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An investigation into pan hydrology and ecology in the Makuleke concession, Northern Kruger, South Africa

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An investigation into pan hydrology and ecology in the Makuleke Concession, Northern Kruger, South Africa
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Examiner 1's corrections

General Comments

1. There are still some issues with punctuation and incorrect use of commas and semi-colons.

1. The grammar throughout the paper has been peer reviewed and corrected.

2. Figure 6.18 and subsequent paragraph – you MUST include a correlation coefficient (r) on a correlation chart! Is the correlation significant? This is very quick to do!

2. The correlation coefficient was calculated and can be found on page 120 in figure 6.2.

3. Section 6.5 water chemistry. There are still several issues with this section but they only require minor amendments.

3. Detection limits were verified and corrected to represent the true, meaningful values used to determine (TWQR) health. The previous approach to the water chemistry was evaluated and the effects key amended to reflect all Zinc measurements. Detection limits were not given a value within the effects key. Limitations of the effects of water quality on aquatic invertebrates have been discussed in sections 2.4, 6.5 and 7.4. It is noted that more aquatic invertebrate data would be required, together with more frequent sampling periods in order to better represent the current data set.

4. Section 6.9. I am not convinced you can say very much about land cover change from Google Earth images taken at different times of year. For example I think the apparent differences in cover between figs 6.31 and 6.32 are more due to simple seasonal vegetation changes and the angle of the sun than to any real longer-term change in cover. I really think you should include a few sentences describing the limitations of this approach.

4. Upon further investigation, it was decided that the section on NDVI and Google Earth imagery used in land cover change analysis should be removed. This is because the data at hand is not extensive enough to derive robust and true arguments as to how the surrounding vegetation of the pans is changing.

Specific Comments

P28 Your list of key taxa from Davies and Day (1998) excludes the largest group – insects!

Aquatic invertebrate insect examples were included.

P31 I do not understand the penultimate sentence which begins "Ionic composition changes within the water body have been linked to an increase in potassium…."

The sentence was removed as it was neither coherent nor valuable to the discussion.

P32 Temperature section – last sentence of first paragraph does not make sense. Also, temperature is only one of many factors which control distribution of organisms.

The sentence has been amended.

P35 line 2 makes no sense

The sentence has been amended.

Fig 4.1 and Fig 4.12 captions – not a photo

The captions have been amended.

P39 line 4 OR the Luvuvhu?

The word "of" was replaced by the word "or"

P44 first sentence: SOILS are classified

The word "soil" was made plural – "soils"

P49 line 4 remove "and"

The word "and" was removed.

P67 first line makes no sense. Line 11 – is NOT followed?

The sentence was rewritten and the word "not" was included.

P83 explain RGB bands. Para 2 line 4 missing "of"

The RGB bands were defined and the word "of" was included in paragraph 2.

P96 last line – ONE side?

The word "one" was included.

P113 last para – losing not loosing

The grammatical error was corrected.

Section 6.2 – all the charts are titled "Soil distribution" which is incorrect, it is soil particle size distribution

The heading was amended to "Soil Particle Size Distribution".

P128 last para poorly worded and could be better explained

The paragraph was reworded and better explained.

P129 end of para 1 – if score of (4) is flooded, what does 5 in Table 6.2 mean?

A definition was provided for the scoring system and an explanation elaborated on.

P141 I do not understand last sentence, very poorly worded

This sentence was reworded.

P162 line 3 TOLERANT not tolerable… THICK muddy sediment?...

Both of the grammatical errors were corrected.

P165 sulphate – leaching not leeching. Nitrite – you say nitrate in third column

The grammatical error was corrected and nitrate was replaced with nitrite.

P166 para 3 Organic minerals? You mean organic compounds? Mineral means not organic!

Organic minerals were amended to reflect organic compounds.

P167 Land cover implies? Missing text after second para?

The paragraph was amended with additional sentences.

Fig 6.34 – date above image does not match stated date on and below image

The referred to figure and section has been removed from this paper (see general comment 4 for explanation).

P171 2nd para – what do you mean by "distinct aridity has occurred"?

