

Plants, People, and Place: Complex, Mutualistic, and Co-evolving Global Patterns Through Time

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By

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Plants, People, and Place: Complex, Mutualistic and Co-evolving Global Patterns Through Time

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ABSTRACT

My thesis studies and analyses the suite of distinctive plant taxa which persist in small patches of vegetation growing in close association with archaeological habitation sites in the southern Cape, South Africa. The unexpected correlation and overlap between botanical taxa collected at 75 site complexes, and ethnobotanical data collected in collaboration with modern Khoi-San communities in the same area, is explored and interrogated. Although sparse, reports of the same suite of taxa recovered from archaeological excavations in the Cape provinces provides depth of time to the study, linking the past to the present. The three-way correlation of a suite of plants closely associated with humans and habitation sites through time, allows for triangulation of the data in order to validate and cross verify the results using more than one frame of reference. Both the plants and the knowledge about their uses have persisted in spite of historical attrition, and alienation of land and language, suffered by the Khoi-San over the past 300 years.

Drawing on a large body of primary and secondary data, and using an interdisciplinary, abductive and pragmatic mixed methods approach, a pattern can be traced throughout Africa and globally. Regression analysis strongly indicates that the most ubiquitous taxa were selected for a purpose and are not randomly present in association with humans. Botanical, anthropological, and archaeological studies seldom focus on the inter-connectedness of people and plants at the sites they inhabited. Very little research into modern vegetation in close association with the sites has been undertaken, and vegetation mapping has not captured the occurrence of these site-specific small vegetation patches recorded during my surveys.

The topographically, geologically, and vegetatively complex and varied southern Cape, and greater Cape area, is extremely rich in archaeological sites and history. This study suggests that the value of site-specific plant taxa to humans throughout the aeons of pre-agricultural history, persists into the present. Due to tolerance of a broad range of climatic and environmental variables, there is value in the study of these ancient and neglected useful plants in the face of climate change. That this vegetation is so closely associated with archaeological sites of cultural and historic importance confers an urgency to recognising the existence and significance of the distinctive and possibly anthropogenic vegetation surrounding the sites.

KEYWORDS: Botany; Ethnobotany; Archaeobotany; Southern Cape South Africa; Archaeological sites; Thicket vegetation; Indigenous knowledge; Plant taxonomy;

Declaration

I declare that the Dissertation/Thesis entitled, “Plants, People, and Place: Complex, Mutualistic, and Co-evolving Global Patterns Through Time,”, which I hereby submit for the degree, DPhil. at Rhodes University, is my own work. I also declare that this thesis/dissertation has not previously been submitted by me for a degree at this or any other tertiary institution and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

J. van Wijk

Name Surname (signed)

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Preface – Personal statement

“Serendipity” ... the discovery, by chance or sagacity, of valid reasons which were not sought for the observation is anomalous, surprising, either because it seems inconsistent with prevailing theory or with other established facts. In either case, the seeming inconsistency provokes curiosity; it stimulates the investigator to “make sense of the datum,” to fit it into a broader framework of knowledge. .. Robert K. Merton (1968)

The research presented in this thesis is based on many years of collecting and studying vegetation in the close vicinity of archaeological sites, and of ethnobotanical research with local communities, mainly in the southern Cape, South Africa. The realisation that the majority of plant taxa which occur today in the close vicinity of sites, had been, and are still being used by local “coloured” communities, was unexpected and unlooked for. This serendipitous realisation led to a broader and more in-depth study of how and why the two sets of data intersected. The context and scope of my thesis changed and broadened exponentially to encompass not only the southern Cape and South Africa, but the rest of Africa and finally went global. As a result, this thesis ranges far wider and is more complex than I, or my supervisors, ever foresaw.

The data I collected over many years forms the basis of this thesis; it was not collected initially with academic research or a postgraduate degree in mind. As a result, subsequent research was not pre-designed or planned, but undertaken in order to make some sense out of the large amount of data collected, and to make it available to others, I registered for a combined botany and anthropology MSc in 2010, upgraded to PhD in 2014. This meant more years of exploring, hiking, revisiting, and re-collecting at the sites, while the ethnobotanical work was extended to communities further afield in the southern Cape.

Thoroughly exploring the whole southern Cape as a participant in the Protea Atlas Outramps team from 1993 to 2002, and subsequently hunting for archaeological sites with a small group of rock art enthusiasts from 2001 to the present, led to an intimate knowledge of the flora and landscape of the area. Many visits to rock art sites in the area led to an increased interest in the archaeology of these fascinating sites and this area, wider southern Africa and globally. Serendipitous meetings with Renee Rust and Sarah Wurz, led to the opportunity of joining the Klasies River team from 2013 to 2017 during which I collected and identified plant specimens to serve as reference material and a detailed vegetation of the area (see published

paper included as Chapter 9). Renee Rust and I also conducted ethnobotanical research in the area (Van Wijk, Y., Rust, R., in preparation)

The continual tug-of-war between the need for academic objectivity, and the subjective intuitive understanding which I felt was essential to convey the intricate and subtle complexities of the interactions and synergies between people, plant and place will be obvious in this thesis. *“Drawing conclusions from empirical evidence, even if we cannot explain the evidence theoretically, is a perfectly sound and by no means “unscientific” method, although the scientists’ ideal will remain, to discover the laws behind the empirical evidence”.* (Erich Fromm, 1996)

New findings are continually being published which negate or update older ones, and knowing when to stop reading was a problem. The use of the Rhodes University Library to access online papers was a joy, and books I ordered from various online bookshops had to substitute for the lack of a large enough academic library in the southern Cape area where I live. The dearth of fellow researchers with whom to discuss ideas and findings made it a lonely road to travel, however. As Vannevar Bush imagined as early as 1945, I expanded my horizons and *“... found delight in the task of establishing useful trails through the enormous mass of the common record.”* I found that to neglect what is so often dismissively called “grey literature”, severely limits one’s ability to either understand or present a full picture. I have unashamedly incorporated more of these non-academic resources than is perhaps usual in an academic thesis in the sciences. I found that it was necessary to do so, and that a great deal of valuable data and knowledge would have been overlooked if they were not consulted.

Being inescapably an elderly, “privileged white”, 4th generation South African of very mixed Western-European lineage, presented ethical and philosophical dilemmas which became increasingly intense and difficult to negotiate, amongst today’s escalating calls for decolonisation of science and academia as a whole. I did however have the privilege of growing up on a farm in close association with Baralong and Sotho people who were schooled in Afrikaans, and taught me their colourful version of the language. As a result I can converse in, and usually understand, the idioms and subtleties of the local ‘coloured’ (modern Khoi-San) dialect of Afrikaans which is now their home language in the southern Cape. The ability to communicate and write in the vernacular of the participants was a huge advantage. Working during the apartheid and early post-apartheid years with local communities

classified as 'coloured', denoting 'mixed race', brought home the urgent necessity for modern Khoi-San to validate their indigeneity and reclaim pride in their culture as the first Peoples of Africa. As a self-identifying 'European-African,' It has been an enormous challenge to fully adhere to and conform to the mores of the entrenched Western European academic world. I particularly associate with the words of Zoe Todd, in an interview with Aaron Vansintjan (2014), *"The euro-western academy is colonial. It elevates people who talk about Indigenous people above people who speak with Indigenous people as equals, or who ARE Indigenous"* (capitals original).

Motivation for the use of the first-person active voice where necessary

In South Africa, the preferred style in writing scientific academic papers and theses is still to be as objective as possible, and for the author to write him- her-self out of the manuscript by using the third person passive voice. Many academic journals have however changed their advice about the use of active versus passive voice. I am therefore motivating for the use of the active first-person voice in this thesis where this is necessary.

"Nature journals like authors to write in the active voice ('we performed the experiment...') as experience has shown that readers find concepts and results to be conveyed more clearly if written directly." How to write a paper: writing for a Nature journal. .

http://www.nature.com/authors/author_services/how_write.html.

"Use active voice when suitable, particularly when necessary for correct syntax (e.g., 'To address this possibility, we constructed a lZap library ...,' not 'To address this possibility, a lZap library was constructed...')." Some notes on Science style. American Association for the Advancement of Science Web site. .

<http://www.sciencemag.org/about/authors/prep/res/style.dtl>.

"Validity of results remains the same regardless of whether they are reported in the active or passive voice". Langdon-Neuner, E (2008)



Plants, People, and Place: Complex, Mutualistic and Co-evolving Global Patterns Through Time

Yvette van Wijk

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Appendix A

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Table D2 - References numbered for Table D1

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Appendix F

Presentations given at conferences and seminars.

2004 - Imithi Amayeza. Southern Cape Clinics seminar, Conville, George

2008 - Medicinal Plant use Graaff Reinet area. Indigenous Plant Use Forum

2014 - Cryptic Anthropogenic Thicket Patches. Thicket Forum, Grahamstown

2014 - Links to a forgotten and untold past. Rhodes Anthropology Dept. seminar

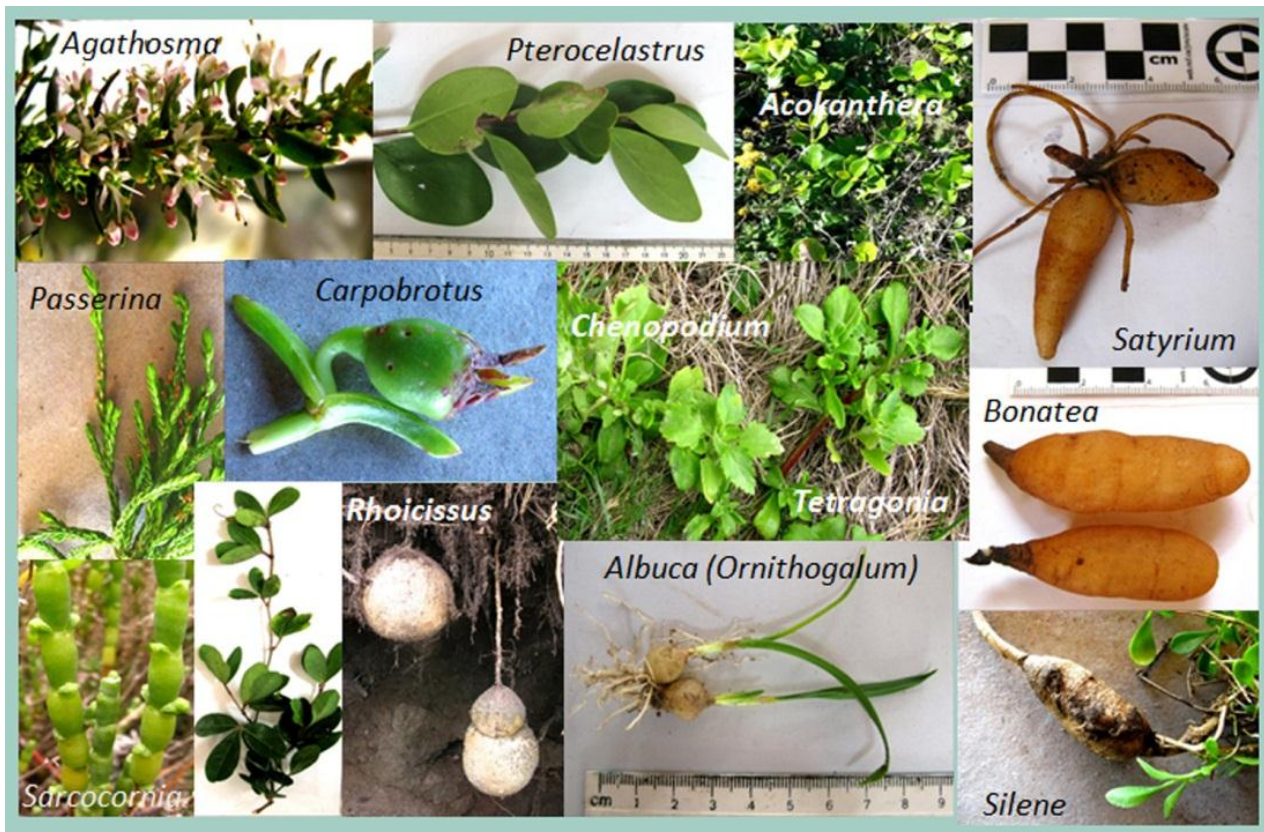
2015 - Caves in the Forest, People were living there. Fynbos Forum, Knysna

2015 - Planting an Idea at Klasies, PAA conference , Wits. Johannesburg

2016 – Relationships, Plants, People, & Place, Fynbos Forum, Port Elizabeth

2017 - Gatherers at Klasies River, ASAPA conference, UP, Pretoria

2017 - Plants, People, and Place, University of Pretoria Botany Dept. seminar



Fruits, roots, and leaves of common plants at the archaeological sites included in this thesis. The two slides above are from the powerpoint presentation - "Planting an Idea at Klasies." The lower slide includes global distribution and close relatives of the plants.

CHAPTER 1

Introduction and background

“Originality often consists in linking up ideas whose connection was not previously suspected, . . . The role of the imagination is to create new meanings and to discover connections that, even if obvious, seem to escape detection,”

-- William Ian Beardmore Beveridge, 1957

1.1 Background

Plants are essential to life on earth, and the awareness of close relationships between plants and humans through time have never been more important to the survival of humanity than they are today. My thesis studies and analyses the suite of distinctive plant taxa which persist in small patches of vegetation, often forming dense ‘green walls,’ growing in close association with archaeological habitation and presence sites in the southern Cape, South Africa. The reason for studying these vegetation patches, was to find out firstly why their composition and structure was so similar throughout, and secondly whether this could be demonstrated by analysing data from a vegetation survey of a wide selection of sites from the coast to the Great Karoo. It has taken me 16 years to document the distinctive vegetation patches at caves, shelters, and overhangs in the southern Cape. Previous and ongoing research conducted over a period of 20 years into the ethnobotany of self-identifying modern Khoi-San descendants in the southern Cape added an intriguing element to the vegetation research. It became clear that the site-vegetation patches were mainly composed of medicinal and useful plants still being used by participants in the ethnobotanical surveys. This realisation led to an attempt to find out whether there could have been a positive selection process for these useful plants on the part of humans inhabiting the sites in the past. The thesis interrogates this unexpected overlap between botanical data collected at the 75 site complexes in the southern Cape, and ethnobotanical data collected in collaboration with modern Khoi-San communities in the same area.

Archaeobotanical data from reports on macro- and micro-botanical remains recovered in the Cape Provinces supplied depth of time to the research, and for comparative purposes I collected site-vegetation at nine archaeological sites in the Eastern Cape, and six in the eastern Free State. Secondary data from the literature provided a wider southern African,

greater African, and Global perspective. As an interdisciplinary project, the following disciplines and fields of study were involved; Botany (taxonomy and ecology); Anthropology (ethnobotany and ethnobiology); and Archaeology (archaeobotany).

The research is original and independent, novel and primary. Vegetation associated with a range of rock art, habitation and presence sites has not previously been studied on this scale. Nor has modern plant use been linked with the presence of a distinct suite of plants associated closely with archaeological sites. Botanical and archaeological studies seldom focus on the inter-connectedness of people and plants at the sites they inhabited. I aim to demonstrate that modern Khoi-San plant knowledge is an integral part of the continuum of mutual and synergistic co-evolution between plants, people, and place.

Reference to past vegetation surveys of South Africa, specifically in the southern Cape, by comparing the biomes and vegetation types proposed by Mucina and Rutherford (2006) and Vlok and Euston-Brown (2002) (see Chap 5.2.1, Table 6, page 79), highlighted the fact that vegetation mapping has not captured the occurrence of these archaeological site-specific small vegetation patches recorded during my surveys. That this vegetation is so closely associated with archaeological sites of great cultural and heritage importance, confers an urgency to recognising the existence and significance of the distinctive and possibly anthropogenic vegetation surrounding the sites. The important taxa are seldom completely absent in the wider landscape, but it is the densification of the taxa in close proximity to the habitation core of each site which is important and measureable here.

Effects other than anthropogenic could have influenced the vegetation at the sites. Different scenarios present interesting and valid alternate hypotheses, and it must be acknowledged that it may have been the discovery of uniquely suitable habitats, micro-climates, and vegetation types that was favoured by humans, that helped to produce the green walls, but not necessarily created or modified by humans alone. The green walls and patches of thicket growing close to the sites could also have been the result over time of animals using and living at the sites and dropping seeds. However, by triangulating the large quantities of data and evidence collected during years of research - from the sites, the ethnobotanical surveys and archaeological finds - the likelihood of these patches being at the least of partly anthropogenic origin, appears empirically plausible, and in line with the use of Occam's Razor (Chase, 2005), than the random chance of natural ecological effects or animal use of

the plants and sites being the dominant cause (see Questions under 1.5 below) These alternative scenarios or hypotheses are discussed more fully in Chap5.3.2, page 85 – 86 and Chap 10.3, page 213.

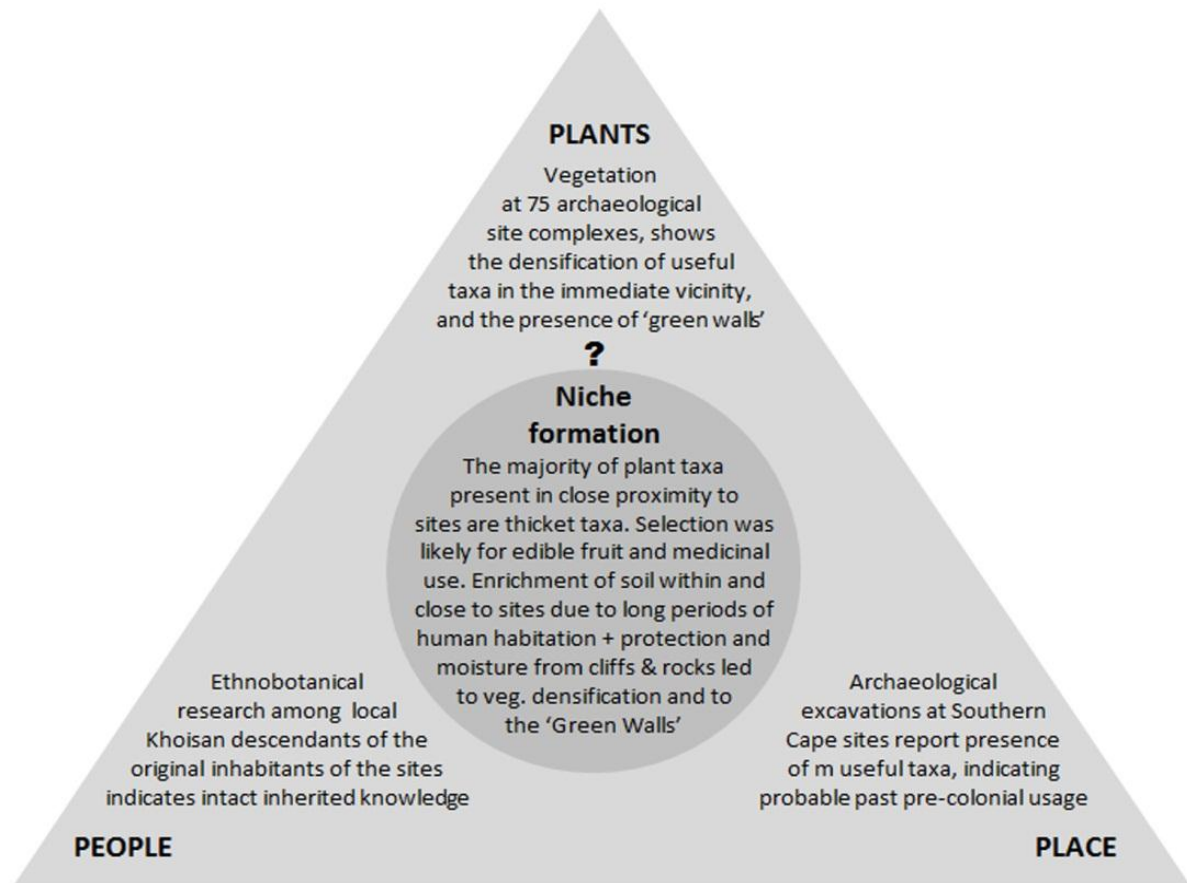


Fig. 1 – Triangulation of data employing three frames of reference

1.2 Overview of the methodological approach

I employ an interdisciplinary, pragmatic, abductive, and empirical approach which is best suited to mixed methods research (R. Johnson, Onwuegbuzie, 2004). Interdisciplinarity plays an increasingly central role in contemporary research but is more often used for collaborative projects, and in the humanities and the social sciences (Mäki, 2016). Both quantitative and qualitative data was collected in order to bring together the strengths of both forms of research to compare, validate, and corroborate results to test the strength of the hypothesis (Newman, Benz, 1998; Creswell, V. Clark, eds 2017). Combining three disciplines, botany and taxonomy, anthropology and ethnobotany, with reference to archaeology and archaeobotany, allowed for triangulation of the data collected in order to validate and cross verify the results using more than one frame of reference (Onwuegbuzie, Leech, 2005).

My research is underpinned by an interdisciplinary, pragmatic and abductive (Feilzer, 2010) grounded theory approach (Wheeldon, & Ahlberg, 2011), which supports the mixed methods research I employ (R. Johnson, & Onwuegbuzie, 2004). Interdisciplinarity plays an increasingly central role in contemporary research, but is most often used for collaborative projects and by the humanities and the social sciences (Mäki, 2016; Esler, Downsborough, Roux, Blignaut, & Milton et al., 2016). As an individual, stand-alone researcher, in the scientific discipline of botany, my journey has not been an easy one. Both quantitative and qualitative data was collected in order to bring together the strengths of both forms of research to compare, validate, and corroborate results (Newman, Benz, 1998; Creswell, & Clark, eds 2017). Combining three disciplines, botany and taxonomy, anthropology and ethnobotany, with reference to archaeology and archaeobotany, allowed for triangulation of the data (see Fig. 1) in order to validate and cross verify the results using more than one frame of reference (Onwuegbuzie, & Leech, 2005).

1.3 Locality of the research

The southern Cape is not a clearly defined political or geographical entity, it cuts across the boundary between Western Cape and Eastern Cape (Fig 2), forming part of a global biodiversity hotspot. Botanically the southern Cape falls mainly within the Cape Core Region (Manning, Goldblatt, 2012), but also includes the Little Karoo, and sections of Nama Karoo and Great Karoo to the north. The area supports a high biodiversity which includes part of the Fynbos Biome, pockets of Renosterveld, elements of the Albany Thicket Biome, and southern Cape afrotemperate forests. Elements of coastal thicket, southern coastal forest, and karroid vegetation also occur (Quick, Meadows, Bateman, Kirsten, Mausbacher, et al., 2016). Mucina and Rutherford (2006) list seven biomes for the area, while Vlok, Euston-Brown, and Wolf (2008), list nine Biomes (Fig 3). The research area stretches from -33.2° to -35.2° (Latitude) and 20.58° to 24.32° (Longitude) covering approximately 43 000 square kilometres. The narrow coastal area is known as 'The Garden Route,' which extends about 300 kilometres along the southern Cape coast from Blombos in the West to Klasies River in the East. The Eastern Langeberge, Outeniqua Mountains, and Tsitsikamma mountains run parallel to the coast. The Little Karoo with its inselbergs, Kamanassie, Gamka and Anysberg lies between the Outeniquas and the Small and Great Swartberg ranges, with the Kouga mountains and Baviaanskloof at the eastern end. The Great Karoo lies north of the Swartberg and Baviaanskloof ranges.

The climate is strongly modulated as the area occupies the transition zone between the globally-significant warm Agulhas Current, the Subtropical Convergence (STC), and the cold Benguela Current (Reason, 2001; Quick, Meadows, et al., 2016). The climate is extremely variable due to the influence of the Cape Fold Mountain ranges lying parallel and close to, the long, rugged coastline. The landward side of the mountain ranges is much drier, hotter in summer and colder in winter. Rainfall is year-round but variable, mainly in spring and autumn, varying from a maximum of 800 ml or more a year at the coast to as low as 150 ml in the Great Karoo. Temperatures vary dramatically, the coast is temperate between 9c to 32c average, but temperatures are more extreme inland in the Little and Great Karoo, and at altitude on the mountains range.

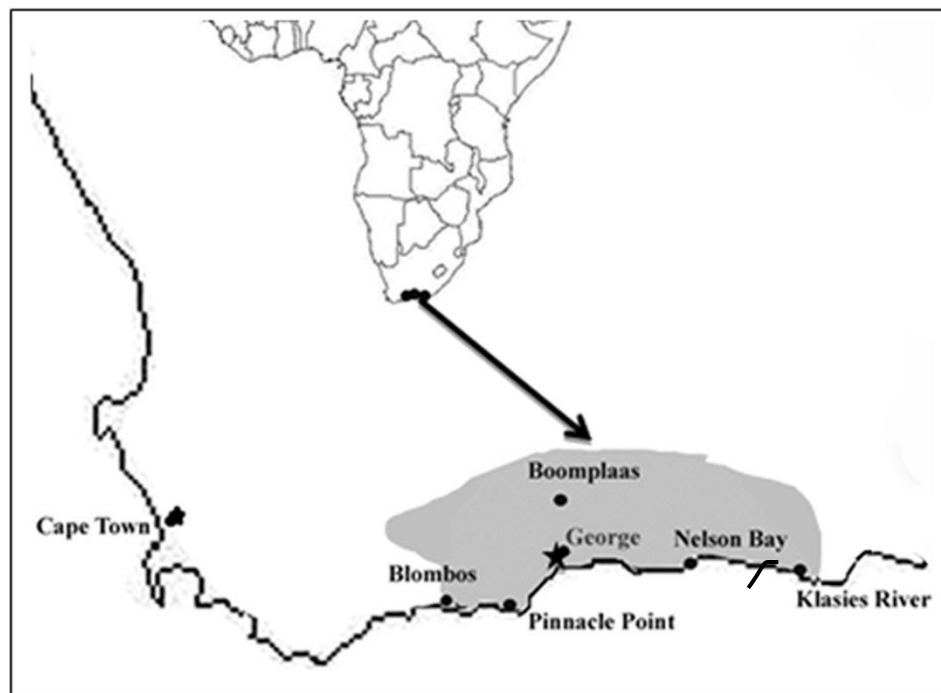
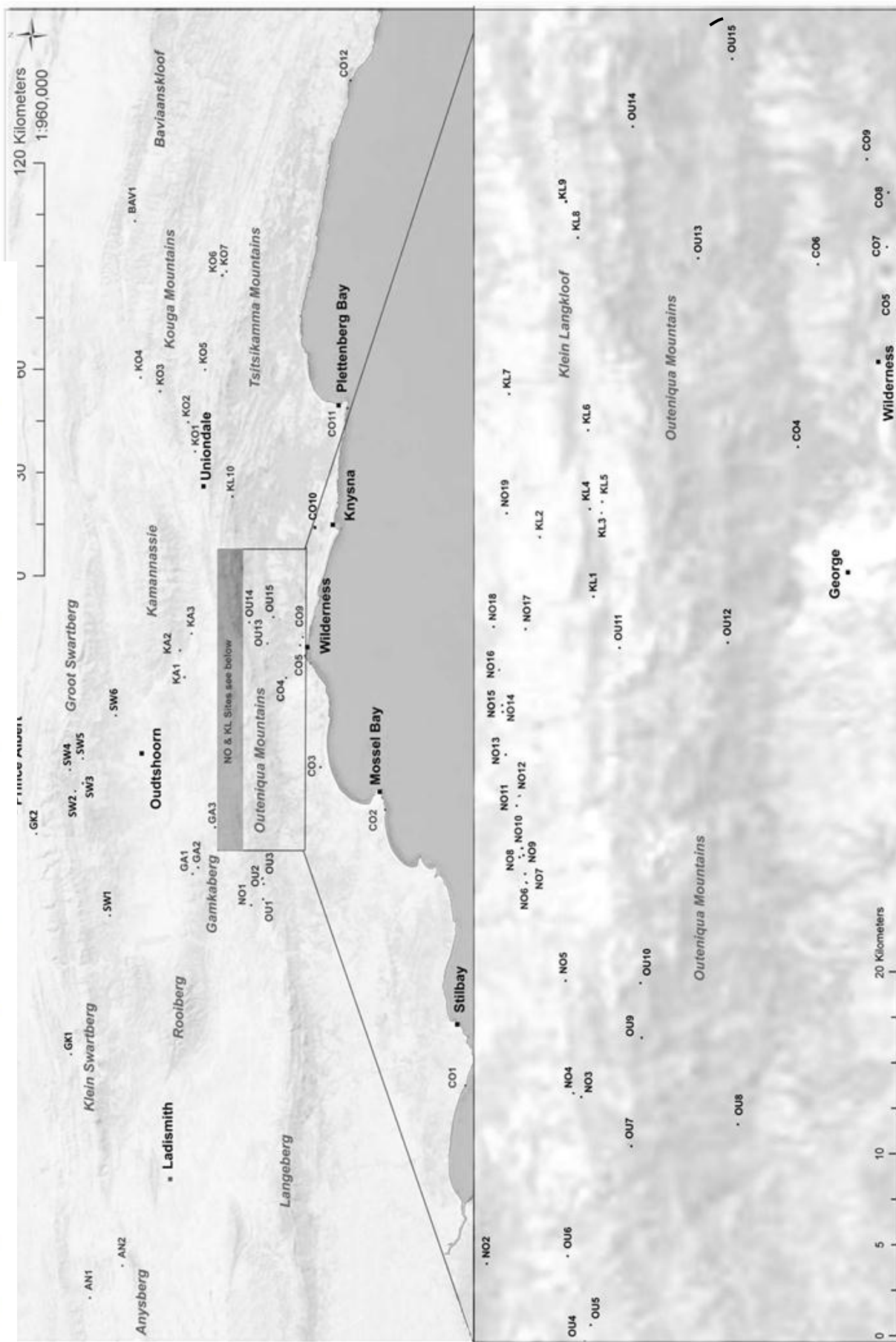


Fig 2 – Location of southern Cape and important archaeological sites

Fig 3 – Map: Localities of the 75 site complexes surveyed of the southern Cape area with major towns and mountain ranges of the region.



1.4 The archaeology of the southern Cape

Ancestors of the San and Khoi were living in the southern Cape for at least one hundred thousand years, but it appears that over the last 10,000 years Later Stone Age people increasingly used the rock shelters in the Cape Fold Mountains (H. Deacon and J. Deacon, 2003). I noticed that the floristic composition of the vegetation growing across the entrance or in the immediate vicinity is very similar at each site. Farmers and conservationists who take an interest in the sites often said: “*find a krantz where Diospyros, Cabbage Tree or Rhus grows thickly and there you will find paintings or artefacts*”.

The topographically, geologically, and vegetatively complex and varied southern Cape area is extremely rich in archaeological sites. Many Early Stone Age Acheulian tool scatters have been reported, dating from a possible one million years ago (Goodwin and van Riet Lowe, 1929), and the typical large handaxes are regularly found throughout the area. There are many Middle Stone Age sites, and hundreds of Late Stone age sites (van Riet Lowe, 1952), the oldest dating back to at least 150 000 ybp. and possibly a few which were still occupied as recently as 200 years ago (H. Deacon and J. Deacon, 2003). The sites I surveyed which are shown on the map (Fig 3, page 6), have not all been examined by professional archaeologists, and only a few have been excavated. Some previously unknown sites were found during my research by searching behind dense vegetation patches up against cliffs. I visited 150 sites altogether and of these 138 had intact associated vegetation patches worth surveying. Some of the sites were very close together and shared the same vegetation patch, so the 138 individual sites were consolidated into 75 site complexes (see Fig 3, page 6).

The southern Cape has made world headlines over the past few decades because of important findings at a string of coastal sites which have provided the earliest evidence to date for modern human cognition at around 120 000 to 160 000 years ago. Evidence has been found at Klasies River (H. Deacon, 1992; Wurz, 2008; D’Errico, Moreno, Rifkin, 2012), at Blombos (Henshilwood, D’errico, et al., 2001; Henshilwood, Marean, et al., 2003), and Pinnacle Point (Marean, Bar-Matthews, et al., 2007; Marean, 2011; Marean, Cawthra, Cowling, & Esler et al., 2014), to much media hype, albeit contentious at times.

Despite the large number of archaeological sites in the area and their importance, very little research into the modern vegetation in close association with the sites has been undertaken. There are exceptions where plant taxa occurring in the vicinity of sites were listed, such as

Moffett and H. Deacon at Boomplaas (1977), at Blombos Richard Cowling's vegetation survey in Henshilwood (1995), and Madelon Tussenius at Klasies River (1984 unpublished), Hilary Deacon took an interest in the wider environment and vegetation of the Cape and wrote (1993), "*The distribution of plants in the landscape has been a major determinant of where archaeological sites occur.*" Results of these earlier surveys, were mainly analysed as pointers to vegetation and climate change, and seldom in connection to use by people. More recently I undertook ethnobotanical research at Klasies River with Renee Rust and Olive Uithaler (van Wijk, Rust, Uithaler, 2017), and conducted an extensive vegetation survey with the aim of providing comparative material to facilitate the identification of macro- and micro-botanicals excavated from the site, and to explore the presence and abundance of plant resources around the sites (see Chap 9, published paper, van Wijk, Tussenius, Rust, Cowling, et al., 2017).

Various macro- and microbotanical studies have taken place at Klasies River (Sievers, Zwane et al., 2016; Bensen, Tussenius, & van Wijk, 2017; Zwane, Bamford, Sievers, & Wurz, 2017; Novello, Bamford, van Wijk, & Wurz, 2017), and others are in process. Ethnobotanical surveys of modern southern Cape Khoi-San communities in the Pinnacle Point area have also been undertaken (de Vynck, B-E. van Wyk, & Cowling, 2016a; de Vynck, Cowling, Potts, & Marean, 2016b; Singels, Potts, Esler, Marean et al., 2015), as well as micro-botanical research (Esteban, Vlok, Kotina, Bamford, Cowling et al., 2017; Albert & Marean, 2012), and palaeoanthropological research (Franklin, Potts, Fisher, Cowling, & Marean, 2015). Although results of the ethnobotanical surveys can seldom be directly linked to the as-yet meagre positively identified micro-botanical results to species level, they, and vegetation surveys, are providing a large amount of comparative material and it is only a matter of time before correlations can be made and more detailed results begin to appear.

1.5 Structure and aims of the Research.

1.5.1 What did I study?

The plant species making up the anomalous, often small and dense, vegetation patches forming 'green walls,' which grow today in close association with archaeological sites in the southern Cape. These vegetation patches appear to display a globally repeating anthropogenically induced pattern. I propose a process by which an ancestrally developed common ability possessed by early humans, and inherited by later generations, enabled them to utilise and manipulate plant resources long before the start of domestication and agriculture

about 10 000 to 12 000 years ago, and even before the earlier dates now being proposed of about 30 000 years ago ([Allaby, Stevens, Lucas, Maeda, & Fuller, 2015](#))

1.5.2 Why did I study this?

To ascertain whether the apparent similarity between the vegetation patches existed, and to link possible presence and past use of the most frequently occurring plants at sites, to their present use by traditional local communities in order to demonstrate the possibility of anthropogenic processes leading to the pattern observed. To uncover the likelihood of links between the past and present, to promote respect for local traditional knowledge. To strengthen evidence for inheritance of knowledge, and help to validate Khoi-San claims to indigeneity. To highlight the potential value of these site-related useful plants during present and future climate change because of their tolerance to a broad range of climate and environmental variables. To show that their possible value to humans throughout the aeons of pre-agricultural history, persists into the present and to acknowledge the validity and depth of time over which indigenous taxonomy has evolved and been passed down in order to encourage the recognition of its importance to modern plant taxonomists as well as to anthropologists, ethnobotanists and archaeobotanists.

1.5.3 How did I study it?

By collecting and identifying specimens of the plants present in the dense vegetation patches in close association with the sites and by conducting ethnobotanical research together with local communities in the southern Cape. By accessing data regarding plants found as macro- and micro-botanicals during excavations at sites in the Cape Provinces, and by triangulation and integration of these three data-sets. In addition by accessing and comparing data from global ethnobotanical and archaeobotanical research in order to extend the scope of the research and begin to display it in a much wider context. At the same time to recognize the validity of traditional science and taxonomy, but acknowledge that today it is imperative to use up-to-date Botanical taxonomy in the Linnaean tradition, in order to identify the plants. Modern taxonomy allows for the ordering of collected data in an understandable and scientifically correct manner for ease of access and allows for further manipulation resulting in understanding and recognition according to western academic norms.

1.6 Thesis structure plan.

Chapters 1 – Introduction; 2 – Literature review; 3 – Methododology; 4 – Results; 10 – Conclusions; are according to conventions used in most theses. 5 – Plants; 6 – People; 7 – Place; present the 3 pronged research and data which has been triangulated to address the aims, questions and the main hypothesis. Chapter 8 and 9 are two stand-alone papers going into greater detail for four sites to highlight important aspects of the sites.

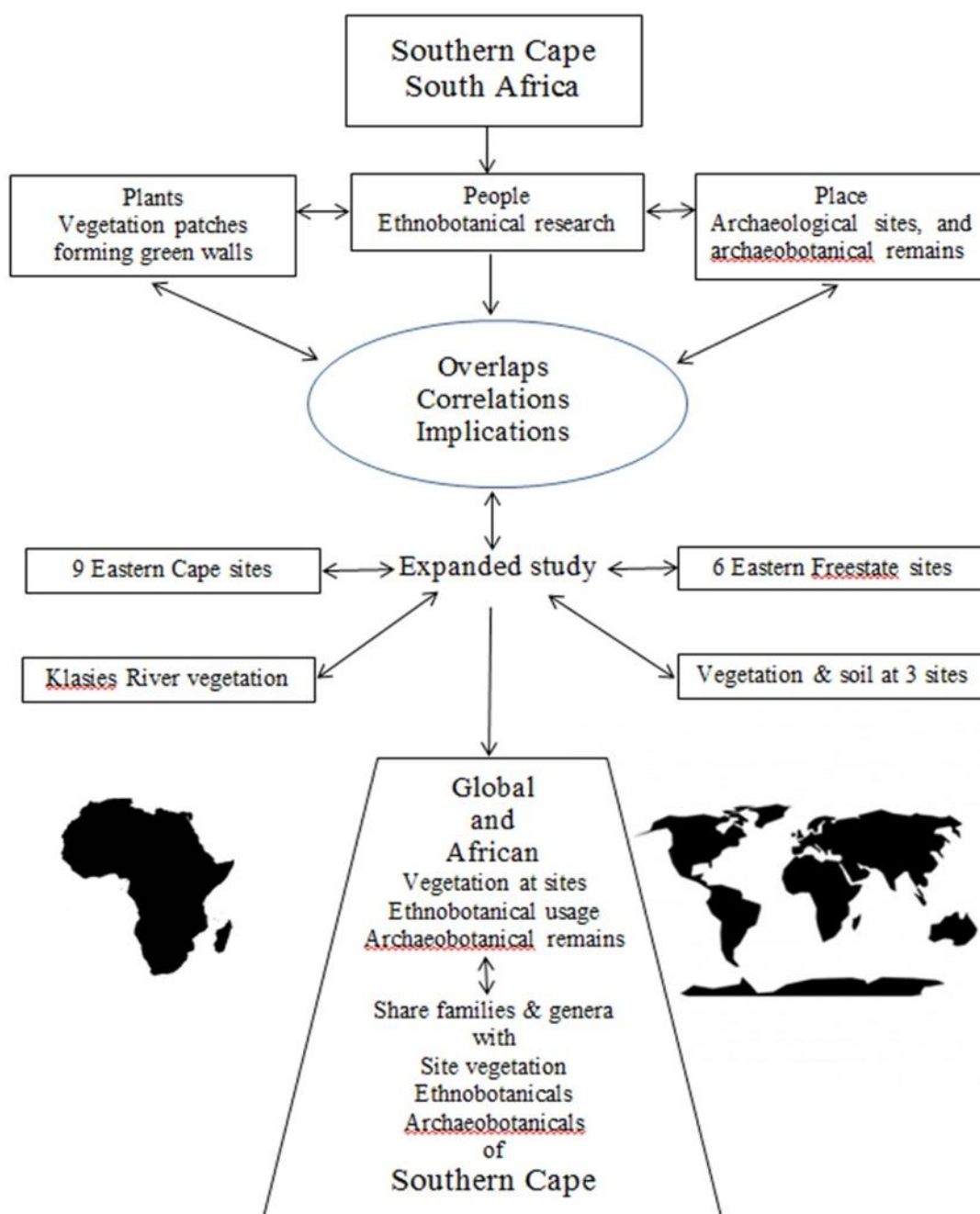


Fig. 4 – Thesis structure plan. The plan is simplified to illustrate the structural skeleton of the wide-ranging and complex research undertaken.

1.7 Questions arising during the course of the research.

These are addressed throughout the thesis and discussed in detail in Chapter 10.3, page 213 – 217.

- a. Could these taxa present today at archaeological sites in the southern Cape be reflecting the fruits and seeds eaten and other plant parts used by gathering-foraging-pastoral peoples who inhabited the sites over thousands of years in the past? Or would other animals, and birds leave a similar legacy?
- b. Could the imprint of human-plant relationships in the past have persisted into the present? Or are these site-specific vegetation patches more likely to be mainly the result of the interplay of abiotic factors and random ecological processes?
- c. Do macro and micro-botanical remains retrieved during excavation of archaeological sites indicate use of those taxa by past inhabitants? Or does their presence in the sediments merely indicate that those taxa that were growing close to the sites in the past were brought in by other animals or birds, or deposited there by natural forces such as wind and water?
- d. Was the southern Cape vegetation similar to today's during the last glacial and after?
- e. Can local ownership of indigenous knowledge and academic freedom co-exist?
- f. It is possible to use indigenous knowledge still possessed by apparently acculturated groups to extrapolate facets of earlier life-ways and retrieve valuable teachings, albeit evolved and adapted through imposed changes in their life-ways?

1.8 Conclusion

The West's concept of "progress" and "civilisation" is not necessarily the only or correct one (Athreya & Ackermann, 2018). There are many versions of culture, and the West does not have a monopoly on that. We are all human beings - *Homo sapiens* - who should and could respect the differing histories and beliefs of all peoples as being of equal worth. Possibilities are examined for decolonising methodologies by advocating for the use of Indigenous principles in research methodology so that research practices can help to assert the legitimacy of indigenous science and acknowledge indigenous people's rights (L. Smith, 2013; Lane, 2017). An outcome to be hoped-for, would be the restoration of pride in inherited knowledge, cultural roots, and sense of place amongst the youth in severely traumatised urban 'coloured' communities, who now represent the majority of the modern Khoi-San of the Cape and southern Africa.

CHAPTER 2

Theories, concepts, ideas, and “ologies” as a literature review

2.1 Introduction

This chapter discusses fields of study or sub-disciplines and theories, philosophies or concepts, which are germane to my thesis, and which come close to embodying the philosophy and interdisciplinarity that I was striving for. To clearly differentiate between fields of study, theories, and concepts, is semantic, and there is much overlap and a plethora of conflicting definitions, which are not all discussed here. I cite and discuss the many writers and researchers who influenced me with regard to their theories, concepts, philosophies, and ideas, all of which proved useful and relevant to my research in one way or another, and which support multi-disciplinary or interdisciplinary thinking and methodology.

To discuss the full spectrum of literature influencing this thesis and cited throughout, would have made this chapter impossibly long and tedious. Situating the thesis within a context accommodating interdisciplinarity and the full breadth of research coverage, required a vast amount of reading. Publications of all kinds, both local and global, in academic journals, as well as grey literature, was necessary (see motivation in preface p.iv). Literature reflecting research in vegetation, ecology, indigenous and Linnaean taxonomy, ethnobotany and ethnobiology, and archaeobotany, is referenced throughout the thesis where applicable, and much is not included in this chapter.

The extensive literature I consulted was necessarily eclectic and wide-ranging in order to uncover a wide range of both early and topical theories and ideas, helpful in integrating the disciplines of botany, anthropology, and archaeology. Much of the writing discussed here inspired and guided my thinking and philosophy, and gave me confidence to continue entertaining theories, ideas, and concepts, which are rarely articulated or addressed in conventional botanical theses. The importance of theory in anthropology is stressed by McGee R.J., & Warms L.R. (2004) but applies equally to botany, data as an end in itself is not enough, theories are necessary to give meaning to the data. With the close connection between plants and humans as the main focus, certain theories, concepts, and ideas, were particularly relevant and useful and all espouse a very similar philosophy, but none

individually, integrated the disciplines and encompasses the full scope of the thesis. The fact that plants are actively and implicitly an inextricable factor in any research into the environment or landscape with a close deep-time relationship to both hominids and humans, has not generally been studied in taxonomic detail nor at a continental or global level.

2.2 Subdisciplines, fields of study, and various ‘ologies

2.2.1 Historical or cultural geography, geoarchaeology, phytoarchaeology,

George P. Marsh published “Man and Nature” in 1865, and “The earth as modified by human action” in 1874 (reprint 1885), in which he was one of the first to acknowledge that pre-historic ancient man had affected his environment. It was Carl Ortwin Sauer’s holistic philosophy and his prolific writing on landscape and cultural ecology in what he called Historical Geography or Cultural Geography that comes closest to articulating my personal philosophy guiding this thesis. Sauer’s insights were wide-ranging, and he linked the distant past to the present, and geography to archaeology, while linking both to past and present human culture. (Sauer, 1925 - reprint 1969, 1941 - reprint 1947, 1956). Sauer’s writing was speculative yet scholarly, and contains many astonishingly prescient insights into our ancestors remote past and their relationship to the environments they occupied and modified (Harris, 2002). Both Marsh and Sauer are notable in that they thought and wrote from a global perspective. Sauer frequently lamented the academic specialisation of the separate disciplines which was steadily increasing during his long life of active research (Sauer, 1941).

As a pioneer of environmental archaeology, Karl Butzer, in a similar vein to Carl Sauer, introduced courses in the 1960’s and 70’s on ‘geoarchaeology’ and also conducted research and wrote extensively on the Pleistocene period in Africa south of the Sahara (Butzer, 1964, 1971). Desmond Clark stated in 1960 - “*It is necessary to know the nature of vegetation and climate . . . the archaeologist must rely on workers in other disciplines, ecologist, palaeobotanist, soil chemist . . .*” sentiments which Butzer echoes but unfortunately does not always implement. In the 1970’s when Butzer (1973) worked in the southern Cape, South Africa, at Robberg, and at Klasies River (Butzer, 1978), both of which are included in my surveys he barely mentioned vegetation. Apart from an unusually accurate but short description of the vegetation at Klasies River site in 1975 Butzer omits mention of the humans who lived there and their relationship with the vegetation. He also studied the coastal area from Knysna to Cape St Francis (Butzer & Helgren, 1972), which includes those two sites, where he stresses that “vegetation” had changed radically throughout the Pleistocene

due to extreme fluctuations between cold and hot periods. Unfortunately, despite Butzer's laments in 1975 about the environmental awareness of anthropologists and archaeologists being two-dimensional, he does not discuss the ecological implications of vegetation and climate changes at these two sites, nor the implications for humans living there ((Butzer & Helgren, 1972; Butzer, 1975).

Coming from a different perspective Robert Brooks and Dieter Johannes (1990) attempted to answer questions very pertinent to my research - How did human populations around the world alter vegetation and soil? How can archaeologists detect and interpret these alterations? (Brooks & Johannes, 1990). Robert R. Brooks (1989) had noticed that vegetation growing at two archaeological sites located thousands of kilometres apart differed dramatically from the vegetation of the surrounding area, and that particular surface vegetation may delineate the scope of prehistoric activities and of trade routes. Brooks and Johannes (1990), investigated the relationship between vegetation and archaeology, and introduced the concept of Phytoarchaeology which linked history and chemistry to archaeology. Although they considered archaeological plant remains (palaeoethnobotany, archaeobotany) during this study, they presented plants at the scale of the landscape, and not the individual genus or species.

2.2.2 Environmental and historical ecology, and historical archaeology

Environmental and historical ecology, together with evolutionary development (EvoDevo), emerged in the 1990's. Historical ecology in particular retained Sauer's interest in human modification of the landscape and pre-modern cultures, and included humans as an integral component of, and in synergy with, ecosystems; it defines history as far older than the written record, encompassing both the Earth history and the social and physical past of our species. In the context of my personal philosophy, historical ecology is an attractive concept in that it is holistic and place-based, allowing for the construction of evidence-validated, open-ended narratives of the evolution and transformation of landscapes, based on records of relationships between people and their environments (Crumley & Marquardt, 1987; Crumley, 1994, 2016; Balée, 1998; Zent, 2007).

Historical ecology also focuses on the anthropogenic transformation of the natural environment through time, ranging from individual species to entire landscapes (Balée, Erickson, 2006) which resonates with the possibility of an anthropogenic process resulting in

the vegetation patches at sites. Crumley and Marquardt (1987) make an important distinction between the ‘environment’ in general which does not inherently include the presence of humans in order to study it, and ‘landscape’ which is defined by relationships between people (humans) and their environments in the past and present. Humans leave a “signature” on the landscape which is studied by archaeologists, geographers, chemists, and anthropologists. In the context of my research what is missing is the botanical study of specific plants and the recognition of the importance of the taxonomic study of specific suites of plants existing within the landscape and useful to the humans both past and present, which is the central focus of this thesis. The distinctive vegetation densifying into green walls at the entrances to sites can be viewed as the signature left by generations of ancestral Khoi-San who inhabited those sites.

2.2.3 Complex adaptive systems – CAS

Historical ecology and Complex Adaptive Systems (CAS) both emerged as a major focus of interdisciplinary research in the social and natural sciences during the 1990’s (Zent, 2007). Complex Adaptive Systems theory arising out of Chaos and Complexity theories, attempts to understand and exemplify the complexities and patterns arising out of relationships between people, plants, and place through time (Levin, 1998, 2002; Holland, 1992). Eldredge’s “Sloshing bucket theory” (2003), and Gould and Eldredge’s “Punctuated equilibria theory” also portray the complexities and anomalies arising from the multitude of variables involved in co-evolution. Folke, Biggs, Norström, Reyers, and Rockström (2016), refer to social-ecological systems as complex adaptive systems and use a social-ecological resilience approach to address and understand their dynamics. Reyes-Garcia, Balbo, Gomez-Baggethun, Gueze, Mesoudi, et al., (2010, 2016), proposed cultural evolutionary theory and conceptualized cultural change as a process of “*descent with modification*”. History and the intertwined nature of social-ecological systems coevolving and dependent on the biophysical environment, further complicate the search for theory and context (Holland, 1992). Most standard theories concentrate on optimal end-points, whereas complex adaptive systems never get to an end, but continue to evolve and exhibit new forms of emergent behaviour. CAS has however largely been high-jacked by modern social, business, and technological systems research over the last decade (Dann & Barclay, 2006).

2.2.4 Ethnobiology or ethnobotany - Connection With Nature (CWN)

Ethnobiology as a potentially truly interdisciplinary process or field of study, has much in common with the concept of Biocultural diversity; they are both more philosophical and sensitive to cultural and ethnic issues than the ethnobotanical approach now perceived by some traditional and indigenous groups as Eurocentric and as collecting information about their use of plants in order to launch economic production back at home in Europe (Ford, 1978, 2012). Ethnobiology as a field of study or sub-discipline, is the study of the biological and cultural knowledge about plants and animals and their interrelationships with various ethnic or traditional and indigenous groups. Ethnobiology is a fairly recent field which developed from earlier work in ethnobotany and was formally defined by Castetter (1944). Ethnobiology encompasses a broader range of approaches which are more in line with this thesis (E. Anderson, 2011; E. Anderson, Pearsall, Hunn, and Turner, eds. 2012). Ethnobiology includes linguistic analyses of folk classifications and the meaning behind nomenclature (Hunn, 2007; Berlin, 2014) and so recognises the important issue of indigenous and traditional taxonomy in the context of my use of the genus as terminal taxon in the analysis of my data, unfortunately in this context it is not explicitly botanical however (see further discussion in Chap 5.6, page 101).

Palaeobotany and archaeobotany are included in this field of study with the use of flotation in reclamation of macro-botanical remains being advocated (E. Anderson, et al., eds 2012). Ethnobiology also addresses the complexity of cultural relations with nature which ethnobotany does not, as well as biological ethics and intellectual property rights (Ford, 2012). E. Anderson (2011) considers that natural products chemistry, genetics, and food plant evolution belong to purely botanical approaches, and as such they are not included in the book "Ethnobiology" (E. Anderson, et al., eds 2012). This is disappointing as ethnopharmaceuticals, chemotaxonomy and the evolution of food plants should fall within the ethnobiological field of study. By distancing ethnobiology from what they consider to be purely botanical studies results in the field only partially fulfilling its potential. Apart from side-lining botany, ethnobiology describes best the field of study into which my research falls, as research based upon Indigenous people's comprehension and participation (Ford R.I., 2012) is an important aim of this thesis.

A recent and still developing field, which logically seems to be part of, or an offshoot, from ethnobiology, is the concept or idea of Connection with Nature (CWS) (Tam, 2013; Zylstra,

[Knight, Esler, & le Grange, 2014](#)) but see criticism from ([Fletcher R., 2017](#)). The CWN field could be criticised, or applauded, as being 'New Age' or even 'Retro-Hippie' with a 'spiritual' or strong sense of 'spirit' connection ([personal opinion](#)). However, motivations for using CWN by Zylstra, Knight et al., ([2014](#)) are attractive to many today, who feel strongly that the human disconnect from nature is at the heart of the perceived environmental crisis, that this separation is caused by physical and psychological factors emerging as a problem of consciousness. Environmental psychologists consider that connection to nature is vital and that it might have a role in mitigating the environmental crisis ([Tam K.P., 2013](#)). One definition of CWN is ". . . *a stable state of consciousness comprising symbiotic cognitive, affective, and experiential dimensions that reflect a realization of the interrelatedness between one's self and the rest of nature. CWN is more than the simple contact or superficial enjoyment of nature: it is an enduring appreciation, empathy, and mindfulness of the intrinsic value and shared essence of all life*" ([Zylstra, 2014](#)).

It is tempting to stress here, that CWN as defined above by Zylstra and Knight, et al., ([2014](#)) describes the kind of conscious 'one-ness' with nature and the environment which is attributed to hunter-gatherers and authentically indigenous peoples, so CWN is a way of "getting back to our palaeological roots" which is popular in so many areas today such as 'Paleo-diets' and "living lightly on the earth" ([de Young, 1990](#)). Zylstra and Knight, et al., ([2014](#)), and Richer and Gearey ([2017](#)), highlight an important caveat in that CWN is biased towards the “Western” culture and philosophies that have historical roots in early European Greco-Roman, Germanic, Judaic and Christian values, and Enlightenment thinking which has today shaped Anglo-European and North American society. Nevertheless, CWN is cross-culturally relevant today as Westernised worldviews are no longer confined to Europe and its former colonies. and it draws much inspiration from non-Western, Indigenous traditions. ([Zylstra, 2014](#)).

2.3 Theories, concepts, philosophies, and ideas

2.3.1 Grounded theory as a pragmatic approach

The research is underpinned by an interdisciplinary, pragmatic and abductive ([Feilzer, 2010](#)) grounded theory approach ([Wheeldon, 2010](#); [Glaser & Strauss, 2017](#)), which supports the mixed methods research I employ ([R. Johnson, Onwuegbuzie, 2004](#)). Grounded theory was initially proposed for qualitative research in the Social Sciences ([Glaser & Strauss, 2017](#)), however, it has intriguing links to the ‘serendipity’ quote by Merton ([1920, re-pub. 2006](#))

used as the quotation to introduce my Preamble to the thesis, “*an unanticipated, anomalous finding which gives rise to a new hypothesis*” is how Merton describes it. Serendipitous findings which changed the way I looked at my research resonate closely with my experience. Grounded theory grows out of the research rather than constrains it, it is also more readily understandable to a wider range of readers (Glaser & Strauss, 2017; Merton, 1968). Yvonne Feilzer (2010) points out that pragmatism applied to mixed methods research allows one to sidestep the contentious issues of truth and reality, and accept, philosophically, that there are singular and multiple realities open to empirical inquiry and oriented towards solving practical problems in the “real world” (Creswell & Clark, 2017; p. 20-28). As a result “*researchers do not have to be the prisoner of a particular [research] method or technique*” (Robson 1993, p. 291).

2.3.2 Biocultural diversity

Carl O Sauer was remarkably prescient in that biocultural diversity studies, which explore the close links between biological diversity richness and cultural diversity, confirmed Sauer’s much earlier insights (P. Jacques & J. Jacques, 2012). It is defined by Luisa Maffi (2007) as “*the diversity of life in all its manifestations: biological, cultural, and linguistic - which are interrelated (and possibly coevolved) within a complex socio-ecological adaptive system*”. Biocultural diversity explores complex adaptative systems (CAS), but is more focussed, and has shown that ecological niches richest in language and ethnicities, correlate and coevolve with areas of highest flora and fauna diversity, indicating a strong link between plants, animals, and indigenous knowledge systems (Posey, 1998a, 1998b; Posey & Overal, eds 1990; Harmon & Maffi, 2002; Maffi, 2005b; Maffi & Woodley, 2012; Cocks, 2006; Barthel, Crumley, & Svedin, 2013). Biological diversity refers to the overall number of individual species regardless of frequency (P. Jacques, J. Jacques, 2012), which supports the method I used during my research when recording plants at sites and plants used by local and traditional communities.

The study of Biocultural Diversity (Posey, 1999; Maffi, 2005b; Maffi & Woodley, 2012) and the concept of culture as multidimensional (Cocks, 2006; Cocks, Wiersum, 2014), illustrate the ability of culture and knowledge (including plant knowledge) to move and surf the waves of change through time and space, informing both cultural history and environmental pattern. Cultural habits, knowledge, memes, and rituals that constantly evolve along with the humans that hold them, are always closely accompanied by the plants that supply all living things

with the essentials of life and existence. Plants, humans, and the environment are not separate areas of study but so closely entwined that they form one (van der Veen, 2014). The study of modern indigenous and traditional groups is no less valid just because they are modern and urban; they remain authentic recipients of their knowledge and culture which evolved through time, “. . . *bio-cultural values and practices are subject to various dynamics in relation to socio-economic change, some lose their importance as a result of modernization, but others endure even in urban conditions.*” (Cocks, Wiersum, 2014). Environmental biodiversity has been shown to mirror cultural and linguistic diversity globally, and both are on the decline (Posey, Overal, eds 1990; Harmon & Maffi, 2002; Maffi, 2005a; Maffi & Woodley, 2012). With the Anthropogenic 6th Great Extinction imminent (Braje & Erlandson, 2013; Hofman, Rick, Fleischer, & Maldonado, 2015), it is imperative that we study and understand the deep inter-relatedness of early humans to their environment through time that actively sustained and built biocultural health before the advent of mono-cultural farming and the industrialised global expansion of technology (Posey, 1999; P. Jacques & J. Jacques, 2012).

2.3.3 Niche construction – evolutionary development (EvoDevo)

Niche Construction aptly describes the process which could have resulted in the presence of dense green walls which are an important feature at the archaeological sites I surveyed. The niche-construction perspective was introduced to evolutionary biology in the 1980s by the evolutionary biologists Richard Lewontin and Odling-Smee (Lewontin, 1982, 1983; Odling-Smee, 1988). During the 1990's it became a subfield of Evolutionary Development biology (EvoDevo), (Laland, Odling-Smee, Feldman, 1996, 2000; Lewontin, 2001; Odling-Smee, Laland, & Feldman, 2003; Laland & Sterelny, 2006; Sterelny, 2007; Laland, Odling-Smee, & Gilbert, 2008; Lehmann, 2008; Boivin, Zeder, Fuller, Crowther, Larson, et al., 2016). Primarily Niche construction and EvoDevo were focused on animal, insect, fungal and bacterial evolution and effects of their niche construction, with surprisingly little attention paid to humans as an integral part of the animal kingdom who themselves both modified, and were affected, by their environment. It also became accepted that every living thing creates a niche for itself and bequeaths the resulting niche to the next generation, and, harking back to Sauer and Brooks, that the effects of human niche creation on the pre-historic environment and its vegetation are still visible (Crites, 1987; Odling-Smee, Laland, & Feldman, 2003; B. Smith, 2011, 2015; Kendal, Tehrani, & Odling-Smee, 2011; Odling-Smee & Turner, 2011). It is now clear that pre-historic, pre-agricultural relationships between people, plants, and place, were not only governed by environmental conditions and ecological changes, but were

potent drivers of processes leading to evolutionary change in their own right (van der Veen, 2014). The 75 sites discussed in this thesis represent niches formed by humans at some time in the past. “.... human beings have moulded environments through their conscious and unconscious activities for millennia – to the extent that it is often impossible to separate nature from culture” (Posey, 1999). Thicket is the dominant vegetation type in the distinctive patches growing today at the sites surveyed. Thicket fits into the “persistence niche” concept of Bond and Midgley (2001) being dense, long-lived, fire resistant, resprouting, and adaptable in a wide range of climatic and topographic conditions (Cowling, Proches, & Vlok, 2005). Thicket then, is an ideal vegetation to enable early human niche construction.

Gary M. Feinman (2015) in “Settlement and Landscape Archaeology” presents the landscape approach as the only way to provide a large-scale perspective for the majority of pre-modern (or pre-colonial) societies, this approach focusses on the definition of distributional relationships between (people), soils, vegetation, and topography. C. Kusimba and S. Kusimba (2009), argue that human societies play key roles in creating and perpetuating ecological processes and that the co-evolution of such systems cannot be ignored. Crawford, writes “...by far the most commonly documented form of human niche construction by small-scale societies, worldwide, (serves) to alter the overall composition of vegetation communities . . . , at the expense of other species of plants of lesser economic value” (2011). And Kirch declares “The accumulated data and interpretations resulting from several decades of research in environmental archaeology . . . have led to a vastly enhanced appreciation of the degree to which human populations have modified their environments, beginning in the late Pleistocene and intensifying throughout the Holocene” (2005).

An approach called Eco-Cultural Niche Modeling (ECNM) was proposed by Banks, d’Errico, Dibble, Krishtalka, West, et al., (2006) in order to establish the importance of environmental factors acting on prehistoric social and cultural systems. The use of ECNM was considered promising in providing an understanding of the geographic spread, migration, and eco-cultural adaptations of prehistoric human populations (Banks, d’Errico, et al., 2006). Pre-modern humans, unlike other animals and insects, are considered to have contributed little to the shaping of ecosystems and evolutionary changes and to have been “outside” nature, much as they are today (Smith, 2016). However, numerous ways in which pre-agricultural and pre-industrial humans have modified and managed ecosystems in a synergistic and sustainable way have been described (B. D. Smith, 2011, 2016). Adaptation to changes in the

environment and climate were far from unidirectional, the co-evolutionary development of plants, people and place, largely through niche construction, has been shown to be a more likely reality (B. D. Smith, 2016; Laland, Odling-Smee. & Gilbert, 2008).

Bruce D. Smith (2011) looked at general patterns of niche construction by small-scale societies, who, as far back as 40 000 years before present were shaping environments to suit their needs. The establishment of vegetation mosaics with extensive interface edge areas represents a very effective strategy to increase diversity of both plant and animal life in the vicinity of home-base niche sites (B. D. Smith, 2011, 2016). Smith identified six general categories of human niche construction, of which two apply directly to my research here – “*general modification of vegetation communities, thereby creating mosaics and edge areas, and resetting successional sequences*” (Turner, Davidson-Hunt, & O’Flaherty, 2003; Smith, 2011) This category resonates with what I discuss in Chapter 6 and 8, regarding the importance of mosaics and edge areas as applied to vegetation types as well as geology and soils “*Encouragement of perennial fruit (and nut) -bearing species creates landscapes patterned with point resources*” (Smith, 2011), which is the pattern I found to be present in the southern Cape.

The likelihood that people and plants co-evolved over deep time in the southern Cape, as elsewhere, while gradually transforming their home-base niches into increasingly suitable habitats for both plants and people, is proposed here. Thousands of years of synergistic co-evolution could result in the unintentional (or partially intentional) densification in useful plants growing near sites, and development of the typically dense, protective and sheltering ‘Green Walls’ at site entrances that I observed. During my research, the glimpse of a dark patch of dense, often almost impenetrable green walls of vegetation visible against cliffs or rocky outcrops, occasionally led to the discovery of previously unrecorded sites, invariably containing signs, however faint, of early human presence or habitation. Humans in the past would no doubt have recognised both this signal and the distinct type of vegetation, and realised that a suitable shelter was likely to be found hidden behind the vegetation.

2.3.4 The Urban Cliff hypothesis – from rock shelters to concrete canyons

As Douglas Larson, Matthes, Kelly, Lundholm, & Gerrath (2004), and Jeremy Lundholm (2011) assert in their work on The Urban Cliff hypothesis, or revolution, so eloquently propose - the urban canyons of brick and cement, concrete and steel, defining our cities and

towns today, have evolved out of the sheltering rocks which housed our ancestors. The Urban Cliff hypothesis has much in common with Niche construction theory but with an emphasis on an inherent need for security and shelter that rocks and cliffs have afforded hominids and humans for hundreds of thousands of years globally (Sauer, 1961; Butzer, 1964). Urban cliffs refer to the concrete canyons of today's large cities where so many modern humans live. This poses some relevant and tantalising ideas regarding the close connections between ancestral humans and the rocks and cliffs that sheltered them (Larson, Matthes, et al., 2004; Lundholm, 2011). Modern research recognises the importance and usefulness of vegetation in the urban concrete canyons of today's mega-cities. Gathering wild plants and fungi in urban areas provides sociocultural and material benefits and helps maintain indigenous and traditional cultural practices, and local ecological knowledge, in South Africa and globally (Poe, McLain, Emery, & Hurley, 2013; S. Cilliers, J. Cilliers, & Seibert, 2013; L. M. Petersen, Charman, Moll, Collins, & Hockings, 2014; Mollee, Pouliot, & McDonald, 2017). Vegetation within the city slows storm water run-off (Armson, Stringer, & Ennos, 2013) and provides habitat for wildlife (Gallo, Fidino, Lehrer, & Magle, 2017).

The archaeological sites I surveyed, sheltered by dense green walls of vegetation, are an example of the topography and geological rock structures which provided homes for the early humans who took shelter and dwelt in them throughout the world. There is a continuum between these natural rock overhangs and shelters which proceeds to the "skerms" or temporary shelters fashioned from flexible thicket species found in the green walls, which protect from sun and the wind and were probably used at the same time as the rock shelters, to the improved "skerms" developed into early "huts" made from saplings fashioned into domed roofs and thatched with grass and leaves, then on to low stone walling to strengthen the base of those huts, and stone corbelled houses or "rondavels" so reminiscent of the original caves, culminating today in our concrete urban jungles (Larson, Matthes, et al. 2004). Wherever humans live they knowingly or unwittingly disperse their useful plants by creating a micro-habitat for taxa which thrive in human mediated conditions. These commensal or anthropogenic plants deliver valuable ecological resources to both humans and the environment as a whole, whether this is recognised or not. It should be possible to quantify and confirm the usefulness of what I call "green walls" at archaeological sites. Larson and Matthes, et al., (2004) trace an ancestral hard-wired human need for the protection afforded by cliffs harbouring rock-shelters and the vegetation that grows in association with them. The Great Chinese Green Wall (X. Wang, Zhang, Hasi, & Dong, 2010; Tan & Li,

2015), and the African Sahelian Green Wall (Ndiaye, 2016; Sacande & Berrahmouni, 2016), both in construction at present, are examples of how powerful the presence of relatively narrow bands of dense vegetation can be in changing the climate and ecology of an area, big or small.

