NOS 2012 Geospatial Model Overview

April 12, 2016

Background/Overview

The purpose of this document and accompanying "NOS 2012 Geospatial Model Overview 28x32.pdf" diagram is to provide a high-level document and visual guide that outlines (not in full detail) the structure and composition of how this REA was completed. This document serves as a 'cliff notes' version for a GIS person to re-trace steps taken by the REA contractor (Alaska Natural Heritage Program: ANHP) and reviewed by BLM. Further documentation will be released when it becomes available during a full and detailed models QC by the BLM National Operations Center (NOC) REA data team.

Abiotic Change Agents

Climate

- There were no climate models delivered with the NOS REA. All climate modeling was performed by ISER (Institute for Social and Economic Research) using SNAAP (Scenarios Network for Alaska and Artic Planning) products. See the full NOS Report for details.
- Within the climate change agent, SNAAP reviewed the top five performing global circulation models (GCM's) from the AR4 scenarios. They used PRISM data to downscale the GCMs to create monthly projections for temperature and precipitation. Within those predictions were the inputs into the ALFRESCO Fire modeling efforts, GIPL Permafrost, and the cliomes models. Likewise, the downscaling produced five model composite temperature and precipitation snapshots for historic, 2010s, 2020s, and 2060s decadal averages. These averages were used thought the REA to determine areas of potential climate stress, date of freeze/thaw and number of growing days.
- See the final REA report for more information on these methods and procedures.

Fire

- Similar to Climate, there were no fire models delivered with the NOS REA. All fire modeling was performed by estimating the effects of future fire dynamics on vegetation through creating a simulated historical landscape (1890). This was achieved with extracting three classes of tundra, black spruce, white spruce, hardwoods and unvegetated areas based upon NALCMS. Historical fire perimeters were

used to calibrate the simulated landscape to create a simulated current landscape. Lastly, the monthly mean temp and ppt. data was used to create the simulated future fire effects on vegetation.

Permafrost

- Similar to Climate & Fire, there were no permafrost models delivered with the NOS REA. All permafrost modeling was completed using a GIPL model to estimate the mean annual ground temperature at a 1 meter depth and the active layer thickness. The models used had inputs of surficial geology, lithic data, soil thermal properties, snow cover, vegetation present at the surface, and the average monthly air temperature.

Biotic Change Agents

Invasive Species

- The invasive species modeling done within NOS included 12 ESRI geospatial models. These models work to create several products. They include:
    - Current/near-term/long-term floodplain shrub lands vulnerable habitats
    - Current/near-term/long-term Infestation Potential (at both a High & Medium future development scenario)
    - Potential impacts of infestations on current CE's
    - Fine-scale distribution of invasion vulnerability
- The invasive species modeling requires inputs from the permafrost, development and climate change modeling as inputs.

Development or Anthropogenic Uses

The main result of the development modeling is the landscape condition model (LCM). The LCM was produced at a 60x60m pixel level as well as averaged to a HUC5 level. There is also an oil & gas focused LCM that is an intermediate product from the modeling that is used in other efforts through the REA. Each anthropogenic input is prepared and Euclidean distance from each impact is calculated given a score at the site and as the distance increases (site impact scores and distance decay). General categories of inputs into the LCM model include natural resources extraction and energy development (mining & wells), transportation & communication infrastructure (roads, transmission lines), subsistence and recreation sites (villages & camps), invasive species (non-native plants).

Landscape Integrity

The landscape integrity product is derived directly from the landscape condition model where the intactness or LCM value is greater than a value of 5. This indicates the upper crust of the intact areas with little relative development.

Conservation_Elements

Coarse-Filter CEs: Terrestrial & Aquatic Coarse Filter

Terrestrial Coarse-Filters (8)

The terrestrial coarse filters begin the distribution of one of the eight habitats listed below. The current LCM model is then extracted from areas within the corresponding distributions. For growing season lengths, (which is a result of the climate modeling) a similar approach is employed. Likewise, the oil based LCM intermediate product referenced earlier is utilized within this toolbox to create an oil based LCM product for each habitat listed below. The geospatial models provided don't include steps showing how the baseline habitat distributions are queried out from the vegetation distribution dataset.

- Coastal Plain Moist Tundra
- Costal Plain wetland
- Sand Sheet Wetland
- Sand Sheet wetland
- Foothills tussock tundra
- Alpine dwarf shrub
- Tidal marsh
- Marine beach, barrier islands, and spits

Aquatic Coarse-Filters (4)

The aquatic coarse filters include four models to derive deep and shallow connected lakes, large and small streams from the USGS NHD products. In addition to these baseline products, climate model results of current mean summer temp and the LCM are used to develop the mean summer temperature of all connected lakes and the LCM values of each connected lake. Large and small streams are also intersected with the Current/Near-Term/and Long-Term growing season length to develop predictions on each intersection.

Fine-Filter CEs: Terrestrial & Aquatic Fine Filter

Terrestrial Fine-Filters (7)

The terrestrial fine filters primarily include extracting the current LCM that resides within the known distribution for each species. Within this toolbox are additional steps for generating raptor concentration areas and intersecting these areas with the climate product of growing season length and march/april/may precipitation. The seven selected terrestrial fine filter species are listed below.

