Arctic LCC Progress Report

1. PROJECT INFORMATION

Title:	Climate Change Vulnerability of Migrating Bird Species Breeding in Arctic Alaska
Report period	January 2011 to August 2012
Report submission date	August 27, 2012
Author of Report	Joe Liebezeit and Erika Rowland

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2. PROJECT OVERVIEW

a. Briefly (4-5 sentences) describe both the research purpose and the underlying need for this research.

As climate change accelerates rapidly in the Arctic and influences wildlife populations, land managers will be increasingly challenged to cope with impending impacts. We used the NatureServe Climate Change Vulnerability Index (CCVI) to assess the relative vulnerability of 54 bird species that regularly breed in Arctic Alaska. The CCVI is a spreadsheet-based algorithm that integrates information on species sensitivity (intrinsic characteristics of an organism that make them vulnerable) and exposure (extrinsic factors of the rate and magnitude of environmental change) to generate relative vulnerability rankings. The results of this assessment should be viewed as a starting point to help guide and inform management, research, and planning priorities within the Arctic LCC.

b. List the objective(s) of the project, exactly as described in your Statement of Work.

The specific goals of the assessment were to:

1. Provide a climate change vulnerability ranking for 54 Arctic Alaskan breeding bird species ranging from highly vulnerable, presumed stable, to likely benefit from climate change impacts, using the NatureServe Climate Change Vulnerability Index (CCVI) tool.
    - For 17 shorebird species provide a climate change vulnerability ranking for their wintering and migration grounds to combine with the breeding ground result for an overall vulnerability ranking spanning their entire life range.
2. Evaluate the relative contribution of specific sensitivity and exposure factors to individual species rankings to better understand how and why climate is or is not impacting species in the region.
3. Consider how this assessment can be integrated with other approaches to help prioritize management, research, and conservation.
4. Comment on the effectiveness of the CCVI tool in this assessment

3. PROGRESS SUMMARY

a. Describe report period progress.

At the start of the project we created a 6-person steering committee to help guide scope and activities. We developed 54 "sensitivity surveys" in order for individual species experts to score the sensitivity factors (i.e., life history traits). Of the 83 experts solicited, 52 agreed to participate. When the completed surveys were returned to us in late summer 2011, we completed a preliminary round of the assessment. Having prepared the necessary geospatial data inputs in advance, we combined the exposure and sensitivity information in the CCVI tool to generate relative vulnerabilities. We presented preliminary results in a workshop setting in Anchorage, Alaska on December 7-9th, 2011 to a group of 29 representing a majority subset of the species' experts who contributed to the sensitivity information. At the workshop some problems with experts' varying interpretation of the sensitivity questions were identified. To address these issues, in early 2012 a sub-group of five avian experts and WCS staff revised the problematic sensitivity factor questions and re-evaluated the original responses of the larger expert group in light of this agreed-upon language and sidebars on interpretations. We re-ran the CCVI with the updated sensitivity information and now have the final results. We are currently writing the final report for this project and anticipate completion at the end of October 2012.

b. Describe preliminary results.

The CCVI results ranked two species as highly vulnerable (Gyrfalcon, Common Eider), eight as moderately vulnerable (Brant, Steller's Eider, Pomarine Jaeger, Yellow-billed Loon, Buff-breasted Sandpiper, Red Phalarope, Western Sandpiper, Ruddy Turnstone), and five as likely to increase (Savannah Sparrow, Lapland Longspur, White-crowned Sparrow, American Tree Sparrow, Common Redpoll) in the Arctic LCC Region. The remaining species were presumed stable by the tool with respect to projected climate changes until mid-century (Figure 1). "Confidence" in the numerical score/vulnerability category generated by the CCVI was assessed through Monte Carlo simulation of sensitivity responses provided by the experts (Figure 2). We examined the influence of the uncertainty in exposure inputs by assessing the vulnerability of the 54 birds species multiple times, using three different climate scenarios from different Global Circulation Models that roughly bracket the expected extremes in temperature and moisture gradient change for the Arctic LCC. The vulnerability rankings differed little between the three sets of exposure input (Figure 3) suggesting that either these vulnerabilities are robust across climate projections, or the tool algorithm is not sensitive to slight changes in exposure. Association with particular hydrological niche, dependence on species interaction, and the potential for changes in the frequency and timing of important disturbance regimes were the most import sensitivity factors for the arctic breeding birds categorized as highly and moderately vulnerable (Figure 4).

