Abstract Booklet

MEDECOS 2022

05-09 September
Langebaan
South Africa

FYNBOS FORUM

hosted by Fynbos Forum

MEDECOS 2022
CLUB MYKONOS, LANGEBAAN
05 - 09 SEPTEMBER

MEDECOS2022 – Partnerships for Global Change

Foreword

As our precious planet proceeds around the sun, and we reach the time (in the southern hemisphere's) season when we shed our winter skin, we look towards a world filled with greenery and new life. It is this change that gives hope for the future amidst uncertainty.

Uncertainty is almost certainly a reality we all had to acknowledge and come to terms with in recent years, and in some way this feeling resonates closely with our Mediterranean community and especially the postponement of MEDECOS since 2020. For the sake of our own sanity, many of us turned our eyes inward and a theme that has emerged is the importance of managing and doing what we can. A linear view of the world is outdated. Systemic resilience, a theme well-known by our ecological community, is nowadays appreciated and approached with renewed interest. May the interconnectedness of our systems and associated partnerships lead us on a resilient path.

There is arguably no better location to enjoy the spring season that the Cape Floristic Region has to offer than the West Coast of South Africa! Langebaan and its surroundings provide a playground that we trust you will relish and appreciate. May the West Coast diversity be your inspiration and resilience - a very warm welcome indeed to all local and international delegates to this year's conference! We trust that this year's event will be an enriching and fruitful experience for all.

Sincerely,

Martina Treurnicht, Chairperson (Fynbos Forum NPC)

FYNBOS FORUM

MEDECOS 2022 XV11
CLUB MYKONOS, LANGEBAAN
05 - 09 SEPTEMBER

05-09 September 2022

THEME: Partnerships for Global Change

MEDECOS is an international conference organised under the auspices of ISOMED, the International Society of Mediterranean Ecology. ISOMED promotes research and education to advance the understanding and conservation of the world's five regions with Mediterranean-type climate regimes, all of which are recognized as globally significant hotspots of biodiversity.

The MEDECOS conferences focus on the ecology and evolution of Mediterranean ecosystems and their species. By uniting scientists and students whose research centres on Mediterranean-climate ecosystems, participants gain insights into the similarities and differences in how these ecosystems function, change, and evolve.

The origins of MEDECOS date back to March 1971, when an international group of scientists convened in Valdivia, Chile, to discuss their work on Mediterranean-climate ecosystems. MEDECOS has been hosted every 3-4 years in different locations of the five Mediterranean areas of the world (Mediterranean Basin, SW Australia, California, Central Chile and the Cape Region in South Africa).

The FYNBOS FORUM is a local affiliation of researchers, planners, managers, landowners and other stakeholders that meets annually to discuss management issues and research results and to formulate priorities for future research and conservation management actions required to ensure the conservation and sustainability of Fynbos ecosystems.

In 2022, the FYNBOS FORUM combines with MEDECOS to host MEDECOS 2022/ FYNBOS FORUM 2022. The main focus of the joint conference is the ecology and evolution of Mediterranean ecosystems and their species, from plants to animals and also microorganisms. By uniting scientists and students whose research focuses on Mediterranean ecosystems, we expect to gain insights into the similarities and differences in how they function, change and evolve. Collectively, we seek ways to understand these unique systems and to effectively address the challenges facing them.

The local organising committee of the Fynbos Forum NPC would like to welcome all delegates to this year's conference! And we especially thank all our keynote speakers, symposia and workshop organisers that have made this year's programme an enticing one! Many thanks to everyone indeed.

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Prizes: WWF, Fynbos Trust, Grootbos, Reynecke Organic Wines, Struik,

Flowers: Lourens Boerdery

Monday, 5 September 2022, 08:45

KEYNOTE 1 – KAREN ESLER

Spotlight on Mediterranean-Type Ecosystems: Model systems for global change comparisons, regional and local responses

Department of Conservation Ecology & Entomology, Stellenbosch University, Private Bag x1, Matieland, 7602, South Africa

The Mediterranean Biome is uniquely special, containing several diverse biodiversity hotspots but subject to a range of biodiversity loss drivers. These include variously interactive drivers of land use/Land cover changes, changes in natural (fire) disturbance regimes, invasions from alien species and anthropogenic climate change. Overt similarities between the five distinct regions of the world that support Mediterranean Type Ecosystems (MTEs) have led to a long history of comparative research, but since drivers of change vary in magnitude across these regions (as does political, social, historical and cultural context), the topics considered important for biodiversity conservation differ. In a recent study of research priorities for MTEs, these regional and sectoral priorities were highlighted, and common to all regions were priorities around governance, climate change and public participation. While local questions reflect globally recognized concerns, priority research questions for Cape biodiversity conservation more frequently deal with nuances of perceptions and behavior linked to conservation, governance and human values. These aspects are best addressed at local levels. A key strength in the Cape is the Fynbos Forum, a 40+ year strong partnership of researchers, planners, managers, landowners and other stakeholders that meets annually to discuss and debate research results, management priorities and conservation actions. This diverse regional network has demonstrated its value in maintaining networks, building sound knowledge bases, developing capacity and supporting implementation. Integrated approaches that provide opportunity for managers and researchers to interact in the long-term are especially valuable to address global change challenges – specifically, I will describe a successful local partnership, the Blaauwberg Large-scale Sand Fynbos Restoration Project, as a model example to achieve such goals. To effectively conserve MTE systems and to counter global change challenges, the conservation sector has to be willing to broaden research agendas to include social sciences, humanities and citizen science, and in this way work towards conservation in a societal context.

Keywords: priority research, partnerships, long-term research, best-practice, collaboration, integrative approach

Monday, 5 September 2022, 09:15

KEYNOTE 2 – ANTON PAUW

Ecology of the West Coast of Southern Africa

Stellenbosch University, South Africa.

The aim of the talk is to introduce visiting scientists to the natural history of the region in which the conference is located. I start with a description of climate, soils and environmental history. Then ask how four key processes namely dispersal, speciation, selection among species and random subsampling has influenced the species composition of the West Coast Region. The actors in these processes include long-proboscid flies, oil-collecting bees, sunbirds, molerats, eland, pincushion proteas, orchids, and irids. I hope to provide some insight into the unique circumstances of the West Coast, while keeping in mind the broader processes that generate and maintain biological diversity. The talk will be illustrated with numerous photographs from the region.

SYMPOSIUM 1: SARA PALACIO & ROBERT BOYD

Plant life on atypical substrates in MTE's

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: Nishanta Rajakaruna

Life on the Rocks: What plants on harsh substrate 'islands' can teach us about diversity, ecology, evolution, and conservation and restoration practices

Biological Sciences Department, California Polytechnic State University, San Luis Obispo, CA 93410, USA

Rock outcrops and other edaphic islands are often characterized by unique plant communities with high proportions of rare and endemic species. Such plant communities, often restricted to fragmented islands of harsh substrates, offer exceptional opportunities for exploring ecological theory, including plant-plant and cross-kingdom interactions. They also provide model organisms for investigating the factors and mechanisms driving adaptive evolution, including the genetic bases for and architecture of traits conferring adaptation and reproductive isolation. Additionally, they offer opportunities to explore cross-adaptation, which is when a trait that evolved for tolerance to one harsh substrate becomes effective as an adaptation for another, allowing species to show cross-tolerance to multiple harsh substrates characterized by a suite of common stressors, including habitat bareness, drought, pH, ionic strength, and specific ions. Plants of harsh substrates offer unique challenges for conservation and restoration and are especially prone to stressors associated with climate change. Much of the research on harsh substrate-plant relations to date has focused on plants of ultramafic and other metal-enriched rock outcrops or saline soils, however, recent research on plants of gypsum and other calcareous substrates, solfatara fields, banded iron formation inselbergs, guano-derived soils, as well as soils that are enriched with anthropogenic inputs of major and trace nutrients and toxic metals, can help reexamine the plant-harsh soil relationship, including commonalities and differences across distinct plant-soil type associations. Such efforts will also provide opportunities for productive collaboration across research groups with expertise on edaphically distinct plant communities (e.g. serpentine vs gypsum) or tools of investigation (e.g. physiological vs phylogenomic) relating to key questions on drivers of plant diversity and community assembly, ecological and evolutionary theory, and conservation and restoration practices.

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: ROBERT S. BOYD

How atypical substrates can affect plant-herbivore interactions

Department of Biological Sciences, Auburn University,

The Funique features of atypical substrates can have important effects on organismal interactions and may provide stimulating avenues for research. Gypsum soils are less well-studied than serpentine soils: therefore, serpentine soil studies may provide novel avenues for investigation of plant-herbivore interactions on gypsum soils. For example, some serpentine plants (metal hyperaccumulators) have extraordinarily elevated metal concentrations (often nickel). Hyperaccumulated nickel can defend plants against some herbivores and therefore act as an elemental chemical defence. But other herbivores (such as the heteropteran Melanotrichus boydi) have apparently evolved metal tolerance and thus can feed with impunity on nickel hyperaccumulators. In gypsum habitats, some gypsophile plants accumulate sulfur compounds but the impact of this chemical trait on plant-herbivore interactions is not yet known. Plant-herbivore interactions may also influence the color of plant species growing on atypical substrates. For example, there is a striking correspondence between substrate color and seed coat or leaf colors of some California serpentine plants, suggesting that visual apparency of these plants to herbivores may drive evolution of traits such as seed coat or leaf color. As with Mediterranean region serpentine habitats, gypsum habitats are often relatively open and may have distinctively colored substrates (due to soil or soil crust features). Studies of coloration of gypsum dune animal species at White Sands National Park (USA) have revealed soil color to be an important selective factor for animal body color, but studies of plant coloration and herbivory in gypsum habitats appear to be lacking. Visual apparency may be an under-studied aspect of plant-herbivore interactions on gypsum and other atypical soils.

Soil type specialization of crop wild relatives

University of Vermont, Burlington VT 05405 USA

Adaptions to extreme soils could allow improved agriculture on marginal and degraded agricultural soils. Compatible wild relatives of many crops occur on challenging soils. These adaptations have not previously been harnessed or examined in crop breeding programs. Here I examine the distributions of the wild relatives of three Mediterranean climate crop legumes, chickpeas, lentils and peas, with a focus on soil type adaptations. Traditionally soil type adaptation has focused primarily on chemical attributes of soils, but in many cases soil textural attributes such as particle size and binding have considerable impacts on root growth. A recent collection of wild relatives of chickpea provides insight into differences in tolerance of soil pH and associated differences in microbial diversity. There is microsite variation in natural populations of chickpea's annual relatives Cicer reticulatum and its sister species C. echinospermum, with within and between site variation in temperature, moisture, and abiotic characteristics. We have measured 18 aspects of soil chemistry, as well as temperatures and relative humidity in the soil. Variation among sites is considerable. All quantified aspects of soil chemistry as well as temperature and moisture differ among the habitats of the two Cicer species compatible with chickpea. There is also substantial variation within sites with soil composition, water availability and thermal regimes varying within sites. Fine-scale characterization of microsite variation will allow us to better understand patterns of local adaptation in wild chickpea, and facilitate the utilization of systematically collected new germplasm from these sites in breeding for complex and variable agricultural conditions in cultivated chickpea. New work is examining variation in penetration of hardpan clays. Although old collections of wild lentil and wild peas have not included comparable precision in soil type measurements, fine scale analysis of known soil types shows similar patterns of adaptation to different soils. With recently completed genomes of all three crops, the potential to use comparative genomics to find and harness genes for soil adaptation are immense.

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: Stefan Siebert

Systematic review of gypsum ecosystems in Africa

Unit of Environmental Sciences and Management, North-West University, South Africa

Gypsum soil is formed on the foggy coastal plain along the west coast of southern Africa due to the deposition of sulphate on lime. It is also found on the semi-arid, inland plateau of Botswana, Namibia and South Africa where it is produced in ephemeral pans or due to geological weathering. In Namibia, gypsum soil has been partially described and mapped accordingly, but in South Africa and other parts it remains a work in progress. This poor knowledge of gypsum soil has hindered ecologists from recognising the associated ecosystems. Gypsum ecology is therefore not on the research agenda in southern Africa. To enhance research in this field, we urgently need to (1) determine the formation types, extent and age of the region's gypsum soil, (2) identify gypsophile species and map their distributions, and (3) relate these species to different gypsum soils and climate.

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: Sara Palacio

Nutritional mechanisms to survive on extreme soils and their relation to plant evolution on gypsum

Instituto Pirenaico de Ecología (IPE-CSIC), Av. Nuestra Señora de la Victoria, 16, 22700 Jaca, Huesca, Spain

The occurrence of special substrates such as saline, serpentine, dolomite or gypsum soils, with a distinct flora associated to them, has puzzled naturalists for centuries. Some of these substrates, and the adaptations displayed by plants to cope with them, are quite well understood. However, other substrates like gypsum soils, are still poorly understood, and the mechanisms displayed by plants to survive on them pose intriguing questions to ecologists.
Gypsum ($CaSO_4 \cdot 2H_2O$) is a rock-forming mineral that also occurs in soils. Gypsum outcrops are widespread throughout the Earth, being present in the five continents, particularly in arid and semi-arid regions. Due to its particular physical and chemical properties and the aridity typical of the areas where gypsum soils develop, this type of soil poses very restrictive conditions to plant life, yet it hosts a highly diversified flora, rich in endemic and rare species.

One of the most restrictive aspects of gypsum soils is their unbalanced elemental composition, with extremely high Ca and sulphate concentrations. Throughout evolution, plant lineages adapted to gypsum soils have developed different nutritional strategies to cope with these atypical nutritional limitations. This talk is an invitation to discover some of these mechanisms and analyze their ecological role and relation to the evolution of gypsum plants from different regions of the world.

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: Yolanda Pueyo

The effects of grazing on a Mediterranean gypsum ecosystem

Gypsum plant communities are often under livestock grazing use in the Mediterranean region. Despite the high ecological value of these communities, little is known about the effects of grazing on plant and soil properties. Plant productivity and diversity, hydro-physical, chemical and biological soil properties were analysed along stoking rate gradients in two sites differing on aridity conditions in the Middle Ebro Valley (NE Spain). Grazing substantially modified plant community and soil properties, being changes more evident at the most arid site. At those arid sites, plant productivity and soil fertility decreased with increasing stocking rates. However, plant diversity was maintained high until intermediate grazing levels. Gypsum plant communities are adapted to grazing, but overgrazing can lead to the loss of ecosystem functionality because of both, direct effects on vegetation consumption and indirect effects on soil properties.

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: Silvia Matesanz

A resurrection experiment to assess rapid evolutionary change in response to drought in a gypsum specialist

King Juan Carlos University, Spain

Understanding the ability of Mediterranean plant populations to adapt to changing environmental conditions is of paramount importance. The resurrection approach, where stored ancestors are revived and compared with descendants in common conditions, has proven to be a powerful tool to detect contemporary evolution. To test rapid evolution of functional traits and their plasticity in response to increased aridity, we grew seeds of Lepidium subulatum, one of the most conspicuous gypsum specialist in the Iberian Peninsula, collected in the same site in 1964 (ancestors) and again in 2018 (descendants). In a first generation (F1), ancestor and descendant plants were reared to maturity in common, optimum conditions to reduce seed storage and environmental maternal effects, and were also genotyped to assess neutral genetic variation. These F1 plants were crossed within collection year to produce 1964- and 2018-maternal families. Offspring of this generation was then grown in two contrasting water availability experimental treatments that reflect natural conditions: well-watered and drought. We measured a wide set of functional traits related to drought stress, including resource-use and phenology and assessed individual reproductive fitness. We compare patterns of phenotypic expression and plasticity between ancestors and descendants and assess evolutionary change over a 54-year period of significant environmental change. We discuss our results in the context of climate change adaptation and their implications for the conservation of a substrate specialist with limited seed dispersal.

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: Mario Blanco-Sanchez

Adaptive population differentiation is linked to local climate in populations of a gypsum specialist across its range

Área de Biodiversidad y Conservación. Universidad Rey Juan Carlos. Tulipán s/n. 28933 Móstoles, Madrid, España

Drought is one of the main selective pressures for plants, and its negative effects are expected to increase due to climate change. This is especially true in semiarid ecosystems in the Mediterranean, and particularly for edaphic specialists, which are expected to have low genetic variation. However, it is largely unknown whether drought has shaped adaptive population differentiation along climatic gradients in Mediterranean semiarid species. We assessed the role of past adaptation in the phenotypic differentiation and plasticity patterns of 11 populations of a dominant gypsum specialist, Lepidium subulatum, throughout a wide geographic and climatic range. Using a common garden experiment with two contrasting watering treatments, we measured a wide set of resource-use, phenology and fitness traits for each experimental plant (N=1100). Furthermore, we assessed neutral population differentiation (FST) using 10 nuclear polymorphic microsatellite loci. To evaluate the role of adaptive (natural selection) and neutral evolutionary processes (gene flow, mutation, and drift) in population differentiation, we performed FST-QST comparisons in both watering conditions and assessed whether trait variation was linked to local climatic differences. Our results showed plastic responses consistent with adaptive responses to drought, which were surprisingly similar across populations, suggesting homogenizing past selection in plasticity. FST was significantly lower than QST for several traits, suggesting that divergent selection has played a key role in the adaptive phenotypic differentiation among populations. Population differentiation was related to local climate, with colder and humid populations showing higher specific leaf area and leaf nitrogen, lower water use efficiency and lower fitness under drought conditions. Overall, our results reveal the presence of adaptive phenotypic differentiation across populations of a gypsum specialist due to past natural selection caused by climatic conditions, and highlight the vulnerability of colder and humid populations to climate change.

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: Arantzazu Luzuriaga

Neighbourhood matters especially under drought conditions: high phylogenetic diversity in experimental assemblages improves community performance

King Juan Carlos University, Spain

Understanding the mechanisms that promote species coexistence in stressful environments has been a hot topic since the beginning of community ecology. In this study, we experimentally explored how phylogenetic diversity can drive community level responses to drought conditions in annual plant communities of gypsum habitats in central Spain. With this aim, we manipulated the phylogenetic structure of species assemblages together with water availability. We laid out a common garden experiment with four taxonomic combinations of annual plant species: two high and two low phylogenetic diversity scenarios. Each species combination was subjected to two water availability treatments, control (average natural rainfall) and drought (33 % of natural rainfall) in a fully crossed factorial design. We recorded plant survival and the number of flowering and fruiting plants per species in each experimental assemblage. High phylogenetic diversity favored species coexistence along time and showed higher plant survival and more flowering and fruiting plants, especially under severe drought conditions. The higher resistance to drought conditions of phylogenetically diverse communities suggests that niche complementarity must be a key mechanism promoting species coexistence in our system. Furthermore, we demonstrated that phylogenetic patterns are indeed excellent proxies not only to understand species assembly but also to delve into community functioning.

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: Marina Ramos-Munoz

Are population differentiation and plasticity to drought affected by the co-occurrence of warming and competition in a dominant gypshophile?

Área de Biodiversidad y Conservación, Universidad Rey Juan Carlos. C/Tulipán s/n 28933 Móstoles Spain.

Drought is critical for Mediterranean plant populations, and its negative effects are expected to become stronger due to climate change. Therefore, the ability of plants to cope with new climatic conditions is crucial for their long-term survival, particularly in species with specific edaphic requirements such as gypsophiles (plants restricted to gypsum soils). Despite the increased interest in the role of phenotypic plasticity and adaptive evolution in the response to water stress, most experimental approaches focus mostly on one environmental factor (water availability). In natural conditions, however, gypsophiles confront not only water stress, but also combinations of other abiotic and biotic stresses, including heat stress associated with warming, and competition. Adaptive population differentiation and plastic responses to drought may be altered by such co-occurring stresses, inducing additive, synergistic, or even antagonistic responses. Using an experimental approach based on multivariate common gardens, we will assess whether phenotypic plasticity to drought and adaptive population differentiation in drought-related functional traits will be affected by competition and warming. We will grow individuals from six climatically-distinct populations of the gypsophile Helianthemum squamatum under eight experimental treatments resulting from the factorial combinations of water availability, warming and intraspecific competition, representing contrasting stress levels that the species experiences in natural conditions. Drought and warming will be implemented using rain-exclusion structures and open-top chambers, respectively, and we will simulate intraspecific competition by altering the density of individuals per pot. We hypothesize that the response to drought will be affected by both warming and competition, and that these responses will vary across populations. Specifically, the combination of drought and competition will likely induce the expression of resource-conservative phenotypes, but, conversely, warming will trigger more acquisitive strategies. Our study will further our understanding on the adaptive response to drought of gypsophile populations in more naturalistic settings.

Monday, 5 September 2022, 10:15

SYMPOSIUM 1: Sergio Muriel

Assessing taxonomic, phylogenetic, and functional diversity of gypsum lichen communities across an environmental gradient in the Iberian Peninsula.

Área de Biodiversidad y Conservación, Universidad Rey Juan Carlos, c/ Tulipán s/n, 28933 Móstoles, Madrid, Spain

Assessing how taxonomic (TD), functional (FD) and phylogenetic (PD) diversities change along environmental gradients may help us to understand the response of biological communities to environmental variation. These biodiversity facets do not necessarily relate to each other and may have contrasting effects on ecosystem functioning. Disentangling the variation of the three diversities (TD, PD, FD) along biotic and abiotic gradients may contribute to our understanding of community assembly processes.

Despite the advances in the study of Biological Soil Crusts (BSC), little is known about the relation between the three biodiversity facets. Here we assess how abiotic and biotic variables shape taxonomic, functional, and phylogenetic diversities in gypsum lichen communities along an environmental gradient in the Iberian Peninsula. To do so, we used species composition and cover, trait data, and phylogenetic data to calculate taxonomic, functional, and phylogenetic diversity indices at community level including the 35 plots surveyed. In order to characterize TD, lichen species richness, Shannon, and Inverse Simpson diversity indices were calculated. Considering FD, several qualitative (e.g., growth form, photobiont, thallus color) and quantitative (water holding capacity WHC, specific thallus mass, STM, chlorophylls, and nutrient content) functional traits were chosen, in order to calculate the community weighted mean (CWM) and Rao's quadratic entropy index (Rao). In addition, intra and interspecific variability of quantitative traits along the gradient was also analyzed. Finally, we constructed a phylogenetic tree with all lichen species to calculate the CWM and Rao indexes for the PD. The result show different environmental variables affecting TD and FD of qualitative traits (CWM and Rao indices, e.g. growth form, photobiont and reproduction). Regarding quantitative traits, different climatic predictors explained both intra and interspecific trait variability.

SYMPOSIUM 2: Brent Mishler & Pablo Vargas Gomez

Spatial Phylogenetics of Mediterranean-type Regions of the World

Monday, 5 September 2022, 10:15

SYMPOSIUM 2: Brent Mishler

Case Study: Spatial phylogenetics of the native California flora, integrating ecology, evolution, and conservation

University and Jepson Herbaria and Department of Integrative Biology, University of California, Berkeley, CA 94720, USA

California is recognized as one of the world's biodiversity hotspots and has a rich history of research on its flora. A re-examination of the flora using newly available herbarium databases and novel phylogenetic approaches is critical given the need to prioritize conservation efforts in the face of rapid habitat loss and climate change. We built a large spatial dataset comprised of specimen-based distributional data from the Consortium of California Herbaria; 1.38 million georeferenced records remained after considerable cleaning efforts. We assembled a phylogenetic data matrix for 1083 OTUs (i.e., terminal clades representing genera or monophyletic parts of genera) for 9 genes. A maximum likelihood phylogeny was constructed. These data were used to find regions of high phylogenetic diversity and phylogenetic endemism within California, employing a spatial randomization to judge statistical significance.

Significant concentrations of paleo-endemism (rare long branches) were found in Northwestern California, northern Great Valley, and western Sonoran Desert, while significant concentrations of neo-endemism (rare short branches) were found in the White-Inyo Range, Death Valley, northern Mojave Desert, and southern Channel Islands. There was a significant positive correlation detected between endemism and aridity across the state.

We also carried out a complementarity analysis to identify new conservation targets that optimally increase protected diversity. Our analysis incorporated a novel continuous metric of current land protection status, fine-scale data on landscape intactness, and an optimization algorithm used to identify priority sites containing concentrations of taxa that are evolutionarily unique, vulnerable due to small range size, and poorly protected across their ranges. We evaluated three different dimensions of phylodiversity: using a phylogram (i.e., genetic divergence), a chronogram (i.e., evolutionary time), or a cladogram (i.e., speciation events). These three metrics yielded conservation priorities that agreed in many places but differed in others. Several top priority regions of the state emerged.

Monday, 5 September 2022, 10:15

SYMPOSIUM 2: Mario Fernández-Mazuecos

Case Study: Spatial phylogenetics of the Iberian vascular flora

Universidad Autónoma de Madrid, Spain;

The emerging field of spatial phylogenetics aims to reveal the patterns of geographic distribution of biodiversity in an evolutionary framework through the combined analysis of large phylogenetic and distribution datasets. In this project, a spatial phylogenetics approach is being applied to an entire flora in the Mediterranean Basin, one of the world's biodiversity hotspots for conservation priorities. Specifically, we are analysing spatial phylogenetic patterns of the vascular flora of the Iberian Peninsula (c. 5500 species), one of the main centres of plant diversity in the Mediterranean. This study will enable: (1) a novel understanding of the spatial distribution of plant diversity and endemism and their environmental correlates in the Iberian Peninsula accounting for historical evolutionary processes (phylogenetic diversity and endemism); (2) an assessment of the suitability of the Spanish and Portuguese networks of protected areas to ensure the conservation of plant evolutionary diversity; and (3) an evaluation and implementation of significant methodological advances in the field of spatial phylogenetics (the application of phylogenomic methods to infer fine-scale patterns, the consideration of the phylogenetic and geographic context of the study region, and the consideration of taxonomic uncertainty). For the latter objective, we are conducting a detailed spatial phylogenomic analysis (based on high-throughput sequencing data obtained using the genotyping-by-sequencing technique) in a specific plant clade, the tribe Antirrhineae. This group displays one of the main centres of diversity in the Iberian Peninsula, and its evolutionary patterns and processes are representative of those shaping Iberian plant lineages in general. Ultimately, the project will fill important knowledge gaps about the distribution and environmental drivers of evolutionary diversity of Iberian plants, and will serve as a starting point to improve conservation strategies by incorporating the preservation of plant evolutionary diversity in the design of networks of protected areas in Spain and Portugal.

Monday, 5 September 2022, 10:15

SYMPOSIUM 2: Rosita Scherson

Spatial Phylogenetics of Mediterranean-type Regions of the World. Case study: Chile

Departamento de Silvicultura y Conservación de la Naturaleza, Universidad de Chile

Spatial patterns of phylogenetic diversity (PD) were studied in Chile, with special emphasis on the Chilean Winter Rainfall-Valdivian Forest biodiversity hotspot. Chile is a very good case to study biodiversity patterns because the geographic isolation of its biota led to high levels of endemism. Even though the country protects about 21% of its terrestrial territory, protected areas (PAs) are unequally distributed, overprotecting the south of the country and leaving the central-northern areas underrepresented. We used different approaches to calculate spatial patterns at different taxonomic and spatial scales, finding the highest agreement between scales when using Operational Taxonomic Units (OTUs) rather than genera, and mobile windows rather than a fixed-area grid. We constructed a phylogeny using 708 OTUs of the native vascular flora of Chile to study patterns of PD and phylogenetic endemism (PE) and used PD complementarity to determine the contribution of PAs to the conservation of the evolutionary heritage of this flora, given the spatially unbalanced distribution of the PA network. PD was higher than expected in the southern area of the country, where PAs are large. In the north of Chile, we found lower PD than expected but important centers of phylogenetic neo-endemism. In this area, the PA network doesn´t provide enough protection to PD, especially considering the endemic lineages. The Mediterranean area has very low PA coverage and is also where most of the population and industries concentrate. This is an area of high PD and PE, and even though the PA network is insufficient, it plays an important role, harboring a larger than expected proportion of both indicators. Using PD complementarity, we propose a set of areas that would yield the highest protection of PD for the vascular flora, especially relevant for the Mediterranean and northern areas of the country.

Monday, 5 September 2022, 10:15

SYMPOSIUM 2: Shawn Laffan

Case Study: Spatial phylogenetics of the Mediterranean flora of Australia

School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, Australia

Australia's flora is characterised by plants that are highly adapted to surviving in poor soils and low water regimes. The isolation of the Australian continent for more than 35 million years has also resulted in a high level of endemicity -- most major plant lineages have ancestral links back to Gondwana, from which they have since evolved into a diverse and unique flora. Previous spatial phylogenetics studies by our group have analysed the eucalypts and Acacia, two of the main canopy-forming plant groups across the continent, as well as angiosperms at the genus level. For all three studies, the South-west Western Australian Floristic Region has been identified as containing centres of paleo and mixed endemism, where the former represents an area containing a higher than expected concentration of lineages that are longer than expected after down-weighting widespread lineages. Mixed regions have higher than expected phylogenetic endemism, but the relative branch lengths are neither longer nor shorter than expected. These potentially represent both cradles and museums of diversity, with concentrations of both newly evolved lineages (neoendemics) and old lineages that are found in few places (paleoendemics). In this talk, we will summarise and synthesise these works with a focus on their Mediterranean results, also expanding them to include new analyses of the complementarity and turnover of these regions with the remainder of Australia.

Monday, 5 September 2022, 10:15

SYMPOSIUM 2: Felix Forest

Case study: The Greater Cape Floristic Region of South Africa

Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3DS, UK

The Greater Cape Floristic Region of South Africa is a small area found in the southwestern corner of the African continent and comprising an incredible floral diversity (i.e. ca 11,500 species, ca 75% endemics). Small-leaved sclerophyllous shrubs and geophytes are the predominant growth forms in the region while tree and annual species represent only a small proportion of the flora. Furthermore, the floristic composition of the region is very distinctive with families such as Iridaceae, Proteaceae and Restionaceae dominating, all minor groups in other floras of the world. This diversity has attracted a lot of interest and many have speculated as to which environmental and/or ecological factors may be the prevailing drivers explaining the richness and uniqueness of the region. This contribution reviews the current state of knowledge of spatial phylogenetic patterns within the Cape region. We describe preliminary results regarding phylogenetic endemism patterns in the region and the distinct contributions of neo- and paleo-endemism to the assembly of the flora. We also report recent results from a study investigating the decreasing longitudinal gradient in plant diversity observed in the region, termed the Levyns' Law. This study investigates the predictions made to explain the Levyns' Law gradient by the age and area (i.e. high diversity is the result of biome and climate stability over evolutionary times) and ecological opportunity (high diversity is the result of increased ecological heterogeneity) hypotheses. The processes linked to this gradient are explored using modelled occurrence data for almost 5,000 species from plant groups typical of the Cape (the so-called "Cape clades") and metrics based on species and phylogenetic diversity (i.e. richness, beta-diversity, phylogenetic diversity, phylobetadiversity). The GCFR offers numerous opportunities to explores patterns and processes using phylogenetic tools; we discuss possibilities where future work could be directed.

Monday, 5 September 2022, 15:15

KEYNOTE 3 – Tony Verboom

Vegetation of the Greater Cape Floristic Region: a floristic perspective

Department of Biological Sciences, University of Cape Town, Private Bag X3, Rondebosch

While vegetation organization and dynamics are typically evaluated from a functional trait perspective, floristics offers an alternative but complementary approach. Informed by the individuality thesis of Ghiselin and the concept of phylogenetic trait/niche conservatism, floristic approaches recognize that biological lineages are evolutionarily unique, their member species displaying distinct behaviours which differ from those of other lineages. In this talk, I use floristics to tease apart the organization, ecological dynamics, and diversity of the Greater Cape flora of South Africa. Focussing first on vegetation classification, I argue that floristics provides a valuable foundation for grouping plant communities into broad, biome-scale assemblages, the boundaries between biomes corresponding to zones of high lineage turnover. Floristic turnover at biome boundaries is variable, however, reflecting variation in the strength of the environmental contrasts that underpin them. Thus, turnover is greatest across boundaries that describe extreme environmental contrasts, with ecological specialization involving trait co-adaptation and consequently low trait plasticity and lability being most pronounced in the context of extreme environments. In the Greater Cape Floristic Region this describes the boundaries between open and closed-canopy vegetation and between the vegetation of extremely infertile versus somewhat more fertile soils. While the floristic affinity of fynbos heathland and renosterveld scrubland is surprising in view of their contrasting edaphic associations, this almost certainly reflects fire-modulated resource fluctuations which are particularly pronounced in fynbos vegetation. By enabling multiple floristic assemblages to be superimposed locally during the post-fire succession sequence, these fluctuations likely also contribute to the exceptional species richness of fynbos vegetation.

SYMPOSIUM 3 – Muthama Muasya, Jasper Slingsby, Tony Verboom

Pan-African MTEs – Integrating multiple dimensions of diversity towards understanding the diversity, ecology, evolution and conservation of MTEs in Africa

Monday, 5 September 2022, 14:00

SYMPOSIUM 3 – Michael Cramer

Quantitative evaluation of the drivers of a Mediterranean-ecosystem (Cape, South Africa) species richness

Department of Biological Sciences, University of Cape Town, Private Bag X3, Rondebosch

Mediterranean ecosystems are home to greater proportion of vascular plant species than the proportion of global land surfaces that they represent. This species richness, representing the balance between speciation and extinction, has been attributed to multiple mechanisms resulting in both high rates of speciation and/or low rates of extinction. An abiding question is, however, what is special about Mediterranean ecosystems that enables this species richness? These regions have been unglaciated for extended periods of time, facilitating low rates of extinction. They have also been identified as “old climatically buffered infertile landscapes” that are highly leached suggesting that soil infertility drives niche specialisation (e.g. cluster roots, ericoid mycorrhiza). Furthermore, resource-poor and -rich habitats are commonly juxtaposed contributing to turnover in environmental resources and thus potentially to species richness. Furthermore, nutrient impoverishment may contribute to fire frequency, exacerbating nutrient loss and creating a feed-forward mechanism for nutrient impoverishment and nutritional specialisations. Despite these arguments we found generally weak relationships between edaphic properties and their variability and species richness in correlative models. The fact that nutrients limit growth and also contribute to fire frequency may also result in the region having a large number of relatively small individuals, contributing to species richness through the Many Individuals Hypothesis (MIH; i.e. more individuals allows greater species packing). Finally, the existence of many species may feed-forward on species richness through interactions of diverse clades (e.g. birds, vascular plants, microbes) by increasing biotic feedbacks and the Eltonian niche-diversity. In this study we evaluate the contributions of environmental turnover, nutrient/fire feedbacks, MIH and biotic feedbacks on species richness, particularly of the Greater Cape Floristic Region. While the lack of ecosystem-resetting disturbances (e.g. glaciation) is undoubtedly a key requirement for high species accumulation, predictably, no one explanation holds the key to understanding species richness.

Unravelling phylogenetic community diversity of the South African quartz habitats

2 Botany Programme, Department of Biological Sciences, Gombe State University, PMB 127, Tudun Wada, Gombe, Gombe State, Nigeria.

The southern African quartz habitat is one of the global biodiversity hotspots and one of the centers of plant endemism in South Africa. Plant species occupying these fields are mostly ecological specialists and local endemics. The high endemism and specialism in these areas have been attributed to extremes of soil aridity and the sharp microclimatic conditions. Despite its unique biodiversity, it remains poorly studied. In the context of phylogenetic relationship, we test the hypotheses that species occupying similar habitats are phylogenetically structured, and any extinction scenario will disproportionately prune their diversity. We undertook field collections where >95% of species occupying the Knersvlakte, the Little Karoo and the Overberg quartz fields were sampled. DNA sequences were expanded to include barcode markers: matK, rbcL, trnL-F and nrITS. We determined phylogenetic diversity at broad geographic and taxonomic scales across the three quartz-field areas. Our molecular analyses developed well-resolved phylogenetic relationships at familial and generic levels and with moderate support at intraspecific levels. Floristically, the quartz fields share common community composition at familial level but differ significantly in evenness at generic and species level. Thus, the four most species-rich families across the quartz areas include Aizoaceae, Asteraceae, Crassulaceae and Cyperaceae in descending order. However, the Overberg is dominated by Asteraceae, Cyperaceae and Fabaceae. The Knersvlakte and Little Karoo are dominated by Aizoaceae, Asteraceae and Crassulaceae. Overwhelmingly, the quartz endemics are assembled from the surrounding non-quartz communities, and predominantly from Cape clades, except for the Mediterranean Frankenia, which is represented by a single species. These findings support the conservation priority values currently attached to South African quartz fields given the high turnover of narrow-ranged endemics and rare species.

Monday, 5 September 2022, 14:00

SYMPOSIUM 3 – Byron Lamont and Tianhua

What have 100-million-year-old flowers in NW Africa and Myanmar got to do with the Cape flora and other MTEs?

