

Greetings and welcome to the **AUGUST 2014** edition of the WDFW Climate News Digest. Our purpose is to provide highlights of relevant climate change news, events and resources for WDFW staff. Feedback or suggestions for items to include in future editions are much appreciated – many *thanks* to those who have sent links and references and please keep them coming. Note that previous editions of the newsletter are now stored on the Habitat Program Sharepoint site -- <http://sharepoint.dis.wa.gov/dfw/habitat/climatechange/default.aspx> and on the agency's [climate change web page](#).

Thanks for contributions this month from Olaf Langness, Bob Vadas, Bruce Botka, David Patte (USFWS), the OCCRI Newsletter and Marc Hayes.

WHAT'S HAPPENING AT WDFW?

Are you thinking about the climate change implications into a project you are involved with? Do you know of a WDFW initiative or one in which we are a partner where we *should* be thinking about future climate change? Have you come across research which feels particularly relevant to the work you do? Please be in touch if you think you have something to share with your colleagues and I'm happy to write it up.

WDFW receives funding from the North Pacific LCC for Climate Change case study

The North Pacific LCC announced FY 2014 funding for projects. [Click here](#) for all project summaries. The WDFW project will focus on integrating climate change into design of water crossing structures. The project will explore how we address risk in decisions related to culvert design, and specifically what aspects of basin characteristics and stream morphology contribute to increase risk from climate change and options for addressing that increased risk. We expect to kick the project off early next month. Questions or comments, please be in touch with [Lynn Helbrecht](#).

Coastal Cutthroat Trout Sensitivity to Climate Change Variables

Bob Vadas and colleagues in the Science Division of the Habitat program recently submitted a paper on long-term population response of Coastal Cutthroat Trout to hydrologic and other environmental fluctuations in the Irely Creek drainage within Olympic National Park. The paper notes that escapement declines significantly during summer/fall dry-outs of adult habitat in Irely Lake, as well as for years with higher spawning temperatures in the stream itself. Paper attached.

CLIMATE ADAPTATION AT OTHER ORGANIZATIONS

National Hockey League Outlines Plan to Fight Climate Change

Climate change is impacting the next generation of hockey players directly, according to a recent [report](#) by the National Hockey League. The report, the first of its kind produced by a professional sports league in partnership with the Natural Resources Defense Council, details a plan for the NHL to reduce its greenhouse gas emissions. "Major environmental challenges, such as climate change and freshwater scarcity, affect opportunities for hockey players of all ages to learn and play the game outdoors," NHL Commissioner Gary Bettman said in statement on Monday.

EPA awards over \$756,000 to research coastal climate change impacts on Swinomish Indian Tribal Community

<http://yosemite.epa.gov/opa/admpress.nsf/0/911BC1980ADDC50485257D1E007B598E>

New Resources from EPA's Green Infrastructure Program

The U.S. Environmental Protection Agency (EPA) recently released a suite of new web resources to demonstrate how green infrastructure can play an important role in building community resilience to climate change impacts. EPA also launched a Green Infrastructure Collaborative last week with the [support](#) of six other government agencies at the President's State, Local, and Tribal Leaders Task Force on [Climate Preparedness and Resilience](#). [Read More >>](#)

Obama Administration Unveils Second Phase of Climate Data Initiative: Food Resilience in a Changing Climate

In March 2014, the Obama Administration unveiled the [Climate Data Initiative](#) to leverage the federal government's open data resources to stimulate innovation and entrepreneurship and empower America's communities and businesses to take action against climate change and prepare for the future. The Initiative's first focus was on coastal resilience, and this week it was announced that its second focus will be on food resilience, aimed at America's agricultural sector and strengthening the resilience of the global food system in a changing climate. The goal is to connect farmers, food distributors, and agricultural businesses with the data, tools, and information they need to understand how climate change impacts - such as more intense heat waves, heavier downpours, and severe droughts and wildfires - are affecting their operations today and steps they can take to both prepare for and become resilient against climate change.

To learn more, visit: <http://www.whitehouse.gov/the-press-office/2014/07/29/fact-sheet-empowering-america-s-agricultural-sector-and-strengthening-fo>.

