Hicke, J. A., C. D. Allen, et al. (2012). "**Effects of biotic disturbances on forest carbon cycling in the United States and Canada**." Global Change Biology 18(1): 7-34.

Forest insects and pathogens are major disturbance agents that have affected millions of hectares in North America in recent decades, implying significant impacts to the carbon (C) cycle. Here, we review and synthesize published studies of the effects of biotic disturbances on forest C cycling in the United States and Canada. Primary productivity in stands was reduced, sometimes considerably, immediately following insect or pathogen attack. After repeated growth reductions caused by some insects or pathogens or a single infestation by some bark beetle species, tree mortality occurred, altering productivity and decomposition. In the years following disturbance, primary productivity in some cases increased rapidly as a result of enhanced growth by surviving vegetation, and in other cases increased slowly because of lower forest regrowth. In the decades following tree mortality, decomposition increased as a result of the large amount of dead organic matter. Net ecosystem productivity decreased immediately following attack, with some studies reporting a switch to a C source to the atmosphere, and increased afterward as the forest regrew and dead organic matter decomposed. Large variability in C cycle responses arose from several factors, including type of insect or pathogen, time since disturbance, number of trees affected, and capacity of remaining vegetation to increase growth rates following outbreak. We identified significant knowledge gaps, including limited understanding of carbon cycle impacts among different biotic disturbance types (particularly pathogens), their impacts at landscape and regional scales, and limited capacity to predict disturbance events and their consequences for carbon cycling. We conclude that biotic disturbances can have major impacts on forest C stocks and fluxes and can be large enough to affect regional C cycling. However, additional research is needed to reduce the uncertainties associated with quantifying biotic disturbance effects on the North American C budget.

FULL TEXT LINK: http://dx.doi.org/10.1111/j.1365-2486.2011.02543.x

Sovern, S. G., M. Taylor, et al. (2011). "**Nest Reuse by Northern Spotted Owls on the East Slope of the Cascade Range, Washington**." Northwestern Naturalist 92(2): 101-106.

During a long-term demography study of Northern Spotted Owls (*Strix occidentalis caurina*) in the eastern Cascade Range of Washington State in 1989 to 2008, we documented 276 nests of Northern Spotted Owls at 73 different territories. Of these nests, 90.2% were on platforms, mostly in clumps of deformed limbs caused by dwarf mistletoe (primarily *Arceuthobium douglasii*), and 9.8% were in cavities in trees. Of the nests associated with dwarf mistletoe, 8.4% were nests built by other raptors and 91.6% were either natural accumulations of debris or debris accumulated by other birds or mammals. Owls switched nests between nesting attempts 81.2% of the time. The presence of a new male or female at a territory did not affect the odds of switching nests between nesting attempts. The odds an owl would reuse a nest were 6 times greater for owls that were successful in the previous nesting attempt compared to owls that were unsuccessful, given the same type of nest structure. The odds an owl would reuse a cavity nest were 4.7 times greater than the odds an owl would reuse a platform nest, given the same level

of nest success the previous year. The estimated mean annual survival rate (φ) of nest structures was 0.98 (SE = 0.006), suggesting that mean life expectancy of nests was 42 y. However, nests on dwarf mistletoe platforms may be more ephemeral than cavity nests or the nest trees themselves, and management for viable nest areas for Spotted Owls should include multiple trees with mistletoe brooms suitable for alternate nests. Our results, and results from other studies, indicate that Douglas-fir (*Pseudotsuga menziesii*) trees infected with dwarf mistletoe are an important habitat component for Spotted Owls and many other species of birds and arboreal mammals on the east slope of the Cascade Range in Washington.

FULL TEXT LINK: http://dx.doi.org/10.1898/10-01.1

Barros, A. M. G., J. M. C. Pereira, et al. (2012). "**Identifying geographical patterns of wildfire orientation: A watershed-based analysis**." Forest Ecology and Management 264(0): 98-107.

