Indigenous Plant Use Forum
18th ANNUAL CONFERENCE 2015
&
Society for Economic Botany
56th ANNUAL CONFERENCE 2015

Theme: Global vision on Indigenous Plants and Economic Botany

Programme and Abstracts

DATE: 28 June – 2 July 2015
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Acknowledgements

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- Rooibos Ltd, especially Gerda de Wet, for assistance and hosting the mid-conference excursion
- Botanica Natural Products PTY Ltd for sponsoring the conference bags.
- All the exhibitors in the indigenous plant product display
- Clanwilliam, Augsburg Agriculture School & NG Gemeente Clanwilliam
- The session chairs for their availability and time
- The adjudicators for their input to determine the best paper and posters by young scientists
- Caterers, sound and technology staff, entertainers for contributions
- The University of Johannesburg (UJ) and the Department of Botany and Plant Biotechnology, University of Johannesburg, for the use of their facilities, logistical support and hosting the website
- Staff and students of UJ for their assistance in organising the conference
- All participants of IPUF-SEB 2015, and especially those that travelled far – without you this conference is not possible
IPUF 2015 Organizing committee:

Prof Ben-Erik van Wyk (UJ; IPUF Chairman)
Dr Emmy Reinten (UJ; administrative)
Mrs Helen Long (UJ; secretariat & treasurer)
Ms Gerda de Wet (Rooibos Ltd; organiser & Clanwilliam support)
Ms Margaret Hulley (UJ; programme)
Ms Ashton Ruiters (UJ; website)
Ms Kemi Sobiyi (UJ; conference tags)
Mrs Janneke Nortje (UJ; registration)
Mr Maponya Leleka (UJ; audiovisual)
Mr Tommy Mabasa (UJ; audiovisual)
Prof Helene de Wet (UniZulu; collaboration)
Mr Thomas Brendler (UJ; IPUF-SEB liaison).

SEB 2015 Organizing committee:

Dr Cassandra Quave, SEB President-Elect and Chair of Organizing Committee
Dr J. Richard Stepp, SEB President and Organizing Committee Member
Mr Thomas Brendler, SEB-IPUF Liaison and Organizing Committee Member
Dr Sunshine Brosi, SEB Secretary and Teaching Tuesday Workshop Organizer
Dr Nanci Ross, SEB Council Member and Chair of the Travel Grant Committee
Ms Annie Virnig, SEB Student Representative and Student Activity Organizer

List of Donors for IPUF-SEB 2015:

Sincerely appreciated and acknowledged are the following for contributions:

- CoMED Health (Pty) Ltd
- Parceval
- Rooibos Ltd
- Thomas Brendler – Plantaphile
- NRF Research Chair in Indigenous Plant Use (UJ)
Entrance to Clanwilliam from N7 route

230 km north of Cape Town

Augsburg School Hall    Hostel          Church Hall            Expo Hall

(Meet and Greet)

Acknowledgement:
Clanwilliam information Office 2015
General information

Geographical location: Clanwilliam, Western Cape, South Africa.

http://www.clanwilliam.info/

- Emergency numbers

Helen Long (IPUF secretariat) 076 125 0467

Emmy Reinten (Conference administrative) 083 440 7649

Thomas Brendler (SEB contact) +1 240 727 40 24

Police (Clanwilliam) 027 482 8181

Hospital 027 482 2166

Clinic 027 482 1692

Ambulance 027 482 2576

Dr Strauss (medical doctor) 027 482 1629

Dr Uys (medical doctor) 027 482 2111

Pharmacy 027 482 1226

Fire Department 027 482 1775

Cederberg Medical Rescuers 10177
• The Society for Economic Botany (SEB)

The Society for Economic Botany (SEB) is about people exploring the uses of, and our relationship with plants, cultures and our environment—plants and humane affairs. SEB was established in 1959 and its mission is to foster and encourage scientific research, education, and related activities on the past, present, and future uses of plants, and the relationship between plants and people, and to make the results of such research available to the scientific community and the general public through meetings and publications. Membership in SEB is open to all individuals interested in economic botany and in the promotion of research in this field.

With members from across the 50 U.S. states and more than 64 countries around the globe, SEB serves as the world's largest and most-respected professional society for individuals who are concerned with basic botanical, phytochemical and ethnological studies of plants known to be useful or those which may have potential uses so far undeveloped. It is recognized that the field of economic botany includes all or parts of many established disciplines such as: agronomy, anthropology, archaeology, chemistry, economics, ethnobotany, ethnology, forestry, genetic resources, geography, geology, horticulture, medicine, microbiology, nutrition, pharmacognosy, and pharmacology, in addition to the established botanical disciplines.

• Indigenous Plant Use Forum (IPUF)

The Indigenous Plant Use Forum (IPUF), was started in 1993 to “promote the cultural, socio-economic and scientific benefits to be derived from the sustainable use of the southern African flora”. Annually a conference is held in various locations throughout southern Africa. These conferences are unique, multicultural and multi-disciplinary events that serve as a meeting point for business people, academics, students, anthropologists, resource managers, conservationists, policy makers and anyone interested in the sustainable use of the southern African flora. Dr Carl Albrecht was the first chairman of IPUF. Since 1995, the current chairman has been re-elected annually. He is Prof. Ben-Erik van Wyk, a Research Professor of Indigenous Plant Use at the University of Johannesburg.

• Symposium venue

The conference will be held jointly at the Augsburg Agricultural School Hall and the NG Gemeente Clanwilliam Hall with the opening at the Skougronde on Sunday afternoon. The following are available: data projector, computer, and laser pointer. Registration will be done at the school hall foyer.

• Computer presentations

Delegates who present PowerPoint presentations are requested to submit their files to the computer operator(s) in the Lecture Halls on the day of arrival or alternatively on the morning of their presentation at 07:45 in the venue. One of the organisers will load the files onto the computer.

• Posters

Poster presenters are personally responsible for affixing and removal of their posters. Posters to be presented will be displayed in the passages in alphabetical order, according to the surname of the first author. Please affix the poster at the position assigned to each presenter. Participants are requested to put up their posters during registration on Monday, 29 June and to remove them by 13:00 on Thursday, 2 July 2015. Session Poster presentations will be in the lecture rooms.
• Notice board
Please check the notice board at entrance for any messages and announcements.

• Meals
Lunches and tea/coffee and evening meals will be served. Venue for meals – check the daily information board as it is weather dependant. Delegates are responsible for their own breakfast. Special dietary requirements will be clearly marked. Please note that no dietary requirements can be met for delegates who registered late and not informed the organisers.

• Indigenous plant use product display
The display will be held on Tuesday, 30 June from 10:00 to 14:00 at the NG Gemeente Clanwilliam Hall. Various companies participate in the display.

• Social function
On Monday evening after the poster session, there is a student get-together with meals at De Kelder. On Thursday 2 July 2015, the IPUF/SEB gala dinner will be held at the Augsburg School Hall. Meet at 18:30 at the venue. The IPUF Best New Product Award will be presented and a prize-giving ceremony will be held during the dinner. A cash bar will be available.

• IPUF Student awards
The awards for the best paper and poster presentations are with special priority to postgraduate students. The winners will each receive a certificate and prize-money. The adjudication guidelines are available at the end of the booklet. Young scientists are the only persons eligible for this award and such persons must have specifically pointed out that they wish to be considered for the award on the registration form. A young scientist will qualify by conforming to at least one of the following conditions at the start of the meeting:
  ▪ Under the age of 35 years at the date of the meeting, or
  ▪ Three or less presentations at prestigious scientific meetings, or
  ▪ Five or less years’ work in the respective discipline, associated with the presentations.

• Cell phones
Delegates are asked to please switch their phones to silent during the sessions. A ringing cell phone disrupts the speakers. The organisers thank you for your co-operation.

• Liability
The organisers give notice that they do not accept responsibility or liability in respect of either person or property, for injury, damage, loss, accident, delay or irregularity which may be occasioned as a result of attendance of the conference and excursions.
**Annual Business Meetings**

**1. IPUF**
The IPUF Business Meeting will be held in the Augsburg School Hall. **All members and interested parties are welcome** to attend the meeting, which will be held on Wednesday 1 July 2015 at 8:30.

During this meeting, the location and the topics of symposia for the **next IPUF conference** will be decided by those in attendance. Delegates are encouraged to participate in this important process by proposing a location and a venue for the 2016 conference. This is also the appropriate time to ensure that topics or symposia of special interest to IPUF members receive the necessary attention in planning the programme for 2016.

Agenda of the Annual General Meeting of the Indigenous Plant Use Forum on 1st July 2015; 8:30 in the Augsburg School Hall

1. Welcome
2. Acknowledgements
3. IPUF 2016 -venue
4. 2016 Theme
5. IPUF symposia themes
6. Plant product display
7. Student Awards (Best Paper and Poster Presentations)
8. Future plans for IPUF
   a. Nomination / voting of the IPUF Chairman
   b. Nomination / voting of the IPUF Vice-Chairman
   c. Nomination / voting of the IPUF Treasurer
   d. Nomination of the IPUF Secretariat
9. General

**2. SEB**
The SEB Business Meeting will be held in the Augsburg School. **All members and interested parties are welcome** to attend the meeting, which will be held on Wednesday 1 July 2015 at 16:00 – 17:00.

Refer also to Workshop 7 in Classroom 4 on Tuesday 30 June 2015 at 13:30
Clanwilliam

Geographical coordinates: 32° 11' 0" South, 18° 54' 0" East

Nestled at the foot of the Cederberg mountains, Clanwilliam is a picturesque town of white Cape Dutch homesteads. One of the ten oldest towns in South Africa, Clanwilliam is rich in settler history and its central location offers a variety of attractions to satisfy nature-lovers, adventurers, flower-viewers and watersports enthusiasts alike. It is surrounded by picturesque vineyards, fragrant citrus orchards and wild flowers in spring. From Clanwilliam you can view the many superb examples of Bushman rock art, walk or hike in the Cederberg mountains, enjoy horseriding and Ramskop wild flower garden or explore the flower routes. The Clanwilliam Dam is renowned as the best in the Western Cape for water skiing and is also popular with anglers.

The town is the centre of the Rooibos tea industry in the Cederberg with factory visits and rooibos products on offer.

Winter – mid May to early August

The winter climate of the Cederberg is a pleasure. We are in the winter rainfall region of South Africa, but the Oliphants River valley (Clanwilliam and Citrusdal) get far less rain than the rest of the Western Cape with an annual rainfall of 180 mm (classified semi-desert). Thus our winter days are often dry, sunny and mild to warm. However our nights are cold once the sun sets. The winter is an ideal time for rock-climbing, bouldering and walking.

Glossary of a few words, sayings and expressions

| Biltong / droë wors - sausage made from minced meat | Goeie more / middag / naand - Good morning / afternoon / evening |
| Braaivleis – barbeque / bbq | Asseblief – please |
| Koeksisters – twisted sugary dough sweet | Baie dankie – thank you very much |
| Pap / Mieliepap – polenta -white stiff porridge made from maize meal, eaten at a braai with meat and tomato and onion sauce | Lekker slaap – sleep well |
| Beskuit / Rusks – dried biscuit which is dipped into tea or coffee | Totsiens – good bye |
| Skuinskoek – local cake delicacy | Hoe gaan dit? How are you? |
| Naartjie – tangerine / mandarin | Lekker – Cool |
| Nagereg - desert | |
| Bakkie - pick-up truck | Veld – wild pastures / vegetation |
| Robots (instead of traffic lights) | Vrek koud – very cold |
It is with great pleasure that I welcome you to the 56th annual meeting of the Society for Economic Botany, held jointly this year with our friends and colleagues in the Indigenous Plant Use Forum. This is a special meeting for the society as it is the first time that we have met on the African continent. It furthers our commitment as a truly international society and allows us to strengthen our bonds with our growing African based chapters. The society made a decision several years ago to be international in both words and deeds and this meeting is yet the latest manifestation of this ambitious undertaking.

The SEB meetings have long had a reputation for creating a friendly and collegial inter-disciplinary space to learn about human-plant interactions in all its many forms. I'd like to think that we transcend the typical notions of what a scholarly society is and does, and we know how to have a good time while doing so. We also care deeply about mentoring the next generation and our student members are the lifeblood of our society. If you are a new student or participating in an SEB meeting for the first time, I look forward to meeting you. For those of who have previously attended an SEB meeting, welcome back! Please take the time to introduce yourself to some of our new members.

I am honored this year to have the opportunity to present the Distinguished Economic Botanist award to Daniel Moerman, professor emeritus at the University of Michigan, Dearborn. Dan is one of our most esteemed members, as well as a friend and mentor to many of us. Congratulations Dan!

I would like to draw your attention to two events that are important to the future of SEB and would greatly benefit your attendance: On Tuesday at 13:30 (Room 4, Augsburg School) there will be an open workshop discussion on the future of SEB during. Although the society is doing well on many levels, there are challenges we face ahead that require creative solutions. Also, my hope is that our discussion will lead to concrete actions and motions during the annual business meeting that will be held the next day, Wednesday at 17:00 in the Augsburg School Hall.

SEB has been fortunate this year to have the help of so many hard working and talented people to organize and plan the meeting. It truly takes a village to make a meeting successful and I would like to especially thank the following people: Ben-Erik Van Wyk, Thomas Brendler, Cassandra Quave, Lisa Philander, Annie Virmig, Trish Flaster, Sunshine Brooks, Karen Hall, Nanci Ross, Bob Bye, John de la Parra, Heather Cacanindin, Bill Dahl, Johanne Stogran, Rob Brandt, Helen Long, Gerda de Wet, Margaret Hulley, Ashton Ruiters, Kemi Sobiyi, Maponya Lelaka, Tommy Mabasa, Emmy Reinten, Helene de Wet and Carl Albrecht.

Some of you traveled great distances, others a short path to get here but regardless, I am grateful to all of you for your participation and attendance. I also want to thank all of the society's members for allowing me to serve as president. My commitment has always been to pass the torch with the society in better shape than when I started. I have every expectation that our next president, Cassandra Quave, will continue this trajectory.

Finally, the SEB council has been hard at work on long term planning and one outcome of this has been a goal to secure annual meeting locations 2-3 years ahead of time. I'm pleased to announce that these efforts have paid off and we will be meeting in Pine Mountain, Kentucky, USA in 2016, followed by Bragança, Portugal in 2017. We will soon be soliciting applications for the 2018 meeting so please consider hosting, all locations will be considered.

As always, I welcome your thoughts and ideas about ways to improve our society. If we do not have the opportunity to talk during the meeting, feel free to email me at this address: stepp@ufl.edu.

For the plants and the people!

Rick Stepp

University of Florida, USA
Message from IPUF – Ben-Erik van Wyk

As the Indigenous Plant Use Forum, we are honoured this year to have a joint conference with the Society for Economic Botany. A special word of welcome to all SEB delegates! It is a special privilege to have an opportunity to meet people with similar interests from all corners of the globe. I also welcome the IPUF delegates, who are again gracing the IPUF conference with their presence and enthusiasm.

We have once before held a joint conference with international (mostly African) participation. This was with the Association for African Medicinal Plants Standards (AAMPS), held in Nelspruit in 2013. Some of us also remember the excellent conference in Gaberone, Botswana in 2006.

It is striking to note the many similarities between IPUF and SEB. Both organization focuses strongly and the empowerment of young scientists and therefore have a culture of friendly and informal interactions. Another similarity is the multi-disciplinary approach and inclusive nature of the organization. IPUF is perhaps unique in sometimes accommodating illiterate intellectuals with profound knowledge of plants and their uses, such as traditional healers and rural entrepreneurs. I join Rick Stepp in thanking the numerous persons who have contributed in organising the 2015 conference (see list of names above), for their efficient way of coordinating all the plans, actions and activities. I greatly appreciate the enthusiasm of Thomas Brendler and his active participation in raising funds and helping with many other aspects of organising the conference and associated events.

It is my hope that long-lasting new friendships and collaborations will emanate from this special event. I also hope that all delegates will enjoy the hospitality of a small rural town in South Africa, as well as the unique atmosphere of the Cederberg Mountains with its San rock art and rich cultural history dating back thousands of years.

When Thomas Brendler and I first discussed the possibility of hosting a joint conference in South Africa, I proposed Clanwilliam as a highly relevant location for a conference on economic botany. Not only is this town the focal point of the rooibos industry, South Africa’s leading natural product based entirely on an indigenous plant, but the Cederberg is also an important centre for another well-known indigenous crop, the local Cederberg-endemic known as round leaf buchu (*Agathosma betulina*). We were fully aware of the challenges of organising an international meeting in a small rural town, but considered that international guests may appreciate the intellectual and cultural exposure to elements of the African culture that they were perhaps not aware of. As IPUF organising committee we had a distinct advantage, because most of our conferences are intentionally held in rural settings to allow local people to participate in some of the events and activities.

I hope that everyone will have an enjoyable and rewarding conference. Thank you to all the delegates for travelling to a special corner of the African continent and for sharing with everyone else the excitement of learning more about plants and people. If we can achieve this aim (a wider and more profound understanding of ethnobotany and economic botany) then the 2015 joint IPUF/SEB conference would certainly have been a great success.

Ben-Erik Van Wyk

University of Johannesburg
In 2015, the Society for Economic Botany is pleased to announce that Professor Daniel E. Moerman is the recipient of the Distinguished Economic Botanist award.

Daniel E. Moerman is William E. Stirton Professor Emeritus of Anthropology at The University of Michigan-Dearborn. He received his PhD in Anthropology from the University of Michigan in 1974. His first work related to plants emerged during his dissertation research with a rural black population in coastal South Carolina in the early 1970s. St. Helena Islanders told him of their complex theory of health involving a subtle system of pressures and flavors of the blood which, if things went badly, could cause various illnesses which they treated with a series of plants (called “weeds”) gathered from fields or planted in their gardens. Since then, he has done research primarily in two areas – medicinal plants (primarily of Native American peoples who originated the uses of most of the plants used by the Islanders), and of the impact on health of the knowledge and understanding of it that people have. His book *Native American Ethnobotany* (Timber Press, 1998) received the “Annual Literature Award” of the Council on Botanical and Horticultural Libraries for 2000. In 2002, his book *Meaning, Medicine and the “Placebo Effect,”* on the role of meaning in the healing process, was published by Cambridge University Press. He was appointed Editor in Chief of *Economic Botany*, the journal of the Society for Economic Botany, in 2004, serving for 5 years; and he served a term as President of the International Society for Ethnopharmacology. He is vice-chair of the Superior [Township] Land Preservation Society which has protected a number of important woods and fields in perpetuity. He is a dedicated woodworker, and he made the Society’s gavel (walnut, apple, white oak, and zebrawood).

Below is a select list of his impactful publications in the field of Economic Botany:

2002: Medicine, Meaning and the “Placebo Effect.” Cambridge University Press. 2002
The plant product display will be held in the side-foyter of the NG Gemeente Clanwilliam Church Hall on Tuesday, 30 June 2015. During this display various companies have graciously agreed to show their indigenous plant products. This is the forum's effort to promote the development, use and manufacture of products based on indigenous plants. All individuals and companies involved in indigenous plant-based products are encouraged to participate in this informal show and promotion.

List of Exhibitors – not complete, nor in alphabetical order, as this is an open session

- **Open Science Network** – information on OSN and activities

- **BioAssaix Screening Services**

  BioAssaix Screening Services is a newly established *in vitro* biological and toxin screening services company currently based at the Nelson Mandela Metropolitan University (NMMU) in Port Elizabeth, South Africa.

  BioAssaix aims to provide a drug discovery platform for researchers to screen potential therapeutic entities such as natural product extracts and synthetic compounds. The need for novel and improved drugs for conditions such as diabetes, tuberculosis and cancer has fuelled an increase in the demand to identify compounds with suitable therapeutic and pharmacological properties. To this end BioAssaix screening services offers an array of target directed in vitro screening assays to identify new drug leads in a disease specific context, and provide an in vitro platform to quantitatively prioritise potential drug leads for further animal and clinical studies. In addition to providing an in vitro testing facility for anti-diabetic and anti-cancer drug development, we also offer other disease directed screening assays targeting TB, HIV and toxicity assessment. Screening services include a detailed screening report and possible option for further small scale custom designed mechanism based in vitro analysis on selected samples.

  In the search for anti-diabetic therapies, selecting an appropriate animal model is challenging if the precise metabolic target is unknown. The multifactor nature of diabetes and the absence of any single animal model which encompasses the entire spectrum of human diabetes pose a dilemma in identifying the anti-diabetic activity as it is not possible to accurately select appropriate animal models and experimental designs without some knowledge of the mechanism through which these elicit a therapeutic effect. To address this problem BioAssaix offers a multi-target in vitro antidiabetic screening platform allowing researchers to prioritise test samples according to therapeutic target.

  **Contact details:**

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  Dr Trevor Koekemoer  
  trevor.koekemoer@nmmu.ac.za

- **University of Pretoria, Plant Science Complex**

  Contact details: Carel Oosthuizen, Anna-Mari Reid & Prof Namrita Lall (namrita.lall@up.ac.za)
Botanica

Botanica Natural Products (Pty) Ltd is a family owned social enterprise located in rural Limpopo, South Africa. Established in 2009, Botanica specialises in identifying, producing and supplying indigenous plant extracts to markets in Africa, Europe, the US and Asia in a socially and environmentally sustainable manner. Botanica cultivates an indigenous plant called *Bulbine frutescens* and distributes various cosmetic ingredients to cosmetic manufacturers in Africa, Europe and Asia.

Botanica is a triple bottom line focused company which is focused on the discovery and development of useful indigenous plant species in South Africa. Botanica contributes to the local community through an ‘Access and Benefit Sharing’ Agreement with a local non-profit company. Botanica employs staff from the local community and provides various social development initiatives in the community. The company also actively promotes the sustainable use of biodiversity, aiming to reduce its Carbon footprint and improve the natural environment.

ARC-ITSC – using Southern African indigenous fruit for fruit juices

Contact Rosemary du Preez (rosedup@arc.agric.za), Karen de Jager (karendj@arc.agric.za) from ARC-ITSC; Private Bag X11208; Mbombela; 1200; South Africa. Tel:+27 (0)13 753 7000

ARC-Infruitec-Nietvoorbij – honeybush development

Honeybush is one of the youngest industries in South Africa. It is an indigenous crop growing in the Cape Fynbos region of the Eastern and Western Cape provinces. The plant is used to make a herbal tea, honeybush tea.

More information www.sahta.co.za

Pakhuys Botanicals

Range of healing ointments, soaps and bath salts using medicinal plants from Cedarberg

Contact: http://www.thestorytellers.co.za; Tracy@thestorytellers.co.za +2782 862 7372

Herbal tea display: BOTSWANA

Mothanka D.M.T., Botswana College of Agriculture, Medicinal Plants Research, Bag 0027, Gaborone, Botswana; mothankadan@yahoo.com; 0026771546727

As they say “several cups of tea a day keeps the doctor away!” but is this true or merely fiction? And is one type of tea any better than the others? There is strong evidence from the literature that herbal tea plants have health improving properties. One of the reputed properties of teas is related to the levels of antioxidants and other helpful secondary metabolites they contain. In this display several herbal plants
consumed as indigenous beverage teas of Botswana will be subjected to organoleptic assessment. All products displayed have been subjected to sterilization by microwave. Among the products exposed for organoleptic assessment is *Myrothamnus flabellifolius* (monnamontsho), *Combretum hereroense* (mokabi), *Lippia javanica* (mosukudu), *Lippia scaberrima* (mosukujane) and *Artemisia afra* (lengana). Amongst other herbal formulations on exposition are bowel cleansing, and anti-inflammatory herbal preparations.

- **Parceval (Pty) Ltd** - Manufacturer of Herbal, Homeopathic and Natural Medicines
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- **Briza Publications** - Publisher and supplier of books centred around South African nature, plant and animal species, field guides, farming, gardening and much more.

  Contact person: Mariana van Wyk (Marketing Representative) – marianavw@yahoo.co.uk
  PO Box 11050; Queenswood; 0121, South Africa. TEL: +27 12 329 3896
  www.briza.co.za / books@briza.co.za
CoMED Health (Pty) Ltd.

CoMed Health is a holding company for a number of Complementary and Alternative Medicine (CAM's) companies and brands, including Natura Laboratory and Bioter Health. The company was formed in 2009 when the 50 year old Natura company was sold into CoMed and on track to become South Africa’s leading supplier of Complimentary and Alternative Medicines (CAM’s).

Natura Laboratory is the number one leading brand in homoeopathy and herbals in South Africa and was founded more than 45 years ago. It comprises two divisions – Natura Retail, offering 150 retail products, and Natura Professional, providing 500 professional division products and direct sales to more than 400 practitioners. Bioter Health was acquired in 2010 and offers 50 products supplied under the Bioter and Brainchild brands to most major CAM retailers.

CoMED Health
PO BOX 659; Silverton; 0127; South Africa
http://www.natura.co.za/  annat@comedhealth.co.za

PlantaPhile

PlantaPhile researches the variety and application of plants in folk medicines in order to make this knowledge public and thus save the wisdom of centuries-old tradition. Use of these plants imply a huge potential for application in Western natural medicine

Thomas Brendler; txb@plantaphile.com
705B Park Avenue, Collingswood NJ, 08108, USA / 18 Hyde Gardens, Eastbourne, BN21 4PT, UK / John-Schehr-Strasse 34, 10407 Berlin, DE.

Centre for Promotion of Exports from Developing Countries

Natural ingredients for health products: CBI export coaching for South African Small and Medium-sized Enterprises

Outline: In South Africa, CBI recently started a project for natural ingredients for health products. These ingredients can include both plant raw materials as well as their extracts, either those from sustainable
use of biodiversity or from cultivated sources. CBI, the Centre for Promotion of Exports from Developing Countries, is a Dutch government organisation. Its projects support SME exporters in developing countries to become successful on the European marketplace. SMEs participating in the project benefit from training and tailored one-on-one consultancy to resolve key bottlenecks in their value chains such as sourcing, processing, documentation and certification and marketing. Moreover, companies are exposed to the market by participating in a European natural ingredient trade fair, like Vitafoods. The project is still open and CBIs invites companies in South Africa to apply.

During this presentation, CBIs local consultant Marthane Swart will give an overview of the project focus, its activities and explain how companies can apply to benefit from this opportunity.

Contact: marthaneswart@gmail.com

- **Rooibos tea house** - Pick your favourite rooibos product and order online. There are more than 100 flavoured/blended rooibos teas - all direct from the farm.

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  Voortrekkerstr 4  
  Clanwilliam, 8135  
  http://www.rooibosteahouse.co.za / netmar@mweb.co.za

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### Teaching Tuesday Educational Workshops  
**Tuesday, June 30th**

(organized and hosted by the Open Science Network)

SEB is continuing a tradition of providing Teaching Workshops at the 2015 conference in South Africa. These optional workshops will provide a hands-on activity useful to teaching in ethnobiology. Each workshop is 2 hours long and limited to 30 participants.

Attendance space is limited and must be reserved. Please register online for these optional workshops. Remember to register early – workshops are likely to fill! Alternative non-ticketed activities, discussions, meetings, or presentations may also run concurrently.

**Workshop 1:**

**When Fieldnotes Become Evidence: Teaching Valuable Note-taking Skills**

Janelle Marie Baker, PhD Student, Anthropology, McGill University, Montreal, Quebec, Canada
Sunshine Brosi, PhD, Associate Professor, Ethnobotany Program Coordinator, Frostburg State University, Frostburg, Maryland, USA

Fieldnotes often become a personal research safeguard indulging our own styles and habits. However, fieldnotes can be used as crucial pieces of evidence for the peoples we work with in court cases for land claims, intellectual property suits, and industrial development hearings. Seemingly routine unpublished fieldnotes, when written and stored properly, have been discovered several years later to contain important evidence. This workshop will outline note-taking methods that allow ethnobotanical fieldnotes to be used in legal proceedings. We will practice such methods through exercises that can be used in undergraduate seminars to form good note-taking habits early in an academic’s career.

Workshop 2:

Product development focusing on botanicals of African continent

Susanne Masters, PhD Candidate, University of Kent, Canterbury, United Kingdom

Looking at local plants and plant uses in a product development workshop within a framework of conservation science, ethics and commercial applications. Working in small groups to examine plant samples and their associated ecological and ethnobotanical profiles, considering pros and cons of using individual species, selecting species for use, projecting supply chains and infrastructure, and highlighting critical ethical considerations. Projected outcomes include knowledge of at least 10 native African species currently used in commercial products. You will also become familiar with commercial uses of plants or their extracts in at least three different industry sectors. Part of the workshop is experience of working as small group on task and presenting back to larger group.

Workshop 6:

Connecting Students to Ecology through Culture: An Ethnobiological Approach

Sunshine L. Brosi PhD, Associate Professor, Ethnobotany Program Coordinator, Frostburg State University, Frostburg, Maryland, USA

Karen Hall, PhD, Applied Ecologist, Botanical Research Institute of Texas, Fort Worth, Texas, USA

Workshop participants will be engaged in active learning resources available on the Life DiscoveryEd Digital Library through the EconBot portal. Participants will be exposed to a variety of ethnobotanical educational resources. For each resource we will identifying a few specific goals or learning objectives and specific ways to add cultural relevance and connections to diverse audiences. In one example we will use the activity of making dyes from plants and each participant will create a handkerchief using natural dyes. Additional activities including making rope and evaluating flours for the presence of GMOs. Objectives will be written from the student’s perspective as an overt and measurable action verb that is aligned with Bloom’s Taxonomy of Learning Domains. The learning objectives will be evaluated as being SMART (Specific, Measurable, Attainable, Results-Focused, and Time-Focused). Participants will then align the learning objectives to core concepts and competencies identified in the National Science Foundation’s document Vision and Change in Undergraduate Biology Education (visionandchange.org) and the Open Science Network’s Vision and Change in Ethnobiology Education (opensciencenetwork.org). Participants will also develop assessments that are linked to both the appropriate level of Bloom’s Taxonomy and the specific concept or competency. Participants will have the opportunity to access and evaluate the activity on the Life Discovery Ed Digital Library (lifediscoveryed.org). The workshop will focus on access to a network of educators interested in promoting and enhancing ethnobotany education, training,
and dissemination of ethnobiological knowledge through the Open Science Network and the Life Discovery Ed Digital Library.

Workshop 5
Jocelyn Muller

Teaching through the NEPA process -- using an environmental management issue open for public comment as a class project. Hybrid/ online teaching: sharing of ideas type of workshop with me more of a facilitator than a workshop "leader"

Workshop 9

Intellectual Property Rights and Access and Benefits Sharing: A Pragmatic Analysis of the South African Case

As a ratifying party to the Convention on Biological Diversity, South Africa is actively working to develop mandated IPR and ABS legislation. Issues of intellectual property, Indigenous knowledge, and access and benefits sharing associated with the commercialization of local environmental knowledge are important considerations for ethnobotanical research. Implementation of IPR and ABS legislation must span from the creation of international and national legal frameworks, to design of permitting and regulation to enforce these laws, to careful and responsible interaction with local communities. But how does this work in practice? How can legislation be designed that serves the purpose of ensuring equitable division of profits but does not deter development of bioresource-based industries, hinder basic academic research, or become illegible to the communities it attempts to serve?

This 3-hour workshop will include a panel with noted IPR and ABS scholars including Anthony Cunningham (School of Public Leadership, Stellenbosch University, panel facilitator), Tom Suchanadan (Director: Advocacy and Policy Development, Department of Science and Technology in South Africa), Carol van Wyk (Director: Knowledge Management at the Department of Science and Technology in South Africa), and Rachel Wynberg (Senior Researcher and Deputy Director, Environmental Evaluation Unit, University of Cape Town). After a brief perspective on the issues from each of the panelists, we will break out into small groups to discuss IPR and ABS in the context of South Africa. Most importantly, we will discuss the Indigenous Knowledge bill currently out for comment before its legalization into law. This workshop will be capped at 30 participants and will have required reading to facilitate in-depth discussion of the issues. This workshop is brought to you by the SEB Student Committee.

Open Science Network Reception (Tuesday, June 30th)
Cost $10 (Includes discounted membership in OSN).

"Come join the Open Science Network (OSN) in an evening ‘active’ reception as we share ethnobiological knowledge with each other. OSN was originally an NSF-funded network of ethnobiologists, seeking to create a virtual and in-person network of scientists willing to share curricula, ideas, research, grant writing and more! In 2013, OSN spun off into its own organization and we hope to continue positively influencing the careers of ethnobiologists. Join OSN at a discount ($10 for 1 year) by agreeing to bring an ethnobiologically-focused item that can be shared with others. Examples could include food, drink, handmade items, or even a small ethnobiologically-focused brochure or flier. Don’t want to bring an item, but want to attend anyway? Entry is $20.”
The mid-conference excursion

Wednesday 1 July 2015

Mid-conference excursion is to Rooibos Ltd.

ROOIBOS PLANTATION AND FACTORY

During the 2015 IPUF / SEB programme, one of the activities will involve a Mid-conference Excursion to the Rooibos Ltd factory in Clanwilliam, an outing to one of the Rooibos plantations and a visit to the Driefontein Co-operative community centre. The aim is to give IPUF and SEB delegates an insight into all aspects of the cultivation and production of rooibos tea (Aspalathus linearis). This is arguably the most important and successful indigenous crop plant.

Rooibos Limited Factory
Rooibos is the most popular caffeine-free tea in the world and it only grows naturally in the Cederberg Mountains of the Western Cape. Clanwilliam is the heart of the Rooibos industry and the home of Rooibos Limited where the majority of Rooibos is produced. A DVD presentation will explain why more than 6 billion cups of this health-giving brew is consumed around the world every year. You will be taken on a tour through the factory where you will be shown the process of sifting, blending, steam treatment and the packaging of Rooibos. At the Quality Assurance Centre you will be able to experience a tea tasting session. Afterwards you can enjoy a thirst quenching cup of Rooibos and you will be able to buy products at the factory shop.

Rooibos Plantation
At one of the Rooibos plantations you will learn more about this unique bush and see where the whole production process begins, from the planting of seeds and the transplanting of seedlings into plantations, to the harvesting of the branches that are sent in bundles to the processing yard.

Driefontein Co-Operative
The Driefontein Co-Operative was established in 2010 and is run by 37 member farmers whose families benefit directly from their labour and the association they have formed with Fairtrade. You will see how the 270 strong community has used the income from Fairtrade sales toward new equipment, domestic upliftment and education.

Lunch is included in excursion
WELCOMING FUNCTION
SUNDAY, 28 JUNE 2015

Riel dancers

Wupperthal BK Riel Family

SOUTH AFRICAN RIEL DANCE TROUPE

The traditional RIEL dance form is recognised as the oldest dance form in South Africa and a creative cultural expression, and was very popular in the forties, fifties and sixties, but has been grossly neglected in recent decades. Born out of traditional Khoi and San ceremonial dances around the fire, the Riel Dance has been practiced by descendants of these indigenous cultures for many years.

Recognized as a form of cultural expression, the Riel was very popular in the forties, fifties and sixties but has been grossly neglected in recent decades. Popular Riel dances include courtship rituals mimicking animal antics along with lots of bravado, showmanship and foot stomping.

The revival of traditional Riel dance in and around Wupperthal is a community initiative close to the heart of BushmansKloof Wilderness Reserve & Wellness Retreat. Founded in late 2012, Die Nuwe Graskoue Trappers (https://www.youtube.com/watch?v=ceVCpPNnXvc) has been trailblazing its way across the Riel dance scene. The name of the troupe is an acronym for the names of some of the villages that the children come from: NuwePlaas, Grasvlei, Koueberg, Suurrug and AgtersteVlei. Dressed in traditional farm workers outfits – the girls in dresses with aprons and old frontier bonnets, and the boys in waistcoats and hats adorned with feathers – is finished with the famous, hand-made red veldskoene (Southern African walking shoes) from Wupperthal.

The project has since come on leaps and bounds, leading to the incredible success in 2014 where they were joined by the 2 newly formed under 12 year, 1 under 18 year, and three senior groups.

The troupe made their debut with much success at the annual Riel Dance Championship final in December 2013, where Die Nuwe Graskoue Trappers became the ATKV Junior Riel Dance Champions 2013. Bertie Zass walked away with the Trophy for Best Musician on a traditional instrument, Accordion and Floris came home with the Trophy for Most Dynamic Riel Dance Leader 2013.

In April 2014 Die Nuwe Graskoue Trappers walked away with the Grand Champion Award 2014 for Best Group Performance, as well as the Gold medal in the ‘Ethnic Folk Dance Category’ at the South African Championships of the Performing Arts 2014. The troupe’s equally talented Band took the Gold medal in the ‘Open’ as well as the ‘Original categories’, and also won the Overall Trophy Award in the ‘Original Category’.

The troupe recently won the Grand Champion Award 2015 for “Best Group Performance” as well as the Gold medal in Ethnic Folk Dance Category dancing Riel; Gold doing a Gumboot
Dance Routine: Gold for a Riel Tap performance in the Open Category in this year’s South African Championships of the Performing Arts. The Band took the Gold medal in the ‘Open’ as well as the ‘Original categories’, and also won the Overall Trophy Award in the ‘Original Category’.

The dance troupe, and the band’s, successful performances have qualified them as Team South Africa 2014, whereby they are invited to take part in the World Championships of Performing Arts (WCOPA) in Los Angeles over the period of July 10th to 18th, 2015. With no formal training themselves, the troupe will compete, as capably, alongside professionally trained performers from across the world.