West Coast Ocean Acidification and Hypoxia Science Panel: An Exciting New Vision

The West Coast Ocean Acidification and Hypoxia Science Panel has a new [website](#). Learn more about the scientists on the Panel, explore their vision, and discover how they are advancing a bold new knowledge base in service of the region's future. The panel was established in 2013 by the California Ocean Protection Council. The website will provide a venue to disseminate and distribute products that are produced by the Panel as they work to summarize information on key themes identified by decision makers

LEARNING OPPORTUNITIES

August 19th, 11:00-12:00 (Pacific time), The Politics and Research behind Pollution, Climate Change, Disease, and Amphibian Declines

Presented by: Dr. Jason Rohr, Department of Integrative Biology, University of South Florida – to register [click here](#).

September 9th, 11:00 am-noon (Pacific Time) Climate Change Adaptation for an at Risk Community - Shaktoolik Alaska

Speaker: Terry Johnson, Alaska Sea Grant Marine Advisory Program, OneNOAA webinar, [click here for more info](#)

September 9-10, 2014, Seattle, WA, Fifth Annual Pacific Northwest Climate Science Conference, <http://pnwclimateconference.org/>

The PNW Climate Science Conference annually brings together more than 250 researchers and practitioners from around the region to discuss scientific results, challenges, and solutions related to the impacts of climate on people, natural resources, and infrastructure in the Pacific Northwest. Emphasis is on talks that are comprehensible to a wide audience on topics of broad interest

October 6th, 4:30-6:00 (Pacific Time), “Bungee Jumping off the Ice-Core Roller Coaster: Ice-Core Records of Global Warming and Abrupt Climate Change”, Dr. Richard Alley

Dr. Richard Alley, Evan Pugh Professor of Geosciences and Associate of the Earth and Environmental Systems Institute at The Pennsylvania State University will be the main presenter for the [Climate Stewards Education Program's](#) monthly meeting in October. Plan now to tune in to this widely known scientist-educator's presentation on ice cores, global warming, and abrupt climate change. Registration Details available in next month's climate newsletter.

October 28-30th, Climate Smart Conservation class, Olympia, WA.

The North Pacific LCC is sponsoring NCTC Climate-Smart Conservation class in Olympia, WA, Oct 28-30, which is based on the [guide](#), “Climate Smart Conservation: Putting Adaptation Principles into Practice”. The course is designed to provide guidance in how to carry out adaptation with intentionality, how to manage for change and not just persistence, how to craft climate-informed conservation goals, and how to integrate adaptation into on-going work. Conservation practitioners and natural resource managers will learn to become savvy consumers of climate information, tools, and models. See the course description and logistics on the [NCTC webpage for this class](#).

Monthly: NOAA Hosts Monthly Webinar Series on Climate Information for Managing Risks in Water Resources

Working with collaborators such as the U.S. National Integrated Drought Information System, Water Research Foundation, Water Environment Federation, Water Environment Research Foundation, and American Water Works Association, the Sectoral Applications Research Program in NOAA's Climate Program Office is hosting a series of webinars the third Thursday of every month. 🗨️ For a listing of webinars, visit [this site](#).

RECORDED WEBINARS

Climate-Smart Guide, Part II – The Art of the Possible: Identifying Adaptation Options- webinar recording from July

Presenters include: Susan Julius- EPA Global Change Impacts & Adaptation Research Program, Jordan M. West - EPA Global Change Impacts & Adaptation Research Program, Molly S. Cross - Wildlife Conservation Society

Description: This webinar is the second in a series focused on the recently released guide, [Climate-Smart Conservation: Putting Adaptation Principles into Practice](#). Armed with an understanding of climate vulnerabilities in the context of climate-informed goals, the next step is to identify a full range of possible adaptation responses. This webinar will focus on Chapter 8 of the Guide and will look at a process for using vulnerability information as the basis for generating specific adaptation options. Case studies will be used to illustrate identification of options, considerations for maximizing climate-smart “design” of options, and applicability of options in the context of the dual pathways of managing for change and persistence.

