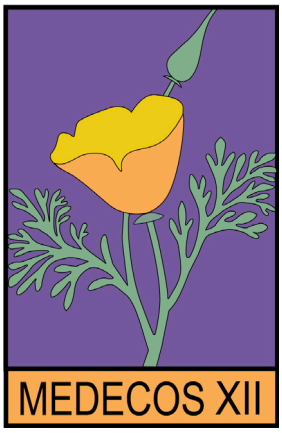

MEDECOS XII

Linking Science to Resource Management

The International Mediterranean Ecosystems Conference

September 6-9, 2011 – Los Angeles, California, United States

***Hosted by*:**

UCLA Institute of the Environment and Sustainability
UCLA La Kretz Center for California Conservation Science
UCLA Stunt Ranch Santa Monica Mountains Reserve

ABSTRACTS

Table of Contents

PLENARY

Evolution of diversity in the world's five Mediterranean-type ecosystems: the role of climatic and topographic dynamics

Cowling, Richard M.[1] , Bradshaw, Peter[2], Colville, Jonathan[3], Ferrier, Simon[4], Forest, Felix[5], Hopper, Stephen D.[5], Ojeda, Fernando[6], Procheş, Şerban[7], Smith, Rhian J.[5] and Rundel, Philip W[8]

[1]*Department of Botany, Nelson Mandela Metropolitan University, P.O. Box 77000, Port Elizabeth 6032, South Africa.*

[2]*South African National Parks, Nelson Mandela Metropolitan University, P.O. Box 76693, Port Elizabeth 6031, South Africa.*

[3]*South African National Biodiversity Institute, Private Bag X7, Claremont 7735, South Africa.*

[4]*CSIRO Ecosystem Sciences, GPO Box 1700, Canberra, ACT 2601, Australia.*

[5]*Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB UK.*

[6]*Departamento de Biología, Universidad de Cádiz, Campus Río San Pedro, 11510-Puerto Real, Spain.*

[7]*School of Biological and Conservation Sciences, University of KwaZulu-Natal, Private Bag X01 Scottsville 3209, South Africa.*

[8]*Department of Ecology and Evolutionary Biology University of California (UCLA) Los Angeles CA 90095, USA.*

It is well established that Mediterranean-type ecosystems harbor extremely rich biotas and that patterns for some regions and taxa refute global predictions based on area, productivity and latitude. It is also well established that diversity shows significant variation among these regions. For plants – and possibly several invertebrate groups – the rank order of regional-scale richness (and endemism) is as follows: Cape > SW Australia >> Mediterranean Basin, California >> Chile. These patterns cannot be explained by predictors associated with the contemporary environment, such as climatic heterogeneity and stability, and environmental heterogeneity. This is hardly surprising, given that contemporary diversity patterns are the product of both local and regional processes that are profoundly influenced by idiosyncrasies of history and geography, and their respective impacts on diversification and extinction. Here we explore the historical dynamics of climate and topography in all five Mediterranean-climate regions. We use this information to make predictions on Cenozoic diversification patterns, which we then test using information derived from dated molecular phylogenies. We conclude that the richest biotas (Cape and SW Australia) have been diversifying since at least the late Eocene, a consequence of relative topographic and climatic stability.

PLENARY

Other Strands of Knowledge

Margolin, Malcolm
Heyday, P.O. Box 9145, Berkeley, CA 94709, USA.

Heyday has been publishing books with a California focus since 1974. I founded the press and for nearly forty years have witnessed the flow of manuscripts submitted and books produced. Some of these manuscripts are floras, natural histories, and environmental texts. Others are works of poets, artists, visionaries, native California Indians, cultural historians, comedians, farmers, and more. In this talk I will reflect on the multiplicity of ways in which landscape is described and what these various ways of interpretation can add to our knowledge and appreciation.

PLENARY

Climate change and biodiversity in the Mediterranean region of Chile: Bridging the science policy gap

Marquet, Pablo A. [1, 2]
[1]*Center for Advanced Studies in Ecology and Biodiversity (CASEB) & Departamento de Ecología, Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile, Alameda 340, Santiago, CHILE.*
[2]*Instituto de Ecología y Biodiversidad (IEB) Casilla 653, Santiago, CHILE.*

Climate change models predict large decreases in precipitation and increases in temperature within most of Chile, but specially so in the middle portion of the country dominated by Mediterranean-type ecosystems. Recent analyses on the effect of these changes upon biodiversity point out that the Mediterranean region will become increasingly dynamic, with high species turnover as a consequence of species moving across landscapes in order to track changes in the environment. Unfortunately, these landscapes bear the mark of inefficient conservation policies and perverse economic incentives that transformed natural habitats into a patch-work of human uses, with little concern for biodiversity, let alone its movement across the landscape. I will point out in this talk that to tackle the challenge of species adaptation to a changing climate in Chile at least three actions become a priority: 1) To develop tools to assess where should Protected Area Networks be expanded including economic considerations, 2) empower local industries to become leaders in protecting biodiversity under climate change and 3) strengthen the connections between academic institutions and the government to bridge the abysm between science and policy. The first action, I will suggest, can be achieved by creating dynamic niche models that track species as they move across landscapes, which along with detailed economic data can provide the key information regarding the costs of expanding regional Protected Area Networks to foster species adaptation. The second action can be carried out by targeting key industries within the Mediterranean region, such as the wine industry. In this regard, I will provide an example of the Wine Biodiversity and Climate Change Initiative in Chile. Finally I will discuss the third action, which is likely the harder one. This, I will argue requires of a new breed of scientists that should be trained through the creation of new graduate programs in Public policy and management that need to be implemented. Unfortunately, this also requires a new breed of Chilean public and politicians.

PLENARY

Linking Science and Resource Management in Mediterranean Ecosystem Parks: Perspectives from the U.S. National Park Service

Sauvajot, Raymond M.
U.S. National Park Service, Pacific West Region, 333 Bush Street, Suite 500, San Francisco, CA 94104
ray_sauvajot@nps.gov; 510-817-1437

Effective park management depends on access to and use of the best available science. However, conflicts between rigorous scientific methods and the needs of open space managers for rapid answers can create challenges when decisions are needed and scientific information is lacking or uncertain. At the same time, conservation and ecological challenges demand close relationships between park managers and scientists, especially in sensitive and threatened Mediterranean-type ecosystems (MTEs). The U.S. National Park Service (NPS) manages many units with MTEs and all are subject to the myriad of threats found in other Mediterranean climate areas. The NPS has formally embraced the use of science in its decision making, and has legislated requirements, formal policies, and directives to ensure that science informs all resource management actions. Recently, the NPS completed a national Science Strategy and in the Pacific West Region, a complementary strategy focuses on identifying and addressing key science needs, ensuring that science is credible and accurate, linking science to education and outreach, encouraging the use of parks by scientists, and supporting professional development for NPS scientists. Critical resource challenges that require scientific engagement include understanding and responding to climate change, addressing threats from development encroachment, habitat fragmentation, and loss of connectivity, detecting and controlling non-native species, monitoring key indicators of resource condition, restoring damaged ecosystems, and mitigating effects from ever increasing recreational demands. Now more than ever, science must be linked to management decision-making to ensure better decisions and more effective conservation. While the NPS is committed to this approach, there is still much to learn. We particularly look forward to future collaboration with scientists and land managers from parks and preserves throughout the world's MTEs to understand the impacts of our shared threats and how these threats can be addressed using science-based management.

Pathways for resilience in Mediterranean cork oak land-use systems in Portugal

Acácio, Vanda [1]
[1]Centro de Ecologia Aplicada Prof. Baeta Neves (CEABN), Instituto Superior de Agronomia, Tapada da Ajuda 1349-017 Lisboa, Portugal

The landscape in southern Portugal is dominated by a distinctive Mediterranean land use system in which cork oak (Quercus suber L.) is the main tree species; this area constitutes the largest cork oak habitat in the world. Cork oak land use systems are European Union protected habitats, with high biodiversity, economic and cultural value, allowing for the protection of soils in dry environments and providing important ecosystem services. The cork oak land use system of today is the result of long-term combined ecological and land use dynamics that have shaped the landscape. In some cases, overexploitation of the land has led to soil degradation and erosion, failures in cork oak recruitment and decreasing tree density. Areas of degraded soil, where cork oak natural regeneration and establishment becomes difficult, are commonly invaded by persistent monospecific stands of pioneer heathland rockrose shrubs (Cistus spp. shrubs). Although traditionally shrublands have been considered as a transient successional state in Mediterranean Europe, I present evidence that Cistus shrublands may represent a persistent alternative vegetation state characterized by lower plant biomass and diversity in former cork oak areas of Portugal. Recent estimations for southern Portugal show that 60% of the shrub¬land patches remain as such after 45 years, and that shrubland persistence is maintained by feedback mechanisms triggered by an interaction of wildfires, drought and inadequate human management and by multiple mechanisms that severely constrain cork oak recruitment in shrubland patches. I discuss alternative pathways through state-and-transition models synthesizing the ecological and land use variables that halt cork oak regeneration and recruitment and drive vegetation transitions leading to persistent shrublands. Unless concerted management actions, restoration programmes and multipurpose businesses are undertaken in the short-term, the cork oak land use systems will not be sustainable.

Herbaceous community composition along aridity gradient: role of woody landscape modulators

Agra, Har'el[1], Arnon, Amir[2], Boeken, Bertrand[3], Gabay, Ofri[4], Groner, Elli[4], Perevolotsky, Avi[2], Segoli, Moran[4], Shachak, Moshe[4], Ungar, Eugene D.[2], Walczak, Margareta[5], and Ne'eman, Gidi[6]

[1]*Department of Evolutionary and Environmental Biology, Faculty of Natural Sciences, University of Haifa, Haifa, 31905, Israel.*

[2]*Department of Agronomy and Natural Resources, Agricultural Research Organization, the Volcani Center, Bet Dagan, 50250, Israel.*

[3]*Wyler Department of Dryland Agriculture, Ben-Gurion University of the Negev, Sede-Boqer, 84990, Israel.*

[4]*Mitrani Department of Desert Ecology, Ben-Gurion University of the Negev, Sede-Boqer, 84990, Israel.*

[5]*Israel Nature and National Parks Protection Authority, Jerusalem 95463, Israel.*

[6]*Department of Science Education-Biology, Faculty of Natural Sciences, University of Haifa-Oranim, Tivon, 36006, Israel.*

Rainfall is a main factor affecting species composition along aridity gradients. 'Landscape-modulators' (LM) are ecosystem-engineers that affect community structure by creating distinctive landscape patches. Ecosystems in the Mediterranean and in other semiarid regions are typically composed woody patches affected by the LM and non-woody patches. We tested the hypothesis that resource contrast between woody and non-woody patches, created by the LM canopy, affects herbaceous species composition and changes the trend in rainfall-effect on species composition along aridity gradients. We studied the effect of LM on abiotic resources and herbaceous plant composition in five LTER sites, located along the N-S aridity gradient in Israel. We compared species composition and abiotic conditions between woody and non-woody patches and examined the effect of LM canopy removal. The differential interaction between the woody LM and herbaceous-plants changed the expected macro-ecological pattern along the rainfall gradient. The differential LM canopy structure, represented by its leaf area index (LAI) best explained the changes in herbaceous species composition and in the similarity in species composition between woody and non-woody patches along the gradient. We propose that the effect of LM is general and valid also in non-Mediterranean ecosystems composed of woody LM and herbaceous un-modulated patches. Species composition patterns along aridity gradients in such systems can be best explained by the LM species and its LAI, which reflect the position along the aridity gradient while integrating the effect of many other environmental factors.

Seventy Years of Vegetation Change in Southern California's Mediterranean-Climate Shrublands

Aguilar, Luis M , Taylor, Robert S
U. S. National Park Service- Santa Monica Mountains National Recreation Area, 401 W. Hillcrest Dr., Thousand Oaks CA 91360, USA.

Geographic Information Systems (GIS) make it possible to study vegetation change in ways that previously were not practical. The Santa Monica Mountains National Recreation Area (SAMO) has converted maps and plot data from the historic Wieslander Vegetation Type Map survey of California (VTM) (1934) into modern GIS geodatabases. We have combined these spatial data with other spatial data sets, including modern vegetation (2005), fire history, land use, terrain, and climate, in ongoing longitudinal studies of vegetation change in a large urban National Park. The hierarchical nature of the National Vegetation Classification Standard used in SAMO's modern vegetation map allows us to crosswalk the modern map classes to the somewhat more generalized classes of the VTM survey. Combining the two maps, we have vegetation descriptions at two times 71 years apart covering an area of 110,480 hectares (273,000 acres). The historic Wieslander survey also included 232 quantitative vegetation plots in our area; SAMO has relocated and resampled all the plots we could safely access on public lands (91 plots). The plot data are more quantitative than the vegetation maps and have been studied through ordinations and other multivariate statistical analyses. We generally expect to see local extirpation of dominant species and vegetation type conversion due to repeated short fire return intervals, but initial landscape scale analyses show only modest correlations with our predictions. Floristic changes appear to be determined by complex interactions of local environmental factors, weather and disturbance history. Fire and drought can be highly interactive. We are now studying these interactions more closely with more detailed observations at local scales.

Effects of Nitrogen Deposition on Vegetation-Type Conversion in Riversidean Sage Scrub using gradient and long-term fertilization studies

Allen, Edith B.
Department of Botany and Plant Sciences and Center for Conservation Biology, University of California, Riverside, CA 92521 edith.allen@ucr.edu

Southern California Riversidean sage scrub (RSS) is undergoing vegetation-type conversion to exotic annual grassland, especially adjacent to urban areas with high N deposition. Levels as high as 30 kg N/ha/yr occur as dry deposition, primarily from automobile emissions. Highest levels occur in urban northern regions of the Los Angeles air basin and decrease along a gradient southward in RSS vegetation. To assess the effects of N deposition on invasive and native composition, vegetation was sampled along the N deposition gradient and also in N-fertilized plots at a site with relatively low N deposition. Exotic grass cover was positively related to elevated soil N along the gradient, while native shrub and forb cover and richness were negatively related to soil N. Plots of 5 X 5 m were fertilized with ammonium nitrate at 60 kg N/ha/yr for 6 years, and monitored even after fertilization ceased, a total of 17 years. Surface soil N concentrations became more similar in fertilized and unfertilized plots after fertilization ceased, but deep soil N was elevated to 75 cm. Fertilization caused an increase in biomass in exotic grass after two years, while decreases in native forb and shrub cover occurred after 11-17 years of fertilization. This indicates a considerable lag effect of elevated N on native vegetation. However, grass biomass of 0.5-1 T/ha with elevated N may be a cause of the frequent fires that occur in the region, and represents a more rapid mechanism for vegetation-type conversion under elevated N. Both mechanisms, long-term loss of shrubs under N deposition and frequent fire caused by increased grass biomass, may account for the decline of RSS vegetation and replacement by exotic grasses.

Allocation of Carbon to Mycorrhizal Fungi in California Mixed-Conifer Forests

Allen, Michael F.
Center for Conservation Biology, University of California, Riverside, CA 92521 michael.allen@ucr.edu

Mediterranean ecosystems are known for convergence above-ground plant structures. However, soils range from highly fertile to extremely infertile. Every strategy to acquire nutrients is exhibited, depending upon the location, from cluster roots, to all types of mycorrhiza. We know virtually nothing about comparative carbon (C) costs, in part because technologies for studying belowground dynamics on time scales at which roots and microbes grow and die have not existed. We initiated new sensor and observation platforms belowground to characterize and quantify belowground dynamics in a California mixed-conifer ecosystem. We measure soil CO_2, T and q at 5-min intervals into the soil profile. Using our automated minirhizotron (AMR), we observe root and hyphal growth, and belowground phenology up to 4x daily. These data are coupled with sensors measuring eddy flux of water and CO_2, sapflow for water fluxes and C fixation activity, and photographs for leaf phenology. Because our data were collected at short intervals, we can describe integrative activity using models such as DayCent. To date, we focused on an arbuscular mycorrhiza dominated meadow and an ectomycorrhizal pine/oak forest site. By measuring root and hyphal dynamics, we constructed C allocation estimates. In the meadow, the productivity of fine root+internal AM was $120g/m^2/y$. Extramatrical AM hyphal peak standing crop was $10g/m^2$, with a lifespan of 46 days. The annual AM fungal allocation was $12g/m^2/y$ internal and $52g/m^2/y$ external, for a net allocation of $64g/m^2/y$, or 14% of the estimated NPP ($120g\ C/m^2/y$). In the forest, standing crop of fungal hyphae was $8g/m^2/y$, with a 36day lifespan, or $76g\ C/m^2/y$. Assuming that EM represent 20% of the fine root mass ($160g\ C/m^2/y$), and 60% of the soil fungal mass, then the EM NPP is $78g\ C/m^2/y$, or 12% of the estimated NPP. Overall, AM and EM allocations are more similar than expected.

The contribution of power line caused fires to community fire risk in the wildland-urban interface (WUI) in San Diego, County.

Alvarez, Noemi.[1], Wein, Anne[1], and Ratliff, Jamie L. [1]
[1]*USGS Western Region, 345 Middlefield Road, Menlo Park, CA 94025, USA.*

The USGS is conducting research on power line caused fires in Southern California. The USGS is analyzing their potential contribution in the causes and determinants of fires in the wildland-urban interface (WUI) in San Diego County, California. To understand the impact power line fire ignitions have on the communities of San Diego County we are conducting a historical spatial analysis on the frequency of fires caused by power lines and the extent of their impact. This analysis will provide a base line for measuring how effective power line management interventions might be. We are utilizing the California Fire and Resource Assessment Program (FRAP) and the Federal Fire Program Analysis (FPA) system fire data sets. Our first contribution is increasing the accuracy of the records of fires caused by power lines in the FRAP fire perimeters database by incorporating additional fires caused by power lines into the FRAP database, as well as correcting some attributes, such as cause classifications. To date, review of reports allowed us to include 70% more acres burned from power line fire ignitions, compared to what is currently in the database for acres burned by power lines caused fires in San Diego County. We are relating the spatial analysis results to the infrastructure of the electrical power grid in San Diego County, as well as the topography to better understand power line fire ignitions risk and impact.

Resilience of an urban coastal sage scrub remnant to wildfire fuel modification

Anderson, Sean S.[1,2], Lambrinos, John G.[3], Huggins, Thomas R.[4], Prigge, Barry A.[4], Schrott, Greg R.[5], Malone, John C.[6]

[1] *California State University Channel Islands, Environmental Science and Resource Management Program, 1 University Drive, Camarillo, CA 93012, USA*

[2] *Pacific Institute for Restoration Ecology, California State University Channel Islands, 1 University Drive, Camarillo, CA 93012, USA*

[3] *Oregon State University, Department of Horticulture, Corvallis OR 97331, USA*

[4] *University of California Los Angeles, Department of Ecology and Evolutionary Biology, 621 Charles E. Young Drive, Los Angeles, CA 90095, USA*

[5] *Archbold Biological Station, 123 Main Drive, Venus, FL, 33960, USA*

[6] *Anchor QEA, 26300 La Alameda, Suite 240 Mission Viejo, CA 92691, USA*

In Southern California, local ordinances require protection of structures by fuel modification buffers. Buffers replace native vegetation with predominately non-natives that have a presumed lower fuel load or lower flammability. Few data exist on the long-term sustainability of these buffers, or the influence of fuel modification schemes on natural succession. This study reports the recovery of an urban coastal sage scrub remnant following the application of a fire fuel modification scheme. In 1962 a two ha patch of coastal sage scrub on the UCLA campus (Los Angeles, CA, U.S.A.) was cleared of native vegetation and planted with non-native grasses and shrubs. Half a century later, native coastal sage scrub species have recovered dominance at the expense of the planted non-native species. Native species represent 73% of the relative foliar cover. Of the 47 species originally planted as part of the fuel modification scheme only eight still remain at a low frequency. Floristically the patch now resembles more contiguous and un-modified stands of coastal sage scrub. However, native annuals are largely absent, and there is a relatively high species richness of non-native annual grasses and perennials. These results suggest that the perennial component of coastal sage scrub can have a high resilience to the application of typical fuel modification schemes, even in small highly urbanized fragments. If these results are general to other sites, intensive and costly management will likely be required to maintain buffers along the urban-coastal sage scrub interface.

Engaging Citizen Science Volunteers in Stewardship and Management of the Irvine Ranch Natural Landmarks

Anon, Susan H., Burger, Jutta C., Lulow, Megan, and Raetz, David.
Irvine Ranch Conservancy, 4727 Portola Parkway, Irvine, CA 92620, USA.

The Irvine Ranch Conservancy (IRC) has an extensive and innovative volunteer coordination and outreach program that effectively matches volunteers with specific interests and skills. Many of our volunteers have an interest in a particular area of study or in general stewardship of the land but do not have a strong background in ecological sciences. IRC has developed a Citizen Science Program that engages volunteers in a variety of projects and is able to extract high quality data that in turn informs stewardship of natural resources and management activities. A newly created and award-winning partner website for the Irvine Ranch Natural Landmarks (IRNL; www.irlandmarks.org) as well as other social media tools makes it easy for the public to get information about the land, register for activities, volunteer, and connect with others by sharing photos and experiences. Advanced trainings allow us to invest in the development of volunteers' knowledge, technical abilities, and leadership skills and gives citizen science volunteers a sense of ownership and pride in their work. IRC has had tremendous success utilizing citizen science volunteers to manage our on-going camera trapping project designed to monitor the effect of human access on wildlife activity since June 2007. Volunteers service and monitor 42 remote cameras across the IRNL and record the collection data. Four different routes have been established such that volunteer teams service a consistent subset of cameras every two weeks. Other citizen science projects involve data collection for studies including oak establishment, cactus restoration, trapdoor spider colony monitoring, raptor nest surveys and riparian invasive plant species surveys. Much of this work would not be possible without volunteer support. IRC is specifically committed to engaging volunteers in projects that both help inform management decisions on the land and help educate the public about the ecology and natural history of the IRNL.

Comparative patterns of alien plant invasions in Mediterranean climate regions of the World

Arianoutsou, Margarita[1], Delipetrou, Pinelopi[2], Vilà, Montserrat[3], Celesti-Grapow, Laura[4], Henderson, Lesley[5], Wardell-Johnson, Grant[6], Ugarte, Eduardo A.[7] and Rundel, Philip W[8]

[1]Department of Ecology and Systematics, Faculty of Biology, University of Athens, 15784 Greece; [2] Department of Botany, Faculty of Biology, University of Athens, 15784 Greece; [3]Estación Biológica de Doñana (EBD-CSIC), Avda. Américo Vespucio, s/n Isla de la Cartuja, E-41092 Sevilla, Spain; [4] Department of Environmental Biology, University of Rome, La Sapienza, I-00185 Rome, Italy; [5]ARC-Plant Protection Research Institute, stationed at South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001, South Africa; [6]Curtin Institute for Biodiversity and Climate, Curtin University; Australia; [7]Department of Botany, University of Concepcion, Concepcion, Chile; [8]Department of Ecology and Evolutionary Biology, University of California (UCLA), Los Angeles CA 90095, USA

The introduction of alien species has altered the composition of biotas worldwide. At the regional scale, climate is an environmental factor that, together with habitat type is fundamental to explaining distribution patterns of alien plant naturalization. Yet, a global assessment of their importance requires a thorough exploration of invasion patterns across homologous biogeographical regions. We compared the levels of invasion in natural habitats and species traits of the naturalized flora across the five Mediterranean regions of the world. A total of 1369 neophytes naturalized in natural habitats where recorded with an overall low (<10%) taxonomic similarity among regions, with the Mediterranean basin being the most distinct region. The highest species similarity was between Chile and Australia and between this group and California. South Africa and the Mediterranean Basin had lowest species similarity levels. The only species common to all regions were the South American *Nicotiana glauca,* the North American *Robinia pseudoacacia* and the Eastern Australian *Acacia dealbata* and *A. melanoxylon*. The majority of the naturalized taxa were herbaceous. Trees were the least frequently recorded growth form, except in South Africa. With respect to the life form, therophytes were the most prominent in Western Australia and Chile, while in California and the Mediterranean Basin phanerophytes and hemicryptophytes were the most frequent. Phanerophytes were the most frequent life form in South Africa. In general, wetlands and grasslands were the habitats with the highest number of naturalized species, but there were distinct levels of invasion in the other habitats across regions. In conclusion, the similarity on alien species assemblages was more associated to the identity of the region than on habitat type. The floristic composition and habitat level of invasion reflects a distinct but loose differentiation between the Old World and the New World regions, possibly as a consequence of bilateral introduction interchanges.

Physiological constraints on structure and composition of fog-dependent forest patches in Fray Jorge National Park, semiarid Chile

Armesto, Juan J., Salgado Beatriz, Stanton Daniel, Gaxiola Aurora
CASEB, Department of Ecology, Pontificia Universidad Católica de Chile, and Institute of Ecology and Biodiversity, Santiago, Chile.

Forest patches are often characterized by an edge surrounding a core, which remains relatively unaffected by the external matrix. This idealization is inherently symmetrical when viewed from above, assuming that resources are delivered either vertically or diffuse horizontally from all sides. However, forest fragments in the semiarid summits of Fray Jorge National Park, are dependent on water and nutrients delivered horizontally by incoming fog in an asymmetric manner. We explored whether limiting resources were delivered and distributed asymmetrically to patches of contrasting sizes and evaluated the effects on the distribution and regeneration of the dominant tree species, *Aextoxicon punctatum, Drimys winteri* and *Myrceugenia correifolia*.

Fragments are structured by the asymmetrical input of water and nutrients, which has shaped seedling distribution and tree mortality. The asymmetry is congruent with the prevailing fog and wind direction and is modulated by the slope of the hills where forest fragments occur. *Aextoxicon* and *Myrceugenia* were present in all forest fragments, while *Drimys,* was only present in the largest fragments. *Myrceugenia*, a tree species restricted to Mediterranean-central Chile, has the highest stomatal density and leaf mass per area (LMA), regenerating in all-sized fragments, especially the smaller and drier ones, as well as the drier forest edges. *Drimys* and *Aextoxicon*, which also occur in wet temperate forests, did not differ in stomatal density or LMA. However, *Drimys* looses turgor at higher pressure than *Aextoxicon*. Therefore, the higher physiological plasticity of *Aextoxicon* allows it to dominate forest fragments.

We show how tree species from temperate wet forests (>1500 mm of annual rainfall) can withstand the conditions of FJNP, where mean annual rainfall is140 mm, but fog inputs may deliver additional 400 mm of horizontally distributed inputs. Distribution of *Drymis* and *Myrceugenia* is constrained by their niche requirements from wet-temperate or drier Mediterranean forests, respectively.

Bryophytes from the mediterranean climate to the high country in California

Ayala-Coleman, Lena M., Wilson, Paul S.
California State University, Northridge, 18111 Nordhoff Street, Northridge, CA 91330, USA.

Mosses differ fundamentally from vascular plants. Many can tolerant desiccation. Hot dry summers are not a challenge; mild wet winters are an opportunity. We are currently studying how the moss community changes across a 3000 m elevational gradient from the foothills with their mediterranean climate to the alpine zone where snow covers mosses throughout the winter. In microhabitats that are subject to rapid drying, number of bryophyte occurrences and species richness are highest in the mediterranean climate. In microhabitats that are wetter, the pattern is not so strong, or higher elevations might even have more wet-site bryophytes. The patterns are structured taxonomically. For example, Pottiaceae are richer at low elevations, whereas Mniaceae are richer at mid and high elevations. Among liverworts, Marchantiales are richer at low elevations, and Jungermanniales are richer at high elevations. There appears to be phylogenetic conservatism in niche affinities. Bryophyte species, in general, seem to have geographic ranges much larger than those of vascular plants. For example, there are species (or closely related complexes of species) that occupy the same microhabitat in lowland California and in lowland Spain. On the other hand, disjunctions between California and Chile seem less common. For high elevation species, there are many in California's high Sierra that extend north, are circumboreal-montane, and also occur in the high mountains of southern Europe and northern Africa. Vascular plant ecologists who assume that bryophytes hate dry climates are in for a surprise.

The unruly and the dammed: Mediterranean-climate rivers and their regulation

Batalla, Ramon J. [1,2,3], Vericat, D. [1,2,4], Kondolf G. Mathias[5]
[1] *Department of Environment and Soil Sciences, University of Lleida, E-25198 Lleida, Catalonia, Spain*
[2] *Forest Technology Centre of Catalonia, E-25280 Solsona, Catalonia, Spain*
[3] *Catalan Institute for Water Research, H2O Building, E-17003, Girona, Catalonia, Spain*
[4] *Institute of Geography and Earth Sciences, Aberystwyth University, Wales. UK.*
[5] *Department of Landscape Architecture & Environmental Planning, University of California, Berkeley*

Channel processes in Mediterranean regions are dominated by irregular hydrology and episodic flooding. In those areas, water availability and demand are out of phase, thus large seasonal and interannual water storage is needed. As a result, Mediterranean-climate rivers tend to be more regulated than humid counterparts. The lower River Ebro (85,300 km^2, Q_{mean}=450 m^3/s) provides an interesting example of this. Regulation of the annual runoff attains 67%, much higher than in northern European counterparts, although lower than similar rivers in California. Dammed rivers do not receive coarse sediments from upstream; in the case of the Ebro, however, the river keeps bedload transport capacity since floods have not been dramatically reduced i.e. bedload reaches 178,000 tons/y. Coarse sediment is entrained from bed and lateral deposits and channel incision is, on average, 1-m since large dams were closed (1960s). In contrast, for long periods of time, flow does not exceed critical discharge for bedload entrainment, facilitating vegetation encroachment that, in turn, reduces sediment source areas. Within this context of change, macrophytes have colonised the main channel massively. This has been here as a major ecological and socioeconomic issue. Flushing flows (FFs) designed on entrainment criteria have been applied regularly since 2002 to control excess of aquatic plants. Such water releases have demonstrated significant scouring capacity, with higher energy expenditure than that observed during natural floods. FFs typically entrain up to medium-size gravel and remove much of the plants, mainly in areas close to the dams (90%); removal efficiency diminishes both downstream and in time. In the context of a sediment-supply system, FFs may cause adverse geomorphic effects, e.g. exacerbating incision; it is thus important to re-assess them regularly at various locations, by monitoring geomorphic responses of the channel. This is done by pre and post-flood surveys in combination with flow modelling that help identifying critical areas where geomorphic effects may be important and quantifying the magnitude of change.

Fire in the five Mediterranean-type ecosystems of the world over the next century: an evaluation of extreme climate projections

Batllori Presas, Enric[1], Parisien, Marc-A.[2], Krawchuck, Meg A.[3], and Moritz, Max A.[1]
[1]Department of Environmental Science, Policy & Management, University of California, Berkeley, CA, USA
[2]Natural Resources Canada, Canadian Forest Service, Edmonton, Alberta, Canada
[3]Department of Geography, Simon Fraser University, Burnaby, British Columbia, Canada

Recent decades have been marked by relatively rapid changes in fire regimes, and further disruptions are expected as global change (climate and land-use alteration) continues. Even using globally generalized models, however, the direction, amplitude, and driving factors of these changes are very heterogeneous and complex, highlighting the need for a systematic regional approach. Mediterranean-type ecosystems (MTEs) are a paradigmatic example of fire-prone vegetation, where fire has played a major role in shaping ecosystem structure, function, and diversity, as well as selecting for characteristic plant traits. Substantial shifts in fire activity can thus have profound effects for the stability of such ecosystems. We used an empirically based statistical modeling approach to project future fire activity in the MTEs over the 21st century, forced by projections from 16 general circulation models (GCMs). A multi-model ensemble approach was chosen because fire is controlled by several climate variables and there is still disagreement among GCMs, especially in future precipitation changes. Despite considerable spatial variability in projected fire probability changes within and among MTEs, we found precipitation to be a major limiting factor for fire activity in all regions examined. Focusing only on the climatic extremes for MTEs, there is general agreement in the direction of fire probability changes under the 4 wettest (mostly fire increases) and driest (mostly fire decreases) climate projections. It is notable, however, that large areas in MTEs are expected to experience reduced fire activity by the end of the century, even in the wettest scenario. We anticipate that climate change, through spatially varied increases in atmospheric evaporative demand, will make fire activity in some MTE areas more energy-limited and in others more moisture-limited (e.g., similar to temperate and desert regions, respectively). Such a trend, which exhibits latitudinal patterns, may differentially affect MTEs of the world.

Vertical and Lateral Carbon Flux in a Subtropical Arid Ecosystem near La Paz, BCS, Mexico

Bell, Tom [1,2], Oechel, Walter [1,3]
[1] *Global Change Research Group, San Diego State University, San Diego, CA 92182*
[2] *Department of Geography, University of California, Santa Barbara, Santa Barbara, CA 93106*
[3] *Fondazione Edmond Mach (FEM), Centro Ricerca e Innovazione (CRI), Via Edmund Mach 138010 – San Michele all'Adige (TN), Italy*

The dynamics of carbon sequestration under water and temperature stress provide important information about carbon exchange in the context of rising atmospheric CO_2 levels, global temperature increase and precipitation shifts. Study of ecosystems under such stressors may inform managers of potential changes in carbon stocks in arid, semi-arid and Mediterranean ecosystems.

The objectives of this study are to identify the variables that drive net ecosystem exchange (NEE) over diurnal, seasonal and inter-annual periods and to determine the importance of lateral fluxes to the carbon budget of a subtropical Sonoran desert ecosystem on the preserve of the Centro de Investigaciones Biológicas del Noroeste (CIBNOR) near La Paz, BCS, Mexico. Using the tower based Eddy Covariance method and litter fall and transport measurements, an accurate measure of lateral carbon transport can be made along with its importance to the overall ecosystem carbon cycle. By analyzing the Eddy Covariance data from 2004-2008, along with previously published data from 2001-2003, an 8-year data set of seasonal and annual carbon flux can be produced. Seasonally, fall and winter show general carbon sinks following large storm events, switching to monthly carbon sources in early spring and increasing through summer. There is a strong control of annual NEE by the current and previous year's precipitation. Inter-annual variability of NEE is due to the variability and interaction of multiple years of precipitation.

Lateral carbon transport experiments show lateral transport of leaf litter is occurring seasonally over large areas and is subject to export from the ecosystem during large storm events. Lateral transport by wind is driven by litter fall produced over seasonal scales. Depending on the geographic and meteorological conditions of the ecosystem, this lateral transport of carbon may distort the annual NEE of the ecosystem when measured by Eddy Covariance.

Simple approaches to restoration of Coastal Sage Scrub habitat in Southern California

Bell, Carl[1], Allen, Edith[2], Weathers, Kristen[2], and McGiffen Jr, Milton[2].
[1]University of California Cooperative Extension, San Diego, California, USA; [2]University of California, Riverside, California, USA.

Approximately 5% of the Coastal Sage Scrub habitat in Southern California that existed prior to European colonization has not been developed for human uses. Over the past two to three decades public agencies and land conservation organizations have worked to acquire some of the remaining lands for preservation. Unfortunately, most of these lands are severely degraded by anthropogenic practices of intensive livestock grazing, farming, and fires. The most visible result of this disturbance is the replacement of the native flora with invasive, non-native vegetation, mostly of Mediterranean origin. Restoration to native flora and fauna is challenging and there are few successful examples to guide others on appropriate methods. Cost is also an important and prohibitive factor. Competition from invasive plants is one of the most difficult impediments to establishing native vegetation. Our information from restoration practitioners and scientists suggests a lack of significant and consistent efforts to diminish the invasive plant seedbank before introducing native plant propagative material. We are comparing annual applications of the non-selective herbicide glyphosate over multiple years to a no herbicide control in a split-plot design as a simple, low cost method of reducing the non-native seedbank sufficiently to allow native vegetation to establish. The sub-plot treatment is sowing seven native species into one half of the main plots compared to a non-sown control. The experiment was established on two sites about 50 m apart at a County of San Diego Open Space Park in 2006. Herbicide treatments were made in the spring each year from 2006-2010. Data collected annually includes plant cover and species richness by main treatment and subplot treatment. In 2010, native plant cover in treated plots was about 50%, consisting of 43 species compared to <5% in the control plots.

Mosaic landscape in Israel: Biogeography and Genetic Diversity of Gall Forming Aphids and their Host Plants

Ben-Shlomo, Rachel[1], Avrani, Sarit[2] and Inbar, Moshe[3]
[1]Department of Biology, University of Haifa - Oranim, Tivon, 36006, Israel;
[2]Faculty of Biology, Technion – Israel Institute of Technology, Haifa, 32000, Israel;
[3]Department of Evolutionary and Environmental Biology, Haifa, 31905, University of Haifa, Haifa, Israel

A mixture of climatic conditions characterizes the eco-geographical landscape of the Levant region. This environmental heterogeneity may create barriers to gene flow and consequently can lead to extinction and/or spatial differentiation between populations. In Israel, the deciduous tree *Pistacia atlantica* (Anacardiaceae) has a wide fragmented distribution along different phyto/zoogeographic and climatic regions, a relic of its wider distribution in moister climates during the Pleistocene and the Holocene. The trees serve as obligate hosts for a group of specialized gall-forming aphids (Homoptera: Fordinae). We examined the genetic diversity of *P. atlantica* trees, and of two gall-forming aphid species, *Slavum wertheimae* and *Forda riccobonii*, in different sites across Israel. The sites represent their wide and fragmented distribution, including northern (mesic) and southern (xeric) populations. Although the trees exhibit very distinct morphologies between mesic and xeric regions, the eco-geographical area had no apparent effect on the level of genetic diversity and differentiation. Analysis of molecular variance (AMOVA) indicated that most of the variance was found within populations, suggesting recurrent gene flow among sites of all tested populations. Genetic differentiation of aphids was found to be distinct from that of the *Pistacia* trees. The aphid species *S. wertheimae* showed a significant genetic differentiation between the northern (mesic) and the southern (xeric) groups, suggesting cryptic allopatric speciation across the region. We detected two major haplotypes one in the Northern Israeli populations and the other, a monomorphic haplotype, found only in the southern Israeli populations in the Negev highlands. Similar propensity was also detected in *F. riccobonii*. Although aphids are highly specialized herbivores, it appears that their speciation does not coincide with the genetic structure of the host plant. Our data suggests that the disjunctive distribution in the Levant should promote speciation via isolation.

A century of extirpation in a large urban wildland: the butterflies of Griffith Park, Los Angeles, California

Bonebrake, Timothy C.[1], and Cooper, Daniel S.[2]
[1]*Department of Atmospheric and Oceanic Sciences, University of California, Los Angeles, 405 Hilgard Ave, Los Angeles, CA 90095, USA.*
[2]*Cooper Ecological Monitoring, Inc., 5850 W. 3rd St., Los Angeles, CA, 90036, USA.*

Founded in 1896, Griffith Park's over 1700 hectares represents the largest municipal park in California and places it in the top ten largest in the United States. Since the early part of the 20th century, biologists and collectors have been interested in the wildlife of Griffith Park and butterflies in particular were the subjects of much early study. For example, the subspecies *Lycaena arota nubila* was discovered in the park in 1922 and first described in 1926 by J.A. Comstock. However, in recent decades periodic and opportunistic surveys of the park have suggested that multiple species are likely no longer present in Griffith Park including *L. arota nubila*. Since 2007 we have monitored the butterfly community at Griffith Park informally and in Feb. 2011 we began weekly transects (Pollard walks) to systematically assess the likelihood of species presence or absence. As of July 2011, we have verified the presence of 32 species. We found 9 species of the Nymphalidae family out of 18 non-migratory Nymphalidae species possible in the park based on historical records and distributions. Of the nine remaining species unaccounted for some appear to have gone extinct from the park early in the century (e.g. *Chlosyne gabbii*) while some have experienced a more recent decline and eventual extirpation (e.g. *Euphydryas chalcedona*). Reasons for the declines are unclear but on-going plant surveys suggest that host plant declines and extirpations may play a role. On the other hand, individuals of *L. arota nubila* were identified in the park in the summer of 2010 emphasizing the difficulty in positively demonstrating extirpation and the tenacity of certain seemingly rare taxa. Finally, these results are relevant to management as continued development of the park and the areas surrounding the park are likely to further alter the Griffith Park butterfly community and their ecosystem.

Fire and the angiosperm revolutions

Bond, William J.
Botany Department, University of Cape Town, Rondebosch, 7701, South Africa.

Climate is generally considered the main factor controlling plant form and the distribution of vegetation (locally modified by soils). This assumption was central to seminal studies of convergent evolution in shrublands growing in Mediterranean-type climates. However mediterranean shrublands are not necessarily at equilibrium with climate or soils. Instead their stature and other attributes may be shared because of convergent fire regimes. All Mediterranean climate regions also support non-shrubby vegetation, including forests, with quite different plant attributes and different fire regimes. The question, then, is whether the fire regimes are primarily determined by extrinsic factors, especially climate, or by the intrinsic properties of the plants themselves. If intrinsic factors are important, then it would be possible to have very different ecosystems, such as shrublands vs. forests, sharing the same extrinsic environmental settings but diverging in fire regime. Changing proportions of alternative states through space and time would depend on factors, intrinsic and extrinsic, influencing the way in which vegetation creates and responds to fire regimes. I explore these questions in the context of angiosperm evolution starting from the spread of early flowering plants in the Cretaceous, the emergence of broad-leaved forests in the early Cenozoic and the rise of grassland and shrubland biomes in the later Cenozoic. Both palaeontological and phylogenetic studies indicate that vegetation fires are ancient and that pyrophytic (flammable shrublands) and pyrophobic (closed forest) formations have existed for many millions of years. The relative areas occupied have fluctuated through time because of changes in both extrinsic (climate, atmosphere) and intrinsic (biological) factors.

Effects of watershed urbanization on Mediterranean-type streams

Booth, Derek B. [1,2], Bledsoe, Brian P.[3], and Downs, Peter W. [2,4]
[1] *Bren School of Environmental Management and Science, University of California Santa Barbara, USA;*
[2] *Stillwater Sciences, 2855 Telegraph Avenue, Berkeley, California, USA;*
[3] *Department of Civil and Environmental Engineering, Colorado State University, Fort Collins, Colorado, USA;*
[4] *School of Geography, Earth and Environmental Sciences, University of Plymouth, Plymouth, UK..*

Changes in the delivery of water and sediment into stream channels, and the resulting imbalance in sediment supply and transport capacity, can lead to changes in channel planform and cross-section via multiple mechanisms. These changes in delivery can result from various disturbances, which Mediterranean-type streams have always experienced—particularly widespread fire and large storms (and, most catastrophically, these two events in sequence). To this list of common watershed disturbances, urbanization must also be added in those regions such as southern California where population growth over the past half-century has been dramatic.

The effects of watershed urbanization in Mediterranean-type streams mirror many of those reported since the 1960's, including flashier hydrographs with increased peak discharge and more frequent flood flows, elevated pollutant concentrations, altered channel morphology, and reduced biotic richness. At first glance, the research and resulting understanding of these systems apply uniformly across all temperate regions of the globe. Closer evaluation of one such Mediterranean region, however, suggests that directly transferring understanding from humid-region watersheds (and, by implication, mitigation developed there as well) without regard for fundamental differences in climate and geomorphology will be problematic.

Urbanizing southern California watersheds have been intensively evaluated over the past decade, both within focused studies of urban streams and as part of broad-based watershed analyses. Key findings include:

- Peak flows show significant increases, akin to (or even greater than) those observed in humid regions despite a greater presumptive prevalence of overland flow in undisturbed catchments;
- Sediment delivery is significantly reduced, reflecting a much greater sediment load from undisturbed Mediterranean-type watersheds (and much greater reductions resulting from urbanization) than in their humid-region counterparts;
- Channel morphologies in both undisturbed and urbanized watersheds exhibit distinctive disturbance responses but have few analogs in humid regions. Channel evolution sequences do not necessarily align with conventional wisdom developed elsewhere.

Phytogeographical Centres of Endemism in the Cape Floristic Region: location, endemism richness and levels of protection

Bradshaw, Peter
South African National Parks, Port Elizabeth, Eastern Cape South Africa

The Cape Floristic Region is world renowned for its numbers of endemic taxa. Approximately 69% of CFR taxa are restricted to it, including many narrow endemics. However, endemism is not uniform throughout the CFR, and it is important from a conservation perspective to determine where endemic taxa are concentrated. A dataset comprising 4414 taxa was analysed to identify Phytogeographical Centres of Endemism within the Cape Floristic Region. Taxa analysed were mostly recognised fynbos taxa (e.g. Proteas, Ericas, Restios) or CFR centred taxa. Clustering algorithms on weighted datasets and additional GIS analysis were used to identify Phytogeographical Centres of Endemism. In addition to confirming and refining previous phytogeographical centres, new centres and sub-centres were identified. Endemism richness was found to vary across the CFR, but generally decreased along northern and eastern gradients, corresponding to the amount of winter rainfall received. The protected area network was evaluated to determine how well it conserves these centres and areas requiring additional protection are identified.

Managing fire risk in temperate forests: insights from the 2009 Victorian (Australia) bushfires

Bradstock, Ross and Price, Owen
Centre for Environmental Risk Management of Bushfires, University of Wollongong, NSW, Australia

Fires in the south eastern state of Victoria in early February 2009 destroyed over 2500 buildings and killed 173 people. These fires occurred chiefly in temperate forested landscapes under weather conditions of the utmost recorded severity. While the size, intensity and level of damage of to human infrastructure are not unprecendented, the opportunities for analyses of the causes of losses are unique due to the potential to integrate detailed spatial data. Analyses indicate that weather conditions are the dominant factor controlling fire severity and inferred fire intensity. Therefore, opportunities for effective suppression in these forests may be negligible when the weather is at its worst. Probability of house destruction under these conditions is a complex function of the interaction between fuel age, forest cover, housing density and distance of vegetation from property. Losses tended to be low when: houses are more than 100m from forests; fuel age in adjacent forests is low; house density is low, and; forest cover up to a distance of 2 km from property is low (i.e. substantially cleared). These results reinforce the necessity to implement appropriate planning for development in the future to limit the exposure of property to fire-prone forests. They also reinforce the necessity to focus fuel treatments to the immediate vicinity of existing developments. The latter requirement poses a formidable challenge to land and fire managers.

Restoration Ecology in an Urbanizing Landscape: Challenges and Opportunities

Brigham, Christy A.[1] Irina Irvine[1]and Joseph Algiers[1]
[1]*National Park Service – Santa Monica Mountains National Recreation Area, 401 West Hillcrest Dr., Thousand Oaks, CA 91360*

Across the Mediterranean ecosystems of the world the influence of people upon natural landscapes is ever increasing. Because Mediterranean climates attract people's settlement and are favorable for agricultural development, Mediterranean ecosystems are known for their juxtaposition of high biological diversity with great pressure from human populations. For restoration ecologists, urbanization can present its own unique set of challenges and opportunities. In our talk we will give a broad overview of some of the challenges and opportunities that a highly human influenced environment presents to the restoration ecologist. We will supplement this general overview with specific examples from restoration projects within the Santa Monica Mountains National Recreation Area in southern California, USA. Specific challenges that we will discuss include the highly permeable nature of protected area boundaries in urban landscapes, the large number of vectors available in urban landscapes for transportation of invasive species and diseases into protected areas, the depauperate nature of the seed bank in many of these areas as well as the incredibly rich invasive species biota which can combine to create a difficult to break "weed cycle". We will discuss our work with removal of species such as *Euphorbia terracina, Lepidium latifolium, Centaurea solstitialis*, and *Phalaris aquatica* as well as post removal restoration efforts. Opportunities found in restoration projects in urbanizing landscapes may include a large and diverse population in close proximity with whom you can engage in citizen science efforts, stewardship learning opportunities, and ecological literacy projects. In addition, there is typically a rich diversity of academic resources and faculty that may be enticed into your projects through interesting research and management questions. After presentations of examples of these phenomena from our own work, we will conclude with some general recommendations for managers hoping to complete successful restoration projects in urban landscapes.

Evolutionary history of the hyacinth family (Hyacinthaceae) and its implications for conservation

Buerki, Sven[1], Jose, Sarah[1], Manning, John C.[2], Goldblatt, Peter[3], Yadav, Shrirang R.[4] and Forest, Felix[1]

[1]Jodrell Laboratory, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3DS, United Kingdom; [2]Compton Herbarium, Kirstenbosch Research Centre, South African National Biodiversity Institute, Claremont 7735, South Africa; [3]B.A. Krukoff Curator of African Botany, Missouri Botanical Garden, PO Box 299, St. Louis, MO 63166-0299, U.S.A.; [4]Department of Botany, Shivaji University, Kolhapur-416 004(MS), India.

The Hyacinthaceae family (or Asparagaceae subfamily Scilloideae), which comprises bluebells, hyacinths and squills, contains about 1000 species assigned to 35 genera. These are distributed in the Old World, principally in Africa and the Mediterranean, while a single genus of only five species is endemic to South America. A large part of the present diversity of the family is found in two of the five biodiversity hotspots with Mediterranean ecosystems, i.e. the Mediterranean Basin and the Cape of South Africa. The importance and role of these regions in the evolution of this group are examined here using a 256-species data set based on plastid DNA sequences and a suite of comparative analyses. We show that all major groups within Hyacinthaceae originated in sub-Saharan Africa, with several of them diversifying mainly within this region followed by several dispersal to other areas, principally the Cape, Madagascar and the Mediterranean. Dispersals to the Mediterranean basin region resulted in important diversifications within this region, which account for most of its present day diversity; a similar pattern is observed for the Cape. Most dispersal events within Hyacinthaceae took place after the Mid-Miocene Climatic Optimum, during a period of global cooling and increased aridification. Using a likelihood method that estimate region-dependent speciation, extinction and range expansion/contractio rates from the Hyacinthaceae phylogenetic tree, we show that the Mediterranean and Cape regions present significantly higher rates of speciation and extinction compared to other regions where this family is found. This is indicative of the importance of the evolutionary potential of these two regions in Hyacinthaceae inparticular, but also in flowering plants in general. The implications for the conservation of these unique regions are briefly discussed.