School of Molecular and Life Science, Curtin University, Australia, and College of Science, Health, Engineering and Education, Murdoch University, Australia

The Cape of South Africa possesses 350 species of Proteaceae in ten genera. About 80% are endemic to the Mediterranean-type climate region of the Western Cape. Origin of the Cape's unique flora, with a focus on the Proteaceae, has had a long history of conjecture. The most recent attempt is Sauquet et al. (2009) who postulated three waves of transoceanic migration from Australasian ancestors. But Proteaceae-type pollen was present in NW Africa from 106 million years ago (Ma). Other key fossil Proteaceae records include 288 km SW of Cape Point at 77 Ma, Arnot pipes/Koingnaas in Namaqua 72−64 Ma and Kimberlite pipes in Central Tanzania 55−49 Ma (plus charcoal). We conclude that the Proteaceae originated in NW Africa-N South America 132−126 Ma before they separated, travelled E then S then finally SW to the Cape over the ensuing 40 My. The other 'arm' of the Proteaceae travelled down the E coast of S America, entering Chile, reaching Australia via Antarctica, and proliferating in mediterranean SW Australia from 85 Ma.

Phylicieae, family Rhamnaceae, is an essentially Cape order, with 150 species in Phylica with all but six species endemic, and three monotypic genera. Shi et al (2022) have recently described flowering shoots of Phylica in Burmese amber (plus charcoal) dated at 110−99 Ma. Since their morphology is identical to extant phylicas this implies that the Cape was seasonally arid and fireprone at least 100 Ma. Ancestral phylicas would have needed to reach Madagascar by ~115 Ma and thence India when Gondwana was still intact. Since Phylicieae is an advanced clade, this implies that the Rhamnaceae arose about 200 Ma giving it plenty of time to migrate to much of globe. Its abundance in other MTEs: Mediterranean Basin (Ziziphus), California (Ceanothus), Chile (Collettia), and Australia (Pomaderris, Trymalium), can now be explained. This remarkable fossil discovery can be used to show that flowering plants are much older than usually thought, reaching well into the Permian (270 Ma).

Monday, 5 September 2022, 14:00

SYMPOSIUM 3 – Anina Coetzee

Pollination contributes to maintaining Fynbos diversity

Dept Nature Conservation Management, Nelson Mandela University, Madiba drive, George

Mediterranean ecosystems host high plant diversity and there are a multitude of mechanisms that generate and maintain this diversity. One of these mechanisms is pollination interactions. I investigate, specifically, the role that bird pollination plays in maintaining plant diversity in the Fynbos, where this mutualistic system is unique due to the low diversity of bird species relative to the high number of bird-pollinated plant species. I focus on the guild of bird-pollinated Erica species. Community patterns across the landscape provides support that both competition and facilitation operate in this system. This is partly explained by the reproductive interference through interspecific pollen transfer due to sunbirds' random foraging behaviour. This behaviour could have influenced flowering phenology patterns and flower morphology evolution. These mechanisms are likely operating in other pollination systems as well. This illustrates how pollination processes can contribute to maintaining high plant diversity and emphasises the importance of conserving mutualistic systems.

Monday, 5 September 2022, 14:00

SYMPOSIUM 3 – Adriaan Grobler and Richard Cowling

Plant diversities of Mediterranean- and tropical-climate regions – which is the richest of them all?

African Centre for Coastal Palaeoscience, Nelson Mandela University, Gqeberha, Eastern Cape 6000, South Africa

Mediterranean- and tropical-climate regions harbour the richest regional-scale floras globally. Until recently, however, comparisons of their diversities have been hindered by a lack of comprehensive inventories of tropical floras. Using taxonomically verified floras, we analyse area-adjusted plant diversities of five Mediterranean- and 35 tropical-climate regions to determine which are the most species-rich regions on Earth. On average, the Neotropics and tropical Southeast Asia support the most diverse floras globally. However, the area-adjusted diversities of the richest floras in these tropical regions are matched by those of two Mediterranean-climate floras, namely the Cape (second richest) and Mediterranean Basin (sixth richest). Except for Madagascar and Burundi, the Afrotropics were substantially less diverse than other tropical regions and nearly half of the investigated Afrotropical regions were poorer than the least diverse Mediterranean-climate region, namely Central Chile. We evaluate the likely ecological and evolutionary drivers of these plant diversity patterns in terms of three hypotheses pertinent to global-scale comparisons: water–energy dynamics; biome stability; and ecological heterogeneity. Water–energy dynamics appear to have limited influence in explaining these diversity patterns: nodes of high global plant diversity are associated with climates that support year-round plant production (tropical climates) and those where the growing season is constrained by a winter-rainfall regime (Mediterranean-type climates). Moreover, while the Afrotropics have higher primary production than the Neotropics and Southeast-Asian tropics, they have markedly lower plant diversity. Instead, these patterns appear to be consistent with the hypothesis that the synergy of high ecological heterogeneity (promoting speciation rates) and historical biome stability (reducing extinction rates) better explain global patterns of regional-scale plant diversity.

Monday, 5 September 2022, 14:00

SYMPOSIUM 3 – Justin van Blerk

The effects of altered rainfall seasonality on fire-prone shrublands in the CFR

Department of Biological Sciences, University of Cape Town, Private Bag X3, Rondebosch

Changes in rainfall seasonality have been identified as a potential threat to the fire-prone shrublands of the Cape Floristic Region (CFR) in South Africa. The long evolutionary history of CFR shrublands under the Mediterranean-type, winter rainfall climate raises the question of how sensitive they are to potential changes in rainfall seasonality. The CFR is home to distinct shrubland communities (e.g., Fynbos and Renosterveld) which co-occur under the same climate but on different soils. Little is known about how adaptation to different soils could mediate shrubland responses to climate.

We report on findings from our 3-year, post-fire, seasonality manipulation experiment in neighbouring Fynbos and Renosterveld shrublands. Here we altered the timing, but not amount of rainfall over permanent post-fire field sites. In both shrubland types, we found that rainfall seasonality patterns determined the intensity of summer drought after fire, affecting the re-establishment of reseeding species populations after disturbance. However, in terms of growth, Fynbos species were largely decoupled from rainfall seasonality relative to neighbouring Renosterveld species. The lack of growth responses to altered rainfall seasonality in Fynbos meant that the observed effects on seedling survival had little overall impact on community structure or species dominance over time. Conversely, the combination of seedling survival and growth responses to altered rainfall seasonality in Renosterveld resulted in strong changes in community structure and species dominance over time. Observed differences in climate-coupling between Fynbos and Renosterveld shrublands are discussed in terms of the trade-off between plasticity and conservatism in nutrient-rich versus nutrient-poor shrubland communities.

THEMATIC SESSION:

Big data & Biodiversity challenges for a shifting future

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Charlie Schrader-Patton

Developing a biomass time-series data stack for southern California chaparral shrublands

USDA Forest Service Western Wildlands Environmental Threat Assessment Center, 1657 NW John Fremont St. Bend OR USA

The Mediterranean-type climate region of southern California is dominated by chaparral shrublands. Chaparral regulates essential ecosystem functions and provides critical ecosystem services such as water, air quality, recreation, wildlife habitat, biodiversity, and carbon storage. Today, chaparral shrublands are experiencing wildfires with increasing frequency and extent compared to pre-European settlement conditions. The USDA Forest Service, which manages over one million ha of chaparral in southern California, is tasked with assessing the impacts of wildfire disturbance on ecosystem services. Essential to this task is understanding the initial loss and subsequent recovery of aboveground biomass in chaparral owing to wildfire. However, most regional and national biomass assessments grossly underestimate shrubland biomass. To address this issue, we developed a method to estimate above ground live chaparral biomass using the deep temporal record of Landsat imagery and annual precipitation as time-dependent predictors. We used Random Forest, an ensemble machine-learning algorithm, to build an aboveground live biomass model using over 700 field plots from several sources. By using Landsat Normalized Differential Vegetation Index (NDVI) images and precipitation raster layers for each year from 2000 to 2021, we can track post wildfire above ground live biomass loss and subsequent recovery. In addition, to estimate carbon stored in different biomass pools – belowground, standing and downed dead, and litter – we developed models of three shrub life history types using field plots and environmental variables. This resulted in estimates of the proportion of seeder, resprouter and facultative seeder shrub species (along with proportion of trees and herbs) per 30 m pixel. The proportion of each life history was cross-referenced with data in the literature to estimate the amount of belowground, standing dead and litter/duff biomass. By developing a method to estimate carbon storage across multiple pools these data can provide a valuable input for resource managers to assess the impacts, and recovery, of shrublands post-fire.

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Emma Underwood

Estimating the Impacts of Wildfire on Ecosystem Services in Southern California

University of California, Davis. One Shields Avenue, Davis, California 95616

Chaparral-type shrublands characterize the world's Mediterranean-type climate regions. In southern California they are the most extensive ecosystem and dominate the four southern USDA Forest Service National Forests. Wildfire is a natural disturbance in California's shrublands and critical for its healthy functioning. However, a rise in anthropogenic ignitions has resulted in increased fire frequency, which is having disastrous effects on property and human lives and incurring millions of dollars in suppression costs. Less obvious, though, are the intangible environmental impacts of wildfires – the consequences on the provision of ecosystem services to the millions of people who live in close proximity. We developed a web mapping tool to quantify fire impacts on six ecosystem services: carbon storage, water runoff and groundwater recharge, sediment erosion, recreation, and biodiversity. The removal of vegetation increases water runoff, recharge and sediment erosion post-fire, and decreases carbon storage immediately after. Quantifying the impacts of wildfire on ecosystem services in addition to routine fire suppression expenses is increasingly recognized as an important component of natural resource management on public lands in southern California. In addition, assessing areas of high ecosystem service provision can help prioritize areas for post-fire management activities, such as stabilizing slopes in areas of high erosion risk, thereby helping to ensure their long-term provision.

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Charlie Schrader-Patton et al.

Post-fire biomass recovery and drought in southern California chaparral shrublands

Geospatial Analyst, RedCastle Resources/ USDA Forest Service

Chaparral shrublands comprise over 70% of the wildland vegetation in southern California, and this biome is fire-prone – and area burned and fire frequency are increasing. These disturbances have a profound effect on the ability of these landscapes to provide ecosystem services such as clean air and water, wildlife habitat, and carbon sequestration. The USDA Forest Service, which manages over one million ha of chaparral in southern California, is tasked with assessing the impacts of wildfire disturbance on these services. Essential to this task is understanding the initial loss and subsequent recovery of aboveground biomass in chaparral owing to wildfire. We modeled biomass across southern California using field data, Landsat NDVI, and a suite of geophysical and meteorological variables, producing 30 m raster surfaces of annual biomass for the years 2000-2021. We then analyzed this biomass time series by tracking the 21 years of biomass values for various burned and unburned sample points across the landscape. In addition to wildfire, southern California has experienced extreme drought in 14 of the past 21 years, and near continuous extreme drought from 2012-2021, except for 2019. These drought conditions are evident in our biomass data, and somewhat confound our recovery estimates as drought suppresses recovery from wildfire. The recovery patterns we discovered shed light on both disturbance types and how they interact which will inform the impacts on ecosystem services provided by southern California in a warmer and drier future climate in southern California.

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Lindie Smith-Adao

Flood hazards in a changing world: Challenges and opportunities in the Garden Route, South Africa

Council for Scientific and Industrial Research (CSIR), PO Box 320, Stellenbosch 7599, South Africa

In its 2022 Global Risks Report, the World Economic Forum states that biodiversity loss and ecosystem collapse, as well as climate action and adaptation failure and extreme weather are highlighted as the top three environmental risks over the next ten years. Anthropogenic environmental disasters, natural disasters and water crises are expected to have significant impacts on economic stability and social cohesion over the next decade. The world has witnessed an alarming increase in the frequency and severity of environmental disasters in recent years linked to climate change. A disaster results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk. Historical records, hazard modelling, early warning systems and simulations can help to identify areas where disasters are likely to occur and the impact they might have. These hazard or risk maps facilitate planning at all levels of government and society. In this study, we focused on the hazard component of risk, extreme flooding events. Using the Garden Route, situated in the Western Cape Province of South Africa, as a case study we highlight how historic and desktop data can be used to identify flood hazards, as well as inform the development of mitigation and adaptation strategies to address such hazards. The research approach involved a combination of modelled, observed, and measured data. Datasets from a wide range of sources were integrated. The analysis in the study focuses on two scales: district level (Garden Route District Municipality) and catchment level. The former involved a flood risk assessment while the latter sought to examine historical rainfall and streamflow changes (i.e., identify extreme flood events) in the Wilderness River Catchment. Challenges and opportunities are also highlighted.

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Catarina Sequeira

Use of UAVs in prescribed burnings and mop-up operations in Portugal

Centre for Applied Ecology "Prof. Baeta Neves" (CEABN-InBIO) , School of Agriculture, University of Lisbon, Portugal

Fire management is a challenge for Southern European countries, whom have been facing longer and severer fire seasons over the last decade. According to the Climate change 2022 IPCC report, extreme wildfire occurrence will increase, and improved strategies are needed to mitigate their negative outcomes. Within the approach of integrated fire management, each phase of the management cycle is considered equally important. One of the strategies employed in the fire prevention phase is the use of prescribed burning, which is a powerful tool for fuel management. The importance of prescribed burning in altering the patterns of subsequent extensive wildfires is recognized in some Mediterranean-type climate areas, such as Australia, USA, and South Africa, which have been demonstrating successful results in the field. Simultaneously, an improved efficiency in the mop-up operations, namely the decrease of rekindles occurrence, will likely reduce the resulting burned area, as well as its impacts.

The use of unmanned aerial vehicles (UAVs) to assist both operations (prescribed burning and mop-up) is starting to be implemented in Portugal. However, during the current process of defining the legal framework, there are several gaps and missing steps being identified. In partnership with the UAVs department of the Portuguese National Civil Protection, we reviewed the current standards and regulatory frameworks for the use of UAV in fire events or prescribed fire in Portugal, as well as internationally, and we started to define the guidelines for an operations' manual for a forthcoming safety plan.
Our preliminary results show that, aside from certain regulations for the use of UAVs issued during specific fire periods, there are currently no regulations for the use of UAVs in pre, during, or post-fire events, or prescribed burnings in Portugal. Most inputs and good practices are welcome to improve and define the guidelines and the regulatory framework.

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Korina Ocampo-Zuleta et al.

AFIRE database: How much do we know about Mediterranean ecosystems plant flammability

Programa de Doctorado en Ciencias mención Ecología y Evolución, Escuela de Graduados, Facultad de Ciencias, Universidad Austral de Chile, Valdivia, Chile.

Flammability is defined as the ease with which fuel burns and spreads fire. Understanding the flammability of plants would allow us to better understand the evolution of species and contribute to the development of fire management plans. We collected global-scale data on flammability variables at the species level. The AFIRE database comprises 13699 records from 197 studies for 1387 species. Mediterranean ecosystems are one of the most represented biomes in this database (31% of the records), comprising flammability data for 437 species. Most of the data correspond to woody species (92% of the records), in particular shrubs (53% of the records). Twenty-seven flammability variables were reported for Mediterranean ecosystems, with ignitability (42%) and combustibility (31%) being the most representative flammability dimensions. Time to flaming (26%) is the most studied variable because of its relationship with fire risk prediction. We have identified nine types of flammability measurement devices, which creates difficulties for comparative studies. The epiradiator is the most widely used combustion device (43%). The use of the grill to assess the flammability of whole branches is under-represented in Mediterranean ecosystems compared to the global database (2% compared to 14% of records). Consequently, leaves and twigs are the most studied plant part in Mediterranean ecosystems (90%), while flammability data for branches are very scarce (3%). It is therefore recommended to extend studies on the flammability of the whole part or large branches, which better represent the flammability of individuals in nature.

Acknowledgments: ANID/FONDECYT 1190999 (Chile, S. Paula) and ANID/PhD fellowship N° 21190817/2019 (Chile, K. Ocampo-Zuleta).

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Alvaro Salazar

Unrevealing the ecoclimatological changes of the ecosystems of Central Chile: are they drying out?

University of La Serena, Raul Bitran 1303, La Serena, Chile

Vegetation in Mediterranean ecosystems is adapted to periods of recurrent drought. However, Central Chile is undergoing its 20th year of severe drought and its natural vegetation is showing signals of drying out. In this work, we use a variety of remote sensing products to disentangle the region's ecoclimatological changes (surface temperature, snow cover, rainfall and atmospheric moisture content) to understand the impacts of this long-term drought in a series of vegetation types across an aridity gradient (from shrublands to temperate forests) along Central Chile. In addition, we run a high-resolution climate model to disentangle the future climate changes in the region that can further threads the region's ecosystems. We discuss the future of this area in the context of climate modelling studies and scenarios of water scarcity for people and ecosystems. This study shows the current impacts of the drying trend and possible mechanisms of changes in the components of the hydrological cycle in the only Mediterranean ecosystem of South America.

THEMATIC SESSION:

Fire-driven evolution of MTE floras

Monday, 5 September 2022, 16:15

THEMATIC SESSION: V Thomas Parker

Reproductive phenological shifts in Mediterranean-Type Climate Arbutoideae (Ericaceae) in the context of drought, seed predation, and fire in western North America

Department of Biology, San Francisco State University

Phenology is a critical ecological attribute commonly coordinated with other plant traits. Phylogenetic trait changes in fruit and other reproductive characters are observed in a group of western North American Mediterranean climate chaparral genera in the Ericaceae, subfamily Arbutoideae (Comarostaphylis, Ornithostaphylos, Xylococcus, and Arctostaphylos) and compared to their North American progenitor (Arbutus). This group of genera illustrate changes in fruits, for example, shifts from fleshy to dry fruit, from thin to stony endocarps, and from bird to rodent dispersal. Other traits associated with these changes include seed dormancy and obligate seeding. Such character shifts among these genera may be the result of evolutionary adjustments to persistently new environmental conditions compared to their woodland progenitor. Our objective was to assess the sequence of trait shifts in the context of phylogeny, and to determine if phenology shifts are associated with any different phylogenetic transitions. Our results indicate that the change from fleshy to dry fruits corresponds with a change in phenology, but other trait changes may be responses to differences in animal interactions and fire regimes. The phylogenetic scale with which this study approached this lineage is temporally large and, while restricting our data to fruits and associated traits, phenological shifts observed suggest strong selection by abiotic factors of a historic drying climate and an extended dry season, while other character changes reflect new fire regimes and changing resident animal communities. The shift in timing of flowering and fruiting in these Mediterranean climate genera in conjunction with the development of dry fruits as well as the change in dispersal vectors from birds to mammals all parallel the results of research in arid or semi-arid regions. This indicates that the investigation of clades can be comparable to that of close conspecifics and can provide a robust model for arid or semi-arid habitats.

Fitness benefits of fire-stimulated flowering

Desertification Research Center (CIDE-CSIC), Spain; (2) University of Sussex (United Kingdom)

Fire-stimulated flowering is a widely recognised strategy that occurs in fire-prone ecosystems worldwide. Species with this strategy flower faster and more profusely in postfire conditions than in absence of fire. This strategy has been studied mainly in South Africa, Madagascar and Australasia and occurs specially in herbaceous plants, most of them geophytes that use stored reserves in the underground organs for a quick post-fire bloom. However, little is known about the fitness benefits of early postfire flowering. We hypothesize that fire can affect flowering phenology and that plants with fire-stimulated flowering benefit from low pollinator competition and high intraspecific pollen arrival due to low-coflowering species in postfire conditions. We studied geophytes in southern Spain and compared recently-burned areas with adjacent unburned areas. We also performed fire experiments in a greenhouse. Our results suggest that fire synchronizes and accelerates flowering phenology and also suggest that pollination success is higher in plants in the burned areas.

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Maya A Zomer

Intraspecific variability in post-fire regeneration traits across a climate gradient

Centro de Investigaciones sobre Desertificación. Consejo Superior de Investigaciones Científicas (CIDE-CSIC)

In flammable Mediterranean shrublands, plant species have evolved to persist with recurrent fire disturbance by germinating profusely after fire from long-lived seedbanks or resprouting from surviving dormant buds. The success of these strategies depends on how they cope with both fire and climate. Thus, we studied intraspecific variability in key post-fire regeneration mechanisms of five species, including heat-released physical seed dormancy and resprouting ability, along environmental gradients of summer temperatures and precipitation in Eastern Spain. Our results demonstrate considerable among-population variability in both traits. We found that seeder populations growing under warmer summers require more heat to release seed dormancy, in order to maintain the soil seedbank during the inter-fire period. Resprouting populations growing in drier conditions had greater resprouting success and vigour, due to increased resource allocation below-ground. Climate projections for the Mediterranean Basin predict rising temperatures and increasing frequency and intensity of heatwaves and droughts. Trait variability across a species' distribution is an indicator of either genetic variation or plasticity driven by the parental environment, and thus can provide a source of adaptation under future climate changes or an opportunity for assisted migration projects.

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Alexandria Thomsen

Impacts of shifting fire season on mediterranean plant species

Centre for Ecosystem Science, School of Biological, Earth and Environmental Sciences, University of New South Wales, Kensington, NSW, Australia.

Fire is a major factor shaping plant communities, and plant species have evolved to persist through a fire regime, broadly characterised by the frequency, intensity, and season of burns typical of their region. However, historical fire regimes are shifting with changing climate and other factors, including increased ignition sources, and implemented fires, producing more frequent burns of varying intensity. As such, seasonality of fire is shifting and despite the effects of fire on plant persistence being well studied, there is still little understanding on the effects of fire season. In this study, we set up two sites with five treatment areas, an early autumn burn, late autumn burn, early spring burn, late spring burn and a control. We surveyed multiple shrub species for impacts of seasonal burns on resprouting vigour and post-fire flowering in the mediterranean region of South Australia. Fire severity will also be measured using soil temperatures, canopy cover consumption and minimum twig diameter. Data will be analysed to control for variances in fire severity and fire-free intervals. Linear and Generalised linear mixed models will be constructed for each measured trait and model selection will be conducted to identify the most important predictors, including fire season, fire severity, and site. This study highlights the impact of season of fire and that it should be considered when making species management decisions, particularly for facultative pyrogenic flowerers.

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Alastair Potts

High temporal resolution repeat photography for vegetation field observations: what can we learn about the dune fynbos-thicket mosaic from >2 years' worth of hourly photos?

Botany Department, Nelson Mandela University, Gqeberha, Eastern Cape

The vegetation growing on the Holocene dunes of the Cape south coast — consisting largely of mosaics of fire-prone fynbos and fire-avoidant thicket — is surprisingly species rich. It is also a fire-prone system. To monitor plant dynamics after a fire, trail cameras were setup at four recently-established long-term monitoring sites on the Nelson Mandela University Reserve, Gqeberha, Eastern Cape. These cameras have recorded hourly photos (and animal-triggered events) for over two years starting after a fire in November 2019. This talk will focus on the natural history observations obtained from this temporal record, and demonstrate the value of these photos as a resource for a diverse array hypothesis generation. These observations help to provide first glimpses into questions such as: Where does all the post-fire ash go, and why is knowing this important? Which plant species come up first, and why? When do grasses grow? Are there post-fire specialist plant taxa in this ecosystem? How does herbivory set-back plant recovery? How might coexistence amongst reseeders and resprouters be facilitated? And finally, why should you have long-term cameras recording your study system?

Monday, 5 September 2022, 16:15

THEMATIC SESSION: Sinenjongo Gcina

Beauty from ashes: understanding the short-term postfire ecology on coastal dune systems

Nelson Mandela University

The post-fire ecology of coastal dune vegetation in the Cape Floristic Region (CFR) is poorly studied. To this end, I provide a descriptive account of the postfire regeneration of plant species at a fine temporal scale and describe the recovery of the vegetation community within a coastal dune landscape. This study bridges a gap between postfire regeneration and the phenological phases of the vegetation found in these coastal dune systems. Geo-tagged photographs of plant species taken weekly in sites that burned during January 2019 served as records of species emergence and informed monitoring of phenological events (e.g., flowering, fruiting, leaf growth, leaf yellowing and leaf abscission). Monitoring took place for most of the plant species from (05/02/2019 – 14/02/2020), the first 12 months postfire. The observations made here revealed that life history types are crucial indicators of resilience to fire as they enable plant communities to recover in areas where fire disturbance has occurred. More studies should be done on life history types in relation to postfire recovery to establish a better understanding of plants in fire-dependent ecosystems.

Monday, 5 September 2022, 17:30

WELCOMING FUNCTION: Loubie Rusch

Successes and gaps on a journey of re-integrating the cape's forgotten foods into local foodways

Owner at Making KOS, Founder of Local WILD | 7 Purley Street | Kenilworth 7708 | South Africa

Loubie situates the context of GCFR wild edibles, particularly for the benefit of visiting participants. She highlights that though they supported the lives of local inhabitants for millenia, over the past few colonial centuries, they have become functionally absent from the local food system and are virtually completely unknown in most households.

She summarises some of the achievements and research gaps in Local WILD's striving to see forgotten local idigenous foods of the Greater Cape Floristic Region re-integrated into local food practices, so they contribute to the wellness of local people and ecologies:
- An emerging Community of Practice in collaboration with the Sustainability Institute and UWC Centre of Excellence in Food Security - exploring its role in creating inclusiveness, momentum and cohesion across a stakeholder network

- A study to establish the nutrition analysis status of the 22 plants as featured in Cape Wild Foods: A Growers Guide - towards encouraging the use of locally adapted species in mitigating local health issues in food insecure households, and in general, more informed awareness about their nutritional benefits

- Evolving an equitable short supply chain that is making cultivated GCFR foods around Cape Town available to home and professional chefs - towards regenerative access, livelihood benefit to small scale growers, and developing end user interest

- Developing a model for cultivation training and data capture underpinned by an understanding of the edibles of local biomes - towards ensuring that scaling the reintegration of local indigenous foods proceeds regeneratively in varied locations.
This short talk is supported by 2 opportunities to make local indigenous food and flavours more real for delegates. The first is through a tasting experience on arrival at the conference venue, and the second during an optional walk and picnic lunch experience where local edibles surviving in the wild can be appreciated.

Tuesday 6 September 2022

Tuesday, 6 September 2022, 08:00

KEYNOTE 4 - RUPERT KOOPMAN

Upcycling the past to shape the present and future of Plant Conservation

The Botanical Society of South Africa

Just as the plants of Mediterranean ecosystems have evolved over time to perfectly fit their niches, the formation of a core of plant observers and citizen scientists is not an overnight event. We will reflect on the Fynbos Research group which led into Fynbos Forum and how the baseline was laid for today's contemporary plant conservation work in the Botanical Society and Custodians of Rare and Endangered Wildflowers . A key contributor to laying the base was MI (Margie Jarman) who recently passed on and it is fitting to remember the key role she played in both the Fynbos Biome Project and the Fynbos Forum.

Our contemporary work tends towards cutting edge but it is NB to return to the roots for inspiration. For example. sites identified in the Jarman Report remain some of the highest priority in the CFR and, although some have been secured, some have been lost.

Previous BotSoc and other fynbos conservation work has leaned heavily on this information as a key reference to, amongst others, the Cape Lowlands Renosterveld Project and Putting Plans to Work. We celebrate the advanced thinking of what was achieved with the data and technology available at the time which is unsung but still vital for current conservation workers to know, use and improve.

Tuesday, 6 September 2022, 08:30

KEYNOTE 5 - JASPER SLINGSBY

Tracking and forecasting change in the Cape Floristic Region

University of Cape Town and SAEON

The hyperdiverse Cape Floristic Region (CFR) is a Global Biodiversity Hotspot. Unfortunately, it is also a Global Extinction Hotspot, threatened by habitat loss and fragmentation, altered fire regimes, invasive species, and climate change, among others. Managing and mitigating these threats requires regularly-updated, spatially-explicit information. Better still would be to have explicit, regularly updated forecasts of anticipated change on timescales relevant for management and policy decisions. Unfortunately, developing effective near-real-time observation systems and ecological forecasts require good fundamental understanding of the ecosystem and its responses to change drivers, necessitating further basic research. I'll present some of my global change related research - trying to improve our basic understanding, monitoring tools and ability to forecast change in the Cape Floristic Region.

THEMATIC SESSION:

Invasive alien species and their control in MTEs

Tuesday, 6 September 2022, 09:30

THEMATIC SESSION - D Van der Colff

Revisiting Protea Atlas Project plots in the Agulhas Plain, South Africa: Has invasions changed things?

South African National Biodiversity Institute, Kirstenbosch Research Centre, Cape Town, South Africa

Invasive alien plant (IAP) species have many impacts on native species and their communities. How these impacts change overtime and the factors influencing these changes will be investigated. The Protea Atlas Project database will be used as a baseline and sampled plots will be re-visited. Proteaceae species and woody IAP presence and estimated abundances will be compared to previous collections. Environmental factors such as veld fire age, vegetation type, altitude, type of site (private vs protected), alien clearing activities, presence of biological control agents and evidence of cut flower collections will be recorded. These variables will be used to identify whether changes observed in the native species are related to natural processes, other disturbances or whether it was influenced by the presence and abundances of IAP species. The data will be analysed using mixed generalized linear models, with plots and date as random effects as well as analysis of transitions between plots. We expect that areas that were heavily invaded in the past will be in a similar or worse condition, where there has been no other disturbances or interventions e.g., fire, alien clearing activities or the use of biological control agents. Sites that had low or no IAP species present, might have an increase, new introductions of IAP species if no other interventions have taken place or may still be uninvaded. Change in native Proteaceae species in uninvaded sites are expected to be strongly linked to time since last fire. Native species are expected to decrease in their abundance and richness depending on the type and abundance of invasive alien species if other disturbances have been accounted for. Here we present the preliminary findings as well as discuss some of the complications of revisiting historical sites.

Tuesday, 6 September 2022, 09:30

THEMATIC SESSION- Matthys Strydom

Invasive Australian Acacia biological control success: Fact or fiction?

Department of Conservation Ecology and Entomology, Stellenbosch University, Matieland, South Africa

Review articles on the invasive Australian Acacia biological control program in South Africa have widely stated that it has been successful. These reports have claimed that the released biological control agents have significantly curbed the reproductive output of their invasive Australia Acacia hosts which has translated into the reduced stand density and rate of spread of these plants. It is further maintained, based on the reported success, that biological control is the only economically viable option for controlling these infestations. Following this logic, it has been suggested that biological control should be the first action taken to control these invasive alien plants. There is, however, little quantitative data supporting the claim that reproductive output of these plants have significantly been reduced to the extent that their future populations are affected. Recent reports on the national status of invasive Australian Acacia in South Africa have shown that these plants have increased their distribution ranges during the past 19 years. To understand this dichotomy, seed bank dynamics of three Australian Acacia in dense monospecific stands were investigated over their invasive ranges in South Africa. It was demonstrated that despite biological control impact on seed production, these plants still produced many seeds (307 to 1942 seed m-2) leading to the accumulation of large seed banks (1017 to 17261 seed m-2). The accumulated seed banks maintain populations with no reduction in the area covered by these plants. Through this investigation it was shown that invasive Australian Acacia use seed predator satiation as a defense mechanism. This has far reaching consequences as inappropriate management interventions can cause the loss of biological diversity as well as waste limited conservation resources. It is even more so as Trichilogaster acacialongifoliae has been released on Acacia longifolia in Portugal based on its claimed success in South Africa.

Tuesday, 6 September 2022, 09:30

THEMATIC SESSION - Pride Mudavanhu

A report back on the efficacy of biological control for the management of alien invasive acacias in South Africa.

Agricultural Research Council - Plant Health & Protection. Vredenburg Campus, Polkadraai Road, P/Bag X5017, Stellenbosch, RSA, 7599.

One of the most invasive tree genera in the world is Acacia (Leguminosae: Mimosoideae). Acacia longifolia (Andrews) Willdenow and A. pycnantha Bentham are native to Australia and were historically rated amongst the worst invaders in South Africa. Nevertheless, biological control has been the primary focus of research since the 1970s, as a long term and sustainable management tool for these alien woody-tree weed species. The current management programme against these species in South Africa relies on insects species introduced from their native range that curtail reproductive capacity and consequently rates of spread and densification of these weed infestations. Post-release evaluation of biological control endeavours among several objectives to measure progress as well as gain a better understanding of the dynamics and efficacy of agents deployed for this purpose. Two seed-feeding weevils, Melanterius ventralis (Lea) and M. maculatus (Lea) were released on A. longifolia in 1985 and A. pycnantha in 2005, respectively, to supplement the two pioneering bud-galling wasps from the genus Trichilogaster, which were deployed prior as biocontrol agents in the early 1980s. This study aimed at assessing the performance of the released agents. Field observations on the interaction between the agent species and their acacia hosts were conducted at various sites in South Africa beginning in 2014 to elucidate levels of seed production by the host plants via measuring seed rain, seed banks and seed mortality as a consequence of agent activity on the infestations. The data collected over the assessment period shows that the biocontrol agents are playing an important role in reducing the reproductive fitness of the afore-mentioned invasive Australian acacias. There is variability both amongst sites and across years in seed production by A. longifolia and A. pycnantha. There is also variability in seed mortality across sites and seasons.

Tuesday, 6 September 2022, 09:30

THEMATIC SESSION- Thembelihle Mlokoti

Aristaea thalassias, a biological control agent of Leptospermum laevigatum¬: why impacts of the agent are considered negligible

Vredenburg Campus, Stellenbosch P/Bag X5017, South Africa

Leptospermum laevigatum is indigenous to the coasts of south and central New South Wales in Australia. It has become invasive in Western Australia, South Australia, South Africa, New Zealand, Hawaii and the USA. It is a competitor to the native fynbos and considered a highly invasive species that needs successful management in South Africa. Biological control of Leptospermum laevigatum has been implemented since the 1980s with limited success to date. Aristaea (Parectopa) thalassias is one of two poorly-performing biological control agents of the plant. A study was carried out over 32 months to investigate factors which may be contributing to the low efficacy of the moth, and larval mortality factors due to parasitism, predation, overcrowding and season were considered. The developmental biology of the moth, which was unknown was also studied. The results demonstrated that the moth is abundant in the field and the rapid development of immature stage permits several generations a year. Although parasitism and overcrowding was low, mortality was ± 50% for all of the immature stages and was significantly impacted by season. Despite this, the moth was still abundant in the field suggesting that mortality was not the sole reason for low efficacy of this agent. Factors such as plant compensation, leaf quality as well as adult mortality, combined with egg mortality may have contributed to survival and efficacy of A. thalassias as a biological control agent against L. laevigatum. While findings from this study have given insights into the survival and population dynamics of A. thalassias on L. laevigatum in South Africa, the evidence presented in this study could not explain the low field efficacy of the agent. Determining why a biocontrol agent is ineffective is a common problem in several biocontrol programmes, and often, is a result of complex issues which may not be easily discernible.

Tuesday, 6 September 2022, 09:30

THEMATIC SESSION - Debbie Muir

Hierarchy of Control and GHS: How to choose the correct pesticide to use in local conditions

Department of Forestry, Fisheries and the Environment, 14 Loop Street, Cape Town, 8000.

Pesticides are used in various operations in South Africa. The Department of Forestry, Fisheries and the Environment (DFFE) uses pesticides for Invasive Alien Species (IAS) control through its newly amended Pesticide Policy that utilizes Hierarchy of Control (HOC) and the Global Harmonized System of Classification of Labelling of Chemicals (GHS) to choose the most appropriate pesticide in local conditions to safeguard both the pesticide operators' health and to protect the environment by using the least harmful pesticide. The DFFE developed mechanisms to implement environmental and social risk assessments (ESRA) prior to choosing the pesticide to use in local conditions in line with the HOC and GHS which also then complies to the Hazardous Chemical Agents (HCA) Regulations promulgated in March 2021. A process of substitution and elimination was followed to remove all Highly Hazardous Pesticides (HHP's) from use and DFFE is now embarking on the next step of engineering controls as PPE is the least precautionary step for protection of pesticide operators.

Tuesday, 6 September 2022, 09:30

THEMATIC SESSION - Deon Rossouw / Andrew Turner

Quantifying the impact and effectiveness of bark spot spray application of herbicide by helicopter on invasive alien pine trees and its non-target effect to indigenous vegetation

CapeNature. Cnr Posduif and Volstruis Avenues Athlone 7700

The uncontrolled expansion of invasive alien plants (IAPs) constitutes one of the major threats to biodiversity of the Cape Floristic Region (CFR). Many natural areas have inaccessible stands of IAPs that provide a continuous source of seed for invasions into uninvaded areas. The alien clearing method of direct Aerial Basal Bark Application (ABBA) of herbicide to the stem and apical buds of invasive alien pine trees (primarily Pinus contorta) has been successfully executed by the Department of Conservation in New Zealand. It is more efficient and less labour intensive than manual mechanical methods due to ease of accessibility with a helicopter. The method uses a highly directed stream of herbicide in a carrier oil from a narrow-barrelled applicator (wand) from a helicopter above the tree. Currently, in the Western Cape, the rate of IAP control and management is not sufficient to reach maintenance phase, therefore these new innovative methods are of interest to conservation organisations as a new tool to combat alien species and reach adequate control measures to inhibit further infestation. As IAPs (particularly Pines, Hakea, Australian Wattles and Gums) are an on-going and expanding threat to biodiversity and water security in South Africa, this method was investigated for use in the Western Cape. Research was done to assess the effectiveness of this method on Pinus pinaster and to measure the negative effects of the herbicide (Triclopyr Ester) on the native vegetation (mountain fynbos) below and around the target trees. Results indicated that the effect of this herbicide on the native vegetation below the pines is acceptable and that this method of alien clearing can be implemented in specific areas within the Western Cape.