Interactive Education Module on Climate Change Science and Modeling

The Climate Change Resource Center (www.fs.fed.us/ccrc/) has released a new interactive online education module on basic climate change science and climate modeling. The module was designed to make climate change science approachable to the general public and to provide flexibility for busy professionals, but also to facilitate a greater level of understanding and depth through interactive features. It will help the Forest Service continue to make progress on the Climate Change Scorecard by giving all employees access to a new education option. The module, “Climate Change Science and Modeling: What You Need to Know”, gives a brief overview of the climate system, greenhouse gases, climate models, current climate impacts,

and future climate projections. Interactive features allow users to control their learning experience, with opportunities to explore outside links, and learn definitions and relevant facts. The main material is followed by an activity specific to the user's geographical region, and completing the activity will generate a personalized certificate. The climate change module is available at www.fs.fed.us/ccrc/climate-basics/education.shtml.

RESOURCES

U.S. Geological Survey Announces "Climate Matters" Newsletter

"Climate Matters" is a new semi-annual publication featuring current activities in the U.S. Geological Survey Climate Research & Development Program. The newsletter highlights recent research findings and their relevance to societal needs, as well as issues of importance for resource managers, policy makers, and the general public. To view the first issue, visit:

http://www.usgs.gov/climate_landuse/clu_rd/newsletter/default.asp.

Climate Change and Indigenous Peoples: A Primer & Traditional Knowledge Guidelines

A Primer and Traditional Knowledge Guidelines documents have been produced to provide foundational information to the Advisory Committee on Climate Change and Natural Resources Science (ACCCNRS) on intergovernmental relationships and science when engaging Tribal and Indigenous Peoples in federal climate change initiatives. [Click here](#) to learn more.

Conserving the Stage: Identifying a Resilient Network of Conservation Lands in the Northwest

The Nature Conservancy, in a project funded by the Doris Duke Charitable Foundation, has released a study that identifies the most resilient sites in the Northwest that will collectively and individually best sustain native biodiversity even as the changing climate alters current distribution patterns, in order to guide future conservation investment. The central idea is that by mapping key geophysical features and evaluating them for landscape characteristics that buffer against climate effects, the most resilient places in the landscape can be identified. The Northwest study area in the 2014 report covers 67 million hectares (165 million acres) and includes all of the East Cascades/Modoc Plateau, Columbia Plateau and Middle Rockies/Blue Mts. Ecoregions and the U.S. portion of the Canadian Rockies ecoregion

The report and data are available at the project website:

<https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/oregon/science/Pages/Resilient-Landscapes.aspx>

Resources for Educators -- Regional Guides for Teaching with the 2014 National Climate Assessment

Experts in climate education recently published a series of guides to help educators use the regional chapters of the National Climate Assessment Report for teaching and learning. The guides aim to unpack key messages for each of the 10 regions and point to high-quality teaching resources that support the messages.

California Climate Commons and Species Distribution Modeling

The [California Climate Commons](#) houses articles which explain important concepts to support understanding of climate change science. The feature article this month is '[Intro to Species Distribution Modeling](#).' Species distribution modeling (SDM) is often an important part of climate change vulnerability assessment and conservation prioritization. This article provides resources to get you started with SDM techniques.

EPA Climate Ready Estuaries Program Launches Redesigned Website

EPA's Climate Ready Estuaries, a program that works with the National Estuary Programs and coastal management community on assessing climate change vulnerabilities and developing and implementing adaptation strategies, has redesigned their website. Resources are now easier to find and webpages are now searchable. New features include interactive maps of Climate Ready Estuary projects, king tides, and more. Update your bookmarks to the new address: <http://www2.epa.gov/cre>.

Surging Seas Risk Finder

- C Climate Central has launched Surging Seas Risk Finder for California, Oregon, and Washington, and made upgrades for all 11 states analyzed for sea level rise and coastal flood risk

Updates include:

- “Fast Look” pages are printable PDF summaries for each place analyzed that integrate diverse findings and key explainers into one-stop destinations. Example: San Mateo County
- New map layers show race, ethnicity and per capita income of exposed populations. Example: San Francisco
- Comparisons for total vs. unprotected exposure allow quick assessment of potential protection from levees, ridges and other major features. Example: California counties

The Surging Seas Risk Finder was recently highlighted at the launch of The White House’s Climate Data Initiative. To inquire about getting a custom analysis, [click here](#). For more information please contact Dan Rizza at drizza@climatecentral.org.