Mediterranean Riparian Vegetation: Improving Studies, Management and Restoration (case studies in south-eastern France)

Buisson, Elise[1], Tamisier, Vincent[1], Dufour, Simon[2]
[1] *IMEP - UMR CNRS IRD, IUT de l'Université d'Avignon, Site Agroparc, BP 61207, 84911 Avignon cedex 09, France.* elise.buisson@univ-avignon.fr
[2] *COSTEL/LETG – UMR CNRS, Université de Rennes 2, Place recteur le Moal, 35000 Rennes cedex, France.* simon.dufour@univ-rennes2.fr

Riparian biodiversity conservation and management are major issues in the Mediterranean biome, where (i) ecosystems are sensitive to climatic and hydrological conditions (and therefore changes) and (ii) their spatial structure remains poorly known both locally and regionally. In order to improve the scientific basis for sustainable management we propose two approaches: field studies and ex-situ experiments. 1) Field studies were conducted on rivers in south-eastern France to develop and test a protocol at different scales (local and regional) and adapted to Mediterranean riparian context integrating hydrological, geomorphological and ecological characteristics; the protocol was then tested on nine rivers and validated. 2) The effects of disturbance on riparian vegetation were surveyed after the massive death and subsequent removal of *Platanus acerifolia* which were commonly planted in the riparian forest of south-eastern France and recently suffered from the fungus *Ceratocystis fimbriata platani*. Vegetation regeneration is highly dependent on the width of the riparian vegetation, on the topography and on the land-use on adjacent sites. 3) Finally, we studied the physiological response of eight tree species (four natives and four exotics) to water availability depending on the type of substrate; the results of this study show that the eight species have a wide variety of needs and responses to limited water supply and confirm the importance of limiting the spread of exotics and maintain a high diversity of habitats in the riparian vegetation.

Ten Years of Research in a Mediterranean Pseudo-Steppe: Impacts of Land-use changes and Ecological Restoration

Buisson, Elise[1], Coiffait-Gombault, Clémentine[1], Jaunatre, Renaud[1], Henry Frédéric[1], Fadda, Sylvain[1], Dutoit, Thierry[1]
[1] *IMEP - UMR CNRS IRD, IUT de l'Université d'Avignon, Site Agroparc, BP 61207, 84911 Avignon cedex 09, France.* elise.buisson@univ-avignon.fr

The plain of La Crau, located in south-eastern France, is the only Mediterranean steppe of western Europe. On a landscape covered by short-stature herbaceous vegetation, this ecosystem hosts an exceptional biodiversity: a unique plant community, several endemic animals (Coleoptera, earthworm) and protected birds (pin-tailed sandgrouse, little bustard, lesser kestrel). Resulting from particular climatic and soil conditions and from the multi-secular itinerant sheep grazing, this original ecosystem is also considered as an outpost of North African semi-arid steppes in the northern part of the Mediterranean Basin. However, its area has been reduced by more than 80% since the 16th century due to military, industrial and intensive agricultural land-uses. Since 2000, research has been carried out to (i) identify the origins and characteristics of the reference ecosystem; (ii) describe the effects of land-use changes on biodiversity; (iii) restore areas after various types of degradation. Our results show the reference steppe is not a degraded forest as it is often misinterpreted for herbaceous ecosystems, but a natural and ancient ecosystem which can be qualified as a biological monument. Created over centuries, it evolved with grazing and particular abiotic conditions. Its structuring has been slow and it is extremely poorly resilient to exogenous disturbances. Despite the progress made in restoration, the existing knowledge and techniques are still inadequate to restore the steppe integrity. However, results are encouraging and some of them will be useful to improve future restoration of steppes and similar semi-arid ecosystems.

Pulled from all sides: Weed legacy and herbivore effects on native plant establishment in a disturbed southern Californian grassland

Burger, Jutta C., Anon, Susan
Irvine Ranch Conservancy, 4727 Portola Parkway, Irvine CA 92620

Grasslands rank among the most threatened native communities in the California Floristic Province. Exotic weeds such as artichoke thistle, brome grasses, and black mustard dominate many protected areas where native grasslands once dominated. Native cover is so low at some sites that even reconstructing the historic community is difficult. At the City of Irvine Open Space Preserve's Quail Hill, several hundred acres of annual grassland are presumed to have once been perennial grassland. Sources of disturbance likely responsible for habitat degradation have been removed, but native vegetation is not recovering. The Irvine Ranch Conservancy established a restoration trial here in order to determine native re-establishment success across different initial weed cover types. Fifty-six 1x1m plots initially vegetated with either non-native annual grasses, artichoke thistle, or black mustard were cleared and planted in 2009 with needlegrass and four coastal sage scrub shrubs, and seeded with a native grassland mix in two successive years. Plots were weeded over the course of the study. Native species were significantly less likely to survive on plots that had mustard versus other cover and non-native grass cover was initially lower in artichoke thistle plots. Legacy soil effects persisted over three growing seasons, long after initial weed cover had disappeared. All plots experienced substantial herbivory by rabbits, which clipped shrubs and needlegrass and most seeded annuals. We conclude that grassland restoration is confounded by top down and bottom-up effects that favor persistence of exotic weeds even when competition is controlled. Soil effects are consistent with previous studies and suggest that restoration activities on mustard stands should incorporate soil remediation activities or more extensive site preparation.

Planning for Climate-Adapted Conservation in a Biogeographic Crossroads

Cameron, Dick [1], Antenen, Susan[2], MacKenzie, Jason[1]
[1] The Nature Conservancy, San Francisco, CA USA; [2] Conservation Biology Institute, Corvallis, OR USA

Climate change is impacting species and natural communities across the globe resulting in changes in distribution, phenology and community composition. Conserving biodiversity in this future will require more dynamic tools to support decisions, more adaptive management and monitoring and a broader suite of protection and restoration strategies to complement existing ones. The Southern Sierra Partnership recently completed a conservation assessment that explicitly accounts for the projected climate effects on species in the design of conservation priorities for a 2.8 M hectare planning area in the Southern Sierra Nevada and Tehachapi Mountains. We mapped three levels of conservation function: core conservation areas (33% of the region) and primary (14%) and secondary (13%) buffer and connectors to link the core conservation areas as part of a Regional Conservation Design. This network of areas meets representation goals given current habitat distribution and potential future distribution using an ensemble modeling approach under A2 emissions scenario. We present this analysis as a science-based hypothesis of how the region will need to managed across ownerships and gradients to maintain its biodiversity and ecosystem services.

Root responses of phreatophytic Mediterranean Type Ecosystem shrubs to groundwater availability

Canham, Caroline A., Froend, Raymond H., Stock, William D.
Centre for Ecosystem Management, Edith Cowan University, 270 Joondalup Drive, Joondalup, 6027, Western Australia.

In many MTEs phreatophytic plants avoid water deficits by accessing ground water. Connection to, and maintenance of contact with this reliable water source is dependent on difficult to measure root responses deep in the soil profile. Root elongation rates of seedlings and the rapid responses of deep roots to seasonal fluctuations in the water table are critical for the establishment and persistence of these species in seasonally water stressed environments. In this project we investigated seedling root elongation rates (establishment) and the response of established plants to different rated of groundwater decline (persistence) in 'rhizopods' 3m in depth. We also used root in-growth bags, in the field, to monitor seasonal root growth at depths of up to 3.7m. Seedlings of both species, which differed in their dependence on groundwater, were observed to have roots extending to the capillary fringe at 1m within 46 to 69 days after transplanting. Root extension rates were significantly higher for the facultative phreatophyte, peaking at 37 mm d^{-1} for *B. attenuata* compared to 18 mm d^{-1} for *B. littoralis.* Plants growing with a constant depth to water table (80cm), which was then manipulated to decline at 2, 4 and 10 cm per day showed a rapid drought response through reductions in stomatal conductance, transpiration and photosynthesis. Mortality of these plants was also high, particularly for the facultative phreatophyte, *B. attenuata*. In the field root growth at the capillary fringe was seasonally independent and followed changes in the depth of the capillary fringe. It appears that the deep root responses of MTE pheatophytes are dynamic and responsive to water availability and this ability enables these species to establish and persist in environments with extreme seasonal water deficits.

Fire Science, Fire Management, and Restoring Fire in Sequoia and Kings Canyon National Parks

Caprio, Anthony C.
Fire Ecologist, Sequoia and Kings Canyon NP 93271

The loss of fire as a keystone process in many plant communities in Sequoia and Kings Canyon National Parks has resulted in significant ecosystem changes. The parks have a goal of restoring fire at a landscape scale to ecosystems perturbed by over 100 years of fire exclusion with an objective of reestablishing a more historic character and condition to improve stability and resilience. While fire's role is being reintroduced, specific restoration targets for its application have remained elusive because of inadequate baseline information about fire regimes within particular vegetation types, which occur over a broad elevation gradient and complex topography. Restoration can be enhanced by improving our understanding of ecosystem dynamics, such as processes that operated prior to fire exclusion, or community age structure and species life history traits, and by monitoring both short and long-term fire effects as fire is restored. Integrating these factors improves our ability to develop and implement fire management strategies suited to current conditions, to assess whether burns are meeting overall management objectives, and determine if new objectives should be developed to meet future challenges, such as a changing climate. For example, the parks use a GIS based "ecological needs" model based on estimates of fire return interval departures (FRID) to integrate aspects of this information and apply it spatially across the parks to assist in fire management planning by both highlighting areas where the restoration of fire may be a high or low priority. Feedback from research and fire effects monitoring indicate that restoring fire is not a simple single burn entry process but will require multiple fire entries to address unnatural fuel and vegetation conditions and that there may be unanticipated consequences, such as increased flammability in some plant communities as species composition shifts, even though overall fuel loads are reduced. Additionally, understanding the historic variation of fire through time, particularly in relation to topography and climate, will allow us to judge whether future changes in fire or fire effects are within or outside an expected range of variation and potentially a result of changing climate.

Management of cork oak ecosystems: increasing tree resilience or vulnerability to fire?

Catry, Filipe X.[1], Moreira, Francisco[1], Pausas, Juli G.[2], Fernandes, Paulo M.[3], Rego, Francisco[1], Cardillo, Enrique[4], and Curt, Thomas[5]

[1]Centre for Applied Ecology, School of Agriculture, Technical University of Lisbon, Lisboa, Portugal; [2] Desertification Research Centre, Spanish National Research Council, Valencia, Spain; [3] Centre for the Research and Technology of Agro-Environmental and Biological Sciences, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal; [4] Institute for the Wood, Cork and Charcoal, Badajoz, Spain; [5]Cemagref, Mediterranean Ecosystems and Risks Research Unit, Aix-en-Provence, France.

Many forest ecosystems worldwide are facing management, climate and fire regime changes that may threaten their sustainability. Those ecosystems where tree bark harvesting is a periodical activity may be particularly vulnerable, since debarking usually reduces tree vigour and protection against external agents. This is the case of cork oak *Quercus suber* ecosystems which are of great socio-economic and ecological importance in the Mediterranean Basin. We asked how *Q. suber* trees respond after wildfires and, in particular, how bark harvesting affects post-fire tree survival and regeneration. We used data collected from 22 different wildfires (4585 trees) that occurred in three southern European countries (Portugal, Spain and France), covering a wide range of ecological and management conditions of cork oak ecosystems. Post-fire tree responses were examined in relation to several tree and site characteristics. Although *Q. suber* is known as a highly fire-resistant and resilient species, we show that tree vulnerability to fire damage is at its highest level just after bark harvesting, and then it decreases with time until cork is 3-4 cm thick, which is usually attained just before trees are debarked again. Thus, particularly during the first half of the cork production cycle, trees are highly vulnerable to fire and therefore managers need to be aware of this. Several management actions could be taken to increase fire-resilience of *Q. suber* ecosystems. Surface fuel reduction and promoting less flammable species, avoiding stem wounds during bark harvesting operations, debarking trees from a given stand in different years, and increasing the length of the harvesting cycle, could reduce the vulnerability of these forests. The developed models can improve the ability to estimate the economic and ecological impacts of fire, and can be used to support management decisions, spanning hazard mitigation through to post-fire restoration.

Intensified Drought in California's Future?

Cayan, Daniel [1,2], Das, Tapash[3], Pierce, David [1]
[1] *Scripps Institution of Oceanography, University of California San Diego, La Jolla, California, USA*
[2] *U. S. Geological Survey, La Jolla, California, USA*
[1] *CH2MHill, San Diego, California, USA*

California's climate is marked by exceptionally strong variability in wetness on seasonal to multiannual time scales, reflecting its sensitivity to fluctuations in storm tracks and other aspects of the large scale atmospheric circulation. Embedded in this variability is a sequence of droughts, displaying a range of intensity and duration. Our climate history is a crucial element in planning, but resource managers could be confronted with a future in which droughts may become even more severe. This is because there is a high likelihood that climate will warm substantially, and the IPCC 4th Assessment generation of climate simulations suggest that Mediterranean environments including parts of California could become drier over the next several decades. Here we examine output from several global climate model (GCM) simulations to investigate how climate change could change the delivery of moisture to California. This output, exercised through the Variable Infiltration Capacity (VIC) macro-scale hydrologic model, is then used to estimate how the impacts of warming and other aspects of climate change may produce changes in runoff, soil moisture and other measures of California's land surface over the 21st Century.

Exploring progenitor-derivative species pairs and their role in island speciation: implications for broad-scale conservation in Mediterranean climate island systems

Clark, John R.[1,2]
[1] *Catalina Island Conservancy, PO Box 2739, 125 Clarissa Ave., Avalon, CA 90704, USA.*
[2] *Rancho Santa Ana Botanic Garden, 1500 N. College Ave, Claremont, CA 91711, USA.*

Progenitor-derivative species pairs occur when a regionally restricted species "buds off" from a widespread species. These species pairs have been documented in cases of edaphic speciation where local adaptation to unique soil conditions can drive relatively rapid speciation. Less well studied but perhaps as common are progenitor-derivative species pairs that form resultant from dispersal-mediated allopatry in islands (J.R. Clark et al., current research). In either case, the progenitor species is rendered paraphyletic for a period of time following formation of the derivative species. Progenitor species are effectively a source for incipient species wherever new ecological opportunities are present. In this presentation, known progenitor-derivative species pairs in Mediterranean-climate ecosystems and associated islands are described and evidence is presented that suggests this mode of speciation is more common than once thought. Examples from the California Channel Islands of emergent and/or potential speciation via this mode are highlighted. It is argued that the current paradigm of conserving rare and endemic taxa disproportionately over widespread "stable" taxa might inadvertently facilitate the loss of haplotype diversity in progenitor species. The loss of this diversity warrants increased efforts to conserve populations in even the most common of species.

Wood rings in rare maritime chaparral shrubs: fire, climate and browsing

Coale, Tyler H., Deveny Adrian J, and Fox, Laurel R
Department of Ecology and Evolutionary Biology, University of California, Santa Cruz, California 95064 USA

Growth rings of woody plants may record separate effects of abiotic and biotic factors on the structure and dynamics of ecological communities. We first showed that growth rings of two rare, endemic shrubs, *Ceanothus cuneatus rigidus* and *Arctostaphylos pumila*, are annual, even in a coastal Mediterranean-type climate in central California with both mild winters and mild summers that are buffered by onshore breezes and sea fog. Then, we teased apart the roles of fire, rain and browsing in this maritime chaparral habitat. Ring widths of both species reflected rainfall in two of the areas; in the other areas, *Arctostaphylos* diameter growth also reflected rainfall, but heavy deer browsing on *Ceanothus* overwhelmed the climate signal. *Ceanothus* germination was more closely related to heavy rainfall, especially during ENSO years, than to fire events. In a separate greenhouse experiment that evaluated these observations, the same proportions of new *Ceanothus* seeds germinated after burning and after receiving regular water for several months, showing that individual seeds could respond to either stimulus; germination of old seeds responded primarily to the fire treatment. Where heavy mammal browsing reduces *Ceanothus* recruitment and growth and increases mortality, the continuance of *Ceanothus* populations must rely heavily on germination from the persistent seed bank during unusually wet years or after occasional fires. Because *Arctostaphylos* can produce new stems from underground roots, individual plants may survive and produce seeds until another fire.

Coupled Weather-Fire Modeling and Remote Sensing of Wildland Fires and Fuels

Coen, Janice L.[1] and Riggan, Philip J.[2]
[1]*National Center for Atmospheric Research, P. O. Box 3000, Boulder, CO, 80307-3000, USA.*
[2] *U.S. Forest Service, Pacific Southwest Research Station, Forest Fire Laboratory, 4955 Canyon Crest Drive, Riverside, California, 92507, USA.*

We present joint modeling and remote sensing case studies of large wildland fires, primarily in southern California. We investigate the factors influencing the growth of large wildland fires using a coupled weather-wildland fire model to simulate the growth of a fire, its impact on the atmosphere, and the subsequent feedback of these fire-induced winds on fire behavior. The methodology uses a numerical weather prediction model capable of modeling fine scale atmospheric flows (under 1 km horizontal resolution) in the steep, complex terrain of southern California ranges. The wildland fire component is based upon semi-empirical relationships for the rate of spread of a flaming front, post-frontal heat release, and a canopy fire model. Simulations model the fire growth and interaction with the atmospheric flow near the fire and how the fire modifies this flow. We compare these simulations with meteorological observations and airborne measurements. Airborne remote sensing imagery from the FireMapper thermal-imaging radiometer on the USDA Forest Service PSW Airborne Sciences Aircraft maps the fire and is used not only for evaluating the error in the simulated extent of the fire perimeter but to reveal dynamically active regions of the fire fronts, their intensity, and their depth. Additional techniques are used to derive spatially distributed quantitative fuel properties that may be used as input to the model. Together, these simulations and observations are used to understand the dynamics of fire fronts, combined effects of fuel, terrain, and weather on fire behavior, and convective effects on fire evolution. Remote sensing data also suggests how fire behavior varies across age classes. We identified flow effects in complex terrain that, along with feedbacks between fire and atmosphere, captured many aspects and phenomena in the unfolding of large wildfires, despite known weaknesses in the empirical models, particularly when applied to southern California chaparral fuels.

The *Arundo* Invasion: Control Strategies Based on Ecological Research in California and South Africa

Coffman, Gretchen C.[1,2*], Dudley, Tom[2], Rundel, Phil W.[3], and Ambrose, Richard F.[4]
[1]*Department of Environmental Science, University of San Francisco, San Francisco, CA, USA*
[2]*Marine Science Institute, University of California, Santa Barbara, CA, USA*
[3]*Department of Ecology and Evolutionary Biology, University of California, Los Angeles, CA, USA*
[4]*Department of Environmental Health Sciences, Environmental Science and Engineering Program, University of California, Los Angeles, USA*

The rapid invasion of the nonindigenous giant reed (*Arundo donax*) has been well-documented in riparian ecosystems in Mediterranean-type climate regions. Millions of dollars have been spent in attempts to remove infestations of this plant from rivers systems in California. Due to the lack of research on *A. donax* ecology, however, decisions regarding prioritization of removal areas and removal techniques often have to be made in the absence of sufficient scientific information. In a Santa Clara River field experiment, I hypothesized that quantity of water, nutrients, and sunlight increase the competitive ability of *A. donax*. Study results suggest that the role of all three factors were critical to the *A. donax* invasion process, but varied in importance based on quantity and availability to plants. Elevated soil moisture and nutrient treatments in full sun resulted in significantly higher *A. donax* biomass compared to three native riparian plants. This indicates that anthropogenically elevated water quantity, decreased water quality and high levels of sunlight are key factors to invasion success especially where disturbance levels are high. Separately, my watershed-scale studies in California and South Africa indicate that nutrient enrichment in riparian ecosystems due to increased urban and agricultural development has played an important role in *A. donax* expansion in the past half century. Furthermore, wildfires have exacerbated the invasion problem in southern California. In a third study, I found that a significant wildfire promoted rapid expansion of *A. donax* infestations near fire-prone shrublands and dominated riparian vegetation only months after burning. Based on these findings and available literature, I present three *A. donax* invasion scenarios and their associated conceptual invasion trajectories to inform successful control of *A. donax.* Additionally, I propose five priorities for *A. donax* control, concentrating efforts where ecological benefits are greatest and associated removal efforts are minimized. A large-scale field experiment was established on a riparian terrace of the Santa Clara River in Santa Paula, California to test this hypothesis. This experiment investigated the effects of nutrient additions, amount of light, and quantity of water on growth and competition between *A. donax* and three dominant native riparian plants: red willow (*Salix laevigata*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and mule fat (*Bacharris salicifolia*). *A. donax* biomass was the greatest under high soil moisture, nutrient and light conditions after one year. After two years of growth, our results indicate that *A. donax* outcompetes all three species under most conditions tested except under the shade treatment which simulates a mature riparian forest canopy with the highest soil moisture. This finding indicates that mature riparian forests may be important for control of giant reed and loss of these habitats encourages *A. donax* invasion. After a fire swept through 300ha of riparian woodlands along the Santa Clara River in 2003, *A. donax* productivity was 14–24 times higher than for native woody species. This greater dominance of *A. donax* after wildfire increased the susceptibility of riparian woodlands along the Santa Clara River to subsequent fire, potentially creating an invasive plant-fire regime cycle. Although successful in removing small infestations of this weed, we still know very little about the ecological conditions that promote continued growth and invasion of *A. donax*.

Impacts of fire exclusion and recent managed fire on forest structure in old growth Sierra Nevada mixed-conifer forests

Collins, Brandon M.[1†], Everett, Richard G.[2,3], and Stephens, Scott L.[2]
[1] *USDA Forest Service, Pacific Southwest Research Station, 1731 Research Park Drive, Davis, CA, 95618*
[2] *Ecosystem Sciences Division, Department of Environmental Science, Policy, and Management, 130 Mulford Hall, University of California, Berkeley, CA, 94720-3114 USA*
[3] *Present address: Department of Natural Resources, Salish Kootenai College, 58138 Highway 93, P.O. Box 70, Pablo, MT, 59855*
[†] *E-mail: bmcollins@fs.fed.us*

We re-sampled areas included in an unbiased 1911 timber inventory conducted by the U. S. Forest Service over a 4000 ha. study area. Over half of the re-sampled area burned in relatively recent management- and lightning-ignited fires. This allowed for comparisons of both areas that have experienced recent fire and areas with no recent fire, to the same areas historically based on early forest inventories. Our results indicate substantially altered present forest conditions, relative to the 1911 data, and can largely be attributed to the disruption of the key ecosystem process for these forests, fire. For areas that burned recently there was a noticeable difference in forest structure based on fire severity. Current tree density and canopy cover in areas burned recently with moderate severity did not differ from 1911 estimates, while areas that burned recently with low severity or were unburned had higher tree density and canopy cover relative to the 1911 estimates. This emphasizes an important distinction with regard to using fire to restore forests, resting primarily on whether fires kill trees in the lower and intermediate canopy strata. Our results also demonstrate nearly a doubling of live tree carbon stocks in the present forest compared to the historical forest. The findings presented here can be used by managers and ecologists interested in restoration of Sierra Nevada mixed conifer systems.

The roles of climate change, land use, dispersal, masting, fire, and predation on the viability of *Quercus engelmannii* (Engelmann Oak)

Conlisk, Erin[1], Lawson, Dawn[2], Syphard, Alexandra[3], Franklin, Janet[4], Flint, Lorriane[5], Flint, Alan[5], Regan, Helen[1]

[1]*University of California, Riverside, Department of Biology, Center for Conservation Biology, Riverside, CA 92521, USA.*

[2]*San Diego State University, Department of Biology, 5500 Campanile Drive, San Diego, CA 92182, USA.*

[3]*Conservation Biology Institute, 136 SW Washington Ave, Suite 202, Corvallis, OR 97333, USA.*

[4] *School of Geographical Sciences and Urban Planning, Arizona State University, P.O. Box 875302, Tempe, AZ 85287-5302, USA.*

[5] *USGS California Water Science Center, 6000 J Street, Sacramento, CA 95819, USA.*

A species' response to climate change depends on future habitat suitability, changes in ecological communities (predators, dispersal agents, etc.), changes in the species' vital rates (of survival, growth, reproduction, etc.), and the species' ability to migrate. To explore these issues, we combine dynamic species distribution models, which predict current and future suitable habitat, with stochastic, stage-based, meta-population models, which use life history traits to predict population trajectory. In particular, we estimate the effects of climate change, land use change, and altered fire frequency on *Quercus engelmannii* (Engelmann oak), emphasizing the roles of fire, masting, dispersal by jays, and acorn predation by insects, birds, and small mammals. Our model predicts dramatic reduction in *Q. engelmannii* populations, especially under drier climates, increased fire frequency, and decreased masting frequency. Current rates of dispersal are not likely to prevent these effects, although increased dispersal could mitigate population declines. Less frequent masting is predicted to decrease *Q. engelmannii* populations, in part because masting events are associated with decreased predation. When predation and masting events are decoupled, the impact of less frequent masting is reduced, stressing the importance of predation.

Initial Recovery of Endangered Island Foxes on California's Channel Islands

Coonan, Timothy J. [1], King, Julie L.[2], and Garcelon, David K.[3]
[1] *U. S. National Park Service, Channel Islands National Park, 1901 Spinnaker Drive, Ventura, CA 93001, USA.*
[2] *Catalina Island Conservancy, P.O Box 2739, Avalon, CA 90704, USA.*
[3] *Institute for Wildlife Studies, P.O Box 1104, Arcata, CA 95521, USA.*

Island foxes (*Urocyon littoralis*) are unique to California's Channel Islands, where they exist as six separate subspecies, one on each of the six largest of the eight islands. Four of the subspecies underwent catastrophic declines in the mid to late 1990s, caused by golden eagle (*Aquila chrysaetos*) predation on the northern Channel Islands and canine distemper virus (CDV) on Santa Catalina Island. Those four subspecies were Federally listed as Endangered in 2004, but are in the process of recovery due to swift and sustained implementation of recovery actions by a consortium of land owners, agencies and non-profits. The bulk of those recovery actions, which included captive breeding, reintroduction and translocation of island foxes, capture and relocation of golden eagles, and vaccination of captive and wild foxes against CDV, occurred from 1999-2008. Island fox conservation has entered a phase of intense monitoring, both to track recovery and to mitigate future threats. Recovery is tracked via annual estimates of density from spatially-explicit capture-recapture methods, and cause-specific mortality from radiotelemetry. Current data suggest 3 of the 4 endangered subspecies are approaching biological recovery. Because the threat of future disease outbreaks or predation remains tangible, the next step in island fox conservation is development of epidemic and predation response plans.

The Effects of Wildfire on Stream Ecosystems in Southern California

Cooper, Scott[1, 2], Bennett, Danuta[2], Dudley, Tom[2], Even, Thomas[1], Klose, Kristie[2], Nelson, Craig[2], Sadro, Steven[2], and Wiseman, Sheila[2].
[1]Department of Ecology, Evolution, and Marine Biology, University of California, Santa Barbara, CA 93106, USA
[2]Marine Science Institute, University of California, Santa Barbara, CA 93106, USA

Although wildfires are a ubiquitous feature of southern California coastal watersheds, their effects on stream ecosystems have been studied little. Wildfires swept through coastal Santa Barbara County in fall 2008 and spring 2009, providing an opportunity to examine changes in nutrient, light, temperature, and particulate organic matter levels, and bacterial, algal, and invertebrate assemblages, in streams affected and unaffected by these fires. Fire impacts on riparian vegetation were patchy, with the riparian vegetation remaining intact in some reaches but being largely removed in others. Fire had few immediate effects on most physical, chemical and biological variables during the remaining dry season, but nutrient concentrations and sediment deposition in streams draining burned basins greatly increased during the ensuing wet season. Stream algal biomass in all burned basins greatly decreased during scouring floods associated with the first large rains of the wet season. Following flooding, however, algal biomass reached high levels in streams where fire reduced the riparian canopy, but remained low in both burned and unburned basins where the riparian vegetation remained intact. Algal assemblages were dominated by diatoms in shaded streams, but increasingly by filamentous algae where the riparian canopy was burned. Invertebrate assemblages tracked changes in algal biomass and riparian leaf litter inputs associated with the burning of riparian vegetation. Some taxa (*Pseudacris*, *Fallceon*, *Callibaetis*) increased as algal biomass increased and leaf litter levels decreased across streams, whereas other taxa (*Lepidostoma*, *Paraleptophlebia*) showed the opposite response, increasing in abundance with increasing riparian canopy cover. In general, short-term stream ecosystem responses to wildfire, particularly when riparian vegetation was reduced, were similar to documented stream responses to increasing land use development; however, stream ecosystems quickly recovered from fire disturbances but showed sustained alterations associated with land use changes.

Role of Protected Areas: *In situ* and *Ex situ* conservation in Lowland Fynbos

Cowell, Carly R.[1,3], Holmes, Patricia M.[4], Stoll, Nicolette. [2,3] and Hitchcock, Anthony A.[2.]
[1]South African National Parks, Cape Town, South Africa; [2]South African National Biodiversity Institute, Cape Town, South Africa;[3] Millennium Seed Bank Project, Wakehurst, United Kingdom;[4]City of Cape Town Environmental Unit, Cape Town, South Africa

The Cape Floristic Kingdom has some of the most threatened lowland habitats in the world and the need for plant rescue and rehabilitation is dire. As climate change accelerates the loss of species and habitats, together with losses brought about by habitat fragmentation, invasive species and pollution, the role of protected areas is becoming more important as refuges, however much of the land within protected areas requires rehabilitation and restoration. The two most important management interventions, both within current conservation areas and in any future land areas acquired for conservation, are alien plant clearance and Fynbos restoration. Through the work of the South African National Parks (SANParks) Habitat Degradation and Restoration Monitoring Programme, measures are being taken to safeguard the biodiversity of Fynbos by banking seeds in the Millennium Seed Bank, housing living collections at Kirstenbosch and by implementing restoration programmes within the national parks. It also helps to avoid duplication of efforts and provides for easy co-ordination of rehabilitation projects within protected areas. Restoration of key conservation areas is a high priority, however restoring and rehabilitating plants back to the wild poses many challenges. My masters study focused on rehabilitating Cape Flats Sand Fynbos (CFSF) vegetation (Critically Endangered) on old field sites, using seed. Seed was collected and stored by the Millennium Seed Bank Project, controlled germination and viability tests were done on collections from the study site. Four sowing treatments were tested for optimal germination and economic viability of restoring CFSF. However the winter of 2010 was extremely dry and many of the seedlings did not survive, a second sowing was required, this highlighted the need for seeds stored in *ex situ* conservation to be on hand. This presentation provides a brief overview of the SANParks Programme and preliminary results on restoring CFSF on old fields.

Adaptive Management of Mediterranean-Climate Salt Marshes in San Diego, California

Crooks, Jeff[1], Cordrey, Michelle[1], Bellringer, Holly[1], and Uyeda, Kellie[1,2]
[1]*Tijuana River National Estuarine Research Reserve, 301 Caspian Way, Imperial Beach, CA, 91932, USA.*
[2]*San Diego State University, 5500 Campanile Dr, San Diego, CA, 92182, USA.*

A central problem in trying to understand, protect, and restore natural ecosystems is the realization that many changes in these areas tend to go unnoticed. This results in the phenomenon of "shifting baselines," where we progressively lower our expectations of what to expect from nature. One way to counter this is to learn as much as we can about ecosystems of the past, including examining the historical ecology of coastal wetlands. Implementing long-term monitoring also helps counteract the shifting of baselines. A program that tracks short-term variability and long-term change in both physical and biological properties in the coastal salt marshes of the Tijuana River Estuary, South San Diego Bay, and Los Penasquitos Lagoon is being used for the adaptive management of these ecosystems. These estuarine areas, which reside a highly-urbanized matrix, are subject to dynamic conditions characteristic of Mediterranean-climate salt marshes. Anthropogenic modification of watersheds, the lagoons themselves, and ocean-estuary exchange also provide continuing challenges for effective ecosystem management.

From fire suppression to fire management in Mexico's Mediterranean climate zone

Cruz-Dominguez, Juan Ramón[1]
[1]*Comisión Nacional Forestal, Gerencia Estatal Baja California, México.*

Ecosystems can be classified according to their relationship to fire. In Mexico, "fire dependent ecosystems" (where fire has an important ecological and evolutionary presence) are found on about 40% of the landscape. "Fire sensitive ecosystems" (where fire is rare enough to play no important eco/evolutionary role) cover about 50% of Mexico, and "fire independent ecosystems" (fire is essentially absent) about 10%. In northern Baja California, the Mediterranean-climate zone of Mexico, the importance of fire is elevated due to the long dry season. Here, fire dependent ecosystems make up an even larger proportion of the vegetated landscape. Until recently, fire management in Mexico was carried out under a policy of strict fire suppression in all ecosystems, but the most recent National Fire Management Strategy (2007-2012) explicitly recognizes the importance of fire in fire dependent ecosystems and allows for such tools as wildland fire use, prescribed fire, and increased interagency coordination and collaboration with rural communities. The Mexican National Commission of Natural Protected Areas (CONANP) and the National Forest Commission (CONAFOR) work together closely in the implementation of the Fire Management Strategy in protected areas. Because the Mediterranean climate zone of Mexico supports so many fire dependent ecosystems, the change from fire suppression to fire management in Mexico necessitates significant alterations to policies, strategies, and tactics in northern Baja California. I discuss some of the challenges associated with on-the-ground implementation of the new National Fire Management Strategy in and around the national parks of northern Baja California, and I highlight some of our success stories.

Conserving oak woodlands in a Mediterranean megalopolis: Los Angeles County develops an economic valuation process for ecosystem services in a planning context

Dagit, Rosi[1]
[1]RCD of the Santa Monica Mountains, Agoura Hills, CA, USA
Scott, Tom[2]
[2] UC Berkeley, Berkeley, CA and UC Riverside, Riverside, CA, USA
Cutter, Bowman[3]
[3]Pomona College, Claremont, CA, USA

Oak woodlands are a keystone ecosystem in Los Angeles County, with over 17 species and 13 alliances recognized. They sequester carbon and contribute substantially to the value of housing and land. These values however, are difficult to maintain as land development consumes many of the last remaining pockets of functional oak woodlands in the county. Approximately 33% of remaining oak woodlands occurs as relatively fragmented habitat on private property. Concern about the loss of these last remnant stands prompted a group of diverse stakeholders to examine ways to protect this valuable resource within the planning framework. How much are oak woodlands worth? What does it cost the community in lost ecosystem services when oak woodlands are removed? How can we develop an equitable, consistent system for evaluating these costs and incorporating them into the development decision-making process? For example, a key factor is the mitigation for carbon sequestration loss. A mature oak can sequester approximately 9 tons of carbon per year. CEQA regulations now require that the value of these services provided by oak woodlands be incorporated into the environmental impact evaluation of a project. The Los Angeles County Oak Woodlands Conservation Management Plan addresses these important resource management questions and provides a road map for policy makers and managers to evaluate the long-term costs and benefits from a variety of strategies, ranging from voluntary conservation easement dedication to more complex mitigation plans. This presentation highlights the both the results (adoption of the plan by Los Angeles County), and the difficulties of building consensus with a diverse stakeholder group.

Reconnecting Topanga Creek- Restoring access and habitat for endangered southern steelhead trout (*Oncorhynchus mykiss*)

Dagit, Rosi[1]
[1]RCD of the Santa Monica Mountains, Agoura Hills, CA, USA

Restoration projects require the alignment of careful planning, adequate funding, and community support. Since 2000, the effort to develop a comprehensive watershed restoration and protection plan in Topanga Creek, Los Angeles, CA, has been underway. Topanga Creek is the third largest coastal creek draining into the Santa Monica Bay and is unique in that the majority of the watershed is in public ownership from the mountains to the sea. The suite of native species specific to this ecosystem is still intact, despite the impacts of a major highway, and residential development. The umbrella species driving the planning process is the southern steelhead trout (*Oncorhynchus mykiss*), which was federally listed as Endangered in 1997. The current population estimate is 500 anandromous adults in the Southern California Distinct Population Segment, which extends from San Luis Obispo to the Mexican border. Topanga Creek was identified in the Southern Steelhead Recovery Plan (NOAA- National Marine Fisheries Service 2009) as a representational small coastal creek supporting a reproducing population of steelhead. A long-term lifecycle monitoring program started in 2001 in Topanga Creek, including a capture-tag-release study. Extensive, stakeholder driven planning resulted in prioritizing restoration actions that were required to preserve and protect this sensitive population. The first restoration project in Lower Topanga (removal of 26,000 tons of lead contaminated fill from the creek channel) was completed in 2008, resulting in improved migratory passage opportunities and expanded spawning and rearing habitat. Further restoration needed to meet the plan goals includes restoration of a functional lagoon and additional improvements to the upstream creek channel. This decade long planning and implementation process provides an example of what does and does not work, and demonstrates how the planning process adapted as the project evolved.

Consumer control of oak demography in a Mediterranean-climate savanna

Davis, Frank W.*, Claudia M. Tyler**, Bruce E. Mahall**

*Bren School of Environmental Science and Management, University of California, Santa Barbara CA, USA 93106-5131. E-mail: fwd@bren.ucsb.edu, Telephone: 805-893-3438, Fax: 805-893-7612. **Earth Research Institute, University of California, Santa Barbara, CA, USA 93106. ***Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA USA 93106

We use matrix models and life table response experiments to analyze long-term experimental and observation data on California valley oak (*Quercus lobata* Neé) to answer three questions: (1) How do mammalian consumers – specifically, cattle, deer and rodents - impact valley oak seedling establishment and sapling survival and growth? (2) How sensitive is oak population growth rate to variation in acorn production and initial seedling establishment vs. sapling survivorship and growth? (3) Can vertebrate consumers account for the observed population decline of valley oak in savannas and woodlands of southern California? We find that consumers exert strong influence on the demography of the species. Deterministic finite population growth rate is <1 for unprotected plants and for plants that are protected from cattle but still exposed to mule deer and rodents. Population growth rate increases to 1.03 with protection from both cattle and deer, mainly because plants are able to quickly reach the tree layer when they are protected from ungulate browsing. Population growth rate jumps to 1.15 for plants protected from ungulates and rodents as a result of increased survivorship and height growth of established individuals and because of increased seedling establishment during the first year. Our experimental findings are consistent with observed patterns in natural populations in our study region, where tree recruitment is rare in both grazed and ungrazed savannas but widespread in areas such as roadsides that are refuges from large ungulates. We conclude that valley oak demography is more sensitive to rates of sapling recruitment and growth than to acorn production or seedling establishment, and that rodent damage and browsing by mule deer or cattle exert strong control on the demography of the species.

The effects of habitat fragmentation by urban development on terrestrial herpetofauna in the largest urban national park in the United States

Delaney, Kathleen Semple [1], Riley, Seth P. D. [1], Fisher, Robert[2]
[1]National Park Service, Thousand Oaks, CA, U.S.A
[2]United States Geological Survey, San Diego, CA, U.S.A.

Habitat fragmentation by urbanization causes populations of animals and plants to be isolated in patches of suitable habitat that are surrounded by non-native vegetation or severely altered vegetation, asphalt, concrete, and human structures. This can lead to local population extirpation and decreased biodiversity within patches. Urban development can also lead to genetic divergence between patches and in turn to decreased genetic diversity within patches through genetic drift and inbreeding. Critical habitat for many reptile and amphibian species has already been lost in Santa Monica Mountains National Recreation Area (SMMNRA) where 11 of the 34 species of herpetofauna found in the Santa Monica Mountains are listed as rare, threatened or endangered by various agencies and 7 others are species of concern for the National Park Service. Using data collected as part of the National Park Service's Inventory and Monitoring program, we will present trends in occupancy and species diversity as they relate to habitat patch size, isolation, and vegetation community. In addition, to examine the genetic effects of urban habitat fragmentation we used microsatellites to reveal fine-scale genetic structure in a highly fragmented landscape near and within SMMNRA. All species we studied showed similar and significant reductions in gene flow over relatively short geographic and temporal scales. The greatest genetic divergence was found where development was oldest and most intensive. Our results suggest that intense urban development may represent the most severe form of fragmentation, with minimal effective movement through and decreased biodiversity within the urban matrix.

Mediterranean Climate Ecosystem Island Conservation in Complex Socioeconomic and Political Settings: Catalina Island, California, USA

de la Rosa, Carlos L.[1,2], King, Julie[1], Clark, John R.[1], Duncan, Calvin[1], de la Rosa, Carlos A.[1], Dixon, Peter[1], Ratay, Sarah[1], Summers, Anthony[1] and Farley, Linda[1]
[1] *Catalina Island Conservancy, PO BOX 2739, 125 Claressa Ave., Avalon, CA, 90704, USA.*
[2] *University of California, Los Angeles; Department of Ecology and Evolutionary Biology, 621 Charles E. Young Dr., South, Los Angeles, Ca 90095-1606*

Most of the major issues that impact Mediterranean climate ecosystems are felt particularly strongly on islands. The Channel Islands of California have been exposed to human impacts for at least 10,000 years. However, the last 200 years or so have been particularly important, largely because of the scale of the changes and the long-lasting footprints these changes have left. Society's evolving system of values for wildlands and natural ecosystems has lagged behind the changes and the continuing effects of decisions made long time ago. The California Channel Islands have mixed post-Native American ownership and a checkered history of uses, such as ranching, agriculture, mining and human occupation. Catalina Island reflects most of these uses and then some. With a resident population of 4,000 people and the yearly arrival of almost a million visitors, the conservation and restoration of the Island's native ecosystem (chaparral, oak woodlands, grasslands, sage scrub and others) is challenging. Major issues include invasive plants, non-native animals, fire, human use and infrastructure, and a fragile economy dependent on tourism. The Catalina Island Conservancy owns and manages 88% of the Island (42,000 acres/17,000 hectares) with a dual mission of conservation and recreational use. Over 60 endemic species of plants and animals, some of them listed as endangered or threatened, as well as several rare plant and animal populations, bring a number of other players into the decision making process, including federal and state agencies, local and county planning departments, and a strongly invested resident and visiting community. The result is a complex social, political, economic, regulatory and cultural context in which conservation and ecosystem management needs to happen. This presentation outlines the key issues and barriers to achieving effective conservation in this island ecosystem and describes the approach that the Conservancy has taken to address the most pressing issues.

Climate Change Ambassadors: Linking Science and Nature to Young Urbanites

de Roulhac, Nicholas[1], Schallert, Kevin [1] and Teel, Susan[1].
[1] *Affiliation 1 (Southern California Research Learning Center National Park Service, Thousand Oaks, CA USA.*

The National Park Service seeks to attract, engage and educate young city dwellers while managing 84.4 million acres of land. The Southern California Research Learning Center and the Crown of the Continent Research Learning Center have executed a replicable citizen science program that fulfills these goals. National Park Staff in California initiated a climate change project by interacting with an after school, minority serving science program. The Students at the Elementary Institute of Science were enrolled in a leadership and educational program focused on the impacts of global climate change. The research and study phase of their curriculum culminated in a service learning expedition to Glacier National Park to study climate change in the National Parks. This pilot program resulted in a replicable scientific engagement model for land management agencies and organizations. This talk will explore challenges, logistics and best practices for this type of collaborative project.

Non-chemical, Research-based Coastal Sage Scrub Restoration at an Audubon Preserve in Southern California

DeSimone, Sandra A.
Audubon California Starr Ranch Sanctuary, 100 Bell Canyon Rd., Trabuco Canyon CA 92679, USA.

Restoration of rare coastal sage scrub at Audubon California's Starr Ranch Sanctuary in southern California commences the second year of non-chemical control of the nonnative herbaceous perennial, *Cynara cardunculus*, which has invaded 251 ha of native and degraded grassland stands at the 1575 ha preserve. We are currently testing methods of enhancing existing native needlegrass grassland stands that comprise 182 ha of these invaded grasslands. Because analyses of aerial photoseries taken over 48 years revealed gradual coastal sage scrub colonization of both degraded and some native grasslands, we decided to actively restore to scrubland in 102 ha of *C. cardunculus*-infested sites in which shrub species have begun colonization. Results from a factorial experiment established an optimum seeding rate and soil tamping technique. Restoration practices were further refined with a second experiment that showed that a combination of direct seeding and plug planting spaced over the growing season would be beneficial in our semiarid region with typically high variability in timing and amount of annual precipitation. Non-chemical control of other nonnative species in restoration sites is ongoing. Previous research demonstrated a facilitating role of small herbivorous mammals in shrub colonization of grasslands. Current research focuses on the possible role of small mammals in controlling palatable nonnative species in restoration sites. Long term data collection on effects of restoration on both small mammals and birds commenced in 2004 and indicates positive relationships. Vegetation monitoring of active and passive restoration in a total of 70 ha indicates that, given adequate annual precipitation, sites can reach 50-80% total native shrub cover after 1-5 years in treatment areas with baseline 0-5% native cover.

The integrated response of Mediterranean Shrubland communities to increased nitrogen availability: an overview

Dias, Teresa [1], Martins-Loução, Maria Amélia[1], Sheppard, Lucy [2], Allen, Edith [3], Michael Allen[3], and Cruz, Cristina [1]

[1] Universidade de Lisboa, Faculdade de Ciências, Centro de Biologia Ambiental (CBA). Campo Grande, 1749-016 Lisboa, Portugal; Centre of Ecology and Hydrology (CEH), Bush Estate, Penicuik, EH26 OQB, United Kingdom); [3] Department of Botany and Plant Sciences, University of California, Riverside, CA, USA.

Mediterranean shrubland ecosystems are primarily limited by moisture, and have varying degrees of nutrient limitation depending upon parent materials. P is variably limited, with, for example relatively lower P in the calcareous soils of the Mediterranean than the granitic soils of California. N limitation is regulated by N:P, such that ecosystems with high N:P are expected to be less sensitive to N deposition. Plant cover strongly influences soil characteristics, and internal N cycling is expected to depend on plant-soil interactions. This combined with high plant diversity results in a very heterogeneous vegetation. The vegetation of Mediterranean ecosystems may be grouped into two plant functional groups (PFG): summer semi-deciduous and evergreen sclerophylls. Each group has been characterized on the basis of its phenology, water relations, carbon exchange properties and abundance during different successional stages. The two PFGs have evolved in response to seasonal aridity in Mediterranean ecosystems, but the differences in soil nutrients have resulted in different nutrient cycling dynamics. The two PFG significantly affect soil superficial characteristics (e.g. soil pH, organic matter, potential nitrification, etc) in distinct ways, which is related to their N use strategies .

In spite of the estimates for increased N deposition on the Mediterranean type ecosystems, there is still a lack of knowledge on how this will affect the structure and functioning of shrublands. Here we compare the effects of increased N availability (dose and forms) on ecosystem functioning based on the following parameters: (i) N retention by the system, (ii) the importance of the biological compartment on N retention and cycling; (iii) changes in plant richness and evenness; (iv) changes in soil microbial (fungi, bacteria and archaea) diversity and functioning. The results reported show that ecosystem responses to increased nitrogen availability are dependent on the characteristics of the ecosystem at the time: N availability (degree of N limitation in the ecosystem), N:P, soil organic matter, biodiversity, dominant species and evenness, and quality of the plant litter. This is very important when contemplating recovery and management of Mediterranean shrubland communities.

If you build it, will they come? How vertebrates respond to changes in Southern California shrubland vegetation

Diffendorfer, James E.
USGS Rocky Mountain Geographic Science Center, P.O. Box 25046, MS 516
Denver, Co. 80225

Given both historical land use and current disturbance regimes, vegetation communities in Mediterranean-climate ecosystems frequently require active management and restoration. In systems driven by bottom-up processes, vegetation restoration should lead to changes in consumer communities, and hopefully, the ability of the managed area to support higher levels of native diversity or targeted species. From 2002-2007 we performed studies that either sampled vertebrate communities across gradients of disturbance in southern California shrublands or tracked changes in both vertebrate and vegetation communities after fire. These studies suggest 3 main results. First, vegetation change has strong effects on vertebrate communities. Second, many vertebrate species are present despite invasive species, indicating shrub presence, not the lack of invasives, may drive responses. Third, though vegetation is a key driver in vertebrate community structure, other factors, such as urbanization, extreme climate events, and predation may play a roll. Ultimately, our results suggest many vertebrate species will come if you restore shrublands in Southern California, and that restoration may not require the full extirpation of invasives.

Natura 2000 habitats of Mediterranean countries are distinct

Duarte, Inês [1], Castro Rego, Francisco [2]
1 CICAE -Centro de Investigação em Ciências do Ambiente e Empresariais, INUAF, Convento Espírito Santo, 8100-641 Loulé, Portugal
2 CEABN - Centro de Ecologia Aplicada Prof. Baeta Neves, Tapada da Ajuda, 1300 Lisboa, Portugal

It is known that the Mediterranean Region is considered a global hotspot of biodiversity. Mediterranean landscapes, more than other European landscapes, have been largely modified over thousands of years, and natural habitats have decreased drastically in the last centuries because of human activities.

Natura 2000 Network was created to protect most valuable and threatened species and habitats in Europe. The 230 habitats types occurring in this network are included in nine classes: (1) Coastal and halophytic habitats, (2) Coastal sand dunes and continental dunes, (3) Freshwater habitats, (4) Temperate heath and scrub, (5) Sclerophyllous scrub (*matorral*), (6) Natural and semi-natural grassland formations, (7) Raised bogs and mires and fens, (8) Rocky habitats and caves, and (9) Forests. We analyzed different spatial characteristics of the distribution of habitats in the network and compared Mediterranean countries and the other European countries.

We confirmed higher habitat diversity in the eight Mediterranean countries (Portugal, Spain, France, Italy, Greece, Cyprus, Malta and Slovenia) compared with other sixteen countries of Europe. The results show that 29% of the habitat types are entirely endemic from these 8 countries and that 77% of all the natural habitat types protected in Europe are present in the Mediterranean countries. These analyses also show that different habitat types have different sizes in Mediterranean and other European countries. Higher fragmentation is detected for coastal, freshwater, bogs and temperate habitats in the Mediterranean whereas matorral, grasslands, forests and rocky habitats show the opposite behavior. It is concluded that protected habitats in Mediterranean countries have distinct spatial features that have to be taken into account when considering conservation of biodiversity.

