell membranes. Thyroid hormone.

Deficiency: Creates muscle disease myopathy. Muscle weakness, weakness, trouble moving, difficulty swallowing, respiratory distress and heart problems.

Sodium

Makes nervous system function. Helps signals move. Works with Potassium to work excitable cells. Transports glucose, amino acids and nutrients. Involved in osmosis. Electrolyte.

Deficiency: Loss of appetite, decreases water intake, slow eating. Severely deficient: May not chew correctly, trouble controlling muscles, unsteady gait.

Stull's animal welfare document "Managing Equine Neglect Cases" (http://www.vetmed.ucdavis.edu/vetext/local-assets/pdfs/pdfs_animal_welfare/managingEquineNeglect.0404.pdf) states that causes of emaciation "Can be multi-factorial and include (Kronfeld, 1993):

- Lack of quantity and quality of feed, especially the nutrient content and balance of energy and protein. Deficiencies of certain minerals and vitamins over the long-term can contribute to emaciation, but also the excessive use of supplements.
- Seasonal declines in the primary feed source such as pasture.
- Malabsorption of nutrients associated with diarrhoea or poor dental function.
- Parasites can be either a primary or secondary contributor to emaciation.
- Conditions such as lactation, pregnancy, or old age increase dietary requirements.
- Pathological conditions such as cancer, diabetes, infections, or diseases of the liver, kidney, or pancreas, or heart can elicit symptoms associated with emaciation.

The Merck Veterinary manual states " The nutrients most likely to be deficient are caloric sources, protein, calcium, phosphorus, copper, sodium chloride, and selenium, depending on age and type of horse and geographic area. Signs of deficiency are frequently nonspecific, and diagnosis may be complicated by deficiencies of several nutrients simultaneously. The consequences of increased susceptibility to parasitism and bacterial infections may be superimposed over still other clinical signs".

This mixture of factors is of significance at East Moor:

- **Lack of quantity and quality of feed and seasonal decline in primary feed source such as pasture**. The grazing on East Moor and other areas of Bodmin is known to be very poor. This can be observed in the photographs taken at East Moor. Animal Plant and Health Laboratory reports usually state there is very poor grazing and no supplementary feed when they have attended Bodmin commons with emaciated animals, and this includes East Moor. Ponies are found to be in good condition on East Moor during the summer, but there are consistently welfare problems during the winter and into the early spring with animals in emaciated condition. The calories in the grass help the ponies to maintain condition in the summer. It would be advisable to test the protein levels in the forage as it is likely there is also a lack of available protein, and this is also a contributing factor which also interacts with the mineral deficiencies. Blood tests on pony 8 did show a low level of protein. The Merck manual states "A deficiency of dietary protein maybe caused by either inadequate intake of high-quality protein or lack of a specific essential amino acid. The effects of deficiency are generally nonspecific, and many of the signs do not differ from the effects of partial or total caloric restriction. In general, the horse will have poor-quality hair and hoof growth, weight loss, and inappetence. In addition, there may be decreased formation of Hgb, RBCs, and plasma proteins." (http://www.merckvetmanual.com/mvm/management_and_nutrition/nutrition_horses/nutritional_diseases_of_horses.html) . It also states that protein deficiency causes decreased milk production in lactating mares and decreased activity in certain liver enzymes.

Sulphur is one of the elements which the forage is deficient in and all the ponies except one youngster were deficient in.

An article by Dr Kris Hiney states that "Horses ingest sulphur in the diet mainly through the consumption of protein…Unless the horse is suffering from protein malnutrition, or is deficient in these specific amino acids (most likely methionine), the horse should be adequate in sulphur. To this date, no one has been able to confirm a sulphur deficiency in horses provided they are not deficient in protein". (https://www.omegafields.com/blog/sulfer-maganese-cobalt-chromium/).