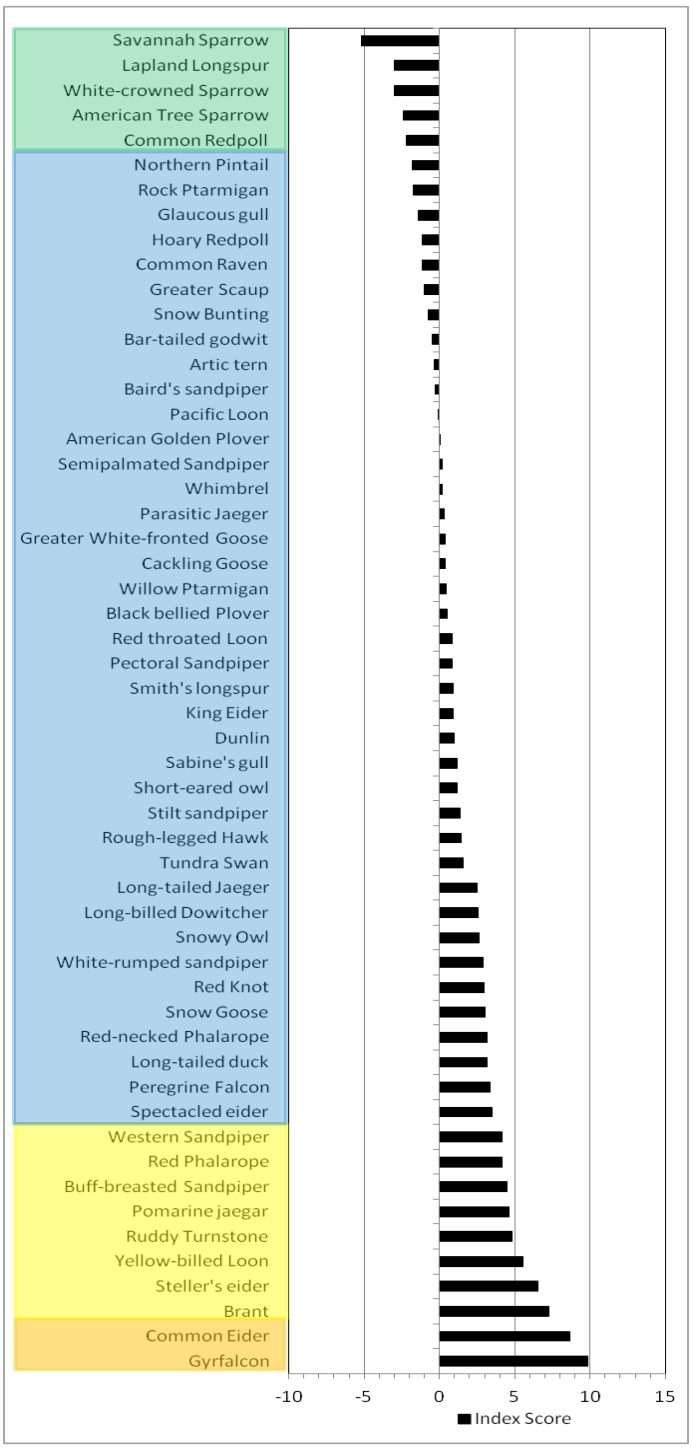

Figure 1. The numerical vulnerability scores and index categories as assigned by the CCVI tool for the initial run. Species scored as likely to increase in abundance are at the top of the list, most likely to decrease in abundance at the bottom.