Restoring South African mediterranean-type ecosystems following alien plant invasion

Esler, Karen
Department of Conservation Ecology & Entomology and Centre for Invasion Biology, Stellenbosch University, Private Bag x1, Matieland, 7602, South Africa.

Following global trends, invasive alien plants are an increasingly large problem in South Africa where growing evidence links invasive alien plant transformation to declines in ecosystem integrity and services. Invasion ecology is a thriving field of plant science research in South Africa. While the primary focus has been on basic issues such as the production of conceptual frameworks and understanding the mode of introduction, distribution, abundance and impacts, there is an increasing awareness of the need to understand the link between invasion and management actions, particularly those linked to restoration of key ecosystems. Working for Water (WfW), with its combined aims to enhance ecological integrity, water security and social development, has been in operation since 1995. WfW has worked under the assumption that its focus ecosystems would "self repair" once the main stressor (dense stands of invasive alien trees) was removed. This assumption is explored using two case studies in alien plant-invaded landscapes in the Fynbos Biome. The first describes the integrated control of the invasive shrub *Hakea sericea* over four decades in South Africa, where landscape-level restoration of mountain Fynbos has been achieved. The second focuses on Fynbos riparian ecosystems, where restoration of indigenous riparian vegetation structure, diversity and function requires a move beyond the assumption of "self repair" to one that includes active restoration actions. In exploring these case studies, the aim is to identify best-practice techniques to ensure ecosystem recovery after alien clearing.

Acorn predation in Mediterranean oak forests: Influence of species-specific traits and landscape attributes

Espelta, Josep Maria[1], Bonal, Raúl[2], Muñoz, Alberto[1], Gaddis, Keith[3] and, Sork Victoria L.[3]

1 CREAF, Autonomous University of Barcelona (UAB), Bellaterra, 08193, Spain. Josep.Espelta@uab.cat
2 IREC, CSIC-UCLM-JCCM), Ronda de Toledo s/n, 13005 Ciudad Real, Spain
3 Department of Ecology and Evolutionary Biology and Institute of the Environment, University of California Los Angeles, CA 90095-1606, USA.

Pre-dispersal seed predation (PSP) can constrain plant recruitment by reducing the number of viable seeds. We use acorn predation by weevils (*Curculio* sp.) in Mediterranean oak forests as a study model to investigate: i) the influence of differences in acorn and insect size and phenology in the intensity of PSP and, ii) whether landscape attributes (e.g. forest fragmentation) can reinforce or relax this antagonistic plant-animal interaction. In mixed *Q. ilex* and *Q. humilis* forests in NE Spain, smaller-seeded oaks (*Q. ilex*) benefit from a reduced PSP because they exclude larger weevils, but also by means of a "free-rider" effect, because the heterospecific (*Q. humilis*) earlier reaches a critical size to be depredated. Whether the advantage of 'being small' in this ecological scenario is offset by other processes, or whether it results in a pressure towards seed and insect size reduction, deserves further attention. Concerning landscape attributes, in fragmented oak forests in California (*Q. lobata*) and Central Spain (*Q. ilex*), we recorded acorn predation by weevils in all forest patches whatever the abundance of oaks and their degree of isolation. This suggests that forest fragmentation does not negatively influence this highly specialized insect, either because higher dispersal ability than often suggested or a high local resilience to the well-known temporal changes in acorn production (masting), even in small forest patches. From the oak perspective, the proportion of acorns predated per tree and the number of multi-infested acorns increases with fragmentation: i.e. it is higher in small forest remnants in urban areas than in larger forest patches. These results suggest that fragmentation may reinforce an antagonistic plant-animal interaction as granivory. Even though oaks are long lived organisms that may persist in small forest patches for centuries, acorn predation by weevils may constrain their reproductive output and their expansion to surrounding areas.

Evaluating the Role of Landscape Attributes and Burn History on Spatial Patterns of Fire Severity in the Klamath Mountains, Northern California, USA: Considerations for Planning Restoration after the Smoke Clears

Estes, B. L.[1], Knapp, E. E. [2], Skinner, C.N. [2],Priesler, H.K. [3,] and Miller, J.D. [4]
[1] *USDA Forest Service, Eldorado National Forest, 100 Forni Drive, Placerville, CA 95667*
[2] *USDA Forest Service, Pacific Southwest Research Station, 3644 Avtech Parkway, Redding, CA 96002*
[3] *USDA Forest Service, Pacific Southwest Research Station, 800 Buchanan Street West Annex, Albany, CA 94710*
[4] *USDA Forest Service, Pacific Southwest Region, Fire and Aviation Mgmt., 3237 Peacekeeper Way, Suite 101, McClellan, CA 95652*

Topography, weather, and fuels are known factors driving fire behavior, but the degree to which each contributes to the spatial pattern of fire severity under different conditions remains poorly understood. The variability in severity within the boundaries of the 2006 wildfires that burned in the Klamath Mountains, northern California, along with data on burn conditions and new analytical tools, presented an opportunity to more thoroughly evaluate fire severity mechanisms. In this study, fire severity was measured by the percent change in canopy cover (0-100%) classified from the Relative Differenced Normal Burn Ratio (RdNBR). Spatial data layers were compiled to determine the relative importance of topography and fuels. Detailed progression maps were also available to better quantify temporal weather variables (e.g., temperature, relative humidity, temperature inversions, and solar radiation). A generalized additive regression model with random effects and an additional spatial term to account for correlation between adjacent locations was fitted to fire severity. In the absence of extreme weather behavior, topographical complexity influenced severity. Upper and mid slopes tended to burn at higher fire severity than lower slopes, while fire severity increased with percent slope but only to a maximum where it tended to tail off. Fuels, primarily vegetation type and time since fire, were both important predictors of fire severity. The landscape dominated by shrub and conifer cover type were more likely to burn at higher severity than if dominated by mixed or hardwood cover type. As would be expected, as time since fire increased so did the potential for higher fire severity. Weather, particularly temperature inversions, common in the complex topography of the Klamath Mountains, trapped smoke and had a dampening effect on severity within the landscape underneath the smoke cloud. Understanding the spatial variability of mixed severity fires allows managers to better plan for future wildfires, including restoring a more natural fire regime by managing lightning ignitions for resource benefit, when appropriate.

Conservation and management policies in the California Floristic Province, Mexico

Farfan, Saul Alarcon, Sergio Mata
Calle 1era y Castillo No. 1090-5 y 1090-6 Zona Centro Ensenada, B.C. Mexico C.P. 22800

The California Floristic Province (CFP), one of the five Mediterranean-type ecosystems on the list of threatened hotspots, extends from southwestern Oregon to approximately 200 miles from the US-Mexico border. In the Mexican State of Baja California, the CFP extends throughout the parallel 30 and includes unique areas such as the Sierra de Juarez and San Pedro Martir, San Quintin Bay and the islands of Coronado, Todos Santos, San Martin, San Jeronimo, Guadalupe and Cedros. Although only 14,000 km^2 (5%) of the 324,000 km^2 are found in Mexico, the degree of endemism, low disturbance and its importance for the survival of keystone species such as the bighorn sheep and California condor, makes this southern portion of the CFP an important site for the conservation of Mediterranean ecosystems. In the last two decades, this region has experienced a considerable increase in development pressures due to the expansion of urban centers, the proliferation of mega-resorts and more recently the construction of industrial sites such as liquefied natural gas plants and wind energy projects to provide energy to California. To mitigate part of the effects of these development pressures, nonprofit organizations, and some government agencies, have been implementing different conservation strategies. The type of conservation strategy implemented depends on the legal tenure, the ecological characteristics of the site or the species found. Currently, Terra Peninsular is part of concerted efforts to use different legal mechanisms such as natural protected areas, Terrestrial and Marine Priority Sites, RAMSAR sites, conservation concessions of the maritime-terrestrial federal zone and federal lands, usufructs and land acquisition to conserve key areas of the Mexican CFP.

Ecosystem Engineering: Can we rebuild the cloud forests of Santa Rosa Island (Channel Islands National Park, USA)?

Faulkner, Kate Roney[1], McEachern, Kathryn[2], Chaney, Sarah[1], Rodriguez, Dirk[1], Power, Paula[1], and Coonan, Tim[1].
[1] *U. S. National Park Service, Channel Islands National Park, 1901 Spinnaker Drive, Ventura, CA 93001, USA.*
[2] *U. S. Geological Survey-Biological Resources Division-Western Ecological Research Center, Channel Islands Field Station 1901 Spinnaker Drive, Ventura, CA 93001, USA.*

Santa Rosa Island, never connected to mainland California, supports numerous endemic plants and animals. Over 150 years of grazing by non-native sheep, cattle, pigs, elk, and deer converted over 75% of the native vegetation communities to alien grasslands and bare ground. Since acquisition by NPS in 1987, there has been a sequential reduction of feral livestock, which will culminate with the elimination of deer and elk in 2011. Removal of cattle and reduction of deer and elk in 1998 resulted in substantial recovery of riparian vegetation, increased stream water retention, and improved water quality. However, dry upland areas are recovering much more slowly. Rill-and-gulley erosion and overland sheet-wash predominate, infiltration is poor, and seedlings have insufficient water or soil to establish. Prior to the introduction of livestock, the upper slopes and ridges of the island supported oak and pine woodlands and chaparral that would have captured significant amounts of moisture from fog, especially during the dry spring and summer seasons. These areas are now largely barren. The warmer, drier conditions predicted with climate change could exacerbate this situation. Many island species are adapted to the cooler and moister environment that has been characteristic of the island. For instance, it appears that summer fog moisture is very important to the growth of the endemic Torrey pine. Restoration of the island's "cloud forests" is a critical step in building resiliency to climate change. A multi-disciplinary team will test the hypothesis that the once extensive woodlands of the island captured fog and provided an important source of water. A pilot study is underway to compare water inputs from fog in different types of vegetation. If fog provides a substantial part of the island water budget, the study will be expanded to quantify effects throughout the watershed on physical and biological parameters.

Linking Social Science to Conservation Education for Chaparral Ecosystems

Fege, Anne[1], Absher, James[2], Benders, Leta[1], DeSoto, Crystal[3], and Teiper, Leanne[1]
[1] *San Diego Children and Nature Collaborative, 4010 Morena Blvd, #100, San Diego, CA, USA*
[2] *USDA Forest Service, Pacific Southwest Research Station,4955 Canyon Crest Dr., Riverside, CA, 92507, USA*
[3] *Local Point-of-View Tours, 5490 Waring Road, San Diego, CA, 92120, USA*

Although historically-dominant but greatly diminished in area, the conservation of remaining chaparral and sage scrub communities in southern California depends on their public and political valuation. Extensive research has shown that significant nature-related life experiences contribute to commitment to conservation of natural areas, yet nature experiences for children and adults have declined over 30 years. Established in 2009, the San Diego Children and Nature Collaborative promotes public awareness, support, and participation in nature-based learning and play, focused on the chaparral and CSS that is the "nearby nature" for millions of southern Californians. As inventory of educational materials showed that chaparral shrublands were largely unrepresented, the Collaborative developed, piloted, and distributed fourth-grade curriculum, nature field trip guidebook, and Pocket Naturalist Guide for chaparral shrublands. Efforts are currently focused on nature providers supporting teachers to integrate this chaparral curriculum and offering naturalist guides to lead classroom walks to "nearby nature." As adults decide whether to schedule nature-based activities in school and non-school settings, the Collaborative interviewed after-school providers and parents in 2011 to assess decision-making processes, institutional factors, and awareness and attitudes of these adults about nature experiences for children. Key factors were alignment with after-school program goals and structure, adults' perceptions of students' experiences, and beliefs in the values of nature experiences to child development. The Collaborative's systematic identification of factors affecting awareness, attitudes, and actions relating to nature-based experiences are expected to enhance its contributions to public and political support for conservation of chaparral shrublands.

Broadening Our Embrace: An Ecological and Evolutionary Tango in the Service of Mediterranean-Type Biodiversity Conservation

Fiedler, Peggy L.
Natural Reserve System, University of California, 1111 Franklin Street, 6th Floor, Oakland, CA 94607 USA.

Land stewardship in regions of immense biological richness, such as the five Mediterranean-type ecosystems around the world, is an endeavor that now more than ever requires an embrace of new ways to integrate data from different time/geographic scales, and from additional (sister) disciplines to understand better current patterns of biological diversity – how the patterns arose and how they are maintained. It also requires broader arguments to ensure the long-term protection and health of these exceptionally biodiverse ecosystems. Identifying individual traits in species, communities, and ecosystems critical to successful Mediterranean ecosystem protection and management therefore necessitates an understanding of both 'deep time' evolutionary traits and present day ecological ones. This also means that biodiversity conservation requires discussion and justification beyond those based upon 'ecosystem services' of Mediterranean regions, to those that include 'evosystem services'. This emerging scientific framework posits that the two concepts are complementary and in fact, provide a more comprehensive argument for the stewardship of Mediterranean-type ecosystem functions and socioeconomic values than is currently ascribed to ecosystems and to biodiversity. An evolutionary perspective is therefore key to the healthy future of Mediterranean ecosystems, allowing options for the future as articulated in the new *Convention on Biological Diversity* strategic plan, especially in light of climate change. Examples from California and Western Australia are presented.

Fire behaviour in southwestern Australian shrublands: evaluating the influence of fuel age and fire weather

Fontaine, Joseph B.[1], Neal J. Enright[1], Janneke C. Lade[2], Ben P. Miller[3], Vanessa C. Westcott[2]

[1] *School of Environmental Science, Murdoch University, Perth, WA 6150 Australia*

[2] *School of Geography, University of Melbourne, Melbourne, VIC, Australia*

[3] *Botanic Gardens and Parks Authority, West Perth, WA 6005, Australia;*

Fuel age (time since last fire) is often used to approximate fire hazard and informs decisions on placement of shrubland management burns worldwide. However, uncertainty remains concerning the relative importance of fuel age and weather conditions as predictors of fire hazard and behaviour. Using data from 35 experimental burns across three types of shrublands in Western Australia, we evaluated importance of fuel age and fire weather on probability of fire propagation and four metrics of fire behaviour (rate of spread, fireline intensity, residence time, surface temperature). We found significant support for a threshold effect of fuel age for fire propagation but limited evidence for an effect of fuel age or fire weather on rates of spread or fireline intensity, although surface heating and heating duration were significantly related to fuel age and shrubland type. Further analysis suggested that dead fuel mass and accumulation rate rather than live fuels was responsible for this relationship. Using BEHAVE, predicted spread rates and intensities were consistently lower than observed values, suggesting further refinement is needed in modeling shrubland fire behaviour. These data provide important insight into fire behaviour in globally significant, fire-adapted shrublands, informing fire management and relationships between fire frequency and fire intensity.

Urban fuels and fire severity

Fotheringham, CJ.[1,2], and, Keeley, Jon E.[1,2]
[1] *USGS Western Ecological Research Center Sequoia National Park, 47050 Generals Hwy Three Rivers, CA 93271, USA.*
[2] *Department of Ecology & Evolutionary Biology University of California, Los Angeles, USA.*

California, like other Mediterranean regions, is prone to recurring wildfires. There is a long history of mitigation management of fires that has largely focused on the wildlands side of Wildland-Urban interface (WUI). These practices include fuel modification, fuel breaks and control burns. Despite increased spending on suppression, mitigation and prevention, every decade sees increases in the seemingly inevitable losses to private and public property. In this study we look at the urban side of the WUI to determine if there are factors that are affecting the loss/survivorship of structures during fire events. Widely available real estate databases and aerial photographs taken before the fires occur are used to assess structure and urban vegetation characteristics such as accessibility to responders, age of structures, presence of patios, decks and out-buildings, shrub cover, palm tree presence, tree cover and canopy intersect with rooflines. Using these data, we have found correlations and are building a model that can be used to assess a structures vulnerability and mitigate losses due to fire.

Community interactions webs are changed by deer browse in maritime chaparral shrublands

Fox, Laurel R.
Dept. of Ecology and Evolutionary Biology, University of California, Santa Cruz, CA 95064, USA

I assessed long-term changes in the community interaction web of long-lived, slow growing shrubs in response to deer browsing, using a field experiment that has been maintained since 1996 in chaparral vegetation near the central California coast. Natural levels of deer browsing are high on *Ceanothus cuneatus rigidus*¸ a woody shrub with symbiotic bacteria (*Frankia*) that can fix atmospheric $N_{2;}$ the other two main shrubs, *Arctostaphylos pumila* and *Ericameria ericoides*, are non-fixers and are not heavily browsed. The goal of this experiment was to identify mechanisms underlying dynamic interactions in this community.

Ceanothus responded rapidly in exclosures that reduced deer browsing: growth and seed production increased and plant morphology began to change within a year, while new *Ceanothus* seedlings were found almost entirely in plots without deer. Over time, *Ceanothus* has out-competed the other shrubs. The seed bank beneath unbrowsed *Ceanothus* did not change despite the large increase in seed output compared to control plants with ambient levels of browsing, because of increased activity from seed-eating rodents. Woodrats, *Neotoma fuscipes*, began removing branches on many of the unbrowsed *Ceanothus* with the new morphology, whereas previously they clipped branches only on *Arctostaphylos*. Nitrogen-fixation, which may have been limited in heavily browsed *Ceanothus*, appeared to increase in plants no longer browsed. However, overall, soil N levels declined in plots without deer. Finally, the net growth of shrubs in the experimental exclosures reduced the amount of open space between them, which negatively affected annual plants that grow and reproduce successfully only in these open areas. In summary, community interaction webs were very sensitive to several different interactions despite apparently slow changes of the dominant plants.

Nutrient mining strategy; patch activity of a root mat in a Phosphorous-limited woodland

Gaxiola, Aurora[1,2], Armesto, Juan[1,2] and Veneklaas, Erik[3]
[1]*Institute of Ecology and Biodiversity,Santiago, Chile.* [2]*Departamento de Ecología, P. Universidad Católica de Chile, Santiago, Chile.* [3]*School of Plant Biology, University of Western Australia Crawley, Australia*

Dense mats of fine roots, which develop beneath and sometimes into the litter layer, are particularly prominent in wet forests on highly weathered soils, and appear to be found where nutrient uptake by the vegetation is strongly dependent on the efficient re-use of nutrients from litter. Woodlands dominated by Proteaceae, common in Australia and South Africa; occur on soils that are among the most nutrient-impoverished in the world. In Banksia woodlands in Western Australia, cluster (proteoid) roots (C-roots) form a dense root mat. In other oligotrophic ecosystems, root mats are considered a nutrient-scavenging strategy. Morphology, development and physiology of C-roots, in contrast, are a phosphorus-"mining" strategy; extracting poorly available phosphorus rather than scavenging diffuse readily available phosphorus. Therefore, we asked; Is root activity in Banksia-woodland root mats diffuse or patchy? If patchy, is it correlated with presence of leaf litter? We quantified presence of C-roots using 9 line transects (180m, 900 sampling points in total), and classified C-roots using root morphological and rhizosphere-chemical indicators, potential correlates were also assessed (plant cover, litter). We used multiple logistic regression to determine which combination variables best predicted presence or absence, and activity of cluster-roots. The root mat covered 80% of the 180m, and 96% of it was dead C-roots, however only 14% of these showed chemical activity. Active C-roots were more common under litter patches than on bare soil (87% *vs.* 13%, respectively; χ^2=9.71; P < 0.001), however, none of the plant families identified as sources of leaf litter enhanced the presence of C-roots (χ^2=830.48; P = 0.35). Banksia C-roots create large root mats, however, metabolic activity is very patchy and strongly associated with spots where leaf litter accumulates. This pattern is not consistent with a nutrient scavenging strategy.

Anthropogenic Fires Shape Seed Traits in the Chilean Matorral

Gómez-González, Susana[1], Torres-Díaz[1], Cristian, Bustos-Schindler[2], Carlos, and Gianoli, Ernesto[3,4,5]
[1]*Laboratorio de Genómica y Biodiversidad (LGB), Departamento de Ciencias Básicas, Universidad del Bío Bío, Chile.*
[2]*Laboratorio de Dendrocronología, Instituto de Silvicultura, Chile.*
[3]*Departamento de Botánica, Universidad de Concepción, Chile.*
[4]*Departamento de Biología, Universidad de La Serena, Chile.*
[5]*CASEB, P. Universidad Católica de Chile, Chile.*

Fire is a major disturbance affecting ecosystems worldwide. Phylogenetic studies have shown that seed persistence (fire-resistance) has evolved with fire in Mediterranean-type ecosystems. However, the existence of specific seed traits resulting from natural selection mediated by fire remains as a key question in plant evolution. We evaluated the role of fire in the evolution of seed traits from a microevolutionary perspective, using as study system a native annual plant (*Helenium aromaticum*) from the Chilean matorral, where fire is a novel disturbance. The interpopulation variation of seed pubescence, seed shape and pericarp thickness was strongly associated with fire frequency, and not to site productivity. Within a given *H. aromaticum* population, fire produced directional selection on seed pubescence and stabilizing selection on seed shape. These were shown to be heritable traits. Our findings provide insights into the understanding of seed trait evolution in Mediterranean ecosystems and demonstrate that human-made fires can be driving evolutionary changes in plant species from ecosystems where fires do not occur naturally. Funded by FONDECYT-3090018.

Soil disturbance by a native rodent and release of exotic herbivores allow niche expansion of an alien plant in the Chilean coastal matorral

Gómez-González, Susana[1], Torres-Díaz, Cristian[1], Torres-Morales, Patricio[2], Gianoli Ernesto[2,3,4] & José L. Hierro[5]

[1]*Laboratorio de Genómica y Biodiversidad (LGB), Departamento de Ciencias Básicas, Universidad del Bío Bío, Chillán, Chile.*

[2]*Departamento de Botánica, Universidad de Concepción, Concepción, Chile.*

[3]*Center for Advanced Studies in Ecology and Biodiversity (CASEB), P. Universidad Católica de Chile, Santiago, Chile.*

[4]*Departamento de Biología, Universidad de La Serena, La Serena, Chile.*

[5] *CONICET-Universidad Nacional de la Pampa, Santa Rosa, Argentina.*

The "niche opportunity" hypothesis proposes that alien plant establishment is generally driven by the integrated effects of environmental conditions, changes in resource availability and enemy release, but there is yet little evidence supporting such a complex interaction in nature. We evaluated the effects of soil disturbance by the native fossorial mammal *Spalacopus cyanus*, microhabitat (beneath shrubs and open areas), and introduced herbivores on the abundance, aboveground biomass, and reproductive effort of the alien annual plant *Fumaria capreolata* in the coastal matorral of central Chile. In absence of disturbance *F. capreolata* was almost restricted to understory microhabitats. Soil disturbance by *S. cyanus* significantly increased the establishment, both beneath shrubs and in open area. This positive response to disturbance was mainly mediated by the reduction of competition with resident species. There was no effect of herbivore exclusion on the abundance and performance of *F. capreolata,* while the biomass of other co-existing species was reduced. Overall, these results suggest that this native rodent favor the invasion of *F. capreolata* by allowing its niche expansion into open areas and by increasing its performance in those habitats already occupied. We show how the interplay between soil disturbance, microhabitat, and herbivore release may explain invasion patterns in natural communities.

Decision support tools for forest management in recreation and fire-prone areas in Southern California

González-Cabán A. [1], Sánchez J. [1], Moya D. [1,2*]
[1] *USDA Forest Service, Pacific Southwest Research Station, Riverside, CA 92507 USA.*
[2] *ETSI Agrónomos. Universidad de Castilla-La Mancha. Campus Universitario. 02071 Albacete, Spain.*
[*] Author e-mail: Daniel.Moya@uclm.es

The success of forest management depends on many factors, including the attitudes of general forest visitors and also specialty recreationists such as wilderness hikers, bikers, or religious experience seekers. Visitors/recreationists have been described relative to management of threatened and endangered species, wildlands and wilderness fire management in several studies. Climate change models predictions suggest increases in aridity and changes in fire regimes (increasing fire risk, fire recurrence and fire severity) in Mediterranean climate areas. These changes would mainly reduce forest productivity and resilience in arid or semiarid ombro-climates. Information from wilderness recreationists in the San Jacinto Wilderness Area, San Bernardino National Forest in Southern California was used to determine their willingness-to-pay (WTP) for hiking into the wilderness area if certain portion of the trail they were hiking was affected by different type of wildfires. Using choice experiment and travel cost method data we generated social welfare estimates for their recreation experiences. We considered visitation patterns in three highly used trails in the area subject to hypothetical fire damage at different levels in the trail (using Viewshed analysis) to gage recreationists' changes in visitation patterns due to fire damage to the trail and increases in visitation costs. Using GIS tools the information was used to create a GIS based economic data layer of recreation values showing how wilderness recreation values varies over the terrain. This economic data layer is then combined with a fire occurrence risk data layer to create a loss function data layer providing a spatial allocation of economic values and potential fire risk. This information is useful for fire managers to determine where to place firefighting resources during high fire occurrence risk days and high potential recreation losses. The approach presented here will help support managers decisions regarding forest management in fire-prone areas to reduce the cost associated with forest fire risks and high recreational values.

Fire Ecology Studies in the World's Largest Mediterranean-climate Woodland

Gosper, Carl R. [1,2], Prober, Suzanne M. [2], and Yates, Colin J. [1]
[1] *Science Division, Department of Environment and Conservation, Locked Bag 104, Bentley Delivery Centre, WA 6983, Australia;* [2] *CSIRO Ecosystem Sciences, Private Bag 5, Wembley WA 6913 Australia.*

The 'Great Western Woodlands' are the world's largest remaining Mediterranean-climate woodland, extending across c. 16M ha of south-western Australia. Woodlands to >20 m occur at as little as 250 mm mean annual rainfall, but are very slow growing. As with other Mediterranean-climate regions, fire is a recurrent natural disturbance and woodland trees require disturbances such as fire to regenerate. However, concern has been expressed regarding the intense and extensive fires that have burnt through the region in recent decades. Sparse knowledge on the fire ecology of Great Western Woodland ecosystems is a major impediment for determining what the real impacts of current fire patterns are and how management agencies should respond. In conjunction with the Great Western Woodlands 'supersite' of Australia's Terrestrial Ecosystems Research Network, we studied the response of Gimlet (*Eucalyptus salubris*) woodlands to time since fire using a space-for-time approach. We measured species diversity, species-area relationships and vegetation structure. Important components of vegetation structure required much longer periods to establish than the mean fire return interval experienced over recent decades. Consequently, if recent patterns of fire were to continue into the future, widespread loss of the mature woodland ecosystem would result.

Responses to Fire of Mediterranean-climate Shrublands in South-western Australia

Gosper, Carl R. [1,2], Prober, Suzanne M. [2], and Yates, Colin J. [1]
[1] *Science Division, Department of Environment and Conservation, Locked Bag 104, Bentley Delivery Centre, WA 6983, Australia;* [2] *CSIRO Ecosystem Sciences, Private Bag 5, Wembley WA 6913 Australia.*

Shrublands in Mediterranean-climate south-western Australia are floristically very rich, but also highly threatened. Since European settlement, native vegetation has been removed over large portions of the landscape, with one of the many consequences of this fragmentation being a disruption in the patterns of occurrence of fires. Analysis of satellite imagery shows that fires have become less frequent in vegetation remnants in agricultural areas than in comparable continually vegetated landscapes. We investigated some of the consequences of these fire regime changes for plant conservation by measuring how species diversity, composition and vital attributes (fecundity and mortality), and vegetation structure, change with time since fire using a space-for-time approach. We studied two shrubland communities that occur in a mosaic across the landscape: mallee-heath, dominated by serotinous obligate seeding species; and mallee shrubland, dominated by serotinous resprouters. In mallee-heath, floristic responses to time since fire accorded with the initial floristic composition model of plant succession, with declining diversity with age. Mallee-heath exhibited structural senescence when > ~45-55 years since fire, with increasing standing dead vegetation, bare ground, and stagnating or declining size in sprouting *Eucalyptus* spp. Among serotinous obligate seeding species, several showed elevated mortality and/or declining reproductive output when long-unburnt, demonstrating programmed senescence. These results combine to suggest that mallee-heath communities are fire maintained, and as such are reliant upon periodic burning to maintain diversity and vigour. Changes with time since fire were less pronounced in mallee shrublands, indicating a greater resilience to variation in fire interval. These responses to time since fire create considerable management challenges in infrequently-burnt and fragmented agricultural landscapes, given the sheer number of remnants in need of fire management and also the potential interactions between fire and other threatening process (such as weeds and secondary salinity).

Interacting effects of water input, nitrogen deposition, and fire on Coastal Sage Scrub

Goulden, Michael[1]
[1]*Department of Earth System Science, University of California, Irvine, CA, USA.*

We investigated the effects of water and nitrogen input and fire on Coastal Sage Scrub species composition, primary production and evapotranspiration in Orange County, California. Continuous measurements of CO_2 and evapotranspiration during 2006-2011 using the eddy covariance technique indicated rapid recovery from fire in a stand that burned in 2007. The rates of CO_2 uptake and evapotranspiration recovered to pre-fire levels within two years, which is faster than has been observed in many other fire prone ecosystems. Similarly, the control plots at a nearby experimental site that also burned in 2007 recovered rapidly, with progressive increases in shrub dominance. In contrast, shrub mortality increased and shrub cover decreased markedly, while herbaceous production was relatively constant, in experimental plots that received 50% less water input relative to controls. And herbaceous production and cover increased, while shrub production and cover was comparatively unaffected, in experimental plots that received increased nitrogen. The eddy covariance and control plot measurements underscore Coastal Sage's resilience to fire on the 10-to-30-year return interval observed at this site. The water and nitrogen manipulations indicate the vulnerability of regenerating Coastal Sage to changes in climate and/or nitrogen deposition. The combination of decreased water input and increased nitrogen deposition had the largest effect on the ecosystem, markedly decreasing shrub cover and shifting the plant community to red brome dominance

Using Smart Phone Apps to Merge Citizen Science, Technology and Ecology

Graham, Eric[1], Irvine, Irina C.[2]
[1]*Center for Embedded Network Sensing, University of California Los Angeles, Box 951596, 3563 Boelter Hall, Los Angeles, CA 90095-1596*
[2]*Santa Monica Mountains National Recreation Area (National Park Service), 401 W. Hillcrest Dr., Thousand Oaks, California 91360, USA*

Citizen science projects engage individuals or groups of volunteers to observe, measure, and contribute data to scientific studies and long-term ecological monitoring. With rapid advances in mobile applications and technologies, and the current proliferation of citizen science programs in the U.S., a number of partnerships between mobile device software developers and environmental projects have resulted. The early outcomes of such partnerships have already enhanced capabilities for both professional and informal participants to record GPS location, images and text, and upload and analyze their observations using their mobile devices. CENS is an NSF-funded Information and Technology Center that employs Computer Science and Electrical Engineering students at UCLA to create open-source software that collects verifiable, scientifically meaningful data. We are building a collection of mobile phone and web-based tools to make the citizen scientist experience more engaging and flexible. Current collaborations include work with Project BudBurst, a national plant phenology tracking campaign, and the National Park Service, with our *What's Invasive!* campaign for rapid detection and mapping of invasive species. Both projects are good examples of technology that support civic engagement in issues that are of social and land management concern. We present details of the apps: real-time invasive plant mapping, phenology tracking, local plant lists and news information, as well as new a gaming feature – *FloraCaching.*

Protecting the Mediterranean Forests of Baja California

Granillo, Isabel [1]
[1] *The Nature Conservancy Ensenada, Baja California, México*

Baja California in México is one of the 5 unique regions in the world that harbors highly biodiverse and threatened Mediterranean climate type habitats. In Baja California these habitats span from wetlands on the coast, through coastal scrub and chaparral to the old growth forests of Sierra de Juárez and Sierra San Pedro Mártir. These mountain ranges provide an array of environmental services that sustain the livelihoods of more than 466.000 individuals. Among these services are: carbon sequestration and storage, water capture, soil retention and erosion control. In 1951, the federal government, through decrees, declared these two sierras as National Forest Reserves. Main objectives were to prohibit logging and protecting the hydrological services provided by these two forested areas. Although these decrees prevented legal logging and have protected the forests to some extent, illegal logging activities, as well as other sources of impact such as unplanned development, cattle grazing, agriculture, altered fire regime, among others, are threatening the integrity of these landscapes, their ecological processes and thus, the environmental services they provide. Furthermore, in 1996, some changes to the General Law for the Equilibrium and Protection of the Environment (LGEEPA) modified the protected areas categories and did not include the National Forest Reserves under the new structure. The Nature Conservancy, together with the local organization Terra Peninsular and the Baja California State government Secretariat for Environmental Protection (SPA) has conducted the required studies to promote the recategorization of these old forest decrees to the correspondent category under the new structure. Besides giving it legal recognition under the new law, the new category agreement will also provide a more precise spatial definition of the protected area, zoning and a management and conservation program.

Evolutionary history of a California endemic oak, *Quercus lobata*

Gugger, Paul F.[1], Ikegami, Makihiko [2], Sork, Victoria L. [1, 3]
[1] *Department of Ecology and Evolutionary Biology, University of California, Los Angeles, CA, USA*
[2] *Bren School of Environmental Science, University of California, Santa Barbara, CA, USA*
[3] *Instiute of the Environment and Sustainability, University of California, Los Angeles, CA, USA*

To survive changing climates, plants must either disperse to track favorable climates or evolve novel adaptations *in situ*. To understand the demographic and adaptive evolutionary response of valley oak (*Quercus lobata*) to late Quaternary climate change, we present data from ecological niche models, neutral population genetics, and putatively adaptive candidate genes controlling response to climate. Neutral nuclear DNA markers suggest divergence between coastal and Sierran populations ~200 ka, consistent with vicariance observed in niche models through the Sangamon interglacial (120 ka). Neutral chloroplast DNA markers suggest strong local populations structure, consistent with long-term population stability and migration patterns inferred from niche models. Finally, we observe signatures of natural selection in several bud burst, osmotic stress, and temperature stress response genes. By comparing geographic patterns of candidate gene variation to neutral variation, we infer that adaptive molecular evolution may have occurred within coastal and Sierran populations since their divergence. These data suggest that an adaptive evolutionary response to Quaternary climate change may have been important for the persistence of some populations of valley oak in California. Our work further highlights the need for collaborations among paleoecologists, climate modelers, and geneticists to gain a more holistic understanding of the response of plants to past and future climate change.

When Native Shrublands Collide with Ideology: a challenge to preservation and restoration

Halsey, Richard W. [1]
[1]*California Chaparral Institute, PO. Box 545, Escondido, CA 92029, USA.*

After the huge 1889 Santiago Canyon Fire in southern California, a regional San Diego newspaper exclaimed, "The menace should be removed by the removal of the brush. It is unsightly and dangerous." After the 2007 Witch Creek Fire, San Diego County's Department of Planning and Land Use developed a plan to remove "invading chaparral shrubs" from thousands of acres of wildland. The California State Park System is currently embarking on a project that will eliminate what they have classified as "unnatural monocultures of *Ceanothus palmeri*" (a common chaparral shrub) in a large state park that is characterized by extensive chaparral plant communities. Due to misunderstandings about Mediterranean-type ecosystems, a bias favoring trees over shrubs, and the large influx of federal money to conduct vegetation management projects, the preservation and restoration of native shrublands in California continues to be challenging. However, new research demonstrating the ecological importance of shrublands, their vulnerability to increased fire frequency, and how humans can live within fire-prone environments without radically compromising habitat values provides hope. Science is also providing a potent legal tool to help protect native shrublands from inappropriate land management strategies based on outmoded paradigms.

Assessing and Monitoring Conditions of Mediterranean-Type Shrublands Using Remote Sensing: California Sage Scrub Communities

Hamada, Yuki [1, 2], Stow, Douglas A. [2]
[1] *Argonne National Laboratory, Environmental Science Division, 9700 South Cass Avenue, Argonne, IL 60439, USA*
[2] *San Diego State University, Department of Geography, 5500 Campanile Drive, San Diego, CA 92182-449, USA*

Semi-arid shrublands in Mediterranean-type ecosystems are experiencing severe habitat loss and degradation due to human-induced or -altered disturbances. These plant communities require close monitoring for conserving and managing important biological resources. Using California sage scrub (CSS) communities of southern California as a case study, we investigate the utility of remote sensing approaches—object-based image analysis applied to 0.6 m pansharpened QuickBird imagery (QBPS/OBIA) and Multiple Endmember Spectral Mixture Analysis (MESMA) applied to 10 m SPOT imagery (SPOT/MESMA)—for estimating fractional cover of true shrub, subshrub, herbaceous plants and bare ground. We also explore the effectiveness of life-form cover maps derived from remote sensing approaches for assessing and monitoring conditions of the community type. The results show that overall and combined shrub cover fractions were estimated more accurately using QBPS/OBIA (RMSE 13%) than SPOT/MESMA (RMSE 16%). Life-form cover from the QBPS/OBIA approach mapped at a 25 m x 25 m grid-cell size seems most desirable for assessing the condition of CSS communities because of its higher accuracy and spatial detail in cover estimates and amenability to extract other vegetation information (e.g., size, shape, and density of shrub patches). With visualization tools such as maps and ternary plots, plant life-form cover can be used for conservation planning (reserve design), assessing community conditions, monitoring CSS community recovery, and detecting early sign of type conversion. In conjunction with field-based data and vegetation type maps, multi-scale monitoring systems may be developed.

A Multi-site Analysis of Valley Oak (*Quercus lobata* Née) Regeneration, Stand Structure and Spatial Distribution in the Santa Monica Mountains, California, USA

Hayes, James
California State University - Northridge, Northridge, California,

Regeneration failure in valley oak (*Quercus lobata* Née) has been a concern among researchers and land managers for many decades. Valley oak is a keystone species and endemic to California, as well as an icon of California landscapes. Nevertheless, research on valley oak stand structure – including expected size-class distributions, sapling:adult ratios, spatial patterning, and how these change through time and across the geographic range – remains incomplete and geographically biased. While researchers have examined various aspects of valley oak ecophysiology including pollination, dispersal, seedling establishment, and survival, more information is needed on how stand structure and pattern vary across scales from the stand to the range in order to make best use of previous work. This study conducted a full census of valley oak stems ≥ 1 cm dbh at three sites in the Santa Monica Mountains to assess stand structural and spatial variability at the southern limit of the species' range. Analysis of size-class densities revealed distinctive stand structures at each site; one had a negative-exponential distribution and another a bi-modal curve peaking in the 80-100 cm range. Stands differed in median dbh and inter-quartile range for saplings and adults. Sapling:adult ratios varied from >1 to 0.5. Multi-scale clustering analysis revealed spatial aggregation of saplings across scales at all three sites, but clustering of adults varied among stands and scales examined. In all cases clustering appears closely related to topographic position (a proxy for soil moisture availability and depth to water table). Both site history and development of the surrounding landscape appear to influence sapling density and spatial shifts of stem establishment. The results help place the structure of southern valley oak stands in relation to work done farther north while also indicating the need for examining the role of site history and landscape change in shaping these stands.

Climate Adaptation Knowledge Exchange: Developing an Innovative Community of Practice

Hitt, Jessica, Gregg, Rachel M., and Hansen, Lara J.
EcoAdapt, PO Box 11195, Bainbridge Island, Seattle, USA.

Climate change is widely acknowledged as a global problem that threatens marine and coastal conservation, management, and policy. Developing robust management strategies now that can help prepare for and respond and adapt to climate change is vital; however, these activities are in their infancy and the field is developing in an ad hoc fashion. This presentation will provide context, guidance, and examples of how climate change adaptation or resilience building is being addressed and/or implemented. It will highlight efforts by practitioners from different regions and scales by showcasing the types of activities that are currently underway and identifying successes and possibilities for coordination. In addition, this presentation will introduce the audience to the Climate Adaptation Knowledge Exchange (CAKE; www.cakex.org), an open access, online resource with an active user community of managers, scientists, and others dedicated to creating an innovative community of practice on climate change adaptation. CAKE includes case studies of on-the-ground adaptation efforts, a virtual library of useful resources to support adaptation action, a community forum with an expert advice column, a directory of individuals and organizations rich with adaptation knowledge, and a tools section full of useful online resources for adaptation action.

No Allee Effects in Lyon's Pentachaeta, a Federally Listed Endangered Sunflower

Holt, Jocelyn R.[1], Wilson, Paul S.[1], Brigham, Christy A.[2]
Department of Biology, California State University, 18111 Nordhoff Street, Northridge, CA 913330, USA.
Santa Monica Mountains National Recreation Area, 401 West Hillcrest Drive, Thousand Oaks, CA 91360, USA.

Potential Allee effects were investigated in *Pentachaeta lyonii*, an annual Asteraceae that is listed as federally endangered. Since *P. lyonii* is self-incompatible, pollination service is essential for persistence. Observations of floral visitors showed that insect composition varied depending on site, year, and over the flowering season. The most common visitors were the bee-flies *Lepidanthrax* sp. and *Paravilla* sp. and the bee *Ashmeadiella californica* subsp. *californica*. These generalist pollinators allowed ample pollination for *P. lyonii*. The absence of Allee effects was further supported by there being no difference in seed production between open-pollination and hand-augmentation treatments within patches. In 2008 there was a proportional increase in per-capita visitation rates with increasing density. Flower heads in low density quadrats did not suffer a significant reduction in seed production compared to flower heads in more dense quadrats. Flowering *P. lyonii* in pots were placed in patches of various densities and at distances up to several meters from a patch. The percent of quadrats visited was higher inside a patch (69%) than outside of a patch (16%), but seed set was not reduced by being placed outside a patch. When examining visitation to potted plants, lone potted plants received visits equal to or greater than potted plants inside patches, possibly because an individual flower head is less attractive when surrounded by conspecifics. These results indicate that other factors such as habitat loss and competition with non-native plants are likely responsible for populations not expanding in size and in some cases declining.

The effects of substrate on adjacent shrub communities, and the distribution of the California endemic, Astragalus jaegerianus Munz

Huggins, Thomas R.[1], Prigge, Barry A.[2], Sharifi, Rasoul[1], and Rundel, Philip W.[2]
[1] Department of Ecology and Evolutionary Biology, University of California, Los Angeles
[2] Mildred E. Mathias Botanical Garden, University of California, Los Angeles

Edaphic habitats are botanically interesting because of differences in vegetation with neighboring sites and because they tend to harbor rare species. In the central Mojave Desert, there are shallow granite substrates where creosote bush, the dominant shrub in the area, is sparser and generally smaller than in the neighboring creosote bush communities on deeper soils. It is on these granitic, shallow-soil sites that the Lane Mountain milkvetch, a rare and federally endangered species, is restricted. The milkvetch is a nitrogen-fixer and grows under and within the canopy of host shrubs. Our previous studies have demonstrated that the milkvetch has no preference for species of host shrub, except *Larrea tridentata*, which appears to be an unsuitable host plant for the milkvetch. In this study, we develop a hypothesis explaining the restricted distribution of the Lane Mountain milkvetch based one characteristics of its shrub community. To do this, we compared shrub transects within milkvetch habitats and in adjacent creosote bush habitats in the year 2000 and again in 2010, a period coincident with long-term drought conditions in the Mojave Desert. Our results show that adjacent milkvetch and creosote bush shrub communities differ significantly in shrub height, shrub volume, and shrub density in the year 2000: the shrubs in milkvetch communities were more numerous but smaller compared to adjacent creosote bush scrub. Surveys in 2010 showed that the drought had significant negative effects on both shrub communities. Shrub densities decreased significantly in milkvetch communities in 2010, but were still considerably higher than shrub densities in creosote bush communities in 2000. We previously hypothesized that the restricted distribution of the Lane Mountain milkvetch might be the result of higher shrub densities in milkvetch shrub communities, which increased the probability of successful seed dispersal and establishment. But, recent evidence suggests that allelochemicals produced by *L. tridentata* may restrict the milkvetch to granite barrens where *L. tridentata* densities are low.

Invasive trees, microbes and nutrient cycling in fynbos riparian ecotones

Jacobs, Shayne [1,2], Esler, Karen [1,3], Naude, Minette [1], Kambaj, Oliver [1], Slabbert, Etienne [4], Cowan, Donald [5], Jacobs, Karin [4], Mantlana, Brian [6], and Rozanov, Andrei [7]

[1]*Department of Conservation Ecology and Entomology, Faculty of AgriSciences, Stellenbosch University, Private Bag X1, Matieland, 7602*

[2]*Stellenbosch University Water Institute, Faculty of Science, Stellenbosch University, Private Bag X1, Matieland, 7602*

[3]*Centre for Invasion Biology, Stellenbosch University, Private Bag X1, Matieland 7602, Stellenbosch, South Africa*

[4]*Department of Microbiology, Faculty of Science, Stellenbosch University, Private Bag X1, Matieland, 7602*

[5]*Institute for Microbial Biotechnology and Metagenomics, University of the Western Cape, Bellville 7535, Cape Town, South Africa*

[6]*Global Change Research Group, South African National Biodiversity Institute, Kirstenbosch Research Centre, Private Bag X7, Claremont 7735, Cape Town South Africa*

[7]*Department of Soil Science, Faculty of AgriSciences, Stellenbosch University, Private Bag X1, Matieland, 7602*

Riparian ecotones in the Fynbos Biome contribute significantly to landscape diversity, and provide a multitude of ecosystem services. Native plant species are adapted to winter high flows and summer drought, but have been replaced in many riparian ecotones by alien invasive woody trees such as *Acacia* and *Eucalyptus* species. Studies in fynbos riparian ecotones show that the invasive *Acacia mearnsii*, a nitrogen fixing tree, is at least as tolerant to drought, or more so compared to the native species. Thus, in the projected hotter and drier Fynbos Biome of the near future, these invasive trees might persist in riparian zones. One consequence of the replacement of native non-legumes with nitrogen-fixing legumes is that nutrient stoichiometry and hence soil and plant nutrient relations may be modified, with potential downstream impacts on water quality. Our studies show that nitrogen, carbon and phosphorus cycling is significantly altered by the replacement of native plants with invasive nitrogen fixers. In riparian zones where *Acacia mearnsii* (and *Acacia longifolia*) dominate, the rate of soil nitrogen mineralization is significantly higher. Due to the elevated nitrogen availability, phosphorus may be in short supply, which is borne out by increased soil phosphatase activity. Soils also respond to the virtual replacement of native trees with leguminous invasive trees by modified bacterial and fungal diversity. While soil respiration is significantly higher in invaded areas, much of the enhancement can be attributed to autotrophic respiration. When *Acacia* trees are removed from riparian environments, our results show that soils return to their pre-invasion state over the course of some years, though soil physical attributes such as soil particle size seem to play a role in the level of recovery.

An overview of the impacts of disturbances on structure and functioning of fynbos riparian zones

Jacobs, Shayne [1,2], Esler, Karen [1,3], Naude, Minette [1], Slabbert, Etienne [4], Cowan, Donald [5], Jacobs, Karin [4], Mantlana, Brian [6], and Rozanov, Andrei [7]

[1]*Department of Conservation Ecology and Entomology, Faculty of AgriSciences, Stellenbosch University, Private Bag X1, Matieland, 7602, South Africa*

[2]*Stellenbosch University Water Institute, Faculty of Science, Stellenbosch University, Private Bag X1, Matieland, 7602, South Africa*

[3]*Centre for Invasion Biology, Stellenbosch University, Private Bag X1, Matieland 7602, Stellenbosch, South Africa*

[4]*Department of Microbiology, Faculty of Science, Stellenbosch University, Private Bag X1, Matieland, 7602, South Africa*

[5]*Institute for Microbial Biotechnology and Metagenomics, University of the Western Cape, Bellville 7535, Cape Town, South Africa*

[6]*Global Change Research Group, South African National Biodiversity Institute, Kirstenbosch Research Centre, Private Bag X7, Claremont 7735, Cape Town, South Africa*

[7]*Department of Soil Science, Faculty of AgriSciences, Stellenbosch University, Private Bag X1, Matieland, 7602, South Africa*

Mediterranean Type riparian environments in the South-Western Cape of South Africa are highly degraded due to a multitude of disturbances acting singly or in combination. These riparian zones are shaped by natural disturbances, summer drought and winter high flows, with fire, typically originating in the surrounding fynbos, and geomorphology acting over longer timespans to determine vegetation structure. Over the last century, native vegetation has increasingly been replaced by woody alien invasive plants such as *Acacia*, *Eucalyptus* and *Pinus* spp. This has major consequences for riparian structure and diversity, with altered light regimes implicated in the modification of insect assemblages, changed stem density and root architecture implicated in changes in erosion-sedimentation rates in riparian environments and water use by invasive trees linked to declining streamflow during summer low-flow periods. Large amounts of public funding have been spent on removing alien invasive trees from riparian zones, but the consequences to riparian functioning are unknown. There is an expectation that these riparian zones will 'self-repair' after removal of the woody material, however, re-invasion by woody and herbaceous alien invasive plants coupled with fires and other disturbances may derail the repair of these valuable ecotones. Disturbances such as invasion by woody alien plants have been shown to lead to changes in soil microbial diversity and soil processes, which may also play a role in determining the trajectory of recovery after alien invasive plants have been removed from riparian environments. We provide a review of the major disturbances of riparian zones in the Fynbos region, and how these interact to alter structure and function.

