出國報告（出國類別：國際會議）

出席國際環境生態復育學會（SER，The Society for Ecological Restoration）2012 環境生態復育國際會議出國報告書

服務機關：行政院環境保護署
姓名職稱：鄭技士惠文
派赴國家：捷克
出國期間：**101** 年 **9** 月 **8** 日至 **16** 日
報告日期：**101** 年 **12** 月

目　　錄

壹、出國目的

國際環境生態復育學會（SER，The Society for Ecological Restoration）成立於西元 1988 年，其會員來自全球 70 多個國家，為推動生態復育、重建及加強生物多樣性與生態系的全球性民間組織，該學會積極推動生態復育相關工作，並曾參與、催生生態多樣性公約（CBD，Convention on Biological Diversity)及拉姆薩爾濕地公約（Ramsar Convention on Wetlands）等國際公約，涉足領域相當廣泛，在生態復育領域中其年會為國際間甚具規模者。期能藉由參與本次會議，瞭解國際間生態復育發展之趨勢，及環保先進國家對於環境保護、生態復育之作法，同時與其他國家進行經驗交流，做為未來推動環境資源部政策規劃之重要思考方向及參考。

貳、行程

日期	地點	工作內容
9 月 8 日~9 日	台灣（台北）至捷克-契斯凱・布達札維（Czech Budejovice）	啟程
9 月 10 日	捷克-契斯凱・布達札維（Czech Budejovice）	開幕式及研討會
9 月 11 日	捷克-契斯凱・布達札維（Czech Budejovice）	研討會
9 月 12 日	捷克-契斯凱・布達札維（Czech	實地參訪

	Budejovice）	
9 月 13 日	捷 克 - 契 斯 凱 • 布 達 札 維 （ Czech Budejovice）	研討會
9 月 14 日	捷 克 - 契 斯 凱 • 布 達 札 維 （ Czech Budejovice）	研討會及閉幕式
9 月 15 日~16 日	捷 克 - 契 斯 凱 • 布 達 札 維 （ Czech Budejovice）至台灣（台北）	返程

參 、 關 於 捷 克 共 和 國 （ Czech Republic）

捷克為一位於歐洲核心地帶的中歐內陸國，北鄰波蘭，西鄰德國，南鄰奧地利，東鄰斯洛伐克，首都及最大城為布拉格（Praha）。其地形為一個三面隆起的四邊形盆地，西部是波希米亞高地，東部是喀爾巴阡山地。河網稠密，主要河流是伏爾塔瓦河和摩拉瓦河。捷克於西元 1993 年 1 月 1 日獨立成為民主國家，西元 2004 年成為歐盟會員國，西元 2007 年被世界銀行列入已開發國家。現在的捷克主要包含了過去奧匈帝國時代的波希米亞與摩拉維亞兩個省份，與一小部分的西里西亞範圍；氣候屬海洋性向大陸性氣候過渡的溫帶氣候，夏季炎熱，冬季寒冷多雪，其中 7 月最熱（均溫為 19.5℃），1 月最冷（均溫為-0.5℃）。全國共分為一個直轄市首都與 13 個州，國土面積約為 78,886 平方公里，總人口數為 1,019 萬餘人，官方語言為捷克語，主要經濟活動為機械製造、化工、冶金、紡織、製

鞋、木材加工、玻璃製造和啤酒釀造等，旅遊也是捷克經濟收入重要來源之一，最高峰時，旅遊業的總收入曾高達國民生產毛額（GNP）的 5.5%。

本次會場位於南捷克的最大城-契斯凱・布達札維（Czech Budejovice，常被簡稱為 CB），是百威（Budweiser）啤酒的發源地，也是 KOH-I-NOOR 鉛筆工廠的所在地，故有啤酒城及鉛筆城的別稱，它位於伏爾塔瓦河和瑪爾他河匯合的平原地帶，於西元 1265 年由布善密斯拉・奧他卡二世（Premysla Otakar Ⅱ）國王所建立，由於貴族的認可及地處商業要道，幾百年來逐漸昌盛，成為捷克最主要的城市之一（南波希米亞州的首府和最大城市）。其現今是天主教捷克布達札維教區主教、南波希米亞大學及全國農產品展覽中心的所在地，距離布拉格約 2.5 小時車程，總人口數約為 9.5 萬人。

契斯凱・布達札維（Czech Budejovice）佈局整齊的街道，對於中世紀的城市設計而言可謂登峰造極，城中還分佈著一系列珍貴的歷史文物，廣場上的市政廳建於西元 1727~1730 年間，有 3 個塔樓，上面的雕塑代表城市的四個基本精神：公正、誠實、智慧和嚴謹，同時期還製造了巴洛克式薩姆索諾瓦噴泉（Samson's Fountain），置於四方形廣場的正中央，成為城市的標誌之一。城市的標誌還有黑塔，高 72 米，建於西元 1550~1577 年，作為廣播台或鐘樓使用，也是皇室布達札維商業繁盛的象徵。黑塔旁邊是巴洛克式的聖尼古拉斯大教堂（Cathedral of St. Nicholas），建於西元 1642~1649 年，是老哥德式教堂被大火焚毀後建造的。建築方面最有價值的文物是多米尼肯教的修道院（Dominikansky klaster s kostelem），上面的大圓頂頗有特色，修道院裡哥德式的聖母瑪麗亞禮拜堂（Obetovani Panny Marie）和旁邊有十字走廊的會議廳是從西元 1265 年建城時開始建造的，直到 14 世紀中期才完工，不久前發現的壁畫與內部五彩繽紛的裝飾格調一致。緊鄰著修道院的是建於西元 1531 年的舊軍火庫（Solnice），飾有階梯式的山形牆，沿

著邦斯基大街還可以走到 14 世紀的城市邊防拉本施坦斯基塔（Rabenstein Tower），沿著斯萊皮和瑪爾莎河岸可以看到另一段城防，城防上有奧塔卡堡壘（Eiserne Jungfrau）及鐵女人塔樓（Iron Virgin），城內還大量保存著完好的哥德式、文藝復興式及巴洛克式民宅。臺灣近年來也意識到，城市舊建物對城市歷史記憶的重要性，除了加強維護古蹟外，也開始著手進行復育或修復工作，契斯凱・布達札維（Czech Budejovice）這種結合歷史、商業及政治中心的大城經驗，著實值得我們借鏡。

肆、活動地點及內容

國際環境生態復育學會（SER，The Society for Ecological Restoration）2012 環境生態復育國際會議於 2012 年 9 月初在捷克契斯凱・布達札維（Czech Budejovice）Clarion Congress Hotel 會議廳舉行。本次會議內容共有 4 場專題論壇（Plenary Session）、44 場分項座談會（Parallel Session）、179 篇以上論文發表（Papers）、89 篇以上海報展示（Posters）及多組實地參訪行程（Mid-Conference Excursions）等。大會議程詳如附錄一。

伍、參加人員

此次參加人員包含地主國捷克、英國、法國、德國、冰島、美國、挪威、愛沙尼亞、紐西蘭、伊朗、匈牙利、巴西、澳洲、西班牙、比利時、波蘭、盧森堡、義大利、瑞典、瑞士、荷蘭、阿根廷、加拿大、芬蘭、日本及韓國……等國家代

表，共約 300 多人。而我國僅本署派 1 人參加。

陸、SER 2012 國際會議概要

一、本次會議主題

本次會議主題為 near-natural restoration（近自然復育），藉由多篇專題論壇及座談，探討及分享生態復育之規劃過程、架構、生態指標、生態模式、參數之定義與流程，進而整合至決策過程之研究與經驗，期能透過加強生態系統建設與優化管理，來達到恢復與重建那些在自然災變和人類活動壓力下受到破壞的自然生態系統。

二、專題論壇（Plenary Session）

本次專題論壇之內容係由本次會議主題「near-natural restoration」延伸而來，包含「新的生態系、外來種及恢復（Novel ecosystems, invasive species and restoration）」、「復育自然的資本（Restoration of natural capital）」、「大規模的復育（Restoration at large scale）」、「理解和管理時空動態（Understanding and managing temporal dynamics）」、「聖海倫火山的原生演替（Primary succession on Mount St. Helens）」、「在生態復育上 使用自動恢復（Using spontaneous succession in ecosystem restoration）」、「在復育上的地下群落（The below ground community in restoration）」、「有效的復育必須克服阻力及外來種的入侵（Overcoming resistance and resilience of invasive species is necessary for effective restoration）」、「被遺棄的乾燥的石灰質和沙質草地、耕地或林地之復育（Restoration of dry calcareous and

sandy grasslands after abandonment, arable field use or afforestation）」、「藉由發展綠色基礎建設來復育生態系的生命力（Restoring ecosystem resilience by developing Green Infrastructure）」、「目標物種的棲地恢復功能（Restoring functional habitats of target species」及「透過結合近自然植被復育方法和自動復育，在舊礦區發展物種豐富的、動態的及多功能的景觀（Developing species-rich, dynamic and multifunctional landscapes in former mining areas combining near-natural revegetation methods and spontaneous succession）」等主題。並透過論文發表及意見交換方式，討論看法及進行經驗交流。會中還透過案例介紹，讓大家了解近自然復育的可能成效，並深刻體會到生態復育的重要性。

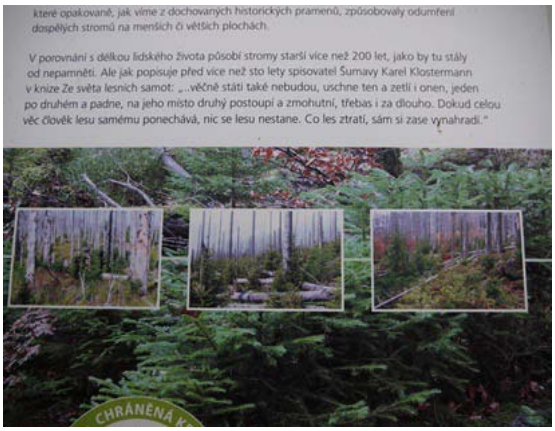
三、分項座談會（Parallel Session）

本次會議論文發表相當踴躍，約有 179 篇以上，因此大會安排同時間不同場次之分項座談會，主要議題除上述之大會主題及專題外，尚包含近自然復育的科學和實踐（The science and practice of near-natural restoration）、棲地復育型態（Restoration of habitat types）、瀕臨絕種及複合族群的再引入與壯大（Reintroduction and reinforcement of populations of endangered species；meta-population dynamics）、入侵生物與生態復育（Invasive organisms and ecological restoration；novel ecosystems）、生態復育的景觀內涵（Landscape context of ecological restoration）、生態復育的社會經濟、文化與立法層面（Socio-economic, cultural and legislative dimensions of ecological restoration）…等主題。

四、實地參訪（Mid-Conference Excursions）

大會安排了 10 種實地參訪行程供大家擇一參加，包含砂坑行程（Sand pit route）、河川沖積扇行程（River floodplain route）、採礦泥炭地及河流復育行程（Mined peatland and stream restoration route）、沼澤行程（Marsh route）、露天礦場/採石場行程（Quarry route）、軍事用地行程（Military area route）、邊境地區行程（Border area route）、森林復育行程（Forest regeneration route）、泥炭地綜合行程（Peatland complex route）、乾草原行程（Dry grassland route）等，並由主辦單位人員帶領參觀及解說，本署代表選擇「森林復育行程（Forest regeneration route）」參加。

森林復育行程包含 2 個參訪點，第 1 個是距離契斯凱・布達札維（Czech Budejovice）約 2 小時車程的舒馬瓦山國家公園（Sumava National Park），第 2 個是世界文化遺產-豪拉邵維采（Holašovice）村莊。在舒馬瓦山國家公園裡，我們要參觀的是被樹皮甲蟲（bark beetle）入侵的高山雲杉林（spruce-forests），現今的雲杉林源於 19 世紀樹皮甲蟲大爆發後的部分自然再生、種植及播種，近來 20 世紀（西元 1990 及 2004 年）時又爆發 2 次樹皮甲蟲入侵，這 2 次之後，有些區域（Plešné Lake 附近）採取不干預的自然復育法，有些地區（Plešné Lake 周圍）採取砍伐及人造林等傳統林業管理方式。而這次參訪的目的就是讓我們看



看這兩種方式的差別所在，我們看到國家公園主管部門透過傳統的林業管理方式，想要控制樹皮甲蟲對雲杉林造成的傷害，但卻留下大片光禿禿的空地，而自然復育法卻讓樹皮甲蟲成為高山雲杉林的動態天然成分，其在林中自然且充足的繁衍下一代，並沒有對其他生物造成負面影響。所以不干預的策略似乎才是復育雲杉林最好的方法，不幸的是，在國家公園，採用傳統林業管理方法（包括砍伐遭樹皮甲蟲出入侵的樹木）佔有主導的地位，這是很難改變的狀況。

第 2 個參訪點-霍拉索維采（Holašovice）村莊 ，距離契斯凱‧布達札維（Czech Budejovice）約半小時的車程，13 世紀時它是捷克南部的一座村莊，當時被稱為巴洛克農民的珍珠。在村莊中央有個魚塘，塘的周圍分佈著一座座莊園，共有 22 座帶有花園的房屋，屋上均繪有巴洛克式徽紋盾牌，這些山形牆房屋源於 19 世紀，是獨一無二的塞爾斯基地區巴洛克式建築群，它在共產主義時代中倖存下來，是捷克保存最完好的村落之一，國際教科文組織於西元 1998 年將其列為世界文化遺產。村莊中的魚塘是用於養魚的，至今，這一帶仍以養魚業聞名，此外，這個村莊還有著生動、歷史悠久的農村傳統，例如：眾所周知的捷克著名歌劇《被出賣的新嫁娘》就是取材於此地，它還是拍攝同名歌劇電影的外景地。

五、會議參與情形摘述

本次參加會議的主要目的為瞭解國際間生態復育發展之趨勢，以作為未來推動環境資源部政策規劃之重要思考方向及參考，故本次會議本署代表參與之專題論壇及分項座談會側重在生態復育案例分享上，並就其中較重要部分進行內容摘述，其餘內容詳見附錄一。

(一) 哈薩克荒廢的草原植被進行大規模近自然復育案例：探討放牧影響的重要性。（作者：A. Brinkert, N. Hoelzel, J. Kamp）

這個案例是討論西元 1991 年蘇聯解體後，整個歐亞草原嚴重的土地利用變化。在哈薩克南部有 80%的耕地被荒廢，畜牧數驟減，放牧也僅限於附近的村莊。很少人知道，透過大自然的演替，這些被荒廢的原始草原植被究竟能恢復到什麼程度？因此，需要對這種近自然復育的影響做進一步的研究，此篇研究假設放牧能提高目標物種的擴散，所以在西元 2011 年夏天，對「有」及「沒有」放牧壓力下之荒廢原始草原，進行植被、生物量及土壤參數的紀錄及採樣，並對生物量及土壤進行化學分析及統計，結果顯示，在有放牧的區域其物種豐富度高於沒有放牧的區域，放牧是影響荒廢草原植被復育成功與否最關鍵的因素，其次為土壤成分。不放牧的區域，有強大的生物量累積，火災頻傳，且典型的草原物種遷移也變慢了。作者依研究的發現建議，草原植被的自然復育應加強放牧，並重新將局部性的家畜放牧擴展至整個區域，以彌補賽加羚羊（Saiga antelope）被偷獵後，放牧數的不足。

(二) 聖海倫火山的原生演替 案例：貧瘠土地復育的教訓。（作者：R. del Moral）

聖海倫火山 現在的地景是西元 1980 年 5 月 18 日 火山噴發後所形成的 ，是一個 馬賽克狀的毀壞棲地 。本篇研究首先採用固定樣地、植被調查和其他方法來進行原生演替的描述，以進一步了解其成因。很多見解及令人驚訝的事情在演替理論及復育生態學中浮現，自發性發展受到壓力及孤立的限制。短距離影響物種組成，很難適應壓力的物種，大多透過遷移散播出去，而耐應力物種則慢慢地抵達和改變群落的結構。物種的遷入是很難被預測的，相似的棲地也可能遷入不同的物種，一般而言，散佈範圍也不同於成熟的草地，演替過程中範圍也會改變，在不同地區的相似棲地，範圍也會有所不同，物種的建立尚有賴物理性的改變及生物性的促進，但有時競爭勝過促進。假如競爭或環境連結夠強，或主要效應和次要干擾的發生背道而馳，相接鄰的地區，演替軌跡也可能會趨近於一致。

這篇研究得到幾個結論，首先，貧瘠土地復育的第一階段應有適當的準備，包含適當的栽培植物（nurse plants）密度及後期植物的引入等，此外，即便傳播的障礙很溫和，飢渴物種（desired species）一定要被引入，這樣能讓物種即便在重度受干擾的基質中也能自動再生。替代性軌跡的產生間接地告訴我們，復育成功可能會產生多重結果，但都是可被接受的。

(三) 透過結合近自然植被復育法和自動復育，在舊礦區發展物種豐富、動態且多功能的景觀。（作者：S. Tischew）

假如我們採用最新的復育計畫及技術，即便在極為衰竭的基地，要發展出豐富、動態且多功能的景觀也是有可能的。採礦場具有異質性、營養貧瘠、動植物物種稀少…等獨一無二的潛質，過去注重侵蝕防治、

土壤改良、空洞補平等，對開採後的礦場景觀造成不必要的破壞，西元1970 至 1990 間，快速生長的非本地物種大量地被種植，這種做法嚴重地威脅到復育礦場附近的本地生物多樣性。相對地，現在的復育計畫及技術之目的是結合採用本地植物及自發性演替兩種方法，來保存或整理異質性基地的狀況。

從德國幾個礦區的案例中，可以找出恢復生氣勃勃生態的科學原則及最佳實踐方法，這些例子證明，生態復育後的舊礦場能夠提供具吸引力的修養服務給生態系中的生物。利益相關者對這些現在流傳在科學家與執行者間的知識更有敏感度了，也對新的方法更有興趣了，所以礦業公司開始重新考慮他們的復育策略。這篇論文的作者主張其將繼續在實踐中了解失敗的原因，進而建立礦場生態復育的標準。

柒、心得及建議

一、 結合跨領域的專長，一同進行生態復育工作

依國際環境生態復育學會（SER）的定義，「生態復育」是企圖盡可能地將一個受損或破壞的生態系統，恢復到該生態系歷史軌跡的某一個點，使該生態系健康、完整及永續的過程。因地震、海嘯、颱風、火山爆發等天災，及人為開發破壞或改變了原有的生態系統、環境及棲地，造成生態系統的功能無法如同原本正常地運作，生物可能會減少甚至滅絕。因此，為了挽救已被破壞或即將被破壞的生態系統，「生態復育」的概念遂被提出，依據當地的氣候、地形、原來的動植物相，與當地的歷史人文等資訊，規劃生態復育的目標，並結合社區參與來共

同進行、維護生態復育的工作。

自然生態系是一非常複雜的系統，所以生態復育具有某一程度的風險與不確定性，而完備的生態規劃、決策架構，可減低生態復育之風險與不確定性，以最小成本達到復育計畫最大的功效。所以生態復育應包括相關領域的科學家、行政人員、甚致民眾，跨領域的結合才能成功，以河川復育為例，復育工作包含農業政策的改變、水資源的管理、公眾壓力的疏導、水利工程人員的覺醒、尋找判定水利工程敏感與效率的方法、執行經驗…等。未來環境資源部的成立，將整合森林、林業、水資源、氣象、地震、污染防治、氣候變遷…等主管機關，應更能結合跨領域的專家與資源，完備生態復育的決策系統，有效提升復育的成效。

二、 與國際觀念接軌，推動近自然復育

由近年來世界各地因氣候變遷不斷發生的種種災害，讓人類深刻體驗到人定勝天的謬誤觀念應即時導正，且由這場會議中許多國家的學者及代表分享之研究與案例，我們可以發現無論何種復育計畫及技術，愈順應自然，愈以生態為基礎，愈少人為干擾，生態系就愈能回復到接近原始的軌跡點上，並成為一個健康、完整及永續的環境。

但反觀我國的復育手段和技術，無論是森林復育、礦區復育、河川整治及復育等，仍到處充斥著砍伐、假植、外來種、編柵工程…等人為干擾行為，所以我們應該將「近自然復育」這種國際概念融入政府政策中，讓我國的復育工作朝永續方展的正確方向前進。

三、 建立本土生態復育決策系統，做為生態規劃、生態工程之參考

自然生態系是一非常複雜的系統，進行生態復育前，需詳盡地規劃其內容、流程與架構，利用量化物理、化學及生物狀況以定義棲息地及現有的問題、發展復育的目的及目標、發展生態系復育之觀念性模式、發展復育的假說、定義主要生態系參數與改善執行的準則、評估及改善復育假說、發展復育設計、執行之可行性分析、成本及影響分析、最終復育設計及執行計畫之發展、計畫執行、執行監測及適當的管理與維持等，並給與充份的時間，以達到最小成本與最成功之復育。

另一方面，生態復育尚需一完整的決策架構，分析環境背景，界定、組織與分析復育的過程，並且整合訊息，幫助環境風險之決策，甚至生態復育之公平性，使得高風險的生態復育之風險減低至最小。因此，生態復育的落實首先應建立本土之生態復育決策系統，以做為生態規劃、生態工程之參考。

附錄一：大會議程

ECER 2012

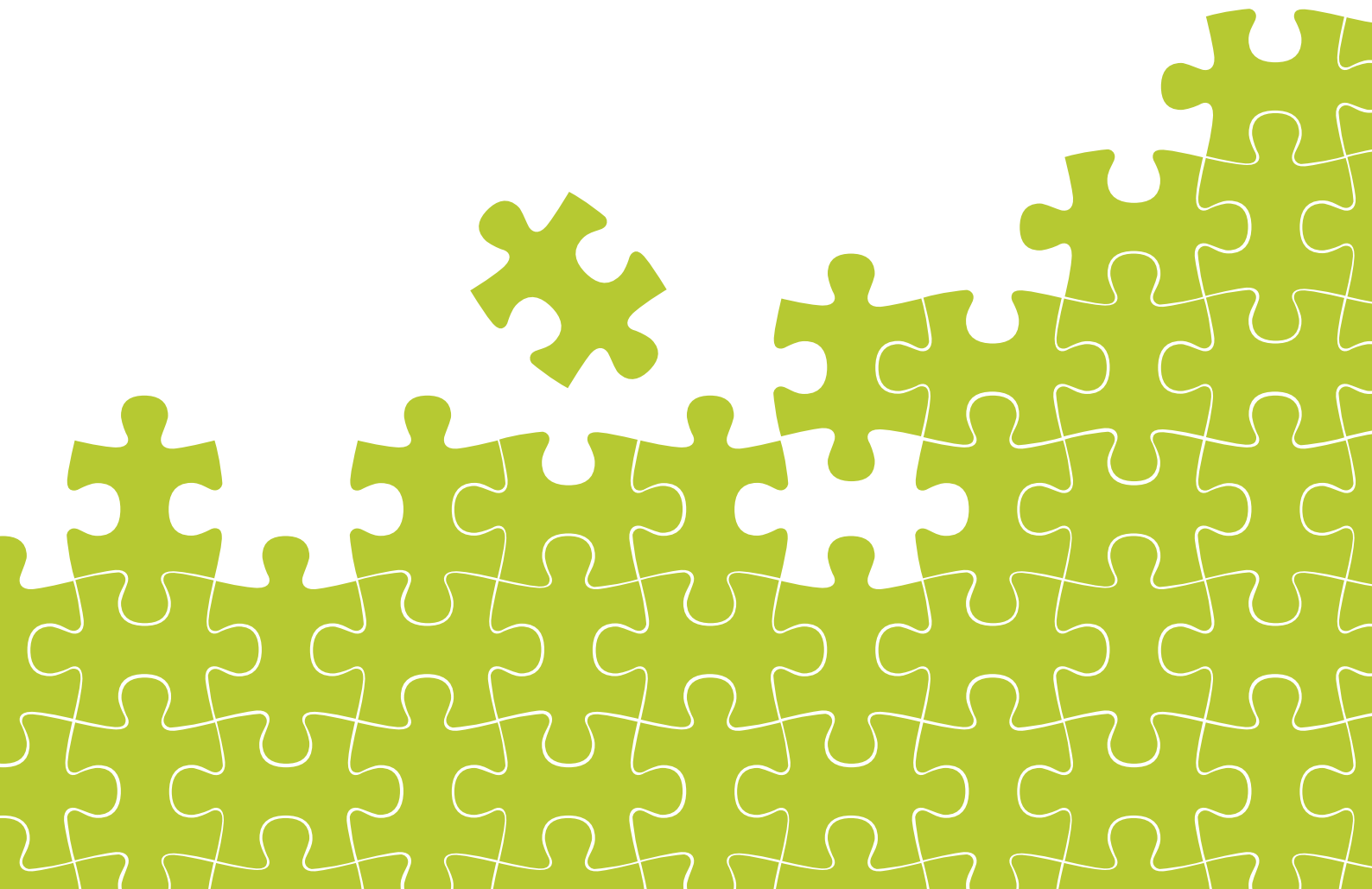
The 8th European Conference on Ecological Restoration

September 9–14, 2012

České Budějovice, Czech Republic

NEAR-NATURAL RESTORATION

Programme and Abstract Book



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CONTENT

Welcome Addresses

Welcome in České Budějovice (Budweis)

We are delighted to have a chance to organize the conference, an important event for the scientific field of restoration ecology as well as practical ecological restoration. Both are developing very fast, being increasingly respected by the public, decision makers, politicians etc. (see, for example, the European Union Biodiversity Strategy which is asking for restoration of at least 15 % of degraded ecosystems across the EU till 2020). We are glad that you are attending the conference in one of the new European Union countries, the second European conference in the region after Budapest 2002. Restoration ecology has a good scientific standard in the Czech Republic and practical ecological restoration thus has a good background. Unfortunately, restoration ecology is still more or less an academic discipline here, which is indicated, among others, by the low interest in the conference by politicians (respective Ministries), decision makers and practitioners (except nature conservationists and a few representatives of mining companies) and the low number of sponsors for the conference. We hope that the conference and its outputs will turn more attention to the perspective and necessary activities which represent ecological restoration. Our country, spoiled by the former communist regime, needs that.

We are pleased that colleagues from the majority of European countries, as well as many from overseas, are taking part. We wish you, as well as us as organizers, a fruitful and pleasant week. Enjoy not only the scientific programme itself, but also the various social events and excursions. We believe that you will also enjoy the atmosphere of the historical town. Thank you for coming.

Finally, we would like to thank the sponsors, the University and Faculty representatives, as well as representatives of other co-organizing institutions, and last but not least the SER-Europe and SER-International boards for their support.

Karel Prach and Klára Řehounková
on behalf of the organizers

Dear Colleagues,

On behalf the board of the European Chapter of the Society for Ecological Restoration SER International I welcome you to the 8th European Conference on Ecological Restoration in České Budějovice.

České Budějovice has a long tradition of restoration ecological research that was always connected with the name of Karel Prach. The this year's main theme of the conference 'near-natural restoration' goes back to Karel's early scientific work in the 1980s on natural succession of mining sites. Inspired by the results of this research he brought forward the idea of 'near-natural restoration' as a new and complementary approach to the widespread technical reclamation of mining sites in his country. The motto 'near-natural restoration' also reminds us that ecological restoration should always follow principles, patterns and processes that can be found in natural or semi-natural reference systems. Otherwise, we are always in danger of becoming gardeners or engineers creating something artificial or even technical that is unsustainable and far from nature. Restoration measures should always be seen as a temporary assist to initiate and accelerate the development towards a near-natural target system. This does of course not include the cessation of traditional human management practice such as burning, grazing und mowing that have shaped grasslands, savannahs and other open habitats for thousands of years all around the globe.

During the past two years, ecological restoration has become a major topic on the agenda of European environmental policy. This applies especially to the new, so called "Green infrastructure" strategy of EU aiming at the restoration of 15 % of degraded ecosystems outsides the NATURA 2000 network by 2020. Key objectives of this strategy are the improvement of the connectivity between natural areas but also the strengthening of ecosystem functions at landscape level. Potentially, there are fantastic chances for ecological restoration in this strategy but also considerable drawbacks and pitfalls that will be discussed in detail in a special session at the conference. I presume our community can make a significant contribution to the ongoing discussion on this new EU strategy.

I would like to thank Karel Prach and Klára Řehounková and the whole organizing team, the sponsors and everybody else involved in the conference organization for their support, idealism and commitment, which are essential to make such an event possible.

Beyond the scientific program, the conference is spiced with excursions to the lovely and highly diverse cultural landscape of southern Bohemia, delicious Czech beer, goulash and dumplings.

I wish you a joyful and inspirational stay in České Budějovice.

Norbert Hölzel
President of SER Europe

I'm honored to be among the first to welcome you to České Budějovice, Czech Republic for the Eighth Conference sponsored by the Society for Ecological Restoration – Europe. I'm also envious since I'm unable to attend and the SER Europe meetings have long been among my favourites. The theme of "NEAR-NATURAL RESTORATION" will certainly provide ideas that enrich all who attend and the entire discipline of ecological restoration. The organizers have assembled a distinguished group of speakers that will certainly stimulate many lively conversations among friends – new and old. A special thanks to the organizers and many volunteers that made this meeting a reality.

The Society for Ecological Restoration takes great pride in our European Chapter and continues to be enriched by our European membership. This meeting demonstrates the strength and vitality of ecological restoration in Europe. On behalf of the entire membership, Board of Directors, and staff of the Society for Ecological I welcome you to České Budějovice for this special meeting of colleagues dedicated to improving our world.

Steve Whisenant, Chair
Society for Ecological Restoration, Bor, South Sudan

Organisers

The conference is organised by the Working Group for Restoration Ecology, Faculty of Science, University of South Bohemia in České Budějovice in collaboration with The Institute of Botany, Academy of Sciences of The Czech Republic, The Agency for Nature Conservation and Landscape Protection of The Czech Republic, The Directorate-General for the Environment (European Commission), Visegrad Fund and under the auspices of SER-Europe.

Conference Chairman

Karel Prach, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic and Institute of Botany ASCR, Třeboň, Czech Republic

Conference Co-chairwoman

Klára Řehounková, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic and Institute of Botany ASCR, Třeboň, Czech Republic

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Bernhard Krautzer, Austria
Rob Marrs, United Kingdom
Roger del Moral, USA
Karel Prach, Czech Republic
Sabine Tischew, Germany
Katalin Török, Hungary
Lawrence Walker, USA

Conference Department

CZECH-IN s.r.o.
5. kvetna 65, 140 21 Prague 4
Czech Republic

General Information

Conference Name Tag

Delegates and Accompanying Persons are kindly requested to wear their Conference Name Tag at all meetings and official functions including Social Programme.

Social Programme Vouchers

Every Delegate will receive the voucher to social activity at Registration Desk, to which was preregistered.
(no voucher needed for the Classical Concert and University Evening)

Language

The official language of the Conference is English. No simultaneous translations will be available.

Computer Area and Internet Access

The Internet Corner is located in Hotel Foyer next to the Registration Desk.

Wireless internet connection is available throughout the venue.

For details ask at the Reception of the Clarion Congress Hotel.

Excursion Departures

The Departures to the mid-conference and post-conference excursions are from the Parking in front of the Clarion Congress Hotel. Time of departure to the mid-conference excursion is at 9:00 on September 12 and to the post-conference is at 14:00 on September 14.

Liability and Insurance

The Organizers of the Conference will not assume any responsibility whatsoever for damage or injury to persons or property during the Conference. Participants are recommended to arrange for their personal travel and health insurance.

Changes to the Scientific and Social Programme

The Organizers reserve the right to adjust or change the Scientific Programme and the Social Programme if and when necessary. Changes will be announced at Registration Desk and on screens at Room Entrance.

Venue

Clarion Congress Hotel České Budějovice

Pražská třída 2306/14
CZ-370 04 České Budějovice
Czech Republic
Tel.: +420 389 102 111
Fax: +420 389 102 333
E-mail: info.cchcb@clarion-hotels.cz
GPS: 48°58'54.134"N, 14°28'21.175"E

Registration Desk

The Registration Desk is located in the Clarion Congress Hotel on ground level. At the Registration Desk we are ready to answer all your questions concerning the ECER Conference and give you all possible assistance concerning Accommodation, Social Programme, Transportation, etc as well.

Opening Hours of Registration Desk are as follows:

Sunday September 9, 2012	15:00 – 21:00
Monday September 10, 2012	08:00 – 21:00
Tuesday September 11, 2012	08:00 – 20:00
Wednesday September 12, 2012	08:00 – 10:00;
	16:30 – 18:30
Thursday September 13, 2012	08:30 – 19:00
Friday September 14, 2012	08:30 – 14:00

IN CASE OF ANY URGENCY
PLEASE CALL
THE REGISTRATION DESK:
+420 724 545 595

Conference Social Programme

Welcome Party

Monday, September 10, 2012
19:00 – 22:00

Included in the registration fee

Classical Concert

Tuesday, September 11, 2012
20:00 – 21:00

Klášterní kostel Obětování Panny Marie /
The Monastery Church of the Sacrifice of Virgin Mary

Included in the registration fee

Excursion to Brewery BUDVAR

Wednesday, September 12, 2012
19:00 – 21:00

Departure from Clarion Congress Hotel.
Including transfer back to Clarion and to the University Campus.

Price 8,- EUR – Pre-registration needed

or

Visit of the University Campus

Wednesday, September 12, 2012
19:30 – 22:00

Free

Conference Dinner at the Restaurant Masné krámy

Thursday, September 13, 2012
19:30 – 23:00

You will have the opportunity to enjoy a four-course menu, accompanied with excellent Budweiser Beer, in the unique premises of the Restaurant "Masné krámy" (Meat Market), which combines modern technologies and the history of a basilica ground-plan building dating back to the 16th century.

Address: Krajinská 13,
České Budějovice

Price 50,- EUR. Pre-registration needed

The on-site registration to the Social Programme is possible at the Registration Desk. The availability is not guaranteed.

FOR DIRECTIONS SEE THE MAP ON PAGE 132

Programme for Accompanying Persons

Trip to the Castle Dívčí Kámen and the Celtic Settlement Třísov

Departure on 11 September 2012, at 9:15 from Conference Venue

Target of this trip are two ancient settlements which are very close to each other (ca 500 m) and are part of the Blanský les protected landscape area (CHKO). Locations are situated between Český Krumlov and České Budějovice above the Vltava River.

Dívčí kámen

is an impressive ruin of a Medieval Castle built at the confluence of the Vltava River and the Křemžský brook. The Castle was founded in 1349 and abandoned in 1506. In addition to historical attractions, the surrounding area is protected as a natural monument with the same name (PP Dívčí kámen). On the southern rocky slopes there are communities of xerophilous plants (*Aurinia saxatilis*, *Festuca palens* etc.) and relict pine communities with dwarf forms of *Pinus sylvestris*. Xeric communities are surrounded by various other types of vegetation. Nowadays, the castle is owned by the small town of Křemže and there is a symbolic admission fee charged.

Třísov

is a former Celtic Settlement (oppidum) and is one of the most important locations of south Bohemian prehistory. It was a large fortified seat established in the Iron Age (about 150 B.C.) by the Boji Tribe. The populated area (26 ha) was located on the flat top of a hill surrounded by walls, which appear now as mounds. From the north and south Třísov was protected by natural conditions – steep slopes. The Settlement was abandoned ca 50 B.C. probably without violence.

Preliminary trip program

- Departure from the Clarion Hotel at 9:15 (at 10:07 departure from the Main station, direction Český Krumlov and Nové Údolí)
- Walk from Třísov through a canyon of the Vltava river to the Dívčí kámen castle (cca 2 km)
- Free time (sightseeing tour of the Dívčí kámen castle)
- Walk to Holubov along the river (cca 3 km)
- Lunch in the Holubov (near the railway station)
- Departure from Holubov by train

The trip program can be adjusted to participants' interests so the actual departure time back to České Budějovice depends on them.

Trip to Český Krumlov

Departure on 13 September 2012, at 8:00 from Conference Venue

On Thursday morning we will depart for the trip to Český Krumlov, one of the best preserved historical towns in Central Europe. This beautiful town is situated on the Vltava River and is full of Gothic, Renaissance and Baroque buildings housing many cafes, restaurants and bars, features a spectacular castle (the second largest in the Czech Republic), and an old-town square. The town's appearance has changed little since the 18th century. In 1992, Český Krumlov was added to the UNESCO World Heritage List. You will have the opportunity to feel it's fairy-tale medieval atmosphere and admire the scenery dominated by the castle and narrow cobbled streets. The Castle is a fine mixture of architectural styles from the 13th to the 19th centuries and holds an outstanding collection of artifacts from the life of the nobility over these ages, including a beautifully preserved baroque theatre. In addition to the multiple historical treasures, the Town offers regularly updated art exhibitions at the Egon Schiele Art Centre and several other smaller galleries.

Preliminary trip program

- Departure from České Budějovice (8:30 at the bus station)
- Walk around town (Old Town Square, Saint Vitus Church)
- Walk through Courtyards of the Castle
- Castle Gardens
- Free time (Egon Schiele Art Centre, lunch, Baroque Theater, Castle Tower, shopping for souvenirs etc.)
- Departure to České Budějovice by bus or train

The trip program can be adjusted to participants' interests so the actual departure time depends on them.

Price for regular delegates is 30,- EUR / free for registered accompanying persons.

Conference Programme at a Glance

	Monday 10 September 2012	Tuesday 11 September 2012	Wednesday 12 September 2012	Thursday 13 September 2012	Friday 14 September 2012
08:00 – 08:30	Welcome Coffee Break				
08:30 – 09:00		Parallel Sessions		Parallel Sessions	Parallel Sessions
09:00 – 09:30			MID-CONFERENCE EXCURSIONS		
09:30 – 10:00	Welcome addresses				
10:00 – 10:30	Plenary session I.	Coffee Break		Coffee Break	Coffee Break
10:30 – 11:00		Parallel Sessions		Parallel Sessions	Plenary session IV.
11:00 – 11:30					
11:30 – 12:00					
12:00 – 12:30	Lunch	Lunch		Lunch	Closing Session
12:30 – 13:00					Lunch
13:00 – 13:30	Plenary session II.	Parallel Sessions		Parallel Sessions	
13:30 – 14:00					
14:00 – 14:30					Post-conference EXCURSIONS 14:00 – …
14:30 – 15:00		Coffee Break		Coffee Break	
15:00 – 15:30	Coffee Break	Parallel Sessions		Parallel Sessions	
15:30 – 16:00	Plenary session III.				
16:00 – 16:30					
16:30 – 17:00		Poster session		Poster session	
17:00 – 17:30					
17:30 – 18:00		General Membership Meeting of SER-Europe			
18:00 – 18:30					
18:30 – 19:00					
19:00 – 19:30	Welcome Party				
19:30 – 20:00			Visit of University Campus		
20:00 – 20:30		Classical Concert			
20:30 – 21:00					
21:00 – 22:00					

Detailed Programme

Sunday, 9 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
	Europe Board Meeting **14:00 – 18:00**				

Monday, 10 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
08:00 – 09:30	**Welcome Coffee Break**				
09:30 – 10:00	**Welcome addresses**				
10:00 – 12:00	**Plenary session I.** *Chair: Jim Harris* Richard Hobbs (Australia) Novel ecosystems, invasive species and restoration: a slippery slope or common ground? James Aronson (France) Restoration of natural capital: a tool for building coherence and consensus Norbert Hoelzel (Germany) Restoration at large scale: Eurasian steppe ecosystems in the Post-Soviet era – unexpected results and future challenges				
	12:00 – 13:15 Lunch				

Monday, 10 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
13:15 – 15:15	**Plenary session II.** *Chair: Richard Hobbs* Lawrence Walker (USA) Understanding and managing temporal dynamics Roger del Moral (USA) Primary succession on Mount St. Helens: lesson for restoration of barren lands Karel Prach (Czech Republic) Using spontaneous succession in ecosystem restoration				
	15:15 – 15:45 Coffee Break				
15:45 – 18:30	**Plenary session III.** *Chair: Lawrence Walker* Jim Harris (UK) The below ground community in restoration – followers, facilitators and thresholds Rob Marrs (UK) Overcoming resistance and resilience of invasive species is necessary for effective restoration: creation of new stable states Peter Poschlod (Germany) Restoration of dry calcareous and sandy grasslands after abandonment, arable field use or afforestion – understanding the (ecological and political) mechanisms! Ruddy van Diggelen (Belgium) Restoring ecosystem resilience by developing Green Infrastructure. What does this mean and how can we measure it?				
	19:00 Welcome party				

Tuesday, 11 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
08:30 – 10:00	**Parallel Session I.** **Riparian I.** *Chair: Andre Schwab* Martine Lejeune (Belgium) Back to the future? Restoring upstream river valleys in the Belgian Ardennes Andre Schwab (Germany) Effects of hydro--morphological changes on riparian vegetation of the Danube floodplain in Southern Germany Murray Thompson (UK) The Effect of Large Woody Debris Restoration on Stream Community Structure Across an Enrichment Gradient	**Parallel Session II.** **Peatlands I.** *Chair: Agata Klimkowska* Agata Klimkowska (Netherlands) Grasslands on bog peat – nature values, drivers of vegetation development and restoration prospects Paulina Cwiklinska (Poland) Sphagnum reintroduction in a milled bog – an example from Northern Poland. Mati Ilomets (Estonia) Moss cover re-establishment on three abandoned peat fields in Estonia Leonas Jarasius (Lithuania) Water level maintenance in the raised bog of Aukstumala	**Parallel Session III.** **Forests I.** *Chair: Mats Niklasson* Mats Niklasson (Sweden) Ecological restoration of beech forests Patrick Audet (Australia) Native species can become mono-dominant by facilitating an altered edaphic climax on rehabilitated North Stradbroke Island Roberto Valenti (Italy) Forest dieback and restoration ecology: a multidisciplinary approach for the case of Palo Laziale wood Pavel Sebek (Czech Republic) Pollarding as a tool for conservation of tree hollow fauna	**Parallel Session IV.** **Grasslands I.** *Chair: Markus Wagner* Markus Wagner (UK) Species-specific microsite requirements in calcareous grassland restoration Melanie Harze (Belgium) Specialist plant species perform better in restored dry calcareous grasslands compared to reference habitats Renaud Jaunatre (France) Topsoil removal improves various restoration treatments of a dry Mediterranean grassland Jamshid Ghorbani (Iran) Restoration potential of degraded semi-arid rangelands in southwestern Iran in relation to soil seed bank Annika Brinkert (Germany) Large-scale near-natural restoration of steppe vegetation on abandoned fields in Kazakhstan – the importance of grazing impact	**Parallel Session V.** **The science and practice of near-natural restoration I.** *Chair: Thierry Dutoit* Thierry Dutoit (Fance) Ecological engineering: for a sustainable ecosystem restoration? Albin Blaschka (Austria) Targeted pasturing: Plant energy content and restoration success Siri Fjellheim (Norway) Ecologically sustainable implementation of the Nature Diversity Act for restoration of disturbed landscapes in Norway – use of molecular markers for defining site specific plant material Roland Schroeder (Germany) Cultivation and hybridization change germination patterns of native plants used for re-vegetation and restoration measures
	10:00 - 10:30 Coffee Break				

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
10:30 – 12:00	**Parallel Session VI.** **The science and practice of near-natural restoration II.** *Chair: Jan Frouz* Jan Frouz (Czech Republic) Factors affecting volunteer establishmen of woody vegetation in post mining heap with special attention to Salix caprea Gyorgy Kroel-Dulay (Hungary) Alien pine plantations have high conservation potential in central Hungary Sebastien Gallet (France) Evaluation of Restoration dynamics by vegetation mapping and transition matrix model: analysis of 20 years of restoration and management in the megalithic site of Carnac (Brittany, France) Mehrdad Akbarzadeh (Iran) Different effects of harvest intensity on vegetative and reproductive characteristics of Bromus tomentellus Boiss. (Case study; Miyaneh, Iran)	**Parallel Session VII.** **Peatlands II.** *Chair: Jeroen Geurts* Lukasz Kozub (Poland) Comparison of influence of topsoil removal and rewetting on ecosystem functions during fen restoration Ivana Bufkova (Czech Republic) Response of drained mires to restoration (Sumava National Park, Czech Republic) Jeroen Geurts (Netherlands) Gradual wind-driven iron addition as a measure to counteract internal eutrophication and restore biodiversity in peat lakes Franziska Seer (Germany) Maintaining species rich alkaline fens – limits and potentials	**Parallel Session VIII.** **Forests II.** *Chair: Kaitlin Schott* Kaitlin Schott (Canada) Nutrient loading of aspen seedlings: giving native seedlings a fighting chance Petros Kakouros (Greece) Post fire restoration of Pinus nigra forests on Mount Parnon (Greece) through a structured approach Yulia Ivanova (Russia) Comparison of forest ecosystems net primary production estimations in west Sayan Mountains	**Parallel Session IX.** **Grasslands II.** *Chair: Kris Decleer* Jonathan Mitchley (UK) The establishment of plant and animal communities on arable land: an experiment in hay meadow creation over ten years Kris Decleer (Belgium) Can the hemiparasite Pedicularis palustris facilitate the restoration of plant biodiversity in fen meadows? Jaak-Albert Metsoja (Estonia) Persistent soil seed bank in successional floodplain meadows in Estonia – potential for grassland restoration Lena Neuenkamp (Germany) The impact of management on biodiversity-productivity relations in Estonian floodplain meadows	**Parallel Session X.** **Restoration of habitat types – General** *Chair: Jan Leps* Renaud Jaunatre (France) A new synthetic indicator to assess plant community restoration success Jan Leps (Czech Republic) Are biodiversity experiments relevant for habitat restoration? Emer Walker (Germany) Provenance effects on plant establishment and competition during grassland restoration Chris Dictus (Romania) Large scale restoration of European habitats: From sandy dry heathland to soaking wet peatland
	12:00 – 13:15 Lunch				

Tuesday, 11 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
13:15 – 14:45	**Parallel Session XI.** **The science and practice of near-natural restoration III.** *Chair: Jakub Tesitel* Rosef Line (Norway) Restoration of road cuts in mountainous areas Feodor Kryazhimskiy (Russia) Lichen recovery on overexploited reindeer pastures. Applicability of Fennoscandian experience for the Yamal Peninsula: study by means of simulation model Jakub Tesitel (Czech Republic) Looking for Achilles' heel of competitive grasses. Can we suppress them by introduction of root-hemiparasites?	**Parallel Session XII.** **Reintroduction and reinforcement of populations of endangered species Meta-population dynamics I.** *Chair: Christiane Koch* Armin Bischoff (France) Local plant adaptation and biotic interactions: implications for species introduction in ecological restoration. Christiane Koch (Germany) Clonal re-introduction of endangered plant species during river restoration – the case of German False Tamarisk in pre-alpine rivers Anna Slechtova (Czech Republic) Successful restoration of sandland as a part of the action plan for Dianthus arenarius subsp. bohemicus (Bohemian Sand Pink) in the Czech Republic Tariq Mahmood (Pakistan) Assessment of some ecological parameters for conservation of Indian pangolin (Manis crassicaudata) in district Chakwal of Potohar Plateau, Pakistan	**Special Session 1** **Guidelines for seed harvest and production** *Chairs: Nancy Shaw, Sabine Tischew* Birgit Feucht (Germany) Guidelines for seed harvest and production Elizabeth Leger (USA) What can natural selection tell us about restoration? Finding the best seed sources for use in disturbed systems Peggy Olwell (USA) National Native Plant Materials Development Program: twelve years and growing Kate Hardwick (UK) The UK Native Seed Hub: working to improve the availability of high quality native seed for habitat restoration in the United Kingdom Sandra Malaval (France) Defining quality standards and transfer zones for native plant propagation and use in France – towards Flore-locale and Messicoles certifications	**Parallel Session XIII.** **Mining sites I.** *Chair: Knut Rydgren* Knut Rydgren (Norway) Ecological design is more important than compensatory mitigation for successful restoration of alpine spoil heaps Nina Nikolic (Serbia) New insights into unassisted ecological restoration: case study on a mining-affected floodplain in Serbia Carmo Silva (Portugal) Bet big on small mammals: the importance of small fauna to access quarry restoration measures and vegetation succession	**Parallel Session XIV.** **Landscape context of ecological restoration I.** *Chair: Jonathan Mitchley* Jonathan Mitchley (UK) Landscape-level restoration of Europe's dry grassland biodiversity: approaches, results and future perspectives Valentin H. Klaus (Germany) Restoration ecology and agri-environmental schemes: Options for mutual benefit in agricultural grasslands Tsipe Aavik (Estonia) Contemporary gene flow suggests low functional connectivity of grasslands in a Swiss agricultural landscape Frederik Naedts (Belgium) LIFE Liereman: heathland restoration on a landscape scale
	14:45 – 15:15 Coffee Break				

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět	University
15:15 – 16:45	**Special Session 4** **The Maya forest garden, a 'near natural' subsistence system** *Chair: Anabel Ford* Anabel Ford (USA) Connecting Traditional Maya Land Use and Ancient Maya Settlement Patterns David Campbell (USA) The Most Diverse Home Gardens in the World Scott Fedick (USA) The Secret Garden: Assessing the Archaeological Visibility of Ancient Maya Plant Cultivation According to Pollination Syndrome Betty Faust (USA) Why go backwards? Comparing the Maya forest-garden with intensive agricultural systems, ancient and modern, in Pich, Campeche, Mexico	**Special Session 3** **The role of wetland restoration in adapting ecosystems to climate change** *Chair: Anne Tolvanen* Anne Tolvanen (Finland) Sustainability of land-use of peatlands Eva Mosner (Germany) Future prospects for floodplain vegetation under climate change Petra Haslgrubler (Austria) Establishment of semi-natural litter meadows in the Enns valley	**Special Session 6** **Man-made effects and solution for ecological restoration in the marine environments** *Chair: Ehud Spanier* Ehud Spanier (Israel) Invasive species, over exploitation and temperature increase as expressed in the yield of Mediterranean trawl and coastal fisheries – can we restore species assemblages using marine protected area (MPA), artificial reefs and other management tools? Sjaak Swart (Netherlands) Knowledge traditions and governance. Restoration and conservation in the Dutch Wadden Sea Lucia Ferroni (Italy) Near Natural Restoration? A pilot study in the Northern Adriatic coast, Italy Jurate Sendzikaite (Lithuania) Conservation of redlisted plant species of endangered salt meadow communities in Klaipeda Seaport territory (Lithuania)	**Special Session 2** **Guidelines for grassland restoration using native seed mixtures** *Chairs: Kathrin Kieh, Anita Kirmerl* Peter Torok (Hungary) Recovery of grasslands using seed mixtures: Application circumstances, problems and successes Anita Kirmer (Germany) Use of directly harvested seed mixtures in grassland restoration Tobias Donath (Germany) Enhancing plant biodiversity in species-poor grassland – methods, processes and mechanisms Kathrin Kiehl (Germany) Restoration of species-rich field margins and fringe communities by seeding of native seed mixtures Richard Scott (UK) Bringing It all back home: The Parable of the sower	**Special Session 5** **Mining operation and biodiversity protection – practical approaches** *Chair: Michael Rademacher* David Willyams (Australia) Geophyte propagation and sustainable establishment in post-mining restored Jarrah (Eucalyptus marginata) forest, Western Australia Jose-Manuel Nicolau (Spain) Geomorphic reconstruction of surface mining disturbed lands to facilitate their ecological restoration. Examples in the Spanish Iberian Range by using the GeoFluv method Petra Konvalinkova (Czech Republic) Practical examples of restoration and species protection from mined sites in the Czech Republic Lubomir Tichy (Czech Republic) Experimental restoration of species-rich deciduous forest on mining deposits in Mokra limestone quarry Klara Rehounkova (Czech Republic) Restoration of psammophytic grasslands in the sand pits: directed vs. spontaneous succession	CANOCO WORKSHOP (For pre-registered only) 15:00 – 18:00 Petr Smilauer (Czech Republic) Canoco workshop will be held on Tuesday, Sept. 11th, between 15:00 and 18:00 p.m. at the Institute of Molecular Biology of Plants, Czech Academy of Sciences, located in the main complex of the University campus. The computer room, marked Pc4, is located in the first floor of the Institute and the access will be marked by labels CANOCO with arrows from the main entrance and assisted by a volunteer.
	16:45 – 18:00 Poster session					
	17:30 – 18:00 General Membership Meeting of SER-Europe					

Wednesday, 12 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
9:00 – 18:00	**MID-CONFERENCE EXCURSIONS 9:00 – 18:00** Departures from the Venue				

Thursday, 13 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
08:30 – 10:00	**Parallel Session XV.** **The science and practice of near-natural restoration IV.** *Chair: Alan Feest* Alan Feest (UK) Assessment of the success of the mitigation for the Cadiff Bay Barrage Michael Marcus (USA) Near natural riverbank stabilization using woody debris Camiel Aggenbach (Netherlands) Can we restore biogeochemistry and vegetation of alder carr by artificial flooding? Kaire Lanno (Estonia) The need for more sufficient restoration effort: slow vegetation change in restored coastal meadows	**Parallel Session XVI.** **Invasive organisms and ecological restoration I.** *Chair: Viktoria Wagner* Viktoria Wagner (USA) Herbicides in invasive non-native plant management: A quantitative overview of use in North America Inger Auestad (Norway) Early detection of invasive alien species – the usefulness of distribution modeling Holly Stover (Canada) Non-native plant species management and ecological restoration of foothills fescue grassland in Waterton Lakes National Park, Alberta, Canada Sonia Newman (UK) Restoration of UK floodplain meadows dominated by native invasive Carex species	**Parallel Session XVII.** **Riparian II.** *Chair: James Hallett* James Hallett (USA) Evaluating restoration trajectories using similarity indices: riparian-influenced systems Kristin Fleischer (Germany) Year-round grazing as restoration approach in floodplains: Impact on vegetation and Orthoptera Olga Skacelova (Czech Republic) Restoration of alluvial pools – problems and achievements Barbara Guida Johnson (Argentina) Environmental degradation and opportunities for riparian rehabilitation in a highly urbanized watershed: the Matanza-Riachuelo in Buenos Aires, Argentina	**Parallel Session XVIII.** **Grasslands III.** *Chair: Renaud Jaunatre* Ivana Jongepierova (Czech Republic) Restoration of grasslands on ex-arable land using regional and commercial seed mixtures and spontaneous succession: successional trajectories and changes in species richness Trygve S. Aamlid (Norway) Production of Site-specific Seed for Ecological Restoration in Norwegian Mountain Areas Orsolya Valko (Hungary) Restoration of dry grassland vegetation by a combination of seed mixture sowing and hay transfer Fabian Borchard (Germany) Response of Orthoptera to upland heathland restoration Jean-Francois Alignan (France) Resilience of Coleoptera assemblages after ecological restoration of a Mediterranean dry grassland (La Crau, Provence, France)	**Parallel Session XIX.** **Landscape context of ecological restoration II.** *Chair: Seth White* Seth White (USA) The landscape context of fish habitat relationships: implications for restoring riparian processes in U.S. Pacific Northwest rivers Emily Howe (USA) Restoring detrital shadows: stable isotopes reveal detritus-based estuarine food web connectivity depends on delta discharge and consumer feeding mode Charles Simenstad (USA) Restoring estuarine food web linkages: using historical change analysis to guide natural process restoration of trophic connectivity
	10:00 – 10:30 Coffee Break				

Thursday, 13 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
10:30 – 12:00	**Parallel Session XX.** **The science and practice of near-natural restoration V.** *Chair: Patrick Audet* Patrick Audet (Australie) Examining the Australian context for post-mined land rehabilitation: A paradigm for the development of 'natural' and 'novel' ecosystems Petr Bogush (Czech Republic) Aculeate Hymenoptera of sand dunes – can we preserve them in sandpits? Szabolcs Lengyel (Hungary) Variability in the responses of animal groups to grassland restoration on former croplands	**Parallel Session XXI.** **Invasive organisms and ecological restoration II.** *Chair: Elise Buisson* Jillian Hetherington (New Zealand) Are biotic or abiotic barriers breached first? Invasion by Lupinus arboreus on Kaitorete Spit, Canterbury New Zealand Elise Buisson (France) Carpobrotus eradication on a Mediterranean island: a compromise between recolonization of Carpobrotus and native species, and soil degradation issues Josu Gonzalez Alday (UK) Effectivenes of Calluna-heathland restoration methods after invasive plant control Sheunesu Ruwanza (South Africa) Both complete clearing and thinning of invasive trees lead to short-term recovery of native riparian vegetation in the Western Cape, South Africa	**Parallel Session XXII.** **Socio-economic, cultural and legislative dimensions of ecological restoration I.** *Chair: Hendrik Schoukens* Hendrik Schoukens (Belgium) Habitat banking in the EU: environmental law as a creator or an obstacle to new markets for ecological restoration? Gustavo Zuleta (Argentina) Restoration and/or prevention: are we doing our best? A critical review of paradigms and approaches Thorunn Petursdottir (Italy) Using a social-ecological system approach to analyze the interactions between agri-environmental policies, farmers and rangeland restoration Magdalena Worlowska (Poland) Ecological installations – in between nature and culture	**Parallel Session XXIII.** **Grasslands IV.** *Chair: Ivana Jongepierova* Julia-Maria Hermann (Germany) Novel concepts for grassland restoration in Southern Brazil? Gregor Stuhldreher (Germany) How much care does a shrub-feeding hairstreak butterfly (Satyrium spini) need in calcareous grasslands? Asa L. Aradottir (Iceland) Using turf transplants for restoration of alpine vegetation Kristin Svavardottir (Iceland) Safe sites limitation of Empetrum nigrum establishment, a common birds dispersed heath species	**Parallel Session XXIV.** **Landscape context of ecological restoration III.** *Chair: Alena Jirova* Eva Mosner (Germany) Population genetic patterns of floodplain willows in highly fragmented river landscapes – a basis for restoration plantings Andreas C. Braun (Germany) Phytodiversity conservation in Chilean forest plantations – status quo and perspectives for a more sustainable future Alena Jirova (Czech Republic) Pattern of old-field vegetation succession on a country scale
	12:00 – 13:15 Lunch				