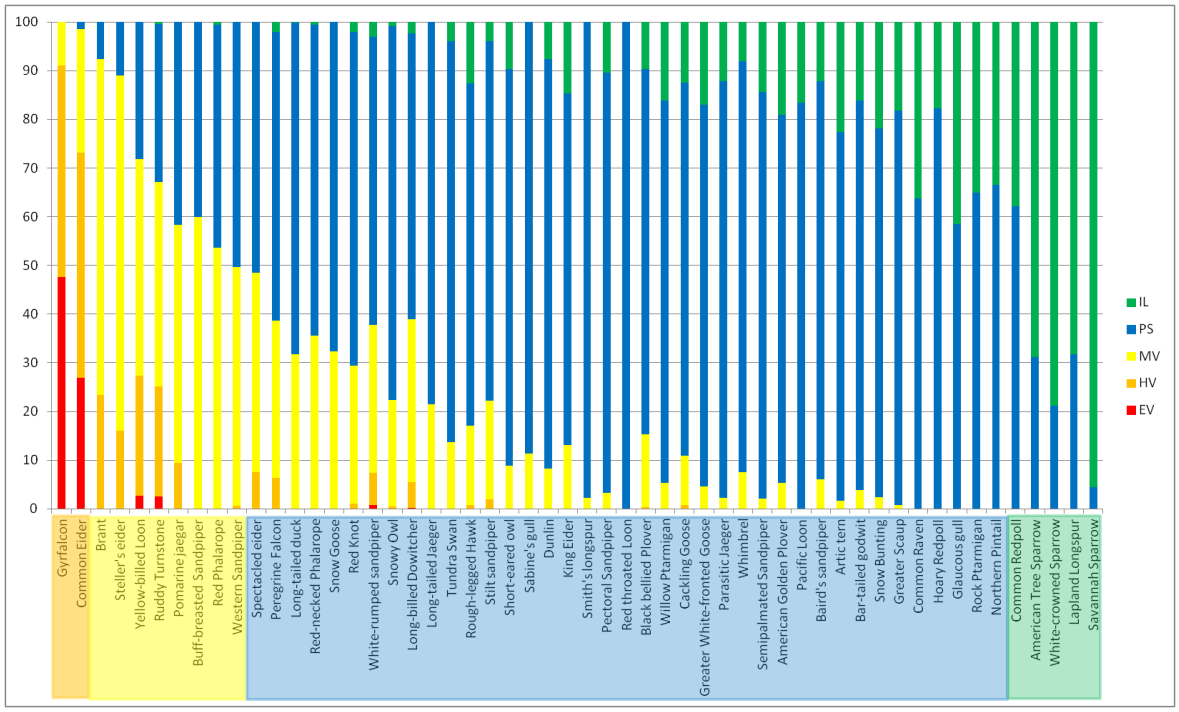

Figure 2. The proportion of the Monte Carlo simulations in different vulnerability categories for each species (bars). The shaded colors over the species names (y-axis) indicate the vulnerability category assigned to the species by the CCVI tool calculations (shown in Figure 1). The proportions are used as a measure of "confidence" in the numerical score/vulnerability category generated by the tool algorithm. *Vulnerability Category:* Extremely vulnerable (EV-red), Highly vulnerable (HV-orange), Moderately vulnerable (MV-yellow), Presumed stable (PS-blue), Increase likely (IL-green).