We searched for geographical patterns in the orientation of wildfires, using watersheds as spatial support for the analysis. An 1975–2005 annual fire atlas of mainland Portugal was used to compute the orientation of fire perimeters and watersheds, using principal component analysis. Circular statistics were employed to test for the existence of a preferred, as opposed to random, mean fire orientation in each watershed, and to search for evidence of orographic channelling of fire by comparing fire orientation and watershed orientation. We also tested for differences in fire orientation patterns under conditions of mild versus severe fire weather. Our findings show that in the 31 year period of the study, 84% of the overall area burned is accounted for by watersheds where fires display preferential orientation. Twelve of 102 watersheds display evidence of alignment between fire and watershed orientation and we found no distinction in fire orientation as response to fire weather. The spatial arrangement of watersheds where fires present similar orientation suggests wind as a major driver of the broader patterns found in this study. Results from this analysis ought to be relevant for supporting the delineation of landscape-scale fuelbreaks.

FULL TEXT LINK: http://www.sciencedirect.com/science/article/pii/S037811271100586X

Naik, P. K. and D. A. Jay (2011). "**Distinguishing human and climate influences on the Columbia River: Changes in mean flow and sediment transport**." Journal of Hydrology 404(3-4): 259-277.

Most hydrologic trends result from a combination of climatic and human influences, and analyses of hydrologic changes often do not differentiate these factors, despite the obvious relevance of this distinction. Here, we separate human and climate influences on the Columbia River hydrologic cycle and sediment discharge on the basis of robust data analyses since 1858. Human influences include water withdrawal for irrigation, flow regulation, reservoir manipulation, mining and deforestation. The Columbia's streamflow and sediment discharge are strongly correlated with large-scale climate patterns, particularly the ENSO (El Niño Southern Oscillation) and PDO (Pacific Decadal Oscillation). The mean annual Columbia River virgin flow at The Dalles has decreased ~16.5%, 8-9% due to climate change and 7-8% due to water withdrawal for irrigation. Climate impacts on the sediment discharge are larger than on streamflow because sediment discharge increases more than linearly with flow. Total sediment and

sand transports have decreased >50% and >70% respectively, only a fraction of which is due to climate change. Changes in the timing of maximum flows from sub-basins, as influenced by flow regulation and irrigation withdrawal, determine freshet timing and play a larger role in determining the maximum flow and sediment transport levels. Flow regulation (since 1970) has decreased peak spring flows by ~45% and increased flow during the rest of the year. The spring freshet flow decrease due to climate change is 11%; the decreases due to water withdrawal and flow regulation are about 12% and 26% respectively. The peak freshet flow now typically occurs 2-4 weeks earlier than before 1900.

FULL TEXT LINK:

Woods, S. W. and V. N. Balfour (2010). "**The effects of soil texture and ash thickness on the post-fire hydrological response from ash-covered soils**." Journal of Hydrology 393(3-4): 274-286.

Ash increases the post-fire hydrological response to rainfall in some situations but decreases it in others, and the reasons for this variability are not well defined. We used simulated rainfall experiments to determine whether the varying hydrological effect of ash can be attributed to differences in the underlying soil texture or the ash thickness. We compared the infiltration rates: (1) before and after controlled burns in 0.5 m2 plots underlain by two sharply contrasting soil textures (sandy loam and gravelly silt loam), and; (2) before and after the addition of 0.5, 2.5 and 5.0 cm of ash to the burned sandy loam plots with the original ash layer removed. The controlled burns left a ~1 cm ash layer comprised mostly of silt and fine sand particles that clogged the largest pores in the sandy loam soil, reducing the final infiltration rate from 91 mm h-1 to 35 mm h-1, but had no effect on infiltration in the silt loam plots. Pore clogging also reduced the final infiltration rate by 20 mm h-1 (40%) and the total infiltration by 16 mm (24%) when 0.5 cm of ash was added to the sandy loam plots. However, increased storage in the ash layer combined with slight increases in the final infiltration rate (by 5 and 18 mm h-1, respectively), increased the total infiltration by 16 mm (30%) and 18 mm (26%), respectively with the thicker ash addition treatments. Thus, the varying effect of ash on infiltration and runoff can be at least partially attributed to between-site differences in soil texture and ash thickness. A thin ash layer (<1 cm) overlying a coarse or macroporous soil will clog the larger pores, increasing the hydrological response, whereas the same ash overlying a fine or non-macroporous soil will have no effect. With thicker ash layers (2-5 cm) storage effects increasingly delay and reduce the runoff response to the point where no overland flow is produced regardless of any pore clogging effect in the underlying soil.