Thursday, 13 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
13:15 – 14:45	**Parallel Session XXV.** **Mining sites II.** *Chair: John Scullion* John Scullion (UK) Carbon sequestration in reclaimed mine soils Jose-Manuel Nicolau (Spain) Runoff as ecological driving force in constructed slopes from coal mining reclamation in Mediterranean--Continental environment Torroba Balmori (Spain) Role of natural shrubs on the forest expansion in restored coal mines in Northern Spain Pedro A. Salgueiro (Portugal) Challenges and strategies to enhance fauna diversity on three quarries in Portugal: ecological recovery from a different scope		**Parallel Session XXVI.** **Other human-made sites I.** *Chair: Anne-Maarit Hekkala* Micha Bunusevac (Luxembourg) Nature and construction Violaine Brochier (France) Effect of composts on soil resistance to compression and water infiltration in reconstituted urban soils Anne-Maarit Hekkala (Finland) Impact of forest restoration on saproxylic and red-listed beetle species Theo Wassenaar (Namibia) Planning for the Namib after mining: restoration research, and monitoring of the Namib uranium rush	**Parallel Session XXVII.** **Socio-economic, cultural and legislative dimensions of ecological restoration II.** *Chair: Guillermo Giannico* Guillermo Giannico (USA) Prioritizing watershed restoration actions using both ecological and socio-economic criteria Dagmar Hagen (Norway) Displeased or simply confused? Reactions from local residents and experts to a urban river rehabilitation project Bahareh Behmanesh (Iran) Assessing degradation in steppe and semi-steppe rangelands of Iran: can indigenous ecological knowledge of pastoralists be used as a method?	**Special Session 9 part I.** **Minisymposium: Novel ecosystems – new normal or red herring? I.** *Chair: Paddy Woodworth* Cara R. Nelson (USA) Novel ecosystems: role of function and history James Aronson (France) Are 'Novel Ecosystems' a Slippery Slope for Restoration Ecology? Luis Balaguer (Spain) Historical references for near-natural ecological restoration Kingsley Dixon (Australia) "Novelty" labelling obscures restoration's achievements and potential **Discussion:** James Aronson Cara R. Nelson Richard Hobbs Luis Balaguer Kingsley Dixon
	14:45 – 15:15 Coffee Break				

Thursday, 13 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
15:15 – 16:45	**Special Session 10** **Soil, soil biota and belowground processes and their role in restoration** *Chair: Jan Frouz* Jan Frouz (Czech Republic) The role of soil fauna in restoration Sandra Magro (Spain) Ecological restoration in crisis time: Zoom into soil invertebrates community on roadslopes Pella Brinkman (Netherlands) Matgrass sward plant species benefit from the occurrence of soil organisms Josu Gonzales Alday (UK) Interactions between vegetation and soil development during early succession on restored coal mines Vaclav Pizl (Czech Republic) Conversion of conventional into biological viticulture systems – the effects on earthworm assemblages	**Special Session 11** **Functional approach to riparian landscape restoration** *Chair: Wiktor Kotowski* Wiktor Kotowski (Poland) Semi-nature or new wilderness? Restoration dilemmas in the Middle Biebrza Basin Ivan Bernez (France) Headwaters ecological restoration at landscape scales Agata Klimkowska (Netherlands) Restoring the process of seepage in fen habitats – combining water retention and nature restoration Petter Hedberg (Poland) Environmental filters in fen restoration highlighted by the use of Functional Diversity indices	**Special Session 7** **Successful restoration projects in Central Europe with special focus on Visegrad countries** *Chair: Viera Sefferova* Miroslava Ruda (Slovak Republic) Restoration of NATURA 2000 sites in cross-border Bratislava capital region (project LIFE10 NAT/SK/080) Karolina Sobekova (Slovak Republic) Revitalisation of the Danube inland delta Katarina Tuharska (Slovak Republic) Conservation of root vole (Microtus oeconomus mehelyi) in western Pannonian lowland Josef Fanta (Czech Republic) Restoration of forests in the Czech Republic and Europe	**Special Session 8** **Restoring Green Infrastructure in Europe** *Chairs: Rudy van Diggelen, Ladislav Miko* Nico Koedam (Belgium) The 'false positives' and the 'false negatives' in Natura2000 and embedding landscapes – a case of Greece Richard Scott (UK) Wildflowers, Culture, mathematics art and ecology, good beer and conversation. The Liverpool experience. Jonathan Mitchley (UK) The establishment of plant and animal communities on arable land: an experiment in hay meadow creation over ten years Asa L. Aradottir (Iceland) Drivers of restoration – lessons from a century of restoration in Iceland	**Speciall Session 9 part II.** **Minisymposium: Novel ecosystems – new normal or red herring? II.** *Chair: Paddy Woodworth* Discussion – continuation: James Aronson Cara R. Nelson Richard Hobbs Luis Balaguer Kingsley Dixon
	16:45 – 18:00 Poster session				

Friday, 14 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
08:30 – 10:00	**Parallel Session XXVIII.** **Reintroduction and reinforcement of populations of endangered species Meta-population dynamics II.** *Chair: Swanni T. Alvarado* Swanni T. Alvarado (France) Restoration of declining populations of threatened woody species: does the age of seedlings influence survival and recruitment? Julia Wegele (Germany) Restoring agro-biodiversity: Testing the effect of Stellaria media on reproduction of the rare arable weed Legousia speculum-veneris Jana Zmeskalova (Czech Republic) Reintroduction and Reinforcement of Populations as a Part of the Action Plans for Endangered Species in the Czech Republic		**Parallel Session XXIX.** **Wetlands various** *Chair: Keith Edwards* Moni Poelen (Netherlands) A fast and inexpensive tool for wetland restoration to estimate internal eutrophication (P, N) Dorota Michalska-Hejduk (Poland) The restoration of wetland heterogenity by supporting the natural processes of habitat regeneration (Kampinos National Park case study, Poland) Alberto Velez Martin (Spain) Recovery of key ecological processes in the Donana marshland after 30 years of isolation and crops Martin Neruda (Czech Republic) Environmental research of hydric restoration of Lake Most Keith Edwards (Czech Republic) Nutrient and water level effects on Phalaris arundinacea and Carex acuta: A mesocosm experiment	**Special Session 12** **Sharing Good Practice in River Restoration across Europe** *Chair: Antonia Scarr* Antonia Scarr (UK) RESTORE (EU life + project): Communicating river restoration best practice across Europe Examples, Discussion	**Parallel Session XXX.** **Other human-made sites II.** *Chair: Isabelle Muller* Berta M. Jauregui (Spain) Good practices in restoring roadslopes Isabelle Muller (France) Ecological restoration of abandoned ricefields to wetlands: seed bank potential and dispersal forcing Lioudmila Volkova (Russia) Restoration of Insect Habitats in the City of Moscow Matthias Harnisch (Germany) Introducing a little wilderness into bourgeois housing areas or: Re-designing urban green with site-specific seed-mixtures – biodiversity, costs, acceptance Daniel P. Rodriguez (Netherlands) Changes within the mussel sector for the restoration of the Dutch Wadden Sea; a sustainable transition?
	10:00 – 10:30 Coffee Break				

Friday, 14 September 2012

	Vajgar	Hejtman	Bezdrev	Rožmberk	Svět
10:30 – 12:00	**Plenary session IV.** *Chair: Karel Prach* Hans van Dyck Restoring functional habitats of target species: how to avoid a far too human perspective? Sabine Tischew (Germany) Yes, we really can: developing species-rich, dynamic and multifunctional landscapes in former mining areas combining near-natural re-vegetation methods and spontaneous succession				
	12:00 – 12:30 Closing Session				
	12:30 – 13:30 Lunch				
14:00 – …	**Post-conference EXCURSIONS 14:00 – …** Departures from the Venue				

Guidelines to Authors and Chairs of Oral Sessions

Slide Preview Corner

Slide Preview Corner is located at the Conference Foyer next to room Svět of the Clarion Congress Hotel.

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There will be a master computer in each meeting room and to ensure smooth transition between speakers and appropriate audiovisual technical support, the Organizers request that speakers do not plan on connecting their laptop to the conference centre projector, nor even bring their own projectors.

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Wednesday September 12, 2012	closed
Thursday September 13, 2012	07:45 – 16:00
Friday September 14, 2012	07:45 – 10:30

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Please obey following lenght of your oral presentation:

Parallel and Special Sessions:

15 min presentation + 5 min discussion

Plenary Sessions:

30 min presentation + 10 min discussion

Chairs of particular sessions are asked to kindly formulate 2–3 sentences summarizing the sessions. These should be presented at the end of each session and then provided electronically to the Conference Organizers.

Extended Abstracts

The conference organisers and the SER-Europe board consider as very important that your contributions can be shared as much as possible not only with other scientists but also with policy makers and practitioners. Easy access to your expertise can be obtained by providing us with an extended abstract. We encourage you to submit the extended abstract – see details in www.ecer2012.eu. Your contributions will be added to the SER Europe Knowledge Base on Ecological Restoration, accessible via http://www.ser.org/europe/SER_Europe_Knowledge_Base.asp.

Abstracts of Oral Presentations

O001

Production of site-specific seed for ecological restoration in Norwegian mountain areas

T.S. Aamlid[1]

[1] *The Norwegian Institute of Agricultural and Environmental Research, Bioforsk, Ost Landvik, Grimstad, Norway*

The Norwegian Nature Diversity Act prohibits the use of non-local plant material for restoration after intervention in natural landscapes. Thus, production of site-specific seed has become an enterprise for Norwegian seed growers. Objectives of the project FJELLFR? ('MOUNTAIN-SEED', 2005–2012) were (1) to collect parent material in mountain regions, (2) to multiply this parent material by seed, (3) to develop efficient seed production techniques. During 2005–2008, seed of 229 populations belonging to 33 species were collected from mountain regions (>800 m a.a.l) all over the country. Most populations were collected of Phleum alpinum (20), Avenella flexuosa (17), Luzula frigida (14), Alchemilla alpina (14), Nardus stricta (11), Carex brunnescens (9), Poa alpina (8), Anthoxanthum odoratum ssp. alpinum (8), Festuca ovina (7) and Agrostis mertinsii (7). Because of poor germination of collected seed, further multiplication was concentrated on the grasses except Nardus stricta. Seed was multiplied over two generations. First generation fields were established by raising plants in nurseries and transplanting them onto beds (12–800 m^2) covered by black plastic. A total of 90 first generation seed lots were harvested from 2007 to 2011, partly by hand and partly using plot combiners. Multiplication of second generation seed was contracted by Bioforsk to ten seed growers in Telemark, southeast Norway. The harvested acreage increased from 0.8 ha in 2009 to 14 ha in 2012. After many problems with the establishment of new seed crops, seed yields in 2010 and 2011 were on average (kg/ha): Phleum alpinum: 208 (24–754), Poa alpina: 733 (296–1538), Festuca ovina: 516 (31–1110). So far, only small quantities (< 100 kg) has been produced of the other species. In order to develop seed production techniques, 39 field trials were carried out from 2007 to 2012. About half of the trials concentrated on selective use of graminicides for weed control. Seed grower's recommendations for the various species will be presented at the conference.

O002

Contemporary gene flow suggests low functional connectivity of grasslands in a Swiss agricultural landscape

T. Aavik[1], R. Holderegger[2], P. Edwards[3], R. Billeter[3]

[1] *Institute of Ecology and Earth Sciences, Department of Botany, Tartu, Estonia*
[2] *WSL Swiss Federal Research Institute, Biodiversity and Conservation Biology, Zuerich, Switzerland*
[3] *Institute of Integrative Biology, Department of Environmental Systems Science, Zuerich, Switzerland*

The success of ecological restoration measures is mostly judged by the number and abundance of species, which have established since restoration. However, the effect of these measures on habitat connectivity is rarely assessed.

Using genetic tools, we evaluated the functional connectivity of a wetland plant *Lychnis flos-cuculi* in two regions of an intensively managed agricultural landscape. In one of the regions, half of the populations had been restored by sowing wildflower seed mixtures eight years before the study. In the other region, two populations were sown three years before the study, whilst most populations were of natural origin. We used assignment and first-generation migrant tests to assess recent and contemporary gene flow among natural and recently restored populations of *L. flos-cuculi*.

According to assignment tests, recent gene flow among the natural populations of *L. flos-cuculi* was higher than gene flow among sown and natural populations. This most probably reflects the common history of the natural populations. However, a low number of first-generation migrants among sown and natural populations as well as among natural populations implied rather low contemporary functional connectivity between all populations despite restoration efforts. The proportion of restored populations in the landscape had no effect on gene flow.

Genetic methods offer a valuable tool for studying the role of restoration measures on the functional connectivity of plant populations. Our findings show that restoration measures may not necessarily enhance functional connectivity among plant populations, at least in the short term.

Keywords: *assignment tests; dispersal; habitat fragmentation; pollen flow; restoration;*

O003

Can we restore biogeochemistry and vegetation of alder carr by artificial flooding?

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In Europe artificial flooding of wet ecosystems was a common agricultural practice. Reintroduction of this practice replaces natural flooding and may contribute to restoration of deteriorated habitats. A question is if in a strongly changed biogeochemical setting artificial flooding is beneficial to ecological restoration. In a 5-year field experiment with artificial winter flooding of a desiccated and acidified alder carr the effects on biogeochemistry and vegetation was assessed. The base rich flooding water infiltrated and basic cation pool increased proportional to flooding duration. A pH rise was both driven by internal alkalinization and increasing base saturation. Rewetting caused a strong internal eutrophication and raised PO4 and NH4 concentrations in soil pore water. In years with stagnation of surface water during summer a strong nutrient release to the surface water caused a high

cover of Lemna and retarded the development of alder plant species. Alder carr species increased when summer inundation and aquatic plant cover became less. The streaming water during flooding attributed to a strong leaching of anorganic P and N. The long term prospects of artificial flooding for alder carr vegetation are unknown. Although water regime and base status are restored, a gradually increase of Phragmites because of eutrophication may have a negative impact on alder carr species. However, because of a strong nutrient leaching, eutrophication and competitive eutrophic species may decrease in future. The results of the experiment will be discussed in relation ecological restoration practice and water management.

Keywords: *restoration; basic cations; internal eutrophication; leaching; inundation;*

O004

Different effects of harvest intensity on vegetative and reproductive characteristics of Bromus tomentellus Boiss. (Case study; Miyaneh, Iran)

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A historical view has been showed that nature and man is the base of globe. The study has been done for determining resistance of key species in the grazing in North West of Iran at Miyaneh which located Azerbaijan -e- Sharqi (East Azerbijan) province. To evaluate of cutting effect (simulated grazing), before the start of growing season, 5000 m^2 of rangeland was enclosed at 2009. 160 plants has been selected in this research grazed (Completely Randomized). Each 10 plants as basic treatments of the eye to cut rates to zero, 25, 50 and 75 percent was allocated. Cessation treatments in three replications with 45 days away were weighed after drying in air to calculate the exact percentage of harvested production. All production bases (except controls) were harvested at the end of growing season. Data analysis was performed as split plot in time using a statistical design. Livestock grazing to less than 40 to 50 weight percent annual growth, even in drought years, guarantee the survival of Bromus tomentellus Boiss. In the study area, but harvesting of the plant to 75 percent in normal years it will not damage the plant.

Keywords: *Harvest; Vegetation; Grazing; Plant; Survival;*

O005

Effectivenes of Calluna-heathland restoration methods after invasive plant control

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Invasion by bracken (*Pteridium aquilinum*) of heathlands in Great Britain is a major challenge for conservation of these habitats. To restore bracken-infested heathland, better insights about the effects of restoration methods *onCalluna vulgaris* and the compositions of other heathland species is needed. Here, we describe the results of four experiments to investigate the role of *Calluna*-heathland restoration treatments (Site 1: stock-proof fencing, *Calluna*seeding with brash, *Calluna* seeding with litter, Site 2: Prescribed burning; Sites 3 & 4: fertilizing, harrowing) in combination with bracken-control treatments in determining species composition in Great Britain over 7–10 years. At Site 1, grazing produced great differences in compositional response in relation to experimental-controls, whereas the ungrazed treatments showed a similar composition to the untreated-controls. *Calluna* seeding (with brash or litter) increased *Calluna* cover slightly in all bracken-control treatments. At Site, 2, prescribed burning increased the differences in compositional response relative to controls being the only sub-treatment that increased significantly *Calluna*. Finally, at sites 3 and 4, fertilizing and harrowing did not increase the effectiveness of restoration in comparison to bracken-control treatments by themselves. The potential use of these restoration treatments for *Calluna*-heathland restoration will be discussed.

Keywords: *Community composition; Grazing; Prescribed burning; Calluna seeding; Fertilizing and harrowing;*

O006

Interactions between vegetation and soil development during early succession on restored coal mines

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It is assumed that when a mine is restored the initial restoration treatment provides a starting soil material on which vegetation can develop. Thereafter, successional change in vegetation composition and structure occurs, which can in turn ameliorate soil conditions and assists further vegetation development. However, there have been few attempts to study vegetation succession and soil change at the same time in coal-mine restoration projects under Mediterranean climates. Here, we explore short-term interactions (over six years) of changes in soil physico-chemical properties and vegetation succession (composition and structure) in these newly forming ecosystems, and discuss potential functional relationships. An important result was that aspect had little effect on changes in soil properties and ecosystem functional/structural properties, but appeared to influence species composition. This indicates that age since restoration was the main driving agent, at least in the short-term, of soil

and vegetation compositional changes during ecosystem development through the coal mine restoration. Moreover, changes in vegetation functional/structural properties were involved in inducing some of the observed soil changes, and appeared to favour an increase in plant community complexity. Finally, as the soil-forming material improves the vegetation that develops reaches a point where compositional differences are driven mainly by abiotic and stochastic factors.

Keywords: *Floristic composition; Restoration work; Vegetation dynamics; Soil disturbance; Soil physico-chemical properties;*

O007

Resilience of Coleoptera assemblages after ecological restoration of a Mediterranean dry grassland (La Crau, Provence, France)

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During the last centuries, the unique European pseudo-steppic area in south-eastern France has been fragmented for intensive agricultural land-uses and has lost 80 % of its originals surface. In 2006, an industrial orchard of 357 ha formerly created on the steppe vegetation in 1987 has been abandoned. In 2008, the impact of the abandoned orchard on biodiversity has been studied and focused on birds, vegetation and insects (Coleoptera). In 2009, in order to rehabilitate the habitat for the endangered steppic birds, peach trees, hedgerows of poplars and irrigation pipes have been removed and the soil surface has been levelled. More than this, to restore the dry grassland vegetation and its associated entomofauna, three restoration treatments have been experimented (soil inoculation, nurse species seeding and hay transfer). The study on Coleoptera in 2008 revealed the existence of an edge effect between the abandoned orchard and the steppe vegetation. Indeed in 2008, the species richness is significantly higher in edges than in the steppe and in the abandoned orchard. Nevertheless, species richness is not significantly different between the steppe and the abandoned orchard and our results show only some differences for the species composition between the steppe and the abandoned orchard. The sampling realized in 2011 on Coleoptera on the different areas considered (steppe; edges; rehabilitated area and restoration treatments) will allow us not only to assess the restoration treatments effects on Coleoptera but also to assess the spontaneous colonization of Coleoptera from the reference ecosystem to the rehabilitated area.

Keywords: *Coleoptera; Resilience; Grassland;*

O008

Restoration of declining populations of threatened woody species: does the age of seedlings influence survival and recruitment?

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Fire is widely used as a traditional tool for the management of tropical lands, and it continues to play a significant role today in diverse agricultural and social practices, and for pasture improvement and renewal. On Ibity Massif, a New Protected Area in Madagascar's central highlands, bush fires are the principal factor causing degradation of tapia woodlands, a savanna-type vegetation dominated by the tree species *Uapaca bojeri*. Fires now commonly occur annually or biannually on Ibity, burning both the herbaceous layer and part of the tree layer, and also reducing the regeneration of certain woody species such as *U. bojeri* by killing young seedlings. In order to determine whether the age at burning influences seedling survival and thus recruitment, four endangered woody species (*U. bojeri, Carissa edulis, Aphloia theaeformis* and *Abrahamia ibityensis*) have been studied since March 2010 in an *ex-situ*experiment carried out at a plant nursery using 2 soil types (local soil with mycorrhizae and standard soil). Controlled burns were carried out on seedlings after 6, 9, 12, 16, 20 and 24 months. Two different densities of *Loudetia simplex*, the main grass in the herbaceous stratum on Ibity, were used as fuel. The results of this study on seedling survival in response to the timing of fire serve as a basis for developing possible protocols for the reintroduction and reinforcement of populations of these endangered species.

Keywords: *tapia woodland; controlled burn; Madagascar savanna; woody seedling survival; fire ecology;*

O009

Drivers of restoration—lessons from a century of restoration in Iceland

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A recent review of restoration in Iceland – describing 85 projects extending over more than 1700 km^2 – provides a unique opportunity to analyse changes in drivers, goals, approaches and main actors of restoration during the last century. Drivers for restoration projects have been diverse and include different legislation and funding schemes; loss of agricultural land to advancing sand, environmental factors such as dust storms and volcanic activity, socio-economic factors regarding land use; mitigation; information about state of vegetation and soil resources and international policy. The restoration goals have varied from halting of soil erosion and improving grazing land to the restoration of biodiversity, carbon sequestration and improved resilience of land in the vicinity of active volcanoes. The main actors of restoration work include governmental agencies, energy companies, farmers,

other land owners, NGO's and interested public. Most of the projects described in the review involve revegetation or reclamation of eroded or severely degraded land to agricultural land, heathland and woodland. Smaller areas have been, or are being, restored to natural birch woodlands and wetlands. In the presentation, we will discuss the interaction between drivers, goals, approaches and main actors of restoration and explore the influence of local, national and global policies on restoration projects.

Keywords: *environmental drivers; policy drivers; socio-economical drivers; history; resilience;*

O010

Using turf transplants for restoration of alpine vegetation

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Sward of native vegetation from areas disturbed by construction can be salvaged and used in restoration. This can be a valuable method for reintroducing native species into disturbed sites at high altitudes where suitable seed is frequently unavailable. If the sward is in a short supply, it may be divided into small turfs that are planted in a receptor area larger than the donor area. The minimum size of turfs for different plant communities and functional groups is, however, not known.

The effects of turf size for restoration of native vegetation were studied in areas disturbed during the construction of a geothermal power plant in SW-Iceland. The turfs came from heathland and grassland vegetation and were planted in road verges and mudflats at 260–410 m elevation. Turf sizes ranged from 5 × 5 cm to 30 × 30 cm and were planted with turf: receptor area ratio of 1:22 to 1:50. Treatments with shredded turfs and controls without turfs were also included.

Heathland vegetation was more susceptible to division into small turfs than the grassland vegetation, but responses varied by functional groups. Grass cover was highest in plots with the smallest turfs, but lowest in plots with shredded turfs. Cover of dwarf shrubs decreased with decreasing turf size. Moss cover, on the other hand, was highest in plots with shredded turfs.

In a related study, the species composition of road verges transplanted with large turfs and turf: receptor ratio of about 1:1 was not significantly different from adjacent undisturbed vegetation after two growing seasons.

Keywords: *alpine; re-introduction; turf transplants;*

O011

Novel ecosystems – new normal or red herring?

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Restoration ecology and conservation science are facing two challenges, from without and within. Firstly, a rapidly changing world threatens the underpinnings of these fields. Secondly, how should we, as scientists and practitioners, respond to these changes? One response has been to highlight the notion of "novel ecosystems". This is an evocative term used to describe systems so irreversibly modified by human activities, invasive species, and climate change that they don't resemble any historical reference ecosystem and therefore cannot, in any meaningful sense, be restored. Some writers on this issue warn that the emergence of novel ecosystems means that restorationists risk promising things they can't deliver. They argue for pragmatism and triage as future priorities for restorationists, rather than restoration to historical reference systems. In reply, others argue that this case is overstated and sometimes very misleading, especially when it is popularised in the mainstream media to assert that novel ecosystems are "the new normal". Conservation and restoration ecologists, they point out, have long recognized that extinct species will never return and that some introduced species are so inextricably embedded in an ecosystem that their removal is probably impossible and undesirable. But they also contend that, notwithstanding the undoubtedly drastic impacts of climate change and other anthropogenically generated shifts in the biosphere, many systems do indeed remain amenable to restoration, provided good science and know-how, and adequate resources are applied. They also assert that historically-based references remain an excellent tool to guide both conservation and restoration, and indeed one of the features distinguishing ecological restoration from other activities, such as reforestation and many forms of ecological engineering. There have been a number of presentations around these issues at previous SER events, but there has never been time to debate the whole gamut of views on this key issue. We invite everyone to participate in this event, where as much time at least will be given to responses from the floor as to a wide range of positions from the platform.

O012

Are 'Novel Ecosystems' a slippery slope for restoration ecology?

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Restoration ecology is a rapidly developing discipline, its maturation matched by rising demand for effective ecological restoration across a wide range of spatial scales and socio-political contexts. Yet some scientists within the field argue that the emergence of "novel" ecosystems challenges the very foundations of the discipline. We contend that the concept of novel ecosystems has a number of weaknesses and its application should therefore be limited. Meanwhile advances in restoration

science and practice offer hope for maintaining and recovering diverse ecosystems that provide cost-effective economic, social, and cultural services. We point to conceptual and practical limitations in novel ecosystem theory to date, illustrate the significant conceptual and technological advances of restoration ecology, highlight successes of ecological restoration, and discuss pitfalls for policymakers inherent in overstating the challenge presented by novel ecosystems, or their inevitability.

Keywords: *definitions; ecosystem services; restoring natural capital; transition towards sustainability;*

O013

Native species can become mono-dominant by facilitating an altered edaphic climax on rehabilitated North Stradbroke Island

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Monitoring of post-rehabilitated sites following sand mining was conducted within the Amity, Bayside, Gordon and Ibis mining areas located across North Stradbroke Island, southeast Queensland, Australia. Based on a chronosequence of land revegetation spanning 4 to 20 years post-rehabilitation, the density and composition of revegetated species assemblages was assessed by distinguishing between periods of 'older' (pre-1995) and 'younger' (post-1995) rehabilitation practices and compared with proximal reference communities. The general rehabilitation outlook appeared promising whereby a functional forest structure had been achieved across most sites over a relatively short time. However, the development of 'older' sites had deviated from the desired natural analogues as indicated by the decrease in under-storey heath and the emergence of Black Sheoak (*Allocasuarina littoralis*) as a mono-dominant species. Changes in the vegetation composition coincided with differences among various edaphic parameters suggesting that altered edaphic conditions could have facilitated an opportunistic colonization by this species. Meanwhile, its above- and belowground feedback behaviour (i.e., relating to leaf-litter allelopathy and soil-nitrogen fixation) may have further perpetuated its mono-dominant distribution. From these projections, it is recommended that considerations be made regarding the ecological context for species re-colonization when planning for post-disturbance land rehabilitation to avoid potentially unproductive rehabilitation outcomes, such as species mono-dominance.

Keywords: *Chronosequence; Eucalypts; Forest regeneration; Landform rehabilitation; Mining;*

O014

Examining the Australian context for post-mined land rehabilitation: A paradigm for the development of 'natural' and 'novel' ecosystems

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This analysis attempts to reconcile existing rehabilitation planning goals and implementation constraints in the form of a paradigm that considers potential and pragmatic ecosystem transformation pathways using the Australian post-mined landscape as a contextual backdrop for investigation. A feature of the framework is that 'novel' ecosystems and agro-ecosystems possessing a range of commercial and societal values could bridge the conceptual divide separating the ecological function of under--rehabilitated (e.g., derelict sites) versus re-instated 'natural' landscapes. Landscape suitability analyses are incorporated in an operative framework to emphasize the influence of regional landscape and climate in the implementation of such management strategies. Altogether, the paradigm could facilitate the identification of widely pertinent rehabilitation goals and assessment criteria with direct implications at the regional scale of post-disturbance land rehabilitation.

Keywords: *'Natural' ecological analogues; 'Novel' ecosystems/agro-ecosystems; Mining; Landscape suitability;*

O015

Early detection of invasive alien species – the usefulness of distribution modeling

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Invasive alien species (IAS) presently cause immense economical loss, and pose great threats to ecosystems and organisms worldwide. IAS may moreover constrain successful restoration of ecosystems. Efficient combat of IAS rests on targeted measures and early detection. The tendency of ornamental IAS to invade road verges makes these areas suitable for early detection and successful monitoring of such species. The generally low prevalence in early stages of invasion necessitates unequal probability sampling of IAS, in which high-risk areas are oversampled in comparison to low-risk areas. We present a method for predicting IAS risk levels based on distribution modeling (DM), exemplified by modeling the distribution of five ornamental species along road verges in Southern Norway. We combined nine environmental variables as predictors and presence-only data for model training in the widely used DM program Maxent. Evaluation by independent presence-absence data sampled in a nested design revealed that good – excellent models could be built. The study thus showed that DM provides a good basis for risk prediction and, accordingly, for monitoring design aimed on early detection of IAS. In addition to predicting species' potential occurrence in space (demonstrated in this study), DM may predict potential occurrence in time. Moreover, DM may aid general identification of species – environment relationships. We recommend DM as a flexible tool with great relevance for a range of other restoration related purposes.

Keywords: *invasive alien species; road verge; early detection; monitoring; plant;*

O016

Historical references for near-natural ecological restoration

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Much of the current debate on the role and value of historical ecosystems as reference material for ecological restoration is built on ill-defined notions and on an outdated view of the role of people and the pervasive effects of their activities. The human ecological footprint on ecosystems and landscapes is most often interpreted simply as a disturbance which creates a long-lasting legacy of "negative" effects. To the contrary, the human impact on ecosystems – at least in the Mediterranean region and most of Europe – should be seen as an integral component of the "ecological memory" of a site or region. The human impact cannot be 'surgically' removed and thus it must be integrated in the construction of a reference. Restoration efforts should not only foster successional change, but also guide or steer the change towards a reference target that takes past human activities into account. Depending on the context, ecological restoration ranges from "assisted succession" to "biocultural restoration". Here we provide several examples to illustrate this approach. We also highlight the relevance of the geomorphic footprint that should not be underestimated, but accurately interpreted when constructing a historical reference to guide ecological restoration.

Keywords: *ecological succession; ecological memory; historical reference; human footprint; novel ecosystems;*

O017

Assessing degradation in steppe and semi-steppe rangelands of Iran: can indigenous ecological knowledge of pastoralists be used as a method?

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Rangeland degradation has been an increasing problem in countries with arid and semiarid rangelands, including Iran especially rangelands surrounding the Golestan National Park. Two study areas (Mirza-Baylu and Dasht) were selected in this region, partly inside and outside the Park where it is a great interest on how pastoralists can assess their rangelands condition. A combination of local and scientific ecological knowledge can empower local communities to assess and manage environmental change easily and accurately and play their roles in rangeland conservation. A structured questionnaire was designed to obtain data on rangeland degradation assessment according to the indicators taken from literature and the indicators were extracted of primary discussion with pastoralists in both study areas. A qualitative Likert scale method was used for assessing the degradation indicators. The collected pastoralists' data were analyzed using Statistical Package for the Social Sciences. Pastoralist first attention for assessing rangelands was to vegetation indicators rather than soil indicators and other indicators. In the Mirza-Baylu seven indicators and in the Dasht 6 indicators were significantly different between inside and outside the Park and most sensitive indicators for assessment of their lands. Current rangelands of both sites were degraded outside the Park comparing to inside the Park especially near to villages. We concluded from our study that pastoralists have the most knowledge about the vegetation and livestock habits of their environment and rangelands area. Involvement of pastoralists and documenting indigenous knowledge of rangelands can provide useful information for the sustainable utilization and conservation of natural rangelands.

Keywords: *Rangeland degradation; pastoralists; indigenous ecological knowledge; vegetation indicators; Golestan National Park;*

O018

Headwaters ecological restoration at landscape scales

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Safeguarding riparian ecosystems is a key issue for maintaining the ecological health on rivers. Riparian vegetation plays a key role in riparian ecosystems by supporting biodiversity and being a physical structure on which the ecological restorationist can count on. The aim of our study was to better understand the influence of the landscape structure, in particular the importance of hedge networks in the re-colonization of riverbanks after passive restoration. The perspectives are to promote a better way of managing salmonids nurseries in the headwaters of Atlantic rivers in Europe.

We studied headwaters in Normandy (France) on the catchment of the Oir River. Streams restoration started for the latest in 2004. Passive restoration consisted in the deletion of stresses caused by cattle on river banks (heavy trampling and grazing), and thus in the natural recolonization by plant communities. We compared the patterns of vegetation in these streams with the ones of another stream located in the same catchment.

The analysis of spatial and temporal transitions of the riparian ecosystems gives us quantitative elements for prediction of the restoration success.

The trees influenced the herbaceous diversity along the river banks after restoration: We analyzed their role of seed-bearers and examined how their spatial configuration and distribution contributes to seed retention by measuring the spatial autocorrelation between seedlings and trees. This study highlights that the usefulness of GIS in mapping and analysis landscape structural changes for understanding relationships between landscape structure and ecological processes. Such results could be used for prediction in the restoration of salmon rivers and could help managers methods and reduce restoration costs.

Keywords: *riparian diversity; salmonid river; spatial analysis; passive restoration; European Atlantic rivers;*

O019

Local plant adaptation and biotic interactions: implications for species introduction in ecological restoration

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Local adaptation is often used as an argument for the choice of local plant origins in species re-introduction and habitat restoration. However, experimental evidence for a better performance of local plants is not always very strong. We evaluate the "home-site advantage" argument using the results of our own studies and recent reviews on local plant adaptation. Local adaptation was tested in reciprocal transplant experiments. Common garden experiments were set up to compare local and several non-local populations.

The introduction of non-local plant populations may also disturb biotic interactions. We evaluate effects of such introductions on herbivore communities. Herbivore attack was analysed on local and non-local plants at natural and common garden sites. Herbivore and plant populations from three different sites were combined under standard conditions in order to examine the co-evolutionary arm's race for herbivore versus plant local adaptation.

Local adaptation could be confirmed as an ecological theory but the magnitude of home-site advantages is usually small. Local maladaptation was shown in several experiments indicating a potential risk for cryptic invasions of alien genotypes. Herbivore number and damage were different between local and non-local populations. Evidence was found for both lower and higher herbivory on local plants. In conclusion, an introduction of non-local plants will not only affect plant performance but also that of related organisms of higher trophic levels and, therefore, ecosystem functions.

Keywords: *local adaptation; species re-introduction; plant origin; trophic interactions; genetic differentiation;*

O020

Targeted pasturing: Plant energy content and restoration success

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For low-productivity ecosystems many management methods have been discussed, among others grazing; because of the traditional influence of livestock on landuse of past centuries, it has turned out to be an effective tool for management and restoration of extensively used ecosystems. But often, the vegetation to change has a reduced carrying capacity for livestock.

Within the work presented, the restoration target is to stop the encroachment of shrubs, resulting in degradation of ecosystem services in the study area, consisting of high pastures, located in the central part of Austria. Objectives are reached through targeted pasturing, leading to a trade off between nutritional status of animals and reaching restoration targets.

During the project period (4 years), a statistically significant decrease of dwarf-shrubs (*Vaccinium sp.*, *Rhododendron sp.*; from 36 % to 6.5 % cover, $p<0.001$, 4 replicates) could be shown by a generalized linear model. Chemical analysis for energy content of biomass harvested showed an increase from 7.95 MJ ME/kg DM (ME = metabolizable energy; DM = dry matter) in the first year to 8.17 MJ ME/kg DM in the fourth year. Literature from Austria shows an average energy content for biomass from a high pasture between 8.23 and 8.62 MJ ME/kg DM. With a yield of 885 kg DM/ha in the first year, total energy yield was therefore 7035.75 MJ ME.

To get acceptance with farmers being able to employ such methods, it is necessary to show that the targets set are compatible with animal production goals, at least in the long run.

Keywords: *High pasture; Vaccinium sp.; Rhododendron sp.; Sheep; Energy content;*

O021

Aculeate Hymenoptera of sand dunes – can we preserve them in sandpits?

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Most of the species of aculeate Hymenoptera (Chrysidoidea, Vespoidea, Apoidea) occupy open habitats; in particular the obligate specialists are capable to serve as very important indicators of various characters of open habitats. We studied aculeate Hymenoptera of sandpits throughout the Czech Republic. The insects were collected by yellow pan traps and sweeping. In total, we found 221 species, 53 of them were included in the Red List of Invertebrates of the Czech Republic, two were thought to be regionally extinct. Altogether 55 recorded species were sand dune specialists. The differences between the sandpits were crucial for the presence/absence of the individual species. Among the important parameters was, e.g., the presence of bare sand patches, vegetation cover, quarrying intensity, and time elapsed since the formation of each

artificial habitat patch. Several sand dune specialists were found only in the sandpits with active quarrying, among them *Bembecinus tridens* and *Andrena barbilabris*. Thus, sandpits were shown as very important refuges for xerothermophilous and psammophilous aculeate Hymenoptera. The current legislature enforces the technical reclamation of post-mining areas over their spontaneous or assisted succession, which leads to the complete lost of these habitats.

Keywords: *sandpit; Hymenoptera; Aculeata; sand dune; conservation;*

O022

Response of Orthoptera to upland heathland restoration

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Understanding how to restore threatened ecosystems is of special relevance for nature conservation. The aim of our study was to use Orthoptera as ecological indicators for the effects of upland heathland restoration in Central Europe.

Orthoptera showed a clear response to restoration. Diversity and density were significantly higher on restored sites than on control sites and existing heathlands. The higher amount of oviposition sites (bare ground) and the warmer microclimatic conditions in the restored sites most likely explain this pattern. In contrast, the existing upland heathlands are poorly managed and, consequently, have a low Orthoptera diversity and density.

Keywords: *conservation management; grasshopper; microclimate; oviposition; vegetation structure;*

O023

Phytodiversity conservation in Chilean forest plantations – status quo and perspectives for a more sustainable future

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In the biodiversity hotspot Central Chile, rapid and massive promotion of forestry with exotic trees – mainly *Pinus radiata* and *Eucalyptus globulus* – has lead to tremendous deforestation and important biodiversity loss. Within less than 40 years, native forests have lost almost 80 % of their original extent. Species richness of plants is significantly lowered within plantations. This decline is attributed mainly to unsustainable management practices. Since the process of deforestation in Central Chile is almost complete, forest companies are starting to move on to Patagonia.

Objectives: The study assesses the impacts of plantation management on phytodiversity in Central Chile and Patagonia. The main objective is to identify management factors that avoid loss of phytodiversity but promote it instead.

Methods: The study is based on Braun-Blanquet assessments from Central Chile and Patagonia. Assessments are analyzed and conclusions drawn with standard statistical procedures.

Results: The main factor that impair biodiversity on the site level is the homogeneous structure of plantations (i.e. trees of the same age and species). At the landscape level, low connectivity with native forests is crucial. However, at numerous sites different conditions are found. These plantations were composed of multiple species and different ages, included native trees and are linked to native forests. Such plantations maintain high levels of phytodiversity and endemism.

Conclusion/Application to Practice: Current management practices lead to an important decline in phytodiversity in Central Chile and are about to cause the same decline in Patagonia. However, various factor were identified that give reason to assume that this decline can be avoided by more sustainable practices.

Keywords: *Phytodiversity conservation; Biodiversity hotspot; Plantation forestry; Pinus radiata; Eucalyptus globulus;*

O024

Large-scale near-natural restoration of steppe vegetation on abandoned fields in Kazakhstan – the importance of grazing impact

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The dissolution of the Soviet Union in 1991 led to severe land-use changes across the Eurasian steppe belt. About 80 % of former arable fields in the southern wheat belt of Kazakhstan were abandoned, livestock numbers decreased and grazing was restricted to the vicinity of villages.

Little is known, if and to which degree the pristine steppe vegetation has reestablished on abandoned fields by natural succession. Moreover, the impact of grazing on near-natural restoration requires further study, as we assumed that grazing enhances the dispersal of target species.

In summer 2011 we recorded vegetation, biomass and soil parameters on abandoned fields and in pristine steppe with and without grazing pressure. Biomass and soil samples were analysed for their chemical components in the laboratory. Statistical analyses were conducted with DCA, indicator species analysis and GAMs.

Results show that grazing is a key factor for restoration success of abandoned fields, whereas differences in soil chemistry are of secondary importance. Species richness was significantly higher on grazed compared to ungrazed abandoned fields. The absence of grazing resulted in persistent grass–dominated stages with strong biomass accumulation leading to frequent fires and slowing down the immigration of typical steppe species.

Since our findings suggest that natural regeneration of steppe vegetation is enhanced by grazing, domestic livestock grazing should be reintroduced over the whole steppe. This would also compensate for the impact of wild ungulates, such as the Saiga antelope, that still suffer from poaching pressure and need more efficient protection before populations can recover.

Keywords: *dry steppe; restoration; grazing;*

O025

Matgrass sward plant species benefit from the occurrence of soil organisms

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Soil organisms are important in the structuring of plant communities. We aimed to assess if soil organisms from original and disturbed matgrass swards and from successfully and unsuccessfully restored fields may contribute differently to the growth of plant species characteristic of original matgrass swards. Second, we aimed to examine if soil organisms may suppress the growth of plant species from disturbed matgrass swards to the benefit of plants of original matgrass swards. In a pot experiment, we added non-sterilized or sterilized soil inoculum from the four different field types to a common sterilized background soil. We planted seedlings of the characteristic matrass sward species *Antennaria dioica* and *Nardus stricta*, plant species from disturbed matgrass swards *Deschampsia flexuosa* and *Agrostis capillaris*, or a combination of the four species. We did not find differences in biomass among soil additions from the different field types. However, especially *A. dioica* showed a large variation in biomass in response to soil additions from specific field sites. Soil organisms increased the biomass of *A. dioica*, *N. stricta* and *D. flexuosa*, but decreased the biomass of *A. capillaris*. The biomass of the characteristic matgrass sward plants was lower in the presence of plants from disturbed swards, irrespective of the presence of soil organisms. Probably *A. capillaris* was so much larger than the other species, that this overruled effects of the added soil organisms. Thus, specific soil organisms are necessary for some plant species, but they may not be able to shift the balance between plant species.

Keywords: *Antennaria dioica; mycorrhiza; nematode; restoration; soil community;*

O026

Effect of composts on soil resistance to compression and water infiltration in reconstituted urban soils

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Soil compaction is one of the most important stresses on plants in urban environment, reducing water infiltration, air circulation and roots growth.

The aim of our study was to evaluate the efficiency of composts addition to reduce urban soil sensibility to compression and to improve water circulation. Two composts were tested: green waste compost or sewage sludge and green waste compost. They were added to soil at two particle sizes (0–20 mm or 0–40 mm) and at two rates of application (20 % or 40 % in volume). Density, porosity and saturated hydraulic conductivity were measured before and after a compressive stress of 100 kPa which is equivalent to the load intensity of a car wheel.

After compression, compost dose had significant effects on the soil physical properties compared to the control. The dry bulk density was considerably lower in the mixtures with 20 % v/v or 40 % v/v of compost, before and after compression, than in the control soil. Water circulation was improved by a factor 2 or 10 in 20 % and 40 % v/v compost mixtures, respectively. The nature or particle size of the compost had a light influence on physical properties and accelerated ageing did not modify these positive effects.

This study suggests that the most interesting results to improve resistance to compression, air circulation and water drainage in urban soils is obtained for the highest proportions of compost (40 % v/v). Furthermore, the use of compost fully stable is recommended to keep the good physical properties over a long period.

Keywords: *green-waste; sewage sludge; particle size; ageing; porosity;*

O027

Response of drained mires to restoration (Sumava National Park, Czech Republic)

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A current mire survey revealed that almost 70 % of mires in the Sumava National Park have been influenced at least once by drainage. Since 1999, a "Mire Restoration Programme" started to be implemented in the area with the aim to restore disturbed hydrology and to stop mire degradation. The main restoration technique used was blocking of drainage ditches. Since 2005, monitoring project aimed at studying the degradation changes caused by drainage and evaluating the success of restoration started to be implemented in the area. Water table fluctuation, hydrochemistry, amount of precipitation, microclimate condition, vegetation on permanent plots and runoff from subcatchments were monitored.

First results suggested that the restoration has had a positive effect on the hydrology at the moderately degraded site. The mean water table rose and its fluctuations were reduced, especially in the dwarf-shrub bog sites and wet forests. The water table beneath *Trichophorum* lawns remained at almost the same level, but also here fluctuations were reduced. The various mire types differed in the hydrochemical response to the restoration. The results suggested that hydrochemical changes are more prominent in wet forests than in bogs. Electrical conductivity, PO_4, Al and Fe concentrations increased in wet forests but remained almost the same in bogs after the restoration. However, data three years after the restoration show only the short--term response of a mire to drain-blocking and may differ from the long-term response.

Keywords: *mire; restoration; hydrology; hydrochemistry; vegetation;*

O028

Carpobrotus eradication on a Mediterranean island: a compromise between recolonization of Carpobrotus and native species, and soil degradation issues

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Bagaud island in south-eastern France is partly covered with two alien plants of the genus *Carpobrotus*. Before launching their eradication, and with the aim of testing eradication protocols, an *ex-situ* seed bank study and an *in-situ*experiment were carried out. In spring 2010, the seed bank was studied in 45 samples: 1) in *Carpobrotus* litter and 2) in the soil at two depths, between 0 and 5 cm deep and below 5 cm deep. In the litter, 78 % of the seeds were from *Carpobrotus* while 22 % were from native species, versus 41 % and 59 % in the soil respectively. We therefore concluded from this *ex-situ* study that the eradication should probably include the removal of both the living parts and the litter of *Carpobrotus*. In autumn 2010, an *in-situ Carpobrotus* eradication experiment was set-up on sixty 1 m^2 quadrats, testing 1) the removal of the living parts of *Carpobrotus*, 2) the removal of the living parts and of the litter of *Carpobrotus*, 3) the previous treatment + the seeding of a mix of 3 native plants, 4) a control with no removal. Vegetation establishment, soil erosion and soil microbiological properties were monitored in spring 2011. When the litter had not been removed, there was little germination for both native and alien plant species, while when it had been removed, there were many germinations of both species-types. The removal of litter led to significant decrease in soil water content, microbial biomass and nutrient cycling (i.e. nitrogen, phosphorus) and also to major soil erosion with autumn precipitations; the native species mix did not have time to germinate and grow to prevent this. Eroded soil can be significantly captured and soil erosion controlled by leaving a 50 cm-large area of *Carpobrotus* at the bottom of slopes above cliffs. Implications for large scale restoration will be discussed.

Keywords: *NATURA2000 habitat 1240 vegetated sea cliffs of the Mediterranean coast with endemic Limonium spp.; seed bank; soil erosion; soil microbiology; invasive species;*

O029

Nature and construction

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Guidelines for sustainability through an ecological approach to design , land management and maintenance along roads, highways and within agglomerations. A document elaborated jointly by the highways dept and the nature conservation dept of the Ministry for sustainable development and infrastructures.

Objectives: Given that the principle function of highway infrastructure is for secure circulation, and an important mechanism for environmental improvement.

The surfaces in question: Surfaces within the traffic and urban infrastructure susceptible to ecological planning and maintenance. Any zone which is public land managed and maintained by the government or local council. The total sum of which would be equivalent to the area of an important national park.

Ecological strategy: Ecological maintenance methods can contribute to an increased biodiversity, conservation, restoration and a multitude of vegetation types. The use of soils and substrates low in nutrients such as rocky out crops, cut slopes, stony surfaces such as gravel, crushed stone or paving can increase biodiversity due to decreased completion for wildflowers.

Conclusions: The concept of ecological planning and maintenance within this brochure is based on the idea that let nature do the work. Mans intervention should be limited and adapted towards the needs of natural processes.

The creation of natural elements within built up areas is the best way to bring nature into everyday life, and thus respect for nature conservation is an everyday issue.

To restore basic values for natural and spontaneous environmental processes within the heart of urban life can contribute to life quality.

Keywords: *Nature; Construction; Restoration; Guidelines;*

O030

The Most Diverse Home Gardens in the World

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Maya domestic gardens, being of complex architecture and phenology, are repositories of native plant species and the ethnobotanical traditions that pertain to them. We examined the alpha and beta diversities of 10 Yucatec, 10 Kekchi and 10 Mopan Maya domestic gardens in western and southern Belize with the intention of measuring their ecosystemic service as refuges for flowering plants. In total, our data set embraced 37,700 individual plants, consisting of 645 species, 515 of which are native to Belize. We demonstrated that Maya domestic gardens are botanical hotspots that are richer in species (including native species) of flowering plants than the subtropical forests that surround them. They are derived from an admirable biophilia – sustained since precolombian times – that we regard to be as great a legacy as late classic Maya mathematics, architecture and astronomy. For purposes of their economic utility to the Maya, these gardens function as anthropogenic extractive reserves. Moreover, these gardens – intergenerational devotions that have endured for thousands of years – may be the prototypes of the contemporary Maya Forest, making that forest, for all practical purposes, a feral domestic garden. In Cayo District, western Belize, we use nonmetric multidimensional scaling ordination to affirm the feasibility of this hypothesis, comparing the species compositions of woody plants in the 10 Yucatec gardens vs. those of three edaphically dissimilar samples of Maya Forest.

Keywords: *Maya; Domestic; Gardens; Biodiversity; Hotspots;*

O031

Sphagnum reintroduction in a milled bog – an example from Northern Poland

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Spontaneous revegetation in post-excavation fields in milled bogs is extremely scarce due to hard hydrological, microclimatic and soil conditions. Drained and bare exploited areas act as a source of CO_2. The long-term goals of vacuum-mined mires restoration are: the reinitiation of peat forming process and carbon sequestration. The improvement of hydrological conditions and Sphagnum reintroduction, which initiates moss layer establishment, seem to be the main activities needed to obtain this goal.

Experimental Sphagnum reintroduction in one of the Polish milled bogs – Czarne Bagno has started in 2006. Before the experiment started, ditches draining bog's cupola had been blocked. Upper layer of decomposed peat was removed. Sphagnum diaspores were obtained from the possibly closest locations, where their populations were big enough to recover. Species chosen for reintroduction (*Sphagnum palustre*, *S. magellanicum*, *S. russowi*, *S. cuspidatum*, *S. fallax* and *S. capillifolium*) are present in contemporary flora of Czarne Bagno beyond excavation area. Their shoots were spread manually within prepared plots in amount sufficient for obtaining 6–10 % initial coverage, and then covered with straw mulch to protect diaspores from blowing away and freezing.

The changes in cover of each Sphagnum species are recorded three times a year. The best regenerating species are *S. palustre*, *S. russowii* and *S. cuspidatum*. In autumn 2011 in some plots the mosses layer reached the 100 % cover. The establishment of plant cover reduced the CO_2 emission, which is now twice lower than within a bare post-exploitation field. Developement of mosses layer promotes the settlement of peat-forming vascular plant species.

Keywords: *bog restoration; Sphagnum establishment; moss layer regeneration;*

O032

Can the hemiparasite Pedicularis palustris facilitate the restoration of plant biodiversity in fen meadows?

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Pedicularis palustris is an endangered hemiparasite in large parts of Europe. Our experiments show that its parasitic behavior can significantly alter plant diversity, biomass production and soil characteristics of large sedge vegetations in fen-meadows. Under the right hydrological conditions and mowing management practice, several target species for nature conservation can benefit from the gaps the hemiparasite creates in above-ground *Carex acuta* vegetation and its dense below-ground root system. The more prominent presence of mosses and lower solidity of the topsoil stimulates the formation of mesotrophic transition mire and quacking bog like systems, which are specifically protected under the European Habitat Directive. Through introduction and/or managing a single species an entire community can be positively influenced. Hence, *Pedicularis palustris*, can be considered as an 'ecosystem engineer'.

Keywords: *fen meadow restoration; mesotrophic transition mire; reintroduction; hemiparasite; Habitat Directive;*

O033

Primary succession on Mount St. Helens: lesson for restoration of barren lands

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The landscape formed after the 18 May 1980 eruption of Mount St. Helens was a mosaic of devastated habitats. I used permanent plots, vegetation surveys and other observations first to describe primary succession and then to better understand its causes. Many insights, some surprising, emerged concerning succession theory and restoration ecology. Spontaneous development is restricted by stress and isolation. Short distances affect species composition. Immigrants were largely species with floating diaspores that were poorly adapted to stress. Stress-tolerant species slowly arrive and change community structure. Colonization is poorly predictable and similar habitats may be colonized by different species. Dispersal spectra commonly differ from those of mature meadows. Although spectra change during succession, spectra of similar habitats in different locations can differ. Establishment depends on physical amelioration and biotic facilitation, but competition can override facilitation. Succession trajectories of similar adjacent sites may converge if competition and environmental links are strong or diverge if priority effects or secondary disturbances occur. Alternative vegetation states developed in several cased, often with no apparent cause, but their stability remains to be determined. These studies lead to several conclusions that inform restoration ecology. With proper preparation, including a moderate density of nurse plants, late stage plants can be introduced in the first stage. Spontaneous regeneration can work in a heavily disturbed matrix, but desired species must be introduced even when dispersal barriers appear modest. Alternative trajectories suggest that restoration success can have multiple results that should be accommodated.

Keywords: *primary succession; landscape effects; restoration guidelines; alternative states;*

O034

Large scale restoration of European habitats: From sandy dry heathland to soaking wet peatland

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Natuurpunt is the major non governmental nature conservation and management organisation in Flanders. Almost 90.000 families are a member and about 5000 volunteers supported by 400 professionals are the driving force in the management of 19.000 hectares of nature.

The 'Vallei van de Zwarte Beek' ('Valley of the Black Stream'), covering 1500 hectares, is the largest nature reserve managed by Natuurpunt in Flanders. Different smaller and larger restoration projects are or have been undertaken in it mainly in the context of the Natura 2000 network goals. The presentation will focus on the two largest ones.

The first is a European Life Project which made heathland, bogland and fen restoration (European habitats 2310, 2330, 4030, 4010, 6230, 7150, 3110 and 3130) on a large scale possible on the military domain where the stream runs through. This cooperation between Flemish and federal government was continuation of a process that humbly started with a few volunteers in the late seventies.

The second is a still ongoing valley restoration project with government support with the main focus on peatland restoration (7140 Transition mires and quaking bogs) and an open valley in a densely populated area.

Underlying studies, goals and actions will be explained. Cooperation is the key factor to face challenges such as military use, growing recreation needs, agricultural influences and hydrological issues in the region.

Keywords: *restoration; heathland; peatland; natura 2000; military domain;*

O035

"Novelty" labelling obscures restoration's achievements and potential

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Global hotspots are regions where restoration is already playing a critical role in conservation and sustainability. If we give up on holistic restoration in hotspots, we face an avalanche of truly irreversible events – multiple extinctions. Novel ecosystem theory, as articulated and popularised recently, contends that many hotspot ecosystems are irreversibly degraded, and is interpreted by some as suggesting that we should give up on restoration and settle for maximising ecosystem functions beneficial to humans. I argue that, on the contrary, there is no technological reason why any ecosystem should not be restorable. We are only just developing the technological capacity to reinstate complex ecosystems, but recent advances are very encouraging. At the very moment when restorationists are making unprecedented breakthroughs, and international interest and demand for restoration are soaring, it is regrettable that some authors are highlighting the novel ecosystem phenomenon, and insisting on the recalcitrance to restoration of an increasing number of systems worldwide. Isn't this handing excuses to those who want to avoid the cost and trouble of restoration? As Bill Clinton might have said, "it's the resources, stupid"! Policy makers are confused in this area now, just as many are as a result of the climate change debate. This makes it harder to argue for restoration funding. Examples will be provided of the approaches used in the hotspot of southwest Australia where programs of dedicated science over decades have delivered outstanding, and often surprisingly good restoration outcomes. These programs might never have got under way had the sites – often undoubtedly very degraded – been designated as 'novel' systems.