"A quality protein source is one that provides a sufficient amount of these essential amino acids, particularly the amino acid lysine, which is often called the "first limiting" amino acid (meaning that if insufficient quantities of lysine are present, the horse's body will have difficulty using any of the other amino acids available)...The reduced food intake of a depressed, protein-deficient horse can become a vicious cycle, as it makes it difficult to remedy the condition with a correct diet. But the protein requirements of an adult horse are low enough that true protein deficiencies are quite rare; they usually occur only when a horse is on very poor pasture or hay with no other supplemental feed for a prolonged period of time" (http://www.thehorse.com/articles/10576/the-power-of-protein).

. Lysine is one of the amino acids needed for protein synthesis. Lysine ensures calcium absorption and this is a mineral which is already very deficient at East Moor. The adults returned low and critically low levels of calcium in their hair testing results. Lysine has many roles including the production of collagen to build bone, production of antibodies in the immune system, production of hormones in the endocrine system, production of enzymes of the digestive system, transporting blood oxygen and nutrients...amongst other important roles in the body. Forage Plus states "Lysine, followed by methionine and threonine are the essential amino acids in most demand during protein synthesis in the horse...It is the amino acid that is often in the shortest supply in forage so it makes sense to supplement for insurance. It is particularly important for horses in heavy work, pregnant and lactating mares and growing youngsters". (https://forageplus.co.uk/protein-and-amino-acids/) . "The challenge in feeding horses is to provide adequate quantities of protein that will allow for sufficient concentrations of circulating amino acids in the blood that the body can draw on to synthesize tissues, enzymes, hormones, as well as tissue repair" (Nutrient requirements of Horses: Sixth revised Edition 2007), page 54 https://www.nap.edu/read/11653/chapter/6).

It should be noted that cows and sheep are removed from East Moor for the winter and are not returned until the spring. The usual periods for removal are between October and April. In the spring, local Commoners were seen to supplement their cattle with hay. Some would chase ponies away to ensure their cattle were fed.

The ponies were not supplemented during the period February to June of 2016. Offers of hay were rejected when offered (either by charities or individuals). A small group of ponies on the "Ridge" side were supplemented by a local couple. Whilst feeding of animals by the general public should not be encouraged, it should be noted that their efforts of taking hay and supplementary feed did result in animals in much better condition than elsewhere on East Moor.

- **Deficiencies of certain minerals and vitamins over the long term.** We were not able to test for deficiencies in vitamins as part of our research but the results did display a range of mineral deficiencies, some of which were extreme in the adult ponies (as already discussed). With poor, deficient soils unable to provide adequate mineral uptake into consumed plants, and with little likelihood of the soils being added to or improved by human intervention, supplementation is essential to ensure that horses get the nutrients they require. This area was more mineral deficient than the Minions/Caradon Commons. Ponies do well on lowland sites with rich plant variety. The nature of the environment at East Moor means there are lower levels of plant diversity than on lowland conservation sites.

- Malabsorption of nutrients through diarrhoea or poor dental function. These conditions were not witnessed at East Moor— most ponies that died during 2016 were youngsters or adults not of great age. Elderly ponies are prone to dental issues but the ponies effected were not elderly.

- **Parasites can be either a primary or secondary contributor to emaciation.** Internal parasites are a common problem for horses in poor body score condition - they can be a cause of the condition or an effect of it. High worm burdens further block the uptake of nutrients. Parasites are considered to be a big problem at East Moor. Marsh also considered that the occurrence of anaemia in hair testing results would most likely be attributable to worm infestation. Charities reported that rescued young and adult horses from East Moor had very high worm burdens. Lice infestations were also reported. Animal Health and Veterinary Laboratory Bodmin welfare reports also frequently list under "Animal Care" that in their experience ponies will not have been wormed by their owners as necessary. With no routine or annual round-ups there is no opportunity for owners to have a strategic approach to worming their animals. Without a management plan in place, worm burdens will remain a problem - due to worm burdens on-site and unsupplemented animals in poor condition having weakened immune systems.

It is usually considered that alternative grazing with ruminants and pasture rotation schemes will aid in disrupting the parasite life cycle. Grazing ruminants in rotation with horses will reduce parasite infestation since most internal parasites are host specific. (http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-7552/VTMD-3976web2014.pdf). Whilst East Moor is cross grazed, it is clearly not sufficient to assume the presence of cows and sheep together with the horses on this site is enough to reduce the worm population for the horses. Some parasite eggs may be killed by frosts but the warm winters of recent years have greatly reduced the occurrence of cold, frosty weather.

