Applied Case Studies: George Washington National Forest

Applied case studies provide examples of how TACCIMO has been applied to support information needs. In this case study, TACCIMO provided supporting materials for the Land and Management Plan Revision Process and resulting Environmental Impact Statement. Report selections for TACCIMO use are identified in *italics*.

GEORGE WASHINGTON NATIONAL FOREST LAND AND MANAGEMENT PLAN (LMP) REVISION

Document Type	Draft Environmental Impact Statement (EIS) for LMP Revision
Location	Appalachian Mountains in western Virginia and eastern West Virginia
Contact Point	Ken Landgraf, Planning and Forest Ecology Staff Officer – klandgraf@fs.fed.us
USFS Guidance Document	Climate Change Considerations in Land and Management Plan Revisions

TACCIMO reports provided underlying scientific support in the form of best available science related to climate change during the LMP revision process. Direct effects of climate change were evaluated, including warmer temperatures, extreme weather events, and increased outbreaks of insects, disease, and invasive species. Indirect effects were also evaluated, such as cumulative impacts on fish species and the future demand for different types of developed and dispersed recreational activities. The following examples provide a sample of specific locations in the EIS document where TACCIMO's resources were used in combination with local and expert knowledge to address climate change.

Local Level Climate Change Trends and Expectations

TACCIMO Use
- Climate Report for George Washington National Forest

The **Local Level Climate Change Trends and Expectations** section summarized climate predictions for the forest. TACCIMO was the primary local level climate modeling resource for the LMP revision. TACCIMO's Climate Report was run for George Washington National Forest, and results of historic and future predicted temperature and precipitation data were summarized into tables and text.

TACCIMO Results

TACCIMO provided predictions from their custom Climate Report for the National Forest.

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"The Template for Assessing Climate Change Impacts and Management Option (TACCIMO) was used to estimate the range of changes in precipitation and temperature that can be expected on the GWNF. The template uses models from Canadian Centre for Climate Modeling & Analysis (Canadian), Hadley Centre for Climate Prediction and Research (Hadley), and US Dept of Commerce/NOAA/Geophysical Fluid Dynamics Laboratory (Commerce). The models are run using three scenarios regarding the level of carbon emissions. Based on data from TACCIMO, the predicted changes in precipitation and temperature are shown in the following tables:"

Table A3.2 Predicted Changes in Precipitation on the GWNF

Precipitation, annual average from 2009-2099 (in)			
Emissions Path	Commerce Model	Canadian Model	Hadley Model
Middle Emissions	46.3	43.9	47.7
Higher Emissions	47.0	43.9	44.7
Lower Emissions	44.4	44.8	45.8
Average of all emission options	45.9	44.2	46.1
Historical Average (PRISM 1970-2000)	43.5	43.5	43.5

Table A3.3 Predicted Changes in Temperature on the GWNF

Average temperature (°F, Monthly Average spanning 2009 – 2099)			
Emissions Path	Commerce Model	Canadian Model	Hadley Model
Middle Emissions	56.3	56.8	57.7
Higher Emissions	56.8	57.0	57.2
Lower Emissions	55.2	55.2	56.1
Average of all emission options	56.1	56.5	57.0
Historical Average (PRISM 1970-2000)	52.5	52.5	52.5

"All of the models predict an increase in precipitation ranging from less than a half inch to more than four inches per year. All of the models also predict an increase in temperature ranging from 2.7°F to 5.2°F."

Affected Environment

TACCIMO Use
- Literature Report for Animal Communities & Fish in the Southern Region

The **Affected Environment** section summarizes the current conditions of the resources, and may also include history, development, and interactions that shape the resources. TACCIMO's Literature Report was used to identify key climate change factors along with peer-reviewed literature describing the effects of climate change on resource issues pertinent to the George Washington National Forest, specifically the impacts of warmer temperatures on local trout populations.

TACCIMO Results
Highlighted Quotations

"The projected changes in fish habitat associated with increases in temperature and changes in hydrology (Preston, 2006) would cause shifts in the distributions of fish and other aquatic species (Kling et al., 2003)." (Joyce et al. 2008)

"[With future climate scenarios] The remaining trout habitat becomes more fragmented than it is at present. With increasing temperature, the largest trout habitat patch becomes progressively smaller (Table 1)." (Flebbe et al. 2006)

"If predictions of the Hadley Centre GCM are assumed, 53% of total trout habitat area and 65% of stream length would be lost, whereas the more extreme Canadian Centre GCM predictions indicate losses of 97% and 99%, respectively." (Flebbe et al. 2006)

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"Increase in average water temperature would shrink usable habitat for cold water species and shift habitat types… A recent study (Flebbe et al. 2006) projects that rising temperature changes from climate change (and the loss of hemlock along streams) will shrink native trout habitat. Using the Hadley Centre model (2.5°C air temperature increase) and the Canadian Centre model (5.5°C air temperature increase), Flebbe found that between 53 and 97 percent of wild trout habitat could be lost as streams become warmer by the year 2100." (Also notes Joyce et al. 2008 (SAP) as source)

Direct, Indirect, and Cumulative Effects

TACCIMO Use
- Literature Report for Vegetation Mgt. & Carbon Sequestration

The **Direct, Indirect, and Cumulative Effects** section analyzes the amount and intensity of effects by alternative, focusing on the effects of management on the future environment. TACCIMO's Literature Report was used to provide a peer-reviewed literature base for determining how management strategies identified in alternatives will impact the carbon sequestration potential of forest stands.

TACCIMO Results
Highlighted Quotations

"Projects planned to delay return of CO_2 to the atmosphere (e.g., by lengthening rotation) both in situ (in forest or plantation) and post-harvest, are most successful." (Joyce et al. 2008)

"Conversion of old-growth forests to young plantations invariably reduces C storage, even when structural components in buildings are considered" (Harmon 1990).

"In a comparison of total C storage, there was 2.2 to 2.3 times as much storage in a 450-year-old *Pseudotsuga-Tsuga* natural stand as in a 60-year-old *Pseudotsuga* plantation (Table 1)." (Harmon et al. 1990)

"Older forests can be strong carbon sinks (Stoy et al. 2006), and older trees absorb more CO_2 in an elevated CO_2 atmosphere, but wood production of these trees show limited or only transient response to CO_2 (Körner et al. 2005)." (Ryan et al. 2008)

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"The single most important aspect for sequestering carbon is to keep forests as forests – avoid the loss of forests. All of the alternatives meet this objective. Older forests sequester large quantities of carbon. Forests (particularly older forests) generally store carbon better than forest products, so harvesting old-growth forests for their forest products is not an effective carbon conservation strategy (Harmon et al. 1990). However, harvest and regeneration of young to middle-aged forests for long-lived forest products can help with carbon storage (Ryan et al. 2008). Alternative C relies on old-aged forests to sequester carbon. The other alternatives use a mix of old-aged forests and harvest to regenerate new forests." (Also notes Joyce et al. 2008 (SAP) as source)