Tuesday, 6 September 2022, 09:30

THEMATIC SESSION - Tshepiso Mafole

The effects of shifting rainfall seasonality on C4 grass establishment in winter-rainfall regions

Biological Sciences, University of Cape Town, South Africa. Centre for Statistics in Ecology, the Environment, and Conservation, University of Cape Town, South Africa.

Recent historical climate analyses suggest that rainfall seasonality is changing in Mediterranean-type ecosystems, including the Greater Cape Floristic Region (GCFR). Winter rainfall is expected to decrease, but there has not been a corresponding decrease in summer rains in many of these regions, raising the relative contribution of rain in summer. Also, these rainfall changes have been accompanied by warming temperatures. Warmer temperatures during the wet winters and higher summer rainfall may support warm-season C4 grasses compared to cool-season C3 grasses and shrubs. In this study we investigated. This study aims to investigate the effects of altered rainfall seasonality on C4 grass invasion into C3 ecosystems, such as the Fynbos along with how this might be mediated by different soil types in the Renosterveld and Fynbos. To test this, we used a combination of greenhouse and field-based rainfall manipulation experiments to assess the response of C4 grass recruitment and establishment. Both experiments applied the nested hierarchical experimental design and used mixed models to investigate study outcomes. Our results indicated that recruitment and establishment were influenced by resource availability (moisture, soil nutrients) during the growing season. However, the establishment was comparatively lower in the field due to slow growth and low survival rates, than in the greenhouse. Nevertheless, these results suggest that moisture, edaphic factors, or the interaction of both may influence the potential to invade. This could provide insights into the mechanisms and limitations of C4 grass invasion in different habitat types in the GCFR and may inform better grassland management practices.

Tuesday, 6 September 2022, 09:30

THEMATIC SESSION - Aileen Anderson & Ricardo Januarie

Restoring rivers through alien clearing, a success story from Grootvadersbosch

Grootvadersbosch Conservancy Trust

The Grootvadersbosch Conservancy Trust is a nonprofit organisation covering 35 000ha between Swellendam and Heidelberg in the Western Cape. A conservancy is a collection of private landowners who work together for conservation. Although, they are designated and declared by Cape Nature as conservation areas, the success of a conservancy depends on the voluntary commitment of landowners to conservation objectives. Those who join work together to maintain a balance between conservation, economic development and agriculture.

The Grootvadersbosch Conservancy was declared in 1992 as one of the first to be established is the Western Cape. Since 2015, the Conservancy has actively cleared over 55km of riparian land, as well as large sections of mountain catchment. They also have a specialised rope access team.The approach has been unique in raising funds from private and government sources. The paper will outline the lessons learnt over the last 7 years in terms of successfully running an alien clearing operation that builds on the voluntary commitment of landowners and creates employment for over 50 people a year. The restoration of the natural vegetation is now apparent and the ecosystem benefits for agriculture have been a key part of sustaining landowner buy-in and financial contributions.

SYMPOSIUM 4 - Jasper Slingsby et al.

Advances in Remote Sensing of Biodiversity in Mediterranean-Type Ecosystems

Tuesday, 6 September 2022, 09:30

SYMPOSIUM 4 - Jasper Slingsby

Introduction to the symposium and the Ecosystem Monitoring for Management Application

University of Cape Town and SAEON

Mediterranean-Type Ecosystems typically contain a diverse mix of shrublands, grasslands and forests that are prone to complex natural dynamics. Fire, post fire recovery, high contribution of bare soil to observed vegetation indices, as well as high sensitivity to rainfall and strong seasonality driven by hot, dry summers and cold, wet winters pose huge challenges to traditional remote sensing methods. Fortunately, the increasing availability of long-term records and advances in techniques and technologies present exciting opportunities to better explore and understand the biodiversity of MTEs from space. In this talk I'll use the EMMA (www.emma.eco) project as context to introduce a symposium that will highlight some of these recent advances and introduce the NASA BioSCape field campaign, to be conducted in the Greater Cape Floristic Region (GCFR) in 2023.

Tuesday, 6 September 2022, 09:30

SYMPOSIUM 4 - Glenn Moncrieff

Global Renosterveld Watch - Near-realtime monitoring of change in a Mediterraneantype Ecosystem

Fynbos Node, South African Environmental Observation Network, Private Bag X7, Rhodes Drive, Claremont 7735, South Africa;

Existing efforts to continuously monitor land cover change using satellite image time series have mostly focused on forested ecosystems in the tropics and the Northern Hemisphere. Less progress has been made in detecting change in disturbance-prone vegetation such as Mediterranean-Type Ecosystems where natural dynamics can be difficult to distinguish from habitat loss. Renosterveld is a hyperdiverse, critically endangered MTE with less than 10% of its original extent remaining in small, highly fragmented patches. I demonstrate how classification of satellite image time series using neural networks can accurately detect the transformation of Renosterveld within a few days of its occurrence and that trained models are suitable for operational continuous monitoring. A dataset of precisely dated vegetation change events between 2016 and 2021 was obtained from daily, high resolution Planet Labs satellite data and used to train neural networks to make predictions based on Sentinel 2 reflectance data. The best model correctly identified 89% of land cover change events. Models have been deployed to operational use and are producing updated detections of habitat loss every 10 days. There is great potential for continuous monitoring of habitat loss in non-forest ecosystems with complex natural dynamics. A key limiting step is the development of accurately dated datasets of land cover change events with which to train machine-learning classifiers.

Tuesday, 6 September 2022, 09:30

SYMPOSIUM 4 - Philip A. Townsend

Regional-scale response of foliar functional traits to the 2011-2017 California megadrought

1. Department of Forest & Wildlife Ecology, University of Wisconsin-Madison, 1630 Linden Drive, Madison, WI 53706 USA; 2. California Institute of Technology, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena CA 91109-8099 USA

A range of emerging remote sensing technologies offer unprecedented capacity to characterize the structure and function of ecosystems. In particular, imaging spectroscopy (aka hyperspectral remote sensing) enables measuring and mapping the foliar trait syndromes that are indicative of resource partitioning and which collectively characterize functional diversity. Time series of imaging spectroscopy data provides the ability to quantify how vegetation responds to climatic variation and disturbances at broad scales. Mediterranean ecosystems are among the most diverse on Earth, and are also strongly susceptible to the effects of the periodic droughts. Here we demonstrate the use of imaging spectroscopy to quantify changes in foliar functional traits over the course of the 2011-2017 California megadrought, which was the driest in recorded history. Mortality due to water stress and beetles have been widely reported, and trait mapping from imaging spectroscopy provides insights into underlying mechanisms. Using AVIRIS-Classic imagery collected over southern Sierra Nevada Mountains and adjacent foothills and grasslands from 2013-2018, we demonstrate a distinct trend across all functional types in changing allocation of resources away from traits related to photosynthesis (nitrogen, chlorophyll) and defense (phenolics) and towards maintenance (leaf mass per area, nonstructural carbohydrates). This was followed by patterns of recovery when the drought eased in 2017. Our results match expectations from the literature and provide a mechanistic basis for understanding spatial and temporal patterns in mortality due both to water stress and lowered resistance to pests.

Tuesday, 6 September 2022, 09:30

SYMPOSIUM 4 - Maria J. Santos

Mediterranean-type ecosystems seasonality and biodiversity: a remote sensing approach

University of Zurich

The unique seasonality of Mediterranean-type ecosystems makes them uniquely positioned for multitemporal analysis of ecosystem functions and their implications for biodiversity. Mediterranean forests, unlike other forests globally, require moisture from the close-by ocean for their persistence, which makes these systems exhibit mild-cold winters with high precipitation, and hot summers with low to no precipitation. These characteristic climates make these systems unique species and functional radiation areas for biodiversity, but also make the monitoring of biodiversity quite challenging in the five areas globally that experience these bioclimatic characteristics: Mediterranean basin, California, the coast of Chile, the SW of South Africa and of Australia. Through remote sensing technology, we can better understand biodiversity responses to these characteristic climate dynamics across trophic levels. Herein, I will present two examples on how to study cross-trophic biodiversity relationships in two Mediterranean-type ecosystems using remote sensing. The first case study, in the cork oak woodlands in southwestern Portugal, I examine how the use of multiple remote sensing datasets explain the onset of productivity and the implications of this phenology to the habitat and movements of the European badger (Meles meles) as an example of what might happen across trophic levels under land use and climate change. The second case study, in the California Sacramento-San Joaquin River delta, makes use of imaging spectroscopy data to explore cross-trophic relationships of aquatic biodiversity in a system experiencing land use and climate changes, and invasive species. With these two examples, I will show how we can not only map and monitoring biodiversity through remote sensing but also understand seasonal and cross-trophic ecological processes that are affected by one or several global change pressures.

Tuesday, 6 September 2022, 09:30

SYMPOSIUM 4 - Adam Wilson

The NASA Biodiversity Survey of the Cape (BioSCape)

University at Buffalo, USA), Erin Hestir (University of California Merced

We provide an overview of the first ever NASA Biodiversity campaign, to be flown in 2023. Incorporating airborne imaging spectroscopy, lidar, and field observations, the campaign will explore the structure, composition, function and threats to biodiversity across South Africa's Greater Cape Floristic Region (GCFR), including freshwater, coastal and marine environments. The GCFR contains two Global Biodiversity Hotspots with the richest temperate flora and the third highest marine endemism in the world. The field campaign includes collection of new hyperspectral data ranging from UV to thermal wavelengths acquired by PRISM, AVIRIS-NG, and HyTES spectrometers combined with the LVIS laser altimeter (LiDAR) aboard the NASA GIII and GV aircraft. These remotely sensed data will be combined with existing and new field observations of the spatial distribution of species, ecosystems, and their traits, processes (e.g. fire) and threats (e.g. invasive alien species) to enable high resolution mapping of biodiversity, functional traits, and three-dimensional structure across environmental gradients and times-since-disturbance. The campaign is working with local research and conservation stakeholders to address locally and globally relevant questions organized around three major themes: 1) the distribution and abundance of biodiversity, 2) the role of biodiversity in ecosystem function, and 3) the impacts of biodiversity change on ecosystem services. This focus represents an important paradigm shift from previous NASA field campaigns, which were primarily biogeochemical, toward an approach for measuring and understanding functional, phylogenetic, and taxonomic biological diversity as key components of ecosystem function.

Tuesday, 6 September 2022, 09:30

SYMPOSIUM 4 - Anabelle Cardoso,

Introducing the BioSCape Research Projects

University at Buffalo, USA & University of Cape Town, SA

BioSCape, A Biodiversity Survey Of The Cape, is NASA's first ever biodiversity-focussed remote sensing field campaign. The campaign will advance our ability to measure and monitor the biodiversity of this and other Mediterranean-Type Ecosystems using remote sensing. This talk will introduce the ten NASA-funded research projects in the BioSCape campaign, review their main objectives, research questions, and the advancements they contribute to the field of remote sensing of biodiversity. The BioSCape research projects use a range of approaches to measure biodiversity and assess ecosystem function in MTE's. Some projects aim to investigate remote sensing algorithms for measuring biodiversity, while others aim to advance our understanding of radiative transfer models or ecosystem function. All projects will use field measurements in conjunction with remote sensing data, including DNA and eDNA sampling, plant functional trait measurement, and acoustic monitoring of animals. The BioSCape projects explore key research themes relevant to MTE's, including recovery from burning, the effects of alien plant invasions, and how urban expansion affects biodiversity.

SYMPOSIUM 5 - Helen de Klerk, Zahn Munch & Vernon Visser

Using remote sensing to understand and manage Mediterranean Type Ecosystems

Tuesday, 6 September 2022, 11:30

SYMPOSIUM 5 - Jon Keeley

Linking drought, shrub dieback and fire intensity

U.S. Geological Survey, Western Ecological Research Center, Sequoia-Kings Canyon Field Station, Three Rivers.

Drought from 2011-2016 contributed to extensive dieback of southern California chaparral and the NDVI before drought and near the end of the drought was used to estimate this dieback, after accounting for other disturbances recorded in aerial photographs. Within the perimeters of two megafires that occurred after the drought, the 2017 Thomas Fire and the 2018 Woolsey Fire had extensive areas of dieback. Comparing dieback with Monitoring Trends in Burn Severity (MTBS) measures of fire severity there was a highly significant negative relationship between drought-caused shrub dieback and fire-caused dieback as measured by fire severity; further support for out remote sensing methodology for pre-fire dieback. Models of fire behavior suggest that one means by which dieback contributes to fire
size is through enhancing spot fires that result from massive dieback when coupled with extreme winds. Current fire danger indices for the region do not incorporate drought-caused dieback, instead using stand age as an estimate of dead fuels. The study highlights the potential importance of drought-induced dieback in chaparral and suggests that existing fire danger indices may be improved by using current dieback estimates.

Tuesday, 6 September 2022, 11:30

SYMPOSIUM 5 - Sally Archibald

Extreme fires and how it applies to mediterranean ecosystems

Centre for African Ecology, School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Johannesburg, Private Bag X3,WITS, 2050, South Africa

In many ecosystems, including Mediterranean ecosystems, there are indications that extreme fires are increasing. Identifying the climatic factors associated with extreme fires has become an urgent research question, and can inform our understanding of the degree to which human management and suppression of fire can be effective in preventing damaging wildfires. Here we present an analysis of matched pairs of extreme and non-extreme fires in the Chaparral system of California to investigate the relative importance of fuel accumulation, aridity, and extreme weather events in driving the occurrence of extremely large fires in the region. We found that both the duration of extreme weather conditions, as well as fuel moisture at the time of ignition are important, but overall predictability was very low. Although we tried to control for spatial effects the importance of
fragmentation and fire suppression by people was none the less apparent in the analysis, indicating the role people can play in mitigating extreme fire events in Mediterranean ecosystems.

Tuesday, 6 September 2022, 11:30

SYMPOSIUM 5 - Kirsten, Tim et al

A regional, remote sensing approach to land degradation assessment in the Little Karoo

Plant Conservation Unit, Department of Biological Sciences, University of Cape Town, Rondebosch 7701, South Africa.

Land degradation in drylands negatively affects the health of ecosystems and the resilience of communities that depend upon them. There is growing consensus that there is a need to develop a methodology which accurately assesses dryland degradation on a local to regional scale. However, there is also a need for an approach to be replicable in other dryland regions in South Africa. In a previous study, a novel approach was developed that combined remotely sensed vegetation productivity data and field observations to map the condition of natural habitat in the Hardeveld bioregion of the Succulent Karoo. This methodology, rooted in fuzzy classification statistical theory rather than traditional hard classification boundary techniques, has now been applied to the Succulent Karoo biome in the Little Karoo region. The resulting map displays the current condition of natural habitat through the lens of vegetation biomass trends and potential drives and correlates of land degradation, such as livestock density.

Tuesday, 6 September 2022, 11:30

SYMPOSIUM 5 - Helen de Klerk

Satellite RS methods for monitoring habitat quality in ecosystems with lower seasonal predictability

Department of Geography and Environmental Studies, University of Stellenbosch, Matieland

Monitoring of habitat condition can encompass degradation or restoration, and is necessary to guide conservation prioritisation and action. Satellite remote sensing (SRS) based monitoring of habitat condition can cover wide areas on a regular basis and supplement traditional field-based monitoring techniques. Many SRS monitoring techniques used are based on phenological patterns of habitats. In areas where phenology is very predictable, these methods work well. Here we look at a variety of areas with different seasonal stability and application of monitoring for different purposes and comment on the abilities of different techniques under these scenarios.

Tuesday, 6 September 2022, 11:30

SYMPOSIUM 5 - Lungile Khuzwayo

Detection and mapping of invasive alien plants in the Western Cape mountain catchments

University of Cape Town. Rondebosch, Cape Town, 7700

The Fynbos Biome is South Africa's most invaded terrestrial region in terms of the prominence of woody invasive alien plants. A modern feature of the Fynbos Biome is the widespread occurrence of dense stands of these trees and shrubs. These invasions reduce stream flow, threaten biodiversity and cause catastrophic fires. Managing these invasions is one of the greatest natural resource management challenges in the region and requires reliable and frequently updated information on the extent, expansion or retraction of the distribution and density of problem species. Remote sensing has been proposed and widely used as a tool for detection and monitoring, generating data on plant species distributions over time that is more cost and time-effective, and less labour-intensive than field-based monitoring. The objectives of this study include the generation of a repeatable classification of the extent of invasion by alien trees in selected mountain catchments of the Cape Floristic Region using high resolution multispectral imagery over multiple years, estimation of the rate of expansion of alien tree invasions in the study areas as well as estimating the impacts on stream flow in the Western Cape mountain catchments through hydrological modelling.

Tuesday, 6 September 2022, 11:30

SYMPOSIUM 5 - Kirsten, Tim, Vernon Visser et al

An evaluation of different approaches which use Google Street View imagery to ground truth land degradation assessments

Plant Conservation Unit, Department of Biological Sciences, University of Cape Town, Rondebosch 7701, South Africa.

Member states of the United Nations Convention to Combat Desertification are required to report on the proportion of land that is degraded in their countries, a requirement that is also tied into the UN Sustainable Development Goals (SDGs). National land degradation assessments are often conducted with the use of remote sensing data which are not always ground truthed. Google Street View (GSV) provides high resolution, panoramic imagery across large parts of the world that has the potential to be used to ground truth land degradation assessments. We apply three different methodologies (visual interpretation of GSV images, GSV image classification, and vegetation index extraction) to derive vegetation cover estimates from Google Street View imagery for the Hardeveld bioregion of the Succulent Karoo biome in South Africa. Visual estimates of cover best predict known habitat condition values (adjusted R^2 = 0.86), while estimates derived from an unsupervised classification of GSV images also predict habitat condition relatively well (adjusted R^2 = 0.52). These results show the potential for using GSV imagery as a rough ground-truthing tool, especially in instances where more traditional ground-truthing approaches are not possible.

THEMATIC SESSION

Restoration of Mediterranean shrublands and rivers

Tuesday, 6 September 2022, 14:30

THEMATIC SESSION - Hugh D Safford

Prioritization tools for post-fire restoration in Mediterranean-type ecosystems in California

Vibrant Planet, Incline Village, Nevada; and Department of Environmental Science and Policy, University of California, Davis, California, USA

California is part of the North American Mediterranean climate region. The Mediterranean Climate Regions (MCRs) are only 2% of the world's land area but support 7% of the world's population and 20% of the world's botanical diversity. High human population growth rates, extreme climate warming and aridification, and altered fire regimes are among the serious threats facing MCR ecosystems. High levels of ecosystem degradation in the MCRs are putting at risk ecosystem services that support key biogeochemical processes, biota, and tens-of-millions of humans. In California, wildfire area and severity are both climbing rapidly and a major management preoccupation is what to do with the huge and growing areas of burned and degraded land. There are many barriers to postfire restoration in California, including lack of funding and institutional capacity, jurisdictional complications, divergent stakeholder viewpoints, changing environmental baselines, and inefficient science-management collaborations. Ecosystem management prioritization strategies and tools developed by science-management-stakeholder collaborations can help bridge many of these barriers. We introduce a new postfire restoration framework for the California National Forests, and then describe three co-produced tools that help managers and stakeholders spatially prioritize postfire restoration actions and identify restoration options in chaparral and forest ecosystems. The Postfire Restoration Planning (PReP) tool integrates plant regeneration strategies, fire history, drought, invasive plant cover, and erosion risk to prioritize postfire restoration actions in chaparral shrublands. POSCRPT (Postfire Spatial Conifer Regeneration Prediction Tool) informs postfire reforestation efforts by combining landscape variables, fire severity, climate, and modeled seedling recruitment to project natural densities of conifer seedlings 5 years after fire. Land TenderTM is a cloud-based, collaborative planning platform that permits creation, comparison, visualization, and prioritization of management actions intended to enhance climate and wildfire resilience. All of these products have high potential for export to other Mediterranean climate regions and elsewhere.

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THEMATIC SESSION - Duduzile Ngwenya

Circumventing prescribed burns to scale up restoration in lowland Sand Fynbos

Department of Conservation Ecology and Entomology, Stellenbosch University, Stellenbosch

When restoring invaded ecosystems, the method of alien clearing and the nature of the soil seedbank influences the quality of restoration outcomes. One of the challenges encountered when restoring previously invaded, critically endangered fire-adapted lowland Sand Fynbos ecosystems is reducing the likelihood of post fire reinvasions. Avoiding post fire resurgence of Acacia saligna seedlings, we tested the efficacy of initiating recovery of native vegetation without conducting a prescribed ecological burn. Functions of a fire - required to restore native species- were simulated through a combination of seed pre-treatment, clearing then stacking slash into brush piles, and raking off litter. Sowing pre-treated seeds on raked plots yielded higher native species cover and richness over time compared to not sowing. However, recovery had not approached the vegetation structure comparable to a reference site after two years. Recruitment of alien species (herbaceous weeds and acacia) was independent of treatment; but over time control (no action) plots had higher acacia cover and densities than other treatments. Nevertheless, acacia recruitment was less than that reported in previous studies involving restoration with prescribed burning. Raking off litter during site preparation, decreased the number of acacia seeds in raked plots (sown and unsown) drastically. The acacia seedbank size continued to reduce in all treatments afterwards but it decreased most rapidly in control plots resulting in relatively similar seedbank size after thirty months. In conclusion, it is possible to control acacia reinvasions whilst initiating recovery of native vegetation without conducting a prescribed burn. Therefore, circumventing a fire in the initial phase of restoring highly degraded, acacia-invaded Fynbos ecosystems is a scalable restoration strategy requiring consideration and further development.

Tuesday, 6 September 2022, 14:30

THEMATIC SESSION - P M L Anderson

Restoration Interventions in Peninsula Shale Renosterveld: Eight Years On

Dept Environmental and Geographical Science, University of Cape Town

Peninsula Shale Renosterveld is a Critically Endangered Mediterranean type ecosystem that requires intervention to achieve restoration in transformed sites. Following a field trial in on a site dominated by alien grasses carried out in 2014, this current study looked at seedling emergence post-fire in 2021. The initial trials explored the effects of 32 interventions, comprised of five crossed factors (seeding, fire, herbicide, tillage, and rodent exclusion), on recruitment. Initial responses were highly variable but did show that multi-factor interventions resulted in the most desired responses. A fire in April 2021 allowed an examination of the longer-term outcomes of the original interventions. Seedling recruitment was recorded in the spring following this unplanned, but well-timed, burn. This paper presents preliminary findings and based on these longer-term insights, makes suggestions for larger scale interventions across the site.

Exploring the concept of applied nucleation as a restoration tool in a previously invaded Mediterranean climate vegetation type

Stellenbosch University, JS Marais Building, Victoria street, Stellenbosch

There is a need to fast track the recovery of indigenous vegetation after the clearing of invasive alien species. This study investigated the concept of applied nucleation as an ecological restoration tool in previously invaded Cape Flats Sand Fynbos, a critically endangered vegetation type found in the lowlands of the greater Cape Town city area. Restoration plots were revisited and surveyed to determine species composition and to assess whether any species had begun to nucleate, colonising the area surrounding the restoration plots. A larger 20m x 20m plot was established around the initial 5m x 10m sowed plot and young plants of the species growing within the sowed plot were identified, measured (volume), and distance to plot edge recorded. Of the 30 species originally sown in 2013, 11 species were found to be persisting in the sowed plots. Of the 11, four species (Anthospermum aethiopicum, Ifloga repens, Dimorphotheca pluvialis, Pelargonium capitatum) were observed to be colonising the habitat surrounding the initial sowed plots. These species were deemed to be nucleating species.

Furthermore, a model was designed for managers and practitioners to aid in making future management decisions. The model simulated the efficacy of applied nucleation under various management regimes, pertaining particularly to the arrangement of brush piles of felled alien Acacia biomass, referred to as obstacles. The study gave insight into the nucleation potential of four Cape Flats Sand Fynbos perennial species. The model simulations showed that a radial pattern of obstacles, 40m2 in size, and 7m apart resulted in the highest facilitation of nucleation. The model also highlighted the importance that biological parameters such as reproductive rate and dispersal kernel can have on the nucleation potential of species. Species with a high reproductive rate and a dispersal kernel which allows for long distance dispersal have the highest nucleation potential.

Ecological restoration after prescribed burning and topsoil translocation: assessing the success and cost-effectiveness of various restoration treatments in South African Fynbos

Department of Conservation and Marine Sciences, Cape Peninsula University of Technology, Cape Town, South Africa

The successful restoration of endangered habitat types at a low cost is of vital importance as we enter the United Nations Decade of Ecosystem Restoration. Over a period of two years, we have tested how successful and cost-effective six combinations of restoration treatments were in the Cape Floristic Region of South Africa. Treatments were applied to an area that was formerly used for horse training and primarily covered in invasive alien grasses. Treatments used were Soil-plant, Soil-mulch-sow-plant, Remove-grass-sow-plant, Burn, Burn-sow, and Burn-sow-plant. Topsoil and mulch were sourced and translocated from an intact natural site. Mechanical methods were used for grass removal. Soil-plant, Soil-mulch-sow-plant and Burn-sow-plant led to plant richness resembling near-pristine plots and ~30% higher than Burn. Native shrub cover was the highest for treatments which included planting. Survival for planted species was 36–41% higher for Burn-sow-plant than for other treatments. Overall, the contribution of sowing was low, with only 9–16% of species sowed being present across all treatments. We show that topsoil translocation can be successful – in the rare case of translocation from a near pristine area – if combined with planting. Other than topsoil translocation, Burn-sow-plant was the most successful treatment at a reasonable cost, despite planting being expensive, while Burn and Burn-sow were less successful, but cheaper. Remove-grass-sow-plant was the least successful and most expensive treatment. We conclude that the most successful treatments are not necessarily the most expensive.

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THEMATIC SESSION - Monique Van Zitters et al.

Rehabilitation Initiatives in the Berg and Breede Catchments, Western Cape.

Department of Conservation Ecology & Entomology & Centre for Invasion Biology, Stellenbosch University; (2) Western Cape Department of Environmental Affairs and Planning.

Anthropogenic-induced ecosystem transformations like land-use change and biological invasions have accelerated throughout the 20th century, especially impacting rivers and associated riparian ecosystems. To recover ecosystem functioning, the Berg and Breede River Rehabilitation Programme has undertaken active (alien clearing and revegetation) and passive (alien clearing and spontaneous succession) rehabilitation of riparian habitat at small scales (0.4 – 2 ha) in the Berg and Breede Catchments. Four or five years post-rehabilitation efforts, we investigated the impact on vegetation composition at 11 sites along the Berg and Breede Rivers, considering differences in abiotic variables and rehabilitation investment. Taking soil and geomorphological variables into account, we found that the cover, species richness and diversity of native vegetation was significantly higher following active rehabilitation after alien tree clearing. Conversely, there was no significant difference in alien species richness, diversity or cover between active and passive rehabilitation. Alien pioneer grass and herbaceous weed species were particularly dominant in both active and passive sites. The mean total cost of active rehabilitation per site was around R 33 per m2.year-1 and investment variables (plant, labour, irrigation) were related to rehabilitation failure indicators but not success. These results are from one to two years post-rehabilitation, and there is a need to monitor vegetation recovery over longer periods post-rehabilitation to understand lag effects. We conclude that this small-scale active riparian rehabilitation has significantly improved native vegetation community composition locally, and results provide initial insights into the effect of abiotic conditions and investment on rehabilitation efforts. The documentation of riparian rehabilitation projects is rare, and this research therefore contributes as a first step towards guiding monitoring, evaluation and costing of riparian rehabilitation.

Monitoring active riparian restoration sites in the Berg & Breede River Catchment, Western Cape, South Africa.

Intaba Environmental Services (Pty) Ltd. Yzerlaan Farm, TUlbagh

The Berg and Breede River Riparian Rehabilitation Programme initiated by Dept. of Environmental Affairs and Development Planning in 2013 has been implemented by various service providers in 3-year tender intervals. From 2019-2022 Intaba Environmental Services rehabilitated 12 sites along the upper Berg and Breede Rivers, together with investigating the success factors of riparian rehabilitation in the field and plant propagation nursery. There is very little practical information available on riparian rehabilitation methodology and in-field studies in a South African context, specifically in the Western Cape and this work will assist in advancing this field of restoration. Plant survival (together with other) measurements for 22 indigenous riparian plant species was undertaken in 4 sites in the Klein Berg River Catchment ranging in size between 3500m2-5000m2. Sampling occurred in 10-30% of the actively rehabilitated area. Active planting occured along dripper lines in the middle and upper dry bank zone at approx. 1,2m spacing intervals. In order to assess plant survival on the rehab sites, each plant species is marked with a specific coloured ribbon (tied to the dripper line) and plant height, condition were recorded over a 2-3 year time frame. Data was captured on planting, in autumn and spring for the first two years after initial planting has occurred. Other factors recorded were: basic geomorphology, soil indicators, abiotic factors and biotic factors. Propagation methodologies for a range of riparian plant species and plant survival rates in the nursery were also recorded. The focus of this presentation will be on observations on the rehabilitation sites and key factors affecting plant survival.

SYMPOSIUM 6 - Lindsey Gillson et al

Using Long-term data to Conserve and Manage Mediterranean Type Ecosystems

Tuesday, 6 September 2022, 14:30

SYMPOSIUM 6 - Lindsey Gillson et al.

Introduction and case study: What makes Fynbos Resilient? Insights from the palaeoecological record

Plant Conservation Unit, Department of Biological Sciences, University of Cape Town

Biome boundaries are expected to be sensitive to changes in climate and disturbance, because it is here that ecological communities are at environmental, ecological or disturbance limits. We used palaeoecological records from the semi-arid and mesic boundaries of the fynbos biome to test hypotheses regarding ecosystem resilience over timescales of centuries to millennia. We hypothesised that fynbos would expand at its mesic boundary at the expense of afro temperate forest under drier and / or more fire prone conditions. We hypothesised that at the semi-arid boundary, fynbos would expand at the expense of succulent karoo under wetter and cooler and / or more fire-prone conditions. Contrary to our expectations, the fossil pollen record at both biome boundaries showed remarkable stability at centennial-millennial timescales. Resilience was conferred through internal reorganisation at a sub-biome scale and an interplay between fire and seasonality at the biome scale. At the mesic boundary, we suggest that decreased seasonality of rainfall during drier phases favoured fire and fynbos persistence, while in wetter periods, increased seasonality of rainfall resulted in enhanced summer drought stress, inhibiting forest expansion. At this boundary, internal reorganisation from grassy to proteoid fynbos states conferred resilience through resistance. At the semi-arid (succulent karoo) boundary, we suggest that increased aridity was offset by less seasonality of rainfall, which enhanced biomass and allowed fire to persist, favouring persistence of fynbos. At this boundary, fynbos sensu stricto retreated during arid phases but recovered during climate amelioration, consistent with resilience through recovery. In both cases, this mega-diverse, disturbance-adapted flora provided a range of traits that enabled fynbos to persist despite environmental perturbation. Our findings contribute to debates over the mechanisms that confer resistance and resilience to environmental change. Understanding and conserving the processes and mechanisms underpinning its resilience will be critical to effective conservation planning and management.

Combining system dynamics modelling and palaeoecology to inform land-use management thresholds in the Cape Floristic Region

Plant Conservation Unit, Department of Biological Sciences, University of Cape Town, Private Bag X3, Rondebosch 7701, South Africa

Social-ecological systems, such as conservation and agricultural landscapes, coproduce Ecosystem Services (ES) that vary over time in response to climate and land-use disturbance. Management often fails to consider this variability over time, as well as feedbacks between ES and drivers that cause system vulnerability, with consequences for sustainable ES provision. Systems-thinking techniques combined with a long-term palaeoecological perspective (centennial-millennial) is needed to build a more realistic, contextual and evidence-based understanding of ES that can inform sustainable land-use management.
This transdisciplinary study investigates the variability of plant biodiversity and water quality (supporting and provisioning ES) and drivers of change (climate, fire and herbivory) using palaeoecology, stakeholder engagement and system dynamics modelling, to inform biodiversity conservation and sustainable agriculture. Palaeoe-data (fossil pollen, diatoms, spores and charcoal) were used to define the historical range of variability. System dynamics was used to identify feedbacks in the dynamic structure, and stakeholder engagement with land-use managers enhanced model development by defining the problem and identifying the model boundary.

Results from two Renosterveld-Fynbos case studies revealed the following: A 1300-year-old palaeo-record from Elandsberg Private Nature Reserve shows a decrease in plant biodiversity driven by increasing grazing and fire during agricultural and conservation activities. The associated eco-tourism model showed that current degraded conditions might be irreversible. Similarly a 300-year-old palaeo-record at Rhenostervlei Farm shows a decrease in plant biodiversity associated with agricultural intensification (vegetation clearing, fire and herbivory). However, water quality varied over time, indicating general resilience despite intensive land-use disturbance. The palaeo-data on potential management thresholds to consider in future stakeholder engagement and possible eco-agricultural model development to inform agricultural viability of Rhenostervlei Farm in the future.
Understanding the temporal variability and dynamic feedbacks between ES and drivers is essential for identifying safe operating parameters and management targets that enhance social-ecological resilience and sustainability during the Anthropocene.

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SYMPOSIUM 6 - Sabine Prader et al

Long-term internal and boundary dynamics of the Fynbos – Forest ecotone: Implications for conservation and management.

Plant Conservation Unit, Department of Biological Sciences, University of Cape Town Private Bag X3 Rondebosch, 7701, South Africa

Over the past decades, Afrotemperate forest has expanded in the Cape Peninsula. This expansion might reflect a recovery from past forest clearance in the 19th Century, or a side effect of fire suppression in the 20th Century. Fire is crucial in determining the modern ecotone boundaries of the alternate stable states of forest and fynbos.
To determine the relationships between forest and fynbos and the key drivers of these alternate stable states paleoecological techniques such as pollen, non-pollen palynomorphs, charcoal and sediment geochemistry were analysed form Late Holocene sediments extracted from Orange Kloof in the Table Mountain National Park.
Results illustrate that forest - fynbos dynamics prior to the European settlement were controlled by the interplay between external and internal divers.
An internal reorganization from an asteraceous fynbos to an ericaceous fynbos occurred at around 150 CE driven by increased water availability and fire activity allowing fynbos to persist despite climatic change. However, around 100 years later at around 250 CE there was a regime shift towards increased dominance of the forest alternative stable state, probably driven by increasing wetter conditions. Following European settlement (1652 CE), forest-fynbos dynamics were decoupled from climatic changes suggesting increased human influence.

The investigation shows that modern forest expansion is coupled to fire suppression and recovery of past forest clearance.

However, past changes in forest extent were related to fire vegetation climate feedbacks. The results suggest that continued fire suppression will facilitate forest expansion at the expense of mega-diverse fynbos vegetation. However, this could be balanced by a drying climate and more intense fires. In either case, there are implications for fire management that will have both social and ecological dimensions. Paleoecological data can assist in navigating this complexity.

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SYMPOSIUM 6 - Rachid Cheddadi

Past climate impacts on the North African mountain tree species and a perspective for their potential future conservation.

Fossil pollen data show that the range of the Atlas cedar in Morocco has varied widely since the last ice age and throughout the Holocene, with extensive populations distributed from sea level to mountainous regions above 2000 meters. Today, the species is threatened with extinction, with ongoing declines in many areas. In the past millennia and the associated climate changes, the Atlas cedar managed to survive in North Africa. This was due to the extensive mountains and their rugged topography, which provided microrefugia with suitable local microclimates. Genetic studies have shown that the fragmentation of the species in these mountains and the long-term isolation of its constituent populations have led to genetic adaptation.

To contribute to the long-term conservation of the species, we developed a conservation index that considered (1) mountain topography to identify potential refugia with suitable microclimates, (2) genetic diversity to assess the adaptive capacity of local populations, and (3) hypothetical climate change in the species' range. This index provided a scale for 33 populations studied and suggests that genetically diverse populations located in rugged areas where future local climate may overlap with their current climatic niche should receive a higher conservation priority.

The idea of this conservation index is to prioritize protected areas based on a match between the relevance of the area to be protected and the populations that need local and long-term protection. The stronger the match, the higher the priority of the area to be protected. The overall goal of this study is to contribute to the conservation of upland tree species in the face of climate change.

Integrating Paleoecology into Long Term Monitoring, Restoration and Fire Management in Fynbos

Plant Conservation Unit, University of Cape Town, South Africa

Fynbos, as with Mediterranean type ecosystems, is projected to be vulnerable to changes in climate as well as other anthropogenic drivers such as changing land-use and the introduction of alien species. All of these factors can impact on ecosystem services. There are efforts to monitor key variables in recent decades, information that can inform restoration. Swartboskloof in Jonkershoek Nature Reserve is one such sites, where vegetation change, streamflow, rainfall, climate and fire have been measured at decadal scales. However, until now there have been no longer term data available to contextualize these recent changes.