Riparian Vegetation Structure and Function in Mediterranean Type Ecosystems: A review

Jacobs, Shayne, [1] Esler, Karen [1,2], Swift, Cheryl [3], Pettit, Neil [4], Reinecke, Karl [1,5], Aguilar, Francisca [6], Buisson, Elise [7]

[1]Department of Conservation Ecology and Entomology, Faculty of AgriSciences, Stellenbosch University, Private Bag X1, Matieland, 7602

[2]Centre for Invasion Biology, Stellenbosch University, Private Bag X1, Matieland 7602, Stellenbosch, South Africa

[3]Department of Biology, Whittier College, Whittier, CA 90605, USA

[4]Centre of Excellence in Natural Resource Management, The University of Western Australia (M090), 35 Stirling Highway, CRAWLEY WA 6009, Australia

[5]Southern Waters Ecological Research and Consulting cc, P.O. Box 12414, Mill Street Post Office, Cape Town, 8010, South Africa; [6]Forest Research Centre, Technical University of Lisbon, Agronomy Institute, Tapada da Ajuda, 1349-017 Lisbon, Portugal; [7]Université d'Avignon, IUT, Site Agroparc, BP 1207, 84 911 Avignon Cedex 9, France

We present a review of the available literature on Mediterranean-type riparian environments, with a focus on vegetation structure and function. Most information on riparian zones is based upon research carried out in cooler, wetter temperate environments, and on riparian zones adjoining forested uplands. Relatively few papers have been published on riparian structure and functioning in Mediterranean-type ecosystems, which in contrast to other temperate systems, experience summer drought with winter rainfall resulting in high river flows. These unique climatic conditions have several implications for riparian vegetation processes such as seedling establishment, plant growth, survival and population and community dynamics. This review will address the following questions: how similar are the drivers that create the structure and maintain the function of riparian habitats in the five global MTEs? Are similarities linked to similar hydro-geomorphologic settings common to MTEs or do other unique basin scale processes and anthropogenic influences override typical environmental drivers in determining riparian structure and function? The outcome of this review is a short assessment of riparian research in MTEs worldwide, identification of gaps in research on riparian zones and a literature review covering the important controls and interactions between riparian biota and abiotic components.

Chaparral seedling ecophysiology of three island endemics from Santa Catalina Island, southern California

Jacobsen, Anna L. and Pratt, R. Brandon
California State University, Bakersfield, Department of Biology, 61 SCI, 9001 Stockdale Hwy, Bakersfield, CA 93311, USA.

Island systems are generally more sensitive to the introduction of non-native species than comparable mainland systems. For island chaparral communities the impact of non-native species may be particularly great when combined with other stresses, such as fire and climate change. Indeed, a previous study found that heavy browsing by introduced deer resulted in greater than 90% mortality in resprouting shrubs during the first few years following fire, suggesting that island plants may be particularly sensitive post-fire. We examined the impact of browsing on seedling establishment and seedling physiology in three island endemic seeders (*i.e.* non-sprouters) on Santa Catalina Island following a large fire in 2007: *Arctostaphylos catalinae* P. Wells (Ericaceae), *Ceanothus arboreus* E. Greene (Rhamnaceae), and *Ceanothus megacarpus* Nutt. var. *megacarpus* (Rhamnaceae). Four sites were established in the burned area with each site containing at least 12 plots exposed to browsing and 12 plots protected from browsing. Predawn and midday water potentials, stomatal conductance, and growth differed between species during the first two years post-fire. *Ceanothus megacarpus* and *C. arboreus* exhibited relatively low seedling mortality (48.1 % ± 6.9 and 55.0 % ± 6.5, respectively) and increased stem cavitation resistance (P_{50} = -4.57 and -4.59 MPa, respectively), compared to *A. catalinae* which exhibited greater seedling mortality (73.3 % ± 8.8) and was less resistant to cavitation (P_{50} = -2.57 MPa). Species were not equally browsed, with 60-100% of *C. arboreus* seedlings experiencing browsing (varying with season), less than 10% of *C. megacarpus* experiencing browsing, and no evidence of browsing of *A. catalinae* seedlings. In browsed species, browsing did not significantly affect seedling mortality; however, browsing did significantly affect plant height and water potential. Differential browsing pressure and seedling physiology may have important consequences for long-term species abundances and distributions on Santa Catalina Island for these island endemic plant species.

The impact of changes in the timing of precipitation on the herbaceous understorey of Mediterranean evergreen oak woodlands

Jongen, Marjan [1], Lecomte, Xavier [1], Pintó-Marijuan, Marta [2] and Pereira, Joao S. [1]
[1] *Centro de Estudos Florestais, Instituto Superior de Agronomia, Universidade Técnica de Lisboa, Lisboa, Portugal;* [2] *Instituto de Tecnologia Química e Biológica*, *Universidade Nova de Lisboa, Oeiras, Portugal.*

In the Iberian Peninsula, the evergreen oak woodlands are of great ecological and socio-economic importance. In Portugal, montados represent 23% of forest area (736,700 ha). They are considered a national heritage, key to biodiversity conservation and ecosystem services. Dominated by *Quercus* species, these open woodlands form an agro-silvo-pastoral system. The herbaceous layer, key to these systems' multi-functionality, is dominated by a diverse community of C3 annual species. It plays a significant role in carbon fixation and ecosystem productivity, as well as influencing nutrient cycling and water balance, with all these variables being highly dependent on timing and magnitude of precipitation. Climate change scenarios for the Iberian Peninsula predict increasing temperatures and increasingly variable precipitation regimes, which will challenge the sustainability and biodiversity of semi-natural ecosystems such as cork oak woodlands. To assess the effects of precipitation variability on the understorey vegetation in a managed cork oak woodland, large ´rain-out shelters´ were constructed. The water manipulation treatment is based on historical precipitation data for the experimental site. The two treatments in the rain-out shelters are: (1) ambient precipitation quantity, with a dry period of 7 days, and (2) ambient precipitation quantity with a dry period of 21 days. In addition to the above two treatments, there are non-sheltered reference plots, receiving natural rainfall patterns. We have gathered a full data set for relevant environmental variables, as well as data on productivity, species composition, soil respiration, soil nitrogen and photosynthesis. Preliminary results show no significant effect of precipitation variability on productivity, although fluctuations in soil water content do result in temporary changes in available nitrogen, microbial activity and soil respiration.

Can small mammals be used as indicator in post-fire regeneration?

Kaynas, Burcin Y.[1], and Gurkan, Behzat[2]
[1]*Mehmet Akif Ersoy University, Faculty of Arts and Science, Department of Biology, Burdur,TURKEY.*
[2]*Yasar University, General Secretary, İzmir, TURKEY*

In Mediterranean ecosystems, numerous fires occur and very large areas are affected by fires every year. These areas are destroyed by fire dramatically in just few hours, days or sometimes months. Burned areas that covered bare rock, ash layer and burned trunks, branches make a start after fire. Pine communities can regenerate in a short time period and this process called by autosuccession. To evaluate developmental stages and stability time of whole community, comprehensive studies are needed. Indicator organism groups can help us about view to community with holistic approach. This study is a part of the project regarding changes of small mammal community in successional period of *Pinus brutia* forests after fire. In this project, community structure and habitat preferences of small mammals in six different successional stages and mature forests were determined. For sampling, mature forest was represented by two replication sites, unburned at least 50 and 80 years. Distance between these two replication sites was about 10 km as bird's eye and they are located at similar altitudes. At the end of the sampling process of microhabitat variables and small mammals of two mature forest sites revealed that species composition of plant communities and vegetation structure were very similar in both sites. However, predominant small mammal species of these two sites were completely different. While *Apodemus mystacinus* was predominant in unburned site at least 50 years, in the other site just *Apodemus flavicollis* was caught. These results on small mammal community thought us that these sites seen as regenerated and reached maturity could not be in the same place in successional gradient.

Changes of small mammal community with successional gradient after fire in Pinus brutia Ten. forests

Kaynas, Burcin Y.[1], and Gurkan, Behzat[2]
[1]*Mehmet Akif Ersoy University, Faculty of Arts and Science, Department of Biology, Burdur, TURKEY.*
[2]*Yasar University, General Secretary, İzmir, TURKEY*

Pinus brutia forests which have widespread distribution in eastern Mediterranean region are fire-resilient with their adaptive features that make them regenerate in a short period. In these ecosystems structure and dynamics animal communities changes depend on conditions of post-fire habitats. In this study, we aimed to determine changes of small mammal community in successional period of *Pinus brutia* forests after fire. To consist successional gradient, the areas burned different years (burned 3, 6, 9, 10, 16 and 26 years ago) and unburned areas for longer period were selected. Sampling was made in three replication sites of every successional stage and two for unburned areas. Sherman live traps were used to capture small mammals in 5x5 grid with 10 m intervals in every replication site. Microhabitat variables were recorded around the all trap locations to determine habitat preferences of small mammal species. Total 675 individuals belong to 6 small mammal species (*Apodemus mystacinus*, *Apodemus flavicollis*, *Mus macedonicus*, *Crocidura suaveolens* , *Rattus rattus* and *Dryomys nitedula)* were caught during the study. *A. mystacinus* is a species which prefers rocky and bare habitats was predominant all sites except one the replication site of the unburned areas. Abundances of *Apodemus flavicollis* and *Crocidura suaveolens* display increase with successional gradient and it was found that both prefer habitats which have higher vegetation height, cover and plant species richness. However, *M. macedonicus* which its abundance negatively correlated with plant species richness, shrub cover and shrub species richness, decrease with the successional gradient. The changes of *Rattus rattus* and *Dryomys nitedula* abundances did not correlated with successional gradient.

Evolution of Postfire Seedling Recruitment

Keeley, Jon E.
U. S. Geological Survey, Sequoia-Kings Canyon Field Station, Three Rivers, CA 93271 and Department of Ecology and Evolutionary Biology, University of California, Los Angeles USA.

The vast majority of woody species in fire-prone environments persist in the face of recurring fire by vegetative resprouting. In Mediterranean-type climate shrublands subjected to a predictable crown fire regime there also has been selection to capitalize on burned sites for reproduction. In these species seedling recruitment is delayed to a single postfire pulse. This talk will focus on the factors selecting for postfire recruitment and the trade-offs involved in different soil vs canopy seed storage.

Wildland-Urban Interface Fire Issues and Options

Keeley, Jon E.
U. S. Geological Survey, Sequoia-Kings Canyon Field Station, Three Rivers, CA 93271 and Department of Ecology and Evolutionary Biology, University of California, Los Angeles USA.

In the US fires are not treated like other hazards such as earthquakes but rather as preventable or controllable hazards through landscape scale fuel treatments and aggressive fire suppression. In southern California other factors such as extreme weather conditions have made it impossible to control all fires and thus loss of homes and lives is a constant threat to communities. There is growing evidence, both from empirical and modeling studies that indicate we are not likely to ever eliminate fires on these highly fire-prone landscapes. Thus, it is perhaps useful to consider fire management more broadly like we do with other natural hazards such as earthquakes. As with large fire events, we cannot stop earthquakes and so the primary emphasis is on altering human infrastructure in ways that minimize community vulnerability. In other words we need to change our approach from risk elimination to risk management. This approach means we accept that we cannot eliminate fires but rather learn to live with fire by communities becoming more fire adapted. This requires a different ethos in all sectors of the fire community. We potentially can make great strides in reducing community vulnerability by finding those factors with high impacts and are sensitive to change in management practice. This involves wildland fire management activities, urban fuels and planning of future developments.

Mediterranean-climate episodic channels: long periods of boredom, brief moments of terror

Kondolf, G. Mathias[1]
[1] *Department of Landscape Architecture & Environmental Planning, University of California, Berkeley*

Societal expectations about how rivers behave are based largely on cultural preferences inherited from northern European landscape aesthetics and supported by1960s-era scientific treatises on 'bankfull discharge' based on observations of rivers in humid climate or snowmelt regimes. These expectations are implicit in many of our institutions and regulations (such as expectations that wetlands be 'wet' all-year), but miss an essential quality of rivers in semi-arid and high-gradient montane landscapes: the episodic nature of flow, sediment transport, and channel change. We can liken the geomorphic regime of such stream channels to life in the trenches in the First World War: long periods of boredom, separated by brief moments of terror. While subject to the same basic controls as humid-climate streams, dryland stream processes occur with greater variability and in combination, resulting in characteristic adjustments in form quite distinct from their temperate region counterparts. Native species are adapted to these distinctive patterns, and when they are suppressed (as below large dams that regulate flow and reduce sediment supply) exotic species often out-compete natives. Recognizing the distinctive physical and ecological processes in Mediterranean-climate rivers is the first step towards developing and applying conservation and management strategies suited to these streams and their surrounding environment.

Managing Endangered Birds in an Urban Environment

Kus, Barbara E.
United States Geological Service, Western Ecological Research Center, San Diego, California, USA 92182

Riparian woodlands are productive and diverse ecosystems that in California once covered ten times the land area they do now. Loss and degradation over the last several decades have reduced riparian habitat to fragmented remnants, resulting in population declines of associated species, many of which are threatened or endangered. In southern California, riparian habitat occurs within a matrix of urban development, posing challenges for management and recovery of endangered species such as the Least Bell's Vireo (*Vireo bellii pusillus*) and Southwestern Willow Flycatcher (*Empidonax traillii extimus*), flagship species for conservation of riparian birds and habitat. In particular, urban and semi-rural environments create favorable conditions for Brown-headed Cowbirds (*Molothrus ater*), which parasitize nests of both species and contributed to their declines. In addition, invasion of exotic species such as Giant Reed (*Arundo donax*) and Salt Cedar (*Tamarix* spp.) reduces native vegetation used for nesting and foraging. Management to address these threats includes annual trapping and removal of cowbirds from riparian areas, and habitat restoration to eradicate exotic vegetation through mechanical removal and foliar application of herbicides. Our long-term monitoring of bird response to these management practices has shown that cowbird control reduces parasitism rates and thereby increases fecundity of both vireos and flycatchers; however, only vireos have responded with population growth. Exotic vegetation removal temporarily reduces the density of vireos in treated areas, but by 1-2 years post-treatment, vireo density and fecundity are indistinguishable from that in undisturbed reference habitat. In contrast, southwestern willow flycatchers nest selectively in Salt Cedar, so restoration may affect this species differently. Our findings document the effectiveness of commonly used management tools, but reveal important species differences in response that caution against generalizing across species when identifying recovery needs.

Fire-stimulated flowering in mediterranean regions – a review

Lamont, Byron[1,2], and Downes, Katherine[1]
[1] *Department of Environment and Agriculture, Curtin University, PO Box U1987, Perth, WA 6845, Australia*
[2] *School of Environmental Sciences, Murdoch University, Murdoch, WA 6150, Australia.*

There is no better demonstration of a fire-dependent process than fire-stimulated flowering (fsf). We have identified ten potential fitness benefits of fsf, centred around pre-empting resources when they are most available. We are compiling a worldwide list of species with fsf and have comprehensive data on 550 species so far, although the listings for mediterranean Europe and California are meagre and fsf is negligible in Chile. Here, we synthesise our data on 386 species for Australia (plus New Zealand) and South Africa (plus Madagascar). 40% of these show obligate fsf (some species become dormant in the absence of fire) while the rest are facultative. Fsf is most prominent in the mediterranean regions of these two (sub)continents (71.2%). Flowering usually peaks 5–12 months after summer-autumn fire, but can be as short as a few days to as long as 2–3 years. Most species are herbaceous monocots (72.3%) but 'woody' monocots and gymnosperms as well as herbaceous/woody dicots are also represented. Of the 35 families represented, the most speciose are terrestrial orchids (45.1%), followed by Xanthorrhoeaceae, Iridaceae, Asteraceae, Proteaceae, Haemodoraceae, Faboideae, Amaryllidaceae, Droseraceae, Poaceae, Dasypogonaceae, Zamiaceae and Myrtaceae (1.6%). Surprises include three parasites, a podocarp, 20 aloes, two trigger plants (*Stylidium*) and several trees. Their 16 orders are spread throughout the seed plant phylogeny from cycads to the most advanced Asterids (only Magnoliids are missing), with at least six independent origins at the Class level, suggesting a long association with fire. Work on the South African orchid, *Disa* (Bytebier et al. 2011) traces fsf back to 18 Mya showing that fire was an effective evolutionary force then. Among the six proteas with fsf, their ages range 1.2–10.8 My (Valente et al. 2010), indicating that fsf is a highly advanced condition in *Protea*. Much remains to be known about the biology of fsf.

Impact of fire on plant-species persistence in natural and post-mine restored shrub communities in mediterranean Australia

Lamont, Byron[1,2], Herath, Dulana[1] and Enright, Neal[2]
[1]*Department of Environment and Agriculture, Curtin University, PO Box U1987, Perth, WA 6845, Australia.*
[2] *School of Environmental Sciences, Murdoch University, Murdoch, WA 6150, Australia.*

In most mediterranean regions, it is inevitable that fire will return as a natural disturbance factor to vegetation restored on anthropogenically-disturbed lands. Therefore, assessment of the ultimate success of restoration programs should include the ways in which these ecosystems respond to such natural disturbances. We compared the response of vegetation to experimental fires on mature (≥ 8 year) post-mine restored and nearby natural shrubland communities in Mediterranean-climate southwestern Australia. Pre- and post-fire perennial plant species composition was assessed in 40 × 40 m plots at three shrubland sites restored after mineral sand-mining, and at five natural shrubland sites. Additional quadrats were monitored for seedling survival over the first summer after fire. Species richness fell by 22–41% after fire in restored sites, but increased by 4–29% in natural sites. Species present before fire were reduced by 40–56% in restored sites and 4–12% in natural sites. Only 42–66% of resprouting species recovered in restored sites, whereas 96–100% recovered in natural sites. Seedling mortality over the first summer after fire was higher in restored sites (59–86% death of individuals) than in natural sites (14–60%). Ordination showed that fire altered the floristic composition of restored sites much more than that of natural sites, and that their vegetation diverged further from the targeted properties of natural communities. We advocate better site preparation, more attention to the herb element, and postfire rehabilitation with under-represented and fire-killed resprouters. Our study highlights the importance of including the ability of post-anthropogenically-altered lands to recover from natural disturbances in determining the success of restoration programs. Herath, DN, Lamont, BB, Enright, NJ and Miller, BP 2009. Impact of fire on plant-species persistence in post-mine restored and natural shrubland communities in southwestern Australia. *Biological Conservation* 142, 2175-80.

Role of fire in evolution of the great Gondwanan family Proteaceae

Lamont, Byron[1,2], He, Tianhua[1,3] and Downes, Katherine[1]
[1]*Department of Environment and Agriculture, Curtin University, PO Box U1987, Perth, WA 6845, Australia.*
[2]*School of Environmental Sciences, Murdoch University, Murdoch, WA 6150, Australia.*
[3]*School of Plant Biology, University of Western Australia, Crawley, WA 6009 Australia.*

In addressing the issue of how to demonstrate that a particular fire-related trait is actually an adaptation to fire, we believe that two criteria need to be satisfied: 1. the trait gives the species a greater fitness advantage in the presence of fire than any other likely agent of natural selection in its particular habitat; 2. the origin and proliferation of that trait through evolutionary time coincides with the occurrence of fire as the agent of natural selection. Neither is easy to demonstrate in practice. Sufficient is known about the ecology of the great Gondwanan family, Proteaceae, to reveal the relative fitness benefits of certain traits in the presence of recurrent fire, though few comparative experiments have been conducted. Recently, DNA-based phylogenies have been converted to time-based chronograms using the excellent fossil record for Proteaceae to give good estimates of the molecular clock. This enabled us to superimpose fire-related traits and fire-proneness of species in the genus *Banksia* (He, Lamont, Downes 2011) and all genera in Proteaceae (Sauquet et al. 2009; Lamont, He, unpublished) on the chronograms to gain insights into their origin and evolution using novel Bayesian MCMC procedures. We show that *Banksia* has been fire-prone since its origin 61 Mya and that serotiny (fire-dependent seed release, drought is ineffective) and dead floret retention (fire-enhancing for seed release) probably arose concurrently. Clonality (fire-avoiding rhizomes) and dead leaf retention (fire-enhancing for seed release) are derived traits and arose < 25 Mya. For the entire family, five episodes of shift from rainforest to fire-prone environments with massive speciation began 85 Mya. Serotiny can be traced back to 74 Mya, passive soil-storage to 71 Mya, and ant-dispersed soil-storage to 44.5 Mya, all showing negligible germination in the absence of fire and their proliferation highly correlated with the historical occurrence of fire.

Fuels and fire management in the Parque Nacional Sierra San Pedro Martir: the difficulties of balancing management politics, stakeholders, and regulations

De Leon-Giron, Gonzalo, and Valles, Eduardo Prieto
Parque Nacional Sierra San Pedro Mártir, Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), and Comisión Nacional de Áreas Naturales Protegidas (CONANP), Ensenada, México

The National Park of Sierra San Pedro Mártir is found in the peninsular ranges of northern Baja California. The Mediterranean climate characteristics of this area, unique in México, favor the relictual nature of northern latitude forest species in the Baja California peninsula. The landscape within the Park is dominated by shrublands and conifer forests that are characteristic of the North American Mediterranean-climate zone, and many species are shared with Alta California. It is probable that the open nature of the conifer forest in the Sierra San Pedro Mártir is due principally to recurrent low to moderate severity fires that have habitually burned at intervals of approximately 15 years. Data suggest that these forests have persisted in this way for many centuries. Today, the ecosystems of the Sierra San Pedro Mártir are co-managed by the federal and state governments (the National Commission of Protected Natural Areas [CONANP] and the Secretariat for Environmental Protection [SEMARNAT], respectively). There is a certain amount of competition between the federal and state governments with respect to environmental policies, and an important task for the park administration is coordination between the two governmental levels. Coordination with the National Forest Commission (CONAFOR) is also key, as CONAFOR leads federal fire management and prevention efforts. The presence of the national astronomical observatory within the National Park since the 1970s has notably complicated the management of fires, as the telescopes require clear air. For this reason, and for other reasons that are more political than ecological, today almost all fires are suppressed within the Park. Forest fuel buildup due to the absence of frequent fire puts the sustainability of the conifer forests at risk, especially when taking into account future climate projections. However, management policies within the Park do not permit the use of prescribed fire, nor mechanical removal of forest fuels. We discuss the ways in which the Park administration is working with governmental, non-governmental, and international partners to resolve these problems, and to guarantee the health and sustainability of the unique ecosystems in the Sierra San Pedro Mártir.

Efficiencies in the restoration of southern Californian shrubland ecosystems across former rangelands

Lulow, Megan[1], Burger, Jutta[1], Sorenson, Quinn[1], Ostmann, Isaac[1], and Fessenden, Brad[2]
[1] Irvine Ranch Conservancy, 4727 Portola Parkway, Irvine CA, U.S.A.; [2]California State University Fullerton, Fullerton, CA, U.S.A

Mediterranean shrubland ecosystems of southern California are one of the most extreme cases of ecological invasion globally. While disturbances to these communities, such as intensive grazing, plowing, and fire likely triggered initial invasion, cases of native re-colonization are limited due to continued disturbance or ecological barriers posed by an entrenched, non-native dominated community. Like many public lands and preserves in California, The Irvine Ranch Natural Landmark has a history of livestock grazing and consists of a mosaic of native communities at various levels of degradation. To combat further ecological decline of remnant native communities, The Irvine Ranch Conservancy is taking an active approach to control invasive encroachment through ecological restoration in priority areas. To achieve these goals, we are investigating the relative efficiencies of different restoration approaches that can be implemented at a sub-watershed scale in a financially feasible manner. Based on data gathered across several restoration sites and embedded trials, we report on the success and cost of different planting approaches, including: site preparation intensities (seasons of weed control and approach); seeding techniques; and separation of seed mixes by functional groups for customized maintenance. At one site, native shrub cover was greater with broadcast seeding with tamping than drill seeding, and at another, cover was greater with imprinting than drill seeding, but only at low thatch levels. Results from a larger restoration site with variable terrain suggests that across species groups, environmental factors such as slope position and thatch level can be at least as important as planting approach, but also that relative success among species groups varies spatially for reasons that are not clear. Additional research on the relative significance of different sources of variation in initial establishment success would greatly improve the efficiencies and hence feasibility of ecological restoration in these systems.

Fire history, serotiny, and seed dispersal cuing in a rare California cypress

Mallek, Chris R.
Department of Plant Sciences, University of California, Davis, CA, USA

The tendency of many Mediterranean-climate plants to retain seed in their canopy for multiple years, a trait known as serotiny, is perhaps the most commonly cited example of plant adaptation in response to fire. However, our understanding of its expression and functional significance comes primarily from research on serotinous species in the families Pinaceae (in the northern hemisphere) and Proteaceae (in the southern hemisphere). I examined patterns of variation in the strength of serotiny among populations of McNab cypress (*Hesperocyparis macnabiana*), a rare and increasingly threatened species in the family Cupressaceae. I also evaluated the extent to which variation in the degree of serotiny correlated with fire history. Although the strength of serotiny in McNab cypress was high overall, I also found significant variation in the degree of serotiny among populations. Consistent with studies of other serotinous species, strength of serotiny was generally higher in populations comprised entirely of even-aged stands that originated following stand-replacing fires. In contrast, serotiny was generally weaker in populations containing uneven-aged stands where some recruitment had occurred in the long-term absence of stand-replacing fire. One exceptional population contained uneven-aged stands despite strong serotiny. Cones from this population were more necriscent (opening upon tissue death) than those from other populations, suggesting that weak serotiny and strong necriscence may represent alternative adaptations for allowing recruitment in the absence of stand-replacing fires. Overall, it appears that differences in historic fire regimes across the species' range have influenced the evolution of serotiny and seed dispersal cuing which may, in turn, result in differential population response to future alterations in fire regime.

Linking Conservation to Ecotourism Management: The Case of Butrint National Park in Albania, a unique UNESCO and Ramsar site

Malltezi, Jamarber[1, 4], Bego, Ferdinand[2], Kola, Raimond[3], and Sulce, Sulejman[1]
[1]*Agricultural University of Tirana, Faculty of Agriculture and Environment, Koder Kamez, Tirana, Albania.*
[2]*University of Tirana, Faculty of Natural Sciences, Tirana, Albania.*
[3]*Butrint National Park, Saranda, Albania.*
[4]*Albanian University, School of Architecture and Urban Planning, Tirana, Albania.*

Butrint National Park (BNP) is located in the southwest corner of Albania. It borders with Greece to the South and the Ionian Sea to the West. Apart of being a National Park, Butrint is an Archaeological Park and is included in the UNESCO's List of World Heritage in Danger, while its wetlands are enlisted as a Ramsar site under the Convention on Wetlands of International Importance. Furthermore, the Butrint Lake and its adjacent wetland and coastal habitats have been identified as one of the 19 most important coastal areas identified as "Specially Protected Area-SPA" in the frame of the activity "Specially Protected Areas of the Mediterranean Sea" of the Barcelona Convention. Finally, Butrint has been recently recognized as ASCI (Area of Special Conservation Interest) and become part of the EMERALD network of Albania. Butrint has been identified as one of the sites of particular cultural and environmental values in Mediterranean region. Geographical position, landscape and biodiversity combined with a very rich culture heritage enable the site to be the most frequented by foreign visitors in Albania. Recent developments and a new Management Plan for BNP challenges traditional tourism in the area and opens way for new ecological-friendly management opportunities to bring more visitors outside the summer touristic season, with new activities such as birdwatching, walking trials, biking, scuba-diving, etc. Nature-based tourism can be encouraged in coastal protected areas to promote sustainable development. Those ecotourism opportunities are however threatened by a number of uncontrolled human activities, such as illegal urbanization and mass tourism, land reclamation activities in the borders of wetlands, mining, irrational marine aquaculture, hunting, excessive grazing and fires. Recently, the BNP administration is implementing several Management Plan recommendations to better address the aforementioned concerns and maximize potential for ecotourism development.

Conservation and Development Agreement at Tejon Ranch, CA, USA

Maloney, Thomas
Tejon Ranch Conservancy, PO Box 216, Frazier Park, CA 93225.

Habitat destruction and fragmentation from urbanization rank among the most severe and pervasive threats in the Mediterranean Regions of the world. A novel conservation and development agreement for Tejon Ranch, the largest privately owned contiguous land holding in California, could be a conservation model for other large private landholdings. Tejon Ranch is situated at the intersection of four major ecological regions and provides habitat connectivity of continental significance. Therefore, conservationists have long looked for ways to conserve significant portions of the Ranch. The Ranch Company is proposing to develop three projects, a commercial center, a luxury home development, and a new town, in three areas of the Ranch totaling 12,140 hectares. These development plans led the Tejon Ranch Company into a two-year negotiation with five leading environmental organizations resulting in the Tejon Ranch Conservation and Land Use Agreement (Ranchwide Agreement) in June of 2008. The Ranchwide Agreement sets forth a comprehensive conservation plan for 97,125 hectares of the 109,265-hectare Tejon Ranch. The Ranchwide Agreement created the independent, nonprofit Tejon Ranch Conservancy to oversee stewardship of and public access to the conservation lands. The Conservancy is mandated to prepare a plan to maintain, enhance and restore conservation values of the conserved lands. The visionary and innovative strategies set forth in the conservation and land use agreement provide a case study for other Mediterranean regions facing intense development pressure. This presentation will describe the agreement and its provisions as a case study of an innovative conservation strategy where simple acquisition would have been prohibitively costly. The talk will highlight lessons learned and elements to be considered when pursuing similar strategies elsewhere.

Post-fire regeneration of mountain fynbos: A comparison of two sprouting life history types

Marais, Karen E. [1], Esler, Karen J.[1], Jacobs, Shayne M.[1], Pratt, R. Brandon [2] and Jacobsen, Anna L. [2]

[1] Department of Conservation Ecology and Entomology, Faculty of AgriSciences, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa

[2] Department of Biology, California State University, Bakersfield, 9001 Stockdale Highway, CA 9331-1022, USA

Fire is a natural occurrence in Mediterranean type climate regions. The plant species that naturally inhabit these regions have traits that facilitate their persistence under a given fire regime; however, fire regimes are changing due to climate change, invasive species, and anthropogenic ignitions. Thus, understanding how native vegetation responds to fire will become increasingly important. The relationships between post-fire resprout success, life history type, and plant functional traits were examined in the southwestern Cape as part of a larger study examining post-fire recovery in sprouting plants in the Mediterranean type climate regions of California and South Africa. Shrubs of two different life histories were examined: Obligate sprouters, which have to resprout to persist because their seeds are killed by fire, and facultative resprouters, which both recruit seedlings and resprout after fire. The aim of this study is to find predictors of resprout success and to see if there are significant differences between obligate and facultative resprouters. Results on mortality and survivorship from post-fire fynbos data show that there was a significant difference in post-fire resprout success between obligate sprouters and facultative sprouters, with a near 100% resprout success of the obligate sprouters, compared to 62% for facultative sprouters. Individuals from obligate sprouter species all sprouted within the first four months post fire, while some individuals from facultative sprouting species were still sprouting a year after the fire. Obligate sprouters had greater relative growth rates than the facultative sprouters, reaching half of their maximum growth over two years in only 184 days compared to 277 days for obligate sprouters. Facultative sprouters were more water stress resistant (measured as xylem cavitation resistance) than obligate sprouters, suggesting a tradeoff between water stress resistance and resprout success.

Climate, fire and Native American land-use in the Lower Klamath River Region, California

Mensing, Scott[1], Crawford, Jeffrey[1], Lake, Frank[2], Zimmerman, Susan[3], Skinner, Carl[2]
[1]Department of Geography, University of Nevada, Reno, NV, USA, [2]United States Forest Service, Pacific Southwest Research Station, Redding, CA, USA, [3]Center For Accelerator Mass Spectrometry, Lawrence Livermore National Lab, Livermore, CA, USA.

Fire is part of the summer dry Mediterranean climate, and forest structure is presumably a response to the dominant climate. California Indians also used fire regularly to manipulate the environment for the gathering of acorns, stimulation of growth for baskets, and improving hunting conditions. The extent to which Native American fires influenced forest structure and composition at a landscape level is still debated. Our study tests the hypothesis that Native Americans significantly influenced forest composition and structure through the extensive use of fire. This study examines two lakes near the lower Klamath River in northern California, Fish Lake and Lake Ogaromtoc, which are near documented Native American settlements (3-5km), but still sufficiently far that evidence of Native American burning should only be recorded if populations were manipulating the landscape beyond villages. We use pollen, charcoal and fire-scar analysis to reconstruct paleo-vegetation and paleo-fire history. Past Native American influences are evaluated by analyzing whether past vegetation changes and fire occurrences are consistent with regional climate reconstructions or whether changes in vegetation and fire occurrence are more consistent with shifts in Native American occupation and land use. Preliminary evidence at each site shows increases in oak during the Little Ice Age at the same time when douglas fir is increasing. We hypothesize that these might represent oak openings in the forest canopy, maintained by fires set by Native Americans. This coincides with a period of active Native American migration, however archeological data are scarce. Though our interpretations are still tentative, our results suggest that Native Americans had more than a local influence on changing vegetation structure in California, and incorporation of humans into our models of vegetation dynamics is critical. We are studying sites in the southern Sierra Nevada to test this hypothesis in a different habitat and among a different population.

Can restoring mountain meadows ameliorate the effects of climate change in a Mediterranean landscape?

Merrill, Amy
Stillwater Sciences, Berkeley, California, USA

This amazing water year aside, most forecasts for snowpack in the California Sierra show diminishing levels (30 to 70% of current) with spring and summer stream flows declining up to 40% by end of the 21st Century. Reduced natural snowpack storage and high winter and spring season flows is likely to produce greater demands for existing and proposed new reservoirs. Such projections have large implications for California's overall water supply and for upstream users such as ranchers and farmers whose livelihoods are dependent on late season flows. It has been widely surmised that healthy meadows store winter and spring water inputs and slowly release stored water during the dry late summer period. Back of the envelop calculations suggest that restoration of the many hydrologically degraded meadows in the California Sierra could increase ground water storage by 50,000 to 500,000 acre-feet per year, an ecologically preferable alternative to further increasing reservoir capacity in the State. At a finer scale, it is also frequently purported that meadow restoration upstream provides longer and greater late season flows for ecological uses and/or local withdrawal. However these assumptions on the downstream flow effects of meadow restoration have been based on mostly anecdotal accounts and a small handful of studies. Through analysis and review of available flow data, reports and publications from meadow restoration sites in the Sierras, we found potentially important but inconsistent fine scale effects of meadow restoration on downstream flows and greater uncertainty regarding the effects meadow restoration could have on water budgets and late summer flows at the regional scale. In contrast, greater certainty about uplift in ecosystem services with restoration or enhancement of mountain meadows exists for biodiversity (including wildlife, bird and plant species), decreased sediment loading, and improved water quality.

Genetic diversity and Population Persistence in a Rare Endemic

Millar, Melissa, and Coates, David
Department of Environment and Conservation, Perth, Western Australia, Australia

The flora of the south west of Western Australia displays a high degree of historical rarity, endemism, small population size and population isolation. These characteristics present a requirement for unique and effective conservation management decisions and raise questions about the long term maintenance of genetic diversity and viability in such taxa. Rare species with recently fragmented distributions and reduced population sizes may be expected to show decreased levels of genetic diversity, restricted gene flow and increased levels of inbreeding. Those with historically fragmented and small populations may also show reduced levels of genetic diversity compared to widespread congeners, due to low levels of gene flow and may develop a degree of self compatibility, due to limited mating opportunities. We assessed aspects of molecular ecology, including levels of genetic diversity, reproductive biology and patterns of contemporary pollen mediated gene flow, as well as the impact of population size and isolation in *Acacia woodmaniorum*, a critically endangered short range endemic with a highly restricted distribution and a number of small, isolated populations. We found levels of genetic diversity were not depauperate when compared to more widespread Acacia species and there was no evidence of genetic bottlenecks or recent reduction in population sizes. The rare endemic has high realised outcrossing rates and high levels of pollen mediated gene flow are evident among populations. Levels of genetic diversity are not significantly reduced in small or isolated populations which maintain high rates of outcrossing. Pollen immigration increases in small populations and decreases with the degree of population isolation but the effects are not significant. The results suggest the long term maintenance of large effective population sizes in association with a highly outcrossed mating system is sufficient to maintain high levels of genetic diversity across the range of *A. woodmaniorum* even in small and isolated populations.

Historic impacts, management objectives and optimal fire regimes for plant species diversity in Kings Park, an urban woodland reserve in SW Australia

Miller, Ben P.[1,2], McChesney, Catherine[1] and Easton, Steve[1].
[1] Botanic Gardens and Parks Authority, West Perth, Western Australia, Australia. [2] School of Plant Biology, University of Western Australia, Crawley, Western Australia, Australia .

Urban conservation reserves are subject to many pressures, and have generally suffered these pressures for a long time. Understanding historic impacts can help managers and researchers to appreciate current conditions and trajectories and to set benchmarks and objectives. Here, we summarise a rich history of impacts and changes in the Banksia - Eucalyptus woodland in Kings Park (a 300 ha reserve in the centre of the city of Perth in Western Australia), to identify key correlates of change. The historic data do clearly identify change in community composition among tree and tall shrub species, and similar change can be inferred for understorey species. This change provides challenges to management hoping to maintain biodiversity in a dynamic system, both in determining suitable objectives, but also in approaches to managing the factors contributing to the change.

The management of risk of negative impacts of fire in urban conservation reserves in fire-prone ecosystems is an equally significant challenge which is often confounded with, and requires balancing against, the needs for biodiversity conservation. While scientific approaches to support these decisions in relation to fire and biodiversity management exist, they are often un-developed or data poor. Here we develop a process based on the ecological behaviour of plant species to determine a theoretical optimal fire-interval for plant species diversity. This process highlights our lack of knowledge, but, by emphasising its utility, sets out a case for simple baseline ecological research. We find that while the developed theoretical optimal fire regime is strongly compromised by uncertainty in some areas, it is moderately insensitive to uncertainty in other areas.

Socio-demographic and climate impacts on residential total water use in the City of Los Angeles

Mini, Caroline[1], Hogue, Terri S.[1] and Pincetl, Stephanie[2]
[1] *Dept. of Civil Engineering, University of California, Los Angeles,* [2] *Institute of the Environment and Sustainability, University of California, Los Angeles.*

Urbanization has environmental impacts that modify ecosystem services associated with vegetation. Semi-arid urban forests have costs related to irrigation that are difficult to evaluate. In the face of climate change and population growth, quantifying and predicting ecosystems costs and benefits are important and challenging. In urban areas, residential water consumption includes both domestic needs and landscaping irrigation, yet accurate partitioning of each of these uses is rare in most environments. The goal of this research is to quantify outdoor landscape water use to have a better understanding of urban water footprints and the dynamics of water consumption within semi-arid cities. Data is being collected from the Los Angeles Department of Water and Power to evaluate household water use by ZIP code and by census block. Neighborhoods were selected to represent city characteristics based on socio-demographic factors. Initial studies focus on the correlation between residential water use and socio-economics, climate and vegetation type across the City from 2000 to 2010. As expected, monthly water use patterns follow seasonal climate variability. Results also show that ethnicity, per capita income, and household size are linearly related to water use per capita. The temporal analysis of vegetation indices shows little correlation between precipitation patterns and urban vegetation. Urban vegetation is well-watered, presenting the same greenness activity over the period despite a decrease in water use. We hypothesize that over-watering is occurring and outdoor use seems to represent a large part of the residential water budget. A multiple regression model is developed that integrates these fundamental controlling factors across the region. Estimates of urban landscape water use will be compared to a remotely-sensed evapotranspiration model with high spatial and temporal resolution. Ultimately, project results will contribute to the implementation of innovative conservation policies to secure future water supplies for a growing population under climate variability.

The effect of rainfall and nitrogen on non-native grass establishment and biodiversity

Molinari, Nicole, D'Antonio, Carla
Department of Ecology, Evolution & Marine Biology, UC Santa Barbara, CA, USA

The introduction of non-native species, climate variability and land use alterations are expected to alter the biodiversity of Mediterranean and grassland ecosystems in the coming century. Rainfall reduction and repackaging (fewer, more intense events) and nitrogen deposition may influence the rate of invasion of potentially transformative non-native grassland species. We investigated the interacting roles of multiple global change factors on the susceptibility of a native grassland to invasion by a non-native annual species, *Bromus diandrus*, that we have shown elsewhere can dramatically reduce local diversity. *Bromus diandrus* exerts its effect on other species through its dense slowly decomposing litter. In 2009 and 2010, we constructed a split plot experimental design in which 1000 seeds m^{-2} of *B. diandrus* were added to half of each treatment plot, while simultaneously altering rainfall amount and distribution, enhancing nitrogen deposition and reducing aboveground plant litter accumulation. This split plot design allowed us to assess whether changes in species diversity responded to the treatments (rainfall, nitrogen and litter manipulations) or whether they were mediated by *B. diandrus* establishment. Data from 2009 suggests that *B. diandrus* invasion into native dominated communities is promoted by nitrogen enrichment and depressed by repackaged rainfall and plant litter removal. This trend held in 2010, a much wetter year, although it was weaker. Species richness in plots seeded with *B. diandrus* decreased with nitrogen enrichment and increased with litter removal in 2010, but did not respond to treatments as strongly in 2009. In non-seeded plots, species richness responded negatively to repackaged rainfall in 2009 and positively to thatch removal in both years. Our results contribute to a growing understanding of how grassland diversity will respond to changes in rainfall variability, nitrogen enrichment and the introduction of non-native species.

A seed dispersal mutualism facilitated by fire in the California Floristic Province

Moore, Christopher M.[1,2], Vander Wall, Stephen B.[1,2]
[1]*Program in Ecology, Evolution, and Conservation Biology, University of Nevada, Reno, Reno, NV, US*
[2]*Department of Biology, University of Nevada, Reno, Reno, NV, US*

Regular, high-severity disturbances can have great effects on ecosystem ecology and evolution. A critical lifecycle stage for many organisms that exist in these areas is recruitment. In the California Floristic Province (CFP)—an area with regular, high-severity disturbance within the lifetime of adult plants that dominate ecosystem function and structure—plants have evolved to re-establish or recruit after fire by respectively resprouting and/or from fire-stimulated seed banks. Those plants that recruit from seed have evolved long-distance dispersal capabilities to recruit to disturbed patches, serotiny to persist through and recruit immediately following fire, or means of seed deposition that accelerate burial to microsites that are safe from fire. Seed deposition mechanisms can be multifarious, and I wish to focus on one that is wide-spread, yet comparatively understudied—scatter-caching. Recent studies of a dominant genus in chaparral, manzanita (*Arctostaphylos*), have shown that these seeds are effectively dispersed by scatter-caching animals. These animals cache manzanita seeds in microsites that protect them from the intensity of fire. Further examination of other plants in the CFP, concurrent with the realization of scatter-caching dispersal syndrome as commonplace, have revealed that many seeds in the CFP have evolved seeds that are attractive to scatter-caching animals as a reward for their deposition service. The benefit of this mutualistic interaction is significant, as soil is effective at protecting seeds from the intensity of fire, which significantly decreases seed mortality during a fire event. This implicates fire as shaping seeds for quick deposition into the soil seed bank directly, and indirectly shaping seeds through biotic mechanisms of deposition.

Density and dispersion of an invasive thistle in its native Mediterranean range compared to two invasive ranges in California and central Chile.

Moroney, Jolene R. and Rundel, Philip W.
University of California, Los Angeles, Department of Ecology and Evolutionary Biology, 621 Charles E. Young Drive South, Los Angeles, California 90095-1606, USA.

Studies of invasive species often test a particular mechanism of invasion (i.e. enemy release, evolution of increased competitive ability, novel weapons) without first determining if the species is indeed more dominant in its invasive range compared to its native range. Like many other invasive species, *Centaurea melitensis* is a ruderal species that germinates early and grows quickly. Presumably, these are traits that might result in dense stands in both native and non-native ranges. The objective of this study was to compare the density and dispersion of the Mediterranean thistle, *C. melitensis*, in its native range with two invasive ranges to test the hypothesis that it is more dominant and has different patterns of dispersion in invasive communities compared to native communities. Populations in the native range (Spain) and two invaded ranges of mediterranean-type climate (California and central Chile) were compared. In each region, six geographically distinct populations were surveyed. Two-stage systematic sampling was used to determine density, and spatial dispersion was evaluated using the Clark-Evans Index of Dispersion (R=sample mean distance/expected mean distance), with spatial dispersion classified as aggregated (R~0), random (R~1.0), or regular (R~2.1). Abiotic features of each site were also analyzed. *C. melitensis* occurred at higher densities in invasive populations than in native ones (ANOVA, df=2, F=60.78, $p<0.0001$), and there were significant differences in density between populations within regions (ANOVA, Spain: df=5, F=690.82, $p<0.0001$; Chile: df=5, F=29.68, $p<0.0001$; California: df=5, F=9.10, $p<0.0001$). Native and invasive populations were dispersed differently (ANOVA, df=2, F=5.31, $p<0.01$). Native populations exhibited random dispersion (one sample ttest, $p<0.05$), and populations in both invasive ranges fell between random and aggregated, with indices of dispersion less than random (one sample ttest, $p<0.05$). This study supports our hypothesis that *C. melitensis* is more dominant and has altered dispersion patterns in non-native environments.

Dynamics of understory plant composition and diversity in Mediterranean cork oak forests in correlation to small scale microclimatic changes

Mosena, Alexander[1], Dubbert, Maren[1], Piayda, Arndt[2], Cuntz, Matthias[2] and Werner, Christiane[1]
[1]*Exp. and System Ecology, University of Bielefeld, Universitätstr. 25, 33615 Bielefeld, Germany;*
[2] *Helmholtz Centre for Environmental Research – UFZ, Permoserstr.15, 04318 Leipzig, Germany*

Various studies have shown the importance of understory plants for carbon and water balance in open Mediterranean oak forests. Though not drought tolerant they can make up to more than 50% of total gross primary productivity (GPP) during spring time (Unger et al. 2009). Tree density might be an important factor influencing understory species composition and longevity during this period. Therefore, the influence of tree cover by cork-oak (*Quercus suber*) on the temporal dynamics of species composition and cover of the understory plant community of a Portuguese oak woodland was investigated between mid-April and mid-June 2011. Renkonen similarities between open and tree sites were calculated. At the beginning of April, species similarity between both sites was rather high (62 % similarity). Corresponding to an increased difference in temperature and moisture between sites similarity in species composition decreased, reaching 35 % after about 4 weeks and 28% at the end of the observation period. Poaceae cover steadily decreased in the open site while the cover of drought-adapted *Tuberaria guttata* increased up to 56 %. However, the dominance of *T. guttata* could not be confirmed in tree covered plots and Poaceae cover remained rather stable for the first 6 weeks (around 30%). Total plant cover decreased over time in open from a maximum of 92 % to 46.2 %, under the trees from 87 % to 19.6 %. The surprisingly large decrease in total cover in the tree plots, despite of more favorable microclimate conditions during the onset of summer drought, was probably caused by intraspecific competition for water and resources between trees and understory plants. The results suggest that temporal changes in species composition and cover of the understory community during spring are substantially altered by tree overstory, which might have large effects on system productivity and carbon balance during springtime.

CapeNature's Regional Ecological Support Teams - The interface between management and science in the Cape Floral Region

Mostert, Candice[1]
[1] *Liaison, Western Cape Nature Conservation Board T/A CapeNature, Cape Town, Western Cape, South Africa.*
[2] *Participant, Go4BioDiv International Youth Forum*

The Regional Ecological Support Team (REST) concept evolved due to an organizational and provincial need to collect and curate relevant and reliable biodiversity data, and the analysis thereof to inform management and directive decision making. The concept is to provide a viable bridging mechanism between field staff, management and the Scientific Services department to ensure the efficient flow of accurate, reliable and relevant data, as well as scientifically process such information and data, between the relevant components. Management interventions of CapeNature's core business are carried out in eight areas within the Western Cape, namely the Boland, Cape Metro, Garden Route, Karoo, North West, Langeberg, Overberg, Breede Berg area's (Majority of the Cape Floral Region). The objectives of the REST's are to support biodiversity planning and review, to support effective data management, to provide ecological decision support, to create and maintain a scientifically sound biodiversity monitoring and evaluation system, to facilitate staff development and to promote biodiversity coordination and networking. To achieve this integration the REST comprises a Regional Ecologist, two Area Ecological Coordinators and a GIS Technician reporting to four different supervisors, namely two Area Managers, the Knowledge Manager and the Biodiversity Manager. The REST Management Plan provides the basis for the development of regional work plans that incorporate the organizational priorities and the area focused priorities. The REST's primary focuses in 2010 included Invasive Alien Plans and Management Unit Clearing Plans, individual component Ecological Matrices, standardizing Ecological Plans of Operations and establishing plant monitoring sites to identify thresholds of potential concern within the Cape Floral Region.

Early management of *Quercus ilex* and *Pinus halepensis* Mediterranean stands naturally regenerated after fire

Moya D. [1*], De Las Heras J. [1], López-Serrano F.R. [1], Ferrandis P. [1], Rubio E. [2], Andres M. [1], García-Morote F.A. [1], Hedo J. [1], González-Jiménez J. [1], Alfaro-Sánchez R. [1], Hernández-Tecles E. [1], Martínez-Duro E. [1], Dadi T. [1]

[1] *ETSI Agrónomos. Universidad de Castilla-La Mancha. Campus Universitario. 02071 Albacete, Spain.*

[2] *ETSI Industriales. Universidad de Castilla-La Mancha. Campus Universitario. 02071 Albacete, Spain.*

[*] Author e-mail: Daniel.Moya@uclm.es

In the Mediterranean Basin, climate change models predict aridity increase and changes in fire regimes (increasing fire risk, fire recurrence, and fire severity) becoming into lower forest productivity and a resilience reduction. However, plant communities have developed traits to survive in this drought-, fire-prone habitat regenerating naturally after disturbances. Suitable forest management would enhance community resilience by accommodating some key community traits to the expected new fire-regime scenarios. We have developed cartography, based on GIS and remote sensing, containing information on vulnerability and resilience of natural areas in Southeastern Spain to evaluate the vulnerability and resilience depending on the forest management, main tree species and site quality. We also set experimental plots to study the effects of decreasing rainfall (simulating drought), salvage logging and the implementation of early silvicultural treatments in different stages of stands naturally regenerated after fire. We have been sampling, recording, and monitoring burned and naturally regenerated areas of burned Aleppo pine (*Pinus halepensis* Mill.) and Holm oak (*Quercus ilex* L.) stands in Southeastern Spain. Results based on ecosystem responses (soil respiration, microbial activity, water deficit…), physiological plant responses (photosintesys ratio, stomatal conductance, water use efficiency…), forest structure (vegetation cover, plant diversity, spatial distribution), seedling survival, and total growth were pointed out to avoid salvage logging, in some cases, and to support early selvicultural treatments. Early thinning was proved to be an useful tool for post-fire management to improve resilience. In adittion, suplementary benefits are given, such as fire prevention, improvement of soil characteristics and increase of the amount of carbon sink and plant diversity. As conclusion, our studies support a proposal based on early silvicultural treatments integrated in the sustainable forest management to improve multiple benefits and to reduce the negative effects of changes predicted in relation to drought and fire regimes.