The sentence was amended to better describe the areas arid surroundings.

P179 In your discussion of NDVI data you seem be confused about what the data can tell you. A one-off NDVI image cannot tell you about change through time, only about relative vegetation health/cover at one point in time! CHANGE in NDVI can tell you about vegetation change through time.

The referred to figure and section has been removed from this paper (see general comment 4 for explanation).

P180 last para – repeats "on the on the"

The additional phrase "on the" was removed.

P191 – as above – you cannot say that Zn values below detection limit fail the AEV!

The detection limits were excluded from the effects key and the text amended.

P192 para 3 makes no sense

The paragraph was rewritten.

P193 Paragraphs on temperature and pH are very confused and badly written. pH is not an indicator of eutrophication, while last couple of sentences of section 7.4 are not coherent and again get confused about nutrients.

The paragraph was rewritten and the term “nutrients” replaced with “ions”

P195 Section 7.5.2 and elsewhere – references to sulphur and “essential proteins” are misguided

Referred to sulphur sections have been amended.

P197 line 3 – sentence makes no sense

The sentence was reworded.

P213 Very poor grammar in first paragraph e.g. lines 14-15

The grammar was reviewed and the paragraph reworded.

Examiner 2’s Corrections

Overall I found this a difficult thesis to read – there are many many editorial errors and the thesis is in need of a professional proof read. The candidate states in an attached report that the thesis had been peer reviewed – am not clear what that means, however the errors, omissions, verbose sentences, sentences incomplete etc are too numerous. I forget which page but in discussion / conclusion I have study, paper and dissertation all on a single page, use of Southern and southern, graphs with headings in graph-box and below that repeat description, inconsistencies with ‘Latin names’, use of single versus double quotation marks, irregular use of page reference with author citation when a direct quote is provided, and, worrying for a Geographer, inconsistencies in legends and scale for comparative maps of the various pans. All of these editorial type errors really do add up and detract from the research, bearing in mind as the examiner I only have the written document to base my decision on.

- Inconsistencies were addressed and amended throughout the paper.

- The scales provided on the maps differ due to the magnification required to study the displayed detail of the study area. Maps depicting a larger area (study area locality) have been given a scale in kilometres, and those showing more detail (wetland/pan delineation and sample sites) have been given a scale in metres due to their magnification.

Please re-look at the Google imagery provided and the dates linked to the imagery – this is a major concern as much vegetation change /analysis has been attempted based on what I am not sure is correct information. By way of example, page 172 has two images of Likangwa Pan – figure 6-37 in labelled as 17/05/2005 and the imagery date on the actual image (bottom right hand line of text) has a label "Imagery Date 5/17/2005" which is correct, however figure 6-38 is headed 1/02/2010, the bottom right hand corner text on image is labelled "Imagery Date 1/1/2008". This makes a huge difference to the analysis and there is no consistency between Pans. What I mean by that is I checked the thesis and Google Imagery and in some cases the figure and image descriptive labels match, whilst in other cases not so. Three issues arise here, first, less worrying, is lack of consistency in labelling, second, of greater concern and I hope I am incorrect and apologise if so, the candidate is attempting to analysis an image from an incorrect assumption regarding date at which image was captured! Third – see page 172 figure 6-38 - candidate has two separate images (1/1/2008 on left and 2/1/2010 on right), this cannot help interpretation.

- The section on Google imagery was removed from this paper as it was difficult to assess vegetation change in detail and to draw conclusive evidence of vegetative change from the images.

A further major issue I had throughout the thesis was the sampling strategy and timing thereof. I worry about only two sampling periods and the comparison of summer versus winter throughout – really think we need to get rid of that idea. It was only when I got to

page 140 that I finally understood why and this is a serious limitation for me – the candidate (figure 6-29) presents rainfall data and it is the first time I find out when the sampling took place – April-May and Nov-December 2011. Besides only two collection times, a greater worry is, according to the information below the figure (which I sincerely hope is an error), is that April-May is described as the 'summer' and Nov-December as the 'winter' collection period. This cannot be correct, I do not believe it is a case of 'wrong way round' as still does not make sense. Is the candidate comparing, as I believe is the case, summer and winter based on collections in April and November?