NOAA and American Meteorological Society Release 2013 State of the Climate Report

The 2013 State of the Climate Report, edited by scientists from NOAA's National Climatic Data Center, is a 24-year tradition encompassing the work of 425 authors from 57 countries. The report uses dozens of climate indicators to track patterns, changes, and trends of the global climate system, including greenhouse gases; temperatures throughout the atmosphere, ocean, and land; cloud cover; sea level; ocean salinity; sea ice extent; and snow cover. These indicators often reflect many thousands of measurements from multiple independent data sets. The report also details cases of unusual and extreme regional events. To view highlights from the report, the full report, visuals, and the press release, visit: http://www.noaanews.noaa.gov/stories2014/20140717_stateoftheclimate.html.

Tribal Climate Change Newsletters from ITEP

Check out the Institute for Tribal Environmental Professionals’ monthly newsletter that provides news items, resources, announcements about funding opportunities, conferences, and training, and other information relevant to tribal climate change issues. To sign up for the newsletter please contact Susan.Wotkyns@nau.edu. [Read Past Newsletters >>](#)

CLIMATE SCIENCE NEWS

An eruption 20 years ago may have shifted global warming trends.

Unusually strong and persistent Pacific trade winds may be resulting in the cooling of the sea surface waters, while the deep ocean waters continue to warm upward.

ENSO Blog (El Niño-Southern Oscillation)

About once a week, a group of climate scientists share a new post and engage in discussions on the El Niño-Southern Oscillation (ENSO). Tune in for scientific perspectives on the ongoing El Niño Watch.

Recent posts include: [Details on the August 7th ENSO Discussion: how has the forecast changed?](#), [The Walker Circulation: ENSO's atmospheric buddy](#), [Other Climate Patterns that Impact U.S. Winter Climate](#)
[Visit the ENSO Blog »](#)

Report Highlights How Climate Change May Affect Water In Colorado

As Colorado's climate continues to warm, those who manage or use water in the state will likely face significant changes in water supply and demand. Additionally, future warming in the state is likely to lead to more heat waves, wildfires, and droughts. These messages are among the findings of *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation*, a new report released by the Western Water Assessment and the Colorado Water Conservation Board.

[Read the Press Release »](#)

[Access the Executive Summary or Full Report »](#)

Ancient Ocean Currents May Have Changed Pacing and Intensity of Ice Ages: Slowing of Currents May Have Flipped Switch

(Excerpt from Science Daily)

Researchers have found that the deep ocean currents that move heat around the globe stalled or even stopped about 950,000 years ago, possibly due to expanding ice cover in the north. The slowing currents increased carbon dioxide storage in the ocean, leaving less in the atmosphere, which kept temperatures cold and kicked the climate system into a new phase of colder but less frequent ice ages, they hypothesize.

The August edition of the Office of the Washington State Climatologist (OWSC) newsletter is now available on line (<http://climate.washington.edu/>) and attached to this email.

Topics include: July climate summary, a note on ENSO forecasting, drought update, temperature and precipitation outlook.

SPECIES AND HABITATS

California Drought Shaping Native Ecosystems

(from the article)

The record-setting in drought California is reshaping its native ecosystems – and giving researchers a glimpse of the future. California has always had an extreme hydrological cycle, with parching droughts interrupted by drenching Pacific storms (see [‘Extreme hydrology’](#)). But scientists say that the current drought — now in its third year — holds lessons for what to expect 50 years from now.

<http://www.scientificamerican.com/article/native-ecosystems-blitzed-by-drought/>

High-Elevation Vegetation Mountain Plants Adapt to Factors Above and Below

(Excerpt from OCCRI Newsletter)

Think of a conical mountain in a warming climate. Will plants simply move upslope to stay within their usual temperature range? It's not that simple, an experiment in the Siskiyou Mountains of Oregon suggests. Temperature and elevation are only part of the picture driving plants' adaptation to warming in alpine ecosystems, Marko Spasojevic and colleagues found. A complex mix of other factors — soil chemistry, topography, plant-to-plant interactions and microclimates (the climate in a small area that may differ from the surrounding climate) — help determine plant survival in a new location. The authors conclude that the buffering effect of topography and microclimates can only be fully understood when considered in the context of above-ground, plant-to-plant interactions and below-ground biogeochemical processes and feedbacks. Without consideration of these effects, the survival of a species in a warmer climate may be underestimated. This study also suggests that at least some species may already be out of equilibrium with

current climate conditions, and may disperse naturally soon.