Here we present preliminary results of fossil pollen, charcoal and dung fungal spores data from a 1.4m long sediment core from Swartboskloof covering the past c 5000 years. Reconstruction of vegetation and fire shows a clear anthropogenic influence over the recent centuries, notably the increase in alien species and higher fire occurrence, specifically evidence of more extreme fires post-colonial invasion at 220 BP. Alongside these anthropogenic changes, we also found an increase in Restionaceae and Ericacae occurring alongside a decrease in Poacecae pollen. Prior to this, fynbos showed remarkably stability at both the intra and inter biome scales. Fynbos composition was more dominated by grassed and dry adapted taxa prior to 345 BP. The abundance of forest pollen, which today co-exists with fynbos but is confined to ravines, did not change significantly over the period of study, suggesting the resilience of fynbos to forest encroachment that has been observed elsewhere in the biome. This is likely due to fire -vegetation feedbacks that help to exclude fire sensitive forest taxa from fynbos areas, contributing to fynbos resilience

Interpreting recent changes in Mediterranean Ecosystems and designing appropriate restoration and management targets requires long-term monitoring as well as knowledge of landscapes history prior to the intensive human impact of the past few centuries. For example, fire regimes in the past 400 years are atypical compared with the longer-term history of the site. This can be linked to anthropogenic influence and fuel load increase from fire suppression. A revision of the burn policy may therefore be needed alongside maintaining the ecosystem. Our study shows how palaeoecological studies can provide information for managing fire and vegetation into the future, that will complement monitoring efforts at decadal scales.

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SYMPOSIUM 6 - Daniele Colombaroli

Long-term records as a guide for ecosystem management in the Mediterranean Basin

Royal Holloway University of London, Egham (UK)

Mediterranean-type ecosystems are shaped by the complex interaction between climate, disturbance regimes and anthropogenic factors. Disentangling such drivers, and their long-term effects on vegetation composition and structure, requires a long-term perspective ranging from the multi-decadal to the multi-millennial time scales. Such temporal perspective can be provided by paleo-records extracted from lake sediments, peatlands and other natural archives. Here I will draw on key examples from the Mediterranean Basin, illustrating the long-term history of human impact and its legacy on Mediterranean ecosystems. Since the Neolithic (ca.7500-8000 cal. BP) people played an active role in keeping ecosystems open and diverse, through the maintenance of different land-use activities such as grazing, coppicing and traditional agriculture practices. The active maintenance of a landscape mosaic in which different land-use intensities occur resulted in highly diversified open landscapes, but led to species losses in Mediterranean evergreen forest. Identifying the drivers and temporal dynamic of both components (natural and anthropogenic) is key for identifying ad-hoc conservation strategies for Mediterranean ecosystems under future climatic and land use changes.

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SYMPOSIUM 6 - John N Williams et al

Wildfire trends in the North American Mediterranean Climate Zone: high severity burn area and proportion exceed historic conditions in Sierra Nevada and adjacent ranges (USA)

University of California - Davis, One Shields Ave., Davis, CA 95616 USA

When Mediterranean-type ecosystems adapted to frequent fire experience disruptions in their historic disturbance regimes, there are risks of species decline or loss, reduced ecosystem function, and even permanent shifts in forest type. We compiled wildfire severity data from 1984 to 2020 for the Sierra Nevada-Southern Cascades region of California to look at current and historic pre-European settlement trends across a broad range of forest types. This study builds on an earlier study by Mallek et al. (2013) that demonstrated how 100+ years of fire suppression was correlated with decreased overall burn area, but relative increases in percent of forest burning at high severity. With new analyses and 13 years of additional data, including nine of the ten biggest fire years on record for California, we show that cumulative annual area burned remains below the historical average. By contrast, the area burned at high severity has risen above the historic average in both percentage and absolute terms for the first time on record. A closer look at these increases in high severity reveals distinct differences by forest type, with the largest percentage gains in low-to-mid elevation forests (oak woodland, dry and moist mixed conifer, and yellow pine forests). By contrast, upper elevation types (red fir, lodgepole pine, and sub-alpine) do not differ notably from historic percentages. This lack of change is likely due in part to the fact that these forests have longer fire return intervals and are thus less affected by a century of fire exclusion. We used generalized linear and additive models to explore these trends and consider where reintroducing fire and other forest management interventions may be used to mitigate the combined effects of suppression and climate change.

Tuesday, 6 September 2022, 16:30

PRINTED POSTER SESSION 1 - Leonor Calvo et al

Functional plant traits response to different burn severity after large wildfires in fire-prone ecosystems in Northwest Spain

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Forest fires are a major hazard throughout Europe, producing significant impacts in our ecosystems. In recent decades, wildfire occurrence in fire-prone ecosystems in the Mediterranean Basin has increased because of changes in land use, increased fuel load and continuity in the landscape. Moreover, these socio-ecological changes are related to increased burn severity and the surface affected. These large wildfires usually result in highly heterogenous spatial mosaics with different degrees of severity that clearly influence vegetation regeneration capacity. However, fire regime characteristics not only affect vegetation regeneration after wildfire but also their biological traits. Many authors recognise the advantage of resprouter species under extreme conditions of fire regime parameters.
To determine how burn severity affects the behaviour of resprouter versus seeder species, we selected a large wildfire (98.8 km2) that occurred in the northwest of the Iberian Peninsula in 2017. The fire affected mainly shrublands (65% of the surface burned) dominated by Erica australis L., Genista hystrix and Citysus scoparius. Other wooded communities affected were natural oak forest (15%) dominated by Quercus pyrenaica Willd. In the study area, a burn severity map of three levels (low, moderate and high) was obtained from a classification (threshold) of a Sentinel-based difference Normalized Burn Ratio image. In each plant community and severity scenario, a total of 5 2 m x 2 m plots were established. In each plot, we sampled the visual cover percentage of all plant taxa in 4 of 1 m2 subplots one year after the wildfire. The results showed that, in high severity scenarios, E. australis shrublands and Q. pyrenaica oak forests underwent greater regeneration of resprouter species. However, obligate seeders and facultative species recovered better than resprouters in G. hystrix and C. scoparius shrubland communities.

Differences between prokaryotic communities from two salty lagoons located in Villafáfila (Spain)

1Departamento de Biodiversidad y Gestión Ambiental, Universidad de León.

There are numerous wetlands in the Mediterranean area that experience seasonal variations in their water levels. They are highly sensitive to climate change. A good example is the Villafáfila lagoons, located on the Spanish northern plateau. These lagoons are of particular ecological interest as they are the habitat of endangered waterfowl, and thus, they are especially protected (included in the Ramsar Convention). Due to their strategic location, the Villafáfila wetlands are a resting point for many birds that make their annual migrations between Africa and Europe. These lagoons are also unique as they are saline. The salinity of these lagoons is attributed to the fact that the upwellings that feed them pass through ancient saline deposits. Also, the amount of salt varies between lagoons. Thus, both salinity and seasonality are at play in this habitat. Here, we have studied differences between prokaryotic communities from sediment samples of two lagoons: Grande, with greater salinity in both water and sediment; and Barillos, less saline. Using a metagenomic approach, we obtained the V3-V4 region sequences of the prokaryotic ribosomal RNA, and used them to study differences between communities in these lagoons. Apart from salinity, seasonality was also a differentiating factor, as sampling was carried out in two times: in spring with the maximum level of water, and autumn, when the lagoons have practically dried up. According to indices of taxonomic distance between communities, the greatest differences occurred between communities of the two lagoons. However, when phylogenetic indices were used, which consider the distance between taxa in a phylogenetic tree, the greatest differences were found between the wet and dry seasons.

Wild fire effects of bacterial communities in Quercus forest and their recovery capacity two years after. A high-throughput sequencing approach

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2Departamento de Biodiversidad y Gestión Ambiental, Universidad de León.

Climate change and the abandonment of traditional forest uses are behind the proliferation of wildfires, in both frequency and intensity, in the Mediterranean area. The now more common heat weaves, together with the amount of fuel that the underbrush accumulates, favors them. Studies have shown that the recurrence of wildfires and their high severity reduce the natural capacity of forest to recover. However, very little is known about soil bacteria's resilience in these Mediterranean ecosystems. Here, we analyzed changes in diversity and composition of the soil bacterial communities in a Quercus pyrenaica forest in a northwestern region of Spain. The area is at the northwestern limit of the Mediterranean climate in the Iberian Peninsula. Samples from high and low severity burnt soils were taken two months after a major fire that had occurred in 2017, and compared to a nearby unburnt control. In addition, to monitor the recovery of bacterial communities, new samples were collected two years later from the same areas. The composition of bacterial communities was examined using NGS techniques. Fragments that include the variable regions V3 and V4 of RNA ribosomal 16S genes were sequenced. Results showed that wildfire causes a decrease in diversity in the short term, especially when the severity of the fire is high. Bacteria from a few taxonomic groups become more dominant, while other groups greatly decrease in frequency. Long-term recovery, however, varied. If the severity of the fire was low, the communities had recovered two years later. If the severity is high, there is variation in the response. Thus, while some samples suggest that diversity has recovered, others continue to show the effect of fire. Also, some taxonomic groups had returned to control levels, while others had not.

Tuesday, 6 September 2022, 16:30

PRINTED POSTER SESSION 1 - Siphesihle Precious Sibiya

Seed germination and desiccation tolerance for the conservation of the threatened Baviaanskloof ceder, Widdringtonia schwarzii (Marloth) Mast.

South African National Biodiversity Institute: 2 Cussonia Ave, Brummeria, Pretoria.

Widdringtonia schwarzii is a large evergreen tree that grows up to 30m in height. The bark us reddish grey, thin and flaky. The female cones are woody, acorn sized and have four compartments that store the seeds. The cones are smooth and rounded when young but, turn rough and form warts as they mature. W.schwarzii is endemic to the Baviaanskloof mountains in the Eastern Cape region, where the average annual rainfall is 300mm. Kirstenbosch National Botanical Garden (KNBG) has an ex-situ collection of W.schwarzii that is said to be larger than the remaining wild populations found in the Baviaanskloof wilderness. The population is fragmented from past timber harvesting and remaining populations are threatened by frequent fires which the plant cannot survive. W.schwarzii is listed as near threatened (NT) on the red data list of South African Plants.

No known studies have proven the viability of W.schwarzii seeds after long term storage and established germination thereafter. There is an equal lack of studies to establish the storage behavior of W.schwarzii seeds. Seed viability will be tested using tetrazolium chloride (TZ). Fresh seeds will be compared with 15 year old seeds withdrawn from the Millennium Seed Bank Partnership (MSBP) Kew. Seeds will be subjected to different types, concentrations, and various periods of scarification to break seed dormancy. The seeds scarification methods will consist of smoke treatment, nicking and cold water, hot water, GA3 and, the control. After these treatments the seeds will then be sown into a suitable medium.
The results of this study will be used to establish a conservation protocol for the seeds of W.schwarzii.

Resilience of enzymatic activities after large wildfires in fire prone-ecosystems in Northwest Spain

Area of Ecology. Faculty of Biological and Environmental Sciences. University of León, 24071 León, Sapin.

Forest fires are one of the main factors that alter and degrade Mediterranean ecosystems in the Iberian Peninsula. Recent increases in fire frequency, extension and severity are modifying soil characteristics, especially its enzymatic activity. Soil enzymes have mainly animal, plant and microbial sources and are good indicators of soil fertility. The amount and type of vegetation influence the microbial community of soil and the processes it develops. Therefore, the alterations caused by fire in plant community may affect the enzymatic activity of soil. The loss of vegetation and microbial biomass induced by fire changes the organic matter content of soil, with a negative effect on enzyme activities.

The effect of burn severity level on soil enzyme activity resilience was studied in the Northwest Iberian Peninsula wildfire that occurred in 2017 and affected around 10,000 ha. This wildfire affected mainly Quercus pyrenaica Willd. oak forests and shrublands communities dominated by Erica australis L., Genista hystrix Lange and Citysus scoparius L. One year after the wildfire, field plots were proportionally fixed to the burned surface of these ecosystems and to the severity categories previously established by the dNBR (difference Normalized Burn Ratio) index. We took two soil composite samples in each plot. β-glucosidase, urease and acid phosphatase enzymatic activities were analysed. Then, we calculated the resilience index (Banning and Murphy, 2008) of these properties for each ecosystem and burn severity level.

Results showed that, in general, burn severity had a negative effect on soil enzymatic activities resilience. The enzyme activities with a lower resilience one year after the wildfire were β-glucosidase and acid phosphatase. Urease resilience index was positive in low severity Q. pyrenaica, G hystrix and C. scoparius communities.

Tuesday, 6 September 2022, 16:30

PRINTED POSTER SESSION 1 - Hugh D Safford, Scott Conway

Land Tender: A collaborative, cloud-based decision support platform for resource management and wildfire mitigation

Vibrant Planet, Incline Village, Nevada; and Department of Environmental Science and Policy, University of California, Davis, California, USA

Interactions between climate warming and human impacts to landscapes and ecological processes are leading to increasing scales and velocities of ecosystem degradation. The scale and complexity of the problem are a challenge to rapid, concerted management response. Key components of responding to complex, multijurisdictional management problems include (1) efficiently incorporating stakeholder input; (2) generating data and analytics that can be understood and manipulated by users; and (3) prioritizing potential investments and actions. Land TenderTM (LT) is a cloud based, visual scenario-building and decision support application built to resolve these and other resource management issues at local, statewide, or national scales. LT incorporates high-resolution data, disturbance simulations, and optimization routines to develop a comprehensive atlas of management scenarios for a given planning unit. A key step is the calculation of the “restorative return on investment”, the sum of treatment-driven avoided costs and direct treatment benefits. Climate change effects are incorporated via changes to fire and drought occurrence and intensity, and by modifying ecosystem site potentials. The optimization function schedules treatments based on user-generated prioritizations of a set of “resilience” categories linked to strategic assets, resources and areas, including water, biodiversity, carbon, economic outputs, forest resilience, and fire safety. Stakeholder participation occurs throughout the workflow, and users can readily visualize scenario treatment tradeoffs, treatment prioritizations, and treatment sequencing. LT outputs include spatial and tabular comparisons of final management alternatives – including projected costs and relative benefits of each alternative across the resilience categories – that can be exported to environmental assessments that precede implementation.

Plant biogeography, ecology and conservation of the Mediterranean biodiversity hotspot in Andalusia (Spain)

Department of Plant Biology and Ecology, University of Seville, Spain
(1) Royal Botanic Gardens, Kew, England

The Mediterranean Basin is considered one of the major biodiversity hotspots in the world. Part of its high diversity is due to a high species turnover across many sub-hot spots and thus regional and local endemism. One of the outstanding regional hotspots is the Baetic-Rifian region in S Spain and NW Africa, harboring about 4500 vascular plant species, although separated by the Strait of Gibraltar in two main ranges. Here we show some data accounting for plant biodiversity within the northern side of the hot-spot, Andalusia. We first show how the floristic and phylogenetic diversity is distributed in the region, including endemism. Then, we focus on the three national parks (Doñana, Sierra de las Nieves, Sierra Nevada) in this region to determine how much diversity is harbored there and warranted of conservation. Finally, we determine components of biodiversity of the threatened flora of Andalusia, in terms of functional and phylogenetic diversity.

Funded by grants PAIDI H2020 P18-RT-3651 BIOVEGAN and FEDER US-1265280 EVOFLORAND

The effect of phosphite treatment against Phytophthora cinnamomi on Leucadendron argenteum (L.) R.Br.

a South African National Biodiversity Institute (SANBI), Kirstenbosch National Botanical Gardens, Rhodes Dr, Newlands, Cape Town, 7735

Phytophthora cinnamomi is recognised as a damaging and important invasive plant pathogen, with over 5000 susceptible host species recorded globally. Previous studies in South Africa have identified P. cinnamomi as the cause of Protea root rot. In recent years, high rates of mortality of silver trees (Leucadendron argenteum) have been observed in Kirstenbosch National Botanical Gardens (KNBG), with P. cinnamomi readily isolated from roots and collar lesions of dying trees. A systemic fungicide, phosphite (Phi) or phosphorous acid (HP03-) is the main form of chemical control against Phytophthora diseases. The current study aims to determine the efficacy of phosphite applications in controlling P. cinnamomi infection in silver trees. Field and glasshouse treatment trails will be established to determine the optimum phosphite application rates and treatment regimes to confer protection against P. cinnamomi in cultivated silver trees. Two hundred silver trees of at least 50mm diameter were identified at KNBG, half were trunk injected with two rates of Phi and the other half were left as untreated controls. Seedlings planted into beds known to be infested with P. cinnamomi were treated applying a randomised block approach, with an equal number of treated versus untreated seedlings. All treated and control plants will be monitored to quantify the effect of phosphite on silver tree growth and survival. Another group of seedlings will be grown in a glasshouse to conduct phosphite treatment trials under controlled conditions. This is the first time phosphite treatment has been used on indigenous South African flora. Silver trees are currently classified as rare and endangered, it is therefore essential that practical management options be developed to reduce the rate of die-back and mortality caused by P. cinnamomi. It is anticipated that the data generated from this study can be used to support restoration projects for this iconic tree species.

Germination requirements of Cotula duckittiae: a vulnerable spring-annual from the winter-rainfall region of South Africa

RC Oliver, Kirstenbosch National Botanical Garden & Cape Peninsula University of Technology.
CP Laubscher, Cape Peninsula University of Technology

From late winter to early spring, parts of winter-rainfall region of South Africa's Western Cape explode into a kaleidoscope of colours. This species, with its limited distribution in the wild, also contribute to this colourful floral extravaganza. Light and temperature are critical abiotic factors influencing the germination of seed.
The wild-collected seed of Cotula duckittiae, vulnerable red-data list, presented germination challenges before its introduction as bedding plant at the Kirstenbosch National Botanical Garden.
The purpose of this laboratory study was to evaluate the influence of temperature, light and dark conditions on the breaking of seed dormancy. Achenes were subjected to constant and alternate temperatures at 7 °C, 12 °C, 17 °C, 22 °C, 27 °C, 12 °C/22 °C and 17 °C/27 °C in conditions of continuous light, darkness and equal alternate (12 hour cycles) of light and darkness. Results indicated that germination ≥ 60% within temperature range 7° C – 17° C and alternating temperature of 12° C/ 22° C. Optimum germination was recorded at 22° C in the dark. This study provided germination considerations for species-restoration, the use as bedding plants in parks or botanical gardens or commercial enterprises

Migration of Pleistocene shorelines across the Palaeo-Agulhas Plain: evidence from dated sub-bottom profiles and archaeological shellfish assemblages

1Geophysics and Remote Sensing Unit, Council for Geoscience, PO Box 572, Bellville, 7535, South Africa

Intertidal zones on shorelines are geologically complex features of the coastal plain, shaped by heterogeneous substrate lithologies. Palaeocoastlines have been heavily modified by sea-level change, ocean currents, wind, waves and swell. Rocks and sediments along intertidal zones create rich habitats for biogenic forms including shellfish, which are highly sensitive to subtle variations in underlying lithology. Here, we assess Pleistocene shoreline migrations on the south coast of South Africa in relation to fluctuating sea-levels and changes in sediment supply. The study area extends from Still Bay to Mossel Bay, South Africa, with a particular focus on Pinnacle Point. Our goal is to better understand the changes to the intertidal zone along these palaeocoastlines and how this may have affected marine resources available to early humans. We interpret marine geological records at select time slices along sub-bottom profiled transects that run perpendicular to the coast. We describe the character of specific shorelines to establish expectations of coastline character which we then compare to archaeological records at Pinnacle Point. We base our interpretations on (1) significant events in Pleistocene glacio-eustatic and depositional records, such as widespread deposition of coastal sand dunes at ~90, ~74 and ~50 ka [MIS 5e–MIS 4], and (2) empirical evidence from high-resolution records of shellfish assemblages at the archaeological sites of PP13B and PP5-6. We demonstrate a prevalence of dissipative beaches and mixed coasts on Pleistocene sea-level lowstands on the coast of the Palaeo-Agulhas Plain. This differs significantly from the modern coastline with its significance of rocky shorelines.

Seismic stratigraphy of the inner to mid agulhas bank, south africa

1Geophysics and Remote Sensing Unit, Council for Geoscience, PO Box 572, Bellville 7535, South Africa

The inner to mid continental shelf of the Agulhas Bank, which forms part of the Palaeo-Agulhas Plain, is scattered with Pleistocene deposits. Their wide lateral extension is the expression of a flat underlying substrate, availability of accommodation space, and depositional processes in response to glacio-eustatic sea-level change. We present seismic sub-bottom profiles up to 30 m deep, sediment cores up to 5 m in length and Pleistocene deposits that date back to Marine Isotope Stage (MIS) 7 from the inner to mid shelf between the Breede River in the West and Plettenberg Bay in the East. Radiocarbon and optically stimulated luminescence dates are integrated with microfossil analysis into a seismic stratigraphic model comprised of twenty Quaternary facies units within two depositional sequences bounded by shelf-wide unconformities. Sequence Boundary 1 (SB1) corresponds to the erosional unconformity with bedrock and SB2 to the MIS 2 glacial lowstand. Incised palaeo-river channels are associated with both sequence boundaries and cored deposits also mapped seismically from estuarine, lacustrine and fluvial systems are grouped to represent the lower floodplain. The most pervasive stratigraphic pattern in these shelf deposits is made up of the depositional sequence remnant of the Falling Stage Systems Tract (FSST) forced regression from MIS 5e–2. The other dominant stratigraphic group is the Transgressive Systems Tract (TST) associated with the Post-glacial Marine Transgression. The TST makes up an almost equal proportion of deposits in both sequences in the sedimentological record as the FSST, despite the shorter temporal span of the TST. A Wave Ravinement Surface marks the rise in sea level from the Last Glacial Maximum in a landward direction.

Tuesday, 6 September 2022, 16:30

PRINTED POSTER SESSION 1 - Lihle Mfeketho and Sisekosethu Ndabeni

The role of fire in fynbos biome : An Eastern Cape perspective

Eastern Cape Umbrella Fire Protection Association , 441 Spring Road , Stutterheim, 4930

Fires can be beneficial or detrimental in the fynbos environment depending on the fire frequency, intensity, season of burn and the size of the fire. The fynbos biome is known to be a fire adaptive, meaning it needs fire at fixed intervals to ensure its survival. These fires may be prescribed to achieve certain management goals or occur naturally. Too frequent fires (unwanted fires) coupled with intensive land use poses a threat to the survival of the fynbos biome. It is therefore essential to constantly find ways conserve and maintain the remaining fynbos species through education and altering legislation surrounding this biome to ensure we know how to use fire to maintain the biodiversity. In this poster we look at the role of fire and fire management in the Amatole District and how it affects fynbos.

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PRINTED POSTER SESSION 1 - Mitch Afrika

Integrating alien invasive plants and veldfire management within the Agulhas plain

Greater Overberg Fire Protection Association - Longstreet, Fire station, Bredasdorp 7280

Two of the most significant threats to lives and livelihoods are wildfires and alien invasive plants. These two have however been traditionally managed independently of each other. Valuable services that impact lives and livelihoods are usually provided through naturally functioning ecosystems. These ecosystems are impacted by the frequency and severity of fire that has increased over the past decade due to land-use changes around the world. There are three reasons why wildfires and alien invasive plants should be managed together: alien invasive plants increase available fuel and thus change fire behavior and regimes, fires can promote plant invasion, and lastly, fire can be used as a tool to control plant invasion. Wildfires and alien invasive plants work as a chain reaction and therefore need to be managed together.

Wednesday, 7 September 2022, 08:00

KEYNOTE 6 - Jaco le Roux

How do soil microbes drive and respond to plant invasion in Mediterranean ecosystems?

School of Natural Sciences, Macquarie University, Sydney, Australia.
Centre for Invasion Biology, Stellenbosch University, Stellenbosch, South Africa

Invasive species can have numerous impacts on biodiversity. Our understanding of these impacts comes largely from the aboveground components of invaded ecosystems. It is only recently that ecologists have begun to appreciate the impacts of invasive species on the unseen majority: microbial communities. Microbes not only play critical roles in structuring native plant communities, but also in the establishment success of non-native species. I will discuss these ideas in the context of mutualisms between rhizobium bacteria and invasive Australian *Acacia* species in Mediterranean ecosystems. In countries like South Africa, different *Acacia* species show variable invasiveness, yet share the same rhizobia. Phylogenetic analyses show that these bacteria have been co-introduced with their host plants from Australia. So, what are the consequences of co-invading acacias and rhizobia for native biodiversity? Ecological networks suggest that acacias and native legumes form highly distinct rhizobial associations. Consequently, rhizobium interactions of specialist native legumes (i.e. those capable of forming associations with only one or a few rhizobia) are more severely impacted by acacia invasion than the interactions of generalist legumes. While some native legumes are able sanction exotic rhizobia, dense acacia thickets homogenise soil rhizobial communities, contributing to positive invasive acacia-soil feedbacks. The latter suggests that broader soil microbial impacts are likely to arise under acacia invasion, illustrated by the lower diversity and complexity of soil microbial networks in invaded sites compared to uninvaded sites. I will discuss all the above findings in the context of plant invasion and how this knowledge can be used to assist management and ecological restoration.

Wednesday, 7 September 2022, 08:30

KEYNOTE 7 - MINGZEN LU

Biome boundary maintained by intense belowground resource competition in world's thinnest-rooted plant community

Santa Fe Institute, New Mexico

By reversing a multimillion-year Earth cooling trend in merely two centuries, our modern civilization has challenged plant species to move, adapt, or go extinct at unprecedented rates and scales. This raises the urgent and fundamental question of how terrestrial biomes — specially their component vegetation dynamics — will respond to the rapidly changing environmental conditions. We examined the novel hypothesis that belowground plant-plant resource competition may be critical for determining the location and composition of biomes. Specifically, we present a 4-yr field experiment designed to evaluate whether rooting strategies, combined with soil resource competition, can act to stabilize the boundary between two distinct biomes in the Cape Floristic region of South Africa: Fynbos and Southern Afrotemperate Forest. Both biomes occur interchangeably on exceedingly phosphorus-poor geological substrates throughout the region and the biome distribution cannot be straight-forwardly resolved by climate-edaphic or other landscape-scale variables. Our findings reveal that the fynbos biome is the thinnest-rooted biome worldwide, standing out even compared with other climatically analogous biomes. What was more unexpected however, was that this biome is limited by nitrogen rather than phosphorus. This finding challenges the historical expectation that fynbos is shaped by persistent and severe phosphorus limitation. Overall, these findings are important for understanding the factors that determine vegetation dynamics, and for predicting how these vegetation dynamics will be affected by human activities including climate change.

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THEMATIC SESSION

Biodiversity & species interactions

Wednesday, 7 September 2022, 09:30

THEMATIC SESSION - Philip Ladd, Emily Eakin-Busher

Development of a facultative brood pollination system in Thysanotus (Asparagaceae)

Environment and Conservation Science, Murdoch University, Murdoch, W Australia, 6150 Australia

Brood pollination is one of the more unusual ways in which plants reproduce. The plant has to trade off damage to its flowers and reduction in future offspring against the production of seeds. There is a continuum from parasitism to mutualism. In two closely related monocots species (Thysanotus) in south western Australia that harbour flower-visiting beetles, in one autogamous species the beetles are parasites that eat the ovules and decrease seed production. In the other species that is normally buzz pollinated the beetle can be a facultative brood pollinator. In most cases adult brood pollinators feed on nectar or more rarely pollen so the Thysanotus system is unusual as the flowers provide no nectar and the pollen is difficult to remove without sonication. The beetles damage the flowers and consume some pollen but this is necessary as the pollen will not be available unless the anther walls are breached. An egg may be laid on the ovary and the hatched larva burrows through the ovary wall and eats the developing ovules, but not all flowers receive an egg even though the flower has been visited by beetles. Thus in the situation where there is no legitimate pollinator there is still seed produced, although a much lower amount than would be the case if the beetles were absent and a legitimate pollinator present. As this type of pollination interaction is unknown in other species of Thysanotus it is not possible to decide if the brood pollination has developed from a parasitic relationship or the reverse. The autogamous species does not need a pollinator and always had higher fruit set and fewer beetles than the population of the other species that lacked a legitimate pollinator. It may be the brood pollination is a serendipitous development from a parasitic relationship.

Diet adjustment along local and landscape gradients of resource diversity

Mediterranean Institute for Advanced Studies (UIB-CSIC). Global change research group. C/ Miquel Marquès 21, 07190, Esporles, Balearic Islands, Spain.

Loss of habitats and native species, introduction of invasive species, and changing climate regimes lead to the homogenization of landscapes and communities, affecting the availability of habitats and resources for economically important guilds, such as pollinators. Understanding how pollinators and their interactions vary along resource diversity gradients at different scales may help to determine their adaptability to current diversity loss related to global change. We used data on 20 plant-pollinator communities along gradients of flower richness (local diversity) and landscape heterogeneity (landscape diversity) to understand how the diversity of resources at local and landscape scales affected: (1) the proportion of actively selected interactions (those not occurring by neutral processes) and (2) the pollinator diet breadth and species' specialization in networks. Flower richness increased the proportion of actively selected interactions (especially for wild bees and flies), whereas landscape heterogeneity had a weak negative effect on this variable. Higher floral richness resulted in a wider taxonomic and functional diet for all the study guilds, while functional diet increased mainly for beetles. Despite this, specialization in networks (d') increased with flower richness for all the study guilds, because pollinator species fed on a narrower subset of plants as communities became richer in species. Our study indicates that pollinators are able to adapt their diet to resource changes at local and landscape scales. However, resource homogenization might lead generalist pollinator communities, where functionally specialized interactions are lost. This study highlights the importance of including different scales to understand the effects of global change on pollination service through changes in resource diversity.

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THEMATIC SESSION - Amparo Lázaro, Carmelo Gómez-Martínez, Miguel A. González-Estévez and Manuel Hidalgo

Portfolio effect and asynchrony as drivers of stability in plant–pollinator communities along a gradient of landscape heterogeneity

A. Lázaro, C. Gómez-Martínez and M. A. González-Estévez, Mediterranean Inst. for Advanced Studies (IMEDEA, UIB-CSIC), Esporles, Spain. – M. Hidalgo, Spanish Inst. of Oceanography (IEO, CSIC), Balearic Oceanographic Center (COB) , Palma, Spain.

Understanding how pollination services can be maintained in increasingly anthropogenic landscapes is a current challenge for basic and applied ecology. The stability of plant–pollinator communities might increase in heterogeneous landscapes with a high diversity of species and alternative habitats, both through larger independent fluctuations of populations (portfolio effect) and increased species asynchrony. However, how the drivers of stability (portfolio effect and synchrony) vary along land-use gradients remains largely unknown. Using independent samplings for plants, pollinators and their interactions in Mediterranean communities along a gradient of landscape heterogeneity, we assessed the relationships between within-year stability and its drivers, and between the drivers of stability, landscape heterogeneity and species diversity. In addition, we evaluated the relationship between the stability of plant–pollinator interactions (temporal mean/SD of pairwise interactions) and the structure of mutualistic networks (modularity, nestedness, connectance). As expected, stability increased with larger portfolio effects and asynchronies. Interaction stability was positively related to pollinator stability, but not to plant stability. Landscape evenness increased the stability of plants, pollinators and their interactions, through increased portfolio effects. However, for plants and pollinators, the effect was detected at a smaller scale (1-km) than for interactions (2-km); and for pollinators and interactions, the effect was only evident from medium-to-high levels of landscape evenness. Temporal synchrony of species/pairwise interactions was an important driver of stability, tightly linked to species/interaction diversity. More asynchronous communities showed a larger portfolio effect and were also those with higher species evenness for all plants, pollinators and their interactions; while synchrony was also weakly positively related to species richness for plants. Interestingly, more modular mutualistic network structures conferred enhanced overall community stability, through higher portfolio effect and asynchrony. Preserving diverse communities within the heterogeneous Mediterranean landscapes may help maintain the stability of pollination services, both through effects on synchrony and the portfolio effect.

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THEMATIC SESSION - Blanca Arroyo-Correa et al.

Inter-individual plant variation in pollinator use shapes community-level pollination networks

Department of Integrative Ecology, Estación Biológica de Doñana, EBD-CSIC, Avda. Américo Vespucio 26, Seville E-41092, Spain

In an ecological community, interaction patterns observed at the species level emerge from the way individuals within populations establish these ecological interactions. Generalist plant species in pollinator use are often the outcome of nonrandom mixtures of individuals that differ in their interactions with pollinators, including both specialist and generalist plant individuals. The high levels of intraspecific trait variation exhibited by most plant species may drive this resource partitioning among individuals, potentially leading to skewed distributions of the roles plant individuals play in ecological networks. Explicitly accounting for differences in resource use (e.g., pollinator use by plants) between individuals is essential to advance the understanding of how community structure is influenced by individual interactions. First, we evaluate how the inter-individual plant variation in interaction patterns with pollinators (i.e. topological role) is distributed across co-occurring species. Secondly, we aim to disentangle the ecological correlates (e.g. plant traits' and neighborhood effects) generating this inter-individual plant variation. Third, we assess how this inter-individual variation within species influences the configuration of community-wide plant-pollinator networks. To tackle these objectives, we use highly-resolved empirical data on plant-pollinator interactions collected in Mediterranean shrublands of stabilized sand dunes located in southwestern Spain.

Direct evidence supporting Darwin's hypothesis of cross-pollination promoted by sex organ reciprocity in a Mediterranean daffodil

1 Department of Plant Biology and Ecology, University of Seville, E-41080 Seville, Spain.

The floral phenotype plays a main role in the attraction and fit of pollinators. Both perianth traits and the positioning of sex organs can be subjected to natural selection and determine non-random mating patterns in populations. In stylar-polymorphic species, the Darwinian hypothesis predicts increased mating success between individuals with sex organs at equivalent heights (i.e. with higher reciprocity). We used paternity analyses in experimental populations of a stylar-dimorphic species. By comparing the observed mating patterns with those expected under random mating, we tested the effects of sex organ reciprocity and perianth traits on mating success. We also analysed phenotypic selection on perianth traits through female and male functions. The (dis)similarity of parental perianth traits had no direct effects on the mating patterns. Sex organ reciprocity had a positive effect on mating success. Narrow floral tubes increased this effect in upper sex organs. Perianth traits showed little signs of phenotypic selection. Female and absolute fitness measures resulted in different patterns of phenotypic selection. We provide precise empirical evidence of the Darwinian hypothesis about the functioning of stylar polymorphisms, demonstrating that mating patterns are determined by sex organ reciprocity and only those perianth traits which are critical to pollinator fit.

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How does artificial afforestation affect pollinator diversity and plant-pollinator networks of the herriza?

Departamento de Biología, Universidad de Cádiz, Campus Río San Pedro, 11510 Puerto Real, Spain

The Mediterranean heathland or herriza is a representative habitat in the western end of the Mediterranean basin (SW Iberian Peninsula and Strait of Gibraltar area), associated to nutrient-poor acid soils and a temperate Mediterranean climate by a marked oceanic influence. It stands out from other European heathlands by the remarkable plant species richness and endemism. One of the main features of the herriza is its profuse flowering, extending almost throughout the year, which attracts a large and interesting pollinating insect fauna, which is poorly known. Despite its uniqueness, the herriza has traditionally been ignored or otherwise undervalued due to other of its key features: a virtual lack of trees. For decades until the onset of the 21st century, it was included in extensive afforestation programs with pine-trees to supposedly increase its productivity and conservation value. However, it has already been shown the negative consequences that pine afforestation has on the plant biodiversity of the herriza. Here, we conducted an extensive field study to understand the effects of the afforestation of the herriza with pines on its pollinator diversity and plant-pollinator networks. We selected five paired sites in the northern (European) side of the Strait of Gibraltar composed of an open herriza subsite and an adjacent pine-afforested herriza subsite. In each subsite we established four 25-meter transects that were sampled five times per year. After two continuous year of sampling, results show that herriza afforestation causes a reduction in pollinator species richness and abundances as well as a reduction in plant-pollinator complexity. These results highlight some of the conservation problems we will face in the future if current efforts on forest plantations worldwide are not correctly designed.

Seed dormancy decay in an endemic pyrophyte driven by anthropogenic disturbance

Department of Biology, University of Cádiz, Puerto Real, Spain

Fire is widely recognized as a strong selective force shaping plant traits. However, the role of anthropogenic disturbance in changing the evolutionary trend of fire-adaptive traits remains little understood. Fire-released seed dormancy is a crucial trait for the persistence of plant species in fire-prone habitats, allowing them to create long-lived seed banks whose germination is triggered by fire-related cues. Drosophyllum lusitanicum (Drosophyllaceae) is a rare carnivorous plant endemic to the western end of the Mediterranean Basin and tightly associated with the herriza, a fire-prone, Mediterranean heathland habitat. Drosophyllum populations readily establish ater fire through fire-cued germination from a persistent soil seed bank. Three to four years after fire, populations decline, finally disappearing and persisting only as seeds in the soil until the next fire. Above-ground Drosophyllum populations are thus transient, restricted to early post-fire stages. However, this species establishes permanent populations in chronically disturbed herriza sites by human activities (e.g. quarries, fire breaks), where vegetation cover is low and fires seldom occur. Such different population dynamics shall be sustained by different seed dormancy patterns between natural and chronically disturbed habitats. To explore this we collected Drosophyllum seeds from natural and disturbed herriza habitats and performed a germination experiment in a growth chamber under controlled conditions. We found a significant decay of dormancy in seed samples from disturbed sites, which could account in part for the different population dynamics of Drosophyllum in natural and human-disturbed herriza habitats. Seed dormancy decay would allow continuous, annual recruitment in human-disturbed populations, but would compromise their soil seed banks and, hence, their long-term persistence. Results also illustrate that limiting or suppressing fire may change the evolutionary trend of fire-adapted species.