- The sampling period was amended to show wet and dry fieldwork sampling periods as opposed to summer and winter sampling periods throughout the paper. The sampling frequency is explained in chapter 1.

The Makuleke Concession is a collection of 30 or so (depending on which reference you use, although according to Ramsar it 'officially' recognises 31 'pans') flood pans, or in the words of Ramsar 'flood plain vleitypes'. Thus, the collection has been defined as a single entity. I understand that the research is about subdividing this agglomeration to make 'management more practical' – it is not clear to me why this is necessary? No word from the managers, no evidence of raised concerns as to existing strategy and, although subdivision into unique systems is possible, no real argument put forward that it is necessary or desirable. My point being that, at a MSc level, I recognise the field and lab based approach which is great and commendable as I do understand the field dynamics and the candidate demonstrates aptitude to overcoming these real field issues, however - sorry to be blunt – why do it? As a practical exercise that demonstrates developing a research question, finding and critically reviewing relevant international and local literature, developing appropriate methods to solving research aim / objectives, collecting and analysing data and providing a general discussion I can accept the submission however I feel that the initial research aim is a poor one. Can we not turn this around – good field work has been done but why this attempt to reclassify each individual pan as a unique system does not help management. There is a reason Ramsar identifies this as a single system, and yes I agree we have different sources, vegetation types, land use, soil types and even percentage organic material and chemical composition within each pan but the scale is to fine and, again I repeat myself, of little managerial use. Simply put, is the candidate not splitting hairs?

- The aims and objectives and research questions, in this paper, have been revised and the study revised accordingly.
- The proposed local/regional classification scheme was suggested to be used in conjunction with the Ramsar classification, and used as a local classification to further define and understand the individual systems accordingly. The local classification will create a well-rounded understanding by incorporating local aspects to the wetland and pan areas.

Specific Comments (by Section/Chapter)

Thank you to examiner for the annotated paper – where legible the corrections were implemented. The wits style guide for postgraduate papers was followed.

Page I – no page number on title page

Abstract – far too brief, reads complex and not clear as to 'what' the research focus is. Get rid of 'also' and 'in order', what is meant by 'correctly monitored', something missing in line 2 ('…to determine the accuracy and applicability pan systems…'). No need to have keywords that are in title of thesis.

Table of Contents – Appendix A onwards – Roman Numerals and not page numbers; References to follow Conclusion and not after Appendices – titled: 'References' and not a Chapter and not 'Works Cited'

- The page numbers, table of contents and reference list were amended to reflect the examiners requests.
- The abstract has been rewritten and the grammar corrected.

Chapter One – weak justification of research, very quickly into own site, little on international perspective, no classification system will cover all options, what about WetHealth – comes in much later, see other SA wetland classifications that have been tried over the years – Rowntree and Wadeson etc – see Water Research Commission Reports. Heavy reliance on Davies and Day. Here, as throughout, many sentences missing references, replace 'like' with 'such as', delete 'in order', replace 'as well as' with 'and' and many 'also's; page reference for direct quotes required. Many generalisations and unsubstantiated statements. Changing of tense, heading for table 1-1 'A table which indicates …' – poor. Why the subheading 'Why the research is being completed'? Why no research aim / objectives in chapter 1?

- Chapter one now reflects the literature provided by WetHealth. Please note that the WetHealth report was not yet published at the time this study was originally submitted.

- Missing references were included in the reference list and the grammar and tenses were corrected.
- The heading “Why this Research is being Completed” provides a brief skeleton of why this study is being undertaken prior to the literature review. It was felt that it would be better to place the aims and objectives after the literature review in Chapter Three so that an idea could be developed through reading the literature then when the aims and objectives are laid out the reader may gain an understanding of what the research is trying to achieve.

Chapter Two – see annotated thesis, many editorial errors, repetitive, references missing from statements, poor quality images, inconsistencies, missing subheadings, what about use of software Aquitox?