Spasojevic, Marko J. et al. (2014). Above- and Belowground Biotic Interactions facilitate Relocation of Plants into Cooler Environments. *Ecology Letters*, 17, 6, 700–709, <http://onlinelibrary.wiley.com/doi/10.1111/ele.12272/abstract>

The subtle role of climate change on population genetic structure in Canada lynx

This research shows that current genetic variability of Canada lynx is strongly correlated with a winter climate gradient (i.e. increasing snow depth and winter precipitation from west-to-east) across the Pacific-North American (PNO) to North Atlantic Oscillation (NAO) climatic systems. This relationship was stronger than isolation by distance and not explained by landscape variables or changes in abundance. Thus, these patterns suggest that individuals restricted dispersal across the climate boundary, likely in the absence of changes in habitat quality. We propose habitat imprinting on snow conditions as one possible explanation for this unusual phenomenon. Coupling historical climate data with future projections, we also found increasingly diverging snow conditions between the two climate systems. Based on genetic simulations using projected climate data (2041–2070), we predicted that this divergence could lead to a threefold increase in genetic differentiation, potentially leading to isolated east–west populations of lynx in North America. Our results imply that subtle genetic structure can be governed by current climate and that substantive genetic differentiation and related ecological divergence may arise from changing climate patterns. [Row, J. R., Wilson, P. J., Gomez, C., Koen, E. L., Bowman, J., Thornton, D. and Murray, D. L. (2014), *The subtle role of climate change on population genetic structure in Canada lynx. Global Change Biology*, 20: 2076–2086. doi: 10.1111/gcb.12526]

Snowshoe hares display limited phenotypic plasticity to mismatch in seasonal camouflage

Plasticity in moult phenology and behaviours in snowshoe hares has been found to be insufficient for adaptation to camouflage mismatch, suggesting that any future adaptation to climate change will require natural selection on moult phenology or behaviour.... As duration of snow cover decreases owing to climate change, species undergoing seasonal colour moults can become colour mismatched with their background. The immediate adaptive solution to this mismatch is phenotypic plasticity, either in phenology of seasonal colour moults or in behaviours that reduce mismatch or its consequences. Researchers observed nearly 200 snowshoe hares across a wide range of snow conditions and two study sites in Montana, USA, and found minimal plasticity in response to mismatch between coat colour and background. It was found that moult phenology varied between study sites, likely due to differences in photoperiod and climate, but was largely fixed within study sites with only minimal plasticity to snow conditions during the spring white-to-brown moult. No evidence was found that hares modify their behaviour in response to colour mismatch. Hiding and fleeing behaviours and resting spot preference of hares were more affected by variables related to season, site and concealment by vegetation, than by colour mismatch. [Zimova, M., L. S. Mills, P. M. Lukacs, and M. S. Mitchell. 2014. *Snowshoe hares display limited phenotypic plasticity to mismatch in seasonal camouflage. Proceedings of the Royal Society B: Biological Sciences* 281. doi: 10.1098/rspb.2014.0029]

Land management trumps the effects of climate change and elevated CO2 on grassland functioning

A meta-analysis is used here to examine drivers at both scales primarily targeting services provided by grasslands relating to plant productivity (above- and below-ground biomass) and soil processes (nutrients and soil respiration) in 38 manipulative experiments published in the last decade. The authors specifically target effects of (i) single and combined land management practices (LMs), (ii) single and combined factors relating to broad-scale climate change and elevated CO₂, and (iii) combined management practices and changes to climate and CO₂. Collectively, this examines the general efficacy of global change models in predicting changes to grassland functioning. The authors found that combinations of management

practices had approximately double the explanatory power for variation in grassland services compared with individual or interactive effects of factors associated with climate change and CO₂. Although this work confirms how climate change and CO₂ can affect many ecosystem-based functional attributes, it suggests that combinations of land management practices remain the dominant set of factors in determining the performance of grassland plant communities. Land management may thus be critical for influencing projected responses to future climate change and elevated CO₂ in models of grassland function at least for factors relating to primary production. [Aurélie Thébault, Pierre Mariotte, Christopher J. Lortie and Andrew S. MacDougall *Journal of Ecology* Volume 102, Issue 4, pages 896–904, July 2014, DOI: 10.1111/1365-2745.12236]