FULL TEXT LINK: http://www.sciencedirect.com/science/article/B6V6C-50XS6PH-2/2/c01cbd12899283a1d9d002526f962941

Jactel, H., J. Petit, et al. (2012). "**Drought effects on damage by forest insects and pathogens: a meta-analysis.**" Global Change Biology 18(1): 267-276.

In the context of climate change, the effects of prolonged or more severe droughts on pest and pathogen damage are a major concern for forest ecosystems. To date, there is great uncertainty about the direction, magnitude and sources of variation in responses to drought by insects and fungi. We report the outcomes of a meta-analysis of 100 pairwise comparisons of insect pest or pathogen damage

to water-stressed and control trees from 40 publications. The type of feeding substrate for insects and fungi and the water stress severity emerged as the main factors influencing the level of damage in water-stressed trees. Overall, primary damaging agents living in wood caused significantly lower damage to the water-stressed trees compared with the control, whereas primary pests and pathogens living on foliage caused more damage to water-stressed trees, in all cases irrespective of stress severity. In contrast, damage by secondary agents increased with stress severity, which was best estimated by the ratio between the predawn leaf water potential in stressed trees and the xylem pressure inducing 50% loss in hydraulic conductance due to cavitation, a species-specific index of drought tolerance. Insect and fungus feeding behaviour, affected tree part, and water stress severity are therefore proposed as three important predictors of forest damage in drought conditions.

FULL TEXT LINK: http://dx.doi.org/10.1111/j.1365-2486.2011.02512.x

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Ångman, E., L. Hallgren, et al. (2011). **"Managing Impressions and Forests: The Importance of Role Confusion in Co-Creation of a Natural Resource Conflict.**" Society & Natural Resources 24(12): 1335-1344.

Social interaction is an important - and often forgotten - aspect of conflicts in natural resource management (NRM). Building on the theoretical framework of symbolic interaction, this article explores how the concept of impression management during social interaction can help understand NRM conflicts. A qualitative study was carried out on a Swedish case involving a conflict over clear-cutting of a forest. To explain why the conflict escalated and destructivity increased, we investigated how the involved actors interpreted each other's actions. For an individual, role confusion occurs when a particular interaction creates a conflict between the presented self and the self expected from the social situation (Goffman 1956). The analysis shows that actors could not use their established social arenas to address dissatisfaction due to the fear of role confusion. Instead, they avoided informal face-to-face meetings and changed the conditions of the social situation to avoid role confusion.

FULL TEXT LINK: http://dx.doi.org/10.1080/08941920.2011.558172

Jakes, P. J., K. C. Nelson, et al. (2011). **"Community wildfire protection planning: is the Healthy Forests Restoration Act's vagueness genius?"** International Journal of Wildland Fire 20(3): 350-363.

The Healthy Forests Restoration Act of 2003 (HFRA) encourages communities to develop community wildfire protection plans (CWPPs) to reduce their wildland fire risk and promote healthier forested ecosystems. Communities who have developed CWPPs have done so using many different processes, resulting in plans with varied form and content. We analysed data from 13 case-study

communities to illustrate how the characteristics of HFRA have encouraged communities to develop CWPPs that reflect their local social and ecological contexts. A framework for analysing policy implementation suggests that some elements of HFRA could have made CWPP development and implementation problematic, but these potential shortcomings in the statute have provided communities the freedom to develop CWPPs that are relevant to their conditions and allowed for the development of capacities that communities are using to move forward in several areas.

FULL TEXT LINK: http://www.publish.csiro.au/paper/WF10038

Rahmstorf, S. and D. Coumou (2011). "**Increase of extreme events in a warming world.**" Proceedings of the National Academy of Sciences 108(44): 17905-17909.

We develop a theoretical approach to quantify the effect of long-term trends on the expected number of extremes in generic time series, using analytical solutions and Monte Carlo simulations. We apply our method to study the effect of warming trends on heat records. We find that the number of record-breaking events increases approximately in proportion to the ratio of warming trend to short-term standard deviation. Short-term variability thus decreases the number of heat extremes, whereas a climatic warming increases it. For extremes exceeding a predefined threshold, the dependence on the warming trend is highly nonlinear. We further find that the sum of warm plus cold extremes increases with any climate change, whether warming or cooling. We estimate that climatic warming has increased the number of new global-mean temperature records expected in the last decade from 0.1 to 2.8. For July temperature in Moscow, we estimate that the local warming trend has increased the number of records expected in the past decade fivefold, which implies an approximate 80% probability that the 2010 July heat record would not have occurred without climate warming.