O036

Enhancing plant biodiversity in species-poor grassland – methods, processes and mechanisms

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Due to land use changes, species poor grasslands are widespread in today's landscape. Their floristic enrichment is increasingly in the focus of restoration activities. Nevertheless, to our knowledge only few studies explicitly investigated the potential of restoration measures to establish typical and rare target species in low biodiversity grasslands. Thus, we set up large--scale restoration measures to test the potential of plant material transfer to establish rare and typical flood-meadow species in species-poor flood meadows along the Northern Upper Rhine, Germany. Seed-containing plant material was transferred to species-poor meadows after grass sward disturbance. We studied vegetation development on nine sites for three years.

Since seedling emergence is a particularly vulnerable stage in the life-cycle of many plant species, interference at this stage may be very effective to set the path for the future development of a restored plant community. Therefore, we set up several microcosm experiments to focus on processes and mechanisms related to this phase of plant establishment. There we were especially interested in the interaction between seeds, seedlings and plant material during seedling emergence and establishment.

Large scale experiments showed that 101 species were successfully re-established on the restoration sites, including 28 Red List species within three years after the transfer of plant material. The microcosm experiments gave valuable insights in mechanisms and processes that determine the early phase of establishment but have also long-term effects on the plant community development. The results of both approaches enable us to give practical recommendations for the re-establishment of plant communities.

Keywords: *grassland restoration; invasibility; seedling emergence; flood meadows; litter quantity;*

O037

Ecological engineering: for a sustainable ecosystem restoration?

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In the past few years, numerous operations of ecological restoration demonstrated a real rehabilitation of ecosystem services and of some components of biodiversity from ecosystems considered initially as "degraded". However, with regard to the chosen reference ecosystem, none of these operations allowed a restoration of ecosystem integrity often acquired during history from an endless number of interactions between biological organisms and their environment. These findings are also coupled today with the necessary insertion of ecological restoration operations within the framework of sustainable development. It is now clear that all the ecosystems in the world cannot be restored (15 % is the objective in Europe by 2020!) by using only civil engineering due to the environmental cost of these interventions. Ecological engineering, which objectives are to apply the principles of ecological theories to environmental management, offers then a tremendous alternative because its objectives are not only to act for biodiversity but also to use the functional roles of biodiversity, such as ecosystem engineers or early bio-indicators of restoration success, such as sentinel species. Integration of these operations at landscape functional scales (i.e. by restoring connections rather than ecosystems) or the local integration of restoration by using empirical knowledge are also many ways of which we need to investigate the sustainability, for the ecological restoration of our natural capital in the long term.

Keywords: *Ecological ingineering; Near-natural restoration; dry grasslands; ants; civil engineering;*

O038

Nutrient and water level effects on Phalaris arundinacea and Carex acuta: A mesocosm experiment

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Phalaris arundinacea L. can be a dominant species in nutrient-rich wet grasslands, resulting in low diversity conditions. A field study in the Trebon Basin Biosphere Reserve (TBBR) showed that a nutrient-poorer section of a wet grassland had changed over time from an almost monoculture of *P. arundinacea* to a slightly more diverse grassland with two co-dominant species (*P. arundinacea* and *C. acuta*) possibly as a result of the cessation of fertilization and mowing. Nutrient-richer areas remained as *P. arundinacea* monocultures. Based on the field results, a mesocosm experiment was established in 2009 to determine the effect of nutrient level and flooding regime on the growth and spread of these two common wet grassland species. Nutrient treatments consisted of Low (= 65 kg NPK*ha^{-1}*yr^{-1}) and High (= 300 kg NPK*ha^{-1}*yr^{-1}) additions, while there were three flooding regimes (saturated = water level -5 cm below soil surface; flooded = +10 cm above soil surface; spring flood = flooding for four weeks in spring with saturated conditions for the remainder of the growing season). Half of the pots were harvested in August 2010 and the remaining half the following August. Measurements included final plant height, above and belowground dry weight, number of daughter plants and plant nutrient (C, N) levels. Nutrient additions significantly increased stem height and

aboveground biomass in *P. arundinacea* vs *C. acuta*. However, *P. arundinacea* was negatively affected by constant flooding, having significantly lower belowground and total biomass than *C. acuta*. Also, *C. acuta* was better at capturing nutrients (C, N) under long-term flooding. It appears that *P. arundinacea* is at a competitive disadvantage in nutrient-poorer conditions as well as when subjected to long-term flooding. Such results may be useful when attempting to restore more diverse wet grasslands.

Keywords: *Wet grasslands; Phalaris arundinacea; Carex acuta;*

O039

Restoration of forests in the Czech Republic and Europe

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Modern forest management aiming at integration of economic, ecological and societal aspects of forests has been accepted by the European Union and became the leading concept of the European forestry strategy. Unfortunately, not all CE countries are following this development. In some "countries in transition" the development in their forest sectors is different, still following the old-fashioned monofunctional and economy-motivated approach. It seems these countries accept the EU forest strategy principles but their forestry sectors obviously do not feel obliged to realize them, at least not fully. The main task of the Czech forestry has been the change of the species composition of forests dominated by conifers (esp. Norway spruce, Scots pine), covering now 73,6 % of the area and managed as monocultures. In the past 11 years (2000–2011), the change to more natural species composition covered not more than 2,9 % of the total forest area. With this speed of change, restoration of a recommended species composition (reduction of conifers; more beech, oaks and silver fir) will take more than 100 years! In Slovakia, conversion of the coniferous forests into mixed ones follows a similar way as in the Czech Republic. In Romania, some valuable remnants of virgin forests, assessed during the "Inventory and conservation of virgin forests program of Romania" organized by a Dutch expert team, were not protected but cleared. Exploitation and clearing of virgin forests in countries outside the EU (e.g. Ukraine, Belarus) are common practice. Contrary to these countries, Slovenia succeded well in formulation of a reasonable forestry policy and a corresponding forest management program. The examples clearly show that both measures of EU and more responsibility of national forestry authorities in particular EU countries are highly needed. Formulation of a consequent forest restoration policy and management following principles of the EU strategy of sustainable forest management is very necessary. Supported by research and education, restoration measures should become a standard component of the management in the field. Good practical examples of such an approach can be found in "old" democratic countries throughout Europe.

O040

Why go backwards? Comparing the Maya forest-garden with intensive agricultural systems, ancient and modern, in Pich, Campeche, Mexico

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The traditional Maya forest-garden (long-cycle swidden) has many variants as it is carefully adapted to local soils, topography and climate; however, it is not static. Contrary to popular beliefs, Maya farmers experiment, evaluate and make decisions to modify, reject or expand their experiments with various agricultural techniques and cultigens. The archaeological evidence suggests that they have done so for millenia. Their ancient systems of intensive agriculture included terraces and raised fields with canals as well as techniques for planting in holes in rock outcroppings. In the past thirty years, Maya farmers in Mexico have also experimented with tractor cultivation in a variant of the green revolution propitiated by a federal agency. When intensive systems fail, the Maya return to the forest-garden, an agricultural adaptation that is most cost effective as it relies greatly on free ecosystem services, provides good habitat for game animals, maintains supplies of timber, avoids disrupting a pattern of local rainfall that benefits agricultural production, and requires only 72 days a year of agricultural labor to feed a family of five. Our research includes the responses of presentday farmers to tractor cultivation, the evidence for an abandoned canal and raised field system constructed in the 7th century, comparison with the canal system in nearby Edzna, and a detailed study of the local variant of the forest-garden that includes the effects of burning on the four preferred agricultural soils in this area.

Keywords: *Maya; agriculture; Yucatan; agroforestry; resilience;*

O041

The Secret Garden: Assessing the Archaeological Visibility of Ancient Maya Plant Cultivation According to Pollination Syndrome

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Different types of plants have specific mechanisms for pollen dispersal. Pollen can be spread by ants, bats, bees, birds, wind, etc. Different pollination syndromes will result in differential representation of pollen in the pollen-rain that settles on the earth or in the sediments beneath a body of water, later to be recovered and analyzed by palynologists. There is an ongoing debate in Maya archaeology about cultivation systems used by the ancient Maya, the significance of various food-plants in subsistence,

and the impact the Maya had on the "natural" forest of the Maya Lowlands. This paper is an initial assessment of the potential visibility in the pollen record of indigenous plants documented as having been used by the Maya for food. The paper will also assess the ability of investigators to distinguish between deforestation (as traditionally defined in pollen studies) versus forest management and succession management that may have emphasized food-plants.

Keywords: *Maya; palonology; agriculture; archaeology; deforestation;*

O042

Assessment of the success of the mitigation for the Cadiff Bay Barrage

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In the development of Cardiff Bay, which was a protected area designated for its birdlife, a substantial area of coastal grazing land was flooded. The success of this mitigation was estimated using the "biodiversity quality" approach entailing the calculation of a range of indices based on bird population survey data. These indices included population per species, site conservation value (SCVI), evenness (Simpson's), and biomass per species. Comparison of these data for the Cardiff Bay before inundation and for the compensation site-post creation showed that the action was very successful with a statistically significant gain for most species (although one species suffered a significant decline). Adoption of the "biodiversity quality" approach has allowed clear evidence of the efficacy of the compensation action of a habitat creation scheme.

Keywords: *Biodiversity quality; conservation value; biomass;*

O043

Near Natural Restoration? A pilot study in the Northern Adriatic coast, Italy

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In the last century the intense urban and tourism infrastructure development led to the virtual disappearance of coastal sand dunes along the Italian Northern Adriatic coast. It is difficult to restore the relict dune areas and it is necessary to propose new solutions to try to recover the urbanized coast by involving people in its protection: if a "natural restoration" is not possible then we can try a "near natural" one. Along the Italian coast, beach resort owners habitually build artificial sand dunes in front of their structures to protect them from winter sea storms. These artificial dunes are usually destroyed in spring at the beginning of the new tourist season. At the Fandango beach resort at Marina di Ravenna (RA) the artificial dune was not destroyed but was planted in autumn 2010, utilizing Ammophila littoralis (Beauv.) Rothm. and Agropyron junceum (L.) Beauv., two dune building species. The plants survived the winter and we had a 100 % survival rate. During autumn 2011 the artificial dune was further enriched with Calystegia soldanella (L.) R. Br. plants, a dune stabilizing species with a considerable aesthetic value. The "planted dune" has been a great success among the beach resort clients and received several expressions of interest from stakeholders of the area. This study aims to describe how it is possible to develop a project of "near natural restoration" in an urbanized coast and to propose a cultivation protocol for some wild plants of the coastal dunes, in order to use them for restoration operations.

Keywords: *coastal sand dune; revegetation; restoration; artificial dune; Ammophila littoralis, Agropyron junceum;*

O044

Guidelines for seed harvest and production

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I. Different methods to gain native seeds

Harvest of donor-sites: Species rich meadows are harvested for example by thresher, seed-brusher or bar mower. The result is a mixture of plant material and seeds of the species existing on the meadow which will be transferred immediately or dried on the receptor-site. Only ripe seeds at the harvesting time will germinate on the receptor-site. This method is good for recultivation on a local frame in projects not out of scale.

Harvest of individual plants and species: After collecting the wild-seeds in their natural habitats they are cultivated as singular species. This suits the purpose to enlarge the amount of seeds for trade in the next generation. The single species are then recomposed in mixtures for different site-related conditions or the needs of the client. The compositions of the mixtures are created according to the natural plant societies and the region of origin of the basic seeds and the future receptor site.

II. Use of seed-mixtures in restauration projects

Wild seed-mixtures can be used for example in bioengineering or renaturalization-projects, for the establishment of species rich borders in intensively used agricultural landscapes or for greening up of industrial sites or roofs.

III. Quality standards for seed production:

- Indigenous origin of the basic seed
- Preservation of a high genetic spectrum of the species
- Cultivation of the basic seed in the same region / seed zone

- Limited number of filial generations in propagation
- Preservation of a high germination rate
- High purity of the harvested seeds
- Control of the flow of goods

Keywords: *native seed production; quality standards of wild seeds; site specific mixtures; native seed certification; harvesting wild seeds;*

O045

Ecologically sustainable implementation of the Nature Diversity Act for restoration of disturbed landscapes in Norway – use of molecular markers for defining site specific plant material

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In Norway, the use of seed for ecological restoration and landscape management in compliance with the new Nature Diversity Act of 2009 is hampered by uncertainties about what is site-specific and hence the lack of site-specific seed mixtures. To meet the challenge, ten model species important for ecological restoration in Norway have been selected for analysis of genetic diversity with the aim of providing a scientific base for choosing local material to be used in development of site-specific seed mixtures. Leaf material from each of the ten model species has been collected from 20 sites covering Norway, and at each site 15 individuals have been sampled per species. We use Amplified Fragment Length Polymorphic (AFLP) DNA-analyses to assess genetic variation. This will reveal geographic structuring of variation, the level of genetic diversity of the different species in Norway, as well as the division between within and between population genetic variation. The information provided by AFLP-analyses about the scale of genetic variation and population genetic structure in the species will create a basis for division of Norway into phytogeographical regions for restoration and provide guidelines by which ecotypes can be amalgamated for development of seed mixtures.

Keywords: *genetic diversity; site-specific; phytogeographical regions; seed mixtures;*

O046

Year-round grazing as restoration approach in floodplains: Impact on vegetation and Orthoptera

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Low intensity year-round grazing as a restoration and management approach has spread since the 1990s in German nature conservation, particularly in the course of floodplain restoration. However, studies on the long-term impact of year-round grazing on vegetation and fauna are still rare. We studied the influence of both, re-flooding and year-round grazing, on vegetation and Orthoptera in a restored floodplain area in Northwestern Germany 19 years after the implementation of measures. We recorded vegetation, biomass and soil properties at permanent plots located in different structural units of a year-round grazing in the restored Lippe floodplain. Overall, a moister and more stress tolerant grassland vegetation developed due to floodplain restoration and year-round grazing. Species diversity and biomass characteristics of different vegetation structures created by grazing differed significantly. The more intensively grazed plots showed the highest species-richness per plot and the best nutritional value of standing crop, indicating a positive feed-back between grazing intensity, diversity and fodder quality. Orthoptera were sampled in restored year-round grazed and, for comparison, in unrestored seasonally grazed sites. We found no differences between the grazing systems in neither species number nor Orthoptera density in the nymph period, but in the adult period both parameters were higher in restored year-round grazed sites than in unrestored seasonally grazed sites. Reasons were enhanced structural diversity under year-round grazing and the existence of flood swards as a product of re-flooding.

Keywords: *floodplain restoration; nature development projects; Orthoptera conservation; Orthoptera diversity; semi-natural grasslands;*

O047

Connecting traditional maya land use and ancient Maya settlement patterns

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Understanding traditional Maya land use is at the crux of interpreting ancient Maya settlement patterns and population density. Addressing the problem of ancient land use and population estimates with the Geographic Information Systems we created and validated a probability map of Maya settlement patterns for the El Pilar area. On this basis, we develop a method that provides a basis for estimating the number of households and population size across the whole El Pilar area. Residential patterns are projected based on geographic variables of soil fertility, drainage and slope, while the maize yields of traditional Maya milpa-forest gardeners provide the basis of subsistence patterns. By classifying residential units and using demographic assumptions of the average family size, we derive population estimates for the Late Classic Maya. We demonstrate the “near

natural" system of the traditional milpa-forest garden cycle and its capacity to support significant populations at the height of the Maya civilization. Most importantly, this system simultaneously sustains the forest environment. The results promote traditional farming practices of the Maya area and offer an indigenous strategy to conserve the Maya forest today and into the future.

Keywords: *Ancient Maya; Subsistence; Population;*

O048

The role of soil fauna in restoration

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Soil fauna may affect ecosystem development by many different ways it affect plant community due to herbivory, seed propagation, spreading of pathogens or beneficial microorganism, ant also by its contribution to soil formation and nutrient cycling, At the same time ecosystem development affect soil fauna development and soil fauna is sensitive indicator of ecosystem and namely soil development. These effects will be demonstrated on examples from succession and ecological restoration and possibilities to manipulate soil fauna in restoration practice will be discussed.

Keywords: *soil fauna; herbivory; pathogen; mutualism; soil formation;*

O049

Factors affecting volunteer establishmen of woody vegetation in post mining heap with special attention to Salix caprea.

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The establishment of willow was studied in one large post mining heap near Sokolov. Willow establishment seems to be affected more by presence of mature willow nearby than by climatic conditions in given year. Despite willow propagate by wind it seems to be in first wave establish only individual scouts than then establish dense willow stand. Willow seedlings however established only in sites where willow cover is low up to 30 % in dense willow stand with closed canopy we do not find any willow seedlings. As the scouts establishment is more likely in the margin than in the center the marginal patches get covered by woody vegetation for 80 % by continual cover within 20 year while central parts of the heap only from 15–20 %. Wave like surface is essential for willows establishment the established is more successful on northern slopes of the waves, and better on steeper slopes.

Keywords: *succession; woody vegetation;*

O050

Evaluation of Restoration dynamics by vegetation mapping and transition matrix model: analysis of 20 years of restoration and management in the megalithic site of Carnac (Brittany, France)

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The megalithic site of Carnac is known all over world for its alignments of more than 2500 standing-stones. In the 80's, over--frequentation (more than 500 000 visitors per year) and a lack of adapted management led to great degradation of the site vegetation, which constitutes not only the framework of the monument but also an indispensable protection for archaeological soils. Thus, in 1991, in order to initiate the restoration of vegetation cover (notably heathland) the whole site (18 ha) was fenced and an adapted management plan (including vegetation management and frequentation control) was initiated in 2001. During this period vegetation of the site was mapped several times: in 1985 (before enclosure), 1997 (5 years after fencing), 2006 (after 5 years of management plan application) and in 2012. As these mappings were, except for the first one, based on the same typology, and on the same base map, they allowed an analysis of vegetation dynamics and management effects over the last 25 years. GIS analysis and transition matrix models were used to describe vegetation dynamics both at the levels of the site and of specific areas. Thus, precise dynamic analysis concerned the recolonisation of initial bare soil and management effects of initially undamaged areas (grassland and heathland). The discussion will focus on specific site considerations such as restoration and management evaluation as well as more general points of view concerning the use of mapping for vegetation dynamics analysis.

Keywords: *Restoration dynamics; Heathland; Mapping; Transition matrix; Evaluation;*

O051

Gradual wind-driven iron addition as a measure to counteract internal eutrophication and restore biodiversity in peat lakes

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In many surface waters, increased phosphate release from the sediment (internal eutrophication) will irrevocably result in algal blooms, turbid water, and the absence of submerged macrophytes. Earlier experiments have demonstrated that addition of iron may lead to decreased internal eutrophication and improved water quality. However, these experiments did not show long lasting effects due to high external loadings. This fact, and the fear of acidification and increased iron and chloride concentrations, refrained water management authorities from using this application.

We therefore tested a more gradual iron addition in a 85 ha peat lake with a low external loading, but with high internal eutrophication. This method should prevent acidification and increased iron and chloride concentrations. A windmill on an anchored pontoon was used to gradually supply 33 g/m^2 iron as iron(III)chloride, over a 1.5 year period. Wind induced currents should spread it over the lake.

A thin iron saturated layer was formed on top of the sediment in almost the entire lake. Phosphate mobilization from the sediment and surface water phosphate concentrations became significantly lower. As a result, algal blooms disappeared, the water became clear and submerged macrophytes developed. The application did not lead to acidification or to high iron and chloride concentrations. Submerged macrophytes were still able to use the iron-bound phosphate in the sediment.

Therefore, gradual wind-driven iron addition is a promising measure to counteract internal eutrophication and to restore biodiversity in relatively isolated peat lakes. High amounts of iron-bound phosphorus may, however, lead to dominance of fast-growing macrophytes.

Keywords: *iron addition; internal eutrophication; lake restoration; phosphate mobilization; aquatic macrophytes;*

O052

Restoration potential of degraded semi-arid rangelands in southwestern Iran in relation to soil seed bank

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Overgrazing and land-use change has resulted in the degradation and fragmentation of many rangeland communities in Iran. This study aimed at evaluating the potential role of soil seed bank in restoring semi-arid rangeland in sites that have been degraded by grazing and cultivation. This was carried out in a part of winter rangelands in Fars province in south-west of Iran. Soil sampling was done in an ungrazed site (an area protected from grazing for 24 years) and four grazed and cultivated rangelands nearby. These were the area with moderate grazing, heavy grazing, rangeland converted to cropland, and abandoned crop filed. Soils were sampled from 0–5 and 5–10 cm depths. Then seed bank composition was identified after seed germination in glasshouse. A total of 68 species were identified in the seed bank, of which 21 species were restricted to one of the areas. Annual plants were common in the seed bank of all sites. Ungrazed and moderately grazed sites had greater number of common species between seed bank and standing vegetation. A reduction in soil seed bank richness and diversity were found in heavy grazing, cropland and abandoned sites. In multivariate analysis the seed bank composition significantly responded to different sites where the seed bank of some unpalatable species benefited from heavy grazing and cultivation. Our results suggest that the restoration of disturbed semi-arid rangelands does not rely only on seed banks.

Keywords: *overgrazing; fragmentation; cultivation;*

O053

Prioritizing watershed restoration actions using both ecological and socio-economic criteria

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A fish habitat restoration plan was developed for six coastal streams in Coos Bay, Oregon, U.S.A. relying on both watershed assessments and landowner involvement. A high level of public participation was characteristic of this process and key to its success. Because riverbank landowners are extremely important to the successful implementation of a stream restoration plan, we took a "neighbourshed" approach to organize the public involvement in this process. The targeted approach we used consisted of a series of "coffee klatches" designed to attract as many landowners as possible from each basin. Initial meetings, used to present the "state of affairs" in each watershed, were followed by field trips to show habitat restoration projects. A second round of meetings and a workshop with a panel of experts were used to prioritize restoration actions. A restoration prioritization scheme was developed incorporating both an "ecological filter" and a "socio-economic filter" to rank all possible restoration actions in each watershed. Depending on their combined priority scores, the various restoration actions were subsequently assigned to the following four categories: "go ahead", "proceed with caution", "interesting but..", and "not

at this time". The resulting draft restoration plan was presented to the landowners to obtain their feedback. That 'calibration' helped developed a more advanced restoration plan that has been well received by all key stakeholders, as landowners indicate their willingness in signing up for restoration projects. Subsequent surveys we carried out indicated that landowners liked the targeted approach and supported restoration they would not have supported otherwise.

Keywords: *Stakeholder involvement; prioritization; restoration planning; decision making; expert opinion;*

O054

Environmental degradation and opportunities for riparian rehabilitation in a highly urbanized watershed: the Matanza-Riachuelo in Buenos Aires, Argentina

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Degradation imposed by human activities on rivers is still considerable in many parts of the world and that is the case of Matanza--Riachuelo watershed, one of the most polluted in Argentina. It is occupied by one of the 27 world's megacities (Buenos Aires) downstream, while in the upper basin agriculture almost completely replaced natural grasslands. In order to evaluate the condition of streams and determine opportunities for rehabilitation, we conducted a stratified random sampling of 83 sites regarding anthropic impacts and riparian vegetation. We determined that 65 % presented at least one sign of canalization: lower basin was associated with concrete slopes, middle basin with straighten banks and upper basin with mounds resulting from dredging. Other anthropogenic impacts were related to predominant land uses in each region: stormwater discharges in the lower basin, bridges and roads in the middle, and access of livestock to riversides in the upper basin. Regarding riparian vegetation, 45 % of the identified species were exotic and three riparian communities were recognized: semi-natural banks, dominated by grasslands with equal cover of native and exotic species, "herbaceous" and "woody" river banks. The cover of exotic species in the last two doubled natives. A detailed characterization of streams is appropriate to identify opportunities for rehabilitation according to the current state of degradation: from geomorphological "re-naturalization" of sinuosity of streams to exotic species control and reintroduction of native plants. We discuss the potential of these techniques as part of the future municipal agenda of authorities responsible for watershed management.

Keywords: *riparian rehabilitation; urbanized watershed; land use; environmental degradation;*

O055

Displeased or simply confused? Reactions from local residents and experts to a urban river rehabilitation project

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Public perceptions and evaluations of the early stage of an urban river restoration in Oslo, Norway, are investigated and discussed in relation to an expert view on the ecosystem state in the site. The previously piped river was partly reopened in 2004, and the aims of the rehabilitation were diverse; to increase the river's self-cleaning capacity, preserve and increase biodiversity, and create and secure areas for recreational use. Ecological restoration is a new management strategy and resource allocation for Norwegian river management, a rehabilitated river and corridor represent a contextually unfamiliar landscape element for inhabitants.

A telephone survey was conducted and botanical inventories carried out before and during the project. Respondents were quite pleased with the vegetation at the site, but also reported that the area had too little character of a park, was too unkempt and they were displeased with the water quality. However, the restoration made the site a more interesting and attractive place to visit.

The diverse aims are complicated to the local residents. The mimic of a reference natural ecosystem seems out of place in this urban landscape surrounding. The park design generates association with water-based fun fairs rather than protecting biodiversity and improving water quality. The local residents' preferences regarding the aesthetics of the site will likely favour a traditional park and not a restored state of nature.

Incorporating integrative management procedures and include public participation in early stages of the planning process will likely diminish the level of conflict between goals.

Keywords: *perceptions; local residents and ecological experts; biodiversity; recreation; water quality;*

O056

Evaluating restoration trajectories using similarity indices: riparian-influenced systems

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Measures of community similarity have found broad application for examining changes in species composition. In habitat restoration, success may be measured by increased similarity between restored areas and reference ecosystems, which represent a desired future condition. Examination of the response of multiple taxa (e.g., small mammals, butterflies) is usually recommended for evaluating the effects of restoration efforts. If the responses are congruent across taxa, sampling efforts can be redirected. This paper examines how measures of community similarity co-vary across three different taxonomic groups. We calculated Chao-Jaccard similarities for small mammals, song birds, and herbaceous vegetation on 34 sampling areas in riparian-influenced habitats in northeastern Washington and adjacent Idaho, USA. Eight areas that represent reference conditions for four habitats (emergent wetland, wetland meadow, riparian shrub, and riparian forest) were monitored for 3 consecutive years to determine temporal variability. Areas under restoration were sampled at 3-year intervals. We used Mantel tests to evaluate the congruence of pairs of taxonomic groups. General congruence in community similarity for the three taxa was observed. This result is consistent with the few other studies that have looked at correlations in community similarity across taxa. This pattern, however, obscured important differences associated with the level of habitat structure, the effects of disturbance, and overall species richness. We suggest that considerably more analysis be done before concluding that one taxon can adequately represent the response of another to restoration activities.

Keywords: *similarity index; riparian; restoration trajectory;*

O057

The UK Native Seed Hub: working to improve the availability of high quality native seed for habitat restoration in the United Kingdom

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In the early 2000s, the UK market for native provenance wildflower seed was c. 20–30 tonnes/year (Walker et al, 2004). Since then demand has increased, driven by UK Government policy and growing media interest. However, evidence suggests that the seed quality is highly variable (Ryan et al, 2008), seed origin is often restricted and many rarer species are unavailable. In responses to these issues, the Royal Botanic Gardens, Kew has expanded the work of the Millennium Seed Bank Partnership to establish the UK Native Seed Hub. This is a research and production facility aiming to carry out research to improve native seed production methods, disseminate information on best practice and supply commercial seed companies and conservation projects with high quality, genetically diverse seed of known origin.

Initial research has addressed two questions; firstly, 'What is the quality of native provenance, wildflower seed available on the UK open market?', and secondly, 'Can seed priming be used to increase germination and establishment of native seed and thus improve the quality and genetic diversity of founder stock?'. Preliminary results from this research are discussed and the UK Native Seed Hub's long term plans are presented.

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Keywords: *seed quality; seed priming; native species;*

O058

Introducing a little wilderness into bourgeois housing areas or: Re-designing urban green with site-specific seed-mixtures – biodiversity, costs, acceptance

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Like many other cities in Germany Riedstadt, which is situated about 30 km south of Frankfurt on the Main, has to deal with a growing gap between the disposable tax revenue and growing expenses due to increasing responsibilities of public administration. Whereas, e.g., the area of inner urban green spaces increased considerably due to new construction sites with their parks, playgrounds, roadside vegetation, etc., the amount of workers in charge for their maintenance did not rise at all. Furthermore there are a lot of tiny green spaces (just between 2 and 10 square-meters), especially along the roadsides in the housing areas, which are extremely difficult to tend to. Therefore many of the public green spaces in Riedstadt are in a wretched state of maintenance. Furthermore they provide only little value in regard to biological diversity, as you can find the all-over-Europe favourite shrubs like *Lonicera pileata*, *Symphoricarpus chenaultii*, *Mahonia auquifolium*, etc. In the whole there are some 15 cultivars, bought from the big nurseries, implying that many of them are genetical identical clones, as they derive from cuttage. As Riedstadt is one of the original members of the "Alliance of Communities in favour of Biological Diversity" (founded on February 1st, 2012), we decided on a way to change the inner urban green spaces that would reduce the costs for the tending as well as enhance biodiversity. After removing the old shrubbery and the soil (which was often densely interspersed with Elymus repens due to the lack of maintenance) we sowed the areas with a seed-mixture developed by ourselves, which comprised about 70 perennial and annual species typical for our region (species of thermophilic and

draught tolerant grasslands and field margins), including some of the Red List. Moreover all seeds were collected in Riedstadt and neighbouring communities by a company who specialised in the production of certified regional seeds – thus using genetical resources that are adapted to the ecological conditions here. This radical change in the appearance of a lot of public green spaces, which we started in Winter 2009/2010, is accompanied by a sometimes highly emotional discussion among the local politicians and population, the introduction of wild species – for some people they are merely weeds – threatening their sense of order.

O059

The below ground community in restoration – followers, facilitators and thresholds

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The below ground community is extremely biologically diverse, and interacts with mineral and organic components to generate soil structure and function. Unfortunately, this vital component of ecosystems is often overlooked – although without it no restoration can succeed. There are three ways in which the below ground community may be viewed as part of a restoration programme or project: Following – as indicators of progress of restoration to indicate the trajectory of a restoration in relation to target states and the effects of different restoration treatments and strategies; Facilitating – as essential components of specific interactions, particularly when inoculation my bring about improved survival/ growth (e.g. mycorrhizae), structural genesis (e.g. earthworms) or nutrient cycling (e.g. N-fixers); and Threshold effects – e.g. through securing novelty in ecosystems by favouring invasive species by means of Red Queen effects. Examples of this type of interaction will be given and their implications for restoration ecology research, and ecological restoration practice discussed.

O060

Specialist plant species perform better in restored dry calcareous grasslands compared to reference habitats

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Calcareous grasslands have long been recognized as biodiversity hotspots in Europe. In recent decades, these ecosystems suffered intensive fragmentation. In Belgium, more than 100 ha have been restored since the early 1990s.

We used population biology indicators to estimate dry calcareous grasslands restoration success on specialist species dynamic. The goal of our study was to evaluate the performance of populations of *Sanguisorba minor*, *Potentilla neumanniana* and *Hippocrepis comosa* present on reference calcareous grasslands, old restorations and recent restorations. We used indicators of population size, vegetative growth, reproductive success and fitness, and we explored the importance of vegetation structure and soil depth on population's performance.

Our results showed that reference grasslands harbored bigger populations of *S. minor* and *P. neumanniana* than restored grasslands. No clear trend was pointed out concerning the vegetative growth. For the three species, reproductive success and fitness of individuals in recently restored populations was significantly higher than in reference grasslands and old restoration. Individuals in recent restorations produced more inflorescences or flowers and seeds. We also pointed out that recently restored parcels were characterized by more bare soil and less shrub cover. Our study pointed out the importance of recurrent management in order to keep habitats opened and showed that recently restored populations play an important role in supporting species persistence in fragmented calcareous grasslands due to their higher reproductive success.

Keywords: *Belgium; Chalk grasslands; Reproductive success; Restoration;*

O061

Establishment of semi-natural litter meadows in the Enns valley

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Nature-conservation areas of high-value (High Nature Value Farmland – HNVF) are valuable capital for the maintenance and promotion of biodiversity. The local restoration of such areas is therefore seen as being of great political importance. The methods concerning winning and using of the diaspore material from donor sites for the establishment of semi-dry grassland was analysed on the damp floor of the Enns Valley's (Styria Austria) which is characterised through litter meadows (so-called *iris* meadows). After harvesting was the share of clean seeds in the threshed material around 60 %. Due to the numerous frost germinators (e.g. *Iris sibirica*, *Molinia caerulea*) the establishment of the experimental site was in late autumn 2006. A relatively slight amount of seed (2–3.5 g/m² threshed material) was sown. After the cleaning cut in Summer, the areas showed already in Autumn 2007 a satisfying vegetation cover, containing a high number of target species from the donor site (e.g. *Molinia sp.*, *Iris sibirica*). On the lean, partially damp areas of the receptor site typical species of the litter meadows and different sedges became dominant during the last years. The transfer rate of target species is rising and five years after the establishment about 50 %.

Keywords: *establishment, litter meadow, Iris sibirica;*

O062

Environmental filters in fen restoration highlighted by the use of Functional Diversity indices

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Ecological restoration of fens consists of restoring the appropriate abiotic conditions and the characteristic species community. The second process is, according to theory, constrained by environmental filters. Through 2 different fen restoration experiments, we describe how Functional Diversity Indices reveal the action of environmental filters during restoration. The first case represents an 8 year-long restoration project of 3 formerly rich fens in east-central Sweden. Trees were cut, and ditches were dammed to restore light and hydrological conditions respectively. The second case is a 3 year-long peatland restoration of a drained formerly rich fen near Warsaw, Poland. Hydrological conditions were restored by top-soil removal, whereas the species community was restored by re introduction of target species by hay-transfer. The restoration site was divided up in stripes, were half the stripes received hay transfer, and half the stripes did not receive hay transfer. Apart from this, there were considerable variations in distance to the groundwater over the site. Our results show that both projects are significantly affected by environmental filters. In the Swedish case shading by trees was the main environmental filter that existed prior to restoration, while its removal by cutting opened the community for the establishment of very diverse species. This opportunity was short-lived, since interspecific competition quickly gained importance. In the Polish case flooding was a strong environmental filter on trait characteristics, stronger than dispersal, which was overcome with hay transfer. The latter caused a higher dominance of competitive species compared to areas without hay transfer.

Keywords: *functional diversity; ecological filters; peatland restoration; species reintroduction; fen;*

O063

Impact of forest restoration on saproxylic and red-listed beetle species

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Among the largest groups of red-listed species in Finland are saproxylic species, which are dependent of dead wood. Reason for their threatened status is mainly forest management, which has led to the lack of coarse woody debris and maintains efficient fire control. As a consequence, species dependent on dead or burned wood have reduced dramatically. Restoration of forests simulates natural disturbances and aims at bringing back essential components typical to natural forests. We have investigated effects of restoration on forest-dwelling species assemblages in 2005–2011. The purpose is to investigate, whether burning improves the quality of habitats for dead-wood dependent beetles and how these species respond in general to restoration practices.

The study design includes 9 pine-dominated study sites in eastern Finland with two burn treatments and untreated control. Prescribed burning was conducted in 2006. Beetles were collected in 2005, 2006, 2007 and 2011. The number of saproxylic beetle species and individuals increased two years after burning, but declined five years after burning nearly to the initial level. However, the number of red-listed species remained at higher level five years after burning. Red-listed beetle species benefit by controlled burning, although some species might disappear following fire application. In the vicinity of adequate source areas, suitable habitats for some endangered fire-dependent beetle species can be maintained with prescribed burnings, where the trees are left at the burned sites after fire. Our results show that fire frequency should be at most five years in landscape-level to maintain viable populations of fire-dependent red-listed species.

Keywords: *Coleoptera; fire; forest restoration; Coarse woody debris;*

O064

Novel concepts for grassland restoration in Southern Brazil?

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The pastures of Rio Grande do Sul, Brazil, belong to a primary grassland area with high native species diversity and are being converted to arable land and exotic tree plantations at alarming speed. Conservation was prioritised by an IUCN resolution in 2008; ecological grassland restoration research is incipient. Ex-arable land and clear-cut areas are re-used as pasture, often after seeding of matrix species, and lack various species groups of primary grassland. Both seeded and spontaneously established species include neophytes: Southern African C4 grasses in the subtropical south, Middle European C3 species in the temperate humid north. No infrastructure is yet available for monitoring and coordinated control of invasive species. The use of fire, a traditional tool in pasture management in the north, is restricted by current legislation and controversially debated. Native species' phenology is not favourable for hay production and transfer and regional seed production has not yet been thought of. Novel concepts are needed in order to set appropriate restoration targets and to develop practicable restoration techniques.

Keywords: *grassland restoration; Brazil; exotic species; target species transfer;*

O065

Are biotic or abiotic barriers breached first? Invasion by Lupinus arboreus on Kaitorete Spit, Canterbury New Zealand

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Ecosystems can be modified by invasive plants to produce a state with very different structure and function. Richard Hobbs proposes that in reaching this new state the ecosystem will cross first a biotic then an abiotic threshold: creating two barriers to autogenic recovery. Identification of these barriers is the key to mitigating the impact of the invasive plant and attempting to rehabilitate ecosystem structure and function. We studied the barriers created by the establishment of the invasive shrub *Lupinus arboreus* on the nationally-significant Kaitorete Spit dune ecosystem. *Lupinus arboreus* has an extensive cover over the New Zealand coastline, so the results from this study can also assist with the rehabilitation of other dune ecosystems.

The establishment of *L. arboreus* has resulted in a modified light regime to the dune vegetation and animals, by creating a canopy across large areas of the dune system where there had previously been only ground cover plus larger herbaceous species. The shrub has modified the wind regime which has changed the sediment profile of the dune lows, and it has modified plant nutrient availability. These three factors have led to the change in plant community assemblage. Moreover, the abiotic changes and the consequential vegetation change have potential negative impacts on several endemic animal species. Thus, the abiotic barrier to recovery came first, the biotic second, the opposite order to that proposed by Hobbs. However, environment and biota constantly affect each other; it might be more appropriate to recognise an interacting abiotic/biotic barrier.

Keywords: *Invasion; Barriers; Lupinus;*

O066

Novel ecosystems, invasive species and restoration: a slippery slope or common ground?

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Rapid environmental change and increased biotic exchange act synergistically to change biophysical envelopes, species distributions and biotic assemblages. The ways in which climate change is liable to affect invasive species and restoration activities are only just beginning to be explored in detail. The implications of radically-changed biotic assemblages and the increased difficulty in maintaining or restoring historic communities for both conservation and restoration have only recently been considered. Dealing with invasive species is often a key element of restoration. However, non-native species are often readily integrated into networks in the invaded ecosystem, such as food webs, and pollination and seed-dispersal mutualistic interactions. The concept of "novel ecosystems" puts non-native species and restoration ecology "face to face in a dark alley" – the concept is troubling to some, but increasingly some degree of pragmatic acceptance is seen as necessary to find practical ways of dealing with rapidly changing environments and species mixes. Does acknowledging the extent of novel ecosystems and the potential value of some non-native species run the risk of sending us down a "slippery slope" where there are no longer any rules and anything goes? Or is there a way of finding a middle ground where effective ways forward are possible? Finally, can a comparison of European and new world systems and attitudes help with this?

O067

Restoration at large scale: Eurasian steppe ecosystems in the Post-Soviet era – unexpected results and future challenges

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After the collapse of the Soviet Union the western Eurasian steppe zone between the northern margin of the Black Sea and the Altai Mountains has undergone tremendous changes in land-use and land cover triggered by deep-going political, social and economical transition processes. In Kazakhstan alone 15 Mio ha of crop land, originating from the so-called "Virgin Land Campaign" in the mid 1950s were abandoned between 1990 and 2000. At the same time stocks of domestic grazing animals such as sheep and goats dropped from about 20 Mio heads to less than 5 Mio. Cessation of arable use and reduced grazing pressure has since then led to the recovery of steppe ecosystems over millions of ha across the entire steppe belt. Basically, this can be considered as one of the largest unintended restoration projects currently going on worldwide. In my talk I will review data from recent research focusing on the ecological consequences of these ongoing regeneration processes. A particular focus will be given to the impact of changing grazing patterns on the restoration of steppe vegetation and avian communities on ex-arable land. Due to the increasing global demand for arable land to grow food and energy crops the western Eurasian steppe belt is currently again facing the reclamation of arable land that might quickly reverse the positive development of the past two decades. At the end of my talk I will discuss strategies how to counteract and mitigate the effects of a renewed agricultural expansion that might lead to serious declines of steppe habitats and species again in the near future.

O068

Restoring detrital shadows: stable isotopes reveal detritus-based estuarine food web connectivity depends on delta discharge and consumer feeding mode

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Recent studies in estuarine detritus-based food webs document strong gradients in the sources of organic matter (OM) assimilated by consumers across diverse landscape scales. These results challenge prior concepts regarding the scale of estuarine food web connections, inferring greater compartmentalization along the estuarine gradient. Given that historical alterations of estuarine landscapes have vastly disrupted the source, biomass, and distribution of OM sources available to important estuarine consumers, naturally compartmentalized systems may be particularly vulnerable to disruptions of food web linkages. However, our understanding of estuarine food web compartmentalization is limited to microtidal environments and/or estuaries receiving little riverine input, both of which may minimize detrital transport. We have quantified the scales of estuarine food web connectivity in relation to landscape setting and river flow regimes such that this fundamental function can be strategically incorporated into restoration planning.

In five Pacific Northwest, USA estuaries representing different scales of fluvial forcing, we use Bayesian stable isotope mixing models to trace OM linkages to benthic-deposit and filter feeding consumers transplanted across the estuarine gradient. Emerging results indicate filter feeding consumers reflect broadening connectivity as fluvial influence increases, suggesting river flow increases detrital mixing across space. Unexpectedly, however, benthic-deposit feeders in the most strongly fluvial estuary reflect more compartmentalization than those inhabiting embayment type estuaries. This suggests that factors affecting the flux, deposition, and retention of detritus, such as the channelization of distributaries, may act to disrupt expected food web linkages. This key food web mechanism could be a strategic objective for restoration planning.

Keywords: *Food web connectivity; Estuary; Landscape context; Stable isotopes;*

O069

Moss cover re-establishment on three abandoned peat fields in Estonia

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Some 10 000 ha of peat fields are abandoned in Estonia. Only in a few exceptional cases and in limited areas the *Sphagnum* dominated plant cover has self-restored. In 2007 we started experiments to re-establish *Sphagnum* cover on three sites using the North American approach. We used diaspores of six species (*S. angustifolium*, *S. fallax, S. fuscum*, *S. magellanicum, S. rubellum*, *Polytrichum strictum*) and of different species combinations. On one site N and P fertilizers were added. Permanent plots were established to systematically monitor the re-vegetation success. Percentage cover of all species within the plots was estimated every year. Samples for moss biomass measurement and surface peat moisture content under mosses were collected. Depth to water table was measured on every site. In the presentation we will outline the importance of depth to water table, soil moisture conditions and fertilization on the establishment of a *Sphagnum* carpet. After the drought summer 3 years after the diaspors introduction the regenerated Sphagnum was replaced by *P. strictum* on one site. On the second site the depth to water level occurred to be the dominant driving abiotic factor in the community structure formation. On the third site the success of moss establishment was importantly related with straw mulch density differences.

O070

Comparison of forest ecosystems net primary production estimations in west Sayan Mountains

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The models for evaluating NPP using ground-truth measurements and satellite data show different NPP values for forest ecosystems of the dark coniferous forest (chern) zone, the mountain-taiga and subalpine zones situated at the West Sayan Mountains. The main difference of the evaluations based on satellite data from those based on ground-truth ones is that they suggest low production chern zone and high production of the mountain-taiga and subalpine zones. In our opinion, the reason can be that NPP calculation was made using the vegetation index, NDVI, whose magnitude is directly dependent on the state of the leaf blades and the presence of chlorophyll in them. Thus, the resulting yearly mean value of NPP for the growth period is smaller in the dark coniferous mixed forest zone and larger in the mountain-taiga and in the subalpine zone when the NPP values obtained from ground-truth measurements. The upper zone is dominated by coniferous trees, whose production is not reduced considerably in late summer.

Keywords: *NPP (Net Primary Production); mountain forest ecosystems;*

O071

Water level maintenance in the raised bog of Aukstumala

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Peat extraction and draining works have taken place in the raised bog of Aukstumala since the very beginning of the 20th century. The most dramatic changes took place in Soviet times after 1968, when protective embankments, water pumping stations, roads and channels were built, large (2/3 of the total bog) area was drained for mechanized peat-cutting. The rest of the territory has been declared as a protected area since 1992. Peat mining works in the neighbouring zone still has a negative effect on water level in the protected area.

That is why several types of water maintenance measures were taken. In order to reduce water flow from the Nature reserve to peat mining fields, 1 km length polythene equipment of water level control was installed and 4 dams were build in 2006. In 2011, this system was prolonged by using natural material of highly decomposed waterproof peat (0.3 km length). There are 94 water measurement wells in 10 different profiles, which allow us to evaluate hydrological conditions of the bog and check the efficiency of water maintaining equipment.

The research data obtained in 2007–2011 shows that water table on the edge of the raised bog (near maintenance system with polythen membrane) was rather stable and significantly higher (0.4–0.6 m) compared to control variant. One-year investigation (in 2011) on the effect of the protective waterproof peat maintenance system did not show significant efficiency for the increase of water level.

Keywords: *raised bog; ; peat mining; water level control; hydrology; protection;*

O072

Topsoil removal improves various restoration treatments of a dry Mediterranean grassland

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Dry grasslands are known to have very low resilience abilities. Main identified issues are low dispersion of target species and high density of more competitive non-target species, especially when soil nutrient content has been increased during former cultivation periods. Several restoration techniques can be use to overcome these thresholds: i) seeded nurse species can rapidly occupy niches and then provide safe sites for target species once endogenous disturbance or stress is restored, such as sheep grazing or drought, ii) hay transfer can provide local species seeds and iii) soil transfer can provide local species propagules (seeds or clones) with associated microorganisms. Topsoil removal has also shown sometimes promising results by lowering ruderal species seed bank and soil trophic level. The objective of the study was to test the efficiency of topsoil removal combined with other restoration techniques in a Mediterranean steppe restoration project. After the rehabilitation in 2009 of a herbaceous sheep grazed habitat suitable for threatened steppe birds in a formerly intensively cultivated orchard in the last French Mediterranean steppe (La Crau area), four experimental treatments (control, nurse species seeding, hay transfer, soil transfer) were applied either on rehabilitated areas where trees had been removed and soil leveled, or on rehabilitated areas where topsoil had been removed after removing trees. Results show that species richness is increased and composition is closer to the target communities when treatments are applied after removing topsoil. Discussion will deal with the insight given by these results in term of community assembly and restoration application.

Keywords: *Combination of treatments; Hay transfer; Soil transfer; Steppe grassland; Topsoil removal;*

O073

A new synthetic indicator to assess plant community restoration success

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The Strategic Plan for Biodiversity 2011–2020 sets as an objective the restoration of 15 % of degraded ecosystems by 2020. This challenge raises at least two major questions: i) How to restore? and ii) How to measure restoration success? Measurement of restoration success is necessary to assess objective achievement and to adjust management with regard to objectives. Numerous studies are trying to work out synthetic indices to assess ecosystem diversity or integrity in the context of global change. Nevertheless, at the community level, there is no such index which would allow the assessment of community integrity regarding its restoration or resilience. Actually a lot of indicators are used such as species richness, Shannon diversity, multivariate analyses or similarity indices, etc. We therefore developed two new indices which give insights on community states: 1) the first index identifies the percentage of the species abundance in the reference community which is represented in the restored or degraded community and 2) the second index identifies the parts of the abundance of species in the restored or degraded community which is over those of the reference community. The use of these new indices will be illustrated and discussed with an example of the recent restoration (2009–2011) of a Mediterranean pseudo-steppe plant community in South-Eastern France (La Crau area). Soil transfer was applied to strengthen dispersion of target species and to provide abiotic conditions close to that of the reference thus limiting competition with non-target species. The use of our new indices provides us information on the success of restoration which appears more limited than with standard indicators.

Keywords: *Ecological Indicator; Ecological Restoration; Plant community; Soil transfer; Species-richness;*

O074

Pattern of old-field vegetation succession on a country scale

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Altogether 282 phytosociological releves (25 m^2) were recorded in old-fields in the Czech Republic, central Europe. The old--fields were aged from 1 to 91 years. The following environmental characteristics were determined for each old-field: soil moisture, substratum acidity and phytogeographical region. Species were classified according to their endangerment, origin and affiliation to vegetation units. Vegetation data were analyzed using mixed models, multivariate statistics and regression trees. All the environmental characteristics had some significant effects on species composition of seral stages. Vegetation succession was clearly divergent in three subseres according to the soil moisture: dry, mezic and wet. The number of target species (*Querco-Fagetea*, *Festuco-Brometea* incl. *Trifolio-Geranietea*) increased during succession, contrary, the number of acheophytes, neophytes and synantotrophic species decreased with the field age. More endangered and target species and less archeophytes, neophytes and synantotrophic species occured in lowlands than in uplands. The number of endangered, target and the total number of species decrease with soil moisture, while the number of neophytes and synanthotropic species increased.

The age of the old-fields and soil moisture appeared as the most important drivers of spontaneous succession in old fields. The spontaneous succession in old-fields proceeds in the case of dry fields towards rare xerotherm communities which are valuable in the point of view of ecological restoration and nature conservation.

Keywords: *Landscape context; Soil moisture; Old-fields; Ordination; Succession;*

O075

Restoration of grasslands on ex-arable land using regional and commercial seed mixtures and spontaneous succession: successional trajectories and changes in species richness

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Dry grasslands in the Protected Landscape Area and Biosphere Reserve of the White Carpathian Mts. in the eastern part of the Czech Republic, central Europe, belong to the species richest plant communities (on a scale of a few m^2) in the world. Many of the grasslands were converted to arable land in the second half of the 20th century, but in the past two decades many of the arable fields have been re-grassed, most of them using commercial low-diversity clover-grass seed mixtures, some of them however by spontaneous succession or using a regional species-rich seed mixture. We asked how grasslands restored in various ways differ in their successional trajectories towards permanent grasslands as reference sites, particularly in species richness and participation of target species. Altogether 34 grasslands restored with a regional seed mixture, 30 restored with commercial seed mixtures, and 16 restored by means of spontaneous succession were compared based on vegetation records (species cover in 5 × 5 m plots). The data were processed using multivariate statistics. Grasslands restored in the three different ways converged in their species composition and developed towards reference grasslands. Considering the number of target grassland species, sowing of regional seed mixtures was the most successful, especially in the beginning, but processes of spontaneous succession led virtually to the same number of target species, even at sites re-grassed with commercial seed mixtures, but more slowly. Development of sites re-grassed spontaneously and by sowing commercial seed mixtures led to the establishment of more mesic vegetation (Arrhenatherion) than when using the regional seed mixture, which was predominantly composed of species typical of dry grasslands (Bromion). Thus, restoration of the most valuable dry grasslands should preferably be based on using properly designed regional seed mixtures.

Keywords: *Dry grasslands, Restoration, Species diversity, Target species, Vegetation*

O076

Post fire restoration of Pinus nigra forests on Mount Parnon (Greece) through a structured approach

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During the last two decades, wildfires of *Pinus nigra* forests have been increased, threatening one of the most important forest ecosystems in Greece, and a priority habitat of Community interest. *Pinus nigra* is a non-serotinous species, thus does not regenerate easily after fire because during summer, when fires usually occur, cones are immature and as a result seed ripening is impossible. In 2007 a forest fire burnt a considerable area of *Pinus nigra* on Mountain Parnon, Peloponnese, Greece.

This paper presents a structured approach to optimise the restoration of *Pinus nigra* forests in Greece and its first application on Mount Parnon, Greece. The approach is a step by step procedure. In step 1 exclusion and ranking criteria of areas prospective for restoration are specified, in step 2 the criteria are applied, resulting in the preliminary selection of areas for artificial restoration (step 3). In step 4 the areas preliminary selected are verified, while in step 5, specific restoration measures are selected. The approach has been applied in an area of 1921 ha of burnt *Pinus nigra* forest. After excluding areas where natural regeneration was expected to occur, the approach narrowed the areas prospective to restoration to 1144 ha, from which 291 were ranked as the most suitable for the first phase of restoration.

The approach has been designed for effective application by forest services allowing proper scheduling of restoration works.

Keywords: *Pinus nigra; Post fire restoration; Parnonas; Sttructured approach;*

O077

Restoration of species-rich field margins and fringe communities by seeding of native seed mixtures

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In Central and Western Europe, species-rich plant communities of perennial field margins and fringes, especially of the class Trifolio-Gerantietea, have become rare due to land-use intensification and ruderalization. Today, fringe structures with high proportions of flowering herbs as habitats for beneficial insects (e.g. pollinators) and other animals (e.g. partridges) are missing in many landscapes, due to destruction and degradation. In 2010, the project "ProSaum" was started in two regions with different climate, near Osnabrueck (Northwestern Germany, 856 mm annual preciptation) and near Bernburg (Central German arid region, 469 mm) in order to restore species-rich perennial field margins and fringe communities by seeding. Seed mixtures for the re-introduction of Trifolio-Geranietea-species and other habitat-specific species were developed in close cooperation with producers of native seeds. In both study areas, the effects of soil preparation and management on the establishment of species from regionally matched seed mixtures were studied in randomized block experiments with similar design. First results show that most of the introduced species have established successfully in 2011. In both study areas, the number and cover of target species did not differ between the soil preparation variants "tillage once" and "tillage twice/thrice". In spring and autumn 2011, additional large-scale experiments were established in order to test the effects of different environmental conditions at landscape level.

Based on the project results, guidelines for the establishment of perennial field margins in agri-environmental schemes and for the use of seed mixtures in public greening projects will be developed and made available for practitioners.

O078

Use of directly harvested seed mixtures in grassland restoration

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The protection of ancient, species-rich grasslands containing regional sub-species and ecotypes is a top priority in nature conservation. In using directly harvested seed mixtures in restoration and re-vegetation it is possible to contribute directly to the preservation and development of biological diversity.

In summer 2009, seed-rich material was harvested via mowing and threshing in two donor sites (Arrhenatherion, Deschampsion) and the material was used in two large-scale trials on former arable land. On the Arrhenatherion receptor site, the nutrient level is similar to the donor site because of cultivation without fertilization in two subsequent years before the experiment started. On the Deschampsion receptor site, the phosphorous content is ten-fold higher than on the donor site. In 2010 and 2011, both receptor sites were mown twice a year with removal of biomass and without fertilisation.

Until summer 2011, both sites showed similar transfer rates of target species (44–54 %), but their share on total coverage is quite different. Whereas target species on the Arrhenatherion trial reached almost 100 % on total coverage, the share of target species on the Deschampsion site amounts to only 13 % (green hay) or 34 % (threshed material), respectively. On the Arrhenatherion receptor site, the vegetation develops in direction to the intended target community, but on the Deschampsion receptor site the spread of target species is hampered by the dominance of highly productive grasses. Our results confirm using regional seed mixtures guarantee restoration success if suitable sites are selected or proper site preparations are carried out.

Keywords: *Ecological Restoration; Green Hay; On-Site Threshing; Arrhenatherion; Deschampsion;*

O079

Restoration ecology and agri-environmental schemes: Options for mutual benefit in agricultural grasslands

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Organic farming is implemented in agri-environmental schemes in several European countries. Thus, it represents one of the most relevant strategies to maintain agricultural production and meanwhile reduce negative environmental impacts of intensive agriculture. Whereas many studies tested effects of organic farming for crop systems, much less is known about benefits of organic farming in grasslands. We used a large dataset from the *Biodiversity Exploratories* project (www.biodiversity-exploratories.de) and compared land-use intensity, vascular plant and arthropod diversity, annual yield and nutrient availability of certified organic and non-certified grasslands.

We found that certified organic grasslands differed only slightly from non-certified grasslands in terms of biodiversity, but also in terms of yield, fodder value and nutrient availability. In contrast, land-use intensity was indeed lower on certified grasslands. This indicates that agricultural grasslands may significantly differ in response to organic certification from crop fields in that more time is required for biodiversity to recover after transition to organic farming. Hence, organic certification may have improved the potential for higher biodiversity, but the recovery of biodiversity might be seriously hampered by additional factors such as depleted local species richness and seed or dispersal limitation. Restoration measures such as propagule transfer and enrichment of farmland habitat heterogeneity could effectively enhance biodiversity and maintain ecosystem services in grasslands. So, optimally, restoration ecology should be considered to complement agri-environmental schemes and organic farming. However, such activities are currently not covered by respective programs and standards.

Keywords: *land-use intensity; agri-environmental schemes; organic farming; species richness; grassland restoration;*

O080

Restoring the process of seepage in fen habitats – combining water retention and nature restoration

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In transformed and intensively used landscapes the processes of seepage were modified and constrained. Consequently the soil processes and habitats depending on groundwater became degraded. As long as the hydrological systems are still in place, restoring at least partly functional seepage zones, together with typical habitats, is possible.