Recent researchers in Europe, China and the Middle East looking into the benefits of ‘Green Vertical Systems’, have measured and quantified the benefits in temperature amelioration, wind protection, regulation of humidity levels, and control of dust and airborne pollution (Köhler, 2008; Pérez, Rincon, Vila, Gonzalez, & Cabeza, 2011). The modern urban environment of concrete and paving is typically lacking the ancient vegetation element, which leads to the disconnect between modern humans and the natural environment and the degradation and loss of biodiversity seen today (Larson, Matthes, et al. 2004). Rural villages, small towns and big cities, often shelter a surprisingly varied and rich anthropogenic flora in cracks and corners, vacant lots, and neglected gardens (Lundholm, 2011), which a few knowledgeable people still make use of, and modern foragers discovering anew. Modern attempts to re-create vertical vegetation walls and green roofs are a step in the right direction (Lundholm, 2006), but would probably be more successful, and incidentally useful, if ancient taxa associated with rock shelters and caves in the local region were sourced and used.

Jeremy Lundholm and A. Marlin make the point (2006) that “*Urban vegetation is commonly described as dominated by weedy species that are adapted to human disturbance.*” and “. . . built form appears to replicate the habitat templates required by rock outcrop species.” (Holm, Pancho, Herberger, & Plucknett, 1979; Randall, 2017a; 2017b) and see discussion in Chapter 5.3.2, about the high percentage of weeds both at sites and used ethnobotanically today). The Urban Cliff hypothesis focus on cliffs and their vegetation has seldom been addressed by other research. Because of the link between archaeological sites and cliffs, the concept of cliffs harbouring distinctive ancient or relict vegetation which is surprisingly homogenous globally, give support to my hypothesis (Larson, Matthes, & Kelly, 2005). The fact that cliffs and steep slopes are so seldom quantified as spatial areas because they are viewed as thin close contour lines on maps, and cannot be measured for area like horizontal surfaces - resonates with my thesis and the paucity of research into cliffs as habitats for both distinctive vegetation and humans who have relied, and still rely, on those plants. The niche-construction perspective was introduced to evolutionary biology in the 1980s (Lewontin, 1982, 1983; Odling-Smee, 1988) and has recently gathered momentum (Laland, Odling-

Smee, & Feldman, 2000, 2003; Sterelny, 2007; Donohue, Dorn, Griffith, Kim, Aguilera, et al., 2005; Lehmann, 2008).

2.3.5 The concept of deep time and plant-primate-human co-evolution

Botanical research into plant and people synergies and mutualism before 10 000 years ago is rare, anthropological and ethnobotanical research deals largely with the last 3 centuries since colonialism began, while archaeobotanical research into hominin use of plants, is mostly restricted to the Pleistocene and beginning of modern human cognition, or the Holocene which concentrates on the relatively short period since the dawn of agriculture 10 000 to 12 000 years ago. It is salutary and important to note the extreme depth of time - 5 million years of hunter-gathering - which preceded the 10,000 to 12,000 years since the start of agriculture. This extended “pre-literate” period is still commonly referred to as “pre-history” compared with what is considered as “history” starting at about 5000 years since the earliest writing. There is a mere 300 years since industrialisation, and only 200 years since the start of what has become the global money-based economy of capitalism and consumerism. Modern-day blindness to the vast period of time dismissed as “Primitive pre-history”, as opposed to what is widely accepted as “the History of civilisation”, is rightfully termed “The Great Forgetting” by Daniel Quin (2010).

Grasping the concept of “deep time” is essential to contextualise the beginnings of hominid-plant-environmental interactions. James Hall is reputed to have said in 1788 that “*the mind seems to grow giddy by looking into the abyss of time*” (reported in Playfair, 1805). Depth of time has been shown to be difficult for the vast majority of modern humans to grasp. J. McPhee who coined the term “deep time” wrote, “*Numbers do not seem to work well with regard to deep time. Any number above a couple of thousand years—fifty thousand, fifty million—will with nearly equal effect awe the imagination to the point of paralysis.*” (1982). 100 years back accounts for 4 or 5 generations of people and takes us back to great- or great-great-grandparents which is about as far as most people are comfortable with. 500 years goes back 25 to 30 generations (as far back as most serious family trees go). 1000 years cover 50 to 60 generations. Creationists believe that the earth was created at noon on the 23rd of October and was calculated at 6004 years ago by Archbishop Usher of Armagh in the 1700’s (Renfrew & Bahn, eds 2013) from a calculation of the number of generations listed in the Biblical Book of Genesis. To evolutionists 200 000 years goes back to our modern human “Ancestral Eve” (calculated from DNA markers), which accounts for one million or more

generations. Janette and Hilary Deacon write, *“The reason why much of Stone Age history has remained a secret for so long is not that it may not be told or that it has not been told in other books, but rather that it has to be individually discovered. Because we are remote from the past, we have to find it and immerse ourselves in it, if we wish to understand it and unlock its secrets. Pursuing the past is rewarding, and we hope it is a challenge more will follow”* (2003 p.8).

The five Million years during which our ancestors survived as hunter-gatherers is a mind-boggling amount of time. During that time a multitude of spiritual, animist, pantheist, multitheistic, and individualistic beliefs arose, which were only displaced (although not entirely replaced), during the past 2000 years by the rise of monotheist or single deity hierarchical religions, Judaism, Christianity, and Islam. These monotheistic religions elevated humans above all other lifeforms, into beings made in God’s image, and therefore having dominion over all living things of the earth. “Civilised” humans were considered the perfect end product, and everything else was there for their benefit. Perhaps because of this “human exceptionalism perspective” (Miller. Scott, & Okamoto, 2012), humans are seen as separate from the natural world. The result being that the study of “pre-agricultural” co-evolutionary relationships between humans-as-primates, plants as vital to human life and the ecosystem, and the landscape environment are few and far between. Although, there is much widely accepted research into close evolutionary relationships between plants, insects, larger animals including primates, and the environment. Humans are seldom credited with impacting on plant evolution, speciation, or dispersal and migration until after the introduction of agriculture and industrialisation (a personal observation). Late Pleistocene and Holocene, early to post-domestication researchers such as Hendry, Gotanda, and Svensson (2017) and many others, writing about “Human influences on evolution” present compelling scenarios and examples as evidence for human-plant evolution, but restrict their research to the recent past, and not deep-time scenarios for human-plant-environment co-evolution.

Through photosynthesis plants produce and maintain the oxygen content of the Earth's atmosphere, and supply all the organic compounds and most of the energy necessary for life on Earth. Because of the oxygen they produced and nutrition they provided, plants made it possible for all other life to evolve and exist on earth. From an evolutionary point of view, primate-plant interactions go back to the Palaeocene – Eocene contact (56 – 61 million years ago) when the early plant-eating Primates were emerging alongside the Angiosperms (ie.

flowering plants) (T. Smith, Rose, & Gingerich, 2006; Gomez & Verdu, 2012; Wayman, 2012; Guevara, Veilleux, Saltonstall, Caccone, Mundy, et al., 2016. Allaby, Kistler, Gutaker, Ware, Kitchen, et al., 2015). In 2012 Sussman, Rasmussen, and Raven, proposed the “Primate-angiosperm co-evolution theory”, (and see Chapman, 1995; Wayman, 2012; Gomez & Verdu, 2012; W. Wang, Li Lin, 2016). Not only primates, but hominids and modern humans, all obtained energy from fruiting plants, and all dispersed the plant seeds they had eaten (Forget, Jordano, Lambert, Böhning-Gaese, Traveset, et al., 2011). Peters, O’Brien, Boaz, Conroy, Godfrey, et al., (1981) report that of six genera contributing staple food items to the three primates studied, modern hunter-gatherers, chimpanzees, and baboons; Acacia (pods), Diospyros (fruits), and Ficus (fruits), all commonly found at sites today, are the first genera to be recognized as belonging to the early-hominid fundamental plant-food niche (see also Huffman, 1997) (Chap 5.3.4, Table 9, page 89).

The first clear signs of hominin-plant interaction are found in the paleontological record between two and three million years ago, (Allaby, Kistler, et al., 2015; Villmoare, Kimbel, Seyoum C, Campisano, DiMaggio, et al., 2015), concurrent with the appearance of the Oldowan and Acheulian stone tool industries. At roughly the same time early hominins evolved enhanced capacities to cooperate and to manipulate their physical environment, driven by co-evolutionary feedback (Sauer, 1947; Wrangham, 2001; Sterelny, 2012). The presence of the earliest *Homo sapiens* fossil finds at Klasies River, and artefacts displaying modern human cognition dating back to 160 000 years ago in sites along the southern Cape coast of South Africa - is where I pick up the thread in this thesis. For thousands of years after the first signs of modern cognition appeared changes involving gathering-foraging people, plants, and the environment, were a largely mutualistic and evolutionarily sustainable processes supportive of biodiversity (Posey, 1999; Maffi, 2005a, 2005b; Balée & Erickson, 2006). The theory which held sway among the majority of early archaeologists and geographers was that millions of years of hunter-gathering had a minimal impact on the environment. However, anthropogenic effects are likely to have impacted local, continental, and global vegetation patterns and landscapes, well before the start of sedentary agriculture 10 000 to 12 000 years before present (ybp) (Sauer, 1947; Dimbleby, 1967; Brooks & Johannes, 1990; Chapman, 1995; Kirch, 2005; Hayashida, 2005). It is likely that hominid and human dispersal of useful plants could make it possible to trace pre-historic migration and trading routes through the presence of these plants (Sauer, 1947). The prevailing view of anthropogenic change as being destructive refers largely to post agricultural historic times,

followed by the industrial and technological ravages of humanities unrestricted use of the earth's non-sustainable resources in the past 100 years (Armelagos & Cohen, eds 1984; McMichael, Powles, Butler, & Uauy, 2007; Diamond, 2010; P. Jaques, J Jaques, 2012; Braje & Erlandson, 2014).

2.3.6 Ecological intelligence – foraging leading to modern human cognition

The role of gathering and foraging in the development of modern cognition, and in the formation of human language has recently emerged as a field of research. 'Ecological and foraging cognition' was essential to enable exploitation of food resources, and to develop spatial memory, and decision making, (Milton, 1981; Rosati, 2017). The social intelligence hypothesis, has long been considered as the major force shaping intelligent behaviour, but ecological intelligence would have been necessary to enable basic survival. The ecological intelligence hypothesis or 'foraging cognition', focuses on the complexities of finding food, and attendant responses to the natural environment (Rosati, 2017). Whether the need to communicate information about the locality of food resources and what they consisted of and were 'named', led to the evolution of language, or the ability to use language enabled spatial recognition and memory, and so enabled the location of food resources - is impossible to know for sure. That language and foraging are closely linked is clear, and the need for naming of the plant foods is especially interesting in the light of the indigenous taxonomy debate (Rosati, 2017; Bar-Yosef, 2017; but see also R. Klein, 2017). The human mind appears to encode the location of gatherable foods into spatial memory, and the capacity to remember was inherited and facilitated efficient gathering of plant foods (Krasnow, Truxaw, Gaulin, New, Ozono, et al., 2011; Nairne & Pandeirada, 2008). Interestingly the retention of gathering knowledge and skill which is relevant to survival appears more active in women, but can be acquired in men (Nairne & Pandeirada, 2008).

There was some consensus that anatomically modern humans made their appearance about 200 000 ybp. (Gronau, Hubisz, Gulko, Danko, & Seipel, 2011; D'Errico, Banks, Warren, Sgubin, van Niekerk, et al., 2017). However, the latest news is of 300 000 year old modern Homo sapiens fossils and artefacts found in Morocco (Hublin, Ben-Ncer, Bailey, Freidline, Neubauer, et al., 2017; Gunz, 2017) and DNA analysis on a pre-Khoekhoen 2000 year old human bones in Ballito, South Africa has pushed this back to 350 000 years old (Schlebusch, Malmström, Günther, Sjödin, Coutinho, et al., 2017), and the possible split between the San-Bushman and earlier hominid. Some behaviours considered as "modern" were present in

Africa earlier, modern human cultural traits emerged at different times in different parts of the world (d'Errico, Banks, et al. 2017), and among different hominins.

Just exactly where and when modern human cognition first manifested, remains a hotly contested subject in which three of the southern Cape sites, Klasies River, Blombos, and Pinnacle Point, have an important part to play (H. Deacon & Wurz, 2001; Henshilwood, Marean, Chase, Davidson, Gamble, et al., 2003; Marean, 2011; Wurz, 2008). Hilary Deacon (1998) proposed that there was increasing emphasis on the use of caves, rock-shelters and associated talus slopes, with a wider-ranging exploitation of resources across different environmental zones towards the end of the Middle Stone Age and during the Late Stone Age. He felt that the way in which people interacted with their surrounding landscape was central to their behavioural system and access to plant food resources (H. Deacon, 1998; Hallinan & Parkington, 2017), in a process where people were “mapping” themselves onto the landscape (H. Deacon, 1992a, 1992b). Behavioural traits required for successfully plant foraging and gathering, signal modern human cognition evolving through time (Shea, 2009, 2012; Shea, Adler, Barham, Conard, Eren, et al., 2010; Sterelny, 2012; Whiten & Erdal, 2012; Lewis & Laland, 2012). The acquisition of these traits, lead to what Maclean (2016) calls “Unique Human Cognition”. These traits are used to indicate the possession of cognition, and probably appeared over a long period of time (Heyes, 2012). Because most are vital skills enabling successful plant food collection to sustain life, they would necessarily have evolved along with gatherer-hunter hominins through time. Chemical properties of plants eaten and the physical act of foraging, finding, recognising and gathering, may have played a role in the development of modern cognition (Sussman, Rasmussen, & Raven, 2012).

Behavioural traits link gathering or foraging with development of modern human cognition

- Selection - Gaze following - Imitation - Copying = Spatial memory + Causal reasoning
- Dexterity – Tool use – Cutting – Digging – Picking = Food processing
- Transmission - Gesture - Vocalisation = Language
- Altruism - Food and tool sharing – Carrying – Storage –Bartering = Co-operation
- Experience – Cultural inheritance – Environmental awareness = Empirical knowledge
- Cumulative change - Adaptation – Invention - Modification = Unique human cognition

2.4 Conclusion - Expanded triangulation for frames of reference.

Illustrating concepts, theories, philosophies, and ideas employed, allowing for an integrated presentation and analysis of data from three disciplines. Painting a complex picture of plants, people and place co-evolving over time. See sections in Chap. 2 above for details of the terms highlighted in Fig. 4 below. See Chap. 4, Table 2, page 60, for list of taxa falling into a, present at sites, b. used ethnobotanically today, c. retrieved during archaeological research.

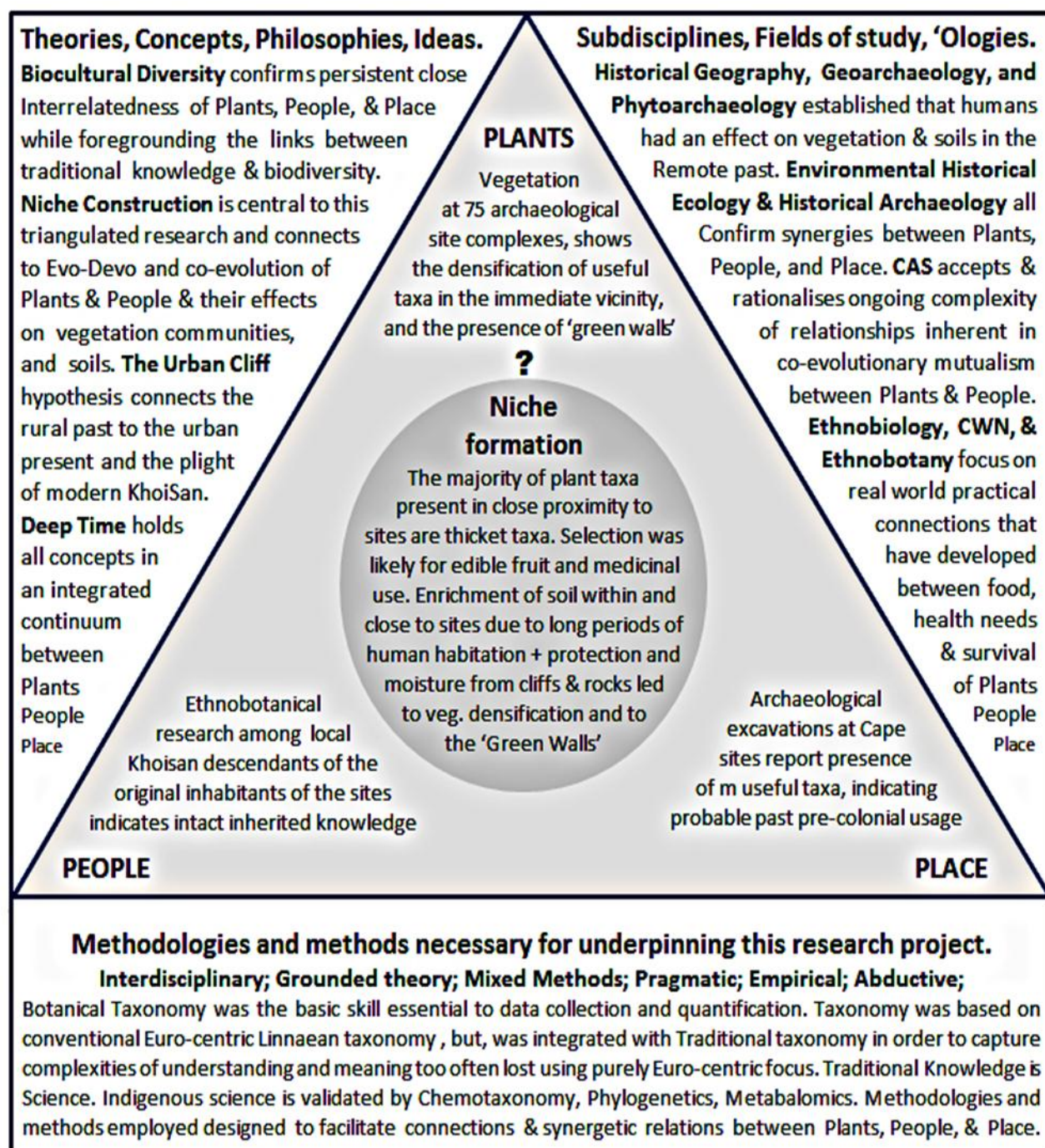


Fig. 5 – Expanded triangulation integrating data and theoretical concepts.

2.5 Key databases used

- Angiosperm Phylogeny Group (A.P.G.IV), 2016. Phylogeny Website. Ver. 12, <http://www.mobot.org/MOBOT/research/APweb/> - St Louis, MO: Missouri Botanical Garden, University of Missouri. Stevens, P.F., 2001 - 2016.
- BOLD SYSTEMS. <http://www.boldsystems.org/index.php/Taxbrowser>
- Catalogue of Life, 2013 Annual Checklist. DVD; Species 2000: Reading, UK. <http://centaur.reading.ac.uk/34322/>
- Global compendium of weeds. <http://www.hear.org/gcw/>
- IAPT International Association for Plant Taxonomy, <https://www.iaptglobal.org/>
- Interactive name resolution service. <http://tnrs.iplantcollaborative.org/TNRSapp.html>
- IPNI The International Plant Names Index (2012). <http://www.ipni.org>
- ISE Code of Ethics, 2011, <http://www.ethnobiology.net/what-we-do/core-programs/ise-ethics-program/code-of-ethics/code-in-english/>
- JSTOR Global Plants. <https://plants.jstor.org/> (was ALUKA)
- Medicinal Plant Names Services (MPNS) <http://mpns.kew.org/mpns-portal/>
- **PRELUDE Medicinal Plants Database**
<http://www.africamuseum.be/collections/external/prelude>
- PROTA (Plant Resources of Tropical Africa). <https://www.prota4u.org/database/>
- POSA South African National Biodiversity Institute, Online website. (Replacing SIBIS) <http://newposa.sanbi.org/>
- Royal Botanic Gardens, Kew (1999). Survey of Economic Plants for Arid and Semi-Arid Lands (SEPASAL) database. <http://apps.kew.org/sepasalweb/sepaweb>
- SAHRA South African Heritage Resource Agency, <http://www.sahra.org.za/sahris/about/sahris>
- SANBI NATIONAL species checklist - South African National Biodiversity Institute. Botanical Database of Southern Africa (BODATSA).
- SIBIS <http://biodiversityadvisor.sanbi.org/online-biodiversity-data/sabif-3/sibis/> (Old) <http://newposa.sanbi.org/sanbi/Explore>
- The Plant List. <http://www.theplantlist.org/>
- TROPICOS of Missouri Botanical Garden. <http://www.tropicos.org/Name/12802837>

CHAPTER 3

Research Methodology and Methods

“Methodology is a branch of knowledge that deals with the general principles or axioms of the generation of new knowledge. It refers to the rationale and the philosophical assumptions that underlie any natural, social or human science study” – S. L. McGregor & J. A. Murnane, 2010 (p. 2). and “If you concentrated on statistics you are likely to miss the most important things, because very often it is the small things that don’t total up.” -- Carl Ortwin Sauer, 1976

3.1 Introduction to methodology

Using an interdisciplinary approach and combining the three major disciplines – Botany and taxonomy for Plants, Anthropology and ethnobotany for People and archaeology and ecology for Place, allowed for triangulation of the data collected in order to validate and cross verify the information and results using more than one frame of reference (Guion, Diehl, & McDonald, 2011). Interdisciplinarity requires being open to alternative methods of enquiry, using different disciplinary tools, and carefully estimating the degree of usefulness of one tool versus another to shed light on the problem (Nikitina, 2005, pp. 413-414). A pragmatic and abductive (Feilzer, 2010), grounded theory (Wheeldon, 2010) approach emerged as the methodology best suited to integrating the separate disciplines involved, and to productively research and present the complexity of relationships between people, plants and place through time. Importantly in the context of this thesis, a pragmatic abductive approach allows for empiricism and supports the validity of lived experience (Wheeldon, & Ahlberg, 2011). Qualitative and quantitative methods are employed where relevant in a triangulated mixed methods design (Onwuegbuzie, & Leech, 2005; Wheeldon, 2010; Wheeldon, & Ahlberg, 2011), in which 3 main sets of different but complementary data was collected falling under 3 disciplines. Collecting both quantitative and qualitative data brings together the strengths of both forms of research to compare, validate, and corroborate results to test the strength of the hypothesis. (Creswell, 2007; Molina-Azorín, & López-Gamero, 2016).

Combining qualitative and quantitative data from three disciplines, botany and taxonomy, anthropology and ethnobotany, and archaeology and archaeobotany, allowed for triangulation of the data collected in order to validate and cross verify the information and results using

more than one frame of reference (Onwuegbuzie, & Leech, 2005). Discussing the use of both qualitative and quantitative research methodology which is also interactive, Isadore Newman and Carolyn Ridenour Benz (1998) consider “... *that the modern-day scientific method is both inductive and deductive, objective and subjective. Design validity is more likely to be built into studies when the researcher is open to both paradigms.*” A deep Time-scale across thousands of years of interaction between people, plants, and place, and embracing a broad geographical and climatic spread, with a wide variety in landforms and ecosystems, made it impossible to examine the data using a single methodology or analyse the data with a single method.

The core of the research was the similarity between distinctive vegetation patches in the immediate vicinity of archaeological sites in the southern Cape, South Africa (Chap. 1, Fig 3 page 6), which appeared to transgress accepted ecological limits. Personal vegetation data was augmented by additional data from a wide variety of publications. For comparative purposes, I collected plant specimens at 9 sites around Grahamstown in the Eastern Cape, and 6 near the Lesotho border in the eastern Free State. Ethnobotanical research was initially in the Knysna George area of the southern Cape (see IMITHI Amayeza Chapter 6.2, page 117 and powerpoint presentation in Appendix F) but the research was later extended to communities and individuals further afield, but within the southern Cape as defined here. The primary data was augmented by secondary data from the literature. As a result of my ethnobotanical work I was familiar with most of the plants that I found growing in close association with the sites I surveyed and was able to personally identify the great majority of them..

To add depth of time to the ecological and ethnobotanical data, I searched the literature for reports of macro- and micro-botanical remains recovered from archaeological sites. Because there are few sites with comprehensive enough reports of archaeobotanical remains from southern Cape sites, I included sites from all the Cape Provinces. Most archaeobotanical research was conducted in order to extrapolate climate and vegetation patterns through time, but was not related to the daily lives and survival of the people inhabiting the sites. Intriguingly, plants from the same suite of useful taxa growing at sites today were repeatedly recovered during excavations, sometimes from layers dating back to at least 5000 thousand years ago or more (Wells, 1965; H. Deacon, 1970; Tussenius, 1989; Binneman, 1997,1998, 2000; Parkington, Cartwright, Cowling, Baxter, Meadows, et al., 2000; Cartwright, 2013; and

see Chap. 4, Table 1, page 54, with further references). Unfortunately, archaeobotanical research in South Africa is still fairly limited, but the reports available for reliably identified and dated macro and micro-botanical remains found at sites in the Cape afford valuable insights into the millennia of human-plant interactions.

3.1.1 Interdisciplinary research

Using an interdisciplinary approach in combining the three disciplines – Botany and taxonomy for Plants, Anthropology and ethnobotany for People and archaeology and ecology for Place, allowed for triangulation of the data in order to validate and cross verify the information and results using more than one frame of reference (Fuchsman, & Henry, 2009; Guion, Diehl, & McDonald, 2011). Interdisciplinarity requires being open to alternative methods of enquiry, using different disciplinary tools, and carefully estimating the degree of usefulness of one tool versus another to shed light on the problem. (Nikitina, 2005). J. T. Klein and Newell (1997), describe Interdisciplinary studies is a process of answering a question, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession.

In South Africa interdisciplinarity, although encouraged by academic institutions, remains a hard road to travel. Karen Esler and Downsborough, et al., (2016) write about the situation in South Africa at present - *“Complex social-ecological problems need sustained interdisciplinary engagements across multiple disciplines, yet academic offerings continue to reflect disciplinary silos”, “. . . lengthy time frames are required for . . . interdisciplinary programs,”* and *“The disciplinary divide in universities, especially between the natural and social sciences persists.”* I can attest to both the presence of the divide, the silos, and the lengthy time frame required. As a lone researcher outside conventional academia, I have had to acquaint myself with a host of conflicting theories, idiosyncrasies, and methodologies, navigate the deep disciplinary silos, and then attempt to integrate it all into a cohesive and convincing body of work! Transdisciplinary research is one step further towards a true integration between disciplines where participatory transdisciplinarity incorporates the non-scientist participants in the knowledge generation process. I feel that in my ethnobotanical work this was sometimes the case, however my work also contained elements of consultative research, where the non-scientist actors were not as actively incorporated into the knowledge production process as I would have liked (see Brent, 2012).

According to Repko and Szostak, et al., (2016), there are three broad categories of traditional disciplines and the three disciplines involved in my research each fall into one of these; botany into biology in the natural sciences, anthropology into the social sciences, and archaeology in the humanities. The reality however, is that more often both anthropology and archaeology more often hover uncomfortably between social science and the humanities, while archaeology confusingly may even fall within anthropology or even geography. Tim Ingold (1993) proposes, “*social or cultural anthropology, biological anthropology and archaeology form a certain unity - are all part of the same intellectual enterprise.*” With botany sharing plant ecology, phytogeography, and phytochemistry with anthropology, and archaeobotany and ethnoarchaeology with archaeology, it would seem to suggest that an interdisciplinary method based on these three disciplines should successfully result in an achievable and coherent whole. However, plant taxonomy, as a major focus of this thesis, remains firmly within the botanical sphere only. As individual disciplines they have developed separate areas of study and generally do not, or cannot, provide the skills or the tools required to study intricate and overlapping interactions, synergies, and mutualism between plants, people, and place, nor the implications of these which inhabit the interstices or contested spaces between them (Esler, & Downsborough, et al., 2016; Repko, Szostak, & Buchberger, 2016); I needed to get to grips with the language of each discipline before using interdisciplinarity to attempt to integrate the many threads of my dauntingly wide ranging research.

3.1.2 Mixed methods research

Faced with complex choices regarding the best methodological approach when writing this interdisciplinary thesis, I followed the mixed methods route. Mixed methods research is both a method and methodology for conducting research that involves combining the strengths of both quantitative and qualitative research in a single study. Qualitative and quantitative research are insufficient on their own; in combination, they can provide a better understanding and more evidence than either approach on its own (Creswell, 2007; Molina-Azorín, & López-Gamero, 2016). The methodological gap between botany as a scientific discipline adhering to a more rigidly scientific quantitative methodology, and anthropology in the Social Sciences and humanities which generally uses qualitative methodologically, present a problem common to interdisciplinary studies (Winberg, Barnes, Ncube, & Tshinu, 2011). Each discipline or sub-discipline supports methodologies found to be relevant to its needs, each has its own assumptions, concepts, theories, and vocabulary (Repko, Szostak, &

Buchberger, 2016). In the Handbook of mixed methods edited by Tashakkori and Teddlie (2003), they attempted to link pragmatism with mixed methods research, arguing that the research question should be more important than either the method or the theory behind the method.

3.1.3 Decolonizing Methodologies

Linda Smith in her book “Decolonizing Methodologies” (2013 2nd ed.), describes the colonising role of Western research methodologies (and see Todd, 2016; Hewson, Javu, & Holtman, 2009). The principles behind Western academic methodologies have often been about Indigenous peoples being primitive and still needing to be ‘civilised’. Decolonising methodologies advocates for the use of Indigenous principles into research methodology so that research practices can help to assert the legitimacy of indigenous science and acknowledge Indigenous people’s rights and sovereignty. Smith writes in her paper “On tricky ground” (2007) - *“The history of research from many indigenous perspectives is so deeply embedded in colonization that it has been regarded as a tool only of colonization and not as a potential tool for self-determination and development.”* Another voice - *“Directly or indirectly, western social sciences, including archaeology and history, have been – and continue to be – an extension of a power system that seeks to impose its will, as well as socio-economic and overall cultural system, as the one valid worldwide system.”* (Andah, 1995) - these are aspects of my research which trouble me, although they did not appear to worry participants in the communities I engaged with. Yet, how can one know if you are overcoming the problem, or are re-imposing the colonial paradigm which is dismissed as merely inconvenient by the participants who are too used to this treatment to react. Is this attitude being given merely a token nod from me and others, rather than a truly heartfelt and deep commitment to avoid research methodology which remains redolent of colonialism? The disjunct between the accepted Western academic paradigm and the need to decolonise it is very pertinent to South African at the moment, with student unrest over “fees must fall” and “decolonising education”.

3.1.4 Identifying to species level, but using the Genus as terminal taxon.

When listing the plants presented by participants of community medicinal plant workshops, and collecting and listing plants found at each archaeological site, I identified, labelled, and data-based them to the species level in the accepted western scientific way (see Chap. 4, Table 1, page 54 - 57). However, when populating large tables showing an overall picture of

what is used and what occurs most often and where, it soon became obvious that to do this to individual species level would be counter-productive and obscure the underlying patterns that emerge so clearly using genera as the terminal taxon. It would also result in very large and unwieldy tables. In addition, only using and recognising the modern Linnaean system of classification at species level to document plant uses and naming, particular and peculiar to peoples who did not, and still do not, use this system of classification, is equivalent to ignoring and negating their inherited knowledge and skills. The fact that pre-historic peoples around the world used, while traditional rural as well as urbanised societies still use, their own traditional taxonomy for the plants they know and use, has to be taken into cognisance, and acknowledged as an integral part of their traditional knowledge systems as well as any ethnobotanical research today. Because traditional naming largely equates to the modern generic level the resulting data adequately represents both systems.

I am aware that this might be criticised as unscientific or not academically rigorous enough. However, it was not used as a way of shirking the trials and tribulations of full identification to species level – all plant specimens collected at sites and presented at community workshops were identified to species level. I then used the species as the basis for all databases which I drew on to produce the more manageable tables and charts incorporated into my text (see Appendix A & B). The genus was used as the terminal taxon in large databases because chemotaxonomically, practically, pragmatically, and empirically, it makes perfectly good sense to do so. In addition, with ever more research in palynology, phytolithology, and molecular DNA of plants today, the genus (sometimes the family) is most often used in cladograms or trees where it is not possible to ascertain the species. Research using the genus as terminal, is widely recognised as the only way in which science can move forward in looking at taxa in deep time and global geographical space. (see Chap. 5.6, page 101, for a full motivation for using the Genus as the terminal taxon).

3.1.5 Combining closely related genera as a solution to name changes

Genus name changes forced me to link some old and new generic names in order to make sense of the data. For instance, the genera *Rhus* and *Searsia* are combined in some tables because *Searsia* in Southern Africa was recently separated from *Rhus* (Moffett, 1999, 2007), before that they were considered one genus, and by indigenous and traditional users they still are. The same problem arises for *Acacia* and *Vachellia* (Kyalangalilwa, Boatwright, Daru, Maurin, & Bank, 2013). Due to difficulties in separating newly designated genera when

collecting data from secondary literature I have had to treat both *Searsia* / *Rhus* and *Vachellia* / *Acacia* as a single genus particularly in the global datasets (see extended discussion in Chap. 5.5.3, page 97 & 98). Other taxa treated as a single genus for analytic purposes, were *Chaenostoma* / *Jamesbrittenia* / *Sutera*; *Mesembryanthemum* / *Sceletium*; *Haemanthus* / *Scadoxus*; *Albuca* / *Ornithogalum*; *Agathosma* / *Empleureum*. Not due to name changes but because of similarity of use and persistent perception among traditional users of the close similarity between these close genera and the fact that they are therefore used for the same ailments or other uses.

3.2 Methods

3.2.1 Collection of botanical data in close association with archaeological sites

From year 2000 to 2015 a total of 3000+ plant specimens were collected, usually within 100 metres maximum radius at the entrance and immediately below each site; a few patches were only two metres in width. 155 sites were visited in total, 138 individual sites were situated within sufficiently intact vegetation to warrant the systematic collection of plants. These 138 were later conflated to 75 coded southern Cape site-complexes (see Chapter 7, Table 12, page 134), combining adjacent sites close enough together to share the same vegetation community in order to prevent duplication of taxa and distortion of the proportional presence of species. Permits to visit the sites and collect in the vicinity were obtained from Cape Nature and SanParks, and permission was given by farmers and land-owners.

With easier accessibility and more time available, total numbers for each species could have been counted or estimated for a standard measured area at each site. Detailed vegetation counts would have enabled quantification of density for the green walls as compared to the surrounding vegetation with similar topographic and geological profiles, and numerically demonstrated the fact that although green wall taxa were not always absent from the surrounding area, it was the densification immediately at the entrance to the habitation core site which was so striking. To compensate for this error, three widely separated sites were later surveyed by means of quadrat counts, with the number and density of each species quantified in an effort to compensate for the lack of total species counts for the remaining sites; these three sites serve as proxy examples illustrating the common pattern observed overall (see Chapter 8.1, page 153).

Two or more samples of every species at each of the 75 sites were collected, within the distinctive vegetation patches in the immediate vicinity of the site. Most plants were photographed in situ and again just before pressing. No taxa were discounted because they also occurred away from the sites - it is the densification of taxa and development of green walls at sites which leads to the pattern observed; not their intermittent presence or absence in the wider landscape. The voucher specimens were identified, documented and databased. They were then pressed, labelled, and processed according to standard herbarium methodology (Forman, & Bridson, 1989; Victor, Koekemoer, Fish, Smithies, & Mössmer, 2004). All specimens were identified to species level, and classified according to order, family, and genera to facilitate later quantification. The 2853 plant specimens collected in total in the southern Cape, comprised 568 individual species, in 269 genera and 99 families.

The ideal is to collect at different times of the year at each site, and to collect all stages of the flowering, fruiting and seeding cycle, but unfortunately this is seldom possible due to time constraints and the difficulty of access to some sites. However, due to year-round rainfall and a temperate climate, flowering and fruiting of many woody plants is staggered and year round – dependent more on rainfall than on the seasons (personal observation), and see also Pierce and Cowling (1984). On the other hand, many herbaceous plants, especially geophytes, show a more seasonal cycle with most activity in the cooler months (De Vynck, Cowling, et al., 2016b). Locating annuals and geophytes, was often successful only because these geophytes had been seen and collected previously (Van Wijk, Tussenius, Rust, Cowling, & Wurz, 2017). Emphasis was placed on collecting examples of the same taxon from different ecological micro-niches, so that macro- and microscopic anatomical variability due to environmental conditions could be observed.

Poaceae (grasses) and Aizoaceae (succulent vygies) were present at the sites but were only collected during the first few years if they were well known to me such as easily identified and numerous *Pentameris* (*Pentaschistus*) species. The non-flowering remnants of grasses presented difficulties in identification, as did the taxonomic complexities of the many small *Mesembryanthemum* (*Sceletium*) species and the large *Carpobrotus* species, especially when not in flower or fruit. In addition there was the difficulty of pressing and preserving succulent Mesembs. The importance of grasses used for bedding (Schrire, ed. 2009; Wadley, Sievers, Bamford, Goldberg, Berna, et al., 2011; Sievers, 2013), and the fact that they were included in the regression analyses of Daniel Moerman, Pemberton, et al., (1999), and Haris Saslis-

Lagoudakis, Williamson, et al. (2011), whose datasets I was privileged to use, made it necessary to include them in my datasets. The uses of succulents as sources of liquid or food (personal comments from participants during walks-in-the-veld, and Downs, 1966) meant that these taxa also warranted incorporation. Lack of consistent collecting at the beginning made it difficult to incorporate these two groups into my data, but it was possible to identify some grasses, at least to genus (Appendix A1), after digitally enlarging images taken during site visits. Where this was possible with Vygies or Mesembs, especially the *Ruschia* species, they were also included. However, it should be noted that Mesembs were more prolific at sites than appears from my data as those not able to be identified to genus were excluded.

After the initial collection of flowering samples from each site as herbarium specimens, the range was expanded to a more comprehensive collection, whether flowering or not - of herbs, shrubs, trees, ferns, grasses, and geophytes, to represent every plant present in the vicinity of the site. A secondary benefit of this type of collection is that it can be utilised to compile a reference database for the area surrounding a site as an aid to identifying macro- and microbotanicals such as seeds, charcoal, phytoliths, parenchyma, and pollen in that has been found or will be found in the archaeological deposits. The vegetation survey of the larger Klasies River area was made not only for this thesis, but mainly as a reference collection to be used as archaeobotanicals are retrieved during the present excavations. The collection and data at the 75 sites consists of presence and absence and was not numerical, each species was counted only once in each vegetation patch.

In order to sample numerical presence of taxa without making a count of every specimen at every site – an impossible task given lack of time and opportunity – I surveyed three separate sites, NO10, KL1, and C5, in different biomes and vegetation matrices, and with different geologies (See Chap. 8.1.1, page 154, an unpublished paper in process of submission). I sampled 20 x 20 metre² quadrats, placed more or less along a contour line incorporating similar rock structure and aspect, and starting as far from the site as possible without changing altitude or topography too much. I sampled every species in each quadrat, and either counted individuals of that species or estimated the number if they were very numerous and/or very small plants. The aim was to enable quantification of the densification of taxa in the patch or green wall, as one neared the core or central habitation site (Chap. 8, Fig. 11, page 175).

Full species lists are an essential tool for present and future botany, anthropology and archaeology researchers, as well as conservationists, ecologists, land-use planners and land-owners. They all urgently need detailed and reliable checklists of this type (personal comment by Gideon Smith SANBI, Pretoria,). Plant species diversity in South Africa and especially in the southern Cape is by no means adequately recorded as yet, and yet this sort of detailed collecting of many areas is not being undertaken or adequately funded at the moment. The vegetation survey within a five kilometre radius of the Klasies River archaeological sites ([van Wijk, Tussenius, et al. 2017](#)), and included as Chapter 9 in this thesis, presents an example of a full species list. For the four grids covered by our survey, the SIBIS (PRECIS) database at SANBI had missed 80% of the species we recorded, which is indicative of the amount of work remaining to be carried out in documenting the vegetation of southern Africa.

3.2.2 Ethnobotanical data collection

Participants were found through purposive informed selection as it was necessary that participants should be actively using plants as remedies, and know how to prepare them. The language spoken was almost always vernacular and idiomatic Afrikaans, with English occasionally used. Local knowledge holders or users, initially those known to the Knysna clinic, were invited to attend the first workshop and bring friends or acquaintances who also knew and used local plants. They were asked to personally collect and bring fresh plants (in a closed plastic bag to keep fresh), which they personally used on a regular basis or knew well. At the workshop everyone sat around a table and laid out their plants in front of them. The first speaker volunteered or was chosen at random, and asked to give their name, plus parents and grandparents names if possible. They were asked where they or their family had originally come from. This was often a farm in the immediate area where their families had lived for generations and which they still refer to as their “home”. Over the past 20 years or so and especially the last 5 years, families have been relocated from farms all over South Africa to the closest “townships” (formerly called Locations), to live in RDP (Reconstruction and Development Program) houses - sometimes, but not always paid for by the farmer. A colloquialism frequently used was, from "oor die berg" referring to “otherside the mountains” as in the Klein Langkloof just over the Outeniquas proper, and less often from the Great Karoo as far as Graaff Reinet. A few came from further West as far as Riversdale, or East to KeithHumansdorp, but without exception from the Cape Provinces.

Each participant gave the name they personally used for the plant being discussed, what the plant was good for; plus methods of preparation and dosage. Most plant names were given in Afrikaans, with a few old Khoi-San names, and only occasionally in English. Notes taken were as detailed as possible and any additional anecdotes were also noted in full. Usually each new plant led to a general discussion where other names were offered and noted, and different uses and preparations described. These general discussions often had the effect of correcting an incorrect identification or use, and allowed for a selfcorrecting feedback loop which had the advantage of eliminating the few mistakes and dubious information.. Some sessions were videoed or voice-recorded where appropriate. General discussion was encouraged after each presentation which serves as a mechanism to ensure that information is correct and that incorrect or doubtful information can be recognised and not quantified. At no time was any lead given as to what plants they should bring, what the plant was called, or what it was used for. No pictures or specimens were shown in advance of the session which can be viewed as asking leading questions. Occasionally books were referred to at the end of sessions to confirm an identification and introduce a discussion about the fact that their knowledge was validated, and is already in the public domain.

Notes were taken throughout each workshop or interview session, and written in the language and idiom used by each informant (Chap. 6.3, Table 11, page 122). Information given was later categorised (in English) to enable quantification of uses, methods, and to rate level of usage or popularity for each taxon. All common or traditional names were noted where more than one was offered by the informant or other participants. Every plant specimen was pressed with temporary labels identifying the informant and information given. I was able to offer formal botanical identifications immediately in most cases, to be confirmed later.

Databases include local traditional names, local ethnobotanical uses, and preparation methods. All specimens were pressed, labelled and mounted, but because of the large volume of specimens, multiple small samples of common species were sometimes mounted on one specimen sheet if better samples had previously been mounted as single specimens. Unusual or difficult to name specimens were always mounted on a single voucher sheet. Almost all specimens were photographed and stored in an digital image library. I considered it important to collect multiple duplicate specimens in order to facilitate the later comparison of differences in morphology and chemotaxonomy of same-species or same-genera from widespread localities, under varying environmental conditions, if the need should ever arise.

Qualitative anecdotal data regarding methods of use, plant part used, and preparation of plants, was converted to quantitative data by categorising uses, as in [Haris Saslis-Lagoudakis, Williamson, et al., 2011](#)), methods of use, and preparation methods.

3.2.3 Identification of plant specimens

I identified the majority of the specimens using knowledge and experience gained from 32 yrs of collecting, 10 years as curator of the southern Cape Herbarium, and thousands of miles hiked in the southern Cape while collecting data for the Protea Atlas project. Specialist help was sought from Johan Baard (Scientific Services, Garden Route National Park, SANParks); Jan Vlok (Regalis Environmental Services); Richard Cowling (NMMU); Sandra and John Burrows; Rodney Moffett; MOBOT; The International Plant Names Index (IPNI); and iSpot (now iNaturalist). Classification follows Manning and Goldblatt's Cape Core plants ([2012](#)), APGIII & IV, and The Red Data list updates by SANBI. Recent synonyms appear in brackets in most tables. Very recent name changes may not have been incorporated. Most specimens were photographed either in situ, before pressing, or both, and images have occasionally been submitted to iSpot for confirmation of identification, and to add to image databases for each area. Images will be uploaded to whatever relevant online database is considered to be most appropriate at the completion of this thesis. A complete set of voucher specimens will be lodged at the Selmar Schonland Herbarium, Grahamstown, with duplicates going to the Ria Olivier Herbarium at Nelson Mandela Metropolitan University (NMMU), Port Elizabeth.

3.2.4 Use Value Indices in ethnobotany - are they valuable?

A question which often arises is - what constitutes good practice in ethnobotanical data gathering? Is "rapid appraisal" (G. J. [Martin, 1995](#); [de Beer, & B-E van Wyk, 2011](#); [B-E van Wyk, & de Beer, 2012](#)) thorough enough to provide complete enough surveys in ethnobotany? In one off rapid appraisal, plants are collected and identified by the researcher ahead of interviews with participants, admissible if collected from the immediate open area, but not so good if using herbarium specimens or plants gathered from gardens and especially from Botanical Gardens, where participants would not normally collect and which contain plants which are not natural to the immediate area. These specimens are photographed, pressed, and then shown to participants, a practise which I feel veers dangerously close to asking leading questions. The participants write, or their answers are noted, usually on pre-printed forms using ticks or a ranked numbering system, to feed into what Ben-Erik van Wyk

and J. J. de Beer (2011, 2012) have termed the "Matrix method" - "*Where participants are scored statistically to rate their level of knowledge and reliability, while the plants are scored to rate their popularity*" (De Beer, & B-E. van Wyk, 2012; B-E. van Wyk, de Beer, 2012; de Vynck, B-E. van Wyk, & Cowling, 2016a; Hulley, B-E. van Wyk, 2018).

Undoubtedly this matrix method results in high-quality data if the objective is only quantification. That this quantitative data is necessary and valuable to assess a theory is accepted, but will it have value for future generations needing to test numerous other theories, where other methods may be used? My argument is that we need to show respect for the knowledge and culture of the participants by not subjecting them to a westernised system of rigorously boxed-in questioning which does not allow for stories and extraneous information to be given and valued, which is possibly and probably more productive than a rigid multichoice numerical matrix system. If the method used here is repeated often enough with both the same groups and different groups, it is self-correcting and effectively as rigorous, while allowing for a wider range of knowledge to emanate naturally, than a pre-programmed questionnaire based on a rigorous matrix method.

I was ambivalent about using the matrix method to statistically rate participant / informant consistency or level of knowledge and reliability (de Beer, & B E. van Wyk, 2011; B-E. van Wyk, & de Beer, 2012; Nortje, & B-E. van Wyk, 2015; Hulley, & B-E. van Wyk, 2018), I was increasingly uncomfortable with the concept of rating or quantifying participants knowledge as it reduces the importance of participant knowledge by rating it as more or less valuable, and can appear to originate from the assumption that the researcher knows more than the participants do. The reason for working with the various community members was to learn FROM and WITH them. Grading their knowledge, like a teacher in school, felt like yet another example of biased, colonialist, top-down research. Pictures and pressed specimens are too often misidentified by people not used to the two-dimensionality of an image flattened on paper. Any group of non-botanical people no matter their educational or wealth level, will almost invariably first identify a picture of any plant by the flower colour alone! I found that, presented with colour pictures, most participants identified a plant picture by flower colour as one of the medicinal or useful plant they normally use of the same colour. Plants may also be ticked as known and used in order to appear more knowledgeable or helpful. Designing research around a set matrix in order to grade participant knowledge can lead to a loss of much valuable information, and nuances are likely to be overlooked and lost because they were simply not expected, sought for, or given space for expression. In addition, apparently

'well-known' knowledge, whether from the most or least knowledgeable participants, may well be incorrect, be rated as either more or less important than it actually is, and then erroneously become entrenched in future research when using this the method.

Although the matrix scoring of participants knowledge was not used in this thesis, I did analyse my ethnobotanical data for Use value or Cultural Use Value using two out of the numerous rating formulas proposed, Heinrich, Ankli, et al. (1998), and Reyes-García, Mart, et al. (2007). I also formulated a formula of my own as a comparative control (see Chap. 6.3.1, Table 11, page 122). Many researchers have reported on the similarities and differences between indices (Hoffman, & Gallaher, 2007; Tardío, & Pardo-de-Santayana, 2008). Although the three index formulas are structured differently, and resulting scores differ between the three methods of analysis, they give largely the same results as far as the order of the species goes, ie. the results are essentially the same no matter which method is used (see Tardío, & Pardo-de-Santayana, 2008) who trialled a different range of indices. The three indices were averaged to give the final measure used (Chap 6.3.1, Table 11, page 122).

The methods used to collect ethnobotanical data are tried and tested, and while not as quantitatively rigorous as the matrix method described above the end result is much the same with perhaps more information and data collected by using more broadbased and liberal methods than in the rigidly applied matrix method. Walk-about are very valuable and a recognised method of collecting an infinite amount of data and new knowledge. The fact that each participant brings a different selection of plants and every participant gives input about their own and everyone else's plants, provides a self-regulating and wide-ranging environment for discussion offering the maximum chance to cover all likely plants in each area. The number of plants is often greater than presented on a pre-prepared sheet of already known medicinal plants of the area. The number of plants presented on any one of my databases from different areas, is comparable to the number presented in papers using the matrix method. By comparing data collected from a wide range of participants living in diverse habitats and not knowing each other, false negatives are taken care of. My criticism of the matrix method arose out of the belief that although useful quantitative data may be collected by following the rigorous but subjective and narrow matrix method, nevertheless, a broader more inclusive and objective method where there is no pre-supposed knowledge held by the researcher and presented to the participants, is more conducive to unbiased, equitable, and genuine knowledge transfer.

3.3 Comparison of vegetation at habitation and non-habitation sites

In order to show that the vegetation communities at sites inhabited and impacted by early humans was unique or distinct, I recognised the need to identify and collect taxa at a control group of sterile sites with no evidence of human presence in order to quantitatively compare the composition of those vegetation patches with vegetation growing at definite habitation or presence sites. A determined effort was made to find such “nul” sites. It soon became evident that it was not possible to define areas which had never been inhabited or impacted by hunter-gatherers or herders in the past with any certainty. However, the ubiquitous stone tool and pottery shard scatters throughout the landscape, and to be found almost everywhere after a thorough search, strongly support my contention that it is simply not possible to equate apparent non-presence of indicators today with absence in the past. It was the large scale of the research, over a wide range of very different habitats and environments which allowed the pattern to emerge but which made quantification problematic. Close inspection of apparently sterile areas, almost always resulted in a few lithics, pottery, shells, or ochre being found as surface scatters. In addition, hunter-gather-pastoralists would have spread seed for thousands of years by tracing their complicated network of daily and perhaps seasonal paths and migration routes throughout the area while foraging, hunting, and minding their stock (see foraging maps in Lewis Binford (1980)). Animals, birds, water and wind would also have spread seed randomly. It is not the mere presence of the distinctive species in the landscape, but their densification at habitation sites which is the issue here. It was not possible to reliably recognise habitation and presence sites as opposed to control sites with no signs of human presence.

The widespread finds of tools and other evidence of presence such as burials and of course rock art tell of a deep-time and extensive occupation of the landscape by earlier peoples. Similarly, the long history of thicket presence throughout the area indicates that it would be naïve to think that humans living and subsisting in the area by gathering and foraging would not have explored every nook and cranny of the landscape in their search for food, useful plants and shelter. Therefore, to attempt to isolate any particular area as never having been visited and trodden by humans became an impossible task.

3.3.1 Sørensen’s similarity coefficient - comparing vegetation at 75 sites.

Because it was impossible to compare the vegetation at habitation and presence sites with non-presence control sites, I used an alternative method to enable at least some quantitative comparison. The sites were subjected to Sørensen's similarity index in order to compare each site to an imaginary ghost site populated with the top 50 most frequently present Genera at the 75 sites complexes. Sørensen's index is a method used for comparing the similarity of two samples using presence and absence data. It was developed by the botanist Thorvald Sørensen (1948). Many indices are used in addition to Sørensen's in order to quantify differences or similarities in vegetation composition such Jaccard's and Bray Curtis, and many newer indices have been proposed (Goodall, 1966). However, Sørensen's suited my purpose, and importantly, in the context of this thesis with the majority of the taxa from big families and genera with very few endemics and no rares, it gives greater "weight" to common taxa rather than rare taxa.

I developed two sets of criteria A. and B. (listed below) to distinguish between habitation sites and possible non-habitation sites. Using these criteria, I divided the 75 sites into A. definite habitation sites, and B. questionable sites probably never inhabited. I constructed an imaginary ghost site containing the 50 genera occurring most frequently at the 75 sites (Chap. 4.2, Table 4, page 67). Each of the site complexes were then compared to the ghost site using the Sørensen's similarity coefficient formula $2a / 2a + b + c$ where:

a = number of species in both sites

b = number of species in first site only (Ghost site)

c = number of species in second site only (site being compared to ghost site)

The results were multiplied by 100 to get a percentage similarity and those results were averaged for group A. (habitation sites) and for group B. (non-habitation sites) to allow for a comparison between the two groups.

A. Indicators of definite habitation

- A large (>3x3m) fairly level floor area within the site, with a reasonable depth of sediment estimated.
- Surface lithic scatters including tools, flakes, cores, upper or lower grindstones, bored stones, and worked ochre.
- Surface pottery shards and/or ostrich eggshell beads.
- A perennial water source, near enough to the site for reasonably easy access (<2 km.).

- The presence of a typical green wall.

B. Indicators of presence but not necessarily habitation

- Evidence of rock art (some images brilliant and clear, but many faded and cryptic), this is not necessarily an indication of actual habitation.
- The presence of shell middens or shell fragments too far from the coast to be naturally present (possibly indicating habitation, but not necessarily).
- Reports of burials and exhumation of skeletons (not necessarily proof of habitation).

Definite habitation sites fulfil all 5 criteria in A. and 1 or more in B.

Presence but non-habitation sites fulfil 2 or less of the criteria in A. and 0 – 3 in B.

3.4 Flammability index - testing site taxa.

An opportunity arose to test some local vegetation for flammability at a residential reserve outside George where thick vegetation was considered to be a threat to the wooden houses allowed within the reserve. Thicket is often described as fire resistant ([Cowling, Proches, & Partridge, 2009](#)), and to test this on plants within the top 50 genera at the sites covered in this thesis seemed like a good idea. Much literature is available regarding flammability of various vegetation types, but very little about the actual testing of individual species for flammability. I adapted a set of criteria as laid out by Hachmi, Sesbou, Benjelloun, et al., ([2011](#)) for Moroccan forest tree and shrub species, and Dimitrakopoulos and Papaioannou, ([2001](#)) on Mediterranean forest fuels. Both these studies refer to J C Vallette's ([1990](#)) methods, and from Tasmania, the work of Chladil, Sheridan, and Macfadyen, ([2006](#)). There does not appear to be a standard flammability index, but 3 criteria were always mentioned; a) time to ignition, b) time of combustion and c) flame height.

The methods I used were an adaptation of all the above, with two criteria added, A. was the time to ignition or wilting with the branch held 15 centimetres above the coals; B. laid on the coals; C. duration of active burning; D. & E were added, and made possible due to the fireplace having sheltering walls which stopped the wind within them and a serendipitous breeze enabling a comparison of the height of the flames sheltered from wind D, and in the wind E.

Criteria or measure of assessment.

- A. Time to ignition at 15 cm above coals (ie. flammability before flame actually touches the plant is considered a dangerous trait, the longer to ignition the safer)
- B. Time to ignition laid on coals (some plants smother the flames in an indication of retardant properties, while others flame readily or slowly)
- C. Time of active burning after ignition (total burning time, some plants burn quickly and die out, others flame actively for a long time, and some stay red hot without flames)
- D. Height of active flame when sheltered from wind - (height of this flame varies greatly)
- E. Height of flame when not sheltered from wind. (Some plants re-flame or increase flame height in wind while others die down immediately).

A selection of 46 samples from local trees and shrubs were cut in the morning after the dew had dried. Each leafy specimen was about 30cm long and if the leaves were sparse more than one was collected for testing. The specimens were labelled and placed straight into plastic bags which were closed to prevent the leaves drying out. A wood fire was lit within a brick braai (outdoor) fireplace that had 60 centimetre side walls on three sides and the open side sheltered from the wind. One person held each leafy branch over the coals with long braai tongs (long-handled cooking tongs), another person used a stop watch to time each step, and I noted details on a pre-printed table. A total of 42 species were tested using both older branchlets with older leaves and new young leaves where available. Flowers were included if present, they are important if the receptacle or seeds are large and sturdy enough to hold the flame or heat for some time such as mature *Protea* flower-heads or *Tarchonanthus* seedheads.

I devised a formula for rating results for each species as a rough index for flammability. Because the relationship between time to flame on the coals was considered as inverse to time of active burning and height of flames in wind, the formula weights the time of active burning and flame height as being more dangerous traits than time to ignition although this needs more thought and continued experimentation.

Formula for the flammability Index = $(A+B)/(C+D+E)$ Scores range from 0.1 – 100.

Results allocated after running the flammability formula

- a) Retardant (No wilting, only singed. > 60 seconds before flaming, index > 25)
- b) Resistant (Index from > 5 to < 25)
- c) Semi-resistant (Index from > 1 to < 5)
- d) Flammable (Index > 0.1 and < 1)

- e) Explosive (if an explosive reaction to either coals or wind and/or of projectile sparks and flying embers are generated)

3.5 Regression analysis of multiple datasets.

I used the method pioneered by Daniel Moerman, Pemberton, et al. (1999), (see also [Douwes, Crouch, Edwards, & Mulholland, 2008](#); [Saslis-Lagoudakis, Williamson, et al., 2011](#)). Regression and residual analysis of medicinal and food plants in various parts of the world including the Cape, to show that certain global plant families demonstrate a definite selection process as opposed to random use. Daniel Moerman, Pemberton, et al. (1999) motivated for the use of the regression analysis - *“The regression-residual system has the advantage of not overemphasizing small families, and, most valuable, it differentiates among large families which produce relatively larger and relatively smaller numbers of medicinal species.”* By extrapolating that the taxa at sites which I have shown to be useful to modern descendants of the pre-colonial inhabitants could be compared to the lists of medicinal and food plants regressed by the above researchers, I could make use of the same method to regress both ethnobotanical useful plants and the site-taxa.

By using the invaluable Cape Flora ([Manning, & Goldblatt, 2012](#); as well as Jan and Anne Lise Vlok’s Karoo Flora (2010), and SIBIS (SANBI) data from the Southern Cape Herbarium including my personal data of species collected in the area, it was possible to quantify both the number of species at sites, or reported as useful by ethnobotanical participants, against the total possible number of species within each family for the western part of the southern Cape region as delimited for this thesis. To ensure coverage of the Eastern Cape species relevant to the Kouga, Baviaans, and Great Karoo areas included in this thesis, was more difficult, as the promised SANBI Flora publication for that area had not gone to press and I was unable to access a preprint copy. However, using a range of references and floras it was possible to compile relatively accurate but not complete lists. Sources included Richard Cowling (1982,1983), David Shearing and Katryn Van Heerden (1994), plus the SANBI, SIBIS species lists, and the “Check-list of the flowering plants of the division of George, Knysna, Humansdorp, and Uniondale” ([Fourcade, 1941](#)). Grahamstown and surrounds species lists were formulated from “The flora of Albany and Bathurst” ([Martin, & Noel, 1960](#)), and the POSA (was SIBIS - SANBI) grid species lists. Clearly no lists are exhaustive or absolutely correct, however one has to work from some basis and these were the best available at the time.

I was privileged to be able to make use of complete species lists for eight countries made available to me by Daniel Moerman and Haris Saslis-Lagoudakis in order to run comparative analyses across various combinations of my data to generate a global list of common top families. Unfortunately the full medicinal plant list assembled by Douwes and Crouch for South Africa was not available from the South African National Biodiversity Institute (SANBI), however, the limited list of top families published in their paper ([Douwes, Crouch, et al., 2008](#)).was included in the analysis.

I performed standard regression analyses using the add-in to Microsoft Excel. The regression residuals were calculated by subtracting the predicted number of useful species from the actual number of species collected at sites or used ethnobotanically. The resulting figure demonstrates a positive residual indicating selection, or a negative residual indicating little to no use or rejection. Families were then ranked by their positive or negative selectivity. I compared various groups of ranked families which were then averaged to find the common highest scoring or “hot” families.

3.6 Research design

The quantitative data I collected from vegetation patches at sites in the southern Cape and mainly qualitative data collected together with Khoi-San descendants of the southern Cape, was used to test the working hypothesis which predicts that the use through time of a suite of useful plants in the past (ie. independent variables extrapolated from modern ethnobotanical data) would influence the vegetation composition of plant taxa growing at present in close association with archaeological sites (ie. dependent variables).

- a. Previously surveyed sites were revisited to be more thoroughly and systematically surveyed at different times of the year and in different seasons.
- b. Three sites were surveyed in detail using quadrats to demonstrate the invariable densification of the distinct useful taxa immediately at the site entrance (see Chap 8, Fig. 11, page 175).
- c. Additional ethnobotanical, archaeobotanical and vegetation data was accessed and databased, from various sources in the literature including theses and reports.
- d. The much larger data-bases now encompassed as much information as it was possible to assemble, for all the Cape Provinces, other South African Provinces, Africa as a

whole, and global. This resulted in data large enough to be used for detailed comparative purposes, and allowed for the use of similarity indices and regression statistics across many axes (see Chap 4.2.1, Table 1, page 54).

3.7 Ethical procedures.

3.7.1 Ethics in ethnobotanical research

My research started before ethical guides were available and before ethnical clearance certificates at academic institutions were required. On enquiry I was told that I could not apply for ethical clearance from Rhodes University retrospectively. However, I attempted to find and follow all relevant guidelines. The IMITHI Amayeza project (Chapter 6.2, page 117), was given the go ahead by the Knysna Municipality Health department and we followed all the correct protocols regarding prior informed consent to the project and the format. All results were made available in printed or in video format to participants and clinics. I continued in the same vein after broadening the research to more communities in the southern Cape.

I met with and was given written approval for my research by the Southern Cape Association of Traditional medicinal Herbalists, in fact I became a member of the body. I was also given written approval by the “King” of the southern Cape Khoi-San in 2010 to conduct my research. Subsequently I was given written approval by the officially recognised Traditional Representative for the San in the Western Cape. I also got permission from WIMSA to carry out my research. Research ethics with regard to the collection of ethnobotanical data followed the recommended protocols as laid out in a number of papers and texts on the subject ([Tapela, Büscher, Maluleke, Twine, & Steenkamp, 2009](#); [ISE Code of Ethics, 2011](#); [B-E. van Wyk, & de Beer, 2012](#)). All plants and their uses listed and discussed are already in the public domain.

3.7.2 Protecting the locality of sites

Visits to archaeological sites and the collection of plant specimens from the areas surrounding them, was governed by accepted norms for the protection of archaeological heritage sites and rock art in particular, and ensuring a good working relationship with landowners and environmental conservation agencies. No farmer refused access to sites, but they did not want the fact that there is Rock Art on their property made widely known. Some are particularly reluctant to have their sites reported to “authorities” or to Nature Conservation. For ethical reasons and to protect the integrity of the sites, none have been labelled with farm names, nor

are GPS co-ordinates given. The ethical dilemma exists as to whether these sites should be reported in an attempt to ensure “official” protection, and for data to be included in national records, or whether the level of protection and cooperation with farmers is still too uncertain to make this the correct option in this area. This paper does not enter into discussion on this issue. Studying and writing about these lesser known private sites without giving a clear idea of their location might seem quixotic and counter-productive, but if already well known sites are the only ones studied, a huge amount of detail and comparative data is never captured and perhaps lost. An overall picture can only be made visible by surveying as many different sites as possible, both private and public.

The landowners who gave permission to survey the sites and collect plant specimens from the surroundings, were assured that the site location would not be made public and the sites would be identified only by a site code in this thesis and any papers based on it. As a separate project, one of our hiking group who visited the sites with me, undertook to send reports, photographs and details, with landowners permission, about each site to the Rock Art Centre at Wits University, which later became the Origins Centre. Later reports were sent to SAHRIS. If a landowner expressed interest, I sent them a DVD of rock art images, as well as a plant species list for the area.

3.7.3 Sites as archaeological and cultural heritage

Accepted protocols were observed for behaviour at archaeological sites especially with regard to the rock art present. No sites were excavated at all during this research, and surface scatters of tools and other artefacts were only photographed and noted, then returned as far as possible to where they lay previously. There was often evidence for disturbance by baboons, porcupines, hyrax and other animals making use of the shelter and frequenting deep holes under the rocks, which means that some artefacts were found on one visit and not necessarily the next. There is no context to these surface artefacts except in so far as they indicate presence or habitation. The stone tool complexes might belong to Stilbay, Wilton or Howiesonspoor, but can give no indication of dates for the site as these artefacts could have been exposed through digging by various animals over time, or would very likely be manuports carried in from elsewhere and from a different time-frame altogether. .

CHAPTER 4

Results and data analysis

“The benefit of using a wider canvas is that processes which on an individual level seem to be favoured by chance, usually produce an amazingly similar pattern viewed on a larger scale”

-- J. Stephen Lansing 2003

4.1 Introduction

This chapter reports on how the methodological approaches and the methods described in the previous chapter were applied and the results of analyses and comparisons. The tables below are subsets of complete databases in the Appendices (DVD disc). Total specimens collected at the 75 site complexes was 2853, an average of 38 for each site. The individual species numbered 568, in 272 genera, and 99 families (see Appendix A1). Ethnobotanical species numbered 211, in 160 genera, and 61 families. All tables are ranked according to the taxa which are most frequently present at the 75 site complexes, with the exception of Table 4, page 67, and Table 5, page 71. Additional tables and discussions follow in the next three chapters: Chapter 5 - Plants, gives more detail about the taxa collected at 75 archaeological site complexes; Chapter - 6, People, relates to the ethnobotanical surveys conducted with local communities; Chapter 7 - Place, refers to the physical sites and their surroundings, topography, soils, abiotic factors, and history.

4.2 Analyses of the vegetation at 75 archaeological site complexes.

To manage the unwieldy number of taxa, tables reflect only the most important species, genera or families. It was necessary and valuable, to collect and database every species at every site, even if they occurred at only one site. Many species encountered once, or only a few times, proved to be important to modern plant users in the southern Cape, throughout Africa, and globally (see Appendix A1 for the complete site-taxa data and Appendix B1 for the complete ethnobotany data).