FULL TEXT LINK: http://www.pnas.org/content/108/44/17905.abstract

James, J. J., T. J. Svejcar, et al. (2011). **"Demographic processes limiting seedling recruitment in arid grassland restoration."** Journal of Applied Ecology 48(4): 961-969.

1. Seeding is an important management tool in aridland restoration, but seeded species often fail to establish. Previous research has largely focused on the technical aspects of seeding with little effort directed at identifying demographic processes driving recruitment failures. 2. In tilled plots, in each of 3 years, we estimated life stage transition probabilities for three species commonly used in sage steppe restoration. We also took similar measurements on seed sown by managers following four major fires. 3. Point estimates and associated Bayesian confidence intervals demonstrated germination probabilities that were consistently high, averaging 0·72. However, estimates suggest only 17 and 7% of

the germinated seeds emerged in the tilled plots and fire sites, respectively. Following emergence, survival across the seedling, juvenile and adult transitions averaged 0·72. This suggests the transition from a germinated seed to an emerged seedling was the major bottleneck in recruitment. Although most individuals died during emergence, this was not always the principal source of variation in recruitment across sites. 4.Synthesis and applications. Processes occurring after emergence, such as mortality during spring and summer drought, may contribute to site-to-site variation in recruitment but are unlikely to be the main causes of restoration failures. Instead, recruitment may largely be determined by processes occurring during emergence, such as freezing and thawing of the seedbed, development of physical soil crusts and pathogen attack on germinated seeds. Using tools such as seed coatings and soil amendments to manage processes inhibiting emergence and developing seed mixes with higher emergence probabilities are likely to greatly improve restoration outcomes in the sage steppe and similar aridland systems.

FULL TEXT LINK: http://dx.doi.org/10.1111/j.1365-2664.2011.02009.x

Steinhoff, G. (2011). "**The Wilderness Act, Prohibited Uses, and Exceptions: How Much Manipulation of Wilderness Is Too Much?**" Natural Resources Journal 51(2): 287-306.

The Wilderness Act of 1964 prohibits a number of uses in federally designated wilderness areas. In accordance with the Act, there shall be no permanent or temporary roads, no use of motor vehicles, motorized equipment, landing of aircraft, or placement of structures or installations. The Act includes an important clause that allows exceptions. The Act states that temporary roads, motor vehicles, structures and installations, etc., are prohibited “except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act.” As will be discussed, this obscure clause has been widely misinterpreted by federal agencies so that it is far too vague, allowing manipulations that are too extensive and destructive of wilderness resources. This article will present a more precise and correct interpretation of the exception clause. Properly interpreted, the Wilderness Act allows needed manipulations of wilderness, such as the construction of trails and bridges, yet rules out actions that are too destructive.

FULL TEXT LINK: http://lawschool.unm.edu/nrj/current.php

Smith, T. J., J. P. McNamara, et al. (2011). "**Small soil storage capacity limits benefit of winter snowpack to upland vegetation**." Hydrological Processes 25(25): 3858-3865.

In the western United States, the mountain snowpack is an important natural reservoir that extends spring and summer water delivery to downstream users and ecosystems. The importance of winter snow accumulation to upland ecosystems is not as clearly defined. This study investigates the

relative contribution of winter precipitation to upland spring and summer soil moisture storage and availability in a semi-arid mountainous watershed. At this site, coarse soil textures and shallow soil depths limit soil storage capacity to 6–16 cm. Winter precipitation exceeds soil storage capacity by 2.5 times. Accordingly, soil moisture profiles at most locations in the watershed reach field capacity in early winter. With soil storage near capacity, water released by snowmelt primarily contributes to deep drainage and makes a limited contribution to the soil moisture reservoir. Water that is retained by the soil after the snowpack melts is lost to evapotranspiration in as little as 10 days. In contrast, spring precipitation extends moist soil conditions by up to 90 days into the warm season, when ecological water demand is highest. These field observations suggest that changes in spring precipitation, not winter snowpack, may have the greater impact on upland ecosystems in this environment. Furthermore, because winter precipitation is in excess compared to the soil storage capacity, soil moisture availability may be fairly insensitive to climate change-induced transitions from snow to rain.