We evaluated the restoration prospects for a study area in East of the Netherlands, focusing on (eco-hydrological) system restoration and function combination: nature and water retention. We analyzed the (reconstructed) system development over time, opportunities for restoring groundwater-fed fens and proposed a restoration strategy. In the past peat accumulation was taking place in the area, and contributed to the development of alkaline fens, transition fens, and later fen meadows. Due to effective drainage and reclamation of land in the 19th century, the natural system collapsed and semi-natural meadows developed. Peat rapidly subsided and mineralized, the up-flow of groundwater was enhanced bus also quickly drained. Further system transformation resulted in a severe degradation and desiccation: plant species indicating seepage and mesotrophic condition are currently only found in the ditches. Improving the situation is possible but actions are needed on the flanks of the system, in order to enhance seepage presence in the topsoil. Combining water retention with nature development is possible, but storage of nutrient-rich water should be separate in space from groundwater retention that can take place higher-up in the system. Actions should focus on restoring gradients from buffered to slightly acid conditions and from groundwater- to rain- or a surface water-dominated system.

Keywords: *landscape system analysis; water retention; groundwater-fed fens and meadows; landscape pattern;*

O081

Grasslands on bog peat – nature values, drivers of vegetation development and restoration prospects

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Grasslands on bog peat are protected in the Netherlands as Natura 2000 habitat H6230. These grasslands have an anthropogenic character. They occur on thick peat soil, are slightly drained and were in the past slightly fertilized. The diversity and heterogeneity of these grasslands is declining and restoration actions are necessary. It is to be expected that these grasslands are an important habitat for typical fauna communities, as they supply more nutrient than bog or heathland and thus can be essential for sustaining many groups of insects. The factors steering development of such grasslands and effective restoration measures are poorly known. We applied a simple system analysis and collected specific informationon the soil chemistry, nature management history, vegetation and fauna for evaluating the factors that are important for such grasslands and for identifying conservation bottlenecks.

Improvement of hydrological conditions is a pre-condition for restoring such grasslands. Compared to bogs, the site conditions are less acidic, weakly buffered and slightly richer in nutrients. Likely, P- and K-limitation play an important role in the vegetation development. The maintenance of species rich variants depends on the fragile balance between different processes: limited water levels fluctuations, nutrient availability or removal and acidification. Grasslands on bog peat are sensitive to (too high) N-deposition. By N-deposition the natural acidification process is accelerated. In addition, there will be a shift in the ratio of Ammonia to nitrate, in favor of Ammonia. The fauna communities reflect the same main environmental gradients as the vegetation.

Keywords: *wet grasslands; acidification; fauna communities; landscape system analysis;*

O082

The 'false positives' and the 'false negatives' in Natura2000 and embedding landscapes – a case of Greece

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Greece (Balkan peninsula) has a wide range of biotopes and an extraordinary species richness at several scales. It is also an area of long standing human land use and land cover changes. Greece's particular geographic constitution, a highly dissected mountainous area with a long coastline, has generated a high ecological diversity. It protected Greece from homogenization into a monotonous agricultural landscape. Yet, it has also been one of the drivers to drain many of its low lying coastal wetlands. As a European peninsula jutting into the Mediterranean Sea Greece is a bridgehead for migratory birds from and towards Africa. This variety and richness well explains the number and extent of Greek sites comprised in the EU Natura 2000 network. Whether this policy and its legal implementation is effective in protecting Greece's biodiversity depends on the actual situation in the field as well as on the integrity of the embedding landscape matrix. We have studied wetland areas in Western Greece as well as an agricultural landscape in Central Greece, areas with either protected or non-protected status. We assessed the value in terms of presence of herpetofauna and breeding or migratory avifauna and evaluated whether the legal status matches the field condition. 'False positives' (legally protected but not well implemented) and 'false negatives' (biologically valuable without any status) were commonly observed. We discuss this observation in terms of the need for a Green Infrastructure implementation, also addressing the governance and policy issues possibly at the basis of the actual situation.

Keywords: *wetlands; agricultural landscape; remote sensing; herpetofauna; avifauna;*

O083

Clonal re-introduction of endangered plant species during river restoration – the case of German False Tamarisk in pre-alpine rivers

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Re-introducing species to areas where they have become extinct is a method increasingly used in restoration projects. As no standardized methods are available it has to be assessed for each species individually under which conditions the re-introduction can be successful. One aspect that has to be considered when re-introducing plant species is the question, whether seeds, seedlings, adults or clonal fragments, e.g. cuttings or rhizoms, should be used.

The endangered German False Tamarisk (*Myricaria germanica*), which is occurring on gravel bars along pre-alpine rivers, is difficult to grow from seeds. Thus, propagation of stem cuttings was investigated as alternative method in the context of river restoration. Experiments were conducted in a greenhouse and in a field site with three treatments: cutting length 5 or 10 cm, vertical burial 5 or 10 cm, and water level low or high. Plants grown in the greenhouse were transplanted to River Isar to test establishment of rooted cuttings on gravel bars. The cuttings in the greenhouse showed high regeneration rates (34–96 %). Survival and biomass production were greatest for 10-cm cuttings buried at 10-cm depth, while only one of the 5-cm cuttings survived at this depth, and no significant effect of variation in water level was observed. None of the cuttings transplanted to field sites survived, most likely due to drought stress and competition. We conclude that for re-introduction of *Myricaria germanica* rooted cuttings can be easily produced in large quantities, while transplantation to near-natural environments has to be improved to benefit restoration measures.

Keywords: *river restoration; species conservation; clonal propagation; Myricaria germanica;*

O084

Practical examples of restoration and species protection from mined sites in the Czech Republic

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Mining activity leads in the beginning to degradation or even destruction of ecosystems existing in the mined site. On the other hand, during and after mining new habitats are emerging and many rare species colonize the sites already in the time of mining operations.

The presentation focuses on description of practical examples of 1) species protection during and after mining process, and 2) ecological restoration in sand pits and quarries of one particular mining company. Results of approved as well as innovative measures and approaches will be presented. The importance of cooperation with various interested groups (scientists, NGOs, nature protection administration and other stakeholders) during realization of such measures will be mentioned as well.

Experience with opportunities and constrains in restoration and biodiverzity management in mined sites will be summarized in the context of legislative and socio-economic background.

Keywords: *mining site; species protection; restoration; cooperation;*

O085

Semi-nature or new wilderness? Restoration dilemmas in the Middle Biebrza Basin

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The Biebrza National Park protects one of the largest European system of fens and fen meadows. Majority of fens of the Biebrza Valley have for centuries been maintained as extensive hay and litter meadows, under nearly unchanged hydrological conditions. In the central part of the valley, groundwater flow was significantly modified in the 2nd half of the 19th century, resulting in the cessation of peat forming processes over several tens of km^2. Formerly inaccessible mires, after drainage have been reclaimed as hay meadows. This management has been sustained until now in the vicinity of villages, whereas more remote meadows become gradually abandoned. Unlikely however to other fen meadow areas, succession was here significantly slowed down due to the foraging of moose, which occurs here in very high densities. Currently, a large-scale project aimed at the restoration of a more natural hydrology is set up in the described area. The implemented measures will include damming of the main canals and re-directing water to formerly cut-off river sections. Depending on the scale of these hydrological interventions, the managers may aim at reconstructing peat-forming conditions, leaving the whole area for wildlife and natural succession, or compromise restoration with the needs of farmers and agri-environmental measures optimizing water level for wet meadow management. We discuss the whole spectrum of options, presenting conflicting arguments related to the conservation of plant diversity, wetland birds, natural peatland processes, carbon sequestration and local socio--economical situation.

Keywords: *Restoration; dilemmas; fen meadows; fens; peat-forming;*

O086

Comparison of influence of topsoil removal and rewetting on ecosystem functions during fen restoration

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During fen restoration, limitation of primary productivity is crucial to enhance biodiversity and restore the positive role of fens in buffering the global climate. We compared two measures commonly used to restore site conditions in fens, i.e. rewetting and removal of degraded topsoil, analyzing the methane emission, nutrient release, the primary productivity and its limitation patterns. The study was conducted in Bagno Calowanie (central Poland), a large, excessively drained fen, where characteristic species survived only in old peat-cuts. In the central part of the peatland, 40 cm of decomposed topsoil was removed over 2 ha. Experimental rewetting plots (3×3 m) were constructed nearby by drowning sods with the degraded substrate in groundwater. During the next 3 seasons we monitored geochemical properties, primary productivity and its limitation patterns, as well as methane emission within degraded, topsoil-removed, rewetted and reference communities. The primary productivity was lower in topsoil removal sites compared to the rewetted plots and more-less equal to the reference situation. Limitation of the primary productivity shifted from K to N after rewetting and approached N/P co-limitation after topsoil removal. Methane emission in topsoil removal sites was lower by order of magnitude than after rewetting, not even reaching the level of reference communities. We conclude that, where economically and logistically feasible, topsoil removal should be preferred over rewetting, as it allows to sooner reach such objectives of fen restoration, as re-establishment of species-rich communities and mitigation of global warming.

Keywords: *rich fen; methane; topsoil removal; productivity limitation; rewetting;*

O087

Alien pine plantations have high conservation potential in central Hungary

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Whenever natural recovery processes are considerable, restoration efforts should be built on these, and should focus on limiting processes. Alien pine plantations (*Pinus nigra* and *P. sylvestris*) cover a considerable portion of potential sand steppe and woodland habitats in central Hungary. We hypothesize that these plantations have high regeneration and restoration potential because (1) natural geomorphology is conserved, (2) initial conditions are favourable (low weed density), (3) soil nutrient content is low, similar to natural habitats, (4) natural vegetation is usually present in the landscape.

We studied the regeneration of sand grasslands following a fire in 2007 that killed pine plantations. We followed the natural succession in 99 permanent plots, 16 m^2 each. Furthermore, in order to test potential limiting factors, we experimentally manipulated pine litter cover and the seed availability of dominant grassland species (*Stipa borysthenica* and *Festuca vaginata*), and stratified according to the presence of invasive milkweed (*Asclepias syriaca*), in a full factorial design, in ten replicates of 1 m^2 plots.

We found that many sand grassland species were present immediately after fire, and their number increased fast, whereas milkweed did hardly spread. The cover of the dominant grasses only slowly inrceased. In the experiment, *Festuca* reached high cover two years after seed addition. Litter removal and the presence of milkweed did not considerably affect grass establishment.

We conclude that pine plantations in the region have high potential to recover into valuable grasslands, and restoration activites could contribute by increasing grass cover by seed addition.

Keywords: *grassland; invasive species; natural regeneration; pine plantation; seed addition;*

O088

Lichen recovery on overexploited reindeer pastures. Applicability of Fennoscandian experience for the Yamal Peninsula: study by means of simulation model

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The dynamics of vegetation and lichen forage store under the impact of growing numbers of domestic reindeer in the Yamal Peninsula was analyzed by means of computer simulations. It was shown that nomadic reindeer husbandry is the primary cause of the observed degradation of vegetative and lichen cover, climatic warming in the region must be fantastically rapid for improving the present situation: global warming seems to be not a sufficient factor for restoration of forage resources in Yamal. Dramatic changes in both productivity and standing crop characteristics indicate the impossibility of keeping on this way of land use under the present industrial and climatic situation. The comparison between lichen ability to recover in Fennoscandia (after overexploitation or forest fires) and in Yamal has revealed the necessity of domestic reindeer numbers reduction much more dramatic than in Norway to evoke lichen-dominated tundra recovery (from ca. 350000 individuals nowadays to 20000 heads). Therefore, in spite of wide-spread cliche, traditional nomadic reindeer husbandry is not an example of human and vegetation coexistence in harmony at all. Even more, the existent exponential growth of domestic reindeer herds seems to be more dangerous for the natural complexes in the region, than, say, the development of oil and gas industry. The present situation requires significant corrections in ethno-cultural and economical policy in the region.

Keywords: *domestic reindeer; overgrazing; tundra; lichens; simulation;*

O089

The need for more sufficient restoration effort: slow vegetation change in restored coastal meadows

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The Boreal Baltic Coastal meadows are semi-natural communities that are developed under moderate human influence and are dependent on regular grazing or mowing. Because of their importance for plant and bird diversity they are priority habitat type of the Habitats Directive; however, a lot of coastal meadows have been abandoned and overgrown with reed. Because of that, several restoration projects have been initiated to restore these valuable communities, one in western Estonia. The main aim of the current work was to study the dynamics of the vegetation, mainly the change in cover of reed vs cover of plant species characteristic to well-grazed coastal meadow, in the course of eight years of restoration. Monitored sites were divided to four categories: continuously managed, restored, poorly restored and not managed. The group of poorly restored meadows consisted of the sites where grazing and/or mowing have not been continuous throughout the restoration. The results showed, that although the average height of the vegetation in restored sites decreased in time and was similar to continuously managed sites at the end of the study, the cover of *Phragmites australis* was still significantly higher in restored compared to continuously managed areas. Similarly, in restored sites the cover of plant species characteristic to managed meadows was still significantly lower compared to continuously managed sites. Our results indicate that the restoration actions used do not suffice for restoration of coastal grasslands within reasonable time span and the increase of the restoration effort is needed to justify conservation funding.

Keywords: *coastal meadows; vegetation change; grazing;*

O090

What can natural selection tell us about restoration? Finding the best seed sources for use in disturbed systems

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Plant populations can be adapted to local environmental environments, and it is presumed that a combination of climatic, soil, and biological factors contribute to patterns of local adaptation observed in the wild. The invasion of new species and/or changes in local disturbance regimes have the potential to drastically change the selective environment for plants in altered systems. In these situations, the traits that confer local adaptation may radically change over small scales, based on the presence or absence of a new selective agent. Research in my lab focuses on the effect of a particularly aggressive invasive species, cheatgrass (*Bromus tectorum*) on patterns of adaptation in native perennial grasses in the Great Basin. We have found that contrasting traits improve survival and increase fitness of native perennial grasses when they are grown

in the presence or absence of this invader. Additionally, we have observed changes in traits such as plant size, phenology, and root allocation in invaded areas that are consistent with natural selection by cheatgrass. A challenge for restoration is to continue to match traits of transplanted material with local adaptive optima, recognizing that the degree of contemporary disturbance may affect plant fitness as much as historical evolutionary relationships with local environmental conditions. Remnant native plants growing in disturbed or invaded areas may be a valuable source of seeds for restoration of similarly disturbed areas, and studies of remnant natives in disturbed systems can help identify traits that are adaptive under new environmental conditions.

Keywords: *evolution; adaptation; invasive species; disturbance; natural selection;*

O091

Back to the future? Restoring upstream river valleys in the Belgian Ardennes

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In prehistoric times (most of the Holocene) river valleys in the Ardennes were covered in alder woodland or boggy birch woodland. By the Middle Ages most of this vegetation had been replaced by hay-meadows. By the 18th century irrigation was a common practice. Maintaining those irrigated hay meadows needed a lot of work. Once chemical manure became available the hay meadows lost any economic value. They were abandoned, planted with spruce, or drained to make intensive pastures. Unfortunately we have no idea of what the irrigated grasslands' vegetation looked like. In the Ardennes a number of small tributaries of the river Meuse are being restored by cutting spruce plantations and filling drainage ditches.

In the Emmels valley, irrigation lasted up to the 1950s. Detailed information is available on the management of some parcels up to 1991 when a nature reserve was created. At that moment a vegetation survey was carried out. Since then ditches have no longer been maintained and the ecosystem returned to a higher water content. Comparing recent vegetation data with the older ones shows how a more natural vegetation is developing and we eventually get a glimpse of what a 21st century's natural brook ecosystem may look like. This also provides precious data to evaluate changes in the vegetation with regard to climate change.

This project is part of the Interreg IVB project AMICE (Adapatation of the Meuse to the Impact of Climate Evolutions).

Keywords: *Ardennes; former hay-meadows; renaturation; natural vegetation;*

O092

Variability in the responses of animal groups to grassland restoration on former croplands

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Although there was a recent increase in the number of studies on vegetation development after grassland restoration, studies of animal assemblages after such restorations are still rare. Here we summarise early responses to restoration in two invertebrate (orthopterans, bees) and three vertebrate groups (amphibians, birds, mammals) using data from a large-scale (760 ha) near-natural grassland restoration project. Species number and abundance of orthopterans decreased in Year 1 and increased greatly in Year 2 and 3 after restoration. In bees, species number decreased gradually as transient species abundant in the weedy and flower-rich first year decreased and species characteristic to natural grasslands increased in abundance. Amphibians had higher abundance in restored than in natural grasslands and their numbers were higher in older than in younger restorations. The diversity of birds increased slightly after restoration but was subject to fluctuations depending on annual weather, with more species using the restorations in wet years. The abundance of several birds that are declining elsewhere, such as farmland birds, increased considerably. Small mammals also showed large fluctuations according to predation pressure and vegetation height, but appeared to benefit from restoration because their species number and abundance on restored grasslands did not differ from that in natural grasslands. In conclusion, grassland restoration provided suitable habitats for a number of taxa, and many of the target species reestablished quickly from neighbouring natural grasslands. Several rare species or species of conservation importance were detected in low numbers as early as four-five years after restoration.

Keywords: *naturalness; animals; landscape-scale; multiple taxa; dry grasslands;*

O093

Are biodiversity experiments relevant for habitat restoration?

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Biodiversity experiments, where species mixtures of varying diversity are sown and their performance is measured, are mostly interpreted in terms of theoretical ecology (relationship between diversity and ecosystem functioning). Many of them resemble typical (meadow) restoration efforts: a species mixture is sown into ex-arable field, resulting in a meadow-like community. My aims are to review the published and our own results of biodiversity experiments to demonstrate, which of their conclusions are relevant for practical restoration.

The performance of individual species in individual sites, their ability to coexist, and the performance of individual mixtures (e.g. their productivity, nutrient cycling), all provide useful information to local restoration managers, but these results are rather specific for the geographical area, or habitat type. On the contrary, the values of *biodiversity effects* derived from biodiversity experiments mostly show that the species rich communities "function" *on average* better than the species poor communities under wide range of environmental conditions. Unfortunately, their applicability for practical restoration is limited: in many

biodiversity experiments, the functioning is characterized by productivity, which is not always the goal of restoration. Many biodiversity experiments use weeding to keep the desired species composition, whereas in real restoration, the subsequent colonization from the local species pool is desired. Our results show that successful establishment of the sown mixture often hinders natural colonization. On the contrary, both the demonstrated complementarity in resource use and the insurance effect suggest avoiding species poor mixtures or monocultures even where biodiversity is not the primary goal of restoration.

Keywords: *Biodiversity effects; Ex-arable fields; Insurance effect; Meadows;*

O094

Good practices in restoring roadslopes

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Topsoil is usually spread on novel surfaces during the restoration of infrastructures. This is a scarce resource that provides seeds, microbial activity and soil nutrients. Traditionally, this resource is stockpiled for long periods and then spread out at 30 cm depth. We will examine the effects of topsoil handling on its physico-chemical properties. The effects of spreading topsoil at depths of 10 cm or 30 cm on plant cover, diversity and floristic composition will be also compared. Soil seed bank and properties were studied before and after topsoil collection. Additionally, fifteen plots were established in an embankment of a railway line in the Mediterranean basin. On them, five replicates of two treatments (10 cm depth of topsoil spreading and 30 cm depth of topsoil spreading) and a control were compared. The experiment lasted for two years. Most of the viable seeds (90 %) were located in the upper 5 cm of soil. Seed bank experienced a dilution of 70 % of its viable seeds and a reduction of soil fertility with soil handling. After topsoil spreading, plant cover was higher in control than in topsoil plots due to the dominance of a few species. One year later, herbaceous cover and species richness were comparable in all treatments, due to the input of seeds from the surrounding areas. Topsoil collection and spreading reduces its quality. After spreading, topsoil enhances the species richness of restored embankments. It is recommended to spread 10 cm of topsoil instead of the traditional 30 cm as plant cover, species richness and floristic composition are not affected.

Keywords: *diversity; topsoil; seed bank; floristic composition; soil properties;*

O095

Assessment of some ecological parameters for conservation of Indian pangolin (Manis crassicaudata) in district Chakwal of Potohar Plateau, Pakistan

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Indian pangolin (*Manis crassicaudata*) is a gregarious, “Near threatened” mammal facing risk of endangerment in the country. The current study assessed some ecological parameters of the species in district Chakwal of Potohar Plateau. Habitat of the species was analyzed by quantifying trees, shrubs and herbs, using “point-centered quarter method” and “quadrate” method at selected sites. For population estimation, counts of active living burrows were made by area searches while its diet composition was investigated by fecal analysis. Information about its hunting and illegal trade was collected from reliable local sources. Results showed six tree, three shrub and seven herb species at study site-I while at site-II, four tree, five shrub and seven herb species were recorded. Average population of Indian pangolin in study area was 0.010 ± 0.003/ha. Scat analysis revealed 38 % ants (8 % heads and 30 % other body parts), and 62 % clay. Two ants (*Camponotus confucil* and *Camponotus termitidae*) and one termite (*Odontotermis obesus*) species were major prey items. Trapping of the species by nomads for illegal trade is the main threat in study area, during past six months, forty scale-less dead bodies and six skeletons of the animal have been recovered from the wild indicating its brutal killing. Moreover, 24 kg scales of the animal were transported from study area to Islamabad city during February 2012, for unknown purposes. The study recommends awareness campaign in the area and also warrants strict implementation of wildlife laws to restore the population of this rare species.

Keywords: *Indian pangolin; population; habitat; illegal trade; pakistan;*

O096

Defining quality standards and transfer zones for native plant propagation and use in France – towards Flore-locale and Messicoles certifications

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In France, most of revegetation, restoration and landscape projects use horticultural and agricultural cultivars and wildflower seeds of unknown or nonlocal origin. These commercial trees and seed mixtures of genetically uniform varieties threaten local diversity through competition with local ecotypes, hybridization (and genetic swamping of surrounding populations with maladaptive genes) and risks of invasion. The problem is even more acute for local populations of rare and threatened plants like some segetal species. As of now, native plant production is very limited in France, unlike its neighboring countries, e.g. Belgium, Austria and Germany. To improve this situation, we are drawing up national systems for certification of wild land-collected and agriculturally produced native seeds and trees through:

- quality standards for native plant material available on the market (e.g. germination and purity for seeds);
- identification of seed and tree transfer zones: areas within which plant material can be moved freely with little disruption of genetic patterns or loss of local adaptation;
- strategies to track plant materials from wild land collection to agricultural propagation and use;
- a set of biodiversity conservation principles from wild land collection to sowing and planting operations;
- national systems for certification of native flora and segetal species, which would include a step by step control procedure of such native species.

The seal of quality provided by the certification system will thus encourage the production and availability of native species locally adapted. Moreover, the wide decision-making platform of this project will contribute to a logistically and economically realistic process.

Keywords: *transfer zones; native; certification; propagation; quality standards;*

O097

Near natural riverbank stabilization using woody debris

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This paper discusses the successful implementation of using engineered log structures, coarse woody debris, soil bioengineering, and tree stumps to stabilize 4095 linear feet (1248 meters) of eroding river bank on the Connecticut River in Massachusetts, USA. The goal of this work was to provide near natural riverbank restoration using coarse woody debris and bioengineering techniques, without the use of stone or other hard armor. The Connecticut River has a watershed area of 11,000 square miles (2,848,987 ha) and has a bankfull width of over 800 feet (244 meters). Annual flows exceed 100,000 cubic feet/second (2,831,685 liter/second) causing significant bank failures and soil erosion.

Engineered woody debris log jams were built at a spacing of approximately 120 feet (36.5 m) on center and secured into the banks to anchor the planned sediment accretion formations. Native willow shrubs and emergent and aquatic vegetation were planted between the log jams to help in the retention of sediment, and to provide wildlife and fisheries habitat. Staff gages, and scour chains were installed vertically along the project's aquatic bench to measure accretion or deposition. To measure bank erosion, bank pins consisting of metal welding rods were installed horizontally into the banks. During the first year of monitoring, the woody debris structures accumulated as much as 30 inches (76 cm) of new sediment by reducing water velocity along the shoreline during flood events. Tropical Storm Irene on August 28, 2011 was a bankfull event which exceeded 110,000 cfs (3,114,853 lps), and submerged the bank and woody structures for over two weeks. Following this storm significant sediment was deposited and retained by the wood structures; there was no measured horizontal bank erosion. The accumulated sediment has permitted emergent vegetation to become established, which further protects the adjacent river banks.

Keywords: *River; Bioengineering; Erosion; Connecticut River;*

O098

Overcoming resistance and resilience of invasive species is necessary for effective restoration: creation of new stable states

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The search for appropriate management strategies to control invasive plants is an important theme in environmental management. However, the recovery of the original species complement does not necessarily respond predictably to restoration efforts. Increasing the successes of restoration practice requires an understanding of the resistance and resilience of invasive species and the response of the developing community after invasive plant control. We investigated the effects of recommended *Pteridium aquilinum*-control treatments on vegetation composition and diversity in seven field-experiments in four regions

of Great Britain. We showed that (i) where the target is to produce *Calluna*-heathland "press" treatments (cutting once or twice per year) were effective for controlling bracken and moving species composition towards an alternative state, but (ii) where the target is to produce acid-grassland both "pulse" and "press" treatments produced changes in species composition in the correct direction, but the effectiveness of "pulse" treatments (spraying) was site-dependent. Therefore, here a test of spray treatment effectiveness is needed on each acid-grassland site. Cutting treatments, however, were site-independent but they took longer to work and were more expensive than spraying ones. On the grassland sites, alternative stable states were produced within 10 years.

Keywords: *long-term monitoring; principal response curves; pulse and press treatments;*

O099

Persistent soil seed bank in successional floodplain meadows in Estonia – potential for grassland restoration

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Studies have found that the role of soil seed banks (SB) as a source for grassland restoration is rather limited, at least where intensive agriculture disfavours the persistence of target species' propagules.

Estonian flooded meadows have largely escaped intensive agriculture but due to abandonment are threatened by shrub encroachment. Can restoration of flooded meadow vegetation on abandoned sites rely on viable soil SB in areas with natural flooding and soil conditions? Do the SB-s of abandoned and managed meadows differ?

We simultaneously studied the vegetation and SB in managed, 20- and 50-yr abandoned flooded meadows in Pedja River floodplain, Central Estonia. The species composition above- and belowground was described and analyzed with multivariate methods (NMDS, PerMANOVA). We used GLM to assess the influence of time since abandonment on SB density, species richness, and similarity between SB and aboveground target vegetation.

The SB-s of managed and abandoned meadows had different species composition. SB density (overall mean 12 513 seeds m^{-2}) was lowest in managed sites. SB richness was higher in 50-yr abandoned and managed sites compared to 20-yr abandoned ones. However, the species compositional similarity of SB and aboveground target vegetation did not differ between managed and abandoned meadows. Therefore the restoration potential of the SB of the abandoned areas was on par with that of the managed meadows.

Our results suggest that even 50-yr abandoned areas constitute refugia for about 20 % of typical grassland species and can thus act as sources for target species populations in grasslands under restoration management.

Keywords: *Grassland restoration; Soil seed bank; Semi-natural grassland;*

O100

The restoration of wetland heterogenity by supporting the natural processes of habitat regeneration (Kampinos National Park case study, Poland)

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Nowadays the natural heterogenity of wetlands is simplified and habitat is dried as a result of farming. The effect of this process is the significant decrease of biodiversity and disappearing of wetland species. In natural conditions Polish wetlands were covered mostly by the vegetation of alder forest dynamic circle. In present time these types of communities cover only 15 % of wetlands which are mostly predominated by fresh meadows. This process is still observed on farmlands while on protected areas (specially in national parks) where land use is extensifying a process of secondary paludification is initated and leads towards increase of natural heterogeneity of wetland habitats. In one of the largest wetland area in Central Poland the research project aimed on reconstruction of primary hydrological conditions in the order to restrain nature degradation and improve biodiversity status was carried on. The field research conducted in 2008–2011 contain botanical, soil and hydrological investigations. The results show that former wetlands originated in a braided river valley predominantly due to fluviogenic water supply. The comparison of current and historical data enable to delimitate the areas where the natural restoration process of wetland ecosystems should be supported by decreasing the outflow of water. The variety of small hydraulic structures located on different location of the drainage canals will increase the wetness of the wetlands basing on the post winter water resources and should partly restore the braided character of the surface waters network and increase the area of alder forest dynamic circle vegetation.

Keywords: *restoration; wetlands; alder forest dynamic cirle; braided river valey; secondary paludification;*

O101

Landscape-level restoration of Europe's dry grassland biodiversity: approaches, results and future perspectives.

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Species-rich dry grasslands in Europe are mostly developed from post-glacial forest cover and have been maintained over centuries by various kinds of low-intensity agricultural and pastoral use but have suffered recent losses in extent and diversity due to intensification and abandonment of management. European grasslands are extraordinarily diverse both in terms of plant and animal species and at all spatial scales. Conservation of this biodiversity requires the maintenance of remaining species-rich grasslands and the restoration of lost grasslands. Restoration ecology is a relatively new science but recent years have seen growth in experimental studies at the site or field level. However, here we widen the focus to the landscape-level i.e. restoration studies including multiple sites in the wider landscape. We draw on a series of case studies from dry grasslands in contrasting regions of Europe to address three specific questions: (i) What were the aims and objectives of restoration? (ii) What results have been achieved? (iii) What does the landscape-level approach offer for restoration? We used the results of large-scale studies in four countries: (1) the UK (400 ha), (2) Czech Republic (500 ha), (3) Germany (230 ha) and (4) Hungary (760 ha). We compare and discuss the restoration techniques used, the efficacy of the methods, the economics of restoration and the policy tools that may be proposed to restore Europe's lost and declining grassland biodiversity. We conclude that landscape-level restoration offers exciting new opportunities to reconnect long-disrupted ecological processes of species dispersal to restore landscape connectivity and enhance plant species diversity at the landscape scale.

Keywords: *Ecological processes; Plant species diversity; Restoration techniques; Policy tools; Connectivity;*

O102

The establishment of plant and animal communities on arable land: an experiment in hay meadow creation over ten years

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In 1999 an experiment was set up to investigate methods of re-establishing species-rich meadow vegetation on ex-arable land in the White Carpathian (Bile Karpaty) Mountains, Czech Republic. Large plots were sown with a regional seed mixture and compared with a commercial grass treatment and a natural regeneration treatment. Data on establishment of sown and unsown plant species and on the abundance of animal groups (Oribatida, Enchytraeidae, Lumbricidae, Oniscidea, Diplopoda and Chilopoda) were collected over ten years together with similar data from ancient grassland in a nearby nature reserve. Using data for 2000, 2004 and 2009 to illustrate successional changes, both the vegetation and the animal data showed a gradual convergence in the direction of the communities characteristic of the ancient meadow vegetation. The results were most convincing for the regional seed mixture treatment (especially from the vegetation viewpoint) but broadly similar trends were found for all treatments and the natural regeneration treatment also performed well, especially for some animal groups. Successional trends varied for the different animal groups and some were dominated by pioneer species throughout the monitoring period and remained quite different to the ancient meadow communities (e.g. Diplopoda, Chilopoda, Oniscidea). Others showed increasing similarity with ancient meadow communities over time (e.g. Oribatida). Reasons for these contrasts include different microhabitat conditions of the ancient meadow (e.g. greater drought). The factors affecting the establishment and successional patterns of plant and animal communities and the value of different animal groups as indicators of meadow restoration are discussed.

Keywords: *Dry grassland; Plant species; Invertebrate groups; Establishment; Succession;*

O103

Population genetic patterns of floodplain willows in highly fragmented river landscapes – a basis for restoration plantings

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In Central Europe, floodplain fragmentation by dykes has led to a fundamental loss of riparian softwood forests and river training has dramatically restricted natural regeneration of the Salicaceae species involved. To maintain this valuable vegetation type, reforestations are commonly conducted. Knowledge about the genetic population structure of existing riparian softwood woodlands is necessary to preserve their evolutionary potential in the long term. In this study, we investigated clonal and

genetic diversity patterns of *Salix viminalis* for 23 stands, taking into account the age of stands (young vs. old) as well as their locations in the floodplain (active vs. inactive) along the Elbe River, Germany. Microsatellites were used in order to assess effects of stand and floodplain fragmentation and to evaluate the extent of clonal structures in the stands. We detected considerable amounts of multi-ramet-genotypes almost exclusively in old and young stands in the active floodplain with old stands exhibiting the largest number. Multi-ramet-genotypes mostly covered distances of less than 10 m, but single long-distance dispersal events were also detected. Genetic diversity patterns revealed one continuous population with no distinction between the different stand types although a certain small-scale spatial genetic structure was identified. Our study suggests that riparian softwood forest species have efficient dispersal strategies to cope with altered floodplain conditions from a genetic point of view. On the basis of the results, management advice is given for selecting genetically suitable planting material for restoration purposes.

Keywords: *floodplain; riparian softwood forest; restoration plantings; Salix; population genetics;*

O104

Future prospects for floodplain vegetation under climate change

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Riparian floodplains belong to the most diverse and productive ecosystems and their important role is emphasized by European directives such as the Water Framework Directive or the NATURA 2000 network. Simultaneously they belong to the most endangered ecosystems in the world due to human impacts such as dyke and dam construction as well as river regulation and training, and land use changes. Climate change is expected to further endanger floodplain ecosystems because of assumed changes of hydrological conditions in the floodplain. Hence existent vegetation as well as potential restoration measures might be affected.

Aim of this study was to assess potential changes in the small-scale habitat distribution of different riparian plant species/ vegetation types along the Rhine River due to climate change. Hydrological as well as species distribution data were used to calculate spatially explicitly habitat distribution of species/vegetation types using habitat distribution models. On the basis of different climate change projections derived from different combinations of global climate models, regional climate models, a hydrological model and a morphodynamic model, potential future habitat distribution and resulting changes in comparison to the current distribution were assessed. Preliminary results indicate negative changes especially for hydrophilic species, while the mesophilic vegetation could benefit from potential changes. Knowledge about abiotic alterations and resulting habitat changes are a basic requirement for an effective conservation and restoration management for this valuable ecosystem and its species.

Keywords: *floodplain; habitat distribution; climate change; modelling; hydrological conditions;*

O105

Ecological restoration of abandoned ricefields to wetlands: seed bank potential and dispersal forcing

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In recent decades, Mediterranean wetland ecosystems have suffered drastic reduction of their area due to the development of agriculture, industry and tourism. In the Camargue (Rhone delta, southern France), this development has led to a loss of 40 % of natural areas. Currently, opportunities arise to rehabilitate marshes on abandoned fields: this is the case for the Cassaere, a former wetlands, now leveled off and composed of abandoned fields. Two main obstacles to the spontaneous recolonization of target plant communities are often the absence of target species in the seed bank and/or in the vicinity and establishment potential of unwanted species due to increased soil fertility. The seed bank dynamics of the Cassaere were studied in order to investigate the potential for restoration success from the soil. Additionally, we tested different restoration treatments, in relation with two local reference ecosystems: meso-xeric grasslands and vernal pools. The results show the absence of target species seeds in surface and deep seed bank and confirm the need for active restoration. Hay transfer allows the establishment of 39 % of target species. However, competitive interactions between target species and unwanted species should be controlled by mowing or grazing to encourage the establishment of our reference plant community.

Keywords: *Wetland restoration; abandoned fields; soil seed bank; dispersal limitation; hay transfer;*

O106

LIFE Liereman: heathland restoration on a landscape scale

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From 2004 until 2010 the NGO Natuurpunt carried out a nature restoration project in the nature reserve "the Liereman Landscape" in northern Belgium. Our main target was to restore heath- and woodlands. These had declined dramatically since the 1950's, due to intensified land use.

At the project start, qualitative habitat fragments were still present. To get a necessary, better insight in reigning abiotic processes, an ecohydrological study was initiated. This study focused on:

- modeling ground- and surfacewater to predict evolution of target habitats
- actions needed to restore and expand target habitats

This study clearly identified intensive land use as a major threat for the development of qualitative habitats. On the short term, frequent flooding by nutrient-rich water from drainage ditches threatens low-lying areas. On the long term, infiltration of fertilizers leads to groundwater acidification and fertilization, threatening low-lying areas. Finally, groundwater levels lowered due to pine plantations.

The following actions were proposed :

- redirecting drainage ditches
- excavating water buffers
- cutting pine plantations

Combining the existing knowledge and new insights of the study, a management plan was elaborated. Land was purchased in key infiltration and seepage areas. Several restoration actions were executed for the once only restoration of target habitats. In total, we restored 43 ha dune heaths and grasslands, 25 ha wet and dry heaths, 60 ha *Nardus* grasslands, 6 ponds and 54 ha forests.

Keywords: *heathland restoration; Life; ecohydrological study;*

O107

Novel ecosystems: role of function and history

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There is increasing interest in the concept of *novel ecosystems* — no-analog species assemblages that arise as a consequence of human action. During 2006, there were only 23 articles published that used this term; in contrast, in 2011 there were 203. However, while rate of publication is increasing, the definition of novel ecosystems remains elusive. Despite general agreement that novel ecosystems are characterized by highly altered abiotic and biotic conditions, there has been confusion over whether they also must have altered ecological function. For instance, some characterize novel ecosystems as those that have been resistant to changes in ecosystem function despite having experienced a high degree of biotic change. Others restrict the term to systems that are highly altered in both composition *and* ecological function. In addition, there has been confusion over what reference to measure novelty against, with historical ecosystem states being ruled in or out by different trains of thought. These differences in perspectives have led to miscommunications about the management implications of novel ecosystems. We argue that novel ecosystems can be either similar in ecosystem function to a reference system or highly dissimilar (but functional similarity is a critical axis for evaluating the need for management interventions) and that novelty should be characterized as the extent to which a site has shifted from its ecological trajectory (in other words, the trajectory it was on prior to anthropogenic disturbance) rather than its dissimilarity from its historic biotic (e.g., species composition) or abiotic (e.g., climate) condition by anthropogenic forcing.

Keywords: *novel ecosystem; ecosystem function; historical fidelity; ecosystem management; reference site;*

O108

Environmental research of hydric restoration of Lake Most

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Hydric reclamation is a new way to cope with impacts of coal mining in the Czech Republic. Recently, two lakes – Lezaky and Milada (North Bohemia) have been finished. Little is known about the complex development of ecosystems in the lakes and in their vicinity under the conditions of the devastated landscape of Northern Bohemia. The hydric reclamation of the open-coal mine Lezaky was chosen as a model area. Samples assessed for hydrobiological analyses have been taken and the appropriate dominance of bio-indicators, the state of trophy, the biological index of saprobity, the character of vertical zonation (showed by deepwater samples) and the chlorophyll-a concentration has been determined. Present results of hydrobiological analysis show low water trophic rate, obviously thanks to phosphorus non-availability. In the scoped area we have found 180 species of plants. There are most interesting halophilic and wetland species of plants. Another important factor for vegetation development is that a huge area was technically restored and forested. We have found 134 bird's species (with 58 protected species) in the lake and nearby. 67 bird's species have a direct food or nesting connection to water and close littoral vegetation. Other 21 species prefer dry and wet open restored areas, mainly with grass. Although technical reclamations are also needed for new landscape formation, preliminary results in concordance with other authors indicated a negative effect on biodiversity of rare species. Most of the investigated area has been already technically reclaimed but there are still possibilities to make new landscape valuable for endangered species.

Keywords: *Hydric reclamation; Lake Most; Northern Bohemia; TACR alfa project; ecosystem research;*

O109

The impact of management on biodiversity-productivity relations in Estonian floodplain meadows

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Floodplain grasslands – ecosystems with high species richness and cultural values – are highly threatened throughout the world due to intensification or abandonment.

Key to habitat conservation is appropriate management, generally mowing and hay removal or grazing.

The present study was conducted in Alam-Pedja Nature Reserve situated in Central Estonia. We focused on the relations of biodiversity and productivity and the impact which mowing and hay removal had on highly productive floodplain meadows.

The aim was to identify the relative importance of biomass cutting, hay removal and nutrient impoverishment on species richness and diversity.

Within two communities *Filpendulo-Geranietum palustris* at higher parts and *Caricetum acutae* in old riverbeds fieldwork included 48 plots regarding regularly mown and abandoned ones. At each plot vegetation was surveyed as well as biomass and litter were harvested per plot, dried and weighed. By the mean of near infrared reflectance (NIR) spectroscopy we measured the concentrations of the main plant nutrients. Three groups of general additive models were calculated, taking i) productivity measures, ii) nutrients and iii) management regime into account. Species number and diversity served as responses. We compared the models by AICc, delta and weights, and found out:

That among the regarded factors litter removal is the most important for supporting biodiversity, but could only partly explain species enrichment due to management.

Nutrients had weaker impact, being reduced by management, but too less to result in biomass reduction.

Hence management of floodplains needs regular hay removal to conserve the typical species richness.

O110

Restoration of UK floodplain meadows dominated by native invasive Carex species

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Floodplain meadows in the UK are typically very species rich. The meadows are managed in a non-intensive manner to maintain the species richness by annual hay cuts and aftermath grazing. *Carex* species can be part of the plant sward, however in recent years many of the meadows have faced an increase in the dominance of native invasive sedge species, such as *Carex acuta* and *C. acutiformis*. The *Carex* dominates by taking up physical space, creating a tall canopy and shading out other plants. This reduces the plant species diversity, for which the meadows are conserved.

This PhD project aims to find a suitable management solution to control *C. acuta* and *C. acutiformis*. The study includes a replicated field trial of three cutting dates established in 2010. The botanical composition of the study plots in a meadow in southern England has been monitored each year and the effectiveness of the normal hay cut at reducing the *Carex* abundance is compared to that of double cuts (a normal cut and either an early or late cut).

Initial results have shown that a double cut does significantly reduce the cover of *C. acuta* and *C. acutiformis* when compared to cutting in June alone. The community composition has also shifted in response to the change in management regime. The results of this study can be adopted by land managers and farmers in the UK to restore the floodplain meadows dominated by *Carex* species.

Keywords: *grassland; mowing experiments; sedge; nature management;*

O111

Runoff as ecological driving force in constructed slopes from coal mining reclamation in Mediterranean-Continental environment

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It is well known that overland flow is a major ecological driving force in drylands. This work shows a finding synthesis of the research conducted in El Moral field site (Teruel coalfield, Spain).

Three trajectories have been identified and modelled, associated to runoff volume, particularly to external run-on coming from the upper part of slopes. When rill systems are formed, arrested succession occurs. Rills efficiently drain runoff away from slopes, reducing rainfall infiltration and increasing water deficit. Vegetation dynamics become severely affected: seedling emergence, plant establishment and seed production are limited along a gradient of rilling. Soil moisture content is spatially redistributed, being higher near rills, and lower on inter-rills, which determines the spatial pattern of the dominant species (*Medicago sativa*).

At intermediate levels of runoff amount, micro-landforms as alluvial fans and bared soil areas, are generated. Vegetation is adapted to the micro-geomorphology developing a patchy mosaic structure. Seven types of ecohydrological units (classified as runoff sources or sinks) have been identified. A functional interaction between sources and sinks following the TTRP approach has been demonstrated.

When runoff does not develop micro-landforms, natural plant colonization leads to another patchy mosaic structure based on *Genista scorpius*, which can be considered as a natural island of hydrologically enhanced biotic productivity. This species develops a biotic control of the main hydrological processes, playing a key role in the ecosystems succession.

These findings highlight the importance of an "expert management of runoff" if the desired objectives of a reclamation project are to be reached.

Keywords: *ecohydrology; drylands; mining; reclamation; runoff;*

O112

Geomorphic reconstruction of surface mining disturbed lands to facilitate their ecological restoration. Examples in the Spanish Iberian Range by using the GeoFluv method

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Failures have been and are too common in spite of the significant development of mining reclamation techniques during the last decades. The most common cause of those failures is the lack of understanding of the long-term geomorphic stability of the reclaimed landforms. In this framework, an increasing number of cases and research initiatives are proving, worldwide, that the use of geomorphic criteria can achieve a truly ecological restoration of lands disturbed by surface mining. This approach goes beyond of what it is called mining reclamation or mining rehabilitation. This is because an adequate topographic design and a proper arrangement of the materials which build the landforms have a critical power over the restitution of decisive ecological processes -mainly dealing with soil and biological functionality. As a result, the provision of new ecosystem services for human well-being at formerly degraded lands by mining is maximized.

Here, we explain several examples of geomorphic designs of quarries in the framework of truthfully ecological restoration initiatives. The quarries are located in two very ecological and hydrological sensitive areas of the Spanish Iberian Range: Somolinos and Upper Tagus (Guadalajara province, East-Central Spain). The designs have been carried out using the GeoFluv method and the Natural Regrade software. For the Somolinos scenario, we provide the details for accomplishing the beginning of the reconstruction -being the first example of such building following the mentioned methodology in Europe- along with the successful erosional behaviour of the reconstructed surface from of July 2011.

Keywords: *Mining; Geofluv; Geomorphology; Reclamation;*

O113

Ecological restoration of beech forests

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Due to human activity natural old-growth beech forests in NW Europe have become reduced to very small areas. In strong contrast to managed forest, natural beech forest is rich in species associated with old trees, senescent trees and dead wood. Due to fragmentation and trivialisation it is likely that a large extinction debt occurs in remaining old-growth fragments. Thus, there is an imminent need to halt on-going local extinctions to preserve biological diversity in these forests. One way to turn the process back may be active re-creation and restoration of trivial young beech forest into forests with high structural and biological diversity in the vicinity of old-growth stands. However, restoration methods based on principles of forest dynamics and substrate requirements of threatened species are largely lacking. Here I present a new method for active ecological restoration of single-cohort previously managed beech forest into multi-aged structurally rich beech forest. The method involves a protocol for spatio-temporally explicit artificial gap formation and the active creation of tree features and wood substrates of high variety. In young beech stands (up to ca 80 yrs of age) the restoration process is projected to last for 100–200 years until natural structure is fully achieved. This is still a considerably shorter time to reach naturalness in comparison with non-intervention management regimes or silviculturally influenced thinning methods. The application of the method in two Swedish beech forests (in the years 2006 and 2008) is presented and discussed.

Keywords: *Fagus sylvatica; conservation; forest dynamics; gap disturbance; extinction debt;*

O114

New insights into unassisted ecological restoration: case study on a mining-affected floodplain in Serbia

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Post-mining wastelands provide an attractive environment to study the fundamental processes of succession, yet data from regions other than Central Europe, which include toxic substrata, are extremely scarce.

We have studied the revegetation process on an exclusive model locality created by long-term and large-scale fluvial deposition of sulphidic Cu tailings over arable fields, where no reclamation had ever been undertaken. In a setup of pronouncedly continental climate, carstic geology and natural vegetation of lowland poplar forests surrounded by the caliciphile xerothermic forests of *Carpino orientalis – Quercetum mixtum* syringetosum type, plant growth on the polluted floodplain soils is constrained by either Cu toxicity or pyrite weathering-induced severe nutrient deficiency combined with high acidity.

Soil and vegetation surveys (species abundance, biomass, foliar analyses) were conducted within a gradient approach framework; the results were jointly analysed by multivariate statistics.

Surprisingly, primary succession invariably starts with the four species of the atlantic element which do not occur in the regional vegetation (*Rumex acetosella*, *Agrostis capillaris*, *Populus tremula*, *Betula pendula*). As spatial gradient closely matched the pollution gradient, very clear revegetation patterns could be observed. No true metallophytes were found, and P-efficiency appears to be the key physiological adaptation.

Vegetation converges to depauperate aspen – birch forests with random and slow immigration of local floral elements. In this new, more xerophytic and oligotrophic habitat the reestablishment of the original alluvial vegetation and land use is unlikely. The conceptual model of vegetation successions and its relevance for sustainable land use planning will be discussed.

Keywords: *floodplain restoration; gradient analysis; spontaneous succession; Cu toxicity; pyrite weathering;*

O115

National Native Plant Materials Development Program: twelve years and growing

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The Bureau of Land Management (BLM) is the leader of the interagency Native Plant Materials Development Program (NPMDP). Wildland native seed collections and propagation are the foundation of this program. Through partnerships with other Federal agencies, state agencies, academic institutions, botanic gardens, and others, the NPMDP works to research and develop native plant materials needed for restoration after fire, energy development, recreation, and grazing. Currently the NPMDP has four ecoregional programs, which focus on the Great Basin, Pacific Northwest, Colorado Plateau and Mojave Desert. These ecoregional efforts allow partners to focus on specific species and seed zones as well as issues facing their unique ecosystems. For example, since 2005, more than one million acres of the

Mojave Desert have burned, which illustrates a need for native plant restoration materials. Climate change and energy development are particularly large forces impacting the southwestern US. Though solar and wind development offer renewable energy resources, the installation of their infrastructure could have devastating effects on the native U.S. flora. Additionally, current climate predictions show that temperature and drought are to increase which could lead to increased fire cycles and invasion from non-native species. These challenges facing America's native flora can be mitigated with the help of this long-term program to develop genetically appropriate native plant materials on an ecoregional level for restoration.

Keywords: *native seed production; seed zones; climate change; seed banking; restoration;*

O117

Using a social-ecological system approach to analyze the interactions between agri-environmental policies, farmers and rangeland restoration

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An effective ecological restoration is based on two main pillars; ecological knowledge and societal support. Restored ecological integrity and function is the target of restoration projects by definition, but the societal acceptance is also vital. Every restoration project is a part of a specific social-ecological system (SES) and by analyzing and understanding the interaction within the SES; we enhance the likelihood of the system's long-term sustainability.

Restoration of degraded rangeland has been practiced in Iceland for over a century but its multiple impacts have never been evaluated. To prepare such an evaluation, we made a preliminary research where we identified the stakeholder groups that are involved in the SES of rangeland restoration. Subsequently, ten farmers and eleven officials were interviewed about their attitude towards restoration, land management, the related administrative system and current agri-environmental policies.

Our results showed that the interviewees shared a positive attitude on the importance of land restoration and they commonly agreed on sustainable land management as the key issue for maintaining/improving the ecosystems' services. The result also indicated the existence of communication gap between different stakeholder groups. All the interviewees stated the lack of clear and holistic agri-environmental policies.

Based on our results, we conclude that there is a need for an overall evaluation of the long-term impact of agri-environmental policies on rangeland restoration and improved land management. Such a research would provide valuable information on the current state and will be useful for developing the agri-environmental policies further.

Keywords: *social-ecological systems; rangeland restoration; agri-environmental policies; impact evaluation;*

O118

Conversion of conventional into biological viticulture systems – the effects on earthworm assemblages

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Conventional vineyards are characterised by extremely high intensity of agricultural practices. To restore the biodiversity and non-productive functions of vineyards, a biological production management system has been developed in Central Europe and adopted by the majority of wine-grape growers in the last decades. The aims of our study were: (a) to find out if the conversion of conventional into biological viticulture systems enhances the diversity and/or quantitative parameters of earthworm assemblages, and (b) to assess if the implementation of biological system in vineyards may lead to the return of rare or endangered species into the agricultural landscape.

Commercial vineyards were studied in three wine production areas in the Czech Republic. In each area, plots under conventional (CP), integrated (IP) and biological (BP) production system and additionally the closest natural site, were chosen for the study and sampled for earthworms in spring and autumn 2009–2011.

The indicators of natural steppe ecosystems (*Allolobophora hrabei* and *Dendrobaena mrazeki*) did not colonised adjacent vineyards, which were exclusively inhabited by euryecious earthworms typical for various agro-ecosystems. The structure of earthworm assemblages in natural sites differed from those in vineyards, where they depended on regional environmental conditions rather then on production system. Nevertheless, earthworm diversity was always higher in BP and IP than in CP systems. The results did not shown clearly positive or negative impact of production systems on quantitative parameters of earthworm assemblages. Nevertheless, sowing alleys with grass-herb mixtures affected positively both density and biomass of earthworms in BP vineyards.

Keywords: *Earthworms; vineyards; production systems; conventional; biological;*

O119

A fast and inexpensive tool for wetland restoration to estimate internal eutrophication (P, N)

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A well-known problem for the restoration of freshwater ecosystems lies in the high concentrations of nutrients and the accompanying presence of algal blooms. Internal loading from sediments play an important role in the deterioration of the surface water quality.

The main goal of this research was therefore to find a simple and inexpensive tool to estimate the internal phosphorus (P) and nitrogen (N) mobilization rates for a large variety of freshwater ecosystems. Intact sediment cores were collected from 29 locations in the Netherlands. The mobilization of P and N, and decomposition rates were measured and a large set of sediment and pore water parameters was analyzed. Different water treatments were tested under stagnant and mixed conditions.

The mobilization rates of P highly correlated with the concentrations of dissolved P in the pore water. We also found a good correlation between the mobilization rates of N (nitrate plus ammonium) to the water layer and the mobilization rates of P. Mixing of the water layer did not lead to a significant change in P- or N-mobilization. Increased alkalinity did not influence rates, but sulphate addition was able to double P-mobilization in a number of sediments. In addition, pore water alkalinity could be used as an indication for high decomposition rates.

For water management it is vital to estimate internal loading rates in order to choose efficient restoration measures. We show that the phosphor concentration in the pore water provides a confident and inexpensive tool to estimate internal P and N loading.

Keywords: *Phosphorus mobilization; Internal eutrophication; Wetlands;*

O120

Restoration of dry calcareous and sandy grasslands after abandonment, arable field use or afforestion – understanding the (ecological and political) mechanisms!

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Dry calcareous and sandy grasslands suffered from a strong decline since the beginning of 19th century due to conversion into arable fields but also during the 1960ies to 1980ies due to abandonment of sheep grazing and subsequent overgrowth by shrubs and trees or afforestation. Several case studies including comparative as well as short and long-term monitoring studies are presented. To understand the way and speed of vegetation re- development a functional approach was applied including traits related to persistence or dispersal in space and time. Soil physical and chemical and in one case population genetic aspects were studied as well. The results are discussed under the actual European, regional and local politics, respectively taking into account the demands of the main land-users, the shepherds.

O121

Using spontaneous succession in ecosystem restoration

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In principal, we have three options how to restore disturbed, damaged or degraded ecosystems: (a) to rely completely upon spontaneous (natural, unassisted) succession; (b) to manipulate spontaneous succession to various degrees to reach a target; and (c) to adopt technical measures, which we can call technical reclamation. Spontaneous successional processes, however, occur within any ecological restoration, thus, succession is a core ecological concept of restoration ecology. Various examples of spontaneous succession efficiency in central European human-disturbed habitats will be shown, together with examples of sites where spontaneous succession failed. Some quantitative comparisons among 35 particular successional seres will be presented, regarding their use in ecological restoration. A general conclusion is that spontaneous succession is usually efficient in sites which are not very extreme in their environmental conditions changing along a composed stress-productivity gradient. It will be argued that, if sites considered for spontaneous succession are properly evaluated in their environmental factors and then spontaneous succession is properly prescribed, more natural target stages are usually reached than by any technical approach. Moreover, this may be done at a substantially lower cost.

Keywords: *spontaneous succession;*

O122

Changes within the mussel sector for the restoration of the Dutch Wadden Sea; a sustainable transition?

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The Wadden Sea is constructed both by nature and society. Natural processes such as sedimentation and erosion enable the formation of mussel banks. The social forces in this coastal area consist of economic (e.g. gas extraction, salt mining, and fishery) and environmental protectionist interests (for instance, the Wadden Sea has been placed on the list of UNESCO's World Heritage Sites). In the Dutch mussel sector these interactions cause tensions because of social and political contradictions; no consensus exits on either goals or means; moreover, there is great scientific uncertainty, because of which, decision-making requires a high level of participation by actors holding different types of knowledge, conflicting interests and perspectives. In this context, recently a covenant was signed by different actors (e.g. research institutes, policy agencies, non governmental institutions, and industry) to enable the *sustainable transition and restoration in the Wadden Sea*. The intention is to search for alternative mussel seed collecting practices as compared to the traditional seafloor harvesting method in order to avoid damage to the mussel banks. The current research is conducted at the interface of ecological restoration and science and technology studies – it is aimed at facilitating the formation of *communities of practice*. This article explores the multi--stakeholder (knowledge sharing) network strategies that can operationalize the transition in the mussel fishery towards sustainable restoration in the Wadden Sea area.

Keywords: *Knowledge sharing networks; Mussel fishery; Sustainable transition; Communities of practice; The Wadden Sea;*

O123

Restoration of psammophytic grasslands in the sand pits: directed vs. spontaneous succesion

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Since the psammophytic grasslands has become very rare and fragmented in the Trebonsko region (SW part of the Czech Republic), there is a chance to support the establishment of this vegetation type on suitable new sites such as abandoned sand pits. Klara's island (app. 0.3 ha) was used in an experimental trial to restore such vegetation type in the sand pit. Raking was used as a method to harvest seeds and cryptogam material in two types of habitats in the investigated region where retreating psammophytic communities still occur. Phytosociological releves were made on the donor sites including

inventory of mosses and lichens. Three variants (control, two different types of donor sites) were realized in a complete block design with five replicates. All permanent experimental plots were analyzed by phytosociological releves prior to and a year after year the experiment started. The first preliminary results indicate that 75 % of higher plants typical of psammophytic grasslands (21 of 27 species) successfully established, in spontaneous plots 25 % of the species mentioned above (4 of 27 species). In plots with transferred biomass, there is still a chance for the other species to establish in the next few years from seeds. It seems that also all mosses and lichens established successfully, especially all dominant species. We are aware that the observation time of the experiment was short (only 2 years) to analyze success of the transition. However, it appears that this method of restoration of rare and endangered plant communities seems to be very promising.