- Editorial errors were corrected, where legible, from the annotated paper. A spell check was completed before resubmission.
- Images were selected of value for the study. The images adequately display the data in question. Where legends were illegible, they were amended and the site coordinates were included on the maps.
- The software Aquitox could provide a valuable assessment for the aquatic invertebrates sampled in the area. However, this software had not been suggested prior to the submission of the paper. The use of the software during the scheduled time for the corrections would result in redoing the aquatic invertebrate’s chapter which would not be feasible in the time frame provided.

Chapter Three – here are the research questions – why inverts – a nice collection but nothing really done with them – this in itself could be a Masters for me. Please check Journal of Freshwater Biology / Ecology – so much has been done on inverts, impact of climatic change, shifts in seasonality, life cycle traits, use as biomonitors etc – so much that could have been done here alone. See all the work by de Moor in South Africa. Why have chapter three at all?

- The aims and objectives were rewritten and the focus changed (see chapter 3).
- Aquatic invertebrates were selected as part of the biota used in the wetland assessment for ecological functioning/wetland health – the systems condition (see chapter 7.6) was derived from the aquatic invertebrate data collected.
- As suggested by the examiner, much can still be completed on aquatic invertebrates in the Northern KNP, unfortunately aquatic invertebrate were not the main focus of this paper as the soils moisture, soil particle size distribution and combustible organic content were. Further aquatic invertebrate studies (gap analysis) in the Makuleke Pan/ wetland systems would provide useful data for the KNP database.

Chapter Four – require an introduction prior to figure 4-1. Figure 4-1: scale of two 'larger' maps, location on KNP map, surrounding countries on localized map? Figure 4-2 – see legend both important river systems in the same colour; reason for a single geographic reference co-ordinate system in figure? Why 'proposed source' and not actual? No need for figure 4-6 at such a scale, figure 4-7 etc – not images unless referring to them as 'screen shots' from GPS. Figure 4-8 of little value – see legend and contour lines not visible. Figure 4-9 – different scale to figure 4-8 which does not aid comparison and requires labels for orientation. Figure 4-11 – is it necessary and see subheading as an example of why I want a proof read throughout, furthermore figure 4-12 is a good example of carelessness which at this level needs to be avoided – I know that no thesis is perfect and there will always be errors – a few of course I will overlook – but there are too many of this nature here. Figure 4-12 beginning of subheading has been 'cut and paste' from elsewhere. Table 4-2 – suggest as an appendix. Figure 4-13 – felt much more could have been made of the 'real' imagery in thesis, explain scale – what is meant by 'state of the vegetation' – do you mean a NDVI. What is the value of a single NDVI image in isolation? Section 4.8.1 onwards – out of context and needs to be presented prior to research site specifics. By end of chapter my question was – why not stick to issue of mining – be specific, sample for spills and compare using inverts as biomonitors?

- The countries have been included on the locality maps.
- The differences in colour indicate the rivers, perenniality and not which river is which (the rivers are labelled).
- "Images" has been changed to figures throughout the paper.
- The topographic map depicts contour lines which are indicated on the map as brown lines.
- Headings were checked throughout the paper.
- A figure caption is provided for each figure. The text below the figure then refers to the above figure and not an additional figure heading, but part of a paragraph.
- The vegetation species list, table 4-2 is now in the appendices as appendix F.
- The section on NDVI has been excluded from the paper due to the limited analysis that could be completed with the data available on the sites.
- The geographic reference coordinates system provided in the figures is according to Ramsar. Other references reflect the GPS location as 22° 24' 5 S, 31° 11' 49 E (WGS 84). According to Google Earth the coordinates at the centre of the Makuleke Concession are 22° 23' 0 S, 31° 10' 10 E.
- Examples of mining spills have been included in section 4 as requested.