4.2.1 The 100 SPECIES most frequently present at the 75 site complexes.

The 100 species in Table 1 are ordered by number of sites each species is present. References to ethnobotanical and archaeological reports see end of Table 1, below. The species in Table 1 are ordered according to the number of sites in which each species is present. Each table in

Table 1 – The 100 SPECIES most frequently present in vegetation patches in close association with 75 site complexes in the southern Cape: their ethnobotanical usage by modern KhoiSan descendants in the southern Cape and how frequently they have been reported as archaeobotanicals from excavations in the Cape Provinces.

Family	Taxon + Authors	# Sites spp. pres.	Common Name	Ethnobotanical uses reported	Archaeo remains
Ebenaceae	<i>Diospyros dichrophylla</i> (Gand.) De Winter	57	Star Apple, Koolhout, Tolbos, Aapkos, Hotnotstolletjie	Bark / M 1,2 / Fruit / E 2	5
Anacardiaceae	<i>Searsia pallens</i> (Eckl. & Zeyh.) Moffett	54	Kuni-bush, Garrabos, t'kuni	Bark, Fruit, Leaf / M4b	*
Solanaceae	<i>Solanum tomentosum</i> L.	53	Gifappel, Slangappelbos	Root, Fruit / M 5,6	7
Anacardiaceae	<i>Searsia lucida</i> (L.) F.A.Barkley	49	Blinktaibos	Fruit / E 2 / G M 5,6	*
Santalaceae	<i>Colpoon compressum</i> P.J.Bergius	45	Bloupruim, Basbessie, Looibos, 'Nantegara, Namtarri, Notchou	Leaf, Fruit / M 2,5 / Fruit / E 1,2,3 / Bark, Stem / O 2,4	1
Asparagaceae	<i>Asparagus aethiopicus</i> L.	38	Wild Asparagus, Katdoring, Kattestert, Hottentotstou	Leaf, Root / M 1,2 / Shoot / E 4	[4]
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i> (L.f.) J.G.West	37	Sand Olive, Sandolien, Ystertoppe,	Leaf / M4b	3
Celastraceae	<i>Maytenus oleoides</i> (Lam.) Loes.	36	Kokoboom	Fruit / E 2 / O 2 / G M 6	4
Geraniaceae	<i>Pelargonium scabrum</i> (L.) L'Hér.	34	Lemon Pelargonium,	Leaf / M4b	[1]
Moraceae	<i>Ficus burtt-davyi</i> Hutch.	31	Wild Fig, Rankvy	Fruit / E 2m,3 / Bark / O 2	4
Ebenaceae	<i>Euclea undulata</i> Thunb.	30	Guarrie, Gwarrie, Ghwarrie	Root, Bark, Fruit / M, E 4b, 2	3
Asteraceae	<i>Elytropappus rhinocerotis</i> (L. f.) Less.	28	Renosterbos, Renosterkoppe, Anoster	Stem, Fruit / M 1,2,5 / Leaf / E 3	1
Poaceae	<i>Pentameris (Pentascistus) pallida</i>	26		O 5	*
Asteraceae	<i>Cineraria lobata</i> L'Hér	24	Geelbossie	G M 5	1
Asteraceae	<i>Osteospermum moniliferum</i> L.	24	Bitou, Boetabessie, Bietou, Bilhó	Leaf / M 2,5,6 / Fruit / E 2,3	1
Solanaceae	<i>Withania somnifera</i> (L.) Dunal	24	Geneesvelletjie, Geneesblaar	Leaf, Root / M 1,3,4a&b,5,6	1
Geraniaceae	<i>Pelargonium zonale</i> (L.) L'Hér. ex Aiton	23	Horseshoe Pelargonium,	Leaf / M 2,4b	*
Poaceae	<i>Ehrharta ramosa</i> (Thunb.) Sw.	23	Polgras, Bushman Grass	Leaf, Stem / O 2	1
Scrophulariaceae	<i>Sutera foetida</i> (Andrews) Roth	22	Stinkblommietjie, Sa'		*
Solanaceae	<i>Lycium oxycarpum</i> Dunal	22	Wolvebos	Leaf, Stem, / M 2,4b,5 / Fruit / E 2	1

Family	Taxon + Authors	Sites spp pres.	Common Name	Ethnobotanical uses reported	Archaeo remains
Anacardiaceae	Searsia glauca (Thunb.) Moffett	21	Blinkblaartaibos, Krintingbessie,	Fruit / E 2,4	*
Anacardiaceae	Searsia tomentosa (L.) F.A. Barkley	21	Wild Currant, Corktree	G M 4b,6	*
Apocynaceae	Carissa bispinosa (L.) Desf. ex Brenan	21	Num-num, Nam-noempies, Noem-Noem	Fruit / E 1,2,3,4,5 / Leaf, Root / M 1,4,5,6	2
Sinopteridaceae	Cheilanthes parviloba Sw.	21	Kleinvaring, Oorstokkies	Stem / M 2 / G M 5,6	*
Anacardiaceae	Searsia pyroides (Burch.) Moffett	20	Deurmekaartaibos, Rivierkaree	Fruit, Leaf / M, E 2,3,4,5	*
Asphodelaceae	Aloe comptonii Reynolds	20		G M 4b,6	[4]
Asphodelaceae	Aloe ferox Mill.	20	Bitter Aloe, Kaapse Alwyn,	Leaf / M 4b, 2	*
Celastraceae	Gymnosporia buxifolia (L.) Szyszyl.	20	Pendoring, Kamnassiehout	Bark, Root, Leaf / M 2,5,6	2
Alzooaceae	Carpobrotus spp.	19	Sour Fig, Suurvy, Tandsprooi, Brakwy, Ghokum, t'Gaukum, Goena, Dikgoena	Fruit / E 1,2,3,4,5 / Leaf / M 1,2,4a&b,5,6	[1]
Myrsinaceae	Myrsine africana L.	19	Cape Myrtle, African Boxwood	Leaf, Stem / M 5 / O 5	3
Scrophulariaceae	Chaenostoma caeruleum (L.f.) Kornhall	19	Sutera, Ruikbossie	G M 5,6	*
Amaranthaceae	Chenopodium murale L.	18	Misbriedie, Varklossie, Tjuana-seep	Leaf / M 1,2,4,5,6 / E 2,3,6	[6]
Araliaceae	Cussonia paniculata Eckl. & Zeyh.	18	Cabbage Tree, Kiepersol, Spekbos, Noolensboom	Root, Stem, Leaf / E 3,4a&b,6	[2]
Lamiaceae	Stachys aethiopica L.	18	Katpisbossie, Kruie, Kattekruie	Leaf, Root / M 4b,5	2
Solanaceae	Solanum retroflexum Dunal	18	Sobo-sobo, Nasgal, Wolwebos	Fruit / M 1,2,3,4,5,6 Leaf / E 3,4,5	*
Asphodelaceae	Aloe arborescens Mill.	17	Kransalwyn, Kraalalwyn	Leaf / M 4b, 2	*
Asteraceae	Euryops rehmannii Compton	17	Harpisbos	G M 5	2
Crassulaceae	Crassula rupestris L.f.	17	Sosatiebos,	G M 4b,6	2
Ebenaceae	Diospyros austro-africana De Winter	17	Bloubos, Tolbosbessie, Aapkos	Leaf, Bark / M 2,5 / O 2	*
Menispermaceae	Cissampelos capensis L.f.	17	Dawidtijeswortel	Root, Stem / M 1,2,4a,5,6	[3]
Scrophulariaceae	Diclis reptans Benth.	17	Koenana, Wild Toadflax	Leaf / M 5	*
Asteraceae	Othonna parviflora L.	15	Bobbejaankjool	G M 5,6	1
Caryophyllaceae	Pollichia campestris Aiton	15	Suikerhappies, Suikerteebossie, Suikerkaroo	Root / M 6 Fruit / E 2	*

Family	Taxon + Authors	Sites spp pres.	Common Name	Ethnobotanical uses reported	Archaeo remains
Celastraceae	<i>Pterocelastrus tricuspidatus</i> Walp.	15	Kershout, Cherry Wood, Witpeer	Leaf, Bark / M 5,6 / Bark, Leaf, Sap / O 2,4	1
Lamiaceae	<i>Leonotis ocymifolia</i> (Burm.f.) Iwarsson	15	Duiwelstwak, Lion's Ears, Wildedagga	Bark / M 1,2,4a&b,5,6 / E 2,3	[1]
Anacardiaceae	<i>Searsia</i> spp (or hybrids)	14	Taalbos	Fruit / E 2	[7]
Asteraceae	<i>Chrysocoma ciliata</i> L.	14	Bitterkaroo, Beesbos, Donkiebos,	Leaf, Stem / O 2	*
Crassulaceae	<i>Cotyledon orbiculata</i> L.	14	Plakkies, Varkoor, Kouterie	Leaf / M 1,2,4a&b,5,6 / E 2,3	2
Crassulaceae	<i>Crassula cultrata</i> L.	14	Plakkiebos, Karky, t'karekey	G M 5,6	*
Crassulaceae	<i>Crassula</i> spp.	14	Plakkieblaar	Leaf, Root / M 2,5 / E 2,3	4
Ebenaceae	<i>Euclea polyandra</i> (L.f.) E.Mey. ex Hiern	14	Baviaanskers, Dwaaskers, Bobbejaanbessiebos,		*
Malvaceae	<i>Hermannia holosericea</i> Jacq.	14	Kwaaiman, Pleister	G M 5	*
Anacardiaceae	<i>Searsia laevigata</i> (L.) F.A.Barkley	13	Taalbos	Bark, Fruit, Leaf / M 4b,5	*
Malvaceae	<i>Anisodonteia scabrosa</i> (L.) D.M.Bates	13	Wildestokroos	Leaf / M 2	[1]
Malvaceae	<i>Hermannia</i> spp.	13	Kwaaiman, Pleister	Leaf / M 2	*
Rutaceae	<i>Agathosma ovata</i> (Thunb.) Pillans	13	False Buchu, Valsboegoe	Leaf / M 1,2,4,5,6 Leaf / E 2,3	2
Amaryllidaceae	<i>Boophone disticha</i> (L.f.) Herb.	11	Gifbol, Seeroogblom, Malkongif	Root, Leaf-scale / M 4b,5 / O 4b	7
Asteraceae	<i>Tarchonanthus littoralis</i> P.P.J.Herman	11	Wild Camphor, Seesalie, Swartsalie, Siriehout, Hottentot Tobacco, Wildesalie	Leaf, Stem, Root / M 1,2,4b,5,6 / Leaf / O 4	2
Fabaceae	<i>Indigofera</i> spp.	11	Leeuhoutjie, Louhoud	Leaf / M 2 / Fruit / E 3	[1]
Geraniaceae	<i>Pelargonium glutinosum</i> (Jacq.) L'Hér.	11	Stickyleaf Pelargonium		*
Geraniaceae	<i>Pelargonium</i> spp.	11	Wild Geranium, Malva	Leaf / M 2,4,5	*
Oleaceae	<i>Olea europaea</i> subsp. <i>africana</i> (Mill.) P.S. Green	11	Wild Olive,	Root, Leaf, Stem, Bark, Fruit / M 4b / Fruit E 2	5
Rhamnaceae	<i>Phytica paniculata</i> Willd.	11	Luisbos		[1]
Thymelaeaceae	<i>Passerina obtusifolia</i> Thoday	11	Bakbos, Gonnabas	Leaf, Bark / M 2,5 / O 2	[2]
Apiaceae	<i>Anginon difforme</i> (L.) B.L.Burt	10	Wildeseldery		*
Aquifoliaceae	<i>Ilex mitis</i> (L.) Radlk.	10	Wild Holly	Leaf, Bark / M 5,6 / Fruit / E 3	1

Family	Taxon + Authors	Sites spp pres.	Common Name	Ethnobotanical uses reported	Archaeo remains
Oxalidaceae	Oxalis pes-caprae L.	8	Geelsuuring, Yellow Cape Sorrel, Soursob	Leaf / M 5 / E 2,4b	*
Oxalidaceae	Oxalis spp.	8	Suuring	Leaf, Bulb / E 3,4	[2]
Rhamnaceae	Phylla spp.	8	Luisbos		[2]
Rubiaceae	Canthium inerme (L.f.) Kuntze	8	Bokdrol, Hardepeer, Turkey Berry, Wolwedoring	Leaf / M 2,5,6 / Fruit / E 2,3	2
Rubiaceae	Galium tomentosum Thunb.	8	Kleefgras, Rooihouttjie	Leaf / M 2,5 / Root O2	*
Scrophulariaceae	Chaenostoma spp.	8	Sutera, Ruikbossie	Leaf / M 2,6 / G M 5,6	*
Solanaceae	Lycium ferocissimum Miers	8	Wolvebessie, Slangbessie, Kariedoring	Leaf, Fruit / M 2,5 Fruit / E 3 / Stem / O 1	4
Solanaceae	Solanum spp.	8	Gifappel, Bitterappel	Fruit / M 1,2	[3]
Zygophyllaceae	Roepera debilis (Cham.) Beier & Thulin	8	Spekbos		[2]
Apiaceae	Notobubon ferulaceum (Aiton) Magee	7	Lidjiesbos, Bergseldery, Gatagaai	Stem, Fruit / M 1,2,5 / Leaf / E 3	*

References for Table 1, pages 55–58: Authors are according to APG1V / MOBOT. (Family and Genus synonyms are given in Table 2).

Traditional names, Van Wijk Y, et al., 2017; Smith C A, 1966; Van Wyk B-E, et al, 1997; Van Wyk B-E, et al, 2000. **Ethnobotanical usage & Plant parts used,** M (medicinal), E (edible), O (other uses). GM (Genus is medicinal). 1. Van Wijk Y, et al, 2017; 2. Van Wijk Y, (this thesis); 3. Fox F W, Norwood-Young M E, 1982; 4a. Van Wyk B-E, et al, 1997; 4b, Van Wyk B-E, et al, 2000; 5. Arnold T H, et al, 2002; 6. Hutchings A, et al, 1996; **Archaeobotanical remains,** Van Wijk Y, npub. [2010]; Deacon J H, 1970; Parkinson J, Poggenpoel J, 1971; Scholtz A, 1986; Tusenius M L, npub. [1984]; Tusenius M L, 1989; February E, 1990; Binneman J, 1907, 1998, 2000; Cowling R M, et al., 1999; Brook G A, et al, 2010; Scott L, et al., 2005; Cartwright C R, 2013. Figures in [] refer to the whole genus not the individual species, * denotes no results for that individual species, # = number.

this chapter will show that although the exact order of the taxa changes according to whether the table is guided by species, genera or family as the terminal taxon, the same suite of genera and families remain near the top of each table. This pattern is echoed by the results of regression statistics at the end of this chapter (Table 5, page 71). When tables are quantitatively analysed according to ethnobotanical or archaeobotanical significance, the same suite of genera and families remain within the top 20 of each. Even after regressing a varied series of data, the same suite of taxa, remain prominently at the top.

All taxa in Table 1, page 54, include authors names, but where only the genus is given the author is for that genus. Where specimens were collected without flowers or fruit and could not be conclusively determined to species level, only the genus is given and this generally refers to more than one species. Many traditional names are listed here, and are of great importance in the context of this thesis, as they underscore the need to recognise the value and validity of Traditional-Indigenous taxonomy (discussed further in Chap. 6.3.4, page 128). Most of the traditional or common names for the plants are in Afrikaans. Afrikaans became the obligatory home language of the Khoi-San during the late 19th and early 20th centuries. In the Cape in particular, early settlers, trekkers, and farmers learnt plant-lore from, and shared their own knowledge of useful plants with the Khoi-San, A few of the traditional names of Bushman or Khoekhoe origin remain in use and illustrate the long history of use made of these plants through time and before colonialism. Other names contain reference to the term “Hottentot” or “Bushman” which are quoted here as non-derogatory historical examples of the derivation of the plant names, which are important indicators of pre-colonial usage for those species. Many of the old Khoe-San names lost or westernised, due to historical ‘prosetelysing missionisation’, so-called imposition of ‘civilisation’, and the determined ‘westernisation’ of the original Khoe-San and their descendants.

Ethnobotanical usages are indicative of the fact that species present at the sites are almost without exception known to local communities as useful plants. The references for usage are limited here to only enough citations to give a good idea of their importance, more data and references can be found in Appendix B. Medicinal and edible references for each species demonstrate the persistence through time for the use and knowledge of these plants; 91% of the 100 species were reported as medicinal, edible, and for various other uses. Appendix B gives full details of ethnobotanical usage in the southern Cape, and Appendix D for Africa-wide and global data.

Excavations where the archaeobotanical survey is paramount are relatively rare in Southern Africa. Due to paucity of data for the southern Cape, results from all of the Cape Provinces are included. 54% of the 100 species have been reported as archaeobotanical remains in Chap. 4.2.1, Table 1, page 54 – 57; Table 2, pages 60 – 61 shows 60% of genera present in excavations. The presence of archaeobotanical remains is generally noted for purposes of mapping climate or cultural changes, however these reports are valuable in that they allow for an understanding of the possible use of these species through time. Of the 100 species 54% are reported as archaeobotanicals in Table 1, page 54. Many macro- and micro-botanical remains cannot be determined to species level, leaving the genus as the terminal taxon of importance and in Table 1, figures in square brackets [] refer to the whole genus and not the individual species. 91% ethnobotanical species and 54% archaeobotanical species is a significant enough result to indicate both the presence and probable use through time, of the majority of the taxa present at sites today.

The most ubiquitous genera and species shown in Table 1, page 54 – 57, are *Diospyros dichrophylla*, *Searsia pallens*, *Solanum tomentosum*, *Colpoos compressum*, *Asparagus aethiopicus*, *Dodonaea viscosa*, *Maytenus oleoides*, *Pelargonium scabrum*, *Ficus burt-dayvi*, *Euclea undulata*, and *Elytropappus rhinocerotis*. These species crop up time and time again as key species in the vegetation patches and in the ethnobotany, although less so in the archaeobotany.

4.2.2 The 50 GENERA most frequently present at the 75 site complexes

In Table 2 it is the genera which are listed and ordered according to the number of sites in which each genus is present. References for archaeobotanical data are the same as for Table 1. Total genera figures in column d. give an indication of the density of the vegetation at the sites. Tick marks in column e. show that the genus is used ethnobotanically at present in the Cape. A tick mark in column f. indicates presence and possible use in the past of that genus. Table 2 is a breakdown of the top 50 genera at the 75 site complexes in which the number and the percentage of sites at which each genus is present is displayed and the number of individual species (presence and absence data) plus the total number of times each species in each genus is present. Presence and absence data is useful for quantification of data, but total species counts give a better picture of the prevalence of some of the genera at the sites.

Table 2 – The 50 GENERA most frequently present in close association with the 75 archaeological site complexes in the southern Cape. The figures in columns **a,b,c,d**, refer to results of my primary vegetation surveys at the sites (see Appendix A). # = number. The ethnobotanical reports in column **e**, refer only to my primary results from the southern Cape (see Chap 6, Table 11, page 122). The archaeobotanical reports in column **f**, refer to all secondary reports from publications on macro- and micro-botanical remains recovered at sites in the Western, Eastern and Northern Cape Provinces (see references for Table 2 under Table 1, page 54). Family and Genus synonyms are (*italicised in brackets*).

Family	Genus	a # sites each Genus is present	b % sites each Genus is present	c # Indv. spp per Gen. prnc/absnc	d Total # spp. per Gen. recorded	e Recorded as used ethnobotanically	f Recorded as archaeobotanicals
Anacardiaceae	Searsia (<i>Rhus</i>)	74	99	15	219	✓	✓
Ebenaceae	Diospyros (<i>Royena</i>)	67	89	5	93	✓	✓
Solanaceae	Solanum	61	81	9	93	✓	✓
Asparagaceae	Asparagus	59	79	15	100	✓	✓
Geraniaceae	Pelargonium	54	72	20	108	✓	✓
Ebenaceae	Euclea	53	71	6	68	✓	✓
Asphodelaceae	Aloe	47	63	4	65	✓	✓
Crassulaceae	Crassula	46	61	14	26	✓	✓
Santalaceae	Colpoon (<i>Osyris</i>)	45	60	1	45	✓	✓
Celastraceae	Maytenus	36	48	5	44	✓	✓
Sapindaceae	Dodonaea	36	48	1	37	✓	✓
Sinopteridaceae	Cheilanthes	36	48	6	46	✓	--
Scrophulariaceae	Chaenostoma (<i>Sutera</i>)	34	45	5	46	✓	--
Malvaceae	Hermannia	33	44	9	53	✓	--
Asteraceae	Elytropappus (<i>Dicerotheramnus</i>)	31	41	3	31	✓	✓
Moraceae	Ficus	30	40	2	33	✓	✓
Araliaceae	Cussonia	28	37	3	28	--	✓
Solanaceae	Lycium	28	37	3	37	✓	✓

Family	Genus	a # sites each Genus is present	b % sites each Genus is present	c # Indv. spp per Gen. prsnc/absnc	d Total # spp. per Gen. recorded	e Recorded as used ethnobotanically	f Recorded as archaeobotanicals
Asteraceae	Senecio	27	36	10	21	√	--
Asteraceae	Cineraria	26	35	2	27	√	--
Poaceae	Pentameris (<i>Pentaschistus</i>)	26	35	1	27	--	--
Aizoaceae	Carpobrotus	25	33	4	26	√	√
Celastraceae	Gymnosporia (<i>Maytenus</i>)	25	33	4	25	√	√
Asteraceae	Euryops	24	32	4	28	√	--
Crassulaceae	Cotyledon	24	32	4	26	√	√
Solanaceae	Withania	24	32	1	24	√	√
Asteraceae	Osteospermum (<i>Chrysanthemoides</i>)	23	31	1	24	√	√
Cyperaceae	Ficinia	23	31	4	23	--	√
Rutaceae	Agathosma	23	31	5	22	√	√
Asteraceae	Helichrysum	22	29	12	28	√	√
Scrophulariaceae	Sutera	22	29	1	22	√	--
Amaranthaceae	Chenopodium	21	28	3	26	√	√
Apocynaceae	Carissa	21	28	1	21	√	--
Thymelaeaceae	Passerina	20	27	6	22	√	√
Malvaceae	Anisodonteia	19	25	4	19	√	--
Myrsinaceae	Myrsine	19	25	1	19	--	--
Rhamnaceae	Phylla	19	25	5	23	--	√
Asteraceae	Eriocephalus	18	24	7	20	√	--
Fabaceae	Indigofera	18	24	5	18	√	--
Oleaceae	Olea	18	24	2	19	√	√
Scrophulariaceae	Buddleja	18	24	3	16	√	--
Lamiaceae	Stachys	17	23	1	18	√	...
Scrophulariaceae	Diclis	17	23	1	17	--	--
Celastraceae	Pterocelastrus	16	21	1	15	--	√
Lamiaceae	Leonotis	16	21	2	16	√	--
Oxalidaceae	Oxalis	16	21	3	17	√	√
Scrophulariaceae	Selago	16	21	6	20	√	--
Caryophyllaceae	Pollichia	14	19	1	14	√	--
Menispermaceae	Cissampelos	14	19	1	14	√	√

Useful genera present total 44 which equates to 84% of the 50 genera being useful, with 38 archaeobotanicals present equating to 76%. As was the case in Table 1, this is significant enough to show that useful plants as used today by descendant Khoe-San reflect continuing and persistent use of the taxa common at the sites, while the high percentage of archaeobotanical remains indicate the use of these plants by inhabitants at the sites through time. Once again the suite of genera and families within the top 20 echo those noted before in Table 1 and later in the results of the global regression analyses (Chap. 5, Table 5, page 71).

The most frequent genera are also those with the most species present at the 75 sites (column d) which indicates that there are many different species in these genera occurring together at some sites. *Searsia* with 219 species present in total, equates to an average of almost 3 different *Searsia* species per site, only one site has no *Searsia* at all but one site has 8 different species. *Asparagus* with 100 species and *Pelargonium* at 108 also have multiple different species in each genus at some sites. Multiple species within one genus in close contact with each other implies the possibility for hybridisation and speciation is high, which might account for all three being classed as big genera in big families (see discussion Chap. 5).

The families into which the most ubiquitous taxa fall are [^]*Ebenaceae*, ^{**}*Anacardiaceae*, ^{**}*Solanaceae*, *Santalaceae*, ^{**}*Asparagaceae*, [^]*Sapindaceae*, [^]*Celastraceae*, ^{**}*Geraniaceae*, *Moraceae*, and ^{**}*Asteraceae*. These families are all key to the vegetation composition at archaeological sites in the southern Cape, throughout Africa and globally. Those marked with asterisks ^{**} fall within the top 20, and with [^] in the top 50 in the global regression analysis. They are also of significance in the ethnobotanical as well the archaeobotanical context.

Table 3 – FAMILIES with more than 20 species present at the 75 archaeological site complexes in the southern Cape: See references for 75 sites under Table 1, page 57, references for additional Africa-wide and global reports in Appendix D1. **1a.** families with more than 20 species per family occurring at the 75 sites; **1b.** total number of species occurring across each family at 75 sites; **2a.** Genera with more than 18 species occurring in each family across 75 sites; **2b.** the number of species in each genus across 75 sites; **2c.** number of sites where each genus is present; **X** - global geographical areas where the Genus is reported as used ethnobotanically and scored out of a possible 15 global regions (Table 4); **Y** - Macro- or micro-botanical remains recorded globally, scored out of a possible 10 global areas; **3a.** the number of species present per genus within each family; **3b.** number of sites in

which each species is present; Results of global regression analysis of vegetation at sites in the southern Cape and eastern Cape, plus the global ethnobotanical data show that families in Table 3, marked with ** are in the top 20, and with ^ in the top 50 positively selected families globally (Table 5, page 71) (See Appendix D1 for regression data and references).

1a.	1b	2a.	2b	2c.	X	Y	3a	3b
Family > 20 spp. @ 75 sites	# All spp per Fam @ 75 sites	Genus > 18 spp. @ 75 sites	# All spp per Gen @ 75 sites	# sites Individual Genus is present	# Global areas / 15 Genus is present	Genus recorded / 10 archaeobotanicals	Species >13 spp. @ 75 sites	# All spp. @ 75 sites
**Asteraceae	309	Elytropappus	31	31	4	1	Elytropappus rhinocerotis	28
		Osteospermum	24	23	7	1	Osteospermum moniliferum	24
		Cineraria	27	26	5	1	Cineraria lobata	24
		Euryops	28	26	5	2	Euryops rehmannii	17
		Helichrysum	30	22	12	1	-	-
		Senecio	21	27	14	4	-	-
		Eriocephalus	20	18	5	1	-	-
		Othonna	19	19	3	-	Othonna parviflora	15
		-	-	-	4	-	Chrysocoma ciliata	14
		-	-	-	7	2	Tarchonanthus littoralis	11
**Anacardiaceae	219	Searsia (Rhus)	219	74	14	7	Searsia (Rhus) pallens	54
		-	-	-	-	-	Searsia (Rhus) lucida	49
		-	-	-	-	-	Searsia (Rhus) glauca	21
		-	-	-	-	-	Searsia (Rhus) tomentosa	21
		-	-	-	-	-	Searsia (Rhus) pyroides	20
		-	-	-	-	-	Searsia (Rhus) sp	14
		-	-	-	-	-	Searsia (Rhus) laevigata	13
		-	-	-	-	-	-	-
^Ebenaceae	161	Diospyros	93	67	12	5	Diospyros dichrophylla	57
		-	-	-	-	-	Diospyros austro-africanus	17
		Euclea	68	53	9	3	Euclea undulata	30
		-	-	-	-	-	Euclea polyandra	14
**Solanaceae	156	Solanum	93	63	15	9	Solanum tomentosum	53
		-	-	-	-	-	Solanum retroflexum	18
		Lycium	37	28	13	1	Lycium oxycarpum	22
		Withania	-	24	9	1	Withania somnifera	24
Scrophulariaceae	147	Chaenostoma (Sutera)	46	34	3	-	Chaenostoma caeruleum	19
		-	-	22	1	-	Sutera foetida	22
		Selago	20	16	6	1	-	-
		-	-	17	1	-	Diclis reptans	17
Crassulaceae	119	Cotyledon	27	27	7	2	Cotyledon orbiculata	14
		Crassula	80	48	7	2	Crassula rupestris	17
		-	-	-	-	-	Crassula cultrata	14
		-	-	-	-	-	Crassula sp	14

1a.	1b	2a.	2b	2c.	X	Y	3a	3b
Family > 20 spp. @ 75 sites	# All spp per Fam @ 75 sites	Genus > 18 spp. @ 75 sites	# All spp per Gen @ 75 sites	# sites Individual Genus is present	# Global areas / 15 Genus is present	Genus recorded / 10 archaeobotanicals	Species >13 spp. @ 75 sites	# All spp. @ 75 sites
*Celastraceae	112	Maytenus Gymnosporia -	44 25 -	37 25 16	12 8 2	4 2 1	Maytenus oleoides Gymnosporia buxifolia Pterocelastrus tricuspidatus	36 20 15
**Geraniaceae	109	Pelargonium - - -	108 - - -	57 - - -	14 - - -	1 - - -	Pelargoniumscabrum Pelargonium zonale Pelargonium sp Pelargonium glutinosum	34 23 11 11
**Asparagaceae	106	Asparagus	100	62	15	4	Asparagus aethiopicus	38
**Malvaceae	91	Hermannia - Anisodonteia	53 - 19	38 - 19	9 - 4	- - 1	Hermannia holosericea Hermannia sp. Anisodonteia scabrosa	14 13 13
Asphodelaceae	79	Aloe -	65 -	47 -	15 -	4 -	Aloe ferox Aloe comptonii	20 20
Poaceae	70	Ehrharta Pentameris	29 26	26 26	1 2	1 -	Ehrharta ramosa Pentameris pallida	23 26
Aizoaceae	69	Carpobrotus	26	25	8	1	Carpobrotus sp.	19
*Fabaceae	58	Indigofera	18	18	12	1	Indigofera sp	11
Santalaceae	58	Colpoon (Osyris)	45	45	7	1	Colpoon compressum	45
**Lamiaceae	50	- -	- -	17 16	8 10	2 1	Stachys aethiopica Leonotis ocymifolia	18 15
Sinopteridaceae	49	Cheilanthes	46	36	10	-	Cheilanthes parviloba	21
Apocynaceae	48	Carissa	21	21	11	2	Carissa bispinosa	21
*Amaranthaceae	45	Chenopodium	26	21	14	10	Chenopodium murale	18
*Sapindaceae	45	Dodonaea	37	37	11	3	Dodonaea viscosa subsp angustifolia	37
Cyperaceae	37	Ficinia	23	-	2	2	-	-
*Apiaceae	35	-	-	-	-	-	-	-
Caryophyllaceae	33	-	-	15	6	-	Pollichia campestris	15
Moraceae	33	Ficus	33	30	15	6	Ficus burt-t-dayvi	31
Rhamnaceae	31	Phylica	23	20	3	1	Phylica paniculata	11
*Rubiaceae	30	-	-	-	-	-	-	-
^Rutaceae	30	Agathosma	25	23	4	2	Agathosma ovata	13
Araliaceae	28	Cussonia	28	28	6	2	Cussonia paniculata	18
Lobeliaceae	26	-	-	-	-	-	-	-
Myrsinaceae	26	Myrsine	19	19	6	3	Myrsine africana	19
Hyacinthaceae	25	-	-	-	-	-	-	-
Thymelaeaceae	24	Passerina	20	20	4	2	Passerina obtusifolia	11
Euphorbiaceae	23	-	-	12	15	8	-	-
Oleaceae	21	Olea	19	18	13	5	Olea europaea subsp africana	11

4.2.3 – Plant FAMILIES with more than 20 species each present at the 75 sites.

The key families prominent in Tables 1 and 2 are again prominent in Table 3 viz. Asteraceae, Anacardiaceae, Solanaceae, Geraniaceae, Asparagaceae, Malvaceae, and Lamiaceae. It is also clear from Table 3 that families with the most species present are most frequently found at sites, which is to be expected. This occurs in spite of the fact that the use of regression analysis is intended to minimise this bias (Moerman, 1991). Top Families in regression analysis are marked with a double asterisk ** (see Table 5, page 71). Additional global “Big Families” (Leonti, Cabras, Castellanos, Challenger, Gertsch, et al., 2013) are marked with a single asterisk *.

4.3 Sørensen’s Index to compare vegetation between definite habitation sites and possible non-habitation sites.

The advice consistently offered when I first registered for postgraduate research, was to compare vegetation at habitation and presence sites with vegetation at sites with no evidence for habitation or presence, in order to test differences in vegetation which could be attributed to the presence of humans. With the aim of collecting data to enable this comparison, I visited many new areas, and made return visits to previously surveyed areas and sites in an attempt to find unequivocally non-presence and non-habitation sites for sampling. I soon realised this was impossible for many reasons. All I achieved was the discovery of yet more presence sites and more evidence indicating that the entire southern Cape should be termed an archaeological presence site. It was clear that I would have to use a different method to quantitatively assess the impact, if any, of humans on the vegetation in close proximity to the sites (see discussion in Chapter 5 – Plants).

All 75 site complexes were scored against a set of criteria (for details see Chapter 3.3, page 45), and using the Sørensen formula were compared to a control or ghost site in order to arrive at the percentage difference in the vegetation present at definite habitation sites as compared to vegetation at the possible non-habitation sites. This method needs refining and re-thinking, criteria are not definitive enough and there is a very fine line between habitation site and presence site as humans would have dropped seeds at both, there is only a matter of degree and quantity which cannot be gauged easily. With a completely different approach, such as by using soil testing, and environmental parameters, it might be possible to actually find sites or areas with no evidence of presence at all.

Results using Sørensen's coefficient index

Group A. 58 definite habitation sites – 46% similarity to the Ghost site

Group B. 17 probable non-habitation sites – 33% similarity to the Ghost site

A 13% difference is not convincingly conclusive, but indicates a slightly stronger selection for the suite of key genera at habitation sites as compared to non-habitation sites. If non-habitation sites contain paintings or tools as many do, the likelihood of edible fruit and seed and at the site is high, and at least some species would be present at both habitation and non-habitation sites. All sites were 'presence sites' as definitive 'non-presence' sites were not found. The margin is small, but more significant than it appears at first glance.

4.4 Straight forward analysis of useful genera from 15 global regions.

As the ethnobotanical data from Africa, the Levant, Arabia, and Mediterranean Europe grew exponentially, it was tempting to travel further and further from southern Africa, following in the footsteps of the earlier hominid and hominin migrants out of Africa. Each new discovery yielded some taxa matching the southern Cape data, which inevitable led to a ever larger database. This large database is greatly condensed in Table 4 (see Appendix D1 for the whole database). To keep the data manageable, it was necessary to combine large contiguous areas of the world. These large regions are represented by the columns in Table 4. The global research followed traced the earliest migrations out of Africa to West, East and Northern Europe initially, but for better comparison, the Americas, Australia, the Middle East and Asia, were later included. Raising the question, if there might be some globally international 'weeds' which connect the whole world's traditional people's use of plants? (See Appendix D for additional references to global plants included in Table 4).

Big Genus and Big Family research is problematic because of the vast scale. The families and genera most frequently present at sites mainly belong to the problematic big genera and big families (see Chap. 5, discussion). Identifying and quantifying correlations between taxa globally across country and continental boundaries is daunting. Correlations between families and genera across the globe are seldom researched. Peter Goldblatt (1978) compared taxa across continental boundaries but does not list any of those I have crossing these boundaries, due to his concern only with the fynbos specifically. This serves to strengthen the divide between the typical site vegetation discussed here and the fynbos.

Table 4 – a simple un-manipulated straight count of presence and absence for the reported useful genera across 15 global regions: Southern Cape; South Africa; Southern Africa; Sub-Saharan Africa; North Africa; Whole of Africa; Levant; Arabia; Mediterranean Europe; South, North & Central America & Canada; Far East; Australasia; Western, Central & Northern Europe; Global. See references in Appendix D1

Family	Genus	75 Sites S Cape		AFRICAN ETHNOBOTANY				GLOBAL ETHNOBOTANY						
		75 sites	% Sites	IMTHI + South Africa	Southern Africa	Sub Saharan Africa	Whole of Africa	Africa, Levant, Arabia, Med Europe	NSC Americas, Far East, Australasia,	Global, - WEN Europe, - Africa	Global+ WEN Eur, - Africa	Global, - WEN Eur, + Africa	Global, + Africa	
				Pos 4	Pos 6	Pos 8	Pos 9	Pos 11	Pos 3	Pos 5	Pos 6	Pos 14	Pos 15	
Asteraceae	<i>Artemisia</i>	1	1	4	6	8	9	11	3	5	6	14	15	
Solanaceae	<i>Solanum</i>	64	85	4	6	8	9	11	3	5	6	14	15	
Asparagaceae	<i>Asparagus</i>	59	79	4	6	8	9	11	3	5	6	14	15	
Moraceae	<i>Ficus</i>	31	41	4	6	8	9	11	3	5	6	14	15	
Euphorbiaceae	<i>Euphorbia</i>	14	19	4	6	8	9	11	3	5	6	14	15	
Cyperaceae	<i>Cyperus</i>	9	12	4	6	8	9	11	3	5	6	14	15	
Urticaceae	<i>Urtica-Didymoxa</i>	6	8	4	5	8	9	11	3	5	6	14	15	
Solanaceae	<i>Datura</i>	2	3	4	6	8	9	11	3	5	6	14	15	
Asphodelaceae	<i>Aloe</i>	47	63	4	6	8	9	11	3	5	6	14	15	
Anacardiaceae	<i>Scaevola-Rhus</i>	75	100	4	6	8	9	11	3	5	5	14	14	
Geraniaceae	<i>Pelargonium</i>	56	75	4	5	7	8	10	3	5	6	13	14	
Asteraceae	<i>Senecio</i>	16	21	4	6	7	8	10	3	5	6	13	14	
Ranunculaceae	<i>Clematis</i>	5	7	4	6	8	8	10	3	5	6	13	14	
Fabaceae	<i>Vachellia-Acacia</i>	3	4	4	6	8	9	11	3	5	5	14	14	
Solanaceae	<i>Lycium</i>	29	39	4	5	7	8	10	3	4	5	13	13	
Oleaceae	<i>Olea</i>	18	24	4	6	8	9	11	2	4	4	13	13	
Polygalaceae	<i>Polygala</i>	9	12	4	5	7	8	9	3	4	5	12	13	
Santalaceae (Viscaceae)	<i>Viscum</i>	8	11	4	6	8	9	11	1	3	4	12	13	
Lamiaceae	<i>Salvia</i>	4	5	4	5	7	8	10	2	4	5	12	13	
Asteraceae	<i>Nidorella (Conyza)</i>	2	3	4	6	8	9	11	2	4	4	13	13	
Rubiaceae	<i>Rubia</i>	1	1	4	6	8	9	11	1	3	4	12	13	

Family	Genus	75 Sites S Cape		AFRICAN ETHNOBOTANY				GLOBAL ETHNOBOTANY					
		75 sites	% Sites	Africa IMTHI + South	Africa Southern	Africa Sub Saharan	Whole of Africa	Africa, Levant, Arabia, Med	NSC Americas, Far East, Australasia,	Global, - WEN Europe, - Africa	Global, + WEN Eur, - Africa	Global, - WEN Eur, + Africa	Global, + Africa
				Pos 4	Pos 6	Pos 8	Pos 9	Pos 11	Pos 3	Pos 5	Pos 6	Pos 14	Pos 15
Ebenaceae	<i>Diospyros</i>	69	92	4	6	8	9	9	3	3	3	12	13
Asteraceae	<i>Helichrysum</i>	25	33	4	6	8	8	9	2	3	4	11	12
Menispermaceae	<i>Cissampelos</i>	17	23	4	6	8	9	9	3	3	3	12	12
Rubiaceae	<i>Galium</i>	8	11	4	4	6	7	8	3	4	5	11	12
Geraniaceae	<i>Geranium</i>	1	1	4	4	6	6	8	3	5	6	11	12
Salicaceae	<i>Salix</i>	1	1	4	5	7	7	9	3	4	5	11	12
Sapindaceae	<i>Dodonea</i>	37	49	4	5	7	7	8	3	4	6	11	11
Hyacinthaceae	<i>Albuca-Ornithogalum</i>	16	21	4	6	8	8	10	0	1	2	10	11
Malvaceae	<i>Grewia</i>	8	11	4	6	8	9	9	2	2	2	11	11
Capparaceae	<i>Cadaba</i>	2	3	4	6	8	9	10	1	2	0	11	11
Hypoxidaceae	<i>Hypoxis</i>	2	3	4	6	8	8	8	3	1	1	11	11
Lamiaceae	<i>Mentha</i>	2	3	4	4	4	5	7	3	5	6	10	11
Rutaceae	<i>Zanthoxylon</i> (<i>Xanthoxylum</i>)	2	3	4	6	8	8	8	3	3	3	11	11
Sinopteridaceae	<i>Cheilanthes</i>	39	52	4	6	6	6	7	3	4	1	8	10
Lamiaceae	<i>Leonotis</i>	16	21	4	6	8	8	8	2	2	2	10	10
Scrophulariaceae	<i>Buddleja</i>	16	21	4	6	8	8	8	2	2	2	10	10
(Buddlejaceae, Loganiaceae)													
Apocynaceae	<i>Cynanchum</i>	7	9	4	6	8	8	8	2	2	2	10	10
Caryophyllaceae	<i>Dianthus</i>	2	3	4	5	5	5	7	2	5	5	9	10
(Campanulaceae)													
Ebenaceae	<i>Euclea</i>	55	73	4	6	8	8	9	0	1	1	9	9
Malvaceae	<i>Hermannia</i>	33	44	4	6	8	8	9	0	1	1	9	9
(Sterculiaceae)													
Aizoaceae	<i>Mesembryanthemum- Sceletium</i>	8	11	4	4	5	6	7	2	3	3	9	9

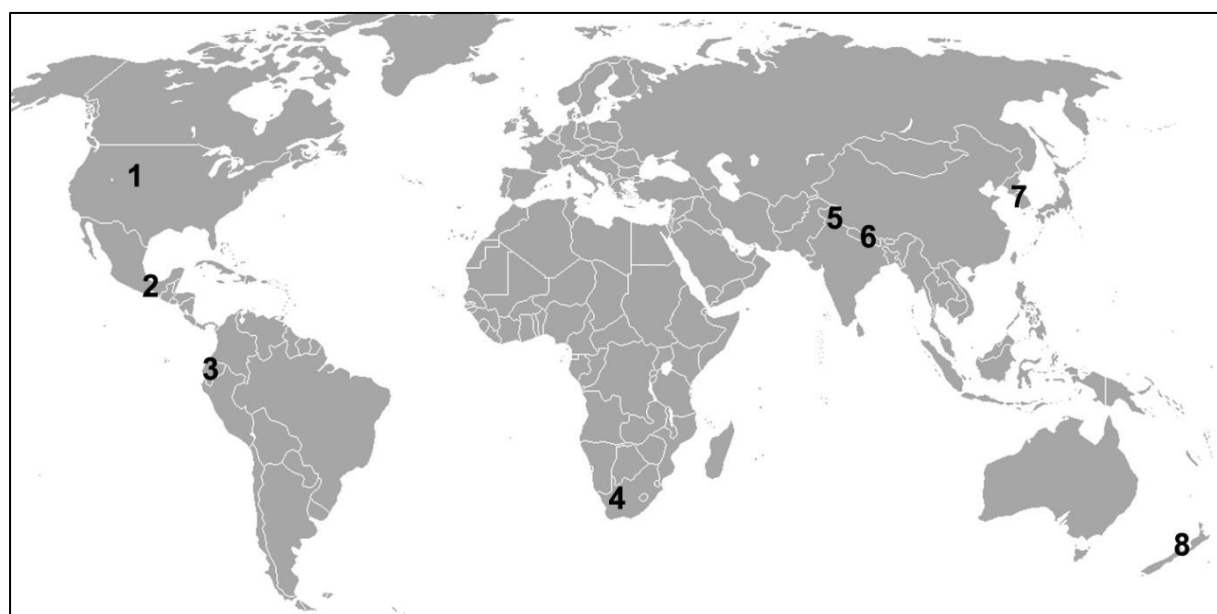
Family	Genus	75 Sites S Cape		AFRICAN ETHNOBOTANY				GLOBAL ETHNOBOTANY					
		75 sites	% Sites	IMTHI + South Africa	Southern Africa	Sub Saharan Africa	Whole of Africa	Africa, Levant, Arabia, Med Europe	NSC Americas, Far East, Australasia,	Global, - WEN Europe, - Africa	Global, + WEN Eur, - Africa	Global, - WEN Eur, + Africa	Global, + Africa
				Pos 4	Pos 6	Pos 8	Pos 9	Pos 11	Pos 3	Pos 5	Pos 6	Pos 14	Pos 15
Apiaceae	<i>Notobubon</i> (<i>Peucedanum</i>)	7	9	4	5	6	6	6	2	2	3	8	9
Hyacinthaceae	<i>Drimys</i> / <i>Urginea</i>	6	8	4	5	7	7	8	1	2	2	9	9
Sapotaceae	<i>Sideroxylon</i>	6	8	4	5	7	7	7	2	2	2	9	9
Apiaceae	<i>Centella</i>	2	3	4	5	7	7	7	2	2	2	9	9
Capparaceae	<i>Boscia</i>	2	3	4	6	8	9	9	0	0	0	9	9
Parmeliaceae	<i>Parmelia</i> (+ <i>lichen spp.</i>)	1	1	4	5	5	6	6	3	3	3	9	9
Alzooaceae	<i>Carpobrotus</i>	26	35	4	4	5	5	6	2	3	3	8	8
Cucurbitaceae	<i>Kedrostis</i>	14	19	4	5	7	7	7	1	1	1	8	8

Table 4 displays the results of a straight count of presence and absence from 15 global regions, ordered by the total reports globally. The full list of taxa present at the 75 site complexes in the southern Cape was the baseline for the taxa included and the table above includes only the 54 taxa occurring in more than 8 global regions. If the baseline was a list of useful taxa from North America or from Australia for instance, the results would show a different selection of top genera. However the families occurring in the top 10 are those showing the highest residuals in the regression analyses so would stay very much the same but perhaps ordered differently.

The results show that 9 genera are reported as used from all 15 global regions. Of these 7 belong to families which occur in the top 20 families positively selected for in the results of the regression analysis (Table 5). 4 of these universally useful genera reported from all 15 regions, ie. *solanum*, *Asparagus*, *Ficus*, and *Aloe*, are among the top 10 taxa most frequently present at sites in the southern Cape and 3 genera are, ie. *Searsia* - *Rhus*, *Pelargonium*, and *Senecio* reported from 14 of the 15 global regions are also among the top 10 genera at southern Cape sites. An ancient universal pattern of selection seems evident for these genera. See all references in Appendix D1.

4.5 The use of regression analysis on a wide range of datasets

By using a straight count and percentage analysis in Table 4, it was possible to show which genera that occur frequently in the patches of vegetation found in the immediate vicinity of archaeological sites in the southern Cape are also frequently reported globally by traditional communities as useful plants. However it proved difficult to robustly demonstrate this hypothesis with conventional statistics. Regression and residual analysis emerged as a promising method for integrating and analysing the large quantities of primary and secondary data. Following the methods used by Daniel Moerman 1991, 1996, (and Moerman, Pemberton, et al., 1999), Haris Saslis-Lagoudakis et al., (2011), and Douwes and Crouch (2009), my site-species, and ethnobotanical species lists, were used as the basis for regression analyses presented in Table 5, page 71. Many permutations of the regression analysis were used to ensure a thorough comparison across datasets. The resulting positive residuals were ordered from highest to lowest, sets of data were combined and averaged to demonstrate overlaps between the datasets. Full species lists of southern Cape, global, and all other data are presented in the Appendices submitted with this thesis.



1. North America (Moerman)	4. South Africa a) Saslis-Lagoudakis b) Douwes & Crouch c) Van Wijk d) Site vegetation	5. Kashmir (Moerman)
2. Chiapas, Mexico (Moerman)		6. Nepal (Saslis-Lagoudakis)
3. Ecuador (Moerman)		7. Korea (Moerman)
		8. New Zealand (Saslis-Lagoudakis)

Fig. 6 – Map showing the areas covered by global regression data utilised.

Table 5 – Regression analysis results for southern Cape, Eastern Cape, South African, and global. Global data included full species lists from Dan Moerman and Haris Saslis-Lagoudakis (see Fig. 6 above), and full site-vegetation plus ethnobotanical species lists from my research for this thesis (Appendices a & B).

	A	B	C	D	E	F	G	H
Data regressed, residuals averaged then ordered and averaged again.	Southern Cape site vegetation	Southern & Eastern Cape site vegetation	Southern Cape site vegetation / southern Cape ethnobotany	Southern & Eastern Cape site vegetation / Southern African ethnobotany	Southern & Eastern Cape site vegetation / Global ethnobotany	Southern Cape ethnobotany	Southern Cape / Southern African ethnobotany	Global Ethnobotany (results of all datasets averaged)
Common to Top 20								
Asteraceae	1	1	1	1	1	4	1	1
Solanaceae	4	7	2	6	2	2	4	2
Lamiaceae	14	17	5	13	3	1	2	3
Anacardiaceae	3	2	3	7	8	7	10	13
Geraniaceae	7	8	4	5	4	3	5	6
Asparagaceae	6	4	8	10	7	12	11	[21]
Malvaceae	8	10	10	8	10	16	8	14
Common to Top 50								
Celastraceae	5	9	7	2	26	11	14	32
Apiaceae	19	16	12	21	5	8	29	4
Amaranthaceae (Chenopodiaceae)	15	12	13	16	36	14	22	39
Ebenaceae	9	5	11	9	[52]	15	13	[59]
Rubiaceae	14	11	14	9	28	23	3	31
Cucurbitaceae	33	31	26	18	22	20	26	23
Vitaceae	29	27	35	32	12	37	41	12
Zingiberaceae (Cannaceae)	0	0	9	11	26	10	12	19
Melianthaceae	[54]	[65]	42	28	21	17	31	8
Fabaceae	10	19	6	36	45	5	9	45
Menispermaceae	44	48	45	40	17	31	48	10
Sapindaceae	18	14	28	20	34	39	30	37
Important Families just outside top 50								
Alliaceae	[62]	[74]	43	23	23	9	28	15
Rutaceae	[91]	[70]	38	26	[54]	6	[61]	30

Regression analyses were run as described in Chapter 3.5, page 49. Table 5. presents the results of regressing various combinations of data in order to quantify how much overlap there is throughout southern Africa between site vegetation A B; site vegetation and ethnobotanical data C,D,E; to quantify the overlap in ethnobotanical plant use between the southern Cape, southern African E, F, southern African and global ethnobotanical data G; and finally all these vegetation and ethnobotanical datasets were regressed and averaged for a global overview H. **Asteraceae*, **Solanaceae*, **Lamiaceae*, **Anacardiaceae*, **Geraniaceae*, and **Malvaceae* all fall within the top 20 of all regression variables, with **Asparagaceae* rated at 21 in the final global regression. Within the top 50 are **Celastraceae*, **Apiaceae*, **Amaranthaceae* (*Chenopodiaceae*), **Ebenaceae*, **Rubiaceae*, *Cucurbitaceae*, *Vitaceae*, *Zingiberaceae* (*Cannaceae*), **Fabaceae*, *Menispermaceae*,. **Sapindaceae*. Three families, *Alliaceae* (including part of *Liliaceae*), *Melanthaceae* and **Rutaceae* show readings higher than 50, but as important southern Cape families are worth noting. Families marked with an asterisk * are all included in Table 3, page 62, presenting the top families at sites with more than 20 species present in each family.

This method was pioneered by Daniel Moerman (1991), and was intended to correct the bias for the likelihood of large families containing more useful species than small families. Research has shown that some families have many more medicinal species than chance would allow, while others far fewer (Moerman, 1996; Moerman, Pemberton, et al., 1999; Douwes, Crouch, et al., 2008; Saslis-Lagoudakis, Williamson, et al. 2011. In my analysis, the independent variable was the number of possible species in the family in the southern Cape (calculated from Manning, & Goldblatt, 2012; Vlok. Schutte-Vlok, 2010; and the SIBIS (now POSA - SANBI) data from the Southern Cape Herbarium and my personal data, of species collected in the area). The dependent variable was the number of species collected at the 75 sites, or reported as useful by participants in the six regions surveyed ethnobotanically in the southern Cape.

4.6 Percentage of sites where grouped genera in the top 50 occur together.

In Fig. 7 (below), the top five genera occur together at 52% of the sites. The range of localities for these 39 sites spread from the Coast, Outeniqua mountains, Northern Outeniqua foothills, Klein Karoo, Swartberg, and Gamka Mountain. It is apparent that the pattern is not governed by topography, geology, climate or altitude, but by some other process. which has brought the genera together at all these sites. In addition, the group of top 10 genera all occur

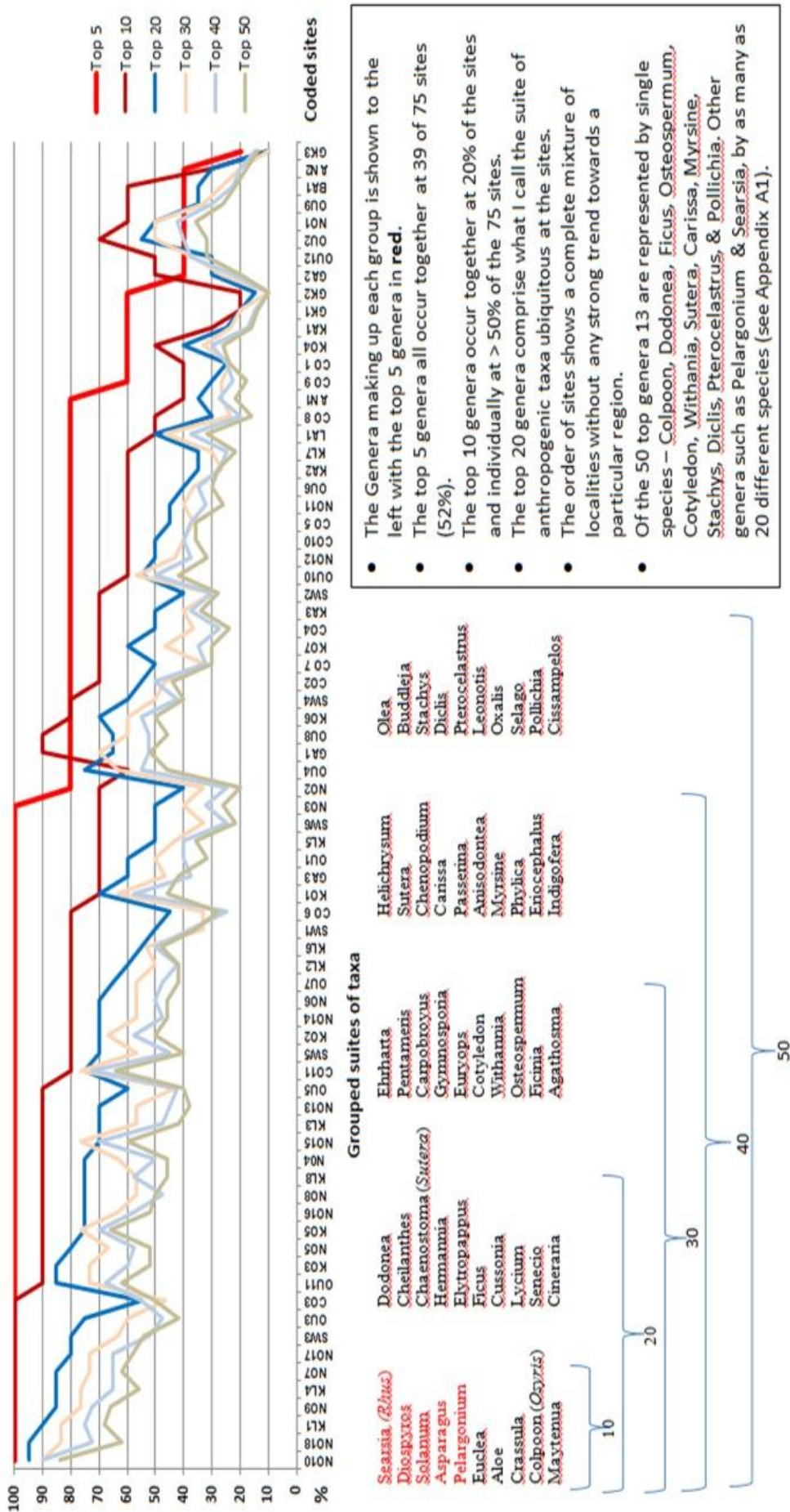


Fig. 7 - Percentage of sites where the groups of the top 5 and 10 genera are shown as suites of ubiquitous taxa occurring within 100m radius of each of the 75 site complexes in the southern Cape. Coded sites, CO = Coastal; LA = Langeberg; OU = Outeniquas; NO = Northern Outeniqua foothills; KL = Klein Langkloof; KA = Kamannassie Mountains; KO = Kouga Mountains; BA = Baviaanskloof; AN = Anyberg Reserve; SW = Swartberg; GK = Great Karoo (see Chapter 1, Fig 2, Map of sites, Page ??).

together at 15% of the sites, and are all reported as useful taxa belonging to the most important families used by traditional-indigenous peoples in the southern Cape, southern Africa, the whole of Africa, and globally (see Tables 4 & 5). Finally, all these genera have been reported as archaeobotanical remains, in the Cape provinces as well as throughout the world.

4.7 Conclusion – the problem with statistics

It was the large scale of the research, over a wide range of very different habitats and environments which allowed a pattern to emerge but which made quantification problematic. Irrespective of geographic distance between sites, there ought to be geographic convergence of taxa in a natural randomly occurring pattern, but low to no correlation between presence and geographic distance would support the hypothesis of a selection process overriding random natural processes. However, the results on running the Mantel test were marginally weighted for geographic correlation and therefore did not support a strong selection process. The insistence of quantification or use of statistics in all disciplines has increased over the years, but there are problems with this. For instance F.W. Went (1974) writes *“I am very little impressed by complicated and clever theoretical or mathematical constructions; in fact, I don't understand many of them. Nor can I follow or accept statistical analyses: if the facts don't speak clearly for themselves, no statistical treatment will make them palatable. I still stand on my earlier criticism of the over-use of statistics in biology.”* There is a pattern to the data presented in this thesis, and the regression results point to a trend for a selective rather than a random pattern. Although these results are not conclusive, an anthropogenic hypothesis is nevertheless a distinct possibility.

In this chapter I have given an overview of the integrated results using three sides of triangulated data collected. The way in which vegetation data from sites, ethnobotanical data from local communities and archaeobotanical data combine to show patterns of commonalities between them was the aim here. The integration of the global data and results from the regression analysis is intended to address the idea that plant and human migration seem to follow a similar or parallel route although I must make clear that this is not a unified same-time linear trajectory but a hop-and-skip, back-and-forth, punctuated movement for both plants and humans through deep time until the present. A comment made by Professor A.E. van Wijk (Botany, Pretoria University), is relevant here, *“... keep in mind that it is quite likely for statistical procedures to never be able to support a thesis premise or hypothesis. In*

fact, I suspect such support, if it exists, would rather come from field observations, logical argumentation and plain common sense. Also keep in mind that it is no failure if an hypothesis is rejected, or more correctly, falsified. Correctness is not a requirement for an hypothesis. An hypothesis is merely a tool and the only requirement is that it must be useful.”

The results in this chapter are augmented and further discussed in the following 5 chapters:

Chapter 5, Plants - Discusses the plants associated with archaeological sites and used by modern traditional and indigenous peoples in more detail, and discusses the wider implications of the results reported in this chapter.

Chapter 6, People – discusses the modern KhoeSan, their history, lifeways and beliefs in the light of the ethnobotanical survey results reported in this chapter.

Chapter 7, Place – discusses the geographical and topographical as well as historical aspects of the southern Cape and location of sites in general, in the light of the results reported on in this chapter. A detailed vegetation survey of 3 sites in the southern Cape is included to illustrate the densification of typical taxa into green walls at the sites.

Chapter 8, Detailed survey of distinctive vegetation patches at 3 archaeological sites in the southern Cape – situated in matrices of different vegetation types and occupying different geological, and topographical areas.

Chapter 9, Klasies River vegetation – consists of a previously published paper written after a full vegetation survey as part of the present archaeological project being undertaken at the Klasies River caves. This is an example of a fine-scale vegetation survey which would enable archaeological projects to more fully connect the sites to their surrounding environment and possible food, medicinal, and practical plant usage, while providing a reference collection to aid in identifying excavated plant remains at Klasies and in the area in general.

CHAPTER 5

Plants

“We can ascribe to man an ancient role in the modification of vegetation. He had habitual campsites; he wore paths out from them that became bordered by trailside weeds ... Seeds and roots were dropped along the trails and at the camps, and some of them grew and reproduced themselves. Kitchen refuse, thrown out about the camps, enriched the soil with ashes and nitrogenous matter, and new combinations of plants found advantage in the altered soil”. . . “if activity was maintained in the same direction, cumulative, and possibly permanent, effects were registered in the association and perhaps the evolution.”

-- Carl Ortwin Sauer, 1947

5.1 Introduction

This chapter discusses and examines results from analysing the composition of the distinctive thicket vegetation patches growing at the 75 sites complexes. A flexible and holistic paradigm is necessary to enable a wider and more realistic grasp of the importance of plants to all peoples, but especially to hunter-gather-herders and modern traditional-indigenous past and present, than is available when only the colonialist western academic paradigm is accepted. As described in Chapter 1, I undertook an ‘in-the-field’ and ‘on-the-ground’ systematic plant collection of all shrubs, trees, succulents, geophytes, grasses, and ferns growing in close association with 75 archaeological site complexes in the southern Cape, nine sites in the Eastern Cape, and six sites in the eastern Free State were included later to compare with the vegetation pattern observed in the southern Cape. Because the research was carried out over a period of 20 years it was possible to repeat collections at different times of the year at many of the sites enabling me to include many, but probably not all taxa. There are geophytes and annuals which are invisible at certain times of the year and easy to overlook. To my knowledge, taxa at archaeological sites have not been targeted for collection and research as thoroughly in any other studies.

5.2 Biomes and vegetation types of the southern Cape

Mucina and Rutherford (2006) list seven biomes and 23 vegetation units for this southern Cape area. The 75 sites lie within seven of these Biomes – Coastal Vegetation, Fynbos, Forest, Succulent Karoo, Albany Thicket, Nama Karoo and Great Karoo and 21 of the

vegetation units. Jan Vlok, Euston-Brown and Wolf (2008) list nine Biomes with 37 vegetation types for the same area, and the 75 sites fall within seven of these biomes and 24 vegetation types of respectively. There are no complete species lists for the Biomes or vegetation types to be accessed, but by comparing the species for each vegetation type in which the sites are located, with those listed as important species for that type in Mucina and Rutherford (2006) it was confirmed that the taxa present at sites fall within the Thicket Biome, subtropical thicket vegetation types, and the as-yet undescribed 'Fynbos Thicket.' Interestingly the sites themselves are seldom located within the mapped thicket types.

The total number of species available for selection from the Cape Core Flora alone is at least 9 400 species in 997 genera and 171 families (Manning, & Goldblatt, 2012), Albany Thicket was estimated at about 1558 species by Vlok, Euston-Brown, et al., (2003). If Nama and Succulent Karoo species listed in Deidre Snijman (2013) could be quantified for the southern Cape area covered in this thesis, the number would increase significantly. The southern Cape as defined here contains an estimated 7000+ species in about 500 genera (Manning, & Goldblatt, 2012; Cowling, Proches, & Vlok, 2005; SIBIS (now POSA). The odds for the top 50 genera comprising 238 species in 31 families randomly forming the core of these homogeneous small vegetation communities from coast to Karoo is low. The homogeneity of the vegetation patches appears too high for the pattern to have occurred randomly without significant selective external driving processes.

Most botanical research in the Western and southern Cape has concentrated on the distinctness of the Cape Floristic Region (Bolus, 1886; Cowling, Proches, & Partridge, 2009; Cowling, & Pierce S.M., 2009; Manning, & Goldblatt, 2012), and on the charismatic Fynbos with its high percentage of rares and endemics. The Greater Cape Floristic Region (GCFR) is considered to be the world's most diverse extra-tropical flora, both in terms of richness and endemism (Colville, Potts, Bradshaw, Measey, Snijman, et al., 2014). Most of this diversity is contributed by the floras of the Fynbos, Renosterveld and Succulent Karoo Biomes (Bergh, Verboom, Rouget, & Cowling, 2014). The GCFR region comprises 11,423 vascular flora species and 1119 genera of which 79% of the species and 22.2% of the genera are endemic (Esteban, Vlok, Kotina, Bamford, Cowling, et al., 2017). The typically small and homogeneous vegetation patches at archaeological sites surveyed in the southern Cape, although set in matrices of fynos, renosterveld, succulent Karoo, and forest, include few fynbos taxa and geophytes, and very few endemics, but do include many thicket genera from

widely dispersed pan-African and global families (Hoare, Mucina, Rutherford, Vlok, Euston-Brown, et al., 2006; van Wijk, Tusenius, et al., 2017).

5.2.1 Is site vegetation consistent with mapped vegetation types?

A comparison was made between the “important species” lists in “The vegetation of South Africa, Lesotho and Swaziland” (Mucina, & Rutherford, 2006) and the actual species at sites. Each of the archaeological sites was located within vegetation types on the Mucina and Rutherford vegetation maps (Mucina, & Rutherford, 2006) by means of a GPS overlay and using Global Information Systems (GIS) (performed by Johan Baard, Scientific Services, SanParks, Knysna). Site species lists were then compared with the important species listed in each vegetation type in the “The vegetation of South Africa, Lesotho and Swaziland.” A comparison was also made with “fynbos thicket”, an anomalous un-mapped vegetation type which Mucina and Rutherford (2006) confirm has not yet been formally studied.

The correlation of 11% between vegetation at sites and the Mucina and Rutherford (2006) important species, indicates that the species growing close to the sites and forming the dense green walls of thicket vegetation do not correlate well with the surrounding vegetation types and are anomalous (Mucina, & Rutherford, 2006). The low percentage match indicates that the species included in the site thicket patches were not recognised and mapped. The only vegetation type with a good match was FRI 1 Kango Limestone Renosterveld at 64%, but note the caveat – as Mucina and Rutherford only listed what are ‘important taxa,’ many taxa not classed as important were absent. No complete database is available from the authors, nor from SANBI in Pretoria.

The site-vegetation patches do however, conform most closely to Mucina and Rutherford’s ‘Fynbos Thicket’ (Mucina, & Rutherford, 2006, Table 6. page 79) which they describe as “*occurring in fire-sheltered habitats embedded as fragments within sandstone, quartzite and granite fynbos . . . possibly ‘pre-fynbos’ relicts of plio-pleistocene subtropical woodlands that dominated the south-western Cape*”. The lists of species given for this unmapped fynbos thicket conforms most closely to the species lists generated during my research (see Table 6 below), and, interestingly they note that - “*.... the fynbos thickets have never been the subject of an exclusive enquiry. - - Due to the very limited extent of patches of fynbos thicket and virtually no floristic data - - this type was not mapped*”. Could these un-surveyed anomalous site patches forming mosaics within fynbos and renosterbos, and composed almost entirely of

plants useful to humans (see Chap 6.3, Table 11, 122), perhaps be describing archaeological selection and be of anthropogenic origin? My survey could initiate a more detailed study of this anomalous ‘Thicket Fynbos’ and its intriguing links with archaeological sites. In the Fynbos thicket type, the species overlap of 65% suggest an independent process due to non-random selection of some kind, and at least partially originated by hominids and humans

Table 6 – Comparison of site vegetation with Mucina and Rutherford’s important species.