(a)	5-Model Composite*/A1B		Temperature Scope				
Common Name	Index Score	CC Vuln	A >4.3C	A 3.8C	A 3.1C	A 2.5C	A <2.5C
Gyrfalcon	9.82	HV	92	8	0	0	0
Common Eider	8.65	HV	100	0	0	0	0
Brant	7.26	MV	100	0	0	0	0
Steller's eider	6.53	MV	100	0	0	0	0
Pomarine jaegar	4.60	MV	100	0	0	0	0
Ruddy Turnstone	4.83	MV	100	0	0	0	0
Buff-breasted Sandpiper	4.49	MV	100	0	0	0	0
Red Phalarope	4.16	MV	100	0	0	0	0
Western Sandpiper	4.16	MV	100	0	0	0	0
Yellow-billed Loon	4.09	MV	100	0	0	0	0
Spectacled Eider	3.49	PS	100	0	0	0	0
Peregrine Falcon	3.33	PS	78	22	0	0	0
Long-tailed duck	3.16	PS	100	0	0	0	0
Red-necked Phalarope	3.16	PS	100	0	0	0	0

(b)	CCCM*/A1B		Temperature Scope				
Common Name	Index Score	CC Vuln.	A >4.3C	A 3.8C	A 3.1C	A 2.5C	A <2.5C
Gyrfalcon	6.22	MV	0	8	86	6	0
Common Eider	5.51	MV	0	18	82	0	0
Brant	6.39	MV	0	100	0	0	0
Steller's eider	5.07	MV	0	0	100	0	0
Pomarine jaegar	4.60	MV	100	0	0	0	0
Ruddy Turnstone	4.83	MV	99	1	0	0	0
Buff-breasted Sandpiper	3.69	PS	0	0	100	0	0
Red Phalarope	4.16	MV	100	0	0	0	0
Western Sandpiper	3.36	PS	0	27	73	0	0
Yellow-billed Loon	4.09	MV	100	0	0	0	0
Spectacled Eider	3.09	PS	0	100	0	0	0
Peregrine Falcon	3.33	PS	78	22	0	0	0
Long-tailed duck	2.36	PS	0	11	89	0	0
Red-necked Phalarope	3.16	PS	100	0	0	0	0

(c)	ECHAM*/A1B		Temperature Scope				
Common Name	Index Score	CC Vuln.	A >4.3C	A 3.8C	A 3.1C	A 2.5C	A <2.5C
Gyrfalcon	9.83	HV	100	0	0	0	0
Common Eider	8.65	HV	100	0	0	0	0
Brant	7.26	MV	100	0	0	0	0
Steller's eider	6.53	MV	100	0	0	0	0
Pomarine jaegar	4.60	MV	100	0	0	0	0
Ruddy Turnstone	4.83	MV	100	0	0	0	0
Buff-breasted Sandpiper	4.49	MV	100	0	0	0	0
Red Phalarope	4.16	MV	100	0	0	0	0
Western Sandpiper	4.16	MV	100	0	0	0	0
Yellow-billed Loon	4.09	MV	100	0	0	0	0
Spectacled Eider	3.39	PS	100	0	0	0	0
Peregrine Falcon	3.33	PS	100	0	0	0	0
Long-tailed duck	3.16	IL	100	0	0	0	0
Red-necked Phalarope	3.16	PS	100	0	0	0	0

Figure 3. Changes in the CCVI tool score and vulnerability category output (i.e., relative vulnerability) between tool runs using different the climate projections from different global circulation models (GCMs) for the "most" vulnerable bird species. (a) Temperature data: A1B SRES emission scenario, SNAP 5-model composite (ECHAM5, GFDL2.1, MIROC, HAD, CCCMA), 2 km resolution; (b) Temperature data: A1B SRES emission scenario, SNAP CCCMA GCM output, 2 km resolution; (c) Temperature data: A1B SRES emission scenario, SNAP 5-model composite ECHAM5 GCM, 2 km resolution. Blue denotes decrease in vulnerability compared with the initial CCVI run (a); red denotes increased vulnerability. [Note: There was minimal difference in historical vs. projected future moisture conditions, based on results from 5 different GCMs. Thus, moisture has little influence over CCVI results in this assessment and is not shown here.]