Keywords: *near-natural restoration; biomass transfer; sand pit; target species; psammophytic grassland;*

O124

Restoration of road cuts in mountainous areas

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At Kalhovd, a mountain area in Southern Norway, roads were built about 60–70 years ago. Due to steep slopes, frost, and erosion, some of the road cuts are still not revegetated. In total 912 individuals of *Luzula multiflora ssp. fridigida (Luzula)* and *Festuca ovina (Festuca)* were raised in a greenhouse from site specific seeds and planted in 3 rows (top, middle, bottom) in road cuts that had been restored by local soil and modified topography or in un-restored road cuts, to see if planting of these species can help revegetate road cuts.

Growth of each plant was recorded in August 2008–2011. There is a significant higher growth of *Festuca* in restored than un-restored road cuts, while there are no significant differences in growth between restored and un-restored road cuts for *Luzula*. *Festuca* has higher growth in the restored road cuts and lower growth in un-restored road cuts compared with *Luzula*. For *Luzula* there is no significant difference in growth between rows, while *Festuca* had a significant better growth in the rows at top and bottom compared to the middle row. In August 2011 seedlings of both species were observed in restored road cuts. More *Luzula* seedlings than *Festuca* seedlings were found.

These results indicate that *Luzula* has a better growth in un-restored road cuts than *Festuca*. *Luzula* may be better for stabilizing the road cuts and may be used for revegetation. However, to ensure the best result, a full restoration of the road cuts should be done before planting.

Keywords: *Luzula; Festuca; site-specific; revegetation; road-cuts;*

O125

Restoration of NATURA 2000 sites in cross-border Bratislava capital region (project LIFE10 NAT/SK/080)

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The trilateral cross-border capital region of Bratislava displays a diversity of natural conditions with high number of habitats and species of European importance. On the other hand Bratislava is rapidly growing and developing city which creates pressure on surrounding natural sites. Therefore BROZ together with partners run the project aimed at restoration of 17 Sites of Community Importance. Management Plans for selected sites are elaborated. The main goal is to secure favorable conservation status of this area by suitable management. Forest composition will by optimized by planting of 45 000 native trees, removal of invasive and allochtonous species on 420 ha and minimum of 9 000 old and valuable trees should be individually protected in co-operation with forest companies (marking and modification of logging). 115 ha of forest steppes and 150 ha of grassland habitats are planned to be restored by local treatment of overgrown vegetation – mowing, mulching and removal of biomass. Subsequently traditional management by grazing will be restored on these habitats. Restoration of water and wetland habitats on 6 localities, especially dried-up, destroyed or isolated river branches, will help to improve the water regime, migration barriers for water organisms will be removed and population of fish species and amphibians will increase. Beside all the practical conservation measures in the field project largely deals with public awareness rising via web page, info brochures, maps, leaflets, documentary movies or complex education programs for schools. On a site information panels, wild life watching hides and tourism infrastructure will guide the visitors.

Keywords: *restoration; Bratislava capital; NATURA 2000; forest habitats; non-forest habitats;*

O126

Both complete clearing and thinning of invasive trees lead to short-term recovery of native riparian vegetation in the Western Cape, South Africa

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In South Africa, large-scale management operations are underway to clear invasive trees along riparian zones and restore ecosystem functions. However, problems such as destabilization of river banks leading to massive erosion and secondary invasions call for the evaluation of other clearing strategies. We assess the recovery of native vegetation after four years of complete clearing of invasive *Eucalyptus camaldulensis* and thinning (40–50 % alien cover removal) along the Berg River in the Western Cape, South Africa. The aim is to determine how these two methods influence the nature of native vegetation recovery. Native and alien plant cover, species richness and diversity were recorded on cleared and thinned sites and compared

to un-invaded control sites and invaded sites. Species richness and diversity were significantly higher in both completely cleared and thinned sites compared to uninvaded and invaded sites. Increases in species richness and diversity in these two sites were a result of re-invasion by alien herbaceous and graminoid species. Relative cover of native trees and shrubs was higher in both completely cleared and thinned sites compared to invaded sites. Detrended Correspondence Analysis revealed that species abundance in completely cleared and thinned sites was similar to that of natural sites. Both complete clearing and thinning methods promote indigenous vegetation recovery and a positive trajectory towards recovery of ecosystem structure and composition can be expected in future. We discuss how these findings can be applied to improve management operations by suggesting a four-stage thinning process that has the potential to facilitate native species recovery.

Keywords: *Biological invasions; Invasive plants; Restoration; Riparian ecosystems; Species composition;*

O127

Ecological design is more important than compensatory mitigation for successful restoration of alpine spoil heaps

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Spoil heaps of surplus rock from hydropower tunnel construction have been placed in the alpine landscape of Norway for more than 100 years, although they have a negative visual impact on the landscape. In the last 40–50 years compensatory mitigation (seeding and fertilization) have been applied trying to speed up their re-vegetation. Unfortunately we lack knowledge about the relative importance of compensatory mitigation, spoil-heap construction method, local environmental factors and regional climatic factors for restoration success. In the present study we examined the species composition of 19 alpine spoil heaps in Western Norway and their undisturbed surroundings using ordination and statistical modeling. Substrate grain size was the principal factor explaining differences in species composition between spoil heaps and their surroundings. Soil characteristics, i.e. organic matter content and pH, and reutilization of topsoil were also important. Seeding and fertilization had non-significant long-term effects on restoration success. The vascular plants and the lichens recovered slowly with respect to total vegetation cover and species richness while bryophyte cover recovered rapidly. Our results indicate that spoil-heap design is more important for restoration success than compensatory mitigation. We therefore suggest that spoil heaps should be designed with a fine-grained top substrate preferably from stockpiled local topsoil, with uneven surface topography that mimics natural topographic variation, while seeding and fertilization should be discontinued.

Keywords: *grain size of the substrate; GNMDS ordination; reference site; reutilization of soil; succession;*

O128

Challenges and strategies to enhance fauna diversity on three quarries in Portugal: ecological recovery from a different scope

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Ecological restoration of quarries often centres on the rehabilitation of habitats regardless of faunal communities. In 2007, we started a project aiming to characterize and increase fauna diversity at three SECIL cement plants in Portugal. This project was supported by SECIL which voluntarily joined European Union's "Business & Biodiversity" initiative.

Here we present our strategies and results to enhance fauna diversity on recovered quarries by implementing an Action Plan that aims to promote conditions to increase the colonisation by fauna of different groups.

The study began with the establishment of a baseline referential concerning ground beetles, butterflies, amphibians, reptiles, birds and mammals. We found between 150 and 170 species in the three areas, concluding that prey availability is high but refuge scarcity may prevent the establishment of some species.

After identification of the main limiting factors, we proposed an Action Plan for fauna recovery based on the promotion of food resources, shelter and water availability while simultaneously minimizing the impacts on fauna due to feral animal predation and disturbance. We based our strategy on an adaptive management program, with periodic monitoring of fauna and continuous evaluation of the effectiveness of each action.

The aim of fauna recovery goes beyond reaching similar communities to those of natural areas. In fact, in ecological restoration is not only important to recover structure and composition but also to guarantee that ecosystem main functions are re-established. Only in this way it will be possible to assure the long-term persistence of the fauna communities.

Keywords: *quarry; ecological recovery; fauna diversity; adaptive management; action plan;*

O129

Ecological restoration in crisis time: Zoom into soil invertebrates community on roadslopes

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Abiotic conditions have been highlighted as the main factors driving plant community assembly on the earliest stage of embankments restoration process. When few species have been established, competitive exclusion modulates plant community composition, as an expression of biotic filters. In this latest period, plant cover continues increasing while richness decreases. Then, 6 or 7 years after road construction, plant litter accumulation in soil generates a crisis with a new successional transition, which mechanisms are unknown yet. We are interested in how soil invertebrate community organizes itself and its relationship with soil characteristics, as potential drivers of this shift in roadfill ecosystem dynamics We selected 6 embankments constructed in 2005 and located on M12 and M13 highways (Madrid, central Spain). During spring of 2009 and 2010, 4 samples of soil were taken on each roadfill for arthropods extraction and soil features analyses. Also QSB index* was calculated for each sample in order to assess soil quality. Our results showed variations in soil invertebrate composition in space and time. Community structure seems to be conditioned by carbon content and soil texture. Even though QSB index tends to increase with time, a negative feedback mechanism was observed. This result may give evidences on the effect of the ecosystem's crisis on arthropods community during roadslope development process. In order to promote ecosystem sustainability on embankments, restoration projects on these scenarios ought to pay more attention to soil communities, which determine soil processes and plant community dynamics. *Parisi, V., Menta, C., Gardi, C., Jacomini, C. and Mozzanica, E. (2005) Microarthropod communities as a tool to assess soil quality and biodiversity: a new approach in Italy. Agriculture, Ecosystems and Environment 105 323–333

Keywords: *Soil ivertebrates; roadslopes; assembly;*

O130

RESTORE (EU life + project): Communicating river restoration best practice across Europe

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We aim to enable European policy makers, river basin planners and practitioners to deliver river restoration. River restoration can provide multiple benefits from increasing habitat diversity, recreation and working with natural process to manage flood risk. People, wildlife, industry and agriculture all need water, meaning water management needs to be better integrated across sectors. European countries are now recognising the importance of engaging people and organisations at a catchment scale.

One of the limitations to delivering river restoration is the lack of shared best practice and knowledge across Europe. The RESTORE partnership is developing existing river restoration networks and raising awareness of river restoration best practice across 21 European countries. We will provide the platform for effective knowledge transfer, information sharing and aid the discussion of the limitations/ benefits of restoration techniques.

This presentation will highlight the European-wide value of RESTORE. The project engagement in RESTORE focuses on three key audiences, that of policymakers, river basin managers and practitioners. The outreach target over three years (Sept 2013) is 90,000 people.

We have created a website www.restorerivers.eu which is a focal point for pooling information and sharing experience within the European river restoration community. It will also host an online knowledge management system of case studies. It incorporates metadata and a semantic search function to help navigate the mass of information that will be captured, making the system even more valuable for its users. This will have just gone live by the time of the conference. We work in association with the European Centre for River Restoration.

O131

Wildflowers, Culture, mathematics art and ecology, good beer and conversation. The Liverpool experience.

R. Scott[1]

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This paper feeds back on Landlife's experience over 37 years of practical ecological activity in Liverpool and across the UK, leading to the establishment of The National Wildflower Centre in 2000, when SER brought their international conference to Liverpool. It reflects on the realities of public engagement and awarenees raising and visible public projects, to stimulate activity beyond small conservation elites and academic circles. The real key to success is for organisations/groups to serve as catalysts to deliver "green infrastructure" to high levels of aspiration, and achieve high levels of social impact, to result in project multiplication.

This paper will feed back on "vox pop" style sessions at both the Avignon and Merida SER conferences, which have attempted to log aspirations of conference participants, as a counterpoint to traditional conference procedures, in view of the fact that to take ecological restoration into more visible cultural agendas we have to do so in more and more creative ways.

As international recessions bite, it is important that ecologists are able to pick up the challenges of our age, and accept the need for engaging a broader public audience beyond academic conferences and academic departments, and even conservation enthusiasts. It may well be closely related to popular culture, football music and even higher mathematics, it is also about how we converse and relate to society. In a time of environmental crisis we must be creative in how we present what we do, to enable others to perceive and celebrate the benefits.

Keywords: *creative conservation,; cultural ecology; vox pop; public engagement; multiplication;*

O132

Bringing It all back home: The Parable of the sower

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Landlife is an environmental charity and a pioneer ecological landscaping in the UK, and public engagement n the UK. In delivering ecological projects Landlife was one of the first organisations to recognise the importance of wildflower seed for the creation of new habitats and in the need for a reliable supply of native wildflower seed, to enable best practice project delivery.

This in itself sets a precedent showing wildflower seed production can be undertaken in none commercial terms , and as a social enterprise. It also shows it can link directly in the delivery of large scale creative conservation projects, both on Merseyside but as a catalyst for practical project work across the UK. Landlife's experience as a wildflower seed producer has fed directly into innovative techniques for project delivery. Landlife by independent activity has been able to show that such important social activity can be sustained, uniquely with minimal government support over a long period of time.

This paper establishes importance of relating the practical experience delivering wildflower landscapes with more academic concerns about delivery, with the reality of environmental degradation and the dynamic impact of climate change. There is a real need to establish a concerted momentum for practical ecological restoration and creative conservation activity in a time of environmental crisis, which reflects a realistic balance between best practice in the recommendations for the use of seed, and the practice of seed production. In truth it is the parable and experience of the sower and harvester.

O133

Carbon sequestration in reclaimed mine soils

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Soils or soil forming materials on reclaimed coal mine sites are typically deficient in organic matter. These soils therefore present an opportunity for sequestration of carbon.

A number of sites reclaimed for different periods after surface or deep coal extraction were sampled in Autumn 2011 and Spring 2012 to establish how profile C stocks had increased since restoration and to investigate the stability of these C stocks. Sites sampled included examples of different afteruse types (mainly grassland and woodland) in order to establish the impact of different vegetation systems on C sequestration.

Analysis of these samples is ongoing but preliminary data suggest substantial accumulation of C in surface layers but limited increases in C stocks at relatively shallow depths. Compaction of lower layers in restored profiles presents a significant constraint on whole profile C sequestration as indicated by comparisons of stocks in reference soils.

In addition to the broader range of ecosystem services realised by restoring mine sites, C sequestration should be considered as an additional restoration objective. Measures to increase the depth of biologically active soil are key to achieving this objective.

Keywords: *Carbon sequestration; Mine soils;*

O134

Pollarding as a tool for conservation of tree hollow fauna

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We investigated beetles associated with tree hollows in stands traditionally managed by pollarding (i.e. periodical removal of upper branches), and compared patterns of tree-hollow incidence in pollarded and unmanaged trees. We found that pollard stands serve as important refuges for tree-hollow fauna even in largely deforested, extensively managed agricultural landscape. In comparison to unmanaged trees, pollards form hollows earlier and more often. Relatively small stands of pollard trees may thus offer enough hollows to sustain populations of hollow specialists, including those considered relict to "primeval forests". Pollarding as a management, however, has largely been abandoned and discontinued. Uncut pollards are susceptible to destruction due to weight of overgrown branches. In traditional pollard stands, restoration of pollarding is crucial for maintaining continual offer of tree hollows and other key habitats. Pollarding is also suitable whenever ensuring continuity of tree hollows and some other habitats usually associated with old trees is needed. Its potential for rapid creation of new habitats for endangered fauna is illustrated by presence of Osmoderma barnabita larvae in a pollard willow <20 years old.

Keywords: *pollarding; tree hollows; restoration; saproxylic; conservation management;*

O135

Maintaining species rich alkaline fens – limits and potentials

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Species-rich alkaline fens of the Caricion davallianae (EU-FFH 7230) are strongly endangered in Central Europe due to agricultural intensification and the cessation of traditional land use. In this study, effects of different management measures on species richness and composition of alkaline fens in Schleswig-Holstein (Northern Germany) were compared. Vegetation of 16 mowed and 19 grazed plots within 22 alkaline fens was investigated on three different scales (1 m^2, 25 m^2, 100 m^2).

In the pastures we furthermore surveyed the intensity of grazing. Additionally, the vegetation which bordered to the plots was inspected in all study areas in order to estimate the potentials of habitat enlargement.

Species richness, evenness and number of endangered species did not differ significantly between the measures on all scales. An average coverage of 26 % of mesotrophic fen species of the Scheuchzerio-Caricetea indicated that all investigated areas provide the potential to maintain alkaline fens. Anyhow, the high percentage of mesic grassland species (Molinio--Arrhenatheretea) revealed impacts of eutrophication and drainage. Major floristic differences between grazed and mowed sites originated in the occurrence of individual plants with low coverage. Thus, to preserve the whole variety of species, both management strategies have to be considered. However, stocking rates of at least 2.0 LU/ha (summer grazing) are required in mixed pastures for a sufficient biomass removal. Results show that the overall latitude of alkaline fens in Schleswig-Holstein with a characteristic species composition covers an area of about 2 ha and thus, measures to enlarge their area are urgently needed. Therefore, we discuss to improve habitat conditions in abandoned surrounding areas by measures as re-introduction of mowing or, in more degraded areas, by rewetting and topsoil removal in combination with hay transfer.

Keywords: *fen restoration; species richness; phytomass removal; grazing intensity; habitat enlargement;*

O136

Conservation of redlisted plant species of endangered salt meadow communities in Klaipeda Seaport territory (Lithuania)

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To preserve salt meadow communities (Cl. *Asteretea tripolii*) with redlisted plant species *Aster tripolium*, *Glaux maritima* and *Juncus gerardii*, Smelte Botanical Reserve (3.6 ha) was established in the territory of Klaipeda seaport in 1988. The inventory of redlisted plants was carried out in 2010–2011. The study was completed on 1032 m long coastline. The number of *A. tripolium* individuals as well as the area (cm^2) of *G. maritima* and *J. gerardii* thickets were observed.

Although characteristic halophylous species are not abundant there, the Reserve is the only habitat in Lithuania, where the largest populations of *A. tripolium* and *G. maritima* are found. The plants are growing only on a narrow (0.5–1.5 m width) belt of the coastline fortified with boulders and constantly washed by water, however, they do not form an entire cover. Only 9 % of the Reserve is occupied by existing or potential habitats of halophylous plants. The thickets of *G. maritima* (23.3 m^2), *J. gerardii* (3.6 m^2) and 4319 individuals of *A. tripolium* were recorded in 2010. In 2011, the decrease of the individuals of *A. tripolium* (28 %) and the thickets of *G. maritima* (45 %) and *J. gerardii* (28 %) it was ascertained.

To increase the population of *A. tripolium*, the experiment was initiated in 2011. Sixty seedlings of *A. tripolium* were grown in laboratory conditions and planted on a 10 m long coastline section. The possibility of restoration of *A. tripolium* population in the Reserve's territory depends on the future results of the experiment.

Keywords: *Aster; Salt meadow, redlisted plant species; Aster tripolium, Glaux maritima, population; Juncus gerardii, conservation, restoration; Smelte Botanical Reserve, Klaipeda seaport;*

O137

Nutrient loading of aspen seedlings: giving native seedlings a fighting chance

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Open-pit oil sands mining causes landscape-level disturbance in Alberta, Canada and Albertan law mandates that these sites be reclaimed with native species to self-sustaining ecosystems. The rapid establishment of tree seedlings is essential to meet these requirements, thus creating a need for quality seedlings. Despite being an important component of upland forests in the region, the indeterminate growth pattern and deciduous habit of aspen (Populus tremuloides) have challenged plant scientists to devise nursery practices that produce quality seedling stock with increased tissue nutrient concentrations (i.e. nutrient loaded aspen seedlings).

In the summer of 2010 eleven fertilizer treatments (including exponential fertilization and artificial shoot termination with paclobutrazol) were applied to containerized aspen seedlings grown from local seed source. All fertilizer treatments were applied in balanced and constant nutrient ratios with only the concentration of the fertilizer varying by treatment. At the end of the first summer, seedlings were harvested and physical (root and shoot dry weight, shoot length, caliper, etc.) and chemical

(leaf, root, and shoot nutrient content including starch, sugar, macro-, and micro-nutrients) parameters were measured. Data analysis shows that treatments created a wide range of nitrogen concentrations (from 0.878 % to 2.357 % in foliar tissue) and premature shoot termination is likely a prerequisite for this accumulation of nutrients in woody and foliar tissues, which increases seedling quality.

Keywords: *Populus tremuloides; nutrient loading; containerized seedling;*

O138

Habitat banking in the EU: environmental law as a creator or an obstacle to new markets for ecological restoration?

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Habitat banking is a compensation mechanism that is linked to the concept of biodiversity offsets. It can be defined as off-site mitigation in which multiple projects with like impacts are compensated at the same location, the "habitat bank". Thus, landowners are encouraged to restore degraded land as the landowner, in return, is permitted to sell these credits to developers, enabling them to satisfy legal requirements imposed by nature conservation law. Although this concept is commonly used in the US, "habitat banking" has not yet obtained the same status in the EU. This lack of application is mainly caused by legal considerations and uncertainties, surrounding this new concept, not only on the European level, but also on the national level. First, the presented research will demonstrate that the strict criteria in art. 6(4) Habitats Directive do not seem to favor a general application of habitat banking within the Natura 2000-context. Compensation through habitat banking will be only possible whenever it is guaranteed that functions are provided which are comparable to the habitats negatively affected. Second, a closer analysis of the national conservation laws in the EU, shows that only few of them contain a general nature protection regulatory scheme. Yet such an instrument is considered to be a more appropriate instrument to enhance habitat banking and ensure no net loss for biodiversity. Some concluding remarks will be directed at other legal considerations which could emerge when applying habitat banking in practice, such as the enforcement of conservation banking agreements.

Keywords: *habitat banking; biodiversity offsets; nature conservation law; market based instruments;*

O139

Cultivation and hybridization change germination patterns of native plants used for re-vegetation and restoration measures

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Native plants are increasingly used for re-vegetation and restoration measures. These plants are cultivated for several generations at plant nurseries and often derive from unknown provenance. A large scale-introduction of such cultivated plant material may lead to problems for species-conservation. Because cultivated plant material is the result of human rather than natural selection cultivated plant varieties often differ from their native progenitors in life-history traits. Using the example of germination patterns, we tested the assumption that native species propagated in nurseries differ in life-history traits from the behavior of the uncultivated progenitors. Cultivated as well as native populations of *Plantago lanceolata* and *Lotus corniculatus*, two species frequently used for re-vegetation purposes, were tested in a common garden experiment as well as in incubators for their germination behavior. We observed significantly faster and more abundant germination in cultivated varieties. Using artificial crossings we found that also hybrids of cultivated and native varieties germinate faster and more abundant than the native varieties. As native populations acquire their life-history traits by natural selection, we have to assume that they represent the optimal adaption to the environmental conditions. If these traits are changed by cultivation or by hybridization between cultivated varieties and local populations, we may alter the long-term survival probabilities of local populations. Hence, the production of native plant material for re-vegetation and restoration needs to introduce cultivation practices which preserve the life-history traits acquired by natural selection.

Keywords: *dormancy; germination rate; human selection; native varieties; seed origin;*

O140

Effects of hydro-morphological changes on riparian vegetation of the Danube floodplain in Southern Germany

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Since June 2010, a new watercourse is running in ancient stream channels and former oxbow lakes of the Danube floodplain between Neuburg and Ingolstadt (Bavaria) to connect the floodplain to the stream and to enhance fluvial dynamics. Vegetation monitoring started already in 2007 to get detailed baseline data and to analyse pre-restoration fluctuations. Nineteen transects of 20 m to 110 m length were installed across the watercourse to analyse small-scale changes in vegetation zonation. In addition, 100 permanent plots were placed randomly in different strata along the water body.

Vegetation analyses in 2011 indicated first restoration-induced changes. Areas with bare soil due to construction measures in formerly dry channels showed increasing vegetation cover. In former oxbows with dense reed vegetation, however, the proportion of bare soil increased and the cover of *vegetation* decreased. Species composition differed clearly between formerly dry channels influenced by construction measures, formerly periodically flooded oxbow lakes, and deep backwaters.

Several floodplain species, which had been found only in the soil seed bank before, could be detected in the actual vegetation in 2011. These were mainly species of the *Bidentetea tripatitae, e.g. Ranunculus sceleratus*.

These results indicate that typical floodplain habitats as mud banks and areas with fluctuating water levels could be restored. The monitoring will be continued to detect further vegetation changes.

Keywords: *Vegetation; Floodplain; Restoration; Dynamic; Danube;*

O141

Bet big on small mammals: the importance of small fauna to access quarry restoration measures and vegetation succession

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In 1982, SECIL-Outao cement plant started a landscape recovery program on its quarries and in 2008 implemented an Action Plan (AP) aiming to increase fauna diversity and abundance in recovered areas. Small mammals show fast responses to vegetation changes which make them suitable indicators of the status of the ecosystem recovery.

Our study aims to characterize small mammal abundance in different landscape units corresponding to natural and recovered quarry areas in a three year span. Simultaneously we evaluated the effectiveness of improving shelter availability for small mammals in an area where their abundance was restricted by high predation pressure from feral animals.

In 2007 (prior to the AP implementation) and 2010 (after AP started), small mammals were live-trapped on ten sampling areas defined by soil type (limestone and marl) and land uses, including quarry areas recovered since 80's, 90's and 00's decades and burned and unburned natural habitat. Small mammal abundance was computed with several variables characterizing vegetation composition and structure and the location of the traps regarding the ten different areas using redundancy analysis. Differences in species abundance between years were analyzed using Mann-Whitney statistical test.

Wood mouse and White-toothed shrew were caught mainly in limestone natural areas, while Algerian mouse was more abundant in areas recently recovered. Natural limestone areas and all most marl areas presented significant differences when comparing both years. Differences in small mammal communities between years were most probably related with vegetation succession, direct changes in some of the studied areas and shelter improvement.

Keywords: *Small mammal; Quarry restoration; Revegetation; Shelter improvement; Indicator species;*

O142

Restoring estuarine food web linkages: using historical change analysis to guide natural process restoration of trophic connectivity

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Compartmentalization and diversity of estuarine food webs are inherently dependent on freshwater inflow, tidal dynamics, residence time, and proximity and flux of different organic matter sources. However, historic alterations of natural estuarine ecoscapes has disrupted connectivity and led to uncoupling of food web pathways, isolating estuarine productivity from key consumer resources. In a prior ECER2012 presentation, the authors describe apparent disruption of food web linkages from estuarine wetland detritus sources to consumers in the Skagit River delta, Puget Sound, Washington USA that we attribute in part to the channelization of distributary channels and the disconnection of surge plain wetlands from tidal-fluvial flooding. Our challenge then is to strategically incorporate such ecological processes as food web connectivity into restoration plans that are both optimal and minimize conflict with stakeholders. The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) is a federal-state partnership designed to assemble such strategic portfolios of restoration, protection and preservation actions for nearshore ecosystems in Puget Sound. A fundamental step in the PSNERP process was to conduct a comprehensive, spatially-explicit analysis of net changes to nearshore ecosystems of Puget Sound – and particularly its estuarine deltas – since earliest industrial development (1850s–1890s). Spatially-explicit quantification and characterization of physical changes to the shoreline are integrated with our understanding of relationships among nearshore ecosystem processes, structures, and functions to interpret the impairment of nearshore ecosystem processes, including delta-scale food web connectivity. We use this change analysis to illustrate how alternative restoration scenarios can be evaluated for their rehabilitation to more natural food web connectivity.

Keywords: *food web; historic change; landscape; restoration;*

O143

Restoration of alluvial pools – problems and achievements

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Alluvial pools (backwaters) represent isolated remnants of an ancient river system. In present cultural landscapes, where the river dynamics is absent, they seem to be determined to extinction because of terrestrialization. This process can take tens to hundreds of years and is often accelerated by human activities in the vicinity, particularly by agricultural eutrophication. Future existence of these wetlands depends on management. Various management tools are used, but their impact on the composition of macrophyte communities and microflora is not always positive for nature conservation. Some

management tools, e.g. introduction of herbivorous fishes, may gradually change life in these water bodies: they cause not only the reduction of submerse and natant vegetation (including rare species), but they also change the functioning of water food chains. As a consequence, the pool community composition can resemble a fishpond instead of an alluvial backwater. In order to compensate for river dynamics, the isolated pools are sometimes artificially connected with the stream system. This solution brings a risk of eutrophication and pollution resulting in increased water nutrient content or even in penetration of water blooms that replace the original algal flora. On the contrary, removing of sediments can result in formation of earlier successional stages, shifting succession back by several decades. When properly performed, the recovery of macrophytes from the seed bank is fast and also flora can be restored from permanent stages and other ways. Any management decision must be based on a detailed knowledge of the locality and its biodiversity.

Keywords: *alluvial pools; management; eutrophication; succession;*

O144

Successful restoration of sandland as a part of the action plan for Dianthus arenarius subsp. bohemicus (Bohemian Sand Pink) in the Czech Republic

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Critically endagered and endemic Bohemian Sand Pink (BSP) is a heliophilous species growing in communities of open sand and sandy soil grasslands. Only one natural recent locality occurs in the Czech Republic – nature reserve (NR) Klenec. An imperative condition for successful establishment of seedlings is open (disturbed) substrate, as the species is not able to withstand competition. Main causes of threat are (1) tree plantations at the BSP habitats in the 1940's and (2) successional changes within the habitat due to changed land use, especially abandonment of traditional management – as a result of that humus layer was generated over years without grazing and mowing and allowed overgrowing of the habitat.

The objective of the restoration was to create conditions suitable for the development of BSP. Humus layer was removed by mechanical digger to a depth of 20–40 cm to a gravelous sand substrate on a segment 0.55 ha large. Monitoring of BSP shows that restoration measures result in increase of population of the species. Before restoration all sowing experiments were unsuccessful, after restoration success of sowing is almost 5 % (expressed as the ratio of number of one-year-old seedlings to sowed seeds). Detailed monitoring of succession shows progressive changes in vegetation composition. Regular management (mowing, removing tree seedlings, disturbances) must begin in no later than 10 years from the intervention. Restoration was also recommended based on results of an enthomological survey.

Restoration of NR Klenec is a good example of colaboration between practitioners and scientists.

Keywords: *action plan; sandland; restoration; monitoring; Dianthus;*

O146

Revitalisation of the Danube inland delta

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In the past the Danube inland delta represented one of the largest and most diverse natural wetland complexes in Central Europe. Large parts of it were destroyed during the last decades what caused major decrease of the typical floodplain bird species (black stork, night heron, little egret, sand martin etc.). The international project "Conservation of Endangered Bird Species Populations in Natural Habitats of the Danube Inland Delta" (LIFE07 NAT/SK/000707) is focused on restoration of wetland habitats within SPA Dunajske luhy (SK) and SPA Szigetkoz (HU). Main project objectives are: (1) restoration of wetlands, dried-up river branches and oxbows, (2) elimination of fish migration barriers, (3) restoration of abandoned meadows, (4) restoration of bird nesting places by planting of native tree species and by restoration of steep river banks. Actually water supply to eight oxbows was successfully established. Consequently the grazing management for the restoration of meadows are realising on few localities including one of the largest Islands in Slovakia – Velkolelsky ostrov. Steep river banks in overall length of 250 m were restored on two places, which were traditionally used by sand martins for nesting, but destroyed as a consequence of river regulation and/or by large stones embankments. Nesting and feeding conditions for birds are being restored also by planting of native trees (a) within the plantations of hybrid poplars and (b) by planting of whole forest stands where hybrid poplars were logged. Since 2009 overall 30 000 pieces of native trees were planted.

O147

Artificial Habitats as restoration tool for lobsters – can the Atlantic success be applied to Mediterranean lobsters?

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An increase, in the last 5 decades, in the number of studies on artificial habitats (AHs) for lobsters stems from the improvement of the knowledge on the recruitment processes, behavior, ecology and behavioral-ecology of several important commercial lobster species and also from the decline of many commercial lobster populations due to overfishing, diseases, and other natural causes. The largest number of these studies is associated with the Caribbean and Gulf of Mexico, mainly due to considerable construction efforts of AHs ("pesqueros" in Cuba and "casitas" in Mexico) used for the fisheries of the Caribbean spiny lobsters *Palinurus argus*. The long term effectiveness of these AHs in enhancing commercial catches by aggregation and/or enhancement of production is still questionable. The second most common studies on AHs are those for *Homarus americanus*. Despite

such efforts, there is presently insufficient evidence as to argue that these AHs are effective at increasing survival of lobsters at the population level. In addition, most studies of AHs for lobsters are limited to a small number of species, confined locally, and are used only in the short term. In order to understand the actual role of these man-made structures in fisheries management and conservation of lobsters, long-term, large scale, quantitative field studies of AHs of the commercially ecologically most important lobsters' species are needed. If this approach is adopted in the Mediterranean AHs might be revealed as useful restoration tools as preliminary studies indicated for large Mediterranean lobsters – *Scylarides latus*, *Palinurus elephas* and *H. gammarus*.

Keywords: *Lobsters; artificial reefs; man-made shelters; casitas/pesqueros; Restoration tools;*

O148

Invasive species, over exploitation and temperature increase as expressed in the yield of the Israeli trawl fisheries – can we restore the indigenous species assemblage?

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The Levant basin is extremely dynamic and has recently demonstrated revolutionary changes in response to numerous made-made factors including biological invasions, increased water temperatures, and effects of overfishing. Many Red Sea organisms have invaded the Mediterranean through the Suez Canal (Lessepsian migrants) establishing permanent populations. Among them are numerous noxious animals affecting human activities and impairing commercial fisheries, including poisonous (e.g., puffer fishes, *Lagocephalus spp.*) and venomous (e.g., the marine catfish, *Plotosus lineatus*) fish. In the last two decades the abundance and biomass of invasive fish in the coasts and shelf of Israel have doubled at the expense of autochthonous fauna. The number of invading fish species is now at least 84, 55 of them established permanent populations, a world record for open marine environments. Competitive exclusion has forced some indigenous species to move to deeper strata. If these phenomena, which are presumably enhanced by overfishing and water warming, continue, populations of indigenous species in the Levant will be depleted. Other temperate species (e.g., the Mediterranean slipper lobster, *Scyllarides latus*) will spend less time in shallow water and the trend of tropicalization might spread to other parts of the Mediterranean. With regard to fishes, the earlier spawning and recruitment seasons of indigenous fishes present managers with an invaluable opportunity to simultaneously curb invasion and facilitate a more sustainable fishery by enforcing a spring moratorium on fishing.

Keywords: *Invasive fish; Levant Basin; Fishing moratorium; Lessepsian migrant; Global warming;*

O149

A preliminary study of a marine protected area (MPA) in the south-eastern Mediterranean – is a MPA effective as a restoration tool?

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The yield of the Israeli trawl fishery has significantly decreased in recent years due to overfishing and the high discard percentage. Since no MPAs exist to date in Israel, a military zone, where fishing has been completely forbidden for many years was studied as an MPA. Catches from this MPA and those from an adjacent actively fished area, with the same substrates and morphology, were compared using the same commercial fishing vessel, operating with the same professional crew, on the same dates and times, using the same equipment: long lines, trammel nets and traps. Preliminary results indicate that despite seasonal variations and those apparently associated with sea states, number of fish species, biomass, and Diversity Index were always higher in the MPA. Groupers (Serranidae), fishes of high commercial value, some of which are on the IUCN Red List of threatened species, were significantly more common in the protected area. MPA catch – mean number of species, mean number of specimens, mean biomass and mean biomass/fish were 5, 11.7, 28.9 and 2.1 times higher than in the control area accordingly. A similar trend was observed regarding the biomass of another commercially important family of fish, the Sparidae. In comparison, the above measures were not higher in the MPA than in the control for the Squirrelfish, *Sargocentron rubrum*, a common non-commercial Lessepsian migrant from the Red Sea. MPAs could serve, therefore, as an important restoration tool for fisheries management, such as sanctuaries for reproductive populations of overfished species as well as nature reserves.

Keywords: *Marine Protected Area; Overexploitation; Bony fish; reproductive sanctuary; Nature reserves;*

O150

Invasive species, over exploitation and temperature increase as expressed in the yield of the Mediterranean trawl and coastal fisheries – can we restore the indigenous species assemblage using marine protected area (MPA), artificial reefs and other management tools?

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Many Red Sea organisms have invaded the Mediterranean through the Suez Canal (Lessepsian migrants) establishing permanent populations. In the last two decades the abundance and biomass of invasive fish in the coasts and shelf of Israel have doubled at the expense of autochthonous fauna. The number of invading fish species is now at least 84, 55 of them established permanent populations, a world record for open marine environments. Competitive exclusion has forced some indigenous species to move to deeper strata. If these phenomena, which are presumably enhanced by overfishing and water warming, continue, populations of indigenous species in the Levant will be depleted. Other temperate species (e.g., the Mediterranean slipper lobster, *Scyllarides latus*) will spend less time in shallow water and the trend of tropicalization might spread to other parts of the Mediterranean. With regard to fishes, the earlier spawning and recruitment seasons of indigenous fishes present managers with an invaluable opportunity to simultaneously curb invasion and facilitate a more sustainable fishery by enforcing a spring/summer moratorium on fishing.

Another possible solution for overfishing is Marine Protected areas (MPAs). Since no MPAs exist to date in Israel, a military zone, where fishing has been completely forbidden for many years was studied as an MPA. Catches from this MPA and those from an adjacent actively fished area, with the same substrates and morphology, were compared using the same commercial fishing vessel, operating with the same professional crew, on the same dates and times, using the same equipment: long lines, trammel nets and traps. Preliminary results indicate that despite seasonal variations and those apparently associated with sea states, number of fish species, biomass, and Diversity Index were always higher in the MPA. Groupers (Serranidae), fishes of high commercial value, some of which are on the IUCN Red List of threatened species, were significantly more common in the protected area. MPA catch – mean number of species, mean number of specimens, mean biomass and mean biomass/fish were 5, 11.7, 28.9 and 2.1 times higher than in the control area accordingly. A similar trend was observed regarding the biomass of another commercially important family of fish, the Sparidae. In comparison, the above measures were not higher in the MPA than in the control for the Squirrelfish, *Sargocentron rubrum*, a common non-commercial Lessepsian migrant from the Red Sea. MPAs could serve, therefore, as an important restoration tool for fisheries management, such as sanctuaries for reproductive populations of overfished species as well as nature reserves.

Habitat loss is another ecological problem in the marine environment. Population of hard substrate and overfished lobsters in the Mediterranean are affected by the deficiency of proper dens that supply shelters against diurnal predators. The use of artificial reefs (ARs) for lobsters can be another restoration tool. It stems from the improvement of the knowledge on the recruitment processes, behavior, ecology and behavioral-ecology of several important commercial lobster species and also from the decline of many commercial lobster populations due to overfishing, diseases, and other natural causes. The largest number of these studies is associated with the Caribbean and Gulf of Mexico, mainly due to considerable construction efforts of ARs ("pesqueros" in Cuba and "casitas" in Mexico) used for the fisheries of the Caribbean spiny lobsters *Palinurus argus*. The long term effectiveness of these ARs in enhancing commercial catches by aggregation and/or enhancement of production is still questionable. The second most common studies on ARs are those for *Homarus americanus*. Despite such efforts, there is presently insufficient evidence as to argue that these ARs are effective at increasing survival of lobsters at the population level. In addition, most studies of ARs for lobsters are limited to a small number of species, confined locally, and are used only in the short term. In order to understand the actual role of these man-made structures in fisheries management and conservation of lobsters, long-term, large scale, quantitative field studies of ARs of the commercially ecologically most important lobsters' species are needed. If this approach is adopted in the Mediterranean, ARs might be revealed as useful restoration tools as preliminary studies indicated for large Mediterranean lobsters – *S. latus*, *Palinurus elephas* and *H. gammarus*.

Keywords: *Mediterranean; Bony fish; Lessepsian migrants; over fishing; marine protected areas; sanctuaries; lobsters; artificial reefs; casitas, pesqueros; enhancement;*

O151

Non-native plant species management and ecological restoration of foothills fescue grassland in Waterton Lakes National Park, Alberta, Canada

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Native grasslands are biodiverse ecosystems declining globally due to human disturbance. Ecological restoration is a promising solution but is challenged by poor native plant reestablishment and control of invasive plants. Arbuscular mycorrhizal fungi (AMF) form mutualistic partnerships with native plants and may have an important role in grassland recovery but more knowledge is needed on the effects of disturbance and invasive plants on these organisms. Steaming is a pollution free alternative to chemical control of non-native plants. The objectives of this study were to investigate steaming and other control methods, revegetation techniques and AMF and examine how these components affect grassland restoration. Reduction in non-native plant cover by steaming, glyphosate (herbicide) application and mowing were compared to a control treatment at three disturbed sites heavily invaded by non-native species in a randomized block design. Revegetation success was compared

for wild collected and native cultivar seed in paired plots and broadcast seeding was compared with transplanting. AMF communities at disturbed sites were compared with AMF communities in undisturbed grassland using molecular identification. Glyphosate was most effective in reducing non-native species but most detrimental to native species and steaming methods were ineffective. The native cultivar seed type performed best but effectiveness depended on species. Transplanting is recommended over broadcast seeding. AMF were abundant in both habitats sampled and identification is in progress; final results will be presented. The knowledge from this study will be used to develop effective strategies to restore degraded grasslands to biodiverse plant communities.

Keywords: *invasive species control; revegetation; mycorrhizal fungi;*

O152

How much care does a shrub-feeding hairstreak butterfly (Satyrium spini) need in calcareous grasslands?

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Many butterfly target species are associated with early successional stages of grasslands. The Blue-spot Hairstreak (*Satyrium spini*) is such a target species. However, it feeds on a host plant, the Common Buckthorn (*Rhamnus cathartica*), that is associated with late successional stages of grasslands. If *S. spini* would also be restricted to late seral stages, there might be a management dilemma due to the contrasting requirements of the target species.

The aim of this study was to assess the oviposition preferences of *S. spini* in calcareous grasslands, and to give management recommendations to promote this species. Therefore, we studied the oviposition microhabitats of *S. spini* in three representative patches of the Diemel Valley (Central Germany) by comparing environmental conditions on occupied and control host plants.

S. spini preferred those host plants that grew under the warmest conditions. Females favoured small (< 1.3 m), sunny shrubs of *R. cathartica* on steep south- and west-facing slopes for oviposition. Hedges and solitary bushes were used in equal parts for egg-laying. About 80 % of the batches were deposited on the upper sides of twig forks close to the surface of the ground (< 1 m).

Our study showed that *S. spini* is a species characteristic of mid-successional stages of calcareous grasslands. Accordingly, habitats of *S. spini* depend on regular management. For optimal land use, we recommend traditional rough grazing with sheep and goats, which creates open grasslands with small *Rhamnus* plants. Moreover, especially for tall hedges within calcareous grasslands, we suggest rotational shrub cutting.

Keywords: *butterfly; oviposition preference; microclimate; calcareous grassland; habitat management;*

O153

Safe sites limitation of Empetrum nigrum establishment, a common birds dispersed heath species

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A controlled large-scale restoration experiment located at an eroded site in South Iceland offers an opportunity to assess the relative importance of safe sites and seed availability on establishment of *Empetrum nigrum*, a common bird dispersed heath species in Iceland. The experiment was established in 1999 with a range of inputs from fertilizer only to revegetation and planting of trees in 1 ha plots. The current study began in 2008, located within three treatments and a control. The reclamation treatments were: 1) sown grasses and fertilizer, 2) as 1 plus six clusters of birch and willows, and 3) fertilizer only. The objective of the current study was to determine whether ecological restoration on an eroded site stimulated establishment of *Empetrum nigrum*, and if so, whether the impact of treatments differed. *Empetrum* plants were recorded annually in September 2008–2011 determining their density and measuring their crown diameters. No plants occurred in control plots and the establishment of *Empetrum* differed greatly between the reclamation treatments. The highest density and largest plants occurred in plots with clusters, and fewest plants occurred in plots receiving fertilizer only. Results indicated, however, that the establishment rate during the study was relatively higher in plots without clusters but fertilized and sown grasses. The reclamation treatments created safe sites and possible also attracted seed dispersal agents. The study shows that ecological restoration triggers relatively fast successional changes from a barren eroded area towards potentially a heath community.

Keywords: *Empetrum nigrum; eroded land; primary succession; Iceland;*

O154

Knowledge traditions and governance. Restoration and conservation in the Dutch Wadden Sea

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In recent years a number of conflicts between stakeholders, restorationists and conservationist, and governmental actors arose in the Dutch Wadden Sea area. Gas exploitation, shellfish fishing and intensified recreation are examples of activities that have led to conflicts. A very recent example is so-called dynamic coastal management where dune areas are no longer fixated, but where natural processes like dune erosion, sand drift and washovers are given a free hand where possible. It is sometimes framed as 'building with nature', Key objectives of this approach are increased resilience, adaptation to climate change, safety measures, and ecological improvement of dune areas. Coastal management is still in an experimental stage and surrounded

by uncertainties, for instance concerning the long term effects on biodiversity and safety. Although diverging interests may be on stake, different knowledge traditions or frames and discourses of interpretation (e.g. experiential, technical, or scientific frames) also play a big role. This paper presents, making use of science and technology studies, an analysis of the dynamics between different knowledge traditions, based on empirical data from dynamic coastal management and some other topics of conflict in the Dutch Wadden Sea area. Important is the question how networks in the context of governance can be build in order to connect and tot exchange perspectives from different knowledge traditions on a fruitfully way.

Keywords: *Knowledge traditions; networks; Wadden Sea; dynamic coastal management; governance;*

O155

Looking for Achilles' heel of competitive grasses. Can we suppress them by introduction of root-hemiparasites?

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When strong grass competitors become dominant in restored grassland communities (e.g. *Calamagrostis epigejos*, *Festuca rubra*, *Arrhenatherum elatius*), they suppress establishment or competitively exclude subordinate species and hence decrease biodiversity. Moreover, these species recently expand to species-rich (semi-)natural grasslands in Central Europe due to cessation of management and eutrophication representing a major threat to diversity. We aim to explore possibility of suppressing these aggressive species by introduction of autochtonous root-hemiparasites. The hemiparasites substantially suppress growth of their hosts, decrease competitive pressure, affect nutrient cycling and hence possibly also increase community diversity suggesting them as a tool for species-rich grassland restoration.

We tested possibility of establishment of hemiparasite populations in stands of the dominant grass competitors. Due to their annual life history, the hemiparasites are very sensitive to competition at the seedling stage; hence the effect of litter removal and soil surface scarification was tested.

The hemiparasites were able to parasitize the target grasses. Autumn biomass and litter removal had a strong positive effect on emergence and survival of hemiparasite seedlings; nonetheless definitive conclusions will be drawn based on their further growth and fecundity during the 2012 vegetation season.

Introduction of hemiparasites could represent an effective and moreover easy-to-do tool for suppression of competitive grass species. In particular, it could be very effective in combination with other management practices (mowing etc.) nowadays largely used in habitat restoration despite limited effectiveness in suppression of some of the target competitive grasses (e.g. *Calamagrostis epigejos*).

Keywords: *hemiparasite; Calamagrostis epigejos; competition; diversity; ecological enginnering;*

O156

The effect of large woody debris restoration on stream community structure across an enrichment gradient

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The natural physical and biological states of rivers are being altered increasingly by long-term exploitation and habitat modification, successful river restoration is therefore critical for mitigating impacts on biodiversity and ecosystem functioning.

Restorations are typically constrained to small patches within individual rivers and often lack adequate monitoring and assessment. This has led to poor diagnosis of both the "problem" and the effectiveness of the "solution" as useful data are rare.

Most river rehabilitation studies have focused on target species (e.g. brown trout) or assemblages (e.g. macroinvertebrates), but little is known of the potential effects at the more complex organisational levels that bind these components together (i.e. food webs, communities, ecosystems).

Our principal aim is to evaluate the impact of "large woody debris" restoration on community structure, in a study across five chalk streams within the United Kingdom, including the Bure and Test in Norfolk and Hampshire respectively, using a Before-After-Control-Impact (BACI) style design. To test whether macroinvertebrate response is constrained in systems with high nutrient concentrations, a further 14 calcareous rivers along a nutrient gradient were also sampled.

Results revealed no consistent relationship between macroinvertebrate assemblages and either nutrient concentrations or habitat structure in these streams, suggesting other methods may be required to gauge the success of restoration. These include assessments of biomass stocks, food webs, and body-size distributions. Preliminary results indicate that total fish biomass is typically higher in the presence of woody debris. Macroinvertebrate biomass and their contribution to fish diet will also be discussed in the presentation.

Keywords: *biomass, food web, macroinvertebrate, nutrients;*

O157

Experimental restoration of species-rich deciduous forest on mining deposits in Mokra limestone quarry

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The Mokra quarry is one the largest limestone quarries in the Czech Republic. Although most of the quarry is surrounded by relatively species-rich oak-hornbeam forests, also some remnants of thermophilous oak woodland have survived there. The destruction of valuable forest habitats was the reason to establish a small experimental area here to test methods which could enable forest restoration on mining deposits.

A 14-year old tree plantation of *Acer pseudoplatanus*, *Tilia cordata* and *Pinus nigra* on a reclaimed area of mining deposits was selected for the experiment. Some plots were covered with a thin layer of soil removed from an old semi-natural oak-hornbeam forest (dispersed over the area), containing roots, stems and seeds of many forest species. Some plots were covered with forest litter (mostly dead leaves) collected and transported manually in large bags. The rest of plots was unaffected as a control. The tree canopy of plots was opened (for about 20–40 %) and young individuals of *Cornus mas*, *Carpinus betulus* and *Crataegus monogyna* were additionally planted in the openings.

At the beginning of this experiment, the herb layer of all plots consisted of mostly ruderal and heliophilous species. Three years later, we observed a significant increase in species in both plots additionally covered with new soil, while the diversity and species structure of the other ones remained rather similar. Even though some ruderal species persisted, many new species of semi-natural deciduous forests appeared.

O158

Yes, we really can: developing species-rich, dynamic and multifunctional landscapes in former mining areas combining near-natural re-vegetation methods and spontaneous succession

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Even on highly degraded site the successful development of species-rich, dynamic and multifunctional landscapes is possible if we apply up-to-date restoration planning and techniques. Mined sites have unique potentials, such as heterogeneity, nutrient poverty, locational dynamics and the presence of numerous and often rare animal and plant species at the landscape, biotope and species level. With the past focus on erosion abatement, soil improvement, and cavity flooding the uniqueness of many post-mining landscapes was unnecessarily destroyed. Fast growing non-native species were commonly planted or seeded from the 1970s through the 1990s. This practice severely threatened native biodiversity in adjacent near-natural restored sites as the planted species frequently became invasive. In contrast, current restoration planning and techniques aim to combine the preservation or shaping of heterogeneous site conditions with the use of native plant material and spontaneous succession.

Scientific principles, best-practice methods for ambitious ecological restoration, and examples from several mining districts will be presented. These examples demonstrate that many ecosystem services such as attractive recreation services are provided by ecologically restored former mined sites. In that context a suitable reference state for post-mining landscapes and their function as stepping stones within the Natura 2000 network will be discussed.

Current knowledge transfer between scientists and practitioners is developing as stakeholders show greater sensitivity to and interest in new approaches. However, even as mining companies begin to rethink their restoration strategies, we continue to recognize failures in practice. Therefore, binding standards for ecological restoration of mined sites are required on national as well as on European levels.

Keywords: *mined sites; reference state; near-natural re-vegetation methods; spontaneous succession; standards for ecological restoration;*

O159

Sustainability of land-use of peatlands

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Due to the multiple needs and values relating to the use of peatlands, strategy work for the sustainable use Mires and Peatlands is being prepared both at the national and regional levels in Finland, the peatland-richest country in the world. To provide scientific information for the planning of the use of peatlands, a research project investigating ecological, social, and economical values of peatlands was launched.

By combining existing ecological data, tens of new high biodiversity areas outside protected areas were found. To increase the ecological sustainability of peatland use, these areas are recommended to be left out from the heaviest land-use forms such as peat mining, and the most valuable ones could be protected and restored.

Social sustainability was investigated using interviews and questionnaires. People could be divided into environmentalists, supporters of present situation, and supporters of the commercial use of peatlands. An important factor causing opposition towards the commercial use of peatlands was the concern towards hydrological problems caused by peatland use. Economical

sustainability was surveyed by cost-benefit analysis, which revealed that peatlands have high economical importance especially in remote areas. Finishing of peat mining completely would therefore have significant effects on the employment of rural communities.

Both ecological and social sustainability of the land-use of peatlands would increase by paying more attention to environmental problems coming especially from peat mining. Nevertheless, the large group opposing all commercial use assumes that the peatland strategies will face strong arguments regardless what will be suggested on peatland use.

Keywords: *peatland; sustainability; greenhouse gases; biodiversity; Choice Experiment;*

O160

Recovery of grasslands using seed mixtures: Application circumstances, problems and successes

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The most frequently applied grassland restoration measure is sowing low to high diversity seed mixtures. The species composition and sowing density of a seed mixture is strongly influenced by the (i) target grasslands to be recovered, the (ii) site conditions and (iii) the availability of seed sources of target species. Generally, low-diversity seed mixtures contain seeds of 2 to 8 competitor graminoid or forb species characteristic to the target grasslands. High-diversity seed mixtures usually contain seeds up to 60 species. Both types of seed mixtures are successfully applied in grassland restorations with marked differences in application circumstances influenced by aims and regions. Low-diversity seed mixtures are cheap and can be easily compiled and applied for large scale restorations. Using low-diversity seed mixtures a fast recovery of perennial vegetation can be expected which is beneficial for rapid healing landscape scars, prevent soil erosion or suppress noxious weeds and invaders. High diversity seed mixtures are generally more expensive and difficult to compose but higher species diversity can be recovered in a short time which is an advantage in regions where native grasslands are fragmented and seed dispersal is very limited. In large scale restoration we suggest the application of combination of both types of seed mixtures. The matrix of the grasslands can be recovered by low density sowing of low diversity seed mixtures but within the matrix small patches should be sown in high density with high-diversity mixtures to ensure the seed sources of additional species characteristic to the targeted grassland.

O161

Role of natural shrubs on the forest expansion in restored coal mines in Northern Spain

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Empirical studies and theory governing plant–plant interactions suggest that, in stress-prone environments such as lands mined for coal with low soil water-retention capacity, shrubs can have a net positive effect on recruitment of other species. In 2011, an experiment was set up in a restored coalmine with the aim of comparing the survival and growth, after the first summer dry season, of *Quercus* seedlings planted in open areas with seedlings planted under the canopy of pre-existing shrub species, as well as the acorn survival. 800 one-year-old seedlings of *Quercus petraea* and *Q. pyrenaica* were planted and 1000 pre-germinated acorns were seeded into metal cages. Acorns and seedlings were also distributed in plots with and without ungulates to test the effect of herbivore damage. Any of the experimental acorns survived to produce seedlings, but an early microhabitat effect was found on predation, being predation higher under shrubs, into no fenced plots and for *Q. pyrenaica*. Seedling survival was 7.9 × higher under native shrubs than in open areas (15.3 and 5.3 for *Q. petraea* and *Q. pyrenaica*, respectively), in both fenced and no fenced plots. *Quercus* seedlings under shrubs also had shoots 1.9 × longer. 17.1 % of seedlings showed herbivore damage, being the 96 % of damage seedlings in the no fenced plots. The use of shrubs as nurse plants for *Quercus* reforestation is a viable technique to increase seedling establishment success in the study area. However, no safe site appears to exist for *Quercus* acorns with this seeding method.

Keywords: *facilitation; Mediterranean ecosystems; Quercus; reforestation; seedling establishment;*

O162

Conservation of root vole (Microtus oeconomus mehelyi) in western Pannonian lowland

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Root vole (*Microtus oeconomus mehelyi*) is endemic subspecies inhabiting the western Pannonian lowland. This small terrestrial mammal lives in wet meadows, marshes, bogs or along densely vegetated stream banks. It especially thrives in elevated parts of marsh sedge patches (*Carex*).

Due to highly specific habitat requirements and sensitivity towards changes in environmental conditions, the root vole's occurrence is limited to a small area. The principal cause of its endangerment is loss of suitable habitats, and thus favorable living conditions. The Danube lowland changed significantly during the 20th century. As a consequence of the past agricultural and water-management interventions, the average water level in some areas significantly decreased which led to a heavy fragmentation and loss of suitable habitats for this species.

There are 16 sites designated as Sites of Community Interest (SCI's) with root vole occurrence out of which twelve are in Slovakia, three in Hungary and one in Austria. The most effective solution to preserve this rare species is to reintroduce traditional methods of agricultural production and to restore wetlands and brooks' bank vegetation in areas still inhabited by root vole.

Habitat restoration activities represent main objectives of the project LIFE08/NAT/SK/000239 Conservation of root vole *Microtus oeconomus mehelyi*. Actions such as restoration of CiliDsk* potok brook in the length of 33,5 km, 360 hectares of restored wetlands, reed cutting and grassland mowing together with extensive research on root vole population are being carried out within the project.

Keywords: *root vole; wetlands restoration;*

O163

Forest dieback and restoration ecology: a multidisciplinary approach for the case of Palo Laziale wood

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Lowland coastal woods are both ecologically and economically important because of their high biodiversity and productivity.

Until the end of 18th century these woods were extended in many areas of Central Tyrrhenian part of Italy but in the last century they have been strongly reduced because of agricultural activities and urbanization. Several changes starting from the end of the last century have been creating conditions often unfavorable for the growth and survival of lowland tree species.