Contact details: (MR) FLORIS SMITH; Founder and Manager of Die Nuwe Graskoue Trappers / Assistant General Manager and Executive Chef of Bushmans Kloof Wilderness Reserve & Wellness Retreat; (027) 482 8200 / deputygm@bushmanskloof.co.za
Facebook: Die Nuwe Graskoue Trappers
**IPUF / SEB 2015 Programme**

**SUNDAY, 28 JUNE 2015**

15:00-17:00  Registration at Augsburg School Hall foyer (near Clanwilliam Lodge)
17:00-21:00 WELCOME to Clanwilliam – Expo Hall (far end of Park Street)
              Meet and greet function – Riel dancers and braaivleis (barbeque)

**MONDAY, 29 JUNE 2015**

07:30-09:00  Registration at Augsburg School Hall foyer
09:00 – 09:15 Welcome & Introduction - Ben-Erik van Wyk (IPUF Chairman)
              & Rick Stepp (SEB President)

**SESSION 1: Rooibos**
Augsburg School Hall

Chairperson:  Prof David Katerere

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>9:15-9:45</td>
<td>An overview on the production and marketing of Rooibos</td>
<td>Colette Cronje</td>
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<tr>
<td>9:45-10:00</td>
<td>Anti-diabetic properties of rooibos – an opportunity to expand the</td>
<td>Elizabeth Joubert</td>
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<td></td>
<td>rooibos value – chain or not?</td>
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<tr>
<td>10:00-10:15</td>
<td>An introduction to vegetation types of the Cederberg /Sandveld area</td>
<td>Rupert Koopman</td>
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<td></td>
<td>and the conservation implications of the commercialization of an</td>
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<td>indigenous plant, Aspalathus linearis</td>
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<td>Time</td>
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<td>Presenter</td>
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<tr>
<td>10:15-10:30</td>
<td>Bioavailability of flavonoids in human plasma following acute intake of a fermented rooibos (Aspalathus linearis) supplement</td>
<td>Liana van der Westhuizen</td>
</tr>
<tr>
<td>10:30-10:45</td>
<td>Nutraceutical value of rooibos food extracts: effect of fermentation</td>
<td>Dalene de Beer</td>
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<tr>
<td>10:45-11:00</td>
<td>Rooibos and human health</td>
<td>Jeanine Marnewick</td>
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<tr>
<td>11:00-11:15</td>
<td>Understanding the absorption and bioavailability of aspalathin</td>
<td>Sandra Bowles</td>
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**11:15 – 11:45** TEA/COFFEE

**SESSION 2a: (parallel) – Ethnobotany and Anthropology**

**Augsburg School Hall**

Chairperson: Prof Heike Vibrans

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>11:45-12:00</td>
<td>‘Plants of the gods’ reloaded: including emic perspectives in the study of ritual plant use</td>
<td>Diana Quiroz</td>
</tr>
<tr>
<td>12:00-12:15</td>
<td>Doepa: History of an indigenised African medicine</td>
<td>Thea de Wet</td>
</tr>
<tr>
<td>12:15-12:30</td>
<td>Propagating a plant and beyond: socio-anthropological issues behind the diversity of guarana reproduction methods in the Brazilian amazon</td>
<td>Mélanie Congretel</td>
</tr>
<tr>
<td>12:30-12:45</td>
<td>Number, color, plant, and animal terms in Tandroy: the indigenous knowledge in Tandroy in Madagascar</td>
<td>Noa Nishimoto</td>
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**SESSION 2b: (parallel) – Warburgia Church Hall**

Chairperson: Prof Tony Cunningham

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<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
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</thead>
<tbody>
<tr>
<td>11:45-12:00</td>
<td>Collaborative propagation of Warburgia salutaris in the Kruger National Park</td>
<td>Michele Hofmeyr</td>
</tr>
<tr>
<td>12:00-12:15</td>
<td>Factors affecting survival of wild populations of the endangered pepperbark tree (Warburgia salutaris) and strategies for propagation</td>
<td>Karin Hannweg</td>
</tr>
<tr>
<td>12:15-12:30</td>
<td>Exploring phytochemical variation in Warburgia salutaris through chemometric modelling of analytical data</td>
<td>Carmen Leonard</td>
</tr>
<tr>
<td>12:30-12:45</td>
<td>The ecological impacts of bark harvesting in Cweza Indigenous Forest of the Eastern Cape Province, South Africa</td>
<td>Masivuye Manci</td>
</tr>
</tbody>
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12:45–14:00 LUNCH and student mentor groups Augsburg School
### SESSION 3a: (parallel) – Ethnopharmacology
Augsburg School Hall

**Chairperson:** Prof Maryna van de Venter

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<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>14:00-14:15</td>
<td>Antimalarial use of Malagasy plants is poorly correlated with performance in antimalarial bioassays</td>
<td>Wendy Applequist</td>
</tr>
<tr>
<td>14:15-14:30</td>
<td>Pancreatic cancer: finding a cure in natural products and South African flora</td>
<td>Gerhardt Boukes</td>
</tr>
<tr>
<td>14:30-14:45</td>
<td>Antidiabetic properties and a sustainable exploitation strategy of ‘copalquin’ medicinal bark complex in Mexico</td>
<td>Sol Cristians</td>
</tr>
<tr>
<td>14:45-15:00</td>
<td>Antidiabetic properties of a spice mixture of garlic, ginger and cayenne pepper</td>
<td>Gloria Otunola</td>
</tr>
<tr>
<td>15:00-15:15</td>
<td>The use of natural coumarin derivatives to combat mycobacterial infections, focussing on biofilm inhibition</td>
<td>Carel Oosthuizen</td>
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</tbody>
</table>

### SESSION 3b: (parallel) – Medicinal Plants
Church Hall

**Chairperson:** Dr James Lyles

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<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>14:00-14:15</td>
<td>Medicinal plants used for treatment of diabetes, hypertension and cardiovascular ailments in West Cameroon</td>
<td>Rui Zhang / Patrick van Damme</td>
</tr>
<tr>
<td>14:15-14:30</td>
<td>Medicinal plants used by lay people in a rural community in KwaZulu-Natal (South Africa) for the treatment of hypertension</td>
<td>Mmbula Ramulondi</td>
</tr>
<tr>
<td>14:30-14:45</td>
<td>Medicinal plants used by three communities (Mahaboboka, Amboronabo, Mikoboka) in Southwestern Madagascar</td>
<td>Tabita N Randrianarivony</td>
</tr>
<tr>
<td>14:45-15:00</td>
<td>Medicinal plants used in the treatment of dysentery in Amathole District Municipality</td>
<td>Olubahumi Wintola</td>
</tr>
<tr>
<td>15:00-15:15</td>
<td>Plants used for the treatment of malaria and jaundice by the Naga tribes of India</td>
<td>Padma R Gajurel</td>
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15:15-16:00 **TEA/COFFEE**
### SESSION 4 a: (parallel) – Medicinal Plants continued
Augsburg School Hall

Chairperson: Dr Cassandra Quave

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<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>16:00-16:15</td>
<td>Medicinal plants used for treating reproductive health care problems in Bamboutos Division, west region, Cameroon</td>
<td>Roger Tsobou / Patrick van Damme</td>
</tr>
<tr>
<td>16:15-16:30</td>
<td>Medicinal plants used for the management of <em>diabetes mellitus</em> in the O R Tambo District of the Eastern Cape Province, South Africa</td>
<td>H Ndlovu / Learnmore Kambizi</td>
</tr>
<tr>
<td>16:30-16:45</td>
<td>Medicinal ethnobotany of the Kamiesberg, Namaqualand</td>
<td>Janneke Nortje</td>
</tr>
<tr>
<td>16:45-17:00</td>
<td>Medicinal and veterinary plants in the Spanish inventory of traditional knowledge related to biodiversity</td>
<td>Manuel Pardo-de-Santayana</td>
</tr>
<tr>
<td>17:00-17:15</td>
<td>Ethnobotanical survey of invasive alien plant species used for medicinal purpose in the Capricorn District, Limpopo Province</td>
<td>Salome Mahlo / M Cherane</td>
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</table>

### SESSION 4b: (parallel) – Cultivation and Crop Development
Church Hall

Chairperson: Dr Emmy Reinten

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>16:00-16:15</td>
<td>Research towards sustainable production of indigenous crops</td>
<td>Riana Kleynhans</td>
</tr>
<tr>
<td>16:15-16:30</td>
<td>Effect of cultivation altitude on green tea quality in Eastern China</td>
<td>Wen-Yan Han</td>
</tr>
<tr>
<td>16:30-16:45</td>
<td>Effects of season, media, hormone and cutting position on survival and rooting of <em>Lobostemon fruticosus</em> stem cuttings</td>
<td>Angelique Swarts</td>
</tr>
<tr>
<td>16:45-17:00</td>
<td>Effects of cold pre-plant treatment temperature on <em>Lachenalia</em> cultivars</td>
<td>Babalwa Matsiliza-Mlathi</td>
</tr>
<tr>
<td>17:00-17:15</td>
<td>The effect of light, temperature and scarification on germination of <em>Solanum nigrum</em> seeds</td>
<td>Callistus Bvenura</td>
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### SESSION 5: Poster presentations – Augsburg School Hall
One (1) minute each

Chairperson: Prof Anthony Afolayan

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>17:45</td>
<td>Use of food crop bi-products in the management of diabetes</td>
<td>Oluwaseyi Aboyade</td>
</tr>
<tr>
<td>17:46</td>
<td>Metabolic profiling of marula fruit, <em>Sclerocarya birrea</em></td>
<td>Wilma Augustyn</td>
</tr>
<tr>
<td>17:47</td>
<td>Evaluation of the antioxidant, anti-inflammatory and anti-proliferative effects of <em>Helinus integrifolius</em></td>
<td>Brian Beseni</td>
</tr>
<tr>
<td>Time</td>
<td>Title</td>
<td>Author</td>
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<tr>
<td>17:48</td>
<td>Bark food: continuity and change of Scots Pine (Pinus sylvestris) inner bark use by Sami people, Fennoscandia</td>
<td>Sandra Bogdanova</td>
</tr>
<tr>
<td>17:49</td>
<td>(^{13})C NMR as a tool for in situ tannin typing and estimation in uncharacterized Acacia species</td>
<td>Susan Bonnet</td>
</tr>
<tr>
<td>17:50</td>
<td>Rooibos tea extracts: natural anticoagulants</td>
<td>Marieta Cawood</td>
</tr>
<tr>
<td>17:51</td>
<td>Rapid analysis of the skin irritant p-phenylenediamine (PPD) in henna products using an atmospheric solids analysis probe (ASAP)</td>
<td>Weiyang Chen</td>
</tr>
<tr>
<td>17:52</td>
<td>Medicinal plants used by midwives at Jonotla, Puebla, Mexico</td>
<td>José Cunill-Flores / Diana Guerra Ramirez</td>
</tr>
<tr>
<td>17:53</td>
<td>Rooibos antioxidants: in vitro models to assess their bioavailability</td>
<td>Ntokozo Dambuza</td>
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<tr>
<td>17:54</td>
<td>Preliminary studies on Sterculia murex (Lowveld chestnut)</td>
<td>Karen de Jager</td>
</tr>
<tr>
<td>17:55</td>
<td>Indigenous knowledge and use of Anisodus tanguticus for climate change adaptation within Tibetan pastoral communities on the eastern Tibetan Plateau, China</td>
<td>Yao Fu</td>
</tr>
<tr>
<td>17:56</td>
<td>The ethnobotanical research and its relevance in the Indian state of Arunachal Pradesh</td>
<td>Padma Gajurel</td>
</tr>
<tr>
<td>17:57</td>
<td>Antibiofilm activity of South African plant extracts against Mycobacterium spp. And their mechanism of action Mycothiol reductase</td>
<td>Nosamosi Gasa</td>
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<tr>
<td>17:58</td>
<td>Nutritional properties and antioxidant capacity of Polyergus alveolaris from Jonotla, Puebla, Mexico</td>
<td>Diana Guerra-Ramirez</td>
</tr>
<tr>
<td>17:59</td>
<td>Can flow cytometry be used for gender verification of marula, Sclerocarya birrea?</td>
<td>Karin Hannweg</td>
</tr>
<tr>
<td>18:00</td>
<td>Relationships between formal education and ethnoveterinary knowledge in Eluwai village, Tanzania</td>
<td>Jennie Harvey</td>
</tr>
<tr>
<td>18:02</td>
<td>Illustration of the impact of illegal harvesting of bark from Warburgia salutaris in the Kruger National Park</td>
<td>Michele Hofmeyr</td>
</tr>
<tr>
<td>18:03</td>
<td>Two dimensional gas chromatography as a tool for identification of minor fatty acid methyl esters of palm and palmist oils</td>
<td>Guy Kamatou</td>
</tr>
<tr>
<td>18:04</td>
<td>Hepatoprotection and immunostimulation of selected medicinal plants against tuberculosis</td>
<td>Anna-Mari Kok</td>
</tr>
<tr>
<td>18:05</td>
<td>Bark anatomy of some medicinally important trees of South Africa</td>
<td>Ekaterina Kotina</td>
</tr>
<tr>
<td>18:06</td>
<td>Plants used for “Wei-Sang” in Tibetan region</td>
<td>Feifei Li</td>
</tr>
<tr>
<td>18:07</td>
<td>Reconstructing paleo-ecological conditions in a high elevation fen in western Maryland</td>
<td>Elizabeth Llewellyn</td>
</tr>
<tr>
<td>18:08</td>
<td>Ecology and selection of jonote tree for fiber obtainment at Sierra Nororiental region, Puebla, Mexico</td>
<td>Adriana Gómez-Lozano / Diana Guerra</td>
</tr>
<tr>
<td>18:09</td>
<td>Ethnobotanical suvey of selected medicinal plants in Vhembe district, Limpopo province, South Africa</td>
<td>Caroline Machaba</td>
</tr>
<tr>
<td>18:10</td>
<td>Phytochemical and molecular analysis of Stevia rebaudiana Bertoni extracts generated from different cultivation methods</td>
<td>Tandokazi Magangana</td>
</tr>
<tr>
<td>18:12</td>
<td>Improved propagation methods of Bulbine latifolia var. latifolia</td>
<td>Joseph Malele</td>
</tr>
<tr>
<td>18:13</td>
<td>Antiproliferative activity of extracts from four medicinal plants from Mozambique</td>
<td>Idah Manduna</td>
</tr>
<tr>
<td>18:14</td>
<td>Propagation of rooibos cutting: preliminary results</td>
<td>Azola Manjati</td>
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</tbody>
</table>
Assessing growth and phytochemistry of *Rhodiola rosea* in coastal Labrador for small-scale enterprise.  
Vanessa Mardones

Using local ecological knowledge to model the distribution of two palm species in southern Mozambique  
Angelina Martins

18:40  EVENING MEAL – venue to be announced / on information board

STUDENT EVENING – De Kelder Restaurant (with coupons)

---

**TUESDAY, 30 JUNE 2015**

**SESSION 6a: (parallel) – General 1**  
Augsburg School Hall

Chairperson: Dr Robert Voeks

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:15-8:30</td>
<td>People, agroecosystems and weeds in Mexico</td>
<td>Heike Vibrans</td>
</tr>
<tr>
<td>8:15-8:30</td>
<td>The integration of Mexico into the global economic botany during the Victorian period: the role of Cyrus G Pringle</td>
<td>Robert Bye</td>
</tr>
<tr>
<td>8:30-8:45</td>
<td>The Food Plants International database of edible plants of the world</td>
<td>Bruce French</td>
</tr>
<tr>
<td>8:45-9:00</td>
<td>An evaluation of pest and disease vulnerability in the urban Forest of Washington D C</td>
<td>Laura Smith</td>
</tr>
<tr>
<td>9:00-9:15</td>
<td>Economic consequences of crown-fire on Oyamel (<em>Abies religiosa</em>) at El Chico National Park, Hidalgo, Mexico</td>
<td>Norma Monjariás-Vega</td>
</tr>
<tr>
<td>9:15-9:30</td>
<td>Detecting the recent change of satoyama forests using varved sediment from Lake Suigetsu, Japan</td>
<td>Junko Kitagawa</td>
</tr>
<tr>
<td>9:30-10:00</td>
<td>The growth of predatory journals is a problem to scientific researchers</td>
<td>Anthony Afolyan</td>
</tr>
</tbody>
</table>

**SESSION 6b: (parallel) – Honeybush Tea Church hall**

Chairperson: Prof Learnmore Kambizi
<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00-8:15</td>
<td>Honeybush as a crop for fynbos areas</td>
<td>Marlise Joubert</td>
</tr>
<tr>
<td>8:15-8:30</td>
<td>Molecular fingerprinting in species of honeybush (Cyclopia)</td>
<td>Marioné Niemandt</td>
</tr>
<tr>
<td>8:30-8:45</td>
<td>Honeybush breeding: impact on industry</td>
<td>Cecilia Bester</td>
</tr>
<tr>
<td>8:45-9:00</td>
<td>Natural fecundity and germination characteristics of selected Cyclopia genotypes</td>
<td>Mlamuli Motsa</td>
</tr>
<tr>
<td>9:00-9:15</td>
<td>Sealed and asleep: the anatomy and dormancies of honeybush (Cyclopia spp.) seed</td>
<td>Jenifer Koen</td>
</tr>
<tr>
<td>9:15-9:30</td>
<td>The effect of rooting media and plant growth regulators on rooting of Cyclopia subternata stem cuttings</td>
<td>Gugu Mabizela</td>
</tr>
<tr>
<td>9:30-10:00</td>
<td>Nutraceuticals from Cyclopia – Ultrafiltration as a green technology to enrich bioactives</td>
<td>Christiaan Malherbe</td>
</tr>
</tbody>
</table>

**SESSION 7: INDIGENOUS PLANT PRODUCTS DISPLAY**

**Church Hall**

Chairperson: Thomas Brendler

10:10 – PowerPoint presentations by exhibitors – 1 minute each

10:30 – TEA / COFFEE

10:30–14:00 Product display viewing

10:30–14:00 Viewing of posters

12:00–13:30 LUNCH

**WORKSHOPS**

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>No</th>
<th>Title</th>
<th>Coordinator</th>
</tr>
</thead>
</table>
|            |                            |    |                                                                      | Dan Moerman
|            |                            |    |                                                                      | Tom Suchanadan
|            |                            |    |                                                                      | Ben-Erik van Wyk
|            |                            |    |                                                                      | Carol van Wyk
|            |                            |    |                                                                      | Rachel Wynberg                     |
| 13:30–15:00| Class Room 1              | 1  | When fieldnotes become evidence: teaching valuable note-taking skills | Janelle Baker and Sunshine Brosi   |
| 15:00–16:30| Class Room 1              | 2  | Product development focusing on botanicals of the African continent   | Susanne Masters                    |
| 13:30–15:00| Class Room 2              | 3  | Interviewing techniques                                             | Ina Vandebroek                     |
| 15:00–16:30| Class Room 2              | 4  | Teaching through the NEPA process                                    | Jocelyn Mueller                    |
### Session 8a: Indigenous Knowledge
Augsburg School Hall

**Chairperson:** Prof Alpheus Zobolo

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>17:00–17:15</td>
<td>Floristic and ethnobotanical resource use among hunting / gathering tribes in the Southern Plains of North America</td>
<td>Wayne Elisens</td>
</tr>
<tr>
<td>17:15–17:30</td>
<td>Comparative Caribbean ethnobotany of medicinal plants shared between the Dominican Republic and Jamaica</td>
<td>Ina Vandebroek</td>
</tr>
<tr>
<td>17:30–17:45</td>
<td>Intergenerational and intercommunity transference of ethnobotanical knowledge: case study of Bubango, Tanzania</td>
<td>Maria Fadiman</td>
</tr>
<tr>
<td>17:45–18:00</td>
<td>Indigenous knowledge on <em>Cucurbita</em> landraces from northern KwaZulu-Natal, South Africa</td>
<td>Nontuthuko Ntuli</td>
</tr>
<tr>
<td>18:00–18:15</td>
<td>Giving crop accessions a context: the need to include ethnobotanical metadata in large-scale initiatives</td>
<td>Rachel Meyer</td>
</tr>
</tbody>
</table>

### Session 8b: General 2
Augsburg School Hall

**Chairperson:** Prof Alpheus Zobolo

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>18:15–18:30</td>
<td>Complementary Medicine (CM) registration in South Africa: <em>Quo Vadis?</em></td>
<td>David Katerere</td>
</tr>
</tbody>
</table>

18:30-20:00 EVENING MEAL – venue to be announced / on information board

20:00-22:00 OSN event – Augsburg School Hall
**WEDNESDAY, 1 JULY 2015**

**IPUF ANNUAL BUSINESS MEETING**

Chairperson: Ben-Erik van Wyk  
Time: 08:30  
Location: Augsburg School Hall  

*All delegates should please make an effort to attend, as this session is used to plan the 2016 IPUF conference*

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**Mid-week excursion – The Rooibos Industry**

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**SEB ANNUAL BUSINESS MEETING**

Chairperson: Rick Stepp  
Time: 16:00–17:00  
Location: Augsburg School Hall

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**SESSION 9: Poster presentations – Augsburg School Hall**  
One (1) minute each

Chairperson: Prof Helene de Wet

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>17:15</td>
<td>Who spread African rice? Curiosities roused by landscape genomic studies on domestication traits</td>
<td>Rachel Meyer</td>
</tr>
<tr>
<td>17:16</td>
<td>A preliminary list of useful plants of Amandawe area in KwaCele, KwaZulu-Natal</td>
<td>Lloyd Mhlongo</td>
</tr>
<tr>
<td>17:17</td>
<td>Commercial competition to indigenous ornamentals in South Africa</td>
<td>Lorraine Middleton</td>
</tr>
<tr>
<td>17:18</td>
<td>Identification of anti-quorum sensing compounds in essential oils through chemometric modelling</td>
<td>Kopang Mokhetho</td>
</tr>
<tr>
<td>17:19</td>
<td>Comparative antioxidant, nutritional and alcoholic analysis of selected edible wild fruits of Botswana</td>
<td>Daniel Motlhanka / Montsho,S</td>
</tr>
<tr>
<td>Page</td>
<td>Title</td>
<td>Authors</td>
</tr>
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<td>------</td>
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<td>----------------------------------------------</td>
</tr>
<tr>
<td>17:20</td>
<td>Nutritional analysis and antioxidant profiling of fruits of <em>Flueggea virosa</em> used by tribal people of eastern Botswana</td>
<td>Daniel Motlhanka / Molefhe, G., Montsho, S.</td>
</tr>
<tr>
<td>17:21</td>
<td>Nutritional, antioxidant and alcohol analysis of fruits of <em>Sclerocarya birrea</em> fruits used by Batswapong tribe of Botswana</td>
<td>Daniel Motlhanka / Koloi, D.T.</td>
</tr>
<tr>
<td>17:22</td>
<td>The effects of varying levels of potassium on growth and anti-<em>Fusarium oxysporum</em> (Ascomycota: Hypocreales) activity of leaf extracts of hydroponically-cultivated <em>Helichrysum cymosum</em> (Asteraceae)</td>
<td>Felix NChu</td>
</tr>
<tr>
<td>17:23</td>
<td>The <em>Sclerocarya birrea</em> (marula) seedlings performance to different fertilizers and planting methods in the Limpopo Province</td>
<td>Rendani Nemakanga</td>
</tr>
<tr>
<td>17:24</td>
<td>Tree response to bark stripping for medicinal use</td>
<td>Ntombizodwa Ngubeni</td>
</tr>
<tr>
<td>17:25</td>
<td>Comparative leaf and stem anatomy of some <em>Rothmannia</em> and <em>Sabicea</em> species (Rubiaceae)</td>
<td>Maria Nwosu</td>
</tr>
<tr>
<td>17:26</td>
<td>Actinomycetes: keeping rooibos plants healthy naturally</td>
<td>Victoria Ontong</td>
</tr>
<tr>
<td>17:27</td>
<td>A survey of plants responsible for causing irritant contact dermatitis in the Amathole district, Eastern Cape, South Africa</td>
<td>Wilfred Otang-Mbeng</td>
</tr>
<tr>
<td>17:28</td>
<td>Two dimensional gas chromatography and antimicrobial activity of seven Kenyan <em>Commiphora</em> species</td>
<td>Emmanuel Pavel</td>
</tr>
<tr>
<td>17:30</td>
<td>The effect of plant medium on the growth of <em>Xysmalobium undulatum</em></td>
<td>Thanyani Ralulimi</td>
</tr>
<tr>
<td>17:31</td>
<td>Metabolomic, genetic and physiological approaches towards understanding anti-cancer mechanisms in a traditional medicinal plant</td>
<td>Andria Rautenbach</td>
</tr>
<tr>
<td>17:32</td>
<td>Quality and safety of roasted nuts of <em>Sterculia murex</em> (Lowveld chestnut)</td>
<td>Thierry Regnier / S Kazaz</td>
</tr>
<tr>
<td>17:33</td>
<td>An inventory of food plants of southern Africa</td>
<td>Ashton Ruiters</td>
</tr>
<tr>
<td>17:34</td>
<td>Density and regrowth of a forest restio (<em>Ischyrolepsis eleocharis</em>) under harvest and non-harvest treatments in dune forests of Eastern Cape province, South Africa</td>
<td>Sheunesu Ruwanza</td>
</tr>
<tr>
<td>17:35</td>
<td>Vulnerability of rice growing areas to saltwater intrusion</td>
<td>Michelle Sanches</td>
</tr>
<tr>
<td>17:36</td>
<td>The productivityof maize agriculture at different modernization levels in Ixtenco, Tlaxcala, Mexico</td>
<td>Christobal Sánchez- Sánchez</td>
</tr>
<tr>
<td>17:37</td>
<td>Factors influencing useful plant richness on land managed by small-scale farmers in Portland, Jamaica</td>
<td>Logan Sander / Ina Vandebroek</td>
</tr>
<tr>
<td>17:38</td>
<td>The effects of <em>Cassia abbreviata</em> and <em>Helinius integifolius</em> on glucose uptake and GLUT1 mRNA expression in (H-4-11-E) liver cells</td>
<td>Isaac Seabi</td>
</tr>
<tr>
<td>17:39</td>
<td>Acetylcholineesterase inhibitors from South African <em>Amaryllidaceae</em></td>
<td>Mary Sibanyoni</td>
</tr>
<tr>
<td>17:40</td>
<td>Ethnobotanical study of <em>Mimusops andongensis</em> Hiern in Benin (West Africa)</td>
<td>Gisèle Sinasson</td>
</tr>
<tr>
<td>17:41</td>
<td>Ethnobotanical profile of indigenous tree species protected within agricultural fields of Mutale local municipality</td>
<td>Peter Tshisikhawe / G Malunga</td>
</tr>
<tr>
<td>17:42</td>
<td>In vitro antimicrobial activity of plants used in traditional medicine in Gurage and Silti Zones, south central Ethiopia</td>
<td>Patrick van Damme / Alemtshay Teka</td>
</tr>
<tr>
<td>17:43</td>
<td>Comparison of plant uses of two mestizo communities in the Peruvian Amazon of the Ucayali region</td>
<td>Patrick van Damme / Lore Vael</td>
</tr>
</tbody>
</table>
17:43  Who owns this seed? The importance of traditional crops, knowledge and seed exchange in KwaZulu-Natal, South Africa  
Jacci van Niekerk

17:44  hERG channel inhibitors in South African medicinal plants with the focus on Boophone disticha (Amaryllidaceae) bulbs  
Elmarie van Rensburg

17:45  Hyperspectral imaging: visual quality assessment for South African herbal teas  
Ilze Vermaak

17:46  Green Gold: where have the ferns gone?  
Wessel Vermeulen

17:47  A method development study: extraction and metabolomics profiling in the neotropical blueberries (Vaccinieae, Ericaceae)  
Anne Virnig

17:48  Hydroponic propagation of Siphonochilus aethiopicus: an endangered medicinal plant  
Sibusiso Xego

17:49  Sustainable management of matsutake mushroom: knowledge gained from integrated research from ecology and utilization patterns  
Xuefei Yang

17:50  Antimicrobial potentials of Ansellia africana extract against bacteria commonly associated with respiratory tract infections  
Alpheus Zobolo / Khethumusa Cele

17:51  Phytochemical evaluation of Salvia officinalis using vibrational spectroscopy and UHPLC-MS analysis  
Busisiwe Zwane

18:45  EVENING MEAL – venue to be announced / on information board

THURSDAY, 2 JULY 2015

SESSION 10a: (parallel) – Marketing and Trade
Augsburg School Hall

Chairperson: Prof Patrick van Damme

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00-8:15</td>
<td>In and out of Africa: the early impact, dispersal and export of Cannabis</td>
<td>Mark Merlin</td>
</tr>
<tr>
<td>8:15-8:30</td>
<td>Integrating customary and statutory systems: possible directions for equitable trade of Prunus africana in Cameroon</td>
<td>Robert Nkuinkeu</td>
</tr>
<tr>
<td>8:30-8:45</td>
<td>Formalization of the natural product trade in southern Africa: unintended consequences and policy blurring in Biotrade and Bioprospecting</td>
<td>Rachel Wynberg</td>
</tr>
<tr>
<td>8:45-9:00</td>
<td>Tracing trade in Tanzanian medicinal plants using molecular techniques</td>
<td>Sarina Veldman</td>
</tr>
<tr>
<td>9:00-9:15</td>
<td>The influence of traditional governance systems on harvester access to and benefits from devil’s claw (Harpagophytum spp.) in the Zambezi Region, Namibia</td>
<td>Jessica-Jane Lavelle</td>
</tr>
<tr>
<td>9:15-9:30</td>
<td>Market and nonmarket incentives drive land use by the Yoreme-Mayo</td>
<td>Andrew Semotiuk</td>
</tr>
<tr>
<td>9:30-10:00</td>
<td>The production and use of acorns in the Republic of Korea</td>
<td>Shawn Overstreet</td>
</tr>
</tbody>
</table>
# SESSION 10b: (parallel) – Biological Activity

**Church Hall**

Chairperson: Dr Ilze Vermaak

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00-8:15</td>
<td>Structure elucidation of <em>Staphylococcus aureus</em> quorum sensing inhibitors from a traditional south Italian treatment for skin infection</td>
<td>James Lyles</td>
</tr>
<tr>
<td>8:15-8:30</td>
<td>Exploring the anti-quorum sensing potential of common culinary herbs and spices</td>
<td>Sekelwa Cosa</td>
</tr>
<tr>
<td>8:30-8:45</td>
<td><em>In vitro</em> wound healing properties of selected South African medicinal plants</td>
<td>William Fewell &amp; Anli Hattingh</td>
</tr>
<tr>
<td>8:45-9:00</td>
<td>Phytochemical constituents and antioxidant properties of acetone extract of <em>Cleome gynandra</em> growing in the Eastern Cape, South Africa</td>
<td>Linda Sowunmi</td>
</tr>
<tr>
<td>9:00-9:15</td>
<td>Anti-inflammatory activity of <em>Artemisia afra</em> in RAW 264.7 macrophages</td>
<td>Luanne Venables</td>
</tr>
<tr>
<td>9:15-9:30</td>
<td>Mobile discovery: searching for new antibiotics with students and indigenous communities</td>
<td>Slavko Komarnytsky</td>
</tr>
<tr>
<td>9:30-10:00</td>
<td>Expression of epitopes for lumpy skin disease Virus on tobacco mosaic virus coat protein scaffold in <em>Nicotiana benthamiana</em></td>
<td>Kelvin Phiri</td>
</tr>
</tbody>
</table>

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**10:00–10:30 TEA / COFFEE**

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# SESSION 11a: (parallel) – Conservation and Sustainable Use

**Augsburg School Hall**

Chairperson: Prof Daniel Moerman

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30-10:45</td>
<td>The <em>Prunus africana</em> trade from Africa and Madagascar 1972 – 2015 : a reality check</td>
<td>Tony Cunningham</td>
</tr>
<tr>
<td>10:45-11:00</td>
<td>Socio-ecological assessment of ecosystem services by urban green infrastructure in residential yards of a tropical city</td>
<td>Sofia Olivero-Lora</td>
</tr>
<tr>
<td>11:00-11:15</td>
<td>Sustaining resource sustainability in a dynamic world</td>
<td>Charlie Shackleton</td>
</tr>
<tr>
<td>11:15-11:30</td>
<td>A strategy to conserve South Africa’s utilised species</td>
<td>Domitilla Raimondo</td>
</tr>
<tr>
<td>11:30-11:45</td>
<td>Building a Bolivian national germplasm collection of crop wild relatives of <em>Oxalis tuberosa</em></td>
<td>Eve Emshwiller</td>
</tr>
<tr>
<td>11:45-12:00</td>
<td>Extant forest plantations as a potential bridge between social needs and ecological management (El Salvador and Niger)</td>
<td>Jocelyn Mueller</td>
</tr>
<tr>
<td>12:00-12:15</td>
<td>The medicinally important genus <em>Alepidea</em> (Apiaceae): tackling a taxonomic and conservation conundrum</td>
<td>Sarah-Leigh Hutchinson</td>
</tr>
<tr>
<td>12:15-12:30</td>
<td>Putting plants to work in an urban tech society</td>
<td>Janna Rose</td>
</tr>
</tbody>
</table>
SESSION 11b: (parallel) - Ethnobotany  
Church hall

Chairperson: Prof Peter Tshisikhawe

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30-10:45</td>
<td>Ethnobotanical uses of wild flora and fungi on the circum-Sicilian island of Pantelleria, Italy</td>
<td>Cassandra Quave</td>
</tr>
<tr>
<td>10:45-11:00</td>
<td>The trade in and household use of <em>Phoenix reclinata</em> hand brushes on the Wild Coast, South Africa</td>
<td>Nwabisa Mjoli</td>
</tr>
<tr>
<td>11:00-11:15</td>
<td>Basketry business in Ambalabe community, Eastern Madagascar</td>
<td>Nivo Rakotoarivelo</td>
</tr>
<tr>
<td>11:15-11:30</td>
<td>Ethnobotany of the Little Karoo, South Africa</td>
<td>Margaret Hulley</td>
</tr>
<tr>
<td>11:30-11:45</td>
<td>Wild plants, pregnancy, and the food-medicine continuum in the southern regions of Ghana and Benin</td>
<td>Alexandra Towns</td>
</tr>
<tr>
<td>11:45-12:00</td>
<td>Traditional uses of cola nuts by Mandé peoples</td>
<td>Daria Mishchenko</td>
</tr>
<tr>
<td>12:00-12:15</td>
<td>Traditional plant use of the Bapedi in Central Sekhukhuneland</td>
<td>Mahlatse Mogale</td>
</tr>
<tr>
<td>12:15-12:30</td>
<td>Diversity and significance of Old World crops by Suriname Maroons</td>
<td>Tinde van Andel</td>
</tr>
<tr>
<td>12:30-12:45</td>
<td>Ethnobotanical review of Vhavenda plant uses</td>
<td>Khathutshelo Magwede</td>
</tr>
</tbody>
</table>

13:00–13:30 – LUNCH

SESSION 12: Essential Oils  
Church Hall

Chairperson: Prof Alvaro Viljoen

Invited keynote speaker - Church Hall

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:30-14:00</td>
<td>Turkey as a source for aromatic plants and essential oils</td>
<td>Prof Hüsnü Baser</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:00-14:15</td>
<td>Potential of indigenous essential oil and seed oil in modern cosmetic and fragrance applications</td>
<td>Karen Swanepoel</td>
</tr>
<tr>
<td>14:15-14:30</td>
<td>Cultivation, uses and essential oil composition of <em>Artemisia atra</em>: A review of current status in South Africa</td>
<td>Babalwa Ntwana</td>
</tr>
<tr>
<td>14:30-14:45</td>
<td>Rose geranium as a commercial crop in rural areas of South Africa</td>
<td>Rosemary du Preez</td>
</tr>
<tr>
<td>14:45-15:00</td>
<td>The cosmetic application of marula oil: a clinical study</td>
<td>Baatile Komane-Mofokeng</td>
</tr>
</tbody>
</table>
A pilot study of the chemosystematic potential of furanocoumarins and essential oil compounds in *Nanobubon* and *Notobubon* (Apiaceae)  
Oluwakemi Sobiyi

Biotic resistance responses of wheat treated with *Artemisia afra* extracts and their repellent ability against the Russian wheat aphid.  
Lubabalo Saba

Distinguished Botanist – speaker – Church Hall

"The Accidental Ethnobotanist"  
Prof Daniel Moerman

18:30 for 19:00  
GALA DINNER – Augsburg School Hall

Master of ceremonies: Dr Carl Albrecht

Awards ceremony

Thanking you and safe journey
Paper abstracts
IPUF & SEB 2015

Kindly note that the abstracts are arranged alphabetically according to the presenter

AFOLAYAN, A.J.
MPED Research Center, Department of Botany, University of Fort Hare, Alice 5700, South Africa

30 June 2015 | Session 6a | Paper

The growth of predatory journals is a problem to scientific researchers

Predatory journals are online-only publications that are for profit. In most cases, they take advantage of inexperienced researchers who are under pressure to publish their work. These journals are quite different from well established and respected academic journals like Nature, Science or South African Journal of Science that publish much of the scientific discoveries which we read about. Generally, most predatory journals do not conduct peer-review of articles before publication. Over the years, the number of these predatory journals has exploded; still, more are constantly introduced. It has become a serious problem for researchers to know which journals are authentic or for a review board to identify good quality publications in the curriculum vitae (CV) of applicants. According to information, some publishers of these journals now buy fake impact factors from fake rating companies to make their publications appear legitimate. The growth of these journals has become a serious problem to scientific information dissemination. Their practice reduces trust in science, allows unqualified researchers to build CVs with fake or unreliable research findings and makes research and publication for legitimate scientists more difficult. This presentation is aimed at initiating constructive debate on predatory journals as it affects the academic career of emerging scientists in South Africa and or as a contribution to the debate if it has already begun.

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29 June 2015 | Session 3a | Paper

Antimalarial use of Malagasy plants is poorly correlated with performance in antimalarial bioassays

Bioassay screening of plant extracts can identify potential lead compounds for drug development. Though plants and associated endophytes often produce complex, novel bioactive compounds, under the current drug-development model the “hit rate” from random screening is so low that some doubt its cost-effectiveness. Targeted screening of medicinal plants is reported to increase the percentage of samples displaying bioactivity in standard assays, including assays targeting pathogenic
organisms. Contrarily, Maranz (2012) suggested that African antimalarial plants might be unsuitable as sources of antimalarial drugs because regionally high prevalence of malaria would result in rapid evolution of resistance to active compounds that directly targeted the parasite. As malaria is highly prevalent in portions of Madagascar, it was of interest to determine whether Malagasy antimalarial plants would outperform randomly selected plants in conventional antimalarial assays.

Data were available for 1294 random plant samples screened in Madagascar for antimalarial activity, of which 39.6% had an IC₅₀ < 50 µg/ml and 21.1% had an IC₅₀ < 20 µg/ml, the minimum potency to be considered a first-pass “hit.” Ethnobotanical literature was reviewed and samples from species or genera having reported use for malaria were coded as such. Samples identified only to genus were coded as having unknown use status at the species level. The 526 samples from genera that included species used for malaria were only slightly more likely than average to display activity (44.3% with IC₅₀ < 50 µg/ml; 23.2% with IC₅₀ < 20 µg/ml). Of these, the 67 samples from individual species with documented use were more likely than average to be modestly active (49.3% with IC₅₀ < 50 µg/ml), yet slightly less likely to be strongly active (17.9% with IC₅₀ < 20 µg/ml). Those species might act effectively on parasite virulence or host resiliency, but in this specific context, targeted screening based on traditional knowledge would not have improved screening efficiency.

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2 July 2015 Session 12 Invited Paper

Turkey as a source for aromatic plants and essential oils

Flora of Turkey is rich and diverse with over 12,000 flowering plant taxa belonging to >9000 species. Over 33% of the flora consists of endemic species and 1/3 of the flora comprises aromatic plants. Flora of Turkey is well documented in 11 volumes of the Flora of Turkey and the East Aegean Islands (1965-2001). Flora of Turkey contains at least 3000 species of aromatic plants belonging to families such as Lamiaceae, Apiaceae, Asteraceae, Rutaceae (Citrus, Dictamnus, Ruta), Cupressaceae (Cupressus, Juniperus, Thuja), Lauraceae (Laurus), Anacardiaceae (Cotinus, Pistacia, Rhus, Schinus), Myrtaceae (Eucalyptus, Myrtus), Rosaceae (Orthrus, Geum, Rosa), Pinaceae (Pinus, Abies, Cedrus, Picea), Verbenaceae (Aloysia, Vitex), Caprifoliaceae (Viburnum), Tiliaceae (Tilia), Hamamelidaceae (Liquidambar), Clusiaceae (Hypericum), Morinaceae (Morina), Solanaceae (Mandragora), Geraniaceae (Geranium, Pelargonium), Liliaceae (Allium), Araceae (Acorus), etc.

Essential oil and aromatic water (hydrosol) production have been carried out since the Ottoman period in Turkey for at least 4 centuries. Annually, Turkey exports over $150 million worth of medicinal and aromatic plants. In 2014, total exports of oregano, laurel and sage amounted to $103 million. In 2014, Turkey exported $32 million worth of essential oils, hydrosols and related products including rose oil (+ concrete) ($14 million), oregano oil ($3 million). Main aromatic plants of Turkey which are and could be used for essential oil production include the cultivated Rosa damascena (Oil rose, Isparta gülü), oregano (Kekik) (from Origanum, Thymus, Coridothymus, Satureja and Thymbra), Sage (Adaçay) (Salvia fruticosa, S. officinalis (cultivated)), mint (Nane) (Mentha spicata, and M. piperita from cultivated plants),
laurel (Defne) (*Laurus nobilis*), Anis (Anason) (from cultivated *Pimpinella anisum*), cedrus (Sedir) (*Cedrus libani*), birch (Huş, 5 Betula species: *B. medwediewii*, *B. pendula*, *B. litwinowii*, *B. browicziana*, *B. recurvata*), Juniperus foetidissima (Kokar ardış), cumin (cultivated *Cuminum cyminum*, kimyon), coriander (cultivated *Coriandrum sativum*, kişniş), rosemary (*Rosmarinus officinalis*, biberiye), black cumin (cultivated *Nigella sativa*, çörekotu), linden (*Tilia* species, ihlamur).

**Honeybush breeding: impact on industry**

In the past twenty years a small herbal tea industry has developed along the coastal districts of the Eastern and Western Cape provinces of South Africa where the endemic shrub honeybush (*Cyclopia* spp.) grows naturally. This herbal tea, with various health properties, quickly became popular internationally and annually more than 200 tons are exported. Soon the rapid growth in demand put the honeybush industry under pressure and a sustainable supply could not be met. Even though most of the tea is collected from wild populations, the sustainability of these supplies is under threat and an alternative source of plant material is needed. To address this, the ARC deployed improved genetic material from its breeding programme through commercial seed-orchards. Several selections were made in three of the six commercial species of *Cyclopia*. These selections were multiplied vegetatively (as clones) through cuttings. More than 60 plants per clone (genotype) were raised to establish a seed-orchard for each species. The plants were planted in a fully randomized complete block design to assist evenly balanced pollination between genotypes. The first orchard, *C. subternata*, was planted in June 2011 and to date about 20 kg seed have been harvested, enabling the industry to establish 200 ha of plantations. This is twice the area previously established from seed collected in the wild. Thus, within four years of the establishment of the first seed-orchard, the industry was able to triple the area of commercial plantations. The ARC honeybush seed-orchards contributed significantly in a very short period of time to the provision of a sustainable source of quality seed and enabled the industry to become more sustainable. It also plays a major role in protecting the biodiversity of the natural population, by reducing the quantities of seed and plant material harvested from wild populations.

**Pancreatic cancer: finding a cure in natural products and South African flora**

Pancreatic cancer is the fourth leading cause of cancer death in the USA and UK. Pancreatic ductal adenocarcinoma accounts for eighty percent of all pancreatic
cancer, and is mainly detected at advanced stages of localized metastasis. This results in poor prognosis. Natural products and medicinal plants have played an important role in the discovery of novel chemotherapeutic agents. Cytotoxicity of prodrugs (i.e. harpagoside, hyperoside, hypoxoside, oleuropein and polydatin) and three medicinal plants (i.e. *Sutherlandia frutescens*, *Tarchonanthus camphoratus* and Plant X) and their purified compounds (i.e. γ-aminobutyric acid, pinitol, canavanine, pinocembrin and 1,8-cineole) were determined against the pancreatic cancer cell lines, MIA PaCa-2 and INS-1, using MTT. DNA cell cycle arrest and caspase-3 activation were determined using propidium iodide and a cleaved caspase-3 antibody, and samples analyzed using flow cytometry. Hyperoside and hypoxoside have shown the best cytotoxicity against MIA PaCa-2 and INS-1 cells at IC50 values of ~50 and ~15 µM, respectively. *S. frutescens* and *T. camphoratus* have shown very little or no cytotoxicity, whereas Plant X had IC50 values of ~55 and ~30 µg/mL against MIA PaCa-2 and INS-1 cells, respectively. Aqueous extracts of *S. frutescens* and *T. camphoratus*, and its purified compounds (at concentrations lower than 100 µM), have shown very little or no cytotoxicity. A purified compound of Plant X, 1,8-cineole, had no cytotoxic effect. In MIA PaCa-2 cells, the DNA cell cycle was arrested in the G2/M phase and cleaved caspase-3 levels were elevated after 48 h of Plant X and hyperoside treatment. In general, the prodrugs were more active when the glucose or galactose units were cleaved by β-glucosidase and β-galactosidase, respectively. It is important to focus on specific cancer cell death pathways when searching for novel chemotherapeutic agents. In the case of pancreatic cancer, the induction of autophagy may play an important role. Natural products and South African flora show promise in finding novel compounds for the treatment of pancreatic cancer.