Amphibians in the climate vise: loss and restoration of resilience of montane wetland ecosystems in the western US

Amphibians in the West's high-mountain areas find themselves in a vise, caught between climate-induced habitat loss and predation from introduced fish. This North Pacific LCC-backed project developed a list of tools that could be of use to land managers working with montane wetlands including a hydrologic model and remote-sensing techniques. [Maureen E Ryan, Wendy J Palen, Michael J Adams, and Regina M Rochefort 2014. *Amphibians in the climate vise: loss and restoration of resilience of montane wetland ecosystems in the western US. Frontiers in Ecology and the Environment* 12: 232–240. <http://dx.doi.org/10.1890/130145>]

Climate warming mediates negative impacts of rapid pond drying for three amphibian species

This study conducted a mesocosm experiment to test the individual and interactive effects of pool permanency (permanent vs. temporary) and water temperature (ambient vs. +~3°C) on three anurans with fast-to-slow larval development rates (Great Basin spadefoot [*Spea intermontana*], Pacific chorus frog [*Pseudacris regilla*], and northern red-legged frog [*Rana aurora*]). We found that although tadpoles in warmed pools reached metamorphosis 15–17 days earlier, they did so with little cost (<2 mm) to size, likely due to greater periphyton growth in warmed pools easing drying-induced resource competition. Warming and drying combined to act antagonistically on early growth (P = 0.06) and survival (P = 0.06), meaning the combined impact was less than the sum of the individual impacts. Warming and drying acted additively on time to and size at metamorphosis. These nonsynergistic impacts may result from cotolerance of larvae to warming and drying, as well as warming helping to offset negative impacts of drying. Our results indicate that combined pool warming and drying may not always be harmful for larval amphibians. However, they also demonstrate that antagonistic responses are difficult to predict, which poses a challenge to proactive conservation and management. Our study highlights the importance of considering the nature of multiple stressor interactions as amphibians are exposed to an increasing number of anthropogenic threats. [Sacha M. O'Regan, Wendy J. Palen, and Sean C. Anderson. 2014. *Climate warming mediates negative impacts of rapid pond drying for three amphibian species. Ecology* 95:845–855. <http://dx.doi.org/10.1890/13-0916.1>]

Precipitation, not warming temperatures, may be key in bird adaptation to climate change

A new empirically-based model analyzing how birds in western North America will respond to climate change suggests that for most species, regional warming is not as likely to influence population trends as will precipitation changes. Several past studies have found that temperature increases can push some animal species – including birds – into higher latitudes or higher elevations. Few studies, however, have tackled the role that changes in precipitation may cause. This analysis finds that for many species, it is precipitation that most affects the long-term survival of many bird species due to associated changes plant growth, soil moisture, water storage and insect abundance and distributions. The researchers examined long-term data on bird distributions and abundance covering five states in the western United States, and in the Canadian province of British Columbia, testing statistical models to predict temporal changes in population of 132 bird species over a 32-year period. They analyzed the impacts of temperature and

precipitation on bird distributions at the beginning of the study period (the 1970s) and then tested how well the predictions performed against actual population trends over the ensuing 30 years. [Illán, J. G., Thomas, C. D., Jones, J. A., Wong, W.-K., Shirley, S. M. and Betts, M. G. (2014), *Precipitation and winter temperature predict long-term range-scale abundance changes in Western North American birds*. *Global Change Biology*. doi: 10.1111/gcb.12642]

Climate warming contributes to native and invasive trout hybridization

Results from a study conducted by Dr. Clint Muhlfeld, US Geological Survey, with funding support from the Great Northern LCC, was recently published in the journal *Nature Climate Change*. The paper reports that rapid climate warming contributes to hybridization between native and invasive trout species. Muhlfeld and his collaborators examined long-term genetic monitoring data with high-resolution climate and stream temperature predictions. Their findings indicate that invasive hybridization could result in genomic extinction for many native species. [*Nature Clim. Change*, 2014/07/, Vol 4, Issue 7, pp 620- 624, <http://dx.doi.org/10.1038/nclimate2252>]

Climate-Aquatics Blog #57: Identifying & protecting climate refuge lakes for coldwater fishes

The climate is changing and fish populations are changing in response (blogs [32](#), [34](#), [35](#), [42](#)). Managing and conserving efficiently this century means having a good sense of where it's all headed and committing limited conservation resources accordingly. Committing to the wrong places risks being run over by the climate change train or squandering resources on populations that would have been fine regardless of what the climate does ([blog #52](#)). The sweet spot lies between the two extremes and figuring out where our investments will tip the balance toward more desirable outcomes later this century. So as alluded in the previous blog ([#56](#)), this time we're highlighting a set of related studies that constitute the current global gold standard in terms of developing the science, information, and management policies for making those commitments for one species in one landscape...