Chapter Five – really not happy with the summer / winter idea – only have two sampling periods and as eluded too above not sure you really have seasonality in sampling which is a big concern and should be something addressed first up. Can we not consider, not ideal but may help, rainfall versus non-rainfall time periods? Many editorial errors in this chapter – see annotated copy. Still not clear on pan boundary delineation, of what use is

soil moisture as opposed to recording molting for example? Once off collection of soil moisture and organic matter is so variable and I need to see much more justification as am not convinced of usefulness. How many replicates per site? Page 79 – why so many sieves – is this division necessary / useful, do not be persuaded by what the software requires. Section 5.3 – how relevant to research questions? Figure 5-15 – legend? Pixel resolution? Labels? Figure 5-17 onwards – please explain the sign / expression / equation "…gradient of ($^{+}$ 10)"? Compare figure 5-17 with figure 5-18 onwards – different scales, no need for repetitive headings, different legends – putting aside my cartographic concerns which we could call 'mere window dressing'; to make figures neat and geographically acceptable, one cannot compare figures at different scales. See figure 5-27 versus 5-28 – look at legend positioning! Small things I know but important. Explain, page 102 "The use of GIS in this study allows for the digitized representation of the study sites"?

- The sampling frequency was revised for this paper. The study will now reflect two sample periods, wet vs. dry; this is explained further in chapter one.
- Annotated copy corrections were addressed where legible and a spell check/grammar check was completed.
- Section 5.3 is relevant as it provides a framework for the GIS data that was acquired for the maps that were created in the paper. The soil sampling and the aquatic invertebrate sampling areas as well as the wetland/pan delineation undertaken in the study are reflected in the GIS maps/used to develop the GIS maps and utilised for the analysis in this study.
- The $^{+}$ indicates an uphill slope in degrees according to the inclinometer, this is reflected in text.
- The maps indicate different scales, some in metres and some in kilometres. The reason for this is due to the magnification on the map, to show details of the specific study sites and/or locality of the study area (Makuleke Concession locality maps refer to kilometres and pan/wetland maps/figures refer to metres).
- The legends provided for the figures have been placed on the maps in an area that does not cover details required for the studies discussion.

- The sentence “the use of GIS in this study allows for the digitized representation of the study sites” has been removed.

Chapter Six – explain figure 6-2 onwards, approach is on page 78, speak of ‘loss in moisture content’ – do you mean samples with high moisture content – I find this confusing. This soil moisture analysis section is a concern – first, possibly just semantics, but the notion of ‘soil moisture loss”, second winter versus summer that according to sampling dates are not winter or summer dates and third what is the real comparison and attempting to determine by doing this? Lack replication, is a single sampling time period and along one pan gradient. I need justification. Speak of ‘significant difference’ – how determined? What about antecedent conditions prior to sampling? I do not understand notion of ‘lower moisture loss percentage’ – surely should be considering soil moisture content? Page 110 use phrase “noticeable difference’ – meaning? How is this different to your “significant difference” of page 108 or “significant percentage increase” of page 111? Evaporation rates? I like conclusion on page 113 – do not agree with winter / summer split still but to be honest this is about all that can be taken from the data. Figure 6-18 – what is a correlation graph? How is carbon loss ‘correlated’ to moisture loss – is this meaningful? So carbon loss independent of soil moisture? Page 116 repeat pages in my copy. Page 118 – explanation worrying, if a lab issue then fix it or redo. Page 119 onwards – what is ‘soil distribution’? Not happy with notion of ‘soil homogeneity’. Why

- “Loss in moisture content” has been amended to state “soil moisture content” throughout the paper.
- As previously stated, in the general comments, the wet vs. dry period refers to the sample frequency for the field work analysis that has been completed.
- Antecedent conditions were recorded on the field work sheet and used as additional site information when drawing conclusions.
- Consistency of terminology throughout the paper has been achieved.
- The correlation graph has been used in this paper as it depicts a positive correlation between combustible organic carbon and soil moisture content; however it is not a strong positive correlation.
- The notation of soil homogeneity has been amended.
- The notation soil distribution has been amended to state soil particle size distribution.

not consider particle size distribution between sites – many fall within the 150 – 450 micron range? Page 125 first mention of D50 etc? A very brief concluding section for grain size (section 6.2.11).