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**Understanding the absorption and bioavailability of aspalathin**

Type 2 diabetes is typified by chronic hyperglycaemia and an effective strategy for managing diabetes is to modulate postprandial hyperglycaemia particularly in insulin resistant individuals. This has been well documented for flavonoids, including aspalathin, a dihydrochalcone C-glucoside, novel to rooibos (*Aspalathus linearis*). Most flavonoids are absorbed by the human body in the small intestine and colon, metabolized by liver enzymes, and have a low bioavailability. Ingested flavonoids must pass the intestinal epithelium in order to be absorbed by body. Absorption across this physical and biochemical barrier involves enzymatic digestion in the lumen and brush border, as well as inside the GIT epithelial cells, with efflux mechanisms in place to pump molecules back in to the lumen after uptake. Aspalathin has been shown to be absorbed after drinking rooibos tea but to date, no mechanism of aspalathin transport across the intestinal barrier has been published. The hydrophilic nature of the molecule suggests that it is not likely to be transported passively and further, the attached C-C-linked glucose is not readily removed. It is therefore, more likely for this class of polyphenol is actively transported by glucose transports such as SGLT1 and/or GLUT2. Understanding the mechanism of aspalathin intestinal transport, absorption and
metabolism will contribute to an understanding of the pharmacokinetics of aspalathin relevant to its bioactivity and dose optimisation.

Our research uses an intact monolayer of Caco-2 cells as a model for the intestinal barrier. We have shown that aspalathin, when present in aspalathin-enriched extracts of rooibos, as well as pure synthetic aspalathin, is transported across the intestinal barrier at a rate typical of moderately absorbed compounds. Contrary to expectations we have not been able to demonstrate that the glucose transporters SGLT 1 and GLUT2 are the primary mechanisms of transport. These findings will be presented and other mechanism(s) still under investigation will be discussed.

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29 June 2015 Session 4b Paper

The effect of light, temperature and scarification on germination of Solanum nigrum seeds

Solanum nigrum L., a popular wild vegetable consumed by the Eastern Cape rural populace especially during times of drought was tested for germination and viability as part of efforts to domesticate the vegetable. To extract the seeds, whole mature berries were either sun dried, air dried or fresh seeds were separated from their pulp and air dried. The seeds were subjected to various factor levels of 3 treatments namely, light, temperature, and scarification. Moisture content was 8.24%. Using the tetrazolium technique, viability in air dried, freshly extracted and sun dried seeds was 78%, 72% and 70% respectively and maximum germination was 76% observed in air dried needle pricked seeds. Pre-chilling and light reduced germination. Exposure to 35°C for 40 days prior to the experiment produced 60% germination. Subjecting air dried seeds to 5N H₂SO₄ for 120 s produced the best chemical scarification results (64%); however, concentrated H₂SO₄ destroyed the seeds. Air drying mature berries was the best method of extracting and drying seeds. Comparing seed viability and the germination results, it is indicating that S. nigrum seeds are highly viable but seedcoat dormancy was presumably the major factor inhibiting germination. Needle pricking was the best method of breaking this dormancy. Furthermore, the moisture content indicates the potential of the seeds to be stored for long periods of time without compromising their viability. Seed viability and germination are therefore presumably not a limiting factor in S. nigrum cultivation and eventual domestication for food.

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30 June 2015 Session 6a Paper

The integration of Mexico into the global economic botany during the Victorian period: the role of Cyrus G. Pringle

The disparity in scientific and technological expertise between Mexico and the global economic powers (USA and western Europe) during the Victorian Age (1837–1901) was bridged by Mexican government’s policies of encouraging exploration by
foreign scientists during the Porfiriato Period (1876–1910). The exponential expansion of the railroad gave botanists ready access to unexplored regions and facilitated the export of living plants and specimens. One of the most prolific plant collectors who significantly increased the knowledge of the national flora between 1800 and 1910 was Cyrus G. Pringle (associated with University of Vermont and Harvard University); he discovered 1,300 new taxa. Given Pringle’s previous horticultural experience, we hypothesize that he also contributed to the development of Mexican economic botany. Pringle’s field notes, horticultural literature of the period, historical seed catalogs, as well as contemporary taxonomic and floristic works were evaluated in order to determine if his scientific contribution consisted of more than the 16,000 numbered specimens, duplicates of which are distributed in 50 herbaria around the world. About 100 species collected by Pringle in Mexico entered international trade. In general, the plants were collected in the wild and moved directly in the horticultural trade. Many of these species reflected the market demand for compulsory exotic plants incorporated into Victorian period gardens that gratified major plant-based frenzies such as: bulbomania, pteridomania, orchidomania, water-plant-mania, and palm-mania. Pringle’s field calendar tracked the phenology of certain plants in order to facilitate the collection of seeds and propagules; his field sites were linked with the Mexican railroad network in order to ensure their timely shipment to international ports. To date, 20 species of bulbs, 20 of ferns, 14 of orchids, and a fewer number of water lilies, palms and flowering perennials in the horticultural trade of the period can be attributed to Pringle’s Mexican collections. In addition to being novel additions to the horticultural flora, about a quarter of these species were described as new to science. Most of these ornamental plants are no longer prominent in contemporary gardens. None the less, his 1885 introduction of the Chihuahuan endemic Heuchera sanguinea (coral bells) was an instantaneous international prize-winning flower. Over a century later, its hybrid progenies motivated “heucheraholics” at Hampton Court in the UK such that the year 2012 was declared “Year of the Heuchera”. Fewer plant collections are registered as medicinal plants, fiber sources and timber trees.

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29 June 2015 Session 2a Paper

Propagating a plant and beyond: socio-anthropological issues behind the diversity of guarana reproduction methods in the Brazilian amazon

Guarana (Paullinia cupana var. sorbilis, Sapindaceae), a vine which reproduces naturally through seeds and originates from the state of Amazonas in Brazil, is cultivated there for its guaranine-rich seeds, to which are attributed energizing properties. It is produced at different scales, within socio-technical systems that range from family agriculture (indigenous or not), to large agro-industrial beverage corporations. In the past decades joint efforts of the industry and of the Brazilian agronomic research allowed a diversification of guarana’s propagation techniques, involving knowledge of different natures. Among the main techniques used today are the transplantation of seedlings taken directly from the forest, on-farm seed selection and plantation, and vegetative multiplication (i.e. cloning) of professionally improved varieties. The purpose of our study is to question the logic that guides small family producers’ choices in terms of propagation techniques, in the face of agricultural policies that encourage cloning methods at the expense of the use of seeds, which has
been judged unproductive and paradigmatic of Amazonian small producers’ “ignorance” and “resistance” to innovation. This work is based on extensive fieldwork carried on with three organizations of guarana producers of the Amazonas, associating ethnobotany and sociology of knowledge via the realization of interviews and participant observations, in order to examine their practices and the arguments they draw on to legitimate their choices. We show that small guarana producers' practices have their own rationale that reaches beyond the strict economical considerations exposed by public actors to valorize the cloning techniques and the diffusion of the genetic material thus obtained. Far from being lived as an isolated technical act, the choice of a multiplication method corresponds for each producer to a particular perception of themselves, of the plant, and of nature. The social identity and qualities conferred to the plant by the multiplication method applied are not unrelated to the political and commercial alliances built by the producers. They often represent the conditions necessary to the sustainability of their activity, of their identity and, sometimes, of their territory.

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2 July 2015 | Session 10 b | Paper

Exploring the anti-quorum sensing potential of common culinary herbs and spices

Exploitation and/or misuse of antibiotics in pharmacotherapy have led to the increasing development of widespread resistance in target pathogens, raising concerns about the future of existing antimicrobial drugs. Targeting quorum sensing (QS)-regulated virulence is a novel approach to antimicrobial drug discovery. This approach places less evolutionary pressure on micro-organisms, so that the development of resistance is not stimulated and bacterial pathogenicity or virulence is attenuated. The identification of natural compounds that can act as QS inhibitors is an attractive tool to control detrimental infections. In the search for novel anti-QS compounds, 14 herbs / spices (Allium sativum, Apium graveolens, Armoracia rusticana, Capsicum annuum, Cinnamomum cassia, Curcuma longa, Glycyrrhiza glabra, Melissa officinalis, Mentha balsamea, Rosmarinus officinalis, Syzygium anisatum Syzygium aromaticum, Thymus vulgaris and Zingiber officinale) were screened for their potential anti-pathogenicity (anti-QS) activities against Chromobacterium violaceum ATCC 12472. This bio-reporter bacterium regulates pigment production by N-hexanoyl-HSL (C6-HSL) QS, which is readily inhibited by AHL analogues and other antagonists. Anti-QS compounds were provisionally identified using high performance thin layer chromatography (HPTLC) coupled with a biosensor overlay assay. This was followed by identification of specific compounds using ultra performance liquid chromatography–mass spectrometry (UPLC-MS). Most plant extracts demonstrated effective antimicrobial activities with bactericidal effect. However, extracts of G. glabra, A. graveolens, C. annuum and S. anisatum, demonstrated good anti-QS abilities (12- 19 mm opaque halo zones) at sub-minimum inhibitory concentration (0.35-4 mg/ml range) values, by interfering with violacein production. The reduction in violacein production ranged from 56.4- 97.3%. Several spots/ zones with violacein inhibitory effect were evident in the ethyl acetate extract of A. graveolens following HPTLC-bio-autography. The major active compounds were identified as 3-n-butyl-4,5-dihydrophthalide
(sedanenolide) and 3-n-butylphthalide using UPLC–MS. It is envisaged that these results will serve as an initial scientific validation leading to the development of therapeutic molecules as prospective anti-pathogenic drugs for mitigating bacterial virulence.

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Antidiabetic properties and a sustainable exploitation strategy of “copalquin” medicinal bark complex in Mexico

The bark of the Copalquin Medicinal Complex (Hintonia latiflora and H. standleyana) has been used in Mexico since the 16th century to treat malarial fever and gastrointestinal ailments. Since the colonial period, it has been an item of international commerce that has led to drastic decline of natural populations due to overharvesting of these tropical trees. Because of its bitter bark, it has recently gained popularity in the national and international “herbolario” for treating diabetes. Due to clandestine collecting methods that completely debark the tree trunks, we considered: 1) does the bark have hypoglycemic activity, and 2) is there alternative to contemporary harvesting practices? Phytochemical analysis of aqueous extracts of the different plants parts was conducted to identify the bioactive principals. In vitro and in vivo studies using extracts were conducted on normal and streptozotocin-induced diabetic mice in order to evaluate antidiabetic activity as well as to determine toxicity according to the Lorke criteria. A phenological and geographical comparison was established in order to find the best harvesting regime.

Hypoglycemic and antihyperglycemic activities were related to the presence of 4-phenylcoumarins and chlorogenic acid in the bark and leaves of both species. Both bark and leaf infusions were not toxic to mice (LD$_{50}$ >5000 mg/kg). The highest concentration of these compounds occurred during the non-flowering phenological phase. Their presence in H. latiflora and H. standleyana provides an ethnopharmacological basis for the employment of this “emergent medicinal plant” in contemporary “herbolaria.” Leaves exhibited phytochemical composition similar to that of the bark. At this moment, we are sensitizing the users of copalquin to the conservation benefits of substituting leaves for bark in the herbal preparations for treating diabetes. In collaboration with local rural populations, we are establishing plantations of H. latiflora so that leafy stem pruning regimes can be established in order to relieve the destructive harvesting pressure on wild trees due to trunk girdling and bark stripping. In this manner, we anticipate that local communities can control and benefit from the commercialization of an added-value vegetative product as well as from the mitigation of damage to the natural dry tropical forest.
An overview on the production and marketing of Rooibos

Rooibos is a true South African success story due to the contributions of many people over more than 200 years. Major role players in the initial marketing of Rooibos will be highlighted in a brief discussion on the history of Rooibos Limited and the growth of this industry over the past 15 years. Although many aspects of the production process have been modernized, in essence processing still entails the main actions such as cutting, bruising, wetting, fermentation and drying. To date the product made with nature’s influence outperforms any attempt from our side to move this process into a more controlled environment. Rooibos still needs some mysterious involvement from nature to produce the best quality.

Rooibos has evolved from a local substitute for “real tea” at the start of the Rooibos story, to where it is today in a niche market being utilized as a uniquely healthy product sought after by consumers all over the world. A short explanation on production, primary processing, secondary processing, quality control and Green Rooibos will give the audience a better understanding of how far this product has come. During the past 20 years science has played a major role in the confirmation of the natural goodness of this beverage and the reasons why the industry is still growing.

Product certifications and food safety regulations are playing a bigger and bigger role in the food industry worldwide and yet again Rooibos adapted to the demands and has its own commodity standard in UTZ and Fairtrade certifications. It adapts well to organic production requirements and is probably one of the few crops that is cultivated exclusively in the area where it evolved naturally.

The Prunus africana trade from Africa and Madagascar 1972 – 2015: a reality check

When it comes to public attention, plants usually have a low profile compared to charismatic mammals such as pandas, rhinos and elephants. Prunus africana, the only African wild relative of peaches, plums and almonds, is an exception, having been mentioned in British parliament and other high-level policy arenas. After 42 years of international trade in wild harvested medicinal bark from Africa and Madagascar, the P. africana trade – Africa’s largest medicinal plant export product - holds valuable lessons for both policy and practice in forestry, medicinal plants conservation and rural development. Due to recent CITES restrictions on P. africana exports from Burundi, Kenya and Madagascar, coupled with the lifting of the 2007 EU-ban in 2011, Cameroon’s share of the global P. africana bark trade has risen from an average of 38% between 1995 and 2004 to 72.6% (658.6 tonnes) of P. africana bark in international trade in 2012. Depletion P. africana populations in Madagascar has resulted in the factory there needing to import bark from the Dr Congo and Cameroon. Yet hopes of decentralized governance of this forest product are misplaced due to elite
capture, concentration of power and “informal taxation” (bribery). In contrast to lucrative bark exports, livelihood benefits to local harvesters from wild harvest are low. In Cameroon, the costs of inventory, monitoring and managing sustainable wild harvests are far greater than the benefits to harvesters. Without the current substantial international donor subsidies, sustainable harvest cannot be sustained. What is required to supply the current and future market is to develop separate, traceable P. africana bark supply chains based on cultivated stocks. More Cameroonian small-scale farmers cultivate P. africana than any other country – an example that needs to be emulated in Madagascar and other parts of highland Africa. With CITES support, this would catalyze P. africana cultivation and trade and take pressure off wild stocks.


CUNNINGHAM A AND MBENKUM F T 1993 Sustainability of harvesting Prunus africana bark in Cameroon – a medicinalplant in international trade People and Plants Working paper no 2

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29 June 2015 Session 1 Paper

Nutraceutical value of rooibos (Aspalathus linearis) food ingredient extracts: effect of fermentation

Food ingredient extracts, prepared by hot water extraction, are some of the value-added products produced from the herbal tea, rooibos. These extracts are increasingly used in ready-to-drink beverages, yoghurt, bread and other food products. Extracts are mainly produced from “fermented” (oxidised), rooibos although green rooibos extracts are gaining popularity due to its high aspalathin content. The study evaluated parameters linked to the nutraceutical value of rooibos, namely phenolic composition and total antioxidant capacity, for food ingredient extracts prepared from fermented and green rooibos. Ten samples, each of single plant origin, were divided into two similar sized sub-samples. One sub-sample was dried “as-is” (green) and the other sub-sample was cut into small pieces, “fermented” and dried. Hot water extract was prepared from each fermented and green sample. Individual phenolic compound contents were determined using high-performance liquid chromatography with diode-array detection, the total phenol content were determined using the Folin-Ciocalteau assay and the total antioxidant capacity (TAC) was determined using the ABTS radical cation scavenging, DPPH radical scavenging, oxygen radical absorbance capacity (ORAC) and ferric reducing antioxidant power (FRAP) assays. Fermented rooibos extracts exhibited significantly lower total polyphenol (13% decrease) and TAC values (16-31% decrease) in all the antioxidant assays. In terms of phenolic composition, the two major dihydrochalcones (aspalathin and nothofagin) showed a similar trend with ca 80% reduction in content as a result of fermentation. Isoorientin and orientin, known oxidation products of aspalathin, were much less affected with only 11 and 16%
decrease, respectively. Isovitexin and vitexin, postulated oxidation products of nothofagin, were similarly less affected by fermentation (11 and 20% decrease, respectively). The flavonols, except for rutin, were decreased by ca 20% by fermentation, while rutin decreased by 38%. The flavone, luteolin-7-O-glucoside and the phenylpropenoic acid, phenylpyruvic acid-2-O-glucoside, were not significantly affected by fermentation. In conclusion, the TAC and total phenol content of food ingredient extracts from fermented rooibos was moderately lower than those prepared from green rooibos, despite extensive degradation of the major antioxidant, namely aspalathin. Apart from the flavones, other oxidation products of aspalathin and other flavonoids may contribute to the antioxidant activity of the extracts.

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29 June 2015 | Session 2a | Paper

Doepa: History of an indigenised African medicine

Doepa, a “Lennon’s Dutch remedy” (Benzoin B.P.C.) now commonly sold in a small tin, has been described by the African Moslem traveller Ibn Batuta, who visited Sumatra in the 1300s, as an incense that is commonly used for its pleasant smell and to keep evil spirits away. At the time, it referred to the balsamic resin of the incised stem of Styrax benzoin or Styrax paralleloneurus. Dupa or Dhupa, arrived at the Cape of Good Hope with slaves from the East and Malaysian exiles in the late 17th and early 18th centuries, soon entering Afrikaans folk traditions. The word Doepa, with its origin in Sanskrit, is commonly used in Afrikaans and has many meanings: it can be a toormiddel (charm), a paljas (spell or magic potion), a toorspreuk (magical saying), or a reference to toorgoed (magic objects). Cape Malay families burn doepa in their homes or mosques and resin pieces are crushed to a powder that is burned in sick-rooms against chest ailments, with the liquid used as a versterkmiddel (tonic) and remedy against wind, fits, or as a lotion. More recently, Dupa has been incorporated into African healing traditions through a process of indigenisation to soothe restless and crying babies. Infants’ fretfulness is attributed to fear for things in the dark outside the house and burning dupa inside will “chase away” imimoya emibi ya baloi/bathakathi (bad/dirty spirits of the witches/sorcerers), or memoya emebe (imimoya emibi) (bad spirits), or imimoya ka satan (bad/dirty spirits of Satan). Burning Doepa to ward off illness, and specifically protecting children against “spirits”, shows remarkable similarities in the way in which it was used during the 1918 flu epidemic: “Take one big spoon of Doepa and burn it on a saucer with red coals in every room. It will take away germs, goëlery (poltergeists) and spoke (ghosts).” As is true for other “Dutch medicines”, the ways people use it continuously change, and the uses often have nothing in common with the intention of the manufacturers.
The genus *Pelargonium* comprises about 270 distinct species of which a large number are indigenous to the Western and Eastern Cape Provinces of South Africa. Rose geranium is a hybrid (*Pelargonium capitatum* and *P. radens*) which was developed for the production of essential oils. This initiative seeks to develop successful commercial growers of rose geranium in rural areas of South Africa. Essential oil crops have not traditionally been produced in South Africa and the development of essential oil agribusinesses which incorporates both primary production of plant material, extraction of the oils and value adding utilizing the essential oil, offer many opportunities for further economic development in the rural areas.

In introducing rose geranium three important steps were deemed necessary as in essential oil production, the end product quality is of critical importance for successful marketing and profitability and this is strongly influenced by the intrinsic characteristics of the planting stock, soil and climatic conditions and cultural practices. A feasibility study was completed to determine the suitability of the area, this included determining the agricultural potential and technical suitability, social and farmer skills, infrastructure and identification of gaps. A trial stage was completed where the crop was evaluated under local conditions. Skill development and capacity were addressed intensively during this stage. Scaling up where production is systematically moved from the trial stage to commercial volumes is currently being implemented. Ongoing technical training is undertaken on all aspects necessary to ensure that farmers are capacitated to produce rose geranium as a sustainable economic enterprise. Farmers are assisted to form primary marketing and supply co-operatives and training on business development, management and marketing have been covered. The village farmer co-operative provides uniformity in quality during production, at harvest and upon delivery. Small successful agri-businesses have been developed and four villages in the Eastern Cape and two groups in North West province are producing glycerine soap utilizing essential oils extracted from herbs grown in the village. Products are currently sold to local guesthouses and in villages. The successful development and implementation of this model can assist other rural areas to introduce sustainable production of rose geranium or other essential oil crops.

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**Floristic and ethnobotanical resource use among hunting/gathering tribes in the Southern Plains of North America**

The Kiowa, Comanche, and Plains Apache (KCA) were nomadic hunting and gathering peoples that were linked culturally, politically, and geographically in the
southern Great Plains of North America. They were closely associated since EuroAmerican contact, were confederated in 1867, and shared a reservation in Oklahoma where most tribal members reside today. Because each tribe remained in its ancestral region, was dependent on bison hunting and plant gathering, and was investigated by ethnobotanists, a catalog of KCA economic plants was assembled. We compared partitioned and compiled KCA data to reconstructed floristic and ethnobotanical inventories to test hypotheses of loss of traditional knowledge, completeness of ethnobotanical surveys, and extent of plant resource use. The KCA utilized at least 164 species of vascular plants native to their 8-county former reservation. Reconstructed native floristic inventories indicated that 12.7% of the KCA reservation flora (1289 species) was utilized economically compared to only 5.8% of the southern Plains flora (2839 species) representing their historic range. Of the 508 native reservation plants (39% of the flora) with economic uses reported in the Native American Ethnobotany database, the KCA utilized 32% of the total ethnobotanical resource pool. When partitioned by tribe, the Kiowa, Comanche, and Apache utilized much smaller percentages of the reservation flora (5% _8%) and the total ethnobotanical resource pool (12%_20%). Our results support hypotheses of loss of traditional knowledge of economic plants following confinement to a subset of their former range and forced adoption of an agrarian/ranching economy. Despite extensive intertribal interactions and a shared natural resource base, the disparities among economic plants reported for each tribe and the limited number of plants appearing in more than one ethnobotanical survey indicate that many plants of cultural significance to the KCA were unreported by ethnobotanists.

EMSHWILLER, EVE, FORONDA, EDSON, MAMANI, ARMANDO, RIOJA, ROGER & ROCABADO, CAROL

Building a Bolivian national germplasm collection of crop wild relatives of Oxalis tuberosa

Conservation of crop wild relatives (CWR) is important because of their potential use in breeding crops that are more resistant to climate change or to other abiotic or biotic stresses(1), but international priorities have been on CWR of globally important crops, rather than regional crops and vegetatively propagated ones. An example of the latter is the tuber crop oca, Oxalis tuberosa Molina (Oxalidaceae), which has an important role in food security and sovereignty in the Andean region. Molecular phylogenetic studies confirmed its origin in a clade known as the “O. tuberosa alliance,” among which are wild, tuber-bearing Oxalis populations in Bolivia, Argentina, and two areas of Peru. However, studies with different molecular markers suggested either that: oca is a hybrid of Peruvian and Bolivian wild, tuber-bearing populations (2), or the Bolivian populations are the most similar genetically to cultivated oca(3). In this collaborative project, sampling to fill gaps to confirm the area of oca’s origin was combined with a conservation effort by INIAF (Instituto Nacional de Innovación Agropecuaria y Forestal) to preserve Bolivian CWR. We compiled species distribution
data from herbarium specimens to guide expeditions. We found populations of the wild, tuber-bearing *Oxalis* by focusing on the transition zone between the cloudforests and the high-elevation grasslands. We also collected multiple populations of ten other species in the *O. tuberosa* alliance clade, including three undescribed species, as well as *Oxalis* species from outside that clade. Plants are being cultivated as a germplasm collection administered by INIAF. Maps of species distributions based on collection data will guide in-situ conservation. Some observations led to conservation concerns, such as populations that were apparently extirpated despite their presence in the recent past, or the finding that the infrequent populations in the drier southern departments could only be found in small moister spots that are likely threatened by climate change. These observations highlight the importance of complementary ex-situ and in-situ conservation. This project shows that conservation of CWR of regional crops and vegetatively-propagated ones by national genetic resource programs is feasible, and a necessary complement to the international focus on globally important crops.

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a drawing contest where students chose plants from the list the elders created. We created a tri-lingual book in Kiha, Swahili and English and co-organized a ceremony to present the local knowledge back into the community.

Trees and roots dominated the plant list, and the village children became actively engaged. Furthermore, the spatial dimensions of the interest extended into neighboring villages and Kigoma city. The writing in Kiha emerged as one of the major draws. The most effective parts of the process were the interviews and the ceremony. The importance of this work comes from the product and the process: the record of their plant knowledge in an aesthetically alluring format and the local involvement in the creation of their own book, lent status to the project. The process of creating a written and illustrated record affected not only those individuals with whom we worked directly, but also the children who watched, the teenagers who drove us on their motorcycles and passing villagers. This interest can act as the building block for fostering a deeper relationship with the ecosystem in which all generations of Ha live. Further studies can be conducted in subsequent years to record the lasting effect of this awareness.

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2 July 2015 | Session 10b | Paper

In vitro wound healing properties of selected South African medicinal plants

Traditional medicinal plants have always, and continue to play a major role in the management of dermatological disorders. In South Africa, the use of medicinal plants for their wound healing properties is extensive. However, the majority of these plant species lack scientific information regarding their biological activities and therapeutic values. In this study, the wound healing properties of 14 aqueous plant extracts were evaluated using in vitro assays relevant to the process of wound healing and other common dermatological disorders. Plant species selected for investigation include, Sutherlandia frutescens, Aspalathus linearis, Opuntia ficus-indica, Grewia occidentalis, Cotyledon orbiculata, Leonotis leonurus, Salvia africana-lutea, Hypoxis stellipilis, Helichrysum petiolare, Helichrysum spp. (to be identified) and Kalanchoe thyrsiflora. The anti-oxidant activity of the plant extracts were evaluated using FRAP and DPPH assays. Initial cytotoxicity screening of extracts using human dermal fibroblast cell lines MRHF and MeWo (malignant melanoma) was conducted to identify extracts suitable for further analysis with regards to wound healing properties. Non-cytotoxic extracts were subsequently screened for anti-inflammatory (NO production, phagocytosis and lymphocyte proliferation assays) activities, after which the effect of extracts on tissue remodeling was assessed (fibroblast proliferation and cell migration assays). Significant cytotoxicity was observed for extracts of Cotyledon orbiculata and Helichrysum petiolare after 48 hours of treatment, and warrants further investigation towards possible anti-cancer activity of these extracts.
The Food Plants International database of edible plants of the world

My life's work, since being asked to teach about indigenous food plants in Papua New Guinea in the 1970s, has been to collate information about the Neglected and Underutilised Food Plants of the world. Currently my database has 27,000 edible plant species. For Africa it covers 7,560 edible plant species, for Southern Africa 2,777 species and for the Mediterranean climate zone, 1,140 edible species. It is a collation of other people's work aiming to get the information back to the people who need it most - the 2 billion people who aim to feed themselves from their smallholder farms. For Africa, perhaps the more crucial need is for edible plants in arid zones. For this biome there are 1,588 edible species. Increasingly, accessible English and highly illustrated publications are being put on our website www.foodplantsinternational.com. The web database is currently hard to use but far more effective copies on disk can be made available to attendees at the conference. It remains an ongoing task with the greatest deficiency being in food preparation and presentation. Agro-sociology must accompany agro-ecology for real progress to be made with food and nutrition.

Plants used for the treatment of malaria and jaundice by the Naga tribes of India

The North Eastern region of India is rich in biodiversity as well as indigenous culture and heritage, represented by more than 130 indigenous communities or tribes. Most of these communities still depend on forest resources for their livelihood. The Nagas living in the state of Nagaland show rich tradition of using local resources for their health cares. The two common diseases Malaria and Jaundice have been found treated successfully by the Nagas using various locally available plant species. With an objective to understand the herbal healing practices adopted by the Nagas for the treatment of malaria and jaundice and identification of the important species the study was undertaken. An ethno-medico- botanical survey was carried out in the state of covering Kohima, Wakha, Zunheboto and Peren districts considering four Naga tribes namely Angami, Lotha, Sumi and Zeliang. Total 72 herbal healers were interviewed during the survey. Data collections were made as per the ethno-botanical methodology with collections of voucher specimens. The result revealed that among the 72 healers from 4 different tribes, 37 were treating malaria while 35 were treating jaundice. Total 35 plant species belonging to 25 families were recorded. For the treatment of Malaria a total of 17 species were used by the 37 healers while for the treatment of Jaundice 18 species were used by the 35 healers. Among the various plants, the common species used by all the tribes and most of the healers are *Adhatoda zeylanica*, *Andrographis paniculata*, *Azadirachta indica*, *Clerodendrum cordatum*, *Momordica charantia*, *Oroxylum indicum* and *Thysanolaena maxima* are for malaria and *Ananas comosus*.
Averrhoa carambola, Saccharum officinarum and Syzygium cumini are for jaundice. Most of these species are used in the form of decoctions. The present observation revealed that the Naga tribes are successfully using the traditional healing practices for curing the malaria and jaundice. Each of the herbal healers follow his own practices and differ with the other healer even within a tribe. The phytochemical properties and bioactive principle of many of these species are yet to be evaluated. Selection and critical pharmaceutical studies of some of these species may lead to the establishment of effective drug for the treatment of these most common health problem of the region.

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29 June 2015 | Session 4b | Paper

Effect of cultivation altitude on green tea quality in Eastern China

Tea (Camellia sinensis) is one of the most welcome cash crops in China. The area under tea cultivation is 2.74 million ha in China and accounts of 64% of world’s total tea land. Tea quality is determined by its variety and the environment. Globe warming, especially the extreme weathers have caused serious problems in tea production. However, how climate change influencing tea quality is still largely unknown. The change of tea quality will affect the income of tea producing smallholders, but the choice of tea consumers as well. To simulate the different climate in tea growing areas, we collected tea samples of one bud and two leaves from 5 sites with different cultivation altitudes (from 200 to 1000m) in Lushan mountain of Jiangxi province, Eastern China (higher temperature in lower altitude). Tea quality components, including total amino acids, tea polyphenols and their constituents were analyzed. The results showed that with the increase of altitude, free amino acids (AA) increased significantly, but tea polyphenols (TP) decreased accordingly, resulting in a remarkable decrease of TP/AA ratio, which is one of the most important parameters determined tea taste of green tea. The higher TP/AA ratio, the lower of tea quality is in a certain range. The constituent of free amino acids, especially theanine, glutamic acid, arginine, serine, γ-aminobutyric acid and aspartic acid significantly increased with increase of the altitude. The constituents of polyphenolic compounds, mainly catechins were also changed with the cultivation altitude. The epigallocatechin-3-gallate (EGCG) and epicatechin gallate (ECG) decreased with the increase of altitude, while the epigallocatechin (EGC) and gallocatechin gallate (GCG) increased, making the total catechins no much change in different cultivation altitudes. Percentage of catechins to total tea polyphenols increased with the increase of altitude. These results showed that the amino acids and percentage of catechins to the total polyphenols and ratio of AA/TP will be decreased with the increase of temperature (lower altitude). Since amino acids and catechins are most important tea quality components contributing the taste and health benefit of tea consumers, we could see that green tea quality will be deteriorated with globe warming. Appropriate measures should be adopted in advance to sustain green tea quality.
Factors affecting survival of wild populations of the endangered pepperbark tree (*Warburgia salutaris*) and strategies for propagation

Pepperbark, *Warburgia salutaris* (Family: Canellaceae), is one of the most highly prized tree species in South Africa due to its high medicinal value. SANPARKS established “The Pepperbark Initiative”, a project aimed at focusing on conservation of this species by addressing various issues including both scientific and social aspects. Being a multi-use species, it has become highly endangered, particularly in the Kruger National Park where illegal bark harvesting is being practiced. Known stands of trees are protected by patrolling field rangers who also identify new populations while on patrol. Bark is harvested unsustainably and trees are effectively ring-barked resulting in death of the trees several months after harvesting. Furthermore, flower and fruit set are exceptionally low and when fruits are set, they are parasitized by fruit flies such that seeds are unable to develop within the fruit. To this end, an investigation of which fruit fly species uses *W. salutaris* as a host was conducted. In order to conserve the species and to reduce pressure on wild populations, various propagation methods (*in vitro* and *ex vitro*) were investigated, including methods which could be readily adopted by neighbouring communities to propagate and establish their own trees at their homesteads. In this study, the use of microcuttings was investigated. Aspects investigated included: season of harvest, type and size of microcutting, rooting medium, rooting hormones and rooting microclimate. *In vitro* investigations included a study of explant type at initiation, treatments to prevent phenolic browning of explants and contamination at culture initiation as well as type of culture and growth regulator composition in culture media. The results of the fruit fly study as well as both the *in vitro* and *ex vitro* propagation trials will be presented. This collaborative effort between SANPARKS, the Agricultural Research Council’s Institute for Tropical and Subtropical Crops and SANBI has resulted in significant progress in the propagation of this species.
demand for *W. salutaris* plant products are high with most populations intensely impacted upon due to harvesting for the medicinal plant trade. *W. salutaris* is listed as Endangered both nationally on the SANBI Red List (2009) and internationally on the IUCN Red List (2010). The Kruger National Park (KNP) is host to the largest remaining wild populations of *W. salutaris* in the Limpopo Province. Although the plants are located within the formal boundaries of the park, illegal harvesting of bark from *W. salutaris* trees is occurring, placing the plants under threat of exploitation. SANParks has a formal *Warburgia salutaris* Conservation Programme in place which informed by a structured monitoring strategy of the population of *W. salutaris* occurring in the park. Through the collaborative efforts of SANParks, ARC, SANBI, SAEON and SAPPI the programme is working towards developing an effective propagation system for the species, and improving sustainable harvesting methods for *W. salutaris* outside of KNP, with the long-term aim of reducing the demand and illegal harvesting of the *Warburgia salutaris* trees found within Kruger. The combination of investigating the efficiency of various propagation techniques, communication and workshops with traditional healers, application of structured monitoring of the *in situ* population in the park and distribution of cultivated *Warburgia* plants to neighbouring communities is showing significant success in the long term conservation of *Warburgia salutaris* in the Kruger National Park.

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Ethnobotany of the Little Karoo, South Africa

This botanically intricate and arid area known as the Little Karoo is located within the Western Cape Province of South Africa, stretching from Montagu in the west to Uniondale in the east. An estimated 3 200 species occur in the Little Karoo (Vlok and Schutte-Vlok, 2010) with a deficiency of recorded knowledge on traditional plant uses. A literature study of available information on medicinally used Little Karoo plants showed at least 243 species with an additional nine animal products also used medicinally, however the documentation of this Khoi-San ethnobotany is still greatly lacking. A simplistic approach towards gaining knowledge from available local literature has revealed this shortage of scientifically recorded indigenous plant uses and the need for ethnobotanical assessments. A number of useful quantitative measurement indices based on local literature was calculated as a Literature Frequency Index (LFI) which expresses the percentage of the total references in order to evaluate the local importance of the species. A Specificity Index (SI) that indicates whether a plant has a single specific medicinal use and a Generalist Index (GI) that is the invert of the SI, measuring multiplicity of medicinal uses was proposed as well. Ethnobotanical field surveys permitted us to determine the possibility of undocumented traditional knowledge about plant uses, particularly in the Zoar area. The shortcoming of recorded data reveals the urgency for qualitative and quantitative ethnobotanical survey work to ensure that the indigenous Cape Dutch and Khoi-San knowledge is fully captured for future generations.
The medicinally important genus *Alepidea* (Apiaceae): tackling a taxonomic and conservation conundrum

*Alepidea* is a largely southern African genus, comprising ca. 28 species, several of which are utilized medicinally, for respiratory and digestive ailments. *Alepidea amatymbica* (known as *ikhathazo* in isiZulu, *lesoko* in Sesotho and *iqwili* in isiXhosa) has been ranked as the most frequently sold of all medicinal plant species within Mpumalanga, and second within KwaZulu-Natal. However, it is clear that several species of *Alepidea* are being traded under this name, partly due to its increasing rarity attributed to unsustainable harvesting practices for a burgeoning local and international trade. In order to monitor the trade of the dried rhizomes and determine the threat statuses, a method is needed to identify the species involved. This task is unfortunately impeded by the lack of a working taxonomy for the genus. Species circumscriptions, distribution and identifications are presently very unclear. A comprehensive revision of this genus is therefore imperative to accurately identify species and facilitate conservation decision making. As a first step towards tackling these challenges, we explore which species are most likely being traded and used medicinally through a critical assessment of the ethno-botanical literature and refined taxonomic information, as well as presenting preliminary data on the potential of DNA sequence data for barcoding the species.

Anti-diabetic properties of rooibos – an opportunity to expand the rooibos value-chain or not?

In Africa, South Africa tips the scale with a national prevalence of people with diabetes of over 7%. Given the prevalence of diabetes in South Africa and the apparent ineffectiveness of current oral anti-diabetic drugs in preventing long-term progression of type 2 diabetics towards insulin dependence, standardised plant extracts may present an alternative to single chemical entities. Rooibos (*Aspalathus linearis*) is a source of health-promoting phenolic compounds including compounds with anti-diabetic properties. The ARC and MRC embarked on a strategy to add value to rooibos in the form of an anti-diabetic nutraceutical product. One of the compounds of interest is aspalathin, a dihydrochalcone C-glucoside, unique to rooibos. Three routes of commercialisation of a therapeutic product containing high levels of aspalathin is evident, i.e. aspalathin-enriched rooibos extract, isolated aspalathin and synthetic aspalathin. Considerations in the production of an aspalathin-enriched extract, starting with compositional variation of the plant material and progressing to production of
extract will be discussed. In the latter case the focus will fall specifically on the
application of quality-by-design principles to optimise recovery of aspalathin from the
plant material and to define acceptable ranges of aspalathin as a critical quality
parameter. Based on these and the effective dose to achieve significant lowering of
blood glucose levels, projections for plant material required to treat diabetics will be
presented. This scenario will be placed in context with production of synthetic
aspalathin as alternative route.

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30 June 2015 | Session 6b | Paper

Honeybush as a crop for fynbos areas

Different *Cyclopia* spp. occur naturally in the winter and summer rainfall areas of
the Fynbos region of South Africa. The species are uniquely adapted to the geography,
geology and climate of the region. The formal honeybush industry began in 1999 and
is one of the newest agricultural industries in South Africa. In spite of efforts to
increase commercial cultivation of honeybush to supply in the demand, *C. intermedia*,
which constitutes the highest percentage of production, is mainly harvested in the wild.
Currently there are no policy and guidelines on wild harvesting, although there is
legislation in place to control harvesting in the wild. Unsustainable harvesting may lead
to extinction of honeybush in certain areas. Greater effort to cultivate different species,
including *C. intermedia*, on commercial scale is needed. The aim of the Agricultural
Research Council is to reverse the ratio of wild harvesting to plantation cropping from
the current 75:25 to 25:75 in the next 10 years. Suitable production areas within the
fynbos region were identified, including arable land, previously used for other crops
such as grain and fruit. Six *Cyclopia* species have been identified with potential as
crops and are under investigation. This talk will focus on the challenges of establishing
plantations on farms and communities, as well as give an overview of the research on
production, including plant selection and improvement.

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29 June 2015 | Session 4a | Paper

Medicinal plants used for the management of diabetes mellitus in the O R Tambo
District of the Eastern Cape Province, South Africa

Diabetes mellitus is a chronic metabolic disorder affecting many people
worldwide. In South Africa, the number of diabetics is steadily rising and is projected to
double in the near future. It is imperative therefore to search for alternative and
inexpensive antidiabetic agents. An ethnobotanical survey of plants used for the
management of diabetes mellitus was conducted in targeted coastal communities in
the O.R Tambo District in the Eastern Cape Province. The survey revealed 30 plant
species scattered in 25 families. The family Asphodelaceae tops the list with three representatives followed by Asteraceae, Apiaceae and Hyacinthaceae each represented by two plant species. The rest of the families are represented by a single plant species. Polyherbal decoctions from underground plant parts are the commonly prescribed remedies. Most of these herbal preparations are taken orally as teas. Helichrysum odoratissimum and Harpephyllum caffrum of the families Asteraceae and Anacardiaceae respectively, were the most cited plants used for the management of diabetes mellitus in the study area.

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30 June 2015  Session 8b  Paper

Complementary Medicine (CM) registration in South Africa: Quo Vadis?

The regulations for the registration of Complementary Medicines sold in South Africa were gazetted in November 2013. Accompanying the regulations was a roadmap for all products to be registered and guideline documents for the processes of registering products prospectively and retrospectively. There has been much controversy regarding the definition of complementary medicines, the disciplines currently included (and excluded) and the implementation plan by the medicine regulator. However, many people have also hailed the framework as progressive which will bring sanity to an industry which has been perceived as dangerously unregulated to the detriment of the public and industry itself.