THEMATIC SESSION

Specialised species, habitats and their conservation

Wednesday, 7 September 2022, 09:30

THEMATIC SESSION - Lola Álvarez-Ruiz et al.

Fire-prone animals: adaptive responses in lizards

Centro de Investigaciones sobre Desertificación (CIDE-CSIC), Ctra. Náquera Km. 4.5, Moncada, E-46113 Valencia, Spain.

Fire is a natural process in many ecosystems. In animals, fire ecology research has focused on fire effects on abundance and persistence of populations. However, the mechanisms behind the observed patterns of animal responses remain unclear. After a wildfire, the low mortality observed in burrowing lizards suggests the resiliency of their populations to fires. Thus, lizards likely have adaptive traits to cope with fires, or even to benefit from them. Here, we unravel these traits and present our advances in this matter. Before a fire arrives, early fire detection is expected to be particularly important for fire avoidance. Reptiles use sensory cues like smell and sound to detect threats; our results suggest that lizards use those cues to detect coming fires. During a fire, there may not be enough time to flee. Reptiles often survive sheltering in crevices or under rocks, and some have the ability to withstand the high critical temperatures reached in shelters during a fire.
The very recent postfire environments may be inhospitable; however, reptiles have the ability to endure days without eating and enter a state of torpor. Moreover, wildfires induce environmental changes that reptiles can benefit from. We found that fire reduced parasite load in lizards. Other benefits could come through postfire enhanced thermoregulatory opportunities or the increasing availability of some prey (i.e: pyrophillous insects). Also, fire-disturbed landscapes induce phenotypic plasticity in lizards. We found that lizards adjust their dorsal coloration likely to optimize their thermoregulation in burnt areas. Wildfires' strong effects on animal communities must be assessed by taxa. Here we advocate for more studies to fill the knowledge gaps in reptiles' fire ecology and hope to provide a conceptual framework to study fire effects and adaptive responses in other animals through a comprehensive approach.

The Rough Moss frog Story

CapeNature, Private Bag X29 Gatesville 7766

The Critically Endangered Rough Moss Frog is restricted to a small sandstone inselberg in a sea of cultivated shale lowlands near Caledon in the Western Cape Province. This inselberg (the Caledon Klein Swartberg) is unfortunately highly impacted by dense populations of invasive alien trees, particularly pines, which alter the water and fire regimes of this fynbos ecosystem. Monitoring of Rough Moss Frog populations, using both aural and microphone arrays analysed with acoustic Spatial Capture-recapture statistics, demonstrate the negative effects of invasive alien species on Rough Moss Frog population recovery after fire. In addition, targeted surveys revealed important new populations in relatively uninvaded sections of the mountain. A cooperative effort between the Klein Swartberg Conservancy, the Endangered Wildlife Trust, the Centre for Invasion Biology, Bionerds, the Fynbos Trust & CapeNature set up a management plan to use controlled fires to manage the pine invasion whilst protecting the most important populations of Rough Moss Frogs.

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THEMATIC SESSION - Jeanne Tarrant et al.

Protecting the unique and threatened frogs of the Western Cape

Thirty per cent of South Africa's amphibian species are threatened or Data Deficient, with the country ranked fourth for the number of threatened amphibians in the Afrotropical realm. The highest proportion of threatened and endemic frogs occur in the Western Cape Province. Noteworthy is that 64% of these species in the region are endemic, often occurring in isolated ranges or specialist habitat niches. In partnership between several organisations, this project focusses on those species for which targeted habitat protection efforts would have significant conservation benefits. These are the Critically Endangered Rough Moss Frog (Arthroleptella rugosa) and Micro Frog (Microbatrachella capensis), the Endangered Western Leopard Toad (Sclerophrys pantherina) and the Data Deficient Moonlight Mountain Toadlet (Capensibufo selenophos). Surveys of these target species since mid-2020 have revealed seven previously unknown localities and led to landowner engagements towards formal habitat protection. Sites so far total over 4000 hectares, and all qualify for Nature Reserve status through the Biodiversity Stewardship approach, whereby we aim to secure the highest level of protection for strategically important sites with high biodiversity and ecological function. Through this approach, landowners retain ownership of their properties, and the declaration becomes contractually binding. We will put management structures and effectiveness assessments in place to ensure appropriate post-declaration support.

The spatial and temporal distribution of soil hydrophobicity in Agulhas National Park, South Africa

Cape Research Centre, South African National Parks, P.O. Box 216, STEENBERG, 7947; Department of Conservation Ecology and Entomology, Stellenbosch University, Stellenbosch, 7600

Soil hydrophobicity and the factors affecting it have been studied in several Mediterranean type ecosystems (MTEs). Some studies have been conducted in fynbos, a South African MTE, but only a few of these studies investigated the factors affecting it. The aim of this study was to determine spatial and temporal occurrences of soil hydrophobicity in the Mediterranean fynbos (Agulhas National Park; ANP) in relation indigenous fynbos and areas with invasive alien plants (IAP), fire, soil texture, organic matter and soil moisture. Areas with unburnt indigenous fynbos, burnt fynbos, unburnt IAP and burnt IAP were selected. The water drop penetration time test was used to determine soil hydrophobicity under field moist conditions, where soil hydrophobicity was tested at the soil mineral surface (0 mm), 20, 50, and 100 mm depths. Sampling began two months post-fire during February 2010 (mid-summer). Seasonal sampling was done during 2012 and 2015 together with seasonal soil moisture measurements. The results showed that soil texture played the biggest role in the distribution of hydrophobicity. Sandy soils showed higher prevalence for hydrophobicity than clayey soils. Soil hydrophobicity was more prevalent in soils under IAP, but it was also found under unburnt indigenous fynbos. Fire didn't play a significant role in the distribution as both burnt and unburnt areas had similar hydrophobicity. Organic matter content did not play a significant role in the distribution of soil hydrophobicity. Soils at 20 mm depth were significantly more hydrophobic while soils at the surface and 100 mm depth were significantly more wettable. There was a clear seasonal trend with soil hydrophobicity being present during the dry summer months and absent during the wet winters of the southwestern Cape. Understanding the factors affecting soil hydrophobicity will aid managers of fynbos protected areas to manage fires and prioritizes clearing IAPs.

Wednesday, 7 September 2022, 09:30

THEMATIC SESSION - Susana Paula et al.

Soil fertility drives fire activity across Mediterranean climate-type ecosystems

Instituto de Ciencias Ambientales y Evolutivas. Facultad de Ciencias. Universidad Austral de Chile. Campus Isla Teja, 5090000 Valdivia, Chile.

Fire is a generalized phenomenon in the Earth system. At the global scale, fire activity is mostly explained by vegetation and climate. However, the global distribution of plant traits and vegetation-types are also modulated by the soil properties. Therefore, fire likely interacts with both climate and soil to affect species traits, community assemblages, and vegetation dynamics, that in turn feedback with the fire regime. Specifically, we predict that regional fire activity decreases with the soil fertility under mesic conditions. We tested this hypothesis across the Mediterranean climate-type ecosystems (MTCs), where the high climate seasonality provides annually dry fuels available for fires under markedly different soils. We compiled remotely sensed fire activity, climate, net primary productivity and soil information for all MTC ecoregions. The relationship among fire activity and the environmental variables were tested through structural equation modelling. Soil characteristics were strongly and directly related to fire activity. Specifically, fire activity increases with soil acidity and high exchangeable aluminium. Plants growing in such soils tend to be nutrient-poor and therefore more flammable than those with nutrient-rich tissues. Our results provide global support for the relationship between wildfires and soil fertility under Mediterranean conditions. Therefore, edaphic fertility should be incorporated into the models predicting future fires in a warming world. Funding: FONDECYT1190999

Saving the Critically Endangered Autumn Aster

SANBI, Rhodes Drive, Newlands, Cape Town

Marasmodes undulata (the Autumn Aster) is a Critically Endangered species only known from one locality in the Drakenstein district, South Africa. Long-term monitoring of the species illustrated a rapid decline in the population from over 300 individuals in 1984 to just three individuals in 2016. This severe population reduction motivated a team from the South African National Biodiversity Institute at Kirstenbosch Botanical Gardens to develop a project to ensure the survival of this species. Funding was received from the Mohammed Bin Zayd Species Conservation Fund to facilitate the propagation of Marasmodes undulata as well as other threatened species occurring on site for reintroduction. This project will support the local municipality to effectively manage the site, create awareness about the special biodiversity occurring there and the importance of conserving it. This is also a pilot project to evaluate the effectiveness of long-term seed storage and identify the possible gaps in using this strategy as a “conservation insurance policy”. In addition to propagating flagship threatened species we aim to restore degraded sections of the site to improve the overall habitat condition. This will support efforts to successfully reintroduce plants to the site. Here we present our methodology for reintroducing highly localised species such as Marasmodes undulata and highlight key lessons learnt

THURSDAY 8 September 2022

Thursday, 8 September 2022, 08:00

KEYNOTE 8 - Frank Schurr

Macrodemography – how large-scale biodiversity dynamics arise from the reproduction, mortality and dispersal of individuals

Institute of Landscape and Plant Ecology, University of Hohenheim, Germany.

The three demographic processes of reproduction, mortality and dispersal determine the dynamics of local populations. Hence, much demographic research has so far focused on local populations of single species. Yet theory states that demography should also drive biodiversity dynamics at large spatial, temporal and organizational scales. This comprises the dynamics of species' geographical ranges, macroevolutionary dynamics, or the dynamics of species-rich communities. Macrodemography, the study of demographic variation in space, time and across multiple species, thus holds considerable promise for advancing the understanding and prediction of large-scale biodiversity dynamics. However, a macrodemographic research agenda faces two major challenges: (1) to understand drivers of demographic variation within and between species, and (2) to understand how demographic processes acting at the level of individuals scale up to large spatial, long temporal and complex organizational scales. Here, I give an overview of recent progress on these topics. I focus on serotinous shrubs from fire-prone Mediterranean-type ecosystems, notably on Proteaceae from South African Fynbos. Their fire-linked life history makes them particularly suited for macrodemographic studies, their remarkable diversity enables comparative demographic analyses, and their key role in Fynbos ecosystems means that demographic research on them has high applied relevance. Research on this model system of macrodemography yields predictions that can be tested in other Mediterranean-type ecosystems and beyond. It should thus shed new light on the mechanisms that drive the past, present and future dynamics of biodiversity.

Thursday, 8 September 2022, 08:30

KEYNOTE 9 - Rob Salguero-Gomez

In the search for demographic oddities and their role in ecology, evolution and conservation biology

University of Oxford

Population ecology has come of age, and with it, a clearer picture of our demographic knowledge across the Tree of Life. After decades of field demographic data acquisition, and supported by the development of multiple open-access databases and consortia, the discipline has finally reached the an unprecedented position of being able to carefully set priorities based on the landscape of what is known and what is not. In this talk, I will make the case for which life histories, biogeographic corners of the planet, and branches of the Tree of Life require more attention and why. I will introduce a technological pipeline that uses autonomous robots, unmanned aerial vehicles, hyper spectral sensors, and cloud computing, to expedite a full, comprehensive knowledge of the demographies of the Tree of Life

SYMPOSIUM 7 - Treurnicht, M. & Schurr FM et al.

Macrodemography

Thursday, 8 September 2022, 09:30

SYMPOSIUM 7 - Joern Page

Plant Functional Traits as Predictors of Species Vulnerability to Multiple Drivers of Environmental Change in the South African Cape Floristic Region

University of Hohenheim, Germany

A generalized understanding of species' vulnerabilities to environmental change is fundamental for successful conservation management that mitigates future biodiversity losses. Differentiated species-specific responses to multiple aspects of environmental change poses a challenge for such integrated risk assessments. In the field of plant ecology, functional traits are an established approach to generalize findings across species, which is of particular importance for highly species-rich ecosystems. We investigate how plant functional traits determine species' vulnerabilities to multiple drivers of environmental change over the entire distribution ranges of 26 Proteaceae species in the South African Cape Floristic Region. The study builds on demographic analyses for the species-specific parameterization of population models that enable range-wide population viability analyses under different scenarios of multiple and interacting environmental changes (climate change scenarios, changing fire regimes, land transformation and wildflower harvesting). Variation in species' vulnerabilities to environmental change is then related to a set of plant functional traits (e.g. leave traits, seed traits and plant architecture) that determine demographic responses for example to fire regime, wildflower harvesting and extreme drought events. The combined analysis of functional trait data and simulated population viability identifies sub-regions where Proteaceae are particularly threated, both within and outside of present reserve networks, and provides a trait-based understanding of species' vulnerability to multiple drivers of environmental change. These results contribute to ongoing broader stakeholder initiatives on biodiversity risk assessments and conservation prioritization and can be integrated across the study species to assess general threats to functional and phylogenetic biodiversity in this plant biodiversity hotspot.

Range-wide demographic variation of Proteaceae responds to biotic and physical environments

Stellenbosch University & University of Hohenheim, South Africa

Understanding how biotic factors and physical environments jointly affect the key demographic processes of reproduction and survival is important to many questions in applied ecology. Despite this importance, these factors are rarely studied from a demographic perspective at large spatial scales, and the biotic component is often challenging to study, especially for long-lived plant species. Here, we examine range-wide demographic responses to biotic interactions (con- and heterospecific density) and physical environments for 30 Proteaceae species from the Cape Floristic Region biodiversity hotspot (South Africa). The Proteaceae study species follow a unique fire-driven life cycle and are serotinous: they exclusively form a canopy seed bank, which contains the seeds produced since the last fire. Fire triggers seed release from the canopy, so that recruitment is largely limited to a short period after fire. For these species, we set out to jointly quantify demographic responses of total fecundity since the last fire (size of individual canopy seed banks) to both con- and heterospecific density, as well as environmental covariates (fire interval, climatic- and soil factors) across species' geographical ranges. Range-wide variation in fecundity was well-explained (R2: 0.45-0.75) by con- and heterospecific density and environmental variables. The effects of fire interval, as well as con- and hetero-specific density, on fecundity were largely consistent across species, but we also detected substantial interspecific differentiation for other fecundity–environment relationships. Our comparative demographic analyses provide insights for understanding how local populations are jointly driven by biotic and physical factors at geographical scales, and how community- and range dynamics emerge from first principles of demography.

Thursday, 8 September 2022, 09:30

SYMPOSIUM 7 - Huw Cooksley

Resource budgets link functional traits to whole-plant performance: a data-driven model of life-history schedules of Fynbos Proteas

University of Hohenheim, Germany

A fundamental assumption of functional ecology is that functional traits determine organism performance and in turn life-histories and fitness. Yet how organ-level traits scale up to whole-organism performance (e.g. growth and reproduction) is rarely addressed. We argue that resource budgets of organisms, and the costs and benefits of allocating these resources to various organs, provide this linkage.

We present an integrated Trait-Resource-Performance (TRP) model, which describes how organ-level traits, representing resource costs and benefits of growth, reproduction and maternal care, scale up to whole-plant resource flows and in turn whole plant-performance and life-history. We use a hierarchical Bayesian latent state-space framework to fit this model to data on the life history schedules, allometries and traits of 600 individuals of 22 serotinous Fynbos Protea species. This allows us to infer: i) resource costs and benefits of key plant organs, ii) individual-level yearly dynamics of resource allocation and acquisition, from germination to the adult stage, and iii) year-to-year variation in both vegetative performance (leaf and wood growth) and reproductive performance (cone production, seed production and defence, maternal care, and thus yearly seed banks).

We find that functional traits that confer benefit to organs also make them more costly, shaping where a plant falls on a ‘fast-slow’ life-history spectrum. We identify allocation-based trade-offs between vegetative and reproductive performance, and temporal trends in resource allocation concordant with life-histories. We identify which traits are good, or poor, predictors of whole plant performance measures. Finally, we predict yearly dynamics of whole-plant performance and resource budgets.

This resource-driven, temporally explicit framework thus improves our mechanistic understanding of how organ-level traits - via organ costs / benefits and resource allocation - scale up to whole-plant fitness measures, and opens the door to exploring questions of both fundamental and applied natures.

Thursday, 8 September 2022, 09:30

SYMPOSIUM 7 - Hanna Walter

Effects of direct and indirect interactions on plant fecundity depend on spatial and functional structure of communities and time since fire

University of Hohenheim, Germany

Biotic interactions in plant communities affect individual fitness and community dynamics. Interactions between plants vary in space, time and with organisational complexity. Yet it is challenging to quantify temporal, spatial and functional determinants of different types of interactions between long-lived plant species and their effect on lifetime fecundity.
We studied how direct, pollinator- and seed predator-mediated interactions affect year-to-year variation in three fecundity components (cone production, seed set and seed survival). Age-stratified data on these components were collected for 497 individuals of 20 serotinous Protea species in 19 even-aged, fire-prone Fynbos communities. We analyse these data with neighbourhood models to infer the sign and strength of interactions, the neighbour plant traits that shape them and the spatial scale of interactions. For each fecundity component, these models describe how neighbourhood effects change with time since fire and with distance between plants. For each focal plant, we predicted neighbourhood effects on individual fecundity components and cumulative reproductive output over time.
Competitive effects on cone production and seed set increase post-fire as biomass and floral resources for pollinators build up. In contrast, neighbourhood effects on seed survival are weak throughout post-disturbance recovery. Neighbour traits related to resource acquisition shape direct interactions, whereas neighbour traits related to resource availability for pollinators and predators shape indirect interactions. The spatial scale of the interactions increases from direct over predator-mediated to pollinator-mediated interactions. The joint effect of these interactions on cumulative reproductive output leads to increasing competition over time.
In summary, we show that temporal changes in biotic interactions depend on functional traits and can be integrated to neighbourhood effects on lifetime fecundity. Studying the temporal, spatial and functional determinants of neighbourhood effects on lifetime fecundity is important for predicting not only individual plant fitness, but also population and community dynamics in changing environments.

Intense clumping of Cape Proteaceae seedlings; conservation, ecological and evolutionary implications.

Dept Biological Sciences, University of cape Town, P Bag Rondebosch, 7701

We analysed the large CapeNature post-fire regeneration data base which consists of hundreds of seedling to parent surveys each comprising 100 * 1 m2 plots surveyed after most fires in CapeNature Protected Areas. Seedlings of both the dominant genera, Protea and Leucadendron, are intensely clumped, frequently with > 20 seedlings per m2 whereas parents occur at densities of < 1 m2. This implies significant post-fire self-thinning of seedlings. The conservation implication of this is that seedling:parent ratios, the present method of determining the desirability of particular fires, does not reflect recruitment levels such as % of 1 m2 plots with any seedlings. Intense clumping implies very limited seed dispersal and of both hairy Protea seeds and winged Leucadendron seeds. The ecological implication of this is that it contrasts with present models suggesting significant long-distance dispersal of serotinous Proteaceae seeds. Self-thinning rather inter-specific competition is the dominant competitive interaction during post-fire succession. The evolutionary implication of this is that niche differentiation amongst Proteaceae species is unlikely to be a significant force.

Thursday, 8 September 2022, 09:30

SYMPOSIUM 7 - Carmen Guiote & Juli G. Pausas

Predation shapes serotiny in a Mediterranean conifer

Centro de Investigaciones sobre Desertificación (CIDE-CSIC), Ctra. Náquera Km. 4.5, Moncada, E-46113 Valencia, Spain.

Wildfires are a natural disturbance in many ecosystems. Consequently, plant species have acquired traits that allow them to persist in fire-prone environments. A key trait for post-fire regeneration of Pinus halepensis is serotiny, which consists of accumulating an aerial seed bank until its dispersion, mediated by fire. There is evidence that fire acts as an ecological driver favoring serotiny. However, serotinous cones are a predictable food source, so predation can select against the frequency of serotiny. In this study we evaluated the effect of predation by squirrels on serotiny levels in P. halepensis. For this, we sampled 6 sites with contrasting levels of predation in the Valencia region and Ibiza island (Spain). For each site, we evaluated the degree of serotiny and predation and measured some morphological cone traits. We found that, in P. halepensis populations, predation pressure decrease serotiny levels and increase cone defenses against predation. Our results also indicate that, within population, these cone defenses modulate predation, and ultimately, the serotiny degree of the trees. This reduction in the serotiny could compromise the potential for post-fire regeneration of the populations, and this is especially relevant in the context of change in fire regimes happening in the Mediterranean basin.

Thursday, 8 September 2022, 09:30

SYMPOSIUM 7 - Andrew Latimer, UC Davis

Mapping tree life cycle transitions after wildfire in California conifer forests

University of California Davis, One Shields Ave., Davis, CA 95616, USA

SYMP_MACRODEMOGRAPHY. In California's fire-prone Mediterranean-climate conifer forests, fires and bark beetle outbreaks have greatly increased mortality rates of adult conifer trees. Will this lead to population crashes and potential biome shifts? Lacking serotinous cones or persistent soil seedbanks, most of these conifer trees rely on seed dispersal from surviving adults. The temporal window for successful seedling establishment is short (3-5 years), because later-germinating trees experience strong light competition from regenerating shrubs. Currently, over a million hectares of California forest is in this immediate postfire state. Yet relatively little is known about the drivers of variation in future conifer species population density in these areas – because until recently, intense fire was relatively rare, and because the tree-to-seedling transition involves hard-to-observe processes. In a project launched last year to follow early postfire tree-to-seedling transition rates after the extensive 2020 and 2021 California wildfires, we have established field plots and conducted UAV aerial surveys to test how early post-fire conditions, including tree survival patterns, impact of fire injury on tree fecundity, and effects of weather on seedling survival and growth affect the population density of young trees. Preliminary results suggest: 1) seed limitation is pervasive in these postfire areas; 2) shrub competition has strong but complex effects on seedling establishment; 3) fire injury strongly affects the timing and amount of seed production by adult trees; 4) some of the tree mortality after fire is delayed by a year or more, and this delay may buffer population declines. Over the next decade, we will follow succession in these plots to measure seedling to young tree transition rates, while resurveying older plots to build a longer time-series of population states. The project aims to improve fine-scale projections of tree population density after wildfire and guide tree replanting efforts.

THEMATIC SESSION

Biodiversity & species interactions

Thursday, 8 September 2022, 09:30

THEMATIC SESSION - Guy Dovrat

Long-term proliferation of large annual thistles in dry Mediterranean rangelands

Department of Natural Resources, Newe-Ya'ar Research Center, Agricultural Research Organization - Volcani Institute, P.O. Box 1021, Ramat Yishay 30095

Spiny plants comprise a large, ecologically and economically important functional group in Mediterranean rangelands. The increasing abundance of large annual thistles in grazed grasslands entails major consequences for ecosystem services. Our study aims to quantify the contribution of large annual spiny plants to rangeland vegetation cover and productivity and to identify management- and climate-related drivers of spiny plant distribution and performance. Using a fifteen-year dataset from an extensive herbaceous pasture experiment in northeastern Galilee, Israel, we examined the effects of livestock management and climate on the cover and biomass of two dominant annual thistle species, Scolymus maculatus and Carthamus glaucus. These thistles constitute a significant proportion of pasture productivity, contributing more than 50% and 25% under high and moderate stocking density, respectively. Despite the similarity in life-form and life-history characteristics, each demonstrates a distinct response to both management intensity and annual climatic parameters. High stocking density had a positive effect on both cover and biomass of S. maculatus. Conversely, C. glaucus biomass estimates were higher under moderate stocking density. Distance from feeding site had significant contrasting effects on each of the focal thistles. Relative humidity and temperature were the most sensitive climatic parameters in explaining the variation in cover and biomass of the two thistles. The directionality of the two species' responses suggests that S. maculatus attains higher biomass than C. glaucus under dry and warm conditions. The proliferation of both large thistles under variable stocking densities and climatic conditions increases productivity but reduces the carrying capacity of Mediterranean rangelands.

Determinants of secondary growth in Bupleurum fruticescens, a dominant species from a highly diverse semiarid Mediterranean shrubland

1 Biodiversity and Conservation Area, Rey Juan Carlos University, Móstoles (Spain)

Climate variability determines plant growth across large spatial scales. However, this broad template is modulated at small scale by many other factors such as soil heterogeneity or plant-plant interactions. Understanding the interplay between these drivers is critical to unravel the potential effects of climate change on community dynamics, particularly in highly diverse communities co-dominated by species with contrasting functional roles. In this study, we assessed the influence of climate, soil heterogeneity, competition, and local species richness on the secondary growth of Bupleurum fruticescens, a co-dominant shrubby species from a semiarid Mediterranean shrubland in central Spain. We established one 8 x 8 m plot where all perennial plants (belonging to 43 species) were mapped (n=8839), recording species identity, height and two crown diameters. The root collar of all B. fruticescens adult plants (n=492) was collected to get their age and estimate their secondary growth by measuring ring widths. Competition indices at intra and interspecific levels, local diversity and species richness were obtained within circles of variable radius (15, 20, 25 and 30 cm) centered around B. fruticescens adult individuals. Soil heterogeneity (nutrient content, metabolic activities, conductivity, texture) was interpolated through kriging from 84 soil cores collected regularly across the plot. Preliminary results suggest that ring width was strongly determined by climate, but also by soil heterogeneity and local species richness. Humid conditions in March and warmer years favored growth, but so did soil conductivity and low clay proportion. Species richness at small scale (<20 cm) reduced growth, but the effect of competition at either intra or interspecific levels was negligible. These findings suggest that the combination of environmental filters acting at large and fine scales together with the biotic context may determine plant performance and their growth spatial patterns in highly diverse Mediterranean shrub communities.

Thursday, 8 September 2022, 09:30

THEMATIC SESSION - Christopher Janousek et al. L

Plant diversity and composition in tidal wetlands across a Mediterranean to maritime climate gradient on the west coast of the United States

Oregon State University, 104 Nash Hall, Corvallis, OR 97331, USA

Tidal wetlands exist at the ecotone between marine, freshwater, and terrestrial ecosystems and endure dynamic conditions including the physiological stresses of salinity and prolonged inundation. We examined tidal wetland plant composition and diversity in 30 sites from southern California to northern Washington to determine spatial differences in plant assemblages, how diversity relates to wetland elevation, and changes in plant richness with latitude. The geographic extent of sampling included the cool, dry outer coast of California; the warmer, dry, and more inland region of the San Francisco Bay-Delta Estuary; and the cool, wetter maritime climate of the US Pacific Northwest. At most sites, plant richness at the plot scale had either a unimodal relationship with elevation in the intertidal zone or it was greatest in high marsh where inundation was low. High marshes, with higher species richness, may therefore be more vulnerable to loss of plant diversity due to sea-level rise. Across the latitudinal gradient of the US Pacific coast, there was a large shift in the composition of marsh species, including the presence of a somewhat regionally unique flora in the fresher region of the large San Francisco Bay-Delta Estuary. Gamma (site-level) diversity tended to be somewhat higher in more northerly sites, while plot-level richness tended to peak at intermediate latitudes (central California to central Oregon). These region-wide data provide insight into how tidal wetland plant diversity and composition vary along climate and elevation gradients, which will be important for establishing conservation and restoration priorities in these ecosystems, especially in an era of accelerating climate change.

Co-existence of different ploidy levels in the renosterbos, Dicerothamnus rhinocerotis (Asteraceae; Gnaphalieae)

University of Cape Town, Rondebosch, Cape Town, 7700

The ecologically important Cape shrub Dicerothamnus rhinocerotis, also known as renosterbos, gives the name to the highly-threatened vegetation type renosterveld, and is known for its broad environmental tolerance and large amount of intraspecific variation. A flow cytometric (FCM) survey genome size clearly indicates that the species comprises both diploid (2x) and tetraploid (4x) cytotypes. This study documents the geographic distributions of the two cytotypes and explores morphological and ecological correlates of ploidy level. Our data set sampled material from 187 sites across the full distribution range of the species We compared cytotype morphologies using multivariate analysis of morphometric characters from stems, leaves and flowers for a subset of 79 plants from the southwestern Cape. We evaluated ecological differentiation using environmental characters from climate layers for the full range of the species, and soil layers for the GCFR. Species Distribution Models (SDMs) were produced using environmental and occurrence data for each cytotype. An association between multivariate morphology and ploidy level was detected with multiple analyses but there is no single morphological characteristic that reliably distinguishes diploid and tetraploid cytotypes. Tetraploids occupy a broader range of phenotypic diversity and can occupy habitats with environmental conditions which exclude diploids. However, the lack of distinct morphological and ecological differentiation between cytotypes of renosterbos does not warrant taxonomic separation at the species level.

Thursday, 8 September 2022, 09:30

THEMATIC SESSION - Ismail Ebrahim, Mashudu Nndanuduleni

Hand pollination of Sorocephalus imbricatus: Does it improve seed set?

SANBI, Rhodes drive, Newlands, 7735, Cape Town

Sorocephalus imbricatus, is a Critically Endangered plant species occurring in the Waterval Nature Reserve near Tulbagh in the Western Cape province of South Africa. This species produces small nutlets with an elaisome which is dropped to the ground and collected by ants and carried into their nests. This well - known phenomenon (Myrmecochory) forms part of the plant's life history but poses a huge challenge for programmes like the Millenium Seedbank, who collect seeds for conservation purposes. We established a small trial to determine the impact of hand pollination on seed set. We will share our methodology and discuss challenges of collecting seeds of highly restricted species with unconventional dispersal mechanisms and how we can improve the chances of collecting seeds for viable ex-situ collections.

Thursday, 8 September 2022, 09:30

THEMATIC SESSION - Allan Ellis

Fly pollinators as drivers of floral diversification of mass flowering Cape daisies

Department of Botany and Zoology, Stellenbosch University, Matieland, South Africa

The striking variation in Angiosperm flowers is often attributed to divergent selection imposed by allopatrically distributed pollinators with different floral preferences. While this pollinator-shift model of floral diversification has been demonstrated in plants with specialised pollination systems, the importance of pollinators as determinants of floral divergence in species with generalist pollination phenotypes, such as daisies, is less clear. The extensive mass-flowering daisy displays in Namaqualand, South Africa, exhibit striking flower colour convergence within communities, but also extensive geographic flower colour turnover within species and genera. I first characterise the previously unrecognised intraspecific diversity of floral signalling, and its evolutionary pattern, in dominant Namaqua daisy lineages. Then by quantifying the geographic pollinator mosaics across which daisy floral signals have diverged, and experimentally testing pollinator preferences for floral colour signals I investigate the drivers of floral signal divergence and convergence. I show that landscape-scale turnover of dominant flower colours in daisy communities is strongly associated with largely non-overlapping distributions of dominant bee-fly pollinators with divergent flower colour preferences, suggesting the importance of pollinator shifts across strong qualitative pollinator mosaics for signal divergence. However, extensive divergence in floral signals, in response to selection imposed by different behaviours of the same pollinator, also occurs across more subtle gradients in the abundance of dominant pollinating fly species. The geographically structured diversification of floral colour signals across qualitative and quantitative pollinator mosaics that I show is perhaps unexpected given the classically generalist pollination phenotype of daisies. However, because of the dominance of single fly pollinators within communities, and the virtual absence of bees as pollinators, I suggest that Namaqua daisies function as pollination specialists despite their generalist phenotypes, thus facilitating differentiation of floral signalling by pollinator shifts and sexual deception.

Thursday, 8 September 2022, 09:30

THEMATIC SESSION - Arjan Engelen, Allan Ellis

Floral divergence of mass-flowering dimorphotheca pluvialis-sinuata (asteraceae): a consequence of pollinator shifts or adaptive wandering?

Stellenbosch University, Stellenbosch, South Africa

Pollinator shifts, the divergent floral-phenotypic and ecological specialization of allopatric plant populations along spatial pollinator gradients, are the most frequently invoked drivers of floral divergence in the Cape. However, divergent floral adaptation may occur in the absence of fitness trade-offs between floral phenotypes, leading to phenotypically diverse but ecologically generalist flowers i.e. adaptive wandering. Focusing on three morphotypes of spring mass-flowering Dimorphotheca pluvialis-sinuata daisies, we quantified floral phenotypic divergence and trait integration, gradients of network and pollinator-use similarity and trait preferences of local pollinators to assess whether the pollinator-shift or adaptive wandering models explain floral diversification in the complex. Multivariate analyses of floral trait data suggest a strong, but imperfect, correspondence with a priori morphotype designations, while comparison of field collections with specimens grown in a common garden suggest that traits discriminating these clusters are not phenotypically plastic. Weak pollinator gradients were evident across morphotype distributions at both the whole-network and focal-species levels, while turnover of interactions was high both among sites housing the same morphotype and among those housing different morphotypes. Contrary to expectations derived from pollinator-shifts, this suggests that pollinator distributional limits do not underlie floral divergence and that these daisies are ecologically generalized. However, indicator species analyses identified strong visitor affiliates with each of the three morphotypes, despite the apparent generalization of Dimorphotheca. It therefore appears that patterns of divergence and pollinator use may be supported by adaptive wandering. Analyses of selection experiments are currently underway to quantify trade-offs potentially maintaining the spatial structure of floral form in the complex.

Thursday, 8 September 2022, 09:30

THEMATIC SESSION - John Compton

Fynbos nutrient dynamics: rock substrate, marine aerosols, dust and fire

Department of Geological Sciences University of Cape Town

Geological substrate, along with rainfall, is a key factor in the distribution of the many plant biomes making up the Greater Cape Floristic Region, a biodiversity hotspot. The principal rock types include nutrient-poor acidic quartzose sand and sandstone, nutrient-rich shale and alkaline calcareous sands, calcrete and aeolianite. Calcareous (limestone) substrates are largely confined to coastal dunes of wind blown beach sand and support strandveld biomes whose composition varies by age and extent of leaching and cementation of the dune sand. Unlike the South Coast, the West Coast does not include limestone fynbos biomes, perhaps because its limestone deposits are too young and separated from those on the South Coast by the Cape Fold Belt syntaxis. Low-lying areas not covered by dune sand are dominated by shale substrates that support renosterveld biomes. Relatively nutrient rich, the renosterveld biomes have been mostly ploughed under, such that their composition, particularly the abundance of grasses, remains poorly known prior to farming and use of fire early on by San hunter-gatherers. Rugged, mountain slopes are dominated by resistant sandstone bedrock having thin, acidic, quartzose (>98% SiO_2) soils that support the sandstone fynbos biome. Nutrient sources include marine aerosols, largely limited to near coastal areas, and wind blown dust that includes minerals and fire ash. Mineral dust is sourced primarily during Berg wind conditions, which erode the Great Escarpment as winds descend from the interior plateau to the coastal plain. Wind blown fire ash and smoke fertilise adjacent unburnt areas while burnt areas experience a net loss of nutrients that are recouped gradually over time by dense root networks and evergreen growth. The strong correlation of biomes to underlying rock substrate allows for the extrapolation of vegetation cover onto shelf areas exposed during glacial period lowstands where the substrate is known.

Thursday, 8 September 2022, 09:30

THEMATIC SESSION - John Compton

Fynbos nutrient dynamics: rock substrate, marine aerosols, dust and fire

Department of Geological Sciences University of Cape Town

Geological substrate, along with rainfall, is a key factor in the distribution of the many plant biomes making up the Greater Cape Floristic Region, a biodiversity hotspot. The principal rock types include nutrient-poor acidic quartzose sand and sandstone, nutrient-rich shale and alkaline calcareous sands, calcrete and aeolianite. Calcareous (limestone) substrates are largely confined to coastal dunes of wind blown beach sand and support strandveld biomes whose composition varies by age and extent of leaching and cementation of the dune sand. Unlike the South Coast, the West Coast does not include limestone fynbos biomes, perhaps because its limestone deposits are too young and separated from those on the South Coast by the Cape Fold Belt syntaxis. Low-lying areas not covered by dune sand are dominated by shale substrates that support renosterveld biomes. Relatively nutrient rich, the renosterveld biomes have been mostly ploughed under, such that their composition, particularly the abundance of grasses, remains poorly known prior to farming and use of fire early on by San hunter-gatherers. Rugged, mountain slopes are dominated by resistant sandstone bedrock having thin, acidic, quartzose (>98% SiO_2) soils that support the sandstone fynbos biome. Nutrient sources include marine aerosols, largely limited to near coastal areas, and wind blown dust that includes minerals and fire ash. Mineral dust is sourced primarily during Berg wind conditions, which erode the Great Escarpment as winds descend from the interior plateau to the coastal plain. Wind blown fire ash and smoke fertilise adjacent unburnt areas while burnt areas experience a net loss of nutrients that are recouped gradually over time by dense root networks and evergreen growth. The strong correlation of biomes to underlying rock substrate allows for the extrapolation of vegetation cover onto shelf areas exposed during glacial period lowstands where the substrate is known.