Mucina & Rutherford (2006)		% Match
	Fynbos Thicket (page 76-78)	65%
FS 8	Blombos Strandveld	14%
FS 9	Groot Brak Dune Strandveld	38%
FFg 5	Garden Route Granite Fynbos	3%
Foz 1	Southern Afrotropical Forest	0%
FFh 9	Garden Route Shale Fynbos	0%
FFs 20	Tsitsikamma Sandstone Fynbos	4%
FFs 15	North Langeberg Sandstone Fynbos	2%
FFs 18	North Outeniqua Sandstone Fynbos	15%
FFs 18 } FRs 16 }	North Outeniqua Sandstone Fynbos - boundary with - Uniondale Shale Renosterveld	25%
SKv 11	Eastern Little Karoo	15%
AT 2	Gamka Thicket	16%
FFb 3	Central Inland Shale Band	0%
FFs 26	South Kamannassie Sandstone Fynbos	0%
FFs 27	Kouga Sandstone Fynbos	3%
FFs 28	Kouga Grassy Sandstone Fynbos	6%
FFh 3	Swartberg Shale Fynbos	10%
FRI 1	Kango Limestone Renosterveld	64%
AT 3	Groot thicket	3%
FRs 6	Matjiesfontein Shale Renosterveld	5%
SKV 8	Western Little Karoo	5%
FFs 23	North Swartberg Sandstone Fynbos	3%
SKv 13	Prince Albert Succulent Karoo	7%
Average correlation		11%

5.2.2 Vegetation at southern Cape, Eastern Cape, and eastern FreeState sites.

The nine sites in the Eastern Cape are all in the Grahamstown area and were surveyed to see if the same taxa which were most frequently found at southern Cape sites were also found at the eastern Cape sites. The Eastern Cape sites were very reminiscent of the southern Cape

sites, in Witteberg and Sandstone quartzites. Thicket is widespread around Grahamstown and the sharp edge between thicket site vegetation and the surrounding area is not always as obvious, but the densification towards habitation sites and formation of green walls remain at the core of each site remains very similar. There is a 93% correlation with the top 30 genera in the southern Cape at sites, with only *Dodonaea* and *Ehrharta* missing in the Eastern Cape list. *Dodonaea* is not common in that area, and as I was not collecting Poaceae at that time, *Ehrharta* spp. could well be present but were not noted or collected. The six eastern Free State sites were surveyed for the same reason and are located in the Ladybrand, Clocolan area close to the Lesotho border. In the eastern Free State most of the surrounding vegetation was grassland and the dense dark green walls of thicket could be seen quite clearly at a distance indicating sites. However, there is only a 50% correlation with the top 50 southern Cape genera. Most of the sites visited were sites regularly visited by interested people and tourists and located in moderate to severely altered agricultural landscapes. However, thicket species remain the most frequent and plant families most frequently present remain consistent after regression analysis with the typically high scoring families elsewhere.

5.3 Thicket vegetation, ancient and widespread

Thicket was only recognised as a biome fairly recently (Cowling, 1983; Vlok, Euston-Brown, Cowling, & Hoffman, 2003; Cowling, Proches, & Vlok, 2005). However, it is recognised as ancient and possibly ancestral (Cowling, Proches, & Vlok, 2005; Mucina, & Rutherford,

Table 7 – 30 genera most frequently present at 75 southern Cape sites, nine Eastern Cape, and six eastern Free State sites.

Family	Genus	75 sites	East Cape	East Freest	90 sites
Anacardiaceae	Searsia (Rhus)	219	26	16	261
Geraniaceae	Pelargonium	108	7	0	115
Asparagaceae	Asparagus	100	19	1	116
Ebenaceae	Diospyros	93	17	6	115
Solanaceae	Solanum	93	7	4	105
Crassulaceae	Crassula	80	20	1	101
Ebenaceae	Euclea	68	12	0	80
Asphodelaceae	Aloe	65	10	0	85
Malvaceae	Hermannia	53	5	2	60
Scrophulariaceae	Chaenostoma (Sutera)	46	6	0	55
Sinopteridaceae	Cheilanthes	46	6	2	53
Santalaceae	Colpoon (Osyris)	45	[3]	[3]	45

Family	Genus	75 sites	East Cape	East Freest	90 sites
Celastraceae	Maytenus	44	1	3	48
Sapindaceae	Dodonaea	37	0	0	37
Solanaceae	Lycium	37	6	1	44
Moraceae	Ficus	33	9	0	42
Asteraceae	Elytropappus (Myrovernix)	31	3	0	34
Asteraceae	Helichrysum	30	5	7	41
Poaceae	Ehrharta	29	0	0	29
Araliaceae	Cussonia	28	7	1	36
Asteraceae	Euryops	28	4	0	32
Asteraceae	Cineraria	27	4	3	36
Aizoaceae	Carpobrotus	26	3	0	29
Amaranthaceae	Chenopodium	26	4	2	34
Crassulaceae	Cotyledon	26	7	0	33
Poaceae	Pentameris (Pentaschistus)	26	0	0	26
Celastraceae	Gymnosporia	25	6	2	29
Rutaceae	Agathosma	25	2	0	27
Asteraceae	Osteospermum (Chrysanthemoides)	24	3	0	26
Solanaceae	Withania	24	1	0	25

2006; Dupont, Linder, Rommerskirchen, & Schefuß, 2011), from 10 million to 120 million years old, widespread, and following the mountain chains into central Africa and the Rift valley in particular, and even further via the Nile corridor, into North Africa and across into the Mediterranean and Levant (Quezel, 1978; Moll, Campbell, Cowling, Bossi, Jarman, et al., 1984; Wu, & Loucks, 1995; Linder, 2003; Galley, Bytebier, Bellstedt, & Linder, 2007; V..R. Clark, Barker, & Mucina 2011; Dupont, Linder, et al., 2011; Potts, Hedderson, Franklin, & Cowling, 2013, Franklin, Potts, et al., 2015). Thicket types sharing common genera can be traced globally (Cowling, Proches, Vlok, 2005), and interestingly, prehistoric human migration routes follow similar paths. Richard Cowling, Serbian Proches, and Jan Vlok (2005) describing Subtropical Thicket, conclude that “. . . is an ancient formation, extending back at least to the Eocene and derived initially from elements in the forest formations that prevailed in the Upper Cretaceous and early Palaeogene period. As a biome, thicket is not uniquely southern African, being part of a formation that was globally widespread in the Eocene and which is extant in many parts of the world.” The majority of taxa present at the southern Cape sites today are classified as thicket. The thicket patches I studied, form an intricate vegetation mosaic which is a recognised phenomenon and is by definition patchy. Wu J., Loucks O.L., (1995) supporting chaos and complexity theory, write “Both natural and anthropogenic factors or processes generate patchiness in nature across a wide range of

spatial and temporal scales”. The thicket patches surveyed at the 75 sites complexes are an integral part of the widespread southern Cape mosaic of various vegetation types (Mucina, & Rutherford, 2006). But large areas of the southern Cape vegetation maps covering the sites I surveyed, display no thicket, mosaic or patches, indicating it has not yet been mapped or recognised as permanent. The thicket mosaics that are mapped in the southern and Eastern Cape show overlap with a few site localities. There is much written about the encroachment of thicket into grassland and farmland (Wigley, Bond, & Hoffman, 2010), but little definitive research into thicket and the natural vegetation in South Africa before 1652. The history of South Africa is dominated by humans and information on Holocene pre-colonial thicket vegetation is nowhere to be found.

The distinctive small vegetation patches at sites are composed of shrubby thicket taxa up to about 2 metres maximum including *Searsia*, *Diospyros*, *Lycium* and *Euclea* species, a typical understory of climbers and scramblers such as *Asparagus*, *Cissampelos* and *Kedrostis*, small woody perennials with deep roots such as *Indigofera*, *Chaenostoma* or *Sutera*, *Hermannia*, herbaceous plants including *Solanum*, *Silene*, *Cineraria*, etc., succulents like *Crassula*, *Cotyledon*, *Carpobrotus*, *Euphorbia*, and a few annual ruderals or commensals such as *Chenopodium*, *Sisymbrium* and *Urtica* (early exotic introductions, or ancient?). The patches are sharply distinct from surrounding vegetation and include only a few elements of the forest, renosterveld, succulent Karoo, and fynbos (Mucina, & Rutherford, 2006; Cowling, Proches, & Vlok, 2005), which form the dominant matrices of the mosaic in which the thicket patches associated with the sites occur.

5.3.1 Big genera and big families.

The typical thicket patches associated with archaeological sites are not restricted to the southern, Western, or Eastern Cape, but are widely dispersed throughout southern Africa, Africa as a whole, and around the globe (see Appendix C and D). The majority of the site taxa belong to widespread “Big Families” (Mabberley, 2008; Leonti, Cabras, et al., 2013; Leonti, 2015) and “Big Genera” (Frodin, 2004). They pose a problem taxonomically, and are not prominent nor popular as a field of study among botanists or systematists, and they certainly have not been as well researched as endemics, rares, or the Cape fynbos. As Frodin (2004) writes, “*Their size has rendered them difficult, if not impossible, to study in their entirety; there have been few full revisions since the nineteenth century*”. Small, rare and endemic genera get more attention as they contain species listed as vulnerable or near extinct

and are seen as indicators of high diversity vulnerable vegetation types seen as a priority for study today.

Many of the taxa present in the thicket patches and green walls are also listed as global “weeds” (Holm, Pancho, et al., 1979; Randall, 2017a, 2007b), which can survive in a wide range of habitats and climates. The normal two to five year post graduate degree is too short to study large and widely dispersed families and genera in enough detail, and funding for longer studies is difficult to motivate. However, families such as *Asteraceae*, *Solanaceae*, *Lamiaceae*, *Anacardiaceae*, *Geraniaceae*, *Malvaceae*, *Celastraceae*, *Apiaceae*, highlighted in my research, are among the largest families, with a surprising number of genera common to different Biomes, countries and climates (Chapter 4, Tables 5 & 6). Big families and genera with wide distributions, and cosmopolitan commensal weeds, are responsible for many of the phylogenetically “hot” groups (Leonti, Cabras, et al. 2013; Saslis-Lagoudakis, Williamson, et al., 2011).

Why these Families and Genera are so large is an ongoing debate, and many theories have been proposed from the great age of the basal clade giving time for speciation to occur (Cowling, Proches, & Vlok, 2005), to climate changes and geological upheavals to as the driving forces for spurts of speciation (Gould, & Eldredge, 1977; Pagel, Venditti, & Meade, 2006; Johnson, & Tricker, 2010), or speciation and mutation occurring due to isolation (Rieseberg, & Willis, 2007). These would doubtless all have played a role in creating the big genera and families. When mammals, primates, and hominins began to migrate between continents, the range the plants covered was greatly extended. Co-migration or parallel-migration allowed for co-evolution over time, and might account for the big families, big genera, and commensal weeds which occur along early migration routes, at habitation sites, and in Ice Age refugia (Potts, Hedderson, et al., 2013). Refugia as an concept, explains how certain families and genera became indicator taxa persisted through time in association with humans, and can trace human and plant migration through time (Sauer, 1947). Research into phylogenetic histories and chemotaxonomic properties of big families and genera associated with early humans through time, will uncover these links, or disprove them.

Table 8 – Big Genera, Big Families, and medicinal genera: References: Frodin (2004); Kew State of the World's Plants (2017); Mabberley D.J., (2008). A. Spp. per family globally B. % spp. Medicinal. C. Families ordered Global Ethno Regression D. Families ordered Global Archaeo + Ethno Regression; E. % of 75 sites; F. Global out of possible 15 zones; G. Spp. per genus globally

Family	A	B	C	D	Genus	E	F	G
Apiaceae	>3700	14.46	4	5	Anginon (SA)	20	1	[c. 7]
Asteraceae	32 581	7.17	1	1	Senecio	36	14	c. 1250
Araliaceae	1325		17	16	Cussonia (A)	37	6	[25]
Anacardiaceae	c. 860		13	8	Searsia + Rhus	98	14	[200]
Apocynaceae	6314	13.59	15	18	Carissa	28	11	[37]
Asparagaceae	3102	11.82	20	7	Asparagus	82	15	[212]
Celastraceae	1300		31	25	Maytenus	49	12	[200]
Commelinaceae	740		32	38	Commelina	12	10	[170]
Crassulaceae	1410		86	84	Crassula (A)	64	7	[200]
Cyperaceae	5539		95	104	Cyperus	12	15	839
Ebenaceae	754		58	52	Diospyros	92	12	767
Euphorbiaceae	6462	13.58	19	27	Euphorbia	19	15	1836
Fabaceae	20 856	11.26	44	45	Indigofera	24	12	700
Geraniaceae	700		6	4	Pelargonium	76	14	[280]
Lamiaceae	7587	13.71	3	3	Salvia	5	13	945
Malvaceae	4225	11.75	13	10	Grewia (A)	9	11	[150]
Menispermaceae	1010		9	17	Cissampelos	23	12	[420]
Moraceae	3102	22.54	34	37	Ficus	41	15	750
Polygalaceae	>700		41	46	Polygala	12	13	500
Ranunculaceae	2450		5	6	Anemone	9	9	[144]
Rubiaceae	11 686	7.53	30	28	Canthium (A)	22	9	[50]
Sapindaceae	1450		36	34	Dodonaea	49	11	[68]
Solanaceae	c. 3000	13.64	2	2	Solanum	85	15	c. 1250

5.3.2 Weeds, co-evolving and co-habiting with thicket

Weeds, their designation and history as co-evolving and useful to humans, is another area of research which is neglected from a biocultural as well as a botanical taxonomic point of view. Botanists seem to go either into ‘indigenous plant’ research and taxonomy, or into ‘alien plants’, or ‘problem weeds’ research’. Weeds, like big genera and families, are not charismatic fields of study, and are too often neglected as useful instead of problematic plants, (but see Dold, & Cocks, 2000; Stepp, & Moerman, 2001; Njoroge, Bussmann0 Gemmill, Newton, & Ngunmi, 2004). The problems of invasive aliens provides a modern research field second only to the overpowering one of Climate Change today (Mack, &

Lonsdale, 2001). The majority of these alien problem weeds which are so intensively studied today, are those plants listed by official alien invasive agencies and NGO's as invasive and requiring eradication. Vast amounts of public and private money, labour and time, are spent on removing and destroying these "dangerous invasives" with poisons which kill numbers of valuable plants, pollinators, and animals. The 'weeds' listed by (Holm, Pancho, et al., 1979; Randall, 2017a), refer mainly to taxa that have proved to be weedy in South Africa and world-wide, and that are able to survive and spread without the aid of humans. Although some of the weeds listed by Holm and Randall are also classified as alien invasives (Randall, 2017b), none of the site taxa fall into this class which need to be eradicated: Nor incidentally do they fall into the narrow group of domesticates that most of the world relies on for food today.

Weeds as medicinal and food plants rate much higher locally and globally than is generally recognised by academia (Stepp, & Moerman, 2001; Dold, & Cocks, 2000). The present popularity for "foraging" in urban habitats is becoming part of modern life across the world and even becoming a fashionable pastime among the so-called "Greenies", who care, and want to live as lightly as possible on the earth, emulating hunter-gatherer lifeways. There is nevertheless a need to look at the role so-called weeds have played in the evolution of humankind. Research by Stepp and Moerman (2001) and Posey (1984) has found well documented proof that many traditional communities harvest more food and medicinal resources from disturbed areas, fallow or abandoned farmland, and secondary growth forest. In other words, where humans have had a large impact on the vegetation already, much as they had on the vegetation surrounding archaeological sites. In addition many of the top weed families are those that are important for medicinals globally, such as Asteraceae, Fabaceae, Euphorbiaceae, Amaranthaceae, Solanaceae, and Malvaceae (Moerman, Pemberton, et al., 1999; Holm, Pancho, et al., 1979; Randal, 2017a).

In the South African context, most alien weeds, usually considered as problem plants are considered to have been introduced after colonisation and especially by the British in horse fodder during the Boer wars. However as can be seen in Appendix D, some of these have been excavated at archaeological sites and date thousands of years back. At Border cave a wooden poison applicator, dated to about 25 000 years ago, retains residues with ricinoleic acid, derived from *Ricinus communis*, supposedly an alien weed in South Africa (d'Errico, Backwell, Villa, Degano, Lucejko, et al., 2012) and found in Sibudu cave deposits (Wadley,

2004). *Withania somnifera* similarly requires further study. The presence of ancient beads recovered in archaeological sites mirrors the probable routes by which alien seeds travelled. In her book “The Side of the Sun at Noon”, Hazel Crampton (2014), has researched the possible routes by which plants such as the Weeping Willow (*Salix babylonica*), and Dagga (*Cannabis sativa*), might have reached inland South Africa before the Dutch settled and travelled there. She makes a credible case for their entry from Mozambique via Arab and Indian traders who had used the monsoon (trade) winds for thousands of years to trade on the East African coast. From there goods moved across the continent with relays of traders travelling West, South and North.

5.3.3 How far back could site-taxa have been present and similar?

How far back in time the same genera found at present might have persisted at the sites and just how similar to modern genera they were is difficult to say, new techniques and methods constantly shift the goalposts. Vogel (1983), considered that major shifts in vegetation would have been minimal since 18 000 ybp. and Janette Deacon and Lancaster (1988) considered it is safe to say that for at least 5000 ybp the indigenous vegetation has remained stable, discounting the more recent obvious impacts of modern agriculture, forestry and rampant development. Geologically the southern Cape has been relatively stable for 5.3 million years since the early Pliocene (Goldblatt, 1997; Wadley, 2004), and over time caves, shelters, and cliffs formed. It is generally accepted that from 12 000 ybp, at the end of the Last Glacial Maximum, the climate has been relatively stable in the southern Cape (Goldblatt, 1997), while even during the glacial the southern Cape was less affected than areas further north (Goldblatt, 1997; Quick, Meadows, et al. 2016). From on-going, but unpublished research into macro- and micro-botanical remains in much older sediments at sites such as Klasies River, Sibudu and Bushman Rock, preliminary results indicate that similar vegetation communities have been present in close proximity to those sites for a long time (Wadley, 2004).

Writing about the vegetation surrounding Cave of Hearths at Makapansgat Brian Maguire (1980) writes - “*Within a radius of 8km of the Makapan Limeworks 117 edible plant species occur. . . Every plant species identified in the fossil pollen studies (Rayner, Moon, & Masters, 1993) from the approximately 3-million-year-old member 3 at the Makapam Limeworks is still locally present.*” Of the food genera present at Makapansgat three million years ago, 52% of the genera are present at the southern Cape sites today (Peters, & Maguire, 1981). Bonnefille (1984, 2010), indicates that from East African pollen research going back three

million yrs. and taking into account vegetation zone shifts due to climate, it is possible to infer that similar vegetation was present at the oldest hominid sites.

The paper by Quick, Meadows, et al., (2016) describes a pollen analysis of Vankerwelsvlei situated just inland of Sedgfield; their results show that the vegetation present up to 110 000 years ago was very similar to that which is present today at the 75 sites surveyed in my research. Similarly, a pollen analysis of the Norga wetlands by Scholtz (1986), gives much the same results. As both of these last two surveyed areas are central to the southern Cape coastal platform south of the Outeniquas which is included in my research, the indications are that since the beginning of the last Glacial these taxa have been present in the area and were predominant in the Vankerwelsvlei area. Pollen analysis has its problems however, not all plants drop as much pollen as wind pollinated taxa do, and some pollen types are shorter lived than others or decompose quicker in a wet substrate. It is impossible to say without pollen analysis of sites whether these taxa were present or densified at archaeological sites over that period, but one can say that they were present and available for use by human inhabitants of the general area and that the dense communities of these plants at sites today were either densified through human use or they are relict patches which persisted at the sites because of favourable abiotic conditions. Karl Butzer (1964) noted that macrobotanical remains are indispensable as auxiliary evidence in palynological interpretations, yet more than 50 years later true interdisciplinary research linking botanical taxonomic skills in identifying macro- and micro-botanical remains remain rare, exceptions include Bonnefille (2010) in East Africa, John Parkington, Caroline Cartwright, et al. (2000) at Elandsbay, South Africa, Christine Sievers (2011), and Lyn Wadley with Christine Sievers (2013), at Sibudu cave, South Africa.

5.3.4 Resource rich green walls of Thicket

Thicket is the ideal vegetation to accompany humans world-wide and to provide a wide range of resources, shelter, and protection at habitation sites (see Chap 6, Table 11, page 122). Thicket vegetation provides resources year-round as the taxa in general are long-lived, re-sprouting, ever-green, non-deciduous, intricately branching, and densely foliated shrubs or small bushes, with minimal leaf drop occurring sporadically throughout the year. The majority of species bear edible fruits, sometimes edible leaves, edible or useful bark and sap, and provide medicines, skin care treatments, cordage, fuel and tinder. I list these from personal observations during a walks-in-the-veld with Elsie Jonas of Boomplaas, Lizzie Stuurman of Touwsrante, Maria Kruger of Prutkraal, and Steffie Williams of Wilderness

(and see ethnobotanical references in Appendix B). Flowering and fruiting times are aseasonal, meaning that same-species individuals do not fruit all at one time even within a relatively small area (personal observation and [Pierce, & Cowling, 1984](#)). Recruitment does not depend on seed, ie: all the fruit can be eaten as recruitment does not depend on seed. Plants grow and spread from root ramets and re-sprout after defoliation, frost, and fire. Many individual thicket plants are clonal and ancient, perhaps thousands of years old (personal comment by Jan Vlok, and see [Midgley, & Cowling, 1993](#); [Hoare, Mucina, et al., 2006](#)).

The thicket patches form dense green walls growing across and often completely hiding the site entrance, and extending immediately below the archaeological site. Some patches are only two metres in width, a few extend up to 100 metres. Occasionally the typical thicket vegetation occurs immediately above the site often where there is a good level view site. These level view sites frequently display scattered tools, flakes and debris. There is an overall similarity in geographical and landscape features such as the invariable presence of cliffs and rocks providing shelter from sun, wind and fire, and an increase in water run off. However, the thicket patches are anomalous in that irrespective of the surrounding vegetation matrix, the biome, or the climate, the composition of taxa in the close vicinity of each site consists of similar combinations or suites of taxa.

There is of course true that animals other than hominids and humans, which inhabited or used these sites over time, would have had an effect on the composition of these green walls. There is also the possibility that the pockets and green walls of subtropical ticket present today are residual patches of a widely distributed vegetation type/biome that have persisted around caves and rocky areas due to the favourable local habitat - space and additional heat provided by the rocks, protection from fire, increased run-off and concentration of rain, plus regular disturbance and localised fertilization by various animals, especially baboons, porcupines, rock rabbits and birds. Densification of vegetation and soil enrichment may equally plausibly be explained by non-human effects, animals have long been considered more important as dispersal agents, than humans – but are they? Animals would have used these plants as food and very possibly as self-medication. However, the whole range of uses that homonins and modern humans put them to are far wider, fuel, construction, tools, and weapons. Given the wider range that encompasses all the most common taxa present in these vegetation patches and green walls, inferring human use is unavoidable.

Thicket has a very high incidence of taxa which bear edible fruits, and many have medicinal properties, and other uses. The diversity of seed sizes, fruit sizes and fruit types peaked in the Eocene around 55 to 50 Million years ago. Fleshy-fruited plants account for 36–42% of woody species in temperate forests and 22–56% in Mediterranean scrublands (Jordano, 2000), and 70–94% of woody species in tropical forests (Fleming, Breitwisch. & Whitesides, 1987). 22 % of the site taxa bear edible fruit, and 76 are medicinal (Table 9, page 89; Chap. 6, Table 11, page 122).

Although some of the fruits or seeds might be considered too small to be an important food resource, they would have been useful even in small amounts for their sweet or sour taste, and for the value in calories, oils, or vitamins they provided (Milton, 2003). Even small amounts of fruit and seed would have formed a dietetically important part of a meal or as a quick snack eaten where and when they were found. Wild fruits still have great value as tasty or nutritious snacks for growing children or women needing the extra vitamins for childbearing or breast feeding. Primate use of even the smallest of fruits and seeds is a good example of how they might have been used (Lambert, & Garber, 1998; Chapman, Bonnell, Gogarten, Lambert, Omeja, et al., 2013), 29% of the site-taxa are also eaten or used medicinally by primates (Huffman, 1997). The fruiting plants found at the sites do not all carry fruit at the same time or even in the same season. I recently found about 20 *Euclea polyandra* shrubs at one site, with only two of them bearing fruit, and one or two in flower. The same holds true for many of the *Searsia* (*Rhus*) species - of four different *Searsia* species at this same site, only one species bore fruit and of that one species, only two of the 15 plants were in fruit while another five of the same species were in flower! In the southern Cape it is often impossible to say for sure that a particular species fruits at any particular time of the year – they do their own thing.

Table 9 – Percentage of edible and medicinal plants used by humans, and primates (see Chap 4, Table 1, page 54).

	Edible fruit	Medicinal	Food and Other uses
Human	22%	76%	24%
Primate	16%	5%	8%

5.4 Fire as evolutionary driver and tool.

One of the most potent tools for managing their landscape in prehistoric times was fire (Sauer, 1950, 1975, 1976; Dimbleby, 1978; Wrangham, Jones, Laden, Pilbeam, Conklin-Brittain, et al., 1999; Pausas, & Keeley, 2009). When hominids first used fire purposefully or learnt to make it themselves is not yet certain nor agreed. However around 1,500,000 ybp. the presence of hearths in which there is evidence of fire as seen from the charcoal macrofossils deep within Wonderwerk Caves in South Africa (Berna, Goldberg, Horwitz, Brink, Holt, et al., 2012; Beaumont, 2011), is the earliest proof of fire used for cooking. Various dates from China (Weiner, Xu, Goldberg, Liu, Bar-Josef, et al., 1998) and Israel (Alperson, 2008) have also been proposed. It is possible that humans first moved into shelters and caves in order to safely be able to cook over open hearths in a sheltered and enclosed environment out of the rain and wind. Fire enabled them to keep predators at a distance at night, to keep warm, and prepare foods that had previously been too fibrous and tough to eat (Carmody, & Wrangham, 2009). The thicket vegetation surrounding the sites is notoriously difficult to burn and if it does burn, coppices readily and quickly. With the right conditions, it would have been possible to burn large areas above the sites on higher mountain slopes and below in the valleys, without posing a danger to the immediate dwelling area. In addition the collection of fuelwood would impact on the extent and density of the vegetation within collecting distance, and on the individual species used for fuel. The effect on vegetation, animal and insect movement and densities would have been considerable

Unnecessary clearing of thicket vegetation from sites in combination with fire, are threats to site integrity and especially to the continued presence and quality of the paintings. I visited and collected at KL1 (see details of this site in Chap 8.3.2, page 163), 13 times over the past 20 years. On two occasions vegetation was hacked indiscriminately by untrained workers supposedly clearing alien weeds, and piled up against the paintings on the cliff walls. In early 2017, a fire burnt at least some of the outlying thicket vegetation and all the dense green wall surrounding the core habitation site, but no damage to the interior and did not reach the painted walls. As a result of a couple of good years with enough rain key taxa in the thicket

Table 10 – Flammability test for typical green wall vegetation

Plant Name	Before	Before	Total a	Flame Height	Duration of flame on coals	Duration flame in wind	Total b	Rating	Results				
	Singe @ 5-2cm	Flame on coals							Retardant	Resistent	Semi- resist	Flammable	Spit Explode
	Sec 0 = 65+	Sec 0 = 65+		cm	Sec	Sec		a/b					
Rapanea melanophloeos	30	65	95	1	0	0	1	95.0	x	x			
Trimeria grandifolia	15	65	80	1	0	0	1	80.0	x	x			
O moniliferum - young leaves	65	65	130	1	1	0	2	65.0	x	x			
Viscum capensis	50	65	115	1	1	0	2	57.5	x	x			
Viscum rotundifolia	50	65	115	1	1	0	2	57.5	x	x			
Anthospermum aethiopicum	23	65	88	1	1	0	2	44.0	x	x			
Searsia lucida	65	60	125	3	2	0	5	25.0	x	x			
Syncarpha paniculata	65	10	75	2	1	0	3	25.0	x	x			
Searsia chirindensis	65	60	125	5	3	0	8	15.6		x			
Searsia crenata, Spallida	65	60	125	3	5	0	8	15.6		x			
Pterocelastrus tricuspidatus	65	65	130	8	5	0	13	10.0		x			
Euclea undulata	45	20	65	2	5	0	7	9.3		x			
Podalyria burchellii	20	15	35	2	2	0	4	8.8		x			
Diospyros dichrophylla - young	20	65	85	5	5	0	10	8.5		x			
Gymnosporia bachmannii	65	50	115	7	10	5	22	5.2		x			
Osteospermum moniliferum + flws	45	60	105	2	20	1	23	4.6			x		
Grewia occidentalis	30	10	40	0	10	0	10	4.0			x		
Helichrysium foetidum	65	35	100	10	20	2	32	3.1			x		
Tarchonanthus littoralis - young	63	5	68	10	10	15	35	1.9			x		
Relhania calycina	65	15	80	15	29	5	49	1.6			x		
Erica discolor subsp. speciosa	30	40	70	20	20	5	45	1.6			x		

patches and green wall had re-grown and this protected the paintings and site. However, the rest of 2017 was particularly dry, and the whole site has once again been burnt. This time everything is completely burnt away, right up to the walls and the well known rock art panels of “falling Buck” might well have been destroyed. (Note – a subsequent visit to this site in early 2018 showed that the paintings had not suffered any damage and there did not appear to be any deterioration, and the typical vegetation was beginning to recover slowly once more.)

5.5 Botanical Taxonomy and identification of plants.

“Taxonomy (the science of classification) is often undervalued as a glorified form of filing ... but taxonomy is a fundamental and dynamic science, dedicated to exploring the causes of relationships and similarities among organisms. Classifications are theories about the basis of natural order, not dull catalogues compiled only to avoid chaos.” ... [Stephen Jay Gould](#), (1989, Chap III p. 98).

“Man is by nature a classifying animal. His continued existence depends on his ability to recognise similarities between objects and events in his physical universe and to make known these similarities and differences linguistically” .. [Brent Berlin](#) (1973).

The identification of plants is a major focus in the context of this thesis. To ensure a fully interdisciplinary focus, I have attempted to integrate the vegetation data fully with the ethnobotanical and archaeobotanical data. The correct use of botanical taxonomy is vital to any research where the environment and vegetation plays a part, and is certainly central to ethnobotany and archaeobotany. Yet, identification of plants using up-to-date botanical taxonomy is seldom fully integrated into anthropological or archaeological studies. Although the terms “vegetation” and “landscape” appear quite frequently in anthropological and archaeological publications, this is merely “botany” in the abstract, with no real interdisciplinary sharing of concepts and detailed taxonomic studies. Frustratingly this abstract use of ‘vegetation’ and ‘landscape’ is even present in botanical and vegetation studies, where complex statistical analysis and diagrams support theories and conclusions with few or no underlying comprehensive taxonomical lists to be seen or accessed. There are notable exceptions, usually where one or more authors are anthropologists, archaeologists, or social scientists, and at least one is a botanical taxonomist (for example see [Cowling, Cartwright, Parkington, & Allsopp, 1999](#); [Parkington, Cartwright, et al., 2000](#); [Dold, & Cocks, 2002, 2012](#); [Cocks, & Dold, 2006](#); [van Wijk, Tusenius, et al., 2017](#)). Less frequently one researcher fills the role of both taxonomist and anthropologist as in Ben-Erik van Wyk’s

work (2009; 2012), and as I do here. Problems arise when non-botanical researchers seek cursory short-term “expert” botanical taxonomic help, but do not include the taxonomist as fellow researcher and co-author, or rely heavily on help from online Google searches and perhaps a library.

It is often said that the history of taxonomy is as old as language (Manktelow, 2010) and she proposes that the need for classification could have been one of the founding reasons for the evolution cognition and possibly of language. However all animals including Primates, have to have this ability to pass on their knowledge of plants to a lesser or greater extent, many have to teach their offspring what to eat and where to find it. From birds through to carnivores most young need a period of care and mentorship by parents before they can go off on their own. This means that learning from example and practice can be taught without formal language and it is very probable that the earliest primates were using the same plants humans use now and learnt about them from their mothers, probably passing the knowledge down to the earliest hominids. Whether one uses Latin binomial names, traditional vernacular names, or just point and show, is not really going to make much difference, except possibly in the number of names the individual learns and remembers. Robin Dunbar’s (2010) fascinating study revealed that the average number of friends and family as close acquaintances a single person can keep up with and interact personally is about 150. *"It has been 150 for as long as we have been a species. And it is 150 because our minds lack the capacity to make it any larger"* (Dunbar, 2010). Brent Berlin (2014) estimated from exercises with both modern students and traditional groups that most ordinary individuals only know and remember about 150 names of plants. Even on Facebook, although the average number of “friends” has grown to around 250 to 350 average for one person, there are only about 150 that any one person can adequately have relatively personal interaction with at one time (Dunbar, 2016). Brent Berlin (1973) however, considered that in pre-literate societies the number of generic forms it is possible to retain was usually between 250 and 800. Language and the use of classification or categorisation would have allowed people to remember more names, including which plants are useful and which dangerous. Once the lists needed to include over 150 names (Dunbar, 2010), categorising started to be useful and this was probably very far back in time.

Some researchers (Berlin, 2014; Manktelow, 2010; but see also Mithen, 1997; Ellen, 2016) propose that the need for classification was one of the founding reasons for the evolution of

language. However all animals including Primates, have this ability to pass on their knowledge of plants to a lesser or greater extent, many have to teach their offspring what to eat and where to find it. From birds through to carnivores most young need a period of care and mentorship by parents before they can go off on their own. This means that learning from example and practice can be taught without formal language and it is very probable that the earliest primates were using the same plants humans use now and learnt about them from their mothers, probably passing the knowledge down to the earliest hominids. Whether one uses Latin binomial names, traditional vernacular names, or just point and show, is not really going to make much difference, except possibly in the number of names the individual learns and remembers. Naming things has been shown to aid memory by the use of mnemonics that are more easily remembered than just abstract units such as numbers or signs. Language must have allowed people to remember more useful facts, including perhaps a longer list of which plants are useful and which dangerous. When lists became too long categorising became useful which was probably very far back in time.

5.5.1 Linnaean taxonomy

Linnaeus based his classificatory system on both pre-historic traditional taxonomy as well as the renaissance systems proposed by early botanists. Linnaeus was not the first to use Latin binomials for plant names, Heinrich Bernard Oldenland for instance used binomials in his collection of South African medicinal plants in the late 1600's (labelled examples can be seen in the Sloane Herbarium Collection in the British Museum). But Linnaeus did formalise the conventions, and he categorised and named a great many taxa himself. In fact, he thought that he had named most of the taxa of the world, that there had been little change in the past, and would be little in the future to the plants as he knew them. With the increased discoveries in the 19th century of thousands more plants it became necessary to formulate rules and regulations to ensure that naming of plants was guided by a single system, this was based on western European biases and Linnaean nomenclature and classification, even though the plants came from all over the globe, already had indigenous names, and had been known and used for millenia by traditional and pre-historic peoples,

Since that time the Linnaean taxonomic conventions have been recognised in most academic botanical schools with the exceptions of the Russian, Chinese and some Asian countries (see ITIS, Catalogue of Life, [Roskov, Kunze, Paglinawan, Orrell, Nicolson, et al., 2013](#)). This Western European method has been accepted as the base-line for naming plants and other

organisms throughout the European colonised world ever since. Certain conventions must be followed if plant lists and identifications are part of the research, but are sometimes ignored or not understood, especially by non-botanists. Author's names should be given the first time the binomial name is mentioned or listed in a table within the publication, but may then be safely dropped. In addition at least the most recent synonyms need to be shown at least once in a publication, preferably every time that taxa is listed if space allows. However, confusion and errors arise when using the convention of giving the full Genus + species binomial name at first mention, but subsequently abbreviating it to the only the first letter for the genus. For instance, *Senecio elegans* is found at many sites along the southern Cape coast of South Africa and may be abbreviated to *S. elegans* – however, this can also refer to at least six different genera all with “*elegans*” as the species name, as well as many other fungal, animal, and insect species, and not only to the species intended, this does not make for clarification but confusion. Using the full correct name each time is not backbreaking extra work, and I adhere to this? The all too frequent result of errors is that confusing and incorrect names, or names without valid author's are published, often resulting in the errors being re-cited and re-published ad infinitum (Erdtman, 1963; Bennett, & Balick, 2014).

5.5.2 Botanical name changes, splitters and lumpers.

Until I began to extend this research outside the southern Cape and southern Africa, I did not realise just how radically taxonomic changes to plant names can affect research that looks at the bigger picture of plant distribution, globally across-continents instead of locally. Modern taxonomy is continually being updated according to the laws of the International Association for Plant Taxonomy (IAPT) which results in fairly frequent name changes. For professional and amateur botanists, these changes take a lot of time to fathom and keep abreast of, and they are very often ignored or misunderstood by non-botanical researchers in other disciplines. The majority of people today, including indigenous and traditional groups, do not know about, and do not understand, the intricacies of academic botanical naming of plants. Even with the recognised rules of the International Association for Plant Taxonomy (IAPT) being applied throughout modern Western herbaria, there are idiosyncrasies that creep in, some changes which are rejected or ignored by different academic institutions, and some which are completely missed or misunderstood by non-botanical and/or non-academic researchers. The number of species in a genus varies greatly and name changes are frequent, often dependent on the taxonomist revising the group being a splitter, who creates new

species out of a single existing species, or a lumpers who clusters two or more existing species under one species name.

In ethnobotany, and to a slightly lesser extent in archaeobotany, one needs to be fully aware of the pitfalls of relying on only Western Linnaean taxonomy which is a relatively recent introduction to plant categorisation while ignoring indigenous or traditional taxonomies which are as old as cognitively modern humans, if not older ([Manktelow, 2010](#)). Out of necessity. I have employed up-to-date Linnaean taxonomy which is widely recognised and used, because it is the only system which allows the large numbers of taxa referenced in this thesis to be unambiguously accessible to academia and other botanists. Linnaean taxonomy is extremely helpful in dealing with the increasingly large numbers of species and taxa throughout the world, and it was the success of this method that allowed botanists to categorise the ever-changing mass of plant affinities and relationships while a vast amount of research and knowledge was built up about the Plant Kingdom – but it is a man-made and fallible system, with very real dangers of over-complication and individual empire building by strong characters in the taxonomic field which can obscure rather than clarify the issues in the long run ([Vernon, 1993](#)). By far the greater proportion of people today only know and use the common names of plants, and all indigenous and traditional cultures still use their own traditional names and conventions. A large percentage of botanical and ethnobotanical knowledge, researched and published in non-English local languages in India, China, Central Asia, Russia, and Japan, is virtually lost or invisible to western academics who adhere strictly to Linnaean taxonomy.

Taxonomic disputes and inter scientist, or country rivalries, are irrelevant when dealing with Indigenous Knowledge systems. Botanical names are important, but the deep knowledge of which plants, named according to local indigenous taxonomy, are used for what, is what is most important to the majority of users. Among non-Western peoples still living close to the earth, recognition is often according to what the plant is used for and this knowledge has been passed down through generations, apart from recognising morphological differences as signs of related taxa, plants may also be recognised by smell, taste, or other subtle differences such as shade of green and colour of fruit or flower, or even which animals and insects eat them ([personal observation](#)).

5.5.3 Examples of problematic name changes

Taxonomic changes often lead to problems, especially for global data (for a general discussion see [Frodin, 2004](#)). Genus name changes forced me to link some old and new generic names in order to make sense of the data. Hence *Rhus* and *Searsia* are combined because *Searsia* in Southern Africa was recently separated from *Rhus* ([Moffett, 1999, 2007](#)), before that they were considered one genus, and by indigenous and traditional users they still are. If a group of "*Rhus*" species is used by one kin group of Khoi-San descendants living in the Klein Langkloof and they all call it "Taaibos", all members of that kin wherever they now live will call it "Taaibos", others from the coastal areas, may call it "Rosyntjebos", but they all use it for the same purposes. For all these people it remains the plant they call "Taaibos or Rosyntjebos" and use for a certain set of purposes, and it makes no difference to them or to the usefulness and agency of the plant that the taxonomists have decided it is no longer "*Rhus*", but is now "*Searsia*" ([Moffett, 1990, 2007](#)). The problem is that non-botanical researchers who have always called it "*Rhus*", may either be unaware of the change, and are unable to pick up that this taxon, which is now correctly "*Searsia*" in South Africa, was and is still used, and known, as Taaibos or "*Rhus*" by indigenous peoples. The plant's name change does not alter its ancient history, its properties, and its usefulness, these have not changed at all - its Latin generic name change is irrelevant to the vast majority of users and is largely ignored by non-botanists.

The same problem arises for *Acacia* with *Vachellia* replacing the older name in southern Africa and *Senegalia* in most of the rest of Africa and for some species in Australia and North America ([Kyalangalilwa, Boatwright, Daru, Maurin, & Bank, 2013](#)). In addition some other South and North American '*Acacias*' now fall under *Acaciella* and *Mariosousa*. Searching for the latest literature on traditional uses for '*Acacia*' species worldwide before 2013 brings up a plethora of references, while after 2013 gives very different results and far fewer '*Acacias*'. If one is not aware of these 2013 changes or those in different parts of the world, connections cannot be made to the original *Acacia* and its wide global use. I collected data for the global database before realising the extent of the *Acacia* changes outside Africa, and as a result some global data might have been omitted, due to not being picked up as *Senegalia*, *Acaciella* or *Mariosousa*.

The genus *Diospyros* in South Africa is yet another example. *Diospyros dichrophylla* is present in 95% of the 75 sites I studied in the southern Cape. Other species such as *D. glabra*,

D lycioides, *D austro-africanus* are also present to a lesser degree, but remain a significant component of the anthropogenic thicket patches I have documented at the sites, with much the same uses as *D dichrophylla*. Species of *Diospyros* are present in archaeological digs where macrofossils have been identified and they are very much present in ethnobotanical lists of plants used today by hunter-gatherer- pastoralist groups globally as shown on the map. The genus name *Diospyros* has been used in South Africa since I first studied botanical taxonomy and the identification of plants about 45 years ago. However, when I tried to find it on lists of South African useful plants that were produced by early South African, and present non-South African researchers, I found that *Diospyros* could be missing entirely. I eventually realised that in some countries the generic names of *Royena* and *Maba* for *Diospyros* (Burt, 1935) are still in use. The southern African species of *Royena* were transferred to the genus *Diospyros* by De Winter and White in 1961 (Wijnands, 1983), and *Maba* transferred to *Diospyros* by Brenan in 1948 (Wijnands, 1983). SANBI checklists (Keith, Germishuizen, Meyer, & Steenkamp, 2006) do clearly note *Royena* and *Maba* as synonyms, but many other floras, and especially ethnobotanical and vegetation surveys do not (eg. Manning, & Goldblatt, 2012). This means that lists compiled before the 1940's and by non-South African botanists, ethnobotanists and archaeobotanists have to be scrutinised carefully in order to recognise these older genus names as now being *Diospyros*, and to get the full picture of the widespread use throughout the world of close relatives to our South African *Diospyros* species.

5.5.4 Indigenous or traditional taxonomy as science

Folk-taxonomy or indigenous taxonomy, is arguably far older, going back to the beginning of speech and language, and so with a much deeper history than Linnaeus' binomial system. However, Western European academic Botany and Plant Sciences have been firmly set in the Linnaean taxonomic tradition since the 18th century and are the accepted method throughout much of the academic modern world. In popular plant classification used by the vast majority of modern people, which is very much the same as indigenous taxonomy (Berlin, Breedlove, & Raven, 1971; Berlin, 1973), the genus is the terminal or basic taxon recognised in naming methods used by traditional societies as well as the majority of non-botanists. By not recognising the importance of the genus as the terminal taxon, and failing to account for species substitution within the genus, much conventional ethnobotanical research, based solely on the Linnaean classification system, has resulted in a serious skewing of the relative importance and usefulness of certain species, genera and families.

The question of indigenous taxonomy paralleling Linnaean taxonomy and constituting a science in its own right remains a contentious issue. Incorporation and acknowledgment of the importance of indigenous and/or traditional plant taxonomic names is vital to understanding indigenous science as an alternative para-taxonomy preceding and paralleling the academic Linnaean system through to the present (Berlin, Breedlove, & Raven, 1973; Berlin, 1973; Atran, 1998; Atran, & Medin, 2008). G. Hobson observed (1992) - “*Traditional knowledge IS science, and the sooner southern scientists make use of that traditional knowledge, the better it will be for their research*”. A disjuncture inevitably arises when attempting to document and understand, or render understandable, ancient beliefs and empirical plant knowledge held by traditional or autochthonous peoples (Wobst, 1978; Agrawal, 1995, 2002; C. Smith, & Wobst, eds 2005; Augusto, 2007). Indigenous knowledge as a science, should not be dismissively labelled as 'prehistoric, primitive, and therefore other', but valued and studied as the basis of all modern science and human history. The conscious world, civilisation, and the gathering of knowledge, did not start with the dawn of agriculture or the earliest writing, nor did it necessarily start in Western Europe, it appears to have started much further back in deep-time and perhaps in Africa (Marean, Bar-Matthews, Bernatchez, Fisher, Goldberg, et al., 2007; Jerardino, & Marean, 2010; Marean, Cawthra, Cowling, Esler, Fisher, et al. 2014). The strict conventions of western academic research are gradually beginning to make space, for the acknowledgement of this immensely older, traditional "science" – “... *the tools of the Academy seldom transfer to others the wonder of place, person and history*” (Ouzman, 2005).

Indigenous or traditional taxonomy evolved with humans as the oldest form of categorisation of the natural world (Raven, Berlin, & Breedlove, 1971; Mithen, 1997; Ellen, 2016). Through the millennia useful plants were, and still are, categorised by a variety of means by indigenous peoples and traditional communities, by morphology or shape mainly, as well as colour, smell, taste, or action. Traditional taxonomy formed the basis for what would become the standard Western European system designed by Linnaeus. Linnaean taxonomy relied on morphological characteristics of plants to categorise them in a hierarchical system which is still used by the majority of plant taxonomists and herbaria today, although new research using DNA and molecular studies is being included today. The Linnaean use of what is often called Botanical Latin names is seldom used, understood or even known by the vast majority of modern peoples who are non-academic and not trained as botanists. As a man-made system Linnaean taxonomy is artificial and as such subject to errors and problems. The Linnaean

system was built on earlier “aboriginal” or indigenous systems which broke the many down into fewer groups of similar kinds, making sense of too many individual items and allowing them to be remembered – ‘*Man is by nature a classifying animal*’ (Raven, Berlin, & Breedlove, 1971). Both pre-historic and modern indigenous peoples collecting plants for various uses would have recognised common generic morphologies, and known their common properties as food and medicine.

5.6 Motivation for the Genus as the terminal taxon

In order to motivate for the use of the genus as the terminal taxon for analysis of the large amounts of data accumulated by my research, it was necessary to show that the genus is the more appropriate basis for analysis than the species for my purposes. Scott Atran (1998) writes – “*Ever since the pioneering work of Berlin and his colleagues, ethnobiological evidence has been accumulating that human societies everywhere have similar folkbiological structures*” (Berlin, Breedlove, & Raven, 1973; Hunn, 1976; Brown, Anderson, Bulmer, Drechsel, Ellen, et al., 1985; Atran, & Medin, 2008; Berlin, 2014). These striking cross-cultural similarities suggest that a small number of organizing principles universally define systems of folkbiological classification. The core of any folk taxonomy, according to Berlin (Berlin, 1973), is the folkgeneric level, “*The cognitive structure of folk biology specifies that generic species are the preferred kinds of things that partition the biological world, that these generic species are composed of causally related organisms that share the same vitalist (teleo-essentialist) structure, and that these generic species further group together into causally related but mutually exclusive groups under groups. In sum the generic species is a core concept of the folk-biology module.*” (NB, Berlin’s rather confusing ‘generic species’ equates to the Linnaean genus).

The ethnobotanical research I conducted shows that when a particular species does not occur in an area another species of the same genera is usually substituted. Likewise when there were two or more species of one genera in an area they were often used interchangeably. Similar looking, tasting and smelling species from the same genera, or related genera, are often grouped according to ‘use’, ‘taste’, or ‘action’. The significance and importance of this is missed when adhering to a strictly Linnaean taxonomy in ethnobotany and ethnoarchaeology. De Candolle (quoted in Swain, ed., 1963) supported this idea in 1830, “*Plants, though of different names and kinds, yet if some affinity may be found betwixt them, then the nature of any two of them being well known, we have thence ground of conjecture as*

to the nature of all the rest.”. Because species evolve and mutate much faster and more frequently over time than genera, distinct problems arise when modern taxonomists or ethnoarchaeologists and ethnobotanists name remnants of ancient plants found in excavations. The likelihood of arriving at the correct genus is moderately good, but for species it is highly unlikely. As suggested in Jon G. Hather, ed. (2013), *“The actual similarities in the plant’s characteristics become the reason for their choice as food, which might be obfuscated by the Western Scientific identification”*.

The genus is the terminal or basic taxon recognised and named by indigenous societies as well as the vast majority of all modern humans (Brown, & Anderson, et al., 1985; Atran, & Medin, 2008). Insistence on the use of identification to the species level for all ecological, ethnobotanical, and archaeobotanical research, results in the skewing of the relative importance and usefulness of species, genera and families. It not only results in the researcher missing much ethnobotanical information of importance, but can result in errors in naming, due to lack of taxonomic training in identification to species level, and as a result much of value is not published at all or is unreliable. Emphasising and insisting on using the modern western scientific species level when listing and discussing indigenous plant use, negates the validity of the ancient indigenous knowledge that is being demonstrated. The fact that pre-historic peoples around the world used, and traditional rural and urbanised societies still use their own traditional taxonomy, ie. ‘common’ names, for the plants they know and use, has to be taken into cognisance and acknowledged as an integral part of their traditional knowledge systems. Because traditional naming largely equates to the modern generic level the resulting data adequately represents both systems.

No exact definition of a species has ever been agreed, The debate around species being unnatural and unstable, with the genus as a more stable and natural classificatory division, is on-going (Givnish, 2001; de Queiroz, 2007). The use of DNA and chemotaxonomic analysis and use of the phylogenetic method might settle this in the future. In palynology, phytolithology, and molecular DNA of plants, the genus, and sometimes only the family, is used in cladograms or trees. Charles Darwin wrote *“I look at the term species, as one arbitrarily given for the sake of convenience to a set of individuals closely resembling each other”* (1859). Hendry, Vamosi, et al., (2000) question species realities by highlighting the anomalies inherent in deciding on the level of difference that makes a species and even discuss scrapping the ‘species’ as a concept altogether. The difficulty lies in deciding whether

two groups should be considered separate species if they are 70% reproductively isolated (or 90% alike morphologically), or if they are 20% reproductively isolated (and only 60% morphologically alike)? What if they grow side by side and differ greatly in colour of flowers and leaf shape, as some do? All these problems make it hard to equate species counts and identities across even closely related taxa (, [et al., 2000](#)), as I found to my cost. Hendry and Vamosi wonder if “*Comparative studies could be replaced with comparisons of nearest-neighbor clusters in genetic space, and could incorporate the amount of difference between the clusters*” ([2000](#)). Could this have been the solution to my struggle with statistically analysing similarities between vegetation communities at sites. The genus as terminal taxon, was my partial solution, but clustering taxa according to uses, validated by chemotaxonomy, phylogeny and DNA, may well provide more realistic results than species delimitation.

Working at a large scale and globally, a strictly species-based method obscures the bigger picture or pattern. A species-based analysis ignores the frequency of species substitution within the genus by users ([Berlin, 1973](#); [Otieno, Abihudi, Veldman, Nahashon, van Andel, et al., 2015](#)), as well as the possibility of species actually being hybrids as is proposed by Schrein and Thackeray ([2017](#)). The chemical commonalities between species within individual or sister genera to a large extent determine properties and uses thus explaining and validating their use by traditional-indigenous peoples who substitute species and occasionally sister genera and seldom make a distinction between species ([Reyes-Gascia, 2010](#); [Onguéné, Ntie-Kang, Lifongo, Ndom, Sippl, et al., 2013](#); [Ntie-Kang, Ndom, Mbaze, Lifongo, Onguéné, 2014](#)). Ragupathy and Newmaster ([2009](#)) comment that “*there may be groups of plants and therefore several remedies available that are preferentially selected by individual healers for various utilities . . . thus indicating the potential biological activity for a group of plants* [[Moerman, 1991](#)]. *These groups may represent Linnaean taxa (ie, genus or family) that share similar biological processes, or aboriginal classifications may group plants that serve a similar utility*” ([Newmaster, Ragupathy, Rebecca, & Nirmala., et al., 2006](#)). Traditional names sometimes distinguish between species by containing prefixes or suffixes which distinguish between species, but the uses are the same or very similar. I consider that the use of chemotaxonomy to identify and classify organisms by comparative analysis of their biochemical composition ([Erdtman, 1963](#); [Fairbrothers, Mabry, Scogin, & Turner, 1975](#); [Onguéné, Ntie-Kang, et al., 2014](#)), amplified by phylogenetic and DNA research ([Hayashida, 2005](#); [Forest, Grenyer, Rouget, Davies, Cowling, et al., 2007](#); [Rønsted, Symonds, Birkholm, Christensen, Meerow, et al., 2012](#); [Saslis-Lagoudakis, Savolainen, Williamson, Forest,](#)

Wagstaff, et al., 2012; Saslis-Lagoudakis, Rønsted, Clarke, & Hawkins, et al., 2015, Yessoufou, Daru, & Muasya, 2015) support my decision to use the genus as terminal taxon.

5.6.1 Chemotaxonomy and the phylogenetic approach

Apart from morphological and physiological Linnaean taxonomy, plants can be classified by comparing differences in the chemical characteristics of plant species (S. Lee, Oh, S. Lee, Son, Bae, et al., 2015). Chemotaxonomy is the study of shared chemistry in closely related plants, also known as chemosystematics (Harborne, 1970, 1984; Gibbs, 1974; Reynolds, 2007), it is a more realistic or natural method with less subjective bias than that of Linnaean morphological taxonomy, but can only be used on plants still living today. Phylogenetics, using DNA analysis, could solve the problems of both morphological and chemotaxonomic systems, as it is capable of developing trees of life linked to time and going back to original ancestors. Chemotaxonomic properties can be used to classify plant species according to their phylogenetic genus and metabolomics is used as a chemotaxonomic tool for classification of plant species. Multivariate statistical analysis indicated that metabolic differences in plant species mainly depended on phylogenetic properties rather than environmental or geological factors (Fischedick, Hazekamp, Erkelens, Choi, & Verpoorte, 2010; Jung, Lee, Kim, Moon, Ji, et al., 2012).

Most species in a genus or family show a basic similarity when it comes to their active effect or chemical constituents (Moerman, & Estabroek, 2003; Zhu, Qin, Tao, Liu, Shi, et al., 2011). Combined phylogenetic and phytochemical studies have shown that there is strong phylogenetic signal in the distribution of chemical constituents in plants (Wink, 2003; Wink, & Mohamed, 2003; Muellner, Samuel, Chase, Panell, Greger, et al., 2005). This provides an additional method to augment understanding of the distribution of chemistry in plants and validate or refine Linnaean morphological taxonomy, and is being applied in the search for novel natural products (Rønsted, Savolainen, Mølgaard, & Jager, 2008; Larsen, Adsersen, Davis, Lledô, Jäger, et al., 2010; Bay-Smidt, Jäger, Krydsfeldt, Meerow, Stafford, et al., 2011). If plants have been empirically proven over thousands of years of use to be efficacious against particular ailments or diseases, then other species in that genus will usually produce the same effect, even if not to the same degree. Dosage can be, and is, tailored to the degree of activity of the particular taxa being used at any time (personal observation). In many published ethnobotanical species lists, up to as many as 6 or more species in one genus may be listed with the same or similar uses (Moerman, 1991).

Saslis-Lagoudakis, Klitgaard, et al., (2011) show that medicinal properties are not randomly distributed in plant phylogenies but that some families contain more medicinal plants than others (Amiguet, Arnason, Maquin, Cal, Sanchez-Vindas, et al., 2006; Bennett, & Husby, 2008; Douwes, Crouch, et al., 2008; Moerman, 1991). In the context of the global links I explore in my thesis, it was gratifying to discover that a correlation exists between global uses as proposed by the following researchers (Moerman, Pemberton, et al., 1999; Saslis-Lagoudakis, Williamson, et al., 2011). The fact that the selection of medicinal plants by indigenous and traditional communities overcomes cultural and taxonomic differences, and can be phylogenetically validated (Newmaster, Subramanyam, et al., 2006; Bletter, 2007; Saslis-Lagoudakis, Klitgaard, Forest, Francis, Savolainen, et al., 2011) once again strengthened my decision to use the genus as the terminal taxon in my analyses.

Chemotaxonomic and phylogenetic research has shown that morphological taxonomy is surprisingly accurate in most cases and that both Linnaean and indigenous taxonomy categorised the plant world surprisingly accurately, especially concerning food and medicinal plants. It appears that non-random phylogenetic distribution of properties is clumped or clustered, due to closely related plant species sharing secondary plant metabolites and their biological activities or biochemistry (Fairbrothers, Mabry, et al., 1975; Saslis-Lagoudakis, Klitgaard, et al., 2011; Yessoufou, Daru, & Muasya, 2015), and therefore, close relatives are likely to share medicinal and other properties. These assumptions were based on reports that most kinds of secondary compounds, including tannins and alkaloids, are phylogenetically conservative in their distribution (Silvertown, & Dodd, 1996; Douwes, Crouch, et al., 2008). Unfortunately, empirical research combining ethnobotanical and phylogenetic information is rare. Less than a quarter of the world's approximately 370 000 plant species have been screened for bioactivity, due mainly to lack of funding, expertise, or the will to speed up the research (Saslis-Lagoudakis, Klitgaard, et al., 2011). Chemotaxonomic metabolomics-based profiling has been used to help select plants with promising pharmacognostic attributes (Lee, Oh, et al., 2015).

5.6.2 Examples of chemotaxonomically close genera and their uses.

The Lamiaceae Family is important medicinally (Table 8, this Chapter), ethnobotanically, and chemotaxonomically (Kornhall, 2004; Mamadalieva, Bobakulov, Vinciguerra, Tiezzi, Abdullaev, et al., 2016). The Lamiates offer good examples of the use of linked traditional names for clusters of species with the same properties and close affinities, they also

demonstrate how they can be separated and rendered invisible by Linnaean taxonomy. Lamiaceae like many other important medicinal families supplies good examples of species and genera substitution. In addition Lamiates are among the most frequently used ‘alien’ or ‘imported’ useful plants used by traditional communities. These most often include the frequently used food flavourings such as Thyme, Sage, Rosemary, Marjoram, and Lavender, which are all reported as used by southern Cape Khoi-San descendant communities. These plants are grown in most westernised colonial gardens and are recommended in virtually every cookery book. They are a prime example of the influence of western media on the plant usage and substitution by common garden herbs for difficult to access indigenous plants by traditional communities (Leonti, 2011).

The chemotaxonomic commonalities among these different Lamiate species and genera is interesting, they all contain unusual diterpenoids and/or triterpenoids (B-E. van Wyk, Van Oudtshoorn, & Gericke, 2009), and the diterpenoid marrubiin is present in both *Leonotis spp.* and *Marrubium vulgare* and likely to be found in other genera and species as well. Many labdane diterpenoids were isolated from *Leonotis leonurus* as well as other *Leonotis* species, and they may therefore serve as chemical markers for characterization of the *Leonotis* genus (He, Lindqvist, & Harding, 2012; Wuad, Li, Fronczek, Ferreira, Burandt, Setola, et al., 2013). *Leonotis leonurus* (Wildedagga), *Leonotis nepetifolia* (Klipdagga), and *Leonotis ocymifolia* (Klipdagga or Geelkopdagga) were all reported as being used medicinally by participants in the southern Cape and by numerous secondary sources (eg. Uphof, 1968; B-E. van Wyk, van Oudtshoorn, & Gericke, 2009; B-E. van Wyk, & Wink, 2004, 2015) for similar ailments ie. chest problems, tuberculosis, fever, diabetes, high blood pressure, for skin problems, and for women’s reproductive ailments. An example of how easy it is to be led astray by using only species names comparison and statistics is *Leonotis intermedia*. I identified this species as present at an eastern Free State cave site and surmised it was probably used as a replacement for *Leonotis* species widely used in the Western Cape, which might not occur in that area of the Freestate. This appeared to be a nice demonstration of how a different species is substituted for the same ailments, and how the traditional common names for species in this genus retain “Dagga” as a common element. However, I found that *Leonotis intermedia*, together with another medicinal eastern Free State species, *Leonotis mollis*, had both been sunk into *Leonotis ocymifolia*, and were now not separate species after all, and my nice example fell away. This demonstrates two things, firstly that species names can be unreliable and fleeting making the genus a better terminal taxon for analysis, secondly, that research

before the name was changed would have noted that up to five different species were used in the Western Cape and the eastern Free State, and value indices would not have picked up on the fact that some species were in fact one and the same.

Leonurus (Motherwort) species from Europe and Asia and naturalised in North America, are chemically similar to *Leonotis*, and are widely used medicinally (Uphof, 1968; Mamadalieva, Bobakulov, et al., 2016). They contain diterpenes including marrubiin, it is used for female reproductive ailments and as a spasmolytic (B-E. van Wyk, & Wink, 2004, 2015), and for Heart and Chest problems (Grieve, 1976). The substitution of close genera native to Southern Africa with close global relatives with similar uses is shown in the use of the indigenous *Ballota africana* (Kattekrui, African Horehound) which is a close relative to the *Leonotis* group (B-E. van Wyk, Van Oudtshoorn, & Gericke, 2009), and used locally for chest problems, fever, asthma, for skin problems, and for women's reproductive ailments; (B-E van Wyk, & Wink, 2004, 2015). *Ballota nigra* (Black Horehound) native to Mediterranean Europe, Levant and Asia is also used for coughs and as a surrogate for *Marrubium vulgare* (Uphof, 1968; Grieve, 1976). *Marrubium vulgare* (White Horehound, Allwong) is a European species which is closely related to both *Leonotis* and *Ballota* and used for coughs, asthma, and fever (B-E. van Wyk, van Oudtshoorn, & Gericke, 2009; Uphof, 1968; Grieve, 1976). *Marrubium vulgare* has become naturalised and is used in the southern and Eastern Cape (personal observation and B-E. van Wyk, & Wink, 2004, 2015), and is reported as a weed globally (Holm, Pancho, et al., 1979; Randall, 2017; B-E. van Wyk, & Wink, 2004, 2015).

The groundcover *Ajuga* species are widespread globally and are quite common archaeobotanical finds in Europe where they are still used as wound healing and women's reproductive problems (Grieve, 1976), and for many other ailments (Uphof, 1968). *Ajuga reptans*, the only member of this genus indigenous to South Africa, was present at the summer rainfall sites surveyed in the eastern Free State, where it is used for female reproductive ailments (Schmitz, 1982). Other closely allied genera in the Lamiaceae are the *Leucas* spp., native to Africa, Arabia, India and Malaysia (Mabberley, 2008), containing triterpenoids and used for asthma and coughs, for skin problems, and for women's reproductive ailments (Uphof, 1968; Mandlik, 2015). Finally it is interesting to note although some of these Lamiates are low growing ground covers and others are erect to a couple of metres, they are morphologically similar and easy to recognise as a result. Lamiate flowers

are tubular, hold nectar and have three upper petals and two lower ones forming a landing stage for pollinators, the inflorescence is usually a series of dense axillary whorls subtended by a pair of leaves and separated by long or short internodes to the end of the flowering stems. Lamiates have square stems which bear serrated or simple leaves of various shapes which are aromatic when crushed, the leaves are generally the plant part used in hot water infusions.

As an interesting corollary to the Lamiate ramifications, some *Leonotis* species are commonly, and somewhat misleadingly, called “Wilde Dagga” (Wild Marijuana) in the southern Cape and elsewhere. “Dagga” in southern Africa, refers to *Cannabis sativa*, family Cannabaceae, or the globally ubiquitous hallucinogen “Marijuana or Hashish”, which in the southern Cape is referred to as “Suiwerdagga” (or real Marijuana). In spite of being illegal until very recently, it was and still is, widely used for diabetes, asthma and many other ailments, due to its bronchodilatory, spasmolytic, and hypotensive activity (Uphof, 1968; Grieve, 1976; B-E. van Wyk, & Wink, 2004, 2015). Although *Leonotis*, *Ballota*, *Marrubium*, *Leonurus*, *Ajuga*, and *Leucas* spp. are not apparently used as hallucinogens, in spite of early travellers reporting the contrary regarding *Leonotis*, it nevertheless appears that an overdose may produce side-effects which can include hallucinogenic-like episodes (B-E. van Wyk, & Wink, 2004, 2015).

5.6.3 Constraints in modern academic taxonomy

Taxonomic identification carried out after systematic physical collection of every species within an area of concern, using personal empirical knowledge combined with detailed morphological examination, is seldom undertaken today. Intensive field taxonomy is a vanishing skill and there is little incentive to produce comprehensive floristic checklists although they remain essential to conservation and research. (Figueiredo, & G.F. Smith, 2010; and personal communication from Gideon Smith, SANBI, Pretoria, 2016).

According to the Kew Report on the state of the World’s Plants (2017), there are about 370 000 plant species and 452 plant families in the world that have been named to date, and every year up to 2000 new plant species are discovered and described. Of these around 28 000 are used medicinally mainly by traditional-indigenous peoples, and Kew estimates the value of traditional plant remedies used per year at around \$83 billion. Only 230 complete plant genomes have been analysed, and only 16% of the traditional medicinal plants are

recognised in official pharmacopoeias around the world. There remains a mountain of chemotaxonomic and phylogenetic work, but especially taxonomic work to be done by fewer and fewer botanical taxonomists.

And yet - there is chronic underfunding for botanical research resulting in a shortage of skilled field taxonomists ([Herbert, G F. Smith, Hamer, & Scholtz, 2001](#) [Prather, Alvarez-Fuentes, et al., 2004](#); [Figueiredo, & G.F. Smith, 2010](#)). The consequences can be seen in what Figueiredo and Smith (2010) call the “*taxonomic impediment*” referring to the present lack of taxonomists to reliably identify plant specimens. There is a growing a reliance on technology, maps, statistical inference, desk-top studies and the use of secondary data, which are replacing the dedicated collector with passion and time to immerse themselves in the field and at the microscope.