Flames, Fuels, Foliage, and FireMapper

Narog, Marcia, Beyers, Jan, Riggan, Philip, Wolden, Lynn and Weise, David
USDA, Forest Service, Pacific Southwest Research Station, 4955 Canyon Crest Dr. Riverside, CA, 92507 USA.

During October 2006, southern California Santa Ana winds drove the Esperanza wildfire through 16,100 ha of chaparral-dominated vegetation encompassing stands ranging from 3 to over 100 years since previous fire. Images of fire progression were taken using the Pacific Southwest Research Station's airborne FireMapper thermal-imaging system. Similar post-fire images tracked vegetation recovery. Existing fuels data, historic fuel breaks and fire maps, and new fire images provided an opportunity to explore relationships between vegetation history, fire behavior and severity, and site recovery. Study objectives included relating aerial imagery to ground-based fire severity determination; evaluating stand age effects on fuel consumption and vegetation recovery; and investigating the utility of FireMapper for assessing vegetation recovery. Initial comparison of fire severity determined from remnant post-fire vegetation structure to fire intensity estimated from FireMapper immediate post-fire imagery, at stratified-random points, showed that differences in fuel loading are visible in the FireMapper imagery. High fire severity was found most frequently in older stands, with young stands often rated low or moderate severity. Nonetheless, "senescence risk" was not apparent in post-fire vegetation measurements: high fire severity did not negatively affect stand recovery. Non-native grasses and forbs colonized all stand ages and fire severities by 3 years post-fire, but were dominate only in the youngest stands. Non-native species predominated on fuel breaks, with little colonization by chaparral shrubs after fire, suggesting these features are quite stable. Ground measurements of vegetation cover tracked well with post-fire imagery, and trends in vegetation recovery could be seen in repeated images. In addition to its usefulness for mapping flame fronts through smoke and instantaneous fire intensity, FireMapper imagery can provide land managers with fire severity information and post-fire recovery assessment.

Fynbos riparian biogeochemistry and invasive alien Acacias

Naudé, Minette [1*], Jacobs, Shayne[1,2], Esler, Karin[1,3]
[1] *Department Conservation Ecology and Entomology, University of Stellenbosch, Private Bag X1, Matieland, 7602, Stellenbosch, South Africa.*
[2] *Stellenbosch University Water Institute, Stellenbosch University, Private Bag X1, Matieland, 7602, Stellenbosch, South Africa*
[3] *Centre for Invasion Biology, Stellenbosch University, Private Bag X1, Matieland 7602, Stellenbosch, South Africa*

Riparian ecotones modulate material fluxes between terrestrial and aquatic environments. Displacement of woody and understory vegetation by woody invasive alien plants is hypothesized to change plant-soil interactions and may reverse the role of riparian ecotones as a source or sink for material. The general objective of this study was to identify and elucidate the relationships between soil properties, soil biogeochemical processes and plant functional biodiversity in natural, invaded and cleared riparian ecotones and associated upland fynbos. We have established a network of sites within seven river systems in the Western Cape in South Africa, all within the fynbos biome. Four of the sites are natural, four have been invaded by mostly nitrogen-fixing *Acacia mearnsii* (also *A. longifolia*), and three are sites that have been cleared of *Acacia* species (predominantly *A. mearnsii*) more than five years ago. Soil samples were collected on a seasonal basis and analyzed for selected parameters. From our results it is evident that invasion changes soil physical and chemical properties (such as pH, EC, and particle size distribution) as well as nutrient cycling processes. Within invaded sites, phosphorus mineralization (acid phosphatase activity), total carbon and nitrogen were significantly higher compared to natural and cleared riparian ecotones and associated upland fynbos. By implication, available phosphorus is in short supply in soils of invaded riparian ecotones, relative to nitrogen. Nitrogen mineralization rates were highest in summer, when it also showed significantly higher rates in invaded sites compared to natural and cleared sites. Total nitrogen and acid phosphatase activity were strongly correlated with the presence of fine material (silt and clay); soils in invaded sites contained significantly more silt and clay. This new knowledge will provide insight into potential barriers for restoration and may improve the strategies for riparian repair after removal of alien *Acacia spp*.

Science-based post-fire management in the eastern Mediterranean: the Mt. Carmel, Israel as a case study

Ne'eman, Gidi[1], and Perevolotsky, Avi[2]
[1] Department of Biology and Environment, University of Haifa-Oranim, Tivon 36006, Israel; [2] Department of Agronomy and Natural Resources, ARO—The Volcani Center, Bet Dagan 50250, Israel.

As a result of nature conservation and afforestation, fire size and frequency are increasing in Israel. Following the 1989 Carmel fire (600 ha), an intensive research effort was launched to determine the effects of fire on soil, plant regeneration, biodiversity of various taxa and to propose a post-fire management in *Pinus halepensis* forest. The results indicated that soil erosion was a minor problem, vegetation is capable of natural regeneration and animal populations return following forest regrowth. The ensuing practical recommendations only partially affected the management policies. Before the 1989 fire the post-fire management of the Israeli Forest Authority included salvage cutting, massive soil preparation and re-planting. The policy of the Nature and Parks Authority was to let natural process to proceed with no intervention. As a result, dense pine forests developed, parts of which have since burned or even re-burned. In 2011 a catastrophic fire (3,000 ha) occurred that re-burned also most of the 1989 fire. In this 22-year period much knowledge has accumulated: fire-risk models that successfully forecasted the 2011 burned area were developed; fire mapping revealed the occurrence of repeated fires and their effect on soil erosion and plant recovery were studied; ecological research determined 20-30 years for full recovery of the ecosystem, depending on site quality; examples from other countries demonstrated that fuel reduction zones are important for protecting urban zones and to prevent large fires to develop. The 2011 fire demonstrated that lack of science-based managements has led to a catastrophic fire. A restoration and management program was presented by a professional committee based on existing scientific knowledge and previous management failures. This program is based mainly on natural forest regeneration, management of the regenerating vegetation aimed to prevent massive dense pine forest to develop, and construction of fuel-breaks around settlements and within the park.

Restoration of frequent fire forests in California: Scaling up from the stand to the landscape

North, Malcolm
Research Ecologist, USFS PSW Research Station and Affiliate Professor, Dept. of Plant Sciences, U.C. Davis.

In California's Sierra Nevada mountains, ponderosa pine and mixed-conifer forests depend on fire for their ecological functions and resilience. Yet it is clear that the public, air resources board, and the Forest Service's infrastructure cannot support what, by one estimate, would be the 450,000 forested ha that annually would need to burn to restore historic fire regimes. This talk explores approaches that may help increase the treatment options, pace, and scale of implementation. Several projects, including some that have been extensively litigated, are now moving forward using ecosystem management concepts that emphasize balancing forest restoration, provision of wildlife habitat, and fuels reduction. Balancing these objectives, however, is probably more effective at a much larger scale, 50,000-100,000 ac, than the 3,000-10,000 ac sizes of most projects. Scaling up would require work force concentration, collaborative planning forums, and a serious commitment to monitoring and transparent 'course correction'. The potential benefits are a more stable, long-term supply of biomass, large-scale maintenance using prescribed fire, and coupling treatments so that high-priority restoration and wildlife areas are supported by areas with economic return. Creation and maintenance of key defense zones will need to remain a priority but increasing wildland fire use may be the only practical 'treatment' option in more remote locations. When treatment plus fire losses are subtracted from annual growth, on average Sierra Nevada forests add another 1.35 million metric tons of biomass each year. All options need to be explored in an effort to fundamentally change the roadblocks to large-scale, proactive forest management.

The effects of elevated CO_2, climate variability, and fire on the functioning of the chaparral of Southern California

Oechel, Walter[1,2], Rossi, Alessandra[1], Murphy, Patrick[1], John Kim[3], Tom Bell[1], Hongyan Luo[4], Lipson, David[5]
[1]*Global Change Research Group, San Diego State University, San Diego, CA 92182, USA*
[2]*Fondazione Edmund Mach (FEM), Centro Ricerca e Innovazione (CRI), Via Edmund Mach, 138010 - San Michele all'Adige (TN), Italy*
[3]*Field Station Program, College of Sciences, San Diego State University, San Diego, CA 92182, USA*
[4]*The National Ecological Observatory Network (NEON) Science Office, Boulder, CO 80301, USA*
[5]*Department of Biology, San Diego State University, San Diego, CA 92182, USA*

Three decades of research on fire, climate change, and elevated atmospheric CO_2 in the chaparral, a Mediterranean-type climate ecosystem, at San Diego State University's Sky Oaks Biological Field Station, has provided information and insights that are useful to understanding controls on Mediterranean-type ecosystem functioning of southern California under current, and likely future, conditions. Results from atmospheric carbon dioxide manipulations show that long-term stimulation of NEE, carbon sequestration, leaf area, fuel accumulation, and VOC production occur and that ecosystem composition, species reproduction, soil microbial composition, and plant-animal interactions, are affected by increased atmospheric carbon dioxide levels. Suggested is the fact that at least these water stressed ecosystems see increased water use efficiency and increased NPP over the long-term from elevated atmospheric carbon dioxide. More than a decade of measurement of net ecosystem exchange by eddy covariance demonstrates the long-term pattern of carbon exchange with stand age, and the short term impacts of variation in climate, especially precipitation, on stand water use and NEE. Annual variability in rainfall has profound affects on NEE, the impact of variation in annual rainfall on NEE lasts more than one year. The functioning of this ecosystem adjusts more quickly than does the composition of the ecosystem. Similarly, the sink strength of NEE following fire recovers more quickly than does community composition and percent above ground cover. The combined impacts of anticipated changes in atmospheric carbon dioxide and climate suggests changes in species composition and NPP. Fire intensity and/or frequency are anticipated to increase due to increases in weather conditions conducive to fire and increases in fuel accumulation due to higher atmospheric carbon dioxide levels. These data show that old chaparral stands can be significant sinks for atmospheric CO_2. And that managing for old growth chaparral can increase carbon sequestration while increasing biodiversity and habitat diversity.

Influence of an intense wildfire on plant diversity and compositional patterns in a riparian forest ecosystem in Southern California, USA

O'Leary, John F.[1], Fallon, Elizabeth[2], and Bredemeyer, William R.[3]
[1]*Department of Geography, San Diego State University, San Diego, CA 92182-4493, USA*
[2]*Department of Ecology, Evolution and Behavior, University of Minnesota, Saint Paul, MN 55108, USA*
[3]*Department of Geography, University of Colorado, Boulder, CO 80309-0260, USA*

Riparian woodlands and forests represent one of the most heavily modified vegetation types in California with losses in lowland southern California estimated to be as high as 95%-97%. Further, in recent decades substantial portions of remaining riparian ecosystems in southern California have been invaded by exotic plants. In this paper we examine species diversity and compositional patterns of coast live oak riparian forest sampled in 1999 before fire and again in 2008 following an unusually intense wildfire in southern California. This riparian ecosystem occurs within a fire-prone matrix of coastal sage scrub and chaparral shrublands. Nineteen of 42 pre-burn adults of coast live oaks (*Quercus agrifolia*) succumbed to the wildfire. Average species richness increased significantly from 1999 to 2008 at all scales examined after the fire. At the plot scale (625-m²), the increase in richness was very largely attributable to herbs. The most striking change in the understory composition was the explosive increase in herbaceous vegetation, particularly cover by non-native annual grasses. None of the plots experienced post-burn mechanical disturbance, but a combination of a lingering grazing effect, fire thinning the overstory, and timing of precipitation might have stimulated the herbaceous increase. Interspecific competition for moisture between non-native herbs and seedlings of *Q. agrifolia* may negatively impact future recruitment of this tree. Further, continued presence of non-native herbs might reduce native biodiversity and impact functional dynamics in this endangered ecosystem.

The effects of fire on forest ecosystems on Guadalupe Island, México

Olivares- Bañuelos, Nadia Citlali[1], Valles-Pérez, Miguel[1] and Villanueva-Díaz, José[2]
[1] *Reserva de la Biosfera Isla Guadalupe, Ensenada, Baja California, México*
[2] *Instituto Nacional de Investigaciones Forestales Agropecuarias y Pecuarias; Centro Nacional de Investigación Disciplinaria Relación Agua-Suelo-Planta-Atmósfera (CENID-RASPA), Gomez Palacio, Durango, México*

Guadalupe Island is managed as a Biosphere Reserve by the Mexican National Protected Areas Commission (CONANP). The island has a volcanic origin dating from approximately 7 my. Although Guadalupe Island was forged by fire, it was not until the late 17th century that humans returned fire to the island, along with exotic species and other types of ecosystem degradation. The objective of our presentation is to show the radical changes that Guadalupe Island ecosystems have endured due to fire and other stressors in a period of 150 years. A number of tree species have been brought to the brink of local (and in one case, global) extinction. Forests originally occupied a land surface of approximately 3395 hectares, but fires and effects of feral goats reduced forest cover (not counting isolated individual trees) to merely 16 hectares. From the evolutionary stand point, forest ecosystems at Guadalupe Island have been transformed from fire independent ecosystems (where fire almost never occurred) to ecosystems that require high investment in fire management. Although fire is thought to have been exceedingly rare before human settlement in the 17th century, we observed spectacular postfire recruitment of the endemic Guadalupe Cypress (*Callitropsis guadalupensis*) after the disastrous September 2008 fire event. At the same time, a large proportion of cypress's individuals were killed by the intense fire, due to the fact that the phenotypic characteristics of the cypress bark is not fire proof. We describe some of the other responses of the Guadalupe Island forests to intermittent anthropogenic fire. Given the precarious situation for the cypress and other island species, it is imperative that future management efforts focus on the exclusion of fire for a period of decades, in order to permit the establishment of a mature forest with sufficient seed production to guarantee long-term persistence. We finish by summarizing some of the restoration and research priorities that guide our planning for the future of Guadalupe Island.

Landscape genetics of *Quercus engelmannii* and two sympatric hybridizing shrub oaks

Ortego, Joaquin [1, 2], Riordin, Erin[1], Gugger, Paul[1], Smith, Carrie[1], and Sork, Victoria L.[1, 3]

[1] *Department of Ecology and Evolutionary Biology, University of California, Los Angeles, CA, USA*

[2] *Instituto de Investigación en Recursos Cinegéticos, Ciudad Real, Spain*

[3] *Instiute of the Environment and Sustainability, University of California, Los Angeles, CA, USA*

Quercus engelmannii, an endemic tree oak of southern California and northern Baja California, hybridize with sympatric populations of two shrub oaks, *Q. berberidifolia* and *Q. cornelius-mulleri*, resulting in hybrids that are more shrubby than tree-like. To understand the role of hybridization in the ecology and evolution of *Q. engelmannii,* we asked several questions about patterns of hybridization and climatic association with the distribution and genetic gradients in each species. How accurate are field assignments of species and hybrids compared to their genetic assignment? Are hybrids primarily F1's, which indicates recent introgression? Do the species have overlapping climate niche models in the areas where hybrids are found? Do the genotypic gradients in the three parental species correlate with different climate variables? We sampled leaf tissue from several hundred individuals across 37 sites. Leaves were kept on ice until returned to UCLA where samples were divided to be pressed for vouchers or frozen until DNA extraction. Using genotypes derived from 10 nuclear microsatellite loci, data analyses included: (i) STRUCTURE and discriminant function analysis to assign individuals to species and identify hybrids; (ii) canonical correlation analysis to test whether the genetic gradients of each species were correlated with climate variables versus geography; (iii) ecological niche models to identify climate factors determining suitable habitat for each species. Our study found numerous individuals, who were classified as pure Engelmann oak in the field, had significant conspecific genetic contribution, but it varied among sites. The niche model of *Q. engelmannii* overlapped more with *Q. berberidifolia* than *Q. cornelius-mulleri*, and the three models differed significantly. Moreover, the genetic gradients of each of the three species associated differently with climate variables. We will discuss the potential impact of climate change on future hybridization of Engelmann oak populations, suggesting both a change in genetic composition and rate of hybridization.

Dispersal and seed bank shifts in the Arbutoideae (Ericaceae): the potential role of fire

Parker, V. Thomas
Department of Biology, San Francisco State University, San Francisco, CA, USA

The Arbutoideae is comprised of six genera principally restricted to regions with Mediterranean-type climates. Based on a molecular phylogeny, seed dispersal and germination characteristics have shifted from bird dispersal with transient seed banks to mammal dispersal with fire-stimulated, persistent seed banks. Fire regimes vary among sites in frequency and type. In this talk, I will explore the extreme differences that exist between dispersal types found in *Arbutus* and *Arctostaphylos* in North America. Recent work indicates that seedlings of species in both genera are relatively shade intolerant and sensitive to damping off by fungi. *Arbutus menziesii* is a relatively tall tree that is a major component of mixed evergreen forests along the central Pacific Coast region. This ecosystem normally experiences high frequency surface fires. Arbutus seeds recruit into gaps of post-fire forest habitats by bird dispersal from adjacent intact forests. *Arctostaphylos* has a high diversity of species in chaparral habitats that principally experience canopy wildfire at lower frequencies. In contrast to *Arbutus menziesii*, *Arctostaphylos* species produce persistent soil seed banks that germinate in place only after a fire. Evidence indicates that the principal dispersal agents of *Arctostaphylos* are scatter-hoarding rodents that provide a significant process in seed bank formation. The caching activities of rodents turn out to be an inadvertent fire adaptation in the context of the lower frequency, high intensity wildfires that characterize chaparral habitats.

Fuel shapes the fire-climate relationship: evidence from the Mediterranean Basin

Paula, Susana [1,2] and Pausas, Juli G.[3]
[1] *Instituto Universitario CEAM - UMH, Charles R. Darwin 14, Parc Tecnològic, 46980 Paterna, València, Spain.*
[2] *Current address: Instituto de Ciencias de la Tierra y Evolución, Universidad Austral de Chile, Casilla 567, Valdivia, Chile.*
[3] *Centro de Investigaciones sobre Desertificación (CIDE-CSIC), IVIA Campus, Ctra. Nàquera Km. 4.5, 46113 Montcada, València, Spain.*

Fire has been a key process in global ecosystem functioning since the early colonization of land by plants. Nevertheless, current changes in climate and fire regimes are causing important ecological and social impacts. Although it is well known that climate exerts a strong control on fire, the underlying mechanism is poorly understood. We propose that fuel structure shapes the fire-climate relationship, and we provide evidence for this in Mediterranean ecosystems. We estimated the drought level switching to flammable conditions, the frequency of flammable conditions and the changes in area burnt under those conditions, along a climatic gradient in the Mediterranean Basin. We found that the climatic threshold for switching to flammable conditions changes along the aridity gradient, being drier at the arid end of the gradient. The differences in fire activity along the climatic gradient were not explained by drought frequency, but by the sensitivity of fire to flammable conditions, which was higher in wetter and more productive regions. These results emphasize the role of landscape structure and management in shaping current and future fire-climate relationships.

Fire shapes plant traits: Introduction & Evidence from the Mediterranean Basin

Pausas, Juli G.
Centro de Investigaciones sobre Desertificación (CIDE-CSIC), IVIA Campus, Ctra. Nàquera Km. 4.5, 46113 Montcada, València, Spain

It is now well accepted that wildfires are fundamental process in many ecosystems, including mediterranean ones. It is also becoming clear that fires has been for long in the Earth, almost since the origin of land plants. However, the assumption that some plant traits are adaptations to fire has remained controversial. In fact, demonstrating that fire, as any other process, has been a selective force for in the evolution of plants is not an easy task, and distinguishing between adaptations and exaptations is a high bar. In this session we aim to compile evidence that many plant traits are indeed fire adaptations as they have been shaped by specific fire regimes through their evolutionary history. Specifically in this talk we review recent experimental studies in the Mediterranean Basin providing evidence that natural selection is shaping fire related traits within different model species. Fire enhance flammability in *Ulex parviflorus* (Fabaceae); and different fire regimes selects for different levels of serotiny and bark thickness within *Pinus* species (e.g., *P. pinaster*, *P. halepensis*). In addition, we found evidence that heat-stimulated germination of different species cannot be explained by summer temperatures in the bare soil. All these experiments contribute to demonstrate that fire is a selective agent shaping plant traits.

Holistic analysis of changing risk in response to fire management

Penman, Trent[1], Price, Owen[1], Bradstock, Ross[1], Metcalf, Simon[2], and Chong, Derek[3]
[1]*Centre for Environmental Risk Management of Bushfires, University of Wollongong, NSW, Australia*
[2]*New South Wales Rural Fire Service, Homebush NSW, Australia*
[3]*School of Forest and Ecosystem Science, University of Melbourne, Australia*

Management to reduce the risk of wildfire losses represents a complex mix of complementary and interacting strategies. A holistic analysis is required to assess the effectiveness of these strategies. Few methodologies allow for the simultaneous consideration of multiple management actions through multiple processes. Here we develop a Bayesian Network (BN) for the Sydney region, the most populated region of Australia. The fire process is modelled from the probability of ignition, through to fire establishment and finally whether it reaches the interface zone. Management actions are able to affect one or many stages along this process. Statistical models of empirical data are developed for the ignition models and a large simulation study was applied for the second and third phases. A structured expert elicitation processes were used to cover gaps in knowledge regarding the efficacy of fire management actions. The technique successfully replicated natural fire patterns and would be readily transferable to other fire prone regions around the globe.

Urban Metabolism – a New Method for Understanding Cities

Pincetl, Stephanie
Director Center for Sustainable Urban Systems, Institute of the Environment, UCLA

It is widely recognized that, for the first time in human history, more people live in cities than in the countryside. This has huge implications for resource extraction, transformation and flows, as well as concentrations of waste. Urban metabolism is a method that attempts to account for the materials and energy flows into cities and the waste generated by urban areas. To move toward greater urban sustainability, a granular understanding of these flows in specific places will be necessary as each city is different in terms of its population and economic activity. Further, how ecosystems are impacted by the activities in urban areas is important to understand so they can continue to provide nature's services over time. To date these flows have rarely been geospatially correlated to reveal who uses what type of energy where and the concomitant waste streams. Thus there is little ability to *understand* energy use in urban areas. Additionally, the social and ecological footprint of the flows have not been drawn and explained. We are developing an expanded and integrated urban metabolism analysis for Los Angeles County, attempting to integrate socio-demographic and geospatial grounding of resource flows and sinks, as well as life cycle, cradle to grave information. This presentation will focus on the reasons for this approach and methodological innovations and challenges.

Best of Two Worlds: Gas Exchange and Hydraulics of Shade and Drought Tolerant Species *Ruscus aculeatus* and *R. microglossum*

Pivovaroff, Alexandria[1], Rasoul Sharifi[2], Christine Scoffoni[2], Lawren Sack[2], Phil Rundel[2]
[1]*Department of Botany and Plant Sciences, University of California, 2150 Batchelor Hall, Riverside, CA, 92521, USA*
[2]*Department of Ecology and Evolutionary Biology, University of California, 621 Charles E. Young Drive South, Los Angeles, CA, 90095-1606, USA*

The genus *Ruscus* (Ruscaceae) consists of evergreen, woody monocot shrubs with modified photosynthetic stems (phylloclades). *Ruscus* is found in dry, shaded woodland areas of the Mediterranean Basin and northern Europe. The drought and shade tolerance of *Ruscus* challenges the "tradeoff model," which suggests that plants can be either drought or shade adapted, but not both. In order to understand the mechanisms that enable *Ruscus* to survive in shaded-drought environments, we studied form-function relations of *R. aculeatus* and *R. microglossum*, focusing on plant morphology and anatomy, gas exchange, hydraulics, and isotope composition. We then compared these trait values to those of other species found in published data. *R. aculeatus* and *R. microglossum* showed clear drought and shade tolerant characteristics including thick phylloclades with low rates of maximum photosynthetic CO_2 assimilation, low surface area of mesophyll cells per phylloclade area (A_{mes}/A), thick water storage compartment, thick cuticle and epidermis cell walls, thick fibrous bundle sheath cells, low stomatal conductance to water vapor, low respiration rates, low light compensation points, low cuticular conductance, low hydraulic conductance, and low modulus of elasticity associated with internal water storage tissue. Carbon isotope composition values ranged from -33.3 to -33.1, typical of an understory plant. Overall, these trait values were comparable to shade tolerant woody evergreen species. *Ruscus* appears to be highly specialized both physiologically and morphologically to occupy shaded-drought regions across a wide geographical range, including extremely low resource understory sites.

Paleofire Activity in Two Mediterranean Climate Regions: A long-term perspective of fire from sedimentary charcoal records

Power, Mitchell J.[1], Shira Tracy[1]R. Scott Anderson[2], Boris Vannière [3], and GPWG Members[4]

[1] Utah Museum of Natural History, Department of Geography, University of Utah, Salt Lake City, Utah, USA
[2] School of Earth Sciences & Environmental Sustainability, Northern Arizona University, Flagstaff, USA
[3] CNRS Research Scientist, Chrono-Environment Lab. UMR 6249 CNRS-UFC, Besançon cedex France
[4] Global Palaeofire Working Group Members

Fire and climate linkages during the last 12,000 years were examined from two Mediterranean ecosystems, including; coastal California and the Mediterranean basin. These regions support Mediterranean climates with winter wet and summer dry precipitation, associated ocean upwelling, and the absence of glaciated terrains. Sites from the Global Charcoal Database were compared to pollen studies from localities in Mediterranean hotspots that contain vegetation and fire histories spanning the last 12,000 years. We hypothesize fire maintains mosaic landscapes by short fire return intervals, contributing to the high levels of endemicity. Analysis of Mediterranean fire history suggests a rapid increase in fire activity between 12,000 and 10,000 cal yr BP, followed by a decline from 10,000 to 9000 cal yr BP. After 9000 cal yr BP, fire activity increased in both Mediterranean regions as greater-than-present Northern Hemisphere summer insolation caused increased fire activity. During the middle-to-late Holocene, from 7000 to 2000 cal yr BP, fire generally decreased in both regions. Analysis of fire regimes during the last two millennia suggest fire frequency has been gradually increasing in California until Euro-American settlement began in the late 19th century. In contrast, fire frequency has been generally decreasing in the Mediterranean basin during the last two millennia, excluding a period of high fire around 700 AD, with significant change in fire regimes during the post-Industrial period in Europe. Both regions have undergone significant changes in fire regimes during the last two centuries and our understanding of natural variability must consider long-term trends in Mediterranean ecosystems. As Mediterranean-type vegetation developed during the past four or five millennia, increased climate variability associated with ocean upwelling and greater ENSO activity, produced increased variability in fire regimes and potential mechanisms for the development of Mediterranean floristic diversity.

Low soil nutrient availability limits legume persistence in the Cape Floristic Region

Power, Simon C.[1], Cramer, Michael D.[1,2], Verboom, G Anthony.[1]and Chimphango, Samson BM[1]

[1]*Department of Botany, University of Cape Town, Private Bag X1, Rondebosch 7701, South Africa*
[2]*School of Plant Biology, Faculty of Natural and Agricultural Sciences, The University of Western Australia, 35 Stirling Highway, WA 6009, Australia*

Legumes are unable to persist beyond the early stages of post-fire succession in the Cape Floristic Region (CFR), unlike species in Ericaceae, Proteaceae and Restionaceae. Over 75% of legumes are short-lived seeders that are likely to have a higher nutrient requirement than persistent resprouters, given their greater investment in growth and reproduction. A capacity to fix N_2 will relieve legumes of low N supply in the oligotrophic soils of the CFR but not other nutrients. We hypothesized that (1) legumes are less effective at acquiring P from sparingly soluble sources compared with Proteaceae and Restionaceae (non-legumes); (2) legume seeders occupy soils with a higher nutrient status than resprouters. To test these hypotheses, the P-acquisition strategies of legumes and non-legumes were assessed when supplied 2 levels of sparingly soluble P, and we characterized the soil nutrient status of seeder and resprouters in *Otholobium* and *Psoralea*. Non-legumes had a lower shoot:root ratio and produced more cluster roots which exuded higher concentrations of carboxylates that are more effective at mobilizing P from sparingly soluble sources compared with legumes. Seeders inhabited soils with a higher nutrient availability than resprouters as evidenced by higher total [N], exchangeable [Ca] and [Mg], and CEC, but lower [Fe]. Only *Otholobium* seeders occupied soils with a higher P availability than their resprouters. Resprouters appeared to be adapted to low P soils as indicated by their weak capacity to down-regulate P-uptake. The similarity in foliar P:K:Ca:Mg ratios between legumes (1:18:18:4) and non-legumes, including Ericaceae (1:15:15:6), however, suggests legumes also require an adequate supply of cations. In order to for legumes to realise a competitive advantage from an elevated N supply they will require sufficient supply of P and other nutrients. Hence, legume persistence may be limited to fertile sites or early post-fire succession where nutrient availability is temporarily elevated.

Conservation implications of variation in *Artemisia californica* traits along an environmental gradient

Pratt, Jessica D. and Mooney, Kailen A.
Dept. Ecology & Evolutionary Biology, University of California, Irvine, CA, U.S.A.

Geographic variation in ecologically important plant traits can influence the strength of plant-herbivore interactions across a species range. Determining differences in such interactions along environmental gradients can help predict community-level consequences of plant responses to environmental change. We examined genetically based geographic variation in the response to predicted climate change of *Artemisia californica*, a keystone species in California's coastal sage scrub habitat. Plants from five populations across the species range were cloned from cuttings and planted in a common garden experiment where we manipulated precipitation and assessed variation in tradeoffs between plant growth and defense among populations, and the implications of this variation for herbivore communities. We found clinal variation in ecologically important traits of *A. californica,* including growth rate and resistance to herbivores. Growth rate was fastest for southernmost populations and decreased northward in accordance with increasing precipitation of field site from which the plants were collected. Southernmost genotypes were twice the volume of northernmost genotypes after one year. *A. californica* source populations differed in the proportion of plants damaged by rabbits with northernmost plants experiencing three times more herbivory than southernmost plants. As plant volume increased the extent of rabbit damage decreased, indicating that some correlate of plant size influences the feeding choices of rabbits. While population level differences associated with adaptation to clinal variation did lead to differences in resistance to rabbit herbivory, we did not observe a tradeoff in resource allocation to growth and defense as the slowest growing plants were also the most susceptible to rabbit herbivory. Per capita aphid population growth rate differed based on plant source population, but these differences did not follow a cline. Taken together, these data provide evidence of local adaption to climate across this species' range, as well as extended consequences of this adaptation for *A. californica's* associates.

Tradeoffs between seedling recruitment and sprouter persistence shape the evolution of chaparral shrub life history types

Pratt, R. Brandon[1]
1. California State University, Bakersfield, Department of Biology, 9001 Stockdale Hwy, Bakersfield, CA 93311, USA

Shrubs that inhabit Mediterranean-type climate regions have different life history types. One of these types is facultative sprouters (FS) that resprout after fire and recruit seedlings from a fire-cued dormant seed bank. Another type is obligate sprouters (OS) that resprout after fire and only recruit seedlings in mature shady sub-canopy sites in between fires. Unpublished and published data for southern California chaparral shrubs showed that FS have lower resprouting success after fire (48% resprout survival) than OS species (96% survival). This raises the question as to why FS species do not resprout as successfully as OS species? An FS individual that did resprout as successfully as the OS would have a clear fitness advantage. One answer to this question could be a tradeoff between seedling recruitment and resprout success. This tradeoff could work by reducing seedling recruitment if the numbers of seeds produced was traded off against resources allocated to storage for sprouting; however, this model is not well supported among chaparral species. Alternatively, a trade off could be at work at the level of the traits that facilitate seedling recruitment post-fire that come at the cost of those that promote sprouting and persistence. In a common garden study of nine species, we found that FS seedlings grew and assimilated carbon more rapidly, had lower root to shoot ratios, and lower shade tolerance than OS seedlings. This suite of traits of FS seedlings would facilitate recruitment in a resource rich post-fire environment in competition with sprouting species and herbaceous annuals and would not be conducive to storage and thus persistence. By contrast, slower growing OS species that recruit in shady microsites in between fires display a suite of traits conducive to allocation of resources to storage that would facilitate resprouting at an early age.

Managing Recovery of Bird Populations Facing Multiple Threats in an Urbanized Landscape

Preston, Kristine L.
Nature Reserve of Orange County, Irvine, California, USA and Center for Conservation Biology, University of California, Riverside, California, USA

Extensive urbanization and agricultural development has resulted in loss and fragmentation of natural habitats in southern California, leading to declines in many plant and animal species, including coastal Cactus Wren (*Campylorhynchus brunneicapillus*). Orange County's Natural Community Conservation Plan conserves 15,000 hectares of natural habitats supporting rare, threatened and endangered species. Despite this protection, Cactus Wrens decreased by over 80% in the reserve system in two decades. Catastrophic wildfire is the primary cause of this decline; however, there are other contributing factors. Reproductive monitoring shows a positive correlation between precipitation and annual productivity, although wet, cold winters also reduce production of young. Cactus Wrens are year-round residents of cactus scrub with poor dispersal capabilities. Populations are isolated by habitat fragmentation from urbanization and wildfire. Opportunities are limited for individuals to successfully disperse, establish a territory or recruit into the breeding population. Other threats include predation (nests, juveniles, and adults) and lack of suitable habitat due to invasive plants, slow recovery of cactus from fire, and overgrowth by other plants. Rapid population declines and small isolated populations raise concerns about gene flow and genetic heterozygosity. Cactus Wren genetic sampling is being conducted with colleagues sampling other regions to determine whether management actions are necessary to improve gene flow. To recover wren populations, cactus scrub is being restored to enhance connectivity and increase breeding habitat. Typically, cactus restoration involves planting pads and small cacti that take many years to grow and become suitable for wrens. Recently, cactus scrub has been available for salvaging so that large clumps can be planted and ready for immediate wren use. Plans are underway to translocate Cactus Wrens from areas designated for development to an unoccupied, isolated site. An ongoing restoration project will improve connectivity between this site and the closest wren population.

Quantifying prescribed fire effectiveness in theory and in practice

Price, Owen, Bradstock, Ross, and Penman, Trent
Centre for Environmental Risk Management of Bushfires, University of Wollongong, NSW Australia.

Prescribed fire is applied throughout the world to reduce the risk from wildfire, but there has been little rigorous evaluation of its effectiveness. One of the main measures of effectiveness is the reduction in wildfire area as a result of treatment (so called 'leverage'). Here, we quantify this effect using empirical analysis and fire simulation. Historical fire mapping is used to quantify the relationship between annual area burnt and the area burnt in preceding years. We apply this method to three contrasting biomes: Australian tropical savannas, New South Wales eucalypt forest and California chaparral. We use simulation to corroborate the results and to explore the theoretical drivers of leverage. Contrasting results were seen across the three biomes. Prescribed fires provide direct 1:1 replacement of wildfires in tropical savannas, whereas in eucalypt forests 3 hectares of prescribed fire are required to reduce wildfires by 1 hectare. In California chaparral there is no relationship between wildfire extent and recent fire history. The simulation identifies two main drivers responsible for the observed differences: the probability of encountering a wildfire and the probability of fire spread. Probability of encounter is higher in biomes with higher fire activity. Probability of spread is a product of weather effects and the degree of reduction in fuel produced by treatment. We argue that in California, treatment is ineffective because wildfires are rare (only 2% of the vegetation burns each year) and extreme fire weather allows fires to spread in sparse fuels.

Tehachapi Conservation Action Plan: Planning for landscape-scale connectivity and permeability

Principe, Zachary[1] and Parker, Sophie[2]
[1]*The Nature Conservancy, Fallbrook, CA, USA*
[2]*The Nature Conservancy, 601 S. Figueroa St. Suite 1425, Los Angeles, CA, USA*

The Tehachapi and Southern Sierra Region provides a unique opportunity to achieve multiple conservation objectives within California's Mediterranean climate zone. Located at the convergence of four ecoregions, the Region contains unique community assemblages and the only remaining intact connection between California's coast ranges and interior foothill and montane habitats. As these ranges are among the most biologically diverse regions in North America, it is important to maintain the movement of genes and individuals to prevent biodiversity loss associated with isolation. With warming temperatures predicted for the Region, species will require an interconnected network of open-space containing features that allow them to move, adapt, and find refugia. This biologically diverse Region has very high habitat intactness with multiple steep elevational gradients and an abundance of physiographic features and microclimates, providing an opportunity to showcase how conservation may minimize the threat of climate change to natural communities. Surprisingly, this Region is located within a two-hour drive of 13 million people in the Los Angeles Metropolitan area.

Following an assessment that determined the enabling conditions were greater than the challenges, the conservation community started planning our engagement in the Region. The planning process was imbedded within a larger effort that incorporated climate change and its predicted influence on species, communities and people. As the desired outcome is to maintain an intact landscape with high levels of permeability, the targets of the planning effort were matrix vegetation communities and wide-ranging species. A suite of situation analyses and ecological models were developed to assist in the process. Important features, indicators, and the current status of each target were defined. Threats were identified and strategies to abate the threats were developed. The greatest threats to the targets and landscape intactness identified were habitat destruction and fragmentation, climate change induced temperature increases and invasive species.

Leaf traits and litter flammability: understanding multi-species mixtures

Quiñones-Magalhães, Rita M. and Schwilk, Dylan W.
Department of Biological Sciences, Texas Tech University, Lubbock, Texas 79409

Our work seeks to understand how individual plant leaf traits influence fire behavior at the community scale. Although it is recognized that plant species vary in their flammability, we currently lack a mechanistic understanding of how plant traits influence fire and of how mixtures of litter behave in a fire. As modified fire regimes and climate change shift the species composition of communities, a mechanistic perspective is especially important in order to understand and predict fire in potentially novel plant communities. This work addresses three questions: 1) How do 8 species common in Sierra Nevada mixed-conifer forest differ in their litter flammability?; 2) What leaf traits are associated with various flammability components?; and 3) Do individual species measurements predict multi-species combinations or are there non-additive effects? Leaf litter was collected in Sequoia and Kings Canyon National Parks, California, from 8 species common in mixed-conifer forest. Controlled flammability tests were performed both on reconstructed monospecific litter beds and on three-species mixed litter beds. We tested for non-additive effects in multi-species mixtures using the weighted mean of single-species measures for each flammability component as a null expectation for each mixture; departures from this null indicated non-additive effects. Results from single-species burn trials show consistent differences between species across most of the flammability components tested. Additionally, most flammability components show a departure from the null expectation, indicating an overall presence of non-additive effects. The exceptions are temperature integration and peak temperature, which show a simple additive effect. Flame spread rate is tightly correlated with litter density, which is predicted by leaf size. Other flammability measurements are not closely linked with litter density, however. Understanding the burning characteristics of mixed stands will prove valuable in classifying species in terms of wildfire danger and aid prescribed burning plans, considering the flammability differences of the species.

Biological and environmental controls in Mediterranean stream communities: How does seasonality affect streams?

Resh, Vince [1] and Mazor, Raphael [2]
[1] Department of Environmental Science, Policy, and Management. 130 Mulford Hall #3114, University of California, Berkeley, CA 94720
[2]Southern California Coastal Water Research Project, 3535 Harbor Blvd #110, Costa Mesa, CA 92626

Mediterranean-climate streams are physically, chemically, and biologically shaped by sequential, predictable, and seasonal events of flooding and drying. Correspondingly, aquatic communities undergo annual cycles of extreme environmental and biological controls. For example, environmental controls dominate in winter and spring during floods, but biological controls grow in importance as discharge declines and the dry season progresses. Perhaps nowhere are these extremes more relevant than in temporary streams, including both long-lasting intermittent streams and ephemeral washes characteristic of more arid areas. Benthic macroinvertebrates were sampled from a dozen perennial and temporary streams in southern California representing a range of conditions, and analyzed for changes in community structure that indicate shifts between environmental and biological controls. Hydrologic regimes were found to be a key predictor in community structure, with highly episodic systems having communities dominated by dipterans and non-insects, while beetles and mayflies were more common in streams with stable hydrographs. Consequently, conventional bioassessment tools (such as the Southern California Index of Biotic Integrity) failed to reflect ecological health in some of these systems. Mediterranean watersheds are a natural laboratory for testing the tradeoffs between environmental and biological controls. Furthermore, increasing anthropogenic stress in these regions requires the development of assessment tools that can accurately describe the ecological health of intermittent and episodic streams.

Modeling the distribution of a threatened habitat: predicting the future distribution of the California sage scrub under climate change

Riordan, Erin C. and Rundel, Philip W.
Department of Ecology and Evolutionary Biology, University of California, Los Angeles, CA, 90095 USA.

Climate change during this century is predicted to cause the contraction of habitats with Mediterranean-type climates along coastal southern California to NW Baja California. Within this region, California sage scrub's high levels of diversity, endemism, and threatened status make it a conservation priority. We assess the threat which future climate change poses to sage scrub using an approach that integrates: online databases of species locality data, GIS environmental data, climate data, and open source species distribution modeling tools—all resources which are freely available to conservation scientists and resource managers. We use species distribution models to predict the geographic distribution of climatically suitable habitats for sage scrub under both current and future climate conditions and to predict changes in the sage scrub range. Future climate change scenarios suggest many species will experience significant contraction in the southern portion of their ranges, especially species currently occurring primarily in northwestern Baja California and San Diego County. Of these species, some are predicted to experience expansion of current northern and interior limits of their ranges, assuming full dispersal scenarios. Species with more restricted current distributions, such as *Rosa minutifolia* and *Salvia munzii,* are predicted to undergo significant range loss under future climate conditions. These results suggest that sage scrub communities will likely undergo changes in species assemblages and biodiversity patterns as individual species respond to changing climate. It is conceivable that current protected areas may not contain the future populations of the species they were originally intended to protect. Given the high conservation priority of California sage scrub and large monetary expense associated with its protection in California, incorporating predictions of future distribution will be crucial for effective conservation planning.

Innovative techniques to restore plant biodiversity to rehabilitated bauxite mines

Ruschmann, Alexander M. [1], and Koch, John M. [1]
[1] *Alcoa of Australia Ltd, Huntly Mine, Off Del Park Road, Pinjarra, Western Australia 6208, Australia*

Alcoa of Australia has two bauxite mines located within the unique jarrah forest in South Western Australia. The mines operate within sensitive drinking water catchments and the region is part of a recognised global biodiversity hotspot. Alcoa rehabilitates approximately 650 ha of jarrah forest each year. As well as restoring a stable and highly functional ecosystem, Alcoa's rehabilitation focus has been to increase species richness and similarity to the pre-mined forest. Several innovative methods have been employed to restore a diverse range of native plant species. Harvesting of fresh topsoil, screening out the gravel fraction and applying the fines as a top dressing can re-instate most natural soil seedbank species. This process is known as soil screening and mixing material from multiple donor sites increases species richness. This technique is used where direct return of whole fresh topsoil is not possible. Obligate resprouters and geophytes are often dominant in the pre-mining forest, but by definition are impossible or very difficult to restore from seed. Tissue culture is used to propagate about 20 of these 'recalcitrant' species and about 100,000 are produced each year. Other species are grown from cuttings and from seed if possible. This totals about 200,000 plantings each year. Monitoring and feedback to increase field survival of these planted species is critical to the success of the operation. Pot size for propagation, protection from grazing, deep root burial and rainfall are just some of the factors that can affect field survival. Traditional methods of seed broadcasting are also applied using a diverse seed mix of 50-80 species each year. Intensive annual and repeat monitoring shows efforts to restore the forest diversity are fruitful. Future work is focussing on increasing the floristic similarity of rehabilitation to unmined forest.

Restoration and global change: can we continue to put our trust in the past?

Safford, Hugh[1,2], Hayward, Greg[3,4], and Wiens, John[5]
[1]USDA Forest Service, Pacific Southwest Region, Vallejo, CA USA; [2]University of California, Davis, CA USA;
[3]USDA Forest Service, Alaska Region, Anchorage, AK USA; [4]University of Wyoming, Laramie, WY USA;
[5]PRBO Conservation Science, Petaluma, CA USA

Ecological restoration, conservation, and resource management are often based on comparisons with reference sites or time periods, which are assumed to represent "natural" or "properly functioning" conditions. Such reference conditions can provide a vision of the management goal and a means to measure progress toward that vision. Although historical ecology has been used to guide resource management in many parts of the world, the continuing relevance of history is being questioned. Some doubt that lessons from the past can inform management in what may be a dramatically different future, given profound climate change, accelerated land use, and an onslaught of biological invasions. In our view the principal issue is not the fundamental value of historical ecology, but rather the ways in which historical information is used. Historical ecology (including paleoecology) and its methods constitute a body of knowledge that holds no prescription for how that knowledge should be applied. Because global change processes proceed at scales of time that are much longer than human lifetimes, any understanding of long-term temporal dynamics in ecosystem states and processes must be based directly or indirectly on information gathered from historical sources. That said, many past management applications of historical ecology have made assumptions about ecosystem stability or ecological stationarity that are clearly untenable in a world in which fundamental parameters like climate, land use, species pools, and nutrient inputs are changing at a rapid pace. We outline three areas where historical (and paleo-) ecology is of fundamental importance to current and future restoration and resource management practice: (1) Understanding patterns and mechanisms of temporal dynamics in ecosystems and their component organisms; (2) Refocusing our management efforts on approaches that maintain essential ecosystem functions and services under rapid global change; and (3) Better recognizing and incorporating the roles of humans in ecosystem dynamics.

US-México collaborative efforts in Mediterranean-zone fire and resource management

Safford, Hugh[1,2], de Leon-Giron, Gonzalo[3], Cruz Dominguez, Juan Ramon[4], Granillo, Isabel[5], Olivares, Nadia Citlali[6], and Ramirez, Carlos[1]
[1]US Forest Service, Pacific Southwest Region, Vallejo, CA USA; [2]University of California, Davis, CA USA; [3]Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), Ensenada, México; [4]Comisión Nacional Forestal (CONAFOR), Mexicali, México; [5]The Nature Conservancy, Ensenada, México; [6]Comisión Nacional de Áreas Naturales Protegidas (CONANP), Ensenada, México

The US Forest Service (USFS) has a long history of institutional partnership with Mexican fire and resource management agencies. Recently, the USFS Pacific Southwest Region and the USFS International Programs office have entered into a collaborative relationship with the Baja California Fire Management Working Group (FMWG), which unites Mexican federal and state agencies like CONAFOR (National Forest Commission), CONANP (National Parks Commission) and SEMARNAT (Secretariat for Environmental Protection), nongovernmental organizations (e.g. The Nature Conservancy), and academic institutions (e.g., Autonomous University of Baja California), among other entities. The overall purpose of the collaboration is to increase coordination, two-way information sharing and technical assistance in resource and fire management in Mediterranean-climate zone ecosystems on both sides of the US-Mexico border. In just over one year of existence, the collaboration has had a number of notable successes. High resolution vegetation maps have been developed for the two peninsular National Parks in the Mexican Mediterranean zone (Parque Nacional Constitución de 1857, y Parque Nacional Sierra San Pedro Mártir); remotely-sensed imagery has been used to assess patterns in fire severity in and around the parks since 1984; Mexican personnel have been trained in vegetation mapping methods and technologies; USFS staff have attended and presented at a number of FMWG meetings; Mexican personnel have visited National Forests in Alta California and US personnel have visited national parks in Baja California; a joint US-México symposium was organized for the 2011 MEDECOS meetings in Los Angeles; and a proposed program of work for the next three years has been developed. Future possibilities for cooperative projects include a grazing and meadow management workshop in Baja California, further training in prescribed fire and fuels management, development of formal fire management plans for the Baja California national parks, and increased México-US collaboration in transboundary fire management.

Resurvey of the Mosses of the San Dimas Experimental Forest: Are Changes in Climate and Pollution Reflected in Shifts in Species Composition and Elevation Distribution?

Sanchez, Janet G.
Department of Biological Sciences, California State University, Los Angeles, 5151 State University Drive, Los Angeles, CA 90032, USA.

The San Dimas Experimental Forest (SDEF) is located within the Angeles National Forest on the south slopes of the San Gabriel Mountains, 35 miles northeast of Los Angeles, California, and covers an area of 17,153 acres. The SDEF was established in 1933 as a center for watershed research with studies focusing on the relationship between chaparral vegetation and hydrology and the chaparral's function in decreasing erosion. Over 30 years ago, a floristic study on the mosses of the SDEF resulted in the collection of over 1100 specimens and the identification of 68 species that were accepted as constituting the moss flora of the study area. I am resurveying the SDEF, identifying the present species, and comparing my findings to the findings from the previous study to determine if there have been any changes in species composition or elevation distribution of mosses. As a result of the extensive research carried out in the SDEF over the last 80 years, there are ample amounts of data on environmental factors such as precipitation, air temperature, evaporation, and water quality that are very valuable in testing hypotheses on the influence of climate change and pollution to the change in distribution of mosses in this study. The expectations are that a warming climate trend over the past 30 years will be reflected by decreased diversity and decreased elevation distribution of mesic or desiccation sensitive species and increased diversity of xeric-adapted species. It is also expected that decreased levels of airborne pollutants in the LA basin over the last 30 years will be reflected by increased diversity of all species, especially corticolous (epiphytic) and aquatic moss species, and increased elevation range of all species. This study will assess the impact of local environmental changes on bryophytes, which has not been previously studied.