Earlier snowmelt prompting earlier breeding of Arctic birds

(excerpt from *Science Daily*)

Biologists have found that migratory birds that breed in Arctic Alaska are initiating nests earlier in the spring, and that snowmelt occurring earlier in the season is a big reason why. The report, "Phenological advancement in arctic bird species: relative importance of snow melt and ecological factors," appears in the current on-line edition of the journal *Polar Biology*. Researchers looked in nearly 2,500 nests of four shorebird species: semi-palmated sandpiper, red phalarope, red-necked phalarope, and pectoral sandpiper, and one songbird, the lapland longspur, and recorded when the first eggs were laid in each nest. The research occurred across four sites that ranged from the oilfields of Prudhoe Bay to the remote National Petroleum Reserve of western Arctic Alaska. "The rates of advancement in earlier breeding are higher in Arctic birds than in other temperate bird species, and this accords with the fact that the Arctic climate is changing at twice the rate." WCS Coordinator of Bird Conservation Steve Zack said, "Migratory birds are nesting earlier in the changing Arctic, presumably to track the earlier springs and abundance of insect prey. Many of these birds winter in the tropics and might be compromising their complicated calendar of movements to accommodate this change. We're concerned that there will be a threshold where they will no longer be able to track the emergence of these earlier springs, which may impact breeding success or even population viability."

J. R. Liebezeit, K. E. B. Gurney, M. Budde, S. Zack, D. Ward. **Phenological advancement in arctic bird species: relative importance of snow melt and ecological factors**. *Polar Biology*, 2014; DOI: [10.1007/s00300-014-1522-x](http://dx.doi.org/10.1007/s00300-014-1522-x)

High-elevation vegetation mountain plants adapt to factors above and below

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Thermal-safety margins and the necessity of thermoregulatory behavior across latitude and elevation, Sunday et al (attached)

(Excerpt from the abstract)

Physiological thermal-tolerance limits of terrestrial ectotherms often exceed local air temperatures, implying a high degree of thermal safety. However, air temperatures can be very different from the equilibrium body temperature of an individual ectotherm. This study compiles thermal-tolerance limits of ectotherms across a wide range of latitudes and elevations and compare these thermal limits both to air and to operative body temperatures. We show that extreme operative body temperatures in exposed habitats match or exceed the physiological thermal limits of most ectotherms. Therefore, contrary to previous findings using air temperatures, most ectotherms do not have a physiological thermal-safety margin.

Jennifer M. Sunday, Amanda E. Bates, Michael R. Kearney, Robert K. Colwell, Nicholas K. Dulvy, John T. Longino, and Raymond B. Huey

Minimizing the Cost of Keeping Options Open For Conservation in a Changing Climate (Mills et al (attached)

Excerpt from the abstract

Policy documents advocate that managers should keep their options open while planning to protect coastal ecosystems from climate-change impacts. However, the actual costs and benefits of maintaining flexibility remain largely unexplored, and alternative approaches for decision making under uncertainty may lead to better joint outcomes for conservation and other societal goals. For example, keeping options open for coastal ecosystems incurs opportunity costs for developers. We devised a decision framework that integrates these costs and benefits with probabilistic forecasts for the extent of sea-level rise to find a balance between coastal ecosystem protection and moderate coastal development. In our example, based on plausible scenarios for sea-level rise and assuming a risk-neutral decision maker, we found that substantial development could be accommodated with negligible loss of environmental assets.

Morena Mills, Sam Nicol, Jessie A. Wells, Jos'É J. Lahoz-Monfort, Brendan Wintle, Michael Bode, Martin Wardrop, Terry Walshe, William J. M. Probert, Michael C. Runge, Hugh P. Possingham, and Eve Mcdonald Madden, Conservation Biology, 2014

National Park Service Report Confirms Climate Change in National Parks

A new report authored by the National Park Service confirms that climate change is happening in America's national parks, and in some cases in rapid and concerning ways. These changes will have implications for what visitors see and experience in national parks and will require new approaches to the protection of

natural and historic resources within parks.