CHAPTER 6

People

“... a pattern of knowledge emerges which is like a patchwork quilt that maintains its appearance although individual patches are worn out and replaced. They are replaced with patches similar enough for the quilt to maintain its pattern or identity.” -- [Chris Low, 2004](#)

“We came from all these many places to Touwsrante and tried to make a life here. We tried to make a community with all these different people - a "Lappiesmekaar" (patchwork) that was as pretty as we could make it.”... [personal comment by Elizabeth Stuurman, Touwsrante](#)

6.1 Introduction

In this chapter I discuss modern Khoi-San descendants, their history, lifeways and beliefs in the light of the results reported in Chapter 4, with additional results emerging from the years of joint ethnobotanical research. South African ethnobotanical research has been, and still is very one-sided, too often the assumption made is that “traditional medicine” equates to the use by Nguni and other Black African tribes or clans. However, this “African” model has dominated public perception of what “African plant knowledge” is all about, and where most of the research has been focussed. This thesis however, is specifically focussed on the San-Bushman and Khoekhoen descendants, now amalgamating as Khoi-San, whose ancestors inhabited the rock shelters and overhangs in the southern Cape and southern Africa for many thousands of years before black African tribes migrated South about 2000 to 3000 years ago. The Khoi-San traditional knowledge and egalitarian culture has persisted into the present, and deserves far more attention paid to it. Although many of the most knowledgeable Khoi-San are now elderly, there are younger, self-identifying Khoi-San, taking an interest in the old traditions and retaining their inherited ability to feel deeply connected to nature, who are making use of wild plants for medicine as well as supplemental foods.

Seasonal migration between the sea and inland as envisaged by John Parkington ([1972, 2001](#)) and Fletemeyer ([1977](#)), although contested by Sealy, van der Merwe, et al., ([1986](#)) and Balasse, Ambrose, et al., ([2002](#)), has not been disproved and would have facilitated the expansion by dissemination of seed of the distinctive suite of thicket taxa found at the 75 sites. Khoi-San people moving between the coast, Little Karoo and Great Karoo would have

used many of the sites not suited to long periods of habitation as logical temporary stopping places on such a route. The 19th century Montagu Pass which follows an ancient elephant path over the Outeniqua mountains offers overhangs and shelters suitable for overnight or short stays. Another route is the old Voortrekker Pass over Duiwelskop which similarly offers shelters along the way (see Chapter 8.1, Fig 2, page 157). It is quite possible that small groups of people might have travelled across the mountains to visit, socialize, find mates, and gather seasonal coastal plant foods or shellfish and seaweed at the coast, or to access the nutritious fruits, seeds and berries available in the Little Karoo as well as sun and dry weather. That shellfish was taken back to many of the inland sites after being preserved in some way is indicated by the seashells frequently found among surface artefact scatters at inland sites (Parkington J, 2001 and personal observation).

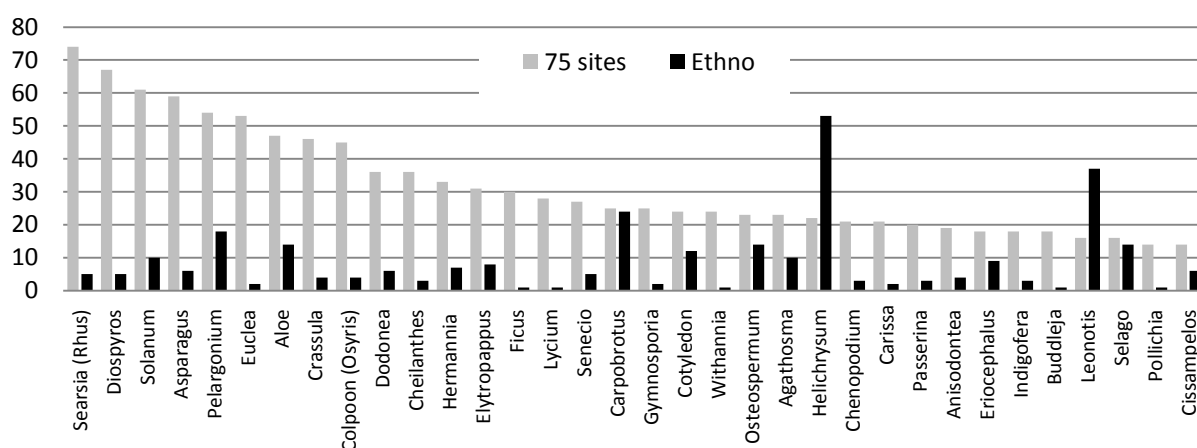


Fig. 8 – Graph showing comparison between site-taxa and ethnobotanical use. The vertical axis refers to the number of sites where each genus is present, and the number of ethnobotanical uses reported for each genus. The horizontal axis gives the names of the top 34 genera.

The graph in Fig. 8 above, is drawn from 50 genera most frequent present at the 75 sites, see Chap. 4, Table 2, page 60, and the southern Cape ethnobotanical database, see Chap. 6, Table 11, page 122. A definite link is depicted between plants growing at present at the sites, and the persistence of ancestral traditional knowledge among apparently acculturated modern ‘coloured’ or self-identifying Khoi-San communities in the southern Cape. No modern use for some genera present at sites, could be a reflection of the fact that the majority of the research was carried out in urban or semi-urban settings where some taxa are simply not available for collection. Urban sprawl, agricultural expansion, and the exclusion of non-paying visitors

from reserve areas, means that some taxa are “out of bounds” to traditional users. It is in the reserve areas where many of the “hard to get” wild species are still to be found. This difficulty in accessing old time favourites results in the use of some weedy and common species such as the common *Osteospermum* (Bitou), and *Selago corymbosa*, and the weedy *Chenopodium*, and *Solanum* (Sobo-sobo), (Chap. 6, Table 11, page 122).

6.1.1 Indigeneity, naming, history and politics

Modern Khoi-San identity, and claims to indigeneity, are complex and often contentious issues (Besten, 2011; Schramm, 2016; (see discussion in Chap 6). Hunter-gatherers left a relatively light footprint on the landscape in that their modification was benign, benefitting both humans and plants (Posey, 1998a, 1998b; Maffi, 2007). Human niche construction which impacted on wild or non-domesticated species often mimics natural events and processes, and to differentiate between the two is difficult (Smith, 2011). It was important to minimise subjective bias due to my personal euro-centric knowledge base and previous ethnobotanical work among the Xhosa in the Transkei and Baralong in the eastern Free State. The probability of the impact on traditional plant use knowledge due to the wide availability of pervasive euro-centric modern media (Leonti, 2011) were recognised and mitigated as far as possible.

Khoi-San, Khoisan, KhoeSan, Bushman, Khoekhoe, and ‘Coloured’ are all terms employed over time to describe descendants of the “First peoples of southern Africa”. A single name encompassing all the participant groups is difficult to negotiate safely, sympathetically and politically correctly. The communities represented in this research present a conundrum when it comes to settling on a name which adequately circumscribes their heterogeneity as well as their surprisingly homogeneous collective cultural affinities and shared indigenous knowledge. The problem was discussed with participants on many occasions and there was no real consensus. Many older people still accept the apartheid classification of ‘coloured’ although others were not comfortable even discussing the topic.

The majority of participants and individuals who freely discussed their naming, seemed to self-identify as Khoi-San descendants (but not KhoeSan), and increasingly and particularly among the youth, with the over-arching collective of “South African First Peoples”. These heterogeneous groups and individuals, are gradually attempting to amalgamate today as Khoi-San or First Peoples. Although the amalgamation is largely politically motivated and fraught

with difficulties, in-fighting, misunderstandings, and as yet little consensus. These outwardly disparate groups, clearly of mixed ancestry, do nevertheless share the most ancient genes in the world. Recent DNA testing across a wide range of ‘coloured’, San, and Khoi groups and individuals in southern Africa, has revealed a common ancient ancestry and the presence of the oldest Haplogroup in the world (Tishkoff, Reed, Freidlander, Ehret, Ranciero, et al., 2009; Lombard, Schlebusch, & Soodyall. 2013; De Jongh, 2016; Schlebusch, Malmström, et al., 2017)

After much debate and discussion with participants, the collective term “Khoi-San” throughout (as in B-E. van Wyk, 2008), giving equal weight to both Khoi and San ancestry. This term refers to and incorporates the many and varied descendants of peoples indigenous to Southern Africa before the arrival of either white colonialists or black tribes from central Africa, as well as those with post-colonial mixed genes who nevertheless retain and claim a core of Khoi-San ancestry and culture. It is hoped that by illustrating ancient and modern ethnobotanical affinities, an avenue may be opened for the apparently acculturated groups to present a united front in order to gain official governmental recognition as legitimate ‘Indigenous First Peoples’ of the land, deserving of full access to their rights as stipulated by the United Nations charter 2007 for First Nation Indigenous Peoples of the world contained in “United Nations Declaration on the Rights of Indigenous Peoples” (DRIPS), (2006).

The participants used mainly Afrikaans names for plants, with the occasional Khoi-San relict, and have an effective system of traditional classification and naming allowing them to not only recognise the plants they use, but also to recognise closely related plants. However, almost all were completely unaware of the scientific classification system in Latin as formalised by Linnaeus, and considered by western science as the norm. An offshoot of my research, I will not be enlarging on here, revolves around the fascinating subject of ‘given’ or christian names and surnames. Each participant was asked to give their own name, as well as those of their parents and grandparents if possible. More participants than would be expected, were interrelated by direct family ties or by marriage, not only within a particular group, but sometimes across groups. The relevance of this to my thesis lies in the fact that it indicates a rather diffuse but interesting family structure to plant knowledge, possibly indicating that certain family lines retain, or always had, more traditional plant knowledge than others. In addition it should be noted that family names hold an important cultural and historical significance both to Khoi-San descendants and to researchers. By categorising names and

origins of parents and grandparents, and linking this to plant names, it is sometimes possible to make links between people's family names, place of origin, and the pattern of names and uses attached to certain plants.

6.1.2 Migration and dispersal of plants and humans

Millions of years of plant use by hominids and hominins would have influenced the dispersal of edible, medicinal, and other useful plants in Africa, and later, globally. Fruits and seeds would have travelled throughout Africa and subsequently with the earliest hominin migrations into Arabia and as far as East Asia, about 1.5 to 2.4 million years ago, and later to the rest of the world (Potts, & Teague, 2010; Eriksson, 2016). Mammals such as bovids, big cats, hippo and giraffe, dispersing from Africa over the same time period as hominins, and which also relied on the vegetation, are thought to have been important for understanding the environments into which hominins dispersed (M.G. Turner, 1989; Martínez-Navarro, 2010; Madurell-Malapeira, Alba, & Moyà-Solà, 2017). The migration journeys of plants, hominins, and animals are increasingly being traced archaeologically (Van der Made, 2011; O'Regan, A. Turner, Bishop, Elton, & Lamb, 2011). Hominid and hominin dispersal and potential migration routes are most often considered as linked to raw material sources of rocks for making tools, the presence of rivers, lakes and fresh-water springs, and the potential for prey due to high mammalian biomass (Potts, & Teague, 2010). What is missing in all this research so far, is specific information relating to the availability of cliffs and rock shelters along migration routes, and the suites of useful plant taxa recognisable by those transhumant or migrating hominins (Larson, Matthes, & Kelly, 2004).

Human aided dispersal in the past could partially account for the greater distance migrated by certain genera than is possible, an answer to 'Reid's paradox', which states that plants disperse further and faster than they can (J.S. Clark, 1998). This implies an anthropogenic origin to the pattern especially when it is supported by the genera being used for food, medicine and a range of other uses by humans historically, and today by descendants of the original inhabitants of the sites. Human impact on sites would arguably make climatic extrapolations from pollen, charcoal and phytolith evidence at these sites doubtful, as they could be skewed by human preferences for certain vegetation and their role in disseminating seed further than would happen under natural conditions by wind, birds, animals or insects (Palmer, 1990). Bruch, Sievers, and Wadley, (2012) recognize this problem and write "*Previous qualitative environmental interpretations of the fossil fauna and flora of the site*

remain ambiguous. Because much of the material is anthropogenically introduced, it is difficult to distinguish between the effects of natural changes in the local vegetation and behavioural changes of the people that inhabited the shelter”.

6.1.3 Pre-colonial and historical perspectives.

It was been widely noted by early travellers to southern Africa, and subsequent writers, that the Bushmen and Khoi-San possessed a complex and sophisticated plant taxonomy and ecological understanding which helped inform their utilisation of medicinal plants for their synergistic effects and as multi-genre treatment for illness ([Augusto, 2007](#)). In Francois Lequat’s travelogues in the 1700’s (republished [2010](#)) he wrote,

“....Hottentots. . . . know how to go exactly to the plant that will cure (them), and administer the remedy with greater success than we oftentimes do ours. The sick that have been brought a-shore at the Cape have often experienced this, and those wounds that very skilful Surgeons have given over, have in a short time been cur’d by these people”.

There are many fascinating early books listing medicinal plants used by indigenous peoples as well as Settlers, and including the San and Khoekhoen, such as Joseph Mackrill ([unpublished, early 1800’s](#)) Ecklon ([1826-1831](#)), Pappé ([1868](#)), A. Smith ([1895, reprint 2011](#)), Marloth ([1913](#)), and including Watt and Breyer-Brandwijk ([1962](#)) - these have not been used for my databases as they reflect such a wide range of users, and too frequently duplicate each other’s information almost verbatim. In addition, all information from these early books has been thoroughly mined and repeated in modern books which I did use, such as Ann Hutchings et al. ([1996](#)), and Ben-Erik van Wyk ([1998, 2000](#)). In Skead’s book on plants mentioned by early travellers in South Africa ([Skead, 2009](#)), there are many stories and reports about plants used by the “hottentots” and Bushmen of that time. To use the information from the early books as data would mean that much information would have been duplicated and certain very commonly referenced plants given a higher rating than they warrant. It is also difficult to judge if it is Khoi-San, or other Africans who use the plants reported, most of these writers moved around the country and eclectically collected whatever they heard or were told. There has been much discussion and controversy around the validity of extrapolating information from modern San living in Namibia or Botswana today and allocating the data to the Cape or other San or Khoi-San who lived in the sites I surveyed, for instance. However, there is value in it if the taxa can be shown to be similar and used in similar ways.

Khoi-San knowledge and expertise was “borrowed and appropriated” by scores of western trained biologists and botanists who collected plants and information at the Cape from very early settler times. The scientific accuracy and worth of the knowledge they found is only now being acknowledged. Bioprospecting increasingly uses indigenous knowledge to speed up and improve results (Augusto, 2007). However, B-E. van Wyk, & de Beer (2012), correctly note that Cape herbal medicine is poorly studied, and that biological diversity and the rich indigenous cultural diversity has unfortunately been equally poorly recorded, and they lament the loss of so many original Khoi-San plant names.

6.1.4 An ancient stream of plant knowledge specific to the Khoi-San

The unique and specific indigenous knowledge held by descendants of the Khoi-San is worthy of more attention and research as a recognizably separate stream of knowing which has infused and impacted all plant use knowledge in southern Africa, and perhaps Africa as a whole. In a small publication by Heintz and Maguire (1974) they present the indigenous plant taxonomy of the *!kô* Bushmen of Western Botswana where the absence of synonymy enables the *!kô* to identify a plant in all states and under all conditions, without the necessity for flowers, fruit, or occasionally even leaves. Khoi-San knowledge has been, and is too often, subsumed within that of Black Africans, of mainly Nguni and Sotho peoples, whose plant knowledge and culture has been so thoroughly researched and published, unfortunately becoming accepted as the primary Indigenous Knowledge of Southern Africa. Scholarly considerations of African medicine have long focussed on sorcery. In a Khoi-San context Bushmen concepts of ‘potency’. The term ‘potency’ was used by Agnes Hoernlé (1918) to denote the power of a Hottentot witchdoctor. In later literature the word became associated with Bushman trance dancers and their healing power, sometimes known as */num* or *tss_* (Low, 2004). Under Lewis-Williams a large body of scholarship and theory has developed around potency and shamanism, this is not addressed here; in the context of my research it appears to be foreign to the knowledge and culture of local Khoi-San descendants.

I found no evidence of belief in shamanism or even understanding of what a shaman is or does. Women who were called “Voetvroue” (midwives), which, are still referred to as knowledgeable about plants and healing, since they are no longer allowed to work at their calling, this term today refers to an older woman of standing in the community, who knows a lot about healing plants. Many people, men and women said they learnt about using plants from their mother or grandmother who was a “Voetvrou”. Occasionally a “Bossiedokter”

(Bush Doctor) was referred to, usually a man, but no-one admitted to being one, or even knowing one. The great majority of plant users were women and it is through the grandmothers and mothers that the traditions are passed down. Among the groups I worked with, their knowledge is used almost exclusively to help family and friends, and is invariably given freely and for no payment, except perhaps the gift of food, a present of some kind, or as a favour returned when appropriate. Insofar as 'magic' or beliefs in the supernatural being discussed, they were reported occasionally as an additional use for some medicinal plant, and were mainly associated with keeping away bad spirits, most often in the form of a Tokolosh. I collected these stories and beliefs as they are an important part of the knowledge and beliefs held, they are not discussed in this thesis, but deserve a research project of their own.

6.2 The IMITHI Amayeza Project – working with municipal clinics

The IMITHI Amayeza project was initiated during the 1980's and was an example of an applied and practical ethnobotanical project. Working with the Knysna Municipal Clinic and local communities in the 1990's, it aimed to empower local communities to recover and use their traditional knowledge to improve their own primary first aid healthcare, and encouraged the use and propagation of culturally relevant and affordable first aid remedies, to the benefit of the whole community ([van Wijk, & Wallace, 2000](#)). The model we developed is still in use today by a number of clinics, hospices, and private individuals, in the southern Cape (see powerpoint presentation in Appendix F) and further afield. IMITHI was an example of research which was not linked in any way to identifying plants for exploitation by pharmaceutical companies, but aimed to empower local communities to recover and use their traditional knowledge to improve their own primary first aid healthcare. The project aimed to work with, not in opposition to, or to replace, existing modern, but expensive and scarce, allopathic medicine normally dispensed by the clinics (for more details see Appendix E for conference presentations).

The IMITHI project was started in order to discover what plants were used by communities in Knysna to see if they could be included in the day to day functioning of the cash-strapped clinics. It was a success in so far as the clinics made and used the simple remedies, but could also recommend that people took their own home remedies for simple primary ailments not needing expensive allopathic remedies. Clinics from broader southern Cape region showed an interest and attended talks and demonstrations, and in diabetes groups some of the individuals successfully controlled the disease with plants and told the other patients about this.



Fig. 9 – IMITHI Amayeza workshops. L. Hornlee, Knysna. R. Touwsranten, Hoekwil.



Fig. 10 – IMITHI gathering at Concordia, Knysna.

6.3 Southern Cape communities participating in ethnobotanical research.

In 27 workshops and “walks-in-the-veld”, 102 participants from 6 widespread southern Cape regions (see Fig. 11, page 120) took part. A total of 1010 uses were listed for 211 species, in 668 reports. Afrikaans was the language most frequently used and all information was noted in the words and language presented by each participant. Information was later transcribed,

translated, and collated to allow for a quantitative analysis of the data. The 213 species fall into 160 genera and 61 families. 34 of the 50 genera, ie. 68%, were reported as used by participants in 26 categorised use groups (see Appendix B for detailed data). The participants in my ethnobotanical research are listed in Appendix B, they unanimously agreed to their own names being used, and I list them as a token of my gratitude and respect. It was a privilege to share their stories and knowledge. South African history from the time of van Riebeeck's landing, and the decimation of the indigenous peoples through smallpox, slavery and what amounted to genocide, is too well known to bear repeating here. However the absence of Black South Africans from many inland and coastal areas of the Western Cape until after 1994 must be mentioned. This had a lasting effect on the history of the modern Khoi-San, and quixotically allowed them to retain much of their traditional culture and knowledge into the present. Apartheid actually re-enforced this isolation, and could be said to have 'protected' the 'coloured' and Khoi-San culture in spite of earlier acculturation (Philander, 2011). After the end of the Apartheid regime in 1994, the ever accelerating influx of Xhosa, Chinese and Central Africans into the interior of the southern Cape today, means that the traditional Cape culture and knowledge must either adapt or lose much of its singularity.

According to plant users in the southern Cape Khoi-San communities, it is the lack of access to the plants which they know and still need which is likely to eventually allow the knowledge to die out. Most areas where the wild medicinal plants grow, are now proclaimed Nature Reserves, Wilderness areas, or belong to private individuals or farmers, and in almost all cases access is denied to anyone who does not live or work there. Laws about picking and harvesting even along the open road, are getting stricter. In every community discussion about this problem came up and people expressed the same fears and problems. This has led to the use of more exotic garden herbs and a few easily grown wild plants, as well as weeds which can be collected in empty lots and along rural roads. Much cultural tradition which revolved around plant use has had to be abandoned as the plants cannot be collected or modern laws and social mores have taken over. In the old days *Wildeals* and *Kooigoed* used to be hung from the doorway and put under the bed during the traditional viewing of the dead. This no longer takes place because "*nou wip hulle jou weg en jy lê klip hard gevries tot die begrafnis.*" (now they whisk you away to lie frozen stiff until the funeral).

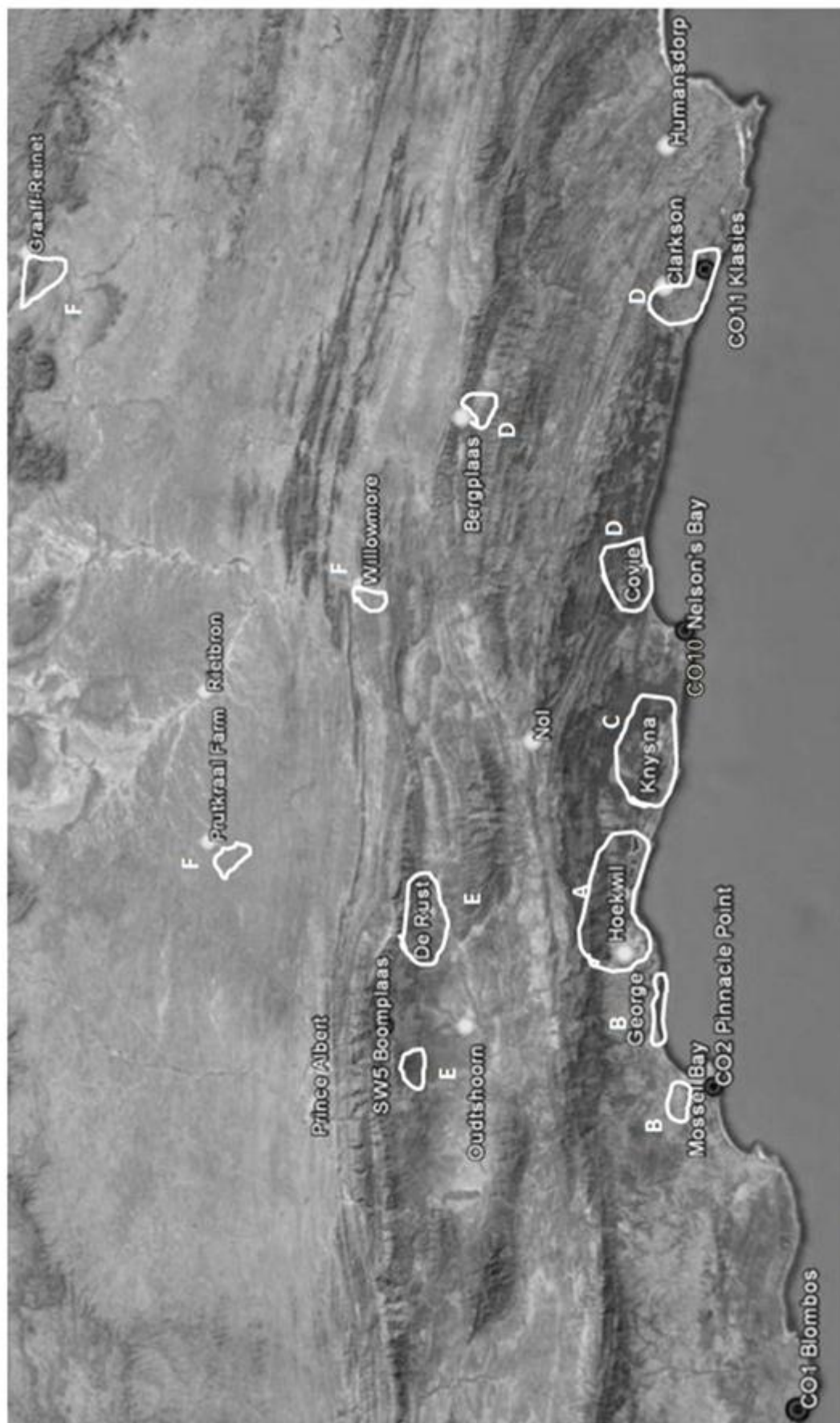


Fig 11 – Localities of 6 regions where ethnobotanical surveys were conducted: Codes. A = Hoekwil (Touwsranteen), Kleinkrantz, Wilderness, Sedgfield (38). B = George, Pacaltsdorp, Mossel Bay (5). C = Knysna (Concordia, Homlee) (35). D = Covje, Klasies River, Clarkson, Bavianskloof (Bergplaas) (7). E = Little Karoo, Noll, De Rust, Boomplaas (7). F = Great Karoo, Prutkraal Farm, Willowmore, Graaff-Reinet (5). Total of 102 participants. (Numbers in brackets refer to number of participants)

Many people reported they get precious dried plant parcels from relatives living elsewhere where certain sought after plants can still be found and collected. An example of one sought after medicine is Boegoe. Various *Agathosma* species occur widely in the Cape Provinces although *Agathosma betulina*, “Wareboegoe” (Real Buchu), does not occur in the southern Cape. Southern Cape participants all prefer *Empleureum uncapularis* which they call “Langblaarboegoe or Bergboegoe.” This sought after Boegoe is only found in the mountains, and now only within Nature Reserves. When someone has some, it is treated like gold, allowed to dry, and used very sparingly. When asked how and where they got it, the most common answer was from a relative in “Working for Water” or “Working on Fire.” These two organisations employ casual labour for a contract period and periodically clear aliens and cut fire breaks in inaccessible reserve areas. Apparently, the precious plant material is not supposed to be collected even if after making firebreaks the plants are left lying to go to waste (I have seen evidence of this personally). Conservation should be of benefit to all and especially to those people who sustainably used the resources for thousands of years in the past. The very common *Agathosma ovata* is an easily found local substitute for more desirable Boegoes, but is not as potent. Access to the archaeological painted sites inhabited by ancestral Khoi-San is almost impossible for modern Khoi-San, and as a result they know very little about these sites or the paintings they hold.

6.3.1 Use Value Indices in ethnobotany

In Table 11, page 122, value Indices for the ethnobotanical data were averaged and the genera are sorted from highest to lowest according to the averaged rating. The number of reports and uses for each genus were recorded and the data analysed using Heinrich’s Species Value Index (Heinrich, Ankli, Frei, Weimann, & Sticher, 1998), and F. Reyes Garcia Cultural Value Index (Reyes-Garcia, 2010); and my own Use Value formula (Chap 3). The three different indices give similar results, but with anomalies, such as Reyes Garcia value for *Helichrysum* being way above the rest. When working at the species level, individual species with high Use Values do not closely overlap with the most frequently found species at sites. However, if the species are clustered into genera or into families then the pattern often shows a higher degree of overlap, confirming that modern uses correlated to taxa found at archaeological sites often have a sound chemotaxonomic basis. The choice of what plant to use for which ailment is therefore not random or driven by superstition or old wive’s tales. There is some value then in employing Use value or Cultural Importance indices, but not in measuring individual participant knowledge.

Table 11 - Ethnobotanical survey in 6 southern Cape areas. Sorted according to averaged Cultural Use and Consensus Values: A.
 Number of reports per genus; **B.** Number of informants; **C.** Number of uses per genus; **D.** Zones out of 6; **E.** Heinrich SVI; **F.** Reyes-Garcia CVI; **G.** Van Wijk V I; **H.** Average Use Values.

Family	Genus (species)	Common Name	A	B	C	D	Ailment	E	F	G	H
Asteraceae	<i>Helichrysum</i> (<i>petiolare, crispum, cymosum / foetidum, splendidum</i>)	Hotnotskooi,	48	24	14	6	Cultural, Internal organs, Heart problems, Pain, Chest complaints, Woman's conditions, Parasites, Internal infections, Respiratory problems, Diabetes, Common infections, External infections & wounds, Household uses, Skin problems & hygiene.	0.73	1.31	1.25	1.10
		Hotnotskooigoed, Kleinkytjie, Kooigoed, Vaalky / Geneesblaar, Lekkeruikbos, Skaapkaroo									
Lamiaceae	<i>Leonotis</i> (<i>leonurus, nepetifolia, ocyimifolia</i>)	Wildedagga,	38	24	14	6	Chest problems, Heart problems, Diabetes, Respiratory infections, External infections, Common infections, Stomach problems, Blood toxins, Pain, Non-specific, Skin & hygiene, Parasites, Women's conditions, Nausea.	0.69	0.59	0.83	0.70
		Klipdagga, Leonotis, Geelkopdagga,									
Aizoaceae	<i>Carpobrotus spp.</i>	Ghokum, Goukum,	18	9	8	6	Edible, Stomach problems, Childhood ailments, External infections, Pain, External infections & wounds, Warts, Common infections	0.71	0.70	0.37	0.59
		Goena, Dikgoena, Suurvuy									
Geraniaceae	<i>Pelargonium</i> (<i>capitatum, zonale, tomentosum, cordifolium, radens, grassularioides</i>)	Malva	16	7	5	6	Common infections, Internal organs, Woman's conditions, Pain, Heart problems,	0.67	0.49	0.35	0.50
Scrophulariaceae	<i>Selago cymbosa</i>	Aambeibossie, Kousa,	14	11	6	3	Internal organs, Stomach problems, Respiratory infections, Woman's conditions, Common infections, Tonic	0.57	0.37	0.25	0.40
		Moerbossie, Slakkiebossie									

Family	Genus (species)	Common Name	A	B	C	D	Ailment	E	F	G	H
Asteraceae	<i>Osteospermum</i> (<i>Chrysanthemoides</i>)	Bitou, Bitoubessie, Bilhô, Bitoubos	16	10	9	4	Edible, Heart problems, Diabetes, External infections & wounds, Common infections, Internal organs, Cancer, Parasites, Veterinary	0.43	0.46	0.19	0.36
Asphodelaceae	<i>Aloe</i> (<i>ferax</i> , <i>arborescens</i>)	Alwyn, Kraalalwyn	11	7	5	6	Edible, Pain, Stomach problems, Parasites, Blood toxins	0.64	0.21	0.22	0.36
Crassulaceae	<i>Cotyledon orbiculata</i>	Plakkie, Slapchips, Plakkieooneer	12	8	4	5	Earache, Sore throat, Plantar warts, Scabies, Earwax	0.67	0.14	0.24	0.35
Crassulaceae	<i>Crassula ovata</i>	Karky, Plakkie ooneer, Plakkieblaar	4	3	3	2	Edible, Diabetes, Pain	0.95	0.01	0.04	0.33
Anacardiaceae	<i>Searsia</i> [<i>Rhus</i>] <i>spp.</i>	Taibos	5	5	2	3	Edible, Skin problems	0.60	0.20	0.12	0.31
Solanaceae	<i>Solanum</i> (<i>incanum</i> , <i>retroflexum</i> , <i>spinescens</i>)	Bitterappel, Slangappelbos	10	8	4	6	Edible, External wounds & infection, Pain, Neurological problems	0.40	0.23	0.16	0.26
Thymelaeaceae	<i>Passerina rigida</i>	Bakbos, Bakbossie, Gonna	7	4	4	3	Cultural, Edible, Household uses, Stomach problems	0.50	0.09	0.10	0.23
Rutaceae	<i>Agathosma</i> (<i>ceriifolium</i> , <i>Ovata</i>) / <i>Empleurum</i> (<i>unicapsulare</i>)	Buchu, Valsbuchu, Steenbokboegoe / Bergboegoe, Langblaarboegoe, Olifantboegoe	37	25	10	3	Non-specific, Heart problems, Internal organs, Common infections, Tonic, Pain, Diabetes, Respiratory problems, Failing eyesight, Stomach problems	0.40	0.14	0.10	0.21
Asteraceae	<i>Elytropappus</i> <i>rhinacratidis</i>	Anoster	3	11	3	2	Pain, Common infections, Nausea	0.50	0.04	0.06	0.20
Malvaceae	<i>Anisodantea</i> <i>scabrata</i>	Wildestokroos	4	3	3	2	External infections & wounds, Parasites, Scalp & hair	0.50	0.01	0.04	0.18
Celastraceae	<i>Gymnosporia</i> (<i>buxifolia</i> , <i>szyszylawiczii</i>)	Pendoring, Kleinpendering	2	1	1	1	Common infections	0.50	0.00	0.04	0.18
Apocynaceae	<i>Carissa</i>	Nam Noempies, Suurbessie	2	2	1	3	Edible	0.50	0.00	0.04	0.18
Ebenaceae	<i>Euclea undulata</i>	Ghwarrieboom	1	1	1	2	Common infections	0.50	0.00	0.02	0.17
Asteraceae	<i>Senecio arenatus</i>	Jonasbos	3	2	3	2	Children's ailments, External infections & wounds, Veterinary	0.40	0.02	0.05	0.16

Family	Genus (species)	Common Name	A	B	C	D	Ailment	E	F	G	H
Ebenaceae	<i>Diospyros (austro-africanus, dichrophylla)</i>	Bloubos, Tolbosbessie, Hotnotstolletjie	6	5	4	3	Edible, Cultural, Childhood ailments, External wounds and infections.	0.33	0.05	0.07	0.15
Asparagaceae	<i>Asparagus spp.</i>	Wildeaspersie, Asparagus, Katjang	4	3	3	3	Respiratory problems, Internal organs, Stomach problems	0.33	0.04	0.06	0.14
Santalaceae	<i>Colpoan [Osyris] compressum</i>	Nantagarra, Nan de Garrra, Scascara	5	3	3	3	Edible, Household, Stomach problems	0.33	0.04	0.06	0.14
Menispermaceae	<i>Cissampelos capensis</i>	Dawidjtiewortel	4	3	3	3	Cultural & superstition, Women's conditions, Pain	0.29	0.05	0.05	0.13
Asteraceae	<i>Eriocephalus africanus</i>	Kapokbos, Kankerbossie, Karoobossie	6	5	6	3	Cancer, Scalp & hair, Heart problems, Stomach problems, Neurological problems, Common infections	0.10	0.20	0.07	0.12
Fabaceae	<i>Indigofera zeyheri</i>	Leeuhoutjie	5	7	2	1	Stomach problems	0.33	0.00	0.03	0.12
Malvaceae	<i>Hermannia spp</i>	Kwaaiman, Pleisterbos	7	5	2	2	Fits, Diabetes, Tonic / Any ailment, Shivering (chill), Sore throat, Cold, Stomach problems	0.29	0.03	0.03	0.12
Sapindaceae	<i>Dodonea angustifolia</i>	Ysterbos	6	3	5	3	Chest complaints, Childhood ailments, Pain, Common infections, Nausea	0.17	0.05	0.05	0.09
Sinopteridaceae	<i>Cheilanthes parviloba</i>	Klein Varing, Oorstokkies	1	1	1	1	Colds, Sore throat, Inflammation, Pierced ears	0.00	0.01	0.02	0.01
Amaranthaceae	<i>*Chenopodium murale</i>	Misbredie	2	2	2	3	Woman's conditions, Childhood problems	0.00	0.01	0.02	0.01
Moraceae	<i>Ficus</i>	Makvey	1	1	1	1	Skin & hygiene	0.00	0.00	0.02	0.01
Solanaceae	<i>Lycium hirsutum</i>	Wolvebos, Wolvedoring	1	1	1	2	External infections & wounds	0.00	0.00	0.01	0.00
Solanaceae	<i>Withannia somnifera</i>	Geneesblaartjie, Fluveelblaar	1	1	1	1	Wounds	0.00	0.00	0.01	0.00
Scrophulariaceae	<i>Buddleja salviifolia</i>	Bossalie	1	1	1	3	Children's ailments	0.00	0.00	0.01	0.00
Caryophyllaceae	<i>Pollichia campestris</i>	Suikerhappies	1	1	1	1	Edible	0.00	0.00	0.01	0.00

It was interesting to find that the top taxa remained much as they do throughout all other tables, regardless of the method used to rate them. I found that there was little consistency in definitions and methods used to measure individual use values across studies. Some researchers studied knowledge as applied to medicinal plants (Sternberg, Nokes, Geissler, Prince, Okatcha, et al., 2001), others the use of wild plants (Reyes-García, Marti, McDade, Tanner, & Vadez, 2007), and some authors focused on crops (Boster, 1987). Interview structure or written questionnaires where used are not standardised. There is no accepted standard formula as each researcher tweaks previous indices to personalise them. I also experimentally developed a formula to see what results it would give. Victoria Reyes-Garcia (2007) comments “*the lack of conceptual consistency and comparable data limit the inferences that can be drawn from empirical analyses of ethnobotanical knowledge.*” As a result, there is no comparable baseline to make comparison possible between my work and theirs, or theirs and other researchers. Each researcher had a different concept of what they were looking for (Reyes-García, Marti, et al., 2007). A methodology which allows for useful comparison across studies regarding the value of one taxon over another culturally, and what drives the creation, loss, or persistence of ethnobotanical knowledge across cultures in the world, has clearly not yet been found.

There also seems to be little use made of the results which is of value to the research. There is little discussion regarding what the results mean, just a long listing of abstruse figures between 0 and 1 which mean very little if they are not fully discussed or explained. The matrix method for rating participant knowledge is discussed in Chapter 3, and is not used here. Hoffman, and Gallaher (2007), while stating that RCI is vital to ethnobotanical research, also comment -

“Quantifying a complex, multi-dimensional concept such as “importance” is a formidable task. In this review, we have attempted to sort out and compare the bewildering array of RCI indices that have grown like wildflowers cross-fertilized by the social and biological sciences. As we have shown, even the most “objective” use-value methods are subjective, especially in the assignment of plant use categories.”

What is of interest is the correlation between the high scoring taxa here in Table 11, page 122 - 124) and those ranked by regression in Chap. 4, Table 5, page 71. *Asteraceae*, *Lamiaceae*, and *Geraniaceae*, score above 0.5 on average. But, *Anacardiaceae*, *Solanaceae*, *Malvaceae*, *Celastraceae* and *Ebenaceae* are only score above 0.5 in Heinrich’s valuation, not in Reyes-Garcia or mine.

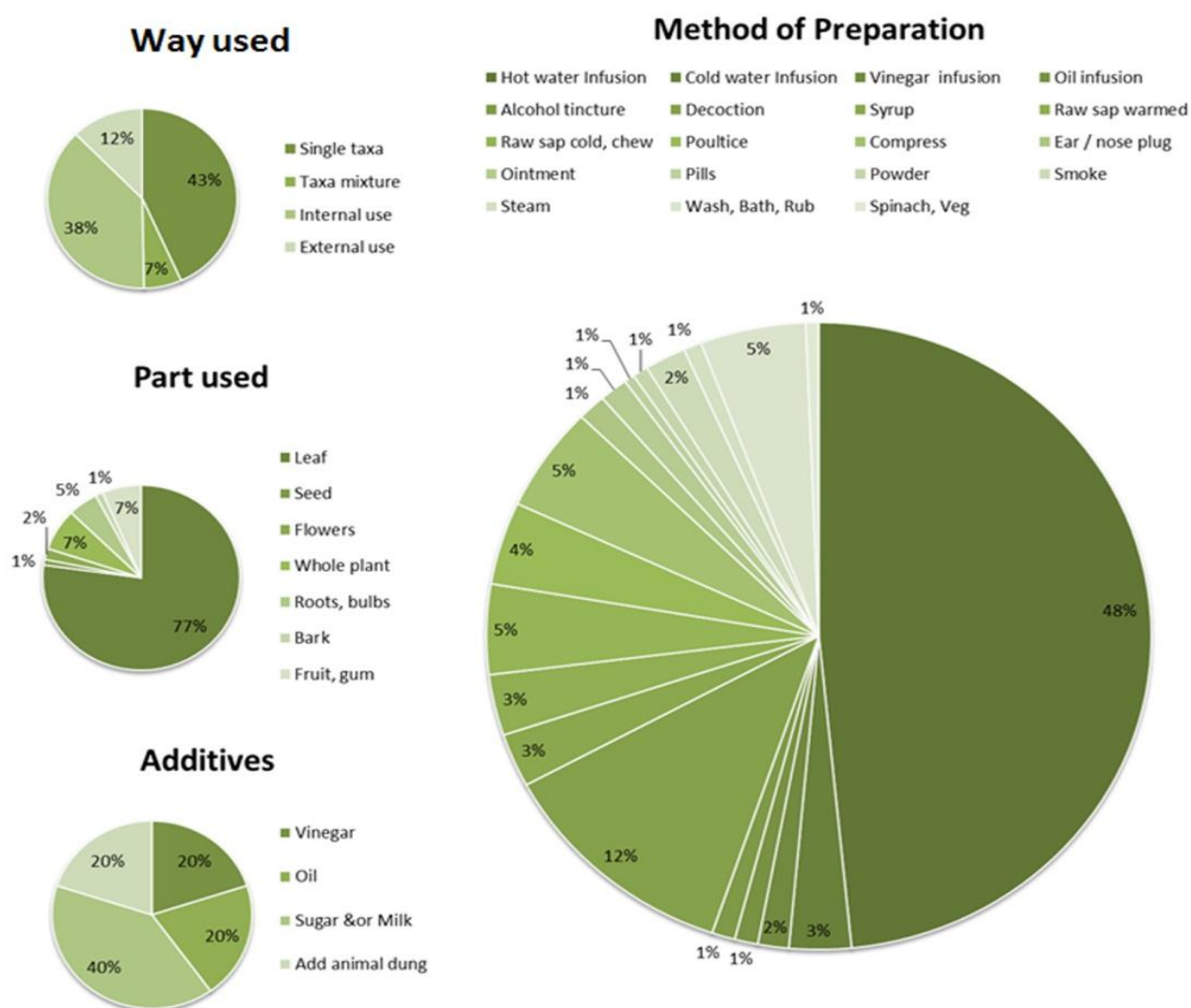


Fig. 12 – Plant preparation methods, parts used, and additives

6.3.2 Can ownership of indigenous knowledge and academic freedom co-exist?

This is a question which poses an ongoing conundrum for ethnobotanical research. The danger of nepotism even in the guise of benevolent family ownership of knowledge (Masemula, 2013; Jaskiewicz, Uhlenbruck, Balkin, & Reay, 2013), and contradictions in the interpretation of recognition and benefits due to informal participation, can be difficult to reconcile with academic freedom to disclose or make public the data gathered (Tapela, Büscher, et al. 2009; B-E. van Wyk, de Beer., 2012). Who actually owns the knowledge about widely used plants? Not necessarily the person who happens to give information, or be asked for it, and not the researcher. Much knowledge is already in the public domain and has been for hundreds of years, since the first Europeans reached the Cape and wrote and

published what they had learnt or "discovered," usually second-hand, and not always correct ([personal observation](#)). Whether they had a moral right to do so, is not for discussion here, but the fact that they published the information they gleaned, means that that information and knowledge spread around the world and was in the public domain forever after. It cannot revert to private or personal knowledge. This 'borrowed' knowledge, whether correctly transcribed or not, has an effect on everyone who reads or hears it, for as long as the book or paper is available to be read. Marco Leonti ([2011](#)) cautions that historical texts and popular books or articles on plant use, and also informant interaction while sharing knowledge during ethnobotanical research projects, all generate information and knowledge which progressively adapts and alters the results of future ethnobotanical research.

Legislating to 'protect' indigenous knowledge has largely failed, and perhaps it is because not enough is really known about what the actual traditional users think and feel themselves. In addition, to allocate "ownership" of knowledge about a certain plant to any one group or clan or community of people is generally not being fair but pandering to what looks like a fair deal when in fact those people will get so little it is meaningless. The important point is that the same plant species or closely related taxa, are usually used so widely country-wide, continent-wide, or globally, that it is impossible to allocate ownership of knowledge to any one group or one person. If a plant and its uses have been reported repeatedly or even just once, that knowledge is in the open domain. More importantly, from a bio-cultural point of view however, is that by broadening our research and study to include a much wider spectrum of traditional peoples throughout a country or the world, correlations between use begin to appear which are lost in local and small-scale studies. To base novelty of plant use on just the one un-reported method someone uses for it, is distorting its eligibility for patent and piracy. Hopefully that the results here make this point quite clear, and obviate any "rights" a buyer might think they have because of some agreement signed with a small convenient group, while the patent protects the company into the future and generates far more money than any group would ever receive for their knowledge.

6.3.3 Impact of modern media on knowledge and use of plants

The language spoken by the modern Khoi-San of the southern Cape is Afrikaans which is still the language of instruction in schools. As relatively few botanical and ethnobotanical books are published in Afrikaans, even those few people who would like to make use of books to learn more about plants and their uses, cannot easily do so. However, the fact that so many

mothers and grandmothers worked as household help for white families has impacted on the use of the plants which are used today, as has a plethora of written, televised, and digital media information available to modern communities (Leonti, 2011). Another reason for substituting European herbs for traditional wild plants is that it is difficult to access the full repertoire of wild plants with restrictions on entering and collecting in the many Nature Reserves. Many uses were given by participants for a range of common garden herbs, a few were used conventionally as flavourings, but most as if they were traditional remedies. These foreign or alien plants are included in the data, as by ignoring the fact that they are part of a continual adaptation to new knowledge, supposes that the knowledge is static and unchanging from the past which it is incorrect. Traditional knowledge is resilient in continually adapting to change both in the natural and social environment; this needs to be recognised and incorporated into ethnobotanical research. The foreign plants are members of genera and families which are of importance among the indigenous plants of the southern Cape and globally. In the case of the “Salie’s” (Sages) one can see how naming and usage adapt to new plants and similar but different species, or across closely related genera (see Chap 5, for discussion about Salie’s). Craven and Kohlberg make this pertinent comment - *“Sometimes the same common name has been given to different species of the same genus and in some cases plants from completely different families or genera may have the same name. This is often due to convergent evolution or plants having the same properties”* (probably 1998).

6.3.4 Validation of Khoi-San plant knowledge

Different species within a genus or even closely related genera, are frequently used as substitutes by indigenous and traditional groups depending on which species is present and available in their particular locality. The genus is essentially the terminal taxon in indigenous traditional taxonomy (Berlin, 1973, 2014) (discussed in Chap. 5.6, page 101). Traditional plant users understood that different species within a genus would probably exhibit the same or very similar properties, long before modern science validated the fact. Chemotaxonomic and phylogenetic studies have demonstrated that chemical properties, particularly in the form of secondary metabolites, are clumped or clustered in families and genera and substitution is valid (see Chap 5.6.2, page 105). Listing each individual species in a database can result in duplication and inconsistencies in analysis and results if it is substituted for another species which is used elsewhere, it does not portray the true picture of usage over a large area through time. Likewise, when a single species is considered as the only "correct" one for a particular use, and other closely related species are ignored, much valuable information is lost.

Modern pharmacological research into plant remedies and drugs has always been important and has validated many traditional remedies, particularly of European origin and those which have hit the headlines over the years such as *Hoodia*, *Sutherlandia*, and latterly Dagga. However, thousands of plant species have been scanned in costly drives to find drug to cure or prevent cancer, tuberculosis, malaria, or HIV Aids. Bioprospecting and Biopiracy both have negative connotations for indigenous plant knowledge and legislation to ban them or make money out of them are constantly on global drawing boards, with little effect on the ground. Those taxa which have been thoroughly scanned and tested have for the most part confirmed traditional usage as appropriate and in this way validate the knowledge held. I have serious concerns about the ethics and efficacy of many of these research projects, in that they are funded by big Pharma companies and so are too often biased and have been shown to falsify results to suit the financial needs of the company (Fanelli, 2009; John, Loewenstein, & Prelec, 2012). I do not enter into this debate here as it is too fraught with politics and many concerns to be dealt with here.

6.4 Plants and humans have a lot in common

Just how much in common humans have with plants is surprising to most people. Our closest living species relatives are the Chimpanzees and Bonobos (Thaler, & Stoeckle, 2016). Humans share about 98% of their DNA with these apes and a surprisingly high percentage with other animals and even with insects, and yes, with plants. Chemically the similarities are many, with only very small difference resulting in the apparently huge division into the two separate kingdoms taxonomically. Haemoglobin is the red pigment (with iron as a component) in blood, that is capable of transporting oxygen. Chlorophyll is the green pigment in plants and certain other organisms that is capable of trapping the energy of the sun to enhance the process of photosynthesis. The chemical make-up of Chlorophyll is very similar to blood, except for the central molecule of iron in blood which is replaced by magnesium in plants (Millar, & Waterhouse, 2005; Hughes, & Latner, 1936). Animals including humans, and plants, need the same elements (carbon, nitrogen, sulphur, oxygen, hydrogen, phosphorus, etc.. Plants get these from abiotic sources while humans (animals) get most of them from plants (Hallé, 2002) - this is the basis of their symbiotic and mutualistic relationship.

CHAPTER 7

Place

“Dwelling as a concept, is central to an understanding and recognition of the landscape clothed in a particular community made up of individual plants. The plants of the landscape envelope and nurture all animate life that dwells within it. Humans are just one part of the life which occupies this landscape: they dwell surrounded by plants, and are dependent on them for life at many levels. Yet acknowledgement of this close synergy is often absent in research, particularly into the way in which early humans survived.” -- [Tim Ingold, 1993](#)

7.1 Introduction

This chapter discusses the geographical and topographical as well as historical aspects of the southern Cape landscape, and the location and structure of sites in general in the light of the results reported on in Chapter 4. Since the first agricultural communities in various parts of the world adopted a settled lifestyle and intense cultivation of monocrops, the natural vegetation has undergone radical change and often eradication, been increasingly seen as irrelevant, and as taking up valuable agricultural space. Where there remains a sufficient pool of peoples who retain enough indigenous knowledge of non-agricultural use of natural or wild vegetation it is still possible to find cross-cutting links between human needs and taxa which address these needs. Where enough of this "original" or possibly "ancient" vegetation has persisted, it is often in refugia such as countryside too rough, infertile or inhospitable to allow large-scale agriculture. Here it is still possible to step back in time and relearn the links and synergies between humans, animals, and vegetation that has provided them with all the resources needed for sustaining life. The southern Cape and many other areas in South Africa and Africa as a whole retain enough of these wild inhospitable places, some very small, but rough enough to maintain the status of 'refugia, and' original enough to provide links to the past.

Hypotheses and theories that have resonance for my study of “Place” in this thesis, are the “Urban Cliff” theory ([Larson, Matthes, et al., 2004](#); [Lundholm, & Marlin, 2006](#); [Lundholm, 2011](#)), and the many papers on Niche construction and its implications ([Smith., 2011](#); [Crites, 1987](#); [Peters, O’Brien, et al., 1981](#); [Boivin, Zeder, et al., 2016](#)). Rock structures in the form of shelters, overhangs, walls, and caves are the sites that remain most obvious and have been

studied in the greatest depth over the past 100 years or so, open surface sites are more difficult to find and to read, but probably cover far more ground over the aeons than rock sites and were very likely connected to the rock sites socially and physically contingent in many ways in the past, although this is difficult to ascertain for certain today. The similarity between the ancient rock structures and today's affluent surroundings in cities is striking, affording niche habitats that are solid, reasonably weather proof and secure, with access to water and food that has now no immediate connection to the environment but of course relies on distant rural global spaces which still provide these resources although unseen. Natural vegetation is too often eradicated from the modern "built landscape" or included merely for adornment, particularly in larger and affluent cities.

7.1.1 How pristine is "Wilderness"?

It is not possible to say that any piece of land has not been anthropogenically altered or affected in some way, there is no pristine wilderness as we have been led to understand that term (Ingold T., 1993; Kirch, 2005; Denevan, 1992, 2011; Dent, 2013). Goldberg and Bar-Yosef (1990), suggest that during the last five millennia, *'human interference with the environment' has supplanted climatic fluctuations as the 'decisive factor' in shaping Levantine landscapes'*. It is not possible to equate non-presence of indicators today with absence in the past. Large scale recent disturbance has completely destroyed many sites or has hidden indications. Mining, agriculture, forestry, urban sprawl, missile testing and wars, to modern rail and road networks have all turned vast areas of land into modern deserts as far as vegetation and signs of prehistoric presence goes. King Richard 111's recent exhumation from beneath a modern car-park is an interesting example (King, Fortes, Balaesque, Thomas, & Balding, et al., 2014).

The western environmental movement, basing their theories on the need to preserve pristine areas for perpetuity has resulted in many unforeseen and possibly disastrous scenarios (Cock, 2000; Wilshusen, Brechin, Fortwangler, & West, 2002). Large tracts of land considered worthy of being called pristine have been turned into nature reserves and national parks after being "preserved" or "conserved" during the colonial era. Government conservation bodies moved any remaining indigenous inhabitants out, and these "high-value high-diversity" areas were put off-limits to the very people who sculpted them for thousands of years, and were responsible for their present high diversity value. They were forbidden and denied access and entry, and ignored and negated as having been the first occupants and conservationists on that

land. Only recently has the loss of diversity, unbalanced numbers of prey and predators, resulting in the need for culling to preserve the trees or the grass, and uncontrollable wild fires due to build up of senescent fuel. These problems have raised doubts about the validity of the “no humans” conservation approach, and led to consultation with the original inhabitants for input to deal with the problems in many countries (Beinart, 2000; Beinart. & McGregor, 2003). Consultation of any value has unfortunately been minimal in South Africa (Cock, 2000; Brosius, 2004).

Where individual plants are fore-grounded, it is in almost invariably in relation to agriculture; plants that humans have begun to domesticate or radically altered to provide food in bulk. Anthropologists write about hunter-gatherers and what they use(d) plants for, often providing long lists and reams of theoretical tables and statistical graphs. They bypass the large and small intimate connections and synergies between those plants and the people they are describing. Botanists describe endless lists of plants, vegetation types, biomes, interactions among plants and wild animals – but where are the intense relationships between plants and humans in botany? Brooks and Johannes (1990) and C.O. Sauer (1941, 1947, 1956) position humans within vegetation and the landscape, and show the symbiotic and dependent relationship of one with the other. But they are geographers, and even here where a few of the plants are named, the vegetation remains an amorphous resource, while botany and taxonomy are not an issue.

7.2 Archaeological sites in the southern Cape landscape.

Archaeology is the only discipline which can paint a picture of the distant past, how people lived and what their day to day lives might have been like. *“All peoples have some direct relationship with the botanical world, and the material evidence they leave behind can be recovered and interpreted. Paleoethnobotany is one of the most important tools we have for developing a picture of ancient life and landscape.”.. Naomi Miller (1997)*

The southern Cape with its series of long folded mountain ranges, inselbergs, rivers and gorges and a variable year-round rainfall, provides a fascinating study area. Add in the hundreds of ancient sites of great archaeological interest, the ubiquitous presence of ancient stone tool scatters, evidence of the earliest modern behaviour by humans, and you have a perfect place to map the co-evolutionary links between people and plants going far back in time. The intricately woven and entangled relationships between people, plants and place, are

underlain by genetic drift, speciation, mutation, combination and recombination between all living entities. This in turn impacts and shapes the environment by ‘*modification of vegetation communities: creating mosaics and edge areas, and resetting successional sequences.*’ (Smith, 2011). All biotic and abiotic entities were and are at the mercy of constantly variable changes in climate and random physical reworking of rock and terrain by water, wind, underground movement and temperature flux. The living biota thrived, struggled, migrated and metamorphosed in order to successfully exist and persist within the limits imposed by the environment and their ability to transform it. These are just some of the extremely complex adaptations systems (CAS) involved in attempting to untangle and infer the unwritten history of the ancient sites, the plants, and the people associated with them (see discussion regarding CAS in Chap. 2.2.3, page 15).

At first glance the 75 site complexes in the southern Cape might appear to be scattered fairly randomly over the map (Chap. 1.3, Fig. 3, page 6). In fact they can be likened to pulsing points of energy and mystery forming links and patterns along a chain of ancient access routes thousands or even millions of years old. The sites congregate along the edges of vegetation types, soil types and geological features, rocky ridges where vegetation types and soil types meet and separate, sheltering under ancient sandstones, granite, and duricrusts sculpted by water and wind doing their work for aeons. There are hundreds of shelters large and small forming niches along ancient routes where prehistoric animals trod and hunter-gatherers foraged, pastoralists herded their stock, and where they all found shelter and lived. Transhumant paths threading sites strung like beads between the inland and coastal areas where a pass through mountains ranges opens for seasonal movement of humans and animals bent on finding easier living or to escape climate changes (Parkington, 1971). The tensions and relationship between “inner or hidden” and “outer and visible” seem to permeate every aspect of the landscape as well as Khoi-San life, past and present. The inner and outer duality remains essential to the way in which humans negotiate and survive their habitation of the earth. The inner mostly hidden ‘spirit and thought’ balances the outer “persona and behaviour” to a greater or lesser extent for every human who has ever lived, and in hunter-gatherer belief systems this dual lifeway applied also to animals and even to inanimate nature. The rock art on the walls of shelters embodies this duality in its ability to be apparent and one with the outer rock face, but to ‘disappear’ into the rock through natural cracks and holes.

Table 12 – Southern Cape, Eastern Cape and eastern Free State site details

Site Code	Altitude metres	Aspect	R Art & arfics	No of spp.	Mucina & Rutherford		Vlok & E-Brown		Geology
					Biome	Vegetation Unit	Biome	Vegetation	
CO1	34	S	A	48	Fynbos	FS 8 Blombos Strandveld	Thicket	Gouritz Dune Thicket	Quarzitic Sandstone (Table mountain grp)
CO2	10 - 15	ESE SE	A	64	Fynbos	FS 9 Groot Brak Dune Strandveld	Marine	Gouritz Littoral Thicket	Quarzitic Sandstone (Table mountain grp)
CO3	170 - 200	NW	A	44	Fynbos	FFg 5 Garden Route Granite Fynbos	Forest	Wolwedans Thicket-Forest	Kaaimans Group
CO4	283	NW	P	27	Fynbos	FFh 9 Garden Route Shale Fynbos	Source	Moordkuils Perennial Stream	Gneissic Granite
CO5	40 - 47	S	A	62	Fynbos	FFg 5 Garden Route granite fynbos	Forest	Wolwe River Fynbos-Forest	Gneissic Granite
CO6	319	S	A	48	Fynbos	FFh 9 Garden Route Shale Fynbos	Fynbos	Melville Mesic Proteoid Fynbos	Kaaimans Group on T M Sandstone
CO 7	31	W	A	39	Forests	FOz1 Southern Afrotropical Forest	Forest	Wolwe River Fynbos-Forest	Granite intrusion in Kaaiman's
CO8	37	S	A	32	Forests	FOz1 Southern Afrotropical Forest	Forest	Wolwe River Fynbos-Forest	Gneissic Granite
CO9	100	NE	P A	46	Forests	FOz1 Southern Afrotropical Forest	Forest	Wolwe River Fynbos-Forest	Kaaimans Group
CO10	31	SW	A	40	Fynbos	FFh 9 Garden Route Shale Fynbos	Fynbos	Noetzie Thicket-Fynbos	Quarzitic Sandstone (Table mountain grp)
CO11	6 - 18	E & S	A	132	Fynbos	FFs 20 Tsitsikamma Sandstone Fynbos	Thicket	St Francis Strandveld	Quarzitic Sandstone (Table mountain group)
LA1	364	W	P A	31	Fynbos	FFc1 Swellendam silcrete fynbos	Fynbos	Fouriesberg Waboomveld	Quarzitic Sandstone (Table mountain group)

					Mucina & Rutherford		Vlok & E-Brown		
Site Code	Altitude metres	Aspect	R Art & arfts	No of spp.	Biome	Vegetation Unit	Biome	Vegetation	Geology
OU1	365	NE	P	27	Fynbos	FFs 18 North Outeniqua Sandstone Fynbos	Source	E-Langeberg Perennial Stream	Quarzitit Sandstone (Table mountain grp)
OU2	367	E	P	20	Fynbos	FFs 18 North Outeniqua Sandstone Fynbos	Source	E-Langeberg Perennial Stream	Quarzitit Sandstone (Table mountain grp)
OU4	625	N	P A	33	Fynbos	FFs 18 North Outeniqua Sandstone Fynbos	Source	Outeniqua Perennial Stream	Duricrust breccia
OU5	576	SE	P A	36	Fynbos	FFs 18 North Outeniqua Sandstone Fynbos	Fynbos	Witberg Waboomveld	Duricrust breccia
OU6	635	N NW	P A	25	Fynbos	FFs19 South Outeniqua Sandstone Fynbos	Fynbos	Witberg Waboomveld	Quarzitit Sandstone (Table mountain grp)
OU7	672	NE	P A	30	Fynbos	FFs19 South Outeniqua Sandstone Fynbos	Fynbos	Doornrivier Mesic Proteoid Fynbos	Quarzitit Sandstone (Table mountain grp)
OU8	734	NW	P A	30	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Diringrivier Waboomveld	Quarzitit Sandstone (Table mountain grp)
OU9	420-463	SW	P A	31	Fynbos	FFs19 South Outeniqua Sandstone Fynbos	Source	Moordkuils Perennial Stream	Gneissic Granite
OU10	513	NW	P A	35	Fynbos	FFs19 South Outeniqua Sandstone Fynbos	Source	Melville Grassy Fynbos	Quarzitit Sandstone (Table mountain grp)
OU11	451	W	P A	68	Fynbos	FFs19 South Outeniqua Sandstone Fynbos	Fynbos	Kleinplaat Grassy Fynbos	Quarzitit Sandstone (Table mountain grp)
OU12	261	NE	P A	23	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Forest	Outeniqua Plateau Forest	Quarzitit Sandstone (Table mountain grp)
KL1	640-657	N	P A	71	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Outeniqua Waboomveld	Quarzitit Sandstone (Table mountain grp)

					Mucina & Rutherford		Vlok & E-Brown		
Site Code	Altitude metres	Aspect	R Art & arftcs	No of spp.	Biome	Vegetation Unit	Biome	Vegetation	Geology
KL2	684	W	P A	34	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Kamanassie Waboomveld	Quarzitic Sandstone (Table mountain grp)
KL3	635	W	P	28	Fynbos	FFs18 North Outeniqua Sandstone Fynbos - boundary with - FFs 16 Uniondale Shale Renosterveld	Fynbos	Herold Renoster-Sandolienveld	Granite boulder
KL4	650-680	N	P A	58	Fynbos	FFs18 North Outeniqua Sandstone Fynbos - boundary with - FFs 16 Uniondale Shale Renosterveld	Fynbos	Outeniqua Waboomveld	Quarzitic Sandstone (Table mountain group)
KL5	672	W N	P A	31	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Outeniqua Waboomveld	Quarzitic Sandstone (Table mountain grp)
KL6	560	NE SW	P A	57	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Source	Outeniqua Perennial Stream	Quarzitic Sandstone (Table mountain grp)
KL7	699	NW	P	23	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Source	Outeniqua Perennial Stream	Quarzitic Sandstone (Table mountain grp)
KL8	653	NE	P A	33	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Source	Outeniqua Perennial Stream	Quarzitic Sandstone (Table mountain grp)
NO1	446	N	P	25	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Fouriesberg Waboomveld	Duricrust breccia
NO2	525-536	E S	P	21	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Fouriesberg Renoster-Sandolienveld	Quarzitic Sandstone (Table mountain grp)
NO3	514	SW	P	24	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Source	Outeniqua Perennial Stream	Quarzitic Sandstone (Table mountain grp)

					Mucina & Rutherford		Vlok & E-Brown		
Site Code	Altitude metres	Aspect	R Art & arftcs	No of spp.	Biome	Vegetation Unit	Biome	Vegetation	Geology
NO4	496-530	NE	P	33	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Drain	Olifants River & Floodplain	Quarzitic Sandstone (Table mountain grp)
NO5	489	NE	P A	44	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Source	Outeniqua Perennial Stream	Quarzitic Sandstone (Table mountain grp)
NO6	607	E W	P A	32	Fynbos	FRs 16 Uniondale Shale Renosterveld	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO7	605-610	N E	P A	51	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO8	568	N	P A	40	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO9	555	E N	P A	56	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO10	554-605	E	P A	89	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO11	624	SW	P	17	Fynbos	FRs 16 Uniondale Shale Renosterveld	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO12	640	E	P	23	Fynbos	FRs 16 Uniondale Shale Renosterveld	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO13	622	W	P A	22	Fynbos	FRs 16 Uniondale Shale Renosterveld	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO14	634-650	E NW	P A	35	Fynbos	FFs18 North Outeniqua Sandstone Fynbos - boundary	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO15	587	NE	P A	54	Fynbos	FFs18 North Outeniqua Sandstone Fynbos - boundary	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia

					Mucina & Rutherford		Vlok & E-Brown		
Site Code	Altitude metres	Aspect	R Art & arfts	No of spp.	Biome	Vegetation Unit	Biome	Vegetation	Geology
NO16	560	W	P A	52	Fynbos	FFs18 North Outeniqua Sandstone Fynbos	Fynbos	Herold Renoster-Sandolienveld	Quarzitit Sandstone (Table mountain grp)
NO17	627	N E	P A	53	Fynbos	FFs18 North Outeniqua Sandstone Fynbos - boundary	Fynbos	Paardeberg Fynbos-Sandolienveld	Duricrust breccia
NO18	650-689	N	P A	68	Fynbos	FFs18 North Outeniqua Sandstone Fynbos - boundary	Fynbos		Duricrust breccia below, sandstone above
GA1	400-408	N E S W	P	57	Albany Thicket	Rooiberg Arid Restoid Fynbos	Drain	Olifants River Floodplain	Quarzitit Sandstone (Tbl Mtn grp)
GA2	716-730	E N E	P	15	Fynbos	AT 1 Gamka Thicket	Fynbos	Rooiberg Arid Restoid Fynbos	Quarzitit Sandstone (Tbl Mtn grp)
GA3	380-387	N E	P A	36	Fynbos	Rooiberg Arid Restoid Fynbos	Drain	Olifants River Floodplain	Quarzitit Sandstone (Tbl Mtn grp)
KA1	469	S W	P	16	Succulent. Karoo	SKv 11 Eastern Little Karoo	Drain	Kamanassie Perennial Stream	Quarzitit Sandstone (Tbl Mtn grp)
KA2	733	S W	P A	28	Fynbos	FFs 26 South Kamannassie Sandstone Fynbos	Fynbos	Kamanassie Waboomveld	Quarzitit Sandstone (Tbl Mtn grp)
KA3	765	N W	P A	25	Fynbos	FFs 26 South Kamannassie Sandstone Fynbos	Source	Kamanassie Waboomveld	Quarzitit Sandstone (Table Mtn grp)
KO1	942	S	P	44	Fynbos	FFs 27 Kouga Sandstone Fynbos	Fynbos	Kouga Perennial Stream	Duricrust breccia
KO2	1017-1150	W E	P	43	Fynbos	FFs 27 Kouga Sandstone Fynbos	Source	Tsitsikamma Perennial Stream	Quarzitit Sandstone (Tbl Mtn grp)
KO3	1066-1384	W	P A	40	Fynbos	FFs 27 Kouga Sandstone Fynbos	Source	Tsitsikamma Perennial Stream	Duricrust breccia on T B Mountain (Sndst)
KO4	1035	N	P A	17	Fynbos	FFs 27 Kouga Sandstone Fynbos	Fynbos	Kouga Arid Proteoid Fynbos	Quarzitit Sandstone (Tbl Mtn grp)
KO5	708-712	N	P A	56	Fynbos	FFs 28 Kouga Grassy Sandstone Fynbos	nil	nil	Quarzitit Sandstone (Tbl Mtn grp)

					Mucina & Rutherford		Vlok & E-Brown		
Site Code	Altitude metres	Aspect	R Art & arftcs	No of spp.	Biome	Vegetation Unit	Biome	Vegetation	Geology
KO6	520-600	W	P A	40	Fynbos	FFs 28 Kouga Grassy Sandstone Fynbos	nil	nil	Quarzitit Sandstone (Tbl Mountain grp)
KO7	645	W	P	26	Fynbos	FFs 28 Kouga Grassy Sandstone Fynbos	nil	nil	Quarzitit Sandstone (Tbl Mountain grp)
SW1	474	S E	P	28	Fynbos	FFh 3 Swartberg Shale Fynbos	Fynbos	Mesic Proteoid	Cango Group Limestone
SW2	773	N E	P	24	Fynbos	FRI 1 Kango Limestone Renosterveld	Thicket	Cango Limestone Renosterveld	Cango Group Limestone
SW3	744	E	P	63	Fynbos	FRI 1 Kango Limestone Renosterveld	Thicket	Cango Limestone Renosterveld	Cango Group Limestone
SW4	780-750	W W	P A	31	Fynbos	FRI 1 Kango Limestone Renosterveld	Thicket	Cango Limestone Renosterveld	Cango Group Limestone
SW5	697	W	P	52	Fynbos	FRI 1 Kango Limestone Renosterveld	Thicket	Cango Limestone Renosterveld	Cango Group Limestone
SW6	587	W	P A	17	Fynbos	FRI 1 Kango Limestone Renosterveld	Thicket	Kruisrivier Waboom-Thicket	Cango Group Limestone
BA 1	569	N E	P A	15	Albany Thicket	AT 3 Groot thicket	nil	nil	Weathered Enon conglomerate
AN 1	913	W	P A	17	Fynbos	FRs 6 Matjiesfontein Shale Renosterveld	Suc Karoo	Klipfontein Apronveld	Quarzitit Sandstone (Tbl Mountain group)
AN 2	688	N	P A	16	Suc. Karoo	SKv 8 Western Little Karoo	Suc Karoo	Vrede Karroid Renosterveld	Duricrust breccia
GK1	1145-1150	S W	P	25	Fynbos	FFs 23 North Swartberg Sandstone Fynbos	Renoster veld	Bosluiskloof Grassy Fynbos	Quarzitit Sandstone (Tbl Mountain grp)
GK 2	774-780	E	P A	21	Fynbos	FFs 23 North Swartberg Sandstone Fynbos	nil	nil	Duricrust breccia
GK3	792-1150	E W	P	25	Suc. Karoo	SKv 13 Prince Albert Succulent Karoo	nil	nil	Quarzitit Sandstone (Tbl Mntn grp)

Eastern Cape								
EC1	687	N W	P	72	Savannah	FFq6 Suurberg quartzite		Quarzitic Sandstone (Tbl Mountain grp)
EC2	576	S N	P	48	Savannah	FFq6 Suurberg quartzite		Quarzitic Sandstone (Tbl Mountain grp)
EC3	686	N	P	18	Savannah	FFq6 Suurberg quartzite		Quarzitic Sandstone (Tbl Mountain grp)
EC4	341	S W	P	32	Savannah	FFq6 Suurberg quartzite		Quarzitic Sandstone (Tbl Mountain grp)
EC5	402	S W	PA	55	Savannah	FFq6 Suurberg quartzite		Quarzitic Sandstone (Tbl Mountain grp)
EC6	570	E	A	32	Albany Thicket	FFq6 Suurberg quartzite boundary with SVs7 Bisho thornveld		Quarzitic Sandstone (Table Mountain grp)
EC7	520	N E	P	46	Albany Thicket	NK14 Albany broken veld		Quarzitic Sandstone (Tbl Mountain grp)
EC8	263	N	PA	35	Albany Thicket	AT8 Kowie thicket boundary SVs7 Bisho thornveld		Quarzitic Sandstone (Table Mountain grp)
EC9	604	N	PA	37	Albany Thicket	FFq6 Suurberg quartzite		Quarzitic Sandstone (Tbl Mountain grp)
Eastern Freestate								
EF 1	1523	E		34	Grassland	GM5 Basotho Montane Shrubland		Table Mountain Group (Sandstone)
EF 2	1625	S E	PA	26	Grassland	GM5 Basotho Montane Shrubland		Table Mountain Group (Sandstone)
EF 3	1779	N W	P	17	Grassland	GM5 Basotho Montane Shrubland - boundary with - GM4 Eastern Free State Sandy Grassveld		Table Mountain Group (Sandstone)
EF 4	1652	S	P	24	Grassland	GM5 Basotho Montane Shrubland - boundary with - GM4 eastern Free State Sandy Grassveld		Table Mountain Group (Sandstone)
EF 5	1652	E	P	31	Grassland	GM5 Basotho Montane Shrubland - boundary with - GM4 eastern Free State Sandy Grassveld		Table Mountain Group (Sandstone)
EF 6	1614		A	35	Grassland	GM4 eastern Free State Sandy Grassveld		Table Mountain Group (Sandstone)

7.3 Sites as dwelling place – from rock shelter to city canyon

It appears that Early Stone Age sites were mostly open-air sites (Volman, 1984), with an increase in use of caves and shelters in the Middle Stone Age accelerating into the Later Stone Age and Holocene (H. Deacon, J. Deacon, 2003). There is Evidence for occupation all around some sites eg. Klasies River complex, more than one cave plus tool scatters over a wide area indicate that people made use of a much wider area than just the caves themselves (personal observation). It could be that caves and shelters formed annexes to larger open-air camps which are now virtually invisible apart from scatters of stone artefacts. At a couple of sites on the West coast there are is some evidence that in the LSA people may have moved out of the caves into reed huts (Webley, 1992). There is evidence that people visiting the coast periodically did not always make use of the caves for habitation, but used open- air sites.