This presentation seeks to give some insight into the regulatory framework in South Africa in general and draw some comparisons with other countries. It will highlight the important issues around Quality, Safety and Efficacy (QSE) requirements of the registration regime now unfolding. In doing this, the presentation aims to create awareness among the public, researchers and industry about the science of medicine regulation and the potential opportunities and challenges which lie ahead.

Disclaimer: The speaker is member of the Complementary Medicines Committee (CMC) of the SA Medicines Control Council (MCC). Please note that the speaker’s views do not represent the official view of the MCC, and given in his personal professional capacity.

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30 June 2015  Session 6a  Paper

Detecting the recent change of satoyama forests using varved sediment from Lake Suigetsu, Japan
Satoyama forest has been formed by constant human interactions to forests. In old time, people utilized forest resources in sustainable way, but recently, satoyama landscape has changed greatly because of the introduction of modern agriculture and forestry during Japan’s rapid economic growth period and the recent shortage of work force in satoyama area. It is said that nearly one third of forests in Japan is satoyama forests and now it is difficult to sustain the condition. One of the main elements of satoyama forest was pine. Pine trees has been used for many purposes, eg. timber and fuel. About 13 percentages of forest is pine in Japan. However, it decreased in a few decades. It is said that pine trees died from pine weevils (Kiyohara and Tokushige 1971), but the outbreak of pine weevils might be ascribe to multiple causes, eg. air pollutions (Endo 2003). After energy revolution, pine forests have been abandoned and pine weevils outbreak might be encouraged by it. Pine withering is serious problem in satoyama forests in Wakasa town, Fukui Prefecture, Japan since 1980s. Therefore, large amount of insecticide has been applied to pine forests. This study aims to clarify the change of forest condition before and after the energy revolution and also detects when pine trees decreased and if it is correlated to the outbreak of pine weevils. Annually-laminated (varved) sediment from about last 100 years to 2014 was recovered from Lake Suigetsu, Wakasa town, Fukui prefecture, Japan. Pollen analysis was conducted every 0.5 mm to reconstruct the vegetation around the lake. The percentages of pine (Pinus subgen. Diploxylon) pollen decrease very recently. Instead, cedar (Cryptomeria) increased. It is the timing of Cryptomeria pollen production increase. Large scale Cryptomeria plantation started from 1950s and based on pollen analysis on Lake Biwa, pollen production increased about 30 years after plantation (Hayashi 2012). From 1960s, the percentages of arboreal pollen, mainly oak (Quercus subgen. Lepidobalanus) increased. Other elements of thickets also increased. This may be caused by abandonment of satoyama forests since 1960s. In any case, the decrease of Pinus pollen corresponds to timing of outbreak of pine weevils, but before the weevil problem manifested, forest condition changed. Pine dying may be caused by multiple causes including the abandonment of satoyama forests. Just spraying insecticide may not solve the problem.

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29 June 2015  Session 4b  Paper

Research towards sustainable production of indigenous crops

South Africa is world renowned for its rich biodiversity, yet the commercialization and utilization of these natural resources is dependent on the availability of quality raw plant material. Raw plant material in sufficient supply and at affordable prices is one of the most limiting factors preventing successful commercialization of developed products, in the natural products industry. Unfortunately the availability of good scientific information on the production of indigenous crops used in the industry is very limited and linking all the different aspects of propagation and cultivation into a viable production system is almost non-existent. There are some exceptions, linked to already established markets, but especially for new product developments, the generation of
production information is of utmost importance. The Department of Horticulture at the Tshwane University of Technology is currently involved in propagation and cultivation research on various indigenous crops with the ultimate aim to develop sustainable production systems. Sustainable production systems include many different aspects linked to propagation, cultivation and pre-processing. A complicating factor that needs to be included in the research is the effect of cultivation techniques on the important compounds in the plants under investigation. Ultimately the compound yield and not the bio-mass yield (in products based on extracts from raw plant material) are the most important yield parameter. The verification of compound yield thus has to form part of sustainable production systems. The presentation will give an overview of all aspects involved in sustainable production as well as a short discussion on some of the crops currently being researched at the Department of Horticulture. Methods for dimorphic seed and cutting propagation of Honeybush tea (Cyclopia spp.) has been developed successfully. An investigation on the leaf cutting propagation of Eucomis genotypes has shown that the physiological age of the mother plant, the genotype and the leaf cutting position influence the survival as well as the production of bulblets from leaf cuttings. Similarly the cutting propagation of Lobostemon fruticosus is influenced by cutting type and rooting media. Seed germination and vegetative propagation of Bulbine latifolia var. latifolia and Xysmalobium undulatum are under investigation and a number of new crops will be included in future.

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Sealed and asleep: the anatomy and dormancies of honeybush (Cyclopia spp.) seed

Honeybush tea, a popular herbal drink, is made from several of the 23 species of leguminous shrubs in the genus Cyclopia, which is endemic to the fynbos biome of South Africa. Increased consumer demand for honeybush tea and its extracts has put harvesting pressure on vulnerable wild populations and necessitated the development of honeybush cultivation programmes. Seed studies are essential as the propagation of honeybush by seed remains problematic. Honeybush seeds are known to be affected by either physical or combinational dormancy, depending on the species' primary fire survival strategy: rapid recolonization by seedlings (seeders) or regrowth from undamaged subterranean rootstock (sprouters). In addition, honeybush species produce colour-dimorphic seeds: both green and brown viable seeds in the same pod. This colour dimorphism has been shown to influence germination response in some Cyclopia species although the mechanism is not yet fully understood. This paper looks at the anatomy of honeybush seeds, investigated through dissection and light microscopy, and discusses the anatomical features of the seeds in relation to seed dormancy and differences in germination response.
The cosmetic application of marula oil: a clinical study

The cosmetic sector is one of the fastest growing markets in the world and natural products such as marula oil have gained popularity as cosmetic ingredients as they are generally regarded as safe compared to synthetic ingredients. As early as the year 2000, marula oil became a popular ingredient in lipsticks, foundations, blushers and eye shadow formulations. The demand increased tremendously such that in 2008 almost US$20 million was spent on marula oil for cosmetic product manufacturing. Marula oil, extracted from the kernels of *Sclerocarya birrea* (Anacardiaceae), is rich in mono-unsaturated fatty acids and reportedly possesses hydrating and moisturising properties. However, scientific confirmation of the efficacy and safety of Marula oil is lacking. This study evaluated the irritancy potential, hydrating and moisturising effect of marula oil on a lipid-dry (xerosis) and normal skin. In addition, the oil composition was determined using two-dimensional gas chromatography. A quantitative clinical trial was conducted between July and September 2014. Healthy caucasian adult female volunteers (*n* = 20) who complied with the inclusion and exclusion criteria for the irritancy patch and moisture efficacy tests participated in the study. Chromameter®, Aquaflux® and Corneometer® instruments were used to evaluate the irritancy, hydration and moisturising effects of marula oil over a period of 96 hrs, 8 days and 30 minutes, respectively. The results revealed that Marula oil is non-irritant (*p* < 0.001), with hydrating properties (*p* < 0.001) when applied to a lipid-dry (xerosis) skin and moisturising (*p* < 0.001) when applied to normal skin. These findings may be linked to the easy absorption of the oil into the skin due to the high percentage of oleic acid (70-78%) and the presence of palmitic acid (9-12%) as determined by GCxGC-MS. It can be concluded that marula oil may be beneficial to include in cosmetic products as it has a soothing, hydrating, and moisturising effect on the skin with moderate prevention of trans-epidermal waterloss which may alleviate premature-aging. In addition, it was shown to be non-irritant.
in the world where nations and economies are increasingly interdependent, young students in developing countries and local ethnic communities often lack critical training, infrastructure, and resources to participate in global health research. Mobile Discovery kit (http://lifehabitat.org) provides a low cost barrier to explore chemical biodiversity of local ecosystems and discover its potential to improve human health by rapidly measuring antimicrobial properties of diverse biological samples from the environment. Use of bacteria from participant’s saliva ensures that no biological samples cross the borders as discovery and intellectual property rights remain with the local community. During pilot stage (Fall 2014), 390 kits were distributed to 289 students and 40 instructors both in a mixture of workshop, high school, and university settings. The participants screened samples from local environments for inhibition of salivary microbial growth and reported a hit rate of 0.3% (>60% inhibition). The most potent antibacterial sample was identified as spotted wintergreen *Chimaphila maculate*, a native Appalachian mountain plant of significance to Cherokee Indian Tribe. In laboratory settings, its extract exhibited >80% inhibition of methicillin-resistant *Staphylococcus aureus* (MRSA) growth at a concentration of 50 ug/ml. In a separate research effort, a set of environmental bacterial isolates from Gauteng region of South Africa was screened for antimicrobial activity using the Mobile Discovery approach. Our results validate and demonstrate the utility of a crowd-sourced science Mobile Discovery pipeline that combines research and education-based learning and provides a powerful tool to identify antibacterial leads from the environment.

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29 June 2015  Session 1  Paper

An introduction to vegetation types of the Cedarberg/Sandveld area and the conservation implications of the commercialisation of an indigenous plant ‘*Aspalathus linearis*”

Rooibos (*Aspalathus linearis*) is rightly celebrated as a healthy tea from the fynbos of the Cederberg and surrounds. With increasing demand both globally and locally, the intensive production of rooibos requires expansion into more natural areas. The Core Cape Subregion of the Greater Cape Floristic Region (previously known as the Cape Floristic Kingdom) is known as to possess one of the richest floras on earth, notable for high diversity and endemism. This talk is a basic introduction to the (fynbos) vegetation types of the rooibos growing areas as well as profiling some of the more than 150 Species of Conservation Concern known to be impacted by rooibos production and discussing the challenges of intensive agriculture in a global biodiversity hotspot.
The influence of traditional governance systems on harvester access to and benefits from devil’s claw (Harpagophytum spp.) in the Zambezi Region, Namibia

Non-timber forest products (NTFPs) can be a major source of income for rural communities in developing countries. Yet these primary producers are often highly marginalised and are typically exploited in trade. While access and benefit sharing (ABS) questions have received considerable international and national attention, their interface with traditional governance systems is poorly understood. Defined as the arrangements and processes between harvesters and community actors and institutions which determine access to and benefits from NTFPs, traditional governance systems may play a greater role in the realisation of benefits for primary producers where customary law and traditional authorities are as influential as national ABS policy and legislation. This paper aims to increase understanding about how traditional governance systems influence harvester access to and benefits from devil’s claw, an internationally traded NTFP through document review, key informant interviews and focus groups in three community conservation areas in the Zambezi region in Namibia. The paper explores the facilitation of harvester access to permits and equipment, the negotiation of pricing by community leaders, and the interface between national ABS policy and local implementation. Key findings focus on the key role played by community leaders and NGOs, the constraints faced by harvesters who have little or no knowledge of pricing and the market and the lack of incentives for optimising benefits for harvesters. The paper concludes that while harvesters are highly dependent on devil’s claw, traditional governance systems may hinder the realisation of equitable benefits.

Exploring phytochemical variation in Warburgia salutaris through chemometric modelling of analytical data

Warburgia salutaris, commonly known as the “fever bark” or “pepper bark” tree and vernacularly as “Ishibhaha”, is an ethnomedicinally important evergreen tree. It is found both in the wild and is grown commercially in KwaZulu-Natal, Mpumalanga and Limpopo in South Africa. The tree also occurs in Zimbabwe, Swaziland, Mozambique, Malawi and Lesotho. A wide range of traditional uses has been reported for this tree. Most notably, it is used as an antibiotic for bacterial infections and also reportedly displays antifungal, antiprotozoal, antioxidant and anti-inflammatory activities, which have been attributed to the presence of sesquiterpenes. These include the compounds polygodial, mukaadial, warburganal and muzigadial in leaf and bark extracts. This is the
first report on the chemical composition of the volatile fraction from *Warburgia salutaris*. Hydrodistilled essential oils were analysed by one dimensional gas chromatography and indicated that the monoterpenes (myrcene, Z-β-ocimene and E-β-ocimene) were the most abundant essential oil components. These compounds have been identified in other *Warburgia* species. However, α-pinene, germacrene D and limonene, have not been previously reported for any other *Warburgia* species. Chemometric analysis of the volatile fraction using two dimensional gas chromatography coupled to time-of-flight mass-spectroscopy revealed both inter- and intrapopulation variation in the profiles. The compounds responsible for the subpopulation variation were identified as the monoterpenes (myrcene, myrtenal, E-β-ocimene), the sesquiterpenes (germacrene D and E-α-farnesene) and the terpene alcohol, linalool. Seasonal variation in the chemistry of the leaf material was also observed. The samples clustered according to the season in which the leaf material was harvested.

An investigation of the non-volatile fraction of the leaf and bark material using ultra high performance liquid chromatography coupled to mass-spectroscopy is currently underway. Initial studies indicate that the phytochemistry of the non-volatile fraction is also influenced by geographical location, genetic traits and the maturity of the tissue.

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2 July 2015 Session 10b Paper

**Structure elucidation of *Staphylococcus aureus* quorum sensing inhibitors from a traditional South Italian treatment for skin infection**

Plants are commonly used in traditional medicines for the treatment of infections as they produce an enormous variety of bioactive small-molecules; however many exhibit only weak antibiotic activity. Nevertheless, plants successfully “fight infections” and evidence is mounting that some traditional treatments for infection are effective in a non-biocidal manner. One important target for anti-infective therapies is *Staphylococcus aureus*, which has been identified as a serious threat to human health in the USA. This is due in part to rising rates of resistance seen in hypervirulent strains of *S. aureus* that produce high levels of virulent exotoxins. Virulence is controlled by an intercellular quorum sensing mechanism that is regulated by the accessory gene regulator (agr) system. Quorum sensing inhibitors (QSI) interfere with the agr system, lowering the production of exotoxins, and thus blocking virulence in a non-biocidal manner. A screen of over 100 Italian plants resulted in identification of a QSI rich methanolic extract (224) from the leaves of a tree used in traditional treatment of skin infections and inflammations in southern Italy. We ask the question, which compounds are responsible for the QSI activity observed and is their activity synergistic in nature?

Through partitioning and repeated chromatography of Extract 224 guided by QSI assays for all agr alleles and HPLC analysis of exotoxin levels, several compounds with quorum quenching activities at sub-inhibitory concentrations for growth were identified. The Extract reduced the exotoxin production by up to 72.5% when compared to vehicle alone in the HPLC analysis. The ethyl acetate partition of the MeOH extract...
(224C) further reduced exotoxin production to 87.1%. However, the most active subfraction of 224C was not as effective, reducing exotoxin production to 77.1%, suggesting synergistic effects. The most active compounds from 224C were purified by semi-preparative HPLC and their structures elucidated using LC-FT-MS and NMR spectroscopy.

The effect of rooting media and plant growth regulators on rooting of *Cyclopia subternata* stem cuttings

Honeybush (*Cyclopia* spp.) is an endemic South African fynbos plant that grows along the coastal and mountainous regions of Eastern and Western Cape provinces. The current economic value of honeybush lies in its use as an herbal tea. The variation in the quality of honeybush produced at present has prompted a need to find alternative means of propagation other than by seed. This research project was aimed at optimizing propagation and adventitious rooting techniques of honeybush stem cuttings. The specific objective of this study was to determine the rooting response of *C. subternata* stem cuttings in different rooting media and plant growth regulators (PGRs). The present research was carried out in a plastic sheet roofed tunnel with 40% shade netting to study the effects of three rooting media i.e. sand and pine bark (1:1 v/v) (Bark mix), sand, polystyrene balls and peat moss (1:1:1 v/v/v) (3mix) and peat moss and sand (2:1 v/v) (Peat mix) and three PGRs (Seradix® B2, Seradix® B3 and Dip & Root™) on rooting potential of *C. subternata* stem cuttings at Agriculture Research council (ARC) Infruitec-Nietvoorbij, South Africa. The experimental design was a factorial design in a randomized complete block with three replicates. Data on cuttings rooted, cuttings survived, length of roots and mass of roots were collected after 63 days of plant’s growth and statistically analysed using ANOVA. Results showed that the different rooting media and different concentrations of PGRs significantly affected the rooting of *C. subternata* stem cuttings. The highest survival rate, rooting percentage, root length and root mass were recorded with Seradix® B2 and Seradix® B3 growth regulators, while cuttings treated with Dip & Root™ growth regulator significantly had lower rooting success. Cuttings propagated in Bark mix and 3mix had higher rooting and survival percentages, longer roots and higher root mass than the cuttings propagated in Peat mix.

Ethnobotanical review of Vhavenda plant uses

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Vhavenda people had a rich social culture intrinsically embedded to the natural environment with their livelihood dependent on its sustainable utilization. Vhavenda plant uses had been documented through several studies that had reported on different categorical uses ranging from medicinal, vegetables, fruits, beverages, firewood, building construction, art and craft. Some of the plants species had been recorded to be utilized in more than one category. To access the information on Vhavenda plant uses, several studies were consulted followed by an ethnobotanical rapid rural appraisal survey within Vhembe District Municipality. Data collected was used to analyse the family categorical trends of plant species usage. The overwhelming majority of plants was reported to be used as medicine for humans and animals healthcare, followed by fruit plants, then vegetable, firewood, art and craft, construction and lastly beverage. Ethnobotanical rapid rural appraisal survey revealed an informative data on plant trend uses from earlier times to present. Data collected using interviews show less plant uses from earlier time to present.

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29 June 2015  Session 4a  Paper

Ethnobotanical survey of invasive alien plant species used for medicinal purpose in the Capricorn District, Limpopo Province

Invasive alien plant species (IAPs) are plants that have migrated from one geographical region to non-native region either intentional or unintentional. The general view of IAPs in environment is regarded as destructive to the ecosystem and they pose threat to native vegetation. However, some invasive plant species are harvested for medicinal usage by local people. The aim of the study is to conduct ethnobotanical survey on medicinal usage of invasive plant species in Capricorn District, Limpopo Province, South Africa. An ethnobotanical survey on invasive plant species was conducted to distinguish species used for the treatment of various ailments in the Capricorn District, Limpopo Province. A guided field work by traditional healers and a semi-structured questionnaire was used to gather information from the traditional healers. Furthermore, a questionnaire was designed to gather information on the common names, plant part used, preparation, administration and illnesses treated were recorded for each species. The study revealed that more than twenty invasive plants are used for treatment of various diseases such as chest complaint, infertility, mental disorder, hypertension, HIV, drop, cough and swollen legs. These plant species belong to 9 families of which Myrtaceae and Papaveraceae are dominant. Roots, leaves, bark and stem, seeds and fruits are used for the preparation of medicine while decoction was the general method of preparation.

Keywords: Invasive alien plant species, Ethnobotanical survey, Traditional healers
Nutraceuticals from *Cyclopia* - Ultrafiltration as a green technology to enrich bioactives

*Cyclopia genistoides* (honeybush) has been earmarked as a resource for the production of extracts enriched in the xanthones, mangiferin and isomangiferin, due to naturally high levels of both compounds in unfermented plant material and successful cultivation. Extracts enriched in these xanthones have application as nutraceuticals due to potential health benefitting properties indicated by a wide range of bioactivities attributed to mangiferin and isomangiferin, a regio-isomer of mangiferin. Single factor experiments were employed to determine the optimal extraction conditions to achieve high extract yield, xanthone yield and xanthone content in the starting extract for enrichment procedures. Extracts high in xanthone content were then subjected to ultrafiltration techniques aimed at increasing xanthone content and with upscalability for industrial applications in mind. A variety of small laboratory-scale ultrafiltration devices (centrifugal, stirred cell and tangential flow membrane systems) were employed in a process of elimination to achieve the most suitable membrane materials, molecular weight cut-off (MWCO) and feed concentrations to achieve permeates high in mangiferin and isomangiferin content. Of the three types of devices used, tangential flow systems proved the most applicable to industrial purposes due to ease of upscalability, the relatively lower fouling index achieved as well as the higher level of control over operating parameters, i.e. transmembrane pressure (TMP) and feed flow rate. The full procedure, from extraction to ultrafiltration, was validated by processing ten different batches of unfermented *C. genistoides* and a strong linear correlation ($R^2 = 0.98$) was found between feed concentration and permeate yield when regenerated cellulose membranes were used. Regenerated cellulose membranes, with 10 kDa MWCO, were the most effective in the enrichment process yielding average enrichments of 20% and 22% for mangiferin and isomangiferin, respectively, at TMP of 2.04 bar and a feed flow rate of 444 mL/min.

The ecological impacts of bark harvesting in Cweza Indigenous Forest of the Eastern Cape Province, South Africa

In South Africa, indigenous forests cover only 0.3% of land surface. The general knowledge is that indigenous forests offer numerous benefits to the adjacent communities. A study on the ecological impact of bark harvesting was conducted in
Cweza Indigenous forest of Engcobo in the Eastern Cape Province. Generally the Cweza indigenous forest offers numerous benefits to the adjacent communities of Engcobo. This research looked at the ecological impacts of bark harvesting on the ecosystem services provided by the Cweza indigenous forest and also identified the mitigation measures for the impacts. Assessment of bark damage, crown condition and tree health was undertaken. Results showed that bark harvesting affected the rate of survival, growth and reproduction of harvested tree species. The study proposes the implementation of extensive monitoring of the rate of bark harvesting in the forest and community engagement in forest resource management as the way of mitigating the impacts of bark harvesting in the forest.

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29 June 2015 Session 1 Paper

Rooibos and human health

Humans are constantly seeking to advance their health and alleviate various ailments with herbal remedies. The past decade has revealed evidence that a flavonoid-rich diet may offer a strategy for the prevention of important lifestyle diseases. Strategies to ensure increased intakes of flavonoids could therefore include the addition of tea and/or herbal teas such as rooibos to the diet as a “health boosting” or “disease preventing” option. The anecdotal health properties of rooibos tea has attracted great interest with an exponential growth in the number of scientific articles reporting on various biological activities of rooibos since the 1990s, with the past decade yielding the most peer-reviewed articles. In spite of rooibos flavonoids’ low bioavailability, an increasing number of studies are reporting promising in vivo activities derived from human studies. In this regard, studies in cardiovascular disease show rooibos to be beneficial to heart health. The various mechanisms playing a role in protection of heart health includes the inhibition of the angiotensin-converting enzyme positive modulation of the lipid profile, i.e. decrease in serum LDL-cholesterol and triacylglycerols and concomitant increase in HDL-cholesterol levels, and improved redox status, i.e. increase in the levels of reduced glutathione resulting in an increased ratio of GSH:GSSG. As secondary objectives to one of these studies, consuming fermented/traditional rooibos daily for 6 weeks were shown, 1) not to affect the iron status of adults at risk for developing coronary heart disease and, 2) lowered the cortisol:cortisone ratio significantly. These studies will be discussed in more detail in the presentation. These results make unique and important contributions to our current knowledge about the health aspects of this proudly South African herbal tea, allowing the rooibos industry to improve their competitive edge while providing them a unique marketing opportunity and by adding value to their existing products. These encouraging results warrant future well planned and executed human studies.
Effects of cold pre-plant treatment temperature on *Lachenalia* cultivars

*Lachenalia* species have been grown as garden plants and widely used as bedding plants and pot plants all over the world for more than a century. Several cultivars with flowers colours ranging from red to yellow have been developed in South Africa in an attempt to commercialise the crop. The single largest constraint to successful pot plant production in the countries in the Northern Hemisphere (where the export market is), is the fact that different plants in one pot tend to flower at different times resulting in unevenness which compromises the quality of the potted product. Temperature is the major external factor controlling growth, development and flowering in flower bulbs. In this study, the effect of storage temperatures on evenness, quality and glass house period of *Lachenalia* pot plants was investigated. A factorial design with randomized blocks was used. Flowering size bulbs of two *Lachenalia* cultivars (Ronina and Rolina) were used which were stored at five different temperatures prior to planting for different periods. Data collected included flowering date, evenness and inflorescence length. In general, there was a decrease in the glasshouse period with an increase in the duration of the cool temperature storage. Both flowering date and number of flowers were significantly influenced by the storage treatments for both cultivars. Cool pre-plant treatments did not have a significant effect on the even flowering of cultivars. Cultivar Rolina in general flowered more evenly than cultivar Ronina.

In and out of Africa: the early import, dispersal and export of *Cannabis*

Initial arrivals of *Cannabis* in the African continent via human agency appear to have occurred relatively late after people had spread out of Central Asia through Southwest Asia and the Eastern Mediterranean regions. These early arrivals probably involved drug plant varieties of *C. indica*, rather than fiber varieties of *C. sativa*. By 1500 C.E., *C. indica* was relatively wide spread in some regions of Africa where it was used primarily for mind altering purposes. Where and when did the early arrivals of *Cannabis* in Africa occur? How and why did it eventually spread over much of the large continent, especially in the eastern and southern regions of Africa? And how and why were the plants and their psychoactive use, at least to some degree as ritual drug plants, moved to the New World. A review of the archaeobotanical, archaeological, ethnobotanical, anthropological and historical literature along with selected oral traditions are used to provide plausible answers to these questions. Early exploration
and commercial trade between Western Europe, the Middle East and Africa and later between Africa and the Americas, often involved the dreadful slave trade. This profitmaking trade in marketable commodities including forced and indentured labor played a significant direct and indirect role in the cultural spread of Cannabis over time. The use and transfer of drug Cannabis, principally by sailors, merchants, indentured laborers and the slaves themselves, underscores the profane and some cases sacred aspects of Cannabis use for its mind altering effects. The agents of dispersal and the transported landscape aspects of both cultivated and weedy Cannabis from regions of Africa to a number of areas in the New World are identified and discussed in this study.

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30 June 2015 Session 8a Paper

Giving crop accessions a context: the need to include ethnobotanical metadata in large-scale initiatives

Global initiatives have emerged that aim to create databases linking and providing access to genotypes and phenotypes of the world’s food crops (e.g. DivSeek). While these resources will be tremendous in moving crop improvement forward, other metadata should not be left behind. Historic geospatial and ethnobotanical data for crop accessions can be greatly informative for building predictive models of fitness of crop genotypes in different environments and cultures. These data could also boost the efficiency of workers using these databases because they would expedite learning crop histories that explain complex evolutionary patterns, such as reverse bottlenecks (Webster, 2011), where past selection occurred for now undesired traits, and build understanding of ancestral traits. Using specific examples, this paper explains the benefits these metadata could provide to diverse stakeholders, and lays out a preliminary categorical structure based on prior species-level meta-analysis experiences. As people work to breed multiple traits—for example, for good flavor, high yield, and salt tolerance—geospatial and ethnobotanical data may guide breeders to choose the best genotypes. For example, some accessions with high yield and tolerance may be used for fodder, but seldom used for human food, suggesting low palatability. Further, the spatial data showing where crops with certain phenotypes have historically been grown may reveal linkage between crop traits, standing in for the shortage of deep phenotyping data compared to genotyping data. The current development of these global informatics resources should include input from interdisciplinary fields so it may build an infrastructure that encourages inclusion of these alternative datasets. The preliminary structure proposed here is derived from a micro-evolutionary reinterpretation of Meyer, DuVal, and Jensen, 2012.

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Traditional uses of cola nuts by Mandé peoples

The present paper surveys the uses of cola nuts by Mandé peoples (Bamana (Bambara), Dan, Looma, Maninka, Mandinka, Mende, Soso, Tura, and others) inhabiting the countries of the south coast of West Africa, north of the Gulf of Guinea including Mali, Burkina Faso, Niger and Chad. The cola nuts are the seeds of Cola nitida (Vent.) Schott. et Endl., C. acuminata (P. Beauv) Schott. et Endl, and several other species of Cola (Malvaceae). The chewing of these seeds as a caffeine-containing stimulant is a popular custom among Mandé just as along other West African peoples. Besides that, some Mandé peoples make use of cola as a dye plant. The reddish-brown dye made of cola nuts is used by Kpelle to manufacture of the sacred cloth, while the Beng mothers draw protecting ornaments on faces of their children with the cola sap. At the same time, cola nuts carry a great symbolic value in the Mandé cultures, and, therefore, they are involved in various social interactions. Cola nuts can function as a gift manifesting hospitality and respect, or as a paying medium that can substitute money in certain occasions, or as a communication tool in some rituals (e.g. the Looma rite of child transfer from maternal to paternal lineage or the Tura expiatory rite). The symbolic meaning of cola nuts depends on their color and size, which vary between the varieties of Cola nitida (i.e. big red seeds found in C. nitida var. rubra, big white seeds in C. nitida var. alba, small pink seeds in C. nitida var. pallida, and small red, white and pink seeds cooccurring in C. nitida var. mixta), as well as on the number of well-developed cotyledons and their lobules. For instance, the Bambara attribute extraordinary power to the seeds with three “cotyledons”, i.e. with one entire cotyledon and another one divided into two lobules. Although the cola nuts were used in a range of animistic practices, their consumption has been approved by Christianity and Islam in the course of their advancement in West Africa, and they even became part of some religious customs (e.g. cola nuts are considered appropriate donation to the imam of a mosque for the wedding ceremony).
16% were removed to make brushes and 2% cut and discarded. Although the number of harvesters had increased during the last decade, most felt that the number of palm plants had remained stable or even increased over the same period. There was a strong consensus that cut fronds were replaced within two months, after which a particular stem could be harvested again. Harvesting and trade were practiced largely by middle-aged to elderly women, who had limited formal education, skills and employment prospects. Most had entered the trade because of cash income poverty. The main markets for selling the palm hand brushes were in nearby urban areas. The income earned from the trade was modest, but still rated highly by the traders, for most of whom it was the second most-important source of cash income. The study also evaluated the level of household use of palm brushes. For many users, the use of palm brushes was found to be the only type of brush suitable for cleaning mud and cow-dung flooring and most importantly for many, their use forms part of a long household use history and culture.

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Traditional plant use of the Bapedi in Central Sekhukhuneland

Sekhukhuneland forms part of the cultural home of the Bapedi, one of the well-known ethnic groups in South Africa. Until relatively recently the people were totally dependent on the environment as a source of food, medicine, building material and crafts, so that the indigenous plants form part of their cultural identity. Bapedi plant use is relatively poorly recorded except for a pioneering study on food plants by Quin and recent contributions on medicinal plants by Semenya and co-workers. The aim of the study is to compile a detailed inventory of useful plants of Sekhukhuneland, including their correct scientific and common names and main uses. This presentation will outline the knowledge that still resides in Sekhukhuneland according to a quantitative survey (using the Matrix Method) conducted in three villages. An inventory of 170 plants was compiled from literature, herbarium records and own observations. Comparisons are made between extant indigenous knowledge and the data in scientific literature. There is an obvious need for an updated comprehensive catalogue of Bapedi traditional knowledge on plants and their traditional uses.
Economic consequences of crown-fire on Oyamel (Abies religiosa) at El Chico National Park, Hidalgo, Mexico

El Chico National Park is located at the Southeast of center Mexico at the side named Sierra of Pachuca, which is included on the Trans-Mexican Volcanic Axis. It is the first Protected Natural Area of Mexico decreed on 1898. Because of its location the Park is a mosaic of steep slopes, low relief stripes and extended valleys. The Sierra of Pachuca flora is rich and varied as reflect of its environmental characteristics, standing out emblematic species as oyamel fir (Abies religiosa), pines (Pinus spp.) and oaks (Quercus spp.). Abies forest are not an easy prey of fire because are considerably wet and with no grasses, even though are consider as a fire-sensitive ecosystem by the phenomena of crown fire which is characteristic of this kind of vegetation. The municipalities of Mineral del Chico, Real del Monte and Pachuca based a big part of their economic incomes on the El Chico National Park with activities such as ecotourism, timber products and non-timber forest products as fungus, fir foliage festoons and tejamanil (fir timber used for construction and scaffolds). One of the principal causes of forest fires are the Park visitors with their bonfires and the incorrect use and extinction of them, leaving sparks and flammable materials carried by the wind causing crown fires. The majority of the fires are recorded on the shore road and easy access visiting sites. This fires decrease substantially the scenic and landscaping importance of the park dropping down the number of visitor and leaving out of raw material for timber and non-timber fir products.
Western Cape. Fecundity was also determined from two natural populations of each species and compared to that of cultivated material. Seeds were collected and weighed to determine seed mass and evaluated for germination rate and cumulative germination per site. Statistical analysis revealed species differences between and within sites. Compared to *C. genistoides*, *C. subternata* had significantly higher fruit set, seed set, seed number and $1/T_{90}$ germination. However, average seed mass of *C. genistoides* was higher than that of *C. subternata*. In *C. subternata*, seed mass/plant was inversely proportional to seed number, whereas, in *C. genistoides*, no such pattern was observed. Generally, cultivated genotypes of *C. genistoides* showed higher fecundity than natural growing genotypes, whereas fecundity varied significantly between cultivated and natural genotypes in *C. subternata*. $1/T_{90}$ germination varied between and within species in all sites, and directly affected final germination. Our findings show greater fecundity in *C. subternata*, which is a non-sprouter; therefore this species will likely have a higher population, better seed germination and establishment rate, in cultivated and natural environments, than *C. genistoides*, a sprouter. In contrast, *C. genistoides* may be expected to have a higher potential to withstand hazardous environments.

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2 July 2015 | Session 11a | Paper

**Extant forest plantations as apotential bridge between social needs and ecological management (El Salvador and Niger)**

In the face of global deforestation, the management of areas of high conservation concern can subjugate social interests. As a response to the growing human-environment interface and the use of forests for subsistence, plantations became popular during a command-and-control period of management. Many plantations were subsequently protected from harvest as conservation awareness increased, resulting in off-limits plantations which has caused undue impact on surrounding natural forests. In this paper, we analyzed case studies of plantations from El Salvador and Niger for commonalities. Our Case study analysis found the following commonalities: utilizing plantations for sustainable harvest can reduce animosity between managers and stakeholders; plantations can serve as a risk-averse testing ground for novel managerial practices; and the sustainable harvest of plantations can reduce deforestation and impacts on biodiversity in natural remnant forests. We argue that extant plantations can become the epicenters of social and ecological conservation through a management shift to sustainable harvesting. Similar management shifts can be applied in other social-ecological systems by taking stock in local stakeholders’ needs as well as past management relics that no longer serve ecological goals. By focusing on these relics, managers can work with stakeholders to change unduly burdening restrictions and promote cooperation between conservationists and local populations.
Molecular fingerprinting in species of honeybush (*Cyclopia*)

Honeybush tea is made from various *Cyclopia* species which are endemic to the fynbos biome of South Africa. It has become increasingly popular as a result of its reported health properties and this has promoted the export of large quantities from South Africa. Accessions of several species of *Cyclopia* are currently cultivated at the Agricultural Research Council (ARC) as a gene bank for a formal breeding programme to improve honeybush genetically and to protect these species. Despite its commercial importance, very little genetic information is available for the genus and no genetic markers have yet been developed for any of the species. Further molecular work is therefore required for applications in plant breeding practices such as the identification of clones and the assessment of genetic diversity. The aim of this project is to use microsatellite markers, also known as simple sequence repeats (SSRs), to assess genetic diversity as well as to DNA fingerprint the different *Cyclopia* accessions that are currently in the ARC germplasm collection. Twenty two microsatellite markers have been developed for the commercially important *C. subternata* and transferability of the markers has been tested on *C. longifolia* and *C. genistoides*. Results of the marker transferability study and preliminary genetic data analysis on the molecular fingerprinting of the germplasm collection will be reported.

Number, color, plant, and animal terms in Tandroy: The indigenous knowledge in Tandroy in Madagascar

This presentation examines the indigenous knowledge and culture of the Tandroy people, native to the southernmost part of Madagascar. Specifically, I illustrate with real-life linguistic data gathered during my field research how the knowledge of medicinal plants, co-existence with animals, and application of natural phenomena are reflected in the expressions and proverbs relating to color, number, and plant and animal terms in the Tandroy language. Tandroy is a Malagasy language, belonging to the Austronesian language family and has not yet received adequate linguistic description. Tandroy people preserve a nonliterate society that does not place value on written materials, but preserves a rich oral tradition descended from generation to generation. While anthropologists and ethnologists have engaged in cultural descriptions and have provided detailed and accurate information on Tandroy ethnography (Decary 1930-33, Heurtebize 1981 etc.), the Tandroy language has gone unstudied by linguists. My ongoing research in Madagascar aims to make the Tandroy language available to linguists and to further our understanding of indigenous Tandroy culture. After a brief introduction of the structure of the Tandroy language, I first illustrate the significance of numbers in Tandroy culture. As is not uncommon cross-culturally, certain numbers hold special significance in Tandroy culture, a typical example being the number seven, *fito*, which appears in a variety of expressions. For
instance, *miteraka fito lahy* (literally “to breed seven men”) has the figurative meaning “to have many children,” *fanahy fito loha* (literally "spirit-seven-head,"’) means “wisdom,” and *hady fito sosona* (literally “hole-seven-layer,"’) means “a very big hole.” I also illustrate the ancient method of money counting recorded in historical documents. Second, I show that color terms can be generally used as adjectives, and illustrate the morphological operations such as affixation or reduplication that can be applied to them in expressions. Lastly, by showing data on expressions using plant and animal terms, I shed light on the indigenous knowledge of the medical use of plants and on certain social morals that are preserved in Tandroy society.

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2 July 2015 | Session 10a | Paper

**Integrating customary and statutory systems: possible directions for equitable trade of Prunus africana in Cameroon**

The tropical rain forest of the Congo basin is endowed with abundant high value indigenous tree species. Many rural household depend on these resources for their food, medicine, and construction needs. More over some of these products are traded internationally, significantly contributing to the economy of the countries of the region. *Prunus africana* is a major Non Timber Forest Product (NTFP) identified in Cameroon. Its bark is also the raw material in health supplements and drugs used to treat prostate problems. It is a major income source for forest based communities and enterprises (Laird et al. in press; Franzel et al., 2009). However *Prunus africana* has been subject to special attention because of its inclusion in Annex II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The NTFPs including *Prunus africana* have always been governed by customary and statutory laws (Laird et al. 2010; Ndibi et al., 1997). Information’s were collected using field survey, field observations, group discussion, interviews and reviewing literature from Ministry of Forestry and Wildlife (MINFOF). The benefits to local communities from involvement in *Prunus africana* activities are a significant incentive for their commitment to the conservation of these species (Ndam et al, 2008). The income earned from the trade could be increased if communities reviewed their internal organization and partnerships with exporters or processing industries and the legislatives and regulatory frame work as well as adding value to their product in order to meet industrial or international trade standards. Mount Cameroun Prunus Management (MOCAP), a Community Based Company has realized the high importance of *Prunus africana* in poverty alleviation (Nkuinkeu, 1999). Nowadays the tendency is to get more involved in sustainable bark harvesting activities in general and the production to marketing in particular. A Memorandum of understanding (MOU) commissioned by the forest authorities is aimed at authorizing the local population represented and organized by MOCAP to exercise theirs user’s right by collecting the bark of *Prunus africana* in the Mount Cameroon National Park. This paper will address
policies and strategies that can enable communities based organizations to reap greater benefits from their forest resources for improved livelihoods.

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Medicinal ethnobotany of the Kamiesberg, Namaqualand

Namaqualand is famous throughout the world for its spectacular display of flowers during spring time as well as its high level of plant endemism. Historically the Nama people were concentrated in the highlands of the Kamiesberg area in Namaqualand and seasonally migrated to other parts of Namaqualand. The Nama is the largest division of the Khoi (pastoral-nomadic) people, one of the most ancient of human cultures. The Kamiesberg area is therefore considered an important Khoisan and Nama cultural centre. With a large number of useful plant species and specifically the ethnomedicinal plant species in the Kamiesberg, the need for urgent detailed documentation and quantitative analysis of medicinal plants and their traditional uses were highlighted. During four research visits to the Kamiesberg, semi-structured and structured interviews were conducted with 24 local inhabitants of the Kamiesberg, mostly of Khoisan decent. The towns in the Kamiesberg visited during the study included: Kamieskroon, Lelefontein, Nourivier and Paulshoek. In addition to the standard methodology, a newly developed Matrix Method was used to quantify medicinal plant knowledge. Results indicated that the Kamiesberg is an important centre of extant Nama ethnomedicinal information and that some of the plant knowledge is rapidly disappearing, especially in the younger generation. Of a total of 101 medicinal plants, 1375 anecdotes and 21 species were recorded for the first time as having traditional medicinal uses and 284 medicinal use records were new to literature. The relative importance, popularity and uses of the plants were quantified. The 97 newly documented vernacular names include 23 Nama (Khoekhoegowab) names and an additional 55 new variations of known names. The calculated Ethnobotanical Knowledge Index (EKI) and other indices quantified the level of knowledge and will allow for future local, regional and even global comparisons. The data obtained from this study is not only of considerable historical and cultural value, but allows for fascinating comparative studies relating to new species records, novel use records and the spatial distribution of traditional plant use knowledge within the Cape Floristic Region. It also gives a new perspective on the Khoisan traditional medicinal system.