“Studies like this are critical to inform national park managers and visitors alike about their local climate impacts so they can take proactive steps to address climate change,” Jarvis said. “Although the National Park Service alone cannot reverse the climate changes highlighted in this report, communicating these impacts with our 275 million annual visitors can make a difference.” More from the [press release](#) From the [report's abstract](#): US national parks are challenged by climate and other forms of broad-scale environmental change that operate beyond administrative boundaries and in some instances are occurring at especially rapid rates. Here, we evaluate the climate change exposure of 289 natural resource parks administered by the US National Park Service, and ask which are presently (past 10 to 30 years) experiencing extreme (<5th percentile or >95th percentile) climates relative to their 1901–2012 historical range of variability. Results show that parks are overwhelmingly at the extreme warm end of historical temperature distributions and this is true for several variables (e.g., annual mean temperature, minimum temperature of the coldest month, mean temperature of the warmest quarter).

POLICY AND MANAGEMENT - MITIGATION AND ADAPTATION

President Obama Announces Series of Actions to Help State, Local, and Tribal Communities Prepare for Climate Change Impacts

U.S. President Obama announced a series of actions to respond to the early feedback from the U.S. State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience. The actions are intended to help state, local, and tribal leaders prepare their communities for the impacts of climate change by developing more resilient infrastructure and rebuilding existing infrastructure stronger and smarter.

<http://www.whitehouse.gov/the-press-office/2014/07/16/fact-sheet-taking-action-support-state-local-and-tribal-leaders-they-pre>

July 29th Statement From Gov. Jay Inslee Regarding News Highlighting Costs of Climate Inaction

“Inaction in the face of climate change could cost our state and country billions of dollars. Today, Senator Murray is holding a [U.S. Senate Budget Committee hearing on the costs of climate inaction](#), which will examine how inaction will create both an untenable environmental challenge for future generations and enormous economic and fiscal challenges for our nation. Also today, the White House Council of Economic Advisors released [a report that shows that delaying action on climate change will dramatically increase the costs](#) of action, as well as the costs of climate impacts. For instance, the report finds that delaying action to reduce carbon pollution will increase climate mitigation costs by about 40 percent. This report emphasizes the need for elected leaders to take action now.

“We’re already seeing the impacts and bearing the costs of climate change in our state. I’ve met with shellfish growers in Shelton who are working hard to deal with increased ocean acidification and the resulting difficulty to grow shellfish. Because of reduced snowpack in our mountains and longer drought periods in central and eastern Washington, we’re seeing water resource challenges requiring significant investments in places like the Yakima River Basin. And I’m meeting with local officials who must rebuild water treatment facilities to anticipate more severe flooding, including recently in Anacortes and later today at Discovery Park in Seattle, with King County Executive Dow Constantine.

“Taking action to reduce carbon pollution is not only important for our children, our environment and our health, it is essential for our economy. The costs of inaction are simply too high. Meanwhile, there are enormous opportunities in developing the clean energy technologies that will cleanly fuel our homes and businesses for decades to come. And once again, Washington state is uniquely poised to lead the nation. I applaud Senator Murray and President Obama for their actions today to highlight the economic risks we face if we continue to delay climate action. And I commend the President for his leadership at the federal level to reduce carbon pollution from our nation’s power plants.”

Risky Business Report Finds U.S. Regions and Business Sectors Face Significant Economic Risks from Climate Change

The American economy could face significant and widespread disruptions from climate change unless U.S. businesses and policymakers take immediate action to reduce climate risk, according to a new report, "Risky Business: The Economic Risks of Climate Change in the United States." The report summarizes findings of an independent assessment of the impact of climate change at the county, state, and regional level, and shows that communities, industries, and properties across the U.S. face profound risks from climate change. The findings also show that the most severe risks can still be avoided through early investments in resilience and through immediate action to reduce the pollution that causes global warming. The report shows that two of the primary impacts of climate change - extreme heat and sea level rise - will disproportionately affect certain regions of the U.S. and pose highly variable risks across the nation. For more information, visit: <http://riskybusiness.org/>.