An AHVLA vet stated that there is no point feeding the ponies on East Moor because they are so full of roundworms. Whilst the worm issue does need to be addressed through appropriate de-worming, veterinary advice would usually be to supplement with food until worming could take place.

Giedt states that internal parasites represent a significant health risk to horses and cost the horse owner in several ways. Parasites rob the horse of intended nutrients, parasites cause anaemia, parasitized youngsters grow slower, and parasites can reduce reproductive and athletic performance of horses. It is expensive to feed parasite burdened horses. (http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-7552/VTMD-3976web2014.pdf)

A pony rescued by Redwings in June returned a worm count of 8000 eggs per gram.

- **Conditions such as lactation, pregnancy, or old age increase dietary requirements.** Forage samples compared to the daily minimum requirements of lactating and pregnant mares in our test results show that the mineral requirement fall short of intake requirements for a broad range of mineral groups. Adult ponies are severely mineral deficient and it seems unlikely that animals currently residing on this site would make it to old age without supplementation or routine animal care provision by their owners.
- **Pathological conditions such as cancer, diabetes, infections, or diseases of the liver, kidney, or pancreas, or heart can elicit symptoms associated with emaciation.** Whilst we have no clear evidence of incidences of cancer on site, mineral ratio indicators did suggest compromised liver and kidney function. Whilst hair and blood tests from pony 8 (which had received some supplementation before rescue) confirmed good liver and kidney function, blood tests on rescued ponies from East Moor in previous years have shown liver problems. Ponies rescued from East Moor in previous years have also tested positive for strangles.

Other aspects related to East Moor:

- Overstocking of animals on site - commoners are usually issued units of animals they are allowed to graze on Common land—units refer to particular numbers of cows, sheep, and horses. This is to try to prevent overstocking and overgrazing. East Moor has fluctuating numbers of ponies turned out, but usually very high numbers. A January 2016 AHVLA report lists 183 ponies on East Moor. With 23 dead ponies recorded, and at least 42 emaciated ponies seized by the authorities on East Moor between January and June 2016, one third of the East Moor pony population were detrimentally effected. During this crisis period more ponies were added to the common. By the 16th June 2016 the number of ponies recorded on East Moor by AHVLA was 149.
- Continually compromised generations of ponies on East Moor, could potentially mean that the effects of starvation are passed on through family groups. This would need to have more research conducted into it—most studies focus on short periods of starvation rather than regular occurrences and their effects.
- The lack of removal of carcasses leaves equine populations vulnerable to the possibility of botulism. Of all the pony carcasses on East moor, only 6 were buried in a mass burial pit (at the point marked 28 on the map on page 2)and one was removed by the authorities in June. Other than this, carcasses of dead ponies, sheep, and cows seem to be routinely left to decay on East Moor. Defra is usually very strict about carcass removals and national newspapers have reported prosecution of UK farmers who have not removed livestock carcasses. On East Moor, carcasses have been left on the open moorland and in water sources. A former burial pit, marked as number 27 on the map on page 2, was dug very close to a water source.
- A lack of management resulted in a very high proportions of stallions to mares, and this in turn led to intense fighting between stallions, particularly during the 2016 foaling season. Mares come into season very soon after they foal. Injuries were sustained by both stallions and mares.

- A slowness to act by the authorities also led to the death of ponies. On Dartmoor, Quarterman are responsible for removing animals in poor condition (whether owned by Dartmoor Commoners or abandoned) on moorland area. At East Moor there seems to have been no organised body to promptly and successfully remove animals in poor condition. AHVLA vets can assess welfare and body condition scores of animals but they have no facilities for removal, nor resources/expertise/equipment to facilitate the rounding up or rescue of ponies. Despite help being offered locally by experienced individuals or groups, large scale round-ups and removals have not taken place without the assistance of Redwings who travel from Norfolk. Because of this, ponies in very poor condition have had to wait months before rescue and some have died in the meantime, or after roundups because they have not been removed. An AHVLA report for April from East Moor stated that 4 further animals needed urgent attention but they were unable to round them up. The next round up date was June. No supplementary feeding was provided and more ponies died in the inbetween period.