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Indigenous knowledge on Cucurbita landraces from northern KwaZulu-Natal, South Africa

Ethnobotanical knowledge on local Cucurbita landraces was documented in three district municipalities of northern KwaZulu-Natal, South Africa. Seven distinct landraces of C. argyrosperma, C. maxima and C. pepo were identified by local (isiZulu) names as iNhlwathi emhlophe, iNhlwathi emnyama, iPhuzi, isiPhama, iThanga, uMpampini oluhlaza and uMpampini ophuzi. The majority had leaves with silvery-white mottling in axils of leaf veins, but isiPhama and uMpampini oluhlaza had uniformly green leaves. INhlwathi emhlophe and iNhlwathi emnyama had the largest fruits and isiPhama had the smallest. Landrace iNhlwathi emnyama maintained its green fruit colour at maturity, while iPhuzi changed to plain yellow/orange fruit colour before maturity. The isiPhama, uMpampini oluhlaza and uMpampini ophuzi had sparse to moderate stem branching habit and the sweetest, less watery fruits of them all. Seed colour ranged from cream to white. Cucurbita landraces were mainly intercropped with maize, in intermittent wetlands particularly in spring and summer. These landraces were mostly fertilized by cattle manure during planting. Shoot tip harvest for vegetable purposes started in about two months from seeding. Insect pests were the main problem during production of these landraces. Farmers retained seeds from previous harvest for future planting. These seeds were stored mostly in tightly sealed glass bottles or any available containers, for a maximum of three seasons. This study was the first attempt to record the types of Cucurbita landraces that are grown in South Africa. It recorded the presence of C. argyrosperma for the first time in this country. It also has a first record of moles, Mopane worms and termites as pests that affect pumpkin production.

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2 July 2015 | Session 12 | Paper

Cultivation, uses and essential oil composition of Artemisia afra: A review of current status in South Africa

The Artemisia genus is amongst the largest and most widely distributed genera of the Asteraceae family. Members of this genus have unique scent and taste, and are of distinctive botanical and pharmaceutical interest. Essential oils of the Artemisia spp. have high demand on international markets. In South Africa, about 27 million people depend on traditional medicine for their health care needs. Artemisia afra is used for treating a variety of ailments such as coughs, colds, headaches, dyspepsia, loss of appetite, colic, whooping-cough, gout, asthma, malaria, diabetes, heart inflammation, rheumatism etc. The plant materials (for medicinal purposes) are collected from the wild, which results in variations in supply and quality due to shortage of labour at certain times of the month, stage at which the plants are harvested, veld fires, etc. The intensive harvesting of these medicinal plants for commercial trade in South Africa poses a threat to many species, including A. afra. To sustainably meet the demand and to mitigate threat of extinction, cultivation can be an option. However, cultivation is hindered by several constraints such as difficulty to propagate and lack of experience.
with proper cultivation requirements. In general, chemical fertilizer applications increase yields for many different crops. But little is known about the response of *A. afra* on fertilization. Essential oil biosynthesis is also affected by climate. The main components of the volatile secondary metabolites identified in *A. afra* vary in plants collected from different geographic regions. For example, artemisyl acetate was found to be the major constituent in Ethiopian oil, while 1.8-cineole was found to be a major constituent in Kenyan oil. In Zimbabwe, α- and β-thujone was the major constituent while only α-thujone was found to be the major constituent of South African oil. Studying the environmental conditions and agronomic practices that influence yield and quality of *A. afra* is, therefore, a prerequisite for cultivation.

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2 July 2015 | Session 11a | Paper

Socio-ecological assessment of ecosystem services by urban green infrastructure in residential yards of a tropical city

The resilience of urban areas, were more than half of the world population lives dependent on the ability of the urban space to maintain simultaneously certain human and ecological functions. A key component is residential green infrastructure, which provides opportunities for the provision of localized key ecosystem services because humans have direct (and indirect) impact on socio-ecological characteristics on these areas through management decisions. On the other hand, the management discourse advocates the use of native trees as sustainable landscaping/urban forestry practices, but the differences in ecosystem services by native or non-native vegetation have been rarely quantified. In order to improve strategies for green infrastructure management, both social and ecological drivers need to be considered. This study addresses ecosystem services production by residential yards as green infrastructure within the R'o Piedras Watershed in conjunction with the San Juan ULTRA-Ex collaborative project. We address questions related to perception and attitudes toward urban residential native and non-native vegetation, how these social drivers are associated to the actual management of green spaces, and the use of an ecosystem assessment tool to evaluate the provision of ecosystem services in residential yards. We found that perceived benefits were numerous with emphasis on atmospheric/climate services (shade, lower temperature, air purification) followed by provision (food) and cultural services (aesthetic value). The distribution of these ecosystem services varies across different socio-economic groups in the city. The use of economic valuation will reveal the provision of these ecosystem services considered important by San Juan residents. By evaluating the structural composition of yards vegetation we will be able to assess their monetary equivalence and the differences in ecosystem services provision among native and non-native species.
The use of natural coumarin derivatives to combat mycobacterial infections, focusing on biofilm inhibition

Coumarins were first isolated in 1820 from *Dipteryx odorata* commonly known as the tonka bean. These molecules are fragrant organic compounds that fall under the benzo-α-pyrone class of chemical compounds. Coumarins occur naturally in several plant families and have shown ample biological activities in previous studies. In the present study ten coumarin derivatives were tested for multiple activities related to Mycobacterial infections. Tuberculosis remains a burden in many countries in the world, especially Sub-Saharan countries. It is also estimated that a third of the world’s population is infected with *Mycobacterium tuberculosis* (M.tb), known as non-active latent infection, which can activate into active TB at any given time if favourable. It is believed that M.tb employs some mechanism to evade chemotherapeutic attack and human immune responses. This has been linked to a quorum sensing regulated biofilm growth habit that the bacteria activate in primary hypoxic granulomas. Antimycobacterial and antibiofilm assays were conducted to determine the efficacy of the coumarins. It was found that the antibacterial activity was medium to high with Minimum inhibitory concentrations ranging between 50µg/ml (Sample U1, U2) and 100µg/ml (Samples U3, U4). Cytotoxicity was done on HepG2 hepatocytes to determine the toxicity associated with the coumarins. All the samples showed low to no toxicity with sample U2 showing the highest at 46.52µg/ml. Due to the hepatotoxicity related to TB treatment, the samples were tested for their hepatoprotective activity on HepG2 hepatocytes, with a toxicity induced by acetaminophen. Samples U1-U5 showed approximately 20% and samples MU1-MU4 a 10% protection. Three enzymes have been identified that is up-regulated in vitro in biofilm formation. These include, mycothiol reductase, thioredoxin reductase and isocitrate lyase. The coumarins were subjected to enzyme kinetic studies on these three enzymes, including an inhibition and subversive substrate assay. It was found that two samples showed subversive substrate activity. In the search for new novel treatments, one should look at all the possibilities and not only focus on one specific mechanism or target. Coumarins showed promising results which can be further investigated in *in vivo* pre-clinical studies.

Anti-diabetic properties of a spice mixture of garlic, ginger and cayenne pepper

Spices are part of the rich cultural and traditional heritage of communities around the world. The role of spices in traditional medicine is also well documented. The uses of medicinal spices are becoming more popular because of their efficacy, minimal or no side effects and synergistic actions. This study evaluated the hypoglycaemic activity of the aqueous extract of a spice mixture of garlic (*Allium sativum*), ginger (*Zingiber officinale*) and cayenne pepper (*Capsicum frutescens*) in
alloxan-induced diabetic male rats. The doses of 200 and 500 mg/kg body weights of the extract significantly decreased elevated blood glucose and lipid levels. In addition, the spice extract markedly attenuated haematological indices, liver and kidney functions. Tubular degeneration and necrosis in the kidney, steatosis and fatty degeneration in the liver as well as pancreatic hyperplasia of diabetic rats were also ameliorated. Generally, the mixture exhibited anti-diabetic activities which were more pronounced at 500 mg/kg. The activities also compared favourably with glibenclamide. These properties are attributed to the polyphenols and antioxidant molecules in the spice mixture which modulated various metabolic cascades that directly or indirectly lowered the level of glucose in the system. In addition, these properties might have been due to insulin release actions of the spice extract. The study suggests a possible role for the spice mixture in glucose metabolism. This paper discusses the implications of these observations on the treatment of diabetes using a spice mixture of garlic, ginger and cayenne pepper.

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The production and use of acorns in the Republic of Korea

Oak acorns are an ancient food with the modern-day potential to help mitigate climate change. The fact that they are produced on trees providing long-term atmospheric carbon sequestration makes this tree “grain” a compelling climate-friendly alternative to annual cereal grains. An important first step in assessing their potential as a modern crop is to understand their traditional production and utilization. The Korean Peninsula is one of the few remaining regions on earth where acorns are still used regularly in large quantities for human consumption. The objective of this research project was to document and analyze traditional acorn production and utilization practices in the Republic of Korea (ROK). Fifteen structured interviews of elders highly knowledgeable in acorn production and use were conducted in villages across all nine political provinces of the ROK during three months of fieldwork in 2014. In order to capture any differences in practices due to environmental conditions, interviews were also split equally across the country’s five ecological provinces. In addition, government statistical archives were scoured to see if a picture of current acorn production and consumption could be developed. The results indicate that the acorns produced in the ROK are all wild-collected with no management practices being employed to enhance production. Bearing larger acorns, Quercus acutissima is the most commonly used species, but Q. serrata is actually the most favored because of texture, starch yield, and flavor. A variety of traditional processing and tannin removal methods were documented along with fifteen different acorn food dishes and seven medicinal uses for acorns. Acorn foods are widespread, with the majority now being produced in commercial factories from imported acorns. In 2012, net ROK consumption was 13,127 metric tons of acorns, with 94% being imported from China, 3% from South Africa, and only 3% being produced domestically. Domestic acorn production has plummeted 75% since 1995 and collection and processing is now seen
as a pastime of the elderly. This research is helping to preserve traditional knowledge in the face of the ROK’s rapid urbanization while simultaneously highlighting the commercial viability of this underutilized climate-friendly food crop indigenous to five continents.

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29 June 2015 | Session 4a | Paper

**Medicinal and veterinary plants in the Spanish inventory of traditional knowledge related to biodiversity**

Spain is one of the largest countries of Europe with an area of 505,992 km² and a population of more than 46,500,000 people. It has a very rich vascular flora composed of 7071 species given its climatic, geographic and ecologic diversity. In addition to this high plant biodiversity, a complex history has brought about a great cultural diversity. A team of more than 60 scientists from more than 20 research centers and universities are developing the Spanish Inventory of Traditional Knowledge, one of the inventories of the Spanish Inventory of Natural Heritage and Biodiversity as reflected in the 42/2007 law of Natural Heritage and Biodiversity. A database with information of more than 180 papers that include more than 40 papers published in Scopus index journals was built. We paid attention to: the species used, modes of use, illness treated, relative importance of each use-report, and importance in the past and in the present. This has resulted in a very rich and dynamic ethnobotanical knowledge most of it only in the memory of elderly people. More than 1800 medicinal plant species are used: 1775 in human medicine and 724 in veterinary medicine, 664 of them both in animal and human health. Among the richest areas, more than 400 plants were used in Pallars (Catalan Pyrenees). Some local experts had an extraordinary traditional knowledge. For instance, one Aragonese women could prepare more than 1,450 remedies with 230 medicinal plant species, 31 animals and 29 minerals. Medicinal plants were mainly used for common digestive, respiratory and skin disorders such as catarrh, sore throat, diarrhoea and other stomach and intestinal disorders, furuncles or wounds. Blood complaints, bruises or muscle-skeletal pains were also commonly self-treated. Households commonly kept a few species for treating the most common disorders, serving as a sort of traditional First Aid Kit. Their contribution was essential to livestock and family’s well-being and health. This group of species is specific to each geographic area and reflects its idiosyncrasy, being very different even among neighbouring territories. To conclude, traditional knowledge is continuously changing, evolving and adapting to the new social and environmental conditions. Despite a clear trend of erosion, especially in veterinary medicine, herbal medicine still play an important role in daily live and there is a need of a culturally sensitive approach by the official health systems to these practices.
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2 July 2015  Session 10b  Paper

Expression of epitopes for Lumpy Skin Disease Virus on Tobacco Mosaic Virus Coat Protein scaffold in *Nicotiana benthamiana*

Plant-based subunit vaccine technology represents a promising source for inexpensive and local vaccine production for diseases and disease strains prevalent in and unique to Africa. Lumpy Skin Disease Virus (LSDV) catastrophically reduces the economic value of infected cattle, and is a prime candidate for development of a plant-based recombinant vaccine. It primarily infects cattle in Africa, and so producing a vaccine locally and inexpensively may offer significant advantages when compared to live or attenuated vaccines, many of which must be transported long distances and kept refrigerated. Plant-based vaccine technology allows for rapid identification of potential epitopes for use in new vaccines, and offers a low-cost alternative to traditional cell culture-based production methods. In this study, we modify the Coat Protein (CP) of the well-studied positive-sense RNA Tobacco Mosaic Virus (TMV) by inserting one of fifteen putative antigenic peptide sequences from LSDV at the N-terminal end of TMV CP. We transiently infect *Nicotiana benthamiana* plants with these TMV constructs containing the modified CP (CP:epitope fusions) via agroinfection. The constructs then spread throughout the plant both locally through the plasmodesmata, and systematically by assembling into functional TMV virions. After the CP:epitope fusion has multiplied within the plants, it is extracted and purified via polyethylene glycol (PEG) precipitation. Live animal trials are then performed to determine the extent of immunological responses in guinea pigs for each putative antigen, and finally candidate constructs are identified for use as livestock molecular subunit vaccines.

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2 July 2015  Session 11b  Paper

Ethnobotanical uses of wild flora and fungi on the circum-Sicilian island of Pantelleria, Italy

In 1969, Galt and Galt conducted an ethnobotanical survey [1] in the community of Khamma on the circum-Sicilian volcanic island of Pantelleria, located 67 km from the Tunisian coast. Since then, a number of botanical studies concerning the local wild flora and cultivation of the zibebo grape and capers have been conducted, but none have investigated traditional ecological knowledge regarding the use of wild plants and fungi. Here, 45 years later, we revisit this topic, examining the current day knowledge and practices concerning wild plants and fungi on the island. A total of 42 in-depth interviews were conducted in June 2014 in six communities. All interviews were conducted in person in Italian with prior informed consent. We employed two primary
means of eliciting responses concerning traditional practices; informants were asked to: 1) free-list the most commonly used plants for wild foods, general medicine, and skin remedies; and 2) view and discuss a booklet composed of photos of taxa listed in the Galt study. A total of 86 botanical and 19 fungal taxa representing 54 families were cited by the study participants. While many plant-based traditions have disappeared from daily practice, especially those related to traditional fishing and hunting, they remain in the memories of the eldest subset of the population. For example, one of the most pervasive species in the landscape, *Opuntia ficus-indica*, has current day uses that persist (e.g., food source and shade source for cultivated vegetables), but its past applications were much more diverse, and included manipulation into hunting snares for birds. Other predominant flora included a number of *Euphorbia* spp., whose toxic latex was regularly used as a fish poison. Fungi, on the other hand, represent an important source of wild food today, and are widely recognized and regularly consumed. In conclusion, we have found that traditional knowledge remains important to everyday practices of Pantescans, ranging in applications from wild foods, agricultural tools, and traditional medicines.

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29 June 2015 | Session 2a | Paper

"Plants of the gods' reloaded: including emic perspectives in the study of ritual plant use"

One of the obstructive features of Western intellectual tradition in the study of human-nature relations is that salient aspects of natural resource use are treated as religious when their causality is attributed to non-human and non-physical agents (e.g. nature set apart as totems, ancestor offerings, or taboos). The same aspects are considered non-religious when material agency is involved, for instance, the use of natural resources as medicine, tools, or food. A conflict arises when considering that the definition of science (i.e. the systematic study of the structure and behaviour of the physical and natural world through observation and experimentation) implies that pursuing perceptions regarding the supernatural world is unscientific. The problem of mutual exclusivity posed by the dichotomy natural/supernatural in Western science is best illustrated in the context of African ethnobotany. In spite of the overriding role of plants in African traditional medicine, herbal remedies are still overlooked when these treatments are applied in a ritual context. One might ask: Is science missing out by dismissing the supernatural? We worked with users of ritual plants in Benin and Gabon. We documented different administration routes of ritual plants and selected those whose uses involved direct contact with the human body. Moreover, we identified 24 commercially or culturally important species and compared their ritual uses with proven pharmacological effects from the literature. In contrast to previous research that explained the effectivity of ritual plant use to be a matter of belief, our study provides evidence for potential pharmacological effects on its users. Analysing emic explanations to the causes and symptoms of the conditions treated with ritual plants may help us understand why some plants, whose use at first seem to have no pharmacological effect, may after all prevent health ailments for which there are no equivalents in Western languages and experience. We conclude by discussing the significance of ritual plant use for public health, as well as the potentials of overcoming the cultural biases of Western science towards the ‘supernatural’.
A strategy to conserve South Africa’s utilised species

South Africa is signatory to the Convention on Biological Diversity and is committed to the implementation of a national strategy to conserve plants that aligns with the Global Strategy for Plant Conservation (GSPC). Between 2013 and 2015, SANBI led the process to develop a National Strategy for Plant Conservation. Here we present South Africa’s Strategy for Plant Conservation, published in May 2015, which includes 16 outcome oriented targets three of which are focused on the sustainable utilisation of plant species. The challenge of conserving medicinal plant species in South Africa will be the main focus of this talk, this falls under Target 12 of the strategy: All wild harvested plant-based products sourced sustainably. The suggested actions of developing a landscape level approach to the conservation of medicinal plants and the option of substituting wild sourced medicinal plants with cultivated plants will be presented.

Basketry business in Ambalabe community, Eastern Madagascar

The lifestyle of the Ambalabe community, a remote rural area in the Eastern part of Madagascar [1], attracts our attention particularly on the plant material they use for basketry. Making baskets is embedded within people’s daily life, especially for farmers like most members of the Ambalabe community. Baskets are among the main export handcrafts products for Madagascar [2]. With the aim to know more on how the local people value plants around them for their daily needs, we conducted an ethnobotanical study on species used for basketry and the way the local population use the finished products. Semi-structured interviews were used during the survey [3]. Our studies found that 33 plant species are used one way or another for the basket making. Twenty-five of these 33 species are used as raw materials, 9 species as dyes, and one species can be used either a dye or raw material. Among the most useful species to get the raw material to make basket are Cyperus latifolius Poir., Eleocharis plantaginea R. Br. and Raphia farinifera (Gaertn.) Hyl. Bixa orellana L., Danais cernua Baker and Indigofera bosseri Du Puy & Labat are the most used for dye. Plants used for basketry are very important for the Madagascar rural communities as not only community members make baskets for their daily farming activities but also to earn extra incomes.
in selling them in market places. However, one of the current major problems Ambalabe people are facing with is that some of the species they really use have become scarce. Aware that the plants they really need become harder to find, they begin to cultivate the most used species such as Raphia farinifera and Bixa orellana. Currently, at Ambalabe site, the local population and the Missouri Botanical Garden has been collaborating to preserve their biodiversity through establishment of a good and sustainable management system for Ambalabe forest. The present paper is then aimed to report our study’s findings regarding basketry business at Ambalabe, and to provide suggestions on how to sustain good relationship between rural community needs and natural resources.

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29 June 2015 | Session 3b | Paper

Medicinal plants used by lay people in a rural community in KwaZulu-Natal (South Africa) for the treatment of hypertension

According to the WHO (2013) approximately 1 billion people had been affected by hypertension globally. In Africa approximately 46% of adult people aged 25 and above have hypertension in comparison with 35% in America. The aim of this survey was to document the plants used by lay people in a rural community for the treatment of hypertension and to determine to what extent they are using these plants concomitantly with prescribed drugs for hypertension. A total of 100 lay people with knowledge on anti-hypertension plants were interviewed using structured questionnaires. Information regarding vernacular plant names, plant parts used, preparation and dosages was collected, together with some health information with reference to hypertension. It was found that a total of 28 plant species were used singularly in decoctions or in 17 different plant combinations to treat hypertension. Twenty plant species have never been documented before for the treatment of hypertension. The species most used were: *Momordica balsamina* (44 interviewees), *Aloe marlothii* (32), *Hypoxis hemerocallidea* (17), *Musa acuminate* (10), *Strychnos madagascariensis* (10), and *Senecio serruloides* (9). Thirty one of the 50 people who had been diagnosed with hypertension were using medicinal plants in concurrence with their prescribed hypertension drugs. None of them had revealed to their healthcare practitioners that they were also using herbal medicines. Although none of the interviewees were aware of the possible consequences of drug interactions they were mindful of some side effects caused by the medicinal plants they used for the treatment of hypertension. According to the majority of the interviewees hypertension is caused by unhappiness and stress and information from the community was their main source on which plants to use to treat hypertension. It is clear from this survey that medicinal plant remedies plays a vital role in the treatment of not just communicable diseases but also in the treatment of chronic ailments like hypertension by lay people in this deep rural area. The findings suggested that there is no awareness of the risks that may accompany the concurrent use of conventional medication and medicinal plants. There is a definitive need to educate health practitioners and patients of the risks they are taking in using simultaneously prescribed hypertension drugs and medicinal plants.
Medicinal plants used by three communities (Mahaboboka, Amboronabo, Mikoboka) in Southwestern Madagascar

This paper reports our finding about the study which was undertaken in three communities (Mahaboboka, Amboronabo, Mikoboka) in Sakaraha, Southwestern Madagascar. Not only villages are far away from sanitary infrastructures and doctors but drugs and consulting fees are unaffordable to villagers. They rely entirely on natural resources for their healthcare. This paper aims to document medicinal plants used by communities in Sakaraha and to present the most important plant species used in traditional medicine in these communities. Semi-structured interview was conducted within 259 informants in 34 villages. For data analysis, agreement among informants about a particular plant for a particular remedy was determined by the Factor Informant Consensus (Fic) [1] and Fidelity Level (FL) [2] of species. Ailments categorization was done following the categorization by Camara & al., 2012 [3]. A total of 235 species belonging to 198 genera and 75 families were recorded as having medicinal use. The richest families in number of species for medicinal use are: Fabaceae, Rubiaceae, Apocynaceae, Asteraceae, Euphorbiaceae and Poaceae. Plant species cited by informants are used to treat 68 various ailments grouped under 14 categories. Ailments related to Pregnancy, Birth and Puerperium (PBP), are cured by several species such as Jatropha curcas, Metaporana parvifolia var. obtusa, Panicum maximum and Echinochloa colona. Celtis gomphophylla, Psidium guajava and Strychnos henningsii are the most important for curing Digestive System Disorder. Acacia bellula and Woodfordia fruticosa, Persicaria minor, Maerua nuda; Garcinia pauciflora; Ensetes aff. perrieri and Abrus precatorius for nervous system disorder, infected wounds, malaria, eye infection and respiratory problems, respectively. Some plant species e.g Maerua nuda, Garcinia pauciflora and Ensetes aff. perrieri are very specific to our targeted communities while the use of some other species such as Psidium guajava for digestive disorder and Abrus precatorius for cough are very common practice in many communities in Madagascar.

Putting Plants to Work in an Urban Tech Society

In twenty years, the UN estimates that over three-fourths of the world’s people will live in urban areas. Even today, the majority of the human population in the world lives in cities, but our understanding of what it means to interact with plants and nature in these settings has been defined by the discourse of mostly architectural,
horticultural, educational and city planning groups. Previously focusing on more remote or rural regions and cultures, ethnobotanical researchers have begun to turn their interests to urban settings because of their interests in including diverse people and their lives, migrations, and work with plants. In political centers, urban people’s plant knowledge (or perceived lack thereof) affects the rest of the world. Methods: Using qualitative content analysis and NVivo software, I collected articles and publications that discussed or portrayed plants from the New York Times, British Broadcasting Corporation, and the iTunes platform from the past decade. I began by coding the materials for uses of plants and the names of plants mentioned, but I later expanded and coded for deeper symbolic representations of plants and their portrayed relationships with people. Results and Discussion: Using examples from popular media and apps, I created a model that can be used to explore the connections between research interests in plant names and uses and lay interests in plant relationships. As social facts, plants can “do work” within societies. Beyond conceptualizing plant categories and use classifications, improved understanding of human-plant relationships and how plants “do work” can have serious implications for future politics involving plants, including food security, climate change, healthcare, and other major global issues.

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2 July 2015 Session 12 Paper

Biotic resistance responses of wheat treated with Artemisia afra extracts and their repellent ability against the Russian wheat aphid

The initiation of defence responses in wheat by polar and non-polar extracts of Artemisia afra were investigated, together with the ability of these extracts to repel the Russian wheat aphid (RWA; Diuraphis noxia: Kurdjumov). The olfactometer bioassay was used to determine the initial repellent effect of the essential oil and extracts against the RWA. *In vitro* activities of the apoplastic PR-proteins and the leaf settling ability of the RWA were studied after foliar application of the extracts to susceptible and resistant wheat plants. The essential oil and non-polar extracts proved to be the most repellent in the olfactometer bioassay during a 10 minute interval. Lower numbers of aphids settled on resistant wheat leaves for all extracts, however the polar extracts proved to be most effective over a 7 day period for susceptible and resistant wheat. Aphid population and disease symptoms on wheat leaves were reduced by these extracts. The polar extracts and essential oil also resulted in significant increased PR-protein activities in susceptible and resistant wheat. GC-MS analysis of the non-polar extracts, revealed the presence of camphor, eucalyptol and thujone as major constituents. The results are indicative of the potential of A. afra extracts to control the RWA in crop plants when applied either correctively or preventatively.
Market and nonmarket incentives drive land use by the Yoreme-Mayo

Humans have impacted most of the lands on earth and thus affected plant resource availability. In Southern Sonora, Mexico, the uncultivated land traditionally used by the Yoreme-Mayo indigenous group is being developed for dryland farming purposes. This study explores the hypothesis that customary use of uncultivated land enables continued practice of Yoreme-Mayo ethnobotanical skills. Yoreme-Mayo informants were asked what plants they use and rely on to make traditional products. For these, both market and non-market values were assessed. Counts of plants in field quadrats enabled calculation of income potential for traditional Yoreme-Mayo producers. These resources currently provide a sustainable income source when compared to land clearing for dryland agriculture. Further, the non-market value of continuing Yoreme-Mayo traditions is high and causes many Yoreme-Mayo to continue their traditional work even if lands are cleared around them. These findings help support the hypothesis that wild lands provide high economic and non-market value to the Yoreme-Mayo of Southern Sonora, Mexico.

Sustaining resource sustainability in a dynamic world

The need for ecological sustainability underpins many management and policy prescripts regarding the harvesting of wild plant and animal resources for consumptive use and trade. However, the notion of ecologically sustainable harvesting is usually enveloped within an inert cocoon of sustainable offtake measures underpinning static quotas of amounts, sizes, seasons or days during which harvesting is limited to prohibited. Whilst the contextual complexity and local and broader fluctuations and trajectories are implicitly acknowledged, there is little embracing of change as a core tenet in managing for resilience rather than sustainability. In this paper we will examine and discuss the nature and sources of inherent variation in resource harvesting systems and the local and broader contexts all of which frequently make the measurement and pursuit of ecological sustainability a complex and, in some instances, an impossible task. We briefly consider the conceptual and outcome differences between sustainability and resilience and how these inescapable fluctuations in local and broader contexts foster or hinder the pursuit of either. We end with consideration of the frameworks or conceptual shifts required to better design ecologically resilient harvesting systems.
An evaluation of pest and disease vulnerability in the urban forest of Washington D.C.

Urban forests are particularly at risk for biological stressors, such as insect pests and exotic diseases, because of diminished health caused by the abiotic stressors including compaction, nutrient deficiency, salinity, and pollution. Individual cities’ urban canopy can be evaluated using tools such as the Pest Vulnerability Matrix (PVM), which is based on individual species relative overall abundance and their risk of infections (McPherson & Kotow, 2013). Another approach is to evaluate biodiversity and species evenness using the Shannon Diversity Index. Urban forests can be insulated from pest and disease impact with a species composition of no more than 10% of the urban canopy represented by the same species, 20% of the same genera, and 30% of the same family (Santamour, 2002). Our project incorporates spatial analysis with the above mentioned urban forestry tools within the District of Columbia (DC). We explored PVM and diversity data across specific management units to create a list of species to avoid in future plantings and suggestions of species to plant in order to achieve a more even species composition and lower PVM. Relative Pest Vulnerability Matrices will prioritize specific areas for monitoring to avoid pest and disease outbreaks and data will be used directly in decision making regarding tree management in the district. Results: Preliminary results show that the overall Pest Vulnerability Matrix for D.C. was 11.88 and varied only slightly across specific Wards from 10.89 -12.90. It is interesting to note that there was not a linear relationship between pest vulnerability and biodiversity; some more diverse wards received high PVM scores based on the disproportionate percentage of “high risk” species. It is not only necessary to insulate with diversity, as is accomplished by Santamour’s 10-20-30 rule, but to also utilize low risk families, genera, and species. A narrative is being developed to inform the DC public regarding the health of their urban canopy. The data will be analyzed at the level of the Advisory Neighborhood Commission so that the bodies governing these small political districts can be educated as to what trees species should be planted (or avoided) in their specific region.

A pilot study of the chemosystematic potential of furanocoumarins and essential oil compounds in the genera Nanobubon and Notobubon (Apiaceae)
Nanobubon and Notobubon, previously considered to belong to the genus Peucedanum from the tribe Peucedaneae, have been transferred to tribe Tordylieae based on molecular and anatomical analyses. Furanocoumarins such as bergapten, isopimpinellin and xanthotoxin have been reported in many members of the tribe Tordylieae. The only African member of Tordylieae that have been studied is Notobubon galbanum because it causes severe blistering and therefore is called ‘blister bush’. It was reported that xanthotoxin and psoralen was the main phototoxic furanocoumarins identified from the aerial parts of this plant. A preliminary evaluation of furanocoumarins and essential oil compounds was carried out on twelve species of Nanobubon and Notobubon. Thin layer chromatography, high performance liquid chromatography and gas chromatography were employed for this study. High levels of both furanocoumarins and essential oils occur in the various plant parts (roots, stems, leaves and fruits) of Nanobubon and Notobubon species. Xanthotoxin appears to be a major chemical marker for both genera. Other furanocoumarins identified includes bergapten, imperatorin, isopimpinellin and psoralen. Leaves and fruits of Notobubon species showed similar main compounds. Highly variable yields of up to 3.9 % were recorded in hydro-distillation of Notobubon species. The essential oil pattern of the leaves and fruits in both genera showed high variability. The genera Nanobubon and Notobubon showed interesting chemosystematic patterns which will further be clarified by employing liquid chromatography-mass spectrometry and gas chromatography-mass spectrometry.

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Phytochemical constituents and antioxidant properties of acetone extract of Cleome gynandra growing in the Eastern Cape, South Africa

Cleome gynandra L. is a well-known nutraceutical plant. Besides its significance as a wild vegetable, its medicinal folkloric uses include the management of inflammatory conditions, cancer and cellular ageing. Despite the wide usage of this species in traditional medicine, there is a dearth of information on its in-vitro antioxidant and phytochemical properties. Therefore, this study was undertaken to evaluate quantitatively the compositions of phytochemicals and antioxidant properties of acetone extract of different parts of C. gynandra. Total phenolics, flavonoids, flavonols, proanthocyanidins, tannins, saponins and alkaloids were determined using standard methods. The antioxidant activities of acetone extracts of C. gynandra were also investigated spectrophotometrically using ferric reducing power, ABTS (2, 2'- azino-bis-3-ethyl benzothiazoline-6-sulfonic acid) diammonium salt, DPPH (1, 1- diphenyl-2-picrylhydrazyl) and NO (nitric oxide) radical scavenging techniques. Amongst the different plant parts, the leaf extract had the highest concentration of total phenolics (126.79 ± 0.55 mg/g), flavonoids (40.58 ± 0.06 mg/g) and flavanols (42.41 ± 0.05 mg/g) while the stem extract had the highest amount of proanthocyanidins (419.01 ± 0.67 mg/g) compared to the leaves (403.29 ± 0.89 mg/g) and fruits (107.18 ± 0.59 mg/g). The reducing power of the extracts was significantly higher than that of the standard drugs used in a concentration dependent manner. The activities of the plant extracts against ABTS, DPPH and NO radicals were dose responsive with IC50 value of 0.2, 0.1 and 0.03 mg/g respectively. C. gynandra possesses high secondary metabolites which accounts for its strong antioxidant ability thus justifying its use as
natural occurring antioxidants in folkloric medicine. The study encourages a regular consumption of this wild vegetable in order to avert oxidative stress related diseases.

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2 July 2015 Session 12 Paper

Potential of indigenous essential oil and seed oil in modern cosmetic and fragrance applications

The demand for natural products in Cosmetics is estimated to be increasing of 10%- 25% per year. The Cosmetic industry is a fast growing and changing industry and African plants are now fashionable to be included in new products. Essential and cold pressed oils, plant extracts, and powders of indigenous plants amongst others are the focus areas. Baobab and Marula oil, pulp and powder of both are under supplied in a growing market of currently developed products that have already been accepted by most international companies. There is now also extra demand for oils and plant fats to replace or blend with shea butter, argan, almond and olive oil. Ximenia, Trichilia, Citrullus lanatus and Kigelia seed oils are now researched for market demand, development and requirements in the cosmetic and fragrance industry. Advantages and problems have been identified with potential of crop development. Pressure on natural resources can be prevented if careful sustainable measures are taken in time.

This study could assist role players of community projects, agricultural and rural development schemes in decisions of choosing alternative crops and for skills and entrepreneurship development and poverty alleviation. The information from the study can also be applied by small scale and emerging farmers in the feasibility studies of utilization of natural products as new enterprises.

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29 June 2015 Session 4b Paper

Effects of season, media, hormone, cutting position on survival and rooting of Lobostemon fruticosus stem cuttings

The eight day healing bush (Lobostemon fruticosus) belongs to the Boraginaceae family and is one of the oldest medicinal plants used in the Cape by Khoi San and early settlers. Preparation of this herb alone or in combination with Melianthus major, Melianthus comosus and Galenia africana are commonly applied externally to treat wounds, sores, ringworm, erysipelas, eczema and other dermatological complaints. Aqueous infusions are taken orally to treat gynaecological complaints. People who administer this herb believe it can heal various ailments in eight days, hence the name “eight day healing bush”. There is a growing interest in the commercial
propagation of \textit{L. fruticosus} due to its medicinal properties. In addition, the natural populations of \textit{L. fruticosus} are being destroyed by veld fires and over harvesting, leading to a need for propagation of plant material especially for commercial use. Propagation using leaf cuttings preserves the clonal nature and uniform character of ecotypes and ensures rapid, cost effective propagation compared to other methods. This study was aimed at investigating the effect of certain parameters on rooting of \textit{L. fruticosus} stem cuttings. The parameters investigated were: two seasons, three plant growth regulators, four different growth media, two different shade treatments and two different cutting positions. The trial layout was a randomized complete block design with two replicates per season and 10 cuttings per treatment as experimental unit. Season, growth media, hormones and cutting position significantly influenced the rooting success of \textit{L. fruticosus} cuttings. The longest roots and highest root score were recorded from cuttings taken in autumn. Bark as growth medium produced the longest roots and peat produced the highest root score. The longest roots and highest root score were produced in cuttings treated with Seradix® B No.2 and heel cuttings similarly produced longer roots and a higher root score compared to apical cuttings. Season, growth media, hormones and cutting position significantly influenced the survival rate of \textit{L. fruticosus} cuttings. The highest survival was recorded in cuttings taken in autumn. In terms of survival bark was the best medium and Seradix ® B No.2 was the best rooting hormone.

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2 July 2015 & Session 11b & Paper \\
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\textbf{Wild plants, pregnancy, and the food-medicine continuum in the southern regions of Ghana and Benin}

Many medicinal plants fall under the food-medicine continuum as resources that meet both medicinal and nutritional needs. In West Africa, women consume wild plant species to maintain and enhance their health throughout the duration of pregnancy. These plants are a culturally resilient and financially accessible form of nourishment for pregnant women in the region, many of whom are malnourished, yet studies that identify both the nutritional and medicinal properties of these plants are limited. The objective of this study was to analyze women’s knowledge of plants consumed in pregnancy in the southern regions of Ghana and Benin from a food-medicine continuum perspective. We gathered data in two fieldwork periods in West Africa (Ghana 2010 and Benin 2011) through herbal market surveys and questionnaires and then conducted a literature review of the documented nutritional and medicinal properties of plants cited in our fieldwork. We sought to answer the following research questions: (1) What are the common plant species consumed as wild and semi-domesticated foods by pregnant women in the southern areas of Ghana and Benin? (2) What are the most frequent motivations and forms for consuming these plants during pregnancy? and (3) What is known about the nutritional and therapeutic properties of these species? In Benin, participants frequently reported ingesting plants during pregnancy in the form of herbal teas. Commonly cited species included \textit{Securidaca longipedunculata}, \textit{Dichapetalum madagascariense}, and \textit{Schwenckia americana}. These plants have demonstrated anti-malarial and anti-inflammatory activity in pharmacological studies. Ghanaian women reported consuming wild greens such as iron-rich \textit{Hoslundia opposita} and calcium-rich \textit{Vernonia amygdalina} in a soup.
based on the African oil palm fruit (*Elaeis guineensis*), a source of fatty acids. Although Beninese and Ghanaian women mentioned different species and different forms of consumption, in both countries women cited “strengthening” as the most common motivation to consume wild plants during pregnancy. Strengthening is a concept that falls under the food-medicine continuum, bridging the local diet and herbal pharmacopoeia of women’s plant use during pregnancy. Ethnobotanical studies of this nature highlight the multidimensional use of plants and can improve health and nutritional programs in the region.

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2 July 2015 Session 11b Paper

Diversity and significance of Old World crops grown by Suriname Maroons

Several Old World crops were introduced to the Americas as provision on slave ships. Enslaved laborers planted leftover in their home gardens, known as the ‘Botanical Gardens of the Dispossessed’. In the former Dutch colony Suriname, cultivation of most Old World crops has been abandoned by coastal Creoles after the abolishment of slavery. Farming became the activity of Asian wage laborers, who preferred to grow their own crops. Many African slaves escaped into the country’s forested interior to settle in tribal communities, practicing shifting cultivation with seeds and cuttings they took from plantations during their flight to freedom. Maroons, descendants of these runaway slaves, still live in remote rainforest villages, but their agriculture was never studied in detail. The recent discovery of African rice (*Oryza glaberrima*) on a Maroon field suggests that probably much more “lost African crops” can be found on their provision grounds. Fieldwork in 2013 focused on Old World crop cultivars grown by Suriname Maroons and their motivations for maintaining this agro-diversity. We investigated the role of “ancestor crops” in traditional dishes, medicinal and ritual applications. We hypothesized that farmers maintained Old World crop diversity to guarantee food security and prepare traditional dishes and specific rituals. Greatest diversity in Old World cultivars was encountered in taro (*Colocasia esculenta*), banana (*Musa* sp.) and okra (*Abelmoschus esculentus*). Most crops were used for food only. Some crops (e.g., sesame, melegueta pepper, African rice) largely lost their food function and served mainly for rituals, while others (e.g., Bambara groundnut, *Vigna subterranea*) were nearly forgotten. Farmers (almost all female) actively exchanged seeds and tubers with family members and other ethnicities, both in the city and in the forest. Spending time in the capital during childbirth or illness, however, resulted in the loss of typical Maroon crops (Bambara groundnut, sesame), as these seeds lost viability during farmer’s absence. Motivation to grow specific crops and cultivars varied from tradition, food preference and seasonal spreading of food availability to the need to carry out typical Maroon rituals related to ancestor offerings and traditional medicine. Documentation of specific cultivar properties and storage of seeds in germplasm centers is urgently needed to safeguard these previously undocumented crop cultivars before they are lost forever.
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Medicinal plants used for treating reproductive health care problems in Bamboutos division, west region, Cameroon

Approximately 80% of the African population uses traditional plants to deal with health problems, basically because of their easy accessibility and affordability. In order to further document medicinal plant use in relation to reproductive health in a traditional setting, we conducted an ethnobotanical study in Bamboutos Division, West Region Cameroon. Data were collected between January and September 2009 through semi-structured interviews and participative field observations. For the interviews, 70 knowledgeable respondents (40 traditional healers and 30 elders) were selected via purposive sampling. Voucher specimens were collected with the help of respondents, processed into Cameroon National Herbarium, Yaoundé following standard methods; identified with the help of pertinent floras and taxonomic experts; and submitted to Department of Botany, University of Dschang. Descriptive statistics were used to analyze and summarize ethnobotanical information obtained. Informant consensus factors (ICF) were used to elucidate the agreement among informants on the species to be used in the treatment within a category of illness. The study evidenced 70 medicinal plant species belonging to 64 genera and 37 families. These plants are used to treat 27 reproductive ailments, with the highest number of species (37) being used against venereal diseases, followed by female (29) and male infertility (21), respectively. The majority (60%) of plant material is obtained from the wild. Herbs were the most-utilized plant form, accounting for 45.7% of total, followed by shrubs (30%). Leaves were the most commonly used plant part accounting for 47.3% of uses, followed by bark (22.3%), whole plants (19.7%), stems (5.2%), tubers (2.6%), and inflorescences and fruits (1.3% each). Families Asteraceae (8 species), Euphorbiaceae (7), and Acanthaceae and Bignoniaceae (4 each), respectively were found to be most-used in the area. Informant consensus about usages of medicinal plants ranges from 0.5 to 1 with an average value of 0.91. Remedies are mostly prepared in the form of decoction (66.2%) and are mainly taken orally. Traditional medicine remains the most-affordable and most easily accessible source of treatment in the study area. Herbs represent the plant form most used in the preparation of remedies. This may be an indication of their easy access as compared to other life forms. The documented medicinal plants can serve as a basis for future modern drug development.
Comparative Caribbean ethnobotany of medicinal plants shared between the Dominican Republic and Jamaica

The Caribbean Islands are a biodiversity hotspot. Plant species of these islands are popularly used by local communities for health and subsistence, especially in rural areas. A database of more than 3000 medicinal uses from previous ethnobotanical research in the Dominican Republic represents an ideal source for comparative research with other Caribbean countries that share many plants with the Dominican Republic, such as Jamaica (1,225 shared plant species). The lush, biodiversity-rich farming parish of Portland in Jamaica represents an ideal site for fieldwork. Our research hypothesis was that medicinal plant knowledge held by rural Jamaicans about shared Jamaican-Dominican plant species will be significantly different between both countries because of their diverse cultural backgrounds. We tested this hypothesis through semi-structured interviews with Jamaican laypeople to collect quantifiable ethnobotanical data, and comparison of cultural consensus values for each species that calculate the variation in medicinal uses attributed to these plants. The results show similar cultural consensus values between both countries for most species and a high degree of consensus within and between countries, pointing to shared medicinal plant knowledge. However, intercultural differences are evident in the prevalent uses attributed to many species. For example, *Crescentia cujete* has consensus values of 0.70 (Dominican Republic) and 0.92 (Jamaica). However, in the Dominican Republic it is prevalently used during and after childbirth, while in Jamaica it is popularly used to treat a hard blow to the back with battered blood. It is therefore important to combine quantitative techniques such as consensus analysis with qualitative assessments to make meaningful ethnobotanical comparisons.