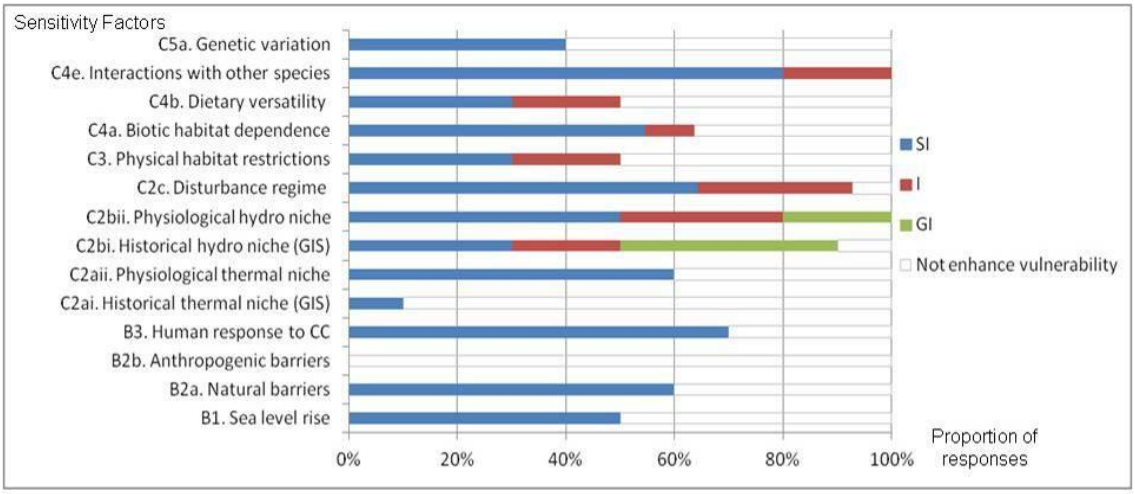

Figure 4. Contribution of the different sensitivity factors to climate change vulnerability for the species ranked as highly and moderately vulnerable.

c. Publications, conference papers, and presentations.

Joe Liebezeit provided a poster presentation of this project (not including results as they were not completed at this point) at the Western Hemispheric Shorebird Conference in Vancouver, B.C. in August of 2011. Joe Liebezeit will present the results of this study in an oral presentation at the Alaska Bird Conference in October, 2012. Erika Rowland incorporated "lessons learned" from this vulnerability assessment process into an oral presentation made at the Society for Conservation Biology's North America Congress in Oakland, CA in July 2012.

d. Education and outreach.

Nothing to report

e. Other products resulting from the project.

Nothing to report

f. Describe any concerns you may have about your project's progress.

We were hoping to have this report done by May of 2012, however, the problems with sensitivity surveys identified at the December 2011 workshop (see Progress Summary section above) set us back by at least a couple of months as it required a concerted effort by a sub-group of experts to complete a reassessment and then rerun the CCVI. We were also hoping to include intensive vulnerability results for the migration and wintering portion for the shorebird species as climate change vulnerability likely varies spatially and temporally across the life cycle of highly migratory shorebirds. We will report these results, however, they should be considered tentative since information on shorebird usage of stopover and wintering areas (particularly in South America and Asia) are poorly understood. Also the new, untested elements that we incorporated into the vulnerability assessment design, upon expert vetting, required modifications that were too significant to address within the project timeframe. We will include the results of this secondary assessment as a "pilot study" in an appendix in the final report. We will, however, accomplish the core objectives of this project and have a detailed report available very soon.

4. PROGRESS STATUS

As mentioned in the previous section we were hoping to have completed the final report by May of 2012 but have had some minor setbacks. Overall, the project has followed the original timeline remarkably well given the large number of people involved at various stages.

We are currently assembling the final report with which we have made substantial progress. The results and accompanying figures and tables are essentially done. We have strong drafts of the introduction, objectives, and methods section. We have also written almost all of the 2-page, species accounts. Our next steps are to flesh out the text for the results, write the discussion, and various appendices, and then piece to document together and format it. This will be a long report (the species accounts will be 108 pages alone!). However, we feel this is an important document that we hope will be a good resource for scientists, land managers, and conservationists working in the Arctic Alaska region. We plan to have the final version done by the end of October 2012.