- Neartic Brown Lemming
- Artic Fox
- Caribou
- Lapland Longspur
- Willow Ptarmigan
- Greater white-fronted goose
- Raptor concentration areas

Aquatic Fine-Filter (5):

There was no fine filter aquatic geospatial modeling done because of a data gap in known distributions. Tabular data exists and ANHP's contribution on this front was to perform data entry of records on the five species listed below.

- Broad Whitefish
- Dolly Varden
- Artic Grayling
- Burbot
- Chum Salmon

Management questions relating to toolboxes

Table 1. NOS 2012 Management Questions with corresponding modeling toolboxes:

Abiotic Change Agents (Section C)		**Corresponding Modeling Toolbox (es)**
AB-1	*Is the fire regime changing on the North Slope and what is the likely future fire regime (or range of regimes) based on climate projections and current knowledge of the relationships between climate and fire?*	*None*
AB-2	*How will permafrost change spatially and temporally over the next two decades?*	*None*
TC-3	*How will changes in precipitation, evapotranspiration, and active layer depth alter summer surface water availability in shallow-water and mesic/wet tundra habitats and how reliable are these projections?*	*None*
TC-5	*How is climate change affecting the timing of snow melt and snow onset, spring breakup and green-up, and growing season length?*	*None*
Anthropogenic Factors (Section E)		
AP-1	*What physical and perceptual limitations to access to subsistence resources by local residents are caused by oil/gas activities?*	*NOS_DV_CNL_LandscapeCondition.tbx*
AP-2	*How are oil, gas, and mineral development on the North Slope impacting near- and far-field air quality, with particular emphasis on communities and "sensitive class 2" areas such as ANWR, Gates, Noatak?*	*NOS_DV_CNL_LandscapeCondition.tbx*
AT-1	*What parameters can help measure impacts from anthropogenic activities independently of natural cycles and vice versa?*	*NOS_DV_CNL_LandscapeCondition.tbx*
AT-2	*What potential impacts will oil/gas exploration and development have on CE habitat?*	*NOS_DV_CNL_LandscapeCondition.tbx* *NOS_TES_A_Current_TerrestrialCoarseFilters.tbx* *NOS_TES_B_NearTermTerrestrialCoarseFilters.tbx* *NOS_TES_C_LongTerm_TerrestrialCoarseFilters.tbx*
AT-3	*What additional contaminants baseline data are needed for fish, birds, marine and terrestrial species, particularly those that affect the health and safety of subsistence foods?*	*None*

AF-2	*What are the measurable and perceived impacts of development on subsistence harvest of fish?*	*NOS_DV_CNL_LandscapeCondition.tbx*
TF-3	*What are the measurable and perceived impacts of development on subsistence harvest of caribou?*	*NOS_DV_CNL_LandscapeCondition.tbx*
Aquatic Coarse Filter CEs (Section I)		
AC-1	*How does water withdrawal from lakes for oil and gas activities (year-round industrial and domestic use and winter operations) affect lake water quantity and water quality, outflow/stream connectivity, and down-basin stream habitat?*	*NOS_DV_CNL_LandscapeCondition.tbx* *NOS_AE_CNL_AquaticCoarseFilter.tbx*
Aquatic Fine Filter CEs (Section J)		
AF-1	*What are baseline characteristics and trends in fish habitat (lakes and streams), fish distribution, and fish movements?*	*NOS_AE_CNL_AquaticCoarseFilter.tbx*
AC-2	*How does oil and gas infrastructure (e.g., roads, pads, pipeline), both permanent and temporary, affect fish habitat, fish distribution, and fish movements?*	*NOS_DV_CNL_LandscapeCondition.tbx*
Terrestrial Coarse-Filter CEs (Section G)		
TC-1	*What are the impacts of oil/gas development (i.e. gravel pad and road construction; pipeline construction) on vegetation and hydrology? (Known impacts include burial, dust, saline runoff and altered soil moisture.)*	*NOS_DV_CNL_LandscapeCondition.tbx* *NOS_TES_A_Current_TerrestrialCoarseFiltes.tbs* *NOS_TES_B_NearTerm_TerrestrialCoarseFiltes.tbs* *NOS_TES_C_LongTerm_TerrestrialCoarseFiltes.tbs*
TC-2	*What are the changes in habitat and vegetation related to changing permafrost conditions, and what will these changes mean to wildlife and habitats?*	*None*
TC-4	*What are the expected changes to habitat as a result of coastal erosion and coastal salinization?*	*None*
Terrestrial Fine-Filter CEs (Section H)		
TF-1	*What are the baseline data for the species composition, numbers of individuals, vegetation type used, and change in numbers/species composition of land birds and their habitat over time?*	*NOS_TES_A_C_TerrestrialCoarseFilters.tbx* *NOS_TES_B_N_TerrestrioalCoarseFilters.tbx* *NOS_TES_C_L_TerrestrialCoarseFilters.tbx*
TF-2	*What are caribou preferences for vegetation communities? Where do these vegetation communities exist?*	*NOS_TES_A_Current_TerrestrialCoarseFilters.tbx* *NOS_TS_CNL_TerrestrialFineFilters.tbx*

TF-4	*What are caribou seasonal distribution and movement patterns and how are they related to season and weather?*	*NOS_TS_CNL_TerrestrialFineFilters.tbx*

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