Connecting Alaska Landscapes into the Future
A collaborative strategic habitat conservation project
May 7th 2009 Update

Project Goals:
Understanding how climate change will affect our ability to sustain biodiversity and traditional subsistence resources into the future is a common challenge facing land, resource, and conservation agencies in Alaska. By using the down-scaled climate models for Alaska to evaluate how distributions of resources and populations may change across the state, we can begin discussions of conservation strategies to maintain important landscape-level connectivity pathways. This project was initiated to start progress on two major goals:

1) Identify lands (and fresh waters*) in Alaska that likely serve as landscape-level linkages, now and in the future, given climate change
2) Identify conservation strategies that will help maintain landscape-level connectivity by focusing conservation efforts, minimizing redundant research and monitoring and sharing data and information for these areas.

*not addressed during the proof-of-concept phase of this project

Background:
The project began in April 2008 with the establishment of a modest Cooperative Ecosystem Studies Unit agreement between the University of Alaska Fairbanks and the U.S. Fish and Wildlife Service (FWS). Through this agreement, Nancy Fresco (Scenario Network for Alaska Planning Coordinator) and Dr Falk Huettmann (Ecological Wildlife Habitat Data Analysis for the Land and Seascape Laboratory) joined John Morton and Karen Murphy of FWS as co-leads on the project.

Broad collaboration is an important component for this project to be successful. Three partnership workshops involving 11 agencies and non-governmental organizations have been held to establish direction for the project (see attached list). The first workshop, in May 2008, refined the project's goals and determined the suite of modeling subjects to be used for the project. The second, November 2008, was used to refine the predictive modeling approach and to settle on methodology and climate models. During our final workshop, April 30th-May 1st 2009, we reviewed the predictive modeling and discussed goals and approaches for connectivity models and agreed on an outline to report the findings from this project.

Methods:
We used the "Composite GCM" climate model for Alaska which is the average of the top-five performing IPCC global climate models (GCM) for Alaska and the Arctic that were downscaled by Dr John Walsh and SNAP from the two-degree resolution to two kilometer resolution for Alaska using PRISM methodology. We used the middle emission scenario, A1B, for all modeling except for one comparative example using the higher emission scenario, A2.

Six modeling subjects were selected to explore distribution and connectivity modeling. The modeling subjects were selected to represent a wide-range of organisms and communities that have different life strategies and connectivity issues. 1) Biomes – the broadest representation of vegetation, topography and climate that describes biological community groups within Alaska 2) Vegetation Communities – using the draft existing vegetation type landcover data for LANDFIRE ecological zones 70 and 71 (northern Yukon Basin) 3) Caribou – a mammal species

that is wide-ranging and has few constraints on its migration 4) Alaska Marmots – a Arctic habitat specialist 5) Trumpeter Swans – a migratory bird which may respond positively to warming climate patterns 6) Reed Canary Grass – an invasive grass species that is dispersed initially along human-use corridors then via waterways.

We used a 'climate envelope' approach to develop predictive models for distribution of the different modeling subjects at three future time-steps in the next century: 2030-2039, 2060-2069, 2090-2099. We used decadal averages of the Composite GCM climate data at each time step to avoid selecting extreme low or high years. We used only the climate data (temperature and precipitation) for the months of December and June. After exploring several options, Dr Falk Huettmann selected RandomForest™ (Salford Systems) as the primary modeling tool to define the current climate envelope for each modeling subject then to define where on the landscape those same climate envelopes exist in the future.

For landscape connectivity modeling, Dr Heuttmann is currently working with two modeling software packages: MARXAN and Circuitscape. Workshop participants defined modeling scenarios for evaluating connectivity options related to the potential biome models. We agreed to focus on the biomes for connectivity models at this stage with the broad assumption that biome regions that are predicted to remain stable for the next 100 years will be important refugia for plants and animals that exist in those regions today.

Results and Discussion:

Based on the predictive models and initial connectivity modeling reviewed last week, the partnership group agreed that this project has made important first steps in understanding how we can use data that are available today to generate tools to discuss climate change effects and conservation strategies. We spent a considerable amount of time discussing the data and research needs that even this simple modeling exercise identifies for individual species and these will be identified in the final report produced this year. We also identified important next steps that could turn this proof-of-concept work into a tool that would be available for managers to use for decision making in Alaska.