7.3.1 What humans need from a site.

Ancient habitation and living sites are tangible examples of what humans need to exist and subsist. Geology, vegetation, the wider environment both living and non-living, and a critical need for water and food, are common parameters governing human life in the past, present, and future. For a long time just these basics were considered when evaluating pre-modern humans and habitats, it was assumed that hominids and early Homo species had no cultural and artistic need for beauty or spirituality. This has changed as ever more finds dating further back in time come to light along the southern Cape coast, in particular with regard to symbolic representation on ochre, and ostrich egg shell, and shell beads (Henshilwood, Marean, et al., 2003; Henshilwood, d'Errico, Vanhaeren, van Niekerk, & Jacobs, 2004; Marean, Bar-Matthews, et al., 2007; Texier, Porraz, Parkington, Rigaud, Poggenpoel, et al., 2010). Modern humans unwittingly retain much from their past, including their needs and their inherited memories holding knowledge. The world today, and human lives and environment have changed drastically after being modified and altered by ever advancing and more sophisticated technologies. Plants as essential to humans, and to all life, have lost their pivotal status in the eyes of so many people during the last few hectic periods of human development, and are now regarded by too many as merely a resource with a monetary value or none, to be manipulated and used. Humans lose their awareness of the centrality of plants in our lives at their peril.



Fig. 13a – Site NO8. A perfect setting for a habitation site. Incorporating a view site on the flat duricrust topping with material for stone tools at hand (scatter of flakes and cores present), and a river within two kilometres.



Fig 13b – Site NO8. Interior with level floor, dense green wall giving protection from sun, wind and rain on the northern side. Situated on the Fynbos and Renosterveld ecotone edge, with a riparian valley below.

provided shelter, lookouts sites, and often large shelters or overhangs. Dark patches of dense thicket forming green walls often direct one to a good overhang or shelter. The ‘giz’ of the plant mass or green wall can indicate to those who know, that the plants include taxa that will provide fruit, fuel and other necessities, as well as a fourth wall of dense vegetation to keep out rain, wind, heat and cold. The shelter itself needs to be dry, as level floored as possible, high enough to stand in comfortably, and not more than about two kilometres from a source of fresh water. The best shelters are in or at the top of a slope that is reasonably easy to ascend, but easy to defend from predators and enemies. A good lookout point above the shelter from which to spot prey or danger is good. Access to a wide range of vegetation types and mixed topographies means that a series of food plants and prey animals should be available throughout the year. In the “Urban Cliff Revolution” (Larson, Matthes, et al., 2004) they propose that cliffs and rock shelters in all biomes were optimal places for humans to exploit (and inhabit) and that the *“combination of "Rock as home" rock as sanctuary" " rock as supermarket" is compelling. No other combination of habitat elements, in our view, has supplied the resources necessary to sustain human life, and the fossil and archaeological record supports this conclusion.”* (Larson, Matthes, et al., 2004).

Modern research recognises the importance and usefulness of vegetation in the urban concrete canyons of today’s mega-cities Larson, Matthes, et al., 2004; Lundholm, 2006). Recent researchers in Europe, China and the Middle East looking into the benefits of ‘Green Vertical Systems’, have measured and quantified the benefits in temperature amelioration, wind protection, regulation of humidity levels, and control of dust and airborne pollution (Köhler, 2008; Pérez, Rincón, et al. 2011). These results serve to quantify and confirm the usefulness of what we have termed “green walls” at archaeological sites. Larson, Matthes, Ludholm, et al., (2004) trace an ancestral hard-wired human need for the protection afforded by cliffs harbouring rock-shelters and the vegetation that grows in association with them. The modern urban environment of concrete and paving is typically lacking the ancient vegetation element, which has resulted in the disconnect between modern humans and the natural environment, ie. the loss of CWN, that has led to the degradation and loss of biodiversity seen today (see Chap 2.2.4, page 15, and this Chapter 7.4, page 147).

There are other factors which go towards making a habitation site a particularly good one. There is often a connection between sites, looking out from one site it is very often possible to see another across the valley or the kloof, they often face each other line of sight and one

can imagine that messages would have been sent between them, food shared, and close social ties made. Many sites have extremely good acoustical qualities and echos, sound could have played an important part of their lives and would have included rock gongs and early music. Pathways connecting sites must have been trodden by game and by people, leading to the question, how many of our roads still follow these ancient highways? “*Roads are the threads of connection binding the people to the land and to memories,*” as stressed by the modern Khoi-San group who are bent on reclaiming their birthright by walking hundreds of kilometres each year to present petitions to the government at The Castle and parliament in Cape Town (Vollenhoven, Fekisi, 2017).

7.3.2 Physical alteration to site surroundings through enrichment of soils.

The maximum natural extent of the typical vegetation at most sites in the south-eastern Cape ranges from one or two meters from the drip-line to 20 to 50 metres with a maximum of 100 metres. Incidentally this coincides intriguingly with the reported 100 metre radius within which inhabitants would generally defecate away from the living space (Silberbauer, 1981; Lee, & Daly, eds 1999; plus comments by John Parkington and Janette Deacon.). References to the sanitation and methods of human waste disposal by inhabitants in the past are surprisingly sparse considering the importance this holds for the alteration of soil structure and chemical properties. Household refuse would likely have been swept and thrown out beyond the drip-line and within the 100m radius, where it decomposed forming humus in the surrounding area or built up into small mounds or middens. Where there is a steep slope below the drip-line the ‘midden’ would have spread down the talus slope.

Soil samples were taken near two sites, NO10 and KL1 (see Chap. 8). Test results show higher ph. readings and significantly increased levels of phosphorus, Magnesium, and salt as one approaches the habitation site itself (see details Chap. 8, Table 1, page 176). Did the dense patches of useful taxa, result at least partially, from the germination of edible fruits and seeds eaten by foragers in the veld, which were carried back to rock shelters and overhangs? The seeds of plants selected as food or medicine, or bedding, fuel, and tinder could have germinated and persisted within the enriched areas directly below or surrounding each site where soil fertility had been increased by long periods of human activity and waste disposal (Sauer, 1947).

Fig 14 – Soil map of the southern Cape with 75 site complexes overlaid



The site locations in Fig 14 often sit on the edges of different soil types. Edges must have been important to inhabitants of the sites. Bordering on a range of different soil substrates, vegetation types and geological areas, would have given early humans access to a much wider range of plant resources and prey animals (Turner, N.J., Davidson-Hunt, I.J. O'Flaherty, M., 2003). The proximity of rivers to sites is also seen, most sites are within 2km of seasonal or perennial fresh water.

The patches of enriched soil can be compared, although on a smaller scale, to anthropogenic Amazonian Dark Earths (Woods, ed. 2004; Lehmann, Kern, Glaser, & Woods, eds 2007; Balée, 2010). Research into “Forest gardens” has shown that much of the Amazon Forest is secondary growth with anthropogenic patterning of increased density of useful plants indicating hidden archaeological sites (Ross, & Rangel, 2011). Central African “Dark Earths” of anthropogenic origin (Fairhead, & Leach, 1996, 2009; Solomon, Lehmann, Fraser, Leach, Amanor, et al., 2016), similarly resulted from the enrichment of the soil due to charcoals and natural human waste deposition and disturbance.

Although nothing similar to Amazonian or central African Dark Earths has been associated with southern African sites as yet, the likelihood is that they are present. Certainly some of the larger patches of thicket grow in dark organically rich soils at some of the sites. For example at Klasies River (Chap 9, Fig. 7, page 207) where I personally measured nearly one metre of deep dark humus rich earth built up under dense thicket growth on fairly steep slopes above the river. The soil and substrate would have been progressively enriched by scattering of food waste, human waste disposal and the presence of latrine areas, but also with humus built up from leaf litter and debris under the dense thicket. Seeds would germinate, grow, and the thicket densify at and near the sites over time. At the entrance to each site where a midden or talus slope of waste formed increasing the depth of soil, the typical green wall effect was encouraged. In this way the “place” surrounding the site, would be transformed into a progressively more attractive and favourable niche for both people and plants. Lechmere-Oertel, et al. (2005) comment on the ability of established thicket taxa to enrich the soil and increase nutrients including phosphorus. Thicket vegetation produces exceptionally high biomass, litter fall and carbon storage (Lechmere-Oertel, Kerley, & Cowling, 2005). The high biomass is due to the accumulation in the soil of organic carbon to a depth of 30cm below dense thicket vegetation.

The study of phytoliths in the soil and in archaeological site strata are a fruitful area of study which is coming into its own. In South African archaeology there is a great need for a comprehensive database of phytolith images in order for comparative identifications to be made when they are found in ancient levels at sites. I was closely involved in collecting and identifying the plants for Alice Novello’s study of modern plant phytoliths at Klasies River (Novello, Bamford, van Wijk, & Wurz, 2017). Esteban, Vlok, et al. (2017) published a recent paper examining modern plant phytoliths from Still Bay in the west, to Knysna in the east;

they comment “*Comparative studies of phytoliths (reference collections) from modern plants are necessary for accurate interpretation of fossil phytolith assemblages,*” (Esteban, J. Vlok, et al., 2017). Unfortunately, neither study has as yet yielded identifications for ancient phytoliths that could be referred to here.

If people influenced the distribution of plants, knowingly or not, by disseminating the seed wherever they foraged and particularly within the surroundings of habitation areas (Sauer, 1941; Howe, & Smallwood, 1982; Howe, 1989; Chapman, 1995; Wenny, 2001), this was necessarily concomitant with their effect on the distribution of animals, birds, pathogens and insects, that live on and in those plant communities. Although most researchers write only about animals, vertebrates or primates as seed disseminators (Russo, Portnoy, & Augspurger, 2006; Vidal, Pires, & Guimarães, 2013, Chapman, Bonnell, et al., 2013), their results nevertheless apply equally to humans, Karl Butzer (1982) states “*People are geomorphic agents. They carry inorganic and organic materials to a site, deliberately or inadvertently, including matter for constructing shelter and housing, making and using tools, and processing and consuming food, as well as matter for fuel, clothing, and ornamentation*”. And Kirch (2005) concurs, “*The accumulated data and interpretations resulting from several decades of research in environmental archaeology . . . have led to a vastly enhanced appreciation of the degree to which human populations have modified their environments, beginning in the late Pleistocene (300 000 to 11 500 thousand years ago) and intensifying throughout the Holocene (12 000 to present).*”

7.4 Disconnect between people and place, loss of CWN (Connection With Nature)

Western culture, thought and science, has relegated most prehistoric peoples and their anomalously still extant, direct descendants, to a 5 million year period of “prehistory”, implying “No History”. That early humans were an integral part of the environment is repeated like a mantra, but what the specific plants were which they ate or used that were growing in the forest on the trees they descended from, or the savannah they chose as bipeds to live in, is vague. However, the animals that existed through the millennia and which they hunted and ate, are named and described in great detail.

“Landscape” has become a fashionable buzzword, but is seldom actualized into any particular realistic piece of earth, where its geology, geography, aspect, slope, altitude, or vegetation is

mentioned or described. Landscapes, and most patterns ecological or otherwise are shaped by the degree of intersection between pattern and process. G.D. Peterson (2002) writes about “ecological memory” as an ecological process which is shaped by past modifications of a landscape. Where ecological memory is strong, landscape pattern is persistent, and landscape pattern may be maintained. Close ties between archaeology, geology, and vegetation at each site are implicit, but have not always been acknowledged or studied as integrated factors forming a critical unit.

7.4.1 Why does archaeology overlook the importance of place?

Plants and place are frequently left out of archaeological studies, descriptions. Even diagrams of the sites often leave them floating in dead space on the page. Many studies are completely devoid of any relationship to the physical landscape or to the plants in their environs. There are exceptions however such as Johan Binneman (1997, 1998, 2000), Hilary Deacon (1970, 1992b, 1993), Lynn Wadley and Chrissie Sievers (2011), and Madelon Tussenius (1989). Archaeologists such as these do mention and list the vegetation in the vicinity of the sites. Others such as Lynn Wadley (2001, 2011) and Johan Binnemann (1997, 1998, 2000) have also obviously noticed the green walls, as they have included trees or bushes along the drip line in many of their site diagrams (see Chap. 7.4, Fig. 15, page 149). Although archaeologists even if they do notice green walls, generally do not identify the plants or situate their sites in the wider landscape. Plants and vegetation as the environment in which people live and move is hidden under a strange cloak of invisibility in archaeological and palaeological, anthropological and sociological writing, where their only acknowledged value is as a food resource for humans and their prey animals. History, Geography, Climatology, Archaeology, Palaeontology, all present their versions of the origins of humans, of their evolutionary history, and their place in the environment - but the environment itself is usually strangely devoid of specific vegetation. Broad terms such as “forest”, “savannah”, “temperate” and “sub-tropical” are used to describe the setting of the archaeological sites, but taxonomically identified genera and species are almost completely absent. People living in and around a site for any length of time have an impact much wider than just the interior of the site itself. Much archaeological work which involves only the interior and a small section of it at that, misses a rich source of information immediately outside the shelter where the waste from years of living has accumulated and rotted down burying artefacts and clues to the lives lived in that place.

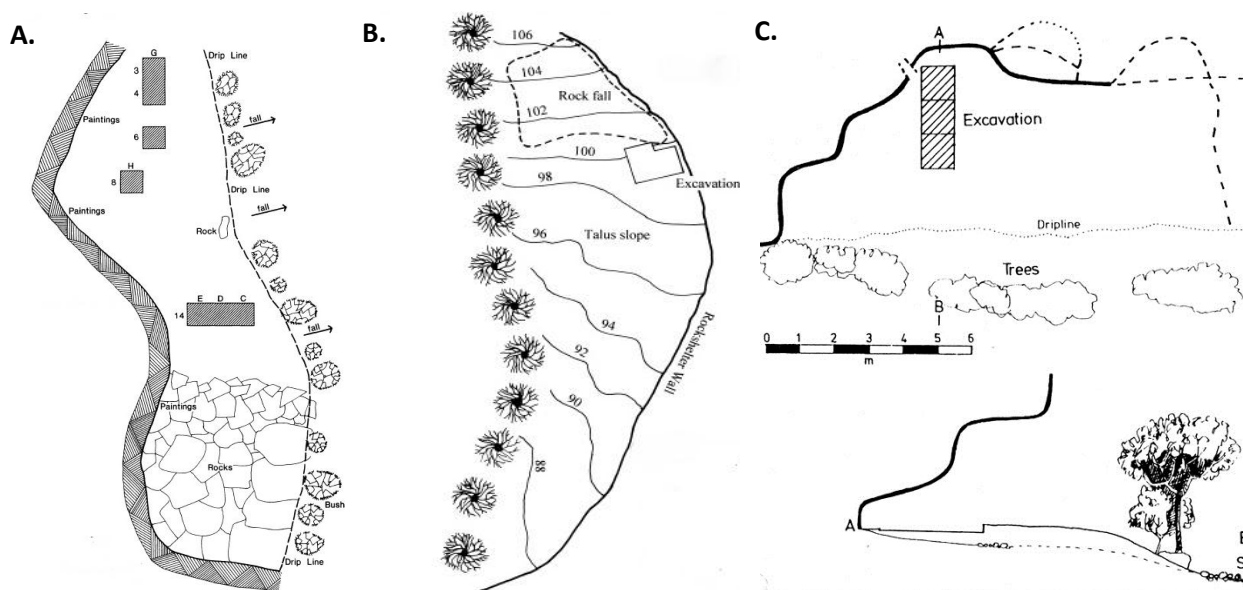


Fig 15 – Site diagrams with green walls (trees or thicket across the entrance): **A.** Lyn Wadley, Mauermanshoek (2001); **B.** Lyn Wadley, Sibudu (2011); **C.** Johan Binneman, Kleinpoort (1998).

7.4.2 Connections between Botany, anthropology and archaeology

Archaeobotany depicts human lives lived through macro- and micro-botanicals retrieved during excavation. Over time the most frequently eaten fruits and seeds would have been sown at and around the sites by humans through accidental scattering or excretion. Selection for larger and tastier fruits, more effective medicinal uses, more efficient fuel, and various other useful properties, although probably not intentional, could have ensured a gradual change in taxa. It is interesting to note however, that in southern Africa to this day, with regard to the Khoi-San peoples, the extended process in no way resulted in domestication of these thicket taxa, nor did hunter-gathering ever culminate in agricultural lifeways. Much has been written and surmised about length of stays in any one particular site. In the occupational layers and debris, it is possible to see clearly when there is an empty layer showing absolutely no signs of human habitation and so infer that the site was uninhabited at that time (only however if this period was long enough to show up clearly in the slowly deposited debris and dust of the period). If a group made yearly journeys from the sea to inland, the layers might not show clearly as the time period was too short and if the group was small and they did not deposit sufficient debris to form a definite recognisable layer archaeologically? Similarly, if the deposit contains certain plant matter such as geophyte corms or hard seeds which are only

ripe or edible at one time of the year – this does not necessarily mean that the people only visited that site at that season.

There are some problems with extrapolating the use of plants for food or for medicine from the micro- and macro-botanical remains retrieved from sites. Soft fleshy bulbs or tubers without hard bases or netted coverings would have been consumed whole or if dropped on the floor would rot away completely and leave no traces. Researchers finding traces of protein can help to trace these to a degree, but not often to species level. Soft fruits such as certain berries or fruit with seeds likely to be eaten by insects or small rodents also disappear from the record. It is even possible that certain seeds would have been ground to powder and used to make a form of porridge or bread or even just to be sprinkled over other food. Another problem would be in the fact that much fruit and tasty tubers would be consumed away from the site as snacks during a long walk or as lunch in the middle of the day. These would be dropped along the way and contribute to the presence of these plants not only at the actual sites but also throughout the area and particularly along much used pathways and sheltered “picnic spots”.

The problem is that all these short-lived foods could easily form the major food source at other times of the year when the geophytes often found in layers are not used. This would also extend the period of stay at the site but leave little evidence to show this. Some of the plants with tubers or soft bulbs were found within collecting distance of the sites (rarely actually within 100 metres of the entrance), but they need not have been available in large enough numbers to furnish adequate meals, one tuber or corm could easily have been used to add to a medley of other wild foods to provide a tasty meal, much as we add an onion or a carrot to our stews etc. They would also bulk up meals or soups as would leaves of different sorts collected as the group foraged during the day.

7.5 Implications of site-vegetation being even partially anthropogenic.

Many pollen, phytolith and charcoal studies to ascertain past climates and predict future changes have relied heavily on micro-botanical collections within and at archaeological sites (February, E. C., 1990; Carrión. & Scott, 1999; Scott, & Rossouw, 2005; Bar-Matthews, Marean, Jacobs, Karkanas, & Fisher, et al., 2010; Hall, Woodborne, & Scholes, 2008; Brook, Scott, Railsback, & Goddard, 2010). The presence of people living at a site for any length of time changes the chemical and physical properties of the soil at that site (Meigs, 1938; Sauer,

1941; Bank, 1953; Brooks, 1989; Rypkema, Lee, Galaty, & Haws, 2007; Widgren, 2007; Wilson, Davidson. & Cresser, 2008; Herries, Hopley, Adams, Curnoe, Maslin, et al., 2010). If the vegetation at these sites was manipulated and therefore anthropogenically impacted by early humans, and enabled to persist at those sites because of the impact that human habitation has on soil fertility and chemical properties, then these sites are not representative of the general vegetation in the surroundings nor the climate that prevailed, and results will have been skewed by this fact. The readings would be anthropogenic rather than natural if the various woody trees were used for firewood and brought in from a distance or harvested at a higher or lower elevation, as with food and medicinal plants.

There are also implications for plant migration and locality patterns, speciation, mutation and hybridization between species, and theories of persistence and niche habitats. Macro- and micro-botanical remains found within the actual site and within about 100 metre radius, are likely to be more a reflection of the plant use by the various peoples living at the site over millennia, and not necessarily just a response to changes in climate. The difficulty in finding any clear-cut correspondence between the many reports of past climate fluctuations, could therefore be a result of the anthropogenic higher phosphates (phosphorus), magnesium, carbon, and other chemical anomalies of soils in the close vicinity of archaeological habitation and presence sites, and therefore on the vegetation persisting there.

7.6 Conclusion

A large number of sites are situated in the ecotone between two different vegetation types and along or just below ridges or plateau edges. The range of natural resources available would have been increased greatly by the sites bordering on more than one vegetation type and lying on geological boundaries, encompassing a wide range in altitude, physical geographical features, and vegetation types within two to eight kilometres of the site. A clearly defined edge where the “green wall” quite abruptly meets fynbos, renoster or karoid dominated vegetation is often clearly visible. Agricultural ploughed fields often occupy the valleys below the sites, or the valley is grazed by large or small stock. The generally steep ($\pm 45^\circ$) and rugged rocky talus slopes below each site are almost always reasonably intact however, and act as a buffer between the disturbed valley bottom and the thicket vegetation densifying as it nears the site. Thicket taxa are not flammable and survive most fires (Cowling, Proches, & Vlok, 2005). The thicket taxa generally re-sprout after a burn, to again provide shelter for climbers and herbs re-establishing from seed (the complete table of species present at 75 sites

is available as supplementary data from Appendix A). Most sites are within not more than two kilometres of a perennial river, a seasonal stream, or at least a seep or spring, and usually not more than 100 to 200 metre above the valley floor, with the majority from 200 to 400m above sea level.

These complex and entangled relationships between plants, people, and place, are underlain by genetic drift, speciation, mutation, combination and recombination between all living entities. Hastorf (1999) writes “*keep in mind that archaeological assemblages will have filtered what was in the environment due to human choice.*” The result of human choice or selection in concert with natural ecological factors has impacted and shaped the environment by “*modification of vegetation communities: creating mosaics and edge areas, and resetting successional sequences*” (B. D. Smith, 2011). All biotic and abiotic entities were and are at the mercy of constantly changes in climate and random physical reworking of rock and terrain by water, wind, underground movement and temperature flux. The relationship between plants, places, and people, both reactive and active are not simple one-way systems, the trajectory loops back and jumps forward, and cannot be traced linearly between the past and the present. The relationship is a coalescence of biotic and abiotic elements in a synergistic and mutualistic process. The living biota survived, struggled, migrated and metamorphosed in order to successfully exist and persist within the limits imposed by the environment, other living entities, and their ability to transform their environment. These complex adaptive systems arguably resulted in the pattern of vegetation at sites and in the plant knowledge inherited by the Khoi-San descendants of the southern Cape.

CHAPTER 8

A comparison between three archaeological sites in the southern Cape

“Biotic and physiographic boundaries are arbitrary abstractions that cut across complex transition belts” and “my plea is for deliberate exploration and development of an approach that will transcend the traditional preoccupation with artefacts and sites in isolation.”

-- Karl Butzer, 1982

8. Abstract

This is a detailed study of three very different archaeological sites in the southern Cape in the light of unexpected correlations between the suite of plant taxa found growing in close association with core habitation areas at these three, and many other sites in the southern Cape. Small patches of thicket vegetation composed of similar communities of shrubs, forbs and climbers grow immediately at the entrance to sites and form "green walls". Complex ecotones, transition zones and vegetation mosaics, shape the vegetation and the surrounding landscapes. The possibly anthropogenic significance of the small patches of useful plants that have been found in common at so many sites, is questioned and discussed. The research had to integrate botany, ecology, anthropology, and archaeology to portray life-ways and culture of the early inhabitants who lived and subsisted within the sites, and in such close association with the vegetation in which the sites are embedded. The objective was to survey three sites in detail in order to demonstrate how the suite of plant taxa forming dense green walls common at the 75 sites I surveyed in the southern Cape, thins out moving away from the core habitation site. The important taxa are not always completely absent away from the core site, but it is the densification of the taxa in close proximity to the habitation core of each site which is important and measureable.

8.1 Introduction

Vegetation patches in close association with 75 southern Cape archaeological site complexes were surveyed for species presence and absence. Results indicated that a distinctive suite of plant taxa were repeatedly present in close association with the sites. These dense vegetation patches exhibited a pattern which indicates selection rather than random and natural

processes. The discovery that there was a correlation between the taxa present in these distinctive vegetation patches from coastal to inland Karoo sites, and situated within various vegetation matrices within different geological contexts; called for a more in-depth comparative study using a full species count in quadrats. Most green wall taxa are thicket species, usually with edible fruits or medicinal properties, which are ancient, widespread, and non-endemic (Chap 5.3.4, page 87, for discussion on this topic).

Hypotheses and theories that have resonance for this study are the “Urban Cliff” theory of Lundholm, Marlin, et al., (2006), and the many papers on Niche construction and its implications (B.D. Smith, 2011; Crites, 1987; Peters, O’Brien, et al., 1981; Boivin, Zeder, et al., 2016). Complex Adaptive Systems theory (Holland, 1992; Levin, 1998, 2002) provides the best explanation for the very complex processes which could have led to the pattern I have observed. John N. Thompson (2009) wrote “... *coevolution is a highly dynamic process that continually reshapes interactions among species across ecosystems, creating geographic mosaics over timescales sometimes as short as thousands or even hundreds of years*” and “*What does species sorting mean within ecological communities when we are combining and recombining species that have been around for millions of years with those that have been around for 20,000 years*”?

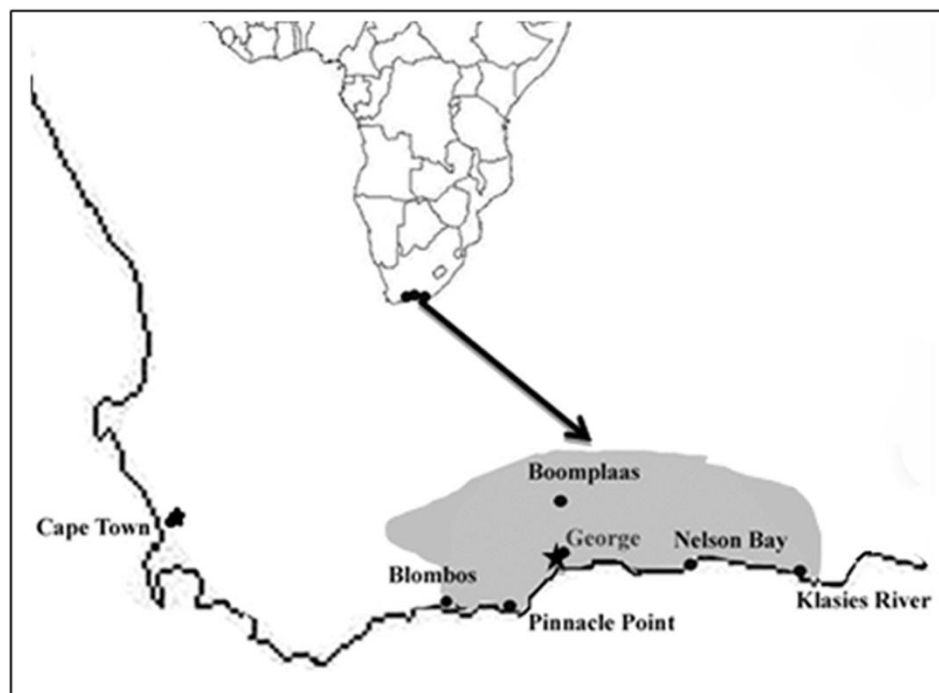


Fig. 1 – Locality map showing the southern Cape area in context

8.1.1 The southern Cape as an archaeological landscape

The southern Cape can be called one very large, extended archaeological site ([personal observation](#)). The topographically, geologically, and vegetatively complex southern Cape area is extremely rich in archaeological sites and evidence of early human presence. Many Early Stone Age Acheulian tool scatters dating from a possible one million years ago have been reported and are still being found throughout the area ([Goodwin, & van Riet Lowe, 1929](#), and [personal observation](#)). There are many Middle Stone Age sites, and hundreds of Late Stone age sites ([van Riet Lowe, 1952](#)). The oldest excavated sites date back to at least 150 000 years ago, and a few might have been occupied as recently as 200 years ago ([H. Deacon, & J. Deacon, 2003](#)).

Garth Sampson, Moore et al., ([2015](#)) used aerial survey photographs of the Seekoei Valley in the Great Karoo, and reported that they counted 13,866 prehistoric Stone Age sites (the majority open-air), representing 700,000 years of occupation in the Seekoe Valley archaeological landscape in the central Karoo. The Seekoe Valley archaeological survey covered roughly the same amount of ground as my survey in the southern Cape. The genera present at these sites and in the vicinity, mirror, to a surprising degree, many of the important taxa present at southern Cape sites. The vegetation of the valley and the uses of the species present are described in detail in Garth Sampson and Neville's recently published book ([2018](#)). No such survey has ever been carried out in the southern Cape, but the Seekoe results are an indication of just how thoroughly the southern Cape would probably have been roamed and inhabited. Once you become accustomed to finding archaeological remnants in unexpected places; stone tools and cores, bored stones, grind stones, sea-shells too far from the sea, ostrich eggshell beads, and the faintest of rock art; it becomes easy to believe that every single square inch of land was trodden and known intimately by the hunter-gatherer-pastoralists who inhabited the many sites.

Rock structures in the form of shelters, overhangs, cliffs, and caves, provide the most obvious early human habitation sites. Some of the better-known southern Cape sites were excavated over the past 100 years or so and provided much information on lives lived and modes of subsistence. Open surface (or open air) sites are more difficult to find and to study, but are probably more numerous than rock shelters. Open air sites were very likely connected to the rock sites socially, culturally and physically in many ways - although this is still difficult to ascertain ([Forssman, & Pargeter, 2014](#); [Sampson, Moore, Bousman, Stafford, Giordano, et](#)

al., 2015). Using the available soil testing methods could allow these open sites to be identified in future (Brooks. & Johannes, 1990; Wilson, Davidson. & Cresser, 2008). Few southern Cape or southern African archaeological excavations or rock art research projects have situated the sites within the landscape using detailed vegetation surveys, nor have they tested soils in the vicinity to aid in ascertaining the extent of the site which might extend to open air areas and not only the rock shelter itself. The presence of people living at a site for any length of time changes the chemical and physical properties of the soil at that site (Meigs, 1938; Sauer, 1941; Bank, 1953; Brooks, 1989; Rypkema, Lee, et al., 2007; Widgren, 2007; Wilson, Davidson, & Cresser, 2008; Herries, Hopley, et al., 2010). If the vegetation at these sites was manipulated and therefore anthropogenically impacted by early humans, and enabled to persist at those sites because of the impact that human habitation has on soil fertility and chemical properties, then these sites are not representative of the general vegetation in the surroundings nor the climate that prevailed, and results will have been skewed by this fact. The readings would be anthropogenic rather than natural, if various woody trees and bushes were used for firewood or kindling and brought in from a distance or harvested at a higher or lower elevation, the same applies to food and medicinal plants.

8.1.2 Motivation for a detailed numerical species survey using quadrats.

After I began work on my PhD, one of the first things people said was - “You need data to show that the vegetation is significantly different at habitation and presence sites from sites with no indications of past human presence”. I agreed that this would be ideal in order to statistically compare the distinctive vegetation patches at habitation sites with a control set of data from non-presence sites. After many months and many kilometres hiked in a determined effort to collect data from sites with absolutely no evidence of past human presence, I was forced to reach the inescapable conclusion that this was simply not possible. Shelters, overhangs, krantzies, rock walls, or boulders - from the largest to the smallest – all or any could have provided permanent, temporary, or fleeting shelter to early humans over the hundreds of thousands of years in which they roamed and lived in the area. The slopes of open mountainside well above sites or the valleys below the sites certainly presented very different types of vegetation where the suite of site taxa are usually very sparse or absent. But, could one consider these valid areas in which to collect the control data? Collecting plant specimens where there was no chance that humans would have found temporary shelter or habitation sites, would be equivalent to collecting from an ploughed or grazed field or pasture in the valley below, or higher in altitude above the thicket zone, and finding a completely

different suite of plants. It would be like comparing apples to oranges as the saying goes, and of no real value at all.

Because it was not possible to clearly define habitation-presence sites as opposed to non-habitation sites and non-presence sites, the three sites described here were studied in depth in order to compare the vegetation at the sites using a variety of methods and both a qualitative as well as a quantitative approach (Fig 2 below). A survey of 75 sites complexes for species presence and absence data had been completed, but it was not feasible to collect complete numerical data for all species as so many sites. To provide a sample in order extrapolate results - these three sites, dissimilar in geology, physical type of site, aspect, altitude, and vegetation matrix type were chosen to be thoroughly sampled by means of a total count of all species within a series of quadrats extending some way to either side of the sites.

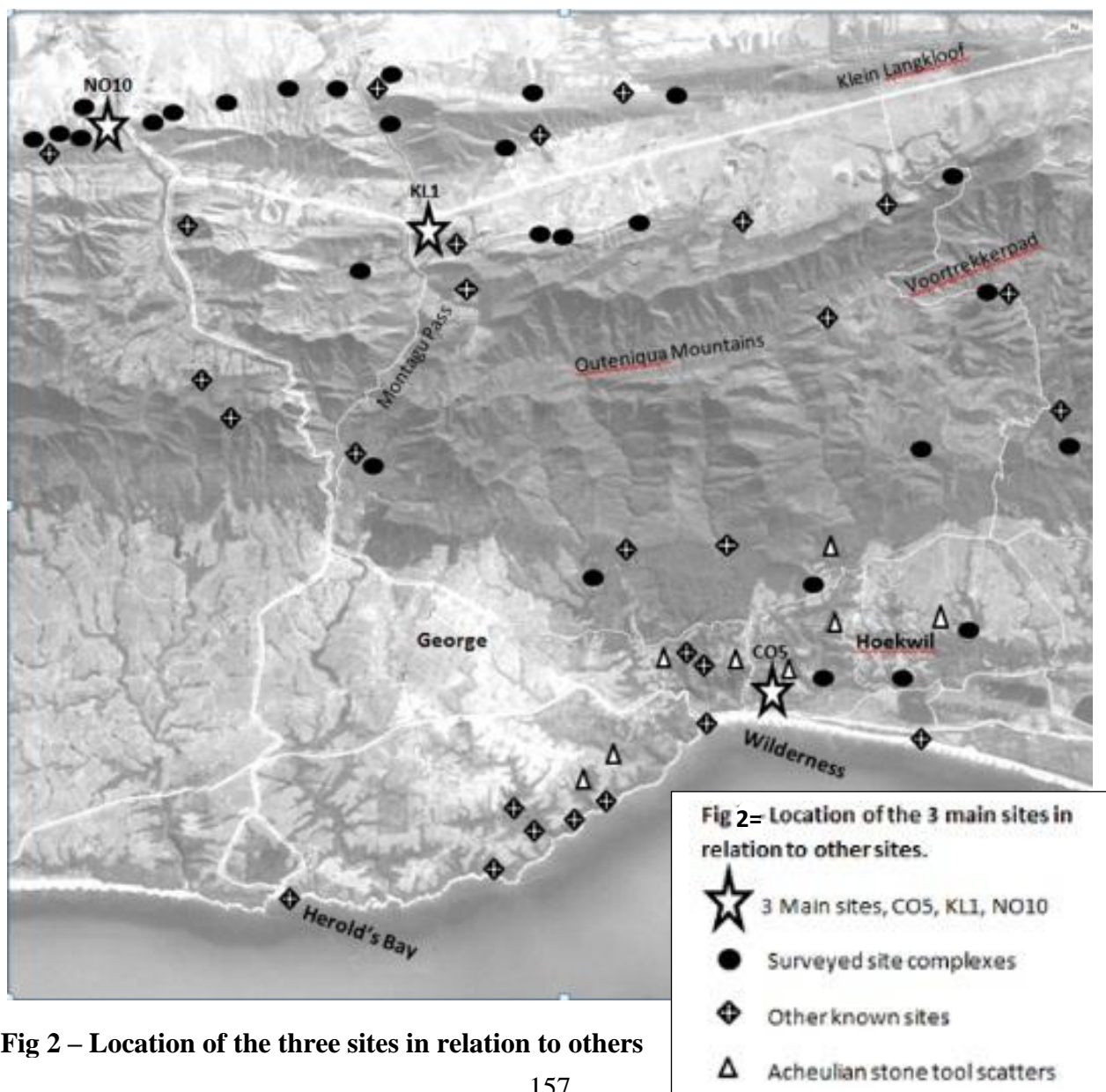


Fig 2 – Location of the three sites in relation to others

8.2. Geology of the three sites

Sites were given code names according to the geographical area, and numbered from west to east. in order to protect their exact localities. NO10 therefore, places this site in the Northern Outeniquas, KL1 is in the Klein Langkloof, and both are on private farmland. CO5 is a Coastal site within the Wilderness Protected Environment. The three sites were selected as examples of different size and types of site, in areas with differing geology, surrounding dominant vegetation types, rainfall, and aspect. The three sites lie along a eastward trending North to South curved line drawn from the first site NO10, where the Little Karoo basin meets the northern foothills of the Outeniqua mountains just West of the main Outdshoorn to George road, through KL1 near the small hamlet of Herold situated in the Little Langkloof running West to East through the Outeniquas, to CO5 at the base of the wave cut southern coastal plateau in the village of Wilderness, located 16 kilometres east of the city of George.

8.2.1 Oervlakte or Duricrusts – NO10

NO10 is situated beneath a duricrust ridge. Cemented silcrete duricrust ridges, sometimes called pedocretes, are remnants of the eroded African surface probably formed sometime during the Eocene, about 60 million years before present. Overhangs and shelters formed beneath the duricrust as water, weather, and uplift, eroded the softer rotted rocks below the crust over time. The Oervlakte as they are known locally, look like flat or gently sloping shelf-like projections forming terraces jutting out almost horizontally from the lower slopes of the Outeniqua Mountains. The duricrust remnants sinuously traverse the approximately 600m contour line along the northern slopes of the Outeniquas and are cut into by narrow or wide kloofs or valleys where surface water drains off the mountains into the Klein Karoo basin below, usually forming small rivers or seasonal streams. The long wavy series of ridges can be clearly seen today above deeply shadowed shelters. On either side of NO10, the Oervlakte run from west to east for about 35 kilometres, from Robinson Pass in the west to Eseljachtpoort in the east, at about 500 to 600 metres above sea level and 50 to 100 metres above the valley floor. Duricrusts also occur around Uniondale, on both South and North slopes of the Kamannassie range and occasionally elsewhere on the southern Cape mountain ranges. Ancient habitation and painted sites can be found under all of them.

The hard African erosion surface usually overlies fairly pointed or water-rounded pebbles and rough fragments of quartzitic sandstone, of very variable size and colouring embedded in softer pale cream, pink, ochre or yellow calcretes, kaolin-silcretes, or illites. These softer

layers were undercut by water, wind and erosion, producing some very large and many smaller shelters and overhangs. These layers often rest on a base of younger Table Mountain sandstone which provide the relatively level floors to the sites, seen as a rim at the base of the back wall, or as a stepped base below the site. There is often a layer of unsorted conglomerate resting on the sandstone base (see Fig. 3, page 162). A medley of uneven rocks and rounded pebbles are embedded in the conglomerate, and most of the paintings are found here. Paintings are on flat sheared surfaces, but also on rounded protruding surfaces from about 40cm in diameter to as small as 3cm pebbles. There are even some red-ochre wavy lines and vague nested “U’s” painted onto the roughly textured ceilings of white kaolin-silcrete.

Typical duricrust sites including NO10, have a duricrust ‘ceiling’ which is a mixture of silcrete-duricrust breccia from 4 metres to more than one metre thick with pointed and variably shaped and sized rocks cemented into the very hard upper layer. These naturally cemented ceilings can appear really dangerous as large rocks embedded in the ceiling hang perilously downwards. That these rocks do sometimes fall out can be seen from isolated small boulders and rocks inside the sites, and some really large house-sized chunks which have broken off and rolled down into the valleys or perched on the talus slopes partway down. One large boulder on the floor of N10 obviously fell out of the back wall, as it has small but fine black figures painted on the lower edge at one side. The ‘floor’ is usually covered in an extremely fine layer of dust a few millimetres thick, in which surface artefacts can be seen or are uncovered by various animals using the sites for shelter.

8.2.2 Quarzitic sandstone – KL1

KL1 is a quartzitic sandstone site facing north on the lower slope of the Klein Langkloof running from west to east through the northern foothills of the Outeniqua mountains. Sandstone is sedimentary rock and about 500 000 years old and is what forms the Cape Fold Mountain belt which consists of parallel mountain ranges that run along the south-western and southern coast of South Africa. These mountains are composed of rocks belonging to the Cape Supergroup, which are very hard, and erosion resistant, forming the steep cliffs ridges and common in the Outeniquas. The valleys tend to be floored by the Bokkeveld Group which are more fertile than the sandstone slopes above. The quartzitic sandstone near Herold on the south side of the Klein Langkloof forms approximately 8 metre-high cliffs forming parallel walls standing on relatively flat and level rocky platforms which are stepped or terraced up the slope of the mountainside (see Fig 4, page 164). The Cape mountain fold

belt often contains anticlines or synclines in which erosion and the action of freezing and shedding has resulted in overhangs and occasionally quite deep shelters. However, here at KL1 the walls of sandstone do not form a normal shelter or overhang as most sites do and the site consists of paintings on the vertical walls with a small habitation site formed from fallen slabs of rock forming a sort of 'rock igloo' with a small space protected from the weather inside. Many overhangs or shelters were formed at the base of sandstone cliffs where a crack or gap was gradually eroded by sea water during a time when the sea was much higher than now.

8.2.3 Granite pavements and boulders – CO5.

Granite is an igneous rock and about 600 000 years old. The large rounded boulders present in the Wilderness and Hoekwil area near George in the southern Cape, are Cape Granite with no apparent bedding. These hard, round boulders, are from giant granite bubbles which pushed up to intrude through the sandstone or Kaaimans rocks. The weathered large round boulder which overhangs the shallow space of what might have been a temporary or partly open-air habitation site at CO5, is a large granite boulder. It is embedded in the lower part of the steep slope below the coastal wave-cut platform. If you look closely at a granite boulder you can see fairly large grains of quartz (white), feldspar (grey) and mica (black) that have crystallised out as the originally molten magma cooled down. The shallow CO5 overhang is nestled beneath the natural curved side of the boulder and not formed by erosion or weathering (Quadrat 1, Fig 5, page 166).

8.3. Descriptions of the three sites and their vegetation

8.3.1 NO10 site complex

This previously unknown site was an exciting find. The whole area has been farmed intensively for six or seven generations since the first white settlers arrived in the 1700's. The family who have farmed the land for the last 100+ years did not know about the rock art to be found in this site and the numerous other shelters found at intervals along a sinuous Oervlakte duricrust ridge clinging for about 35 kilometres in total to the northern slopes of the Outeniqua Mountains. None of these shelters had previously been mapped or reported, although most have paintings present. It was not possible to find any Khoi-San descendant family that could give any insight into the area or the sites. Much of the landscape is transformed to a lesser or greater extent and this is undoubtedly why the area has been largely ignored by both archaeologists and botanists. These overhangs and shelters were probably considered to be of

little interest as it was assumed that there would be very little rock art to be found on the rough interior conglomerates and clays, providing unpromising surfaces, and situated within such a severely transformed area.

The deeply shaded shelters fringed with typical dense thicket vegetation, are clearly visible beneath the duricrust capping and must have provided ideal shelters for pre-colonial hunter-gatherer and pastoralist inhabitants. The shelters are deep enough for protection from the weather, face east for the morning sun, have a large open flat area just above for a lookout spot, and a river in the valley below not more than one kilometre away (see Fig. 4, Page 164, N10). The 70 metre long and narrow main habitation area also contains a seasonal spring or seep, with the all above covered by complex and dense painted figures, many of them insect-like and enigmatic. Scattered surface artefacts and pottery plus a lower grind stone were recorded as present. The dense green wall of vegetation extending the length of this site and down the talus slope in front for four to five metres, shows the highest percentages of important site taxa. It seems likely that modern goat herders, wanderers, and honey collectors might still be visiting the sites, wild bees in these duricrust sites must have been a bonus for inhabitants in the past and another reason for the popularity of the sites perhaps. The honey is obviously still collected today as evidenced by the stick ladders present, and burnt wax and debris below the hives. For us, surveying the sites, the bees are a major problem. A bad accident when one of our hiking group was attacked by a whole swarm, put him in hospital in intensive care for days, and have sent us running many a time! If the bees were quiet and the day cool, we would continue to survey sites and vegetation, but in the heat of the day, the presence of increasingly active bees frequently interrupted or prevented surveys.

The incredibly stoney, but apparently relatively fertile, agricultural lands just above the duricrust ridge on the almost level Oervlakte platform, is 'ploughed' and planted with wheat when rainfall permits. The sites themselves are relatively unaffected by the farming, due to the talus slopes and kloofs below the sites being dotted with large house sized boulders. The talus slopes have the typical 45° angle of slope, too steep for farm machinery, and seem to be even shunned by breeding ostriches and grazing cattle when present. Goats seem to have had little impact on the areas immediately around the sites although some of the many puzzling global edible weeds found within the sites, such as *Chenopodium*, *Stellaria*, *Sonchus* and *Urtica*, could have been carried into the sites via goat droppings and grow there now because of the higher fertility in the immediate overhangs and just beyond. The typical dense green

wall of thicket vegetation protecting the site complex contains the highest percentage of important useful taxa of all 75 sites complexes. The 4 *Searsia*, 2 *Diospyros*, and 3 *Asparagus spp.* and *Solanum tomentosum*, *Aloe ferox*, *Ficus burt-dayvi*, belong to the suite of distinctive and useful thicket taxa which occur most frequently at the 75 sites surveyed in total for this thesis. This could indicate that this area was particularly rich in resources, or it could be the epicentre for the radiation of these taxa throughout the region, but this issue is not debated here.

NO10. A series of shallow overhangs under-cutting the hard silcrete duricrust layer locally termed Oervlakte..

Set in a matrix of North Outeniqua fynbos¹ also termed Paardeberg fynbos-Sandolienveld².

Outlook over the Little Karoo basin from the Northern Outeniquas to Swartberg.

Altitude 605m. Aspect East

Seep in core site & River within 600m.

Paintings, artefacts, pottery shards, lower-grindstone, wild bee-hives all present.

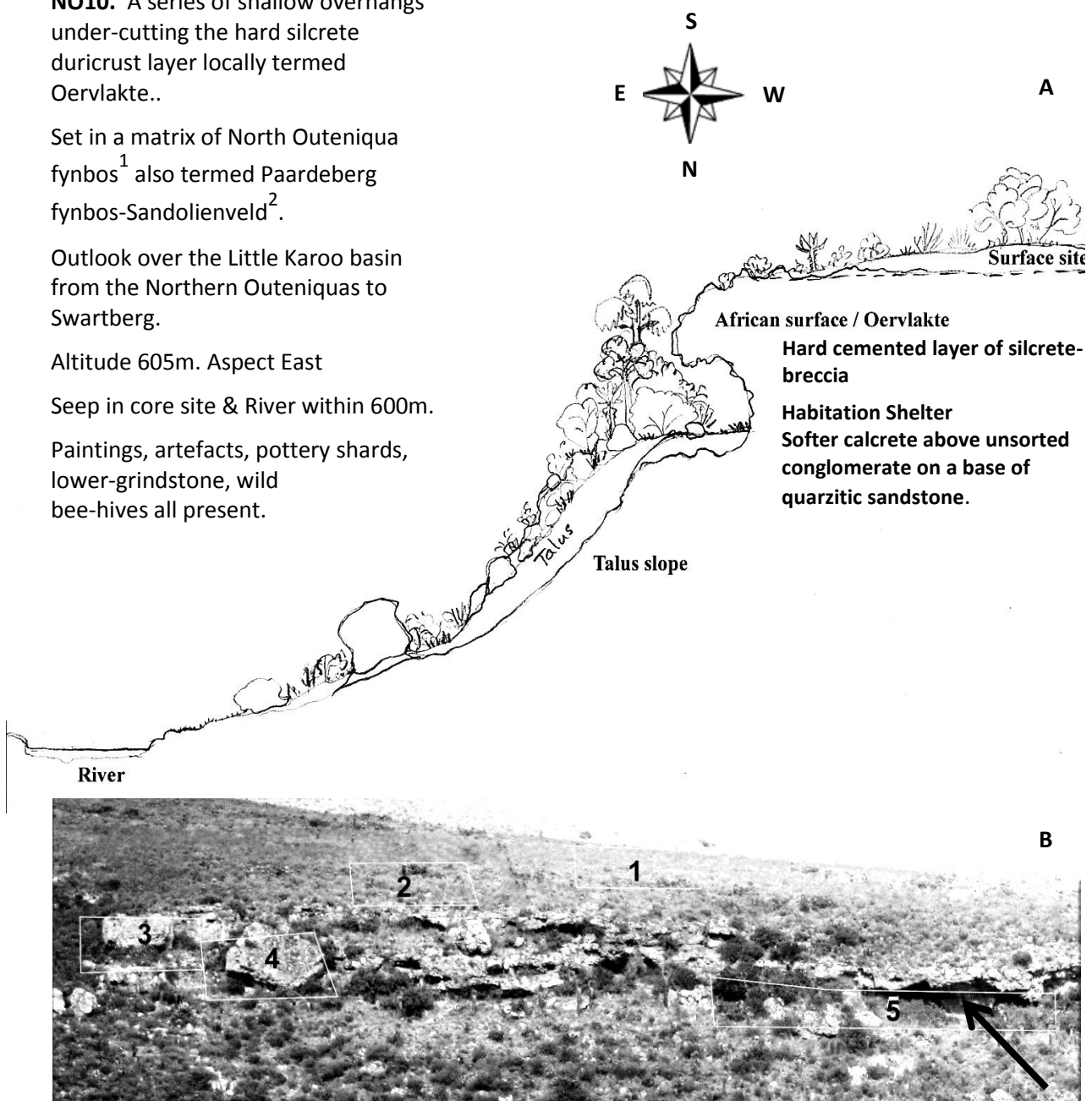


Fig 3 - A. Cross-section site N10. B. Panorama of the ancient African Surface forming the “oervlakte,” under which the sites are situated, numbers refer to quadrats.

Vegetation types referred to in Fig. 3 above are from: 1. Mucina and Rutherford (2006)
2. Vlok and Euston-Brown (2003). Quadrat number refers to the quadrats marked on the aerial views of the sites, Figs. 6,7 & 8.

8.3.2 KL1 site complex

The cliffs or walls of quartzitic sandstone form two long north facing painted galleries, one above the other (Quadrat 3 & 4). The cliff walls are about 8 metres tall here and vertical with deep cracks or joints, running from top to bottom at intervals. There is a small habitation site under fallen sandstone slabs at the bottom Western corner of the lower gallery (Quadrat 5). At this site complex a well-known series of paintings called the “Falling Buck” panel are present, and numerous other paintings, mostly on the wall of the lower gallery. Only after many visits to this site did I find the small low roofed habitation site. It was in such dense thicket that one could hardly get to it and I found it only because I was collecting plant specimens in that area. It is formed by a collapse of the sandstone wall at the western corner of the lower gallery which has left two entrances and a third chimney like opening at the back. The site contained a small selection of thick rough pottery shards, a few scrapers and a nice sunken grindstone area on top of a flat fixed stone lintel at the one entrance. In addition, there appear to be what could be cupules drilled into some of the rocks which could also have been made from water dripping perhaps. This site is easily visible from a major road very near to it and is visited by many groups and interested people due to its ease of access. There is little damage from visitors, although the artefacts I left there after photographing them have since disappeared.

The biggest threat comes from unsupervised alien bush clearing by untrained workers who twice cleared all the vegetation of the protecting green wall by hacking it down, and leaving it left piled up as a fire hazard against the painted walls. Regrowth was quick and the same community of plants sprout readily each time. However recently another fire burnt through and it appears to have decimated all the growth right up to the walls. The matrix vegetation is Northern Outeniqua fynbos although only *Protea nitida* is found there, no *Ericas* and a few isolated *Restios*, none within the immediate green wall zone. The ploughed agricultural land marking the beginning of the Bokkeveld Shale and Renosterveld vegetation, starts just 70 metres below the site where the 30° to 40° slope flattens out into a pebble strewn field sometimes planted with wheat or barley which harbours many look-alike acheulian tools that deserve attention. The site faces South overlooking the Klein Langkloof valley below, and a

string of farm dams which are all that is left of the original small seasonal river. The perennial Doringrivier runs less than two kilometres to the West of the site and there is seasonal seepage into shallow rock indentations near the habitation area.

KL1 consists of stepped cliffs of quartzitic sandstone forming parallel walls running west to east.

Set matrix of North Outeniqua sandstone fynbos, also termed Outeniqua Waboomveld

Altitude 640m

Aspect North

Paintings, artefacts, pottery shards, grinding surface, paintings, wild bee-hive all present.

Semi-perennial river two kilometres & a small seasonal pool.

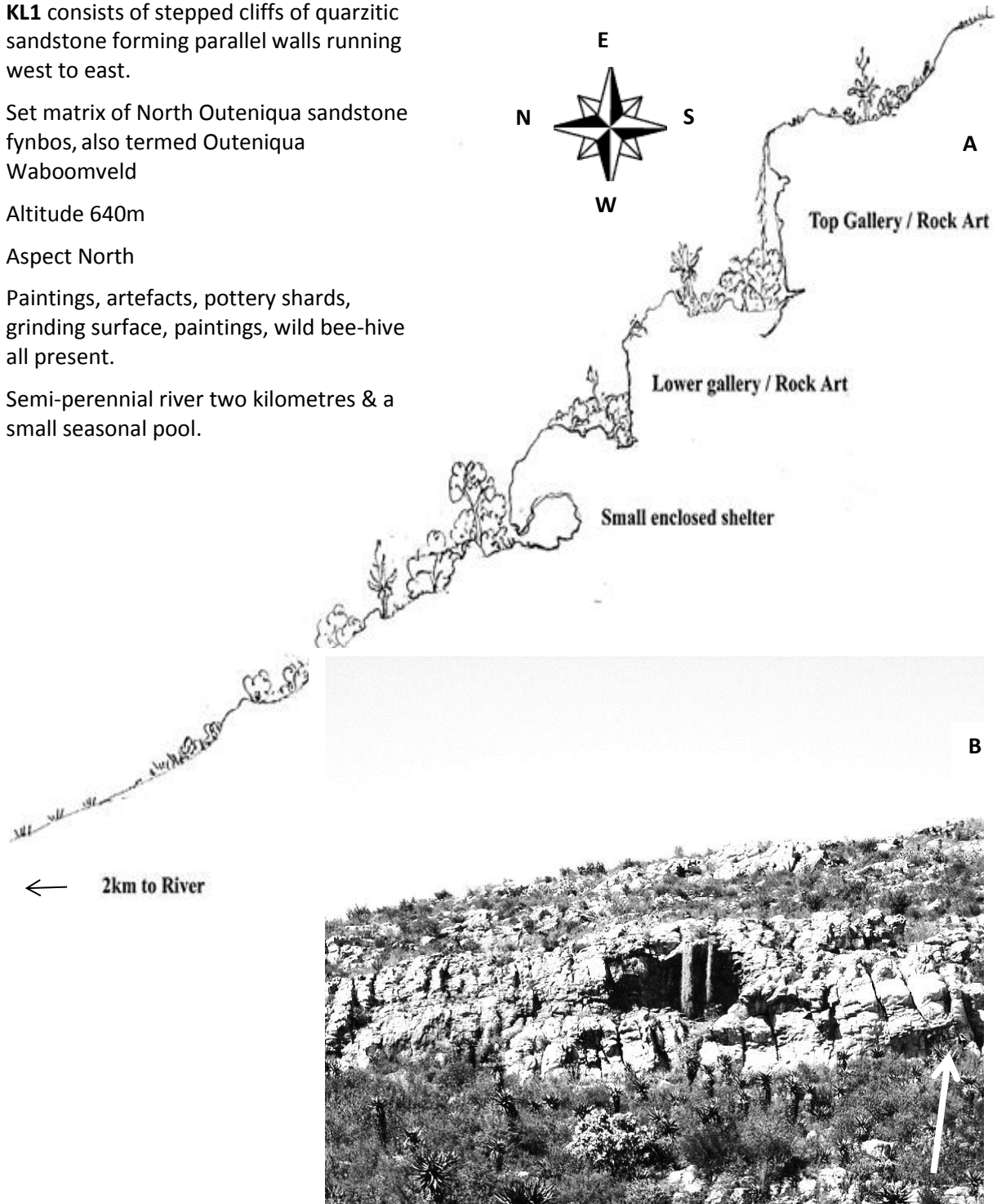


Fig 4 – A. Cross-section of site KL1. B. View of the whole site showing the two galleries and The arrow points to the small habitation site hidden behind a wall of greenery.

8.3.3 CO5 site complex

Located under a large weathered rounded granite boulder the site perches precariously at the top of a steeply sloping shell midden, set in dense coastal forest-like thicket. This site is within the Wilderness Protected Area which is administered by SANParks. Although invisible to passers-by it is accessible and vulnerable to disturbance (Quadrat 1). The densely bushed access route leads steeply up into the site from the road, over the base of the midden and there is a certain amount of subsidence as a result. The cutting for the road probably resulted in the steep angle of about 60° from the lip of the site, which causes shell and artefact debris to continually slip down onto the road where it is crushed and dissipated by cars and pedestrians using the road. The 'floor' area is small but contains a surface scatter of stone flakes and some pottery, while the midden is full of many kinds of shell and a few stone flakes and scrapers. The dense surrounding forest-like thicket vegetation forms a typical green wall which provides adequate shelter from the weather and hides the site from view.

The small open area immediately above the granite boulder provides a good level vantage point and lookout over the Touw River estuary immediately below (Quadrat 3), the flat grassy areas stretching to the east where game no doubt grazed in the past, and out to sea where a plethora of marine resources were available for collection. The site is just 400 metres from the Touw river estuary and one kilometre from the sea. The small site could have been a temporary habitation site or part of a larger open-air site connected to the nearby granite pavement (Quadrat 2) which also produced a few flakes and pottery. This small site set in dense coastal forest has fewer of the typical suite of taxa common to sites in the southern Cape. Considering its position within the urban area and the disturbance to the midden, this is to be expected. The overlap in taxa remains significant enough and the coastal site is valuable as a comparison to the other two sites to the north of the Outeniquas.

This site has never been excavated probably due to the shallow substrate on granite. Two other sites just to the east of CO5, CO6 and CO7 were both excavated in the early days before archaeology was regulated by a Heritage body or laws about exhuming skeletons. Many skeletons were removed from both the other sites and presumably reside now in Cape Town Museums or in Port Elizabeth. Apparently, the bones were not of great age and one can speculate whether they were victims of the deadly smallpox which preceded the earliest settlers and if these were the last hunter-gatherers to live in these sites.

CO5 is a small site nested beneath the curve of a large worn granite boulder.

Garden Route granite fynbos¹, or Wolwe river fynbos-forest²

Altitude 35m.

Aspect South

Pottery shards and stone flakes present

Sporadically open semi-tidal Estuary
400m, seashore onw kilometre (likely to have changed over the past 1000 – 20 000 years

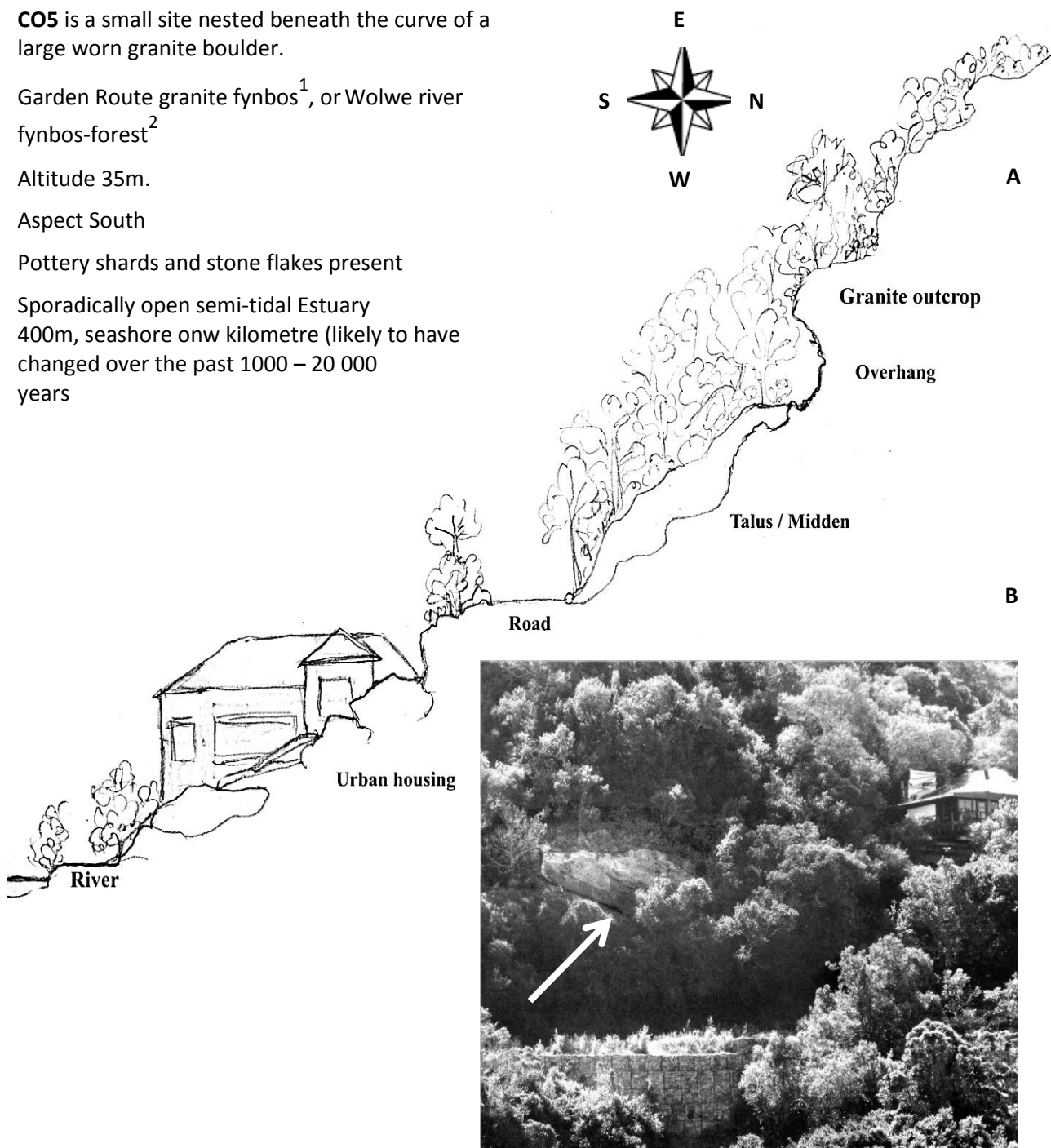


Fig 5 – A. Cross-section of site CO5. B. View of the site hidden in thick vegetation above the road, the arrow indicates the location of the actual site below the granite boulder.