- The relatively low value of moorland ponies (which can sell for as little as £10 at market) may mean that owners are reluctant to provision feeding and healthcare. The provision of feeding and healthcare is a legal requirement under the Animal Welfare Act 2006.

- The lack of management, monitoring, and enforcement on this Common has made it impossible to determine whether animals are owned or abandoned. Microchipping and passporting of ponies on Bodmin is a legal requirement. A lack of enforcement, or the opportunity for this to take place (through annual drifts/roundups) has led to a lack of accountability. There have been no prosecutions despite the level of neglect.

- An atmosphere of hostility and intimidation by some individuals associated with Common appears to means that AHVLA staff and some local residents fear for their own personal safety. Freedom of Information requests submitted to AHVLA requesting numbers of pony welfare incidents attended by AHVLA per Bodmin common per month could not be fulfilled. Defra considered that revealing the name of a Common could "Identify further information and would, or be likely to, endanger the health and safety of staff or the public. This poses a substantial risk to the health and safety of individuals associated with the ponies that would be of significant severity and is likely to occur in some cases. We consider this to be a significant factor in maintaining the exemption.

  APHA has balanced the real threat to health and safety of individuals which disclosure of the requested information would be likely to cause, against the public interest arguments in favour of disclosure. In this instance, APHA does not consider that disclosing the information request in order to inform public debate and to promote accountability and transparency would justify the risk to individuals' health and safety".

  APHA did provide redacted reports of pony welfare incidents attended per month, per year by APHA but the number of incidents per common was withheld. They stated that "All welfare visits regarding the Bodmin ponies are initiated by welfare intelligence and are not routine". APHA also state that they do not have an allocated budget to cover the welfare of ponies on Bodmin Moor and they did not provide an estimate of how much they consider Bodmin pony welfare costs APHA each year.

- The approach to East Moor has not been one of preventative action. The authorities have only acted when animals have reached emaciated condition.

The welfare of horses and ponies on East Moor, and Bodmin Moor generally, is covered under the jurisdiction of the UK Animal Welfare Act 2006, which states:

Promotion of welfare

9 Duty of person responsible for animal to ensure welfare

(1)A person commits an offence if he does not take such steps as are reasonable in all the circumstances to ensure that the needs of an animal for which he is responsible are met to the extent required by good practice.

(2)For the purposes of this Act, an animal's needs shall be taken to include—

(a)its need for a suitable environment,

(b)its need for a suitable diet,

(c)its need to be able to exhibit normal behaviour patterns,

(d)any need it has to be housed with, or apart from, other animals, and

(**e)its need to be protected from pain, suffering, injury and disease.**

(3)The circumstances to which it is relevant to have regard when applying subsection (1) include, in particular—

(a)any lawful purpose for which the animal is kept, and

(b)any lawful activity undertaken in relation to the animal.

This research sheds new light on the issues surrounding equine welfare problems at East Moor. In order to address the problems and bring about long term change, the results will need to be acted upon by the owners of the animals, the Bodmin Commoners' Council, the landowners, and the authorities to address the problems which have been highlighted. It may be public pressure which ultimately brings about any change.

The approach to East Moor by the authorities has not been one of preventative measures, but acting once animals have reached emaciated condition. More action needs to be taken to prevent these annual welfare problems. In September 2016, a roundup of all the ponies on East Moor took place. 40 stallions were permanently removed from the moor. Ponies were wormed, and microchipping and passporting of owned animals took place. Whilst this is a very positive step, supplementing the equine population throughout the winter is going to be a key factor in ensuring the survival of animals on this area of moorland.

