From:	Freifeld, Holly
To:	Doherty, Kevin
Cc:	Wiechman, Lief; DElia, Jesse; Davis, Dawn; Amy Nicholas; Angela Burgess; Craig Hansen; Genevieve Skora; Lara Drizd; Joy Gober; Kate Norman; Sarah Backsen; Rich Young
Subject:	Re: GRSG 2015 - RSVP: climate change and maps for species report (rephrased request for your input....)
Date:	Wednesday, November 19, 2014 12:38:07 PM

Great exchange so far - thanks very much.

So far, here's what I've got:

1. Max summer temperature - Jun-Aug. Everyone agrees on this.
2. Precip is trickier. Spring and summer or annual? If we could obtain averages for April-August, would that suffice? (I assume that the incorporation of climate change into the R&R matrix modeling will dive into this in far greater detail and this map won't be the be-all, end-all w.r.t. climate and fire.)
3. Snow-pack (annual average?) seems popular as well.

What do you think? Anyone else want to weigh in? I would like to wrap this up by COB tomorrow (so I can submit the GIS and data requests)**.**

Re climate and demography: Between Dawn, Lief, and Kevin, sounds like population sensitivity to changes in individual vital rates may vary across the range; this suggests to me that assessing direct impacts of climate variables on demography/population dynamics is a project unto itself!
So, unless Kevin anticipates doing bioclimatic-envelope type of analysis as part of the modeling work, addressing this topic for the status review will be, like many topics, a matter of reviewing the literature and other "best available" information -- and running the resulting discussion by the appropriate experts. Many thanks to all three of you for tips about additional literature to look at.

Thanks again, everyone. It's great that we are "cross-pollinating" among writers and modelers about this. Maybe we would benefit from more of that on topics other than climate change, too...?

Holly

On Tue, Nov 18, 2014 at 8:11 AM, Doherty, Kevin <kevin_doherty@fws.gov> wrote:

> Hi all,
>
> Everything said makes sense to me as well.
>
> I would offer a caution about the differences between the eastern and western distribution of sage-grouse and the climatic relationships identified by Bloomberg and Sedinger. I know both Brad Fedy and Cam Aldridge have looked at climatic influences on the eastern range for both lek data sets and telemetry data and did not find significant relationships. Further, in the Powder River Basin we almost saw different life history strategies between populations that are ~70 km away. Similar lambda values, but one relying more on nest success and the other relying more on adult survival. In talking to Pete in NV he has seen a similar pattern in radio marked birds. Bloomberg and Sedingers work is awesome, there is no doubt about that. I do worry about extrapolating those results to other parts of the range, especially the areas with different climatic envelopes that are not as extreme as parts of the great basin.
>
> Cheers
> Kevin
>
> On Tue, Nov 18, 2014 at 7:23 AM, Wiechman, Lief <lief_wiechman@fws.gov> wrote:
>
>> Agree with everything said here. I believe Guttery has a paper that ties some of the variable Dawn suggested to chick survival as well. Also sounds like we almost have 2 maps here, maybe one that helps inform fire as Jesse suggested and one that ties back into population demographics using the variables Dawn suggested.
>>
>> So I guess I echo a map related to fire with information on snow pack/depth, spring (and summer) precip, and max summer temps -- in addition to, snow pack/depth, annual precip, and summer temp.
>>
>> LW
>>
>> ***Lief Wiechman***
>> **Sage-grouse Ecologist**
>> **U.S. Fish & Wildlife Service**
>> **Mountain-Prairie Region**
>> **307.772.2374 x236**
>> **lief_wiechman@fws.gov**
>>
>> On Mon, Nov 17, 2014 at 5:20 PM, DElia, Jesse <jesse_delia@fws.gov> wrote:
>>
>>> I would add to Dawn's comments that from a fire-cycle perspective it will be important to look at changes in spring precip - as this drives the growth of fine fuels....and summer precip - as dryer summer conditions mean higher probability of large wildfires, especially following years of high spring precip.
>>>
>>> Annual precip is not as good an indicator of fire probabilities. So my vote is for spring and summer precip and max daily temp in the summer.

Jesse

On Mon, Nov 17, 2014 at 3:54 PM, Davis, Dawn <dawn_davis@fws.gov> wrote:

Holly,

Just re-reading a paper by Blomberg et al. (2012) which evaluated the ability of climate variables to characterize temporal variation in sage-grouse population dynamics. The study found that climatic processes, indexed by annual rainfall and maximum summertime temperatures (May-Aug) had a strong relationship with recruitment and adult survival. In addition, annual variation in precipitation variables (e.g., rainfall or snow depth) explained ~75% of the annual variance in population size. From a demographic perspective, I would look at annual precipitation/rainfall, max. daily temperature for summer (Jun-Aug) and mean monthly snow pack.

Another paper that is available online early (also by Blomberg et al.) found postfledging survival was nearly twice as great following the coolest and wettest growing season (F = 0.77 0.05 SE) compared with the hottest and driest growing season (F = 0.39 0.05 SE). The premise of this paper is that the potential response of species to climate
change may be evaluated by quantifying demographic responses to short-term variation in characteristics of
climate, such as weather. These predictable relationships can then be used to evaluate species' vulnerability to
future climate change by integrating long-range climate projections with prospective population models (see attached).

Still digging through the literature to see how we can tie these variables to vegetation attributes related to sage-grouse life history traits (e.g., links between changes in plant production).

On Mon, Nov 17, 2014 at 3:23 PM, Freifeld, Holly <holly_freifeld@fws.gov> wrote:

Hi all,

I'm working with Rich Young to pull together data and submit a GIS request for some climate maps for the species report. These maps -- current conditions and a couple sets of future conditions -- will be important visual aids to set the stage in our overall review of potential climate change impacts to sage-grouse. This review will include the results from quantitative models that Kevin's group is working on as well as our review of all the rest of the "best available."

My question is: what climate variables will be most salient to see on these maps? See the matrix below. This is the range of climate variables available from our potential data sources. It's probably reasonable, in terms of workload, to aim for maps (again, current and future conditions) of two variables, maybe three at most. I've put in straw-man Xs for the maps that seem good to me, but I have scant knowledge of this ecosystem. What do you-all think? Add your Xs wherever you think they should go. I will compile.

I hope this will only take a few minutes - please respond this week. And please fire away if you have any questions!

Thanks,
Holly

SEASON	Annual	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov
CLIMATE VARIABLE					
Maximum daily temperature				**X**	
Minimum daily temperature					
Diurnal temperature range					
Average daily specific humidity					
Average daily precipitation amount	**X**				
Average daily wind speed					
Average daily eastward component of wind					
Average daily northward component of wind					
Downward shortwave radiation					
Runoff					
Snow					
Soil storage					

~~~
~~~

--
Jesse D'Elia
Candidate Species Conservation Coordinator
Endangered Species Division, Pacific Regional Office
U.S. Fish and Wildlife Service
911 NE 11th Avenue, 4th Floor, Portland, OR 97232
503.231.2349 phone; 503.231.6243 fax
jesse_delia@fws.gov

--

Kevin Doherty, PhD
Spatial Ecologist
USFWS Region 6 --Science Applications
134 Union Blvd, Lakewood, CO 80228
Phone: (303) 921-0524
Email: kevin_doherty@fws.gov