Within this context an integrated multidisciplinary research (Climate, Forestry, Hydrogeology, Phytopatology, Pedology) has been carried out to analyze the causes of the massive forest dieback occurred in Palo Laziale Site of Community Importance (SCI IT6030022). This wood is located 40 km north of Rome and hosts the priority habitat 3170* (Temporary Mediterranean ponds) of Habitat Directive 92/43 CE.

The endophytic pathogen infestation of Biscougnaxia mediterranea has been identified as the final reason of the forest dieback.

However the lethal infestation has been fostered by the simultaneous effects of several stress factors such as climate change, soil salinity and sodicity and changes in sylvicultural management.

A project of restoration ecology has been elaborated including two different type of interventions.

A specific sylvicultural management to foster the natural renovation of the wood species and reforestation of the area through native species.

A specific hydraulic engineering of the area able to face both the climate change (precipitation decrease) and the manage of the fresh water inside the SCI.

Keywords: *Lowland coastal woods; Soil salinity; Climate change; Multidisciplinary approach; Forest dieback;*

O164

Restoration of dry grassland vegetation by a combination of seed mixture sowing and hay transfer

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Technical reclamation of grasslands is a powerful tool for biodiversity conservation in fragmented landscapes. Hay transfer and sowing seeds of local provenance are used most frequently to recover grassland vegetation in former croplands. The joint application of these two methods is rarely used, although it has the potential to gain a predictable and directed vegetation development with effective early weed suppression. Low diversity seed mixture sowing and hay transfer were applied in three former croplands (a former cereal, alfalfa and sunflower field) in Egyek Pusztakocs region, NE Hungary. We tested the following hypotheses: (i) The cover and biomass of weeds are lower in vegetation recovered by the joint application of sowing and hay transfer than by seed sowing only. (ii) A higher rate of establishment of *Festuca* species is expected with sowing and additional hay transfer than with sowing only. Our results supported both hypotheses. We found that the joint application of seed sowing and hay transfer significantly accelerated the development of perennial grassland vegetation and provided a higher rate of weed suppression in the first year and onwards than seed sowing only. A higher establishment rate was detected for perennial grasses including *Festuca* species in all plots with hay addition than with sowing only. Our results suggest that a combination of hay transfer and low diversity seed sowing may provide a cost-effective solution compared to the more costly high-density sowing, and if proper sources for high-diversity hay are available may replace high-diversity seed mixtures.

Keywords: *seed sowing; grassland recovery; plant material transfer; weed suppression; restoration success;*

O165

Restoring ecosystem resilience by developing Green Infrastructure. What does this mean and how can we measure it?

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The actual EU Biodiversity Strategy to 2020 includes the protection and further development of so-called Green Infrastructure to enhance ecosystem resilience, presumingly beneficial both for biodiversity conservation and for the ecosystem services these systems supply. A closely related policy consists of setting priorities for ecosystem restoration to achieve the 2020 target of restoring at least 15 % of degraded ecosystems. Both policies are closely linked because restoration activities are intended

to enhance GI resilience. The present talk will focus on what ecosystem resilience is and what ecosystem properties add to it. More in particular I will discuss the relation between resilience and species richness, ecosystem complexity, (meta) population size, habitat area, coherence, and ecosystem condition. Based on these relationships I will present possible indicators and judge their usefulness to assess the actual situation. Such analysis not only identifies (scientific) knowledge gaps but, even more important, streamlines the discussion on GI planning and prioritizing restoration activities. I will finish with some first prioritization of what GI elements to conserve and/or restore as a start for further discussion in SER.

O166

Restoring functional habitats of target species: how to avoid a far too human perspective?

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Most conservation and restoration programs have both habitat and species-oriented approaches (e.g. Europe's Habitats Directive). Species-specific programs are considered useful (or even necessary in some cases) when conservation or restoration measures at the general habitat-level are not sufficient for the viability of highly demanding species of conservation concern. Although species-specific approaches may include a number of direct measures, it most typically is about indirect measures to improve 'their' habitat. But what exactly is a species' habitat? There is quite some confusion about this key concept in the ecological literature. I will argue that there is a strong bias towards a far too human perspective on habitats and how to restore them. What we see, is not always what other organisms get. We need to carefully distinguish between structural habitats and functional habitats the way it is done for landscape connectivity in landscape ecology. Bottom-up and top-down approaches for dealing with habitat issues are often implicitly assumed to converge, but in human-dominated landscapes this may frequently not be the case. I will explore the consequences for habitat restoration and species conservation. The "Umwelt"-concept from ethology will be introduced in this conservation and restoration framework. The resource-based, functional habitat approach offers a novel way of improving realism in recognizing and restoring habitats of target species in rapidly changing environments. The concepts and their application will be illustrated by recent and ongoing studies on birds and butterflies. A more functional, mechanistic approach for recognizing species' habitat will not only allow a better understanding and scope for action for threatened species, but also for widespread species that show strong declines over recent years.

O167

Recovery of key ecological processes in the Donana marshland after 30 years of isolation and crops

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Could the isolation and the agricultural transformation of a marsh area for almost 30 years lead to the irreversibility of the original ecological processes? Otherwise, after the abandonment of crops and certain restoration actions, what recovery level could be achieved? And how fast? Finally, which environmental factors will shape the success degree of these interventions?

These questions are being answered with the experience gained during our study, carried out between 2004 and 2011, after the restoration activities of more than 2600 hectares of non-tidal marsh in Donana National Park (SW Spain). Inside this area, agricultural use was possible since 1978, thanks to its isolation and draining, with the construction of perimeter dikes and the installation of a drainage ditches system. After the abandonment of that farmland, the restoration actions undertaken in 2004 were based on the recovery of both the local hydrology (removing all the drainage ditches and levelling the natural channel of the area) and the connectivity with the adjacent marsh (removing part of the perimeter dikes).

Flooding cycles in the estate, which are derived from rainfall and highly affected by the restoration actions, nowadays play a major role in the evolution of ecological changes. Its spatial and temporal magnitude, related to the fluctuating nature of the Mediterranean climate, have been determinant of soil salinity changes, seed dispersion by hydrochory and re-establishment of marsh species previously disappeared.

Keywords: *restoration; marsh; hydrology; crops; vegetation;*

O168

Restoration of insect habitats in the City of Moscow

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The Kurkino Nature Park in Moscow includes i.e. the disturbed area. The habitat restoration measures should improve the desired tendencies in spontaneous processes. In 2008 we have selected a poorly vegetated sand soil patch inhabited by rare insect species protected in Moscow: *Cicindela hybrida*, *Cicindela campestris*, *Bembix rostrata*, *Anthidium punctatum*, *Anthophora bimaculata*, *Dasypoda hirtipes*, *Smicromyrme rufipes*. Several of them forage in the adjacent patches of the more dense herbage inhabited in its turn by other protected species as *Conocephalus discolor*, *Tettigonia cantans*, *Decticus verrucivorus*, *Pholidoptera cinerea*, *Metrioptera roeselii*, *Bombusveteranus*, *Zygaena viciae*, *Anthocharis cardamines*.

The objective was to ensure the existence of the mosaic of habitat patches enough for supporting the mentioned groups of species.

The thinning out the vegetation up to 30 % surface cover supports the habitats of burrow insects as well as the beetles foraging on the soil surface. Removing the sods on the peripheral zone of the habitat allows the insects displacing here after the currently used habitat part overgrown. The removed sods are 3 × 3 meters in size and situated in 6 meters from one to another. Each year the impacted zone should be shifted on 3 meters.

Hay-cutting of adjacent herbage by 5–10 meters strips (one third area per year) prevents from grasses, bush, and tree overgrowing. Some willows are kept for bumble-bee spring foraging. The period of hay-cutting varies for avoiding damage for nesting birds.

The measures allow conserving the habitats and are implemented by the direction of the natural park.

Keywords: *Insects; Urban; Habitat restoration; Habitat mosaic; Habitat dynamics;*

O169

Species-specific microsite requirements in calcareous grassland restoration

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The vegetation of restored grassland often fails to match the high species richness of target communities. Re-establishment of habitat specialists characterize by a narrow ecological amplitude is more likely to fail than re-establishment of generalist species, as the latter tend to be better adapted to the more fertile conditions usually prevailing at restoration sites. It has been hypothesized that the poor performance of specialist species in restoration may be due to a failure either in creating sufficient establishment microsites in the initial phase of restoration or, in the longer term, by appropriate sward management. In a four-year experimental study, we applied a range of techniques for creating establishment microsites in combination with different grazing regimes that may affect continued regeneration of such microsites, and monitored the effects of these various options on the performance of a number of specialist species of calcareous grassland introduced by sowing into an existing species-poor grassland on ex-arable land. Initial establishment from seed was positively linked to bare ground creation prior to sowing. After four years, differences in the performance of several of the introduced species with respect to the tested grazing regimes only just started to emerge.

Keywords: *calcareous grassland; grazing regime; bare ground creation; establishment; microsites;*

O170

Herbicides in invasive non-native plant management: A quantitative overview of use in North America

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Invasive non-native plants can cause considerable environmental damage by replacing native species and altering ecosystem processes. Managers frequently respond to this threat by spraying herbicides, which is relatively inexpensive and requires less human labor than other control options. However, concerns among the public over non-target toxic effects cause growing conflict between practitioners and the public in invasive non-native plant management (INPM). Transparent management procedures and quantitative information are indispensable to create trust and a baseline for objective discussions among all stakeholders involved. We reviewed current herbicide usage in INPM in North America (Canada, United States) by surveying more than 50 governmental offices (both at the federal and provincial level) and commercial agro-statistic companies. Specifically, we asked whether 1) quantitative information is available for herbicide usage in INPM, and if so 2) whether data existed on the type of herbicides used (active ingredients), amounts applied and areas treated. Our study revealed that data is available only for the four biggest land managing agencies in the U.S. (Bureau of Land Management, Fish and Wildlife Service, Forest Service, National Park Service) – although this information is not easily accessible to the public. Based on data that these agencies shared, our preliminary analysis showed that at least 300,000 ha are sprayed each year. In order to allow for objective discussions with the public, we recommend a more rigorous and transparent documentation of herbicide use in INPM.

Keywords: *Invasive species management; Pesticides; Herbicides; Public policy; Public participation;*

O171

Provenance effects on plant establishment and competition during grassland restoration

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Sufficient quantities of seed material from donor sites are frequently not available for grassland restoration, which has lead to the use of regionally propagated genotypes or commercially cultivated species in grassland seed mixes. The main question that arises from this practice is: does provenance matter?

While the effects of provenance have been previously studied, the importance of grassland matrix species provenance and its influence on the establishment of the main target species have not been sufficiently investigated. This study examines (1.) provenance effects of dominant matrix species on establishment and competition of target species used for restoration, (2.) interactions between matrix species and target species and (3.) the overall effects of nutrients modifying these interactions.

A regional provenance (north of Munich) and a cultivar (*Festuca rubra* commutate L.) of *Festuca rubra* were grown with three forb species from calcareous grasslands (*Buphthalmum salicifolium*, *Dianthus carthusianorum*, *Linum perenne*) from a regional provenance and a commercial cultivar. Glasshouse and field experiments (north of Munich) were used to determine the provenance effects of *F. rubra* on the target species under varying nutrient conditions.

The results from this on-going experiment have so far shown that regional *F. rubra* had higher germination and seed mass than the cultivar. The expected results are that the *F. rubra* cultivar and the target species cultivars would benefit disproportionally from nutrients, resulting in a negative effect on the establishment of the target species and compromising the restoration efforts.

Keywords: *provenance; matrix species; nutrient addition; Festuca rubra;*

O172

Understanding and managing temporal dynamics

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Static approaches to restoration are short-sighted and often unsuccessful because they do not account for the fact that all communities are temporally dynamic. Ecological succession provides a practical and theoretical framework for restoration activities over many time scales, from minutes to decades, rather than viewing restoration as the static recovery of community structure or composition. Short-term nutrient cycles and microbial activities, as well as longer-term species replacements and soil development, are examples of the temporal range at which drivers of successional trajectories occur. Successional theory also provides insights into how disturbance frequency and severity affect community development through their filtering effect on colonization and survival, and by their influence on species interactions. Restoration activities that use a dynamic successional framework will provide the template that promotes both short- and long-term ecosystem processes. However, predicting successional trajectories at specific local scales is still challenged by many of the same unknowns that face restorationists, e.g., the relative importance of stochastic versus deterministic drivers, the importance of biological legacies and species traits, the role of ongoing disturbances and changing biotic responses, and the influence of human manipulations, whether intentional or not. Therefore, creative restoration projects integrate successional concepts and also potentially contribute to a non-equilibrium view of temporal dynamics.

Keywords: *non-equilibrium dynamics; succession; time scales;*

O173

Planning for the Namib after mining: restoration research, and monitoring of the Namib uranium rush

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The Namib Desert is undergoing an unprecedented change. The rush for Namibia's uranium resources has, in the short space of 10 years, completely altered the landscape of the central Namib Desert, with impacts expected on almost all aspects of the environment. A Strategic Environmental Assessment (SEA) commissioned by the Ministry of Mines and Energy determined the scope and extent of these potential and actual impacts, and defined a set of "Environmental Quality Objectives" (EQOs) for the mining rush. A Strategic Environmental Management Plan defined a number of indicators of performance in the wise management of impacts. These EQOs and their indicators, and the guiding SEA, dictate a range of monitoring and research requirements. Here we describe these challenges and define the most critical research topics. Research should focus on understanding disturbances in the ecological context of hyper-aridity, and on devising management tools to enable better, smarter restoration. Specific topics include the properties of soils and waste materials that can be manipulated to improve plant establishment and survival, the factors that improve colonisation rates and decrease extinction rates, factors that are associated with small ranges, and many more. Overall, efforts should focus on influencing both the general discourse on environmental sustainability and the "decision trend" – the total set of decisions that should ensure sustainable use of the Namib.

Keywords: *Namib Desert; Gobabeb; restoration research; monitoring; training;*

O174

Restoring agro-biodiversity: Testing the effect of Stellaria media on reproduction of the rare arable weed Legousia speculum-veneris

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Arable weeds have adapted to agro-ecosystem since the Neolithic period and rely on the disturbance regime in arable fields. The use of herbicides, crop rotation and high fertilization have led to a shift in species composition on arable fields, especially, affecting winter annuals. These species are rare on arable fields in central Europe, because they are lacking in the soil seed bank. As most dispersal vectors for arable weeds are lacking these days, there is a need for restoration or 'assisted migration' by re-seeding target species on arable fields. Organic farms go without herbicides so they provide potential habitats for the re-establishment of rare arable weeds. Suitable sites are considered not to be contaminated with noxious weeds that can harm the establishment of the target species and negatively affect crop yield. There is little knowledge on the mechanisms of competition between common and rare arable weeds.

To quantify how the common weed *Stellaria media* influences establishment and reproduction of a target species for restoration, *Legousia speculum-veneris*, a competition experiment was established. In a glasshouse nine treatments with five replicates were set up to investigate the development of *L. speculum-veneris* under different densities of *S. media*. As a crop *Triticum aestivum* was chosen to investigate competition and yield effects in the experimental system. Traits that are measured are biomass and seed number of the target species. The expected outcome of the ongoing study is reduced biomass and reproduction of the target species with increasing plant density of the common weed.

Keywords: *agro-ecosystem; re-establishment; arable weed; competition;*

O175

The landscape context of fish habitat relationships: implications for restoring riparian processes in U.S. Pacific Northwest rivers

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Stream ecology theory has long emphasized the need to incorporate landscape context, yet practitioners have been slow to adapt. This presentation describes a monitoring program in the Pacific Northwest, U.S.A., designed to evaluate whether aggregate restoration activities can positively affect threatened spring Chinook salmon. Factors commonly cited as impediments to salmon survival are often inter-correlated and difficult to tease out using classic univariate statistics. A multivariate ordination was conducted of reach-scale habitat characteristics across eight watersheds in the Columbia River basin to discover an appropriate landscape-scale classification, which in turn helped reveal patterns of anthropogenic impacts on site-level fish habitat. In a focal watershed, the upper Grande Ronde River, juvenile Chinook salmon density was linked to landscape classification and site-level habitat conditions. Structural equation modeling revealed that across the entire basin, large woody debris and pools positively affect fish density through direct and indirect pathways, but are also dependent upon mean annual streamflow. These relationships vary across landscape classes, with high elevation mountain reaches behaving differently than lower elevation floodplain and constrained reaches. Relationships were also discovered among riparian condition, recruitment of large woody debris, and aquatic invertebrate production. These findings have direct management implications for guiding the location and type of restoration within a landscape context.

Keywords: *river restoration; landscape; large woody debris; Oncorhynchus tshawytscha; riparian area;*

O176

Geophyte propagation and sustainable establishment in post-mining restored Jarrah (Eucalyptus marginata) forest, Western Australia

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Geophytes – plants with underground storage organs – are an important and varied component of the understorey in the Jarrah (*Eucalyptus marginata*) forest of south-west Australia. Geophytes are resilient to the annual summer droughts and regular wildfires, but have been difficult to re-establish in areas mined for bauxite. Re-establishing a self-sustaining Jarrah forest community is a core environmental objective of this mine restoration program. Therefore, it was concerning that there were fewer geophyte species in the post-mining forest compared with the pre-mining forest. Over the last 16 years successful large scale *ex situ* propagation and restoration methods have been developed for 21 geophytes.

Twenty eight geophyte species from fourteen families, including *Clematis pubescens*, *Tetraria capillaris*, *Pteridium esculentum* and *Drosera stolonifera* were investigated. Combinations of *in vitro*, *in vivo* and *in situ* experiments were required in the development of successful large scale propagation and restoration methods. This presentation will provide an overview of the research program, highlighting the value of phenology studies and the interactions between wild biology, propagation and plant establishment in restoration sites. The translation of the research into practical procedures, now used during routine Jarrah forest restoration on rehabilitated bauxite mines, will be described. The key finding was that larger underground storage organs at planting time led to higher field survival. Concepts were developed that may be relevant for horticultural and ecological restoration research on other geophytes. Consideration is given as to how best to measure successful propagation and the sustainable establishment of planted geophytes in restoration projects.

Keywords: *Geophyte; propagation; mine restoration; plant establishment; understorey;*

O177

Ecological installations- in between nature and culture

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Nowadays, in the times of biotechnological discoveries, the borders between natural and cultural spaces are blurred. This situation can be artistically expressed in ecological installations, explored with the aid of all senses. The nature is model and point of departure for the works. Very often the artists use living organisms that become integral parts of their works and in some cases their co-authors. The installations of Miroslaw Maszlanko such as arches or constructions recall the archetypal forms of architecture, whereas the production of the works of art resembles the work of spider or other living organism. Aleksandra Manczak creates installation with the use of trees wrapped in foils or boxes created for this purpose. Their exposition in the gallery allows to look at this crucial, yet neglected elements of nature from different perspective. Czekalska and Golec invites the animals to the galleries, they are also known for their creation of avatars- small tools constructed in order to protect

the insects. The installations art provokes various questions concerning our attitude towards nature, its conditions and rights. Ecological art should motivate to ecological actions. It allows us to reconsider our relationships to the natural world, beyond anthropocentric and hierarchical attitudes. In our time, while defining cultural spaces we should not forget about their natural facets, that are often inseparably linked to them .Culture is not far away from nature.

Keywords: *ecological installation; ecological actions; nature-culture;*

O178

Reintroduction and reinforcement of populations as a part of the action plans for endangered species in the Czech Republic

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Action and management plans are aimed at activities focused on reduction of biodiversity decline and conservation of species in the Czech Republic. Nature Conservation Agency prepares action and management plans according to the IUCN standards and implements them for the most endangered species of plants and animals. The plans include detailed analysis of biology of a given species, individual threats, clearly formulated objectives and concrete measures that should be implemented. Action plans (AP) represent a complex of active measures to protect species *in situ* and *ex situ* (breeding or cultivation).

Using of the reintroduction and reinforcement of populations measures is included in 6 of 9 authorised APs, namely for Marsh Angelica (*Angelica palustris*), Long- stalked Pondweed (*Potamogeton praelongus*), Bohemian Sand Pink (Dianthus arenarius ssp. *bohemicus*), Bohemian Early Gentian (*Gentianella praecox* ssp. *bohemica*), Freshwater Pearlmussel (*Margaritifera margaritifera*) and European Ground Squirrel (*Spermophilus citellus*).

The main goal of this paper is the introduction of conditions which are essential for this "special species management" in the Czech Republic and the presentation of practical methods based on applied research of each species. Important part is a sharing of our experiences with the implementation of measures and the discussion about them. Details for all czech action/ management plans are available at www.zachraneprogramy.cz.

Keywords: *Action Plan; Reintroduction; Reinforcement of populations; Endangered species; Czech Republic;*

O179

Restoration and/or prevention: are we doing our best? A critical review of paradigms and approaches

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To whom and why we restore ecosystems is, ultimately, a cultural issue. Most authors agree that paradigms and social values are critical to determine restoration efforts. Under this context, I compared world degradation causes and restoration discourses to establish whether we are asking the right questions. Over the last four decades (1970–2010), major indicators associated to environmental degradation causes show unsustainable figures: increase of human population (87 %); higher consumption (per capita) of wood products (205 %) and energy (109 %); continuous conversion of natural lands to agro-industry or cattle raising (5–10 %); higher PBI (909 %); reduced lifespan of manufactured products (or planned obsolescence, 10–200 %). Linked to this pattern, our discipline showed two periods in order to restore disturbed habitats and revert degradation. During the first one (1985–2005), these aims were strongly addressed. Theoretical models, rehabilitation techniques, inter-disciplinary and social actions were developed worldwide providing multiple alternatives and valuable experiences. However, during the recent years (2005-onwards), degradation causes and the production/consumption model have become ignored. In contrast, job offers are emphasized and concepts such as ecological services, novel ecosystems, and *"rapid changing world"* are used in a confusing way or to justify the *"degradation model"*, and do not help to have a truly common language with economists and developers. I propose, as physicians should devote much efforts in preventive medicine rather than treating sick patients, that restorationists devote special research efforts to revert the current degradation rate (passive restoration: planning, zoning, conservation) regardless of permanent needs for active restoration (planting, sowing, fertilizing, branching).

Keywords: *degradation causes; preventive restoration; social values; contrasting paradigms;*

Abstracts of Posters

P01

Filter effects of the C4 Bothriochloa ischaemum in regenerating temperate grasslands

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The threat of exotic invasive species on the native communities is generally recognized. Less is known about "local invasion" when a native subordinate species become aggressive and start to spread in the landscape. *Bothriochloa ischaemum* is a subordinate components of the natural xero-mesophil grasslands in Hungary. This subordinate species can increase due to erosion or in overgrazed stands. We assessed the effect of *Bothriochloa ischaemum* on community assembly in spontaneously regenerating abandoned fields (in abandoned croplands, orchards and vinyards). Fine-scale pattern of vegetation was sampled in 52 m long transects of 5 cm × 5 cm contagious microquadrates recording the presence of rooting species. Constraints on species co-occurence (assembly rules) were evaluated by information theory models and by randomization tests. Our results show that presence of *Bothriochloa ischaemum*put strong constraint on other species at fine-scale, decreasing species richness, beta-diversity and spatial heterogenity of grasslands by reducing the number and diversity of species combinations. The amount of litter, which increases parallel with the coverage of *Bothriochloa ischaemum*, enhances its negative effect. Species who are subordinate in undisturbed communities contribute little to ecosystem functioning. However, they might play important role in landscape-scale regeneration processes by filtering the colonizing species from the local species pool. Climate change and growing human disturbances create proper conditions for the spread of some originally rare and subordinate species, like the C4 *Bothriochloa ischaemum*. Therefore it is important to understand the factors controlling these "native invaders" and to develop proper management.

Keywords: *plant neighbourhood diversity; spontaneous succession; local invasion; assembly rules; filter effect;*

P02

Effect of different grassland management on populations of two endangered Phengaris butterflies and their host organisms

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Phengaris teleius and *Phengaris nausithous* are the endangered butterfly species strictly specialised to the host plant *Sanguisorba officinalis* and ants of *Myrmica* species. We studied the effects of water regime, mowing and grazing on the *Phengaris*, *Sanguisorba* and *Myrmica* to identify the most suitable restoration management for planned extension of the nature reserve "Pod Lesem" in the Protected Landscape Area Elbe Sandstones, the Czech Republic.

According to our study the butterfly population preferred irregularly cut meadows with abundant *Sanguisorba* population and with wet organic soil of high porosity and saturation ability. *Myrmica* species were rare at this type of meadows. There were no *Phengaris* butterflies in the species poor, heavily grazed and trambled pastures. The highest species diversity of plants, ants and butterflies was found at regularly cut meadows but the two *Phengaris* species were rare there. The clue problem for the butterfly population in the studied grassland complex seemed to find an optimal management not only for the butterflies but for the host ants, too.

Keywords: *Phengaris teleius; Phengaris nausithous; wet grassland management; Myrmica;*

P03

Riparian forest structures and their applications to greenway restoration in South Korea

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This study analyzed structures of natural riparian forests in South Korea and explored planning models applicable to restoration of riparian greenways to secure their ecological functions. A total of 21 streams or valleys were selected considering watersheds and climate regions of 4 major rivers in the country. The study then surveyed mature structures and growing environments of riparian forests typical of the study streams at 122 sample plots. Native forest communities associated with environmental gradients from floodplains to uplands were typified based on importance values of woody plant species and

classification criteria of forest types in the country. As a result of this quantitative analysis, riparian forests were classified into 6–12 community types for watersheds of 4 major rivers. Although the majority of dominant tree species of the community types were distributed widely over the study streams, some tree species were dominant at the community types of relatively warmer regions. This study generated planning models for restoration of riparian greenways by reflecting structural characteristics of the community types. The models included species selection and composition, density, distance, and soil characteristics for tree plantings by community type, along with greenway width. Riparian greenway for a case site was designed and implemented to realize planning models suggested, after appropriate forest communities were selected reflecting growing environments of the site. This implementation emphasized not merely earlier landscaping, but ecological plantings with great structural diversity to enhance multiple greenway functions.

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Keywords: *Natural forest; Community type; Riparian greenway; Planning model; Ecological planting;*

P04

Short-term effects of sowing different kinds of matrix species on old-field succession in the Hungarian Great-Plain

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Restoring natural grasslands by sowing matrix species often fails to reach their goal because sown species may limit the establishment of other target species, and they maintain the restored site in a species poor state. To examine this phenomenon we have set up an experiment in Tiszaalpar, the Middle-Tisza Region on an ex-arable field abandoned in 2008, and surrounded with semi-natural salt, sand and loess-steppe meadows. In three replicates, we sown *Festuca pseudovina,* a native grass for the experimental area, and *Lolium perenne* that is only found in degraded habitats. Species composition was sampled annually in 4 × 4 m^2 and 2 × 2 m^2 permanent plots. Spatial pattern development (beta diversity and spatial heterogeneity) was also monitored in permanent transects of 5 × 5 cm^2 contiguous microquadrats. *Lolium* established well and developed homogenous, species poor stand, while *Festuca* established less successfully. Species composition and total cover did not differ between untreated plots and plots sown by *Festuca*. However, beta-diversity was higher in *Festuca* treated plots, indicating higher spatial variability and heterogeneity. Higher beta diversity implies higher diversity of microhabitats, i.e. potentially more opportunity for the colonizing species. Therefore in the plots where *Festuca* was sown, we expect better regeneration and higher species richness in the in the future. We suggest that with carefully selection of the sown matrix species we can avoid to fail our restoration goals, and help the establishment of target species by keeping open the windows for colonization and by providing diverse microhabitats for their establishment.

Keywords: *grassland restoration; Festuca pseudovina; diversity; establishment control;*

P05

Is spontaneous regeneration of floodplain forests possible?: a repeated analysis after five decades passive conservation in Bzura River Valley (Central Poland)

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For a long time, large scale hydraulic engineering works had been carried out in the river valleys of Central Poland. Transformation of wetlands into agricultural fields was one of the main objectives of such works. Impact to nature is well known due to e.g. long-term phytosociological research. Significant changes in species composition and structure of the floodplain forest is observed as results of valleys' drainage. Such phytosociological studies were carried out in the 60s of XX century at Bzura valley. This is one of the most valuable and the largest wetland in Central Poland. Bzura valley has already been under a strong human pressure since the nineteenth century. However, for the last 50 years, in the valley, no hydraulic engineering works has been done, which could cause further drainage of the land. Only a few small dams on the channels were built. In 2011, the phytosociological survey was repeated in order to check whether spontaneous restoration of floodplain forests

The results indicate that due to abandonment of the ditches' maintenance and the construction of channels' dams, the process of further draining of floodplain forests has been halted. However, the process of regeneration does not occur. Present in the studied plots, the proportion of characteristic plant species is lower than in the 60s of XX century.

Keywords: *wetlands; dynamic tendency; vegetation; alder carr forests;*

P07

Vegetation of leveled and wavy spoil heap during first 8 years of succession

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For the heaping of the spoil heaps in Sokolov brown coal mining district two methods are used. One left on the heap surface waves approximately 1 m high and 3 m wide waves, while in the other method surface of the heap is leveled immediately after the heaping of the substrate (tertiary alkaline clay). To compare the succession on the heap deposited with wavy and leveled surface an experimental system where both heaping methods were used, was established in the year 2003. The vegetation

was there annually observed since the year 2006 onwards by the estimation of the vascular plant species cover in the 18 plots of 3 × 3 m (9 on heap with wavy surface and 9 on the heap with leveled surface). Colonization of the heap with leveled surface was faster at the leveled spoil heap (in terms of number of species and total cover of the plot). However, the leveled surface promoted the clonal plant species, including *Calamagrostis epigejos*, which is known for its ability to suppress other plant species, while the wavy heap promoted the woody species, which are considered as important for the progress in the succession. Hence, the wavy surface of the heap can be regarded as the more suitable for the woody vegetation establishment.

Keywords: *spoil heap; succession; vegetation;*

P08

Monitoring restored peatlands in Finland

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In large parts of Finland over 75 % of the original peatland area has been drained for forestry. Drainage has profound effects on function and diversity of mire ecosystems, mainly due to changes in hydrology.

Restoration of peatlands drained for forestry is required to conserve biodiversity and peatland habitats, to improve the quality of protected areas and to re-establish long-term carbon sequestration into peat. The prerequisite for the recovery is to restore hydrology by filling in the ditches.

Research and long term monitoring of the effects of restoration create a close link between science and practice. In Finland, The Natural Heritage Services of Metsahallitus has set up long-term monitoring networks to assess the success of restoration and need for a change or adaptation of the restoration methods.

The vegetation and hydrology monitoring networks include seven different habitat types at restored and pristine sites – altogether 134 sites in different parts of the country. The monitored vegetation variables include vascular plants and mosses that are the key species groups for the re-establishment of peat accumulation and thus the natural-like functioning of restored peatland ecosystems. Hydrological monitoring includes monitoring of water-table level and water quality as well as monitoring the impact of restoration on the quality of runoff waters. The butterfly monitoring network includes 21 pine bog sites with three different treatments (drained, restored and pristine) at each site.

In each site, monitoring has been started before restoration and is planned to last several decades.

Keywords: *Monitoring; Mire; Restoration;*

P09

Effect of N and P on the growth of Scorpidium scorpioides and Campylium stellatum on calcareous spring fen

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Calcareous tufa-forming spring fens are endangered mire types worldwide. However, the re-establishment of moss carpet is a crucial task because bryophytes are considered to be ecologically important constituents in the plant cover of Ca-rich fens. Campylium stellatum (Hedw.) J. Lange & C. Jens. and Scorpidium scorpioides (Hedw.) Limpr. are common bryophyte species distributed on Ca-rich spring fens in Estonia. In 2010 we set up fertilization experiment at the part of the Paraspollu fen (North Estonia) weakly drained some 100 years ago but where the water level is now raised up. We hypothesized that two key moss species differ in their response to N and P addition and water level rise up. Tufa, deposited from groundwater and precipitated on mosses, constituted in average about 47 % of the dry weight of S. scorpioides and some 40 % of C. stellatum. First year results indicate that production of S. scorpioides was depressed by N, whereas growth of C. stellatum occurred to be P-limited. However, both species have high capacity to take up N from surrounding in correspondence to the added amount of P. The differences in the water level between treatments had insignificant effect on the growth of the two species.

Keywords: *Campylium stellatum; Scorpidium scorpioides; calcareous tufa; water level; Estonia;*

P10

Response of different light environments on several floristic species in semi-open grasslands in Japan

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Many grassland species in semi-natural landscapes have been maintained in wooded meadow systems where patches of short plant communities are persisted in a mosaic of forest and grassland. In Japan, many herbaceous species in semi-natural grasslands have been temporally persisted in an early stage of coppice woodlands. However, abandonment of coppicing causes a decline of such 'natural landscape', leading to a need of ecological restoration of the semi-open habitats through resuming of coppicing. Understanding the response of shading on species representing the semi-natural habitats should improve the detailed restoration methods. In the present study species response to the different light environment (relative illuminance of 50, 25, 10%, and no shading) was surveyed for seven species representing grasslands dominated by *Miscanthus sinnensis*. Seedlings of five individuals per each shaded condition per each species were grown between May 2011 and October. Results

showed that dry matters of *Cymbopogon tortilis* var. *goeringii*, *Arundinella hirta*, *Patrinia scabiosifolia* and *Aster iinumae* were significantly smaller in 25 % than 50 % relative illuminance. Among them *C. tortilis* var. *goeringii*, *P. scabiosifolia* and *Aster iinumae* were significantly larger plant height in brighter condition. On the other hand, steady decreasing trend of biomass in smaller light availability was not observed for *Adenophora triphylla* var. *japonica* and *Cirsium oligophyllum*. The two species remained low plant heights at any light conditions. Species-specific traits observed in this study could be important indicators for the persistence and the competitiveness of species in the semi-open grasslands.

Keywords: *shading experiment; biomass; plant height; semi-open habitat;*

P11

Wildfire impact on forest vegetation in sandstone areas of Czech Republic

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The importance of wildfire for existence of certain northern globe forest ecosystems is well known from Mediterranean, North America, Scandinavia or Siberia. The general perception of Central Europe region is that this phenomenon does not occur naturally there and its ecological impact on forest vegetation dynamics has been neglected. But closer observations from areas where the wildfires occur and the current palaeoecological knowledge show that ecological role of wildfire on forest dynamics should be acknowledged there. The areas where the wildfire occurs noticeably more frequently are the Central European sandstone landscapes with the Scotch pine forests as a prevailing vegetation type.

The aim of our project is to describe the fire impact on forest vegetation on broader temporal scale (168 years) and try to sum up the ecological importance of the wildfire for the local Scotch pine forest communities.

The wildfire impact on the forest vegetation was revealed by phytosociological sampling of various post-fire succession phases. The oldest detected burnt-out area was 168 years old. The first results show the significant difference in the species composition among particular successional stages. The impact of previous fire was still noticeable even in stages older than 100 years. Particular tree species show different fire-survival and post-fire regeneration ability. The Scotch pine seems to be a one of the most fire-adapted local tree species.

Keywords: *Wildfire; Sandstone; Succession;*

P12

Comparison of diversity and richness of plant species at different levels of grazing (case study; East Azarbaijan Province, Iran)

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Biodiversity of grassland ecosystems are directly affected by the characteristics of growth and diversity of plant species. Excessive livestock grazing on the pasture, which reduces the harmful stress and loss of diversity, are critical elements of the plant. This research has been done for evaluate effect of different grazing intensity on species richness and diversity in grasslands which located in Miyaneh, East Azarbaijan, Iran. Three sites with different grazing management include poor grazing, moderate grazing and heavy grazing selected. Sampling was conducted on 18 transects with 90 plots (one square meter area of each plot). List of species within each plot, vegetation cover percentage and density of each species were recorded. Margalef index calculated results indicated that there are no statistically significant differences among low and moderate grazing area, but differences between low, moderate and severe grazing area in the 5 % level of significance there. Results show that areas that are affected by severe grazing have been incomplete regeneration in the future sustainability of ecosystems is at risk. Also in areas with poor and moderate grazing due to being beaten of soil, regeneration may reduce and possibility of flooding in the area is growing more.

Keywords: *Grazing; Plant; Margalef Index; Regeneration; Biodiversity;*

P13

Nitrogen dynamics in oxbow lakes in lowland river floodplains

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Floodplain lakes are seen as important bio-geochemical barriers in the riverine landscapes. According to the Flood Pulse Concept and River Continuum Concept they have a great potential to function as 'biogeochemical sinks' for river-transported nutrients. Their ability to retain nutrient loads in oxbow lake water varies in time and results from a great diversity of ways, manners, and sources of supply. Interactions between oxbow and the river, resulting from hydrological regime, connectivity and lake morphology, play an important role in the nitrogen dynamics and distribution.

The aim of the study was to show the differences in nitrogen cycling in lowland floodplain lakes located in temperate climate zone, differed by hydrological connectivity. Based on the data from 33 oxbows along the Slupia, Lyna, Drweca and Biebrza rivers (N Poland) from the years 2002–2011, we found longitudinal and vertical gradients in TIN concentrations related to hydrological conditions. The seasonal dynamics of the nutrients was related to the water exchange affected by flow regime

and a phase of vegetation development and water aeration. The direct input of N-rich river-water to the floodplain lakes leads to the deterioration of their trophic status. In lotic environments, the inflows as well as outflows are important sites for the transformation of nitrogen. In order to stop the development of water eutrophication and to restore the lakes to reasonably healthy conditions, both the external and internal loading has to be reduced.

Keywords: *Nitrogen; oxbow lake; river floodplains;*

P14

Studies on Pannonian loess steppe regeneration through old field succession in the Csanadi-hat region (SE Hungary)

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Currently, transformation of old fields into grasslands is receiving increased attention. We established a long-term project on a strictly protected area in order to study the spontaneous old field succession influenced by the adjacent natural loess meadow (Kis-gulya steppe reservation near to Battonya). The project aims at exploring how the species composition of natural grassland effects on the manner and speed of secondary succession. Temporal changes of species composition and the degree of the loess meadow regeneration will be monitored annually. In the abandoned field 13, while in the meadow 4 large permanent quadrats (1000 m^2) were established with an arrangement of nested subplots of various sizes. Spatio-temporal pattern development will be monitored with four permanent 52 m long transects of units of 5 × 5 cm contiguous microquadrats. Our preliminary analyses show that the quality (naturalness) of the loess steppe of high species richness (cca. 280) was very close to the dynamically stabile, well-organized loess grasslands known from other regions of Hungary. In the abandoned field the most frequent species (*Sinapis arvensis*,*Triticum aestivum*, *Silybum marianum* in 2010 and *Tripleurospermum perforatum*, *Cirsium arvense*, *Sonchus asper* in 2011) were similar to the early old field successions in the neighbourhood. The total number of species (cca. 205) was much higher compared to the well-known old field experiences and several native specialists have already occurred. In one part of the old field seeds were sown in 2011 and vegetative transplanting of some species is also planned.

Keywords: *old field; succession; Pannonian loess steppe; abandoned field; Hungary;*

P15

Kurgan as a source of diaspores in the recovery of steppe vegetation

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Kurgans (dome-shaped burial mounds) in SE-Europe were erected by ancient nomadic tribes. Nowadays, when 80–90 % of the Ukrainian steppe has been ploughed, kurgans are located among large fields. Earlier research showed that the vegetation of 25 % of Ukrainian kurgans was well preserved. The aim of our research was to assess the role of kurgans as a source of diaspores in the restoration of the steppe on abandoned fields. The study was conducted in an orchard abandoned 10 years ago, which was located in the vicinity of a kurgan (70 km NE Kherson, Ukraine), in the Pontic grass steppe zone. We mapped the distribution of steppe plant species within a 5 × 5m grid squares covering an area of 4.800 m^2 bordering the kurgan. Within each square we recorded the occurrence and abundance of all species. We confirmed the occurrence of 29 steppe species (half of all target species present on the kurgan). We tested the correlation between the cover of target species and the distance from the kurgan as well as the relationship between average distance and prevailing way of dispersal of these species. The plots in the immediate vicinity of the kurgan supported the highest number of rare steppe species. Some anemochorous species also occurred far away from kurgan; even the valuable non-anemochorous species were able to spread from the barrow in a relatively short time. Our research confirmed the expansion of the steppe species from kurgan steppe flora expansion from refuges on kurgans and indicated their possible role in the steppe restoration.

Keywords: *steppe vegetation; kurgan; near-natural restoration;*

P16

Vegetation and management of standing wetlands: the case of fishponds in SE-Styria, Austria

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Standing wetlands are one of the most vulnerable habitat types in the European Union. In the former Austro-Hungarian Empire, fishponds were used to supply the local population with freshwater fish. Today, they are a crucial habitat type that faces threats due to changing land use regimes. In this project, we carried out fieldwork in the wetlands of the Natura 2000 site "Lafnitztal – Neudauer Teiche" in southeastern Styria, Austria. Particular objectives of this regional study are to 1) identify habitat types and plants of high conservation interest (listed under the EU Council Directive 92/43/EEC) based on 217 vegetation releves, 2) detect main threats, and 3) propose a management plan that ensures a favourable conservation status of the habitats. In the studied area we have identified two habitat types listed in Annex I of the Habitats Directive: "Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojuncetea" (habitat code 3130) and "Natural eutrophic lakes with Magnopotamion- or Hydrocharition-type vegetation" (3150). Eutrophication is the biggest threat

to both habitat types, in the area. Consequently, we propose that reducing eutrophication should be a management priority. Specifically, we suggest the following actions that are in line with the EU Council Directive 1) transforming nearby crop field to grasslands, 2) reducing soil erosion by maintaining the integrity of receiving waters, and 3) abandoning any forms of intense fish farming. Further actions beyond the recommendations of the Directive are biomass harvesting and, as a more radical and costly intervention, sediment excavation.

Keywords: *wetlands; ponds; management; Habitats Directive; eutrophication;*

P17

Restoring boreal forest ecosystems in the light of climate change

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High latitude ecosystems in the northern hemisphere are particularly susceptible to changes in climatic regimes. Within these regions, ongoing intensive forestry has significantly altered boreal forest ecosystems, and continues to do so, which is amongst others illustrated by reduced species diversity. To mitigate such negative effects, habitat restoration has frequently been implemented. However, future changes in the geographic distribution of species will alter community composition and biotic interactions, which in turn might render current efforts to restore habitat ineffective. In addition, different climatic conditions will likely also have an impact on disturbances such as the frequency of forest fires, the level of windthrow, and pest infestations as well as on management practises. We simulate the effect of future climate change, disturbances and different management and restoration practices on boreal forest ecosystems in Sweden, using a forest landscape simulation model called LANDIS-II. We show the effect of different levels of mitigation which might be needed to reduce negative effects of future climate change on species inhabiting boreal forests.

Keywords: *boreal forests; climate change; forest landscape simulation model; species diversity; forest restoration;*

P18

Designing a large-scale experiment concerning the restoration of pure pine stands

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Resulting from a historically intensive timber production, vast forest areas in Germany and Central Europe are dominated by even-aged pine monocultures, including a large portion of the natural heritage forests administered by the Deutsche Bundesstiftung Umwelt (DBU). Due to climatic changes and heightened demands regarding the provision of forest ecosystem services, particularly even-aged monocultures are associated with increasing risks, resulting in an amplification of forest management uncertainties. Many forest owners therefore strategically aim for a higher degree of naturalness to improve forest stability and elasticity.

However, this issue has not yet been the subject of systematic scientific investigations in the respective region. The present project will design for a large-scale experiment in pine monocultures documenting the long-term effects of different restoration measures. The initiation and spatial arrangement of the restoration measures must 1) be spatially variable, 2) accommodate stochastic natural processes, and 3) be open with respect to the final outcome. In this context, the DBU offers several thousand hectares of potential research sites.

The project is structured into three work packages:

(1) *Literature review, study visits and analysis of existing large-scale forest ecology and restoration experiments*; resulting in a methodological overview and the subsequent definition of site selection criteria.

(2) *Compilation of existing spatial data and on-site evaluation of site suitability*; where suitable field sites are pre-selected based on available data and maps.

(3) *Final concept for a large-scale restoration experiment*; containing a site-specific study design, a conceptual design of initial and follow-up inventories and a supporting scientific programme.

Keywords: *Scots pine; restoration experiment; experimental succession; forest ecology;*

P19

Conservation of top predator in intensively utilised agricultural landscape

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The Little Owl (*Athene noctua*), top predator once widespread in the rural landscapes of Europe, has shown a substantial decline in many European countries. The causes of population decline are linked to intensification in agriculture resulting in reduced productivity induced by energetic constraints after egg-laying. For the species conservation, it is crucial to restore and maintain suitable hunting habitats to enhance prey availability during breeding season.

Our study tested the effectiveness of restoration of intensive/extensive pastures and meadows to support the population of Little Owl in Denmark. Ten individuals, provided with restored habitat types with different management adjacent to the nest were followed by radio transmitters during the breeding season of 2011. We tested the effect of habitat type, vegetation height/density and the distance of the restored habitat from the active nest on the habitat preference by owls and the intensity of its utilisation for hunting.

Little Owls preferred meadows mown more times per year in comparison to pastures. They also preferred to hunt on extensively grazed pastures in comparison to intensive pastures. These preferences reflect the availability of main prey determined in pit-fall traps. Little Owls hunted only in the distance up to 400 m from the nest, if suitable habitats were available. The habitat restoration measures, ensuring natural prey availability and accessibility adjacent to nest have positive effect on reproductive parameters and activity of Little Owls. We recommend restoration of meadows and extensive pastures within 400 m from the nest as the effective measure to support the population of Little Owl.

Keywords: *Little Owl; restoration; habitat use; conservation; hunting preferences;*

P20

Nucleating technique used for ecological restoration in the semiarid region of Brazil

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Human activities and natural events have caused enormous damage to the Caatinga, biome that covers most of the semiarid region of northeastern Brazil, which completely justifies the use of nucleation which will promote “ecological triggers” for the formation of stable communities. This study investigated the efficiency of nucleation procedures for environmental restoration in degraded areas. The technique, called Bocaj, consisted of opening of a set of holes, spaced 0.2 m from each other, with 0.15 m diameter and 0.2 m depth which were filled with soil + litter which came from a Caatinga area. The experimental design was characterized by the opening of 15 sets of 20 holes in three parallel transects, the Center for Desertification of Serido, located in the semiarid of Paraiba, Brazil, in November 2011. The monitoring of the experiment for data collection was done every 15 days. The species that established in the pits were recorded and identified. After five months, it was found that seed germination occurred in 93.3 % of the pits. The main species that germinated were *Aristida setifolia* H.B.K. – Poaceae; *Sida cordifolia* (L.) – Malvaceae; *Alternanthera brasiliana* L. Kuntze – Amaranthaceae; *Desmanthus virgatus* (L.) Wild – Leguminosae; *Centrosema rotundifolium* Mart. ex Benth – Fabaceae (Faboideae) and *Hyptis suaveolens* Salzm – Lamiaceae. The existing moisture in the pits from the mixture of soil + litter was essential for seed germination. The Bocaj technique exerted a nucleating function and its implementation is recommended.

Keywords: *nucleation; Bocaj technique; Desertification; Aristida setifolia; Centrosema rotundifolium;*

P21

Carbon Stock in Different faces of the Caatinga in Paraiba, Brazil

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The Caatinga can be a significant deposit of carbon that is still little known and explored. In areas of caatinga vegetation the behavior of the understory is marked by the presence of ephemeral species that complete their phenological cycle within 45 days after the beginning of the rains. The present study aimed to determine the amount of organic carbon in an area of Caatinga in different successional stages in the semiarid of Paraiba, the chamber understory. The study was carried out at Cachoeira de Sao Porfirio farm, in the city of Varzea, Paraiba, Brazil. Four areas were selected each measuring 3000 m^2, with vegetation in different successional stages: an area with degraded pasture, Initial Secondary Caatinga, Late Secondary Caatinga and Preserved Caatinga. In each of the different successional stages three parcels of 20.0 m × 50.0 m were installed in which the collection of data were made from samples of understory (herbaceous stage) using PVC frame in two seasons (rainy and dry). The experimental design was completely randomized with factorial arrangement 2 × 4 (two seasons and four areas), with 15 repetitions. There was no significant difference in the factors (seasons and areas) when analyzed individually, but their interaction was significant. Higher concentrations of organic carbon were found in the Preserved Caatinga; for the understory, the area of Initial Secondary Caatinga was the one with the higher carbon content in the rainy season, while in the area of Late Secondary Caatinga showed the highest values in the dry season.

Keywords: *organic carbon; degraded pasture; herbaceous stage;*

P22

Characterization of soil mesofauna in area under forest restoration in semiarid Brazil

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The mesofauna soil consisting of mites, springtails, some groups of myriapods, arachnids, several insect orders, oligochaetes and some crustaceans, is highly dependent on soil moisture, with terrestrials. This study aimed to evaluate the distribution of mesofauna soil in the semi-arid region of Paraiba, Brazil. The experiment was conducted in the city of Varzea, between September/2011 and March/2012. Three transects were demarcated in which soil samples were collected with the help of metal rings with 5.2 cm and 4.8 cm in diameter for the extraction of mesofauna soil using Berlese-Tullgren apparatus. The samples were then conducted to the laboratory and exposed to light, the apparatus, for 96 hours. The mesofauna was identified with a 40× binocular lens. In the evaluation of the mesofauna environmental performance the total number of individuals were mesuared,being the wealth of organisms measured by the Shannon diversity index and Pielou evenness. During the experimental period 60 individuals were taken and divided into eight groups. The Acarina group, due to its higher number of individuals, may be tough and perfectly adapted to conditions of high temperatures and large variations in local water system, and therefore considered dominant species. The groups Collembola and Hymenoptera can be considered intermediate. The other groups (Diplura, Isoptera, Pseudoscorpionida, Aranea), despite the small number of individuals are important in regulating the flow of internal energy of the caatinga. The lowest values of Shannon and evenness were obtained for groups Acarina, Collembola, and Hymenoptera, indicating a higher density.

Keywords: *Berlese-Tullgren apparatus; Shannon index; Pielou index; caatinga vegetation;*

P23

Changes of species-rich meadows in the Ojcow National Park (southern Poland) during 50 years

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The Ojcow National Park was established in 1956. In this time valley bottoms in the park were dominated by species-rich meadows (association *Arrhenatheretum elatioris*) which were managed by traditional methods, including mowing twice a year, extensive grazing after the hay-harvest and regular manuring with cow dung. Changes in management practices connected with park establishment and agriculture transformations led to changes in species richness and composition of meadow communities. The main questions were how meadows vegetation changed due to different management practices and whether active protection i.e. regular mowing could help in restoration of *Arrhenatheretum*. The vegetation in 20 semi-permanent plots was recorded using Braun-Blanquet method. Phytosociological releves were made three times: in 1958–60 then in 1986—87 and 2011–12. Data comparison shows that those parts where vegetation is still mowed with hay-making and fertilized with mineral compounds represent impoverished stands of *Arrhanatheretum* as in 1980s. In those plots where mowing was abandoned *Urtica dioica-Cirsium oleraceum* community developed. In sites abandoned since ca. 5 decades tree seedlings and saplings have also appeared. At those plots where active protection was conducted, the number of meadow species is higher than in 1980s, when they were used irregularly. Nevertheless *Urtica dioica* and *Cirsium oleraceum* still exist there, although with lower abundance. The study provides strong evidence that regular mowing with hay removal is decisive factor in process of fresh hay meadow restoration. Despite that it seems that former species richness will not be recovered because of plant dispersal limitation in contemporary landscape.

Keywords: *Arrhenatheretum elatioris; active protection; regular mowing; southern Poland;*

P24

Effects of carbon addition on plant productivity and establishment of target species in newly established perennial field margins

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An increasingly intensive use of European agricultural landscapes led to the loss of flower- and species-rich field margins and perennial fringe communities. In the project “ProSaum” species-rich perennial field margins are restored by seeding of native seed mixtures. Earlier studies in grasslands had shown that the dominance of grasses and other non-target species can be reduced by nitrogen immobilization induced by carbon addition. In 2011 we started two experiments in order to test the effects of carbon addition on the establishment of target species. We hypothesized that the addition of a mixture of sugar and sawdust would reduce the cover and phytomass of dominant grasses (e.g. *Elymus repens*) and would have a positive effect on the establishment of target species introduced by seeding.

Experiment A was conducted in a field margin established by seeding in autumn 2010. The effects of carbon addition (1282,05 g/m^2) and mowing were tested in 2011. In experiment B, two different carbon treatments (1282,05 g/m^2 and 2564,10 g/m^2) were carried out during the soil preparation directly before seeding in April 2011.

First results show that carbon addition had a significantly negative effect on aboveground phytomass in both experiments. In experiment B, the cover of bare soil was significantly higher on plots with high carbon addition than on control plots. In both experiments, however, carbon addition led to a significant decrease of the number of target species in summer 2011. Vegetation analyses will be continued in 2012 to study long-term effects of carbon addition on the establishment of target species.

Keywords: *carbon addition; nitrogen immobilization; target species; field margin;*

P25

Catalogue of biotopes with prevailing non-productive features

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A catalogue of biotopes with prevailing non-productive features (mainly their role in nature protection) has been designed in order to implement principles of ecological restoration into restoration concepts in designing new landscapes after brown coal surface mining. The catalogue includes 37 biotopes sorted into four groups according to four basic land reclamation types: forest, agricultural, aquatic and others. For each biotope, a description is provided including its features and purpose, the principles of its establishment, its recommended management, and its nature-protection value, enriched with some illustrating photographs.

Forest stands should be thinned out by creating more open stands, grassy areas, areas with spontaneous development, and forest ecotones. Concerning agricultural reclamation, biotopes providing shelter for various kinds of animal species (scattered vegetation such as hedgerows, shrub belts, avenues of trees, solitary trees, and groves, but also fallow land and small-sized wetlands) need to be implemented. Newly established water bodies should be featured with a natural-looking appearance, banks with a gradual slope, a wide littoral zone, and a great number of interconnected wetlands, wet meadows, or periodically flooded pools. Among other interesting biotopes are those that have developed on sites where no technical operations were carried out. They include halophytic habitats, wet surface depressions appearing due to terrain consolidation on the top, or at the foot of a spoil bank, and spontaneously developing xerothermic biotopes of forest-steppe like vegetation. Finally, there are some special shelter installations or hiding places for invertebrates, reptiles, mammals, and birds.

Keywords: *mining; biotope; restoration; biodiversity;*

P26

Spontaneous grassland recovery in extensively managed alfalfa fields

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Spontaneous succession in lack of restoration-focused case studies is often underappreciated in restoration; however it is a cost-effective alternative without active intervention. We studied the regeneration of loess grasslands in extensively managed (mown twice a year) lucerne fields using space for time substitutions in Hortobagy, East-Hungary. In our study we addressed the following questions: (i) How effective is lucerne in weed control? (ii) What are the temporal dynamics of the disappearance of lucerne? (iii) How fast is the recovery of grasslands in extensively managed lucerne fields? With the increasing age of fields, the cover of lucerne decreased (from 75.2 % to 2.2 %), and the cover of perennial graminoids increased (from 0.5 to 50.2 %). Mean total cover showed no significant differences between the age groups (mean cover >77 % in every age groups). No weed dominated stages were detected during the spontaneous grassland recovery in lucerne fields, the cover of weeds was low (<10 %) in all studied age groups. As the age of fields increased, no litter accumulation and no changes of mean total biomass were observed. We found that the recovery of basic loess grassland vegetation is possible within 10 years, but not the complete recovery of the characteristic species pool. We identified several advantages compared to technical reclamation: no early weed dominated stages and litter accumulation was found and only little cost can be expected. However, the recovery of species rich loess grasslands further management (e.g. propagule transfer by hay and/or moderate grazing) is required.

Keywords: *Medicago sativa; old-field; secondary succession; space for time substitution; weed control;*

P27

Restoration of natural dynamics by topsoil removal in Elymus-dominated Wadden-Sea saltmarshes

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After the establishment of the “Wadden Sea National Park of Lower Saxony” in 1986, grazing abandonment and the presence of an artificial drainage system led to the dominance of *Elymus athericus* in some areas of the Ostheller salt marsh of the island Norderney. In 2008, a restoration project was started as compensation measure for building works due to cable laying for the offshore wind park “Alpha Ventus”. At an area of 8.5 ha *Elymus athericus* stands with 20 cm topsoil were removed. The soil material was used to fill artificial ditches and a large tidal creek, which had shown increasing backward-erosion towards the island.

Elevation measurements and vegetation analyses were carried out on restoration plots and reference plots in 2008 and 2010. The results showed that the creation of wetter conditions by lowering of the soil surface and filling of ditches was successful. Inundation frequency increased due to the restoration measures. As expected, the topsoil removal plots were colonized by pioneer species as *Salicorna europaea* or *Suaeda maritima* followed by low-marsh species (e.g. *Puccinellia maritima, Aster tripolium*). Future monitoring will show if the rewetting will be strong enough to affect the remaining *Elymus* stands at adjacent sites without topsoil removal.