Bioavailability of flavonoids in human plasma following acute intake of a fermented rooibos (*Aspalathus linearis*) supplement - rooibos flavonoid bioavailability

The bioavailability of rooibos (*Aspalathus linearis*) polyphenolic compounds requires further investigation to substantiate claims of the beneficial effects of its unique combination of polyphenolic compounds. The aim of this study was to assess the relationship between rooibos flavonoid levels and the antioxidant status in human plasma following acute consumption of a fermented rooibos supplement. Healthy
males (n=30), consumed three capsules of either a rooibos or a placebo supplement, in a double blind, randomised crossover placebo controlled study. Blood samples were drawn at baseline (prior to consumption of the capsules and a standardised breakfast); at 1hr (prior to two exercise regimes to induce oxidative stress) and at 3hrs. The capsules were assessed for the main rooibos flavonoids by HPLC; the antioxidant content in terms of total polyphenol (TP), flavonol and flavanol content and the antioxidant capacity with colorimetric and fluorescence assays. Plasma samples were analysed for antioxidant capacity, total polyphenol content and levels of specific rooibos flavonoids, and/or their putative metabolites (by LC-MS). Plasma conjugated dienes (CDs) and thiobarbituric acid reactive substances (TBARS) were determined to assess oxidative lipid damage. The redox status of glutathione (GSH:GSSG) was determined in whole blood. The main flavonoid levels in the rooibos supplement capsules were iso-orientin (4.5 ± 0.2 mg), orientin (2.8 ± 0.2 mg) and vitexin (1.3 ± 0.08 mg). The TP content of 1 capsule (115 ± 7 mg) was equivalent to the TP content of two cups of fermented rooibos. Acute intake of an equivalent of 6 cups of rooibos (three capsules) resulted in a significant increase in plasma ORAC after 1hr (4.6%, P<0.001) and after 3hr (4.8%, P<0.05) with no changes affected by the placebo treatment. Lipid peroxidation was also significantly decreased by rooibos causing a 3.76% (1hr, P<0.05) and a 4.1% (3hr, P<0.01) decrease in CD levels when compared to the placebo. No significant changes were observed for the redox status of glutathione. The LC-MS analyses for the plasma rooibos flavonoids and their putative metabolites will be included in the presentation. This study is the first to report that a polyphenolic-rich rooibos supplement increases the antioxidant capacity, providing sufficient protection again postprandial-induced oxidative stress.

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2 July 2015 | Session 10a | Paper

Tracing trade in Tanzanian medicinal plants using molecular techniques

In Tanzania, commercial trade is one of the larger threats to wild populations of medicinal plants. However, monitoring the trade of wild-harvested herbal medicine is complicated, as most material in Tanzanian markets is traded in dried, shredded or powdered form. Molecular approaches to the identification of biological material, such as DNA barcoding, allow for the identification up to species level of processed material that has hitherto been impossible to identify. The objectives of this research project are to: 1) make a quantitative investigation of traditional herbal medicines traded in the Dar-es-Salaam and Tanga markets; 2) identify diversity and volumes of medicinal plants traded in Dar-es-Salaam and Tanga; 3) investigate conservation issues arising
from medicinal plant trade. A total 46 of semi-structured interviews were conducted with medicinal plant vendors in Dar-es-Salaam and Tanga. Twelve medicinal plant stalls were selected for detailed quantitative market surveys. Identifications were made using a combination of literature, morphology, and DNA barcoding using DNA sequences from identified reference voucher collections from fieldwork, herbaria and critically-checked online repositories. 222 single-ingredient medicinal plant samples were acquired, corresponding to at least 154 ethnosppecies. 83 medicinal mixtures were collected, each reportedly containing 2-16 different plant species. Molecular methods proved to be successful for the identification of some of these powdered medicinals sold on the markets. Market vendors recognize that some species are becoming more and more difficult to obtain from the wild, including some of the most commonly traded species. Molecular methods enable identification of plant-based products that lack characters for morphological identification, and allow monitoring of trade that was hitherto impossible. Based on various interviews, overexploitation of medicinal plants seems to become increasingly problematic, possibly due to unsustainable harvesting of barks and roots. Conservation-wise this could prove specifically pressing in case of medicinally used Eastern Arc endemics.

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2 July 2015 Session 10b Paper

Anti-inflammatory activity of Artemisia afra in RAW 264.7 macrophages

Artemisia afra is a South African plant that is used as traditional medicine for the treatment of many ailments, and is most commonly used to treat respiratory conditions, including tuberculosis (TB). Recently, the anti-cancer potential of A. afra was reported, although the plant is not known to treat cancer. Inflammation is critical for the pathogenesis of TB and there is also a well-established link between cancer and inflammation on a molecular level, by the NF-κB pathway. The transcription factor NF-κB regulates the transcription of many genes responsible for the physiological response of the immune system to cause inflammation. Although A. afra is used to treat TB but is not known to treat cancer and both TB and cancer are linked to inflammation, we aimed to determine the anti-inflammatory activity of the plant. The in vitro anti-inflammatory activity of an A. afra ethanol extract was evaluated in murine macrophages (RAW 264.7). Levels of cyclo-oxygenase-2 (COX-2), the anti-inflammatory cytokines interleukin 2 and 4 (IL-2, IL-4), the pro-inflammatory cytokine interferon gamma (IFN-γ), activation of NF-κB and nitric oxide (NO) production were measured to assess the anti-inflammatory potential of the extract. Results from this study indicated a down-regulation in the expression of inducible nitric oxide synthase (iNOS) and the enzyme COX-2 in RAW 264.7 cells treated with A. afra and stimulated with lipopolysaccharide (LPS). This is evident by the decrease of nitric oxide (NO) in a dose dependent manner and the decreased levels of COX-2 enzyme, respectively. This was shown to be mediated by the disruption of NF-κB activity.
People, agroecosystems and weeds in Mexico

This contribution synthesizes a number of studies on the relationship of people, their agroecosystems and the weeds evolving in them in Mexico and Mesoamerica. Weeds are plants that are successful in human-disturbed habitats without being deliberately cultivated. In Mesoamerica, the maize agroecosystem has various characteristics that are distinct from most Old World agroecosystems, and these characteristics have consequences both for the weed flora and the structure of the food system. The large stature of the main crop has promoted the evolution of large-sized, insect pollinated, animal or self-dispersed weeds. Also, people can walk in maize fields. This has the practical consequence that vegetables, the annual plants needed in smaller quantities, are obtained from the fields: the milpa (mixed maize field) doubles as a vegetable garden. The vegetables are both cultivated - such as squashes - and spontaneous (“weeds”, quelites). These spontaneous species may be managed at various intensity levels. Several have been shown to have improved traits because of in situ selection. They may also be economically relevant, both as part of the agricultural production and as a risk-reduction strategy for farmers. Thus, they have policy relevance. The complement of perennial plants such as cultivated fruit trees, agaves, cacti and medicinal plants, as well as spontaneous specimens of the same groups, are often found in field margins, a commonly overlooked part of the production system. Several studies of the ecological origin of medicinal plants in Mesoamerica have shown that the most important and most commonly used species are obtained from home gardens and ruderal sites, such as waysides and field margins. This shows the necessity of distinguishing agrestal from ruderal weeds in studies. I suggest that the African traditional agroecosystems based on large-statured millets could exhibit some similar characteristics, like the integration of vegetable production in the grain fields (and the consequent lack of separate vegetable gardening), perhaps also in situ selection.

Medicinal plants used in the treatment of dysentery in Amathole District Municipality

A survey of the medicinal plants used for the treatment of dysentery in five local municipalities of Amathole District in Eastern Cape Province was carried out through a questionnaire-guided interview. With the help of an interpreter and using random sampling, 55 indigenous respondents were interviewed. They respondents comprised of 25 traditional medical practitioners, 15 herb-sellers and 15 rural elders. Fifty one plants species belonging to 32 families were documented as species used for the treatment of dysentery in the study area. Fabaceae had the highest representation of plant species (seven). Other families were Asphodelaceae, Apiaceae, Geraniaceae, Anacardiaceae, Bignoniaceae, Ebenaceae, Euphorbiaceae, Hyacinthaceae,
Asclepiadiaceae, Achanthaceae, Asteraceae, Balanophaceae, Celstraceae, Convolvulaceae, Cornaceae, Iridaceae, and Hydronaceae. Two medicinal plants with the highest frequency of prescription were *Hydnora africana* and *Alepidea amatymbica*. The leaves are the commonest parts used (28%) followed by the roots (24%), bark (22%) and the whole plant (9%). Methods of preparation of recipes are either decoction, infusion or tincture. The use of some recipes as an enema was also reported. The study of the pharmacology and mode of action of the plants will contribute immensely to our knowledge of their therapeutic values.

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2 July 2015 | Session 10a | Paper

**Formalization of the natural product trade in Southern Africa: unintended consequences and policy blurring in Biotrade and Bioprospecting**

Concerns about ecological sustainability and inequality are driving the increased formalization of the natural product trade. This includes both biotrade, whereby non-timber forest products are traded for use as bulk, raw materials or commodities in various commercial sectors; and bioprospecting, which focuses on the exploration of biodiversity for commercially valuable genetic resources and biochemicals. While sustainability and equity now form part of the biodiversity governance lexicon, and recently have been codified through the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation (ABS), there has been little interrogation as to whether the policy tools used to achieve these goals are appropriate and what interests they ultimately serve. This paper aims to address this research void by examining efforts to formalize biotrade while addressing the blurred regulatory lines that increasingly exist between biotrade and bioprospecting. Drawing on interviews with producers, communities, companies and government officials, and through longitudinal research spanning more than a decade, three case studies are explored from southern Africa – baobab, devil’s claw and pelargonium – along with their associated regulatory frameworks in Zimbabwe, Namibia, South Africa and Lesotho. Findings emphasise the unintended consequences that can arise from over-regulation and poorly formulated laws; affirm the need to develop hybrid solutions that draw both on customary and statutory laws and institutions; suggest that formalization can create worrying opportunities for elite capture; and emphasise the need to pursue solutions that are more respectful of local knowledge and needs and which are based on a coordinated and regional approach to trade and regulation.
Medicinal plants used for treatment of diabetes, hypertension and cardiovascular ailments in West Cameroon

In Cameroon, numerous people rely on medicinal plants and possess lots of experience-based knowledge on the use of these plants. Plant knowledge from indigenous people is rapidly disappearing, however; this is due to environmental, social and economic pressures, processes and changes. This study aims to document and quantify medicinal plant knowledge on the treatment of diabetes, hypertension and cardiovascular ailments in Fokoue and Santchou subdivisions of Menoua Division, West Cameroon. Information related to medicinal plant species and plant remedies was collected through semi-structured interviews with 34 informants accompanied by homegarden sampling, walk-in-the-woods and snowball sampling. Quantitative methods, including use reports, cultural importance index, relative frequency of citation and fidelity level were used to analyse the data. In total, 49 medicinal plant species of 26 different botanical families were recorded in Fokoue and Santchou subdivisions of Menoua Division, West Cameroon. Most-cited plant families were Acanthaceae, Amaryllidaceae, Apocynaceae, Asteraceae, Lamiaceae, Poaceae and Rhamnaceae. Plant species Allium sativum, Aloe vera, Asystasia spp., Cymbopogon citratus, Gouania spp., Persea americana, Sonchus oleraceus and Vernonia amygdalina were evidenced as relatively important species for treating diabetes, hypertension and cardiovascular ailments. The area's indigenous people possess abundant knowledge of medicinal plants used for treating diabetes, hypertension and cardiovascular ailments in Fokoue and Santchou subdivisions of the Menoua Division, West Cameroon. Our findings confirm uses of plants documented elsewhere, but also add interesting new information that will be confirmed through formal biochemical analysis and clinical trials.

Poster abstracts

IPUF & SEB 2015
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**Use of food crop by-products in the management of diabetes**

There were 387 million diabetics worldwide in 2014, about 90% of it representing type-2 diabetes. This disease caused 4.9 million deaths in 2014, and its incidence is increasing worldwide, with low and middle income countries bearing the brunt of its mortality, the financial burden of its management and the loss of labour force due to its complications. In Africa, 76% of diabetes deaths are in persons below the age of 60. In the prevention, management and treatment of this disease, food plays an important role. Functional foods have been known to possess several health benefits to humans. However, little is known about the use of the by-products of these food crops in the treatment and management of type-2 diabetes. Examples of such by-products include apple pomace, grape pomace, banana peel, soy pulp and marula pulps. The utilization of these by-products, which until now been an environmental burden, will add value to the food crops, reduce the cost of the management of diabetes and also enable rational management of these wastes. This study therefore reviews food crops and their potential as antidiabetic agents.

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**Metabolic profiling of marula fruit, Sclerocarya birrea**

*Sclerocarya birrea,* the marula, is distributed throughout Africa, from KwaZulu-Natal northwards to Ethiopia and Sudan. The stem bark of the tree has various ethnotherapeutic uses in South African traditional medicine, such as anti-inflammatory, anti-malarial, anti-diarrhoeal etc. The marula is also processed as beer, juice, jam and cosmetic products as well as the ever popular Amarula liqueur. Notwithstanding the popularity of this fruit for its commercial use the metabolic profile of volatile and non-volatile components have not been elucidated. In this study the metabolic profiles of the green fruit while still on the tree, the green fruit when it drops and the ripe yellow fruit were compared to determine the production and development of volatiles as well as non-volatile secondary metabolite within the fruit as it develops. The metabolic profile of the fruit found in two different regions, Mbombela and Pretoria were also compared. Head space volatiles were analysed using thermal desorption followed by GC x MS. Phenolic profiles of fruit extracts were obtained by HPLC. Chemometric
models constructed from the data revealed a clear distinction between the profiles of the fruit at different seasonal development as well as the location of the sampled fruit. The compounds responsible for these separations were identified.

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Evaluation of the antioxidant, anti-inflammatory and anti-proliferative effects of Helinus integrifolius

The use of plants for medicinal purposes is wide-spread. Yet the therapeutic potential of plants remains poorly documented. Helinus integrifolius of the family Rhamnaceae is among such plants. It is a woody climber, widely distributed in the southern parts of Africa where it thrives in rocky areas. It is traditionally used to stabilise the foam in beer because of its high saponins content. Saponins have been shown to have antioxidant and anti-inflammatory properties. The ethyl acetate, methanol, acetone and hexane extracts of Helinus integrifolius were used to evaluate its antioxidant, anti-inflammatory and anti-proliferative potential in this study. The TLC profiles of each extract were developed in different mobile phases and visualised by either ultraviolet light or acidic vanillin. The TLC plates sprayed with 0.2% DPPH enabled qualitative assessment of antioxidant activity. Total phenolic compounds of the extracts were quantified spectrophotometrically. Antioxidant activity of the extracts was quantified in terms of their ability to scavenge DPPH free radical and to reduce ferric ion to ferrous ion.

The effect of the extracts on cell proliferation was determined using the MTT assay on the cervical cancer (HeLa), breast cancer (MCF7) murine macrophages (Raw264.7) and fibroblast skin (Bud-8) cell lines. Apoptosis assessment was further carried out on Raw264.7 cells using fluorescence microscopy. The anti-inflammatory effect was determined by monitoring nitric oxide (NO) production by Raw264.7 cell using the Griess reagent. The effect of the extracts on the production of reactive oxygen species was determined by measuring the amount of fluorescence produced by Raw264.7 cells stained with dichlorofluorescin-diacetate (DCFH-DA). It was also shown that the plant contained an assortment of compounds some of which have anti-oxidant activity, especially the methanol extract. The methanol extract contained the highest amount of total phenolic compounds which may have contributed to it showing the best DPPH and ferric reducing power. The extracts were selectively cytotoxic to all the cancerous cell lines in a concentration dependent manner. The methanol extract greatly reduced both nitric oxide and reactive oxygen specie (ROS) production. Further studies need to be done to ascertain the mode of action especially using the methanol extract as it showed impressive antioxidant, anti-inflammatory and anticancer activity.

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Bark food: continuity and change of Scots Pine (Pinus sylvestris) inner bark use by Sámi People, Fennoscandia
It is a narrative about the living environment and the use of pine bark as a method of subsistence in non-agricultural subarctic societies of the past and present. Being a source of the economic, social, and ideological significance, it has been regarded as the oldest vegetable food and recorded to be used by the indigenous Sámi people of northern Scandinavia extending back to 2800 BP (1). In the Sámi food economy it has been used in diverse ways and was considered as nutritious and healthy (2). My main research question in this study was: How and why has the perception/use of pine bark peeling for food among Sámi changed over time? To answer it an interdisciplinary approach to the study was chosen. My primary methods were textual analysis, image analysis, interviews with participant observation and photography as secondary methods. I have conducted 10 interviews with archaeologists, historians, craftsmen, community Elders, both men and women. I was also collecting pine inner bark samples, working with private archives, museums and other archival institutions to gather documents to supplement interviews. Representing the voices of Sámi people this study sheds new light on the fact that the knowledge of gathering, storing and preparing bark food among the Sámi has been lost (3). Furthermore, it invites to rethink the ethnographic narrative on bark food widely known as famine food as a form of re-presentation and practice.

The results of this study contribute to the field of ethnobotany, first of all, by presenting an update for the article by Anna-Maria Rautio et al. (2013) “Nutritional Content of Scots Pine Inner Bark in Northern Fennoscandia” published in Economic Botany, Vol. 67, Issue 4. Moreover, I have documented the rationales people had and still have for using the inner bark for food by applying the traditional knowledge in practice, documenting different harvesting techniques, presenting traditional barking tools and recipes, described the collected samples. Hopefully, the project will contribute to informing the encounters between peoples in the North, reveal and heal the burdens of history, suggest new approaches to curation of Sámi ethnobotanical heritage, as well as revitalize the tradition to a greater degree through cooperation among indigenous and non-indigenous institutions.

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13C NMR as a tool for in situ tannin typing and estimation in uncharacterized Acacia species

Vegetable tannins are complex polyphenols that are present in most plants. They are classified into condensed (proanthocyanidins), and hydrolysable, tannins. Proanthocyanidins are natural plant-derived polymers and their ability to complex with proteins underlies their physiological, anti-bacterial, anti-viral and anti-feedant protective roles. They are also used industrially in leather tanning, wood adhesives, water purification, and mud additives for oil drilling. In South Africa, the production of wattle (Acacia mearnsii) bark extract for leather tanning is an important sustainable agro-processing industry in KwaZulu-Natal and about 100 000 hectares plantations are harvested yearly. It creates employment in the rural areas and earns foreign currency.
In order to explore alternative sources of condensed tannins we did a comparative qualitative study on uncharacterized acacia species. The potential of solid state $^{13}$C NMR spectroscopy as a technique to estimate the proanthocyanidin tannin content of uncharacterized sources of the native tannin-containing materials was demonstrated by Wilson and Hatcher in 1988. To test this, we compared spectra from black wattle (A. mearnsii) bark with spectra from the bark of three other native Australian acacia species, Acacia pycnantha ("golden wattle"), A. dealbata ("silver wattle") and Acacia decurrens ("green wattle"), and the southern African Acacia karroo. All are actual or potential commercial sources of proanthocyanidin tannins. We concluded that NMR offers the advantage of being applicable to source materials in their native state, and has potential applications in optimizing extraction processes, identification of tannin sources, and characterization of tannin content in cultivar yield improvement programmes.


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**Rooibos tea extracts: natural anticoagulants**

Thrombosis, the formation of blood clots, is a cause of not only heart attacks and strokes, but also of deep vein thrombosis (DVT) and pulmonary embolism. Several proteins called coagulation factors are involved in hemostasis and the formation of blood clots. All the factors are found in the blood in their inactive forms. When a vessel is damaged some coagulation factors are activated in a sequence of steps (coagulation cascade) that eventually help to form a clot. The activated partial thromboplastin time (APTT) test is used to evaluate several coagulation factors e.g. XII, XI, IX, VIII, X, V, II (prothrombin), and I (fibrinogen). Prolonged APTT is an indication of coagulation factor deficiency and further studies can then be performed to identify what coagulation factors may be deficient or dysfunctional, or to determine if a specific inhibitor to a coagulation factor is present in the blood. Factor VIII (FVIII) is a plasma sialoglycoprotein that plays an essential role in normal hemostasis by acting as a critical cofactor for the serine protease, activated factor IX (FIXa). Our results showed that the APTT was delayed by an aqueous fermented rooibos tea extract. Upon further investigation it was established that the coagulation factor VIII-level decreased. This demonstrates that there are active compounds in rooibos tea that inhibit FVIII. Fractionation and partial identification of the water-soluble compounds isolated from green and fermented rooibos tea were conducted. The antioxidant activity and the effect of the different fractions on the APTT and FXIII levels in blood were tested.

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**Antimicrobial potentials of *Ansellia africana* extract against bacteria commonly associated with respiratory tract infections**
Respiratory tract infections (RTIs) are a cause of high mortality rates worldwide due to the emergence of bacteria resistant to the currently used antibiotics. The medicinal plant like *Ansellia africana* which has been reported traditionally to be useful in treating respiratory problems might be the key to finding alternative treatment options. The aqueous, acetone and dichloromethane extracts of both the root and stem of *A. africana* were screened against five bacteria that are commonly associated of RTIs namely, *Klebsiella pneumoniae* (ATCC 4352), *Klebsiella pneumoniae* (ATCC 31488), *Moraxella catarrhalis* (Clinical isolate), *Staphylococcus aureus* (ATCC 25925) and *Mycobacterium smegmatis* (ATCC 14468) using the agar well diffusion method. The broth micro-dilution assay was used determine the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). The chequer board method was used to assess the extracts’ interactions. The results revealed that the acetone root extract possessed 80% activity, acetone stem extract had 60% activity, and both dichloromethane extracts had 50% activity while the aqueous extracts had 0% activity. The zones of inhibition were ranging from 8.33±1.53 to 19.3±4.93 mm. The extracts’ MIC values were found to range from 2.5-10 mg/ml while bactericidal results were observed against *M. smegmatis* (ATCC 14468) and *S. aureus* (ATCC 25925) only. Stem acetone extract caused 78.95% of membrane damaging activity against *S. aureus* in comparison to 3% Triton X-100. Synergistic interactions were only observed between the acetone stem and root extracts against *M. smegmatis* (ATCC 14468). All the interactions of extract with antibiotic were indifferent. The antibacterial activity found in *A. africana* suggested that it may possess compounds with potential in RTIs treatment, especially against those caused by Gram positive bacteria such as *S. aureus* and *M. smegmatis*.

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**Rapid analysis of the skin irritant p-phenylenediamine (PPD) in henna products using an atmospheric solids analysis probe (ASAP)**

*Lawsonia inermis*, commonly known as henna, has been treasured for its cosmetic and medicinal applications and is inextricably linked to ancient human cultures. It is widely used as a hair dye to mask greyness and is popular for body decoration. In many cases, an aromatic amine compound *para*-phenylenediamine (PPD) is blended with natural henna to accelerate the dyeing process and intensify the colour. However, PPD (C₆H₈N₂) is an allergen that may cause severe irritation to the pharynx and larynx, bronchial asthma and sensitization to the skin. This synthetic molecule is primarily used as an ingredient of oxidative hair colouring products, as an antioxidant in rubber and is also a constituent of fur and textile dyes. In this study, a rapid direct-analysis method was established for the detection and identification of PPD using an atmospheric pressure solids analysis probe (ASAP) coupled to a Q-ToF mass spectrometer (MS). This relatively new technique can be used to ionize both polar and non–polar small-molecule compounds. The results achieved by ASAP-MS were compared with those obtained by ultra performance liquid chromatography-electrospray ionisation-mass spectrometry (UPLC-ESI-MS). The presence of the adulterant was confirmed by ASAP-MS analyses in all the samples found to be positive for PPD using LC-ESI-MS. The main advantages of ASAP-MS for PPD detection is that no prior sample clean-up, concentration or chromatographic separation is required. A single run can be completed within a minute. The proposed ASAP-MS technique is
convenient, rapid, reliable, low-cost and eco-friendly and is a powerful tool for PPD screening of Henna products.

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**Medicinal plants used by midwives at Jonotla, Puebla, Mexico**

In Mexico as in many rural communities in the world is a costume to be supervised by a midwife during pregnancy. These women as an empirical occupation being accoucheuse, nowadays are currently supported by the health sector through certifications and trainings. Within the work and according with their ecological context and worldview midwives use different medicinal plants. In the municipality of Jonotla live ten midwives which belong to the ethnic group of Nahuatl or Totonaco. The municipality midwives were interviewed as well an empirical traditional doctor for a list of plants used in their work, obtaining the name in Spanish, Totonac and / or Nahuatl, and the description and time of employment before, during or after pregnancy.

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**Rooibos antioxidants: *in vitro* models to assess their bioavailability**

Oxidative stress contributes to the pathogenesis of many diseases and consequently antioxidant therapy has attracted much attention as a potential therapeutic strategy. Regardless of the quantities ingested, antioxidants need to reach the diseased tissues at concentrations sufficient to combat oxidative stress. Bioavailability is thus a defining criterion for the therapeutic efficacy of antioxidants. In addition, therapeutic antioxidants must possess biologically relevant characteristics which can target the specific molecular mechanisms responsible for disease related oxidative stress. While many chemical antioxidant assays are available to quantify antioxidant capacity, they relate poorly to the biological environment and provide no information as to the bioavailability. The present comparative study thus aims to characterise green and fermented Rooibos extracts, well recognized for their exceptional antioxidant capacity, in terms of antioxidant bioavailability and efficacy in a disease relevant cellular setting.

Chemical antioxidant assays (FRAP, DPPH and ORAC) confirmed the potent antioxidant capacity of both green and fermented rooibos, with green rooibos possessing antioxidant activity superior to that of fermented and Chinese green tea. Bioavailability was assessed using the PAMPA assay and the results indicate that green and fermented rooibos have a permeability coefficient of $5.7 \times 10^{-6}$ and $6.9 \times 10^{-6}$
Chinese green tea permeability coefficient was $8.5 \times 10^{-6}$ cm/s. These values were comparable to those of rifampicin, which is known to have a high permeability across intestinal epithelium with a permeability coefficient of $5 \times 10^{-6}$ cm/s. To assess the antioxidant efficacy in a cellular context, 3T3-L1 preadipocytes were pre-treated with rooibos extracts and then exposed to different conditions to induce oxidative stress. Although both fermented and green rooibos extracts attenuated starvation induced apoptosis and $H_2O_2$ induced cell death, the efficacy did not reflect the chemical antioxidant capacity. Taken together the data emphasises the need to characterise antioxidants beyond simple chemical antioxidant capacity.

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Preliminary studies on *Sterculia murex* (Lowveld chestnut)

In South Africa there are numerous fruit species that are well known and highly prized by local people who often depend on these trees for food security. Africa has a wide diversity of fruits that provide a source of vitamins, minerals, amino acids and trace elements to rural populations. Very few fruits from Africa have been developed into commercial crops. Value adding offers opportunities for development of these species. The Lowveld Chestnut (*Sterculia murex* Hemsl.), occurs only in the Lowveld regions of Mpumalanga and Swaziland. The large five-lobed fruit are light green and covered in hard, hairy spines. The seeds are large, embedded among hairs that cause irritation to humans. The edible seeds are very nutritious having a high protein and oil content. The seeds have a pleasant, sweet flavour and are delicious when roasted over a fire. The potential to develop the seeds (nuts) as a commercial product was investigated and evaluation of the nuts was carried out to determine quality and suitability for marketing. Analyses carried out included the Rancimat analysis, which allows shelf-life prediction of edible fats and oils, peroxy value determination, free fatty acid test, p-Aniridine value determination and oil content. Constraints for commercialization including harvesting, pests, diseases and dehusking will be discussed.

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Indigenous knowledge and use of *Anisodus tanguticus* for climate change adaptation within Tibetan pastoral communities on the eastern Tibetan Plateau, China

Few studies have investigated the role of indigenous knowledge in local climate change adaptation practices on the Tibetan Plateau. Here, we present a case study of Tibetan pastoralists on the eastern Tibetan Plateau who have developed a novel use for a toxic herb, *Anisodus tanguticus* (Maxim.) Pascher, to help them cope with extreme winter events. Our study investigated their knowledge and use of this plant, evaluated this plant’s importance for local communities; analyzed its possible phytochemical effects and explored how use of this plant is linked to climate change adaptation. The study methods consisted of semi-structured interview and participatory observation. An in-depth household survey was conducted in two villages, in addition to key informant interviews in seven villages. We found that the use of *A. tanguticus* as supplementary livestock feed may be regarded as a measure for climate change adaptation.
adaptation in the study area. Local communities have a rich repository of knowledge about *A. tanguticus*, including its habitat, life history, uses, and health enhancing effects, which may be associated with four constituent alkaloids. Its functional use in the diet of most livestock enables them to endure snow disasters and extreme cold events. Based on local practice, the timing of its harvest is considered crucial in preventing poisoning of the animals. Overall, The Tibetan people have long interacted with their environment and its biodiversity. Consequently, they have acquired knowledge and developed various practices to enable them to live in the context of a highly unpredictable climate.

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The ethnobotanical research and its relevance in the Indian state of Arunachal Pradesh

The Eastern Himalayan region including the state of Arunachal Pradesh is very rich in its floristic diversity. The state commonly known as the “Land of the rising Sun” is located in northeastern parts of India. It is also one of the richest states in the country in cultural diversity harbouring 26 major tribes and 110 sub tribes living harmoniously in the forested hilly terrains. Because of the richness in biodiversity and ethnic diversity, the state can be considered as an important place for ethnobotanical research. Proper documentation of the ethnobotanical knowledge of these tribal communities will lead in understanding the wide range of resources are being utilized and also for selection and management of economically potential resources. The objective of the present work is to review the ethnobotanical research undertaken in the state and to discusses its relevance. All the possible publications and other literature on ethnobotanical work and related field were collected and examined. The data collected by the authors during the past 15 years were also added. The result of the study revealed that, historically although the ethnobotanical work in the state may be linked with the botanical exploration initiated by the botanist like W. Griffith, J. D. Hooker, I. H. Burkill, Kingdom Ward, etc. way back in 1850s (1850-1940), the real ethnobotanical works have been undertaken mostly after 1980s. During the past 30 years attempts have been made by various workers to explore the rich ethnobotanical heritage of the tribes and as result a large number of wild plants have been listed from the state with their utilization pattern. It has been found that more than 1200 species have been used with majority (>80%) of them are as ethnomedicine and edible plants. Today, identification of numerous economically viable plants have been made through these studies, the management of which may uplift the socioeconomic condition of the people and the state.

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Antibiofilm activity of South African plant extracts against *Mycobacterium* spp. and their mechanism of action using mycothiol reductase

Tuberculosis is an infectious disease, mostly affecting lungs or abdominal area. The causative agent of TB is a bacterium called *Mycobacterium tuberculosis*; it is the
second leading cause of death in the world. Natural sources have been considered as an alternative, as resistance of *M. tuberculosis* to commercially available drugs. Twenty South African medicinal plants were evaluated for their antituberculosis activity. Plant extracts were evaluated for *in vitro* antimycobacterial activity using the Microtitre Alamar Blue Assay and Cytotoxicity with XTT (2,3-Bis-(2-Methoxy-4-Nitro-5-Sulfophenyl)-2H-Tetrazolium-5-Carboxanilide) assay. Cytotoxicity test was done on human macrophages (U937 cell line). Of all the 20 extracts 7 showed activity against *Mycobacterium* with a minimum inhibitory concentration ranging from 125-31.25 μg/ml. *Ficus sur* had a selectivity index of 3 followed by *Salvia africana lutea* and SP plant from Malpighiaceae family with a selectivity index of 2. The plant extracts were further tested for their activity against Glutathione disulfide reductase (Human analogue) and Mycothiol disulfide reductase (Mycobacterium analogue). The inhibitory activity of the plant extracts was determined using a DTNB-coupled Glutathione/Mycothiol disulfide reductase assay. *Typha minima* showed a potential inhibitory activity against Mtr with an effective concentration at which 50% activity is inhibited (EC50) of 47.89±47.5μg/ml and had less inhibitory activity against Gtr with an EC50 of 813.5±3.21μg/ml. The 20 plant extracts were screened to evaluate whether they had antimicrobial and antibiofilm formation activity. Utilizing *Mycobacterium smegmatis* as the organism, which is a genetic homologue to Mycobacterium tuberculosis. The plant extracts; SP plant from Malpighiaceae family, *Salvia africana lutea, Withania somnifera* showed considerable antibiofilm activity and was validated by determining quantitatively. The effective concentration (EC50) was determined and *Leonotis leonurus, Salvia africana lutea* and SP plant showed potential biofilm formation inhibition at concentration 45.55±0.2475μg/ml, 100±56.83μg/ml and 61.39±60.59μg/ml respectively.

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Nutritional properties and antioxidant capacity of *Polyporus alveolaris* from Jonotla, Puebla, Mexico

Among the wild mushrooms such as those of *Polyporus* genera that grow in the decaying logs of jonote’s tree (*Heliocarpus appendiculatus*), in Jonotla, Puebla state, Mexico the special mushroom identified as *Polyporus alveolaris* is consumed as feed, however, nutritional studies as a potential human feed supplement of this resource have not yet been undertaken. The aim of this research is to contribute the study of nutritional properties of this species, as an alternative source of protein. The proximal composition of mushrooms was determined by AOAC methods, total phenolics and antioxidant capacity were assessment from hydro-methanolic extract of mushrooms by Folin-Ciocalteu method and the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, the results were expressed as Gallic Acid Equivalent (GAE) and Trolox Equivalent (TE) respectively. The content of protein (34.65±0.82%), fat (1.39±0.08%) and raw fibre (24.39±1.17%) were estimated on a dry weight basis. Total phenolic content was 3.48±0.18 mgGAEg⁻¹ in DPPH assay, the relative radical scavenging capacity (RDSC) was 3.57±0.08 mmol TEg⁻¹. The results obtained in this study show that *Polyporus alveolaris* could be important from a nutraceutical point of view, for its content of protein and antioxidant activity.
Can flow cytometry be used for gender verification of marula, *Sclerocarya birrea*?

Marula, *Sclerocarya birrea* (Anacardiaceae), is a medium to large, deciduous tree well-known for its plum-sized edible fruits. It is widespread throughout Africa and in South Africa occurs as far south as KwaZulu-Natal, although it is dominant in the Limpopo Province where it occurs in woodlands on sandy soils. Male and female flowers are borne on separate trees. This species has a wide range of uses including a number of cultural and medicinal uses as well as a high economic value in terms of product development from the bark, wood and fruits. As a result, not only are the fruits highly prized for the famous Amarula alcoholic beverages which are a successful commercial industry, but several other agri-processing industries are being developed which make use of the fruits. Since the fruits are borne on the female trees only, it would be useful to determine the gender of seedlings prior to formal planting and cultivation so that orchards contain the majority of female trees. Flow cytometry analysis which is used to determine ploidy level and nuclear DNA content, provides a fast, efficient and non-destructive method of sample analysis. In this study, different tissue types harvested from known male and female trees were investigated for their ease of analysis. DNA content of the known male and female samples was determined and compared in order to assess the applicability of flow cytometry as a method for gender verification in marula.

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Relationships between formal education and ethnoveterinary knowledge in Eluwai village, Tanzania

Ethnoveterinary medicine (EVM) is widely accepted to be cheap, safe, effective, and culturally sensitive, and is extremely important in primary livestock healthcare in developing regions (1). Traditional knowledge (TK) such as ethnoveterinary knowledge (EVK) is under threat of erosion through an ‘extinction of experience’ (2), which may be fuelled by formal education which subordinates TK and TK transmission systems to western scientific knowledge (WSK) and school, and removes children from informal learning networks and experiences through which they traditionally learn TK (3). This is particularly significant if young people must travel to urban areas to attend school. For the Maasai cattle are a primary food source and social currency, thus they have a great deal of TK about how to care for their herds. This study investigated the relationship between formal schooling and EVK among Maasai students attending a non-government intercultural school, and their unschooled peers in a rural village in Monduli District. It did this by comparing lexical knowledge through freelisting activities, and substantive knowledge gleaned through semi-structured interviews conducted in Kimaasai through an interpreter. Questionnaires were used to understand the socio-economic background of students, highlighting a range of factors which interplay in the process of TK erosion. It also investigated attitudes toward EVM among both students and villagers through questionnaires and semi-structured interviews. The research
highlighted the continued importance of EVM to rural livelihoods in the study site; EVM was found to be highly valued by pastoralists who often use it complementarily to conventional medicine. Formal schooling was found to be negatively related to young peoples’ EVM, however several factors interplayed with this relationship including: parents’ occupation (subsistence/mixed vs. commercial only), active teaching of ethnoveterinary medicine by informal teachers at home, and students’ practical experiences of livestock care, such as herding livestock away from home during the dry season (ronjo). These interactions suggest that educators, families, and communities should work together to maintain traditional learning networks and knowledge transmission both in and out of school. Finally, the study revealed the overwhelmingly positive attitude of students participating in an intercultural curriculum toward TK, cultural values and rural livelihoods. It concludes that rural location, staff from local ethnic groups, and culturally sensitive curriculum content and teaching methods may help to reduce the negative impact of formal schooling on TK and cultural identity.

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Illustration of the impact of illegal harvesting of bark from Warburgia salutaris in the Kruger National Park

Warburgia salutaris is an important medicinal plant that is widely used for a variety of ailments but is extremely rare and only found in isolated populations in the wild. It is expensive to buy, and is classified as an endangered species. The Kruger National Park (KNP) population faces a number of threats possibly including climate change and has been subjected to illegal harvesting of increasing intensity over the past few decades. This regional scarcity has resulted in local pressure on the population within the Kruger National Park, in the form of uncontrolled illegal harvesting of bark from the “protected” trees. This could pose a threat to the current status and long term survivability of the plants. In addition to the biodiversity conservation pressure, there is further pressure on the KNP population in the form of demands for access to natural resources. The denied access to natural resources within the park is thought to contribute negatively to park-neighbour relations. Through the Warburgia salutaris Conservation Programme, it is hoped that protection of this population can be done through promoting the sustainable use of W. salutaris including the promotion of alternative sources of W. salutaris tissue, to reduce the local illegal harvesting of W. salutaris from within the KNP, to monitor the W. salutaris population in KNP to be able to detect changes in its status, and to provide benefits and in so doing, build a stronger constituency for conservation of the plant with the traditional healers and their associated communities. In addition to this, SANParks has 8 armed field rangers who actively patrol the known populations of Warburgia trees within the boundaries of the KNP and monitor any activity or harvesting in the area. These field rangers also monitor various aspects of the plant population, habitat and landscape conditions and also actively searching for new pockets of plants in remote areas. This intervention has been successful to date and continues to provide more
information and support for the continued protection of this valuable component of the
Kruger Park ecosystem.