8.4. Nutrient enrichment of soils near the sites

I took soil samples in each quadrat during this survey as a preliminary test to see if there was a difference between nutrients in the soils near the sites, and those beyond the 100 metre threshold. The maximum natural extent of the typical vegetation at most sites in the southern

Cape ranges from one or two meters from the drip-line to 20 to 50 metre with a maximum of 100 metres. This intriguingly coincides with the reported 100 metre radius within which inhabitants would generally defecate away from the living space (Silberbauer, 1981; Lee. & Devore, 1976; Hallé, 2002; John Parkington & Janette Deacon personal communication). General household refuse would likely have been swept and thrown out beyond the drip-line and within the 100m radius, where it decomposed forming humus in the surrounding area or built up into small mounds or middens. Where there is a steep slope below the drip-line the ‘midden’ or sweepings would have slipped down the talus slope.

A point is succinctly made by Odling-Smee, Laland and Feldman (2003) “*A basic feature of living organisms is that they take in and assimilate materials for growth and maintenance and eliminate or excrete waste products.*” The enrichment of soils and dissemination of useful plants by eating and subsequent deposition of fruits, seeds, and roots and the very important fact that every living thing excretes in some way is a neglected area of research. References to pre-historic ‘sanitation’ and methods of human waste disposal in the past, are surprisingly sparse, in fact almost non-existent considering that every human must engage in the ‘activity’ of urination and defecation every single day throughout their lives. In addition, the importance this activity holds for the alteration of soil structure and its chemical properties is of great importance to the presence of communities of plants in association with habitation sites. Thicket species prefers a richer soil than fynbos, and itself generates a great deal of humus under the canopy with all-year-round leaf drop. Animals and humans, unlike plants, only have one way in which too dispose of their excreta, they used to leave it lying where it fell (Halle F., 2002). Leaving it where it falls is essential to the way in which the cycle of life works, the excreta feeds the soil, sows the seeds, and feeds the plants that germinate, which in turn feed the insects, animals and humans - then the whole cycle begins again - or it did before modern technology came along and flushed all those valuable nutrients with quantities of valuable clean water, straight into the sea.

The puzzling thing is not that this cycle is so essential and healthy, but that western science ignores the potentially valuable human input. Many archaeologists and Phytolithologists and Palynologists have researched coprolites, mostly animal, with a few brave souls tackling the human end (Martin, & Sharrock, 1964; Callen, & Martin, 1969; Minnis, 1989; Reinhard, & Bryant, 1992; Horrocks, Jones, Beever, & Sutton, 2002). This line of research seems to have gone out of fashion, perhaps being too difficult to rationalise or explain as a life’s work? But

a sort of Victorian prudishness seems to have prevented anthropologists, archaeologists and palaeobiologists from writing about the importance of describing, in detail, where humans excreted their waste in prehistoric times - or in fact today in slum areas, or on farms and along roadsides. It is extremely important to the pattern of vegetation and the communities of plants present in association with human habitation and presence. The fertility, Ph., chemical structure, and water-holding properties of the soil are altered by this manuring, and seeds are sown.

The link between change in the texture and chemical quality of soils induced by human presence in the past, and the vegetation at sites, has not been studied in southern African. Amazonian Dark Earths have been thoroughly researched ([Fairhead, & Leach, 1996](#)), and recent evidence for similar dark earths has been noted in Africa from Liberia, ([Fairhead. & Leach, 2009](#)). No dark earths have been studied in connection with southern African sites yet (but see Chapter 10, page 207). The possibility of greater anthropogenic changes to soils at habitation sites dating very far back in time and including more recent pastoral and iron age sites, as being important in vegetation change and genetics ([Sauer, 1941](#); [Brooks, & Johannes, 1990](#)) could throw new light on ecological and taxonomic research in the future.

8.5 Methodology and Methods

8.5.1 Ethics with regard to archaeological sites

In order to conform with the code of ethics regarding access to sites on private land and within Nature Reserves, no farm names or GPS co-ordinates are given, and only Codes are used to refer to the three sites. Although no farmer refused access to sites, most did not want the presence of Rock Art on their property made widely known. A few farmers specifically did not want “authorities” or Nature Conservation to be given information about the sites. Permission was given to include but not identify privately owned sites in my thesis. The ethical dilemma exists as to whether these sites should be reported in an attempt to ensure “official” protection and for data to be included in national records, or whether the level of protection and cooperation given by farmers is adequate. Reports and images from their sites were sent to land-owners. Ultimately, whether the owner wants the sites on their property reported or not remains their decision, and pragmatically it is better to gain access to the sites and survey them, than not. This dilemma introduces the delicate issue of who is ultimately the “inheritor” or “owner” of the sites? Or as ancient heritage sites considered ‘sacred’ by aware individuals among the Khoi-San peoples, should they be at the very least be afforded access

and information about the sites? I do not enter into that debate here, however. This paper does not enter into discussion on this issue. Studying and writing about these lesser known private sites without giving a clear idea of their location might seem quixotic and counter-productive, but if only well-known public sites are studied, a huge amount of detail and comparative data would never be accessed and perhaps in the end be lost altogether. An overall picture can only be portrayed by surveying as many different sites as possible, both private and public.

8.5.2 Counting species in quadrats to demonstrate densification of taxa.

A series of quadrats were laid out to assess the densification of the typical genera moving towards the core habitation area of each site. As the edaphic influence of rock faces or overhangs, aspect and geology might be instrumental in supplying the habitats exploited by the typical genera found at most sites, it was decided that instead of walking the conventional straight transects with quadrats at fixed intervals, quadrats were placed in areas which occupied similar physical and topographical spaces to those of the central site. Each site presented a new challenge and methods had to be adapted for each to suit the terrain and return the most relevant results. These findings are used to explain the significance of the vegetation patches at habitation and presence sites as they exist in the present, and to enable the extrapolation of past processes resulting in the present pattern.

Because the sites were situated within difficult physical landscapes and vegetation, it was impossible to mark out quadrats of exactly the same size and shape. All three sites are on fairly steep slopes and in rough rocky terrain (see Figs. 3, 4, & 5, this Chapter). Except for NO10 set in a matrix of sparse and relatively short Nama Karoo bordering on Renosterveld vegetation, the quadrats had to be placed within dense and often thorny growth and rough rocky pavements and rocky ridges. It was impossible to lay string in straight lines. Red flags tied at each corner on poles were visible from the rest of the quadrat and the area was thoroughly walked in zigzag lines from one side to the other. Some quadrats were long and narrow and others square as size was governed by the levels and rock outcrops present, if quadrats were of uneven size the numbers of species were calculated proportionally by percentage to represent a consistent 20 square metre quadrat. Each quadrat was as close to 20 metres square as possible given the rough terrain, if smaller it was later scaled up to be comparable. All species within each quadrat were collected and either counted individually if less than 10 specimens were present, or estimated as > 10, >20, up to > 50, very small plants

that might be present at over 50 individuals were counted as 50 or prevent them from artificially dominating the community. When generating graphs and charts the numbers were assigned in these groups.

8.5.3 Site NO10 - Quadrats of 20 metre² were marked out from one kilometre to the East at more or less at the same altitude as the upper gallery at the site, and starting just before the broken ridge of small sandstone cliffs began. The habitation core area and painted walls of the site are located about halfway along the broken line of cliffs and ridges. Distances between quadrats were not equal on account of the rough and difficult terrain. Quadrats were placed both higher the main series of sites and along the length of the ridge from south to north in very similar physical conditions to the main habitation site.



Fig. 6 –Aerial view of NO10 showing numbered quadrats. Core habitation area = large red dot.

8.5.4 Site KL1 - Quadrats were surveyed along parallel below the rock walls stretching from west to east, very similar to those of the site itself. In this complex site paintings are present on two levels on the rock walls (Quadrats 3 & 4) and a small habitation site at the western end of the lower painted wall. Quadrat 6 was laid to the west on the rocky pavement in front of a lower wall and a completely different selection of plants grew in cracks and fissures. There were hundreds of juicy small *Eriospermum capensis* bulbs present with some *Boophone disticha* and a few ubiquitous *Rhus* spp. *Aloe lineata*, *Anginon swellendamense*, and *Elytropappus rhinocerotis* occur here, indicating a Renosterveld ecotone.



Fig 7 – Aerial view of KL1 showing numbered quadrats. Core habitation area = large red dot.

8.5.5 Site CO5 – The first quadrat covered the small site under the granite boulder plus the sand and shell midden falling steeply below it. The 2nd was a vegetated granite pavement 100 metres to east of the main site. The 3rd quadrat was on a slightly more open area immediately above the large granite boulder forming the overhang of the main site, and 4th 300 metres to the west of the main site overhang. One of every species present, was

collected and counted in each quadrat, Sample specimens were identified to species level, pressed, dried, labelled and mounted on standard herbarium sheets according to normal herbarium practice.



Fig 8 – Aerial view of CO5 showing numbered quadrats. Core area = large red dot.

(full species data in Appendix A). Sørensen's index was used on the species lists with an imaginary Ghost site as a control. Sørensen's similarity coefficient formula is $(2a / 2a + b + c) \times 100 = \% \text{ similarity}$. Where a = number of species in both sites; b = number of species in second site only (Ghost site); c = number of species in first site only (site being compared to ghost site).

8.6 Soil sampling in quadrats for NO10 and KL1

Soil samples were collected in the quadrats laid out for vegetation sampling. Five samples of 300 ml were collected from each quadrat at about 10cm below surface after brushing away loose plant pieces and gravel. The five samples from each quadrat were mixed together and placed in zip lock plastic bag labelled with the number of the quadrat with a centre-point GPS reading. The samples were sent for testing to SGS in Somerset West, with instructions to test for Phosphorus in particular. The tests carried out were standard agricultural soil tests plus additional tests for available and non-available phosphorus and carbon ([Pastor, Gallelo, Cervera. & de la Guardia, 2016](#)).

8.7 Results

8.7.1 Sørensen's similarity index.

Percentage of similarity to the control Ghost site are: NO10 82%; KL1 60%; CO5 43%;

The average similarity between the three is therefore 67%, which indicates a possible selection process accounting for the taxa present in the distinctive and dense thicket patches at the sites. Selection by humans for use as food, medicine and other -purposes, and enrichment of soils due to human presence over a very long period of time is strongly suggested as a driver of this process leading to the pattern observed.

8.7.2 Vegetation at the sites

Results from the various analyses conducted confirm the thicket patches and green walls as being distinctive and at least partly of anthropogenic origin. In spite of the presence of Fynbos, Renosterveld, and Waboomveld in the vicinity of NO10 and KL1 these do not constitute important species within the distinct thicket patches. At CO5 although true Afromontane forest species are present in the area surrounding the site, none of the species near the site itself are categorised as Afromontane Forest by Ladislav Mucina and Michael Rutherford (2006).

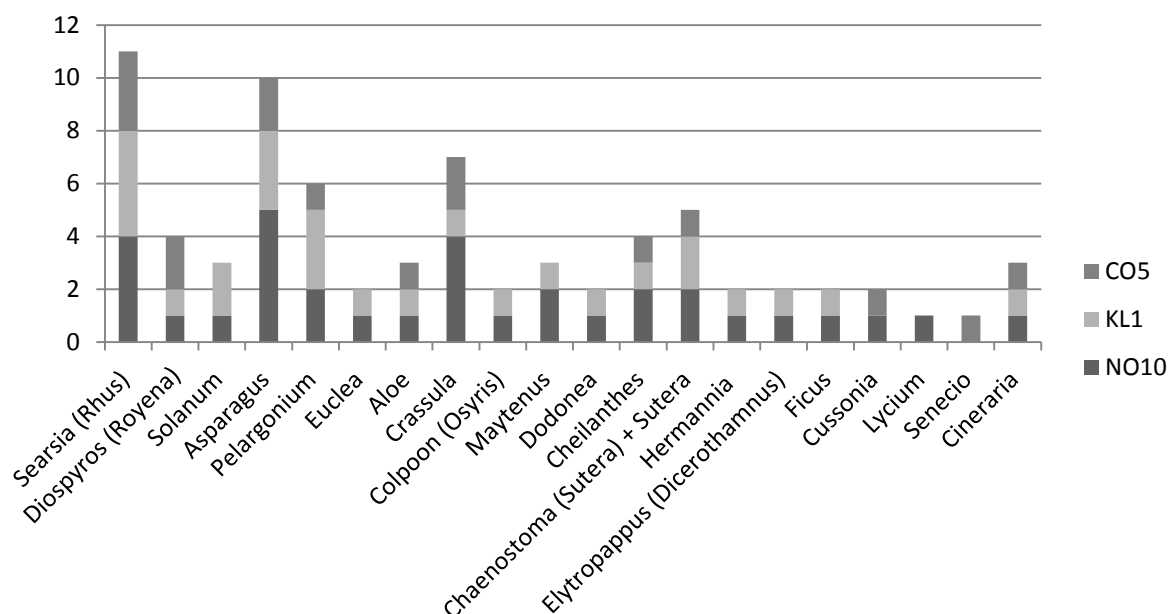


Fig. 9 – Comparison of top species at the three sites: The vertical axis gives number of sites each genus is present at each site. The genera listed on the horizontal axis are the 20 most frequently present genera at 75 sites. Nine of these genera occur at all three sites = 42%. All genera occur at one or more of the three sites.

A common thread connects the taxa at these sites, even those not frequently present. They are all widely reported and documented by myself and many other ethnobotanists as being used today by modern Khoi-San descendants of the original inhabitants of the sites. The majority of the plants have medicinal uses, but many have a wide range of multiple uses, see; Hutchings, Lewis, Scott, & Cunningham, 1996; Arnold, Prentice, Hawker, Snyman, Tomalin, et al., 2002. B-E. van Wyk, & Gericke, 2000; B-E. van Wyk., 2008, B-E. van Wyk., van Oudtshoorn, & Gericke, 2009; Loundou, 2008; Philander, 2011; L. M. Petersen, Charman, et al., 2014; Dold, & Cocks, 2002, 2012) and in the colonial past (Ecklon, 1826 - 1831; Pappé, 1868; A. Smith 1895, reprint 2011; Watt, & Breyer-Brandwijk, 1962; C.A. Smith, 1966). Many of the taxa are also reported as macro- and micro-botanical remains in archaeological excavations (Wells, 1965; Moffett, & H. Deacon, 1977; H. Deacon, 1970; Binneman, 1997, 1998, 2000; Wadley, Sievers, et al., 2011; Sievers, 2013).

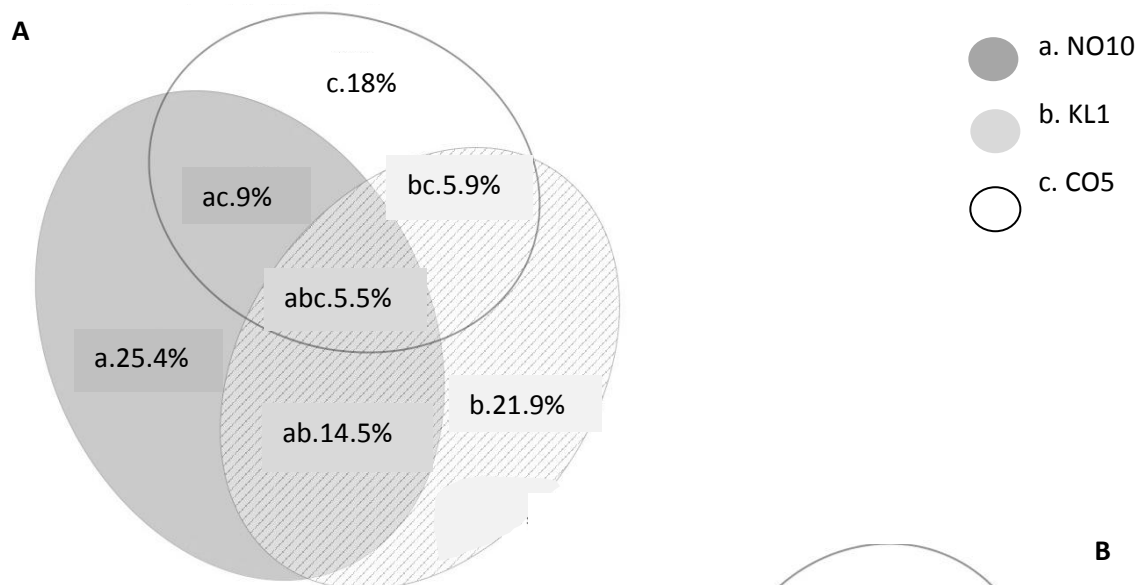
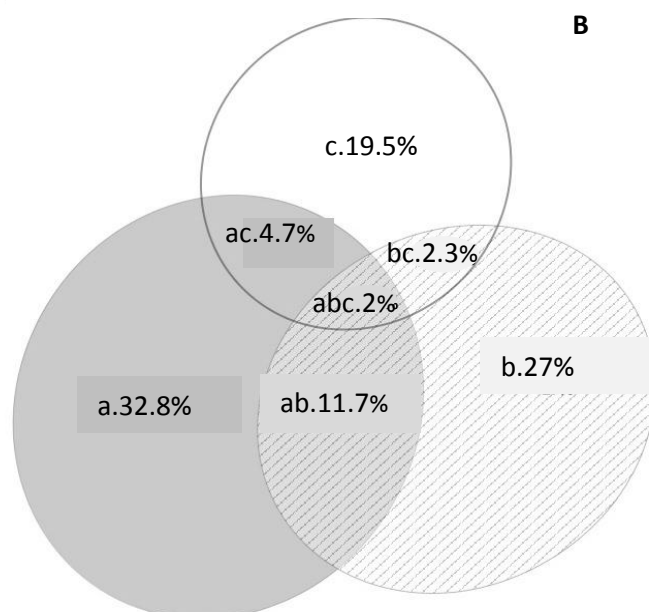


Fig. 10 – Venn diagrams showing overlap between A. genera, and B. species



Genera No's in diagrams

1	Searsia (Rhus)
2	Aloe
3	Asparagus
4	Felicia
5	Euclea
6	Diospyros
7	Pelargonium
8	Ficus
9	Colpoon
10	Dodonea
11	Sutera
12	Withania
13	Lycium
14	Hermannia
15	Anginon
16	Carissa
17	Cussonia
18	Solanum
19	Carpobrotus
20	Crassula
21	Selago
22	Cheilanthes
23	Maytenus
24	Euphorbia
25	Gymnosporia
28	Tylectodon
29	Euphorbia
30	Coryledon
31	Helichrysum
32	Chrysocoma
33	Chlorophytum
34	Roepera
36	Ficinia
40	Adromischus
41	Nymphia
44	Diclis
46	Cineraria
50	Senecio
52	Cissampelos
53	Rhodocoma
55	Oedera
56	Eriocapulus
57	Theseum

Fig.11- NO10, series of quadrats showing densification of distinctive suite of useful thick taxa towards core habitation area. (See Fig. 6 aerial view of quadrat layout)

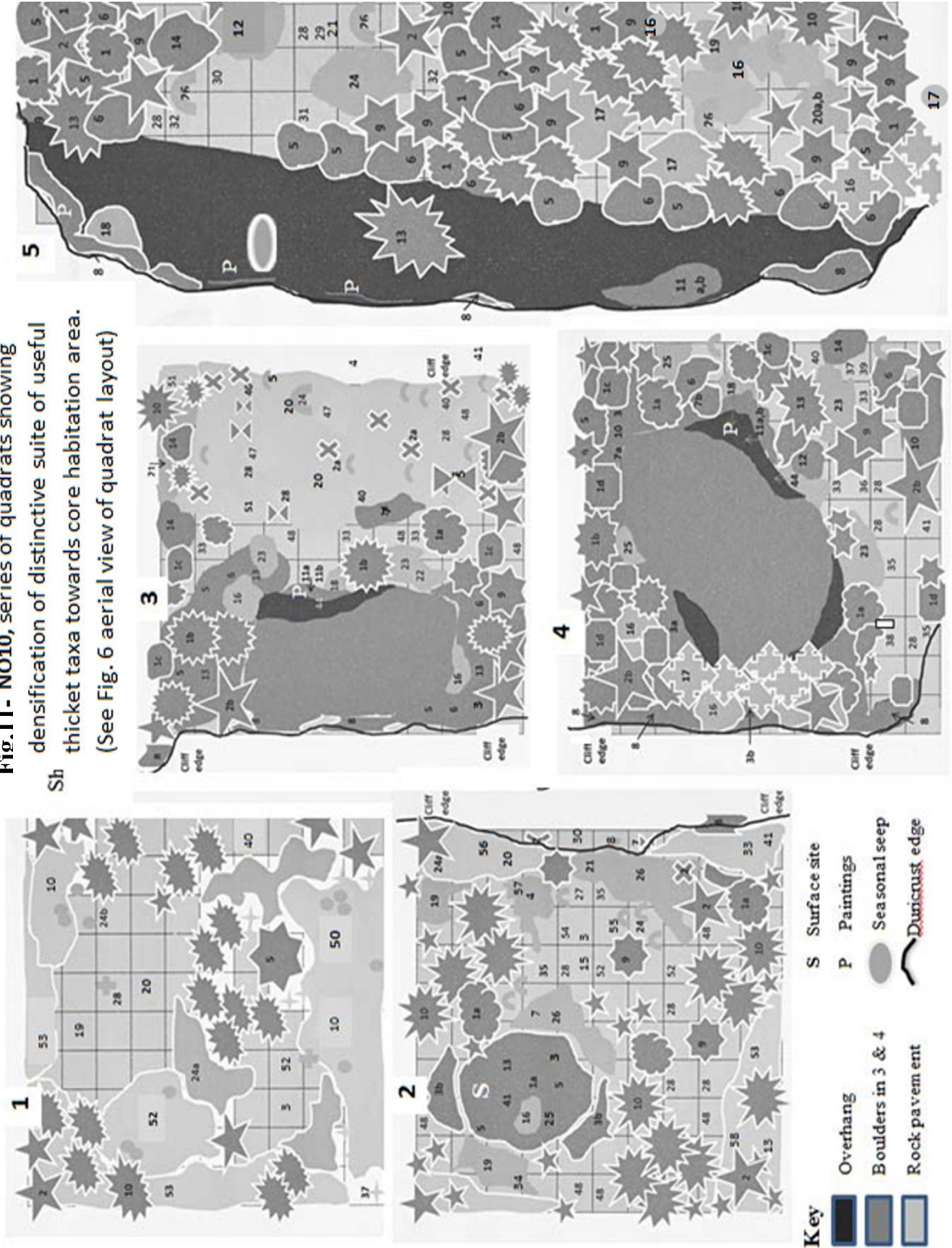


Fig 11 shows the densification of the most important site taxa towards the core habitation area at NO10. At this site a detailed diagram of each quadrat was drawn and the top 20 genera forming the distinctive suite of site taxa as ascertained by the larger study of 75 sites were marked on the quadrat diagrams, to show the number of each species and relative area each covered. The top five genera were shaded a darker tone than the rest in order to demonstrate the densification of these taxa. As the overall tone of each quadrat diagram darkens, the densification and increase in these five genera can be seen clearly.

8.7.3 Results of soil tests on samples from NO10 and KL1

Samples from some, the quadrats surrounding the sites were tested but not within the actual site, according to the standard agricultural soil test criteria. Additional tests for available and non-available Phosphorus as well as Calcium were performed. Figures highlighted in pale grey show the lowest concentrations and those in the dark grey area the highest concentrations.

Quad	pH	P	K	Ca	Mg	Na	K	Ca	Mg	Na	K	Ca	Mg	Na	KCl (H ⁺)	Ca:Mg	(Ca+Mg)/K	Mg:K
		Bray 1	Amm Acetate				%				meq = cmol(+)/kg					Norms		
KL1		mg/kg	mg/kg													1.5-4.5	10 - 20	3 - 4
6	4.2	41	63	383	116	42	4.8	56.8	28.2	5.4	0.16	1.92	0.95	0.18	0.16	2.0	17.8	5.9
5	7.2	75	147	4176	624	61	1.4	78.4	19.2	1.0	0.38	20.88	5.14	0.27	0.00	4.1	69.1	13.6
4	5.7	76	98	2335	530	54	1.5	70.7	26.3	1.4	0.25	11.68	4.36	0.23	0.00	2.7	63.9	17.3
3	4.6	59	68	1527	334	31	1.6	71.3	25.6	1.3	0.17	7.64	2.75	0.13	0.03	2.8	59.6	15.7
0	5.6	23	81	1346	180	22	2.4	79.1	17.3	1.1	0.21	6.73	1.48	0.10	0.00	4.6	39.6	7.1
NO10																		
2	3.8	25	75	701	91	25	3.8	69.2	14.7	2.1	0.19	3.51	0.75	0.11	0.51	4.7	22.2	3.9
3	4.4	145	125	610	152	111	6.2	58.9	24.1	9.3	0.32	3.05	1.25	0.48	0.08	2.4	13.4	3.9
4	6.1	69	218	1358	484	462	4.2	51.0	29.8	15.1	0.56	6.79	3.98	2.01	0.00	1.7	19.3	7.1
5	8.1	216	691	3273	880	4147	4.1	37.7	16.6	41.6	1.77	16.37	7.24	18.03	0.00	2.3	13.3	4.1
	PH	Phosphorus	Phosphate	Calcium	Magnesium	Sodium	Phosphate	Calcium	Magnesium	Sodium	Phosphate	Calcium	Magnesium	Sodium	Hydrogen	Calcium / magnesium	Ca/mg/ Phosphate	Magnesium / Potassium

Table 1 – Results of soil tests at NO10 and KL1 on the left of the table, compared to the the normal average readings to the right of the table.

Samples from quadrats numbered 5, both immediately below the habitation areas show the highest ph readings – KCl at 7.2 and NO10 at 8.1. Quadrat numbers ‘5’ at both sites show the

highest readings for Phosphorus, Phosphate, Calcium, Magnesium, and Sodium and are dark highlighted in the table above. In both cases these samples came from just outside and up to 10 metres below the core habitation areas (see Figs. 6 & 7). The pale highlighted values occur well away from the habitation areas in both sites. With hindsight, samples should have been taken from all the quadrats including those furthest away from the sites, as well as from outside the thicket patches where the vegetation changes fairly abruptly to that of the matrix vegetation. This was not done and weakens the assumptions that can be made, but points to a future research opportunity.

At KL1, Sample 0 was taken about 200 metres below the site on the edge of the change from thicket to Renosterveld where the slope flattens out and the agricultural ploughed land begins. but also because of the steepness of the slope which increases from that line. This sample should have increased fertility due to these renosterveld soils, and especially as the wheat fields are likely to have been artificially fertilised at some time if not at every planting – however, the concentrations are significantly lower than sample 5b just below the core habitation area.

Phosphorus (P) is unique among the elements in being a sensitive and persistent archaeological indicator of human activity. At both NO10 and KL1, the (P) readings are significantly higher nearer the core habitation sites. It has long been of interest to archaeologists because of its potential to inform them about the presence of past human occupation and its intensity (Holliday, & Gartner, 2007; Pastor, Gallelo, et al. 2016). Anthropogenic pre-historic additions of phosphorus to the soil come from human refuse and waste, burials, and the effect of dense thicket leaf drop which builds up decomposed humus in the soils. Once added to the soil, phosphorus in its common form as phosphate, is stable and generally immobile and can remain for thousands of years. Many elements are left in the soil by humans but few are as ubiquitous, as sensitive, and as persistent an indicator of human activity as phosphorus.

8. 8. Conclusions

Using an interdisciplinary, pragmatic, abductive, mixed methods research approach, I have shown in this paper that the similarity between the taxa at the three sites is over 60%, that intense densification is peculiar to the core habitation area of each site although the green wall extends across adjacent painted sites as can be seen in NO10 and K11. The soils

associated most closely with the core habitation areas at two of the three sites show increased Ph and concentrations of soil nutrients in comparison to the peripheral painted sites. The fertility steadily declines as one moves away from the core habitation area, as does the density and presence of the suite of distinctive and useful thicket taxa. The results of this survey suggest that there could well have been an anthropogenic process accounting for the presence of the distinctive and useful taxa growing today at these three pre-colonial archaeological sites in the southern Cape.

There is no doubt that other animals, birds and insects living in, or at, and interacting with the sites over thousands of years could and would have influenced the vegetation composition at sites as well as changed the soils in their vicinity to a degree. Abiotic factors should also be factored in. However, the focus in this paper is on the possible anthropogenic effects and legacies, and these other factors although valid were not researched to the same extent. See Chap 5, page 9 – 10; Chap. 5.3.4, page 99; Chap. 10.3, page 213).

Globally, I have shown in my thesis that the suite of taxa most frequently found at all three sites are those most frequently selected for medicine, food, and various other uses by indigenous and traditional peoples throughout the world. The majority of these taxa are also shown to be chemotaxonomically active and to have produced many of the modern medicinal drugs of the 19th and 20th centuries (Zhu, Qin, Tao, Liu, & Shi, et al. 2011). The majority of the species found at the sites are still used and known by modern Khoi-San descendants in the southern Cape Chap. 6, Table 11, page 122). In addition, the top suite of taxa, are frequently those retrieved as macro and micro-botanicals during excavation of sites in the Cape Provinces.

Looking further afield, a similar pattern emerges throughout the southern Cape, Africa, and globally. How did the pattern form and when? Did the earliest migrants out of Africa choose sites where they recognised useful plants already present? Did the plants migrate with the people from earliest times or later? Could the same small, dense, plant communities have persisted at the same sites for hundreds if not thousands of years? All these questions await answers and could lead to a much greater understanding of how much in the way of valuable wild plant resources used for millennia by Khoi-San ancestors and today by their descendants, are unused, un-researched, and under-appreciated in the southern Cape and wider southern Africa today.

A greater appreciation of these anomalous thicket patches could promote further research into their value as drought and fire-resistant empirically proven useful taxa, rather than unwanted weedy intruders taking up valuable space on farms looking to increase grass cover for ever increasing goat herds or ostriches. Uninformed removal and clearing of thicket in general is the biggest threat to the distinctive, useful, and ancient thicket patches I have been researching. Removal also exposes archaeological sites to sunlight, wind, and rain, and paintings are at risk if not protected by the sheltering dense green walls of vegetation.

CHAPTER 9

Vegetation survey of Klasies River archaeological sites

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Preface to the published paper

I was lucky enough to be included in the present Klasies River archaeological project under the leadership of Sarah Wurz. The paper included here was a result of collaboration between researchers looking at different aspects of the site, who all had an interest in documenting and collecting voucher specimens from the surrounding vegetation in order to build up a comparative database for identifying possible macro-botanicals recovered during the course of excavation. Papers have begun to emerge as a result of this vegetation survey. I did the bulk of collecting with enthusiastic help from the others and personally identified the plants, helped on occasion by Richard Cowling who is familiar with the area and knows the vegetation well. Renee Rust and I undertook an ethnobotanical survey at the same time, and a paper is in preparation documenting our findings.

This paper gives a good idea of how further surveys of more of the 75 sites could help build up a comprehensive comparative database for future archaeological purposes. But, it also highlights the need for further collection of complete floras for the whole of the southern Cape and Western Eastern Cape which have not been adequately covered in the past. Data held by SANBI is deficient for many grids not close to university cities. Without comprehensive species lists, the likes of “Plants of the greater Cape floristic region” (Manning J., Goldblatt P., 2012) for the whole of South Africa, conducting analyses on the flora such as regression analysis is not possible – this requires full detailed lists of all possible species within each family. There is much scope and need for botanists, anthropologists, and archaeologists to conduct interdisciplinary research such as this paper demonstrates.

Modern vegetation at the Klasies River archaeological sites, Tsitsikamma coast, south-eastern Cape, South Africa: A reference collection

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Supplementary Data is available in Excel at Plant Ecology and Evolution, supplementary data site - <http://www.ingentaconnect.com/content/botbel/plecevo/supp-data> and in Appendix F this thesis.

9.1 Abstract

Background and aims - The Klasies River cultural landscape, on the Tsitsikamma coast, south-eastern Cape, South Africa, features prominently in modern human origins research. The archaeobotanical information for the Klasies River landscape and its immediate environment is sparse. The aim of this study is the collection of a taxonomically valid and comprehensive reference database of modern botanical specimens as an aid to identifying macro- and micro-botanicals such as seeds, charcoal, phytoliths, parenchyma and pollen in the Klasies River archaeological deposits. This is an essential step in providing context for the identification of past vegetation and its usage by Stone Age populations.

Methods - Herb, shrub, tree, grass, fern and geophyte voucher specimens were collected in 24 areas in the vicinity of the Klasies River sites, and further inland within a 5km radius, between 2013 and 2015. The collecting was done at different times of year so that all stages of the flowering, fruiting and seeding cycles for most plants could be sampled.

Key results - A total of 268 species, in 196 genera and 78 families were collected. Only 69 of these 268 species currently appear on the relevant database grid of the Integrated Biodiversity Information System (SIBIS), the South African National Biodiversity Institute (SANBI). Our work clearly indicates the need for thorough and systematic collecting at archaeologically significant sites in the Cape region to provide further environmental proxies for the interpretation and contextualisation of the development of anatomically modern human behaviour.

Conclusions –The Klasies River landscape, although located within the broad Fynbos Biome, cannot be classified as such, as relatively few fynbos species are represented in the core area surrounding the sites. The vegetation is in fact a complex mosaic of thicket, forest and coastal vegetation. This densely interdigitated vegetation provides a wide variety of useful resources.

Key words - Klasies River archaeological sites, Tsitsikamma region, southern Cape, south-eastern Cape, thicket, forest, coastal vegetation, fynbos, medicinal plants, edible plants

9.2 Introduction

The Klasies River cultural landscape is situated on the Tsitsikamma coast, south-eastern Cape, South Africa, about 90 km west of Port Elizabeth (Fig. 1). This landscape, a National Heritage site, consists of a 2 km stretch of coast between the mouth of the Klasies River (known locally as the Kaapserivier) to the west and Druipkelder Point to the east and includes buffer zones into the intertidal zone and coastal platform towards the south and north respectively. There are five major archaeological features on this landscape: Main Site (Figs 1 & 2) occurs closest to Klasies River mouth and consists of a complex of caves (Caves 1, 1A, 1B, 1C & 2). Caves 3 and 4, not yet investigated archaeologically, occur further to the east, with Cave 5, the eastern most feature, close to Druipkelder Point. Various parts of the Klasies River landscape have been excavated since the 1960s by Singer and Wymer (1982), Hilary Deacon (1986, 1989, 1993), and Johan Binneman (1995). Sarah Wurz, University of the Witwatersrand, starting a new project in 2014. The excavations at Main Site and Cave 5 have revealed Middle Stone Age (MSA) and Later Stone Age (LSA) occupation of the sites from the first part of the Late Pleistocene to the Late Holocene. Acheulean bifaces and MSA artefacts have been noted in the deflation hollows of the fossilized Geelhoutboom dune on the plateau above the cave sites (Fig. 1).

Main Site was intensively occupied by coastal foragers between ca. 120 000 and 55 000 years ago and thus preserves an extraordinarily comprehensive record of cultural adaptation within

the context of one of the earliest MSA coastal economies that has been recorded (Singer, & Wymer, 1982; H Deacon, 1989; H. Deacon, & Geleijnse, 1988; Wurz, 2002,2012). Cave 5 also preserves evidence of a pulse of occupation contemporaneous with ca 120 000 year old layers at Main Site (Singer, & Wymer, 1982). Some of the earliest and most extensive fossil evidence for early anatomically modern humans occurs at Main Site (Singer, & Wymer, 1982; Deacon, 2008; Grine, Wurz, & Marean, 2017). From around ca. 4800 BP -- 2300 BP (Nami, de la Pefia, Vàsquez, Feathers, & Wurz, 2016), coastal dwellers again occupied Main Site, and also Cave 5 (Singer. & Wymer, 1982), demonstrating that this landscape has provided a favourable habitat over a long period of time. Several studies have already been undertaken to provide insight into the palaeo-environmental aspects of these Stone Age occupations, for example, the analyses of the large mammal fauna, microfauna, shellfish and isotopes (e.g. R. Klein, 1976, 1980; Singer, & Wymer, 1982; H. Deacon, 1986, Avery G, 1986, 1987; H. Deacon, & Lancaster, 1988; Thackeray, 1988; van Pletzen, 2000; Langejans, Dusseldorp, & Thackeray, 2017). More recently Late Pleistocene speleothems from Cave 1C have been studied (Braun, 2014). Several on-going research projects are referred to below as unpublished research (unpub. res.).



Fig. 1 – Panorama of main site. Situated in the complex Klasies River landscape.

Archaeobotanical information for the Klasies River landscape and its immediate environment is sparse, although preliminary studies of small charcoal samples were undertaken (H. Deacon, 1986, Madelon Tussenius, University of the Witwatersrand, South Africa, personal comment) and, more recently, the first seeds (Zwane, 2015) and parenchyma (Larbey, et al., Cambridge University, UK, unpubl. res.) have been identified. Besides obtaining data on past vegetation, archaeobotanical analyses at other sites, for example Sibudu Cave, have shown

that they have much potential to provide unexpected, nuanced interpretations of populations' behaviour and adaptation (e.g. [Wadley, 2015](#)). Plants provide micronutrients, not available anywhere else, which are essential to human diet and health – humans cannot live without plants as food and medicine. Seeds, fruit, leaves, roots, tubers, bulbs, gum, buds, flower stalks, internodes, nectar ([de Vynck, B-E. van Wijk, et al. 2016a](#)), plus shoots, bark, cambium, sap, pollen, pods, and galls were, and still are, all utilised. H. Deacon ([1989, 1992a&b, 1993](#)), suggested that a long history of ethnographically known plant exploitation may have been evident at Klasies River since the Late Pleistocene. He interpreted carbonised material observed in blackened layers at the site as altered plant remains ([H. Deacon, 1993, 1995](#)). Hilary Deacon ([1993](#)) also suggested that when above-ground food resources were limited, plants with underground storage organs (USOs) would have been important sources of carbohydrates (see [De Vynck et al. 2016a&b; Singels, et al., 2015](#)). USOs may not have been the only carbohydrate resource at Klasies River or elsewhere as grasses may also have been an important food resource (e.g. [Henry, Brooks, & Piperno, 2014; Eoin, 2016](#)).

One of the goals of the current excavation project at Klasies River is to expand archaeobotanical investigation for both the Later Stone Age and Middle Stone Age deposits. In archaeological reports, the botanical context provided for the Klasies cave sites is noted as fynbos, either as a vegetation type or as a biome (e.g. [R. Klein, 1976; Faith, 2011, Henry, Brooks, & Piperno, 2014](#)) or as a complex forest-scrub and forest-grassveld-macchia mosaic ([Butzer, 1978](#)), with some reference to Afromontane Forest ([H. Deacon, 1993](#)). With the exception of specimens collected for wood samples by Madelon Tusenius in 1984 and 1985, no systematic sampling of the composition of the vegetation has been undertaken at the Klasies River cultural landscape and its immediate environment. An essential step in providing comparative material and context for past vegetation and its usage by the Stone Age populations is to produce a taxonomically valid and comprehensive botanical database.

In this paper we report on the collection of 90--95% percentage of the modern botanical species in close proximity to the Klasies River Main Site and Caves 3 and 4, and we describe and characterise the present vegetation within the regional biophysical context (Tables 1 & 2). We also indicate which of the taxa collected are edible and/or medicinal or have other uses (Tables 1, 3A & B), and we emphasise the high prevalence of useful species collected. The latter topic is, however, to be covered more comprehensively in another paper ([van Wijk, Rust, unpubl. res.](#)). The vegetation we sampled in detail in close proximity to the Klasies

River sites is a complex mosaic of predominantly thicket, forest and coastal vegetation, with a few fynbos elements.

9.3 Biophysical context

Klasies River falls within the Cape Fold Belt geomorphic province where the dominant bedrock comprises quartzitic sandstones of the Peninsula Formation of the Table Mountain Group (TMG). These, together with other formations of the TMG and some narrow bands of Bokkeveld Group shales, form the Tsitsikamma coastal plateau, a narrow (50--13km) relatively level plain ranging from ca. 150--260m in altitude and located between the coast and the Tsitsikamma Mountains. The plateau is massively incised by the narrow gorges of short rivers such as the Klasies and Tsitsikamma rivers, locally named Kaapservier and Kamrivier, hence Kaapsedrif and Kamsedrif occurring between the mountains and the coast (Fig. 3). Periods of lower sea levels in the past, for example, between 100--55 000 BP, would have had significant impacts on the vegetation and past resources as the coast would have been between two and five km away (Langejans, Dusseldorp, & Thackeray, 2017).

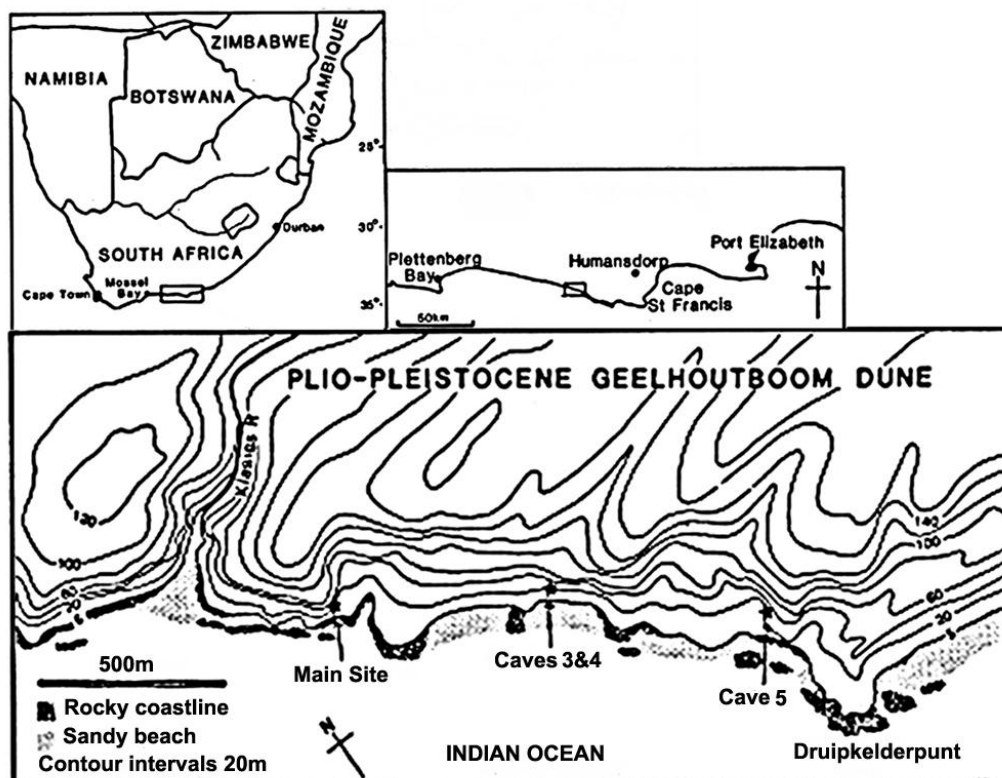


Fig. 2 – Locality of the Klasies River archaeological sites, Tsitsikamma coast, South Africa. (Adapted from Deacon and Geleijnse 1988).

At present, the coastal margin, including the ca 100--150m coastal cliffs, is mantled by a 2--3km wide coastal band of Cenozoic (Algoa Group) sediments of a coastal and aeolian origin (le Roux, 2000). These sediments include the Nanaga Formation - Pliocene to Early Pleistocene aeolian deposits, e.g. those of the Geelhoutboom fossil dune (H. Deacon, & Geleijnse, 1988) - as well as the unconsolidated windblown sand of the vegetated dunes of Holocene age (le Roux, 2000). The sea-land contact zone at present is deeply indented and fractured with ragged rocks forming small points, tunnels, and narrow bands which are vegetated right to the edge of the rocks. Rock outcrops alternate with small sandy bays, often covered in a thick layer of rounded quartzite cobbles of varied size and colour, which were utilised for tool-making in the past (Singer, & Wymer, 1982).

Seasonal temperature variation is low and this equable climate is a consequence of the stabilizing effect of the warm Agulhas Current. Between 1959 and 2001, the annual average minimum and maximum temperatures recorded at Cape St Francis, some 60km east of Klasies River, were between 9 and 18° C in winter and between 18 and 23° C in summer (du Plessis, 2015). Because of the cooling effect of the onshore winds bringing mist and sea-spray, temperatures are lower in the vicinity of the sites than up on the plateau and inland (Lubke, 1985). As is typical of the Cape south coast, rainfall is all year round with small peaks during autumn and spring (Weldon, & Reason, 2014). The average annual rainfall on the southern slopes of the nearby Tsitsikamma mountains is between 875--1375 mm (Hosking, & du Preez, 1999) and at Storms River weather station 25 km west of Klasies River it is 810 mm (Grey, 1987). This is optimal for Afrotropical forest and more than enough to sustain thicket. The prevailing winds are from the west-southwest in winter, but in summer the frequency and strength of east-southeast winds increases (Elkington, 2012; Lubke, 1985).

The Klasies River sites are located in the broad Eastern Fynbos and Renosterveld bioregion of the Cape Floristic Region's Fynbos biome (Mucina, & Rutherford, 2006). However, as is typical of this bioregion, Fynbos and Renosterveld interdigitate and form mosaic structures with three other biomes, namely Forest, Subtropical Thicket and Grassland (Cowling, 1982, 1984; Cowling, & Potts, 2015). There are species-based botanical assessments relevant to the broader area which encompasses Klasies River, such as that of the southern Cape forests (Geldenhuys, 1993), the Tsitsikamma National Park to the west (Hanekom, Southwood, Ferguson, 1989) and the Oyster Bay dunes to the east (Cowling, 1984). Several national or

regional vegetation maps, mainly at relatively crude scales do exist for the area (e.g. [Acocks, 1988](#); [Cowling, & Heijnis, 2001](#); [Mucina, & Rutherford, 2006](#), [Vlok, et al. 2008](#)), but all are too coarse to realistically depict vegetation patterns in the immediate Klasies River area.

In general, vegetation of the Algoa Group sediments along the coastal margin comprises a complex array of vegetation types whose distribution is governed by exposure to salt laden winds, exposure to recurrent fire, soil formation and aspect. However, owing to heavy infestations of alien trees (*Acacia longifolia*, *A. saligna*), especially on the inland slopes of the dune cordon, it is difficult to discern the original vegetation composition. The Nanaga sands support a complex mosaic of forest, thicket, grassland and fynbos, as is the case further east of Klasies River ([Cowling, 1984](#); [Hoare, Mucina, et al., 2006](#)). In wind- and fire-protected sites such as incised drainage lines leading to the coast, the vegetation is Southern Coastal Forest, a subtropical type with a relatively rich tree flora. Conspicuous species include *Sideroxylon inerme*, *Ekebergia capensis*, *Olea capensis* subsp. *capensis*, *Canthium inerme*, *Pterocelastrus tricuspidatus*, *Gymnosporia nemorosa*, *Cassine peragua*, *Acokanthera oppositifolia* and *Searsia chirindensis*.

Drier and more exposed sites support patches of dune thicket, which may occur in large blocks, such as the wind-exposed slopes along the coast, or as clumps in a matrix of grassland or fynbos. The composition is similar to the dune thickets described by Cowling ([1984](#)). Dominant species are *Sideroxylon inerme*, *Pterocelastrus tricuspidatus*, *Euclea racemosa*, *Putterlickia pyracantha*, *Tarchonanthus littoralis* and *Searsia glauca*. The younger (Holocene) dunes support a mosaic of dune fynbos and thicket, a community that has been well described by Richard Cowling ([1984](#)) in the Cape St Francis area.

Along the coast, either on hummock dunes or on harder surfaces exposed to salt-laden winds is an azonal community of low herbs and shrubs, many of which are succulent. This community forms part of Mucina and Rutherford's Cape Seashore vegetation ([2006](#)). The vegetation of the coastal plateau is included in the Tsitsikamma Sandstone Fynbos of Tony Rebelo, Boucher, et al. ([2006](#)). Remnant patches of fynbos on well-drained plateau areas suggest dominance by overstorey proteoid shrubs with a lower stratum of ericoid shrubs, restioids and grasses. Geophytes are conspicuous after fire. Almost all of this earlier vegetation on the plateau has, however, been replaced by pastures, pine plantations and dense stands of alien trees.

9.4 Materials and methods

The first botanical reference material was collected by Tussenius in 1984/1985 and consisted of woody taxa to be used as a comparative collection for the identification of charcoal remains from the Deacon excavations. During the present excavation project, the existing wood reference material has been expanded to a comprehensive collection of representative modern specimens of herbs, shrubs, trees, ferns, grasses and geophytes by van Wijk, Rust, Tussenius, Larbey, Novello and Cowling (Table 1 & supplementary table), to compile a reference database as an aid to identifying macro- and micro-botanicals such as seeds, charcoal, phytoliths, parenchyma and pollen in the Klasies River archaeological deposits.

Specimens were collected as widely as possible in the immediate core area, close to Main Site and to Caves 3 & 4 in collecting areas 1 to 19 (Fig. 4). Additional collections were made further inland within a 5km radius of Main Site in areas 20 to 24 (Fig. 3). These included a patch of Fynbos and a relatively intact forest section on the western slope above the Klasies River itself (collecting areas 20 & 21 respectively in Fig. 3). Wood specimens were also collected inland above Cave 5 by Tussenius in 1984, and Cowling subsequently collected in that area in 2015 (collecting area 22 in Fig. 3).



Figure 3 – Greater collection area within 5 kilometres of Main Site: 20 Fynbos remnant, 21 Forest remnant, 22 above cave 5, 23 on plateau, 24 Kamsedrif.

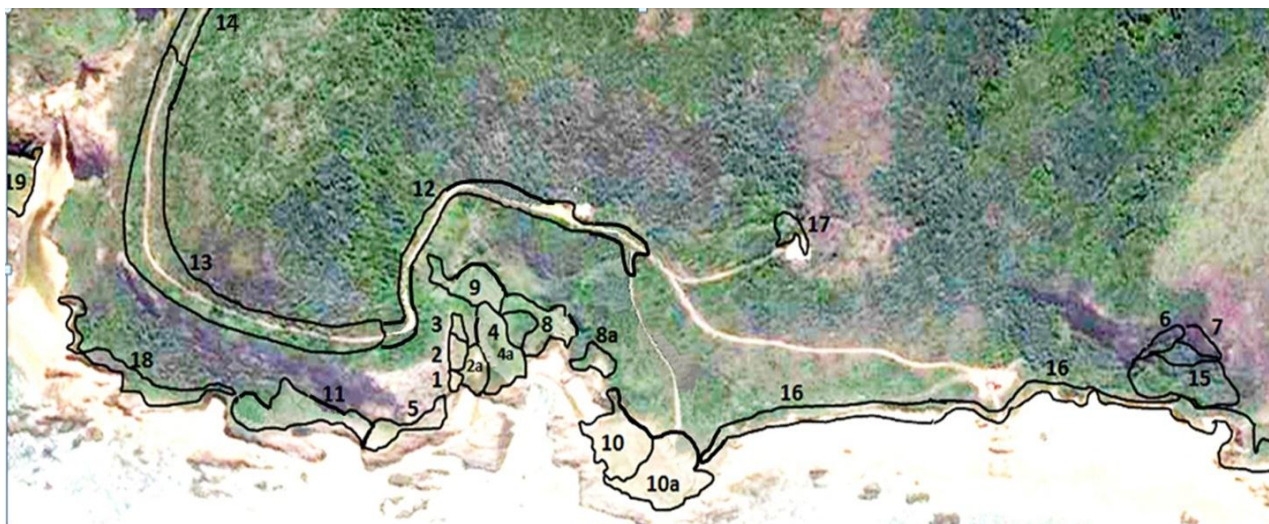


Fig. 4 – Greater collection areas numbered and described.

- 1 - at entrance to Cave 1a – badly worn and trampled, succulents and grass
- 2 - rubble berm on lower eastern edge of Cave 1c – disturbed and unstable
- 2a - low veg in slight depression and wash-away to east of area 2 – fresh water seep present
- 3 - high northern end of berm beside Cave 1c – milkwood forest & thicket from 20 cm to 2 m
- 4 - concave slope rising to the north – grassy species-rich wind-sheared vegetation
- 4a - Similar to 4 but including wind-sheared 'Lilliputian' forest & thicket species
- 5 - steeply sloping area between shore & cliff to cave 1b – low grassy wind-sheared thicket
- 6 - immediately at entrance to Cave 3 – dense thorny thicket & forest
- 7 - immediately at entrance to Cave 4 – thorny thicket, succulents and herbs
- 8 - mixed species-rich grassy veg - thicket in lee of wind, sloping up to cliffs on north-west
- 8a - dense vegetation, mostly thicket & forest up to 2.5 m
- 9 - long valley sloping steeply up west, grassy, succulents, geophytes, thicket in lee of wind
- 10 - grassy flats between cliffs and seashore – low grass, succulent, coastal / littoral
- 10a similar to 10 but with more low shrubby and succulent species / littoral
- 11 - from the edge of rocks above sea-shore – from low grassy scrub to thicket 1 m
- 12 - along both sides of entrance track sloping south – dense coastal thicket
- 13 - along both sides of entrance track sloping west – thicket, forest, lianas
- 14 - along both sides of entrance track sloping north – thicket, + few fynbos spp.
- 15 - small coastal forest patch below caves 3 & 4 – sheltered by fore-dune with thicket
- 16 - narrow band on edge of beach & fore-dune – low coastal veg., thicket at eastern end
- 17 - small patch of 3–4 m forest and thicket, some disturbed grassy area
- 18 - along footpath above rocky edge to seashore – thicket to 1.5 m+, below forest patch
- 19 - small beach & cliff on west bank of Klasies River - cliff & estuarine vegetation.

The ideal is to collect at different times of the year at each site, and to collect all stages of the flowering, fruiting and seeding cycle for most plants, but unfortunately this is seldom possible due to time constraints and the difficulty of access to many sites. In this study however, four week-long collecting seasons at different times of the year by van Wijk between 2013 and 2015 made it possible to collect duplicate specimens in flower or bud for pollen sampling, and in seed or fruit for identification of charred seed remains. Collecting took place in November, December, February, March and May with unfortunately no collecting in the

winter and early spring. However, due to year-round rainfall and a temperate climate, flowering and fruiting of woody plants appear to take place all year round - depending more on rainfall than on the seasons (Yvan Wijk personal observation, see also [Pierce, Cowling, 1984](#)). On the other hand, many herbaceous plants, especially geophytes, showed a more seasonal cycle with most phenological activity in the cooler months ([de Vynck, Cowling, et al. 2016b](#)).

The 2015 collection of underground tubers, bulbs, and roots specifically made for research on parenchyma in archaeological contexts ([Larbey et al., unpubl. res.](#)) in which 34 species were located, was successful only because these geophytes had been seen and collected in flower or seed previously. In terms of the wood collection, an attempt was made to collect as many of the woody taxa currently growing in the vicinity of the cave sites as possible. Emphasis was also placed on getting examples of the same taxa from different ecological micro-niches so that any microscopic anatomical variability due to environmental conditions may be observed. Sampling for the wood collection is an on-going project. Leafy voucher specimens for the woody taxa collected in the 1980s, as well as charred specimens of the associated wood samples, are lodged at Iziko: S A Museum, Cape Town. All ethnobotanical and vegetation survey specimens collected by Van Wijk, Rust and Tussenius from 2013 to 2015 were pressed to serve as voucher specimens for reference purposes. Most of these specimens were photographed before pressing and images have been, or will be, submitted to iSpot for confirmation of identification, and to help assemble an image database for the area. Additional special samples were collected in flower or bud in 2013 and 2014 for future pollen research, and in seed for identification of charred seed remnants recovered during excavation. These flower and seed vouchers went to Johannesburg to be deposited in the Evolutionary Studies Institute herbarium at the University of the Witwatersrand. A complete set of voucher specimens will be lodged at the Selmar Schonland Herbarium, Grahamstown, with duplicates to the Ria Olivier Herbarium at Nelson Mandela Metropolitan University Port Elizabeth.

Identifications were made mainly by Yvette van Wijk, with assistance from Johan Baard, Jan Vlok, Richard Cowling (Ria Olivier Herbarium), Tony Dold (Selmar Schonland Herbarium), Sandra Burrows and Rodney Moffett, with some input from iSpot (<http://www.ispotnature.org/communities/southern-africa>). Classification and authors are from the Angiosperm Phylogeny Group (APG) 111 www.mobot.org/mobot/research/apweb/, and the International Plant Names Index (IPNI) <http://www.ipni.org/index.html>. Naming for

all Angiosperms follows Manning and Goldblatt (2012), and Pteridophytes follow Crouch, Klopper, et al., (2011). To prevent confusion due to many recent name changes, synonyms are given in the tables for family, genus and species wherever relevant.

9.5 Results

A total of 268 species, in 196 genera and 78 families were collected and are listed in Table 1 (see also supplementary table). The species were collected in 24 numbered areas shown in Figs 3 & 4, and represent presence and absence data. Accessibility in some of the sites was hampered by sheer cliffs, impenetrable thorny vegetation or dense stands of the alien invasive tree *Acacia cyclops* and some areas have not been collected. The species tally from these areas is therefore unlikely to be comprehensive. The number of collecting areas in which each species was collected is indicated in Table 1. The common names of each species including, where possible, Khoe-San names are given in the table and are according to Batten, et al. (2001), iSpot, Manning and Goldblatt (2012), C.A. Smith (1966), B-E. van Wyk and Gericke (2000), and B-E. van Wyk, van Oudtshoorn, et al. (2009). The uses of these taxa as medicinal and/or edible plants, as well as those with other uses are also indicated (Fox, & Norwood-Young, 1982; Hutchings, et al. 1996; C.A. Smith, 1966; B-E., van Wyk, van Oudtshoorn, et al. 2009; Arnold, Prentice, et al. 2002; B-E. van Wyk, & Gericke, 2000; Pote, Shackleton, Cocks, & Lubke, 2006; van Wijk, & Rust, unpubl. res.)

Where the actual species present at Klasies is not referred to in the references cited, but the genus is however described as a medicinal genus, it is listed in Table 1 and the supplementary table as a ‘medicinal genus’ (GM). Similarly, an edible genus or a genus with other uses is indicated as GE or GO respectively. There is often substitution of species within a genus by users depending on what is locally available which validates our use of these categories included here in order to show more clearly the overall high level of useful plants present in the Klasies area. In addition, the vegetation types in which each taxon occurs locally is noted (Tables 1 & 2). The vegetation types – forest, thicket, coastal vegetation or fynbos – have been identified according to species check lists from the relevant literature (Cowling 1982; Hanekom, Southwood, et al. 1989; Geldenhuys 1993; Lubke, & van Wijk 1998a & b). Mucina and Rutherford (2006) list taxa for each vegetation type, but make it clear that these are only the “important taxa” and do not represent every species to be found in that specific vegetation type. Many of the species collected at Klasies River occur in more than one vegetation type and are therefore included in each type.

Table 1 Klasies River species list 2013 to 2015 - Synonyms are italicised in brackets - aliens marked with *. M = medicinal, E = edible, O = other use. GM = Genus reported in the literature as medicinal, GE = edible, GO = other use. FM = Family reported in the literature as important medicinally. F = forest, T = thicket, C = coastal, fy = Fynbos.

Taxon	Areas present	Common name	Uses	Veg type
<u>Acanthaceae</u>				
<i>Hypoestes aristata</i> (Vahl) Roem. & Schult. (<i>verticillaris</i>)	19	Ribbonbush, Seeroogblom	E	FTC
<i>Justicia leptantha</i> (Nees) T. Anderson	3	Kiesieblaar	GM	x
<i>Isoglossa ciliata</i> Lindau	6	Businessman's plant	GM	FT
<u>Adiantaceae (Pteridaceae)</u>				
<i>Adiantum capillus-veneris</i> L.	1	Maiden Hair fern	M	x
<u>Agavaceae (Anthericaceae)</u>				
<i>Chlorophytum comosum</i> (Thunb.) Jacques	4	Hen & Chickens	E	FTC
<u>Aizoaceae</u>				
<i>Carpobrotus deliciosus</i> (L.Bolus) L.Bolus	10	Sour Fig, Suurvy, Tandsprooi, Brakvy, Gaukum, Dikgoena	M E	TCfy
<i>Conicosia pugioniformis</i> (L.) N.E.Brown	1	Snotwortel, Varkslaai	E	T
<i>Delosperma litorale</i> (Kensit) L.Bolus	4	Kalkklipvygie	GM	TC
<i>Delosperma saxicola</i> Lavis	1	Rotsvygie	GM	x
<i>Drosanthemum floribundum</i> (Haw.) Schwantes	5	Douvygie	x	T
<i>Lampranthus spectabilis</i> (Haw.) N.E. Br.	2	Rankvygie	x	x
<i>Mesembryanthemum aitonis</i> Jacq.	7	Brakvygie, Brakslaai	M E	C
<i>Ruschia lineolata</i> Schwantes	10	Muisvygie	x	x
<i>Tetragonia decumbens</i> Mill.	3	Dune spinach	E	TC
<i>Tetragonia fruticosa</i> L.	13	Sea spinach	GM	TC
<u>Amaranthaceae (Chenopodiaceae)</u>				
<i>Chenolea diffusa</i> Thunb.	8	Seawrack, Soutbossie	M	TC
* <i>Chenopodium ambrosioides</i> L.	2	Wormseed, Galsiekbos	M E	x
* <i>Chenopodium murale</i> L.	5	Misbredie, Varklossie, Tjuana-seep	M E	x
* <i>Chenopodium vulvaria</i> L.	1	Pisbossie	GM	x
<i>Exomis microphylla</i> (Thunb.) Aellen	5	Hondepisbossie, Rambos	M E	TC
<i>Pupalia lappacea</i> (L.) Juss.	3	Klitz, Sweethearts	M E	FT
<i>Sarcocornia littorea</i> (Moss) A.J.Scott	3	Samphire, Lidjiesbos, Ganna-asbos	E	TC
<u>Amaryllidaceae</u>				
<i>Haemanthus albiflos</i> Jacq.	1	Paintbrush, Poeierkwas, Veldskoenblaar	M O	FTC
<u>Anacardiaceae</u>				
<i>Searsia chirindensis</i> (Baker f.) Moffett (<i>Rhus</i>)	1	Wild Currant, Boskaree	M E O	F
<i>Searsia crenata</i> (Thunb.) Moffett (<i>Rhus</i>)	10	Soettaaibos, Korentebos	E O	FTCfy
<i>Searsia glauca</i> (Thunb.) Moffett (<i>Rhus</i>)	6	Blinkblaartaibos, Krintingbessie,	E O	FTCfy
<i>Searsia nebulosa</i> (Schönland) Moffett (<i>Rhus</i>)	1	Sandtaaibos	E	T
<i>Searsia pyroides</i> (Burch.) Moffett (<i>Rhus</i>)	6	Deurmekaartaaibos, Rivierkaree	E O	T
<u>Apiaceae</u>				
<i>Apium decumbens</i> Eckl. & Zeyh.	6	Sea Celery	M	C
<i>Centella asiatica</i> (L.) Urb.	2	Pennywort, Waternavel	ME	x
<i>Dasispermum suffruticosum</i> (P.J.Bergius) B.L.Burt (<i>Heteroptilis</i>)	2	Sea Parsley	E	C
<i>Lichtensteinia interrupta</i> E. Mey.	1	Wild Anise, Kalmoes	M	x
<i>Notobubon ferulaceum</i> (Thunb.) Magee (<i>Peucedanum</i>)	2	Lidjiesbos, Wildeseldery, Gatagaai	GM	T

Cont. - Table 1 Klasies River species list 2013 to 2015 - Synonyms are italicised in brackets - aliens marked with *. M = medicinal, E = edible, O = other use. GM = Genus reported in the literature as medicinal, GE = edible, GO = other use. FM = Family reported in the literature as important medicinally. F = forest, T = thicket, C = coastal, fy = Fynbos.