The drawdown phase of dam decommissioning is a hot moment of gaseous carbon emissions from a temperate reservoir

Department of Evolutionary Biology, Ecology and Environmental Sciences, University of Barcelona, Barcelona, Spain

Dam decommissioning (DD) is an integral part of the life cycle of water reservoirs to solve problems posed by ageing dams. Large stocks of carbon in reservoir sediments may result in substantial carbon fluxes due to DD, although there is limited empirical evidence on the impacts of DD on carbon dynamics in reservoirs. We studied the effects of DD on carbon dioxide (CO2) and methane (CH4) fluxes from impounded water, exposed sediment, and running water before, during, and three to ten months after drawdown of the Enobieta Reservoir, North Iberian Peninsula. Areal CO2 fluxes from exposed sediment (mean ± SE mmol m–2 day–1: 295.65 ±74.90) and running water (188.11 ± 86.09) decreased over time and were higher than areal CO2 fluxes from impounded water (–36.65 ± 83.40). Areal CH4 fluxes did not change over time and were noteworthy only in impounded water (1.82 ± 1.11). Total ecosystem carbon (CO2 + CH4) fluxes (kg CO2e day–1) did not follow a clear temporal pattern, but they were higher during and after than before reservoir drawdown due to greater CO2 fluxes from exposed sediment. The reservoir, which oscillated between a negligible source and a net sink of carbon, thus, became an important emitter of carbon along these first 10 months after reservoir drawdown. Future studies should examine mid- and long-term effects of DD on carbon fluxes, identifying the drivers of areal CO2 fluxes from exposed sediment.

THEMATIC SESSION

Demography, population dynamics and biogeography

Thursday, 8 September 2022, 11:30

THEMATIC SESSION - Andrew Turner

Lessons from 18 years of frog population monitoring in the fynbos

CapeNature, Private Bag X29 Gatesville 7766

As a response to global amphibian declines and global climate change CapeNature began formal long-term frog monitoring at two sites in 2002. Two additional sites were added later to expand the spatial scope of the project and to include two threatened frog species. Here we present generalised linear model and time series analyses of the climate and frog population estimate data over the past 18 years at the two original sites. These results indicate weak influence of climate as a driver of frog population dynamics and a strong influence of fire. These data assist in determining appropriate fire return intervals which has a direct management implication. The complications arising from different frog species responses is discussed and workable management goal is suggested.

Eucalyptus globulus Labill. regeneration from seeds in Portugal's mainland

1 Centro de Ecologia Aplicada Prof. Baeta Neves (CEABN), InBio, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal;

Eucalyptus globulus Labill. is native to SE Australia and Tasmania, where fire influences its life-cycle. This species was introduced into several regions worldwide and it is considered an invader in certain areas. However, knowledge about its naturalization is scarce. In Portugal's mainland, this species is dominant in 26.2% (8.45x10*3 ha) of the afforested area, ca.160 years following its introduction. Depending on their structure, these eucalypt-dominated stands can be fire-prone. Our work aimed for a greater understanding of E. globulus naturalization in Portugal's mainland, focusing on the role of fire in this process. An innovative multiscale approach was used to address the problem. Results show that natural regeneration of E. globulus from seeds occurs in every region of the territory. In general terms, mean wildling densities are 3.1 times higher in Portuguese than in Australian plantations. Notably, some wildlings are reproductive. Nevertheless, spatial distribution of both wildling occurrence and density is not uniform on national (mainland), regional, local, and stand scales. Proximity to reproductive trees is of primary importance. Moreover, climate and soil affect broad scale distribution and performance of seminal regeneration, while site quality and forest management are fundamental on a local scale. Finally, fire plays a relevant role: inducing seed release from burnt trees; providing safe microsites for plant recruitment and development; charring substances in litter, otherwise toxic for early development; and allowing the establishment of plants in the mid-term. In fact, maximum wildling densities observed were 9.9 plants/m2 and 0.3 plants/m2 inside burnt and unburnt plantations, respectively. In summary, cultivated trees can produce offspring which grows, establishes, and may produce seeds next to parent trees. Therefore, naturalization is in progress and widespread in Portugal's mainland, and fire facilitates it. These results may be relevant to understand eucalypt naturalization in other regions, and to evaluate and reduce invasion risk.

Using natural populations to assess plant reintroduction success: an example with a long-lived endangered shrub

University Complutense of Madrid. Department of Biodiversidad, Ecology and evolution. C/ José Antonio Novais 12, 28040-Madrid (Spain)

Reintroduction of endangered species is an important tool in biodiversity conservation and management. For an integrative assessment of the performance of reintroduced populations, it is important to evaluate not only survival, growth and reproduction rates separately, but also their potential inter-relations. In our study, we reintroduced an endangered Mediterranean shrub in two locations in Spain, and compared its demographic performance to that of two natural populations as a way to assess reintroduction success. In both natural and reintroduced locations, we selected sub-locations with milder and harsher substrates for plant growth. We monitored the survival, growth and reproduction of ca. 1000 individuals in natural populations (12 years) and of ca. 500 individuals in reintroduced populations (6 years). Reintroduced populations showed, relative to natural populations, lower survival in seedlings and small adults, and lower growth in large adults, but also higher reproduction in large adults. In contrast with the comparison of separate demographic rates, interannual correlations among rates were largely similar in natural and reintroduced populations. The main temporal correlations consisted of 1) a negative relationship between growth in a certain year and survival, growth and reproduction in subsequent years, and 2) a positive relationship between reproduction in a certain year and growth and reproduction in subsequent years. These results seem to arise because growth is more plastic and opportunistic, and may be detrimental in the plant's long term if excessive, whereas reproduction is more adaptive, and does not respond to circumstantial conditions but to a more planned life cycle strategy. Finally, our results were more patent under harsh-substrate conditions, highlighting the importance of considering resource availability when planning and evaluating reintroductions.

Thursday, 8 September 2022, 11:30

THEMATIC SESSION - Andreas L.S. Meyer

Potential impacts of temperature overshoot pathways on the fauna of Mediterranean-type ecosystems

African Climate and Development Initiative, University of Cape Town, South Africa

The Paris Agreement on climate change sets a long-term goal to limit global warming to “well below” 2°C above pre-industrial levels and to “pursue efforts towards 1.5°C”. However, current climate policies are insufficient to limit global warming levels to 1.5°C. This has increased the relevance of temperature overshoot pathways. A temperature overshoot is a temporary exceedance of a given global warming level (e.g. 2°C), followed by a return to or below that level. Here, we explored the potential impacts of a 2°C temperature overshoot by quantifying, globally and in Mediterranean-type ecosystems (MTE), the dynamics of exposure and de-exposure to potentially unsafe temperatures for amphibians, birds, mammals, and reptiles. While the duration of the global overshoot period was approximately 60 years, the exposure of species was considerably longer (around 100 globally and 165 years in MTE). Although the duration of exposure is higher in MTE, the number of populations exposed is lower, with a peak exposure of 2% in MTE vs. 8% globally. The California chaparral and woodlands were the MTE ecoregion with the highest exposure peak (5.6% of the animal populations analysed), followed by the fynbos ecoregion (3.2%). The southern Australia mallee and woodlands showed the lowest peak exposure (0.7%). Our findings suggest that animal populations occurring at MTE will be less exposed to unsafe temperatures during the overshoot when compared to the global average. However, the duration of exposure will be much longer in MTE, which could pose serious threats to the populations exposed. Integrated assessments including other organisms and threats (e.g. habitat loss) are needed to provide a more comprehensive picture of the impacts of an overshoot on MTE and guide management and conservation policies.

Thursday, 8 September 2022, 11:30

THEMATIC SESSION - Nancy Job

The South African Biodiversity Data Pipeline for Wetlands and Waterbirds (BIRDIE)

South African National Biodiversity Institute

In the face of a crisis in biodiversity and ever-increasing pressure on our wetland ecosystems, waterbirds can serve as flagship monitoring indicators. Through cross-disciplinary collaboration, increased computer power, and the application of statistical ecology, this project hopes to achieve previously inaccessible insights about the distribution and population dynamics of waterbird species, and their association with the wetlands that support them, that the raw data might not reveal. The South African Biodiversity Data Pipeline for Wetlands and Waterbirds, affectionately named BIRDIE, is a multi-institutional collaboration. It aims to link nation-wide, citizen science-driven, waterbird data to conservation managers, researchers and other stakeholders and, ambitiously, through a constructed data pipeline, aims to support them in site management and decision making. At a national level, the outputs from BIRDIE will contribute to Red-Listing assessments and the National Biodiversity Assessment, and will also support reporting on international commitments, such as the RAMSAR Convention on Wetlands of International Importance, the Agreement on the Conservation of African-Eurasian Migratory Waterbirds, and the Convention on Biological Diversity.

THEMATIC SESSION

MTE conservation needs and actions

Thursday, 8 September 2022, 11:30

THEMATIC SESSION - Melissa Whitecross et al.

Recognising, Assessing & Reporting OECMs in the Western Cape

Birdlife, South Africa

The draft targets of the Convention on Biological Diversity (CBD) Post-2020 Global Biodiversity Framework have indicated that a new area-based target to replace Aichi Target 11 will aim to see 30% of the world's marine, freshwater and terrestrial surface conserved by 2030. This will be achieved through the protection of the network of protected areas and the expansion of the conservation estate through an identified ecologically representative and well-connected network of 'other effective area- based conservation measures' (OECMs). OECMs are a conservation designation for areas that are achieving long-term, effective in-situ conservation of biodiversity outside of protected areas. They will be a crucial mechanism for South Africa and the global community to achieve the new CBD 2030 Target 2. The identification of OECMs in South Africa will require both spatial planning and in-field assessments that will likely align strongly with the expansion of the biodiversity stewardship mechanism to ensure safeguarding of potential OECMs in the future. BirdLife South Africa in collaboration with Conservation Outcomes, CapeNature and the Department of Forestry, Fisheries and Environment with support from the WWF Nedbank Green Trust has commenced the first assessment of OECMs in the Western Cape. The aim is to spatially identify and assess the network of potential OECMs as a means of quantifying the capacity and resource requirements needed to effectively report on OECMs at a provincial scale. This project will form an important case study for other provincial assessments of OECMs in South Africa and will lay the foundation for national uptake of the OECM concept to enable South Africa to report on their full conservation estate to the World Protected Area Commission as a signatory of the CBD.

Thursday, 8 September 2022, 11:30

THEMATIC SESSION - Evan Meyer et al

California Plant Resuce: A network for ex situ conservation in California

Theodore Payne Foundation, Center for Plant Conservation

As climate change, habitat loss, proliferation of invasive species and other threats loom over the unique biodiversity of California, long term ex-situ seed storage of rare plants offers an affordable conservation tool and a stop gap to extinction. California Plant Rescue (CAPR) was founded in 2014 as a coalition of botanical gardens and NGOs with the specific focus of ramping up ex-situ conservation efforts of the rare and endangered flora of California through germplasm (seed and living tissue) collections. In addition to long term ex-situ conservation of botanical diversity, these collections have significant value in research, applied habitat restoration and endangered species recovery efforts. Since its inception, the collaboration has achieved a marked increase on the number of taxa stored in conservation seed banks. In particular, an infusion of $3.6 million of state funding in 2019 as part of the California Biodiversity Initiative greatly ramped up collections efforts throughout the state, and, as a result, California has met the UN global goal of preserving 75% of its rare and endangered plants in ex-situ collections. This presentation will share information on how the collaboration is structured and administered and compare the state of ex-situ conservation before and after this framework was developed. In addition, it will share lessons learned while facing the unique challenges of ex-situ plant conservation in a Mediterranean type climate.

Thursday, 8 September 2022, 11:30

THEMATIC SESSION - Rut Sánchez de Dios, Felipe Domínguez Lozano

Biogeography of a plant threat: herbivory

University Complutense of Madrid. Department of Biodiversidad, Ecology and evolution. C/ José Antonio Novais 12, 28040-Madrid (Spain)

Herbivory is the most reported threat within the Spanish Red List of threatened flora. On the other hand, we are involved in a global process where land use change is an important aspect. In Mediterranean Basin countries land-use change is involving both land abandonment and rapid urbanization as well as changes in densities of managed (livestock) and unmanaged herbivore species.
Our goal is to study the biogeographic (large scale) effect of herbivory on the plant threatening process in Spain in the light of the reported present global change. For that we map and model the effect of registered herbivory as a plant threat as well as different environmental and anthropic drivers: livestock density, richness of wild herbivore species, protected areas, anthropic disturbance and altitude. Finally, biogeographic patterns are identified by means of a multifactor analysis.
Our results point to wild herbivores richness as a main direct driver of herbivore threat underplaying the effect of livestock density. As a result, herbivory as a plant threat is mainly located at mountainous undisturbed protected areas. This might constitute a conflict of interest in protected area conservation strategies where herbivores and rare plants coexist.
In addition, a group of plant threatened by herbivory were identified in areas where no longer livestock nor wild herbivores have a significant effect. Those plants are on need of further research to understand the effect of lack of herbivore communities on plant conservation

Thursday, 8 September 2022, 11:30

THEMATIC SESSION - Yanis Bouchenak-Khelladi and Florian Boucher

Northern Africa's mountains: Biodiversity & Extinction Hotspots

University of Dijon, UMR Biogeosciences, 6 bvd Gabriel 21000 DIJON

Northern African mountains (NAMs) consist of the Great Atlas, stretching around 2,800 km through Morocco, Algeria and Tunisia, and the Ahaggar mountains, covering around 600,000 km2 in the Sahara of Southern Algeria. NAMs exhibit a very complex geological history starting around 2 billion years ago (BYA) with the presence of metamorphic rocks in the Ahaggar mountains, followed by several orogeny phases, spanning from 300 to around 2 million years ago (MYA). This complex and poorly known geophysical history has allowed the evolution of a unique fauna and flora, with high levels of endemism and the presence of a high number of charismatic mammals, even though most are now extinct. The Algerian Fir (Abies numidica) and the Tassili Cypress (Cupressus dupreziana) are endemic plant species to the Moroccan Rif and the Algerian Tell, and the Ahaggar Mountains, respectively, and each consists of just over 100 individuals. Numerous mammal species (such as the Cuvier's gazelle (Gazella cuvieri), the Addax (Addax nasomaculatus), the Barbary Macaque (Macaca sylvanus), the Atlas deer (Cervus elaphus barbarus)) are endangered or critically endangered whereas many other species went extinct in the last 5,000 years, such as Barabary lions (Panthera leo leo). Habitat degradation due to unsustainable pastoralism is currently heavily increasing with a significant loss of North African steppes (dominated by a grass species, Stipa tenacissima), a habitat that hosts many endemic plant and animal species. Biodiversity surveys need to be developed further in NAMs mainly because: (i) most of the biodiversity data need taxonomical revisions with the help of molecular tools and, (ii) biodiversity surveys need to be performed across the whole spatial scale of NAMs. It is crucial to initiate an international effort to deploy biodiversity surveys expeditions in the region to reassess the biological richness of NAMs. The major challenge for a thorough conservation planning of NAMs remains the political instability of the region with at least four armed conflicts in and around NAMs.

Thursday, 8 September 2022, 11:30

THEMATIC SESSION - Kerry Maree and Carla Wood

The Table Mountain Fund: A fund dedicated to the conservation of the Cape Floristic Region

Manager: Table Mountain Fund, Kirstenbosch National Botanical Gardens,
Project Manager: Table Mountain Fund, Kirstenbosch National Botanical Gardens.

The Table Mountain Fund is a conservation trust fund dedicated solely to the protection of the Cape Floristic Region. Founded by WWF-SA as an outpouring of concern by local Capetonians in 1998, the Table Mountain Fund has gone on to support over 340 conservation projects spread across the fynbos biome amounting to more than R95 million. These projects have ranged from vital scientific research to the formal establishment of private protected areas, environmental education and outreach, land acquisition and donation for incorporation into the Table Mountain National Park, and initiatives which have gone on to deliver sustainable, socio-economic benefits to the people of the region. But most importantly, as an independent endowment fund, the projects have answered to the people of the region and have been responsive to the on-the-ground lived conservation challenges as opposed to often experienced, top-down aid-agency directed focal areas. Partnering through the decades with a wide range of local conservation non-governmental organisations, state organisations, social enterprises, community-based organisations and private corporations, the Table Mountain Fund is an example of how well-structured and prudently governed funds, which allow for responsive, nimble and dedicated financial support to local beneficiaries of a region, can enable meaningful and long-lasting conservation and social impacts. In true Cape Floristic Region spirit, the Table Mountain Funds' approach to conservation is one of partnerships, collaboration and shared-learning.

Thursday, 8 September 2022, 11:30

THEMATIC SESSION - Donovan Kirkwood

Stellenbosch University Botanical Garden: strategy of an academic botanical garden in a biodiversity hotspot

Stellenbosch University Botanical Garden, Stellenbosch, Western Cape, South Africa

Stellenbosch University Botanical Garden (SUBG) is situated within arguably the most transformed and threatened parts of the globally exceptional Cape Flora. I'll talk about our model and approaches to achieve important research, education and conservation outcomes despite modest staffing and resources. There will be some unusual strategies and of course, plant pictures.

Thursday, 8 September 2022, 13:45

KEYNOTE - Wendy Foden

Responding to climate change impacts in Mediterranean ecosystems: challenges and opportunities

Cape Research Centre, South African National Parks, Tokai, Cape Town
Climate Change Specialist Group, IUCN Species Survival Commission, Gland, Switzerland
Global Change Biology Group, University of Stellenbosch, Stellenbosch

Climate change impacts on biodiversity are now common-place, with impacts spanning genes, populations, species, ecosystems and their services. Countries' generally poor progress in cutting greenhouse gas emissions means that such impacts are ongoing and escalating, and since critical thresholds of polar land and sea ice melt have now been surpassed, threats resulting from sea level rise and changing ocean currents are irreversible over hundreds to thousands of years. The need for conservation action is clear and urgent, but several factors are obstructing and slowing our progress.

The conservation community has embraced climate change vulnerability assessment. With notable exceptions, assessments have most commonly focused at species levels, upscaling these to infer impacts on ecosystems and in specific geographic areas (e.g., protected areas, countries). Although subject to limitations, such assessments are valuable for identifying the biodiversity most at risk from climate change, and may help to identify the mechanisms underpinning vulnerability. As such, they have formed an important foundation for development of conservation strategies and adaptation plans. I discuss examples, including a case study of South Africa's National Parks.

Evidence of real-world roll-out of adaptation plans is, however, concerningly rare, as noted in the IPCC Sixth Assessment Report. I discuss possible reasons, including the inherent conservatism of modern conservation practice and the relatively short duration of typical funding cycles. Because climate change is a new threat, the suite of adaptation tools has many gaps and its long- and medium-term effectiveness remain unclear. Developing a shared evidence base and filling the adaptation toolbox with appropriate tools is urgently required. Mediterranean ecosystems face particular climate change trajectories relative to other systems, with both shared and differing impacts and challenges. Meeting the urgent adaptation need is dependent on a strong, cooperative response by the science community and a collective focus on innovative research and practice.

SYMPOSIUM 8 - Stephen Jackson, Nicola van Wilgen & Wendy Foden

Climate change adaptation: Understanding impacts and vulnerability and taking conservation action

Thursday, 8 September 2022, 14:15

SYMPOSIUM 8 - Alexander Gershunov (Scripps) & Stephen Jackson

Precipitation regime change in Mediterranean climate regions: the roles of subtropical drying, extreme events, and atmospheric rivers

Mediterranean climates represent a balance between mid-latitude storms in winter and subtropical dryness in summer. Moisture dependence on a handful of winter storms leads to high interannual hydroclimatic variability, which is an important determinant of ecosystem structure and ecological dynamics. Under future climate change, Mediterranean regions of the world are projected to dry as precipitation frequency decreases, particularly in the shoulder seasons of fall and spring. Mediterranean-climate regions are projected to become effectively more subtropical, with the dry season lengthening as the subtropical subsidence zone expands poleward in a warming climate – a trend already observed. Drying will be accompanied by even greater interannual moisture variability as the frequency of storm events decreases and the wet season narrows. California represents an important exception among the drying Mediterranean regions; the Aleutian Low will counteract poleward expansion of the Subtropical High, strengthening the atmospheric rivers that are responsible for most of California's precipitation extremes. Thus, California is projected to experience an increase in frequency and magnitude of extreme storms. Analyses of atmospheric river activity in historical and projected climate epochs, using a suite of global climate models from Phase 5 of the Coupled Model Intercomparison Project, confirm that atmospheric rivers will become wetter, increasing the frequency and intensity of extreme precipitation events and counteracting the drying trend resulting from the decreasing frequency of precipitation from other storm systems. As California's hydroclimate becomes more dependent on extreme precipitation from atmospheric-river storms, the region will experience an increase in hydroclimatic volatility, but not wholesale drying. Alternation of longer-duration dry periods with more-extreme storms may represent a novel winter-climate regime, posing challenges to ecosystems and resource managers alike. Other Mediterranean climate regions have not been studied in such detail. Although they are also likely to experience increasing interannual variability of precipitation, they will, unlike California, gradually tend towards drier conditions overall.

Impacts of global change on terrestrial ecosystems in the Mediterranean climate regions and their implications for ecosystem management and restoration

Vibrant Planet, Incline Village, Nevada, USA

Ecosystem management and ecological restoration are focused on preventing and repairing ecosystem degradation, but the rapidity and pervasiveness of global change threaten to exceed our capacity to respond at appropriate and sufficient spatiotemporal scales. In the Mediterranean Climate Regions (MCRs), projected climatic changes will exacerbate hydrological stress, as warming and projected decreases in growing-season soil moisture worsen the annual drought. However, interactions between climate drivers and other stressors – wildfire, pest and disease outbreaks, invasive species, and so on - will have important and potentially contrasting indirect effects on soils and the ecosystems that grow on them. The implications for ecosystem composition, structure, function, dynamics and sustainability are profound. I outline how interactions between global change, soils and disturbance are likely to affect terrestrial ecosystems in the MCRs, and what the implications of these effects may be for ecosystem management and ecological restoration. I finish with a summary of current restoration strategies and practices, and a consideration of how soil and vegetation responses to global change-related stressors and disturbances might require changes in the way we plan for and implement ecosystem management and restoration. MCR ecosystems and their soils will experience major changes over the next 50-100 years. Adherence to the basic tenets of ecosystem management and ecological restoration will provide the best chance of conserving these ecosystems and sustaining the services they provide.

Climate change impacts in South Africa: Vulnerabilities and implications for protected areas

SANParks Cape Research Centre, Tokai Road, Tokai, South Africa

The pole-ward/higher elevation range shift of North America's Edith's checkerspot butterfly created waves in 1999 as it became the first documented climate change impact on nature. Just two decades later, the number and variety of documented climate change impacts has become pervasive across biomes and ecological processes. The impacts of droughts, exacerbated by extended heat waves and/or shorter fire return intervals, as well as intense flood episodes and storm surges have had numerous impacts in South Africa. For the first time, protected areas are not necessarily the solution for biodiversity conservation. The static nature of protected areas, particularly those disconnected from other intact natural environments, creates multiple species and ecosystem level vulnerabilities. In addition, ecosystem and biodiversity degradation may reduce ecosystem service, tourism and income generation opportunities. Mediterranean ecosystems in particular, with frequent high rates of fragmentation and small protected areas, often necessitate species and site-level interventions, not always required in larger more contiguous landscapes with lower floral diversity. We explore the observed and predicted climate change impacts in South African protected areas, with a focus on identifying park-level vulnerabilities. Table Mountain National Park, a park within a city, provides a useful case study given its location, high floral and vertebrate diversity as well as its importance as a water source area and a tourist destination. We explore park-level vulnerabilities from multiple angles, including identifying particularly vulnerable species, risks to people and infrastructure, and assessment of the uniqueness of particular areas within the park. The latter analysis was enabled using micro-climate data in conjunction with various physical characteristics such as soil type, slope and aspect to identify unique bio-environments and their spatial replication or uniqueness across the park. We draw on this example to provide insights into the challenges facing Mediterranean protected areas in the coming years.

Extreme climate change impacts in arid Southern Africa: Richtersveld National Park

University of Hamburg

To understand the impact of climate change on biodiversity and ecosystem services, robust monitoring data are essential. This is especially true with regard to hyperarid regions at the margin of the Southern Namib Desert. The presentation reports on the results of 40 years of individual-based monitoring of 58 relevés of 100m² size, located within a diversity of vegetation types and climatic zones of the Northern Richtersveld. Eleven of the relevés were fenced off to exclude grazing/browsing of larger mammals. Data collection started in a drought phase in February 1980, caused by low rainfall in three preceding years. The following 35 years can be interpreted as a phase of recovery. Since 2015, five consecutive years with rainfall far below the average caused an extreme decline in species numbers and population sizes. Species numbers per 100m² dropped from more than 70 to less than 19 and in many cases even to zero. Monitoring shows extraordinary survival abilities of a few unexpected species of Aizoaceae (e.g. Drosanthemum inornatum, Eberlanzia ebracteata) and Crassulaceae (Cotyledon orbiculatum and several Crassula spp.). Most important in terms of ecosystem functions and services is the extreme decline of essential ecosystem engineers like Brownanthus pseudoschlichtianus. Their complete dieback in many landscapes will have severe cascading effects and cause large scale erosion. Based on these results it is possible to formulate recommendations for an adaptive management approach during times of extreme drought impact.

Thursday, 8 September 2022, 14:15

SYMPOSIUM 8 - Megan Jennings

Collaboration for conservation and climate adaptation action in southern California

Institute for Ecological Monitoring and Management, San Diego State University

Developing and implementing strategies for climate resilience and adaptation through landscape-scale planning requires interdisciplinary and cross-sectoral partnerships that bring together researchers, practitioners, and communities. To support adaptation and resilience to climate change for both ecosystems and local communities in southern California, researchers, managers, planners, non-governmental organizations, policy leaders, businesses, artists, and educators have come together in a collaborative partnership under the umbrella of a boundary-spanning organization, the Climate Science Alliance. The Climate Science Alliance builds bridges among these groups with the goal of safeguarding our communities and natural resources from the impacts of our changing climate. We do this by leading capacity-building activities and partnerships that increase awareness of climate change impacts, promote solutions, and facilitate action. The hallmark of the work the Alliance network does is a ‘climate-smart cycle’ we have developed to advance climate adaptation planning and implementation in the region. Using several case studies of our model in action, we will illustrate how the 'climate-smart cycle' relies on ongoing discussions among the partner network to identify high priority information needs which lead to co-production of research with practitioners to develop actionable science, cooperative development of feasible climate adaptation strategies, and dissemination of this information among the partner network as well as local communities. The power of this approach lies in our ability to cooperatively identify gaps in our understanding of climate impacts and work together to create and implement solutions. Through meaningful engagement and collaborative production of knowledge, science, and shovel-ready products, this diverse partner network is developing integrated approaches to reduce climate vulnerabilities and promote resilience within southern California’s diverse ecosystems and human communities.

Thursday, 8 September 2022, 14:15

SYMPOSIUM 8 - Gregor Schuurman

Adapting to climate change in the US National Park Service in a time of uncertain and unprecedented change

U.S. National Park Service, 1201 Oakridge Drive, Fort Collins CO 80525, USA

Managers and scientists widely acknowledge climate change as one of the greatest threats to protected areas and ecosystems, and the ecosystem services they provide. United States National Park Service (NPS) Director Jonathan Jarvis, for example, stated in 2010 that “climate change is fundamentally the greatest threat to the integrity of our national parks that we have ever experienced.” Climate change affects ecosystems both directly because it is a fundamental driver of ecological composition, structure, and function, and indirectly because it is a “threat multiplier” that amplifies other stressors. However, responding to this profound threat is challenging. First, climate change is inherently complex and frequently impossible to reduce to a single useful forecast. Second, as directional forces increasingly threaten to drive ecosystem structure, composition, and function outside historical ranges of variability in ways that are often irresistible, longstanding concepts of historical range of variability and naturalness seem less and less useful for decision making. How, in a time of uncertain and unprecedented change, can a manager best use limited conservation resources and pursue realistic resource-management goals? To help natural resource managers address this challenge, the NPS Climate Change Response Program and partners have developed two key adaptation tools: (1) a climate change-informed adaptive management approach that explicitly works with climate change uncertainty and (2) a Resist-Accept-Direct (RAD) framework to guide managers as they decide when, where, and how to resist, intentionally accept, and actively direct ecological change. This presentation will use case studies to illustrate how the NPS and partners are using these tools to help managers work with complex information and unprecedented challenges to adapt strategically to ongoing and projected climate change.

Thursday, 8 September 2022, 14:15

SYMPOSIUM 8 - Kyle Smith, Ian Russel & Jonathan Britton (SANParks)

Challenges managing temporary estuaries in South African national parks, from floods to fisheries

Marine Ecologist, Scientific Services, South African National Parks, Sedgefield, South Africa
Aquatic Scientist, Scientific Services, South African National Parks, Sedgefield, South Africa
Section Ranger, Garden Route National Park, South African National Parks.

Estuaries are complex and dynamic social-ecological systems challenged by escalating anthropogenic pressures including development, pollution, habitat degradation and climate change. Management of these systems frequently necessitates trade-offs between value domains of different stakeholders (individual and organisational). Two temporarily open/closed estuaries within the Garden Route National Park but falling within urban footprints are used to highlight the practical realities and complexity of conservation management under such situations. We describe how the short-term social gains of premature mouth breaching are being offset by potential longer term flooding risks and environmental degradation including changes in water chemistry, aquatic plant and water bird communities, loss of recruitment opportunities, invasion by alien biota and potential changes in human benefits. We argue that the system was caught within a social ecological trap decreasing system resilience and adaptability leading us to question whether management approaches would maintain or restore biodiversity and ecological functioning, in particular under predicted climate change scenarios. Steps taken to improve the situation have included i) an increase in communication and a change in the dialogue between stakeholders, ii) re-introduction of park management forums, iii) proactive and early mouth opening preparation and the iv) incorporation of real time catchment rainfall data into mouth breaching decisions. To further secure benefits for both people and nature within these systems, and achieve positive long term social and ecological outcomes under climate change influence requires multidisciplinary research directed at increasing adaptive capacity and resilience of estuarine social-ecological systems.

Thursday, 8 September 2022, 14:15

PRINTED POSTER SESSION 2 - Leonor Calvo et al.

Functional plant traits response to different burn severity after large wildfires in fire-prone ecosystems in Northwest Spain

Area of Ecology. Faculty of Biological and Environmental Sciences. University of León, 24071 León. Spain.

Forest fires are a major hazard throughout Europe, producing significant impacts in our ecosystems. In recent decades, wildfire occurrence in fire-prone ecosystems in the Mediterranean Basin has increased because of changes in land use, increased fuel load and continuity in the landscape. Moreover, these socio-ecological changes are related to increased burn severity and the surface affected. These large wildfires usually result in highly heterogenous spatial mosaics with different degrees of severity that clearly influence vegetation regeneration capacity. However, fire regime characteristics not only affect vegetation regeneration after wildfire but also their biological traits. Many authors recognise the advantage of resprouter species under extreme conditions of fire regime parameters.
To determine how burn severity affects the behaviour of resprouter versus seeder species, we selected a large wildfire (98.8 km2) that occurred in the northwest of the Iberian Peninsula in 2017. The fire affected mainly shrublands (65% of the surface burned) dominated by Erica australis L., Genista hystrix and Citysus scoparius. Other wooded communities affected were natural oak forest (15%) dominated by Quercus pyrenaica Willd. In the study area, a burn severity map of three levels (low, moderate and high) was obtained from a classification (threshold) of a Sentinel-based difference Normalized Burn Ratio image. In each plant community and severity scenario, a total of 5 2 m x 2 m plots were established. In each plot, we sampled the visual cover percentage of all plant taxa in 4 of 1 m2 subplots one year after the wildfire. The results showed that, in high severity scenarios, E. australis shrublands and Q. pyrenaica oak forests underwent greater regeneration of resprouter species. However, obligate seeders and facultative species recovered better than resprouters in G. hystrix and C. scoparius shrubland communities.

Differences between prokaryotic communities from two salty lagoons located in Villafáfila (Spain)

Departamento de Biodiversidad y Gestión Ambiental, Universidad de León.

There are numerous wetlands in the Mediterranean area that experience seasonal variations in their water levels. They are highly sensitive to climate change. A good example is the Villafáfila lagoons, located on the Spanish northern plateau. These lagoons are of particular ecological interest as they are the habitat of endangered waterfowl, and thus, they are especially protected (included in the Ramsar Convention). Due to their strategic location, the Villafáfila wetlands are a resting point for many birds that make their annual migrations between Africa and Europe. These lagoons are also unique as they are saline. The salinity of these lagoons is attributed to the fact that the upwellings that feed them pass through ancient saline deposits. Also, the amount of salt varies between lagoons. Thus, both salinity and seasonality are at play in this habitat. Here, we have studied differences between prokaryotic communities from sediment samples of two lagoons: Grande, with greater salinity in both water and sediment; and Barillos, less saline. Using a metagenomic approach, we obtained the V3-V4 region sequences of the prokaryotic ribosomal RNA, and used them to study differences between communities in these lagoons. Apart from salinity, seasonality was also a differentiating factor, as sampling was carried out in two times: in spring with the maximum level of water, and autumn, when the lagoons have practically dried up. According to indices of taxonomic distance between communities, the greatest differences occurred between communities of the two lagoons. However, when phylogenetic indices were used, which consider the distance between taxa in a phylogenetic tree, the greatest differences were found between the wet and dry seasons.

Wild fire effects of bacterial communities in Quercus forest and their recovery capacity two years after. A high-throughput sequencing approach

Departamento de Biología Molecular, Universidad de León.
Departamento de Biodiversidad y Gestión Ambiental, Universidad de León.

Climate change and the abandonment of traditional forest uses are behind the proliferation of wildfires, in both frequency and intensity, in the Mediterranean area. The now more common heat weaves, together with the amount of fuel that the underbrush accumulates, favors them. Studies have shown that the recurrence of wildfires and their high severity reduce the natural capacity of forest to recover. However, very little is known about soil bacteria's resilience in these Mediterranean ecosystems. Here, we analyzed changes in diversity and composition of the soil bacterial communities in a Quercus pyrenaica forest in a northwestern region of Spain. The area is at the northwestern limit of the Mediterranean climate in the Iberian Peninsula. Samples from high and low severity burnt soils were taken two months after a major fire that had occurred in 2017, and compared to a nearby unburnt control. In addition, to monitor the recovery of bacterial communities, new samples were collected two years later from the same areas. The composition of bacterial communities was examined using NGS techniques. Fragments that include the variable regions V3 and V4 of RNA ribosomal 16S genes were sequenced. Results showed that wildfire causes a decrease in diversity in the short term, especially when the severity of the fire is high. Bacteria from a few taxonomic groups become more dominant, while other groups greatly decrease in frequency. Long-term recovery, however, varied. If the severity of the fire was low, the communities had recovered two years later. If the severity is high, there is variation in the response. Thus, while some samples suggest that diversity has recovered, others continue to show the effect of fire. Also, some taxonomic groups had returned to control levels, while others had not.

Resilience of enzymatic activities after large wildfires in fire prone-ecosystems in Northwest Spain

Area of Ecology. Faculty of Biological and Environmental Sciences. University of León, 24071 León, Sapin.

Forest fires are one of the main factors that alter and degrade Mediterranean ecosystems in the Iberian Peninsula. Recent increases in fire frequency, extension and severity are modifying soil characteristics, especially its enzymatic activity. Soil enzymes have mainly animal, plant and microbial sources and are good indicators of soil fertility. The amount and type of vegetation influence the microbial community of soil and the processes it develops. Therefore, the alterations caused by fire in plant community may affect the enzymatic activity of soil. The loss of vegetation and microbial biomass induced by fire changes the organic matter content of soil, with a negative effect on enzyme activities.

The effect of burn severity level on soil enzyme activity resilience was studied in the Northwest Iberian Peninsula wildfire that occurred in 2017 and affected around 10,000 ha. This wildfire affected mainly Quercus pyrenaica Willd. oak forests and shrublands communities dominated by Erica australis L., Genista hystrix Lange and Citysus scoparius L. One year after the wildfire, field plots were proportionally fixed to the burned surface of these ecosystems and to the severity categories previously established by the dNBR (difference Normalized Burn Ratio) index. We took two soil composite samples in each plot. β-glucosidase, urease and acid phosphatase enzymatic activities were analysed. Then, we calculated the resilience index (Banning and Murphy, 2008) of these properties for each ecosystem and burn severity level.

Results showed that, in general, burn severity had a negative effect on soil enzymatic activities resilience. The enzyme activities with a lower resilience one year after the wildfire were β-glucosidase and acid phosphatase. Urease resilience index was positive in low severity Q. pyrenaica, G hystrix and C. scoparius communities.