Section 6.3 – have a scale of 1-5 for flooding in table 6-2 and in following paragraph discuss a scale or 1-4 – same? How often was 'flooding' checked – weekly? Soil classification – own work? Section 6.4 – this is where I first saw the sampling time period issue! Please resolve as goes to all other sampling strategies, observations, data collection / analysis, discussion – everything! See on page 141 describe summer as Jan-March. On page 142 have March as summer and November as winter – no!, then page 146 winter is in October.

Page 147 –inverts, mention 'taxa could be collected and stored on site' –surely samples were collected and were they really stored 'on-site' – why? Page 155 onwards – use of phrase 'most prominent'? Great data set for comparison and correlation – get a PCA running here. Linking invert data with climate change – see de Moor South African work. Make too many assumptions regarding inverts with little evidence or cited literature. Careful in table 6-11 use of phrase 'Latin Name' – meaning and have different 'levels' of taxonomic resolution. Page 162 – idea of '..tick muddy sediments' interests me. Table 6-13 – as an appendix.

Land cover – see above comments regarding dates of imagery. Please sort this out as is worrying and maybe incorrectly analysed as a result. Page 174 – cannot find the road to the west of the wetland? Relate all to ground survey as validation. Chapter missing a summary /conclusion.

- The scale of flood in section 6.3 has been provided with a definition, enabling the reader to interpret the scale of flood data.
- As previously stated, in section 6.4, the frequency of sampling refers to the wet and dry period. The sampling period undertaken is as follows: March (wet) - post rainy season, November (dry) – pre rainy season.
- A PCA was not feasible due to time constraints however it is recognised that a PCA would be a useful tool to interpret the data.
- Scientific names were included for aquatic invertebrates on species level.
- The spelling of "tick muddy sediments" was amended to say "thick".
- The section on and cover change has been removed (see general comments).

Chapter Seven – see annotated in text comments. Much will change depending on previous corrections. Page 191 is a good example in this chapter of justification for a sound proof read. Most of chapter reads as results and not a discussion – ask yourself the question is the information new – if so should be in results and not in a discussion chapter. Overall impression is trying to read far too much into two sampling time periods. Page 213 first-time it becomes apparent that the NWCS is the foundation for the classification approach. Please re-read these last few pages of the discussion with my earlier comment regarding why subdivide into wetland / pan into its own unique classification category –

how useful is it? Why not use biological assessment for classification? Page 216 last sentence – cannot state they 'appear stable'

- The paper was amended to reflect chapter 6's changes and was proof read.
- It is noted that the sampling periods would require more frequent sampling to improve the data set.
- The proposed local classification is to be used in conjunction with the Ramsar classification. This paper does not suggest that proposed local classification replaces the Ramsar classification, but rather be used as a local/regional classification to show differences between the individual systems.

Chapter eight – see in-text commentary, many incomplete sentences, will need a strong argument for why a separate classification that subdivides the 'system' into unique wetlands / pans is necessary. Why no scale / score for inverts?

- The annotated copy was used to make amendments where legible.
- The aquatic invertebrates were utilised in the proposed classification to provide the system condition (see section 7.6).
- The proposed local classification is to be used in conjunction with the Ramsar classification. This paper does not suggest that proposed local classification replaces the Ramsar classification, but rather be used as a local/regional classification to show differences between the individual systems.

Chapter nine – references should be placed before appendices and appendices are not chapters. Plate 9-2 label? Do not understand heading to Appendix C? Appendix D – again please check dates of imagery, for example figure 9-6 headed as 11-12-2004, but on screen shot of image has a date of 1/1/2008? Appendix E – relevance?

- References were placed before the appendices.
- Appendices were removed from chapters.
- Appendix E's relevance in the paper is made to extreme flood events and possible study gaps.

Chapter ten – please place reference list after chapter eight. Should be headed 'References'. Are a few inconsistencies of full stops, missing vols, incorrect use of italics or italics missing and replaced by underlining, and possibly one or two missing references – please see annotated copy of thesis.

- The reference list was placed after chapter 8.
- The section "Cited Work" has been renamed "References".
- Annotated copy of the paper was used to amend the references in the reference list.