The group agreed that further development of the potential modeling approach was imperative for developing a usable tool for conservation planning. Some of the steps identified by the group that should be done before these data are used for planning include using all months from the Composite GCM data; randomly select years within each decadal step for each model run rather than using decadal averages (this would capture the extreme variations which are often critical to the existence of species at different locations); ideally run different downscaled GCM models; compare model outputs in a sensitivity analysis to establish confidence in identifying refugia on the landscape etc. We also discussed upcoming datasets (e.g. the permafrost and soil depth predictive model) that should be available in the near future that could be used to improve this approach. Continued collaboration of interagency and NGO groups, plus including traditional ecological knowledge will be important for future steps to be successful.

The final report which describes the project, the strength and weaknesses of the modeling approaches, data gaps and the potential next steps will be available by the end of 2009. Please see the attached pages for an example of the modeling for "Potential biomes" and project participants.

The following table lists participants that have attended one or more of the three partnership workshops for this project. Several individuals have been instrumental in the interim modeling steps developed between workshops.

Last name	First name	Affiliation/role
Paragi	Tom	ADF&G
Tessler	David	ADF&G
White	Kevin	ADF&G
Smith	Melanie	Audubon Alaska, GIS
Guyer	Scott	BLM
Krabacher	Paul	BLM
McCoy	Ramone	BLM
Dutton	Karla	Defenders of Wildlife
Matson	Noah	Defenders of Wildlife
Jerry	Danielle	FWS
Mann	Francis	FWS
Platte	Bob	FWS
Reynolds	Joel	FWS
Stehn	Bob	FWS
Zelenak	Jim	FWS
Sterne	Charla	FWS/notetaker
Couvillion	Amalie	Nature Conservancy
Wachob	Doug	Nature Conservancy
Shephard	Michael	NPS
Spencer	Page	NPS
Boucher	Tina	UAA Natural Heritage
Carlson	Matt	UAA Natural Heritage
Gotthardt	Tracey	UAA Natural Heritage
Friberg	Mary	USFS
Douglas	David	USGS
Jones	Ben	USGS
Loya	Wendy	Wilderness Society

Project co-leads			Contact information	
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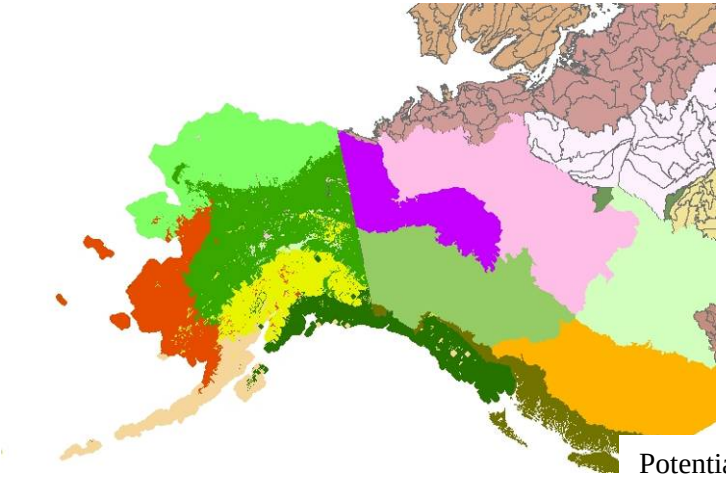
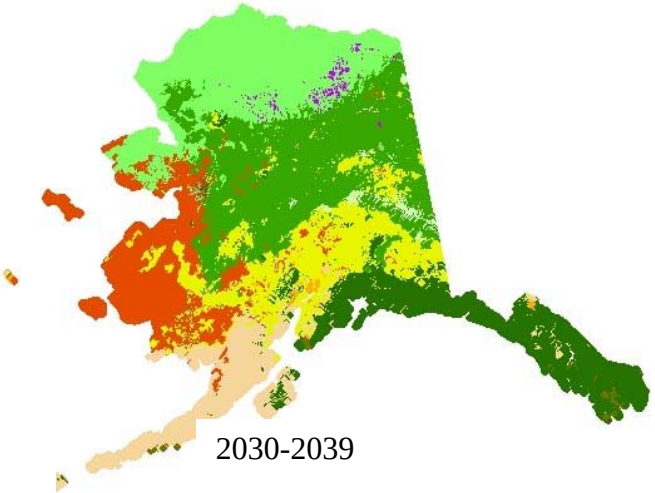
Morton	John	FWS/organizer/co-lead	John_M_Morton@fws.gov	907-260-2815
Murphy	Karen	FWS/organizer/co-lead	Karen_A_Murphy@fws.gov	907-786-3501