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Two dimensional gas chromatography as a tool for identification of minor fatty acid methyl esters of palm and palmist oils

Vegetable oils are essential nutrients and important sources of energy. A deficiency of essential fatty acids may lead to growth retardation and dermal symptoms. Palm oil is obtained from the fruit mesocarp while palmist oil is obtained from the kernel of *Elaeis guineensis*. This study was undertaken to determine the compositions of these oils using both conventional gas chromatography (GC) and the more sophisticated technique of two dimensional gas chromatography (GCxGC). The oils were methylated and converted to their corresponding fatty acid methyl esters (FAMEs) to determine possible differences in their FAME profiles. One dimensional GC coupled to mass spectrometry (MS) with flame ionization detector (FID) and GCxGC–Time of Flight (ToF)–MS were used to determine the fatty acids of palm and palmist oils from Cameroon, Nigeria and Ghana. Most of the FAMEs were identified by NIST library spectra. The major compounds in palm oil were hexadecanoic acid methyl ester (27.4-37.0%), 9-octadecenoic acid methyl ester (22.1-43.0%), 9-12-octadecadienoic acid (8.5-13.4%) and stearic acid methyl ester (7.5-13.7). Some FAMEs were present in small amounts, but could be used to differentiate palm oil from different origins. These include 11-octadecenoic acid methyl ester, 12-methyl tetradecanoic acid methyl ester, 8,11-octadecadiynoic acid methyl ester, 2-pentenoic acid, 2-methoxy-3-methyl, methyl ester, 2,6-dimethyl-8-oxoocta-2,6-dienoic acid methyl ester, 9,12,15-octadecadienoic acid (Z)-methyl ester, which could only be identified by GCxGC-ToF-MS. The palmist oil FAME compositions were very consistent and were characterised by high levels of dodecanoic acid methyl ester (35.2-40.1%), 9-octadecenoic acid methyl ester (14.0-17.6%), hexadecanoic acid (Z) methyl ester (11.2-15.0%) and myristic acid methyl ester (15.1-17.8%). However, qualitative and quantitative variations were evident when the minor FAMES were considered. Compounds including boronic acid methyl ester, propanoic acid, 3-hydroxy methyl ester, 2-oxo-decanoic acid methyl ester were identified as possible markers to differentiate the two palmist samples when using GCxGC–ToF–MS. As expected, this technique was found to be more sensitive than one dimensional GC for the analysis of FAMEs in vegetable oil samples, allowing many additional minor FAMEs to be identified.

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Hepatoprotection and immunostimulation of selected medicinal plants against tuberculosis

Tuberculosis (TB) is a disease caused by the bacterial pathogen *Mycobacterium tuberculosis*. It is associated with high mortality rates in both developing and developed countries. Many higher plants are found medicinally associated with tuberculosis
infection. Plants belonging to thirteen families were selected, based on their traditional usage for tuberculosis and associated symptoms. Eight plants showed the best antimycobacterial activities (MIC-value ≤ 500.0 µg/ml) against *M. tuberculosis* H37Rv. Cytotoxicity values on U937 and HepG2 cells were obtained and the IC50 values ranged between 40 ± 4.30 and > 400 µg/ml for the U937 cell line and 72.4 ± 1.50 and > 400 µg/ml for the HepG2 cell line. *Heteromorpha arborescens* had the lowest IC50 value in both cell lines. Of the 19 samples that underwent the DPPH antioxidant assay, *Eucalyptus deglupta* and *Melianthus major* showed significant free radical scavenging activities. Hepatotoxicity induced by acetaminophen identified *Searsia lancea* with hepatoprotective activity of 59.37% at a ¼ IC50 concentration. Out of the 7 samples that were investigated for their immunomodulatory capabilities, *Eucalyptus deglupta* produced the most IL-12 with *Sutherlandia frutescens* also showing positive results for IL-12 production. In the present study, *Eucalyptus deglupta* showed the most promising results with good activity against *M. tuberculosis* with an MIC-value of 250 µg/ml. It also has potent antioxidant activity with an IC50 value of 1.33 µg/ml. This sample also stimulated high production of the cytokine, IL-12. *Searsia lancea* showed moderate antimycobacterial activity with an MIC-value of 500 µg/ml. The antioxidant potential also showed promising results with an IC50 value of 4.50 µg/ml. The hepatoprotective capability of *Searsia lancea* was 59.34% at a ¼ IC50 concentration. Another sample *Sutherlandia frutescens* showed effective antimycobacterial activity with an MIC-value of 250 µg/ml. It also stimulated production of IL-12 with 13.43 produced. These three samples can be considered for further studies for the consideration as adjuvants for current tuberculosis treatment.

**Bark anatomy of some medicinally important trees of South Africa**

Bark is a complex of tissues located in the outer part of the stem of woody plants. In South Africa, the bark of about 40 species is regularly traded and used as traditional medicine. Bark anatomical data are widely used in pharmacognosy, taxonomy, ecology and forensic studies. However, information about the bark structure of African trees is incomplete. The bark anatomy of 15 medicinally important South African woody plants (*Adansonia digitata*, *Adenia gumifera*, *Calodendrum capense*, *Erythrina lysistemon*, *Harpephyllum caffrum*, *Heteromorpha arborescens*, *Heteropyxis canescens*, *H. natalensis*, *Leucosidea sericea*, *Prunus africana*, *Ptaeroxylon obliquum*, *Sclerocarya birrea*, *Syzygium cordatum*, *Warburgia salutaris* and *Zanthoxylum capense*) were studied using classical anatomical methods. Combinations of anatomical characters are of taxonomic value and may also be used for the identification of medicinal raw material. These characters include the type of formation of the periderm, the pattern of secondary phloem (in transverse section), the length and structure of sieve tubes and fibres or fibre-like sclereids and rays, the type of axial parenchyma, the presence and type of secretory structures, crystals and sclereids.
Plants used for “Wei Sang” in Tibetan region

“Wei Sang” is the custom of burning offerings sacrifices in Tibetan culture. “Wei” means “small fires” and “Sang” means “cleaning”[1]. It was originated from Ben religious belief and survived when Tibetan Buddhism developed. The places for “Wei Sang” activities include nature sacred sites, temples, and behind or in the yard of houses in Tibetan region. There are stone pagodas or white pagodas in these areas for placing plant materials. Most of these plants came from local plants species and varied in different places. The plant materials the Tibetan choose for Wei Sang share some similarities: the smoke must be fragrant and white when burning[2]. However, the studies on “Wei Sang” culture and associated plant materials were ignored, although Wei Sang is with extreme significance in the Tibetan religious believes. To investigate and document the plant species used for “Wei Sang”, ethnobotanical surveys were conducted in Shangri-La and Weixi counties of Yunnan, Muli County of Sichuan and Milin County of Tibet, China. Information was collected using semi-structured interviews and key informant interviews. Ninety-seven species belonging to 34 families and 71 genera were collected and documented. Of these 97 species, one species is fern, 12 species in 3 families and 8 genera are gymnospermous, 84 species in 30 families and 62 genera are angiosperm. The number of species belonging to Asteraceae is the most (22 species, 22.7%). As for the life forms, 45 species are herbs, 30 species are trees, 19 species are shrubs and 3 species are vines. Tibetan people only use thin and young branches and leaves of trees or shrubs, never cut down the whole woody plants. The part of herbs they used is the whole plant or aerial part. Seven species are endangered plants and 13 species are endemic to Tibetan region. Species in Pinaceae, Cupressaceae and Asteraceae are the most frequently used plants. Among these plants, 27 species are also used in Tibetan medicines. “Wei Sang” played an important role in the religious activities of Tibetan. Some species under high frequency usage condition might be disturbed, especially the endangered species. The fragrant smoke of these plants could contain some volatile constituents. Thus, this study can serve as a basis for future investigation of “Wei Sang” culture and exploit rationally these “Wei Sang” plant species.

Reconstructing paleo-ecological conditions in a high elevation fen in western Maryland

Palynology, the study of pollen grains and other spores found in archaeological or geological deposits, is used in reconstructing historical vegetative conditions and evaluating vegetation dynamics. Sediments, charcoal, pollen and spores can be used to assist in active restoration efforts by providing a reference of species and
communities that were present in the past as a target for restoration. Palynology can also indicate species that have gone through genetic bottlenecks and determine the relationships between species dynamics and anthropogenic events, such as fire return intervals, or abiotic conditions, such as drought or temperature fluctuations. Application of long-term records to restoration allows for management decisions to be made anticipating climate change and in light of how vegetation has responded to previous climatic events. Changes in vegetation composition are predicted to result from the influences of the three specified drivers, fluvial activity, climate change and anthropogenic impacts which have affected the dynamics of the landscape. A paleoecological reconstruction project was conducted at a high elevation mountain fen in Western Maryland. Specific objectives of this project were to evaluate the dynamics of rare and declining tree species including tamarack (*Larix laricina* (Du Roi) K.), butternut (*Juglans cinerea* L.), and eastern hemlock (*Tsuga canadensis* (L.)) to evaluate genetic bottlenecks and associations of decline with abiotic factors. In addition fire return intervals and evidence of anthropogenic activity were analyzed. Sediment cores were obtained from the least disturbed areas of the fen using a mechanic corer and samples were sent out for radio carbon dating. Pollen and charcoal counts were completed from the organic sections of the cores and placed into percentage diagrams. This project provides long-term reconstruction of the vegetative dynamics in the area in order to prioritize restoration activities in lieu of changing climatic events.

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Ecology and selection of jonote tree for fiber obtainment at Sierra Nororiental region, Puebla, México

Jonote tree (*Heliocarpus appendiculatus* T.) is the main support of many families of this region. It is the raw material for the manufacturing of handcraft as: baskets, mecapales, vases, backpacks, bags and crates. The commercial activity of those is the principal economic income, although the commercialization of the fiber ready for artisanal use. The selection of the adequate tree for fiber is based on dasometric characteristics: size, height, diameter, vigor. This process takes place the dry season most of the time. The separation of the external of the internal crust is carried out in situ, the internal fiber is the one used on handcrafting. Different Sierra Nororiental artisans from the ethnics totonaco and nahuatl were interviewed about the obtainment of jonote fiber, all consist with some similarities about selection, obtaining and processing of the fiber.

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Ethnobotanical survey of selected medicinal plants in Vhembe district, Limpopo Province, South Africa

Medicinal plants are widely used in some countries as a primary source of prevention and control of various diseases in animal and human. The current study was conducted to identify medicinal plants used by local people and traditional healers.
to treat various ailments in Vhembe district, Limpopo, South Africa. A questionnaire was designed to gather information on the local name of plants, plant parts used and methods of preparation administered by the traditional healers. The study revealed that more than twenty medicinal plants are used for treatment of various diseases such as chest complaint, sexual transmitted infections, headache; swollen legs, hypertension, blood purification, asthma, and infertility. Specific part of the plant used for medicinal purposes varies from species to species and from one traditional healer to another. The dominant families were Fabaceae, Myrtaceae and Euphorbiaceae. Some of medicinal uses of identified plants which have not been recorded in the consulted literature, have also been documented. Noticeably, many of these plants are grown in the wild. Roots, fruit, bark, leaves, seeds and in some instance the whole plant parts are used for the preparation of medicine while decoction was the general method of preparation.

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²Phytochemical and molecular analyses of *Stevia rebaudiana* extracts generated from different cultivation methods

*Stevia rebaudiana* Bertoni a perennial herb native to Paragua contains sweet zero-calorie *ent*-kaurene diterpene glycosides found in the leaves. There is potential to establish this plant as a crop leading to a new agricultural industry which may be of benefit to South Africa’s economy. Using tissue culture as a scientific study tool the germination of Stevia seeds were tested after a tetrazolium test showed a low viability of 23%. Furthermore, seeds were germinated *in-vitro* on one-tenth Murashige and Skoog medium (MS) (1962). Seeds were subjected to four variables; scarification using 70 % (v/v) sulphuric acid, placed on media with smoke solution, placed on a combination of both treatments or in gibberellic acid. Seed germination was best when seeds were treated with smoke solution and gibberellic acid induced germination (final mean 0.21 and 0.19 respectively) but other treatments showed very poor germination. An efficient tissue culture system for *S.rebaudiana* was established using the seedlings. Nodal explants showed better growth than the leaf explants. To study the macro- and micro-nutritional requirements of *S. rebaudiana* plants, the effects of nitrogen and phosphate were studied on the *S. rebaudiana* micro-plant system. Phosphates affect the growth production and regeneration *in vitro* but higher levels of steviosides are accumulated depending on higher nitrate-medium. Distinct clusters based on the metabolomic profile are due to nitrogen and phosphate treatment affecting stevioside metabolism and flavonoid production respectively.

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Characterisation and biological activities of fractions from leaves of *Anonidium mannii*
Anonidium mannii is a plant of the Annonaceae which is used traditionally in Africa for the treatment of gonorrhoea, malaria, cancer, skin inflammation and dysentery. In this study we will evaluate antimalarial, antifungal, antibacterial activities and cytotoxicity of different fractions in order to provide a scientific rationale for the traditional use of Anonidium mannii as well as provide possible novel drugs in the treatment of multi drug resistant strains of parasites and bacteria. Extracts from the leaves were obtained by using solvent extraction and different fractions obtained using column chromatography eluted with solvents of varying polarities to obtain a wide range of metabolites. The antimalarial activity of the various fractions and some pure compounds was evaluated using plasmodium lactate dehydrogenase (PLDH) assay. Cytotoxicity evaluated using HeLa cells. Antibacterial activity of the extracts was evaluated using micro-dilution assay against Gram-positive (Staphylococcus aureus and Enterococcus faecalis) bacteria and Gram-negative (Escherichia coli and Salmonella typhi) bacteria. Antifungal activity was evaluated against Candida albicans. The fractions that showed best antimalarial activities were: C1AM6P with an IC50 of between 0.0849 to 6.291 μg/ml; C2AM8P with IC50 between 0.5152 to 4.914 μg/ml and C1AM1P with IC50 between 1.327 to 1.966 μg/ml. AM3C a pure compound gave the best antifungal activity with an MIC of 62.5μg/ml. AM9C another pure compound showed the best activity against S. typhi with a value of 31μg/ml. AM2C another pure compound showed an activity of 62.5μg/ml against E. faecalis. The best cytotoxicity was demonstrated by the fraction C2AM3P with an MIC of 7.1449 ± 0.1656 while AM1C which is a pure compound also had an activity of 20.20997 ± 1.21307. The study showed promising antibacterial, antifungal, antimalarial and anticancer activity of Anonidium mannii. These results validate the use of Anonidium mannii against cancer, skin inflammation which is caused by fungus, malaria and bacterial diseases. Further work still has to be done to confirm the anticancer activity and to deduce the structures of the pure compounds.

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Improved propagation methods of Bulbine latifolia var. latifolia

The genus Bulbine (Xanthorrhoeaceae) consists of ± 80 species from Australia and Southern Africa. B. latifolia var. latifolia commonly known as rooiwortel, ibhucu and ingcelwane is endemic to South Africa and widely distributed in Gauteng, KwaZulu-Natal, Mpumalanga, Eastern Cape and Western Cape Provinces. B. latifolia var. latifolia is well known for its medicinal application and the leaf sap is used in a similar way as the gel of Aloe vera for the management of wounds, rashes, cracked lips, itches, ringworms and burns. The stem powder is used to increase the level of testosterone and as an aphrodisiac. The infusion of root decoction is used to quell vomiting, diarrhoea, convulsion, venereal diseases, diabetes and rheumatism. B. latifolia var. latifolia was among other plants identified by Muthi Futhi Trust for commercial production and this community based project need information on the propagation system of the plant to ensure sustainable production. Two propagation methods, seed germination and vegetative propagation were investigated under controlled environmental conditions. Seeds were sown in petri™-dishes lined with moist double filter papers and placed in incubators for germination under five different temperatures (10°C, 15°C, 20°C, 25°C and 30°C) for a period of 30 days. The experimental design was conducted as a Latin square with five replicates. Preliminary
results indicate the highest germination rate at temperatures between 15°C and 25°C. Three vegetative propagation techniques were also conducted namely: vertical, horizontal and divisional root cutting. The cuttings were sterilized in a solution of 1.0% sodium hypochlorite for 10 minutes and planted in a polyethylene bags in moist vermiculite and placed in the incubators under five different temperatures (10°C, 15°C, 20°C, 25°C and 30°C) for root and shoot development. The experimental design was conducted as Latinized row/column with three replicates. All three methods of root cutting were able to develop shoots and roots at temperatures between 15°C and 25°C.

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Antiproliferative activity of extracts from four medicinal plants from Mozambique

The success of plant derived compounds such as vinc a alkaloids and paclitaxel highlight the potential of plants to produce therapeutic products for the treatment of cancer. This study is an exploratory investigation of the antiproliferative effects of root extracts from four Mozambican medicinal plants on cancer (breast, melanoma and renal) and normal human foetal lung fibroblast cells using the Sulphorhodamine B assay. *Combretum hereroense* was selectively potent against MCF7 breast cancer cells while it showed moderate activity on TK10 renal and UACC62 melanoma cells. Extracts from *Cassia abbreviata*, *Protorhus longifolia* and *Xylopia parviflora* generally showed weak anticancer activity. The plant extracts used in the study were classified as low hazards when applied on WI-38 normal foetal lung fibroblast cells. The highly selective anticancer activity of *Combretum hereroense in vitro* warrants further investigation into its anticancer properties.

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Propagation of rooibos cuttings: preliminary results

Rooibos (*Aspalathus linearis*) is an endemic South African fynbos species, unique to the Cederberg region, north-west of Cape Town. Rooibos is today very popular and consumed in many countries, mainly due to its potential health-promoting properties, especially its antioxidant activity. However, a shortage of good quality plant material is currently hampering the growth of the industry. Rooibos can be propagated vegetative or by seeds, but vegetative studies have shown poor rooting results. To investigate this further the ARC lay out two small trials in a complete randomized block design during November 2014. The aim of these trials was to get an indication of the effect on rooting by comparing two different growth mediums (volume ratio mix 1:1:1 peat moss: sand: polystyrene and 2:1 peat moss: sand) and two different types of cuttings (top and second). Cuttings were placed on a bottom heated warm bed with mist sprayers. After 4 months data were taken on percentage plants survived and rooted, number of roots, length of roots, mass of roots and biomass. The preliminary results indicated that more research is needed on vegetative propagation of rooibos and that it can be
improved by using different mediums and type of cuttings. Size also seems to play an important role. These preliminary results will now be used to design trials on improving the rooting ability of rooibos cuttings.

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Assessing growth and phytochemistry of Rhodiola rosea in coastal Labrador for small-scale enterprise

Rhodiola rosea (L.) (Crassulaceae) is an amphi-Atlantic plant with considerable value in both traditional pharmacopeias as well as the commercial natural products industry. Despite its broad ecological amplitude, little is known about the effects of environmental conditions or habitat upon its phenotypic plasticity and phytochemistry. In particular, while only a few studies have investigated the biology of North American populations of rhodiola, none have examined the abundant coastal populations native to Labrador, an area that is being significantly affected by climate warming. Interviews with Nunatsiavut Inuit elders in Labrador have documented traditional knowledge and use of rhodiola, locally known as tulligunak, as well as enthusiasm for the development of a community-based enterprise to market value-added, locally cultivated rhodiola as a natural health product. However, the geographical variability in growth and phytochemistry of local rhodiola populations must first be addressed, in order to inform cultivar selection and cultivation conditions. We investigated the effects of latitude, substrate, and sex (female vs male) on the growth and phytochemistry of coastal Labrador populations of rhodiola. Wild plant specimens were sampled from northerly (Nain) and southern (Rigolet) populations, and from sand, organic, or rock substrates to compare growth, morphology, and phytochemistry. Latitude and substrate were found to have a significant effect upon overall growth and biomass, while the differences between males and females were not significant. Greatest biomass was found in specimens gathered from southern populations and those growing in sandy and organic substrates. Substrate had a significant effect on salidroside, rosavin, and tyrosol, with less tyrosol and salidroside in rocky substrates, and less rosavin and rosarin in sandy soil. Sex did not have a significant effect upon phytochemistry. These results will inform development of a community-based enterprise with tangible and intangible benefits for a remote aboriginal community. Importantly, by cultivating local strains of rhodiola for commercialization, this will help mitigate pressure on wild populations of rhodiola due to commercial harvest activities.

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Using local ecological knowledge to model the distribution of two palm species in southern Mozambique
In southern Mozambique *Hyphaene coriacea* and *Phoenix reclinata* are two important palm species used by local people as sources of weaving material, roofing material, traditional beverages and fruits. Information on the occurrence of each species obtained via local ecological knowledge is especially useful in areas where there is no previous formal mapping assessment, and can be used as starting point to build models of species distributions, which was the objective of this study. A participatory mapping approach was implemented through 15 local village workshops to elicit the local knowledge of species presence and absence and preferred and avoided habitats. Workshop participants were selected from different palm user groups and village members with an extensive knowledge of the area. Each participant was asked to locate sites in the study area where each palm species occurs, marking on tracing paper overlaid on a geo-referenced map where the species occur, after first orientation of local reference landmarks on the map. The results were then debated within the group to reach a collective opinion on the distribution of each palm species. Participants were also asked about the characteristics of areas where these species are normally found. The data were digitized and used to construct each species geo-referenced current distribution map to be used in further ecological surveys.

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**Who spread African rice? Curiosities roused by landscape genomic studies on domestication traits**

Whole genome resequencing of traditional crop varieties African rice (*Oryza glaberrima* Steud.) was domesticated in Western sub-Saharan Africa over 2000 years ago. Different theories about its center of origin of domestication have been posited. One theory suggests the upper Niger River Delta as a center, and others have suggested multiple centers or secondary centers that also include areas along the Atlantic coast. Whole genome resequencing of 95 African rice landraces allowed for population genetic analyses to be done that show clear distinct populations among these candidate centers. Using this framework, we explored alleles related to adaptation including domestication and diversification to tolerate new landscapes. Surprisingly, resulting patterns point to a secondary center as a source of genetic diversity at putatively adaptive loci, which adds a third theory whereby African rice was domesticated in a single origin but not in the inland delta, but rather, the lower Niger basin. In this study, we report details on the history, the archaeological and linguistic records, the crop traits, and the diverse human uses of African rice that require reinterpretation under the lens of this new third hypothesis. The putative functions of adaptive loci are put into hypotheticals on the time, place, and rate that selection would logically have commenced, and then are tested against landscape patterns. ave uncovered genetic-geographic correlations that clarify important centers of origin and admixture. For recently domesticated crops and for thoroughly-studied models, historic explanations for these population genetic patterns, including trade routes and human migrations, have been published. However, the completion of population genomic
analyses on two crops of major importance in Africa, the date palm (*Phoenix dactylifera* L.), and African rice (*Oryza glaberrima* Steud.), both not considered model crops, have raised numerous new questions about their post-domestication spread out of their origins. 62 date palm varieties ranging from Morocco to the Indian subcontinent were resequenced and a genetic map of >12 million single nucleotide polymorphisms (SNPs) was used to examine nucleotide diversity, linkage disequilibrium, selective sweeps, and sequence polymorphism around candidate domestication/diversification loci. Similar analyses were performed on a dataset of >6 million SNPs generated by resequencing of 95 African rice landraces spanning major cultivation hubs in sub-Saharan Africa. Given that there is limited post-Neolithic North or West African archaeological, ancient linguistic, and migratory data for African rice or date palm, the resulting population genetic patterns have illuminated many new questions about the role of humans in the spread and post-domestication evolution of these crops, specifically over the past three millennia. Fortunately, in both datasets, we observed strong geographic structure in population assignments, phenotypes specific to locations suggesting culture-specific preferences, and candidate genes that underlie those phenotypes. Together, these results suggest that with expanded sampling of landraces, for which genotype and phenotype data can be obtained, it will be possible to create refined depictions for the routes of migration and cultural groups responsible for the spread of date palm and African rice.

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**A preliminary list of useful plants of Amandawe area in KwaCele, KwaZulu-Natal**

As part of a larger study of the ethnobotany of the Amandawe area in KwaCele, KwaZulu-Natal, a checklist of useful plants was compiled. Five key literature sources were used but the final list was enriched by the personal experience of the senior author, who grew up in the area. The list includes 690 useful plant species, of which 402 are used for medicine, 215 for craft purposes, 191 for food and 100 for spiritual and charm use. Some examples of commonly used species will be presented. It is evident that a large number of species have traditional uses and that a more comprehensive review of the literature will be useful. The larger number of medicinal plants agrees with other studies, where the number of medicinal plants usually far exceeds the number of food plants. It will be interesting to further explore spiritual and charm uses, given the large number of species involved. Further work is necessary, not only to record the way in which plants are used locally in the study area, but also to determine the relative importance of the species (for various use categories) using quantitative ethnobotanical methods.

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**Commercial competition to indigenous ornamentals in South Africa**

The purpose of this research was to determine the importance of market competition as a limiting factor to indigenous ornamentals in the garden and landscape
sector of the South African market. Growers’ perspectives were investigated with the purpose to interpret and use the information as a possible marketing tool to increase the use of such plants. A countrywide survey was undertaken by sending questionnaires to 151 ornamental plant growers in South Africa. Statistical analysis of data from 65 respondents generated the quantitative data for establishing the relative importance of six aspects related to market competition. Statistical instruments of the SPSS statistical program were used. The survey results confirmed that there were a number of factors which limit, to a greater or lesser extent, the use of indigenous ornamentals in South Africa. The greatest such factor was the lack of suitable indigenous plants to substitute the more popular exotic horticultural plant varieties (e.g. roses, conifers, palms, fruit trees) (82%). The increased availability of exotic ornamental plants (74%), coupled with the arrival on the market of new exotic varieties (72%), was a further limiting factor. Other, more moderately important limiting factors included market saturation (63%) and the market dominance by certain exotic plant groups (62%). Experts participating in the survey believed that plant imports from countries with high degrees of botanical diversity were the least important limiting factor (41%). In conclusion, the greatest limiting factor was the general lack of suitable plants among our indigenous flora that can be used as substitutes for some of the main popular horticultural plant groups. The extent to which indigenous plants can be adapted to match the characteristics of such popular plants will, to a large degree, determine whether they will find a more widespread appeal in the ornamental plant market. Competition from exotic plants for market share however should be seen as a normal and healthy feature of the industry. Problems related to market dominance and saturation can be overcome by sourcing new indigenous ornamentals in groups offering the most promising market potential.

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Identification of anti-quorum sensing compounds in essential oils through chemometric modelling

In recent years, the search for new antimicrobial drugs has intensified due to an increase in the incidence of bacterial and fungal resistance. Quorum sensing (QS), defined as bacterial cell-to-cell communication, plays an important role in biofilm formation and the pathogenicity of bacteria, enabling them to reach critical mass before initiating infection. This ability renders the host more vulnerable to infection. Compounds, known as quorum sensing inhibitors (QSI), that are able to block this communication avenue by binding to bacterial membrane receptors, are promising drug targets. Since microbial survival is not challenged, anti-QS activity does not stimulate the build-up of bacterial resistance. Although essential oils are well known for their antibacterial activities, the anti-QS activities of these natural plant isolates and their constituents have not been investigated in depth. In this study, 107 essential oils were investigated for their anti-QS activities using Chromobacterium violaceum. This assay involves the spectrophotometric quantification of violacein, a purple pigment produced by the bacterium. The chemical compositions of the oils were initially determined by one-dimensional gas chromatography coupled to quadrupole mass spectrometry (GC-MS). This was followed by two-dimensional gas chromatography analysis with time-of-flight mass spectrometry detection (GC-GC-MS). Data were aligned and exported to MS-Excel 2010 using the Statistical Compare tool of the ChromaTOF® software. No
data transformations/pre-treatment techniques were applied to the raw data. The GC-
MS and GC-GC-MS, as well as the anti-QS data, were analysed using chemometrics
(SIMCA P+13.0. software) to establish the relationship between the chemical
compositions of the essential oils and the observed biological responses. The
construction of orthogonal projection to latent structures discriminant analysis (OPLS-
DA) models enabled the identification of the marker compounds, attributed to the
observed anti-QS properties. Geraniol, geraniol, sabinene and cis-sabinene hydrate,
amongst others, can be regarded as biomarkers associated with good AQS, while
myrcene, beta-phellandrene, alpha- and beta-pinene are correlated with samples
exhibiting poor AQS activity. These findings can be used to predict the ability of
essential oils to act as QSIs.

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Comparative antioxidant, nutritional and alcoholic analysis of selected edible
wild fruits of Botswana

Indigenous wild fruit trees of Botswana although mostly undomesticated play
important roles in people living in rural areas of Botswana. They are an important
source food and medicines for both human beings and livestock. In most rural villages
of Botswana, wild fruits are also crucial sources of revenue generation through alcohol
production and sale. There is strong evidence that wild fruits are valuable sources of
vitamins and minerals essential for proper maintenance of good health. However, in
spite of their long history of use, their biological activity has not been studied. In the
present study antioxidant, nutritional and alcohol contents of fruits of Grewia flava,
Grewia flavescens and Berchemia discolor were determined. Total Phenolic analysis
by Folin Ciocalteau was performed in methanolic fruit extracts for all the three plants.
Between 50µg/ml and 200µg/ml, all extracts exhibited scavenging power ≥80% (similar
to control, Quercetin). All the plants showed significant quantities of the assayed
nutritional elements. The total phenolic content was G. flava (3028 mg/L GAE); B. discolor (2890mg/L GAE) and G. flavescens (1990mg/L GAE). The 96 hour alcohol
contents of the fermented fruits were G. flavescens (7.67%v/v); G. flava (6.58%v/v) and B. discolor (5.21%v/v). These findings justify the potential of these plant resources in
assuring food security in the developing world.

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Nutritional analysis and antioxidant profiling of fruits of Flueggea virosa used by
tribal people of eastern Botswana

Flueggea virosa fruits are one of the fruits commonly consumed as diet and
used for medicinal purposes in Botswana. In spite of the long history of use,
information on its bioactive compounds remains scarce. An evaluation of total
phenolics and free radical scavenging activity of the crude extracts was studied using
the Folin-Ciocalteau assay and DPPH (1,1 –diphenyl-1-picrylhydrazyl) scavenging
The methanolic extracts of *F. virosa* were screened for their free radical scavenging properties using Quercetin as a standard antioxidant. The overall scavenging activity of *F. virosa* fruits was found to be strongest in increasing concentration, the scavenging power ranged between 42.5% at 25µg/mL to 82.8% at 200µg/mL and the standard levels ranged between 90.1% to 91.8% for the equivalent concentrations. The total phenols were observed to be 419.8 GAE (mg/L), this was lower than that of the seed extract (743.11 GAE mg/L). Nutritional composition of the fruits was determined using Kjeljahl method and Atomic Absorption Spectrophotometer. Protein content was 4.935 % and the following mineral concentrations: 6.67mg/L Ca, 52.8mg/L K, 4.67mg/L Mg, 0.372mg/L Na, 0.669mg/L Mn, 0.149mg/L Cu, 3.23mg/L Fe, 0.380mg/L Ni, 0.160mg/L Pb, -0.012mg/L Cd and -0.932mg/L. The results indicated that these fruit species contain appreciable amounts of nutrients and nutritionally these fruits could contribute positively to the mineral intake. The study also revealed that the fruits poses no danger in light of heavy metal toxicity. The present study reveals that the consumption of selected plant would exert several beneficial effects by virtue of their antioxidant activity and could be harnessed as formulation in food supplement and in pharmaceuticals. These species should be integrated into agroforestry systems for sustainable use and conservation, as well as preservation of the associated knowledge through the positive practice of the indigenous bio cultural knowledge.

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Nutritional, antioxidant and alcohol analysis of fruits of *Sclerocarya birrea* fruits used by Batswapong tribe of Botswana

*Sclerocarya birrea* fruit is edible with uses ranging from nutritional, medicinal and also an important source of an alcoholic beverage. The nutritional value of the fruits was determined using Atomic Absorption Spectrophotometry. The total heavy metal content of the alcoholic beverage was also determined by the same spectrophotometric technique. The alcoholic content of the fermented fruit juice was be analysed using the standard alcoholysyer. Antioxidant capacity and total phenolic contents of both fresh fruit pulp extract and skins was determined by the DPPH (Diphenylpicryl hydrazyl) free radical scavenging assay and Folin Ciocalteau methods respectively. Free radical scavenging power of skins and pulp 88% and 69% respectively. The total phenolic contents of the skins and pulp was 1231.3GAEmg/l and 830GAEmg/l respectively. The alcohol content for the fermented juice was 5.22%v/v after 66 hours. The results for elemental analysis were as[pulp:skins] K(29.89mg/g:20.86mg/g);Na(0.37mg/g:0.50mg/g);P(2.35mg/g:2.06mg/g);Mg(2.51mg/g:1.88mg/g);Ca(2.74mg/g:3.69mg/g); Fe(0.03mg/g:0.03mg/g); and concentrations of Zn,Cr,Cu,and Mn were ≤0.01 whilst levels of Se, Ni and Pb were below detectable limits. The results of the present study justify the long history of use of the fruits as sources of nutrients and health improving agents through their antioxidant property.
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The effects of varying levels of potassium on growth and anti-\textit{Fusarium oxysporum} (Ascomycota: Hypocreales) activity of leaf extracts of hydroponically-cultivated \textit{Helichrysum cymosum} (Asteraceae)

Hydroponics technology provides opportunity to manipulate nutrient supply to plants with the view of determining optimum conditions for growing indigenous medicinal plants. The main objective of the present study was to discern the optimal potassium (K) supplement level for \textit{H. cymosum} by evaluating the effects of different hydroponics K levels on growth, K-leaf content, anti-\textit{Fusarium oxysporum} f.sp.glycines (Ascomycota: Hypocreales) activity and total activity. Six weeks old seedlings of \textit{H. cymosum} were treated with varied concentrations of K (58.75 ppm, 117.5 ppm, 235 ppm and 470 ppm). These concentrations were based on a modification of Hoagland’s hydroponic nutrient formula. Plants were maintained under greenhouse conditions and growth parameters (plant height, number of leaves and fresh weight of aerial parts) and tissue analysis were recorded 8 weeks post treatment. Sub-samples of the aerial parts of plants grown under the different treatments were air dried, extracted with acetone and tested against \textit{F. oxysporum}. Plants exposed to 235 ppm K showed a significantly (P < 0.05) marked increase in leaf number from weeks 3 to 8 (1057.3 ± 158.6%) as well as highest plant fresh weight of aerial parts (2.64 ± 0.265 g). In contrast, plants exposed to 117.5 ppm K showed the least percentage increase in leaf number (3 ± 0.4) and fresh weight (0.45 ± 0.037 g). Percentage increases in plant heights recorded among participating plants in the different treatments ranged from 300 ± 74 to 453 ± 30 and were not statistically different (P > 0.05). Overall, there was no significant different (P > 0.05) among the treatments with respect to tissue nutrient content; tissue K ranged from 3.56 ± 0.198 to 4.67 ± 0.29%. The acetone extraction yield increased with increasing K fertilization: 58.75 ppm (16.67 ± 2.35 mg), 117.5 ppm (22.5 ± 4.79 mg) and 235 ppm (210 ± 38.5 mg), but dropped at 470 ppm K to 40 ± 4.08 mg. Results from the anti-\textit{F. oxysporum} bioassay showed that 58.75 and 235 ppm K treatments produced the most bioactive acetone extracts; MIC values of 0.49 and 0.645 mg/l, respectively. Acetone extracts obtained from plants exposed 235 ppm K recorded the highest total activity (81.73 ml/g), which relative to the other K treatments was significantly higher (P < 0.05). In conclusion, the optimum nutrient K level for growing \textit{H. cymosum} hydroponically was 235 ppm.

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The \textit{Sclerocarya Birrea} (marula) seedlings performance to different fertilizers and planting methods in the Limpopo Province

A lot of research has been conducted and published on germination of \textit{Sclerocarya birrea} seeds (Nerd and Mizrahi, 1993; Akinnifesi et al., 2007 and yet the accessibility of information on seed germination of \textit{S. birrea} at community level is still a challenge. Only a few commercial plantations, nurseries and community gardens exist for marula trees. Communities are experiencing shortages of marula fruits for
processing into different products, due to competition with animals and other farmers, as well as conservation of marula trees. To supply communities with seedlings the germination of marula were again addressed. The cultivation of the marula trees in the farmland will be beneficial because the farmers will access the fruits closer, learn the effective method of planting the marula trees (either by seed or vegetative propagation), know the best soil fertilization method (either chemical or organic) and other establishment and development stages of the plant better. The objectives of the study were to evaluate the efficient planting method for producing marula seedlings and determine the performance of marula seedlings on different fertilizers. Marula seeds collected at Makonde Village and were stored at room temperature for a year to overcome the reported dormancy period (Black, 1989). The experiment conducted was a latin square design replicated four times over a four month period. The CRD experiment was conducted with three planting methods (direct seed sowing M1, seedlings transplanting M2 and vegetative propagation M3) replicated four times on a spacing of 10x10m amounting to 100 trees ha⁻¹ and irrigated daily with 600ml of water until root development to determine the best planting method of marula. The CRD experiment was conducted with four levels of soil fertilizer types 3:2:1(30) NPK (F2), compost (F3), kraal manure (F4) and control (F1=soil) and replicated four times wherein the plant height was measured with a measuring tape and number of leaves were counted from emergence stage until branches have developed. The rates of fertilizers being 0 (control) kg plant⁻¹, 187.5 kg of 3:2:1 (30) NPK ha⁻¹ and 2000 kg ha⁻¹ of compost which were mixed well with both top and sub soils. The Sclerocarya birrea seedlings that were not fertilized maintained the low stunted half green half brownish growth whereas the seedlings fertilized with NPK, kraal manure and organic compost had a fluctuating growth with the NPK. However seedlings fertilized with organic compost had many healthy number of leaves with tall and green S. birrea seedlings.

The results showed that transplanted seedlings adapted well to the four levels of soil fertilizer types 3:2:1(30) NPK (F2), compost (F3), kraal manure (F4) and control (F1=soil) by growing quickly with green and healthy seedlings. There was no difference between the transplanted seedlings and the vegetative planting methods during the stand establishment and seedling growth. Domestication of S. birrea trees is easily achievable (Nerd and Mizrahi, 1993) and communities should no longer experience shortages of marula fruits for processing into different products, due to competition with animals and other farmers. For faster growth and quicker harvesting of marula fruits the cuttings method performed better than the direct seed and transplanting planting methods. Hence farmers incur no extra funds/ costs for purchasing chemical fertilisers such as NPK and LAN since farmers will use compost which they can make from available materials available in their farms.

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Tree response to bark stripping for medicinal use

Plants have been used for centuries to treat a wide range of ailments in the history of all civilizations. However, a growing interest in medicinal plants requires appropriate management to prevent over-exploitation of target species. The study aimed to investigate the bark re-growth response and wood decay consequences of bark stripping on the Ocotea bullata and Curtisia dentata, two frequently bark harvested tree species in South Africa. The study was conducted in Afrotemperate
forests of the southern Cape in the Garden Route National Park. The study involved the experimental removal of 1 m long strips of bark along the stems of 179 trees. Different factors that may influence the rate of bark regrowth such as tree diameter growth, wound size and season of harvest were investigated. Ten years after experimental bark stripping, ten trees per species were felled and wood discs collected to investigate the decay along the stem using a computer tomography scan. *Ocotea bullata* was found to have a significantly better bark regrowth and minimal decay within the stem, while *C. dentata* showed poor bark regrowth and high extent of decay within the stem. The results further indicated a relatively poor bark regrowth and high mortality in smaller diameter trees (≤ 20 cm), which suggest that a minimum tree size for bark harvest trees needs to be stipulated in the bark harvest prescriptions. Higher individual tree diameter growth rates supported better bark regrowth rates in both species, which allowed for the formulation of preliminary model that would assist forest managers to determine the bark harvest cycle for *O. bullata*. For neither of the species did strip width and harvest season significantly influence rates of bark regrowth. In conclusion, the harvesting of bark for *C. dentata* through bark stripping is not viable, owing to poor bark regrowth, high extent of wood decay and poor tree survival. Good bark regrowth and minimal wood decay on *O. bullata*, indicate much greater potential for sustainable strip harvesting.

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**Comparative leaf and stem anatomy of some Rothmannia and Sabicea species (Rubiaceae)**

The Rubiaceae is the fourth largest angiosperm family after the Asteraceae, Orchidaceae and Fabaceae (sensu lato = Leguminosae). It is a predominantly tropical family of plants with 650 genera and 13000 species. The Rubiaceae constitute an important component of all topical woody vegetation, especially the Rainforest understorey in West Africa, namely from Senegal to Equatorial Guinea, East Africa and Madagascar. The molecular studies proposed anew classification in three subfamilies-Rubioidae, Cinchonoideae and Ixoroideae. Two recent phylogenetic studies proposed a new tribe Sabieeae to be classified in the subfamily Ixoroideae s.l. (Rubiaceae) but with conflicting circumscriptions. Mature leaves and stems of Rothmannia longiflora Salisb., Rothmannia fischeri (K.Schum) bullock ex Obem.. Rothmannia whitfieldii (Lindl) Dandy, R. hispida and four Sabicea species: Sabicea calycina Benth, Sabicea dinklegei K. Schum. and Sabicea urceolata Hepper were obtained from the National Botanic Garden of Belgium (BR) and the the Department of Plant Science and Biotechnology, University of Nigeria, Nsukka Herbarium (UNH) respectively. Materials were preserved in 70% alcohol. Freehand sections were made and stained with either phloroglucinol and concentrated hydrochloric acid or Safranine and Astral blue. Sections were mounted in a mixture of Sudan III/glycerine and observed under a Leica Laborlux 12 photomicroscope. Histochemical tests were carried out on sections using Sudan III solution, aqueous iodine solution to identify some bioactive compounds such as alkaloids, fats and tannins. The present study aimed to characterize the leaf and stem anatomy and micromorphology of four Rothmannia and four Sabicea species from the tropical zones. The four Rothmannia and Sabicea species studied have bifacial and hypostomatic leaves, contain tannins and idioblasts with crystals sand. The vascular systems in the petioles and in the leaves form an arc. Leaf blade bundle is collateral
with parenchymatous sheaths and associated with libriform fibres. Stomata are abundant on the adaxial surface of lamina but fewer on abaxial side in Sabicea. The two genera differ in the presence or absence of glandular, septate trichomes. Woods of both genera are diffuse porous with wide vessel elements. Vessels have predominantly uniseriate with a few biseriate rays. Parenchyma accompanying the rays are paratracheal, libriform fibres with simple to minutely bordered pits on the radial and fragrancy walls with septa are features that point towards apomorphy and mesomorphy. However, floral characters such as single flower with few stamens are morphological variables that point towards plesiomorphy. Since the Sabicea species studied are herbaceous they may be classified as apomorphous while Rothmannia may be designated as plesiomorphous.