Taxon	Areas present	Common name	Uses	Veg type
<i>Notobubon laevigatum</i> (Aiton) Magee (<i>Peucedanum</i>)	3	Lidjiesbos, Bergseldery, Gatagaai	M E	FT
<u>Apocynaceae</u>		-	<u>FM</u>	
<i>Acokanthera oppositifolia</i> (Lam.) Codd	3	Bushman's poison, Boesmansgif	M	FTC
<i>Carissa bispinosa</i> (L.) Desf. ex Brenan (<i>haematocarpa</i>)	12	Num-num, Nam-noempies, Noem-Noem	M E O	FTC
<i>Cynanchum ellipticum</i> (Harv.) R.A.Dyer	4	Dawidjiewortel, Bobbejaantou, Bokhoring, Nenta	M E	FTC
<i>Cynanchum natalitium</i> Schltr.	5	Dawidjiewortel, Bobbejaantou, Bokhoring, Nenta	E GM	FTC
<i>Secamone alpini</i> Schult.	3	Melktou, Bobbejaantou	GM	FTC
<u>Aquifoliaceae</u>		-	-	
<i>Ilex mitis</i> (L.) Radlk.	2	Wild Holly	M E	F
<u>Araceae</u>		-	<u>FM</u>	
<i>Zantedeschia aethiopica</i> (L.) Spreng.	2	Arum Lily, Hottentotsblare	M E	F
<u>Araliaceae</u>		-	<u>FM</u>	
<i>Cussonia thyrsiflora</i> Thunb.	4	Spekbos, Nooiensboom	E	TC
<u>Asparagaceae (Liliaceae)</u>		-	<u>FM</u>	
<i>Asparagus aethiopicus</i> L.	1	Wild Asparagus, Katdoring, Katjang	M E	FTCfy
<i>Asparagus densiflorus</i> (Kunth) Jessop (<i>sprengeri</i>)	10	Wild Asparagus, Katdoring, Kattestert	M	T
<u>Asphodelaceae (Liliaceae, Xanthorrhoeaceae)</u>		-	-	
<i>Gasteria acinacifolia</i> (J.Jacq.) Haw.	2	Beestong, Ox Tongue, Hottentot Rice, Bontkouterie	E GM	FT
<i>Trachyandra divaricata</i> Kunth	2	Veldkool, Hotnotskool	E	FC
<u>Aspleniaceae</u>		-	-	
<i>Asplenium adiantum-nigrum</i> (Kunze) J.P. Roux	2	Maidenhair Fern	M	x
<u>Asteraceae</u>		-	<u>FM</u>	
<i>Arctotis linearis</i> Thunb.	1	Gousblom	GM	C
<i>Arctotheca prostrata</i> (Salisb.) Britten	5	Cape weed, Gousblom, Skaapoor	M	x
<i>Arctotheca populifolia</i> (P.J.Bergius) Norl.	1	Seepampoen	GM	TC
<i>Artemisia afra</i> Jacq. ex Willd.	1	Wildeals	M	T
<i>Berkheya decurrens</i> (Thunb.) Willd.	3	Grootdisseldoring	M	T
<i>Cineraria geifolia</i> (L.) L.	13	Geelkransbossie	GM	x
<i>Cotula sericea</i> L.f.	10	Buttons, Ganskos	M	TCfy
* <i>Cotula coronopifolia</i> L.	1	Ganskos	GM	C
<i>Dimorphanthera fruticosa</i> (L.) Less. (<i>Osteospermum barberae</i>)	2	Cape Daisy	GM	TC
<i>Felicia echinata</i> (Thunb.) Nees	3	Seeloubossie	GM	TCfy
<i>Gazania rigens</i> var. <i>leucolaena</i> (DC.) Roessler	5	Strandgousblom	M	C
<i>Gazania rigens</i> var. <i>uniflora</i> (L.f.) Roessler	9	Botterblom, Gousblom	M	TC
<i>Gazania pectinata</i> (Thunb.) Hartweg	2	Gousblom	E	x
<i>Gerbera piloselloides</i> (L.) Cass.	2	Swarteebossie, Pitpursies	M	F

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Taxon	Areas present	Common name	Uses	Veg type
<i>Helichrysum albanense</i> Hilliard	1	Everlasting	GM	T
<i>Helichrysum anomalum</i> Less.	1	Everlasting, Hotnotstee	GM	Cfy
<i>Helichrysum aureum</i> (Houtt.) Merr.	1	Everlasting	M	x
<i>Helichrysum cymosum</i> (L.) D.Don	5	Kooigoed, Hotnotskooigoed, Hotnotstee	M	FTCfy
<i>Helichrysum herbaceum</i> (Andrews) Sweet	1	Everlasting	M	x
<i>Helichrysum petiolare</i> Hilliard & B.L.Burt	5	Kooigoed, Vaalky, Geita Hotnotskooigoed, Langbeenghyta,	M	FCfy
<i>Helichrysum rosum</i> (P.J.Bergius) Less	2	Everlasting	GM	x
<i>Helichrysum teretifolium</i> (L.) D.Don	5	Verpis	GM	TCfy
<i>Helichrysum umbraculigerum</i> Less.	5	Kerriebos, Kerriekruie, Hotnotstee	x	x
<i>Metalsia muricata</i> (L.) D.Don	6	Blombos, Witsteekbossie	M	TCfy
<i>Oncosiphon africanus</i> (P.J.Bergius) Källersjö (cf. query)	1	Wild Chamomile, Kamella	GM	x
<i>Osteospermum (Chrysanthemoides) moniliferum</i> L.	1	Bitou, Boetabessie, Bietou, Bilhō	M E	FTCfy
<i>Othonna carnosa</i> Less.	4	x	GM	T
<i>Plecostachys serpyllifolia</i> (P.J.Bergius) Hilliard & B.L.Burt	1	Vaaltee	M E	T
<i>Senecio angulatus</i> L.f.	1	Cape Ivy	M	FTC
<i>Senecio elegans</i> L.	5	Strandblometjie	GM	C
<i>Senecio oederifolius</i> DC.	12	Hongerbos, Ragwort	GM	FT
<i>Senecio othonniflorus</i> DC.	1	Sybos	M	T
<i>Stoebe plumosa</i> (L.) Thunb.	1	Slangbossie, Vaalbossie	M	Cfy
<i>Syncarpha argentea</i> (Thunb.) B.Nord.	1	Everlasting, Sewejaartjies	GM	C
<i>Syncarpha striata</i> (Thunb.) B.Nord.	2	Everlasting, Sewejaartjies	GM	x
<i>Tarchonanthus littoralis</i> P.P.J.Herman	6	Wild Camphor, Seesalie, Siriehout, Swartsalie, Hottentot Tobacco	M O	FTCfy
<u>Boraginaceae</u>		-	<u>FM</u>	
<i>Cordia caffra</i> Sond.	1	Ouhout, Septee	M E	FT
<u>Brassicaceae</u>		-	<u>FM</u>	
<i>Heliophila linearis</i> DC.	3	Bloubekkie	GM	T
<i>Heliophila subulata</i> Burch. & DC.	2	Blompeperbossie	M	x
<u>Campanulaceae</u>		-	<u>FM</u>	
<i>Prismatocarpus campanuloides</i> (L.) Sond.	1	Bell Flower	M	x
<i>Wahlenbergia undulata</i> (L.f.) A.DC.	1	African Bluebell	M E	x
<u>Capparaceae</u>		-	<u>FM</u>	
<i>Capparis sepiaria</i> L.	2	Wild caper, Wag-'n-bietjie	M	FTC
<i>Maerua racemulosa</i> Pax	1	Without, Bush Cherry	E	FTC
<u>Caryophyllaceae</u>		-	<u>-</u>	
<i>Silene (primuliflora) crassifolia</i> L.	7	Dune Catchfly, S'nama	M	FTCfy
<i>Silene undulata</i> Aiton	4	Wildetabak, Ubulao	M E	FT
* <i>Stellaria media</i> (L.) Vill.	7	Chickweed	M	X

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Taxon	Areas present	Common name	Uses	Veg type
<u>Celastraceae</u>				
<i>Cassine peragua</i> L.	2	Bastersafrican, Koeboebessie	M O	FTCfy
<i>Elaeodendron croceum</i> (Thunb.) DC.	2	Saffron, Safrican	M O	FT
<i>Gymnosporia nemorosa</i> (Eckl. & Zeyh.) SzyszyÅ., (<i>Maytenus</i>)	6	Pendoring, Kamnassiehout	M	FT
<i>Lauridia tetragona</i> (L. f.) R.H. Archer (<i>Cassine</i>)	3	Droëlewer	E	FTCfy
<i>Maytenus procumbens</i> (L. f.) Loes.	7	Duinekokoboom	O	TCfy
<i>Mystroxydon aethiopicum</i> (Thunb.) Loes.	4	Cape Cherry, Safricanbas, Koeboehout	M E O	FTC
<i>Putterlickia pyracantha</i> (L.) Endl.	1	Wolwedoring,	x	FTC
<i>Pterocelastrus tricuspidatus</i> Walp.	14	Kershout, Cherry Wood	M O	FTCfy
<i>Robsonodendron maritimum</i> (Bolos) R.H.Archer	1	Duinesybas	x	FTC
<u>Commelinaceae</u>				
<i>Commelina africana</i> L.	2	Yellow Wandering Jew	M	FT
<u>Crassulaceae</u>				
<i>Cotyledon orbiculata</i> L.	8	Plakkies, Varkoor, Kouterie	M E	FTC
<i>Crassula atropurpurea</i> (Haw.) D.Dietr.	1	Persplakkie	GM	T
<i>Crassula cultrata</i> L.	4	Plakkiebos	GM	T
<i>Crassula expansa</i> Aiton	1	Strepies	GM	TC
<i>Crassula nudicaulis</i> L.	1	Skraalplakkie	GM	TC
<i>Crassula orbicularis</i> L.	2	Klipblom	M	FT
<i>Crassula ovata</i> (Mill.) Druce	1	Plakkieblaar, Karky, t'karekey	M E	T
<i>Crassula pellucida subsp marginalis</i> (Dryand) Tolkein	4	x	GM	FTfy
<i>Crassula tetragona</i> L.	1	Karkai	M	T
<u>Cucurbitaceae</u>				
<i>Kedrostis nana</i> Cogn.	5	Stinkpatat, Bospatat, Karu	M E	FT
<i>Zehneria scabra</i> Sond.	2	Cape Zehneria	M E	FTC
<u>Cyperaceae</u>				
<i>Carex aethiopica</i> Schkuhr	6	African Tussock Sedge	E	FC
* <i>Cyperus rotundus</i> L.	4	Nutgrass, Watergras, Uintjie	M E	x
<i>Ficinia nodosa</i> (Rottb.) Goetgh., Muasya & D.A.Simpson	2	Vleibiesie	x	TC
<i>Ficinia ramosissima</i> Kunth	2	Biesie	x	Tfy
<i>Ficinia bergiana</i> Kunth	1	Biesie, Rush	x	x
<i>Isolepis sororia</i> Kunth	1	Sedge	x	x
<i>Schoenus nigricans</i> L.	1	Black Bog Rush	x	x
<i>Tetraria involucreata</i> (Rottb.) C.B.Clarke	1	Rush, Biesie	x	fy
<u>Dennstaedtiaceae (Aspleniaceae)</u>				
<i>Pteridium aquilinum subsp. capense</i> (Thunb.) C. Chr.	1	Bracken Fern	M	Ffy
<u>Dipsacaceae</u>				
<i>Scabiosa incisa</i> Mill.	1	Wild Scabious, Pisgoedbossie	M	T

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<u>Dryopteridaceae</u>				
<i>Rumohra adiantiformis</i> (G. Forst.) Ching	1	Seven Week Fern	x	FCfy
<u>Ebenaceae</u>				
<i>Diospyros dichrophylla</i> (Gand.) De Winter	7	Star Apple, Koolhout, Tolbos, Hotnotstolletjie	M E O	FTCfy
<i>Euclea racemosa</i> L.	5	Kersiebos, See-ghwarrie	M E	FTCfy
<u>Ericaceae</u>				
<i>Erica glandulosa</i> subsp. <i>fourcadei</i> (L.Bolus) E.G.H.Oliv. & I.M.Oliv.	2	Erica	O	fy
<i>Erica pectinifolia</i> Salisb.	1	Erica	O	fy
<i>Erica peltata</i> Andrews	1	Ker-ker, Raasheide	O	x
<u>Euphorbiaceae</u>				
<i>Acalypha ecklonii</i> Baill.	3	Katpisbossie	GM	FT
<i>Acalypha peduncularis</i> E.Mey. Ex Meisn. (incl. <i>A. zeyheri</i> Baill)	1	Besembos	M	T
<i>Adenocline acuta</i> (Thunb.) Baill.	5	Spurge	M E	FT
<i>Euphorbia erythrina</i> Link	2	Pismelkbos	GM	T
<u>Fabaceae</u>				
* <i>Acacia cyclops</i> Cunn. ex Don	14	Port Jackson, Rooipitjie, Makboom	M O	x
<i>Dipogon lignosus</i> (L.) Verdc.	2	Wild pea	M E	FTCfy
<i>Erythrina caffra</i> Thunb.	1	Coral Tree	M	FT
<i>Indigofera porrecta</i> Eckl. & Zeyh.	3	Leeuhoutjie, Louhoud	M E	x
<i>Indigofera tomentosa</i> Eckl. & Zeyh.	1	Louhoud	GM	x
<i>Psoralea repens</i> P.J.Bergius	1	Creeping Psoralea	M	TC
<i>Rhynchosia caribaea</i> (Jacq.) DC.	2	Vaalertjie	M	F
<i>Tephrosia capensis</i> (Jacq.) Pers.	3	Rankbossie, Platertjie	M	Tfy
<i>Tephrosia grandiflora</i> (Aiton) Pers.	1	Rooiertjie	M	T
<i>Trifolium burchellianum</i> Ser.	5	Wild Clover	M	x
<i>Vigna vexillata</i> (L.) A.Rich.	1	Wild Sweetpea, Wilde-ertjie	E	x
<u>Gentianaceae</u>				
<i>Chironia peduncularis</i> Lindl.	1	Christmas Berry, Aambeibossie	GM	C
<u>Geraniaceae</u>				
<i>Geranium incanum</i> Burm.f.	1	Ou-meid-op-die-werf, Mickie-Jan-Willem	M E	Tfy
<i>Pelargonium capitatum</i> (L.) L'Hér.	8	Wild Geranium, Malva	M	TC
<i>Pelargonium grossularioides</i> (L.) L'Hér.	2	Rooirabasam	M	x
<i>Pelargonium odoratissimum</i> (L.) L'Hér.	1	Scented Geranium, Malva	M	x
<u>Hyacinthaceae</u>				
<i>Albuca virens</i> (Lindl.) J.C.Manning & Goldblatt (<i>Ornithogalum tenuifolium</i>)	6	Slymuintjie, Jikui, Gambry	E	T
<i>Drimia uniflora</i> J.C.Manning & Goldblatt	5	Fairy Snowdrop	GM	x
<i>Ornithogalum graminifolium</i> Thunb.	3	Grass Chink	GM	T
<i>Veltheimia bracteata</i> Harv. ex Baker	1	Sandlelie, Quarobe, Kwarobe	GM	FT
<u>Hypoxidaceae</u>				
<i>Spiloxene trifurcillata</i> (Nel) Fourc. (<i>Pauridia</i>)	2	Sterretjie	GM	x
<i>Hypoxis cf stellipilis</i> Ker Gawl. (cf)	2	African Potato, Toevanna	M O	TC

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<u>Iridaceae</u>				
<i>Aristea ecklonii</i> Eckl. ex Klatt	1	Blue Stars	M	x
<i>Bobartia orientalis</i> Gillett	1	Geelblombiesie	GE	Tfy
<i>Chasmanthe aethiopica</i> (L.) N.E.Br.	2	Suurkanol	GE	FTC
<i>Watsonia knysnana</i> L.Bolus	1	Watsonia	GE	x
<u>Juncaginaceae</u>				
<i>Triglochin elongata</i> Buchenau	1	Bulbous Arrowgrass	M E	C
<i>Triglochin striata</i> Ruiz & Pav.	1	Three-rib Arrowgrass	GM	TC
<u>Lamiaceae</u>				
<i>Clerodendrum glabrum</i> E. Mey.	1	Tinderwood	M	FT
<i>Leonotis leonurus</i> (L.) R.Br.	1	Duiwelstwak, Lion's Ears, Wildedagga	M E	FT
<i>Salvia africana-lutea</i> L.	3	Strandsalie, Bruinsalie	M	TCfy
<i>Stachys aethiopica</i> L.	3	Katpisbossie, Kruie	M	FTCfy
<u>Linaceae</u>				
<i>Linum africanum</i> L.	5	African Flax	M	Cfy
<u>Lobeliaceae (Campanulaceae)</u>				
<i>Lobelia aniceps</i> L.f.	2	Leafy Lobelia	M	FC
<i>Lobelia cuneifolia</i> Link & Otto	5	Wedge Leaved Lobelia	M	F
<i>Lobelia flaccida</i> (C.Presl) A.DC.	6	Wild Lobelia	M	x
<i>Monopsis decipiens</i> (Sond.) Thulin	2	Wild Violet	M	x
<u>Malvaceae</u>				
<i>Grewia occidentalis</i> L.	7	Raisin bush, Kruisbessie, Vierpuntjies, Booghout, Pylhout	M E O	FTC
* <i>Hibiscus trionum</i> L.	1	Wild Hibiscus	M	x
<u>Meliaceae</u>				
<i>Ekebergia capensis</i> Sparrm.	1	Cape Ash, Essenhout	M	T
<u>Menispermaceae</u>				
<i>Cissampelos torulosa</i> E.Mey. ex Harv. & Sond.	1	Dawidjtjieswortel	M	FT
<u>Moraceae</u>				
<i>Ficus burtt-davyi</i> Hutch.	7	Wild Fig, Rankvy, Hottentotstou	E O	FTC
<u>Myricaceae</u>				
<i>Morella cordifolia</i> (L.) Killick	1	Waxberry, Gammabos	M E O	FTCfy
<i>Morella serrata</i> (Lam.) Killick	1	Waterolier, Bergwasbessie	M	Ffy
<u>Myrsinaceae</u>				
<i>Rapanea gilliana</i> (Sond.) Mez	1	Dwarf Cape Beech, Kleinblaarboekenhout,	GM	TCfy
<i>Rapanea melanophloeos</i> (L.) Mez.	5	Cape Beech, Boekenhout	M	FC
<u>Nymphaeaceae</u>				
<i>Nymphaea nouchali</i> var <i>caerulea</i> Burm.f.	1	Blue Water Lily	M E	x
<u>Oleaceae</u>				
<i>Chionanthus foveolatus</i> (E.Mey.) Stearn (<i>Linociera</i>)	4	Pock Ironwood	M	FTC
<i>Jasminum angulare</i> Vahl	1	Wild Jasmine	M	FT
<i>Olea capensis</i> L.	3	Wild Olive, Ironwood	M E O	FC

Cont. - Table 1 Klasies River species list 2013 to 2015 - Synonyms are italicised in brackets - aliens marked with *. M = medicinal, E = edible, O = other use. GM = Genus reported in the literature as medicinal, GE = edible, GO = other use. FM = Family reported in the literature as important medicinally. F = forest, T = thicket, C = coastal, fy = Fynbos.

Taxon	Areas present	Common name	Uses	Veg type
<u>Orchidaceae</u>			-	
<i>Bonatea speciosa</i> (L.f.) Willd.	4	Wood Orchid	GM	FT
<i>Satyrium parviflorum</i> Sw.	3	Orchid	M	x
<i>Satyrium princeps</i> Bolus	1	Orchid	GM	TCFy
<u>Oxalidaceae</u>			-	
<i>Oxalis smithiana</i> Eckl. & Zeyh.	6	Suuring	E	x
<u>Penaeaceae</u>			-	
<i>Penaea cneorum</i> Meerb.	1	Brickleaf	GM	Ffy
<u>Pittosporaceae</u>			-	
<i>Pittosporum viridiflorum</i> Sims	2	Cheesewood, Kaarsuur	M	FC
<u>Plantaginaceae</u>			FM	
<i>Plantago crassifolia</i> Forssk.	5	Weebelaar	GM	TC
<u>Plumbaginaceae</u>			-	
<i>Limonium scabrum</i> Kuntze	6	Sea Lavender, Brakbossie	x	TCfy
<u>Poaceae</u>			-	
<i>Cynodon dactylon</i> (L.) Pers.	1	Bermuda Grass	M	TCfy
<i>Digitaria eriantha</i> Steud.	2	Fingergrass	M O	T
<i>Ehrharta calycina</i> Sm.	5	Polgras, Bushman Grass	x	FTCFy
<i>Ehrharta erecta</i> Lam.	1	Panic Veldtgrass	x	FT
<i>Eragrostis capensis</i> (Thunb.) Trin.	1	Love Grass, Hartjiegras	GM	FT
<i>Eragrostis curvula</i> (Schrud.) Nees	1	Weeping Lovegrass	E	T
<i>Helictotrichon hirtulum</i> (Steud.) Schweick.	1	Oat grass	x	x
<i>Heteropogon contortus</i> (L.) P.Beauv. ex Roem. & Schult.	1	Tanglehead	M	Tfy
<i>Pentameris pallida</i> (Thunb.) Galley & H.P.Linder (<i>Pentaschistis</i>)	1	Duinegras	x	T
<i>Polypogon strictus</i> Nees	1	Baardgras	x	C
<i>Setaria</i> sp.	1	Foxtail Grass	GM	T
<i>Sporobolus africanus</i> (Poir.) Robyns & Tournay	1	Paramatta Grass	M	TCfy
<i>Sporobolus virginicus</i> (L.) Kunth	11	Brakweek	GM	TC
<i>Stenotaphrum secundatum</i> (Walter) Kuntze	16	Buffalo, Strandkweek	M E	FTCFy
<i>Themeda triandra</i> Forssk.	2	Rooigras	M	TFy
<i>Tristachya leucothrix</i> Nees (<i>Apochaete hispida</i>)	1	Trident grass	x	fy
* <i>Vulpia myuros</i> (L.) C.C.Gmel.	1	Wildegars, Wild Barley	x	T
<u>Polygalaceae</u>			-	FM
<i>Muraltia squarrosa</i> (L. f.) DC.	1	Skilpadbos	M	Tfy
<i>Polygala ericaefolia</i> DC.	1	Milkwort	GM	Tfy
<u>Polygonaceae</u>			-	FM
<i>Rumex sagittatus</i> Thunb.	1	Climbing Sorrel, Ranksuring	M E	TC
<u>Proteaceae</u>			-	
<i>Leucadendron salignum</i> R. Br.	2	Tolbos, Geelbos	M O	Cfy
<i>Leucadendron spissifolium</i> I.J. Williams	1	Tolbos	x	x
<i>Leucospermum cuneiforme</i> (Burm.f.) Rourke	1	Pincushion	x	fy

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Taxon	Areas present	Common name	Uses	Veg type
<i>Protea coronata</i> Lam.	1	Green Protea	GM	x
<i>Protea cynaroides</i> (L.) L.	1	King Protea	GM	fy
<i>Protea neriifolia</i> R. Br.	1	Protea	GM	fy
<i>Protea tenax</i> R. Br.	1	Ground Protea	GM	fy
<u>Rhamnaceae</u>				
<i>Phylica litoralis</i> (Eckl. & Zeyh.) D. Dietr.	3	Luisbos	x	TCfy
<i>Phylica purpurea</i> Sond.	4	Luisbos	x	Ffy
<i>Rhamnus prinoides</i> L'Hér.	2	Blinkblaar, Hondepishout	M E	FT
<i>Scutia myrtina</i> (Burm.f.) Kurz	6	Katdooring, Rank	M E O	FTC
<u>Restionaceae</u>				
<i>Restio leptoclados</i> Mast. (<i>Ischyrolepis</i>)	4	Besemgoed	O	fy
<i>Restio triticeus</i> Rottb.	1	Besemgoed	O	TCfy
<i>Thamnochortus fruticosus</i> P.J.Bergius	2	Thatching reed	O	x
<u>Rosaceae</u>				
<i>Cliffortia ilicifolia</i> L.	1	Doringtee, Rysbos	M	fy
<i>Cliffortia linearifolia</i> Eckl. & Zeyh.	1	Glastee	GM	Tfy
<i>Rubus pinnatus</i> Willd.	1	Wild Blackberry, Braambossie, Vaalbraam	M E	F
<u>Rubiaceae</u>				
<i>Burchellia bubalina</i> (L.f.) Sims	1	Wild Pomegranate	M	FTC
<i>Canthium inerme</i> (L.f.) Kuntze	2	Bokdrol, Hardepeer	M E	FTC
<i>Canthium spinosum</i> (Klotzsch ex Eckl. & Zeyh.) Kuntze	2	Doringtou	M E	FTC
<i>Psydrax obovata</i> (Klotzsch ex Eckl. & Zeyh.) Bridson	3	Psydrax, Kwar, Quar	M	FT
<u>Rutaceae</u>				
<i>Agathosma apiculata</i> E.Mey. ex Bartl. & H.L.Wendl.	4	Anys Buchu, Knoffelbuchu, Hottentotsboegoe	M	Cfy
<i>Agathosma ovata</i> (Thunb.) Pillans	2	False Buchu, Valsboegoe, Rondeblaar boegoe	M E	FTfy
<i>Agathosma serpyllacea</i> Licht. Ex. Roem. & Schult.	1	Steenbok Buchu, Steenbokboegoe	M O	x
<i>Clausena anisata</i> (Willd.) Hook.f. ex Benth.	1	Perdepis	M	FT
<i>Coleonema pulchellum</i> I.Williams	1	Confetti Bush, Aasbossie, Muishondboegoe	M	T
<i>Zanthoxylum capense</i> (Thunb.) Harv.	5	Perdepram, Wildekardamom	M O	FTC
<u>Salicaceae (Flacourtiaceae)</u>				
<i>Scolopia zeyheri</i> (Nees) SzyszyÅ.,	4	Doringpeer, Wolwedoring	M	FT
<u>Santalaceae</u>				
<i>Colpoon compressum</i> P.J.Bergius (<i>Osyris</i>)	7	Bloupruim, Basbessie, Looibos, Nantegara, Namtarri, Notchou	M E O	FTC
<i>Thesidium fragile</i> (Thunb.) Sond.	5	Teringbossie	GM	TCfy
<u>Sapindaceae</u>				
<i>Allophylus decipiens</i> (E.Mey.) Radlk.	5	Rooibessie	M	FTC
<u>Sapotaceae</u>				
<i>Sideroxylon inerme</i> L.	10	Milkwood	M E	FTCfy

Cont. - Table 1 Klasies River species list 2013 to 2015 - Synonyms are italicised in brackets - aliens marked with *. M = medicinal, E = edible, O = other use. GM = Genus reported in the literature as medicinal, GE = edible, GO = other use. FM = Family reported in the literature as important medicinally. F = forest, T = thicket, C = coastal, fy = Fynbos.

Taxon	Areas present	Common name	Uses	Veg type
<u>Scrophulariaceae</u>				
<i>Chaenostoma polyanthum</i> Benth. (<i>Sutera</i>)	3	Sutera, Ruikbossie	GM	T
<i>Chaenostoma cordatum</i> (Thunb.) Benth. (<i>Sutera</i>)	4	Sutera, Ruikbossie	GM	FT
<i>Jamesbrittenia microphylla</i> (L. f.) Hilliard (<i>Sutera</i>)	1	x	GM	Tfy
<i>Selago corymbosa</i> L.	1	Slakkiebos, Aambeibos	M	T
<i>Selago myrtifolia</i> Rchb.	1	Bitterbos	GM	T
<i>Teedia lucida</i> (ex Sol.) Rudolphi	1		M	FT
<u>Sinopteridaceae (Pteridaceae, Adiantaceae)</u>				
<i>Cheilanthes hirta</i> Sw.	1	Kleinvaring, Oorstokkies	M	F
<u>Solanaceae</u>				
<i>Lycium ferocissimum</i> Miers	10	Woldebessie, Slangbessie, Kariedoring	M E O	T
<i>Solanum africanum</i> Mill. (<i>americanum</i>)	7	Dronkbessie	M	TC
<i>Solanum linnaeanum</i> Hepper & P.-M.L.Jaeger	5	Gifappel, Bitterappel	M	T
<i>Solanum retroflexum</i> Dunal (<i>Solanum nigrum</i>)	1	Sobo-sobo, Nasgal, Wolwebos	ME	T
<i>Withania somnifera</i> (L.) Dunal	3	Geneesvelletjie, Geneesblaar	M	T
<u>Stilbaceae (Loganiaceae, Buddlejaceae)</u>				
<i>Nuxia floribunda</i> Benth.	11	Wildevlier, Wild Elder	M	F
<u>Theophrastaceae (Samolaceae)</u>				
<i>Samolus porosus</i> Thunb.	2	Water Pimpernel	GM	C
<i>Samolus valerandi</i> L.	1	Brookweed	M	x
<u>Thurniaceae (Prioniaceae)</u>				
<i>Pronium serratum</i> (L.f.) Drège	1	Palmiet,	E	x
<u>Thymelaeaceae</u>				
<i>Passerina corymbosa</i> Eckl. ex C.H. Wright	1	Bakbossie	GM	Cfy
<i>Passerina ericoides</i> L.	2	Bakbos, Christmas berry, Dronkbessie, Gonna	M O	x
<i>Passerina rigida</i> Wikstr.	7	Bakbos, Gonnabas	M O	FTC
<i>Struthiola hirsuta</i> Wikstr.	1	Roemenaggie, Aand gonna	x	fy
<u>Urticaceae</u>				
<i>Didymodoxa caffra</i> (Thunb.) Friis & Wilmot-Dear	2	Nettle	x	FT
<u>Vitaceae</u>				
<i>Rhoicissus digitata</i> (L. f.) Gilg & M. Brandt	18	Wild grape, Wildepatat, Boesmansdruif	M E O	FTC
<i>Rhoicissus tomentosa</i> (Lam.) Wild & R.B. Drumm.	3	Forest grape, Bobbejaantou	M E	FTC

Tables 1 and 2 show that the vegetation sampled within the wider 5km radius at Klasies River is comprised of thicket (163 spp., 33%), forest (100 spp., 20%) and coastal species (109 spp., 22%). Of the collected species, 49 co-occur in forest, thicket and coastal vegetation, 78 in forest and thicket, but only 19 occur in all 4 vegetation types. The 73 species associated with

fynbos vegetation account for only 15%. The 55 species not included in any reference lists contribute 10%. Thicket and forest types form a mosaic structure in much of the study area with many thorny taxa which form dense, impenetrable stands (Fig. 5). Thicket and forest species are particularly dominant in the areas sampled close to the cave sites - collecting areas 3, 8, 8a, 9, 12, 13, 14 and 17 in the vicinity of Main Site, as well as Areas 6, 7 and 15 near Caves 3 and 4 (Fig. 4). Coastal vegetation occurs mainly in areas 2a, 4a, 5, 10, 10a, 11, 16, 18 and 19 and is very species rich. The coastal species are associated with the sea-spray affected littoral and hummock dune vegetation. Most of the fynbos species listed in Table 1 were growing in a small patch of fynbos in area 20 (Fig. 3), while some fynbos taxa were also present on the plateau in areas 14 and 23 (Figs 3 & 4, and supplementary table).

For purposes of comparison, species lists were obtained from the Integrated Biodiversity Information System (SIBIS) of the South African National Biodiversity Institute (SANBI, <http://biodiversityadvisor.sanbi.org/online-biodiversity-data/sabif-3/sibis/>). SIBIS check lists for four coastal 1:50 000 grids including and surrounding the Klasies River area - 3424AA, AB, BA & BB - were compared with our species list. The results of this study show that the Klasies grid Clarkson 3424AB is significantly under-represented on SIBIS, with only 69 of the 268 species we collected (Table 1) appearing on the SIBIS database. The lack of data captured by SIBIS (now Brahm's) for the Klasies grid, and the lack of other surveys undertaken or published specifically for this grid, precludes the use of this data for analysis. The Cape St Francis 3424BB grid, representing the area to the east of Klasies, is however better collected, doubtless due to years of collecting by Richard Cowling and the local Fourcade Botanical Club (<http://stfranciskrommetrust.co.za/outreach-fourcade/>). Of the 922 species in the SIBIS list for 3424BB, 137 species occur in our Klasies species list; at only 15% of the SIBIS total, this is still minimal, and again does not allow for useful data analysis.

A large proportion of the shrubs and trees listed in Table 1, particularly in forest and thicket vegetation, have medicinal properties and/or bear edible fruits. Table 3 shows that 67% of the 268 species listed in Table 1, were reported as useful during our ongoing ethnobotanical survey and in the literature cited previously (in the first paragraph of this section). In addition, 23% of the species are listed in Table 1 as GM (medicinal genera in the literature cited) which brings the overall useful tally to 90%, while only 10% had no reported uses.

Table 2 – Collected species grouped into vegetation types according to cited references

Vegetation Type	Table 1 spp. listed in refs.	No spp. collected per veg type	% of 268 spp. collected
Southern Cape Forests Geldenhuys (1993)	93	FOREST 100	20%
Southern Afrotemperate Forest (FOz 1) Mucina & Rutherford (2006)	18		
Southern Coastal Forest (FOz 6) Mucina & Rutherford (2006)	13		
Tsitsikamma National Park Hanekom (1989)	23		
Subtropical thicket, Subtropical Thicket Ecosystem Project (STEP) Vlok & Euston-Brown (2002)	148	THICKET 163	33%
Humansdorp region, Kaffrarian thicket Cowling (1982)	27		
Subtropical Dune Thicket (AZs 3) Mucina & Rutherford (2006)	38		
Gamtoos Thicket (AT 4) Mucina & Rutherford (2006)	39		
Eastern & Southern Cape Coasts Lubke & van Wijk (1998)	73	COASTAL 109	22%
Tsitsikamma National Park Hanekom (1989)	52		
Cape Seashore Vegetation (AZd 3) Mucina & Rutherford (2006)	20		
Algoa Dune Strandveld (AZs 1) Mucina & Rutherford (2006)	26		
Humansdorp region, S Coast dune fynbos Cowling (1982)	19	FYNBOS 73	15%
Southern Cape Dune Fynbos (FFd 11) Mucina & Rutherford (2006)	20		
Humansdorp region, Grassy fynbos Cowling (1982)	31		
Tsitsikamma National Park Hanekom (1989)	31		
Absent in referenced literature	55	55	10%

Mucina and Rutherford (2006) list taxa for each vegetation type but make it clear that these are only the “important taxa” and not every species to be found in that specific vegetation type. Many of the species collected at Klasies River occur in more than one vegetation type and are therefore included in each type.

Table 3 -- Quantification of useful species for the 268 species listed in Table

# individual species reported as being useful (ie: medicinal, edible, other, see below)	# species in Genera referenced as useful	# Nul uses	Total species listed in Table 1
179	62	28	268
67%	23%	10%	100%

Table 4 - Uses allocated to the 179 individual useful species in A. Many species have more than 1 use category. Of the total reported uses for the 179 individual species, 57% were medicinal, 30% edible and 13% had other uses.

Medicinal	Edible	Other	Total reported uses for 179 spp.
148	77	36	261
57%	30%	13%	100%

9.6 Discussion

In this review and analysis of the vegetation we provide a new detailed description and characterisation of the Klasies River landscape. Our work extends the current knowledge of vegetation in this area significantly although there is still much research and systematic plant collecting to be done before the composition of its vegetation is understood more fully. We have shown that the Klasies River landscape, which forms a part of the SIBIS 3424 AB map vegetation record, is under-represented and our collection of a restricted area has added 168 species to this record. The fact that the Klasies area has not been well collected previously, and that the coastal strip is privately owned with restricted entrance by permission only, as well as the difficulty in collecting in impenetrable sections and on the steep cliffs, could explain why 55 species or 10% of the species we collected are not present in any of the lists referenced in table 2. Some exotic species recorded such as *Chenopodium spp.*, *Withania somnifera*, *Solanum nigrum / retroflexum*, *Stellaria media*, *Cyperus rotundus*, and *Centella asiatica* are not listed in the literature researched, possibly because they are considered, perhaps erroneously, as relatively recent and weedy introductions to the area. It is thought-provoking that most of these weedy species occur frequently at archaeological sites throughout the southern Cape (Y. van Wijk, personal observation) and all are widely used today.

The collection of a range of modern botanical specimens has also enabled us to address the perception that the Klasies sites are located in fynbos vegetation. Mucina and Rutherford (2006), for example, characterise the Klasies River area as Southern Cape Dune Fynbos on the Algoa sediments and Tsitsikamma Sandstone Fynbos on the plateau. This might have led to the perception that fynbos comprises “96.83% of the major habitat types represented in a 10 km radius around Klasies River” (Marean, Cawthra, et al., 2014). However, as shown in tables 1 & 2, the vegetation in the immediate vicinity of the sites is a complex mosaic consisting of mainly thicket, forest and coastal vegetation types, with some fynbos elements.

Figure 5 – A, impenetrable vegetation in upper area 3: *Lycium ferocissimum*, *Sideroxylon inerme* and *Hypoestes aristata*; B, forest patch in area 15 and protective fore-dune in area 16, located between



and below caves 3 and 4; C, area 10 & 10a, large patches of *Trachyandra divaricata* (veldkool, wild cabbage) in the foreground; D, upper section of area 11, Cliff vegetation.

The great diversity of vegetation types – a feature typical of the south-eastern Cape (Cowling, 1984; Cowling, & Potts, 2015) - is due to a variety of factors which have resulted in the extremely varied terrain providing a wide range of micro-habitats and micro-climates often

associated with distinctive vegetation types or even biomes. These factors include the underlying geology and associated soils, fire, aspect and salt-laden wind exposure. Where the sea winds and salt spray blows unhindered, the vegetation is no more than 10 to 20 cm tall yet remains species rich and could be called “Lilliputian” (Acocks, 1988) coastal thicket-forest. Where the valleys or slopes are protected from the prevailing winds by cliffs and ridges, the thicket-forest comes into its own and trees as high as three to four metres are present, often within just a few metres of dwarfed examples of the same species. For example, isolated dwarfed *Sideroxylon inerme* (milkwood) trees only 20cm in height occur in area 2 whereas dwarf milkwood forest 20 cm high, intertwined with thorny *Lycium ferocissimum*, is found higher up the same south facing slope in area 3. This abruptly becomes 1--3 metre impenetrable milkwood forest as the ground suddenly falls away to the north (Fig. 5).

Afrotemperate coastal forest 3--6 m tall survives in sheltered areas below Caves 3 and 4, (Fig. 6), below Cave 5, and above area 18. On low lying sections along the coast, such as areas 10, 10a, and sections of 18, the vegetation consists of salt-tolerant grass, low herbs, geophytes and shrubs, many of which are succulent. Large tracts of closely packed *Trachyandra divaricata* (Veldkool) in this grassy seashore vegetation (Fig. 7) promise good pickings of flowerbuds for a nutritious green bredie (stew) in Spring (B-E. van Wyk, 2000, and Y. Van Wijk, personal observation). A variety of cliff dwelling succulent plant species populate the cracks and ledges of the weathered and eroded quartzitic sandstone of the cliffs above areas 8, 9 and 11 (Fig. 8). This cliff vegetation includes tree and thicket species as well as geophytes such as the rare *Satyrium princeps* and succulents such as *Gasteria acinacifolia*.

The richness and complexity of the vegetation is not adequately shown by the presence and absence data in table 1. While fynbos is regarded as more species rich than thicket and forest vegetation types, it is confined to small patches on the inland plateau in the broader study area. The coastal vegetation is however very species rich. An example of this is, to some extent, illustrated by listing the surprisingly numerous species collected in one measured square metre of what appeared at first glance to be simply low grassy ground cover. This square metre in area 8 contained 21 different species, including trees, herbs, creepers and geophytes (see Fig. 9).



Figure 6 – One square metre with 21 species present. *Adenocline acuta*, *Senecio elegans*, *Senecio angulatus*, *Cotula coronipifolia*, *Carpobrotus deliciosus*, *Crassula pellucida* subsp. *marginalis*, *Rumex saggitatus*, *Hypoestes aristata*, *Trachyandra divaricata*, *Ornithogalum graminifolium*, *Indigofera porrecta*, *Cynanchumnatalicum*, *Putterlickia pyracantha*, *Ficus burtt-davyi*, *Acokanthera oppositifolia*, *Cineraria geifolia*, *Centella asiatica*, *Stenotaphrum secundatum*, *Ehrharta calycina*, *Polypogon strictus*, *Sporobolus virginicus*. (Compound Voucher YvWijk 6382).

The soil underlying this small plot is nutrient-rich, spongy with humus, and dark black-brown in colour. This topsoil, a fertile loam, covers the fossil dune(s) and is also evident in areas 4, 8, 9, 12, 13 and 14 (Fig. 4). This dark brown earth is the result of millennia of thicket growth, die back, perennial leaf shedding, and capture of wind-blown sands and soil from the coast and inland (Tinley, 1985, and Y van Wijk, personal Observation). The 80--90cm depth of the dark humus-rich loamy soil covering the fossil dune directly above the Klasies River main site, (Fig.10) is an indication of the ancient origin of the dense thicket community in this area. Although climate oscillations during the Pleistocene would have affected the distribution of thicket, thicket extent in the Klasies region has probably changed little since the end of the Late Pleistocene (Cowling, Proches, et al., 2005; Potts, Hedderson, et al., 2013). In contrast to the loams, the plateau soils are mainly infertile, poorly drained, duplex forms (sand overlying clay at 0.5--1.0 m depth) (Strydom, & Schafer, 1997).

In the context of the total South African flora of nearly 24 000 species only 3000 or 12.5%, have been reported as medicinal (B-E. van Wyk, 2000; Arnold, Prentice, et al., 2002). The 57% of medicinal plants out of a total of 268 species collected near the sites at Klasies

(Tables 1&3B) indicates a much higher proportion of medicinal species than would be expected, and



Figure 7 – A vertical cutting through the fossil dune in area 13. Showing depth of loam supporting dense thicket vegetation.

the 43% of species which are edible or have other uses is also impressive. Edible species and those with other uses have not been quantified for South Africa and the difficulty of doing so is formidable. Of the 78 families collected (Table 1), all except 3 are reported as useful, while 33 of these families have been shown through chemical and pharmaceutical research to be particularly active medicinally (Hutchings, et al., 1996; B-E. van Wyk, 2000; Zhu, et al., 2011).

Of the 163 thicket species present, 56 species (34%) are reported as edible, lending support to De Vynck et al. (2016a) who demonstrate that thicket taxa comprise the bulk of edible species in Cape south coast landscapes. Geophytes or underground storage organs (USOs), are plentiful and varied (Table 1), but are well hidden in dense thicket and groundcovers when not in flower. Year-round collection of specimens and intimate knowledge of the area is necessary to ensure they are adequately quantified. It is interesting that two freshwater plant species, *Prionium serratum* and *Nymphaea nouchali* var. *caerulea*, were collected within the wider 5km radius. Although neither are listed in the vegetation literature cited, both are

important because they could provide carbohydrates in larger quantities year-round than the seasonal geophytes (Fox, & Norwood-Young, 1982; Wrangham, Cheney, Seyfarth, & Sarmiento, 2009; de Vynck, 2014).

The presence of so many useful taxa puts the richness of the Klasies River area in perspective. The large number of medicinal taxa and those with edible fruit, leaves, bark and USOs available, plus the presence of highly nutritious seaweeds (Anderson, Simons, & Jarman, 1989; Buchholz, Krause, & Buck, 2012) and the very important availability of much needed salt (Brigand, & Weller, 2015), would have meant that coastal areas were sought-after, resource rich areas because of their abundant and useful plant wealth, as well as readily available seafood and faunal prey.

The botanical data collected by us during the present study, makes it possible to compare the vegetation at Klasies with that at 74 other archaeological sites in the southern and south-eastern Cape which form part of a larger study about the connection through time between humans and the surrounding vegetation at habitation sites, being undertaken by Y van Wijk (Rhodes University, S.A., this thesis). This connection begs further investigation of the nature of the areas associated with archaeological sites, for example, about how ‘pristine’ they actually are. Concepts such as the synergistic co-evolution of plants and humans, and the anthropogenic effects on vegetation pattern can be seen as distinct possibilities. The results of vegetation sampling at Klasies River show considerable overlap with the vegetation at other important southern Cape coastal sites, for example, Nelson’s Bay, Pinnacle Point and Blombos. Klasies River has however a much higher species diversity than other sites.

Our work clearly indicates the need for thorough and systematic collecting at archaeologically significant sites in the Cape region. This is particularly important considering the many archaeological sites that occur in the area, and the need for and increasing interest in comparative material for further archaeobotanical research. The collections provide data for the identification of and comprehensive research on the archaeobotanical remains in terms of past vegetation and plant use, and will provide further environmental proxies for the interpretation and contextualisation of human behaviour in the past. It will also contribute to the broader debate about the context in which the development of anatomically modern humans took place.

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CHAPTER 10

Conclusions

"The interpretations are impressionistic but through the abundance of lines of evidence they seem to be coherent, and importantly as it turns out, only the overwhelming abundance of data allows anything approaching the recognition of patterns rather than the documentation of curiosities."

-- Iain Davidson, 2014

10.1 Introduction

By drawing on a large quantity of primary and secondary data and using an abductive and pragmatic mixed methods approach, I have been able to show that there is a pattern which is demonstrated by the distinctive suite of useful plants which are common to archaeological habitation sites, modern traditional-indigenous ethnobotany both locally and globally, and recovered from excavations of archaeological habitation sites dating back many thousands of years. I discovered that the pattern can be traced throughout Africa and globally. Regression analysis strongly indicates that these taxa were selected for a purpose and are not randomly present in association with humans (Chap. 4.5, Table 5, page 71).

It was the association between the distinctive 'Green Walls' present at sites and the long history of human habitation or presence at these sites which begged for investigation and motivated this research. The abundance of data amassed, together with the complexities and imponderables inherent in such a wide-ranging and under-explored field presented multiple challenges. Quantitative data collected at 75 site complexes vegetation patterns was analysed using regression analysis methods and compared using Sørensen's index. Niche construction and Urban Cliff theories and ideas were relevant and helpful in identifying possible processes leading to the pattern observed. Ethnobotanical research included qualitative approaches from which quantitative data could be derived "*a posteriori*," and this was analysed together with the vegetation data in order to ensure a strong interdisciplinary basis to the thesis while assessing correlations and links between the two datasets that indicated links between the past and present. While this thesis may not present a rigorously testable theory of present vegetation and use patterns, and human-plant evolution leading to the pattern observed, it is much more than just a story (Sterelny, 2012).

By using the genus as the terminal taxon in analyses of large quantities of data, I was able to show that plant use and indigenous knowledge held by traditional-indigenous cultures has a scientific foundation, although this remains contested and largely unrecognised by western dominated sciences. My method allowed me to minimise the ever-present danger of obscuring important issues and blurring the larger picture by adhering to conventional and accepted western academic mores and methods. Traditional methodologies and indigenous taxonomic systems should not be overlooked or ignored, as is so often the case; as this is equivalent to dishonouring the very cultural knowledge which comprises the core purpose and “raison d’être” of ethnobotanical research. Species are used interchangeably within a genus for the same purposes depending on which species is available in a particular locality, and closely related genera within a family are sometimes also substituted ([personal observation](#)). Results reported in the literature show that properties and chemical constituents are usually shared by, and are often specific to, a genus and a family, which vindicates the use of genus as the terminal taxon. After their extensive regression analysis across three disparate cultures in three globally separated countries, Saslis-Lagoudakis, Klitgaard, et al. (2011) conclude that “. . . *similar ethnobotanical uses can arise in parallel in different areas when related plants are available there.*”

10.2 Summary of the thesis

I have presented a scenario in which people and plants co-evolved over time in the southern Cape, as elsewhere, whilst gradually transforming potential sites into increasingly suitable habitation niches. Dense, often almost impenetrable green walls of vegetation composed of a suite of distinctive thicket taxa, are often visible against cliffs or rocky outcrops, which led to the discovery of some previously unrecorded sites. These sites almost invariably contained signs, however faint, of early human presence and/or habitation. While attempting to locate sites which had clearly never been affected by human presence, I discovered that this is not possible, one cannot extrapolate absence in the past with lack of conclusive evidence in the present. It is also clear that pre-colonial peoples inhabited and foraged over the southern Cape so thoroughly that it is possible to envisage the whole southern Cape as a large archaeological site which most probably extends throughout the present Cape Provinces.

I found that little South African inter-disciplinary research has been published which successfully integrates the separate disciplines of botany (ecology and environmental history), anthropology (ethnobotany and historical anthropology) and archaeology (archaeobotany and

landscape archaeology). Examining the interrelationships from deep time to the present, and triangulating interdisciplinary research questions in a broad context, based on interactions between people, plants and place, made it possible to integrate or synthesise ideas and methods from the three disciplines into a new and more comprehensive understanding that is additive to knowledge.

I proposed that hominids and humans had a greater impact on the evolution and migration of globally common useful plants than has previously been acknowledged. Botanically and morphologically very complex processes over time have resulted in the speciation and persistence of the suite of distinctive taxa closely associated with pre-historic human habitation sites (Henry, Brooks, & Piperno, 2014; Bull, & Maron, 2016). In Chapter 4. Complex Adaptive Systems (CAS) theories were discussed which partially explain intricacies which allow for this pattern to develop and be understood (Levin, 1998; Holland, 1992; Folke, Biggs, Norström, Reyers, & Rockström, 2016). Punctuated Equilibrium also helps to explain aspects of the co-evolution of plants and humans when short stressful periods and events drove change at an accelerated pace for both (Gould, & Eldredge, 1977). The intricately woven and entangled relationships between people, plants and place (van der Veen, 2014), depict the extreme complexity of relationships between people, plants and place through time, which makes a definitive proof of human impact on the evolution and migration of plants through time difficult if not impossible to quantify. However, evidence for the impact of humans on vegetation composition at sites and possibly along migration routes around the world has been demonstrated although not proven in this thesis.

Hominid and Human impact on vegetation and their environment was the result of millions of years close interaction between vegetation and animals in the environment. Thousands of years of synergistic co-evolution could result in an unintentional - perhaps partly conscious - densification of useful plants growing near sites, and the development of sheltering ‘Green Walls’ at site entrances. Successive modifications over hundreds of thousands of years led to the mutualisms that reinforced the composition of vegetation communities near habitation sites and the patterns which were formed wherever humans travelled and took shelter in the southern Cape, greater Africa and throughout the world. The composition of the vegetation patches at human habitation sites are not fragmented and random, but present a surprisingly homogenous and persistent global pattern (see Chap 5). In the southern Cape, South Africa, the distinctive suite of plant taxa present at archaeological sites, are still known and used by

modern Khoi-San descendants. Generations of gatherer-hunter-pastoralists, ancestors of the modern Khoi-San, lived and subsisted with an intimate connection to the same suite of plants. Archaeobotanical reports for the presence of micro- and macro-botanical remains of modern useful taxa within the sedimentary deposits of excavated sites (see Chap. 4.2, Table 1, page 54-57), strongly suggest the use of these taxa through time, and indicate that many of the plants present at sites today have been used by humans over thousands of years (see Chap 5). The idea that complex global patterns emerge from localized interactions and selection processes, and that processes operate at diverse scales of space, time and organizational complexity (Levin, 1998, 2002; Lansing, Kremer, & Smuts, 1998; Lansing, 2003) is an important concept in my thesis.

The ubiquitous and widespread taxa forming protective green walls all exhibit an array of useful properties, structurally as well as chemically (MOBOT, Angiosperm phylogeny website). It is these attributes which conceivably resulted in the ubiquity of the useful plant taxa after tens of thousands of years of use by hominins and humans. These correlations indicate convergence in use and presence associated with humans, not only at southern Cape sites but on a much wider scale up the rest of Africa and globally. The plethora of species and the high degree of substitution across genus and family, makes it difficult to trace possible translocation of species, but migration routes of humans and plant taxa are too similar to be entirely unrelated. Quixotically, these wild taxa which sustained early humans for millions of years, and continue to provide support to many modern traditional-indigenous peoples in southern Africa and globally, have seldom been domesticated. Having escaped the perils of domestication and artificial genetic modification (GMO), these plants surely warrant in depth research in the light of our environmentally sensitive and insecure future.

10.3 Research Questions (see Chapter 1.5) answered – or not?

- a. *Could these taxa present today at archaeological sites in the southern Cape be reflecting the fruits and seeds eaten by gathering-foraging-pastoral peoples who inhabited the sites over thousands of years in the past? Or would other fruit-eating animals, and birds leave a similar legacy?*

Both scenarios would have contributed to the presence of fruit bearing plants at sites. Perhaps these anomalous "green walls" associated with caves were originally established by animals other than man. Man may merely have learned from the animals which plants are, for example, edible. That so many of these plants are still

used today as medicines is indicative that they would have been used in this way in the past, but extrapolation from present to past is not always correct. Although there is a plethora of research into the part which animals and to a lesser extent, insects, played in the diet of ancient hominids and early modern humans ([van Itterbeeck, van Huis, 2012](#)). There is however, little research into the fauna associated with archaeological sites in relation to the effect which the diet of animals might have had on the sediments. Animals living or finding shelter in caves or overhangs are called Troglodytes ([Sket, 2008](#)), if they live there but forage outside, or Accidentals if they only take short term shelter there. Animals sometimes making use of the shelters in the past and present, include porcupines frequenting holes under the rocks, jackals, hyaenas, hyrax, and leopard. Only porcupines, hyrax, and to a small extent jackals subsist on plant food, none of them depending heavily on fruit or seed, while small rodents would certainly introduce seeds but are more likely to live in dense vegetation than within the rock shelters. Baboons are often considered to make use of rockshelters, but in fact they prefer cliffs and rock faces or ledges where they cannot be trapped inside by their major predator the leopard ([Hamilton, 1982](#)), for the same reason it is very rare to find ungulates in shelters or caves even as accidentals. Bats, swifts and swallows are common residents and some raptors nest on the cliffs above sites, none of these are fruit or seed eaters. Carnivores and raptors might, however, deposit some semi digested plant seed from the intestines and stomach of their prey, which is not likely to persist in the sediment being softened and partly deconstructed already. A variety of reptiles are found in and near rock shelters, mainly lizards and snakes, neither are plant eaters. Little research is available regarding insects living in overhangs caves, but apart from possible food for humans, they would not contribute significant plant parts or seed to the sediments. The long association that humans have had with these sites, and the fact that descendants of those early humans still use and know the same plants would probably favour the human influence over random animal influence. The participant communities represent descendants of the indigenous peoples who inhabited the sites in the past, and with their knowledge input, it appears very likely that the plants still growing at sites could well be a legacy of their use and dispersal by humans in the past.

- b. *Could the imprint of human-plant relationships in the past have persisted into the present? Or are these site-specific vegetation patches more likely to be mainly the result of the interplay of abiotic factors and random ecological processes?*

To help answer this question regression analysis was used to compare across three databases, vegetation at sites, ethnobotanical, and archaeobotanical data. This demonstrated which genera and families correlated and overlapped across all three and which showed positive selection rather than random non-targeted use. (see Chap. 4.5, Table 5, page 71). This facilitated triangulation of the data and support for persistence of the thicket patches as well as traditional usage of the taxa. The important taxa are seldom completely absent in the wider landscape, but it is the densification of the taxa in close proximity to the habitation core of each site which is important and measureable.

Do macro and micro-botanical remains retrieved during excavation of archaeological sites indicate use of those taxa by past inhabitants? Or does their presence in the sediments merely indicate that those taxa were growing close to the sites in the past were brought in by other animals or birds, or deposited there by natural forces such as wind and water? This is difficult to answer (and see discussion under a) and b). Much research does not yet supply definitive enough data to genus or species level to allow for robust correlation. The human use of medicinal plants in the past is very difficult to measure or infer from archaeobotanical remains, it is likewise difficult to decipher the difference between plants consumed or used for other purposes such as bedding, tools and weapons. However, the number of these same plants which have been found and recorded as archaeobotanicals during excavations, in the southern, Western, and Eastern Cape, South Africa, and globally, indicates that humans probably played a large part in influencing and possibly producing the vegetation pattern seen today. The triangulated data for not only the presence of this thicket type, but the fact that many of the taxa have been discovered in very ancient sediments in archaeological digs, and also that all the taxa are still used by descendants of original inhabitants, lends weight to my hypothesis. The three-way match leads to my conclusion that this group of plants are likely of anthropogenic origin.

- c. *Was the southern Cape vegetation similar to today's during the last glacial and after?* Depth of time for possible plant use and presence at sites through time, was accounted

for by the collection of additional published data recording archaeobotanical plant lists from sites in the broader Cape Province, Frica, and globally. Researchers who have attempted to identify macro- and/or micro-botanicals including charcoal from digs have shown that macro-botanicals dating to about 2000 to 4000 years ago are able to be identified to genera and sometimes to species (Binneman 1997, 1998, 2000; H. Deacon, 1970, 1992b, 1993; Tusenius, 1989; Allott, 2006; among others). Micro-botanicals such as pollen, phytoliths, parenchyma, DNA etc, are now being recovered and studied more often, but most taxa are not identified beyond the family at most, only to life-form. Until micro-botanicals are recognised as an important facet of modern botanical study, it is unlikely that these technically challenging studies will help answer the question as to whether the vegetation composition included specific genera or not in the past, and for how long. However, it is possible to tell the broad vegetation type without identifying to genus or species level. Most studies of this type are working with material of anything up to 90 000 years old (Wadley, 2004; Albert & Marean, 2012). If these studies show that the vegetation type at any one of the sites referred to in this thesis was similar at any time in the past, then one can say that it is likely that at least some of the genera and species present today were present in the deep past. Some archaeo-pollen studies go back as far as three million years (Maguire, 1980; Bonnefille, 2010), and many of these identifications are to genus with some to species level. See Chap 5.3, page 81.

d. *Can local ownership of indigenous knowledge and academic freedom co-exist?*

This question needs a full thesis on its own. De-colonising methodologies, education, media and capitalism are just a few of the factors to address. The demographics of modern populations would suggest that in a few decades, the western way of life will be swamped by different and new systems of living and thinking. The present pattern of wealth being controlled by so few, and the vast numbers of poor searching for ways to stay alive but also improve their lot, must all demand social, political, environmental, and educational changes. In which case academia has no option but to change along with the general demographic, in fact it needs to lead the way if it wishes to remain relevant at all. The world in April 2017 had a population of >7.5 billion people, growing by 684 000 every 3 days (after replacement), of which 76% are urbanised with sanitation (Population Institute, 2017), the remaining 24% have no modern sanitation and many are living in rural areas.

- e. *Is it possible to use ethnographic research with apparently acculturated groups to extrapolate facets of earlier life-ways and retrieve valuable teachings from the indigenous knowledge they still possess, albeit evolved and adapted through the imposed changes in their life-ways?*

The consistency with which knowledge shared by local communities is validated in so many ways throughout this thesis, would argue that ethnographic assumptions are therefore often valid. A caveat however, is that research should be sensitive to the value of the knowledge retained by these groups, and not see it as inferior or unscientific because of the lack of western ideas of true indigeneity, but as valid and important in its own right.

10.4 Key contributions

The possibility of linking age-old knowledge to the future by means of modern scientific research and technology was exciting and relevant. Regaining respect for past sustainable environmental practices is especially valuable with the threat of Climate Change looming large and the possibility of the sixth extinction during the present Anthropocene heralded by many (Smith, & Zeder, 2013; Thomas, 2015). Ideally modern scientific advances should be used to reinforce and validate age-old wisdom and beliefs whilst learning valuable lessons from them, but at the same time not allowing technology to overpower the validity and value of traditional indigenous knowledge, and so rendering the health and wealth benefits unavailable to the knowledge holders themselves. A major focus throughout this thesis has been on ensuring that traditional knowledge should be used for the benefit of the communities holding and sharing that knowledge. Ethical data collection methods were employed, and plant collection methods were advocated that stressed sustainability and an awareness of the environmental problems of today (Tapela, Büscher, et al., 2009; ISE Code of Ethics, 2011).

An important focus was to ensure that the paper be understandable and of interest, not only to specialists and academics, but to as wide a slice of the modern population as possible. Most importantly to indigenous Khoi-San peoples intrinsic to the research. By combining Linnaean with indigenous taxonomy an ancestrally developed common ability by early humans in the southern Cape is indicated, to utilize, manipulate and transform plant resources either accidentally or with intent, that is far older than, and has no connection to, Western Eurocentric settled agriculture. An increased sensitivity to the differences between the

southern African Khoi-San heritage of intense one-ness with the environment, which has so little in common with sedentary agriculture and modern economics, is called for.

That there are key families and genera which are used by traditional peoples for food, medicine and many other purposes has been demonstrated (see Chap 4, 5 and 6 for results of various analyses). However, perhaps the most interesting realisation to have emerged is that studying people-plant relationships in a rigid taxonomically restricted manner, obscures some of the most useful and interesting links that have been made across boundaries since deep-time. Boundaries between peoples firstly, but also between species and genera which may have very closely related, and similar chemotaxonomic substitutes in other parts of the world, which go unrecognized. Knowledge of plant use seeps through barriers of taxonomy, culture, politics, biome, country, and continent. Importantly, the great majority of these plants are not those we recognize and endlessly research today as humanities major staple food plants.

10.5 Limitations

Combining and integrating theories, concepts, and data from botany, anthropology and archaeology which would normally be three separate research projects, into a fully interdisciplinary study was challenging, though fascinating. The fact that minimal research into close relationships between plants, people, and place through time had been done previously meant starting in a vacuum and trying to build my own theories with only my own data for support.

Combining and integrating theories, concepts, and data from botany, anthropology and archaeology into a fully interdisciplinary study proved challenging ([Lach, 2014](#); [Esler, Downsborough, et al., 2016](#)). There has been minimal detailed research into patterns emerging from close relationships between plants, people, and place through time, with the emphasis on plant-people interactions and use, specifically before and without reference to, domestication and agriculture. Vast bodies of research regarding plants as food and medicine were not relevant to my research as the period leading up to and since the advent of domestication and settled agriculture is overpoweringly dominant in research world-wide. In addition, the study of humans as gatherers and foragers of plant foods in the past has been continually overshadowed by humans as meat-eaters and hunters ([Ellen, 2016](#)).

Robust statistical results for vegetation community composition convergence did not emerge as clearly as I had hoped it would, implying that my hypothesis is only partially supported. It is problematic that the genera common to most sites are also some of the most ubiquitous taxa in southern Cape thicket and beyond our borders. This resulted in weak discriminating power when attempting to use statistical methods to uphold the presence of a pattern influenced by human agency. Articulating an over-arching theoretical framework in Chapter 2, which adequately encompasses the complexities of the interdisciplinary research was not easy nor perhaps, entirely successful.

The lack of conclusive statistical support is more a reflection of the need for further research than a rejection of the overall thesis premise or hypothesis. The selection for useful taxa does not necessarily mean that the same suite of taxa, are always present at every site or used today for the same ailments. It is more that the same set of needs are fulfilled by the range of taxa present or chosen. The realisation that one has to be open to a wider perspective into what constitutes a fixed “suite of anthropogenic taxa” and broaden the scope of the research to incorporate a whole continuum or cline of closely related taxa which might not even be in the same genus. This realisation is important, in that it partially explains the difficulty in quantifying similarities between sites by using conventional statistical packages, but it also suggests a new type of comparative research which has barely been recognised as yet.

Perhaps the biggest difficulty to overcome throughout this research and in writing about it, is the dubious privilege of indubitably being, and being viewed as “WEIRD” (Western, Educated, Industrialised, Rich, Democratic) ([Henrich, Heine, & Noranyazan, 2010](#)).

10.6 Recommendations

Life as we know it today, is very different for the great majority of people on earth to that of 100 years ago, and even more so to that of 1000 or 2000 years ago. Domestication of food plants and animals, monotheistic religions, industrialised and intensive agriculture, globalisation, sophisticated technology, capitalism, consumerism, rampant urbanisation, all have served to inexorably widen the divide between humans and the natural world leading to a loss of critically important CWN. Our mechanised industrialised world has an incredibly short history but an inordinately large effect ([Sauer, 1938](#); [Marsh, 1965](#); [Diamond, 2010](#)). The modern euro-centric period which has so infiltrated and dominated the world through colonialism, mono-cultural agriculture, and exponentially sophisticated technology, is just a

minutely small 200-year blip in the five million-year timeline of hominin hunter-gathering-foraging ([Athreya, & Ackermann, 2018](#)). Yet this ‘new’ way of life seems to be rendering the world uninhabitable to many living things, resulting in dwindling wildlife population sizes and range shrinkages, indicating an anthropogenic erosion of biodiversity ([Ceballos, Ehrlich, & Dirzo, 2017](#); but see also [Thomas, 2015](#); [Bull, & Maron, 2016](#)).

It is too late and clearly impossible for the present world to go back to hunter-gathering-foraging-pastoralism now. But, it is surely timely and urgent that humanity should recognise and re-evaluate the vast potential in ancient and highly nutritious wild foods and effective plant medicines. Importantly, researchers need to acknowledge that agriculture and industrialisation, are no more ‘civilised’ nor ‘better’ than indigenous proto-historic cultures of sustainable synergistic co-existence; they are simply two different pathways, each equally deserving of in depth research. In the light of the hugely adverse impacts which modern industrialisation and agriculture have had on the environment, it is clear that close study and respect for the validity of alternate ways of existing are needed and very apposite. The large quantity of data collected through this research was presented in the hope of encouraging further research into possible processes originating in ancient co-evolution of plants and people resulting in the present patterned mosaic of thicket isolated within a wide range of other vegetation types.

The relationships between people, plants and place prehistorically, were not only governed by environmental conditions and ecological changes, but were potent drivers of processes leading to evolutionary change in their own right. The importance of pre-historic humans as agents of change has been downplayed in the past, while the power that modern human have to change climate and environment today is arguably overstated. At present archaeologists and heritage managers fail to consider vegetation as an integral part of archaeological and cultural heritage sites. The importance of retaining persistent vegetation in close association with archaeological sites, and its relevance and value to the site and to their research is stressed. Both archaeologists and botanists should be aware of the scientific importance of archaeological sites and their immediate surroundings and vegetation. Sites are valuable not only for revealing the history of humans, but they also provide information on the history of the plants, the surrounding environment, and the journeys and migrations made by both humans and plants ([Dimbleby, 1978](#)).

The implications of the vegetation growing in association with archaeological sites being anthropogenic is far reaching. Many pollen, phytolith and charcoal studies to ascertain past climates and predict future changes have relied heavily on micro-botanical collections within and at archaeological sites development (Carrión, & Scott, 1999; Scott, & Rossouw, 2005; Bar-Matthews, Marean, et al., 2010; Hall, Woodborne, & Scholes, 2008; Brook, Scott, Railsback, & Goddard, 2010). If the vegetation at these sites was manipulated by early humans and enabled to persist at those sites because of the impact that human habitation has on soil fertility and chemical properties, then these sites are not representative of the general vegetation in the surroundings nor the climate that prevailed. It is important to note that results would have been skewed by this fact. There are also implications for plant migration and locality patterns, speciation, mutation and hybridization between species, and theories of persistence and niche habitats.

10.7 Suggestions for future research

- Botanical taxonomists should be closely involved in archaeological excavations and cross-training of both archaeologists and botanists should be encouraged to ensure that plant remains are recovered safely and efficiently and identified more effectively
- Interrogate more deeply the possibility that the abiotic physical characteristics of rocky sites determined the vegetation type and structure. Link this to effects over thousands of years of animals, birds and insects, in addition to humans, in producing an apparently anthropogenic landscape, and affecting the chemistry of the soils, resulting in a habitat or niche suitable for human habitation, rather than being formed through human use?
- Many of these plants belong to under-researched 'Big Genera' and 'Big Families' with a wide global distribution. Their dispersal through time (Frodin, 2004; Hammer, & Khoshbakht, 2015) could be at least partially the result of their usefulness to humans in the past, promoting co-evolution, mutualism, and parallel migration.
- This thesis suggests that living plants as well as archaeobotanical plant remains are cultural artefacts in their own right. The protection and ecological benefits which the vegetation patches and dense green walls confer on painted archaeological sites is worthy of recognition and attention.

- Large databases with a plethora of species could be analyzed by using the genus as the terminal taxon. This proved instructive here, especially in geographically broad research. There is value to ethnobotany of the identification to genus level highlighted by evidence of the validity of chemotaxonomic similarities across the genera.
- Chemotaxonomically closely related species and genera can substitute for same-genera species with similar properties. The insistence on identification to species level in archaeobotanical and pharmacological research and publication hampers the publication of valuable data, and reduces the value of the research for examining broad based human-plant relationships over space and time.

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