Land Tender: A collaborative, cloud-based decision support platform for resource management and wildfire mitigation

Vibrant Planet, Incline Village, Nevada; and Department of Environmental Science and Policy, University of California, Davis, California, USA

Interactions between climate warming and human impacts to landscapes and ecological processes are leading to increasing scales and velocities of ecosystem degradation. The scale and complexity of the problem are a challenge to rapid, concerted management response. Key components of responding to complex, multijurisdictional management problems include (1) efficiently incorporating stakeholder input; (2) generating data and analytics that can be understood and manipulated by users; and (3) prioritizing potential investments and actions. Land TenderTM (LT) is a cloud based, visual scenario-building and decision support application built to resolve these and other resource management issues at local, statewide, or national scales. LT incorporates high-resolution data, disturbance simulations, and optimization routines to develop a comprehensive atlas of management scenarios for a given planning unit. A key step is the calculation of the “restorative return on investment”, the sum of treatment-driven avoided costs and direct treatment benefits. Climate change effects are incorporated via changes to fire and drought occurrence and intensity, and by modifying ecosystem site potentials. The optimization function schedules treatments based on user-generated prioritizations of a set of “resilience” categories linked to strategic assets, resources and areas, including water, biodiversity, carbon, economic outputs, forest resilience, and fire safety. Stakeholder participation occurs throughout the workflow, and users can readily visualize scenario treatment tradeoffs, treatment prioritizations, and treatment sequencing. LT outputs include spatial and tabular comparisons of final management alternatives – including projected costs and relative benefits of each alternative across the resilience categories – that can be exported to environmental assessments that precede implementation.

Plant biogeography, ecology and conservation of the Mediterranean biodiversity hotspot in Andalusia (Spain)

Department of Plant Biology and Ecology, University of Seville, Spain

The Mediterranean Basin is considered one of the major biodiversity hotspots in the world. Part of its high diversity is due to a high species turnover across many sub-hot spots and thus regional and local endemism. One of the outstanding regional hotspots is the Baetic-Rifian region in S Spain and NW Africa, harboring about 4500 vascular plant species, although separated by the Strait of Gibraltar in two main ranges. Here we show some data accounting for plant biodiversity within the northern side of the hot-spot, Andalusia. We first show how the floristic and phylogenetic diversity is distributed in the region, including endemism. Then, we focus on the three national parks (Doñana, Sierra de las Nieves, Sierra Nevada) in this region to determine how much diversity is harbored there and warranted of conservation. Finally, we determine components of biodiversity of the threatened flora of Andalusia, in terms of functional and phylogenetic diversity.

Funded by grants PAIDI H2020 P18-RT-3651 BIOVEGAN and FEDER US-1265280 EVOFLORAND

The effect of phosphite treatment against Phytophthora cinnamomi on Leucadendron argenteum (L.) R.Br.

South African National Biodiversity Institute (SANBI), Kirstenbosch National Botanical Gardens, Rhodes Dr, Newlands, Cape Town, 7735

Phytophthora cinnamomi is recognised as a damaging and important invasive plant pathogen, with over 5000 susceptible host species recorded globally. Previous studies in South Africa have identified P. cinnamomi as the cause of Protea root rot. In recent years, high rates of mortality of silver trees (Leucadendron argenteum) have been observed in Kirstenbosch National Botanical Gardens (KNBG), with P. cinnamomi readily isolated from roots and collar lesions of dying trees. A systemic fungicide, phosphite (Phi) or phosphorous acid (HP03-) is the main form of chemical control against Phytophthora diseases. The current study aims to determine the efficacy of phosphite applications in controlling P. cinnamomi infection in silver trees. Field and glasshouse treatment trails will be established to determine the optimum phosphite application rates and treatment regimes to confer protection against P. cinnamomi in cultivated silver trees. Two hundred silver trees of at least 50mm diameter were identified at KNBG, half were trunk injected with two rates of Phi and the other half were left as untreated controls. Seedlings planted into beds known to be infested with P. cinnamomi were treated applying a randomised block approach, with an equal number of treated versus untreated seedlings. All treated and control plants will be monitored to quantify the effect of phosphite on silver tree growth and survival. Another group of seedlings will be grown in a glasshouse to conduct phosphite treatment trials under controlled conditions. This is the first time phosphite treatment has been used on indigenous South African flora. Silver trees are currently classified as rare and endangered, it is therefore essential that practical management options be developed to reduce the rate of die-back and mortality caused by P. cinnamomi. It is anticipated that the data generated from this study can be used to support restoration projects for this iconic tree species.

Germination requirements of Cotula duckittiae: a vulnerable spring-annual from the winter-rainfall region of South Africa

RC Oliver, Kirstenbosch National Botanical Garden & Cape Peninsula University of Technology.
CP Laubscher, Cape Peninsula University of Technology

From late winter to early spring, parts of winter-rainfall region of South Africa's Western Cape explode into a kaleidoscope of colours. This species, with its limited distribution in the wild, also contribute to this colourful floral extravaganza. Light and temperature are critical abiotic factors influencing the germination of seed.
The wild-collected seed of Cotula duckittiae, vulnerable red-data list, presented germination challenges before its introduction as bedding plant at the Kirstenbosch National Botanical Garden.
The purpose of this laboratory study was to evaluate the influence of temperature, light and dark conditions on the breaking of seed dormancy. Achenes were subjected to constant and alternate temperatures at 7 °C, 12 °C, 17 °C, 22 °C, 27 °C, 12 °C/22 °C and 17 °C/27 °C in conditions of continuous light, darkness and equal alternate (12 hour cycles) of light and darkness. Results indicated that germination ≥ 60% within temperature range 7° C – 17° C and alternating temperature of 12° C/ 22° C. Optimum germination was recorded at 22° C in the dark. This study provided germination considerations for species-restoration, the use as bedding plants in parks or botanical gardens or commercial enterprises

Migration of Pleistocene shorelines across the Palaeo-Agulhas Plain: evidence from dated sub-bottom profiles and archaeological shellfish assemblages

Geophysics and Remote Sensing Unit, Council for Geoscience, PO Box 572, Bellville, 7535, South Africa

Intertidal zones on shorelines are geologically complex features of the coastal plain, shaped by heterogeneous substrate lithologies. Palaeocoastlines have been heavily modified by sea-level change, ocean currents, wind, waves and swell. Rocks and sediments along intertidal zones create rich habitats for biogenic forms including shellfish, which are highly sensitive to subtle variations in underlying lithology. Here, we assess Pleistocene shoreline migrations on the south coast of South Africa in relation to fluctuating sea-levels and changes in sediment supply. The study area extends from Still Bay to Mossel Bay, South Africa, with a particular focus on Pinnacle Point. Our goal is to better understand the changes to the intertidal zone along these palaeocoastlines and how this may have affected marine resources available to early humans. We interpret marine geological records at select time slices along sub-bottom profiled transects that run perpendicular to the coast. We describe the character of specific shorelines to establish expectations of coastline character which we then compare to archaeological records at Pinnacle Point. We base our interpretations on (1) significant events in Pleistocene glacio-eustatic and depositional records, such as widespread deposition of coastal sand dunes at ~90, ~74 and ~50 ka [MIS 5e–MIS 4], and (2) empirical evidence from high-resolution records of shellfish assemblages at the archaeological sites of PP13B and PP5-6. We demonstrate a prevalence of dissipative beaches and mixed coasts on Pleistocene sea-level lowstands on the coast of the Palaeo-Agulhas Plain. This differs significantly from the modern coastline with its significance of rocky shorelines.

Thursday, 8 September 2022, 14:15

PRINTED POSTER SESSION 2 - Lihle Mfeketho and Sisekosethu Ndabeni

The role of fire in fynbos biome : An Eastern Cape perspective

Eastern Cape Umbrella Fire Protection Association , 441 Spring Road , Stutterheim, 4930

Fires can be beneficial or detrimental in the fynbos environment depending on the fire frequency, intensity, season of burn and the size of the fire. The fynbos biome is known to be a fire adaptive, meaning it needs fire at fixed intervals to ensure its survival. These fires may be prescribed to achieve certain management goals or occur naturally. Too frequent fires (unwanted fires) coupled with intensive land use poses a threat to the survival of the fynbos biome. It is therefore essential to constantly find ways conserve and maintain the remaining fynbos species through education and altering legislation surrounding this biome to ensure we know how to use fire to maintain the biodiversity. In this poster we look at the role of fire and fire management in the Amatole District and how it affects fynbos.

Integrating alien invasive plants and veldfire management within the Agulhas plain

Greater Overberg Fire Protection Association - Longstreet, Fire station, Bredasdorp 7280

Two of the most significant threats to lives and livelihoods are wildfires and alien invasive plants. These two have however been traditionally managed independently of each other. Valuable services that impact lives and livelihoods are usually provided through naturally functioning ecosystems. These ecosystems are impacted by the frequency and severity of fire that has increased over the past decade due to land-use changes around the world. There are three reasons why wildfires and alien invasive plants should be managed together: alien invasive plants increase available fuel and thus change fire behavior and regimes, fires can promote plant invasion, and lastly, fire can be used as a tool to control plant invasion. Wildfires and alien invasive plants work as a chain reaction and therefore need to be managed together.

Potential germplasm for legume forage domestication from the Mediterranean Fynbos biome of South Africa

Department of Biological Sciences, University of Cape Town, Rondebosch, South Africa

Fabaceae plants contribute greatly to a high quality of pasture in rangelands due to high levels of protein in their tissue. Despite this established importance, only a about 18 of the over 760 Fabaceae species in the Fynbos biome have information published on chemical composition, utilisation or cultivation. We assessed chemical and fibre composition of grazeable renosterveld vegetation in the Overberg region to test the hypothesis that Fabaceae has chemically superior palatable species relative to Poaceae, Asteraceae and Asparagaceae species. Plant samples were collected from 11 sites across the Overberg region and analysed for macro- and micro-elements, fibre and secondary compounds. At each site, replicated soil samples were also collected and analysed for pH, macro- and micro-elements. Individual species differences within each family existed with species of Aspalathus angustifolia, A. hispida, A. nigra, A. submissa and Asparagus capensis showing the greatest levels of crude protein relative to other Fabaceae and non-Fabaceae species. The total fibre fraction of the forages measured by NDF and ADF showed that Poacea was the most fibrous relative to Fabaceae and Asteraceae. Total polyphenolics and condensed tannins were low in all species irrespective of plant family. With few exceptions, all species contained adequate levels of most macronutrients including K, Ca, Mg and Na that met the minimum requirements for sheep production. There was positive and significant correlation between soil and leaf nutrients in the area, supporting the view that plant nutrients reflect soil chemistry. With high levels of crude protein and digestibility and medium to low levels of neutral detergent fibre, the Fabaceae species A. hispida, A. angustifolia, A. nigra and A. submissa were regarded as superior forage species in the Mediterranean renosterveld, therefore recommended for further evaluation as potential fodder crops.

Growth and physiological responses of rooibos (Aspalathus linearis (Burm.f.) R. Dahlgren) to heat and drought stress

Department of Biological Sciences, University of Cape Town, Private Bag X3, Rondebosch, 7701, South Africa

Climate change has in recent decades impacted ecosystems negatively, with Mediterranean systems being particularly vulnerable. The changes in rainfall patterns and amounts, along with the increases in surface temperatures is affecting the growth and physiology of plants and agricultural productivity globally. Aspalathus linearis (Burm.f.) R. Dahlgren (rooibos) is an important agricultural crop producedin the Cederberg region, South Africa. This region experiences a Mediterranean-type ecosystem, characterised by hot, dry summers and cool, wet winters. Rooibos, occurring naturally here, is very deep rooted and yet not much work has looked at its root response to drought nor how the effects of increasing temperatures affect the plants' production. The objective of this work was to determine physiological and morphological responses of rooibos grown under different water regimes (glasshouse study) and assess the effects of temperature on growth and stress tolerant traits in the field. Plants grown under low moisture then droughted, had higher root/shoot ratios and thinner roots, both of which are drought tolerant mechanisms effective for water and nutrient uptake. These plants recorded lower Pmax, gs and E after three days of drought and 50% lower biomass. Plants grown with adequate water were affected after five days of drought and had higher biomass. Rooibos had a combination of acclimatized adaptive changes such as transpirational leaf cooling, low chlorophyll, and high phenolic content during summer in the field, thereby mitigating the effects of elevated temperatures. Low rainfall and the occurrence of dry spells and drought, associated with climate change are likely to reduce the production of rooibos in the Cederberg region. In addition, the increasing mean temperatures and subsequent stress on the plants, suggests that a shift in rooibos farming further south, to areas that are cooler and wetter, would produce better growth and yield in rooibos tea without compromising the quality.

Hydraulic safety margins in mountain fynbos communities: how close are they to the edge?

1 SAEON Fynbos Node, Cape Town, South Africa

Embolism in the plant xylem transport network represents a disruptive process that leads to loss of function and damage in downstream tissues. Plant susceptibility to loss of function can be assessed at any time point by coupling knowledge of static xylem physical tolerance limits with dynamic xylem pressure potential. Here, we examine the embolism avoidance hypothesis in mountain fynbos, testing the central claim that these plants tend to avoid any loss in hydraulic conductivity under normal conditions and only exceed critical water potentials in response to severe water stress. To do so, we quantified the water potential difference between the minimum seasonal water potential (Pmin) and the water potential associated with 50% loss of hydraulic conductivity (P50), typically referred to as the hydraulic safety margin (HSMP50). Xylem susceptibility to embolism (P50) was quantified using the optical technique. Pmin was assessed using water potential data from two sites over two rainfall years. Our results show that only one out of seventeen species (Diosma hirsutus) surpassed the P50 threshold in the drier year, and that only two species (D. hirsutus and Paranomus bracteolaris) displayed any embolism at all at the drier study site. Both species had more negative safety margins in the drier conditions than in the previous sampling year. There was also convergence in HSM among restioid, ericoid and proteoid functional types (FT), despite varying physical tolerance limits in these FT. The majority of species (> 80%) maintained HSM greater than 1 MPa, which differs from reports that globally 70% of all angiosperm species operate at narrow (< 1 MPa) safety margins. We propose that the evergreen, sclerophyllous mountain fynbos vegetation may have evolved conservative safety margins in response to nutrient impoverishment of the underlying substrate, in order to maintain leaf function for multiple years.

Thursday, 8 September 2022, 16:35

THEMATIC SESSION - Adam West, Rob Skelton and Todd Dawson

Sap flow versus snapshot? Revealing the intricacies of mountain fynbos responses to seasonal drought

Department of Biological Sciences, University of Cape Town, South Africa
SAEON Fynbos Node, Cape Town, South Africa
Department of Integrative Biology, University of California, Berkeley, USA

Understanding the potential impacts of climate change on the megadiverse Cape Floristic Region (CFR) requires a thorough understanding of plant physiological responses to the environment, particularly to that of drought. Most prior studies examining physiological responses of fynbos species have consisted of campaign-based measurements, capturing snapshots in time of plant water relations and photosynthesis. The objective of this study was to quantify continuous in situ physiological responses, within mountain fynbos, to thoroughly interrogate patterns of plant response to summer drought conditions identified by previous snapshot campaigns. Using miniature continuous sap flow technology, in combination with long-term observations of water potential, gas exchange and assessments of xylem vulnerability to embolism, we tracked in situ physiological changes in three sample species, representing the three dominant growth forms in the fynbos (proteoid, ericoid, restioid), over two years. Our continuous measurements allowed us to examine, in unprecedented detail, the diurnal and seasonal responses of each species, enabling us to test the accuracy and generality of the snapshot campaign measurements previously captured in the region. Our results revealed considerable variation in the timing and extent of dehydration-induced declines in productivity between the species. However, considerable variation in xylem vulnerability to embolism resulted in convergence in long-term water transport function. Importantly, continuous sap flow measurements revealed hitherto unseen patterns in water-use, highlighting the importance of the summer drought period in structuring these communities.

Widespread synchronous decline in a Mediterranean forest driven by accelerated aridity

Laboratorio de Ecología del Paisaje y Conservación, Departamento de Ciencias Forestales, Universidad de La Frontera; Temuco, Chile.

Widespread ecosystem collapse in direct response to climate change is a critical phenomenon that is poorly documented. We investigated climatic trends and associated forest photosynthetic productivity through 2000–2021 across 440,000 Mediterranean forest stands worldwide to detect change signals. For most Mediterranean ecosystems, regional response was negligible. However, in central Chile, there was an abrupt, synchronous decline in >90% of the forests across ~500 km latitudinal range in response to a hyper-drought year (2019) following a decade-long mega-drought, the driest decade in the last century for any Mediterranean ecosystem. These extreme conditions were projected by climatic models to occur in 2070-2090. A strong change in community assemblage is expected, since the species adapted to mesic conditions were the more affected. Our results indicate that climate change impacts are accelerating and offers a spyglass to future scenarios for ecosystems facing chronic water deficit.

THEMATIC SESSION

MTEs as socio-ecological systems

Thursday, 8 September 2022, 16:35

THEMATIC SESSION - Ancois C. de Villiers et al.

Manifesting inspired landscapes: A case study of supporting landscape-based wellbeing in South Africa

Department of Conservation Ecology and Entomology, Stellenbosch University

Landscape-based restoration initiatives have become a popular and useful approach to transforming social-ecological systems into more resilient and sustainable states. However, the lasting and effective impact of these efforts is potentially undermined by a predominant emphasis on technical interventions and biophysical attributes of "success", which overlook the influence and value of psycho-social dimensions. Conceptual frameworks exist to frame both ecological and social features and dynamics of landscapes, but the implementation of these frameworks is still vague, particularly for the complex, contested, and uncertain nature of South African landscapes. Therefore, the study explored this gap with the question of: How can partnerships of practitioners and community members implementing landscape-based initiatives nurture, track and evaluate social capital, inspiration (including values and motivation), and learning to guide a collaborative transformative process within a complex uncertain, and contested context? This study used an in-depth case study in the Baviaanskloof and Langkloof, Eastern Cape, based on the experiences of Living Lands, an NPC facilitating collaborations for landscape rehabilitation using their partner Commonland's 4Returns impact framework. A participatory action research approach was applied with methods including: i) iterative literature reviews; ii) interviews and group discussions with researchers and practitioners involved in landscape-based transformations; and iii) workshops, interviews, and participant observations with the case study practitioners and landscape communities. Data analysis included thematic coding of transcripts, notes, and documents. The presentation will share initial reflections and findings on how the case study implemented a dynamic integral approach to frame and measure social, economic and ecological impact. Furthermore, the implications of using such a framework will be discussed. Namely, the alignments and misalignments among stakeholders on what is meant with landscape transformation, whose transformation, for what reasons, and who gets to decide.

Thursday, 8 September 2022, 16:35

THEMATIC SESSION - David C Le Maitre

Wildfires in the fynbos. Will we ever be prepared?

Conservation Ecology and Entomology, Agrisciences, Stellenbosch University

In June 2017, the town of Knysna experienced the most destructive wildfire on record. More than 900 homes were damaged or destroyed, 7 lives were lost, and the economic losses amounted to at least R3 billion. The impacts of this fire, and other major fires since then, have been limited time and time again by the extraordinary efforts of firefighters and citizens which have saved lives, houses and other assets. We know that fires are natural and inevitable in fynbos, yet many communities have done little, or have even actively resisted, interventions aimed at helping them to protect themselves. This presentation focuses on the importance of being prepared for fires and the measures that everyone needs to take and support to reduce the risks posed by wildfires. There are three areas where preparedness is needed if we are to reduce the likelihood of even worse losses as climate change increases the numbers of dry and hot days (i.e. high and extreme fire danger days). Rural landscapes where planned burning of the fynbos, in conjunction with clearing of alien plant invasions, is aimed at maintaining biodiversity and managing fuel loads. The Wildland-Urban Interface (WUI) where the aim is to minimise fuel loads and, thus, fire risks using fire and the clearing of invasive alien plants. Last, but not least, the protection of dwellings, other buildings and vulnerable infrastructure in the WUI by maintaining a safe space and taking measures to fire-proof these structures. While these measures will reduce the fire hazard other measures are needed to address exposure and vulnerability. Communities exposed to wildfires must develop FireWise plans setting out how they will respond to fires, including identifying safe areas for evacuation. We are still a long way from learning the lessons that these wildfires are driving home.

Thursday, 8 September 2022, 16:35

THEMATIC SESSION - Conceição Colaço* Vanda Acácio and Catarina Sequeira

Smart solutions for fuel management in Portugal

Centre for Applied Ecology "Prof. Baeta Neves" (CEABN-InBIO) , School of Agriculture, University of Lisbon, Portugal

In June 2017, the town of Knysna experienced the most destructive wildfire on record. More than 900 homes were damaged or destroyed, 7 lives were lost, and the economic losses amounted to at least R3 billion. The impacts of this fire, and other major fires since then, have been limited time and time again by the extraordinary efforts of firefighters and citizens which have saved lives, houses and other assets. We know that fires are natural and inevitable in fynbos, yet many communities have done little, or have even actively resisted, interventions aimed at helping them to protect themselves. This presentation focuses on the importance of being prepared for fires and the measures that everyone needs to take and support to reduce the risks posed by wildfires. There are three areas where preparedness is needed if we are to reduce the likelihood of even worse losses as climate change increases the numbers of dry and hot days (i.e. high and extreme fire danger days). Rural landscapes where planned burning of the fynbos, in conjunction with clearing of alien plant invasions, is aimed at maintaining biodiversity and managing fuel loads. The Wildland-Urban Interface (WUI) where the aim is to minimise fuel loads and, thus, fire risks using fire and the clearing of invasive alien plants. Last, but not least, the protection of dwellings, other buildings and vulnerable infrastructure in the WUI by maintaining a safe space and taking measures to fire-proof these structures. While these measures will reduce the fire hazard other measures are needed to address exposure and vulnerability. Communities exposed to wildfires must develop FireWise plans setting out how they will respond to fires, including identifying safe areas for evacuation. We are still a long way from learning the lessons that these wildfires are driving home.

Thursday, 8 September 2022, 16:35

THEMATIC SESSION - Mengyi Zhang

Integrating Indigenous Edible Plants Into Local Food Agricultural Value Chain: the Challenges and Opportunities in the Cape Town Area

University of Cologne, Institute of Geography, Albertus Magnus Platz, 50923 Cologne, Germany

The study is a case study on the value chain of selected Cape Floristic Region (CFR) indigenous edible plants in the Cape Town area, supported by the forum for Plant Biology and the Politics of Nutrition (BiPoN).

With the emergence of agro-industrial food systems, introduced plants have replaced many local species, which has led to the loss of biodiversity (Cámara-Leret et al., 2019) and left the food system vulnerable to climate changes (Perrings & Halkos, 2015). Cultivating indigenous edible plants offers an opportunity to build more resilient agricultural systems and a potential pathway to a more diverse local food diet while conserving native biodiversity.

This study was carried out in the Cape Town region, aiming to map out the value chain of selected CFR indigenous edible plant production, analyze the challenges and opportunities, and evaluate the potential for commercialization. Preliminary results from field research indicate that ecological benefits are valued by growers, while economic benefits are not significant at the current small production scale. One of the main challenges for commercialization is the lack of linkages between producers and customers, however, due to the administrative costs involved and limited funding, the question of who should take on the intermediary role remains. For producers, most of the constraints come from limited market demand (low familiarity with tastes, small share of use, etc.) and some from the production side (general smallholder issues in the townships, including soil, water, land, infrastructure and security, and limited knowledge on cultivation methods, etc.). Government financial support is missing as CFR edible plants are undervalued on their potential contributions to the local social-ecological system. This research is particularly useful in guiding relevant market development interventions and raising awareness of the ecological and economic value of CFR edible plants, contributing to the development of a more resilient agri-food system.

THEMATIC SESSION

Restoration of Mediterranean shrublands and rivers

Thursday, 8 September 2022, 16:35

THEMATIC SESSION - Caroline Gelderblom and Kirsten Watson

Securing water source areas through collaborative governance platforms

WWF South Africa and the Department of Environmental Affairs and Development Planning

The fynbos covered catchments of the Western and Eastern Cape comprise some of South Africa's most important water source areas supporting the region's economy and people. In recognition of their importance government, the private sector and civil society are coming together to develop innovative mechanisms to secure them. This presentation will explore the establishment of collaborative cross sectoral governance platforms at local, regional and national scales and some of the associated challenges and opportunities. We will also discuss mechanisms that are being developed to secure water source areas through the investment into ecological infrastructure, strategic support within institutions to leverage impact and approaches to enhance efficacy of implementation.

Impact of the gall-forming rust fungus Uromycladium morrisii on the invasive tree Acacia saligna in South Africa: 30 years of monitoring.

ARC-Plant Health and Protection, P. Bag X5017, Stellenbosch, 7599, South Africa.

First introduced into South Africa in 1987, for the biological control of Acacia saligna, the gall-forming rust fungus Uromycladium morrisii rapidly spread though the range of its host tree in South Africa. In 1991 a total of ten permanent monitoring sites were set up, each consisting of four transects approximately 10 m apart. Although various sites were destroyed as time went by, by 2020 three of these sites were still being monitored and provide 30 years of continuous data on tree numbers and size, and gall numbers, in these populations. Fires that have occurred during these years produced high levels of post-fire recruitment. However, between fires the general trend has been of reduced tree densities. Two of these sites, with high initial tree density, had their densities reduced by 98 and 96% by the end of monitoring. The other site, with a low initial tree density, had a reduction of only 28% by the end of monitoring. However, this site experienced a fire in 1994 after which its tree density was approximately double the initial density, and the tree density had declined after the fire by 59% by the end of the monitoring. Once considered to be potentially the most damaging invasive plant in the Cape Floristic Region, this biological control programme has successfully reduced the impact of this tree.

Invasive alien plants on the Outeniquas … a never-ending battle

Western Cape Nature Conservation Board (CapeNature), Private Bag X658, Oudtshoorn, 6620, South Africa

The Outeniqua World Heritage Site is located in the Outeniqua Mountain Range of the Garden Route area of the Western Cape. This protected area of 58 190 ha which falls within one of South Africa's Strategic Water Source Areas, has a very rich fynbos flora, comprising approximately 1200 species of which at least 110 are recorded as being of conservation concern. In addition, there are also several animal species of conservation concern that have been spotted in the area. In the management plan that is currently being drafted for the protected area a number of key threats have been identified, such as inappropriate fire regimes, invasive alien plant infestations, over-abstraction of surface and ground water, habitat fragmentation and extreme weather conditions leading to droughts, storms and flooding.

The historical establishment of pine plantations for the production of timber adjacent to protected areas along the Garden Route has had a major impact on the management of these areas, especially since both pines and fybos are fire-prone. Other invasive alien plant species have also become problematic (e.g. Silky Hakea, Australian Blackwattle, Stinkbean, Blackwood, etc.) and all of them also thrive on fires. In recent years the protected area has had several very large fires, which have exacerbated the recruitment and spread of these invasive alien plant species. Furthermore, there have been constraints on the deployment of contractor teams due to COVID-19 restrictions and budget cuts and, on top of that, the Garden Route experienced severe flooding events at the end of 2021, which have resulted in road infrastructure being washed away in many places. In order to achieve the goals stipulated in the management plan several strategies have been highlighted, the most important of which is the establishment and strengthening of partnerships with various institutions and stakeholder groups.

Friday, 9 September 2022, 08:00

KEYNOTE - Kerstin Braun

Climatic stability recorded in speleothem stable isotopes affects diversity of Mediterranean climate regions

Institute of Human Origins, School of Human Evolution and Social Change, Arizona State University, Tempe, Az 85287, USA

The geography and genesis of diversity remain an enduring topic in ecology and evolution. Mediterranean Climate Ecosystems (MCEs), with their high plant diversities in winter rainfall climates, pose a challenge to popular hypotheses evoking high water-availability and temperature as necessary prerequisites for the evolution of high diversity. The world's highest extratropical plant diversity and endemism are found in South Africa's Cape Floristic Region (CFR) and have been attributed to greater Pleistocene biome stability compared to other MCEs (Cowling et al., 2015; Linder, 2008). In this study we test the hypothesis of environmental stability as a fundamental driver for the evolution of regional-scale floristic diversity using speleothems oxygen ($\delta^{18}O$) and carbon ($\delta^{13}C$) isotopic values as proxies for past climatic variability in the CFR and other MCEs.

We present a new ~420 ka-long record of speleothem oxygen and carbon stable isotopic compositions from Robertson in the western CFR. The dispersion of these stable isotope records is used as a measure for climatic variability. We compare our new record to speleothem records that cover full glacial and interglacial conditions and are located in other MCEs (California and the Mediterranean Basin) as well as in eastern regions of the CFR. All sites used in this comparison have lower vascular plant biodiversity than the western CFR.

Analyses of the dispersion of the $\delta^{18}O$ and $\delta^{13}C$ data sets show that the highly diverse western CFR experienced extraordinary climatic stability across several glacial-interglacial cycles, compared with the less diverse regions within and outside of the CFR. This result provides compelling support for the hypothesis that lower extinction rates associated with Pleistocene biome stability underpins hyper-diversity in MCE regions.

Friday, 9 September 2022, 08:50

SYMPOSIUM 9 - Curtis Marean

Past and future paleoecological research on the submerged South African Plains

Arizona State University

The last decade has seen a remarkable increase in knowledge of the terrestrial phases of the now submerged Agulhas Bank. A coordinated transdisciplinary empirical and modeling effort began in 2010 and resulted in a journal special issue (Quaternary Science Reviews, 2020) as well as many continuing publications focused on the palaeoecology of this Palaeo-Agulhas Plain (PAP). This success leads to the need for assessment of 1) goals that were achieved, 2) goals that were not achieved, 3) lessons for transdisciplinary success, and 4) plans for the future. We succeeded at 1) developing robust maps of the changing coastline, geology, and soils and their nutrient status, 2) developing records for long time spans of climate, environment, paleontology, and archaeology on the northern fringe of the PAP, 3) modeling the Last Glacial Maximum climate at high resolution, 4) modeling vegetation during the Last Glacial Maximum, 4) developing empirical knowledge of the return rates for many resources that would have been important to humans, and 5) integrating those return rates into an Agent Based Model that allows modeling of human behavior. Modeling climate at multiple climate states and coupling that output to our vegetation model was not achieved so remains a future goal. Our transdisciplinary success rested on regular workshops and facetime, learning to talk effectively across disciplines, marshalling international resources, a full commitment and a sense of 'ownership' of all project members, and effective leadership structure. A new goal is to subject the Palaeo-Benguela Plain to similar treatment due to its likely significance for the modern Cape Floral Region and human evolution.

Friday, 9 September 2022, 08:50

SYMPOSIUM 9 - Hayley Cawthra,

Producing geological and soil maps of the Palaeo-Agulhas Plain's submerged landscape for the Last Glacial Maximum

Council for Geosciences

The South African Cape South Coast is bordered by one of the broadest continental shelves in Africa. The Agulhas Bank, inshore shelf and presently exposed coastal plain make up the Palaeo-Agulhas Plain (PAP). Quaternary sea levels have been significantly lower than at present for ~90% of the Pleistocene, exposing a terrestrial ecosystem on what is now the submerged shelf. The presently drowned component makes up 94% of the total area of the PAP. Past work hypothesised contrasting character of this submerged landscape compared to the subaerial environment and we assimilate newly-acquired geophysical and geological datasets to produce geological- and soil maps from the Last Glacial Maximum on a scale of 1:750,000, covering an area of ~55,000 km. Three broad geomorphic zones are defined: the Western section from Cape Agulhas to Cape Infanta, the Central section from Cape Infanta to Knysna and the Eastern section extending eastward of Knysna. We demonstrate that Mesozoic sedimentary deposits crop out near the surface on this current-swept shelf and soils derived from siltstone and shale bedrock are prominent up to 64 km distant from the modern shoreline and beyond this, weathered limestone dominates the substrate sequences. We show that the submerged landscape was a unique terrestrial environment and that there is no exact modern-day analogue in the region other than a small (~70 km2) area located at the edge of the Agulhas Plain near Cape Agulhas. The expansion of this plain is coupled with exaggerated floodplains, meandering shallowly incised rivers and wetlands. The submerged shelf is dominated by fertile soils compared to the dissected onshore belt, and extensive calcareous dunefields extending up to 10 km inland from their associated palaeoshorelines covered much of the emergent shelf. The data show a low-relief "plains" landscape, which contrasts strongly to the topographically complex contemporary coastal foreland.

Friday, 9 September 2022, 08:50

SYMPOSIUM 9 - Johanna von Holdt

Why are mima-like mounds of South Africa (heuweltjies) common in the Mediterranean ecosystem?

Department of Environmental and Geographical Sciences, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa.

The regularly spaced dense (200 – 600 mounds per km2) mima-like landscape mounds (heuweltjies - Afrikaans for small mound, ca. 1 m high, 30 m diameter) of South Africa are common in the winter-rainfall zone of South Africa. The origin of these mounds is contentious, but the current debate suggests either a termite- pattern or a vegetation-induced pattern. In both cases, the pattern may be reinforced by subsequent modifications that include aeolian deposition and water-based erosion. There is no a priori reason why the patterning of the mounds should be strongly associated with a Mediterranean climate. However, the mound development may be associated with dry and windy summers and wet winters. We hypothesized that dry summer conditions facilitate aeolian deposition while wet winter conditions facilitate water erosion, and that it is the combination of these two processes that play a key role in mound formation and subsequent dynamics. We determined the association of heuweltjies with the concentration of rainfall in winter using Maxent. We also conducted aerial surveys to analyse the spatial distributions and morphological characteristics at three geographically separate sites and sedimentological analysis (e.g. texture, soil carbon, soil compaction) at one site. Although sediments at two of the three sites were distinctly aeolian, we found no evidence for the origins of heuweltjies as nabkhas from mound morphology, spatial distribution, or variation in sediment texture around the mounds. We suggest that heuweltjie spatial pattern and morphology is initiated by hydrological processes, with redistribution of aeolian sediments contributing to subsequent mound development. The association of heuweltjies with relatively arid winter-rainfall climates results in sparse low-stature and low-cover vegetation as a result of summer drought. Sparse vegetation, erosive winter rains and summer winds and associated aeolian deposition may contribute to the mound morphology.

Friday, 9 September 2022, 08:50

SYMPOSIUM 9 - Adriaan Grobler

The importance of C 3 and C 4 grasses and CAM shrubs in the Greater Cape Floristic Region under contemporary and Last Glacial Maximum climates

Nelson Mandela University

The Greater Cape Floristic Region (GCFR) – a hotspot of biological diversity and archaeological evidence for modern human evolution – is a climatically complex region where broad climatic gradients influence the relative importance of plant photosynthetic types in local vegetation. Photosynthetic pathways of vegetation imprint an isotopic signature on palaeorecords, thereby allowing for the reconstruction of historical climate and vegetation. In this study, we use vegetation plot data, coupled with the photosynthetic-type affinities of plant genera, to relate their relative cover to bioclimatic drivers and use these to create a spatial distribution model of C 3 and C 4 grasses and CAM shrubs across the contemporary GCFR. We then use palaeodistribution modelling, drawing on downscaled climate models for the Last Glacial Maximum (LGM), to hindcast the LGM distributions of photosynthetic pathways for the GCFR and its then-exposed offshore areas, including the Palaeo-Agulhas Plain (PAP). Our palaeodistribution models suggest that, even though there were some marked reductions in CAM cover and shifts in C 3 - and C 4 -dominated grass layers, these were mostly localised, with changes at the regional scale being relatively muted. The lack of significant upheavals in the distribution of these photosynthetic types suggests that the GCFR presented a relatively stable and dependable resourcescape for hunter-gatherer populations through the glacial–interglacial cycle of the Pleistocene–Holocene transition, especially along the central and eastern PAP where mixed C 3 –C 4 grassy vegetation would have supported a diverse faunal community. Our maps of relative C 3 -/C 4 -grass and CAM-shrub cover represent a major improvement over earlier works by providing a more accurate surrogate for relative biomass of different photosynthetic types in local vegetation and by mapping this at a much finer spatial scale. Our distribution maps therefore present a more realistic depiction of stable carbon isoscapes across the GCFR – under both an interglacial (Holocene) and glacial (terminal Pleistocene) climate – against which palaeo-records can be assessed.

Friday, 9 September 2022, 08:50

SYMPOSIUM 9 - Kerstin Braun

Late Pleistocene climates of the Cape Floristic Region based on speleothem records

Arizona State University

Secondary cave carbonates, speleothems, are powerful source materials for the reconstruction of past climates. The deposits can be dated precisely to ages above 500,000 years ago using U-Th methods and the stable isotopic ratios of oxygen and carbon (δ18O, δ13C) in the carbonate can be used as proxies for past climates and environments.
Here we present speleothem δ18O and δ13C records from the boundary between the Cape coastal lowlands and the Palaeo-Agulhas Plain (PAP) on the present-day South African south coast and from inland regions within the Greater Cape Floristic Region. Our main objective is to identify the effects of glacial-interglacial climate change on the rainfall systems and vegetation in this transitional region. Monitoring of present-day year-round rainfall δ18O values in Mossel Bay show a considerable shift on a seasonal basis. On the basis of these large shifts, we interpret speleothem δ18O as primarity reflecting changes in rainfall seasonality. The δ13C values of speleothems are determined by the δ13C of soil CO2, which depends on the type (C3/C4/CAM) and density of vegetation. Changes of speleothem δ13C values are therefore mainly interpreted as shifts between the dominance of C3-rich Fynbos and other plant communities (e.g. subtropical thicket and Renosterveld) that can have increased abundances of C4 grasses and CAM plants.
The main finding of this research in terms of vegetation dynamics is that there is a close relation between variations of the vegetation type and rainfall seasonality at all sites that we have studied whereby increased summer rainfall usually is associated with higher abundances of C4 grasses and/or CAM plants. On glacial-interglacial timescales, the boundary regions between the Cape coastal lowlands and PAP suggest more summer rain and C4/CAM vegetation present during cooler phases than in warmer intervals. This pattern is opposite to much of the southern African region.