FULL TEXT LINK: http://dx.doi.org/10.1002/hyp.8340

Garlough, E. C. and C. R. Keyes (2011). "**Influences of moisture content, mineral content and bulk density on smouldering combustion of ponderosa pine duff mounds**." International Journal of Wildland Fire 20(4): 589-596.

When applying prescribed fire to long-unburned but fire-adapted ecosystems, fuels managers require better decision-support models to determine appropriate conditions for achieving desired effects. Prolonged combustion in duff accumulations at the base of large conifers may lead to fine root mortality, cambial injury, enhanced susceptibility to bark beetle attack, and possibly tree death. A laboratory experiment was conducted to investigate how moisture content, mineral content, and bulk density affect smouldering combustion in ponderosa pine (Pinus ponderosa C. Lawson) duff mound fuels of the south-eastern Klamath Mountains, California, USA. Samples were divided between upper and lower duff for a total of 100 burn tests. Moisture content was adjusted to observe the transition through the ignition and spread limit. Bulk density, mineral content and percentage consumption were recorded for each burn. The moisture content threshold for smouldering combustion was 57 and 102% respectively for upper and lower duff. Percentage consumption was inversely related to moisture content for both layers of duff, and partially dependent on mineral content for lower duff. Bulk density was a non-significant factor in either ignition or percentage combustion for the conditions examined here. Results from this study identify important attributes of duff that control the burning process in order to inform prescribed burning decisions.

FULL TEXT LINK: http://dx.doi.org/10.1071/WF10048

Condon, L., P. J. Weisberg, et al. (2011). "**Abiotic and biotic influences on Bromus tectorum invasion and Artemisia tridentata recovery after fire**." International Journal of Wildland Fire 20(4): 597-604.

Native sagebrush ecosystems in the Great Basin (western USA) are often invaded following fire by exotic Bromus tectorum (cheatgrass), a highly flammable annual grass. Once B. tectorum is

established, higher fire frequencies can lead to local extirpation of Artemisia tridentata ssp. vaseyana (mountain big sagebrush) and have cascading effects on sagebrush ecosystems and the species that depend on them. We conducted a landscape-scale observational study to examine the distribution and cover of B. tectorum and A. tridentata 6 years after a large wildland fire. We used structural equation models to quantify the interacting influences of pre-fire tree canopy cover, perennial species cover, distance from potential seed source, and site environment on post-fire cover of B. tectorum and A. tridentata. Results confirmed a hypothesised negative effect of pre-fire tree canopy cover on post-fire cover of A. tridentata. Site- and landscape-level abiotic factors influenced pre-fire tree canopy cover, which, in turn, influenced the probability of rapid recovery to A. tridentata. However, B. tectorum cover was primarily influenced by a positive effect of incident solar radiation and a negative effect of perennial herbaceous species cover. Restoration efforts to reduce tree canopy cover should be limited to productive sites with sufficient cover of perennial herbaceous species to facilitate site recovery.

FULL TEXT LINK: http://www.publish.csiro.au/paper/WF09082

Peterson, D. L., C. I. Millar, et al. (2011). **Responding to climate change in national forests: a guidebook for developing adaptation options**, USDA Forest Service, Pacific Northwest Research Station. General Technical Report: 109.

This guidebook contains science-based principles, processes, and tools necessary to assist with developing adaptation options for national forest lands. The adaptation process is based on partnerships between local resource managers and scientists who work collaboratively to understand potential climate change effects, identify important resource issues, and develop management options that can capitalize on new opportunities and reduce deleterious effects. Because management objectives and sensitivity of resources to climate change differ among national forests, appropriate processes and tools for developing adaptation options may also differ. Regardless of specific processes and tools, the following steps are recommended: (1) become aware of basic climate change science and integrate that understanding with knowledge of local resource conditions and issues (review), (2) evaluate sensitivity of specific natural resources to climate change (rank), (3) develop and implement strategic and tactical options for adapting resources to climate change (resolve), and (4) monitor the effectiveness of adaptation options (observe) and adjust management as needed. Results of recent case studies on adaptation in national forests and national parks can facilitate integration of climate change in resource management and planning and make the adaptation process more efficient. Adaptation to climate change will be successful only if it can be fully implemented in established planning processes and other operational aspects of national forest management.

FULL TEXT LINK: http://www.treesearch.fs.fed.us/pubs/39884