P28

The potential of Unmanned Aerial Vehicles as innovative sensor platforms to support restoration monitoring in cut-over bogs

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Restoration of peat bog ecosystems is a long-lasting process taking decades to centuries, if even possible. Monitoring during the entire process is a crucial component of successful restoration. Traditionally this monitoring is performed with labour intensive field sampling methods, which is additionally hampered by difficult access due to the rewetting of the restoration sites. Consequently, in the last decade remote sensing monitoring approaches increasingly attract attention. Here, we used autonomously flying Quadrocopters, supplied with either a panchromatic or colour NIR calibrated small frame digital camera to generate high resolution images of a restored bog. Based on ground truth data derived from field observations, we exemplarily performed a semi-automatic object orientated classification process using reflectance, geometry and texture features. A setup of implemented decision rules supported the classification of units relevant for the restoration of cut-over bogs such as open water bodies, *Sphagnum cuspidatum* lawns, *Eriophorum vaginatum* hummocks, and *Betula pubescens* individuals. The applied classification exhibited an accuracy of more than 90 % demonstrating the future potential of UAV-based NIR remote sensing for the monitoring of restored cutover bogs which might include the partly replacement of laborious field surveys particularly in inaccessible terrain. Based on our results we conclude, that quadrocopter-like UAV's will play a significant role in future ecological monitoring studies, since they are small sized, non-emissive, available at comparatively low cost, highly flexible, are easy to handle and provide vertical take off/landing and a standstill stage during data.

Keywords: *remote sensing; near-infrared imagery; Sphagnum; Eriophorum; spatial resolution;*

P29

Human pressure on mangrove forests in Southwest Iran

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The mangrove ecosystem is a complex of various inter-related elements in the land sea interface zone which is linked with other natural systems of the coastal region such as corals, sea grass, coastal fisheries and beach vegetation. It is a very productive ecosystem sustaining various forms of life. Its waters are nursery grounds for fish, crustacean and mollusk and also provide habitat for a wide range of aquatic life, while the land supports a rich and diverse flora and fauna. Prolongation of critical conditions in the Persian Gulf has endangered its aquatic ecosystem. Water purification equipment, refineries, wastewater emitted by onshore installations, especially petrochemical plans, urban sewage, population density and extensive oil operations are factors contaminating the Persian Gulf waters. Illegal discharges by tankers of crude and fuel oil wastes remain the most serious marine pollution problem. Beach tar oil is widespread, often in high concentrations throughout the region, however, the low levels are generally found in the water column and biota due to rapid break down resulting from intense solar radiation and high summer temperatures. Population density has been the major cause of pollution and environmental degradation. Pollution may cause the mortality of mangrove forests by affect on root, leaf and soil of the area. Study was showed high correlation between industrial pollution and mangrove health and increase of population, coupled with economic growth, inevitably caused the use of mangrove lands for various purposes such as construction of roads, ports and harbors, industries and urbanization.

Keywords: *Mangrove forest; Pollution; Persian Gulf; Population; Environment;*

P30

An overview to forest and forest policy of Iranian dry lands

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Most of Iran is located in the Pala-arctic realm and is considered the center of origin of many genetic resources of the world; include many original strains of commercially valuable plant species such as wheat, medicinal and aromatic species. The Southwest of the country has some Afro-tropical features, while the Southeast has some species from the Indo-Malayan sub-tropical realm. Arid and semi-arid regions of the interior and far south, which are characterized by long, warm and dry periods, cover about 90 % of the country. The annual precipitation rate in such regions varies between 30 and 250 mm. Dry land area is the total terrestrial area falling within three of the world's six aridity zones–the arid, semi-arid, and dry sub-humid zones. These areas are especially vulnerable to land degradation. The ratio of average precipitation to average evapotranspiration-called the aridity index- is between 0.05 and 0.65 in Iranian dry lands. High priority in national forest programs give to the rehabilitation and sustainable management of forests and trees in environmentally critical areas, recognizing the linkage between forest

protection and sustainable development and improving the coordination among such policies and programs. In the national forest policy and forest protection strategies, priority has been given to rehabilitation and sustainable forest management of environmentally critical areas. It is believed that sustainable forestry is necessary for sustainable development. To achieve this goal, several cross-sectoral measures have taken with other organizations such as meteorological organization, ministry of energy, department of environment and agriculture sector.

Keywords: *Forest; Dry land; Sustainable; Environment; Policy;*

P31

Ants as eco-engineers in natural restoration of human made habitats

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Three dominant seed-transporting ant species of different size categories (Tetramorium caespitum, Lasius niger, Formica pratensis) on the plateau of abandoned ore sedimentation basin were studied as pioneer colonizers of this industrial waste deposit from the viewpoint of their functioning in plant seed dispersal. Long-term monitoring of this locality among similar others in the Czech Republic (Kovar 2004) started in the year of its origin after the water releasing and/or its abandonment without any kind of reclamation (1975). Seed removal experiments by ants with plant species found in close vicinity of tailings were aimed at comparative study of two periods within continuing stand succession: the first one in 1998–2000 and the second one in 2011–2012. Vegetation shift after this temporal extent is possible to describe as the change from mostly open substrate with mosaic vegetation of mosses, lichens, small number of herb species and some seedlings of pioneer trees towards more structured mosaics of herb, shrubby or woody stands with relatively tall (5 m) deciduous dominants. Increasing plant species diversity is documented on places occupied by ant nests of distinct density and illustrated with the species-area curves different from places without ant presence. Coincidence of selected substrate parameters with biodiversity of both compared plots suggests the important role of ants as eco-engineers in natural restoration of human-made habitats.

Keywords: *abandoned tailings; ants; seed dispersal; facilitation; primary succession;*

P32

Forest ecosystem development on reclaimed oil shale mining areas in Estonia

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Opencast oil shale mining creates significant areas of degraded land that requires reclamation. Afforestation is a suitable and sustainable reclamation option for post-mining landscapes. Black alder, silver birch and Scots pine stands (1–40-year-old) on reclaimed mining area were investigated with aims to analyse the growth, biomass, nutrient concentration and fine root morphological adaptations in relation to the tree species and stand development, and to assess the suitability of studied species for the reclamation of post-mining areas. Among the studied young plantations, black alder had the highest survival, growth and biomass compared to silver birch and Scots pine. Scots pine allocated more biomass into leaves and fine roots than deciduous species. The lower leaf/fine root biomass ratio was in proportion to better survival of seedlings; the lowest and highest values were found for black alder and silver birch, respectively. Soil pH decreased and soil N concentration increased with stand age. Different strategies of short root morphological adaptations were observed in coniferous and deciduous tree species on the post-mining area. For Scots pine, extensive building of a fine root system was inherent, whereas deciduous trees improved mineral nutrition more by morphological adaptations of fine roots. As to the early development of stands, black alder was best adapted to the harsh conditions of the post-mining substrate; it was efficient in nutrient assimilation and produced a high biomass. Considering the ecological and economic aspects, it can be suggested planting more black alder or mixed stands for the reclamation of post-mining areas.

Keywords: *post-mining reclamation; biomass production; fine root morphology; nutrient accumulation;*

P33

Forest ecosystems respond to changing water regime in Aidu exhausted opencast oil shale quarry in Estonia

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The disturbance to the existing ecosystem on opencast mining is overwhelming on all different ecological scales: species, ecosystem and landscape level. The novel conditions are created in bedrock, in vegetation establishment and in habitats distribution on landscape level. For ecological restoration afforestation with Scots pine have been used in these areas since early 1960s. Scots pine has proven to have highest adaptation abilities for afforestation of these novel calcareous sites and has shown comparable growth results as growing on fertile mineral soil. During the mining the water is extracted from mining pit, on Aidu quarry the ground- and rainwater has been continuously extracted. On 2012 the water extraction is going to be stopped in the exhausted and afforested areas. Leaving area to a gradually changing water table in the next coming years.

For following the effect of changing water regime and forest ecosystem respond we have set up a network of permanent monitoring plots in the area. We hypothesize: 1) Scots pine and Silver birch dominated stands are able to adapt with the sudden changes in water regime; 2) the adaptation period is different for stands with different age and the younger stands will have vastly shorter adaptation period; 3) the stress effect to tree growth is essentially traced best in the trees annual height growth; 4) long-term effect of water regime changes is observable in ground layer vegetation and tree layer species composition change.

The study includes a complex monitoring of changes in: 1) forest stand level (studies of stand structure and species composition, individual competition and annual height growth); 2) ground layer vegetation (studies on moss, grass and shrub layer species and abundance on subplots on each of the monitoring plots); 3) soil (studies of soil structure change, soil organic layer development and recordings of soil texture, pH, contents of K, P, N organic C and total C); 4) groundwater table (groundwater level fluxes).

Keywords: *forest ecosystem adaptation; afforestation; Scots pine; groundwater table;*

P34

Vegetation change in response to grazing exclusion in montane grasslands, Argentina

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Montane grasslands in the Southern Pampas of Argentina are expected to show a high potential for recovery after heavy grazing due to their evolutionary history in the presence of large herbivores and their high productivity. Biodiversity in the area is mostly preserved through landscape heterogeneity (e.g. rocky outcrops, different altitude and exposition), but grassland recovery is necessary to avoid erosion and maintain ecosystem functionality. The objective of this work is to compare plant diversity, biomass and botanical composition among grazed and non-grazed areas at different times following grazing exclusion. Vegetation was assessed on exclosures established in 2006 and on nearby areas open to grazing by feral horses in December 2006, 2007, 2008 and 2009. In 2009 we added 15 year old exclosures to the analysis. Species richness declined 24 months after grazing exclusion, mainly due to a decrease in the abundance of forb species. Above-ground biomass showed a 3-fold increase 12 months after grazing exclusion. After three years of grazing exclusion, species richness and biomass were similar to those corresponding to older exclosures (15 years old). The composition of plant communities also changed following horse exclusion, with three and 15 years old exclosures dominated by perennial grasses typical of late seral stages. Our results support the hypothesis that montane grasslands in the Southern Pampas of Argentina may recover fast from grazing by large herbivores without application of specific restoration techniques.

Keywords: *feral horses; grassland diversity; grassland recovery; Pampas grasslands; South-America;*

P35

Bioaccumulation of heavy metals in the soil macrofauna, needles and bark of Pinus sylvestris L. in relation to total metal concentrations in soil

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The results of researches with the use of accumulative bio- indicators can provide important information on the environmental degradation of different branches of the industry as well as of environmental processes. In the presented paper 25- year old Scots pine needles, necrotic pine bark, topsoil (to 10 cm deep) from pine's surroundings and soil macrofauna living there were used as the accumulative indicators. The area examined is situated 1900 m from Aluminium-works and 2500 m from Power plant. Comparing the soil heavy metals (Pb, Cd and Ni) content with that of macrofauna extracted from the soil and with pine needles on the test site, there was significantly higher content in the body of macrofauna. In macrofauna community (which density, diversity and trophic structure were analysed) the biggest number of predators was detected. The heavy metals accumulated in larger amounts in the body of soil predators than in saprophages and phitophages. In comparison with soil in the body of predators was observed particularly high (dozen or so times higher) content of Cd, whereas the content of Ni was more than two times higher and the content of Pb only 1,3 times higher. In the bark the lowest content of the heavy metals was noted. The comparative use of different indicators is crucial for the evaluation of contamination of the environment and can lead to solutions concerning environmental restoration.

Keywords: *Pb, Cd, Ni; topsoil; soil macrofauna;*

P36

Landfill restoration for grassland biodiversity

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There are approximately 2,200 working landfill sites in England and Wales, covering 28,000 ha and they are closing at a rate of about 100 sites per year. This represents a significant land holding which could have the potential to play a role in grassland restoration in the UK. (The Grassland Trust estimates that there are only around 100,000 ha of semi-natural, unimproved grassland remaining in England and Wales).

The University of Northampton recently investigated the potential of restored landfill sites to support biodiversity focussing on plants, birds, carabids, and pollinating insects by comparing restored grassland on landfill sites to similar habitat on paired reference sites of recognised conservation value. The key findings of this research were that, although there were differences in species composition, there were no significant differences in species richness between restored landfill and conservation sites for most taxa/groups analysed. Moreover landfill sites were found to have a higher species richness for hoverflies, provided rich and abundant floral resources for pollinators, and also provided nesting habitat for UK Red List grassland bird species such as skylark *Alauda arvensis*, grey partridge *Perdix perdix*, lapwing *Vanellus vanellus*, tree sparrow, *Passer montanus*, and starling *Sturnus vulgaris*.

Keywords: *Landfill; biodiversity; restoration;*

P37

Experimental top soil removal on Pannonian halophytic vegetation along salinity gradient

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Changes in the land-use (drainage, ploughing of natural grasslands, abandonment) in the 1960-ties caused heavy degradation of the inland halophytic vegetation of the Pannonian lowland, mainly in its marginal parts. Restoration of these saline habitats is highly required. The effect of top soil removal was tested by 3-year small-scale manipulated experiment in SW Slovakia (Kameninske slanisko Nature Reserve). Top soil was removed in three contrasting types of vegetation with different salinity levels (i.e. different levels of habitat degradation): *Artemisia santonicum*-type (ARSA), *Festuca pseudovina*-type (FEPS) and *Arrhenatherum elatius*-type (AREL). The data were analysed by multi-way ANOVA and by multivariate methods (DCA, RDA). Species richness in the scale 10 × 10 cm decreased significantly after removal and proportion of halophytes on overall species richness increased significantly in two types with the highest soil salinity. But total number of halophytes was not influenced by the soil removal. The treatment resulted significant change on the plots with the highest salinity (ARSA) where the succession has been notably inhibited. The effect of the removal was short-time in the type with moderate salinity (FEPS) and on heavily degraded stands (AREL) the removal stimulated further recruitment of ruderal species. Top soil removal seems to have limited potential for preserving saline and alkaline habitats and it is recommended to combine with extensive grazing and to apply only on moderately degraded vegetation with the presence of the target species propagules in the adjacent stands.

Keywords: *salinity; halophytes; degradation; top soil removal; Slovakia;*

P38

Planting three dominant native species in an urban forest for ecological restoration purposes

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Forest remnants in fragmented landscapes tend to be smaller, isolated and irregularly shaped, increasing the edge effects, which presumably have detrimental consequences for the organisms that remain in them. However, edges may represent areas where conditions are less drastic than open sites for plant establishment. The aim of this study was to evaluate the effects of forest edge and open areas on the growth and survival of three dominant native species (*Quercus rugosa, Crataegus mexicana and Prunus serotina* subsp*. capuli*) of the Barranca de Tarango, Mexico City, in order to determine the most suitable areas for their establishment in future restoration programs. These species were selected because of their native origin and their potential for ecological restoration. Within each site 240 individuals of these species were planted at different densities (480 in total). Both, the forest edge and the open area were characterized by environmental variables (temperature and relative humidity, soil profiles and light incidence). One year after the plantation, survival of the three species was lower in the open area (12.9 %) compared to the forest edge (17.5 %). *C. mexicana* showed the highest survival followed by *Q. rugosa* and *Prunus serotina* subsp*. capuli*. Survival of the individuals of these species was severely affected by the construction of an urban highway in the area. So far, no significant differences in individual growth were found between areas. In general, the forest edge has more appropriate characteristics for plant establishment; also, any of these species can be used in restoration projects.

Keywords: *Forest edge, open area, urban forest; urban forest restoration, native species;*

P39

Study of a ravine in Mexico City: a proposal for its ecological restoration

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Changes in land use, particularly intense during the last 50 years, have transformed woodlands, agricultural and livestock farming areas of Mexico City into industrial and urban developments. The reservoir for forest and stream ecosystems occurs potentially in ravines of the southwestern part of the city. This study was planned to develop a restoration program for recovering native forests that provide ecosystem services, particularly 70 % of the water supply for the city. The study was carried out in one of these ravines (Barranca de Tarango) and comprises: a) an account of its soil characteristics, b) a description of the structure and floristic composition of the remaining forest, c) an estimation of its diversity, and d) the preparation of maps by means of geographic information systems (GIS). We found 20 families with 33 genera and 43 species. Among the tree species useful for restoration programs we found several species of *Quercus*, *Crataegus mexicana* and *Prunus serotina*, and various species

of shrubs (*i.e. Baccharis conferta*, *Eysenhardtia polystachya*) and herbs (*i.e. Salvia mexicana*, *Bouvardia ternifolia, Loeselia mexicana*). Soils in the study area do not show any nutrient limitation for vegetation development. GIS data layers (soils, geomorphology, altitude, slope orientation, vegetation, etc.) produced four sets of areas for restoration purposes. The species to be introduced, the procedures to be followed and the actions that must be taken are suggested for each area. A multi criteria evaluation showed that 10 % of the total area (270 has) exhibit the best characteristics for a successful restoration program.

Keywords: *ravine; Quercus spp.; multicriteria; GIS;*

P40

Effect of litter thickness on seedling establishment: an indoor experiment with short-lived Brassicaceae species

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Recruitment by seeds is essential both in vegetation dynamics and in supporting biodiversity in grasslands. The recruitment by seeds is feasible in suitable vegetation gaps by the seed rain and/or by establishment from persistent soil seed banks. Cessation of grassland management results in litter accumulation, which leads to the decrease of species diversity by decreased availability of open patches. It is generally concluded, that thin litter layer is often beneficial, while thick litter layer detrimental for germination and seedling establishment of short-lived species. However studies on the magnitude of these effects on germination and seedling establishment in relation to litter thickness and seed attributes (i.e. seed mass) are scarce. This motivated a designed indoor experiment to explore the effect of litter on seedling establishment. We germinated six short-lived Brassicaceae species (*Arabidopsis thaliana, Capsella bursa-pastoris, Descurainia sophia, Erophila verna, Lepidium campestre, Lepidium perfoliatum*) with different seed mass using increasing amounts of litter. We found that both seed mass and litter had significant effect on germination and establishment of the sown species. Small-seeded species were negatively affected by thick litter layer (300 and 600 g/m^2). No negative litter effect was detected for species with high seed masses (*Lepidium* spp.). Our results suggest that suppression by litter on the germination and seedling establishment is less feasible for large seeded short-lived species than for small seeded ones.

Keywords: *Cruciferae; seed size; litter accumulation; weed control; biodiversity;*

P41

Establishing of ex-situ basis for in-situ re-introduction of several endangered species of georgia's flora

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The present work deals with rare, endangered plant species, Georgian/Caucasian endemics of limited local distribution which are included in the Red Data List of Georgia (2009): Campanula raddeana Trautv., Gymnospermium smirnovii (Trautv.) Takht., Fritillaria caucasica Adam, Paeonia caucasica (Schipcz)Schipcz., Satureja bzybica Woronow, Tulipa biebersteiniana Schult.&Schult.f., Tulipa eichleri Regel, Iris colchica Kem.-Nath., Lilium caucasicum (Miscz.)Grossh. and Lilium kesselringianum Miscz. Self-reproduction capacity - ability for propagation by seeds, actual and potential seed formation capacities, percent of seeds' germination and sprouting and also seedlings' development were studied. The following conservation works have been accomplished: seed bank of target species was established and deposited to the Caucasus Regional Seed Bank. Seed collections were duplicated to the MSB, Royal Botanic Gardens (RBG), Kew. Living collections and stock of seedlings in pots has been established on the collection plot at the Georgian National Botanical Garden (NBGG) and reserve of seeds for re-introduction works was created. Ex-situ reserve of living material will be used for in-situ re-introduction of the particular species to the natural habitats where this or that species was distributed formerly but disappeared by some reasons. Currently collaborative work is in progress together with British colleagues from the RBG, Kew within the scope of MSBP-2. The pilot project is aimed at establishing seed bank and developing propagation protocols for the 5 endangered species: Campanula kachethica Kantsch., Cyclamen colchicum (Albov) Albov, Galanthus kemulariae Kuth., Paeonia steveniana Kem.-Nath. and Pulsatilla georgica Rupr. Wild populations of these species have been assessed and biological peculiarities of seed formation processes investigated. Germination and propagation protocols have been developed, terms and optimum conditions for seed sowing established for 5 target species both at NBGG and the Royal Botanic Gardens, Kew. Outcomes of this collaborative work (information on wild populations of target species, seed bank, germination and propagation protocols) will serve as a basis for the future habitat restoration projects.

Keywords: *ex-situ; in-situ coservation; seed bank; seed forming capacity; propagation protocol;*

P42

Urban green spaces supporting biodiversity: Rove beetles (Staphylinidae) respond to urbanization

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The effect of urbanization on rove beetles was assessed in a forested area in and around Debrecen city (Hungary). Staphylinids were collected by pitfall trapping during their activity period in lowland oak forest patches. Altogether 3105 individuals belonging to 84 species were trapped during the study. We found that overall species richness of rove beetles increased significantly with decreasing urbanization as it is predicted by the increasing disturbance hypothesis, and contradicting the intermediate disturbance hypothesis that predicts the highest species richness in the moderately disturbed suburban area. The number of forest-associated rove beetle species was significantly lower in the urban area compared to the suburban and rural area, as predicted by the habitat specialist hypothesis. The richness of species directly or indirectly feeding on decaying organic materials (saprophilic, phytodetriticol species hypotheses) were also the species richest in the rural area compared to the urban one.

Keywords: *disturbance; forest specialist species; habitat affinity; Staphilinids; urbanization;*

P43

A new guide for boreal forest habitat restoration

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In Finland the restoration of forest ecosystems has become an established way to manage protected areas since the Forest Biodiversity Programme for Southern Finland (METSO) was launched in 2003. The guide compiles information gathered from about twenty years of experiences of forest habitat restoration. It describes the most widely used methods, including controlled burning, ways to increase the amounts of decaying wood by damaging or killing trees, measures to increase diversity by creating small openings in the tree canopy, and practices applied when managing herb-rich forests, and habitats on sunlit slopes. The guide also briefly describes how cultural heritage can be considered, and outlines procedures for planning habitat restoration work. Factual insets, written by experts, focus on the latest research findings related to habitat restoration and on the special requirements of important species groups.

Keywords: *boreal forest restoration; guidelines; controlled burning; decaying wood; canopy gaps;*

P44

Status and restoration potential of peatland forests in Estonia

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At present the most part of natural peatland forests are lost because of extensive amelioration and only small fraction (ca 10–15 %) of previously widely distributed mire forests are still on favorable conditions today in Estonia. In 2007–2009 some 400 peatland forest sites located outside protected areas were inventoried aimed to distinguish mire forests still valuable by their natural state. Stand parameters, pH, electric conductivity and depth of surface water, peat type, decomposition rate, bulk density, N, P contents were measured on each site, also human impacts and natural state of mire forest habitat were assessed. Sites landscape character on 1900, 1930 and 1960 A.D. were reconstructed using historical maps.

Of the studied peatland forests by their area belonged 5 % to *minerotrophic swamp forest with moving water*, 20 % to *minerotrophic swamp forest with stagnant water*, 12 % to *transitional mire forest*, 26 % to *ombrotrophic bog forest* and 38 % to *drained peatland forests*. Larger portion of "well-looking" mire forests have secondary origin as developed from open mires result to weak or moderate drainage impact. Previous pristine mire forests have mostly degraded and transformed to the drained peatland forests.

As an implication for restoration of the mire ecosystems natural state, it is essential to regard possibilities to restore habitat conditions like water regime and also potential of ecosystem self restoration (presence of typical species). In case of planning open mire restoration activities it is essential to deliberate over if it is practical to clear-cut areas where already secondary but natural-looking mire forests have formed.

Keywords: *peatland forest; mire;*

P45

Effects of cervid browsing on shrub and tree height structure in a moderately degraded peatland in Biebrza Valley

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Wild herbivores play a significant role in ecosystem processes. However little is known about the effect cervid populations have within natural and degraded peatlands, where water level changes have driven succession towards forest and many rare species are disappearing. Also of interest is their potential impact on the regeneration and persistence of such restored ecosystems. This study analyzes the influence of cervids on 3 plant communities in a moderately transformed peatland (Biebrza Valley), a region densely populated by moose. In each of the plant communities 5 exclosures of 49 square meters paired with plots exposed to browsing were established. The height of all shrub species was measured at time of establishment and after two years. Further, density of herbivore droppings and degree of damage to shrub species due to browsing was calculated on transects in each of the plant communities. The data show a significant effect of browsing, resulting in decrease of mean shrub height. It also suggests that moose might play a positive role in *Betula humilis* communities, a rare and protected species in Poland. Reducing the height of highly competitive *Salix cinerea* may support their coexistence. Overall the effect of browsing was strongest on *Salix cinerea* in all observed communities. This study shows that by influencing vegetation cover wild herbivores can play a significant role in peatland ecosystems, and thus should be included in research and planning concerning ecological restoration of degraded peatlands.

Keywords: *peatlands; cervids; animal-plant interactions; Biebrza Valley;*

P46

Unexpectedly positive effect of the electric lines: help to the heathlands

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The heathlands are important elements in the landscape, both from the biological and historical point of view, as they are evidence of specific land-use in the past. In Central Europe they were mostly created by human activity (deforestation, pasture, turf cutting, mowing or burning). Land-use changes during the 20th century (especially controlled forestation or spontaneous succession) have led to gradual disappearance of heathlands here.

In the western part of the Czech Republic only few fragments of the lowland dry heathlands remain, being in various stages of degradation. We found some of these stands occupying the strips under the electric power transmission lines. Frequently repeated cutting of the young wood maintains these strips open (deforested). As the heathlands were historically frequent in this region, these places may function as heathlands refuge.

To reveal the role of these 'underline' heathlands, we compare the stands of different history and of various recent conditions. We chose several target groups of organisms: vascular plants, bryophytes, lichens, spiders, ground beetles and ants, in which the species diversity is evaluated. Preliminary results show great variability of the species composition in all studied groups and localities. However, the rare species and/or heathland specialists were found also at the localities under the electric lines. Presence of these species indicates that rides under the electric lines could be seen as a new type of management maintaining heathlands in the landscape.

Keywords: *heathlands; vegetation; lichens; spiders; ground beetles;*

P47

Conservation status of wet heathlands and purple moor grass and rush pastures in Brittany (France): definition of criterions, indicators, references and assessment methods. Ph. D. thesis project 2011–2014

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In large decline for 50 years, wet acidiphilus habitats are threatened by reaffectation, improvement, eutrophication and abandonment. Henceforth, their diversity and functions are recognized through local and european conservation schemes. Thus, these habitats are subjected to many conservation and restoration program including agri-environmental measures. In the same time, conservation policies, as European “Habitat” directive impose more and more evaluation reports, at local, national or biogeographical levels. In France, evaluation of national agri-environmental contracts should soon be based not only on technical criterions but also on ecological criterions. Nowadays, assessment of habitats status, essential for the evaluation of management or restoration operations, is mainly based on expert judgement, as well-defined reference systems are not available. This situation favours the expression of subjective points of view and leads to assessments oriented on the most accepted values and criteria whereas clear goals are necessary. In this context, we’ll try to define a global assessment method of wet heathlands and Purple Moor Grass and Rush pastures, scientifically pertinent, precise and easy to use by practitioners. Main questions that have to be treated are:

- What are the most pertinent spatio-temporal scales for the definition of reference states?
- What are the attributes of habitats in favourable state and those of degraded ones?
- What should be the most robust, integrative and simplest indicators of the conservation status?
- How can we define threshold values and reference values for each indicator?
- How sociological and economical parameters could be integrated in final conservation assessment?

Keywords: *Conservation status assessment; Wet heatlands; Purple moor grass and rush pastures; Western France;*

P48

Earthworm assemblages on afforested colliery spoil heaps – the effects of tree species

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The aim of the study was to describe earthworm assemblages on heap sites afforested with different tree species and to compare them with those on un-rehabilitated sites left to natural regeneration. The study was carried out on the Velka Podkrusnohorska spoil heap after brown coal mining located near the town of Sokolov, Czech Republic. Seven types of forest stands, i.e. those afforested with lime, alder, oak, larch, pine, spruce and that with spontaneous succession, each in four replicates, were chosen and sampled for earthworms in 2005 and 2006.

Two earthworm species were only found at sites left to natural regeneration. At the afforested sites, species richness was higher, ranging from 4 under larch to 7 under alder plantations. Earthworm biomass at sites with coniferous afforestation did not differ from that at natural regeneration sites and was lower than at sites with deciduous afforestation, independently on the tree species used. Analogously, no difference was found in the density of earthworms between natural regeneration sites and those afforested with coniferous trees. A significant effect of tree species on worm density was however observed at sites with deciduous afforestation. Dense earthworm populations developed in alder and lime plantations, while worm density under oak was lower, similar to that under larch and even pine.

In general, both the density and biomass of earthworms were positively correlated with soil organic matter content (Cox), content of available potassium in soil and with the mass of fermentation layer, and negatively with the depth of fermentation layer.

Keywords: *Earthworms; colliery spoil heaps; afforestation;*

P49

Evaluating Restoration – A vegetation ecological approach for benchmarking ecological compensation measures in railway engineering

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Ecological compensation measures for impacts of large construction projects have become the state of the art in fulfilling the European law, but implementations often miss the goal. A new high speed railway line in Lower Austria led to an environmental impact assessment entailing a broad range of compensation conditions. A vegetation survey was conducted representing the diversity of habitats introduced into the landscape. Habitat mapping aimed at the description of the landscape context and its change. Habitat diversity increased remarkably. Spontaneous wetland developments on water-technical buildings tend to be most natural. River restoration measures indicate good natural dynamics in softwood species but very poor outcomes at wet meadows. Fallow plots show strong aftermaths of high nutrient input. Many areas are dominated by seed mixtures with a high content of grass varieties. Habitat (re-)creation within an intensive, depleted agriculture landscape depends on the suitability of habitat types on the available ground. It is necessary to further precise directives for ecological compensation, to ensure evaluation of feasibility throughout planning and implementation processes, as well as a mandatory monitoring standard. For example, measures with seed mixtures should be chosen more accurate to fit the plant community goal or redesigned to hay mulch transfer.

Keywords: *environmental impact assessment; compensation; infrastructure; Ecological engineering; vegetation ecology;*

P50

Revegetation of a closed landfill in a context of maritime cliff top: transfer of harvested vegetation and superficial soil litter for restoration of grassland and heathland, Island of Ouessant, France

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The most common method for revegetation of closed landfills consists in covering them with rich soil to allow a rapid vegetation cover. However, closed landfills can also be considered as a potential for positive action for biodiversity. In this study, we describe an experimental ecological revegetation of a one hectare capped landfill located in the context of maritime cliff vegetations on the island of Ouessant, western France. The target vegetation for this operation consists in a gradient between grassland and heathland, both natura 2000 habitats. Poor nutrient soil conditions of these vegetations were recreated on the top of the closed landfill using local granite gravels. In the vicinity, grassland and heathland vegetations were cut and harvested

to obtain biomass and seeds. The abundant superficial heathland soil litter, which contains a rich source of available seeds and organic matter, was also collected both manually and with vacuum collector to minimize impact on the soil. The collected material was spread regularly on the granite substrate, covering ten percent of the site. A two-year botanical survey shows that target species colonization is successful in harvested biomass and soil litter treatments, with the presence of Erica cinerea and Ulex Gallii. Spontaneous succession of target species on bare soil is almost inefficient after two year. Moreover some ruderal and scrub species appear in the empty space, which could complicate the success of the operation.

Keywords: *maritime cliff; heathland; grassland; landfill revegetation; seed and soil litter transfer;*

P51

Tourism and species richness on sandy Baltic Sea beaches – a contradiction?

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Population growth, industrial economy, coastal defense and climate change threaten Baltic Sea beaches. In our study we investigate the effects of human impacts on beach plants. Findings are fundamental for the development of a concept which should agree habitat and species conservation with tourism.

Vegetation releves were carried out on seven beach sections of three categories of disturbance intensity: Beaches completely open for people (A); closed beaches in nature conservation areas (B); beaches with closed backshore and foredunes but with touristic access on the lower beach area and the water side (C). To consider the sea-land gradient, beach sections were divided into ten transects with six 4 m^2 plots each.

Results showed low species richness for all categories. Species richness was significantly higher with “C” than with “A”. Evenness values of "A" were significantly higher than of “B” and “C”, which can be explained by increased gaps in vegetation cover due to trampling activity. Gaps within vegetated areas on beaches are highly vulnerable to erosion. Furthermore, differences in species composition between categories increase with distance from the sea. Annual driftline plants (Cakiletea maritimae) are significantly promoted by moderate trampling on the lower beach in “C”. All disturbed beaches exhibit a higher amount of ruderal species (Artemisetea).

We conclude that plant species richness of sandy Baltic Sea beaches can be promoted by partial closing. This protects the habitat of typical beach plants and allows people to access the water. In the following years of the research project we will investigate the potentials of reintroducing endangered plant species and the survival of animal populations.

Keywords: *beach ecosystems; species protection; trampling; driftline plants;*

P52

Effect of fertilizers on macrozoobenthos in small saline inland waters

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In the brown-coal mining region of western Bohemia – Sokolov basin, the ecosystems are renewed at places of original pits or in areas, which were established outside of mining area-called dumps. A lot of pools was created spontaneously or newly established by hydric restoration.

These pools are unique in the Czech Republic. High salinity (up to 11 ‰), conductivity (3000–16000 $\mu S.cm^{-1}$), alkalinity (8,5–15,5 $mmol.l^{-1}$), concentration of sulfates (maxima 15000 $mg.l^{-1}$), natrium (3000 $mg.l^{-1}$), magnesium (900 $mg.l^{-1}$), calcium (200 $mg.l^{-1}$) and low concentrations of dissolved phosphorus (0,01–0,1 $mg.l^{-1}$) are typical for this area.

Three groups of pools different in conductivity were fertilized by cow dung, municipal wastewater treatment sludge and inorganic NPK fertilizer at doses used in carp ponds. Positive effect of fertilization on the density and biomass of macrozoobenthos was proved in all groups. The highest increase of biomass was recorded after application of NPK, the lowest increase in pools with cow dung. No effect of fertilization on the diversity of macrozoobenthos was observed. The highest species diversity was found in pools with the lowest conductivity (3000–6000 $\mu S.cm^{-1}$). Species diversity was significantly correlated with the presence of aquatic vegetation. Several halobiont species were recorded in studied pools. Chironomus aprilinus, Meigen, 1830 (Diptera-Chironomidae) was recorded in the Czech Republic for the first time.

In summary, the dump ponds represent unique habitats in the Czech Republic and should be maintained in the landscape. Larger ponds with lower salinity (≤6000 $\mu S.cm^{-1}$) can be stocked for angling and their productivity increased by fertilization.

Keywords: *coal mining; hydric restoration; saline inland waters; Chironomus aprilinus;*

P53

Habitat-specific response of the macrozoobenthos to the river rehabilitation – a case study of the Kwacza River (N Poland)

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The Kwacza River have been substantially modified to protect Atlantic salmon and migratory trout spawning grounds in the Slupia river basin (N Poland). The rehabilitation works have been carried out in 2007 along 2.5 km section to modify the channel forms and increase heterogeneity of micro-habitats to satisfy requirements of a broad range of aquatic organisms. Macroinvertebrates were assessed along the restored channel section containing a variety of instream rehabilitation structures: 22 wooden flow deflectors (intended to increase flow, depth and substrate heterogeneity within the channel), 11 large boulder rip-raps (to divide thalweg, change velocity and make active lateral erosion), 6 wooden weirs (to stabilize water level). At each of 10 crossections established, invertebrates were compared with a stretch of the river without rehabilitation structures and subdivided into different benthic micro-habitats. Restoration structures on the Kwacza River appeared to have significant influence both on the abundance and number of macrozoobenthos taxa, which increased by 20. An intensive migration to the bank sites lit-up through the tree clear-cutting. Flow deflectors had a significant impact on the taxa richness along the restored stretch of the river. Depth and substratum particle size differed between flow deflector and other micro-habitats due to greater velocity downstream of the deflector tip. At a habitat scale, the benthos at shallow rip-raps, but not flow deflectors, had higher abundance and diversity than reference benthos.

Keywords: *river rehabilitation;*

P54

Restoration of Pannonian halophytic vegetation in Southern Slovakia

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Pannonian basin salt marshes are very rare remnants of historically widely distributed native habitats in intensively managed lowland agricultural landscape of the Danube Lowland. Salt marshes are highly influenced by pannonic climate with extreme temperatures and aridity in summer. The enrichment of salt in the soil is due to high evaporation of ground water during summer. A recultivation of landscape and drying of wet saline soils has caused a strong reduction of open seasonally dried out depressions. The above mentioned human activities have led to the soil salinity decrease which has caused that open saline vegetation is currently close to extinction. The present project aims to describe the spatial distribution of halophytic plant communities along salinity gradient and explores the relationship between different ecological types of halophytic vegetation and soil properties at 10 Sites of Community Interest. Typical feature of the investigated soils was alkaline soil reaction and increased soil salinity, which varies considerably at investigated sites. However, the electric conductivity of the saturation extract exceeded the limit for saline soils (4 dS/m) only at few much localized spots. Salinity was caused mainly by sodium bicarbonates and sulphates. For effective implementation of the restoration measures, it is important to localize the areas of increased and high salinity within the target areas. Restoration will be achieved through several activities, aiming at an improvement of the water regime towards decreased leaching of soil salts by precipitation water and increased groundwater discharge and evapotranspiration. The proposed activities include creation of small scale depressions and clay barriers. Local disturbance of the topsoil layer is needed for the protection of halophytic species, which are weak competitors. Clay barrier parallel to a drainage canal will restrict groundwater movement towards the canal and therefore it will increase the level of groundwater at the locality before the barrier.

Keywords: *halophytic vegetation; soil salinity;*

P55

Impact of aluminium smelter on air and snow cover pollution in Krasnoyrask City and Natural protected area Stolby

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The main purpose in this work is investigation of variations in time and space of snow cover pollution for Krasnoyarsk city territory and natural protected area “Stolby”. Krasnoyarsk is an industrial Siberian city with a population of about 1.000.000 inhabitants and an area of nearly 340 sq. km. The “Stolby” is situated in the central part of Krasnoyarsk region at the south-west boundary. The total area of “Stolby” cover about 47 thousand hectare. It is a nature scientific research park. Spatial distribution of fluoric, chloride, nickel and aluminum pollutants from Krasnoyarsk Aluminium Smelter were considered. Tests of atmospheric air and snow cover were investigated. Tests were selected in the city territory and in the territory of the national natural park “Stolby” It is revealed that the territory of the reserve is in a zone under strong permanent influence of emissions of the aluminum

enterprise. It is shown by meteorological observations and trajectories analysis for air pollutants. The fluoride concentration in city territory varies from 0,30 to 2,1 mg/l, at the same time concentrations vary from 0,01 to 0,23 mg/l on the "Stolby" territory. It is not expected situation because natural protected area lies in opposite direction from typical wind direction distributions for Krasnoyarsk.

Keywords: *air pollution; snow cover; natural protected area; aluminium industry; air pollution transport and dispersion;*

P56

A new guidebook for boreal peatland restoration

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In Finland restoration of peatlands in nature conservation areas started in the 1990's. Since then Metsahallitus together with partners have restored nearly 19 000 hectares of fens, pine bogs and spruce mires that had been drained for forestry purposes. Restoration by filling in and blocking ditches allows the recovery of the hydrology and peat-forming vegetation. A considerable part of the restorations have been funded by EU LIFE projects targeting various mire complexes throughout the country and by the national Forest Biodiversity Programme METSO launched in 2003. The guidebook compiles the lessons learnt over the 20 years of Finnish experiences. It includes general information on ecology of peatlands, concentrating on hydrology, peat layer and vegetation. The fundamental changes in these variables after drainage are shortly described. The guidebook outlines the entire process of peatland restoration, starting from setting the targets of restoration, proceeding to planning and conducting the necessary restoration measures and ending with monitoring the ecological effects of restoration. The main body of the guidebook is formed by detailed descriptions of the best practices of restoration methods such as filling in the ditches and building different types of dams. More than twenty detailed descriptions about the more complicated and difficult case studies are also included. Factual insets, written by experts, focus on the latest research findings and expert assessments related to peatland restoration and on the special requirements of important mire species groups, such as birds and butterflies. An English version of the guidebook will be available by early 2013.

Keywords: *Restoration; Peatland; Guidebook; Finland;*

P57

Times series analysis applied to roadside reclamation: How the ground cover affect to microclimate conditions along time?

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Analysis of microclimatic factors can be essential in restoration ecology of degraded scenarios by human activities as roadside. Nevertheless, microclimate is also altered by plant development through its effects on the albedo, evapotranspiration, and water infiltration, among others. In that sense, we explore to what extent changes in above ground cover can modify microclimatic conditions on roadslopes.

The study area was situated in Madrid, central Spain, on the M-12 highway in 2 southfaced roadcuts where therophytic grasses are dominant vegetation. The experimental design was performed in 10 plots (50 × 50 cm) with different ground cover degree, 5 plots per roadcut. On each plot we measured photosynthetically active radiation (PAR), temperature and moisture in soil and temperature and relative humidity in air, all of them every 30 minute for 2 year. Likewise, plots were photographed monthly for a year. We selected eCognition Developer to estimate separately ground cover of vegetation, litter and bare soil.

Time series analyses suggested that above ground microclimatic variables appear to be independent of the ground cover dynamics. However, variation on ground cover dynamic could influence on the temporal structure of microclimatic variables in soil. A suitable roadside management oriented to establish a minimum ground cover may encourage positively the community establishment process by means of improving microclimate conditions for plant community on roadslopes.

Keywords: *Time series; Roadslope; micloclimate; vegetation;*

P58

Restoration potential of soil seed banks in loess grasslands

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Soil seed banks can play a crucial role in the recovery of former grassland biodiversity in degraded and fragmented landscapes. We studied the vegetation and seed banks of an abandoned and degraded *Cynodonti-Poetum* loess pasture and a species-rich natural *Salvio-Festucetum* loess grassland in Hortobagy, East-Hungary. The percentage cover of vascular plants was recorded in twelve, 1×1-m plots in June, 2009. From each plot, 3 soil cores (4 cm diameter, 10 cm depth) were collected in March, 2010. Samples were treated using the seedling emergence method. We specifically asked the following questions: (i) How dense are the local seed banks? (ii) Which species of the vegetation possess a persistent seed bank? The vegetation of the degraded loess pasture was characterised by low species richness scores (6–15 species/m^2), conversely, in the natural loess grassland significantly higher species richness scores were detected (23–31 species/ m^2). Mean seed bank densities were similar in both

grassland types (20,200 seeds/m^2 in *Salvio-Festucetum* and 22,800 seeds/m^2 in *Cynodonti-Poetum*). Regardless to grassland type, seed banks were characterised by common forbs (*Hypericum perforatum* 6,200 seeds/m^2, *Galium verum* 4,270 seeds/m^2, *Achillea collina* 2,100 seeds/m^2) and graminoids (*Carex stenopylla* and *C. praecox* 2,480 seeds/m^2, *Poa angustifola* 1,060 seeds/m^2). Among weeds only *Conyza canadensis* (6,760 seeds/m^2) and *Veronica persica* (1,215 seeds/m^2) possessed dense seed banks. Most of the characteristic loess grassland species possessed only sparse seed banks (e.g. *Filipendula vulgaris*, *Pimpinella saxifraga*, *Salvia austriaca*, *S. nemorosa*). Our results suggest that seed banks have only a limited role in maintaining species diversity in loess grasslands.

Keywords: *biodiversity; grassland restoration; soil seed bank; plant trait;*

P59

What can be adapted from North-American grassland burning to European grassland conservation?

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Prescribed burning is an integral part of the North-American grassland conservation practice, while in European grasslands this technique is rarely applied. European grassland managers and scientists are increasingly interested in cost-effective, alternative ways of biodiversity conservation and prescribed burning can be a vital solution to several conservation problems. Our goal was to draw attention to the use of prescribed fire as a neglected but promising conservation measure in European grasslands. We evaluated the results of European attempts to use burning in grassland conservation and we found that European studies on this topic are scarce, and mostly yearly dormant-season burning is applied. The reviewed studies concluded that yearly burning solely is not an appropriate option to preserve and maintain species-rich grasslands. Second, we discussed burning studies from North-America to identify which findings can be adapted to the European grassland conservation strategy. In North-America, contrary to Europe, the application of burning is fine tuned in terms of frequency and timing and is generally combined with other restoration measures (grazing, seed sowing or herbicide application). Thus, multiple conservation goals, like invasion control and increasing landscape-level heterogeneity can be linked. Finally, we emphasize that for the application of prescribed burning in Europe, the general findings of carefully designed case studies should be combined with the practical knowledge of conservation managers concerning the local application circumstances to reach specific management objectives.

Keywords: *biomass; climate change; ecosystem services; fire; invasive species;*

P60

Restoration of near-natural state of drainage-influenced spring fen vegetation

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Effects of cutting Molinia caerulea tussocks and raising the water level on the re-establishment of plant cover were studied on a Ca-rich spring fen site in N-Estonia. In 2009, five experimental blocks of 10 × 10 m were established, each managed in 5 different ways: water table raised and 1) tussocks cut to the ground level or 2) to the half height, 3) living biomass of Molinia and litter removed, 4) no mowing (control A), 5) no mowing, water level not raised (control B). Plant cover analyses were done on every block on plots (1 × 1 m) established by 3 rows by 7 plots (varied by the water level) in July every year. On blocks 1 and 2 native low-tussock graminoids Carex davalliana and Schoenus ferrugineus germinated well on bare peat ground and some herb juveniles appeared. Molinia almost disappeared. Bryophyte coverage rose by up to 7 % on plots with above-ground water table. We achieved an increase in vascular species richness on blocks 1 and 2 compared with controls but not in bryophytes as only few most common species (Campylium stellatum, Fissidens adianthoides, Drepanocladus cossonii, and some Scorpidium scorpidioides) appeared. On block 3, coverage of native fen graminoids, invasive species Molinia caerulea, and plant litter were almost the same as on control blocks by the end of the third year of the experiment.

Keywords: *ground water; microtopography; Molinia caerulea; species richness;*

P61

Seed bank dynamics in mesotrophic grassland created on arable land

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Plant species from temperate grassland are characterized by relatively short-term seed persistence in the soil. Nonetheless, the soil seed bank appear to play an important role in the continuous regeneration of populations of many species and it has been shown that the probability of species to persist locally in remnants of species-rich unimproved grassland is positively linked with their capacity to form persistent soil seed banks, suggesting that buried seed populations may be able to increase the capacity of plant populations to buffer themselves against local extinction during periods characterized by unfavourable environmental conditions. Surprisingly few studies have investigated the temporal dynamics of soil seed banks after the introduction of target species at grassland restoration sites, compared with the huge number of studies aiming to assess the role of extant seed banks as a source for re-colonization of target species lost from the vegetation. We have investigated the temporal dynamics of soil seed banks in three restored grassland sites that were part of a multi-site study to investigate the effects of pre-sowing

cultivation and of species introduction by sowing (natural regeneration vs. species-poor seed mixture vs. species-rich seed mixture) on the success of grassland creation on arable land. The seed bank of the various experimental treatments at these sites was sampled at the beginning of the experiment in 1994, and then again in 1998 and in 2001. Seed bank dynamics of both sown and of unsown species were strongly affected by seed mixture, whereas effects of cultivation were only marginal.

Keywords: *mesotrophic grassland; ex-arable land; seed bank dynamics; soil cultivation; seed mixtures;*

P62

How forestation alters the seasonal and spatial patterns of base cation chemistry in a degraded bog – Implications for peat bog restoration

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In this study we compared non-forested and forested habitat types of a degraded bog in Western Germany with regard to the base cation chemistry of their pore waters. The peat profiles were sampled in 10cm intervals every month from April to July 2009 down to a maximal depth of 150 cm with a portable suction unit. In the laboratory pore waters were analyzed for Ca, Mg, K and Na concentrations. Additionally, electrical conductivity and pH were measured in surface pools for each month. Every habitat type was sampled within four replicate plots, showing the same vegetation structure.

Strong differences were found between the concentrations and distributions of base cations in the pore water profiles from the different habitat types. The forested sites revealed higher concentrations for all base cations, but especially for Ca and Mg. Seasonality had an effect on element distributions in pore waters, but its influence was particularly strong at the forested sites. Element distributions and seasonality were caused by several interacting biological and physicochemical processes, such as plant uptake and mineralization or evaporative concentration and dilution by rainwater. The possible reasons are discussed in detail.

Our study draws implications for the restoration of degraded ombrotrophic peat bogs. The influence of mineral-rich waters on the invasion of non-bog plant species as *Molinia caerulea* or *Betula pendula* is discussed. In particular, the role of an intact buffer zone around the bog ecosystem and stable water tables is highlighted.

Keywords: *base cations; bog restoration; pore waters; biogeochemistry;*

P63

Strategy for maximizing native plant material diversity for restoration and genecology research

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Consideration of the origin and genetic diversity of native plant material is one of the most important choices in a restoration project. Seed zones are used to select plant materials best adapted to current and expected future climatic conditions at a selected planting site. We are using provisional seed zones identified by the United States Forest Service (http://www.fs.fed.us/wwetac/threat_map/SeedZones) where common garden studies have not been completed and species-specific seed zone data is unavailable. By mapping the distribution of known collection sites over the provisional seed zone map, we can determine areas for future seed collection efforts for such purposes as genecological/common garden studies, seed increase for immediate restoration, and germplasm conservation. As examples, we selected three priority restoration species for genecological studies to establish species specific seed zones in the Great Basin, USA. Using ARCVIEW we plotted the past collection sites of these three species onto the preliminary seed zone map for the Great Basin. We could then identify collection gaps within the range of each species. In the following field season we can locate populations within these areas in order to maximize diversity for genecology studies and on the ground restoration projects occurring in each seed zone.

Keywords: *seed zones; native plant material; genecology;*

P64

Information population parametres for management of rare bog species (Rivne Natural Reserve, Ukraine)

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Successful adaptive management needs effective methods for detecting short-term changes in population structure. In order to improve the nature conservation state of rare plant species we propose some practical recommendations concerning with the use of structural-functional population parameters for their monitoring on the territory of nature preserved areas.

Populations of 8 model rare bog species such as Carex chordorrhiza, C. dioica, Juncus bulbosus, Salix lapponum, Scheuchzeria palustris, Hammarbya paludosa, Lycopodiella inundata, Drosera intermedia (Ukrainian Red Data Book, 2009) have been investigated on the territory of Rivne Natural Reserve (Ukraine) during 2010–2011. Their habitats have been highly transformed because of the permanent anthropogenic influence in the past (hydrologic regime changes etc.). But the reasons of plant species rarity are specific. That is why it requires different methods for management, depending on the biological features of species, in particular, on the type of biomorphe (mono- and polycentric species).

The self-maintenance of "typical" monocentric species is mainly ensured by their seed reproduction. So the indication parametres of their monitoring should be based on the accounting of generative individuals in the population, their seed productivity, morphometrical features and the efficiency of seed origin undergrowth formation.

Polycentric species are characterised by both vegetative and the generative reproduction. The important conditions of their existence are regular vegetative rejuvenation and renewal of partial individuals. That is why it is necessary to find out correlation between the number of generative and vegetative sprouts of individuals and their density, to study vegetative mobility and seed germination of species.

Keywords: *population; management; rare species; indication parametres;*

P65

Reintroductions: meeting the restoration challenge with threatened species

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Since many plants have transient seed banks, and many are dispersal-limited, spontaneous recovery of rare plant populations in restored sites may be constrained by the absence of naturally occurring propagules. In this case, the reintroduction of individual plants in the wild is an essential measure to conserve threatened species.

We reviewed the scientific literature in order to learn more about reintroductions carried out worldwide and especially in Europe. A survey was also conducted among 473 botanic gardens, universities and conservation organisations which we knew had undertaken some reintroduction experiments, without having published the results.

Since the early 80s, we observe a steady and regular increase of the number of publications devoted to plant reintroductions. According to our survey, successful reintroductions do not necessarily depend on large budgets. Similarly, a partnership with many instances is not a guarantee of success. For those reintroductions carried out in Europe, we found that they were conducted mostly in dunes and meadows, which is quite relevant as these two habitats are among those with the worst conservation status. However, there seem to be a lack of interest for other habitat types with a bad conservation status, such as bogs, mires and fens were quite few reintroductions were reported.

The usefulness of surveys is beyond doubt because they bring us information that is usually not mentioned in publications. Furthermore, even if the number of publications has risen sharply in recent 30 years, plant reintroduction remains essentially an activity whose results are not disseminated.

Keywords: *plant reintroduction; species translocation; population reinforcement; population augmentation;*

P66

Ecology restoration responses using landscape indicators in an abandoned Mediterranean dryland of the South-Eastern Spain.

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European Mediterranean ecosystems are considered as landscapes prone to soil degradation processes. The current degradation level of the pressured ecosystems has been caused by natural factors (lithology, relieve, vegetation potential recovery, bioclimatic conditions), and by anthropogenic factors (land use pressure). The intensive exploitation of lands during the last decades and the followed land abandonment lead these areas to high levels of desertification. In 2003, the Valencia Regional Forest Service implemented a restoration demonstration project in Albatera municipality from the south-East of Spain. This area was considered one of the more affected by desertification in the north Mediterranean Europe. The restoration site is a small catchment (25 ha), that was reforested by a wide number of native evergreen species applying the high technologies of plant breeding, site preparation works, and the most recent techniques of water and nutrient harvesting to ensure plant establishment and soil loss reduction in short-medium term. The long term objective of this restoration demonstration project is to recuperate the initial state of vegetation structure and soil functioning processes of the ecosystem before the anthropogenic pressure. Therefore, we analysed the landscape indicators: soil functioning indices and vegetation cover (from 2005–2008) in order to predict the landscape trajectory. The obtained models show that this degraded dryland of the Mediterranean semi-arid responds by the hysteresis process. That makes in question the resilience potential of the Mediterranean degraded landscapes in recruiting the lost vegetation structure and recuperating soil functioning values after the long and historical disturbance despite the implemented restoration efforts.

Keywords: *restoration ecology; degraded dryland; Landscape indicators; vegetation recruitment; soil functioning;*

P67

Reintroduction of endangered wetland plant species to Trebon Basin sand-pits

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The Trebon Basin (S Bohemia, Czech Republic) is a flat area that has been influenced by man for centuries. The formation of network of artificial channels and fishponds was performed in the initially wet, inaccessible area. High original diversity of aquatic and wetland plant species in oligotrophic fishponds, denudated fishpond bottoms and littoral stands, however, has been negatively influenced by intensive fish production, fertilization and absence of summer drainage since the second half of the 20th century.

Since 1990, the Collection of aquatic and wetland plants of the Institute of Botany at Trebon has paid great attention to rescue cultivations of endangered aquatic and wetland species of the Czech flora. In collaboration with the Trebonsko Protected Landscape Area Authority, we have dealt with the reintroduction of several endangered species typical of early successional stages, e.g., denudated fishpond bottoms. For this purpose, we selected abandoned sand-pits, which provide both appropriate water quality and free substratum for species growth and reproduction. The terrain at suitable sites was modulated by heavy machinery before restoration efforts. Following the species reproduction in the rescue culture, the whole plants or their propagules were planted out. We have recorded successful establishment and growth of the following species: *Cyperus fuscus, Gratiola officinalis, Illecebrum verticillatum, Isolepis setacea, Nuphar pumila, N. x spenneriana, Pseudognaphalium luteo-album, Ranunculus lingua or Utricularia bremii.*

Keywords: *denuded fishpond bottoms; sand pits;*

P68

A possible use of seed bank samples: testing the methodology for reintroduction

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In the frame of 'The establishment of the Pannon Seed Bank for the long term ex situ conservation of Hungarian vascular wild plants' Life+ programme (2010–2014), approximately at least 800 species of the Pannonian native flora will be stored in the Pannon Seed Bank. In the project we would like to set an example of how seed banks can assist in situ species conservation activities. Therefore seed bank samples of 10 species characteristic to Pannonian sand steppes (*Festucetum vaginatae* Rapaics ex Soo 1929) are to be reintroduced on oldfields in the Hungarian Kiskunsag Region. Seeds are to be collected over three years from 2011 to 2013. Seeds will be reintroduced following 0–3 years of storage in the Pannon Seed Bank to test the effect of storage on seed quality. Seeds will be stored at 0°C following drying to a 4–8 % moisture content. Part of the seeds will be reintroduced following propagation at two sites. Seeds will be sown as seed mixtures in six oldfields of altogether 2 hectares. Five sites will be used for sowing seed mixtures from direct field collections without any propagation. The sixth site will be used for reintroduction of seed mixtures from both propagation sites and direct collections. Reintroduction and restoration success will be evaluated by monitoring the phenology of the reintroduced species and vegetation development using phytosociological releves. This way comparison of seed sample quality and reintroduction success in different years and the effects of storage will be feasible.

