Moose-Wilson Corridor Soundscape Report
Compiled by NPS/Shan Burson
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SUMMARY

The soundscape of the Moose-Wilson corridor varies depending on the proximity of the road, and the Snake River and its tributaries. The natural soundscape depends on the season and time of day. Natural sounds include birds singing, mammals, amphibians, and insects vocalizing, wind in the trees, and flowing water. Because of the low speed limits Moose-Wilson road traffic noise typically does not carry far into the backcountry (other than un-muffled motorcycles and trucks). Noise associated with ground and air activities at the Jackson Hole Airport impact the soundscape of the corridor in its entirety to a greater extent than the Moose Wilson road. The natural soundscape dominates much of the backcountry at all times and along the road during the night and in the winter.

SOUND MONITORING

Sound monitors have been placed in seven different locations within the Moose-Wilson corridor over the past eleven years. The chart below shows the location, season, and dates that each of these sound monitors was in place. The map shows their locations as indicated by a yellow thumbtack.

Location	Season	Dates
White Grass Ranch (WHGR)	All	Feb 2004 – Feb 2005, Jan. 2015
Murie Ranch (MURA)	Summer	Jun-Aug 2009
Moose-Wilson Road 1 (MWR1)	All	Nov 2012 – Oct 2013
Moose-Wilson Road 2 (MWR2)	Late Summer	Aug-Sep 2013
Moose-Wilson Road 3 (MWR3)	All	Nov 2013 – Nov 2014, Feb 2015
Phelps Lake Jump Rock (PLJR)	Late Summer	Sept 2014
Phelps Lake East (PLLN)	Late Summer	Sept 2014

REGULARITY OF DAYTIME SOUND SOURCES IN THE CORRIDOR

The charts below show the percent time audible of common sound sources as measured from 7 am to 7 pm for locations along the Moose-Wilson road and in the Moose-Wilson corridor backcountry. This is a measure of the percentage of time a particular type of sound can be heard. For example, the sound source "All Road Vehicles" can be heard 75% of the time between 7 am and 7 pm along the Moose-Wilson road in summer.

The most commonly heard sounds along the Moose-Wilson road in summer are "All Road Vehicles," "Birds," and "Insects." The most commonly heard sounds along the road in winter are "Unidentified Motor," "Wind," and "All Aircraft." At backcountry sites, the most commonly heard sounds are "Birds" and "Flowing Water" in summer and "Unidentified Motor," and "All Aircraft" in winter.

Along Moose-Wilson road

Source	Summer	Winter*
All Road Vehicles	75%	1%
Birds	52%	16%
Insects	19%	0%
Wind	17%	26%
Flowing Water	14%	19%
All Aircraft	12%	22%
Unidentified Motor	9%	45%**
Squirrels	6%	3%
People's Voices	2%	2%
Silence	0%	5%

*From the section of Moose-Wilson road that is not plowed.

** Majority of unidentified motors likely cars on Hwy 89 and ground activity at airport.

At backcountry sites (Murie Ranch in summer, White Grass Ranch in winter)

Source	Summer	Winter
All Road Vehicles	1%	6%
Bird	61%	11%
Insect	16%	0%
Wind	16%	11%
Flowing Water	59%	0%
All Aircraft	26%	31%
Unidentified Motor	32%	37%
Squirrels	32%	8%
People's Voices	0%	6%
Silence	0%	11%

DAYTIME SOUND LEVELS BY SEASON

The charts below show the median, average, 90th percentile (L90), maximum, and minimum loudness recorded between 7am and 7pm during both summer and winter along the Moose-Wilson road and at backcountry sites it the Moose-Wilson corridor. Loudness, or sound pressure, is measured in decibels (dBA), which are explained below.

Median loudness in the Moose-Wilson corridor is greater in summer than in winter for both roadside and backcountry locations. Median loudness is greater at roadside locations than in the backcountry during the summer. However, median loudness is the same for both roadside and backcountry locations in winter.

Along Moose-Wilson road

Acoustic Metric	Summer	Winter
Median	37 dBA	25 dBA
Average	43 dBA	32 dBA
L90 (quietest 10%)	28 dBA	22 dBA
Maximum	82 dBA	76 dBA
Minimum	19 dBA	10.3 dBA

At backcountry sites (Murie Ranch in Summer, White Grass Ranch in winter)

Acoustic Metric	Summer*	Winter
Median	32 dBA	25 dBA
Average	42 dBA	32 dBA
L90 (quietest 10%)	29 dBA	23 dBA
Maximum	90 dBA	74 dBA
Minimum	23 dBA	8.6 dBA

* Near Snake River

Explanation of Decibels (dBA)

0 dBA is the lower threshold of human hearing
15-20 dBA is the level of a recording studio
50-60 dBA is the level of conversation
A 10 dBA change is a doubling or halving of perceived loudness
A 3 dBA change is a doubling or halving of sound energy

INSTRUMENTATION AND METHODS

Sound monitoring sites were chosen to represent acoustically distinct areas within the Moose-Wilson corridor. Sites included areas adjacent to the Moose-Wilson road and sites in the backcountry away from the influence of road vehicles.

Automated acoustic instrumentation collected continuous one-second sound levels and digital recordings. High quality continuous digital recordings were made with mp3 recorders. Calibrated sound level meters, preamplifiers, and microphones with windscreens were used to collect A-weighted wideband and 33 unweighted one-third octave band frequency (12.5-20,000 Hz) sound

pressure levels each second (1-second L_{eqs}) during the entire sampling period. Anemometers collected wind speeds and direction.

After the initial deployment, each monitor was visited at least monthly. A field data sheet was completed during each visit. Basic site information, time arrive/time depart, latitude and longitude, habitat/vegetation types, equipment type and serial numbers, and software settings were documented.

The acoustic monitors, contained within weatherproof containers, were powered by batteries some with photovoltaic charging systems. The monitors could operate continuously for weeks between site visits.

Audibility

Ten seconds of every four minutes of the continuous digital recordings were analyzed. These daily 360 10-second samples were combined, calibrated, and analyzed. The entire 24-hour period was used.

The percent time audible for each sound source was calculated using the samples as a surrogate for all periods of the day. For example, if a particular sound source was audible for half of the samples (180 of 360 samples) its percent time audible was calculated as 50%. Although any sampling scheme may miss an occasional sound, comparison with attended logging, other sampling schemes, and continuous recordings demonstrated that a 10 seconds/4 minute scheme, over multiple days, closely approximates actual percent time audible of frequent sound sources (e.g., bird songs or road vehicles).

It was increasingly difficult to identify sound sources as distances increased from the recording location to the sound source. Therefore sound source reporting is hierarchal (e.g., motorcycle; road vehicle; motorized sound; non-natural sound; unknown). The most specific identification possible was used.

Sound levels

Sound pressure levels (decibels) were compiled and common acoustic metrics were calculated using NPS software. Wind contamination (distortion) at wind speeds exceeding 11 mph were deleted. Acoustic data collected during visits to the monitoring site were also deleted from analyses.

For more information on soundscape monitoring in the Moose-Wilson corridor and Grand Teton National Park, please contact Shan Burson at shan_burson@nps.gov.