Conclusion

- There are a combination of factors that have led to the emaciation and death of ponies on East Moor and these include:
  - Lack of quantity and quality of feed and a seasonal decline in the primary feed source (pasture). A lack of protein is also indicated.
  - Deficiencies of minerals and vitamins over the long term.
  - Parasites.
  - Increased dietary requirements of pregnant and lactating animals which have not been met.
  - Compromised health.
  - Also indicated are problems of overstocking of animals, a lack of management, a slowness to act by the authorities, no supplementation of animals, a lack of enforcement of identification of animals, the low value of moorland ponies, an atmosphere of hostility, and a reactive rather than preventative approach from the authorities.
- A lack of carcass removal presents a disease risk from botulism.
- Testing conducted on East Moor revealed no toxicity of the heavy metals arsenic, beryllium, and uranium which have been found at Minions and Caradon. There are also no toxicities of lithium and aluminium. One pony on East Moor had a profile with toxic levels of iron, high levels of aluminium, beryllium and uranium, and a level of arsenic. It is believed that this pony had been brought to the moor from another area, or that it had inherited toxicity if it had been born on East Moor. Levels of toxicity can effect a ponies' uptake of minerals, uptake of forage, and effect their health.
- There has been no supplementary feeding or provision of minerals onsite. The extent of mineral deficiencies have not been appreciated. East Moor is an active breeding environment with pregnant mares and young animals requiring extra nutritional intake. Testing showed adult ponies were severely deficient in minerals. All were deficient or severely deficient in zinc and calcium. The majority were also deficient in boron, cobalt, copper, manganese, molybdenum, phosphorus, potassium, selenium, sodium, and sulphur.
- Forage results revealed deficiencies in calcium, phosphorus, potassium, sodium, sulphur and chloride. These are 6 of the 7 macrominerals that are required in larger amounts to other minerals. Levels of macrominerals available on site fall short of the requirements of breeding and non-breeding horses. These levels of deficiency will also be impacting the other livestock on-site. A high level of manganese, and a level of iron above daily mineral requirements of ponies, is likely to be effecting the ponies' uptake of other minerals such as cobalt, copper, calcium, selenium, phosphorus, and zinc.

- The levels of deficiency may be producing the neurotoxic type symptoms witnessed in the effected ponies.

Recommendations

- Supplementation of minerals, and hay at East Moor during the winter, is essential. For animals living in a semi-feral environment, Marsh recommends the provision of loose minerals on the moor, which are considered more effective than mineral blocks at helping to address deficiency issues. If hay is sourced from areas with better mineral values this would help to combat the deficiencies present on site. Whilst members of the public may like to donate feed, it should be distributed by owners, or individuals agreed by the Commoners' Council. This is so that the appropriate forage is provided and distributed in an acceptable manner. If supplementation cannot be provided on East Moor during the winter then ponies should be removed from the moor for the winter, as already happens with the cows and sheep. Supplementation could then take place on the farm. Supplementation of minerals would also benefit other livestock onsite and any provision should be checked for the safety of all livestock on-site. Minerals should be available all year around. There are sufficient calories in the East Moor grazing for hay not be to needed in the summer.
- Any carcasses should be properly and promptly disposed of. Carcasses present a disease risk to equines from botulism.
- A system needs to be established with a knowledgeable and skilled set of individuals who can promptly and safely drift animals from the moor, and ensure a removed animal receives veterinary assessment and treatment.
- A management system needs to be established with annual roundups, removal of colts, identification of animals (through passporting and micro-chipping), and a worming strategy. The progress made through drifting the entire population of East Moor and removing stallions, worming, and identifying animals needs to be maintained and built on.
- Enforcement of quotas of livestock to prevent overstocking.
- In areas with persistent annual welfare problems the authorities should look to take a preventative rather than reactive approach.
- The movement of ponies with toxicity from other areas to East Moor means that animals with toxicity can still be passed into the food chain. There needs to be awareness that any toxicity accumulated will be passed on to the consumer, whether that is scavenging wildlife, hunting dogs at kennels, zoo animals, and/or humans where animals are being passed into the human food chain.
- Further testing should be conducted on other Bodmin sites with previous mining activity, particularly those Commons with ongoing animal welfare problems. East Moor revealed a different profile to Minions/Caradon and there are other Commons on Bodmin which have persistent welfare problems.

People4ponies is an equine charity dedicated to helping wild and traumatised ponies
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P4P People4ponies 'Welfare In Action'