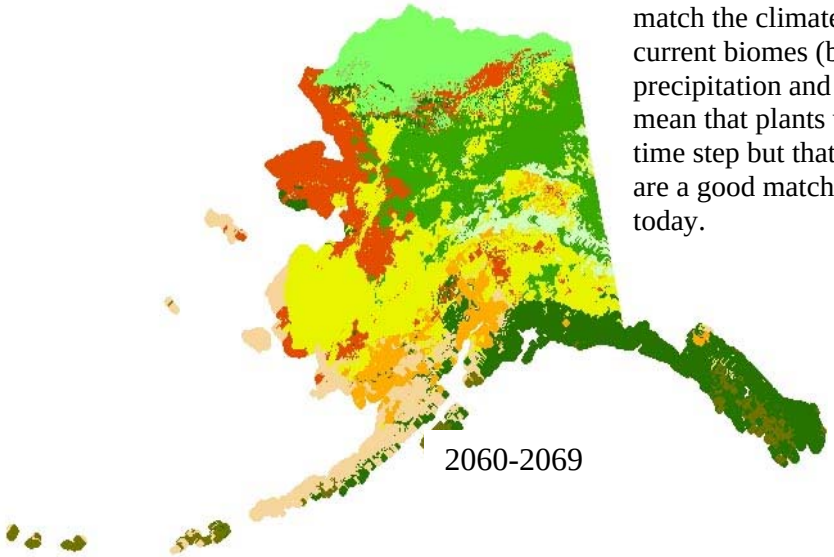


Modeled current 2000-2009 w/Canadian biomes used as training data

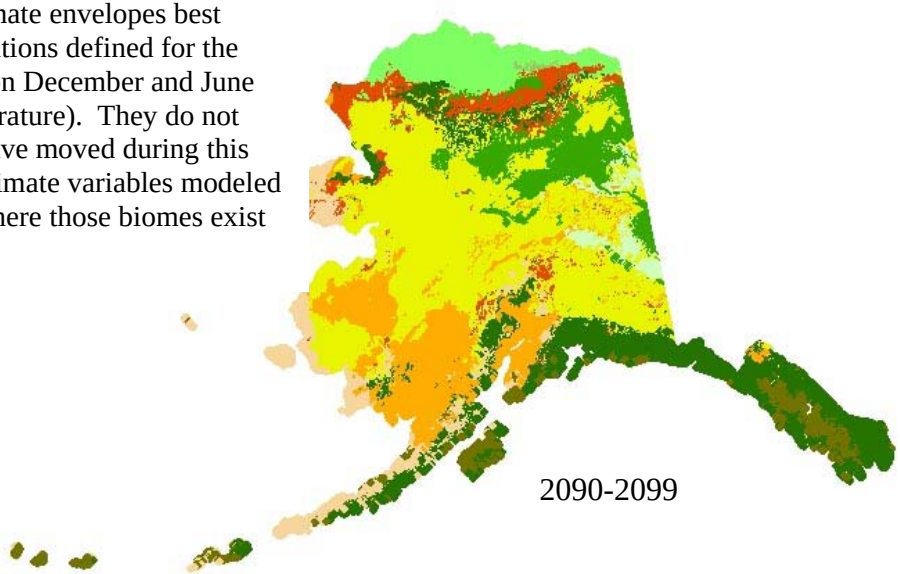
2030-2039

Potential Biomes – modeled based on the climate envelope developed from the Composite GCM, A1B data for December and June. Current climate envelopes for 6 western Canadian biomes were also developed then incorporated into the future predictive models.

Future potential biome distributions represent locations where the climate envelopes best match the climate conditions defined for the current biomes (based on December and June precipitation and temperature). They do not mean that plants will have moved during this time step but that the climate variables modeled are a good match for where those biomes exist today.



2060-2069



2090-2099