Consequences of drought-induced vegetation change for water cycling along a desert-shrubland gradient

Santiago, Louis S., Alstad K. P., de Guzman M. E., Pasquini S. C., Pivovaroff A. L.
Department of Botany & Plant Sciences, University of California, Riverside, CA 92521

The transition between chaparral shrublands and Mojave Desert vegetation represents an intersection of two major vegetation types in California and contains a mix of chaparral and desert shrubs, as well as endemic species that only occur along this margin. This vegetation boundary has large potential for drought-induced vegetation change because nearly all species are at the edge of their range. We studied 17 species to determine how drought avoidance and resistance strategies such as drought deciduousness, rooting depth, and vulnerability to xylem cavitation promote species co-existence in an arid ecosystem of considerable floristic complexity. We identified several major trade-offs in hydraulic strategies. Leaf area:sapwood area increased with xylem vulnerability illustrating a trade-off in hydraulic architecture. Species with high rates of hydraulic conductivity had greater vulnerability to xylem cavitation illustrating a trade-off between safety and efficiency of water transport. Stable isotopic composition of xylem water indicated that most species were deep-rooted, yet several species obtained water predominately from shallow soil layers. Minimum seasonal water potential also played a key role in determining plant strategies and likely contributed to species coexistence in this functionally diverse arid ecosystem.

Species traits in post-fire regeneration in the Western Mediterranean basin: the role of climate and fire

Saura-Mas, S. [1], Lloret, F. [1],
[1] *CREAF (Center for Ecological Research and Forestry Applications) and Unit of Ecology, Department of Animal and Plant Biology and Ecology, Autonomous University of Barcelona, E-08193 Bellaterra, Barcelona, Spain.*

Post-fire regeneration is a key process in Mediterranean shrubland dynamics, which is determined by species traits related to demographic and growth responses to the disturbance. In these ecosystems, however, climate-induced stress is also recognized as a major selective pressure determining functional attributes. Here we analyze the relationship between functional traits and post-fire regeneration strategy of woody species from the Western Mediterranean Basin. Concretely, we have studied leaf traits related to water use and nutrients, inflammability and combustibility plant traits, and root structure characteristics. Some of the leaf traits such as decomposition of leaf litter have also been studied under climatic change scenarios. Our results suggest that some leaf traits and plant properties, such as cell water relations, are clearly associated to post-fire regenerative strategy. Respect to resprouter species, the seeder species tend to have higher leaf phosphorous content, quicker decomposition rate, and more drought tolerance, hence achieving lower leaf water contents. These traits correlated well with higher leaf flammability. They can be explained as a response to high variable environments, particularly in terms of water resources, and are also commonly associated to early successional species, which show life-history traits that fit well the disturbance regime induced by fires. Recent studies have pointed out that most seeder species of the study region have evolved under the Mediterranean climate established in the Quaternary, while many non-seeder species have evolved from the Pre-Mediterranean climate, in the Tertiary. We suggest that since seeder species evolved under the highly fluctuating Mediterranean climate, where wildfires are also promoted, they developed a syndrome of attributes that involves both drought tolerance and enhanced high post-fire recruitment. This interpretation seems relevant in the current context where an increase of drought and wildfires' recurrence may be major effects of climate change in these ecosystems.

Quantifying effects of invasive pigs and climate variation on survivorship of an island endemic plant

Schultz, Emily L. [1], Almeida, L. Zoe[2], McEachern, A. Kathryn[3] and Thomson, Diane M. [1]
[1]*Claremont-McKenna Colleges, Claremont, CA, USA.*
[2]*Scripps College, Claremont, CA, USA.*
[3]*U.S. Geological Survey, Ventura, CA, USA.*

Jepsonia malvifolia (Saxifragaceae) is a plant endemic to the California Channel Islands, with an underground corm palatable to introduced pigs. Managers suspected that population declines were related to pig predation, but it was unclear how climatic variation also affected population trends. We used long-term monitoring data to determine the effects of both invasive pigs and climate variables on survivorship in *J. malvifolia* populations on Santa Cruz (SCI) and Santa Rosa (SRI). We estimated four between-year transitions for SRI, from the period immediately following pig removal in 1992. For SCI, three transitions were observed before pig removal in 2004, and four after. We used forward stepwise logistic regressions to test for changes in survivorship on SCI after pig removal, and effects of climate variables such as mean annual growing season precipitation and temperature on survivorship, independent of pig effects. We also tested for the influence of factors such as island, plant size, and density on survivorship.

Pig removal was associated with dramatically increased *J. malvifolia* survivorship on SCI, but large plants (Odds ratio for without pigs: with pigs=5.72) were more strongly affected than small ones (Odds ratio for without pigs: with pigs=1.85). On SCI, years after pig removal also had significantly higher mean growing season temperatures, potentially confounding climate effects with those of herbivores. Analysis of data from both islands taken during years when pigs were absent showed that higher temperatures were significantly associated with increased survivorship in both large and small plants. Survivorship also went down significantly with higher *J. malvifolia* numbers, indicating an important role for density dependence. These results provide evidence for negative effects of invasive herbivores on an endemic plant. They also illustrate the importance of controlling for factors such as climate variation and density dependence in assessing the results of management actions, like invasive species removals.

A plant distribution shift: temperature, drought or past disturbance?

Schwilk, Dylan W. [1], and Keeley, Jon E.[2,3]
[1] Biological Sciences, Texas Tech University, Lubbock, Texas, USA; [2] U.S. Geological Survey, Western Ecological Research Center,Sequoia-Kings Canyon Field Station, Three Rivers, California, USA; [3] Department of Ecology and Evolutionary Biology, University of California, Los Angeles, California, USA

Simple models of plant response to warming climates predict vegetation moving to cooler and/or wetter locations (in mountainous regions, "marching upslope"). However, the mechanisms explaining species-specific responses to changes in temperature and water availability are most likely much more complex. For example, in species with episodic seedling recruitment, past disturbance history may interact with temperature and drought in producing patterns of establishment and mortality. We re-examined a recently reported vegetation shift in the Santa Rosa Mountains, California, to determine the mechanisms behind the reported uphill shift of a plant distribution. Our focus was on a key species in this reported pattern, *Ceanothus greggii*: an "obligate seeding" shrub that recruits post-fire. This life-history allowed us to calculate stand ages and a time series of past per-capita mortality rates by counting growth rings on live and dead individuals. For five elevations used in the prior study, we calculated time series of past per-capita mortality rates by counting growth rings on live and dead individuals. Using a model-selection framework, we tested three alternative hypotheses explaining the time-series patterns of mortality: H1) mortality increased over time consistent with climate warming, H2) mortality peaked 40-50 years post fire at each site, consistent with self-thinning, and H3) mortality was correlated with past drought. We found that the sites were different ages since the last fire, and that the reported increase in the mean elevation of *C. greggii* was due to higher recent mortality at the lower elevations which were younger sites. The time-series pattern of mortality was best explained by the stand age/self-thinning hypothesis (H2) and poorly explained by either gradual warming or drought. At least for this species, the reported distribution shift uphill appears to be an artifact of disturbance history and stand age and is not evidence for a climate warming effect.

Physiological and structural significance of small leaf size in dry areas such as mediterranean ecosystems

Scoffoni, Christine[1], Rawls, Michael[1], McKown, Athena [1], Cochard, Hervé[2], and Sack, Lawren[1]

[1]*Department of Ecology and Evolutionary Biology, University of California, Los Angeles, 621 Charles E. Young Drive South, Los Angeles, CA, 90095-1606, USA*

[2]*INRA, UMR 547 PIAF, F-63100 Clermont-Ferrand, France*

[3]*Clermont Université, Université Blaise Pascal, UMR 547 PIAF, BP 10448, F-63000 Clermont-Ferrand*

One of the most well-known trends in plant biogeography is that smaller leaves are typical in drier areas. However, there have been no direct explanations. Across plant species, leaves vary enormously in their size and their venation architecture, of which one major function is to replace water lost to transpiration. The leaf hydraulic conductance (K_{leaf}) represents the capacity of the transport system to deliver water, allowing stomata to remain open for photosynthesis. Previous studies showed that K_{leaf} relates to the vein density (= vein length per area). Additionally, venation architecture determines the sensitivity of K_{leaf} to damage; severing the midrib caused K_{leaf} and gas exchange to decline, with lesser impacts in leaves with higher major vein density that provided more numerous water flow pathways around the damaged vein. Because xylem embolism during dehydration also reduces K_{leaf}, we hypothesized that higher major vein density would also reduce hydraulic vulnerability. Smaller leaves, which generally have higher major vein density, would thus have lower hydraulic vulnerability. Tests using simulations with a spatially explicit model confirmed that smaller leaves with higher major vein density were more tolerant of major vein embolism. Additionally, for ten species ranging strongly in drought tolerance, hydraulic vulnerability determined as the leaf water potential at 50% and 80% loss of K_{leaf} was lower with greater major vein density and smaller leaf size ($|r|$ = 0.80-0.86; $P < 0.01$). These relationships were independent of other aspects of physiological and morphological drought tolerance. These findings point to a new functional role of venation architecture and small leaf size in drought tolerance, potentially contributing to well-known biogeographic trends in leaf size.

Xylem Embolism Repair in California Coastal Sage Scrub and Chaparral Shrubs

Schenk, H. Jochen [1], Espino, Susana [1], Hessom, Elizabeth C. [2], Mocko, Kerri [3], Martínez-Cabrera, Hugo I. [3], and Jones, Cynthia S.[3]

[1] *Department of Biological Science, California State University Fullerton, Fullerton, CA, USA.*
[2] *Department of Environmental Sciences, University of California Riverside, Riverside, CA, USA.*
[3] *Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, CT, USA.*

Drought-induced xylem embolisms disrupt plant water transport and can lead to significant losses in hydraulic conductivity. Over the last 15 years, evidence has accumulated that plants can repair embolisms even when their hydraulic systems are under negative pressure, a process sometimes referred to as "novel refilling". The underlying mechanisms for this process have remained unknown, and there has been no comprehensive study of this phenomenon across different plant species. The objective of this study was to test for embolism repair (ER) under negative pressure in shrubs of coastal sage scrub and chaparral vegetation in southern California, two vegetation types with Mediterranean climate and a long summer drought period. Shrub hydraulic traits were characterized by measuring wood density, vessel-, fiber-, and parenchyma-traits using light- and scanning electron microscopy, and by measuring xylem vulnerability curves. Diurnal measurements of branch water potentials, stomatal conductance, and percent loss of stem conductance (PLC) were conducted for two drought-deciduous species, *Artemisia californica* and *Salvia mellifera*, and one evergreen species, *Eriogonum fasciculatum*, in coastal sage scrub and two evergreen chaparral shrubs, *Malosma laurina* and *Ceanothus crassifolius*. Nocturnal ER under negative pressure was detected for *Artemisia, Eriogonum*, and *Malosma* at branch water potentials ranging from -0.2 to -1.2 MPa, but not for *Salvia* and *Ceanothus*. All five species had nocturnal stomatal conductance; closed stomata were observed only during one night in *Salvia*. Vessels in species with ER had a much higher fraction of their perimeters bordering on vessel-associated axial parenchyma cells than species with ER, which tended to have more vessel-ray contact and more vasicentric tracheids. The findings suggest that embolism repair under negative pressure is associated with nocturnal transpiration, that it occurs only during the active growing period in the species studied, and that it requires living vessel-associated cells that are not part of the ray system.

A Comparative Landscape Study of Forest Disturbance Patterns in Alta and Baja California

Schmidt, Cindy[1], Loik, Michael[1]
[1]*University of California, Santa Cruz, Santa Cruz, CA, USA*

Western U.S. forests are currently experiencing widespread mortality due to both anthropogenic and natural causes. Fire suppression policies have led to stand thickening and build-up of understory fuels, resulting in increased competition for resources, weakening trees. Increased pollution and continued drought have further weakened trees. If these conditions do not kill trees directly, they increase their vulnerability to insect infestation and disease, which may ultimately result in tree death. These conditions have also resulted in larger and more severe forest fires which, when combined with the dramatic human population increase in mountain regions, have greatly endangered life and property. In contrast, until the 1980s fires in the Sierra de Juarez and Sierra San Pedro Martir (SSPM) ranges in Baja, California were allowed to occur without much human intervention, resulting in shorter median fire return intervals and fewer stand-destroying fires. Although current fire management policies in the Mexican parks are focused on fire suppression, this legacy of frequent burning until the recent past has resulted in more open forest stands, lower stem densities, and much less accumulation of fuels. This research compares forest disturbance patterns due to fire, drought and insect outbreaks in Alta and Baja California between 1984 and 2010 using Landsat satellite imagery. Specifically, burn severity maps of the San Bernardino National Forest and the SSPM acquired from the U.S.D.A. Forest Service, Region 5 remote sensing lab have been compared. Spatial and temporal forest mortality patterns have been analyzed using Landtrendr, a program that uses continuous time-series Landsat imagery to capture both short-duration events and long term disturbance trends.

Monitoring and enhancing wildlife movement across a freeway in urban southern California

Schoonmaker, Catherine M., Riley, Seth P.D., and Sikich, Jeff S.
National Park Service, Santa Monica Mountains National Recreation Area, Thousand Oaks, CA.

Habitat loss and fragmentation due to urbanization can have significant impacts on wildlife movement and survival. In highly fragmented urban landscapes such as those in southern California and other Mediterranean ecosystems (e.g. Australia, South Africa, Europe) where hospitable climates can lead to large urban centers, freeways and roads often separate remaining natural habitats. At Santa Monica Mountains National Recreation Area, a national park north of Los Angeles, we have been studying the impacts of roads on the behavior and ecology of wildlife since 1996. We have documented significant effects of roads on the survival, movement, and even the gene flow of various wildlife species. Along highway 405 in Los Angeles County, one of the busiest freeways in the U.S., we are examining the effects of wildlife movement across the freeway during the construction of an additional lane. We are using remote cameras to monitor wildlife use at four crossing points (two bridges and two underpasses) before construction, during-construction, and post-construction, to determine the impacts of widening the freeway on wildlife movement and if enhancing a road bridge will increase wildlife use. During the pre-construction phase, we acquired 3329 photos of medium/large wildlife in the natural habitat adjacent to the freeway (82%) and at the crossing points (18%). We have detected all of the larger local wildlife species in the natural area near the crossing points including; bobcats, deer, and mountain lions but only a few species were detected using the crossing points on a regular basis, specifically coyotes and raccoons. Although deer and bobcats visited the crossing points, less than 1% of the total detections for both species occurred at the crossings, and there were no detections of mountains lions. As city populations continue to grow throughout Mediterranean regions, highway construction projects, which often widen highways to reduce traffic congestion, will continue to occur and may have significant negative impacts on wildlife in the area. Long-term road studies such as this one will help us gather valuable information about mitigation efforts along busy freeways and wildlife movement in challenging urban landscapes.

Large-scale changes in the distribution, demography, and biomass of Mediterranean-climate oaks of southern California precede the impact of global climate change

Scott, Thomas[1,2], Zambino, Paul[3], Washington, Cara[2], Goforth, Brett[2], Eskalen, Akif [4], and Lynch, Shannon[4] .

[1] Dept. Environmental Science Policy and Management, Univ.of California, Berkeley, CA, USA; [2] Dept. Earth Sciences, Univ. of Calif., Riverside, CA, USA; [3] US Forest Service, Forest Health Protection, San Bernardino, CA, USA; [4] Dept. of Plant Pathology, Univ. of Calif., Riverside, CA, USA.

Mortality and decline of red oaks in the Mediterranean climates of southern California is an example of how species' prevalence in their distributions can be hollowed-out without opportunity for an offsetting elevational or latitudinal expansion. Changes in distribution and demography of several red oak species have occurred before significant, predicted climatic shifts, although climatic factors may be involved. Mortality is instead presumed to have been caused by spread of a recently introduced pest and activity of native and possibly introduced pathogens in wildland ecosystems which have also been altered by human actions. Over the past 10 years, over 40,000 hectares of oak woodlands have been damaged by the introduced pest, goldspotted oak borer (*Agrilus auroguttatus*) and by bot canker disease pathogens (*Botryosphaeria* / *Diplodia* species). This mortality and decline is occurring in a region where over 70,000 hectares of oak habitats have been burned by catastrophic wildfires, fostered in part by wildland infringement of over 65,000 exurban homes. Mortality in California black oak and coast live oak (*Quercus kelloggii* and *Q. agrifolia*) has reached 50%, with an additional 20 to 40% of trees in irreparable decline. This trajectory of mortality could exceed damages expected solely from projected stress clines from climatic factors of temperature, precipitation, growing season, etc. The result is that some oak woodlands thought most susceptible to climate change have thus far remained intact, while woodlands that were thought to be less susceptible to change have already been decimated.

Emergence of novel pine-oak Mediterranean ecosystems: results of shrubland regeneration and afforestation

Sheffer, Efrat [1], Kigel, Jaime [1], Pervolotsky, Avi [2] and Canham, Charles D. [3]
[1] *Robert H. Smith Faculty of Agricultural, Food and Environmental Quality Sciences, The Hebrew University of Jerusalem,Rehovot,Israel;* [2] *Agriculture Research Organization Volcani Center,Bet-Dagan,Israel;* [3] *Cary Institute of Ecosystem Studies, Millbrook, New York.*

Mediterranean Ecosystems have been exposed to millennia of human exploitation, mainly in the form of grazing and wood cutting, that in many areas have severely decreased vegetation cover. Over the past century there have been two major patterns of land-use change in Mediterranean Israel: (*i*) a decrease in the intensity of traditional land-use combined with passive management to allow recovery of native shrub communities; and (*ii*) active restoration by extensive planting of forests on degraded sites. Consequently, the Mediterranean landscape of Israel is currently composed of a spatial mosaic of two very different ecosystems: evergreen shrublands and woodlands dominated by native oak species (primarily *Quercus calliprinos* Webb), and plantations of conifers, primarily native Mediterranean pines (*Pinus halepensis* Mill.). Both active and passive restoration have been carried out without explicit consideration of potential landscape scale interactions and landscape long-term dynamics. The proximity of oak and pine communities has created opportunities for reciprocal species colonization among ecosystems. Pines from planted forests are expanding and colonizing natural vegetation whereas oaks are developing within pine stands. Reciprocal colonization is now leading to the emergence of a new vegetation system. We will present a large-scale analysis of landscape interactions of Mediterranean pine and oak communities in Israel, and how these processes create novel communities. Using maximum likelihood estimation we developed spatially-explicit models that explain the processes that both promote and resist successful colonization of one patch type by the dominant species in another patch types. Specifically, we investigated how pine and oak colonization are controlled by: 1) the spatial configuration of the landscape and its effect on propagule arrival, and 2) local environmental conditions acting as resistance factors that limit recruitment of colonizing individuals. Models can be used to predict the formation and structure of future woody ecosystems. We suggest that restoriation or conservation management plans of Mediterranean ecosystems should take landscape processes in consideration.

Taking the Heat: Seasonal responses of *Heteromeles arbutifolia* to extreme heat events

Shuldman, Michal[1], Simonin, Kevin[1,2], Roddy, Adam[1], and Dawson, Todd[1]
[1] *Department of Integrative Biology, University of California, Berkeley, Berkeley, CA, USA.*
[2] *Faculty of Agriculture, Food and Natural Resources, University of Sydney, Sydney, New South Wales, Australia.*

Numerous studies have examined species' responses to changes in the average conditions they experience but few have ever examined responses to extreme events such as heatwaves. The length of the "heatwave season" in California is predicted to increase; yet, it is unclear whether it will start earlier or end later. In a Mediterranean-type climate, sudden heat in the cooler, wet spring should affect plants differently than extreme heat at the end of a warm, dry summer. Moreover, population-level responses may vary between resprouting individuals and nearby individuals with intact canopies. To determine whether naturally occurring spring and fall heatwaves effected different responses in water use and carbon, we examined the responses of one population of the widespread near-endemic shrub *Heteromeles arbutifolia* growing in Napa County, CA. Within this population some shrubs had their canopies mechanically removed four years prior. During the spring heatwave plants had higher water use compared to pre-heatwave days. The difference between pre-heatwave (e.g. resprout = 96.14 mmol m^{-2} s^{-1}) and heatwave stomatal conductance (e.g. resprout = 121.08 mmol m^{-2} s^{-1}) was largest in the early morning. During the fall heatwave plants had higher conductance before the heatwave than during the heatwave. During the spring heatwave carbon isotope discrimination of leaf sugars was not significantly different between shrubs and resprouts. During the fall heatwave shrubs had significantly lower C isotope discrimination (Δ=15.7 ± 0.4) than resprouts (Δ=17.2± 0.2), indicating shrubs had higher intrinsic water use efficiency (iWUE). Ongoing work will determine the relative effect of photosynthesis and stomatal conductance on the observed patterns in iWUE. *H. arbutifolia* responds to extreme temperatures in spring differently than in fall, suggesting that changes in the timing of heatwave onset versus changes in the duration of the heatwave season may have different impacts on this native plant species.

Plant-plant interactions in the restoration of Mediterranean semi-arid environments

Smanis, Athanasios, Valdecantos, Alejandro, and Fuentes, David
Centro de Estudios Ambientales del Mediterráneo (Foundation CEAM), Valencia, Spain

Semiarid Mediterranean landscapes commonly show patchy vegetation and, hence, a sink-source dynamics of water fluxes. Resource export dominates in source areas while in sink ones there are net accumulation of water and sediments. Ecological processes are enhanced in sink spots triggering nutrient mineralization, plant above and belowground growth, and C and organic matter production. Activities aimed at restoring degraded semiarid Mediterranean rangelands should consider the way these ecosystems function and take advantage of natural fluxes of resources. At the same time, plant-plant interactions are especially relevant in resource-limited ecosystems. The outcomes of these biotic relationships depend on the balance of positive and negative effects resulting from species' interactions under site conditions. In this study we asked (1) whether the restoration of semiarid Mediterranean landscapes may include simultaneously introduction of several individuals of different species in the same planting hole, (2) whether it is dependent of resource availability, and (3) whether the co-existence or exclusion of individuals depends on specific functional traits. We established planting plots in SE Spain with *Olea europaea* seedlings as the target species with experimental factors dealing with water availability, woody-woody and woody-grass interaction. Soil moisture, foliar relative water content (RWC) and seedling survival and growth were monitored during the first year. We observed that a dry well was a simple technique that significantly improved soil moisture, seedling growth and physiological status. The interaction with seedlings of other woody species reduced growth and RWC of *O. europaea* while no interaction was observed with grasses except under the driest conditions. However, no significant mortality related to any experimental factor was recorded. These first results suggest that: i) competition does exist between woody seedlings planted in the same ontogenetic stage while ii) grasses only outcompete under extreme water limitation, may be due to niche differentiation of belowground tissues.

Is there evidence of a tradeoff between drought and shade tolerance in coastal desert shrubs in north-central Chile?

Squeo, Francisco A., Karina Martínez-Tillería, Andrea P. Loayza
Department of Biology, Universidad de La Serena, Centro de Estudios Avanzados en Zonas Aridas (CEAZA), and Institute of Ecology and Biodiversity (IEB), Casilla 599, La Serena, Chile.

A key question to understand plant community dynamics in arid environments is whether shade and drought have interactive effects on plant performance. Smith and Huston (1989) hypothesized that the response of plants to the joint effects of irradiance and water is characterized by a tradeoff between drought and shade tolerance, so that species that can tolerate greater levels of shade are more vulnerable to drought than species that are more light-demanding. In order to evaluate this tradeoff, one-week-old seedlings of six coastal desert shrubs of north-central Chile (*Centaurea chilensis*, *Encelia canescens*, *Flourensia thurifera*, *Pleocarphus revolutus*, *Senna cumingii*, and *Haplopappus parvifolius*) were planted in the field under six treatment combinations: three light environments (low, intermediate and high radiation) and two water levels (natural rainfall, and natural rainfall plus 100 mm irrigation). We quantified seedling survival for each species during 22 weeks, estimated relative growth rate (RGR), and examined how light and water affect whole-plant responses, particularly specific leaf area, leaf-mass ratio, leaf area/root surface and root/shoot ratio. We found species-specific differences in the temporal pattern of mortality. Survival of *C. chilensis* did not vary with respect to the water or light treatments. Survival in the other species responded to changes in water, light or their interactive effects. Considering the response of all species pooled together, treatment combinations of low water with both high- and low-light negatively impacted overall seedling survival. RGR was higher in low light conditions only in *C. chilensis* and *P. revolutus*. Light and water treatments affected specific leaf area and Leaf area/root surface ratio in four species, and leaf-mass ratio in two species. Biomass allocation was independent of light and water for all species except *F. thurifera*, which showed an increase in root biomass in treatments with natural rainfall only. Water and light affected seedling survival in all but one of the species considered. Overall, however, we did not find evidence to support a tradeoff between drought and shade tolerance.

Wind, Wings, and Wilderness—decision support for minimizing ecological impacts in the southern Sierra and Tehachapis

Stallcup, Jerre Ann, Antenen, Susan, Spencer, Wayne D., Staus, Nancy L., Anderson, Allison, and Strittholt, James R.
Conservation Biology Institute, Corvallis, OR, USA

Developing low-carbon renewable energy is a national and state priority, and the Tehachapi Wind Resource Area has been identified as *the* priority area for achieving the State of California's 33% renewable energy goal by 2020. Currently, wind projects are evaluated on a project-by-project basis, without regard to direct and indirect impacts at a regional scale. However, new federal guidelines recommend landscape-scale screening as the first step in a tiered approach to evaluating potential cumulative effects on landscape connectivity and population-scale impacts to both terrestrial and volant wildlife species. The Conservation Biology Institute is working with managers of public lands in this region to develop a science-based planning framework that will facilitate decision-making on siting and operation of wind energy facilities on a landscape scale. I will present our approach for developing a spatially-explicit and transparent decision-support tool, using the Ecosystem Management Decision Support system, to characterize the regional ecological significance of different parts of the study area, thus allowing us to map areas where wind energy development presents low, medium, and high potential for conflict with vulnerable species and habitats. CBI will also develop a spatially explicit web-based tool that will allow users to analyze potential impacts of development footprints (e.g., new wind farms and associated infrastructure) on mapped conservation values. The objectives of the project are to (1) work with public land managers and state and federal permitting agencies to develop a science-based regional conservation strategy for increasing wind-energy development compatibility with the conservation of vulnerable species and ecological values, and (2) institute more transparent and coherent criteria and approaches for review and permitting of wind energy applications, as well as conservation of areas and ecosystem functions critical to long-term ecological resilience.

Exploring Collaborative LARGE Landscape Conservation Linkages In The Mediterranean Ecosystem of Southern California: National Park Service Special Resource Studies

Steigerwald, Margie, Dove, Anne M. and Butler, Barbara
National Park Service, Pacific West Regional Office, Park Planning and Environmental Compliance, 401 W. Hillcrest Dr., Thousand Oaks, CA, 91360.

Throughout the nearly 100-year history of the agency, the National Park Service system has grown to include 394 national parks, monuments, battlefields, recreation areas and other designated units. Over time, these units have been added to the system through a variety of ways and for a variety of reasons. In the National Park System General Authorities Act of 1970, Congress declared that areas comprising the national park system are cumulative expressions of a single national heritage. As such, potential additions to the national park system should contribute in their own special way to a system that fully represents the broad spectrum of natural and cultural resources that characterize our nation. The 1998 National Parks Omnibus Management Act established a new process for identifying and authorizing studies of new units. From this legislation, the "Special Resource Study" process emerged, establishing specific criteria for evaluating and recommending new additions to the national park system. In southern California, two special resource studies are currently underway including the San Gabriel Watershed and Mountains Special Resource Study and the Rim of the Valley Corridor Special Resource Study. Both of these studies focus on landscape scale linkages that may help conserve the flora and fauna of Southern California, one of the global "hotspots" of Mediterranean ecosystem biodiversity." The studies will also make recommendations for improving recreational access to parks for one of the world's most densely populated communities, Los Angeles.

Jeffrey pine-mixed conifer forests in the Sierra San Pedro Martir: Example of forests with high resiliency

Stephens, Scott, L.[1], Fry, Danny [1], and Collins, Brandon [2]
[1]*Department of Environmental Science, Policy, and Management, 130 Mulford Hall, UC Berkeley, Berkeley, CA. 94720-3114 USA.*
[2]*USFS Pacific Southwest Research Center, Davis CA. 95616, USA.*

Knowledge of the ecological effect of wildfire is important to resource managers, especially from forests in which past anthropogenic influences, e.g., fire suppression and timber harvesting, have been limited. Changes to forest structure and regeneration patterns were documented in a relatively unique old-growth Jeffrey pine-mixed conifer forest in northwestern Mexico with a Mediterranean climate after wildfire. This forested area has never been harvested and fire suppression did not begin until the 1970s. Fire effects were moderate especially considering that the wildfire occurred at the end of a severe, multi-year (1999-2003) drought that killed millions of trees in similar forests in Southern California, USA. Shrub consumption was an important factor in tree mortality and the dominance of Jeffrey pine increased after fire. The Baja California wildfire enhanced or maintained a patchy forest structure; similar spatial heterogeneity should be included in US forest restoration plans. Most US forest restoration plans include thinning from below to separate tree crowns and attain a narrow range for residual basal area/ha but this is changing especially in the Sierra Nevada. Homogeneous restoration goals essentially produces uniform forest conditions over broad areas that are in strong contrast to the resilient forests in northern Baja California. In addition to producing more spatial heterogeneity in restoration plans of forests that once experienced frequent, low-moderate intensity fire regimes, increased use of US wildfire management options such as managed wildfire could also be implemented at broader spatial scales to increase the amount of burning since the current area burned in California ecosystems is approximately 6% of what burned pre 1800.

Ecological risk assessment of Butrinti Lagoon ecosystem in Albania

Sulce, Sulejman[1], Bani, Aida and Malltezi, Jamarber[1, 2]
[1]*Agricultural University of Tirana, Faculty of Agriculture and Environment, Koder Kamez, Tirana, Albania.*
[4]*Albanian University, School of Architecture and Urban Planning, Tirana, Albania.*

The research activity carried on the Butrint Lagoon highlights the crucial role played by agricultural activities, urban pressure and fishing management in assessing of significant water quality pollutants and sea food safety. This study characterize typical exposure profiles for aquatic resources to physical constituents, macronutrients and heavy metals in the different pools of ecosystem (soil, sediment, water and mussels) during four seasons through seven sampling stations (SS) at the Butrint Lagoon. Results show that the average values of DIN in the water were characterized by mean values found in other Mediterranean lagoon with the maxima in August (8.32 ± 3.30 µmol) and the lowest in May (5.42 ± 2.09 µmol). The maximal values correspond to SS4 and SS6 and are considered as high "eutrophication risk", while the values of DIN forms were NO^{3-} >NH^{+}>$NO2^{-}$. The average values of P-PO_4^{3-} were in same trend as DIN. At SS4, SS5 and SS6 the ratio N:P was >16 and in this case P was the limiting factor while at the other stations N was the limiting factor. According the chemical parameters the lagoon water was in most part oligotrophic, but deemed mesotrophic at SS6 and SS6 (during August and November) and at SS2 and SS4 (August only). Ca, Cr and Cu were lower than the European guidelines, while Hg and Pb were highest than limits in several SS in the bottom layer. The content of Pb and Cu in the sediment correlate with content in the mussels ($r=0.504$, $p<0.05$ and $r=0.88$, $p<0.05$, respectively) while the other not. E. coli at SS6 in November was at higher levels than that defined by EU (330 MNP/100g), while at SS6 in August this value was near the limit (280 MNP/100g), whereas at the other stations the values were <200 MNP/200g. *Salmonella spp.* were not detected on 25 g (according to EU Regulation). In mussels *E. coli* was in lower concentrations than the EU limits in all other stations and periods. The bio toxins were not detected in either case. It seems that *E. Coli*, Cd, Hg, Pb and N are main contributors to ecological concerns in Lagoon water quality and consequently on mussels quality. The most important identified contributors that affect negatively the water and mussels quality are: waste water of Ksamil village (at SS6), the hydro-pumping station (SS7), declined lands of Bufi Lake (SS4) and sediments, especially at SS5, SS6 and SS7.

Ecology and Susceptibility of California's Bar-Built Estuaries to Eutrophication

Sutula, Martha[1] and McLaughlin, Karen[1]
[1]*Southern California Coastal Water Research Project, 3535 Harbor Blvd, Suite 110, Costa Mesa CA 92626, USA.*

Estuaries, found at the terminus of coastal watersheds, among the most biologically productive aquatic habitats on earth, supporting a large number of aquatic and terrestrial species. In California, a region with a Mediterranean climate, ninety percent of the estuaries are within a class called "bar-built"—those experience seasonal restriction and/or closure at the ocean inlet due to seasonally low freshwater flow and an energetic wave environment that builds a sand bar at the inlet. Urbanization of coastal watersheds in Mediterranean climates have greatly altered the timing and quantity of freshwater flows and increased nutrient loads to estuaries, particularly during the dry season, causing eutrophication. The response of bar-built estuaries to nutrient loading is highly variable, in part due to differences in geomorphology, hydrology and the biological communities that mitigate the ecosystem response to nutrient overenrichment. This talk will describe the defining hydrogeomorphic and ecological characteristics of bar-built estuaries, the factors that influence their susceptibility to eutrophication, and discuss options for management and restoration.

How evergreen are riparian species in the Western Cape of South Africa?: A comparison of leaf traits across a moisture gradient

Swift, Cheryl.[1], Hollis, Lovvet.[1], Rempen, Eric.[1], Jacobs, Shayne.[2]
[1]Department of Biology, Whittier College, Whittier, CA, USA. [2]Department of Conservation Ecology and Entomology, University of Stellenbosch, Stellenbosch, South Africa.

Rainfall patterns typical of Mediterranean type ecosystems present a unique set of problems for woody species along streams. High water availability in the spring and early summer creates conditions favoring a "competitor strategy" selecting for traits such as rapid growth and efficient exploitation of resources. However, summer drought often contributes to greatly reduced streamflow in the late summer and fall. These conditions would favor a "stress tolerant strategy" selecting for traits such as slow growth rates and long lived leaves in order to make the most of limited water availability during highest evaporative demand. Riparian ecosystems in the Western Cape of South Africa differ from California in that the dominant woody species are evergreen, not deciduous. Evergreen and deciduous trees have distinctly different properties which would make them seem fit for different strategies; evergreen species are more typical of a stress tolerant strategy. Our study compared a number of leaf traits of five different species typical of riparian habitats in the Western Cape of South Africa across three different locations with different water availabilities. We hypothesized that the evergreens in locations with higher water availabilities, individuals would have traits more similar to deciduous trees. In locations with lower water availability, traits would be more similar to evergreen species. Leaf specific mass was significantly lower for individuals of Brabejum stellatifolium in locations with higher water availability; however there was no significant difference in maximum photosynthetic rates across locations or species overall. Two of the species, Meterosideros angustifolia and Brachyleana nerifolia had lower LSM than co-occurring B. stellatifolium in the locations with higher water availability. These results suggests that leaf traits of evergreen species typical of riparian habitats in the Western Cape represent a mix of adaptations to stress and competition and are distributed along a evergreen-deciduous continuum.

Land use planning to reduce wildfire risk in southern California

Syphard, Alexandra D.[1], Keeley, Jon E.[2,3], Bar Massada, Avi[4], Brennan, Teresa J.[2], Radeloff, Volker C.[4]

[1] *Conservation Biology Institute, 10423 Sierra Vista Avenue, La Mesa, CA, 91941,USA.*
[2] *U S. Geological Survey, Western Ecological Research Center, Sequoia-Kings Canyon Field Station, 47050 Generals Hwy Three Rivers, CA 93271, USA.*
[3] *Department of Ecology & Evolutionary Biology, University of California, Los Angeles, USA.*
[4] *Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, 1630 Linden Drive, Madison, Wisconsin, 53706, USA.*

Wildfires are an important ecological process in Mediterranean-climate ecosystems, but they also present a hazard to people living in the wildland-urban interface (WUI). In southern California, a Mediterranean-climate region with one of the largest areas of WUI in the US, nearly 10000 structures were destroyed or damaged by wildfires since 2000. The primary strategy to alleviate this hazard has been wildland fuel reduction, with some recent attention focused on house characteristics and homeowner responsibility. Although large numbers of homes are constructed in the most hazardous areas of the landscape, land use planning has been largely overlooked as a potential strategy to reduce wildfire risk. To assess the extent to which housing pattern and location contribute to structure loss in southern California, we developed and analyzed an extensive geographic dataset of structure locations, including more than 5500 that were destroyed or damaged by wildfire since 2001. We also modeled and mapped fire risk as a function of explanatory variables that included housing pattern and location. The pattern and location of structures strongly affected their susceptibility to wildfire, and structure loss was highest when structures were at low to intermediate densities, surrounded by wildland vegetation, and in small, isolated neighborhoods. Structure location relative to the coast and historic fire patterns were also significant influences. The strong importance of housing pattern and location suggest that land use planning may be an important avenue for reducing future wildfire risk in the WUI. We are currently evaluating future development scenarios to identify land use planning decisions that provide the optimal potential for reducing future fire risk.

Fire Hazard Analysis: Modeling the Santa Ana "Devil Winds," Extreme Wildfire Behavior, and the Geography of Disaster in Southern California

Taylor, Robert S.
U. S. National Park Service- Santa Monica Mountains National Recreation Area, 401 W. Hillcrest Dr., Thousand Oaks CA 91360, USA.

The Santa Monica Mountains National Recreation Area (SAMO) is 153,000 acres (62,000 hectares) of a complex intermix of public parkland, private residential development, and private open space not yet developed. Including adjacent buffers, the National Park Service works to preserve natural resources on 220,000 acres (89,000 hectares).

Our native vegetation is naturally very flammable in the dry season. Every fall, Santa Ana Winds (foehn winds) blowing through southern California's shrubland canyons predictably create infamously dangerous wildfire conditions. Native plant communities are well adapted to surviving the firestorms that have periodically swept this landscape for millennia. But the exurban human communities now sprawled across that same landscape are quite vulnerable to disastrous loss of property and life from wildfire and they are also an ongoing source of fire starts. Much of our modern landscape is over-burned relative to its apparent prehistoric condition. Frequent large wildfires pose ongoing threats to ecological sustainability and public safety.

Historically, fuel treatment (vegetation clearing) projects have been implemented by various county and city fire departments with little coordination or planning. The fire safety benefits of native vegetation/ fuel treatments are typically short-lived, but they cause long-term resource damage. They are also expensive. Thus it is important to limit their size and place them only in the very most effective locations. SAMO has conducted a systematic, science-based analysis to characterize fire hazard across the landscape and determine where the best opportunities to limit fire spread exist.

Santa Ana winds channeled by terrain strongly determine the behavior all our large fires. Modeling Santa Ana wind patterns across this landscape at a fine spatial scale allows NPS to model fire behavior and fire hazard more realistically,. Results of our analyses support our fire and resource management programs, and produce visually striking products for use in fire education programs.

Citizen Science Can Be a Tool for Defensible Results

Teel, Susan[1], Schallert, Kevin [1], and de Roulhac, Nicholas[1]
[1] *Affiliation 1 (Southern California Research Learning Center National Park Service, Thousand Oaks, CA USA.*

Skeptics question the benefits associated with the use data collected by citizen scientists and dismiss the quality of data collected by people not professional trained in the sciences. National Park Service (NPS) managers have been hesitant to include data collected by citizen scientists when defensible results are necessary. Concerns about the population abundance of the northern island loggerhead shrike on Santa Cruz and Santa Rosa Islands provoked a multi-agency research team to struggle with concerns and questions regarding the value of citizen science. Lessons learned from this study reveal that contributions of citizen scientists are both scientifically valuable and the data collected can be as accurate as conventional methods. This paper discusses a replicable model to mitigate traditional concerns with citizen science while maximizing the benefit of citizen science in research studies.

Post-fire Photosynthetic Plasticity Differs Between Obligate and Facultative Sprouting Species of Californian Chaparral

Tobin, Michael F.[1], De Guzman, Mark E.[2], Jacobsen, Anna L.[1], and Pratt, R. Brandon[1]
[1]*California State University, Bakersfield, 9001 Stockdale Highway, Bakersfield, CA 93311 USA.*
[2]*University of California, Riverside, 900 University Avenue, Riverside, CA 92521 USA.*

Chaparral shrubs can suffer complete crown death during periodic wildfires in southern California. To reestablish in burned areas, chaparral shrubs can recruit seedlings from a fire-cued seed bank or sprout from a lignotuber (root crown). Among sprouting species, seedlings of obligate sprouting (OS) species do not recruit in burned areas, whereas seedlings of facultative sprouting (FS) species do recruit into these areas. We investigated how maximum photosynthetic rates (A_{max}) in resprouting plants changes in response to the dramatic shifts in plant root:shoot ratio and concomitant increases in water and nutrient resource availability that follow wildfire. We hypothesized that resprouting plants would have higher A_{max} than unburned plants, especially during periods of seasonally low precipitation. Increased A_{max} could allow resprouting plants to increase carbon assimilation during post-fire resource pulses. Further, we hypothesized increases in A_{max} would be greater in OS than FS species. To address these hypotheses, we monitored A_{max} of chaparral plants at a recently burned site. Four months after fire, near the end of the winter wet season, resprouts of four OS and four FS species generally had higher A_{max} than unburned plants. During the summer dry season, A_{max} declined modestly in resprouts but declined substantially in unburned plants, concordant with pre-dawn water potentials. Among resprouts, the A_{max} of OS species declined less than FS species during the dry season, but the decline in A_{max} did not differ among OS and FS species for unburned plants. Changes in resprout A_{max} were mirrored by smaller declines in pre-dawn water potential for OS than FS species. Maximum photosynthetic rate is one of a suite of functional traits that shift after fire in resprouting plants. Increased A_{max} may enable resprouts to exploit post-fire resource pulses, with the greater increase in OS resprouts potentially enhancing their success relative to resprouts of FS species.

Animal movement in response to landscape features: A finite mixture modeling approach

Tracey, Jeff[1], Zhu, Jun[2,3], Boydston, Erin[4], Lyren, Lisa[5], Fisher, Robert[1], and Crooks, Kevin[6]

[1]US Geological Survey, Western Ecological Research Center, San Diego, California, USA; [2]Department of Statistics, University of Wisconsin, Madison, Wisconsin, USA; [3]Department of Entomology, University of Wisconsin, Madison, Wisconsin, USA; [4]US Geological Survey, Western Ecological Research Center, Thousand Oaks, California,
USA; [5]US Geological Survey, Western Ecological Research Center, Carlsbad, California, USA;
[6]Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, Colorado, USA.

Movement of animals in landscapes is an important subject in ecology and conservation biology, yet few models exist for analyzing such data. In this paper we present models of individual animal movement in relation to an object or field in a landscape. We take a finite mixture modeling approach in which the component densities are conceptually related to different choices for movement response to a landscape feature, and the mixing proportions are related to the probability of selecting each response as a function of one or more covariates. We employ particle swarm optimization (PSO) followed by an EM algorithm to obtain maximum likelihood estimates of the model parameters. We provide examples in which we analyze simulated data and observed data for movement of three bobcats ({\it Lynx rufus}) in relation to urban areas in southern California, USA. For the bobcat examples, a behavioral interpretation of the model results shows that the bobcats avoid urban areas by moving toward less urban areas as the proportion of urban land cover in the surrounding area increases. Such analysis is important in the fields of behavioral ecology, landscape ecology, conservation biology, wildlife epidemiology, and wildlife demography.

Understory species play a dominant role determining changes in ecosystem carbon source/sink strength in a cork-oak woodland (montado)

Unger, Stephan[1], Pereira, João S.[2], Máguas, Cristina[3], Soares David, Teresa[4], Aires, Luis M.[5] and Werner, Christiane[1]

[1]*Exp. and System Ecology, University of Bielefeld, Universitätstr. 25, 33615 Bielefeld, Germany;* [2]*ISA, Technical University of Lisbon, Tapada da Ajuda, 1349-017 Lisbon, Portugal;* [3]*CBA, University of Lisbon, Campo Grande, C2, 5ª, 1749-016 Lisbon, Portugal;* [4]*Estação Florestal Nacional, Oeiras, Portugal;* [5]*Departamento de Ambiente e Ordenamento, Universidade de Aveiro, Portugal; e-mail: stephan.unger@uni-bielefeld.de*

Net carbon flux partitioning was used to disentangle abiotic and biotic drivers of all important component fluxes influencing the overall sink strength of a Portuguese montado during a spring to summer transition. We analyzed how seasonal drought affected ecosystem assimilation and respiration fluxes in this evergreen cork-oak woodland and attributed variations in the component fluxes (trees, understory, soil microorganisms and roots) to observations at the ecosystem scale. We observed a two thirds decrease in both ecosystem carbon assimilation and respiration (R_{eco}) within only 15 days time. The impact of decreasing R_{eco} on the ecosystem carbon balance was smaller than the impact of decreasing primary productivity. Flux partitioning of GPP and R_{eco} into their component fluxes from trees, understory, soil microorganisms and roots showed that declining ecosystem sink strength was due to a large drought- and temperature-induced decrease in understory carbon uptake (from 56 to 21 %). Hence, the shallow-rooted annuals mainly composing the understory exert an unexpectedly large impact on the source/sink strength of this open evergreen oak woodland during spring to summer transition. Thus timing of the onset of drought might have a large effect on the annual carbon budget. In response to seasonal drought R_{eco} was increasingly dominated by respiration of heterotrophic soil microorganisms, while the rhizosphere flux was found to be of minor importance. Soil respiration decreased with drought but its contribution to total daily CO_2-exchange increased by 11.5%. This partitioning approach disentangles changes in respiratory and photosynthetic ecosystem fluxes that are not apparent from the eddy covariance or the soil respiration data alone. By the combination of understory vs. overstory carbon flux partitioning with soil respiration data, we gained a detailed understanding of drought-induced processes controlling net carbon exchange of cork-oak woodlands, which might become increasingly important under the viewpoint of global climate change.

Characterizing vegetation accumulation patterns in a chronosequence of San Diego chaparral vegetation

Uyeda, Kellie and Stow, Douglas
Department of Geography, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182

The short term vegetation recovery of chaparral following a fire is fairly well understood, but the long term recovery is more difficult to study and appears to be more complex. In this project, we examined Moderate Resolution Imaging Spectroradiometer (MODIS) satellite imagery using a combination of chronosequence and time series approaches to study the long term patterns of post fire recovery in San Diego chaparral. We generated a chronosequence by organizing the data into areas that had most recently burned each year from 1919 - 2007, and tracked the average Normalized Difference Vegetation Index (NDVI) of each of these areas for each growing season from 2000 through 2010. For each area and each growing season, we calculated several metrics of seasonal and total growth. Older groups of chaparral tended to have lower metrics of seasonal growth, but higher metrics of total vegetation levels. This indicates that as stands of chaparral age, they add less new growth in each growing season, but maintain higher overall vegetation levels compared to younger stands of chaparral.

Postfire restoration in Spain

Vallejo, V. Ramon
CEAM, Valencia, Spain.

Spain has been conducting large afforestation programs since more than a century, especially for watershed protection. Large forest fires started to occur in the late 1970s, and the routine approach for postfire restoration was planting pines and building check dams, according to the prevailing forest management practices at those times. Increasing short-interval recurrent wildfires have threatened the persistence of pine plantations. Along the last two decades, postfire restoration practices have been increasingly diversified, both in the number of plant species used in plantations and in the type of actions carried out. Short-term rehabilitation measures to control postfire erosion and runoff at the hillslope scale are becoming common practices, mostly using charred wood to construct log dams and contour branch barriers. Actual restoration practices are very much dependent on the media impact of a given fire, which is related to fire size and social damages, and public budget availability. Trying to provide a comprehensive strategy for postfire restoration, we are developing and testing a new protocol that includes the basic scientific knowledge provided by fire and restoration ecology during the last decades. For regional planning, fire-vulnerable forests and shrublands are identified according to vegetation resilience and postfire erosion risk, using a GIS-based approach. Vegetation resilience is assessed on the basis of fire regeneration strategies of dominant plant species. At the management scale, the need of short-term emergency actions is assessed according to field surveys of fire severity, vegetation resilience and erosion risk. Vulnerable areas deserving emergency actions are those predicted to have low plant cover regeneration rate and high erosion risk. Medium and long-term actions are planned according to the specific management objectives for the burned area, and the prediction of long-term ecosystem recovery. These actions may include regeneration reinforcement, (re) introduction of tree or shrubby species, and fire-prevention measures.

Restoration Project at Isla Guadalupe, Mexico

Valles-Pérez, Miguel[1], Olivares-Bañuelos Nadia Citlali[1], and Tapia-Cruz Martín[2]
[1] *Reserva de la Biosfera Isla Guadalupe, Comisión Nacional de Áreas Naturales Protegidas. Av. del Puerto No. 375 local 30, C.P. 22880Ensenada, Baja California, México*
[2] *Jefe del Departamento de Suelos de la Comisión Nacional Forestal (CONAFOR), Avenida Reforma Sn, Centro, 21000 Mexicali, Baja California*

Restoration is without a doubt the most demanding effort on any field; when related to restoration near pristine conditions of ecosystems, it implies greater efforts in terms of manpower, material and expenses. This specific process in Guadalupe Island results even more complex due to the state of degradation in which the island ecosystems are found as a result of 150 years of exotic species of flora and fauna, and human activities that lead all ecosystems to a point where is nearly impossible to restore them to their original condition. However, as the institution in charge of conserving Mexico's natural resources, CONANP has continued with mitigation and restoration measures achieving coordination with other institutions of the Mexican Government such as CONAFOR. Within these measures are: the restoration of 550 hectares using *in situ* production of four of the main tree species at the Reserve (*Pinus radiata* var. *binata, Calliptrosis guadalupensis, Brahea edullis y Juniperus califórnica*); building infrastructure to preserve and save fresh water, building and enabling of a forest nursery, implementing different reforestation techniques, infrastructure to avoid soil erosion, fuel material management, etc. Furthermore, restoration of island ecosystems also involves generating knowledge and complex operation due to the remote location of the Reserve.