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Arizona State University

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Last Glacial Maximum vegetation of the south coast of the Cape Floristic Region: implication for the evolution of its coastal biota

Nelson Mandela University

The Palaeo-Agulhas Plain (PAP), when fully exposed at low sea stands (such as during the Last Glacial Maximum), comprised an area - centred offshore of the contemporary Cape south coast - about the size of the existing Cape Floristic Region. The paleovegetation of the PAP has been modelled using climate, soil, fire exposure, and adjustments for changes in water use efficiency based on temperature and [CO2] regimes during the Last Glacial Maximum. Our results suggest that the PAP was dominated by extensive Limestone Fynbos and Dune Fynbos-Thicket Mosaic associated with marine sediments, and that Alluvial Savanna and Grasslands, largely absent from the modern landscape, would have been extensive and provided a habitat capable of supporting a diverse mammalian fauna. Our focus here is on the flora of calcareous substrata (dune sand and limestone)' comprising an extant flora for the entire Cape of 1 300 species, 42% of which are endemic to these substrata. This flora represents a massive and recent (Plio-Pleistocene) radiation of a selection of Cape clades. Given the tiny areas occupied by calcareous substrata on the contemporary Cape coast, we argue that the environments provided by the PAP would have played a crucial role in this coastal radiation, the most recent diversification event in the Cape. Here we discuss features of this flora that provide insights on the causes and consequence of this coastal radiation.

Friday, 9 September 2022, 08:50

SYMPOSIUM 9 - Kale Sniderman

Last glacial maximum (LGM) vegetation and climate in southwest Australia, the Cape Floristic Region's sister plant-biodiversity hotspot: insights into the drivers of sclerophyll hyperdiversity

University of Melbourne

The Cape Floristic Region's closest environmental analogue is the Southwest Australian Floristic Region (SWAFR). Both regions feature extraordinarily high plant species richness and endemism packed into small areas, confounding tropics-centred theories that explain global diversity patterns in terms of energy- and moisture-availability. Other theories suggest that the CFR and SWAFR may have experienced unusually stable palaeoenvironments, reducing extinction rates by dampening long-term habitat variability.

The most direct way to test this idea is to document the vegetation response to glacial-interglacial climate changes, which elsewhere drove profound vegetation changes. Palaeoenvironmental stability theory predicts that, in contrast to less diverse regions, vegetation in the CFR and SWAFR at the Last Glacial Maximum (LGM, ~21 ka) differed little from the Holocene vegetation. Here, I present records of LGM vegetation from both the SWAFR and from Mediterranean-climate southeastern Australia, generated by extracting fossil pollen from radiometrically-dated stalagmites.

The pollen data indicate that in far southwestern Australia (near Margaret River), forest cover was largely absent at the LGM, replaced by taxa now typical of species-rich shrublands (especially Banksia:Proteaceae, and diverse Myrtaceae). However, further north, near the Eneabba endemism hotspot, there was a major loss of Holocene dominants Banksia and Eucalyptus, and increased presence of typical southern Australian glacial taxa (Casuarinaceae, Poaceae, Asteraceae, Chenopodiaceae), though diverse Myrtaceae-dominant shrub communities may have dominated local vegetation. Quantitative climate reconstructions from both the SE and SW Australian pollen records indicate that LGM climatic moisture availability was similar to today, or slightly higher. This implies that the steep species richness gradient between SW and SE Australia does not result from unusual climatic stability, implying instead that the SWAFR's extremely oligotrophic soils may be the ultimate driver of the region's hyperdiversity. I will discuss the implications of this data for understanding the evolution and maintenance of the SWAFR and CFR floras.

Friday, 9 September 2022, 08:50

SYMPOSIUM 9 - Jan de Vynck

The human foraging potential of the Palaeo-Agulhas Plain

Nelson Mandela University

To determine the economic calorific potential of the drowned and extinct Palaeo-Agulhas Plain (PAP), seasonal foraging experiments of various resources within set habitat types on the extant adjacent landscape (resourcescape) were performed, with Indigenous descendants of the south Cape. Resource productivity datasets cover terrestrial, both plant and fuelwood, as well as marine resources from the intertidal. Faunal assemblages were reconstructed from death assemblages, a continuously expanding dataset of fossil trackways, and community models based on weight ratio theory. The potential returns for these resource suites are linked to their respective geological substrates and by reconstructing the geologies of the PAP (with reference to climate and major oceanic currents), we can estimate the PAP's economic foraging potential from the perspective of past hunter-gatherer populations. The PAP consisted of relatively homogenous terrestrial and marine habitat types compared to the extant south Cape landscape, which had distinct variation in habitat areas and a few hidden habitat surprises. Intertidal resources show potential increased returns on the PAP as aeolianite reefs, which is the highest-yielding extant marine habitat type on the current shore, dominate the PAP shoreline. Modelled terrestrial fauna also shows an increased foraging potential due to a higher proportion of nutrient-rich grassland vegetation present on the PAP compared to the current south Cape. Sand fynbos, a productive vegetation on the south Cape for human foraging is absent, whereas grasslands for which no modern analogue is available, is very abundant on the PAP. The reconstruction of the PAP - and simulating early human survival in this region using agent-based modelling - utilized the expertise of a range of scientists and lays the foundation to extrapolate to other regions. I briefly discuss how the PAP's reconstructed calorific landscape might compare to the Palaeo-Benguela Plain (PBP), a region that extends from Cape Point along the entire west coast of South Africa – an area characterised by a different geology, vegetation composition and climate.

A comparison between the plant food foraging potential of the current south Cape and the extant Palaeo-Agulhas plain from the perspective of early hunter-gatherers

Nelson Mandela University

The aim of my research was to determine – using a behavioural ecology approach – how the Cape south Coast flora contributed to the existence of early humans in this region. We conducted monthly foraging excursions over a two-year period with 68 long-term inhabitants of the region who possess knowledge on indigenous edible flora (n=451 bouts). In total 90 edible plant species were harvested with a mean hourly return rate of 0.66 +- 045 kg/hr or 141 +- 221 kcal/hr. Plant returns were distributed unevenly throughout the landscape, showed little seasonal variation and increased in the recent post-fire environment of fynbos vegetation. Plots harvested by humans for three consecutive years showed that geophyte returns (g) in year three were > 50% of the first year's harvest. Staggered emergence of geophytes was the primary reason returns did not drop to zero after the first year's harvest. This plant foraging data combined with other datasets of habitat productivity (mammals and coastal shellfish), were incorporated into an agent-based model by Wren et al., (2020) to predict how past hunter-gatherers survived in the Cape south coast during high sea levels. Their findings suggest that human populations were primarily plant-based although low encounter rates and poor returns made it a tough environment to survive in and therefore population numbers were most likely very small. In this presentation, we make preliminary predictions of how plant foraging returns may have differed during lower sea levels when the Palaeo-Agulhas Plain, nearly four times the size of the current coastal lowlands, was exposed, and what implications this might have held for Pleistocene hunter-gatherer populations.

Friday, 9 September 2022, 08:50

SYMPOSIUM 9 - Jan Venter and Chris Brooke

Using functional groups to predict the biomass spatial distribution of the large mammals on the Palaeo-Agulhas Plain, South Africa during the Last Glacial Maximum

Nelson Mandela University

The Palaeo-Agulhas Plain (PAP, now submerged off the coast of South Africa) formed a novel ecosystem that provided high quality grasslands to its inhabitants. The PAP was home to large-bodied grazing herbivores that are no longer found in the Cape of South Africa today. Understanding how these species (both extant and extinct) used this environment remains a challenge. Using archaeological and paleontological records, knowledge of species, geology and modelled vegetation types we aimed to predict the biomass for five large herbivore functional groups along a rainfall gradient using South African protected areas as a proxy. Thereafter, we used this information understand the spatial distribution and predict probability of occurrence of these functional groups using environmental drivers, landscape of fear and early humans. On the PAP herbivore biomass increased in all biomes with increased rainfall, except in the grassland biome and for medium-sized social mixed feeder species in savanna and thicket biomes. In the fynbos biome, probability of occurrence was highest for the medium-sized social mixed feeders' functional group in the thicket for small non-social browsers, large browsers, and non-ruminants and in grasslands for water dependent grazers. In our models, human influence affected functional groups to varying degrees but had the strongest effect on medium-sized social mixed feeders. These results aid in improving our understanding of the likely herbivore community composition and relative biomass structure on the PAP, an essential goal toward understanding how early humans utilized large mammals as a food resource.

Friday, 9 September 2022, 08:50

SYMPOSIUM 9 - Curtis Marean

The Palaeo-Agulhas Plain: Its significance to modern human origins

Arizona State University

Some of the world's richest archaeological and palaeontological records for the origins of modern humans are found along the south coast of South Africa. These sites include Blombos Cave, Pinnacle Point, and Klasies River, and a new record at Knysna is being developed. All these sites sit near the shoreline, but through most of their Pleistocene occupation, the coast had retreated to expose the Palaeo-Agulhas Plain. The ecology of this plain has been, until now, a mystery. This poses significant problems for our understanding of modern human origins because there are strong indicators that this plain was crucial to the lifeways of these ancient people. A large international research group worked together to build a first-order reconstruction of this plain under strong glacial conditions. This effort used climate modeling, vegetation modeling, and faunal modeling, joined to empirical records to construct a detailed palaeoecology of the plain. This palaeoecology is built into an agent-based model to explore possible human behavioral patterns. The archaeological sites suggest levels of behavior and culture that are more complex than seen elsewhere in the world at contemporary times, and the reasons for this have been debated. Our reconstruction of this plain provides an explanation – during glacial phases these people could exploit a triumvirate of resources normally not found at the same location – inter-tidal shellfish, rich plant resources, and large grazing ungulates.

Friday, 9 September 2022, 09:00

SYMPOSIUM 10 - Global Forest Communicators Network (supported by UN FAO)

Are u being heard ? The power of effective communication

SYMPOSIUM OUTLINE TO FOLLOW

THEMATIC SESSION

Current biodiversity conservation challenges for a shifting future - habitat restoration and fragmentation

Friday, 9 September 2022, 11:10

THEMATIC SESSION - Sjirk Geerts et al.

A framework to guide stepping-stone corridors by citizens for ecosystem function: Rehabilitation to connect urban conservation areas in Cape Town South Africa

Department of Conservation and Marine Sciences, Cape Peninsula University of Technology, PO Box 652, Cape Town 8000, South Africa.

With the increasing pressure on natural habitats through land use change, there is a growing focus on the services provided by urban green spaces. There is an increasing need for urban greenspaces to be multifunctional and serve a wide range of provisioning – from urban to cultural – functions. The process of urban rehabilitation is an opportunity for re-creating ways of relating to nature, while creating stepping-stone and corridor gardens to act as stepping-stones for species to move between natural habitats. To bring together rehabilitation projects that otherwise would be isolated and uncoordinated, and create Fynbos steppingstone gardens that enhances ecosystem function but simultaneously engage citizen scientists, we use Cape Town as a case study and propose a 6 step framework: 1) site selection 2) assess and imagine, 3) plant selection, 4) garden design, 5) planting and, 6) monitor. We summarise these steps and then explain each of these steps in detail. The concept of rehabilitation is not new, but here we enhance it through coordinated efforts and provide a framework on to how best to adapt this knowledge to urban landscapes with heavy social demands. To coordinate this adaptive approach we provide an interactive open sourced web based stepping-stone corridor mapping platform: www.fynboscorridors.org. We propose that this approach will firstly, transform ecologically low-functioning urban spaces into indigenous gardens that support biodiversity. Secondly, establish resilient rehabilitated areas that will contribute to increased ecological function and diversity within urban landscapes. Thirdly, connect individual indigenous gardens to create a stepping-stone corridor network for seed dispersers and pollinators, enhancing gene flow of their dependent plant species. Fourthly, encourage stewardship of local biodiversity and reconnect urban communities to nature. And lastly, improving social connectivity through collective corridor building and promoting multi-purpose shared spaces that have social, cultural and ecological significance.

People, Plants and Pollinators - Community Conservation on the Cape Flats

Ingcungcu Sunbird Restoration, 4 Millstone Close, Chapmans Peak, Cape Town, 7975

Conservation efforts on the Cape Flats are often overwhelmed by the socio-economic challenges of Cape Town's poorest communities; land invasions, dumping, pollution and poaching to name a few. The few remaining patches of critically endangered Lowland Fynbos are further under threat through habitat fragmentation isolating them from the surrounding mountains and disconnecting them from important bird and insect pollinators. The lack of quality green spaces and resultant disconnection between people and nature further exacerbates the social and ecological challenges on the Cape Flats.
For conservation to have a fighting chance within Cape Town's rapidly growing urban areas, communities must be involved in, and experience the benefits of, active fynbos rehabilitation. There are many grassroots organisations, community groups and greening programs, which are already enhancing the quality and aesthetics of often neglected open spaces throughout the city. But are these being effectively used to increase local biodiversity and enhance ecological function? If not, what resources are needed and available to guide this process?

We present examples of community-based fynbos rehabilitation projects where:
1) community involvement goes beyond 'participation' and 'outreach', and focuses on promoting stewardship and supporting biodiversity champions;
2) community members are guided through practical hands-on fynbos rehabilitation steps that are effective and achievable; and
3) community resource networks (skills, knowledge, materials) are emphasised, supported and enhanced.

Collectively, these projects are transforming open spaces into locally indigenous gardens to form a network of stepping-stone corridors across the Cape Flats, reconnecting isolated patches of critically endangered fynbos and supporting the movement and protection of urban pollinators. By engaging community members in hands-on learning experiences in nature, these programs are reconnecting people, plants and pollinators, inspiring pride in our natural heritage and promoting an inclusive, adaptive and co-created approach to urban fynbos conservation.

Using mitigation resulting from environmental impact assessments as a tool to strengthen conservation of threatened species and habitats in the lowlands of the Cape Floristic Region.

Capensis Ecological Consulting, 156 Main Road, Muizenberg 7950

The Cape Floristic Region in South Africa contains an extremely high level of both narrow range endemic species and species threatened with extinction. Especially on the lowlands, entire vegetation types are threatened due to land transformation, and often all that remains of natural habitats are isolated and degraded fragments. Economic and population growth has put pressure on land for development, which can place these habitats and the species within them at risk of being lost. However, South African legislation requires that impacts on threatened habitats and species be identified as part of an environmental impact assessment before a development can take place. Where such impacts are identified, mitigation is required in order to limit impacts to acceptable levels. This is achieved either through avoiding development of sensitive parts of a site and/or restoring degraded habitat through alien vegetation control, seeding, propagation or translocation of sensitive species from within a development footprint. Alternatively an offset site is identified elsewhere which contains representative habitat and species of conservation concern. In either case, this can potentially have a positive impact on the habitat or species involved, especially those poorly represented within existing conservation areas, or where no resources would otherwise have been available for effective conservation of these sites. However, in such cases it is vital to have competent implementation of such mitigation efforts, and be realistic both in terms of what is viable to achieve in a local context while at the same time allowing ecological processes to take place.

The Perils & Positives of Planting Indigenous..?

The McDowell Trust, 127 Constantia Road, Witteboomen 7806

Aliens have represented the traditional foe within our uniquely diverse Fynbos Biome. Recently the practice of rehabilitation of natural remnants has also rejected establishment of non-local indigenous species. Enter a new hazard - the recent fashion to establish/re-establish locally occurring taxa - "mantra - indigenous is good". For management, one can identify alien & even non-local taxa but can fail when attempting to identify unwanted ecotypes/phenotypes of locally indigenous species. Deliberate/ accidental establishment of non-local sourced material in breeding proximity to pre-existing populations of the same species, can have consequences to both pre-existing populations and their associated communities, affecting the the scientific integrity of the conservation area. However the need is accepted for 'bulking up' populations of Keystone and Red-rated) taxa in situ and notably a need to re-establish taxa of original occurrence with proven local extinction (including in seedbanks). Whereas some researchers may advocate a beneficial case for 'outbreeding', it is contended that the narrow natural distributions of most fynbos taxa fail to warrant the need for applying this mainly Zoological paradigm. Proven inbreeding depression in Fynbos is not known. Induced outbreeding might have isolated application for survival of single wild clones. My Protocol advocates that that reintroduction of locally extinct taxa should be only come from nearest populations in suitably similar natural habitats - record keeping being essential. The crux is how strictly and deferentially should this guideline be applied. The underlying assumption is to apply the strictness of said guideline inversely to the decrease in extent of taxon's "natural mobility". Local endemics are, by definition, range bound. The term "Indices of Care in Reintroduction" is coined and related mainly to Natural Mobility of a taxon physically and genetically. (The Human Factor is excluded here.) In same sequence, the Mobility factor represents both Functions of maximum Propagule Dispersal distance on one hand and that of maximum Distance for Pollination on the other hand - certainly not in equal weightings! Common knowledge to the pollination biologist maybe, but needs to be translated into actual conservation management. Propagule Dispersal (mainly via seed) is easiest to measure eg mammal dispersal = low distance, wind dispersal = far distance. Distance for Pollination adheres to a couple of less distinct rules viz faunal pollination vectors tend to be less capable over long distances than via abiotic vectors such as wind and water. To confound matters, one can identify taxa where both wind and/or insects contribute to seed production (ambophily). Thus generally less care needs to be taken with establishing Provenance with those species having high mobility compared with those with low mobility. The characteristics appear in extremis with 'high mobility' taxa likely to show genetic uniformity over a larger natural range than that for 'low mobility' tax. Thus there is a consequent raised Index of Care in Reintroduction for the 'low mobility' taxa. Reference will be made to paradoxical members of the Protea, Erica & Iris Families in their fields of conservation.

Effects of afforestation of tree-less habitats on the productivity of neighbouring cork oak woodlands

Universidad de Cádiz 11510. Puerto Real, Cádiz. Spain. & Instituto de Investigación Vitivinícola y Agroalimentaria (IVAGRO), Campus Río San Pedro. 11510. Puerto Real, Cádiz. Spain.

Tree plantations are rapidly spreading worldwide due to their rapid economic turnover and their supposed role in climate change mitigation. Planting trees in naturally open, tree-less habitats (afforestation) is known to drastically impact their biodiversity and ecosystem services. However, indirect effects of afforestation on the non-targeted, neighbouring ecosystems remain an open question. This is of critical importance when tree plantations surround natural habitats of high ecological and economic value, such as cork oak (Quercus suber L.) woodlands in the western Mediterranean Basin. In the strait of Gibraltar region, cork oak woodlands are typically found on mid-slopes below Mediterranean heathlands or herriza patches that cover the ridges and summits. Despite its remarkable biodiversity, the herriza has historically been subjected to afforestation programs. Here, we use a combined approach of remote sensing and dendrochronology techniques to investigate the long-term effects of afforestation of the herriza on the vigor and productivity of neighbouring cork oak woodlands in the last half century, from landscape scale to individual trees. We hypothesized that the afforestation of the herriza would adversely affect the growth and vigor of cork oak trees downhill. We assessed spatiotemporal NDVI dynamics of cork oak woodlands below afforested and natural herriza patches. Also, ring width series of individual Q. suber trees were crossdated and variations in secondary growth rates were analyzed for both scenarios. Preliminary results show a lower vigour of cork oak woodlands found below afforested herriza. This agreed with a marked negative effect of afforested patches on the secondary growth of Q. suber trees. Our study highlights the negative effects of herriza afforestation on the ecological performance of neighbouring Mediterranean cork-oak woodlands and the ecosystems services they provide.

Frequencies distributions of spiders during year round survey from two sites of vineyards in Northern Israel

Shamir Research Institute, Haifa University, Kazerin 1290000, Israel

In this research, two sites of vineyards in Northern Israel were surveyed for diversity of invertebrates: Geshur vineyard (32.755°N;35.714°E;366mASL), and Ramat Magshimim vineyard (32.813°N;35.806°E;406mASL). From these vineyards, invertebrates were collected by pitfall-traps during the year of 1998 usually monthly. Those invertebrates were separated to different systematical orders between the years 1998-2000. The spiders that were collected in that survey were identified between the years of 1999-2000 in the National Nature Collections at the Hebrew University of Jerusalem, Givat-Ram Campus, Jerusalem. From Geshur vineyard there were collected in this research more than 414 spiders' specimens of 20 different families of spiders. From Ramat Magshimim vineyard there were collected in this research 123 spiders' specimens of 19 different families of spiders. Cybaeidae were found in both vineyards during autumn, and not in other seasons. Gnaphosidae were found in both vineyards during most of the year. Linyphiidae were found there during that winter season. Lycosidae were caught there mainly during February-March 1998. Theridiidae were caught in Geshur vineyard during most of that year, and in Ramat Magshimim vineyard during the winter of that survey period, with peaks on February. Thomisidae were found in Geshur vineyard mainly during the autumn season, and in Ramat Magshimim those spiders were rare. Zodariidae were caught in both vineyards during that summer season. The frequencies of most of the spider groups that were found in this research were bigger from Geshur vineyard than from Ramat Magshimim vineyard. This can be related to that about 100m-200m south of Geshur vineyard there was or is an area of natural Mediterranean shrub, while Ramat Magshimim vineyard was or is located in between cultivated areas. It is known, that vicinity of agricultural fields to natural areas may increase species diversity, species richness or frequencies of animals and plants in those agricultural areas.

Fire severity and recovery of a holm oak forest in a wildland-urban interface in Central Spain

Department of Enviromental Science, Faculty of Enviromental Science and Biochemistry, University of Castilla-La Mancha (UCLM), Toledo, Spain

The severity of a fire is one of the characteristics that can determine the response of the vegetation, influencing the capacity of species to germinate or resprout. The severity of a fire can be established through indicators or severity indices derived from satellite images, especially in the case of large fires. These indices need to be validated in the field, especially when a detailed assessment is needed to study the response of plant populations. The CBI (Composite Burnt Index) is one of these indices and can be used for the validation of severities derived from satellite images. In this study, we analysed the effects of fire severity on the response of two resprouter species, Quercus ilex subsp. ballota (evergreen and monoecious) and Pistacia terebinthus (deciduous and dioecious) in an urban-forest interface zone with a low frequency of fires. Likewise, the similarity between the fire severity derived from satellite images and the CBI was analyzed. The study area (Toledo, Central Spain) is a holm oak forest affected by a fire (1230 ha) in June 2019. The burnt area includes high, medium and low severity zones, identified from satellite images. In each severity category 10 plots of 312 m2 were established between July and September. All individuals of woody species included in each plot were labelled, and their immediate regenerative response and percentage of herbivory were estimated. The CBI showed differences between fire severity categories from satellite images and field measurements. During the first months after the fire (July-February), the two species studied had resprouted, but their responses were different, and the percentage of herbivory can compromise their regeneration in the short and medium term.

Obligate-seeder Banksia in south-eastern Australia threatened by increased fires

Arthur Rylah Institute for Environmental Research.
Department of Environment, Land, Water and Planning.
PO Box 137, Heidelberg, Victoria, 3084, Australia.

Climate change is driving more extensive, frequent and severe fires, as exemplified by the wildfires in south-eastern Australia during the 2019-2020 summer. Increased fires threaten the persistence of populations of obligate-seeding woody plants with long reproductive maturity periods and no soil seed banks.
Prior to the 2019-2020 wildfires, we used a chronosequence approach to study the seed production of Banksia cunninghamii, which has characteristics that make it vulnerable to frequent fire. About 60% of plants had produced no seed cones in the first decade after fire, and the maximum canopy seed bank was reached between 15 and 30 years post-fire.
Following the wildfires, we investigated recruitment of B. cunninghamii, and recorded seedlings at sites where plants were ten years or older. Recruitment was low where fire severity was very high, because seed cones were destroyed by extreme heat. In previous years we had recorded a large reduction in seedlings after one or two summers.
Using spatial analysis, we compared a habitat distribution model for B. cunninghamii with areas burnt in 2019-2020 and areas burnt less than 10 years before that. A large proportion of the distribution of B. cunninghamii within the area of the 2019-2020 wildfires had been burnt less than 10 years previously, raising concerns that this species may have declined across part of its range.
Management and research attention are needed for relatively widespread keystone species such as B. cunninghamii, which are at risk of declining in population size and distributional extent due to increased fire and climatic warming.

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Friday, 9 September 2022, 11:30

E - POSTER SESSION - Pueyo, Y et al.

The effects of grazing on a Mediterranean gypsum ecosystem

Instituto Pirenaico de Ecología - CSIC

Gypsum plant communities are often under livestock grazing use in the Mediterranean region. Despite the high ecological value of these communities, little is known about the effects of grazing on plant and soil properties. Plant productivity and diversity, hydro-physical, chemical and biological soil properties were analysed along stoking rate gradients in two sites differing on aridity conditions in the Middle Ebro Valley (NE Spain). Grazing substantially modified plant community and soil properties, being changes more evident at the most arid site. At those arid sites, plant productivity and soil fertility decreased with increasing stocking rates. However, plant diversity was maintained high until intermediate grazing levels. Gypsum plant communities are adapted to grazing, but overgrazing can lead to the loss of ecosystem functionality because of both, direct effects on vegetation consumption and indirect effects on soil properties.

Population age structure of a mediterranean oak coppice woodland growing in cyprus

Faculty of Forestry and Wood Technology, Mendel University in Brno, Czechia

Localities with coppice woodlands preserved up to these days are important culturally-historical traits and integral part of landscape. Recent scientific reports provide an important basis for the evaluation and improvement of their ecological concepts. A dendroflora with such particular features in Cyprus is the endemic oak Quercus alnifolia Poech. This oak, occurs only on the Troodos Ophiolite Massif and is the dominant species of dry habitats in pine and maquis woodlands.
The objective in this study was to reveal the age structure of the Quercus alnifolia stored coppices. For this purpose, we used tree-ring science as a proxy based on the limited existing knowledge in Quercus alnifolia wood anatomical structure. Until now, two unsuccessful attempts held 100 and 40 years ago respectively (Imperial Institute of the British Empire & Commonwealth Forestry Institute of the University of Oxford). In order to achieve the precise dating of the species, wood micro-sections were prepared from 162 samples which were collected from Paphos Forest in the form of disks. Only the most dominant and undamaged stems were selected out of 100 different coppice stools.
The study showed that the samples had a maximum age of 150 years with an average of 108 years, thus having an average stem diameter and stem height of 13 cm and 6 m respectively. In terms of age structure, 67% of the population was more than 100 years with an average stem diameter and stem height of 14,3 cm and 6,5 m respectively, while only the 11% of the population was less than 80 years with an average stem diameter and stem height of 10,6 cm and 5,7 m respectively. These results are in identification with specific historical factors which outlined the critical characteristics in the determination of the present old growth coppice structure of this ecosystem: the establishment of the first provisions on Forest Management in 1881 and the final regulation of grazing in the 1940s by the British.

Climate change and forest ecosystems of Greece

Department of Ecology and Systematics, Faculty of Biology, National and Kapodistrian University of Athens, Greece e-mail: marianou@biol.uoa.gr; https://uaeco.edu.gr

The potential effects of climate change upon forest ecosystems have been a focal point in the international scientific literature. Several effects have been reported such as reduction in tree growth rate, increased drought related mortality . Exposure to a changed fire regime has been also reported as a serious potential threat both to ecosystems response as well as to their distribution. In the current contribution potential effects of climate change upon distribution of forest ecosystems in Western Greece is presented. The Region of Western Greece hosts important biodiversity areas, with forest ecosystems of Pinus nigra, forests of the endemic Abies cephalonica, as well as forests designated as biogenetic reserves and nature monuments. Shifts in the potential distribution of the characteristic tree species of these forest types was modeled using species distribution models under the IPCC climate change scenarios and compared to the current one.

Shoot flammability of 223 species from three continents

Instituto Multidisciplinario de Biología Vegetal (CONICET-UNC) y Facultad de Cs. Exactas, Físicas y Naturales, Universidad Nacional de Córdoba, Argentina.

Flammability is a fundamental trait relevant from individual plants to landscape level, and with evolutionary and ecological implications. In a context of accelerating human-driven environmental change, which often increases the frequency and extent of fires, flammability appears as a priority for many stakeholders in different regions of the world. Quantitative comparisons of flammability within and across regions have historically been hinder by differences in methods and metrics. Here, we analyse shoot-level flammability measured with a standard method in 223 species (73 families) from three regions with contrasting fire regimes: Argentine Dry Chaco (35 species), New Zealand (50 species), and Southern South Africa (138 species), belonging to five growth forms (i.e. grasses, forbs, shrubs, trees and tree/shrubs). We expected species from South Africa, which has a well-known long history of periodic fires, to be more flammable than New Zealand species, where fire has been historically rare and recent. The Chaco has an evolutionary history of fire shorter and less intense than that of South Africa, but longer and more intense than that of New Zealand, therefore we expected an intermediate response. We used 'burned biomass' (BB) and 'maximum temperature' (MT) as indicators of flammability. For woody species, both variables were significantly higher in South Africa, intermediate in NZ and lower in CH. For grasses –only limited data from Chaco and South Africa– BB did not differ between regions, but MT was higher in South African species. For forbs, MT did not differ between regions, but BB was higher in SSA. Chaco species showed less variability than the other regions across all growth forms. The reported flammability patterns improve our understanding of fire as an ecological and evolutionary factor shaping different floras. Vegetation modelling efforts would greatly benefit from jointly considering flammability and tolerance to fire for predicting the future of ecosystems.

Friday, 9 September 2022, 11:30

E - POSTER SESSION - Ittai Warburg

Species diversity of isopods during year round survey from two sites of vineyards in Northern Israel

Shamir Research Institute, Haifa University, Kazerin 1290000, Israel

In this work, pitfall-traps were placed usually monthly during the year of 1998, in two sites of vineyards in Northern Israel: Geshur vineyard (32.755°N;35.714°E;366m ASL) and Ramat Magshimim vineyard (32.813°N;35.806°E;406m ASL). The invertebrates that were captured in this work were separated to different orders between the years of 1998-2000. The isopods that were caught in this work were identified between the years 1999-2001. Of 6 isopod species that were found in this work, one species – Armadillo sp. was found in Geshur-vineyard, and not in Magshimim-vineyard. The following four isopod species were found in both vineyards: Armadillo sp. Aff. platypleon (Schmalfuss, 1986), Leptotrichus naupliensis (Verhoeff, 1901), Porcellionides pruinosus (Brandt, 1833) and Porcellionides sp. L. naupliensis was found in both vineyards year-round with prominently big amounts in Geshur-vineyard, where it was peaked on August and December. P. pruinosus was very rare in both vineyards. One species – Porcellio deganiensis Verhoeff, 1923 was found in Magshimim-vineyard year-round, and not in Geshur-vineyard. The amount of isopods captured in Geshur-vineyard during that survey period (339 isopod specimens), was higher than the isopods amount captured in Magshimim-vineyard in the same period (114 isopod specimens). Simpson's index of diversity was found to be higher in Magshimim-vineyard than in Geshur-vineyard (0.671 vs. 0.322). However, isopod species richness was the same in both vineyards. Interestingly, August in that survey period, was the month with the peak numbers of isopods captured in both vineyards. Most of those isopods were of L. naupliensis and Porcellionides sp., which were also the most common isopod species in that overall survey in each of those vineyards. This finding is surprising, because isopods favor humid conditions. Maybe this was because of dew that fell at nights in that summer, or because of irrigation in those vineyards during that summer, that attracted isopods also from adjacent habitats.

Friday, 9 September 2022, 12:20

KEYNOTE 12 - Kathleen Kay

Divergent edaphic adaptation promotes speciation, coexistence, and persistence in the California flora

University of California, Santa Cruz

Mediterranean climate ecosystems (MCEs) are renowned for their floristic diversity and comprise many plant species radiations tightly packed into relatively small geographic areas. Comparative work in many MCEs, including the California flora, suggests that rather than MCEs being hotbeds of plant speciation, the remarkable diversity can be attributed to low extinction rates over long timescales and spatial coexistence of close relatives. Topography, and the associated variation in edaphic (soil) conditions, may contribute to the plant diversity in MCEs by providing diverse niches for species coexistence and divergent adaptation. Moreover, harsh and unusual soils may provide a refuge for the persistence of species that are otherwise poor competitors. I use serpentine soil-plant associations in the California flora to address several outstanding questions about the mechanisms by which edaphic adaptation contributes to plant diversity. I investigate the spatial scale and repeatability of edaphic divergence between coexisting congeners. I ask whether, and how, edaphic divergence limits gene flow among populations within a species and between recently diverged sister species. I use a comparative study across the California serpentine flora to ask whether adaptation to harsh soils is typically associated with loss of competitive ability and whether that loss can help explain edaphic endemism. I use examples from my lab's work in several California plant lineages to address these questions, and I pose additional questions for future work, with the goal of a synthetic understanding of how edaphic factors contribute to floristic diversity of a Mediterranean Climate Ecosystem.

Friday, 9 September 2022, 12:50

KEYNOTE 13 - Alexandra Syphard

Unraveling the complex effects of global change on altered fire regimes in California

Conservation Biology Institute

Catastrophic effects of wildfires on human lives and assets have increased the prominence of wildfire in the media and across the scientific community. Consequently, there is growing awareness of the importance of wildfire as a natural process, and there is a rich and rapidly growing body of literature on wildfire and global change. Nevertheless, the complicated nature of changes in fire regimes creates confusion in the media and is leading to widespread misconceptions about how and why fire regimes are changing, and which management decisions are most appropriate in different contexts. Although wildfire impacts to humans are increasing monotonically, changes to natural fire regimes and associated ecological consequences are more variable. The relative contribution of global change drivers to altered fire regimes varies geographically, even within similar regions. In California, an environmentally heterogeneous state with a Mediterranean climate, fire return intervals have been altered in nearly opposite directions, for different reasons. The effects of climate change, vegetation management, human land use, and invasive species on ecological conditions and natural fire regimes vary in direction and magnitude, yet there have been many thousands of structures lost to wildfire across the entire state in recent years. In the northern part of the state, climate change and forest stand conditions will likely be top concerns for driving future large fires. In southern California, however, human ignitions, invasive species, and fire weather are most important. Although the pathways vary, fire-driven vegetation type conversion is driving substantial ecological transformations statewide and is one of the most serious threats to biodiversity and ecosystem integrity. Better understanding and awareness of this complexity and geographical variability will be critical for matching appropriate solutions to the problems.

Monday, 5 September 2022, 15:45

SPECIAL SESSION – Sierra Standish

Oral history project - The Mediterranean-type Ecology Network Oral History Project

In 1971, Francesco di Castri and Hal Mooney invited research scientists from around the world to Valdivia, Chile to share their work on mediterranean-type ecology. This would later be considered the first in a sequence of MEDECOS meetings. Now—more than fifty years later—the MTE Network Oral History Project seeks to document the history of MEDECOS and the work of its participants.

This presentation is a call to members of this community to help formally generate an oral archive for future generations. Oral history is the process of creating sound recordings of interviews with individuals who have personal knowledge of past events. Because oral history records individual's stories in their own words, it captures thoughts, memories, experiences and perspectives—elements of history that typically do not get documented in other kinds of sources. MEDECOS participants constitute a decentralized but vibrant array of specialists who are united by common concerns; collectively, they possess a wealth of experiences that enrich our understanding of the field.

The project lead, historian Sierra Standish, will schedule individual meetings with interested participants to conduct in-person, one-on-one interviews at the MEDECOS 2022 gathering. Meetings can happen either indoors or outdoors, either in the field or in the conference setting. The objective is to create a series of WAV format audio recordings that will later be transcribed and, eventually, be made web accessible. The project poses general questions about the interviewees' professional life, both within and outside of the MEDECOS context. Sample questions include: What are your areas of specialization, and how did you become engaged with them? What brought you to collaborate with other scientists and/or land managers who work on mediterranean-type ecosystems? How has your field and this organization changed over time? What do you think future generations should know about MEDECOS?

MEDECOS Conference XV
Friday, 9 September 2022
08:30–09:45
Hall 3-4, Athene Conference Centre
Club Mykonos, Langebaan, Western Cape

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What can we learn from the world of advertising?
Robert Grace, Founding Partner and Head of Strategy, M&C Saatchi Abel

Cutting through the haze: communicating sustainability
Kai Lintunen, Leader of the UNECE/FAO Forest Communicators' Network (FCN) and Head of International Communications, Finnish Forest Association

Communicating science to the wider public: how edible insects became a trending topic
Maria De Cristofaro, Outreach and Capacity Building Forestry Officer, Food and Agriculture Organization of the United Nations. Global Coordinator of the Regional Forest Communicators Networks

Embracing the lighter side of science communication
Patricia Sfeir, Leader of the Mediterranean and Near East Forest Communicators Network and Manager, Rural Development Programs, Seeds International

Changing behaviours: communicating fire prevention from Smokey the Bear to Bambi
Kay Montgomery, Leader of the Africa Forest Communicators Network and National Invasive Species Advocacy Programme, Department of Forestry, Fisheries and the Environment, South Africa

Audience questions and debate

Moderator: Ingwald Gschwandtl, Forest Policy Expert and Chair of the Global Coordination Group of the Regional Forest Communicators Network

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