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Actinomycetes: keeping rooibos plants healthy naturally

The fynbos biome, is consider to be a biodiversity hotspot and 70% of the over 9 000 plant species found within the biome are endemic. South Africa has a long oral history of using fynbos species for medicinal applications and several fynbos-derived natural products have been commercialized. Aspalathus linearis (rooibos) is not only consumed as a tea, but its extracts are used as an additive to foodstuffs and cosmetics. Rooibos tea is internationally recognized for its various beneficial health properties and sweet tasting flavour. The tea has a soothing effect on the body and anti-oxidative properties, which makes it such an appealing plant to study. Since the analysis of the plant has been a popular choice for researchers, many studies focusing on the plant itself have been published. However, studies on microbial diversity of rooibos are only in its infancy. It is well known that the rhizosphere, particularly the soil attached to the root system, is colonized by abundant microbial populations. These bacteria reduce biotic and abiotic stressors, therefore stimulating growth of the host plant. Research into plant growth-promoting bacteria (PGPB) has led to many agricultural applications, such as biofertilizers, biopesticides and phytoremediation. In addition, it has been found that some endophytic bacteria have the ability to produce similar metabolites to their host plant. Hence, the aim of this project is to isolate and characterize endophytic actinobacteria from naturally growing rooibos plants, with the objective of screening these bacteria for the production of bioactive compounds such as oxidative enzymes and antibiotics. Microbial diversity will be assessed by a traditional culture dependent and as well as metagenomic screening with actinobacterial-specific 16S rRNA primers. Initial isolation experiments have revealed that rooibos roots are colonised by large numbers of actinobacteria, predominantly Streptomyces species and several isolates were found to produce antimicrobial compounds. Metagenomic analysis identified highly diverse communities were present and OTUs potentially representing novel actinobacterial genera were identified. This study highlights that rooibos plants may be the source of PGPB, including beneficial actinobacterial species.
A survey of plants responsible for causing irritant contact dermatitis in the Amathole district, Eastern Cape, South Africa

A basic understanding of adverse cutaneous reactions and the common plants that cause each type can enable vulnerable individuals to discover the source of their dermatitis and thus prevent re-exposure. The aim of this study therefore, was to document the plants responsible for irritant contact dermatitis (ICD), along with their respective irritants and clinical presentations. Interview questions were focused on the local names of plants that contain irritating chemicals and physical characteristics that cause ICD. Forty four plant species distributed in 24 families and 34 genera were reported as causative agents of ICD. Mechanical ICD was reported to be caused by 23 species, closely followed by chemical ICD (20 species) and mechanico-chemical ICD (6 species). Species with the highest frequency of citations were *Allium cepa*, *Acacia karroo*, *Capsicum annuum*, *Citrus limon* and *Zea mays*. The most representative families were Euphorbiaceae (for chemical ICD), Urticaceae (for mechanico-chemical ICD), Fabaceae and Rutaceae for mechanical ICD. Most of the classes of chemical compounds identified as being responsible for chemical ICD were restricted to plants of specific genera such as the diterpenes in Euphorbia spp., disulphides in Allium spp., terpenes in Citrus spp. and isothiocyanates in Brassica spp. Thorns and hairs were reported for causing Mechanical ICD in 6 plant species each, including widely cultivated plants such as *Acacia karroo* and *Citrus reticulata*. Irritant contact dermatitis is a common cutaneous disorder in individuals exposed to plants in the Eastern Cape, especially among workers of the food and flower industries. Health practitioners should therefore consider the possible work-related causes of dermatitis, especially in cases associated with a clear history of symptoms.

Two dimensional gas chromatography and antimicrobial activity of seven Kenyan *Commiphora* species

The genus *Commiphora* belongs to the Burseraceae family. The name is derived from two Greek words; *kommi* (meaning ‘gum’) and *phero* (meaning ‘to bear’). *Commiphora* species are small trees or shrubs with short trunks and spinescent branches. Various plant parts are widely used as medicinal plants to treat pain, skin infections, inflammatory conditions, diarrhoea and periodontal diseases. Several collections of seven *Commiphora* species (*C. myrrha*, *C. confusa*, *C. neglecta*, *C. pseudopaolii*, *C. guidotii*, *C. holtziana* and *C. kataf*) collected from Kenya were analysed by comprehensive two-dimensional gas chromatography coupled to time of flight mass spectrometry (GCxGC–ToF–MS). In vitro evaluation of the antimicrobial activity of hexane extracts against *Staphylococcus aureus*, *Enterococcus faecalis*, *Escherichia coli*, *Moraxella catarrhalis*, *Candida albicans*, *Candida tropicalis*, and *Chromobacterium violaceum* was performed using the well diffusion method. In addition, a microdilution susceptibility assay was used to evaluate the minimal inhibitory concentrations (MICs) of the *Commiphora* extracts. Multivariate analysis of the hexane extracts, based on the...
GCxGC–ToF–MS data which revealed more than 150 compounds, which were tentatively identified. The major constituents found in the extracts were trans-α-bergamotene, α-octimene, β-elemene, caryophyllene oxide, α-humulene, γ-elemene, hedycaryol, aromadendrene, α-bisabolene, santalene, α-bourbonene, curzerene, p-cymene, curzerenone, terpinen-4-ol, germacrene D, trans-sabinol, 9,10-dehydro-isolongifolene, β-spathulenol, δ-elemene, cis-verbenol. These compounds represent about 70% of the total components identified. Amongst the species investigated, only C. confusa, C. neglecta, C. guidotii, C. holtziana and C. kataf extracts exhibited antibacterial activity. The MIC values ranged from 0.062 to 8.0 mg/mL. Analysis of the hexane extracts by GCxGC–ToF–MS revealed quantitative and qualitative variation in the chemical profiles of Commiphora species. Furthermore, the antimicrobial activities displayed by the hexane extracts justify the use of these plants in traditional medicine for the treatment of skin infections.

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The effect of plant medium on the growth of Xysmalobium undulatum

Xysmalobium undulatum (common name: milk bush) is an important and widely used medicinal plant of South Africa and products from this plant have already entered the commercial pharmaceutical market, under the name “Uzara”-derived from the active compound of the plant, uzarin. The sustainable use of medicinal plants in both the informal and formal market is dependent on a regular supply of quality medicinal plant material. Although extensive research takes place on the ethnobotany, biochemical and pharmacological applications of indigenous South African medicinal plant species, the cultivation research is very limited. X. undulatum is one of several species selected for commercialization by the Muthi Futhi Trust, a community based project in Dakeni near Eshowe in Zululand. The absence of information on the best methods for propagation and a propagation system is limiting the progress to sustainable production for the Dakeni community. X. undulatum can be propagated from seed; however seedling survival has become a challenge as seedlings die after transplantation. Suitable growing media is one of the aspects that can play a role in transplantation success. In this study the effect of eight growing media on seedling survival, growth and root production was investigated. A randomized block design was used with five replicates per medium and two plants as an experimental unit. Seedlings were transplanted in eight liter tall plastic bags and grown under 30 % shade net at Booyens Nursery in Pretoria. Preliminary results show that the medium used influenced the survival, growth rate and length of seedlings. Growth media mixes containing a higher percentage of sand in general performed worse than media mixes with other components.
Metabolomic, genetic and physiological approaches towards understanding anti-cancer mechanisms in a traditional medicinal plant

Mortality rates in Africa are very high, with breast cancer being the second most common form of cancer in women. *Dodonaea viscosa* L. Jacq. is used for a vast range of diseases as a traditional medicine and has demonstrated anti-cancerous properties in previous studies. With a long use as a traditional medicine stemming from the Khoi-San, this plant is highly traded and is included in traditional remedies to combat the progression of cancer. In this study, a metabolomic, genetic and physiological approach was used to differentiate chemotypic and/or genetic differences among populations of *D. viscosa*, and elucidate bioactivity of plants. A non-invasive estrogen receptor positive human cancer cell line (MCF-7), a metastatic estrogen receptor negative human cancer cell line (MDA-MB-231) and a normal breast epithelial cell line (MCF-12A) were used together with an *in vivo* tumour-bearing mouse model to evaluate bioactivity. Liquid chromatography mass spectrometry-based metabolomic profiling was used to assess samples collected from different locations in the Western Cape. The MTT assay was used to assess cell viability after treatment in MCF-12A cells, MCF-7 cells and MDA-MB-231 cells. The efficacy of the plant extract was compared with a conventional chemotherapeutic agent, doxorubicin, using a tumour-bearing mouse model. Three chloroplast DNA markers were analyzed for plants from the four most distant geographic locations in an initial screening for genetic differences. There is chemotypic variation in populations of *D. viscosa*, with the Stellenbosch population exhibiting the highest cytotoxic potential. Extracts demonstrated bioactivity against the breast cancer cells, but had limited toxicity to normal breast epithelial cells. Apoptosis was evident by the apoptotic markers detected in Western blot analysis after treatment with the extract. Doxorubicin (Dox) and the extract exhibited equivalent reduction of the tumour size in the tumour-bearing mice model. Genetic differences were observed in samples from the Cederberg region for the *matK* gene. The vital potential of *D. viscosa* as an adjuvant treatment for breast cancer has been demonstrated in this study.

Quality and safety of roasted nuts of *Sterculia murex* (Lowveld chestnut)

Lowveld Chestnut (*Sterculia murex* Hemsl.), also known as “gebeleweni” or “umBhaba” in Swazi; “Mohlatshane” in North Sotho or “Laeveld kastaiing” in Afrikaans, is an indigenous tree of South Africa, with a very restricted distribution to the eastern Mpumalanga. The tree grows up to 12 meters and is renowned for its distinctive flowers, palmately leaves and large woody, spiky fruits. Mostly found in the wild, *S. murex* produces oily and sweet seeds which are commonly eaten by baboons and
other monkeys. Although the fruit is rich in oils and eaten by the communities, especially by the children, no data is available on the nutritional values and safety of the nuts. This study reports on the safety and quality of fresh and roasted nuts harvested around Nelspruit in early 2015. The preliminary results indicate that the average moisture content of the raw nuts was 10% and the water activity was 0.719. Therefore, it was expected that the nuts could be susceptible to mould and yeast growth. The initial microbiological analysis confirms the presence of these organisms. The presence or absence of mycotoxins is also investigated. Due to the high water content, a drying of seven to ten days at 30 to 35 degrees Celsius was found to be required in order to obtain a suitable product for roasting. Currently, different roasting processes are being investigated to lower the moisture content and water activity and to obtain a shelf stable product with the desired sensory profile. To complete the table on nutritional value, the roasted nuts were subjected to protein and fat analysis.

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An inventory of food plants of southern Africa

The most recent comprehensive review of food plants of southern African was undertaken by Fox and Norwood-Young in 1982. Since then there have been many nomenclatural changes as well as new ethnobotanical records. A review of “Food from the Veld” as well as other important literature is being done in order to produce a modern day, updated, inventory of all recorded food plants. The inventory will be used to determine the percentage of edible plants within the southern African flora based on the most recent checklist. This work will form the foundation to determine new records during upcoming fieldwork.

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Density and regrowth of a forest restio (Ischyrolepis eleocharis) under harvest and non-harvest treatments in dune forests of Eastern Cape Province, South Africa

*Ischyrolepis eleocharis* (Mast.) H.P.Linder is a perennial rush or sedge-like herb in the Restionaceae family and has been harvested for various uses from coastal forest dunes of South Africa. Around 2005 a ban on *I. eleocharis* harvesting was instituted by provincial conservation authorities in Bathurst coastal forest based on their unsubstantiated impression that the species population was decreasing. Here we report on the population density pre- and post the harvest ban, as well further explore the autecology of the species by assessing plant density relative to environmental factors (slope and aspect) and a controlled experiment on regrowth after harvesting at different intensities. The results show that the shoot density of both living and dead *I. eleocharis* increased significantly over the past eight years. This concurs with results from the harvesting experiment which showed that *I. eleocharis* recovered rapidly within a year of harvesting. Both aspect and slope play a key role in the distribution of *I. eleocharis*, with most plants found in open patches in the forest located on the summit
and upper slopes of dunes facing the landward side. These results indicate that I. eleocharis is highly abundant and resilient to harvesting.

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Vulnerability of rice growing areas to saltwater intrusion

Changing climate has a rippling effect on our ecosystems, both natural and manmade. Normally coastal aquifers have a layer of freshwater floating on top of dense salt water; rapid sea level rise (53 cm estimated rise from 1950-2050) compromises this top layer and can increase the salinity of the aquifer past safe drinking or irrigation levels. According to the Food and Agriculture Organization, “Approximately 20% of irrigated areas are estimated to suffer from salinization problems”. This study is a comparison of two agricultural centers for rice production to evaluate the need of agricultural reform because of climate change: the Mekong River Delta in Vietnam, a major export source of Asian rice (Oryza sativa L.), and the coastal river systems from Senegal to Guinea-Bissau, an important center for African rice (O. glaberrima Steud.). GIS data layers were obtained from IRRI and other scientific agricultural communities and combined with climate and environmental geospatial data including soil types and known coastal flooding. Results allow us to project the economic impacts of crop loss due to salt water intrusion, which demonstrate that salt tolerant rice is especially important in the Mekong River Delta. It is also necessary to develop adaptive agricultural practices, many of which have long been in place in West Africa, such as later transplanting. We also hope results can aid in the implication of current developments in salt-tolerant strains of rice and in broader agricultural policy.

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The productivity of maize agriculture at different modernization levels in Ixtenco, Tlaxcala, Mexico

The present-day mosaic of maize production systems in Mexico is the result of a mixture of modern and traditional practices and technologies. The latter predominate in maize production systems in the state of Tlaxcala despite innovations developed and promoted by various agricultural institutions. This investigation examined the vegetation and economic components of maize production systems at three modernization levels in Ixtenco, Tlaxcala, Mexico. We expected that under the conditions of the study area, maize production systems with traditional agricultural technologies were kept because they were more productive, considering all of their yield components, and that more advanced modernization would decrease the diversity of weeds. The three modernization levels were defined as follows: planting with draft animals and landrace seeds; planting with tractor and landrace seeds, and planting with precision machinery and hybrid seeds; the planting technology was associated
with a number of other traditional or modern practices. The 28 study plots were located at three different altitude levels, and were selected to have the three modernization levels in adjacent fields, in order to minimize variation due to soil and local weather. In each site, yield of grain, maize straw, and useful weeds, as well as the weed species composition, was documented on a 5 x 5 m plot.

We found no statistically significant difference in grain yield between the study plots, though the animal-draft fields had a higher average. However, the landrace maizes yielded 60% more straw, which was salable in the region and preferred by buyers. This fact easily explained farmer's preference for landrace maize. Alpha weed diversity varied by altitude, but not with modernization. However, the hybrid maize plots had more grasses, more introduced plants generally, and specifically the pernicious weed *Cyperus esculentus*, which was new to the region. Though the weeds for food and forage were still well-known, their use had practically disappeared in the last 10-15 yr, mainly because of the widespread application of herbicides and the disintegration of the previously established combination of maize farming with small-scale animal husbandry.

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Factors influencing useful plant richness on land managed by small-scale farmers in Portland, Jamaica

For centuries, small-scale farmers in Jamaica have managed and cultivated a variety of plants for use as subsistence and market crops, fodder, construction materials and medicine. Free-listing, semi-structured interviews, guided farm visits and quantitative analysis were used to identify attributes of 16 farmers and their 51 farms and homegardens (“yards”) that correlate with reported useful plant ethnovariety richness in Windsor Forest, a rural village in Portland Parish, Jamaica. Specifically, we asked: 1) which factors most influence useful plant richness managed by farmers? 2) Is higher useful plant richness maintained on farms or homegardens? 3) Which functional groups of plants explain most of the variation in useful plant richness on farms and homegardens? 4) Does farmer effort and supplemental labor input influence useful plant richness? 5) And, how are reported chemical use and praedial larceny distributed across farms and homegardens and do these factors influence useful plant richness? The cumulative size of the homegarden and all farms (p<0.001) and the household size of the farmers (p=0.19) explain most of the variation in useful plant richness for each farmer (r²=74%). On a per-unit area basis, homegardens contained more useful plant varieties than farms (p=0.018), while overall, farms contained more useful plant varieties (p=0.012). Variation of tree crops (p<0.001) and annual crops (p<0.001) explained most of the total useful plant variation on farms and homegardens (r²=93%). Farms that received the most farmer effort were correlated with higher useful plant richness (p=0.058), while receiving help (p=0.689), receiving remittances (p=0.262), and payments made for supplemental farm labor (p=0.765) did not correlate to higher useful plant richness. The use of chemicals had no effect on useful plant richness, except for a negative effect on tree crop varieties (p=0.065), and higher levels of praedial larceny were reported on farms than homegardens (p=0.001). These results underscore the complexity of agrobiodiversity conservation and livelihood strategies in rural Jamaica.
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The effects of *Cassia abbreviata* and *Helinus integrifolius* on glucose uptake and GLUT 1 mRNA expression in (H-4-II-E) liver cells

Diabetes mellitus is one of the common metabolic disorders that cause significant mortality and morbidity. It is characterised by hyperglycemia, insulin resistance and obesity. Traditional healers have always used herbal medicines to their patients for treatment of variety of diabetes related ailments, among others. The aim of the study was to determine if *Cassia abbreviata* and *Helinus integrifolius* stimulates glucose transporter isoform1 (GLUT 1) on the liver cell lines. Cells were treated with water extracts of both plants, and then incubated at 37 °C and 5% CO2 for 3hrs and 24hrs respectively. Insulin and metformin were used as positive control. Glucose uptake studies were performed by measuring amount of glucose uptake in cells treated with extracts of *Cassia* and *Helinus*. Induction of GLUT 1 mRNA expression levels were determined by PCR. RNA was extracted and converted to cDNA; gene specific primers were used in PCR for amplification, followed by 2% gel electrophoresis.

*C. abbreviata* resulted in a concentration-dependent increase in glucose uptake. In case of *H. integrifolius*, no increase in glucose uptake was observed. Metformin stimulated an increase in glucose uptake especially after 24 hrs in liver cells. The expression levels of GLUT1 mRNA in these cells were upregulated by both plant extracts. *Cassia abbreviata* increases glucose uptake potential in liver cells, and upregulates GLUT1 mRNA expression levels in liver cells. On the other hand, *Helinus integrifolius* did not induce absorption of glucose, but results in expression of GLUT mRNA.

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Acetylcholinesterase inhibitors from South African Amaryllidaceae

Amaryllidaceous plants produce pharmacologically active alkaloids such as galanthamine, which has been commercialized for the treatment of Alzheimer’s disease. This neurological disorder is associated with progressive degeneration of memory and cognitive function, and is caused by the loss of cholinergic neurons in the brain and decreased levels of acetylcholine. Inhibition of the enzyme acetylcholinesterase is considered a promising strategy for the treatment of neurological disorders, since it is key to the breakdown of acetylcholine. The search for therapies that can be applied for the treatment of Alzheimer’s disease has been ongoing for many years, with researchers also focussing on natural products as potential drug candidates. South Africa harbours an impressive number of species belonging to the Amaryllidaceae. The aim of the study was to evaluate the potential of South African species to inhibit acetylcholinesterase. Bulbs of 45 plants representing 14 genera and 29 species were obtained from various horticulturalists. After being air-dried at room temperature, the material was ground to a fine powder. Each sample was extracted with methanol using ultrasonication. Anticholinesterase activities of the extracts were
evaluated *in vitro* using a qualitative thin layer chromatography bioautography assay, followed by a quantitative 96-well microtiter plate assay. Galanthamine was used as the positive control. The methanol extracts of *Nerine undulata*, *Haemanthus montana*, *Nerine huttoniae*, *Amaryllis belladonna* and *Brunsvigia marginata* inhibited acetylcholinesterase in the microtiter plate assay by 70.1%, 78.3%, 81.2%, 85.5% and 90.2%, respectively. Inhibition of the enzyme by specific compounds was evident on the TLC bioautograms as white zones against a purple background. These compounds will be identified using a hyphenated technique comprising HPTLC-bioautography and MS. Both qualitative and quantitative assays have indicated that several species of South African Amaryllidaceae are good acetylcholinesterase inhibitors and may have potential for the management of Alzheimer’s disease.

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**Ethnobotanical study of *Mimusops andongensis* in Benin (West Africa)**

Non Timber Forest Products (NTFPs) play important roles in rural households’ diets, health, economy and other aspects of rural wellbeing. The widespread importance of NTFPs potentially poses many threats to the species from which they are extracted. Thus, understanding local peoples’ uses and dependency on forest resources is vital for the development of sustainable strategies of use and conservation. This study aimed at providing information on the use and local knowledge variation on *Mimusops andongensis* a multipurpose tree species used in Benin. Data was collected through 200 structured interviews. Informants were randomly selected from four villages. The fidelity level (FL) and the use value of different plant parts of the species were estimated. The variation in ethnobotanical knowledge was assessed by comparing the use value between ethnic, gender and age groups.

About 68 percent of the interviewees said they knew the species. Of these, 69 percent made use of it mainly for medicinal purposes to treat many ailments, as well as for construction and as fuelwood. Nearly all parts of the tree were used, including the leaves, the bark, the wood and young stems/branches, the fruits and the roots. Most respondents used the wood and the young stems/branches (FL = 85 and 23 %, respectively), followed by the bark (FL = 21 %), the leaves and fruits (FL = 11 %). The roots were the least used part of the plant (FL = 2 %). The wood was mainly used for construction, charcoal production and as fuelwood and the young stems/branches as toothbrushes and for firewood. The bark, the leaves and roots were used as medicine for headaches, malaria, child growth, stomachaches, scabies and curses, and fruits were consumed by children. Despite its multipurpose character, this species remains underutilized in the region. Considering the current threat of habitat degradation, action is needed in order to ensure the long term survival of the species and local communities’ uses.

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Ethnobotanical profile of indigenous tree species protected within agricultural fields of Mutale Local Municipality

Agricultural farms, forests, and protected areas are likely to backup future livelihood options as a result of plant species intentionally and unintentionally conserved within them. The research investigated the ethnobotanical importance of indigenous trees protected within agricultural farming system of Mutale local municipality. Tree layer of indigenous species were recorded and classified into families, parts used and their utilization purposes. Data on nineteen tree species was documented from twenty two agricultural fields. The recorded tree species were classified into sixteen families with Fabaceae, Combretaceae, Capparaceae being the dominating families. *Sclerocarya birrea* belonging to Anacardiaceae family was the plant species which was well represented in the agricultural farming fields. It occurred in 21 farms, followed by *Adansonia digitata* (19 farms) which belongs to Malvaceae family, and *Boschia albithrunca* (16 farms), *Maerua angolensis* (15 farms) which both belong to the Capparaceae family. Shade use category amongst tree species protected within agricultural fields was the dominant category followed by medicine, food, demarcation fence, livestock fodder, and firewood. Protection of these indigenous trees within agricultural fields will go a long way towards conservation of declared protected and endangered species.

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In vitro antimicrobial activity of plants used in traditional medicine in Gurage and Silti Zones, south central Ethiopia

In order to overcome the escalating problems associated with infectious diseases and drug resistance, the discovery of new antimicrobials is crucial. The aim of the present study was to carry out in vitro antimicrobial analysis of fifteen medicinal plant species selected according to their traditional medicinal uses in Gurage and Silti Zones, south central Ethiopia. Methods: Ethanol extract of the plants were investigated for their antimicrobial activity against twenty bacterial strains and one yeast. The minimum inhibitory concentration (MIC) was determined by broth microdilution method. Results: *Asparagus africanus*, *Guizotia schimperi*, *Lippia adoensis var adoensis* and *Premna schimperi* were active against *Candida albicans*, *Enterococcus faecalis* and *Staphylococcus aureus* at a concentration of 512 μg/ml or lower. Significant antibacterial activity (MIC ≥128μg/ml) was observed for extract of *G. schimperi* against seventeen tested resistant and sensitive Staphylococcus strains, at a concentration comparable to standard antibiotics. Moreover, this extract showed activity for the test against *S. aureus* ATCC 33591, ATCC 33592 and SA3 strains at a concentration of 128 μg/ml which is two-fold dilutions lower than oxacillin (512 μg/ml). Conclusions: The study revealed antibacterial activities of plants used in folk medicine in south-central
Ethiopia. The usefulness of this plants in particular G. schimperi can be strengthened through further phytochemical and toxicity analyses.

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Comparison of plant uses of two mestizo communities in the Peruvian Amazon of the Ucayali region

Although mestizos are the largest group of inhabitants in the Peruvian Amazon, up till now, their plant uses have not been studied well, especially not in the Ucayali region. Furthermore, this area has to deal with high rates of deforestation and (illegal) logging. This not only threatens the local people’s livelihood, but also their traditional knowledge. Therefore, the aim of the study was to document the plant use of two mestizo communities, and compare both communities to determine the differences in plant use and to study which factors are responsible for these differences. Data were obtained in two mestizos communities in the Peruvian Amazon of the Ucayali region. Data collection occurred between August and September 2014. Data collection was carried out through focus group discussions. We obtained lists of botanical and local names together with parts used and for which purpose, the plant’s habitats and whether or not they are sold or traded. We also collected plant samples in the field.

We will present and discuss major species used, and highlight main differences and uses between both communities, and the way ahead for protection of most important species of interest.

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Who owns this seed? The importance of traditional crops, knowledge and seed exchange in KwaZulu-Natal, South Africa

Indigenous seed, knowledge and agricultural systems are vital for small-scale farmers in South Africa: they enhance food security, strengthen social cohesion, maintain cultural integrity, and build climate resilience. Increasingly, however, such systems are under threat from rural flight and urbanisation, changed lifestyles and eating habits, degraded ecosystems, and the continued introduction of hybrid varieties and genetically engineered seed. Despite these threats, little research exists to describe the extent to which traditional seed is still valued and exchanged by small-scale farming communities, and the importance of these systems for food security. This paper describes research conducted in South Africa to investigate small farmers’ knowledge of seed and perceptions of its value; to gather farmer’s opinions on seed
ownership; and to map seed exchange practices. Fieldwork was conducted in two regions of northern Kwa-Zulu Natal Province, and comprised focus groups, key informant interviews, farmer surveys, and a participatory mapping exercise.

Key findings focus on the strong flow of traditional seeds within and among communities, and the central role of seed in cementing social relations, with more than half of exchanges due to kinship or wider community ties. The conditions of exchange varied, from direct trade for other seed, through to seed “insurance” for following years, or donations. Farming communities grew a wide range of crops, but all listed traditional maize as their most important crop due to the variety of ways this staple can be prepared. The perceived value of traditional crops was noted as their high nutritional value; hardiness; good yields; and drought resistance. Traditional crops were also considered to save farmers money and to promote self-sufficiency. Most farmers believed that they were the owners of the seed they planted. Results affirm the significance of maintaining and developing this agricultural diversity. Conclusions underpin the need for government to recognize the importance of small-holder farming systems for present and future food security and sovereignty; to prevent the contamination of such systems by the inappropriate introduction of hybrid and genetically modified varieties; and to implement a supportive policy environment for farmers’ rights.

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hERG channel inhibitors in South African medicinal plants with the focus on Boophone disticha (Amaryllidaceae) bulbs

The abbreviation hERG stands for human ether-a-go-go related gene which helps to coordinate normal cardiac rhythm in humans. hERG encodes the ion channel underlying the rapidly activating delayed rectifier potassium current (IKr) which is vital for ventricular repolarization. Inherited mutations of hERG gene can cause long QT syndrome, a disorder that can lead to fatal arrhythmias. Arrhythmias can also occur from clinically successful drugs that induce a blockage of hERG channels, and must be withdrawn from the market. Therefore, new chemical entities must be tested for hERG channel blockade before human clinical trials can begin. In contrast, almost nothing is known about hERG channel inhibition of natural origin for example medicinal plants. Most people consider medicinal medicine to be generally safe, on the other hand it is known that some medicinal plants cause drug interactions or have unwanted effects. 700 Plant extracts from South Africa were screened to identify hERG channel inhibitors in an in vitro assay with Xenopus oocytes expressing the human hERG channel. The methanol extract of the bulb Boophone disticha showed a 25% hERG inhibition. In South Africa B. disticha is the most commonly used plant of the Amaryllidaceae family for traditional medicine and has been used for several centuries. The bulb scales are a very rich source of alkaloids. However B. disticha is extremely toxic and can lead to death, mainly due to the alkaloid constituents. Five compounds have been isolated by a combination of high-speed counter current chromatography and column chromatographic techniques. The stereochemistry is being determined and compounds are also to be tested for hERG channel inhibition.
Hyperspectral imaging: visual quality assessment for South African herbal teas

Rooibos (Aspalathus linearis) and honeybush (Cyclopia species) teas indigenous to South Africa are popularly consumed locally as well as internationally for its purported health benefits. Studies have confirmed anti-oxidant, antimutagenic and anticancer activity mainly due to the presence of polyphenols. Hyperspectral imaging (HSI) integrates conventional spectroscopy and imaging to obtain spectral and spatial information from a sample. The potential of short wave infrared (SWIR) hyperspectral imaging in combination with chemometric data analysis as a rapid quality control method for commercially important herbal teas was investigated. Images were acquired with the sisuChema short wave infrared (SWIR) hyperspectral pushbroom imaging system at a spectral range of 920-2514 nm. Principal component analysis (PCA) was performed to remove background pixels and to visualise the data. Classes (i.e. Rooibos or Honeybush) were interactively assigned using the score images and plots. Partial least squares discriminant analysis (PLS-DA) classification models developed were subsequently used to accurately predict the species identity of commercially available herbal tea samples introduced as an external dataset, producing a visually interpretable result. The results showed that the labeling information is correct but that Honeybush tea is in most cases present in very low amounts. It is evident that hyperspectral imaging is an objective and non-destructive quality control method that can be successfully used to determine the botanical species included in herbal teas in addition to giving an indication of the abundance of each species in polyherbal tea mixtures.

Green Gold: where have the ferns gone?

The natural forests of the southern Cape, South Africa are managed as part of the Garden Route National Park in accordance with a multiple-use management system, with conservation, resource use and ecotourism important land-use types. Although known for its good quality furniture timber, the fronds of seven-weeks fern (Rumohra adiantiformis), used as greenery in flower arrangements, have been harvested on an economic scale from the southern Cape forests for more than 30 years, both for the local and export market. The economic importance of the species, termed by some as “Green Gold” at the time, is reflected by the fact that when fern harvesting was at its peak, the income generated from R. adiantiformis exceeded that of indigenous timber. Of even greater significance is the fact that, with the commercialisation of the species (and with it also being grown in shade houses and pine stands), a whole sustainable industry with huge socio-economic benefits developed around this forest species.

When commercial harvesting started in the 1980’s little was known about the ecology, dynamics and productivity of the species. Applied research was initiated at different levels, and harvest prescriptions developed through an adaptive management approach, to advise managers on sustainable use. These include long-term monitoring
to gather baseline data on natural fern growth and population development, as well as in picking areas to assess harvest impact on the resource. As stricter harvest prescriptions were implemented and harvest volumes gradually declining, there was still a steady increase in the income generated, indicating the value of and demand for the product. However, a long-term consistent decline in the sustainable yield was experienced, and over a period of less than two decades the yield and income generated from natural forest became insignificant.

The declining trends in fern yield were recorded in fern picking areas as well as populations not subjected to harvesting, indicating that *R. adiantiformis* populations are dynamic with long-term spatio-temporal variation in population structure and productivity. These long-term changes are synchronised with natural disturbance patterns and forest succession. However, indications are that other drivers of change at a different scale could also have played a role in the drastic decline in resource availability from natural forests in the Garden Route.

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**A method development study: extraction and metabolomic profiling in the neotropical blueberries (Vaccinieae, Ericaceae)**

The Colombian Andes are a biodiversity hotspot for the blueberry tribe (Vaccinieae, Ericaceae). The Vaccinieae are best known for their economically important and antioxidant-rich temperate species, including blueberry (*Vaccinium corymbosum* L.), cranberry (*V. oxycoccus* L.), and lingonberry (*V. vitis-idaea* L.). Despite scientific focus on the temperate Vaccinieae, it has been shown that neotropical Vaccinieae genera demonstrate antioxidant activity significantly higher than temperate Vaccinieae, leading them to be the most antioxidant-rich food known. They therefore present an excellent study system to evaluate the mechanisms behind high antioxidant activity in functional foods. Research on functional foods has shown that diets rich in fruits and vegetables are correlated with a decreased incidence of chronic diseases; however, further studies have failed to show significant bioactivity of isolated antioxidant compounds *in vivo*. This suggests that bioactivity is due to synergistic interactions, whereby two or more compounds present in the whole food act together to produce a greater bioactivity than the sum of their individual bioactivities. If synergistic interactions contribute to bioactivity, it is important to evaluate the entire metabolome to assess how diverse compounds interact to achieve antioxidant activity. Likewise, it is important to use cellular assays able to detect synergistic interactions that occur in the human body rather than traditional chemical assays. My dissertation research evaluates the role of synergistic interactions in the antioxidant activity of three ethnobotanically important blueberry species native to El Queremal, Colombia. The research presented here details the validation of extraction methodology and compound detection using UPLC-qToF-MS on four congeneric species: *Cavendishia engleriana* Hoerold, *C. grandifolia* Hoerold, *C. lebroniae* Luteyn, and *C. tarapotana* (Meisn.) Benth. & Hook. f.

Following a literature survey of metabolomic extraction methods used to
characterize Vaccinieae spp., three extraction solvents were selected for comparative analysis: 70% acetone, 70% methanol, and 2.5 methanol: 1 water: 1 chloroform. Analyses showed 70% methanol as best able to resolve the diversity of compounds present in the fruit. Further analyses demonstrated repeatability utilizing a specific lyophilization, homogenization, extraction, sonication, and centrifugation methodology. Separation using UPLC was optimized using published methodology in combination with methodology in use in our laboratory, and qToF-MS detection performed using standard parameters. Metabolite fingerprints for each of the four species provide preliminary data about polyphenolic compounds characteristic of the Cavendishia genus. This data generated here provides the basis for further metabolomic investigations of the role of synergy in antioxidant activity of neotropical blueberries.

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Hydroponic propagation of Siphonochilus aethiopicus: an endangered medicinal plant

S. aethiopicus is an important plant as far as human health is concerned. The plant has been used by traditional healers in Africa for various ailments and scientific research has confirmed its medicinal properties, but it has been over-harvested and is nearly gone in most of Africa. It is currently listed in the Red Data book of South African plants. As a result of its medicinal purposes and conservation status it is crucial to conduct research to increase its production and protecting the crop from being over-exploited in the wild. Micropropagation by tissue culture has been used to cultivate this species but this is an expensive way to source plant material. This study was conducted in an environmentally controlled greenhouse at the nursery of the Cape Peninsula University of Technology, Bellville campus. The study was implemented to determine the effect of various combinations of substrates and water stress on growth of S. aethiopicus to enable the identification of the best blend for cultivation of this species through semi hydroponics. Four treatments were used. Coconut fibre was used as a major component, coir was amended with perlite, vermiculite and sifted bark in different ratios. Plants were divided into 2 groups each with 24 plants, one group watered every third day and the other receiving water every fifth day to determine effect of water stress on growth of the plant. Results from the experiment indicated that wild ginger grows well in hydroponics and in high temperatures. Substrate mixes showed different results depending on water holding capacity of the substrate. Good quality water is becoming scarce and more expensive greenhouse growers are looking for ways to save water and a good growing substrate that can help growers to save water.

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Sustainable management of matsutake mushroom: knowledge gained from integrated research from ecology and utilization patterns

Matsutake are a group of economically important wild mushrooms that contribute greatly to rural livelihoods and local economies in many parts of the northern
hemisphere. The sustainable utilization of this natural resource is gaining increasing attention, which requires the understanding of both the ecology of the mushroom and the on-the-ground management. We present an integrated research on matsutake in China with information on its sustainable utilization. Studies includes the distribution, biogeography, production, market chain, fruiting response to climate change, comparative utilization patterns, genetic diversity, above-below ground interaction, and microbial community.

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Phytochemical evaluation of *Salvia officinalis* using vibrational spectroscopy and UHPLC–MS analysis

*Salvia officinalis* L. (Sage), a medicinal plant belonging to the Lamiaceae family is native to the Mediterranean region. However, it has become naturalized in many areas and is extensively cultivated in Albania. The therapeutic value of sage is well documented with a history of use for treating inflammatory disorders and infectious diseases. As with many phytomedicines, the chemical composition of the raw material influences the bioactivity and ultimately the quality and efficacy of the remedy. With this in mind, the current study was undertaken to investigate phytochemical variation within *S. officinalis* samples obtained from different geographical regions within Albania. A total of 138 samples were collected from 12 regions and the aerial parts were ground to fine powder. Vibrational spectroscopy (Mid-infrared (MIR) and near-infrared (NIR)) techniques were used to analyse the pulverised samples. MIR spectra were collected within the wavelength region 4000–500 cm\(^{-1}\) on an Alpha-P Bruker FT-IR spectrometer while NIR spectra were accumulated on a Büchi NIRFlex N500 FT-IR system in the wavelength region 10000–4000 cm\(^{-1}\). UHPLC–MS analysis of methanol leaf extracts was performed on a Waters Acquity UPLC system coupled to mass spectrometry. Both the spectral and chromatographic data were analysed using SIMCA-P+ 13.0. Hierarchical cluster analysis (HCA) of spectral data displayed two distinct groups with 30% and 13% variation in the chemistry for MIR and NIR, respectively. The observed variation was confirmed with UHPLC–MS clustering patterns where two major classes (26% variation) were also observed. Interestingly however, the regional location of the samples did not influence the clustering patterns as some overlap between the regions was evident in both the score plot and the dendrogram. Using the S-plot and the corresponding loadings line plot of the first principal component (PC1), it was possible to identify wave regions within the MIR (3300–640 cm\(^{-1}\)) and NIR (6400–4012 cm\(^{-1}\)) spectra contributing to the two sub-clusters observed. Similarly, the UHPLC-MS data filtered out retention mass (R.T/mz) pairs identifiable for the two sub-clusters observed. In conclusion, *S. officinalis* from Albania displays a conservative chemical profile of the non-volatile constituents however, two chemotypes have been identify that warrant further investigation to identify the biomarkers contributing to this distinction.
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Adjudication criteria and guidelines

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<td>8. Quality of results obtained</td>
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<td>9. Conclusion</td>
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OBJECTIVE

The objective of these awards is to encourage a high standard of presentations at the annual Indigenous Plant Use Forum (IPUF) meeting by adjudicating and rewarding the best presentations (paper and/or poster) by a young scientist.

CRITERIA

The criteria for adjudication are:

1. **Audibility and clarity** (10 points)
   This refers to the extent to which the entire audience can hear and understand what the presenter is saying. It includes the manner, tone, volume, speed and clarity of the speech, and their variation to capture and retain the interest and attention of the audience. Appropriate use of hand and body language must be included in judging this point.

2. **Visual contact with audience** (10 points)
   This is adjudicated on the extent to which the manner and success of the presenter feature in the establishing and maintaining visual contact with the audience. The presenter must look at, and talk to the audience, and ensure that the audience’s attention is focused on him/her.

3. **Logical sequence of ideas** (10 points)
   This covers the logical sequence from the beginning to end. It also covers the flow of thought in the presentation and the extent to which this is logical and used to enhance the communication of the message to the audience.

4. **Quality and use of visual aids** (10 points)
   In addition to the quality of the visual aids, of equal importance in adjudicating this point, is the proficiency of use of the aids and the extent to which they are used as an aid to support and enhance the presentation. The flashiness of the aids should not overpower or dominate the presentation to the detriment of communicating the message.

**NB:** A presentation must be remembered for what was communicated and not what aids were used.
In the case of a poster presentation, the candidate must not be penalized if all the text (with figures, tables, photos, etc) is not legible to the whole audience at the time of the presentation, as the poster may be presented from the place where it is displayed.

**NB:** All the text and ideas on the poster must however be understood, legible and clear to any person who wants to look at the poster during his/her own time, without the presenter having to be present and explain.

5. **Appropriate use of time** (10 points)
   This refers to the extent to which the presentation is delivered within the time limit and is not rushed, drawn out or truncated.

6. **Significance of the problem** (10 points)
   This refers the significance or impact in either basic or applied research.

7. **Experimental design** (10 points)
   This refers to the design of the experiments, if the stated objectives were addressed by the methods used, if the experiments were well planned and executed.

8. **Quality of results obtained** (10 points)
   This refers to the significance, originality and quality of the results obtained.

9. **Conclusion** (20 points)
   This is adjudicated based on the interpretation and implications of the results, the correlation of the conclusions with the results presented, and suggestions for future areas to be investigated.