Fire Regimes and Ecology in Transitional Woodlands and Shrublands of Semi-arid, Mediterranean South-West Australia

van Etten, Eddie J.B.[1], Stock, William D.[1], Knuckey, Christopher[1] and Dalgleish, Sarah [1]
[1]*Centre for Ecosystem Management, Edith Cowan University, Perth, Australia.*

This paper summarises recently completed and on-going research aimed at understanding the ecological role of fire in vegetation of the transitional climatic zone between the Mediterranean south-western corner of Australia and the arid interior. Studies are focussed on two areas in this zone: 1) near coastal (Kalbarri); and 2) inland (Yalgoo). The vegetation of both areas is predominately eucalypt woodland on heavier soils and mixed species shrublands on sandplains. This transition is of interest for fire ecology research because: 1) it experiences large-scale wildfires yet we know little about the impact of such fires; 2) appropriate management actions remain uncertain; 3) the area comprises intact landscapes of high conservation value; and 4) it is hypothesised that the biota will show intermediate fire adaptations and responses between those typically found in drier and wetter climates either side of the transitional zone. Spatial analyses of fire scars detected using remote sensing show strong associations between fire occurrence and vegetation/landform type for both areas. Although the number of fires per year is negatively correlated with rainfall and is generally is increasing, area burnt does not appear to be changing, with very large fires occurring every 30-40 years. Land tenure was associated with fire regime in the Kalbarri area which reflects the influence of fire management. Field studies in the sandplain shrublands of the Yalgoo area using a space-for-time approach did not reveal a time since fire effect on fuel levels and plant species richness/composition apart from an immediate post-fire influence (i.e. first 5-10 years). Edaphic factors, particularly depth of soil, appear to have a greater effect on species composition and rates of vegetation/fuel recovery than fire regime. Vegetation is dominated by ‘seeders’ with few examples of fire-dependant species (eg fire cued seed germination or dispersal); this is indicative of adaptations more typically found in lower rainfall, drought-prone regions.

Can climate change increase fire severity independent of fire intensity in Mediterranean forests?

van Mantgem, Phillip J.[1], Nesmith, Jonathan C. [1,2], Keifer, MaryBeth[3], Klinger, Robert[4], and Knapp, Eric[5].
[1]*USGS, Redwood Field Station, Arcata, CA U.S.A.,* [2]*University of California, Berkeley, CA U.S.A,*
[3]*National Park Service, Boise, ID, U.S.A.,* [4]*USGS,* Yosemite Field Station, Bishop, CA, U.S.A., 5*USFS, Pacific Southwest Research Station, Redding, CA, U.S.A.*

There is a growing realization that regional warming may be linked to increasing fire size and frequency in Mediterranean forests, a trend occurring in concert with increased fuel loads in forests that historically experienced frequent surface fires. Recent studies have also suggested that warming temperatures are correlated with increased fire severity (post-fire tree mortality). The mechanism whereby fire severity might increase in response to warming is presumed to be increasing probabilities of severe fire weather (higher air temperature, lower relative humidity and fuel moisture). While likely true, this view discounts the biological context of the fire event. Here we present evidence that trees subject to environmental stress are more sensitive to subsequent fire damage. Tree growth records, used as an index of health for individuals, show that for two tree species in the Sierra Nevada of California that poor growth leads to increased probabilities of mortality following fire. Plot-based fire monitoring databases from across the western United States of America also demonstrate that indices of drought stress are strongly predictive of post-fire tree survivorship. In sum, these results suggest that recent climatic trends may lead to a *de facto* increase in fire severity, even when there is no change in fire intensity.

Influence of summer marine fog and low cloud stratus on water relations of evergreen woody shrubs (*Arctostaphylos*: Ericaceae) in the chaparral of central California

Vasey, Michael C[1,2], Loik, Michael E.[1], Parker, V. Thomas[2], Shuldman, Michal[3]
1Department of Environmental Studies, University of California Santa Cruz, Santa Cruz, CA; [2]Department of Biology, San Francisco State University, San Francisco, CA; [3]Department of Integrative Biology, University of California Berkeley, Berkeley, CA.

The summer dry season in California is moderated by a persistent layer of fog and low cloud cover along the Pacific coast. Evergreen sclerophyll shrubs, such as *Arctostaphylos* species in the chaparral of central California, are predicted to be influenced by an associated summer coast-to-interior climate gradient. It follows that lowland coastal (maritime) shrubs should have less negative midday water potentials (Ψ_{min}) than upland coastal shrubs (transition) and inland shrubs (interior), stable isotope ($\delta^{13}C$) values should suggest greater water use efficiency (WUE) in the interior, and xylem vulnerability to cavitation should be greater along the coast than the interior. Facultative resprouters are predicted to have less negative Ψ_{min} than coexisting obligate seeders in the same microhabitats. We found that maritime shrubs did have significantly less negative Ψ_{min} than transition and interior shrubs. This relationship is consistent over broad temporal and spatial scales. Coexisting seeders did have significantly more negative Ψ_{min} values in transition and interior habitats than resprouters but not in maritime habitats. Abiotic microclimate data demonstrate that maritime habitats have more favorable water availability conditions than transition and interior chaparral habitats. WUE data were generally consistent with Ψ_{min} data. Maritime seeders are more vulnerable to xylem cavitation than transition and interior seeders but this relationship does not hold for resprouters. Stable isotope ratios of $\delta^{18}O$ in stem water demonstrate that a local endemic *Arctostaphylos* seeder obtains up to 100% of its water from fog during the late dry season. Maritime chaparral in California is recognized as a community with high levels of local endemism. Because rare *Arctostaphylos* seeders in maritime chaparral are more vulnerable to xylem cavitation than interior seeders, the potential deterioration of the summer marine layer in central California is of conservation concern relative to these shrubs and possibly other sensitive species that occur in this habitat.

Biodiversity Conservation in Working Landscapes of the New World Mediterranean: Lessons from the Winelands

Viers, Joshua H. [1*]
[1]*Department of Environmental Science & Policy, University of California, Davis, 1 Shields Ave. Davis, CA 95616, USA*
*jhviers@ucdavis.edu

Wine is a high value product whose identity and success are closely linked to geography and environment, particularly in the Mediterranean biome. Places like Stellenbosch, Napa and Maipo are recognized for their reputation of providing the ideal climatic and edaphic conditions that produce both high quality wines and biological endemism. Given this connection to place, there is an opportunity to involve vineyards in addressing conservation issues related to the habitat that gives these landscapes their character. However, there is collective recognition that vineyard conversion is a major threat to Mediterranean ecosystems, but also that within the winegrowing economic sector there is a willingness to effect positive change in practice. While sustainable vineyard development and management approaches are becoming increasingly prevalent, the benchmarks of sustainability, however, remain unclear and are generally lacking in scientific basis. As a result, there is a need for the synthesis of best practices for biodiversity conservation in working landscapes, using collective experiences from working in vineyard landscapes or "winelands". This approach is intended to identify and improve landscape-scale vineyard design and management practices with an eye towards safeguarding biodiversity. Pressing issues like balancing the water demands of industry and biodiversity, or anticipating the implications of climate change, will require partnerships between growers and scientists. Such engagement can come from the conservation community, but it will also require borrowing from practices used in other sectors. It will require land owners to make difficult decisions about land and water uses; and it will require consumers to embrace and support growers who invest in these approaches. If these actions come together, vineyard landscapes have the potential to be a sustainable mosaic with common agroecological objectives, and the wine industry, with its socioeconomic standing and geographic identity, will be a promising steward for effective habitat protection in the Mediterranean biome.

Fire regimes for refugia in Mediterranean-climate south-western Australia during anthropogenic climate change

Wardell-Johnson, Grant,[1] and Burrows, Neil[2]
[1]*Curtin Institute for Biodiversity and Climate, Curtin University; GPO Box U1987, Perth Western Australia;* [2]*Department of Environment and Conservation, 17 Dick Perry Avenue, Kensington, Western Australia.*

Refugia are habitats that components of the biota retreat to, persist in and can potentially expand from, under changing environmental conditions. In fire-prone environments such as south-western Australia, natural barriers to recurrent bushfires have led to the formation of fire refugia − habitats that burn less frequently than the surrounding environment. Dryer and warmer conditions in the region make more of the landscape flammable for longer, increasing the likelihood of large and erratic bushfires, so dismantling the natural barriers to fire spread. We consider two case studies of low disturbance-frequency refugia in this region where the integrity and functioning of fire refugia is threatened. The organic-rich swamps, granite outcrops and tingle forests are fire refugia in a matrix of more fire resilient jarrah forest in the high rainfall zone. Resilient shrubland occurs within a matrix of granite outcrop fire refugia and fire-frequency sensitive woodland in lower rainfall zones. We ask: what are the fire management options to protect the intrinsic values of these refugia under inexorable climate change, and what is the likelihood of success? Planned burning will continue to play a role in managing these refugial assets under climate change. We outline developments in fire management policy, planning and science that aim to protect south-western Australian fire-refugia. Mosaic or patch burning during winter/spring in the fire-prone and resilient habitats in which the south-western Australian refugia are embedded minimises the frequency of fire in refugial habitat. Management priority, including fire management, is towards avoidance of regimes that mimic prevailing drying and warming conditions in these refugia. In addition to assisting fire suppression in all but extreme weather, recently burnt areas maintain heterogeneity and can afford some protection under mild or moderate conditions when most fires occur. Continued warming and drying threatens these ecosystems, regardless of the best fire management intentions.

Different strategies of an exotic invasive species and mediterranean functional types impact ecosystem carbon and water cycling

Werner, Christiane
Experimental and Systems Ecology, University of Bielefeld, Universitätstr. 25, 33615 Bielefeld, Germany; e-mail: c.werner@uni-bielefeld.de

Mediterranean species can be grouped into different functional types regarding their ecophysiological strategies to cope with fluctuating resources and environmental stresses. Leaf stable carbon isotope discrimination ($\Delta^{13}C$) provided an effective ecological tracer in a diverse Portuguese macchia, allowing clear distinction between drought semi-deciduous malacophylls, evergreen sclerophylls and gymnosperms. Across all studied species, $\Delta^{13}C$ was highly correlated to phenology (length of growing period) and leaf structure (leaf mass and N per area), but weakly to water potentials, thus integrating structural, functional and phenological attributes (Werner & Máguas 2010). Evergreen sclerophylls are particularly well adapted to drought by low resource use under limiting conditions. However, a non-native resource-demanding acacia successfully invades water-limited sand dune systems. This drought-susceptible N-fixer follows a water spender strategy. Labeling experiments indicated that drought adaptations of the native species did not provide a competitive advantage under water limiting conditions, but that their low resource utilization benefited *Acacia longifolia*. Under natural conditions the acacia understory markedly altered ecosystem functioning: *A. longifolia* contributed significantly to transpiration in invaded pine forest (up to 42%) and both water use and carbon assimilation rates were significantly reduced in a invaded compared to non-invaded *Pinus pinaster* stands (Rascher et al. 2011). Hence, exotic species can have significant impacts on hydrological and carbon cycling in resource-limited semi-arid ecosystems through a repartitioning of water resources between the native and invasive species. Moreover, the introduction of novel traits into a community like high resource use (water spender) and N-fixation can promote invasiveness through changes in the water and nutrient cycle of the invaded system, thereby potentially disrupting the co-evolved interactions within the native plant community. This may have broad implications for the sustainability of Mediterranean dune forests in the future, since water is predicted to be an increasingly limited resource under climate change scenarios.

Werner & Maguas 2010, Funct Plant Biol, 37, 467–477, doi 10.1071/FP09081
Rascher et al. 2011, Ecosystems doi:10.1007/s10021-011-9453-7

Divergent drought responses in the fynbos: results from a climate manipulation

West, Adam [1], February, Edmund [1], Dawson, T.E. [2]
[1] *Botany Department, University of Cape Town, Rondebosch, South Africa;* [2] *Department of Integrative Biology, University of California, Berkeley, Berkeley, CA, USA.*

Drought is an important abiotic driver of vegetation composition. In the fynbos biome (southwestern South Africa), the frequency and intensity of drought is expected to increase due to anthropogenic climate change. The extraordinary biodiversity of this region, particularly in the more mesic West, is thought to be a result of the relatively stable climate since the Pleistocene that aided rapid speciation while limiting extinctions. How sensitive will this flora be to an increase in drought? Trade-offs faced by plants imply that drought resistance should be no greater than necessary for a given environment. Thus, species in climatically stable environments, such as wetter mountain slopes, might have the lowest resilience to an increase in drought. How sensitive is mesic mountain fynbos to an increase in drought? To test this we conducted a multi-year, experimental drought study in mountain fynbos. Using a suite of physiological and morphological measurements, we tested the sensitivity of the key floral elements (proteoids, restioids and ericas) to drought. We hypothesized that rooting depth would be the key determinant of drought sensitivity (proteiods<ericoids<restioids). Contrary to our hypothesis, the shallow-rooted restioid species were largely unaffected by the drought treatments. *Erica* species were most affected, suffering dieback, mortality and reduced reproductive output. Proteoid responses were varied. *Leucadendron laureolum* adults and seedlings were unaffected by drought, but *Diastella divaricata* experienced considerable mortality. Traits most correlated with drought sensitivity were hydraulic strategy (isohydry versus anisohydry), rooting depth, moisture source and growth form. These highly divergent responses to drought, with both considerable sensitivity and resilience being found, suggest a complex response of biodiversity to drought in this system. We interpret these results in the context of hydraulic theory and discuss mechanisms to scale these results up from the plot-level to the region.

Autumn fire risks in coastal southern California conditioned on antecedent climate and Santa Ana wind indices

Westerling, Anthony L.[1], Haiganoush K. Preisler[2], Daniel R. Cayan[3,4]
[1] *Sierra Nevada Research Institute, University of California Merced, Merced, California, USA*
[2] *Pacific Southwest Research Station, USDA Forest Service, Albany, California, USA*
[3] *Scripps Institution of Oceanography, University of California San Diego, La Jolla, California, USA*
[4] *U. S. Geological Survey, La Jolla, California, USA*

Wildfires periodically burn large areas of chaparral and adjacent woodlands in autumn and winter in southern California. These fires often occur in conjunction with Santa Ana weather events, which combine high winds and low humidity, and tend to follow a wet winter rainy season (Westerling et al 2004). Because conditions fostering large fall and winter wildfires in California are the result of large-scale patterns in atmospheric circulation, the same dangerous conditions are likely to occur over a wide area at the same time.

Statistical models have been used to prepare experimental seasonal forecasts at monthly time steps with monthly updates through the summer fire season for coastal southern California on a 1/8-degree grid since 2009 (Preisler et al 2011). These models are driven by antecedent climate observed up through the month preceding the forecast issue date. Because high winds on meteorological timescales play such a prominent role in Autumn wildfire events in coastal southern California, useful extension of these models to cover autumn fire risks in coastal southern California should incorporate scenario analyses, with fire risks explicitly contingent on both antecedent climate and Santa Ana wind forecasts. Here we present a preliminary analysis of autumn fire risks in coastal southern California conditioned on both antecedent climate and experimental Santa Ana wind indices developed at Scripps Institution of Oceanography.

References:

Westerling, A.L., D.R. Cayan, T.J. Brown, B.L. Hall and L.G. Riddle 2004: "Climate, Santa Ana Winds and Autumn Wildfires in Southern California," EOS, 85(31): 289,296.

Preisler, H.K., A.L. Westerling, K. M. Gebert, F. Munoz-Arriola, T. Holmes 2011: "Spatially explicit forecasts of large wildland fire probability and suppression costs for California" International Journal of Wildland Fire, 20, 508-517.

Conservation Management Planning at Tejon Ranch, CA, USA

White, Michael D.
Tejon Ranch Conservancy, PO Box 216, Frazier Park, CA, USA

The 270,000-acre Tejon Ranch was the subject of a conservation and land use agreement that resulted in conservation of up to 90% of the property. The agreement also established the Tejon Ranch Conservancy as the steward of the conserved lands and obligated the Conservancy to prepare an adaptive management plan for these lands. However, our lack of understanding of the diverse ecological systems at Tejon Ranch makes management planning a challenge. We have identified grasslands and oak woodlands as priorities for management and are conducting focused field studies to understand the composition, structure, function, and condition of these communities. These field studies are informing the development of conceptual models that will allow us to formulate resource-specific conservation goals, develop adaptive management hypotheses, and identify key uncertainties that require additional research. For example, the grasslands at Tejon Ranch comprise diverse community types that vary in their suitability for wildlife species of conservation concern. This may lead us to identify certain grassland community types as distinct conservation targets with their own conservation goals. Our grassland conceptual models indicate that some forb-dominated community types would benefit from management that keeps vegetative biomass low, while other community types may not. In some oak woodlands at Tejon Ranch, recruitment rates appear insufficient to offset mortality, and suitable climate envelopes for individual oak species are projected to shift significantly with changing climates. Field studies indicate that the presence of understory shrubs may be increasing sapling recruitment in some oak communities. Our conceptual models of oak woodlands suggest management actions to improve sapling recruitment, such as protection of seedlings from grazers or, potentially, altering cattle grazing or reducing feral pig disturbance to increase understory shrub cover. To maximize long-term benefit, these actions should be focused in areas of stable climate suitability.

The multiple benefits of forest restoration: a case study at Independence Lake in the Sierra Nevada, CA

Winford, Eric [1]
[1] *Geography Graduate Group, University of California, Davis; Davis, CA, USA.*

The 700-acre Independence Lake in the Northern Sierra Nevada lies in a basin surrounded by fire-adapted mixed-conifer forest. The lake contains one of the last wild runs of Lahontan cutthroat trout, a threatened species under the U.S. Endangered Species Act. Efforts to protect the fish's habitat have resulted in projects that provide multiple benefits. In this case study, forest restoration that removed small diameter trees in the forest reduced the potential severity of wildfires which could cause erosion into the lake. The small trees that were removed generated bio-energy, which offset the need for energy from fossil fuels. Due to the high fire return interval typical of Sierra Nevada forests, the reduction in fire severity caused a net increase in carbon sequestered in the forest, helping with efforts to fight climate change.

The Velocity of Change in Fire Management in the Santa Monica Mountains National Recreation Area, California – Is it Fast Enough?

Witter, Marti [1]; Handley, Tim[1]; Elwood, Gregory[1]; and Burkett, Cameron[1]
[1] *Santa Monica Mountains National Recreation Area, Thousand Oaks, CA 91360*

The Santa Monica Mountains National Recreation Area (SMMNRA) is nationally significant because it protects 60,000 ha of rare coastal California Mediterranean ecosystem in one of four "hot spots" for endangered species in the United States. The SMMNRA is a complex mosaic of private and public landholdings that make any kind of resource management coordination difficult, including fire management. Major fires in the SMMNRA occur several times per decade and usually burn in the fall as intense, rapidly spreading wind-driven crown fires. Further, fires often pass through an intermix of homes and wildlands and cause major property losses. From a resource perspective, the SMMNRA is threatened by high fire frequencies and short fire return intervals that in the most extreme cases can result in vegetation type conversion. Over the past 20 years, a paradigm shift in the park's fire management program changed its fire management from prescribed burning in the 1990's to the current emphasis on strategic fuel modification at the wildland-urban interface. Despite the steady progress in better fuels management, formidable obstacles remain to prevent on-the-ground changes to make community wildfire safety more effective while minimizing resource impacts from ineffective practices. We will discuss examples of some of the successes, current obstacles and research affecting implementation of good fire management practices in the SMMNRA - particularly in the context of climate change and future development patterns.

Short Term Monitoring of Tuz Gölü Lagoon and Adjacent Coastal Habitat Complex for Wetland Management / Mediterranean Coast of Turkey

Yilmaz, Kemal T.[1], Kosztolanyi, Andras[2], Alphan, Hakan[1], Akça, Erhan[3], Çevik, Cem[4], Çakan, Halil[5], Ünlükaplan, Yüksel[1], and Kapur, Selim[6]

[1] *Dept. of Landscape Architecture, Çukurova University, Mithat Özhan Blvd, 01330 Adana, Turkey*

[2] *Department of Ethology, Lorand Eötvös University, Pázmány Péter sétány 1/c. H-1117 Budapest, Hungary*

[3] *Vocational School of Adıyaman University, 19 Atatürk Blvd, 02040 Adıyaman, Turkey*

[4] *Dept. of Marine Biology, Çukurova University, Mithat Özhan Blvd, 01330 Adana, Turkey*

[5] *Dept. of Biology, Çukurova University, Mithat Özhan Blvd, 01330 Adana, Turkey*

[6] *Dept. of Soil Science, Çukurova University, Mithat Özhan Blvd, 01330 Adana, Turkey*

Turkey is rich in wetlands, ranking first in this respect among the Middle Eastern and European countries. Almost 75 wetlands are larger than 100 hectares. One of those ecologically important sites namely Çukurova is located in the southeast coast of the Anatolian peninsula, and a wide alluvial coastal plain (7 000 km^2) formed by three rivers; Seyhan, Ceyhan and Berdan. It is reported that 240 bird species and 601 vascular plant taxa were observed along the coastal area between Seyhan Delta and Gulf of Iskenderun where five lagoons appear. The lagoons, which are surrounded by extensive salt marshes and sand dunes, are important breeding sites for various wetland birds. This ecological complex is a key migratory stop-over site in the Mediterranean Basin. The site is a protected area, managed by the Nature Conservation and National Parks General Directorate of Turkish Ministry of Environment and Urbanization. An interdisciplinary research project was conducted to provide data, particularly on spatial distribution of the water surface area and related coastal habitats and the seasonal change of the distribution. The outcomes of this project contributes to the Wetland Management Plan, has been preparing by the authority. The overall objective of the project is to monitor the seasonal changes, occur in the ecosystem complex, by means of suitable methods and indicators. For this aim; temporal or spatial changes on (1) habitat type, (2) lagoon surface area, (3) vegetation and bird species indicators, and (4) soil salinity were monitored. CORINE classification was employed for identification of the habitats, and the evaluation was based on vegetation community indicator. Eleven distinct habitat types were identified and matched with the list of endangered habitats in EU as stated in the annexes of BERN Convention. GIS was used for mapping spatial distribution of the habitats, and habitat map was created.

POSTER

Determining the Mediterranean origins of invasive red brome in California: a preliminary assessment to understanding plant-soil feedbacks

Allen, Edith B.[1], Allen, Michael F.[1], Ellstrand, Norman C.[1], Silvera, Katia[1], Sanders, Andrew[1], Redak, Richard A.[1], McDonald, Chris[2], Bell, Carl E.[2], Aronson, James[3], Baréa, José Miguel[4], Blank, Robert[5], Cristofaro, Massimo[6], Cruz, Christina[7], Manrique, Esteban[4], Gokhan, Serdar[8], Kashefi, Javid[9], Lopez, Alvaro[4], Miranda, Juande[4], Nemli, Yildiz[8], Ochoa-Hueso, Raúl[4], Pérez, Estefania[10], Querejeta, Ignacio[4], Rector, Brian[5], Roldán, Antonio[4], Secmen, Ozcan[8], Sforza, René[9], and Türkseven, Suleyman[8]

[1]*Center for Conservation Biology, University of California, Riverside, CA 92521, USA.*
[2]*University of California Cooperative Extension, Southern California, USA.*
[3]*CNRS-UMR, Montpellier, France.*
[4]*Consejo Superior de Investigaciones Científicas, Spain.*
[5]*USDA-Agricultural Research Service, Reno, NV, USA.*
[6]*ENEA C.R. Casaccia, UTAGRI, Rome, Italy.*
[7]*Dept. Biologia Vegetal, Faculdade de Ciencias de Lisboa, Portugal.*
[8]*Ege University, Izmir, Turkey.*
[9]*European Biological Control Laboratory, France and Greece.*
[10]*Misioneras Concepcionistas, Algeciras, Spain.*

Invasive species from the Mediterranean have transformed California ecosystems by causing vegetation-type conversion of native plant communities, reducing biodiversity, and changing plant-soil feedbacks. We initiated studies of plant-soil feedbacks as a mechanism of invasion for *Bromus rubens* and *B. madritensis* subsp. *rubens* (both known as red brome). These are among the most abundant invasive grasses in undisturbed as well as disturbed southern California native vegetation, but are ruderals in the Mediterranean. We hypothesize that their abundance is controlled by differences in soil nutrients and rhizosphere microorganisms in native and invaded habitats. California has more nutrient-rich soils and different rhizosphere microbes that may allow red brome to proliferate. We are currently undertaking a study of the biogeographic origins of red bromes prior to further rhizosphere studies, to determine sites of origin from the Mediterranean. During spring 2011 we surveyed red bromes across the Mediterranean from the Iberian peninsula to Turkey. The greatest movement of genetic material was likely from Spain with the California Mission settlements of the 1750's and southern Italy after California statehood in 1949, but settlers arrived from other Mediterranean countries as well. The Flora of Europe and local floras list *Bromus rubens* in all Mediterranean countries, but we located it primarily in Spain in areas that matched the precipitation of southern California (250-450 mm). Other southern Europe Mediterranean countries and Turkey have precipitation > 450 mm and had abundant *Bromus madritensis* subsp. *madritensis*, but not *B. madritensis* subsp. *rubens* or *B. rubens*. We have not yet searched the Mediterranean islands, some of which have precipitation < 400 mm and may be sources of red bromes, but are proceeding with a genetic analysis to determine the relatedness of Spanish red bromes with California populations. We look forward to communication with colleagues concerning the presence of red bromes across the Mediterranean.

POSTER

Control of invasive annual grasses with herbicides aids restoration of purple needlegrass (Nasella pulchra)

Bell, Carl[1], Witter, Marti[2] and Ekhoff, John[3],
[1]University of California Cooperative Extension, San Diego, California, USA; [2]National Park Service, Santa Monica, California, USA; [3]California Department of Fish and Game, San Diego, California, USA

Purple needlegrass, a native perennial bunchgrass of lower elevation grassland, chaparral, and oak savannah communities in California, was thought to be the dominant species on over 9 million ha. Purple needlegrass is still present, but these landscapes are now dominated by exotic annuals. This displacement is believed to be the result of intensive grazing, more frequent fires, rodents, cultivation, and competition from introduced exotic plants. Restoration of grassland in California is often synonymous with recovery of the purple needlegrass population. Methods that have been investigated to shift the dominance in grasslands back to purple needlegrass have included fire, livestock grazing, clearing and planting, and mowing, but these practices are not commonly used. Selective use of herbicides is a method that is showing promise in field trials in Southern California. Selective in this context means herbicide application in the spring over all plants present in an area, killing the invasive annuals without significant injury to purple needlegrass. Five herbicides, fluazifop-P-butyl, clethodim, glyphosate, triclopyr, and aminopyralid were compared to an untreated control in four experiments. Two experiments were conducted on a weed-free purple needlegrass nursery to evaluate herbicide injury to the grass without the confounding influence of competitive invasive annuals. There was no difference between treatments and the untreated control in these experiments. The other two experiments were conducted on a sparse (ca 2% cover) population of purple needlegrass amidst invasive annuals. Spring time applications kill the non-native annuals and thereby eliminate competition with purple needlegrass. Purple needlegrass cover was as much as 5 times higher than the untreated control in some of the herbicide treatments 28 months after initial application in these sites. Purple needlegrass biomass and basal diameters in herbicide treated plots demonstrated similar improvements over the untreated controls.

POSTER

Analyzing the trophobiotic relationship between ants and aphids in a Mediterranean citrus-grove using stable ^{13}C und ^{15}N isotopes

Brewitt, Katrin [1], Piñol, Josep [2], Werner, Christiane [1], Platner, Christian [1]
[1]Experimental and Systems Ecology, University Bielefeld, Bielefeld, Germany; [2]Ecology Unit and CREAF, Autonomous University of Barcelona, Bellaterra, ES

Trophobiosis is considered as a very important ecological factor for ants, at least in temperate and Mediterranean climates. Many ant species are known to feed mostly on honeydew released by aphids. However, little is known about the nutrient fluxes between ants and aphids in the Mediterranean region and the relative importance of trophobiosis for functional diversity of ants. Aim of our investigation is the classification of ants into functional groups based on their diet. Analysis of stable carbon and nitrogen isotopes is a useful tool for assessing the trophic position of animals in food webs. However, there is still a lack of studies combining direct observation between the trophobiotic partners with $\delta^{13}C$and $\delta^{15}N$ analysis of ants and their potential food sources. Here, we monitored aphid-colonies in both fertilized and non-fertilized areas of a Mediterranean Citrus-plantation near Barcelona, Spain, and recorded the trophic contact between aphids and ants. The organic fertilizer that is being used at the plantation functions as a labeling in this tritrophic system. For all components of this tritrophic system (soil, host-plant, aphid-ant) we measured the $\delta^{13}C$and $\delta^{15}N$ signatures. The results showed an unexpected $d^{15}N$ enrichment from aphids to ants, indicating the relative importance of additional nitrogen sources. This indicates clearly that trophobiosis plays a minor role for the ants in the studied ecosystem. Ongoing work will therefore focus on other potential food resources.

POSTER

Status and trends of compensation programs required by the Environmental Impact Assessment (EIA) law in the Chilean Mediterranean Region

Bustamante-Sánchez, Marcela A.[1], Reyes, Julian[1], Espinoza, Sergio[1], Gatica, Paula[2], Gallardo, Belén[3], and Armesto, Juan J.[3,4]

[1]*Facultad de Ciencias Forestales, Universidad de Concepción, Victoria 631, Concepción, Chile.*
[2]*Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C, Concepción, Chile.*
[3]*Departamento de Ecología, P. Universidad Católica de Chile, Alameda 340, Santiago, Chile.*
[4]*Instituto de Ecología y Biodiversidad, Casilla 653, Santiago, Chile.*

Human land use may adversely impact many natural habitats. In Chile, large-scale transformation of natural habitats for development activities requires an Environmental Impact Assessment (EIA), specifying compensation measures. Land developers must present a proposal to offset potential impacts to threatened species and native vegetation during the planning process; the government agency reviews and approves or rejects the proposals on a case-by case basis. Here, we characterize the status and trends of compensation programs already in effect in the Mediterranean region of Chile (33^0 – 38^0 S). We analyzed all the proposals approved by the EIA system affecting native forest ecosystems. The following types of data were collected: type of development project, place where the offset activity was done, plant species used in planting or restoration, and place where the plants were obtained. Additionally, we collected information about plant nurseries available in the region. Overall, our research shows that more than 50% of the development proposals carry out compensatory activities, including plantation. Most of the compensatory programs are carried out in the same area or close of the impact area of the project, use only native plant species; however, they use a reduced number of species, mainly trees. Most of the programs do not identify where the plants were obtained. Nurseries existing in the region produce exotic ornamental and orchard plants, but only a small proportion of native trees. There is a lack of guiding procedures about plantation and there is no standard method for determining impacts and offset requirements nationwide. The current system does not measure the success of reforestation linked to compensation, that is, whether the location and timing of activities truly compensate for the environmental services lost. Monitoring of reforested areas is also lacking, so it is not known whether trees planted survive or not and for how long.

POSTER

Predicting post-fire tree mortality and regeneration to help management decisions

Catry, Filipe X.[1], Pausas, Juli G.[2], Fernandes, Paulo M.[3], Rego, Francisco[1], and Moreira, Francisco[1]

[1]Centre for Applied Ecology, School of Agriculture, Technical University of Lisbon, Lisboa, Portugal; [2] Desertification Research Centre, Spanish National Research Council, Valencia, Spain; [3] Centre for the Research and Technology of Agro-Environmental and Biological Sciences, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal.

Wildfires are an increasing threat to Mediterranean Basin ecosystems. However, managers from this region still confront with a lack of information about the fire effects on most species, and particularly on broadleaves. Although tree resprouting tends to be a strongly binary character in crown-fire ecosystems, the traditional view that all resprouters survive fire and all non-resprouting species die, is a strong simplification of post-fire responses. Additionally, for broadleaves, the post-fire recovery of the community is very different if resprouting is produced from basal buds (stem mortality) or from epicormic buds (stem survival). We compiled data from 11 summer wildfires occurred in different regions of Portugal, western Mediterranean, including the post-fire condition of 3060 trees from 14 species (12 broadleaved and 2 coniferous). We developed models relating post-fire tree responses with tree characteristics (e.g. species, total height, DBH, bark thickness), fire severity indicators (e.g. bole char height, crown volume damaged) and spatio-temporal factors (e.g. topography, climate, season). The tree responses were investigated following an hierarchical approach: whether trees die or survive; for surviving individuals whether stem die or survive; and for trees with stem survival whether regeneration occurs only in the crown or it occurs simultaneously in the crown and in the root collar (basal sprouts). Models including all species show that the main factor determining tree survival following fire was the species trait related to their resprouting ability. Mortality was much higher for non sprouters (conifers) than for sprouters (broadleaves). Among sprouters, the deciduous species had significantly higher mortality that evergreen species. Additionally, trees subjected to more severe fire conditions and located in sites that burned in early summer also suffered higher mortality. For the surviving trees, fire severity and bark thickness were the most important factors affecting stem mortality and regeneration type.

POSTER

Latitudinal Gradients in Leaf Traits of a California Endemic Oak, *Quercus lobata*

Coria, Roky.[1], Gaddis, Keith D.[1,2], Espelta, Josep M.[3], and Sork, Victoria L[1,2]
[1]*Department of Ecology and Evolutionary Biology, University of California Los Angeles, Los Angeles, CA 90095-1606, USA*
[2]*Institute of the Environment and Sustainability, University of California Los Angeles, Los Angeles, CA 90095-1606, USA*
[3]*Unitat d'Ecofisiologia i Canvi Global CREAF-CEAB-CSIC, CREAF (Centre de Recerca Ecologica i Aplicacions Forestals), Universitat Autonoma de Barcelona, 08193 Bellaterra, Barcelona, Spain*

Quercus lobata Née, also known as Valley Oak, is an endemic California species and keystone species for a broad range of oak woodlands and oak savannah ecosystems. Plant species that inhabit a large geographical range experience varying environmental factors across their distributions and often a gradient in adaptive traits may be seen along environmental gradients. Leaves are the most important organs in plants for survival and growth and their size, shape, thickness and anatomy are essential in maximizing photosynthetic gain while minimizing transpiration loss. Studies have shown that in Mediterranean climates water loss is the greatest factor limiting plant growth. Therefore leaf traits that effect water loss, photosynthetic capacity, and ecophysiology may influence overall plant fitness and be under selection. In this study we seek to examine patterns of variation in leaf morphology and characteristics across the geographic distribution of *Quercus lobata* Née. In fall 2010, leaves were collected from 26 sites (n=26) across California. Various leaf morphological traits were measured, including leaf size, leaf thickness, and pubescence as well as ecophysiological traits such as chlorophyll content and C^{13}, which is a surrogate for water use efficiency. We hypothesized that leaf traits would be a function of geographical gradients with leaf thickness and pubescence increasing with lower latitudes and leaf size decreases with lower latitude, where it is expected to be warmer and drier. We have found that leaf thickness, pubescence and water use efficiency are correlated with latitude, while leaf size did not show any relationship. The key ecophysiological measure that showed a correlation with latitude was water use efficiency. Local characteristics in leaf morphology indicate selective pressures that have shaped the current distribution of this species; however future studies are needed to test the extent to which these differences are due to genetic and/or environmental factors

POSTER

Relationships among a soil fungus, grass biochar and a South Australian native grass

Crook, L., J. Gibbs, M. Kokkinn
Division of Health Sciences, University of South Australia, Australia

Native grasslands have evolved with fire, forming synergistic relationships with soil microbes. This study investigates the ecophysiological relationships between an avirulent soil fungus, *Gliocladium virens*, a native wallaby grass, *Austrodanthonia fulva* and grass biochar, through greenhouse experiments. When the grass, *Austrodanthonia fulva*, was inoculated with *Gliocladium* and grown in washed river sand with 10% biochar, plant height and root length were significantly greater than for the uninoculated controls without biochar. This result highlights the potential existence of complex relationship between flora, fungi and soil nutrients, which encourages further research in the laboratory, greenhouse and field trials.

POSTER

Vulnerability of selected native and invasive woody riparian species in the Fynbos Biome to cavitation

Crous, Casper [1,2], Jacobs, Shayne [1], Esler, Karen [1,2]
[1] *Department of Conservation Ecology and Entomology, Stellenbosch University, Private Bag X1, Matieland, 7602*
[2] *Centre for Invasion Biology, Stellenbosch University, Private Bag X1, Matieland 7602, Stellenbosch, South Africa*

Riparian ecosystems of the Mediterranean south-western Cape region are projected to experience drier conditions due to a combination of water extraction and a warming and drying trend due to climate change. Further, alien invasive plants (IAPs) such as Australian *Acacia* spp. have been shown to use significantly more water than native species, which prompted a major public works programme aimed at eradication of these woody plants from riparian environments. These programmes will be aided greatly by information on the relative ability of native and invasive species to survive in drier conditions, which will inform and enhance restoration initiatives. We determined whether woody IAPs are more drought resistant than native species (vulnerability to cavitation) across three riparian zones in the south-western Cape that each differed in streamflow quantity. *Acacia mearnsii* had consistently higher drought-tolerance (lower P_{50} values and denser wood) compared to native species (*Meterosideros angustifolia* and *Brabejum stellatifolium*) under reduced water availability. The invasive species also had the largest safety margin when water potential at 50% loss of conductivity was compared to minimum water potential at the end of the dry season, showing the ability of the species to maintain xylem functioning in drier conditions. Native species also differed in their ability to withstand loss of conductivity under drier conditions. We conclude that differences between native and invasive species exist, and *B. stellatifolium* may be more suited to restoration initiatives than others. Apart from being profligate users of water, the invasive alien *A. mearnsii* can withstand drier conditions, even more reason to accelerate eradication programmes in the face of projected declines in streamflow.

POSTER

Impact of understory and tree vegetation on infiltration and redistribution of rain water in soil of a Mediterranean cork-oak forest (montado)

Dubbert, Maren[1], Piayda, Arndt[2], Cuntz, Matthias[2] and Werner, Christiane[1]
[1]*Exp. and System Ecology, University of Bielefeld, Universitätstr. 25, 33615 Bielefeld, Germany;*
[2] *Helmholtz Centre for Environmental Research – UFZ, Permoserstr.15, 04318 Leipzig, Germany*

To investigate the influence of over- and understory vegetation effects on soil water infiltration and redistribution depth profiles (up to 60cm) of volumetric soil water content (VWC) and soil and understory water fluxes were measured during spring 2011. To separate effects of vegetation cover and shading, plots with different treatments were installed: root-free plots, plots with roots but without vegetation cover and control plots with full herbaceous understory cover. To estimate the influence of tree-cover on soil water dynamics, all treatments were installed both directly in the shade of cork oak trees and in an adjacent open area. Understory largely facilitated infiltration of rain water into the upper soil layers and VWC increased after rainfall by up to 15% in vegetation plots as compared to max. 10% on bare soil, depending on rainfall intensity and VWC prior to rainfall. Tree coverage had negative effects on soil water infiltration on vegetation plots, probably due to rain water interception of trees. Also vegetation and root plots under trees had continuously decreased VWC in 60cm in comparison to bare soil and open area plots, which might be attributed to oak root water uptake. VWC returned to initial values within 5-7 days after rain. Soil evaporation was highest immediately after the rain event with up to 1.9 $mmol*m^{-2}*s^{-1}$. In contrast, total understory evapotranspiration (ET) only gradually increased within one week after rainfall from 2.2 to 3.1 $mmol*^{-2}*s-^{1}$. Consequently impact of soil evaporation on total understory ET was highest directly after rainfall, steadily declining its contribution to 10% within the following 2-3 weeks. These contrasting developments of soil and plant fluxes were most probably due to different drivers controlling E and T. While soil evaporation was mainly driven by VWC, plant transpiration rates were mainly driven by VPD, which only gradually increased after rainfall.

POSTER

How does Fog Affect the Fire Regime?

Emery, Nate C.
UC Santa Barbara, Santa Barbara, CA, 9317, USA.

Fog is a significant force in shaping plant communities (1), particularly in coastal California ecosystems subjected to summertime fog, which ameliorates temperatures and reduces drought stress (2). Climate change is projected to reduce fog in some areas (3), while increasing in others during the next century (4). Another important physical process that shapes plant communities in coastal California is fire. Understanding and predicting patterns of fire occurrence and effects of fire on the landscape is paramount because of the growing urban/wildland interface throughout much of California. My research seeks to bridge these two environmental processes by examining shrubland ecosystems. I'm currently following chaparral and coastal sage scrub communities at coastal and interior sites for fuel moisture and plant water isotopes. Fuel moisture is closely tied to plant flammability (5) and is actively used by the US Forest Service to determine Fire Danger Ratings (6). Plant water isotopes are used to approximate the source of water taken up by a given plant. I plan on determining the relative fog water contribution to my focal shrub species throughout the dry-down season. Coupling the water isotope signal with changes in live fuel moisture content is the beginning of my exploration into how fog may affect the fire regime of coastal California.

[1] Dawson, TE *Oecologia* 117, 476-485 (1998) **[2]** Fischer, DT et. al. *Journal of Biogeography* 36, 783-799 (2008) **[3]** Johnstone, JA and TE Dawson. *PNAS* 107, 4533-4538 (2010) **[4]** Bakun, A *Science* 247, 198-201 (1990) **[5]** Dimitrakopoulos, AP and KK Papaioannou *Fire Technology* 37, 143-152 (2001) **[6]** NFDRS: http://www.wrh.noaa.gov/sew/fire/olm/nfdrs.htm

POSTER

Forward to the Past; Removal of non-native animals from Channel Islands National Park, U.S.A.

Faulkner, Kate Roney [1]
[1] *U. S. National Park Service, Channel Islands National Park, 1901 Spinnaker Drive, Ventura, CA 93001, USA.*

Channel Islands National Park consists of five islands off the coast of southern California. The islands were never connected to the mainland and provide habitat for many plant and animal taxa that occur nowhere else. Additionally, the islands provide critical habitat for biota which depend on the naturally lower levels of predation, herbivory, and disturbance typical of islands. Since the 1970s, the National Park Service and our partners have eliminated most of the non-native mammals introduced to these islands. Three of the park islands, Santa Barbara, Anacapa, and Santa Cruz, are free of non-native mammals. Deer and elk will be eliminated from Santa Rosa Island in 2011. Black rats remain on San Miguel Island. There has been substantial ecological recovery as a result of the non-native animal removals. The population of Xantus's murrelet, a rare nocturnal seabird, is increasing on Anacapa Island as a result of eradicating black rats. The western harvest mouse has increased in numbers and extent on Santa Cruz Island, likely in response to increases in vegetation due to removal of sheep. Native plants are increasing on Santa Rosa Island in response to removal of cattle. However, some areas, such as highly eroded habitats, have been very slow to change. The spread of some non-native plants was facilitated by the non-native animals and, therefore, removal of the animals has been an effective management tool. However, some invasive plants require additional control actions. It is important to monitor the ecological effects of animal eradications and determine what additional management may be necessary to avoid unintended negative consequences. Interventions will be needed for many years to protect and recover the natural biological diversity of the Channel Islands. Biosecurity practices should be expanded to minimize the risk of future introductions of non-native species and to detect new introductions early.

POSTER

Wildlife Use of the Los Piñetos Underpass in Santa Clarita, California

Freidin, Robert[1], Shreck, Diane[1], Scruggs, Brooke[1], Shulman, Elise[1], Swauger, Alissa[1], Tashnek, Allison[1], and Boydston, Erin [2], and Longcore, Travis[1]
[1] *UCLA Institute of the Environment and Sustainability, La Kretz Hall, Suite 300, Box 951496, Los Angeles, CA 90095-1496*[2]*; US Geological Survey, Western Ecological Research Center, 401 W Hillcrest Dr, Thousand Oaks, CA 91360*

Corridors between fragmented habitats are critical to the maintenance of certain wildlife populations, especially those of larger, terrestrial mammalian carnivores. Commercial development is being considered in the small wedge of land between Sierra Highway and State Route (SR) 14 in northern Los Angeles County, California. The Los Piñetos underpass is currently a corridor under SR 14 that provides a connection between Mountains Recreation and Conservation Authority (MRCA) and City of Santa Clarita protected land and this site. Beyond this wedge is a habitat connection to the Los Padres National Forest, which makes the Los Piñetos underpass the most likely connection between two regionally significant blocks of protected habitat. To document wildlife use of this underpass, we installed ten remotely triggered cameras, in stages, over two months around this area. We installed seven cameras near and under the underpass, and three cameras as controls up to 1 km from the underpass, in protected lands. Following 429 trap-nights, our photographs showed use of the area by coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), Audubon's cottontail (*Sylvilagus audubonii*), California ground squirrel (*Otospermophilus beecheyi*), gray fox (*Urocyon cinereoargenteus*), and American badger (*Taxidea taxus*). The cameras along the road also captured human and vehicle activity, which we found to statistically differ temporally from that of the wildlife. We also produced data on species accumulation over time, relative activity of coyotes, and directionality of underpass use. Geographically, we found that animals traveling southeast via the underpass are veering toward an area of proposed development, and that the corridor location suggested by project proponents may not be in the area where animals are traveling, although further research on the proposed development parcel is warranted.

POSTER

Application of high resolution hyperspectral and LiDAR remote sensing to analyze the invasion of an exotic Acacia tree in Portuguese dune ecosystems

Große-Stoltenberg, André [1,3], Hellmann, Christine [2], Thiele, Jan [1], Lehmann, Jan [1], Fernandes, Patricia [3], Antunes, Cristina [3], Burai, Peter [4], Lenart, Csaba [4], Oldeland, Jens [5], Máguas, Cristina [3], Buttschardt, Tillmann [1], and Werner, Christiane[2]

[1] Instiute of Landscape Ecology, University Münster, Münster, Germany. [2] Experimental and Systems Ecology, University Bielefeld, Bielefeld, Germany. [3] Centre for Environmental Biology, University Lisbon, Lisbon, Portugal. [4] Institute of Agroinformatics and Rural Development, Karoly Robert College, Gyöngyös, Hungary. [5]Biocenter Klein Flottbek and Botanical Garden, University Hamburg, Hamburg, Germany.

Invasive plant species can have a high impact on ecosystems services, biodiversity and ecosystem functioning. Analysing impacts of invasive species requires distribution data on landscape scale. Combining high resolution hyperspectral and LiDAR remote sensing data is an innovative method to detect exotic plant species especially when they are invading the understory of forests. These data can deliver detailed information about the biochemistry of the canopy and about the vegetation structure for detection and impact assessment. The Australian tree *Acacia longifolia* L. is an exotic invasive species in Mediterranean dune ecosystems. It alters ecosystem characteristics such as water and nutrient cycling, as well as vegetation structure in the open dunes and in the understorey of dune forests (Rascher et al. 2010, 2011). Studies on stand level show that it is able to facilitate its invasion while having negative impacts on native ecosystems. We collected airborne and field data along a coastal strip of 35 kilometers in SW Portugal. The fusion of these data is the appropriate way to track *A. longifolia* and to generate data of its distribution and invasions trends on landscape scale. This is to our knowledge the first study that aims to detect an invasive species in Mediterranean open dunes and dune forests by combining hyperspectral and LiDAR remote sensing data at very fine spatial and spectral resolution with various ecological field data including field reflectance spectra at leaf and plant level, biochemical leaf analysis, hemispherical photographs, and high accurate differential GPS vegetation mapping. This study could generally set the basis for further research on the invasion of exotic tree species in Mediterranean ecosystems. It could add significantly to monitoring schemes of endangered ecosystems worldwide, threatened e.g. by *Acacia* invasion, by helping identifying areas that are susceptible to invasions, leading to an early-detection scheme and evaluating control measures.

POSTER

Spatiotemporal links between fire, soil moisture and resource redistribution in the chaparral

Hanan, Erin J[1], Schimel, Joshua P[1], D'Antonio, Carla M.[1] and Roberts, Dar A.[2]
[1] *Department of Ecology, Evolution and Marine Biology, University of California Santa Barbara, Santa Barbara California 93106*
[2] *Department of Geography, University of California Santa Barbara, Santa Barbara California 93106*

Chaparral soil properties are reorganized over time and space by intertwining biotic and physical feedback mechanisms. Interactions between fire and hydrology in particular can drastically enhance the cycling of nutrients and alter their retention rates at multiple scales. In order to study watershed responses to high intensity landscape fire, we conducted on-the-ground sampling of soil nitrogen dynamics in the Mission Canyon and Rattlesnake Canyon Watersheds that span the foothills of the Santa Ynez Mountains in Santa Barbara County, California. Large portions of these watersheds burned intensively in the November 2008 Tea Fire and/or the May 2009 Jesusita Fire. Fifteen burned and three unburned 15 m by 15 m plots were established in November 2009 and were monitored on a monthly basis through June 2011. In each plot four in-situ field-incubation cores were installed to provide an index of overall nitrogen availability. Bulk density, water holding capacity, volumetric water content, total carbon, total nitrogen, soil pH, exchangeable nitrate and ammonium, and microbial carbon and nitrogen were quantified for all soil samples. We also used AVIRIS imagery to determine burn severities for each plot using the Normalized Burn Ratio (NBR) and Differenced NBR (dNBR) indices. Initial results show that burn severities were high across all sampling locations. Soil samples collected prior to the onset of rain were relatively enriched in ammonium, and low in nitrate. Following the season's first rain event, ammonium concentrations decreased while nitrate levels simultaneously increased. These results are consistent with previous studies showing that ammonium tends become more concentrated following fire. Monthly variation in ammonium and nitrate concentrations within cores, as well as leached ammonium and nitrate captured by resin discs is being compared over both years to nitrogen export from streams to better understand the controls over sediment and nitrogen flux within cismontane chaparral watersheds.