Keywords: *seed bank; oldfields; propagation; common milkweed; ex-situ;*

P69

Recovery of a population of Carabus nitens (Col. Carabidae) in an area of nature development

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In the area of Mantingerveld (Drenthe, the Netherlands) reclamation of the so-called waste lands stopped in 1958, leaving 3 small and 1 larger patches of heathland scattered throughout an area of arable land. In 1963 the biological station in Wijster started to sample one of those patches, Hullenzand, 18 ha in size, on carabid beetles. In the beginning of the sixties the carabid composition remained more or less complete but at the end this patch started to lose some of its characteristic stenotopic heathland species. For instance the species Carabus nitens was last reported here in 1971 and not caught anymore afterwards. In 1990 the nature protection organization Natuurmonumenten (Nature monuments) started to buy the areas in between the patches and tried to restore the heathland-like character of the area by top-soil removal. In 2004 we started to test whether or not the area was suitable for C. nitens again, by introducing it in enclosures. Since then every year more and more individuals of this species were caught, especially in the nature development area of the Mantingerveld. Nowadays it is one of the most abundant species in this part of the Mantingerveld. Because also other stenopic heathlands species became rather abundant in those areas, we conclude that top-soil removal is a good tool to restore heathland communities on the longer term.

Keywords: *Carabus nitens; Top-soil removal; heathland restoration; introduction; carabid beetles;*

P70

Invasive species of Adjara (South Colches)

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The Caucasus, falling in the "Colch" section of Euro-Siberian Floristical region has been identified as one of the Earth's 34 biologically richness and most endangered terrestrial Eco-Regions by Conservation International (CI), World Bank, and GEF. South Colches (Adjara and Artvin) is one of the rich floristical region in Caucasus.

The Georgian Flora of vascular plants includes some 189 families and over 4100 taxa. From them 460 taxa of alien origin recorded in Georgia (archeophytes and neophytes combined), about 80 species are cultivated species that are not, or rarely, found in the wild, or there is no valid data on their current occurrence in Georgia. The 380 remaining alien species have become subspontaneous, adventive, naturalized and invasive. The Adjarian flora of vascular plants includes 290 taxa of alien plant. The alien flora of Adjara (South Colches) is still insufficiently studied. Current knowledge clearly indicates that invasive plants will deteriorate some of the unique natural ecosystems of the country and pose threats to the indigenous species diversity, agriculture and human health.

Keywords: *invasive plant;*

P71

The significance of abiotic environmental conditions for ecological restoration: A case study of plant invasion in a gypsum quarry

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Control of invasive plant species is a common stage included in ecological restoration of open-cast mines. Knowledge of environmental conditions is important to establish invasion vulnerability to alien species. A case study was recorded for an invasive plant species, *Onopordum acanthium*, in the gypsum quarry "Yesos alfa Saint-Gobain Placo Iberica", which is located in the semiarid area of Ebro river Valley (NE Spain). Main adaptive advantages of *O. acanthium* facilitating invasion are: high seed production, great diversity of seed dispersers and high growth rate. A gypsum landfill was covered in 2009 with a natural topsoil layer coming from surrounding areas (head of the quarry) to facilitate rehabilitation from spontaneous plant growth. Four physicochemical soil parameters were analyzed: soil volumetric water content, soil crust compaction, electrical conductivity and pH. *O. acanthium* biomass was recorded during the optimal phenological stage. According to our results, there was a heterogeneous soil spatial pattern in the restored area, including two types of substrate. Soil properties from patch 'A' allowed the invasion of *O. acanthium*. By the contrary, patch 'B' showed values closer to those soils found in natural gypsiferous ecosystems, limiting the establishment of invasive species. Therefore, a right decision relating to topsoil source and management of soil abiotic conditions could be essential to control alien species in rehabilitation programs of gypsum quarries.

Keywords: *invasive species, Onopordum acanthium, Valle del Ebro, ecological restoration, abiotic conditions.;*

P72

Effect of invasive Asclepias syriaca L. on grass seedling establishment during restoration of Hungarian semiarid sandy oldfields

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Invasive common milkweed (*Asclepias syriaca* L.) has been invading large areas of sandy old fields in Hungary. Despite being abundant, relatively few studies investigated the effects of milkweed invasion on the outcome of restoration activities. In our study, we tested the effect of milkweed presence on the establishment of grasses (*Festuca vaginata* and *Stipa borysthenica*) characteristic to open sand grasslands (*Festucetum vaginatae* Rapaics ex Soo 1929). Thirty-six 2 × 2 m quadrats were designated in an oldfield invaded by milkweed in the Kiskunsag Region, Hungary. Regular mechanical milkweed removal was applied to half of the quadrats to receive milkweed free plots six times during 2010 and 2011. Grass seeds were sown in separate quadrats in September 2010. Grass seedlings and milkweed shoots were enumerated in September 2010, and in May, June and September 2011. Mechanical control resulted in a five fold decrease in milkweed shoot number by September 2011. Milkweed control had no significant effect on seedling number, however, number of both grass seedlings was higher in quadrats without milkweed control at each recording time in 2011. This was probably due to dry summer weather in 2011 when milkweed shading increased seedling survival. According to our study, common milkweed did not prevent grass germination of open sand grasslands. This implies that in terms of grass seedling establishment, milkweed control is not essential during restoration of semiarid sandy oldfields. Our study was supported by the 'Establishment of the Pannon Seed Bank for the long-term ex-situ conservation of Hungarian vascular wild plants' LIFE+ project.

Keywords: *invasion; dry grassland; seeding; mechanical control; oldfield;*

P73

Long term wind erosion activity in North-East Iceland

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Iceland is a volcanic island in the North Atlantic Ocean with maritime climate, including mild and moist winters but cool summers. In spite of moist climate, large areas are with limited vegetation cover and >40% of Iceland is classified to very severe erosion, with severe land degradation occurring in most part of the island. Last decade has been influenced by active volcanic eruptions and increasing reported dust storms, major sources of erosive material. The aim of this paper is to place Icelandic dust production area into international perspective and estimate to what extend are recent natural phenomena impacting the land degradation. Meteorological observations with dust presence codes and related visibility were used to identify the frequency

and the long-term changes in dust production in NE Iceland. There were annually 16.4 days on average with reported dust storms on a weather station within the NE erosion area, indicating extreme dust plume activity and erosion within the NE deserts, even though the area is covered with snow during the major part of winter. Last decade reported highest occurrence of dust events in six decades. We have measured saltation and aeolian transport during storms in Iceland which give some of the most intense wind erosion events ever measured. Dust affects the ecosystems over much of Iceland, providing new, un-weathered materials on the surface. It is likely to affect the ecosystems of the oceans around Iceland, and it brings dust that lowers the albedo of the Icelandic glaciers, increasing melt-off due to global warming.

Keywords: *dust storm; wind erosion; saltation; volcanic ash; Iceland;*

P74

The phytorregulators as a tool for improving the germination of seeds and its application in the restoration of ski slopes

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Ski slopes construction result in the destruction of the alpine ecosystems and landscapes because removes the upper soil layers and the vegetation, and as a consequence makes the slopes more prone to loss of soil, seeds and nutrients when intense rainfall occurs. Therefore it is necessary fast restoration in order to establish stable vegetation cover as possible and protect the soil against erosion. On the other hand, ski slopes preparation and skiers themselves compact the snow and the main consequence is the induction of soil frost. Natural re-vegetation in these circumstances is difficult and slow.

We have studied the effect of low temperatures on the germination of seeds pre-treated with some phytorregulators in three high mountain species used in the restoration of the ski slopes of the Sierra Nevada ski resort (S. Spain).

Seeds of Genista versicolor, Reseda complicata and Thymus serpylloides, endemics of the Baetic Mountains (S. Spain) were pre-treated with benzylaminopurine, gibberellic acid and ethrel, at 10^{-6}M and 10^{-5}M for 6 hours and after they were frozen at -20ºC for three months. Seeds were then sown in Petri dishes and sterile water was added. Following this, the dishes were moved to a germination chamber, 25ºC/5ºC and 14/10 h light/dark and the germination was measured daily during 21-day period.

The pre-treatments used in these experiments were effective after the seeds being frozen and this could enable a considerable improvement in the restoration procedures, both on bare soil and with the reinforcement of other ski slopes with little plant cover.

Keywords: *restoration;*

P75

Remote sensing for estimation of land use management effects on Tundra ecosystems

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The main task of this work is independent remote estimation using free remote sensing data, the estimation which is provided without total field observations of tundra territories. Nowadays different types of pressure on tundra ecosystems is growing rapidly. Due to that, severe problem of providing complex estimation of anthropogenic effect and climate changes on tundra ecosystems are arising. That estimations have to allow to reveal causes of degradation and other negative changes in tundra communities acceptably, accurately and in time. The system of remote monitoring that uses remote sensing data of different resolution and different spectral characteristics is directed to solve these problems.

To describe a state of vegetation the following remote sensing data were used: albedo, surface temperature, vegetation indexes, the index of soil moisture and the net primary production. Parameters that we have selected are linked not only with the quality (special composition, physiological status), but also with the standing crop or biomass of vegetation. For each index a function of value frequency distribution was calculated for territory in which anthropogenic pressure is expressed with the same calculations for a sample “clear” {relatively undisturbed} territory. Monthly data for vegetation period and annual mean values were analyzed. Vegetation indexes distinctly reveal the current state of vegetation, being the most operative among all the considered parameters. Hence, it is possible to conclude that the proposed set of the remote data seems to be necessary for correct assessment of the role of anthropogenic influence upon tundra ecosystems in the Yamal Peninsula.

Keywords: *remote sensing data; tundra ecosystems; anthropogenic influence;*

P76

Modelling landscape trajectories of a Mediterranean pine forest after the passage of wildfire in the South eastern Spain.

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The direct regeneration is not always the vegetation response to wildfire disturbance in the Mediterranean basin. The agradation and degradation are other types of ecosystem responses; depending on the wildfire occurrence and severity, to the resilience capacity of the forest population, and to the bioclimatic conditions post-fire. In a *Pinus halepensis* forest of Alicante (South eastern of Spain), of the semi-arid Mediterranean climate that has been burned by a moderate-high fire severity in autumn of 2002. The neighbourhood areas of the burned perimeter have been historically affected by annual recurrent wildfires during 5 years consecutively (1993–1997). That fire occurrence couldn't change the spontaneous invasion of opportunist species described in the early-succession stages during the first three years after the passage of fire. We survey the recuperation of the burned area by the monitoring of landscape indicators: vegetation cover rates and soil functioning indices along 4 years (2004–2008) in order to predict the trend of vegetation structure and soil functioning to the final stages of succession on long term. The modelling of the soil functioning and vegetation cover indicators in time series could draw the total trajectory of the burned ecosystem toward the predicted future state. The obtained models support the theory of auto-succession process, leading to equalize values between landscape indicators of the burned and the unburned areas. We assume that the obtained results confirm the homeostasis capacity of the Mediterranean ecosystem; which allow the auto-regulation of the *Pinus halepensis* forest after the passage of the fire.

Keywords: *restoration ecology; pine forest; wildfires; auto-succession; soil functioning;*

P77

Restoration of hay meadows on ex-arable land:commercial seed mixtures vs. spontaneous succession

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In many areas of Europe there are policies to restore former arable land to grassland. In practice, this usually involves the use of commercial seed mixtures. The abundance of all vascular plants species in 35 ex-arable fields, sown with a commercial seed mixture or spontaneously revegetated, was studied in one landscape area to compare two methods of grassland restoration. Species abundance was also evaluated in the close surroundings of the fields. Data were processed using multivariate (ordination) and univariate statistics. Period of time since abandonment, size of the field and type of grassland restoration (so wn vs. spontaneously revegetated) had a significant influence on vegetation. However, for the target meadow species, the type of restoration did not exhibit any influence. After about 20 years the contribution of meadow species that had established spontaneously in the studied fields was similar to that of their surroundings. We concluded that artificial sowing on ex-arable land is not necessary to develop semi-natural grasslands if (i) there are sources of appropriate diaspores in the immediate surroundings, (ii) the site is not very rich in nutrients and (iii) farmers do not need grass production immediately. In these situations and over this timescale natural regeneration would allow substantial savings of money and labour.

Keywords: *agriculture management; grassland; rate of succession; species pool; vegetation;*

P78

Indigenous knowledge for restoration and conservation in Wadi Allaqi, Egypt

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Indigenous knowledge for restoration and conservation in Wadi Allaqi, Egypt

Hanaa Abdou*, Hoda Yacoub**, Menno Gerkema*, Jac. Swart*, Wadi Allaqi is a major 'dry river' area in Southern Egypt which drains from the Red Sea hills to the Nile valley. UNESCO declared it a conservation area in 1989 and a Biosphere Reserve in 1993. The area supports a number of nomadic Bedouin populations. Sheep and goat grazing have dominated their main household economy. The vegetation of Wadi Allaqi e.g. Acacia and Najas spp. is of considerable socio-economic importance to these people, which have longstanding knowledge on careful management of the area. However, current socioeconomic developments resulting in settlement of Bedouin populations, new roads, mining and military use, partly related to the newly formed lake Nasser, have led to increasing habitat destruction. In addition, Bedouin traditional knowledge is increasingly exposed to constraints by new technologies, governmental policy to settle Bedouins and rapid commercialization. This study aims to investigate and document Bedouin environmental knowledge in order to gain an understanding of how Bedouin people manage their natural resources in the context of socio-economic change and if and how this knowledge can be used for restoration and conservation of the area. The project focuses especially on the knowledge of women and aims to highlight their role in the livelihood and for in the sustainable development. Insight on these aspects may contribute to biodiversity and sustainable use of natural resources. In addition it is expected that the results will support the transmission of useful Bedouin useful indigenous knowledge to new generations.

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Keywords: *Wadi Allaqi; Indigenous knowledge; Conservation; Acacia spp; Najas spp;*

P79

FIORA: a new tool for public green, private garden and ecological restoration

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FIORA is a newborn Italian nursery of wild plants focused on the cropping of herbaceous autochthonous plants. Using such species could be a real opportunity for creation of sustainable new businesses. Wild plant populations have characteristics that were selected over time in response to the conditions of the environments where they grow (ecotypes).So using plant material of local origin can guarantee the best possible results in terms of success and persistence over time. Many wild herbaceous perennials also have an aesthetic value, making them interesting to be used not only for ecological restoration, but also for public green and private garden. At European level several guidelines and/or Regulations are about the use and marketing of seeds of wild herbaceous perennials demonstrating how these issues are becoming important. Considering that the demand and need for herbaceous perennial with a certificate origin may grow in a next future, the mission of FIORA is to enhance the Emilia-Romagna (Italy) flora of wild herbaceous perennial, developing a company with these objectives: 1- to draft cultivation protocols for production of seeds and/or plants from vegetative propagation; 2- to disseminate to the public the economic and environmental benefits resulting from the use of such plant material; 3- to evaluate the obtainable yields, as well as to optimize both the productive aspects and the commercial ones, for the marketing of such material in different contexts: urban, suburban, industrial, agricultural, natural and whose main uses are related to environmental restoration, cover crops, public green and recreation areas.

Keywords: *nursery; wild herbaceous plants; seeds; local certificate origin; Italy;*

P80

Policy salient language in restoration ecology

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Ecological concepts such as “biodiversity” and “sustainable development” find their way into national and international policy statements, making it necessary to consider whether or not we use these words in our science. According to political scientists, once an issue has entered the political discourse we can say that it did so because it has “saliency,” i.e., it is relevant to the decision-making process. Issue saliency may play a vital role in linking scientific knowledge with sustainable action, since scientific information will be incorporated into social responses to environmental issues only when stakeholders perceive the information as credible (scientifically adequate), salient (relevant), and legitimate (respectful of the stakeholders’ values and beliefs). To determine if journals are publishing articles on restoration with policy salient words, we examined the language of articles in 19 journals over two time periods, 1998–2000 (288 articles) and 2008–2010 (1,012 articles), for 14 environmental concerns. We found that salient issues were often absent from the abstract, title and even full text of articles, although there is an increasing trend of including them. Journals with a stated aim of affecting policymaking do not publish more restoration articles with salient language than those that lack an explicit policy aim. Because articles without policy relevant terminology may be rendered “invisible” to decision-makers, we suggest that using terminology recognizable to stakeholders might enhance the impact of restoration ecology on decision-making processes.

Keywords: *policymaking; research communication; language; issue salience;*

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A regional assessment of ecosystem restoration: A case study on the Nordic countries

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The Nordic countries with their relatively large range of natural conditions but historically similar social and policy structure provide an opportunity to analyze how restoration strategies have developed across boundaries. The objective of this study was to investigate the relative importance of land use pressures and natural, social and policy drivers for development of ecological restoration strategies across habitats using the Nordic countries as an example of a region. The study was a part of a Nordic network “Restoration of Damaged Ecosystems in the Nordic Countries (ReNo)”, funded by the Nordic Council of Ministers during 2009–2011. Recent national assessment reports on ecological restoration in individual Nordic countries, associated databases and expert evaluations were used for analysing ecological restoration in the region. For comparing restoration strategies amongst habitats and countries the five myths of Hilderbrand and associates were used. Restoration efforts

differed amongst habitats and countries with forests and peatlands receiving the most efforts in Finland, freshwater systems in Sweden, heathlands/natural grasslands in Iceland and Norway and cultural ecosystems, mainly abandoned agricultural land, in Denmark. Majority of restoration activities were initiated by local or governmental authorities and paid by public money. EU habitat directive provided funding for large restoration programs, and seemed to be an important economic driver. Our analyses suggest that habitat types determine which strategy is used in ecological restoration whereas socio-economic drivers are more important when it comes to decide when and where restoration is carried out. These results need to be evaluated in other regions.

Keywords: *drivers; habitats; restoration myths; land use pressure; restoration strategies;*

P82

The content of heavy metals in meadow soils

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The content of heavy metals in the natural environment (soil, water, air) is increasing and is dangerous for the proper development of all living organisms. the soil is contaminated with heavy metals, from processes such as dust sedimentation, the flow of sewage and the application of mineral fertilizers and pesticides. The content of heavy metals like cadmium, lead, zinc, copper and nickel was investigated in the meadow soils in the district opring, autumn and winter season 2010/2011. The meadows re located at different distances from the road 2 m, 40 m and 200 m. The soils tested showed an average pH of neutral to alkaline and humidity 8.7 %–34 %. Statistically significant showed differences in the content of Zn, Cu, Ni, Pb between stations. In relation to cadmium did not show such dependence. The content of this element (0.68–0.87) is similar occurred at all stations. The number of pedofauna were also analyzed in the studied meadow soils. It has been found, however, that significant differences in metal content did not affect the density of soil fauna at different stations.

Keywords: *heavy metal; meadow soils; pedofauna; density;*

P83

Problems and solutions in restoring riparian greenspace in South Korea

H.K. Jo[1], J.Y. Kim[2]

[1] *Kangwon National University, Department of Landscape Architecture, Chuncheon, Korea Republic of (South Korea)*
[2] *Graduate School of Kangwon National University, Department of Landscape Architecture, Chuncheon, Korea Republic of (South Korea)*

The purpose of this study was to survey structures of riparian greenspace established in 4 major river watersheds of South Korea, and to explore desirable strategies to enhance greenspace functions. The study selected a total of 45 restoration sites and field-surveyed growth environments, planting structures, tree conditions, and management activities to assess functions of riparian greenspace. Sparse planting and high radiation on ground surface caused intrusion of competing weeds, especially climbing plants, which limited normal growth of planting trees at some sites. Planting technique was represented by single layer composed of one or a few species and a similar tree size. There was no consideration of species composition essential for ecological planting to increase ecological functions of riparian greenspace. Soil conditions were so poor that they could not meet minimum requirements for normal tree growth. Dead trees accounted for about 10 % of all of planting trees and poorly growing trees occupied 60 %. Annual weeding was the only management after planting. It is essential to establish some criteria on species selection and planting technique in restoring riparian greenspace. Ecological planting for each river watershed, which is based on structures of natural riparian forests, is required to enhance multiple greenspace functions. Preparing proper soil conditions and mulching ground surfaces with woodchips is also recommended to ensure normal growth of planting trees and minimize unnecessary management cost.

* This study was supported by the CAER (Center for Aquatic Ecosystem Restoration) of Eco-STAR project from MOE (Ministry of Environment, Republic of Korea).

Keywords: *Greenspace function; Planting structure; Planting technique; Soil condition;*

P84

Ensuring the survival of endangered plants in the Mediterranean

T. Gil[1], J. Mueller[1], A. Kyratzis[2], C. Fournaraki[3], G.P.G. del Galdo[4], G. Bacchetta[5], L. Hugot[6], M.V. Fornes[7]

[1] *Millennium Seed Bank, Royal Botanic Gardens, Kew (RBGK) (UK)*
[2] *The Agricultural Research Institute Nicosia (Cyprus)*
[3] *Mediterraean Agronomic Institute Chania (Crete, Greece)*
[4] *Department of Biological, Geological and Environmental Sciences, University of Catania, Italy*
[5] *Centro Conservazione Biodiversita, University of Cagliari. Italy*
[6] *Conservatoire Botanique National de la Corse, France*
[7] *Jardi Botanic de Soller, Spain*

The Mediterranean Basin is one of the most biodiverse regions of the world. It contains close to 10 % of the known flowering plants of the Earth of which over half are endemics. The region's flora is critically threatened from human development and even with a high legal protection plant species will remain vulnerable to changes in climate, external weather events or invasive alien species. In order to safeguard the Mediterranean vascular flora it is necessary to apply integral conservation measures whereby in-situ conservation actions are complemented through ex-situ techniques, such as seed banking and habitat restoration. The main goal of the project we present is to ensure the survival of threatened plant species in the Mediterranean islands through ex-situ conservation measures. This project will run for three years until September 2014 as an initiative led by RBGK joined by the six conservation organisations that participate in this poster presentation. It is funded by the MAVA

Foundation. These organisations work together to achieve ex-situ conservation of 900 plant taxa through seed banking. Criteria for the prioritisation of target species were agreed by all partners and collecting lists were developed. After the first collecting season, a significant number of high-quality seed accessions of priority species were collected. Researches will be carried out on these priority species and data will be disseminated (http://www.medislandplant.eu/) to aid conservation and restoration activities. Alongside collecting, a Mediterranean Basin Island seed conservation network will be built to foster cooperation, collaboration and to promote the exchange of experiences and ideas.

Keywords: *Threatened habitats and flora, Mediterranean island, ex-situ conservation*

P85

It is possible to detect 600 years old archaeological objects by CRS plant strategies and Ellenberg indicating values on present vegetation?

J. Ondracek[1], M. Hejcman[1], P. Karlik[2], T. Klir[3]

[1] *Czech University of Life Sciences, Ecology, Prague, Czech Republic*
[2] *Czech University of Life Sciences, Dendrology and tree breeding, Prague, Czech Republic*
[3] *Charles University, Institute for Prehistory and Early History, Prague, Czech Republic*

We asked whether there is any effect of sixty-year long settlement activity in the 14th century on the contemporary soil chemical properties and forest vegetation. An abandoned medieval village was situated in the central part of the Czech Republic near Labe (Elbe) river on sandy soil in mixed deciduous forest 100 years old. Dominant trees were Quercus robur, Tillia cordata. Relevees of present vegetation and soil samples were collected on destructions of buildings (which were constructed from wood and soil), former courtyards, village square and gardens. For all plots we have calculated mean value of plant strategy (CRS – Competitor, Ruderal, Stress tolerant) and Ellenberg indicating values (EIV). Competitor strategy was the most frequent in gardens. Stress tolerant strategy was the most frequent on the village square. Frequency of ruderal strategy decreased in the direction of destruction from buildings, courtyards, village square to gardens respectively. EIV values for light, humidity and nutrient status were significant. EIV values for light increased in the direction of destruction from buildings, courtyards, village square and gardens. The driest conditions were indicated on destruction of buildings and village square compared to courtyards and gardens. The highest nutrient content were found on the destruction of buildings followed to courtyards. The least amount of nutrients was indicated on the village square and in the garden. We have found big influence of human activities, which could be detected in CRS plant strategies and EIV on present vegetation. The main message of the research is that even relatively short-term settlement activities can generate irreversible changes in ecosystem functioning.

Keywords: *nutrients; land use history; phytoindication; CRS plant strategy; abandoned medieval village;*

P86

Spontaneous restoration of smal wetlands in arable fields

P. Vittek[1]

[1] *Department of Botany, Faculty of Science, University of South Bohemia, Ceske Budejovice, Czech Republic*

Recently, the draining system starts to collaps down in some arable fields which were earlier drained up. This leads to local waterlogging and subsequent abandonment of such parts. Vegetation of these early successional stages was investigated in the southern part of the Czech Republic. Phytosociological releves (5 × 5 m in size) were done in each of the new wetlands, and species lists were recorded in the whole area of each particular wetland. Age, the distance to the margin of the arable field, and the distance to a nearest permanent wetland were estimated. Influence of the factors on species composition and the course of the initial spontaneous succession were investigated using uni- and multivariate statistics. It appeared, the initial wetlands may develop rather fast and contain typical wetland vegetation which may provide suitable habitats for other biota, such as insects and amphibians.

P87

Restoration of an extracted peatbog: Are transplants of target species capable to establish?

L. Vlkova[1]

[1] *Department of Botany, Faculty of Science, University of South Bohemia, Ceske Budejovice, Czech Republic*

Restoration of the peatbog Soumarsky most in the Sumava NP, Czech Republic, started in 2000 with blocking drainage ditches and increasing water table. There were 26 boreholes installed to measure water table fluctuations in monthly intervals. Around each borehole, vegetation record was made and three specimens of Oxycoccus palustris and Andromeda polifolia were planted. Survivorship of the transplants was related to the average water table and composition of vegetation around the boreholes. Preliminary results of the experiment demonstrated that we must consider both dispersal limitations and habitat limitations in the establishment and spread of the typical peatbog species. It should be considered in the next restoration attempts.

P88

Diversity of microscopic life in various water bodies in the landscapes affected by mining activities

O. Skacelova[1], I. Prikryl[2]

[1] *University of South Bohemia, Botany, Ceske Budejovice, Czech Republic*
[2] *ENKI p.b.a., hydrobiology, Vodnany, Czech Republic*

Landscapes formed by surface and underground mining can provide many interesting habitats for freshwater organisms (cyanobacteria, algae and invertebrates): both the early successional stages of wetlands and water bodies differing in size and depth enable development of ecological communities undisturbed by human impact. These water bodies, often of small surface but deep, frequently host rare water organisms of oligotrophic or mesotrophic stands. Wetlands of spoil heaps in Western Bohemia have, due to water saturation and chemical composition of soil (claystones with high content of sulphates), many similarities with former inland saline habitats, but salinity is much higher and conditions more extreme. The formation of soil crust containing halophilous cyanobacteria and diatoms is typical there. Both the species composition and water chemistry of lakes on spoil heaps changes with their successional age; usually, the halophilic organisms are replaced with alkaliphiles. Species composition in large and deep lakes, originating when large-scale mining quarries are filled with water, undergoes also pronounced succession. Rare and peculiar water organisms can be dominants in plankton communities, forming successional stages of various length. In general, these water bodies are highly valuable refugia for many rare species. However, only some of them are protected by nature conservation, others are converted to a recreational areas including sport fishing or swimming, and some are destroyed completely by continuing surface coal mining.

Keywords: *mining; water bodies; successional stages; algae; invertebrates;*

P89

Management of open areas in a natural floodplain of river Luznice, South Bohemia

D. Pithart[1], J. Koptik[1]

[1] *Daphne CR, Ceske Budejovice, Czech Republic*

Due to the decline of agricultural management in wet areas within the central Europe, number of valuable near nature floodplains have been gradualy loose their open areas since the second half of 20th century. River Luznice floodplain is an example of such a floodplain with preserved hydrological status, meandering river bed and about 200 valuable floodplain pools and oxbows. Forest free spaces, original pastures or hey meadows, overgrow mostly with *Phalaris arundinacea* and *Urtica dioica* stands, and consequently with various willow soft floodplain forest. As a consequence, aqatic, semi -aquatic and wetland habitats are substantially shaded and loose their biodiversity, namely in phytoplankton, aquatic macrophytes and fish, where the reduction of species number can reach 80 %. The sustainable management plan aimed at maintenance of open areas should combine wood and bush removal (provided by local community without any cost for nature protection) with censequent sensitive grazing. Incentives for these activities and their harmonizing with nature protection needs are subject of ongoing project, granted by Czech Ministery of Environment.

Author's Index

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Practical Information A–Z

A

Accommodation

Should you need any help with your accommodation, please contact our staff at the Registration Desk.

Airport

Prague International Airport:

It is located 160 km from České Budějovice – 2,5 hrs. by car; 3–4 hrs. by train/bus.

Letiště Praha, a. s.
Letiste Praha - Ruzyne,
160 08 Praha 6
Tel.: +420 2 2011 1111, +420 2 9666 1111
Fax: +420 2 3535 0922
AFTN: LKPRYDYX
SITA: PRGCZ7X, PRVCZ7X
http://www.prg.aero

Blue Danube Airport Linz:

It is located 130 km from České Budějovice – 1,5 hrs. by car; 3 hrs. by train+bus.

Flughafen Linz GesmbH
Flughafenstraße 1
A-4063 Hörsching
Tel.: +43 7221 600-0
Fax: +43 7221 600-100
E-mail: info@linz-airport.com
http://www.flughafen-linz.at

Vienna International Airport:

It is located 220 km from České Budějovice – 3 hrs. by car; 5 hrs. by train.
Lost & found contacts:

Austrian Airlines Group
Tel.: (+43-1) 7007-62522
E-Mail: viellos@austrian.com

Austroport
Tel.: (+43-1) 7007-33512

Celebi Ground Services
Tel.: (+43-1) 7007-36343

ISS Ground Services
Tel.: (+43-0) 57400-1918
Tel.: (+43-0) 664805741918
E-Mail: arrival.services@at.issworld.com

B

Badges

You have received your personalised name tag at the Registration. The name tag must be worn at all times to access the sessions and the Welcome Reception. Admittance to the sessions and reception without badge is not possible. **Only full participants may attend the sessions** (no accompanying persons).

C

Cash Machines

Cash machines are located inside of the shopping gallery IGY, at Pražská street 200 m from the venue.

Climate

České Budějovice are a city with a "mild continental climate". The average temperature in September varies between 10 °C and 25 °C.

Cloakroom

The cloakroom is located next to the Registration Area.

Conference Dinner

The official Conference Dinner takes place at Restaurant Masné krámy (street Krajinská 13) on Thursday, September 13, 2012, 19:30–23:00. For pre-registered delegates only.

Conference Language

The conference language is English. No interpretation is to be provided.

Currency / Exchange

The Czech Currency is called the Czech Crown (CZK). Banknotes are circulated in values of 5 000, 2 000, 1 000, 500, 200, 100 and 50 Crowns with coins valued as 50, 20, 10, 5, 2 and 1 Crowns.

Exchange offices are located throughout the City Centre (exchange offices, banks, post offices). Exchange services are also available at banks in City Center.

D

Doctor / First Aid

In case of an incident contact Hotel Reception or conference staff.

Hospital České Budějovice, a. s.
B. Němcové 585/54
370 01 České Budějovice
Switch board: +420 387 871 111

E

Electricity

Electricity used in Czech Republic is 230 Volts; standard European system of round pins with two holes. A transformer is necessary for your electrical or electronic equipment if using different voltage (ie. USA, Canada).

Emergency numbers

112 General emergency number
The number can be used for urgent help from Police, Fire brigade, or Emergency medical assistance, though the following numbers can also be dialed directly:
150 Fire
155 Medical emergency (Ambulance/First aid)
156 Prague City police
158 Police

Excursions

For assistance on excursions, please contact the Info Desk at the Registration Area.

The meeting point for all excursions is located outside of the Hotel Main Entrance. **Please make sure to arrive 15 minutes prior to the planned start of the excursion.**

F

First Aid

Please see Doctor / First aid section above.

Food and Beverages

Coffee-breaks and Lunches are included in the Registration Fee and will be served in Hotel Restaurant on conference level of Clarion Congress Hotel.

H

Healthcare

When travelling around the Czech Republic you might need medical assistance. You can be sure you will be treated with high European standards. The country has 216 hospitals and every 10 000 inhabitants are catered for by 108 hospital beds (67 beds for patients with terminal diseases). If any assistance is needed please contact our registration staff or hotel personnel.

I

Information

The information can be obtained at Registration Desk.

Insurance and Liability

The Organizers do not accept liability for personal injury or loss or damage to private property of participants and accompanying persons either during or while travelling to the Conference.

Internet

Internet Corner is available at hotel foyer on ground floor. Please note that the computer is available to other guests of the Clarion Congress Hotel as well.

L

Lost & Found

A lost and found service is available at the Registration Area.

Lost or stolen credit card? Call one of the following services to take care of it:

+420 224 125 353	Visa
+420 222 800 111	American Express
+420 261 354 650	MasterCard/Eurocard
+420 267 314 285	Diners Club

M

Messages

A message board will be located at the Registration Area. You can post your messages here.

Mobile Phones

Participants are kindly requested to keep their mobile phones in the off position in the Meeting Rooms while sessions being held.

P

Parking

Participants arriving by car are advised to use parking space available at the Clarion Congress Hotel premisses. Parking fees are not included in the registration fee.

Pharmacy

The nearest pharmacy at City Center on Mail Square Přemysla Otakara II.

Lékárna
nám. Přemysla Otakara II. 88/26
370 01 České Budějovice, České Budějovice 1
Tel.: +420 386 321 632
Fax: +420 386 321 845
www.lloyds.cz
Opening hours: Monday – Saturday 8:00 – 18:00

Presentation Submission

It is essential for the smooth running of the Conference that all speakers hand in their presentations at least 1 hour prior the beginning of their session in Slide Preview Corner next to room Svět of the Clarion Congress Hotel. For further details please see section **"Guidelines to Authors and Chairs of Oral Sessions".**

Program Changes

The Organizers cannot assume liability for any changes in the program due to the external or unforeseen circumstances.

R

Registration

Cancellation policy / Name changes.
Onsite cancellations are applicable to cancellation fee in full.
Name changes unnotified in advance will be treated as a new registration.

S

Safety

České Budějovice are among the popular destinations in the Central Europe. Compared to many same sized cities České Budějovice are safe. České Budějovice are an unthreatening city to walk around. Violent crimes in the city centre are rare. The main criminal problem is petty pilfering (pickpockets) from cars and pockets. As with any city, always use caution and care when travelling around.

Shopping

Shops in České Budějovice are open from 9:00 to 17:00, Monday through Saturday. The Supermarkets are open from 8:00–21:00, Monday through Sunday. The Tesco Supermarket is open 24/7.
All major credit cards are accepted in larger shops.

Slide Preview Corner

Is located next to Svět room of the Clarion Congress Hotel. Please make sure to hand in your presentation at least 60 minutes prior to the start of your assigned session. Our staff in the Speakers Preview Corner will be happy to assist you.

Smoking Policy

Smoking is forbidden in all Conference Areas.

Social Program

Please see **section Conference Social Programme page 6**.

T

Taxi

A Taxi can be requested at the Reception Desk of the Clarion Congress Hotel.

Time

The Czech Republic lies within the Central European Time zone, i.e. GMT+1 hour, Daylight Saving Time (GMT+2 hours) is in effect from the End of March until the End of October.

Tipping

Service almost always included in hotel and restaurant bills. A further tip of a few coins is appropriate. Typically, the tipping in restaurants would be around 5–10%, tourist guide 10 %.

V

Venue

Clarion Congress Hotel České Budějovice
Pražská třída 2306/14
CZ-370 04 České Budějovice
Česká republika
Tel.: +420 389 102 111
Fax: +420 389 102 333
E-mail: info.cchcb@clarion-hotels.cz

GPS: 48°58'54.134"N, 14°28'21.175"E

Czech-English Glossary

Glossary of Basic Terms

Hi	Ahoj	AH'hoy
Hello	Dobrý den	DO-bree DEHN
Good morning	Dobré ráno	DOH-brehh RAHH-noh
Good afternoon	Dobré odpoledne	DOH-brehh OHD-poh-lehd-neh
Good evening	Dobrý večer	DOH-bree VEH-chehr
Good night	Dobrou noc	DOH-broh nohts
Yes	Ano	AH'noh
No	Ne	Neh
Please	Prosím	PRO-seem
Thank you	Děkuji	Dyekooyih
Excuse me / Sorry	Promiňte	PROM-min-teh
How are you?	Jak se máte?	yahk seh MAA-teh?
What is your name?	Jak se jmenujete?	YAK se y'me-noo-ye-te?
Can you help me?	Můžete mi pomoci?	MOOH-zhethe mee POH-motsee?
What is the time?	Kolik je hodin?	KOH-lihk yeh HOH-dihn?
How much does it cost?	Kolik to stojí?	KOH-lihk toh STOH-yee?
Excuse me, waiter? (getting attention)	Promiňte, číšníku?	proh-MIHNY-teh, cheesh-NEE-koo?
Entrance	Vchod	fkhot
Open	Otevřeno	oh-teh-VRZHEH-noh
Closed	Zavřeno	zah-VRZHEH-noh
Exit	Východ	VEE-khot
Push	Tam (tlačit)	tahm
Pull	Sem (k sobě)	sehm
Toilets	Toalety	toa-LEH-tih
No smoking	Zákaz kouření	ZAHH-kahz KHO-rzhenee
No entry	Zákaz vstupu	ZAHH-kahz vehs-toop-pooh
Goodbye	Nashledanou	NAH SLED-dah-noh

5th World Conference on Ecological Restoration

Reflections on the Past, Directions for the Future

Save the Date

Madison, Wisconsin, USA • 6-11 October 2013

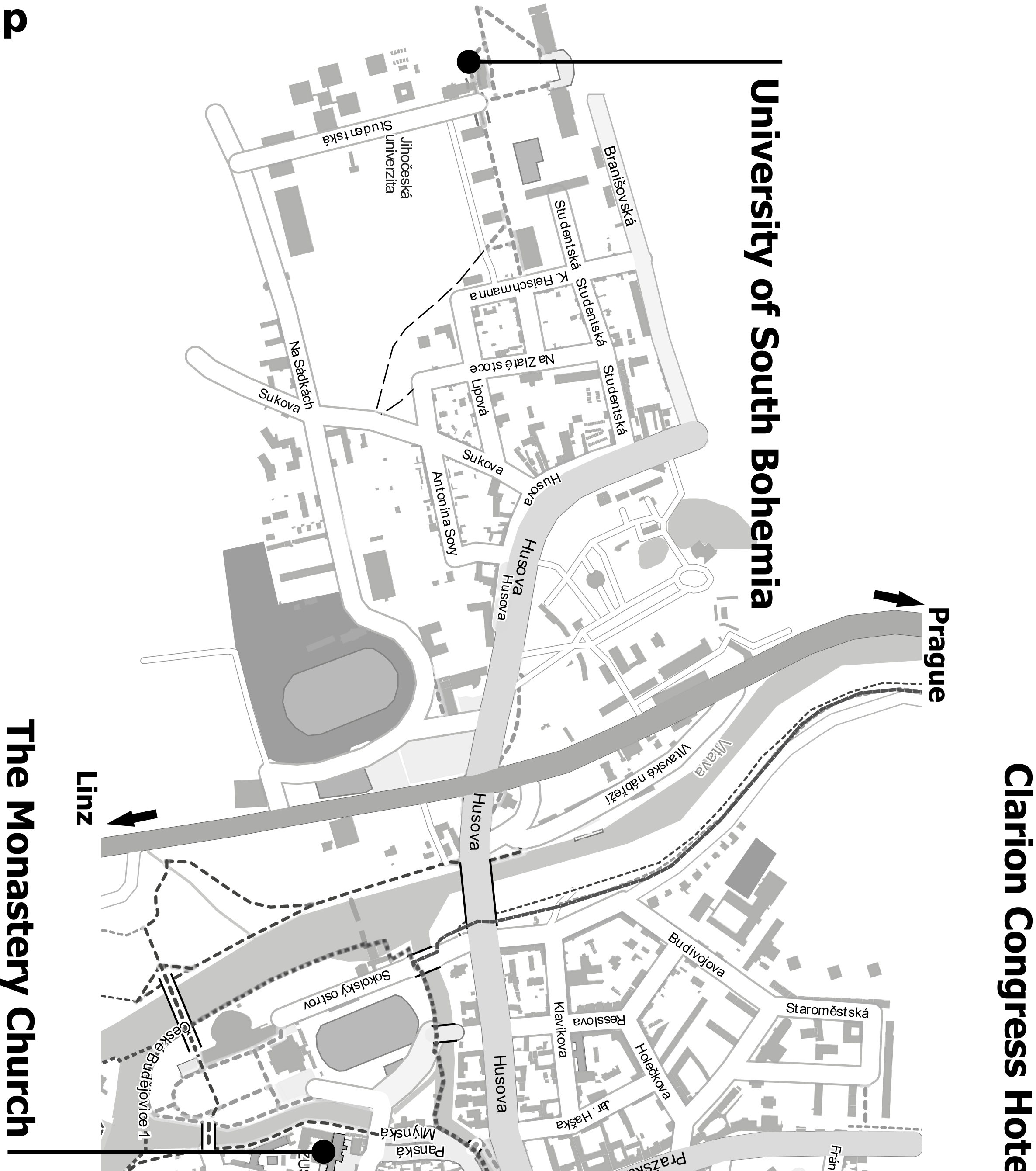
The Society for Ecological Restoration (SER) is pleased to announce the SER2013 World Conference on Ecological Restoration: *Reflections on the Past, Directions for the Future*, to be held October 6-11, 2013 in Madison, Wisconsin, USA. SER2013 is the Society's 5th World Conference and 21st Annual Meeting. It also marks the 25th Anniversary of SER's founding right here in Madison in 1988. The 4-day scientific program will feature numerous symposia covering a wide range of topics as well as prominent keynote and plenary speakers, training workshops and field trips to local restoration sites. Local partners include the University of Wisconsin-Madison Arboretum, the Aldo Leopold Foundation, and the International Crane Foundation.

SER SOCIETY FOR ECOLOGICAL RESTORATION

Celebrating 25 years of leadership in the field of ecological restoration

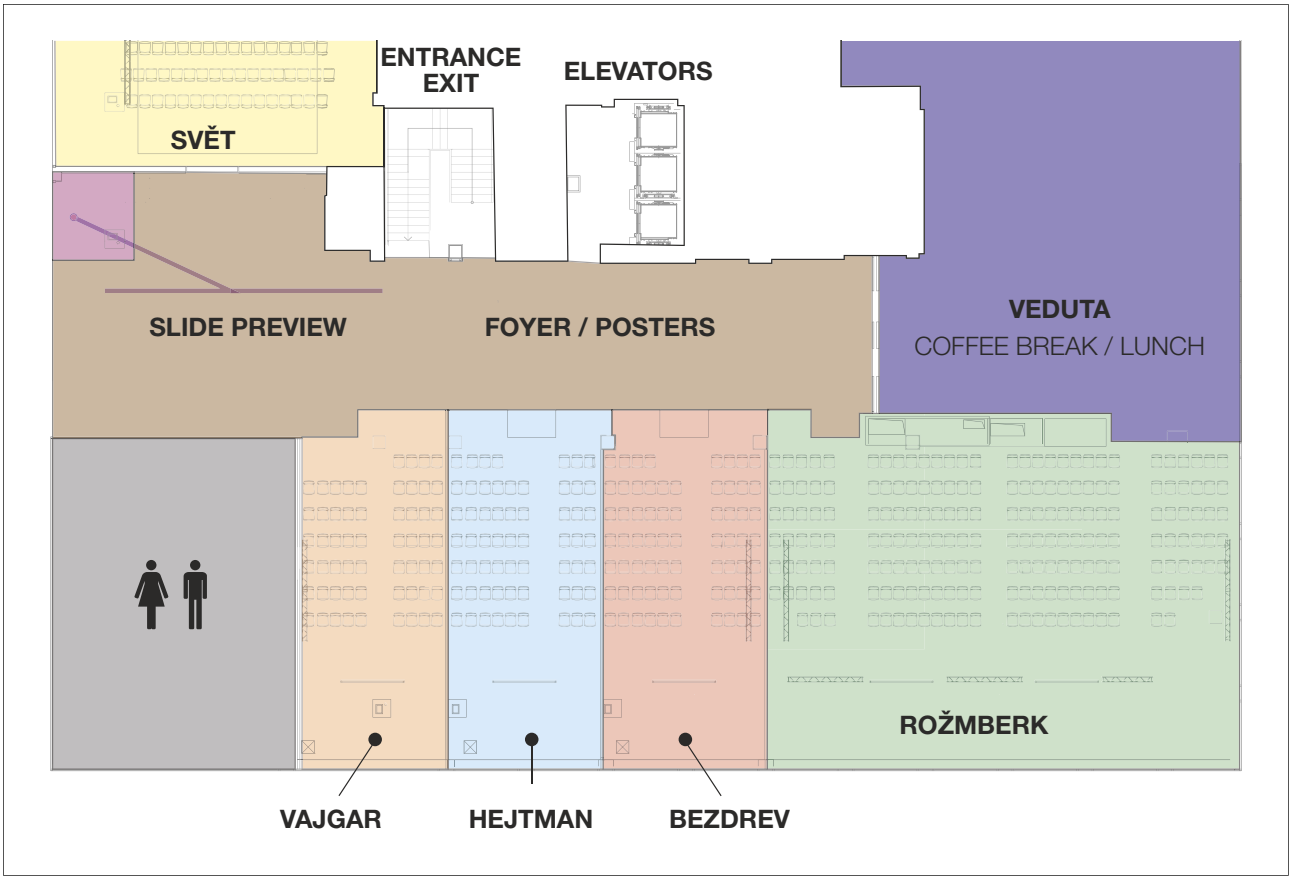
www.ser2013.org

Map

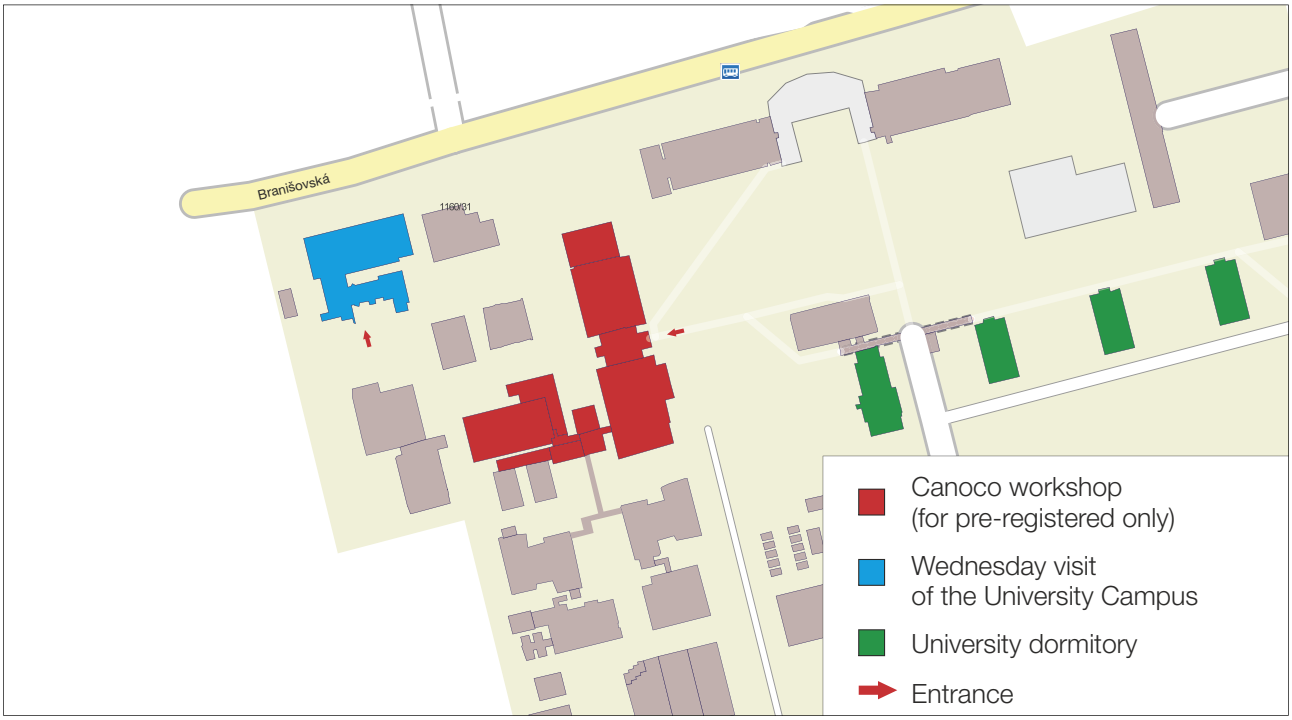

University of South Bohemia
Prague
Linz
Clarion Congress Hotel
The Monastery Church
Restaurant Masné krámy
Jihočeská univerzita
Studentská
Branišovská
K. Fleischmanna
Na Zlaté stoce
Lipová
Na Sádkách
Sukova
Antonína Sovy
Husova
Vltava
Vltavské nábřeží
Sokolský ostrov
Budivojova
Staroměstská
Resslova
Klavíkova
Holečkova
Dr. Haška
Pražská
Fráni Šrámka
Skuherského
Kostelní
třída 28. října
Krajinská
České Budějovice 1
České Budějovice 3
Mlýnská
Panská
Česká
Biskupská
Hroznova
Široká
Karla IV.
Piachého
U Černé věže
Kanovnická
Konzervatoř
Jírovcova
Na Sadech
Jirsíkova

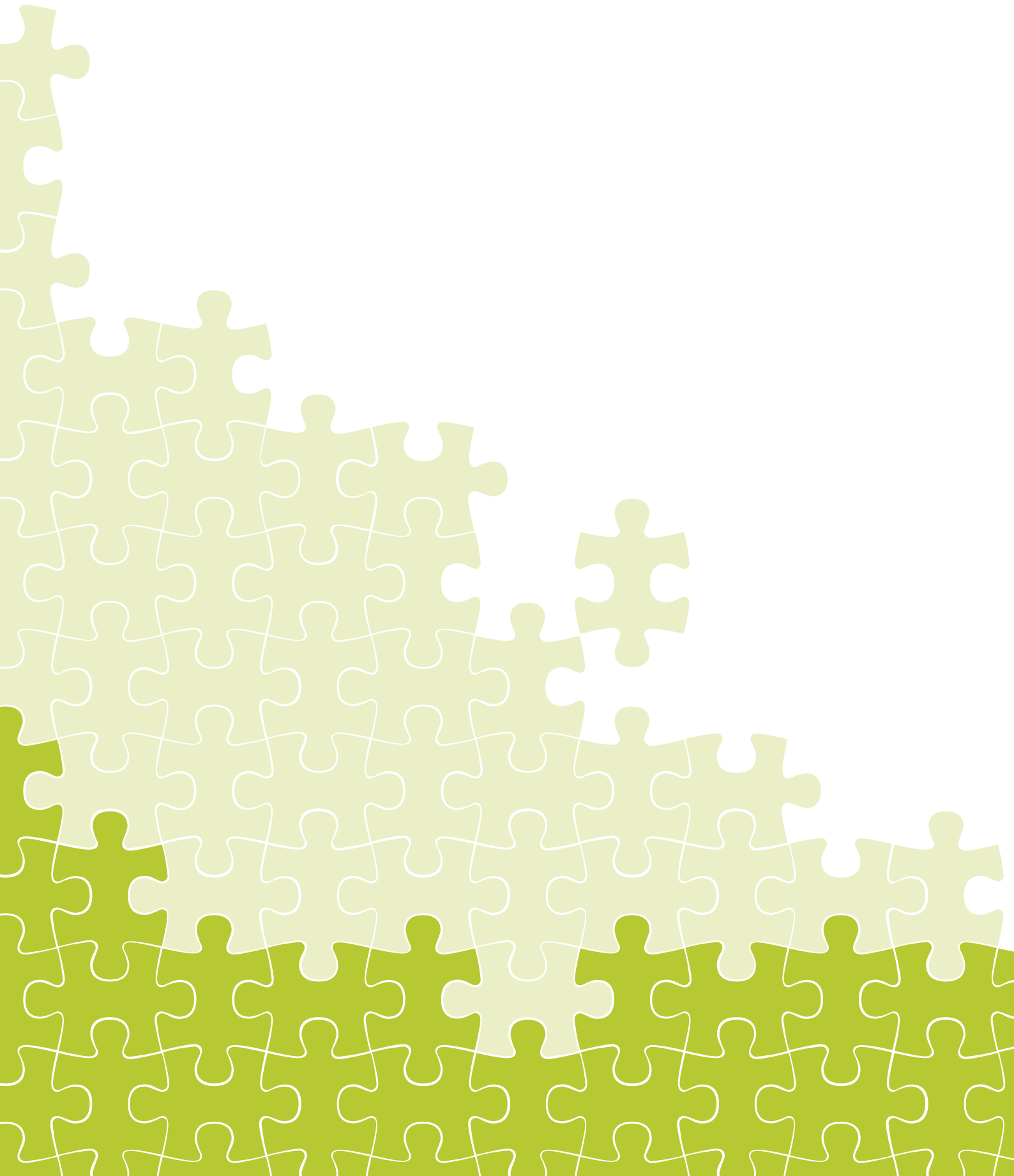
Floorplan

Conference Foyer – 2nd Floor of the Venue



University of South Bohemia





附錄二：照片集錦

Fig1　SER 2012 會議舉辦場地（Clarion Congress Hotel）

Fig2　專題論壇（Plenary Session）會場一景

Fig3　專題論壇（Plenary Session）會場一景

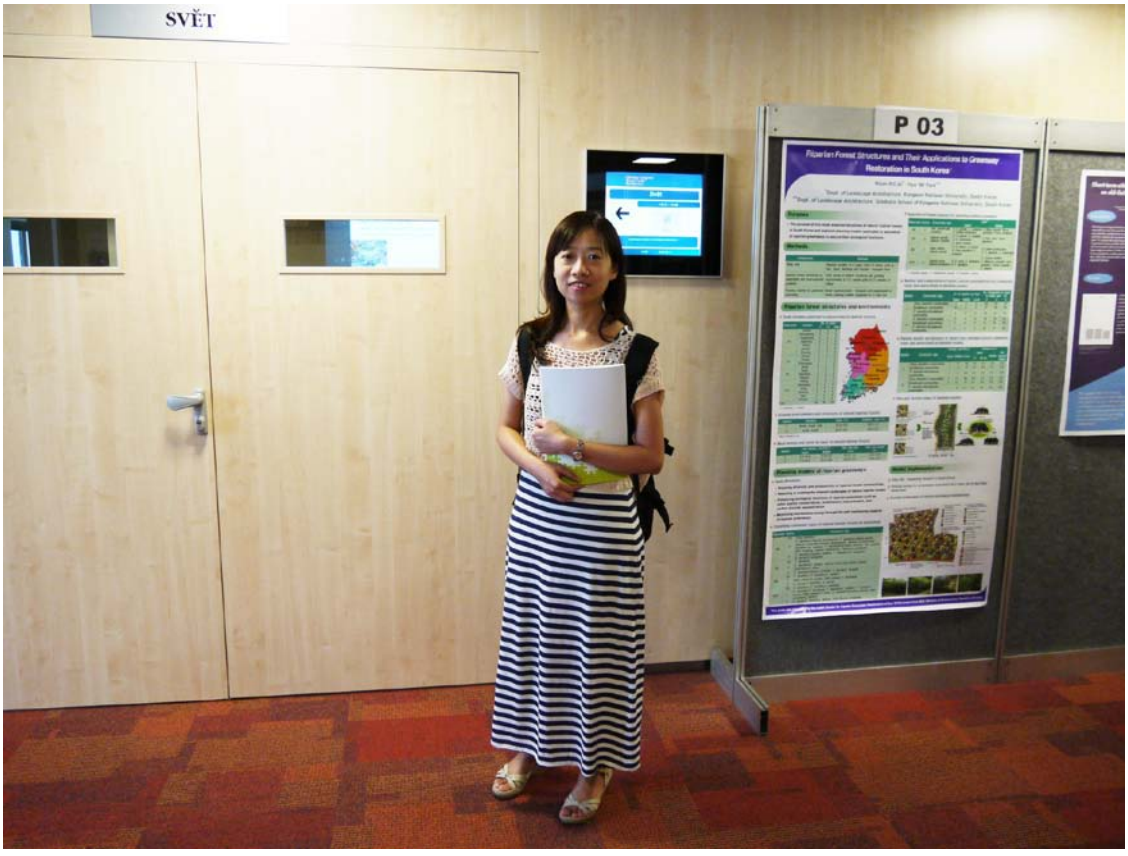


Fig4　會場一景

Fig5　分項座談會（Parallel Session）會場一景

Fig6　分項座談會（Parallel Session）會場一景

Fig7　分項座談會（Parallel Session）會場一景

Fig8　分項座談會（Parallel Session）會場一景

Fig9　分項座談會（Parallel Session）會場一景

Fig10　分項座談會（Parallel Session）會場一景

Fig11　海報發表區一景

Fig12　海報發表區一景

Fig13　中場休息一景

Fig14　會場一景

Fig15　實地參訪（Mid-Conference Excursions）一景

Fig16　實地參訪舒馬瓦山國家公園（Sumava National Park）一景

Fig17　實地參訪舒馬瓦山國家公園（Sumava National Park）一景

Fig18　實地參訪舒馬瓦山國家公園（Sumava National Park）一景

Fig19　實地參訪舒馬瓦山國家公園（Sumava National Park）一景

Fig20　實地參訪霍拉索維采（Holašovice）村莊一景