POSTER

Invasion of an exotic *Acacia* impacts nitrogen budgets of native species and adversely affects biodiversity in protected Mediterranean dune habitats

Hellmann, Christine[1], Rascher, Katherine G.[1], Máguas, Cristina[2], and Werner, Christiane[1]
[1]Experimental and Systems Ecology, University of Bielefeld, Universitätsstraße 25, 33615 Bielefeld, Germany; [2]CBA, University of Lisbon, Campo Grande, C2, 1749-016 Lisbon, Portugal; e-mail: christine.hellmann@uni-bielefeld.de

The exotic N_2-fixing *Acacia longifolia* is highly invasive in Mediterranean dune systems. In the presence of this invader, ecosystem structure and functioning in terms of carbon, water and nutrient balances are substantially altered. Furthermore, biodiversity, which is naturally highly diverse and rich in endemic species, is strongly reduced. However, few studies consider the spatial dimension of these influences on the native ecosystem. We investigated the spatial scale of the influences of *A. longifolia* on native species diversity, community composition and N dynamics in a nutrient-poor dune system at the Atlantic coast of Portugal. As *A. longifolia* introduces symbiotically fixed N with a distinct isotopic signature to the system, changes in the N signature ($\delta^{15}N$) of the endemic shrub *Corema album* could be analyzed and used to trace and spatially resolve the influence of the invader on N dynamics of native species. *C. album* leaf $\delta^{15}N$ showed a clear spatial pattern related to the presence of *A. longifolia*. Leaf $\delta^{15}N$ values increased significantly from -11‰ to values close to 0‰ as a function of distance to the invader's canopy, providing evidence that *A. longifolia* enriched the system with atmospherically derived N ($\delta^{15}N$ ~0‰). This influence reached up to 8 m into the uninvaded vegetation. N dynamics of the native system were thus shown to be markedly altered beyond the canopy of *A. longifolia* stands. Concomitantly, native species diversity declined, with Shannon Wiener H' decreasing from approx. 8.5 in the uninvaded vegetation to a value of 6 at the edge of the *A. longifolia* canopy. Furthermore community composition was markedly altered. As adverse effects of *A. longifolia* on the native ecosystem are substantial, these findings are relevant for restoration efforts, since the area affected by invasion exceeds the physical extent of the invader by far.

POSTER

Landscape Legacies: Biogeochemical and ecohydrological properties of natural and cultivated 'heuweltjies' (mima-like mounds) of the fynbos and succulent karoo in South Africa

Jacobs, Shayne [1], Booi, Nozuko [1], Bekker, Stefan [2], Ellis, Freddie [2], Esler, Karen [1], Hoffman, Eduard [2], Milton, Sue [3], Strever, Albert [4]

[1] *Department of Conservation Ecology and Entomology, Stellenbosch University, Private Bag X1, Matieland, 7602*

[2] *Department of Soil Science, Stellenbosch University, Private Bag X1, Matieland, 7602*

[3] *RenuKaroo Veld Restoration cc, PO Box 47, Prince Albert, South Africa, 6930*

[4] *Department of Viticulture and Oenology, Stellenbosch University, Private Bag X1, Matieland, 7602*

'Heuweltjies' are soil surface features associated with the termite *Microhodotermes viator*. While there is some debate as to their origin, it is clear that the activities of the termite have major consequences for plant and animal communities of the succulent karoo and the fynbos, where these termitaria occur. In the succulent karoo, disturbance on heuweltjies gives rise to unique plant communities, with higher succulent cover, higher annual cover and more invasive plant species. Scant information is available for heuweltjies in the fynbos biome. Even less is known about the legacies of these patches within agricultural areas, where soils have been disturbed significantly and natural vegetation cleared to make way for *Vitis vinifera* and other crops in the fynbos and the succulent karoo biomes. Here we show that carbon, nitrogen, phosphorus and base status are all elevated on the heuweltjies, but that the magnitude of the increase is higher in the succulent karoo. The rate of cycling of carbon and nitrogen is also higher within soils of heuweltjies. Despite often aggressive soil preparation for cultivation to *V. vinifera*, some soil properties within former heuweltjie patches remain significantly different from off-heuweltjie areas. Ecohydrology of these patches is significantly different from off-heuweltjie areas, even where cultivated. Growth vigour of *V. vinifera* is higher on heuweltjies in the fynbos, though not in the succulent karoo, and investigation of native species common to heuweltjies and off-heuweltjie areas in undisturbed landscapes suggests that this may be due to more conservative use of water. Higher growth vigour, however, may be detrimental as *V. vinifera* berries on heuweltjies have delayed ripening due to shading by leaves, which leads to higher titrable acid content and lower sugar content of berries, with an effect on the resulting wine style. As this leads to higher within-block variability it can complicate vineyard management, especially harvest decision making.

POSTER

The Distribution of Sexes Across a Rainfall Gradient in a Subdioecious Southern California Chaparral Shrub *Rhus ovata* S. Watson (Anacardiaceae)

Keldgord, Heather[1], Pratt, R. Brandon[1]
[1]*California State University, Department of Biology, 90001 Stockdale Highway, Bakersfield, CA 93311, USA.*

Separate sexes are not common in plants; about 6% of the 250,000 known vascular plant species are dioecious. The distinction between monoecious and dioecious plants is not strictly binary and some species are subdioecious containing both dioecious and monoecious individuals. In the southern California chaparral community, *Rhus ovata*, is one such subdioecious species where only females produce fruit while the hermaphrodites produce flowers with pollen (thereby fulfilling the reproductive role of males). We hypothesized that because females allocate greater resources to reproduction, females have fewer resources available for vegetative growth, survival, and defense. This may limit the level of stress tolerance that females can achieve compared to males, and have ramifications for the ecology of the different sexes in semi-arid southern California. We predicted females to be less abundant in areas with limited resources than males. This was tested by determining the sex ratios of *Rhus ovata* at six sites across a broad rainfall gradient in the southern Californian chaparral (sites average annual rainfall ranges from 221mm/yr to 701 mm/yr). Beyond the predicted shift in sex ratios, additional predictions of differences between the sexes were tested across the rainfall gradient, such as niche segregation, size dimorphism, and differential investment in defense of tissue. Female plants were found to have a greater total reproductive investment than males. Sex ratios across a rainfall gradient did not exhibit a relationship and counter to our prediction; females were more abundant at our driest field site (36 females to 24 males). Overall, males were larger than females; however, this result was driven by differences at the wettest and at drier sites they did not significantly differ from the females. Further analyses are examining the possibility that males and females exhibit niche segregation, differ in stress tolerance, or differ in structural defense of their tissues.

POSTER

Individual and annual variation in flowering and leaf phenology of savanna population of valley oak, *Quercus lobata* Née

Lentz, Andy[1] and Sork Victoria L.[2, 3]
[1] *Sedgwick Reserve, University of California Santa Barbara, CA, USA*
[2] *Institute of the Environment and Sustainability, University of California, Los Angeles, CA, USA*
[3] *Department of Ecology and Evolutionary Biology, University of California, Los Angeles, CA, USA*

The timing of flowering may affect fruit set if early and late flowering trees are out of synchrony with population with respect to pollen availability. Moreover, if timing has a genetic basis, then selection might select against asynchronous individuals. In this study, we ask three questions. First, do early and later flowering valley oak individuals show a reduction in acorn production? Second, do the same individuals flower early and late across years? Third, what environmental factors influence individual and annual variation in the timing of flowering in our population. The study site is an oak savanna at the University of California Sedgwick Reserve, administered by UCSB. During winter and spring of 2007-2010, we monitored dates of budburst, emergence of male catkins and female flowers, and leaf elongation in 100 *Quercus lobata* adults. Our findings indicate that individuals that flower in the early 10% and late 10% of the population had lower acorn production than the middle 80% of the trees. We also found a significant correlation on rank order of date of flower across trees from year to year. We will report on environmental factors that influences timing of flowering across years and among individuals within a year. This study provides evidence that timing of flowering has a genetic basis and that selection against early and later flowering trees favors the synchronization of flowering within this valley oak population. These results indicate that natural or human-caused reduction in adult density might jeopardize acorn production in adults.

POSTER

Responses of Medium and Large Mammals to Increased Recreation and Other Activities over an Eight Year Period in the Puente Hills Preserve

Lucas, Shannon
Puente Hills Landfill Native Habitat Preservation Authority, 7702 Washington Avenue, Suite C, Whittier, CA, 90602

A study was conducted by the USGS in 2001-2002 at the Puente Hills Preserve in southeastern Los Angeles County to study recreational effects to wildlife in and around a tunnel under a busy regional road. In 2009-2010, the study was repeated using the same scent-station transect and motion-sensor camera locations in order to evaluate any changes in wildlife use considering a nearly five-fold increase in human activity. Most notable was the change in bobcat activity. Camera data indicates that bobcat tunnel use has decreased by more than half, but transect data indicates that bobcat presence has nearly tripled. The decrease in bobcat activity at the tunnel may be due to the substantial increase in human activity. The increase in bobcat activity along transects may be because there were high levels of disturbance in 2001-2002 from habitat restoration activities, which have since decreased and the restored habitat as matured. However, this increase does not bring bobcat activity levels to those recorded in the area in the late 1990s before it was officially opened to recreational activities. These results indicate that recreational and restoration activities may influence bobcat activity, which is important for Preserve management as they are a key indicator species.

POSTER

Fire, climate and management interactions in the United States

Jon E. Keeley[1,2] and Thomas W. McGinnis[1,3]
[1]*USGS Western Ecological Research Center, 47050 Generals Highway, Three Rivers, California 93271, USA*
[2]*Department of Ecology & Evolutionary Biology, University of California, Los Angeles, California, USA*
[3]*Email: tmcginnis@usgs.gov*

Worldwide there are concerns that human-induced global climate change may be the primary cause of increasingly large and numerous wildfires, but historically, multiple factors have affected both relative area burned and density of wildfires. In the United States, national fire policy, forest and rangeland management practices, vegetation changes and human population patterns have all played a role in fire history and interact in various ways with changing climatic patterns. We will explore the interactions that have occurred over the past 40 years on federal wildlands administered by the United States Forest Service and Department of Interior in various eco-climate domains.

POSTER

The complex issue of the *Acacia saligna* species complex

Millar, Melissa[1], Byrne, Margaret[1], O'Sullivan, Wayne[2]
[1]*Department of Environment and Conservation, Perth, Western Australia, Australia*
[2]*Great Western Woodlands Collaboration, West Perth, Western Australia, Australia*

Species complexes often display high levels of morphological, ecological and genetic diversity. This diversity presents problems for the characterisation and identification of composite taxonomic entities. The *Acacia saligna* (Labill.) H.L.Wendl. species complex is a taxon in which inadequate formal resolution hinders the development of appropriate conservation guidelines for populations, across the species natural range, in the south west of Western Australia. The species complex is being developed for agroforestry in breeding programs in a number of countries around the world and inadequate resolution also means that diversity captured in these programs cannot be accurately described. This may have implications for the efficiency of such programs. Due to its extensive history of use *A. saligna* is also a significant invasive weed in many countries around the world. Taxonomic resolution of the complex, which shows a remarkable degree of morphological and ecological plasticity, may assist in the development of eradication and control measures for invasive populations. In order to define the entities within the *A. saligna* species complex we genotyped individuals from 32 populations across the species range at five microsatellite loci. Bayesian analysis resolved five distinct genetic entities and their natural geographic distributions. Three genetic lineages correspond to commonly known informal '*stolonifera*', '*saligna*' and '*lindleyi*' variants. There was also clear genetic division between western and eastern populations of '*saligna*' and between northern catchment and other populations of '*lindleyi*'. There is no genetic support for an informally described 'pruinescens' variant. River catchments at the northern extent of the species range appear to be important refugia and the current centre of species diversity. Populations in the more disturbed south west show evidence of genetic bottlenecks and inbreeding. This information will aid conservation of natural populations and genotypic data can be used as a diagnostic tool to identify invasive populations and diversity present in breeding programs of *A. saligna* in Australia and overseas.

POSTER

The role of ecophysiology in the invasion success of Acacia cyclops in a Mediterranean-climate ecosystem

Morris, T.L. [1,2], Barger, N.N [1]. and Cramer, M.D [2,3]
[1] *Department of Ecology and Evolutionary Biology, Campus Box 334, University of Colorado, Boulder, CO 80309, USA;* [2] *Department of Botany, University of Cape Town, Private Bag X3, Rondebosch, 7701, South Africa;* [3] *School of Plant Biology, Faculty of Natural and Agricultural Sciences, The University of Western Australia, 35 Stirling Highway, WA 6009, Australia.*
taryn.morris@colorado.edu

Invasive alien Australian *Acacia* species (subgenus Phyllodineae) are considered some of the worst invasive species in the world, often most successful in Mediterranean-climate ecosystems. *Acacia* species are known to have widespread impacts including the reduction of floral and faunal diversity, the alteration of nutrient cycles and reduction of aboveground water resources. The enhanced biomass and plant size as well as their copious production of nutrient rich seed has been suggested to enhance competitive success. The ability of these plants to obtain resources to support a biomass much greater than that of the local vegetation is of interest, particularly considering their common association with nutrient poor soils and summer drought regions. This study investigated whether the ecophysiology and morphology of *Acacia cyclops* differed from that of three co-occurring native species driving competition for resource acquisition and use. Sampling was conducted in both wet and dry seasons at three sites in the Strandveld vegetation type of the Cape Floristic Region, South Africa. Data on a suite of ecophysiological and morphological characteristics were measured including water use efficiency, transpiration, conductance, photosynthetic capacity and stem water potentials. Additionally, isotopic signatures of plant xylem water were compared in order to assess the potential for *Acacia cyclops* to access deeper soil and nutrient sources than the native species. *Acacia cyclops* showed greater photosynthetic capacity, conductance and transpiration than the native species *Euclea racemosa* and *Rhus laevigata* in both the wet and dry seasons. Interestingly, measurements did not differ significantly from *Chrysanthemoides monilifera*, a strong invasive plant in regions of Australia. Results will be further discussed. Understanding how resource acquisition mediates the success of *Acacia* species will help scientists and managers to better predict landscape distributions both now and under future scenarios.

POSTER

Dynamics of understory plant composition and diversity in Mediterranean cork oak forests in correlation to small scale microclimatic changes

Mosena, Alexander[1], Dubbert, Maren[1], Piayda, Arndt[2], Cuntz, Matthias[2] and Werner, Christiane[1]

[1]*Exp. and System Ecology, University of Bielefeld, Universitätstr. 25, 33615 Bielefeld, Germany;*
[2] *Helmholtz Centre for Environmental Research – UFZ, Permoserstr.15, 04318 Leipzig, Germany*

Various studies have shown the importance of understory plants for carbon and water balance in open Mediterranean oak forests. Though not drought tolerant they can make up to more than 50% of total gross primary productivity (GPP) during spring time (Unger et al. 2009). Tree density might be an important factor influencing understory species composition and longevity during this period. Therefore, the influence of tree cover by cork-oak (*Quercus suber*) on the temporal dynamics of species composition and cover of the understory plant community of a Portuguese oak woodland was investigated between mid-April and mid-June 2011. Renkonen similarities between open and tree sites were calculated. At the beginning of April, species similarity between both sites was rather high (62 % similarity). Corresponding to an increased difference in temperature and moisture between sites similarity in species composition decreased, reaching 35 % after about 4 weeks and 28% at the end of the observation period. Poaceae cover steadily decreased in the open site while the cover of drought-adapted *Tuberaria guttata* increased up to 56 %. However, the dominance of *T. guttata* could not be confirmed in tree covered plots and Poaceae cover remained rather stable for the first 6 weeks (around 30%). Total plant cover decreased over time in open from a maximum of 92 % to 46.2 %, under the trees from 87 % to 19.6 %. The surprisingly large decrease in total cover in the tree plots, despite of more favorable microclimate conditions during the onset of summer drought, was probably caused by intraspecific competition for water and resources between trees and understory plants. The results suggest that temporal changes in species composition and cover of the understory community during spring are substantially altered by tree overstory, which might have large effects on system productivity and carbon balance during springtime.

POSTER

University of California Natural Reserve System – Leading Mediterranean-Type Ecosystem Stewardship Collaboration for the 21st Century

Noah, Chen Yin and Fiedler, Peggy L.
Natural Reserve System, University of California, 1111 Franklin Street, 6th Floor, Oakland, CA 94607 USA.

The University of California (UC) Natural Reserve System (NRS) is a network of protected natural areas throughout California. Its 37 sites include over 135,000 acres owned or managed by the University, making it the largest university-administered reserve system in the world. Most major state ecosystems are represented, from coastal tidepools to inland deserts, and coastal wetlands to Sierra Nevada coniferous forests. The reserves also serve as a gateway to more than a million acres of protected public lands. Since its inception in 1965, the NRS provides undisturbed environments for research, education, and public outreach programs, and in so doing, has contributed immeasurably to UC's core missions of teaching, research, and public service. The great majority of the 37 NRS reserves lie within the broader Mediterranean-climatic zone of California/Baja California, and all but two Great Basin and two desert (Mojave, Colorado) reserves are situated within the California Floristic Province. Mediterranean-type regions globally, and California in particular, face more acutely than other climatically defined bioregions, the global threats of the homogenization of flora and fauna, uncertainties of formerly well-respected and widely used management tools such as fire, and the increasing pressures of conservation at the urban-wildland interface. Many challenges lie ahead for the NRS as public funding dwindles and climate change threatens to transform the state's most important and cherished landscapes. Nonetheless, we believe that the NRS is uniquely poised not only to protect California's increasingly threatened Mediterranean-type ecosystems, but also to facilitate opportunities for combining international scientific resources and experience in ecosystem management to define, develop, and disseminate leading edge approaches to the effective stewardship of the world's unique Mediterranean-type ecoregions.

POSTER

Analog Forests, the sustainable cork oak ecosystems in Portugal

Nunes, Luisa Ferreira
Escola Superior Agrária de Castelo Branco, Qta Sra Mercules, 6000 Castelo Branco, Portugal.
nunani@gmail.com

Biomimicry is a new science that studies nature's models and then emulates these forms, process, systems, and strategies to solve human problems – sustainably. The cork oak ecosystems (Montados) in Portugal are a great example of balanced conservation and economic development. Their preservation is vital for the well-being of the Mediterranean region. In this presentation we identify aspects that give sustainability to the cork oak forests. The study evaluates the relationships between the ecosystem's biological components in the form of a biomimicry functional model that explains and responds to the needs of solving sustainability problems, which can be applied to the management of different situations. Observed aspects ranged from the recycling of nutrients, natural selection of trees through insects and pathogens, and also the protective characteristics against dryness and fire that the trees themselves develop.

POSTER

Comparison of Chaparral Re-growth between Wind- and Fuel-driven Fire Areas

Rachels, Diane [1]
[1] *San Diego State University, San Diego, California, USA*

Wildfires are a common occurrence in Southern California shrublands and island forests. Currently there is no consensus on wind-driven fire effects on the chaparral community. This study seeks to understand the connection between climate, vegetation type and structure, and environmental response to extreme fire events both in damage and recovery. Differences in ecosystem response to fire events may factor in re-growth and succession of life form in chaparral. The amount of re-growth determines fire fuel amount which is important to fire planning agencies and shrubland managers. The life-forms to be mapped include shrub, sub-shrub, and herbaceous vegetation types that have grown back in previously mapped chaparral communities. The location studied is a portion of the 2003 Cedar fire burn area in San Diego, California. This fire area is unique in that one side was burned with wildfire fueled by dry, strong easterly Santa Ana winds that later died down, burning the remainder of the area under a mild westerly wind allowing fuel-fed conditions. This research also seeks to create accurate maps of the chaparral life-forms through Object Based Image Analysis (OBIA). Classification and comparison of one meter spatial resolution aerial imagery will use two different object-based feature extraction programs. Although frequently used for classification of urban areas and land cover types, object based image analysis (OBIA) is relatively innovative for life-form classification in an arid ecosystem. This research seeks to add to the OBIA body of knowledge.

POSTER

Water and carbon cycling in a Mediterranean pine forest are substantially altered after invasion by an exotic *Acacia*

Rascher, Katherine G.[1], Große-Stoltenberg, André [2], Máguas, Cristina[3], and Werner, Christiane[1]

[1]*Experimental and Systems Ecology, University of Bielefeld, Universitätsstraße 25, 33615 Bielefeld, Germany;* [2]*Institute of Landscape Ecology, University of Münster, Germany;* [3]*CBA, University of Lisbon, Campo Grande, C2, 1749-016 Lisbon, Portugal; e-mail: katherine.grieve@uni-bielefeld.de*

In water limited ecosystems, where potential evapotranspiration exceeds precipitation, it is often assumed that plant invasions will not increase total ecosystem water use, since all available water is evaporated or transpired regardless of vegetation type. However, invasion by exotic species, with high water use rates, may potentially alter ecosystem water balance by reducing water available to native species, which may in turn impact carbon assimilation and productivity of co-occurring species. Here, we document the impact of invasion by an understory exotic woody species (*Acacia longifolia*) in a semi-arid Portuguese dune Pine forest. The N_2-fixing *Acacia longifolia* is highly invasive in many Mediterranean dune and pine forest ecosystems. To quantify the effects of this understory leguminous tree on the water use and carbon fixation rates of *Pinus pinaster* we compare an invaded and a non-invaded pine stand. *A. longifolia* significantly altered forest structure by increasing plant density and leaf area index in the mid-stratum of the invaded forest. *A. longifolia* contributed significantly to transpiration in the invaded forest (up to 42%) resulting in a slight increase (9%) in stand transpiration in the invaded relative to non-invaded forest. More importantly, both water use and carbon assimilation rates of *P. pinaster* were significantly reduced in the invaded relative to non-invaded stand. Our study clearly shows that exotic plant invasions can have significant impacts on hydrological and carbon cycling even in water-limited semi-arid ecosystems through a repartitioning of water resources between the native and invasive species.

POSTER

Mule deer impacts to an island ecosystem and post-fire regeneration on Santa Catalina Island, California, USA

Ratay, Sarah E. [1,2], Dvorak, Tyler M. [1]
[1] *Catalina Island Conservancy, 125 Clarissa Ave, Avalon, CA 90704, USA.*
[2] *Department of Ecology and Evolutionary Biology, University of California, Los Angeles, Los Angeles, California 90095–1606*

Mule deer (Odocoileus hemionus) are an introduced ungulate on Catalina Island and are present at a population density affecting the health and abundance of native plants. Preferred forage of mule deer includes both Catalina's rare and endemic plants, as well as other native species. As a result, this disproportionately affects the most crucial species through reduced seedling recruitment and inhibited post-fire regeneration, further intensifying the problem of an invasive herbivore. Successful recovery of Catalina's native flora is crucial to restoring ecosystem health and function after recent fires in which 13% of the island has burned. Within the last decade feral pigs and goats have been eradicated from Catalina and bison are under herd management. Mule deer remain the only non-native herbivore not sufficiently controlled. Mule deer are managed as a game species on Catalina Island by the California Department of Fish and Game, thus annual sport hunting is the only available conservation action to limit population size. This program is not designed to control invasive animals for habitat recovery and conservation. Additional measures are warranted given the severity of impact and number of rare and endangered species affected by the deer.

POSTER

Patterns of zonation in riparian scrub

Reinecke, M Karl [1, 2], Esler, Karen J [2] and King, Jackie M [3]
[1]*Sothernwaters Ecological Research and Consulting cc, PO Box 12414, Mill Street, 8010, Cape Town, South Africa.*
[2]*Department of Conservation Ecology and Entomology, Faculty of AgriSciences, University of Stellenbosch, Private Bag X1, Matieland, 7602, Stellenbosch, South Africa.*
[3]*Water Matters cc, PO Box 209, Constantia 7800, Cape Town, South Africa.*

Vegetation in riparian areas occurs in distinct lateral zones that differ in species composition. The occurrence of lateral zones results from differential species responses to prevailing environmental conditions. Flow is the primary driving variable, which together with the sediment regime, influences *inter alia* the structure of the river channel, moisture regimes and plant life histories. The timing and quantity of flow is correlated with many other physicochemical characteristics of riverine ecosystems that influence riverine biota. It is widely accepted that multiple influences dictate riparian community composition and structure. However, an increased appreciation of the influence of water resource developments on downstream riverine ecosystems through their manipulations of the natural flow regimes, and the concomitant need for environmental flow assessments has led to the need to better understand the links between flow and the lateral zone communities in order to predict their responses to changes in flow. In South Africa, various authors have linked lateral zone communities to one or two key abiotic (usually flow) variables, such as flood recurrence interval or channel geomorphic units. These classifications were based on *a priori* delineation of lateral zone types and thus remain untested. Canopy abundance data on the distribution of riparian vegetation was collected from 18 undisturbed Western Cape rivers in contiguous belt transects. The location (elevation and distance) of sample plot was surveyed in along cross-sections through each belt transect. A range of multivariate statistics were used to discern patterns of zonation, the significance of separation between groups and the contribution of individual taxa towards group separation. The presence of obligate, facultative and incidental riparian species guided the naming and designation of groups. A Classification and Regression Tree was used to develop a predictive model for the location of different zone types based on elevation and distance from the active channel.

POSTER

Threats of climate change and land use on two vulnerable trees species native to Southern California

Riordan, Erin C. [1], Gillespie, Thomas W. [2], and Pitcher, Lincoln[2]
[1] *Department of Ecology and Evolutionary Biolog, University of California, Los Angeles, CA, 90095 USA.*
[2] *Department of Geography, University of California, Los Angeles, CA, 90095 USA.*

With many species already responding to climate change and more predicted to respond within the century, effective protection of future biodiversity must address climate change. Mediterranean-climate regions are at particularly high risk, with the combined impacts of land use and climate change expected to cause some of the highest proportional biodiversity losses observed worldwide by 2100. We investigate the impact of climate change on two trees in Los Angeles County that are listed as vulnerable by the International Union for Conservation of Nature (IUCN) and are endemic to the California Floristic Province, *Quercus engelmannii* and *Juglans californica*. We use species distribution models and GIS analysis of high resolution land cover and climate data to evaluate their potential future ranges and better understand the threats they face. We use presence data from georeferenced herbarium specimen records and field surveys to model and project the contemporary species-climate relationship onto future climate change scenarios and land cover types. Statistical analyses suggest that the Maxent models accurately predict the species' distributions and therefore are useful for natural resource management. Future climate change scenarios suggest that the potential range of *Quercus engelmannii* will be significantly reduced by 2080 while the potential range of *Juglans californica* will significantly expand in northwards. Based on current land cover types, over 30% of the current potential range of *Quercus engelmannii* has already been developed and climate change scenarios suggest the species will migrate to areas already developed. The inverse appears true for *Juglans californica.* Georeferenced species records, species distribution models, and climate and land cover data can provide natural resource managers in Mediterranean-climate regions with first order hypotheses about the current and future status of these vulnerable species.

POSTER

Mediterranean grasses invasiveness in California could be related to some morphological and reproductive traits after survival by drought their resistance patterns

Savé, Robert[1] ; de Herralde, Felicidad[1]; Aranda, Xavier[1]; Young, Truman[2]; Clary, Jeffrey[2]; Roberts, Warren[2] ; Vaughn, Kurt[2]; Evans, Richard[2] and ; Biel, Carmen[1].
[1] Ecophysiology/Environmental Horticulture, IRTA, 08140 Caldes de Montbui, Barcelona, Spain. [2] Plant Sciences Department, University of California,One Shields Ave, Davis, CA 95616, USA [3] University Arboretum, University of California, One Shields Ave, Davis, CA 95616, USA

In seasonally xeric systems like California's Central Valley, competition between native and exotic grasses is most likely for water, so some ecophysiological characteristics provide clear advantages in Mediterranean species than American in order to obtain and avoid water losses, related to environmental conditions, mainly in the first steeps of succession. We studied the response of a California native perennial grass grown with two competing annual grass species, one a California native and the other a Mediterranean invasive common in California. In addition, we investigated the effect of two different rainfall distributions (California and Catalonian distributions) on this competitive interaction. This study was developed on, one California native perennial species, *Stipa* (formerly *Nassella*) *pulchra* from and two annual species, *Bromus hordeaceus* from Catalonia and *Festuca* (formerly *Vulpia*) *microstachys* from California. The seeds were sown in October 26 (*Stipa* and *Bromus*) and November 9 (*Festuca*) 2004 in 1 meter square^{2}greenhouse plots. In each plot the total precipitation of 580 mm/season, simulated with a drip irrigation system, was distributed either according to the monthly rainfall average of Winters (California) rainfall or Cabrils (Catalonia) rainfall. We measured plant cover by zenithal digital pictures, number of infloresences and number of seeds, leaf and infloresence height, and recovery following a simulated summer drought. From present results we must be conclude that the specific differences among grasses are a very important trait in order to understand their responses in front drought stress. So, some reproductive traits are related to phylogenetic origin of plant material and the competitiveness with other grasses. In spite of these interesting points must be considered that ecophysiological characteristics evaluated in this research show important invasive potential, because they can develop competitiveness among them and also because the potential warming and global change can play in this way.

POSTER

Physiological Response of an invasive Species of the Coastal Sage Scrub, *Centaurea melitensis*, to Different Soil Nitrogen Supply

Sharifi, Rasoul[1], Moroney, Jolene[1], Woo, Suh[1], and Rundel, Phil[1]
[1] Department of Ecology and Evolutionary Biology, University of California, 621 Charles E. Young Drive South, Los Angeles, CA 90095-1606, USA

Plant invasions are widely recognized as a significant threat to biodiversity worldwide. Invasive species can change the structure and function of ecosystems and cause local extinctions of native species. They also alter the nitrogen dynamics in a coastal sage scrub (CSS) community. *Centaurea melitensis* (Malta starthistle) is a Mediterranean annual thistle that is invasive throughout most of California and in many other western states. In this study, we tested the physiological and phonological response of *C. melitensis* to four levels of soil nutrients (high, medium, low, and no added nutrients). This research was conducted at the UCLA greenhouse and in the field. Our field study site is located in Forrestal Nature Preserve City of Rancho Palos Verdes, which is a mixed CSS community. A portable steady state gas exchange system (LI-6400) was used to measure the light saturated maximum rates of photosynthesis (A_{max}), transpiration (E), stomatal conductance to water vapor (g), and internal carbon dioxide concentration (c_i). The instantaneous water-use efficiency (WUE; A/E) was calculated from the gas exchange measurements. Carbon isotope ($\delta\ ^{13}C$) analysis of leaf tissue was used to characterize the integrated WUE. In addition, the lengths of the leading shoots, number of flowers, number of lateral shoots, and leaf characteristics were measured. There was a significant difference in A_{max} in plants with no added nutrients compared to plants with all levels of added nutrients, and also between the low and medium nutrient treatment groups. Similarly, water-use efficiency was lower in the no added nutrients and low nutrient treatments than in the medium and high nutrient treatments. Our study indicates that this invasive species has a significant positive response to added soil nutrients, and therefore, merits investigation into the implications of the impacts of anthropogenic nitrogen deposition on *C. melitensis* and native species in the field.

POSTER

Microbial diversity in riparian zones invaded and cleared of woody alien invasive plants in South Africa

Slabbert, Etienne [1], Jacobs, Shayne [2,3], Jacobs, Karin [1]
[1]*Department of Microbiology, Faculty of Science, Stellenbosch University, Private Bag X1, Matieland, 7602*
[2]*Department of Conservation Ecology and Entomology, Faculty of AgriSciences, Stellenbosch University, Private Bag X1, Matieland, 7602*
[3]*Stellenbosch University Water Institute, Faculty of Science, Stellenbosch University, Private Bag X1, Matieland, 7602*

Riparian ecotones are defined as the interface between terrestrial and the aquatic environments and are characterized by sharp ecological gradients. Riparian ecotones are a unique feature within the fynbos landscape and contribute greatly to overall biodiversity of the biome. However, the contribution of fynbos riparian ecotones to soil microbial diversity and community structure has thus far not been investigated. The ecological role of soil microbes are often overlooked and very little is known about the identity of micro-organisms in the soil. Studying the turnover of microbial communities across and along the length of this ecological feature will enhance the understanding of the overall microbial diversity and distribution. Adding to the complexity of riparian ecotones in the Western Cape, soil microbial communities may also be influenced by outside factors such as invasion by alien plant species like *Acacia mearnsii* and *Acacia saligna*, both woody legumes. Molecular techniques make it possible to investigate these complex microbial communities by looking at their DNA fingerprints. These techniques have recently been used in various studies to link to microbial communities with aboveground plant diversity as well as soil process. This study investigated the community structure of 12 fynbos riparian sites with various invasive statuses using automated ribosomal intergenic spacer analysis (ARISA). The results revealed clear differences within the soil microbial community structures between the different zones of the riparian ecotones. The structure of the microbial communities also correlated with the invasion status of the particular riparian sites. With the use of high throughput sequencing to soil ecology, the classification of the soil microbial communities is now also possible. This will further clarify the identity as well as function of individuals in soil microbial communities.

POSTER

Morphological evidence of hybridization between a southern California tree species, *Quercus engelmannii*, with two sympatric scrub oak species

Smith, Carrie E.[1], Ortego, Joaquín[1, 2], Sork, Victoria L. [1, 3]
[1] *Department of Ecology and Evolutionary Biology, University of California, Los Angeles, CA, USA*
[2] *Instituto de Investigación en Recursos Cinegéticos, Ciudad Real, Spain*
[3] *Instiute of the Environment and Sustainability, University of California, Los Angeles, CA, USA*

The Engelmann oak (*Quercus engelmannii*) is an endemic tree species to the southern California/northern Baja California region, which is Californian currently classified as vulnerable due its small distribution range, extensive landscape transformation, and fire. Further, extensive hybridization Engelmann oak with two sympatric scrub oak species (*Q. berberidifolia*, *Q. cornelius-mulleri*) may threaten the genetic identity of Engelmann oak. Sample included 215 individuals from 21 sites located across the entire distribution range of the Engelmann oak. To characterize the species morphologically, we measured the following leaf traits: length, width, petiole length, thickness, trichromes, spines, and veins. Then, using nuclear genetic markers from a related study, we classified all trees into five classes: pure (n=3), hybrid with *Q. berberidifolia,* or hybrid with *Q. cornelius-mulleri*. To understand the extent to which introgression has affected the morphology of these species, we tested the hypothesis that putatively pure individuals for each species are different from each other and that separate analyses of the two pure classes with their respective hybrids show distinct clusters. We find (1) putatively pure individuals are morphologically different and 2) these five classes were morphologically distinct from each other and the hybrids are intermediaries of their parents. We conclude that morphologically, putatively pure individuals are distinct from each other and from their hybrids. Overall, our findings indicate a high degree of introgression in Engelmann oak and should be considered to guide future management practices aimed at protecting this charismatic species.

POSTER

Estimating the population size of island loggerhead shrikes on Santa Rosa and Santa Cruz Islands, USA

Stanley, Thomas R. [1], Teel, Susan[2], Hall, Linnea S.[3], Dye, Linda C.[4], Laughrin, Lyndal L.[5]
[1] U.S. Geological Survey, Fort Collins Science Center, Fort Collins, Colorado, 80526
[2] U.S. National Park Service, Southern California Research Learning Center, Thousand Oaks, California, 91360
[3] Western Foundation of Vertebrate Zoology, Camarillo, California, 93012
[4] U.S. National Park Service, Channel Islands National Park, Ventura, California, 93003
[5] University of California Santa Barbara, Natural Reserve System, Santa Barbara, California, 93106, USA

Island loggerhead shrikes (*Lanius ludovicianus anthonyi*) are an endemic, genetically distinct subspecies of loggerhead shrike on California's Santa Rosa and Santa Cruz Islands. This subspecies is listed as a Species of Special Concern by the California Department of Fish and Game and has been petitioned for federal listing under the Endangered Species Act. Because of suspected low numbers and the possibility of federal listing, there was an urgent need to rigorously estimate the number of remaining individuals and their locations on the Islands. In 2009 and 2010 we surveyed sample units on Santa Rosa and Santa Cruz Islands using a double observer method with independent observers, where units were selected under a stratified random sampling design. For Santa Rosa Island we estimated shrike abundance was 169 in 2009 and 240 in 2010, and for Santa Cruz Island we estimated shrike abundance was 35 in 2009 and 42 in 2010. These numbers, especially for Santa Rosa Island, are higher than previously reported but nevertheless are still low. Rapid vegetation change on both islands due to recent removal of non-native herbivores may threaten the habitat and status of this subspecies, and so we suggest that that intensive demographic and habitat use projects be initiated immediately to obtain additional information for the successful perpetuation of this subspecies.

POSTER

A Comparison of Post Fire Recovery in Riparian Habitats in Fynbos and Chaparral

Swift, Cheryl[1], Faught, Courtney[1], Heller, Shelly[1], Ulrich, Peaches[1], Jacobs, Shayne[2], Esler, Karen[2]
[1] *Department of Biology, Whittier College, Whittier, CA, USA*
[2] *Department of Conservation Ecology and Entomology, Stellenbosch University, Stellenbosch, South Africa*

Fire is an important driver of plant evolution and community organization in shrublands typical of Mediterranean type ecosystems (MTE) shrublands, but, little work has been done on response to fire in riparian habitats within MTE. Our study examines post-fire response of riparian habitats in the fynbos of the Western Cape of South Africa, and the chaparral of Southern California. We examined mortality, resprouting habit, and fire intensity as a function of distance from the stream edge and stream size. We also compared seedling establishment as a function of distance from the stream edge. Our site in South Africa burned in March of 2009, and was sampled in January of 2010, and our site in California burned in August of 2009 and was sampled in July and August of 2010. Although the dominant woody taxa of riparian habitats in South Africa and California differ in growth habit, post-fire recovery was similar except that mortality was higher along larger streams in South Africa. Fire intensity was greater for smaller streams as indicated by the smallest remaining branch. Crown sprouting was more prevalent along larger streams. Crown resprouting decreased with distance from the stream, and although mortality decreased with distance from the stream for large streams in both locations, there was no effect of distance for small streams. Seedling density decreased with distance from the stream edge. The results suggest that mortality in both areas has little to do with fire intensity as measured by the smallest remaining branch. Overall, the riparian communities in these two MTE appear to respond in fire in a similar fashion, although the increased mortality in South Africa is of concern if fire frequency increases as a result of global change.

POSTER

Root growth potential and seedling morphological attributes of four Mediterranean hardwood species

Tsitsoni K.T.[1], Tsakaldimi M[1]., Prodofikas Ch[1].,
[1]*Aristotle University of Thessaloniki, Faculty of Forestry & Natural Environment, Laboratory of Silviculture, P.O. Box 262, 54124 Thessaloniki, Greece*
Corresponding Author: Tel +30 2310 992763, e-mail: tsitsoni@for.auth.gr

In many Mediterranean ecosystems due to large and longstanding human impacts, degradation processes are not local and extensive heterogeneous areas need to be restored. The lack of a reliable nursery practice to assess quality of planting stocks led to the failure of many reforestation and restoration projects. The rapid development of the underground and aboveground section of plants is a factor directly related to the success of plantings. Thus, it is important to develop a mechanism to evaluate nursery seedling quality and performance prior to field planting. Knowledge of the Root Growth Potential (hence RGP) and familiarity with the plant root system is a key to understand ecological fundamentals that influence seedling quality and subsequent growth. This study was conducted to evaluate two measures of RGP (number and length of new roots of first and second order), central root length and shoot morphological characteristics as seedling performance attributes of four Mediterranean hardwood species; *Cercis siliquastrum, Paliourus spina-christi, Quercus ilex* and *Pistacia lentiscus*, which could be used for reforestation and restoration projects. RGP and the other morphological characteristics were determined on two extraction dates (after 3 months from the sowing and 20 days later). Also, the existence of any correlations was investigated to determine whether a relationship exists between belowground and aboveground plant growth. From the results of the growth and the correlations of the morphological characteristics of the species, it could be assumed that the species *Pistacia lentiscus* and *Cercis siliquastrum*, which presented the highest RGP, will show better seedling performance. However, the RGP results should be interpreted cautiously when using them as an indicator of seedling performance potential, because the validity of the RGP as a measurement of seedling vigour is largely a function of site conditions and its predictive ability increasing as the site becomes harsher.

POSTER

Factors Affecting Plant Distribution where the Chaparral meets the Desert

Vanderplank, Sula
University of California, Riverside, CA, USA.

In North America, the transition from Mediterranean-type vegetation (California Floristic Province (CFP)) to coastal fog desert (Vizcaino Desert) occurs in north-western Baja California, Mexico. The area has a predominant contingent of CFP plants yet is a conservation hotspot with ~30% of the native flora being locally endemic. There is little variation in seasonal temperature between the 30^{th} -32^{nd} parallel, but rainfall decreases rapidly as one moves south. The drought-deciduous species of the Coastal Sage Scrub slowly give way to an increasing number of succulent and rosette-forming taxa that result in a specialized Succulent Maritime Scrub. The factors affecting the distribution of narrowly endemic species in this transitional climate zone are of key importance for making sound management decisions. Edaphic conditions have a strong effect on plant distributions. Several restricted habitats (e.g., adobe lenses, vernal pools, and sandstone outcrops) support specialized plant species within them, which are not documented elsewhere. The addition of shell to the soil over the last <4,000 years (in ancient shell middens) significantly changes species distributions along the coast. Soil characteristics are likely to significantly inform conservation planning in this region. Oscillations in available moisture favor a regional flora that is largely plastic in its phenological response to local weather patterns. Habitat corridors are likely to be particularly important in this region to allow gene flow across large distances in wet years. Locally endemic species appear to be more synchronous in their flowering periods (at least on an inter-annual basis). Timing and seasonality of plant phenological events in turn affects all higher trophic levels. Increased understanding of these pulses in the availability of resources may elucidate selective pressures and ecological cycles in the local flora.

POSTER

The effects of climatic variables on plant leaf traits and community cover in an arid ecosystem

Velasco, Lauren and Jenerette, Darrel
University of California, Riverside, 900 University Avenue, Riverside, CA 92521, USA

Plants of arid ecosystems must survive some of the harshest conditions on earth, as a result they have had to develop a number of morphological and physiological strategies to survive. However, with anthropogenic climate change we are seeing greater variability in arid ecosystem temperature and precipitation. Understanding which climatic variables are the largest drivers of variability in drought tolerance and community structure is integral to making predictions about a species ability to adapt and survive. To learn more about how temperature and precipitation affect plant drought tolerance and community structure, we measured Specific Leaf Area and Leaf N within a wide range of plant species along an elevation gradient in the San Jacinto Mountains of California. This elevation gradient provides gradients of decreasing temperature and increasing precipitation. We also measured percent cover of individual species within sites and calculated total coverage for sites. We predict that with decreases in temperature and increases in precipitation plants will exhibit decreases in traits associated with drought tolerance and community cover will become more dense. Initial results indicate that while some plants, including *Adenostema sparsifolium*, *Encelia farinosa*, and *Ceanothus greggii* follow trends of increasing Specific Leaf Area, this is not found in all plants. Leaf nitrogen showed similar trends, with some plants showing increases Leaf N, but not all. We found increases in plant cover with increasing altitude with a slight decline at the highest altitudes. These findings indicate that some plant species may be more amenable to change than others or that some species are simply using strategies to survive in high heat and low precipitation which we are not currently measuring. However these data provide important insights as to how aridland plants will be able to adapt under changing climate conditions.

POSTER

Midterm effects of a wildfire in a Mediterranean creek: fire vs. seasonal drought

Verkaik, Iraima[1], Vila-Escalé, Mireia [1], Rieradevall, Maria[1] & Prat, Narcís[1]
[1] *Freshwater Ecology and Management (F.E.M.) Research group. Departament d'Ecologia. Universitat de Barcelona. Av. Diagonal, 645. 08028 Barcelona. Spain*

Fire is an important and recurrent disturbance in the Mediterranean watersheds however the knowledge of the effects of the wildfires on aquatic ecosystems is reduced. After a wildfire in 2003 affecting several creeks in Sant Llorenç Natural Park (NE Spain), nine sites were established and annually sampled to evaluate the expected effects and to monitor the biota recovering. Here we present results on the mid-term effects of the wildfire on the macroinvertebrate assemblages. Two months after the wildfire the number of macroinvertebrate families was significantly lower compared to the unburnt creeks (19 vs. 25). Important alterations of chemical parameters did not last long because of floods after the wildfire. Through the next 4 years the number of macroinvertebrate families did not show differences between the burnt and the unburnt creeks. A severe seasonal drought endured during the year 2005 and caused the lowest number of families found in all the sampling period. Our results suggest that the fire could increase the effect of other disturbances as seasonal drought; and show the high resilience of the Mediterranean communities to disturbances. We compare also our first year after the fire results with other non-Mediterranean type of streams were fire is also a common disturbance. Although we found some similar responses (e.g. higher proportion of *r*–strategist insects) in burned streams, it seems that the ocurrence and timing of other disturbances like flood and drought may mediate fire effects on macroinvertebrates response.

POSTER

The influence of environmental factors on carbon allocation in the Mediterranean shrub Halimium halimifolium L.

Wegener, Frederik, Beyschlag, Wolfram; Werner, Christiane
Exp. and Systems Ecology, University of Bielefeld, Universitätsstraße 25, D-33615 Bielefeld

An integrated understanding of carbon allocation mechanisms and their dependence on environmental factors is of major importance. It is known that different plant organs have distinct carbon isotope signatures ($\delta^{13}C$, e.g. 1‰ to 6‰ difference between leaves and roots[1]), which was shown to be reflected in post-photosynthetic fractionation effects on foliage respiration. The extent of this phenomenon depended on species and environmental conditions. We hypothesized that this can be explained by different carbon allocation strategies. Three treatments were used to induce shifts in carbon allocation in *H. halimifolium*: control, nutrient limitation (higher investment in roots), and light limitation (higher investment in shoots). We used a soil/canopy chamber system that enables independent measurements of above and belowground $d^{13}CO_2$-exchange. This allowed us to calculate the carbon gain during photosynthesis and the carbon loss during respiration on a whole plant level. The carbon allocation to different plant organs and their $\delta^{13}C$ values were analyzed over one year. Furthermore, detailed short-term allocation pattern of recently fixed carbon were investigated in a $^{13}CO_2$ pulse labeling experiment, revealing a rapid carbon transfer to the roots, where assimilated ^{13}C was detected in soil-respired CO_2 after 4.5 h. The results give valuable new information on the coupling of different above-and belowground carbon allocation strategies and the $\delta^{13}C$ pattern of plant material and respiration.

[1]Wegener, Beyschlag, Werner (2010); *Funct. Plant Biol.* **37**, 849–858.

POSTER

Modeling Locally Endangered Plant Species in the Santa Monica Mountains

Willis, Kate[1,2], Gillespie, Thomas [1,2]
[1]University of California, Los Angeles, Los Angeles, CA, 90095, USA [2]National Park Service of the Santa Monica Mountains, Thousand Oaks, CA, 91360, USA

The landscape in the United States is constantly evolving due to human land use. A local example of this is seen in the Santa Monica Mountains, with increasing populations and wealth leading to an increase in demand for land in Malibu, Thousand Oaks, and other surrounding areas. This land is not only being developed to support sizable homesteads, but also for commercial use such as vineyards and ranches. Surprisingly, many of these developed areas are within the greater perimeter of the Santa Monica Mountains National Park (SMMNP). The SMMNP exists in patches, with private land owners inhabiting small land parcels within the national park itself. Because of the close proximity, these residential areas have an effect on the natural vegetation in the area because they are directly adjacent to the park. The number of these private land owners has increased significantly over the past century, which has already changed the landscape and the species composition in the area considerably. These compositional changes could be due to runoff from regular watering and fertilizing of the landscaped homes, as well as from the exotic and invasive plant species spreading from personal gardens and landscaping. This project identifies and models the current endangered plant species presence within the park. This has been completed using remote sensing and the Maxent species modeling program. The potential sites of native and locally endangered plant species are located for present day and future scenarios. Future scenarios are calculated at ten year intervals for the next 100 years using IPCC climate change and calculated land use change scenarios in the SMMNP. This is important for preservation because it allows us to plant native and endangered species in conditions where they are likely to survive with impending climatic and land use changes.

POSTER

The California Fire Science Consortium – a new tool for collaboration between fire scientists and fire managers

Witter, Marti [1], Keeley, Jon[2], and Kline, Tim[3]
[1] Santa Monica Mountains National Recreation Area, Thousand Oaks, CA 91360, [2]USGS Western Ecological Research Centre, Sequoia National Park, Three Rivers, CA 93271, [3]University of California, Berkeley, CA 91360

The California Fire Science Consortium, along with a number of other regional groups across the United States, has received multi-year funding from the Joint Fire Science Program to improve the quality and timeliness of the two-way movement of fire science information between scientists, land managers, and stakeholders in the state's fire community. Our primary goals as a consortium are twofold: 1, to become a clearinghouse for all fire science resources relevant to the regions within the state of California, and 2, to encourage collaboration between fire researchers and land managers and other stakeholders. Our goal is to make the California Fire Science Consortium the primary resource to both access and better understand fire science, to open new channels of communication and to encourage new science applicable to fire management. Our planned activities include listing and describing existing research with new syntheses; assessing the quality of research and applicability to land management; demonstrating research in the field; identifying research needs and information gaps; and identifying means to validate the effectiveness of fire management practices needed by managers and stakeholders for their projects. A new website will be the hub of these activities*: http://www.cafiresci.org*. Already available on the website are webinars, science briefs, reviews, management guides, links to other fire websites, current papers related to management topics, and a preliminary bibliography. There are also links to regional areas with products related specifically to the individual regions, including the Sierra Nevada, Mojave and Sonoran Desert, Northern California, Central and Southern California and the Wildland-Urban Interface. Please come by during the poster session to learn more, visit the website, register, and give us your feedback.